PREVENTION OF SIGNIFICANT DETERIORATION (PSD)

PERMIT SUMMARY SHEET

Permit No.: 0550023

Source Name: Sunflower Electric Power Corporation – Holcomb Unit 1

Source Location: Holcomb Generating Station, S32, T24S, R33W, Finney County, Kansas 67851

I. Area Designation

K.A.R. 28-19-350, Prevention of significant deterioration of air quality, affects new major sources and major modifications to major sources in areas designated as "attainment" or "unclassifiable" under section 107 of the Clean Air Act (CAA) for any criteria pollutant. The State of Kansas is classified as attainment for the National Ambient Air Quality Standards (NAAQS) for all the criteria pollutants.

The Holcomb area in Finney County, Kansas, where this modification is taking place, is currently in attainment or unclassifiable for all criteria pollutants. As such, the PSD program, as administered by the State of Kansas under K.A.R. 28-19-350, will apply to the proposed project.

II. Project Description

Sunflower Electric Power Corporation (Sunflower) owns and operates the 360-MW coal-fired Holcomb 1 (H1) electric utility generating unit (EGU) and associated facilities and equipment at its Holcomb Generating Station (Holcomb Station) located near the City of Holcomb, Finney County Kansas

Sunflower plans to reduce NO_X emissions on H1 through the use of a new Low NO_X Combustion System comprised of low NO_X burners and an overfire air system. Construction and operation of this permit in compliance with the NO_X emission limit will fulfill Article 2.1 of the Settlement Agreement signed on May 4, 2009 by Sunflower and the Governor of Kansas.

III. Significant Applicable Air Emission Regulations

This source is subject to Kansas Administrative Regulations relating to air pollution control. The application for this permit was reviewed and evaluated for compliance with the following applicable regulations:

A. K.A.R. 28-19-300. Construction Permits and Approvals; Applicability. "Any person who proposes to construct or modify a stationary source or emissions unit shall obtain a construction permit before commencing such construction or modification."

B. K.A.R. 28-19-350. Prevention of significant deterioration of air quality. "The provisions of K.A.R. 28-19-350 shall apply to the construction of major stationary sources and major modifications of major stationary sources in the areas of the state designated as an attainment area or an unclassified area for any pollutant under the procedures prescribed by section 107(d) of the federal clean air act (42 U.S.C. 7407 (d))."

IV. Air Emissions from the Project

The potential-to-emit of at least one of the PSD regulated pollutants from the existing Holcomb Station exceeds 100 tons per year. Hence, Holcomb Station is considered to be a major stationary source under provisions of K.A.R. 28-19-350.

The total projected emissions increases from the proposed modification are listed in Table 1-3 of Section 1 and detailed out in Appendix C of the application. Proposed projected emissions increases of carbon monoxide (CO), oxides of nitrogen (NO_X) and carbon dioxide equivalent (CO_2e) were compared with the Significant Emission Rates for PSD applicability for the criteria and non-criteria pollutants. The projected emissions increase is above the PSD significance level for CO and will be reviewed under the PSD regulations. NO_X emissions will be greatly reduced under this modification. CO_2e emissions will also be reduced under this modification.

Hence, this project will be a major modification of an existing major stationary source resulting in a net significant increase of CO. This project will be subject to the various aspects of K.A.R. 28-19-350, such as the use of best available control technology, ambient air quality analysis, and additional impacts upon soils, vegetation and visibility. Good combustion practices were selected as BACT for CO with a limitation of 0.25 lb/MMBtu. Compliance with the CO limitation will be determined with a continuous emission monitor system (CEMS).

The proposed NO_X emissions reduction project is described in Section 1 of the application. The May 4, 2009 Settlement Agreement (see Section II) requires Sunflower achieve compliance with a NO_X limitation of 0.22 lb/mmBTU. The emission limitation will be contained in the permit and compliance will determined with a CEMS

It should be noted that the initial PSD construction permit for H1, dated May 19, 1980, contained a CO limit of 0.064 lb/mmBTU. However, Condition No. 1 of that permit indicates that "if the CO and NO_X BACT emission limits cannot be achieved simultaneously, the NO_X emission limit shall take precedence and a new CO/BACT emission limit shall be established by the EPA (or its delegated representative)…" Condition No. 1 of the permit also states: "As part of any readjustment of the CO-BACT emission limit under this permit condition, the owner/operator of Unit No. 1 must make a determination through the use of agency-approved dispersion models that emissions from Unit No. 1 will not cause or significantly contribute to a violation of the National ambient Air Quality Standards (NAAQS) for CO."

