PREVENTION OF SIGNIFICANT DETERIORATION (PSD)

DRAFT PERMIT SUMMARY SHEET

Permit No.: 0550023

Source Name: Sunflower Electric Power Corporation - Holcomb Unit 2

Source Location: Holcomb Generating Station, S32, T24S, R33W, Holcomb, KS 67851

Area Designation:

K.A.R. 28-19-350, Prevention of significant deterioration of air quality, affect 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 (Table 1-2). The State of Kansas is classified as attainment for the National Ambient Air Quality Standards (NAAQS) (see Table 1-3) for all the criteria pollutants.

The Holcomb area in Finney County, Kansas, where this construction is taking place is in attainment for all the criteria pollutants.

Project description:

Sunflower Electric Power Corporation plans to modify a generating facility located in Holcomb, Finney County, Kansas. The generating station will install Holcomb Unit 2, a super critical 895megawatt (MW) (8700 mmBtu/hr heat input) pulverized coal (PC) fired boiler. The existing coal, lime, and ash handing equipment will add equipment to accommodate additional throughput required by this modification. A new cooling tower, a natural gas fired auxiliary boiler, an emergency generator and a diesel fire pump shall be added. The Holcomb Unit 2 boiler will fire Powder River Basin (PRB) sub-bituminous coal, low sulfur bituminous coal as primary fuel and natural gas as a backup fuel.

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 will be evaluated for compliance with the following applicable regulations:

1. K.A.R. 28-19-300. Construction Permits and Approvals. Requires “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."

2. 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))."

3. K.A.R. 28-19-720 New Source Performance Standards, which adopts 40 CFR Part 60 Subpart IIII (the emergency generator and the emergency diesel fire pump).

4. The PC fired boiler is subject to 40 CFR Part 60 Subpart Da - "Standards of Performance for Electric Utility Steam Generating Units for Which Construction is Commenced After September 18, 1978" as amended January 28, 2009, the natural gas fired auxiliary boiler is subject to 40 CFR subpart Db – "Standards of Performance for Industrial-Commercial-Institutional Steam Generating Unit" as amended January 28, 2009, the additional coal handling system is subject to 40 CFR Part 60, Subpart Y- "Standards of Performance for Coal Preparation Plants" as amended October 8, 2009 and the emergency generator and the emergency diesel fire pump are subject to 40 CFR Part 63 Subpart ZZZZ "National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines" as amended March 3, 2010 (which refers to compliance with 40 CFR Part 60 Subpart IIII complies with this regulation for the of the emergency generator and emergency fire to be installed).

5. The modification is not subject to the Clear Air Act Section 112g, MACT case by case determination. The HAPs requirements in the permit will verify the modification is not a major source of HAPs.

<u>Air Emissions from the Project:</u>

Potential-to-emit of one of the PSD regulated pollutants from the Sunflower Electric Power Corporation generating station exceeds 100 tons per year. Hence, this facility is considered to be a major stationary source under provisions of K.A.R. 28-19-350.

The potential-to-emit from the modification of the facility (i.e. Holcomb Units 2 boiler, the additional coal, lime and ash handing equipment, the natural gas auxiliary boiler, the emergency generator and fire pump, and the new cooling tower) are listed in Tables 1-4 and Appendix D of the permit application. Proposed potential-to-emit of NOx, SO_2, CO, $PM/PM_{10}/PM_{2.5}$, Sulfuric Acid Mist, and VOCs were compared with the Significant Emission Rates for PSD applicability for the criteria and non-criteria pollutants. The increase in potential-

to-emit is above the PSD significance level and would be reviewed under the PSD regulations. Total Fluorides and lead were below the PSD significance levels.

The proposed project of the boiler, the additional coal, lime and ash handing equipment, the natural gas fired auxiliary boiler, the emergency generator and fire pump, new cooling tower and the associated fugitive emissions along with the operating scenarios are given in Part 1, Section 2.1 through 2.2.9 and Material Handling flow diagrams in Appendix C of the application. The uncontrolled potential-to-emit used for BACT analysis of the boiler uses 0.25 pounds per million British thermal units (lb/mmBtu) for NOx, 0.9 lb/mmBtu for SO_2, 6.154 lb/mmBtu for particulate matter, 0.12 lb/mmBtu for CO, 0.003 lb/mmBtu for VOC, 0.0037 lb/mmBtu for Sulfuric Acid Mist, and 14 lb/TBtu for lead, which corresponds to typical emission values for PC boilers firing PRB coal. These values are given in Tables 4-11 for NOx, Table 4-18 for SO_2, and Tables 4-22 particulate matter.