Condition 1 of the May 19, 1980 PSD permit also required that as part of any readjustment of the CO/BACT emission limit, the owner/operator of Unit 1 must make a determination through the use of EPA-approved dispersion models that emissions from Unit 1 will not cause or significantly contribute to a violation of the National Ambient Air Quality (NAAQS) for CO and that the modeling studies were subject to KDHE and EPA review and approval. Condition 1 also indicated that the CO/BACT emission limit shall not be adjusted to an emission rate that would cause or contribute to a violation of the CO NAAQS. The air dispersion modeling analysis submitted with the permit application satisfied these criteria.

The Air Emissions Limits for this permit, as indicated in sections V.A and V.B of the permit, were established based on the above criteria.

A separate permit modification to the May 19, 1980 permit is also being issued concurrently with this permit to reflect the change to the CO emissions limit.

On June 3, 2010, the U.S. Environmental Protection Agency (EPA) issued the final Greenhouse Gas (GHG) Tailoring Rule (75 FR 31514). This rule established the thresholds for GHG emissions under the PSD permit program for new and existing industrial facilities. GHGs are a single air pollutant defined as the aggregate group of the following six gases:

- carbon dioxide (CO_2)
- nitrous oxide (N_2O)
- methane (CH_4)
- hydrofluorocarbons (HFCs)
- perfluorocarbons (PFCs)
- sulfur hexafluoride (SF_6)

Starting in January 2011, sources currently subject to the PSD permitting program (i.e., those that are newly-constructed or modified in a way that significantly increases emissions of a pollutant other than GHGs) are subject to permitting requirements for their GHG emissions under PSD. For those affected facilities,

only GHG emissions increases of 75,000 tpy or more of total GHG, on a carbon dioxide equivalent (CO_2e) basis, need to determine the Best Available Control Technology (BACT) for their GHG emissions.

PSD does not apply to the GHG emissions from this proposed project. Even though the proposed modification is considered a major modification under the PSD permit program and Sunflower is required to obtain a PSD permit (called an "anyway source"), there is no potential emissions increase of GHGs from the modification.

V. Best Available Control Technology (BACT)

The BACT requirement applies to each new or modified affected emissions unit and pollutant emitting activity. Also, individual BACT determinations are performed for each pollutant emitted from the same emission unit. Consequently, the BACT determination must separately address, for each regulated pollutant with a significant emissions increase at the source, air pollution controls for each emissions unit or pollutant emitting activity subject to review. Sunflower was required to prepare a BACT analysis for KDHE's review according to the process described in Attachment A. KDHE's evaluation of the BACT for the proposed Emission Reduction Project's analysis is presented in Attachment B.

KDHE has concurred with Sunflower for the following:

BACT for Carbon Monoxide is 0.25 lb/mmBtu, thirty day rolling average, including periods of startup and shutdown. BACT for CO is good combustion practices.

Ambient Air Impact Analysis

The owner or operator must demonstrate that allowable emission increases from the proposed facility, in conjunction with all other applicable emissions increases or reductions, would not cause or contribute to air pollution in violation of:

1) any national ambient air quality standard (NAAQS) in any air quality control region; or
2) any applicable maximum allowable increase over the baseline concentration in any area (increment).

Sunflower used the EPA approved AERSCREEN model to evaluate the impacts of CO that will result from the project at H1 for 1-hour CO and 8-hour CO. Sunflower's evaluation was reviewed by KDHE using EPA's AERSCREEN program, which incorporates the latest version of AERMOD in its calculations.

The emission rate, point location, and stack parameters for the emission source used in the model were based on the data presented in the permit application. These input data are shown in the table below.

Stack Parameters for H1 Steam Generator[1]				
Load	**Stack height (ft)**	**Stack diameter (ft)**	**Exit temperature (°F)**	**Exit velocity (ft/s)**
100%	475	16.33	180	113.5
75%				85.2
50%				56.8
25%				28.4

After a review of the appropriate satellite imagery and land use data obtained from the U.S. Geological Survey (USGS), it was concluded that the area is "rural" for air modeling purposes.

AERSCREEN estimates concentrations without the need for the user to input meteorological data. The "regulatory default" settings for minimum and maximum temperature, minimum wind speed, and anemometer height were used to determine the meteorology in this model. The meteorology was calculated using the AERMET seasonal tables. Being in western Kansas, the surface characteristics option had the number six selection of "Grassland." The dominant surface profile is average moisture since western Kansas is not classified as an arid region.

Sunflower's H1 generating unit stack height exceeds 65 meters; therefore, the model's Building Downwash option was selected and the building dimensions supplied by Sunflower were used for the model run.

The modeled emission rate was set at 1.0 grams per second (1 g/s) for all load cases. Since only one source is being modeled, this was done so the results are directly scalable to this rate and multiple emission rates do not need to be considered in separate modeling runs. The resulting concentration from the AERSCREEN model can be directly multiplied by the proposed emission rate for H1 to arrive at a corresponding concentration. The AERSCREEN program also includes averaging time factors for worst-case 1-hour and 8-hour averages. The results from the significance determination are shown in the table below.

[1] Emissions from this unit are based on a 0.25 lb/MMBtu emission rate and Unit 1's heat input rate of 3,390 MMBtu/hr. See also Table 5-5 in Part 5.0 of the Permit Application, the Air Disperson Modeling Analysis.

Significance Determination Table						
Load	**Averaging Period**	**Maximum Concentration ($\mu g/m^3$)**	**Proposed Emission rate (g/s)**	**Scaled Concentration ($\mu g/m^3$)**	**Modeling SIL ($\mu g/m^3$)**	**Exceeds SIL?**
100%	1-hour	1.743	92.33	160.9	2,000	No
	8-hour	1.568		144.8	500	No
75%	1-hour	1.912	69.25	132.4	2,000	No
	8-hour	1.720		119.1	500	No
50%	1-hour	2.287	46.17	105.6	2,000	No
	8-hour	2.059		95.1	500	No
25%	1-hour	3.240	23.08	74.8	2,000	No
	8-hour	2.916		67.3	500	No

For the 1-hour and 8-hour CO averaging periods the modeled impacts for the proposed facility fall below the modeling SIL so no refined modeling is required. The modeling results are also well below the pre-application monitoring threshold of 575 $\mu g/m^3$ for the 8-hour averaging period. There is no pre-application threshold established for the 1-hour averaging period. Therefore, pre-construction monitoring is not required for CO.

VI. Additional Impact Analysis

A. Commercial, Residential, and Industrial Growth

The growth analysis considers predicted air quality impacts due to emissions resulting from the commercial, industrial and residential growth associated with the LNB/OFA project. Only permanent growth is considered and impacts from emissions from temporary and mobile sources are not included in the analysis.

There will be no associated growth due to the LNB/OFA project. Project construction will be limited and no commercial or residential growth is projected to occur because of this project. Given the temporary nature of the construction and the lack of other source growth in the area, the Project is not expected to cause any adverse construction or growth related air quality impacts

B. Visibility Impairment

An additional visibility impact analysis may be used to determine if the air emission increases associated with a proposed PSD project will have an impact on Class II sensitive areas such as state parks, wilderness areas, or scenic sites and overlooks. Visibility impairment is a function of the

emissions of primary particulate matter, NO_X (including NO_2), elemental carbon (soot), and primary sulfate (SO_4). This project will substantially decrease the emissions of NO_X, thereby improving visibility over current conditions. As CO, not a visibility impairing pollutant, is the only pollutant with an emission increase, the project is not predicted to negatively impact visibility.

Federally designated Class I areas are afforded special protection in the air permitting process. Generally, Class I area visibility analyses are only conducted for projects located within 100 km of a Class I area. The nearest Federal Class I Area is the Great Sand Dunes National Monument, nearly 400 km west of the proposed facility. Wichita Mountains National Wildlife Refuge is slightly more than 400 km southeast of the proposed facility. A visibility analysis was not required since the proposed project results in a substantial decrease in NO_X emissions and there is no increase in any other visibility-impairing pollutants.

C. Vegetation

In accordance with 40 CFR 52.21(o)(1), the owner shall provide an analysis of the impairment to visibility, soils and vegetation that would occur as a result of the modification to the source. Sunflower determined that the proposed project and the associated increase in CO are not expected to have significant effects on vegetation.

Air pollutants can affect vegetation through direct absorption through the foliage, or uptake from the soil of trace elements deposited in the soil. The effects of air pollution on vegetation can include visible damage to foliage and fruit, changes in metabolic function, adverse changes in plant activity, and crop yield reduction. The effects of air pollutants on vegetation fall into three categories: acute (short exposure to high concentration), chronic (lower concentration over months or years), and long term (abnormal changes to ecosystems and physiological alterations in organisms that occur gradually over very long time periods).

The United States Department of Interior (USDOI) has published a document called Impacts of Coal Fired Power Plants on Fish, Wildlife, and their Habitats. This document was used to consider the effects of CO on vegetation. Sunflower Electric Power Corporation conducted a survey of the vegetation located in the vicinity of the modification, which indicated the predominant types of vegetation are pasture and crop land. Switchgrass, little bluestem, big bluestem, Indian grass, and Canada wild rye are found in pastures and meadows. Wheat, corn, soybeans, and alfalfa are the predominant row crops. Trees occur in hedgerows, creek beds, and along the Arkansas River. While adequate information is available to make generalizations regarding air pollution impacts on various types of vegetation, concrete conclusions as to site-specific vegetation exposure

impacts cannot be presently concluded from available research study data. At the Sunflower facility vegetation is composed of disturbance-tolerant weedy species including lamb's-quarters (*Chenopodium album*), pigweed (*Amaranthus sp.*), and Russian thistle (*Salsola kali*). Turf grasses, such as western wheatgrass (*Agropyron smithii*) and tall fescue (*Festuca arundinacea*) are planted in lawn areas.

Concentrations of CO, even in polluted atmospheres, are not typically detrimental to vegetation. CO has not been found to produce detrimental effects on plant growth at concentrations below 1,800,000 $\mu g/m^3$ for a one week exposure.[2] NAAQS are set for 1-hour and 8-hour averaging periods, at rates more stringent than the literature exposure threshold. Therefore, the NAAQS were utilized for comparison with modeled concentrations to predict any CO effects on vegetation. Additionally, the USEPA has stated that "*for most types of soils and vegetation, ambient concentrations of criteria pollutants below the secondary national ambient air quality standards (NAAQS) will not result in harmful effects*."[3] Since the maximum model-predicted 1-hour and 8-hour CO impacts are significantly lower than the NAAQS, no adverse impacts to vegetation due to the proposed project are expected from CO emissions.

D. Soils

Two soil types are mapped at or near the project site (Harner *et al.* 1965). They include:

- Tivoli fine sand
- Tivoli-Vona loamy fine sands

Both soil types are deep, noncalcareous, very sandy soils in steep, duny (numerous sand-dunes) terrain. The soils are low in fertility and drain very easily. Water is absorbed quickly, and consequently, runoff is very low. Blowout of the soil is prevalent where vegetation is lacking. Erosion often is a problem.

Sulfates and nitrates caused by SO_2 and NO_X deposition on soil can be beneficial and detrimental to soils depending on its composition. However, the modification on H1 will not affect SO_2 emissions from the unit, and NO_X emissions will be decreasing as a result of the project, so no adverse effects are anticipated.

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[2] Smith, A.E. and J.B. Levenson. *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals.* Argonne National Laboratory, USEPA Publication EPA-450/2-81-078. December 12, 1980.

[3] *New Source Review Workshop Manual.* Environmental Protection Agency, Office of Air Quality Planning and Standards, October 1990, Draft. (NSR Manual).

Attachment A

KEY STEPS IN THE "TOP-DOWN" BACT ANALYSIS

STEP 1: IDENTIFY ALL POTENTIAL AVAILABLE CONTROL TECHNOLOGIES.

The first step in a "Top-Down" analysis is to identify, for the emission unit in question, "all available" control options. Available control options are those air pollution control technologies or techniques with a PRACTICAL POTENTIAL FOR APPLICATION to the emissions unit and the regulated pollutant under review. This includes technologies employed outside of the United States. Air pollution control technologies and techniques include the application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of the affected pollutant.

STEP 2: ELIMINATE TECHNICALLY INFEASIBLE OPTIONS.

The technical feasibility of the control options identified in Step 1 is evaluated with respect to the source-specific (or emissions unit specific) factors. In general, a demonstration of technical infeasibility should be clearly documented and should show, based on physical, chemical, and engineering principles, that difficulties would preclude the successful use of the control option on the emissions unit under review. Technically infeasible control options are then eliminated from further consideration in the BACT analysis.

STEP 3: RANK REMAINING CONTROL TECHNOLOGIES BY CONTROL EFFECTIVENESS.

All remaining control alternatives not eliminated in Step 2 are ranked and then listed in order of over-all control effectiveness for the pollutant under review, with the most effective control alternative at the top. A list should be prepared for each pollutant and for each emissions unit subject to a BACT analysis. The list should present the array of control technology alternatives and should include the following types of information:

1) control efficiencies;
2) expected emission rate;
3) expected emission reduction;
4) environmental impacts;
5) energy impacts; and
6) economic impacts.

STEP 4: EVALUATE MOST EFFECTIVE CONTROLS AND DOCUMENT RESULTS.

The applicant presents the analysis of the associated impacts of the control option in the listing. For each option, the applicant is responsible for presenting an objective

evaluation of each impact. Both beneficial and adverse impacts should be discussed and, where possible, quantified. In general, the BACT analysis should focus on the direct impact of the control alternative. The applicant proceeds to consider whether impacts of unregulated air pollutants or impacts in other media would justify selection of an alternative control option. In the event the top candidate is shown to be inappropriate, due to energy, environmental, or economic impacts, the rationale for this finding should be fully documented for the public record. Then the next most stringent alternative in the listing becomes the new control candidate and is similarly evaluated. This process continues until the technology cannot be eliminated.

STEP 5: SELECT BACT.

The most effective control option not eliminated in Step 4 is proposed as BACT for the emission unit to control the pollutant under review.

Attachment B

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT'S EVALUATION OF SUNFLOWR ELECTRIC POWER CORPORATION, HOLCOMB GENERATING STATION UNIT 1 PROPOSED BEST AVAILABLE CONTROL TECHNOLOGY (BACT) OPTIONS

Sunflower Electric Power Corporation (Sunflower) evaluated the BACT analysis to control emissions from the Emission Reduction Project. The only significant emission increase from this project is Carbon Monoxide (CO).

CO BACT for the Emission Reduction Project

CO controls consist of good combustion practices or oxidation catalyst. Overfire air can provide an element of CO control as it allows further burn-out of the pollutant. Otherwise, the best identified method to control CO emission from a coal-fired boiler is through the use of appropriate combustion control techniques.

The PSD regulations require BACT, which requires the source to evaluate the control options for technical feasibility. Regenerative Thermal Oxidation (RTO) and catalytic oxidation were examined as possible CO control options. Both RTO and catalytic oxidation were found to be infeasible as a CO control method for the steam generator due to critical technical problems.

No instances of a thermal oxidation system being used to control emission from a gas stream similar in makeup to the H1 coal-fired stream generator have been identified. As such, thermal oxidation has been determined to be technically infeasible. Installing an oxidation catalyst to control CO emission was deemed technically infeasible because, in addition to oxidizing CO, an oxidation catalyst will also oxidize a significant portion of SO_2 to SO_3 in the gas stream. SO_3 in the presence of water forms sulfuric acid mist which is highly corrosive to equipment downstream of the catalyst. Also, due to the high amount of PM present in the flue gas stream, the ash acts as a scouring mechanism, plugging and eroding the catalyst after a very brief period of operation, resulting in extremely high operational and maintenance costs to effect more frequent catalysts replacement.

Based on the technical constraints, the use of good combustion practices to meet CO emission levels of 0.25 lb/mmBTU is proposed by Sunflower as BACT. KDHE agrees with this analysis.