The after-controls potential-to-emit of the boiler is calculated using low-NOx burners (LNB) and separated over-fire air (SOFA) equipment along with selective catalytic reduction (SCR) for NOx control, fabric filter for PM_{10} control, and dry flue gas desulfurization (FGD) and ancillary equipment for SO_2 control. These values are given in Table 4-11for NOx, Table 4-18 for SO_2, and Table 4-22 for particulate matter. The increase in emissions represents all that are contemporaneous with the proposed changes.

Hence, this project will be a major stationary source resulting in a net significant increase of NOx, SO_2, CO, PM/PM_{10}, Sulfuric Acid Mist, and VOC. 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.

Best Available Control Technology (BACT)

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 Electric Power Corporation 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 boiler, coal, lime and ash handing equipment, auxiliary boiler and new cooling towers' analysis is presented in Attachment B.

In short KDHE has concurred with the Sunflower Electric Power Corporation for the following:

For the PC fired boilers:

BACT for Nitrogen dioxide is 0.05 lb/mmBtu, thirty day rolling average, excluding startup and shutdown, for the proposed boiler. The boiler shall use low-NOx burners (LNB) and separated over-fire air (SOFA) equipment along with selective catalytic reduction (SCR).

BACT for carbon monoxide (CO) is 0.12 lb/mmBtu, thirty day rolling average, including periods of startup and shutdown. BACT for CO is good combustion practices. If the CO and NO_X emission limits cannot be achieved simultaneously, the NO_X emission limit shall take precedence and a new CO BACT emission limit, based on a review of performance test results, shall be revised in accordance with the EPA's July 5, 1985 memorandum titled "Revised Draft Policy of Permit Modifications and Extensions".

BACT for sulfur dioxide is 0.060 lb/mmBtu or 0.085 lb/mmBtu depending on the sulfur content of the solid fuel being burned, thirty day rolling average, excluding periods of startup, shutdown, and malfunctions. The boiler shall use dry flue gas desulfurization (dry FGD) system and low sulfur coal.

BACT for volatile organic compounds (VOC) is 0.003 lb/mmBtu. BACT for VOC is good combustion practices. If the VOC and NO_X emission limits cannot be achieved simultaneously, the NO_X emission limit shall take precedence and a new VOC BACT emission limit, based on a review of performance test results, shall be revised in accordance with the EPA's July 5, 1985 memorandum titled "Revised Draft Policy of Permit Modifications and Extensions".

BACT for particulate matter (PM), particulate matter less than 10 microns (PM_{10}) and particulate matter less than 2.5 microns ($PM_{2.5}$) (filterable particulate matter) is 0.012 lb/mmBtu, thirty day rolling average, including periods of startup and shutdown. BACT for total (filterable and condensible) PM_{10} and total $PM_{2.5}$ is 0.018 lb/mmBtu. If the PM_{10} limit and/or $PM_{2.5}$ limit of 0.018 is not consistently achievable, then additional testing will determine the appropriate limitation. If the limitation must be changed, the permit shall be revised in accordance with the EPA's July 5, 1985 memorandum titled "Revised Draft Policy of Permit Modifications and Extensions". BACT for PM/PM_{10}/ $PM_{2.5}$ is a fabric filter.

BACT for total elemental lead for any unit shall not exceed 1.4 lb/TBtu, averaged over the period specified in the test protocol.

BACT for sulfuric acid mist for any unit shall not exceed 0.0037 lb/mmBtu, averaged over the period specified in the test protocol.

BACT for the auxiliary boilers for NOx emissions is low NOx burners and for SO_2 is combusting only pipeline natural gas.

BACT for other pieces of equipment include the following: catalytic converter for emergency generator, high efficiency drift eliminators for the cooling tower, baghouses/bin filters and chemical/water suppression for material handling systems.

Mercury (Hg) Limits for PC fired Boiler

Although Hg is no longer considered a pollutant regulated under New Source Review, the source has agreed to a limit of 0.020 lb/GWh while burning subbituminous coal or blends. The emission limitation expressed in the permit's **Air Emission Limitations** paragraph 2h is based upon an assumed 85% reduction of mercury concentration, a mean mercury-in-coal concentration of 0.172 ppm, and a presumption of technology efficacy demonstrated during Department of Energy tests conducted on the companion Holcomb 1 unit in 2004. Should the installed equipment be confirmed to be in proper working order, and should it be found unable to cause the established emission limitation to be consistently achieved, whether related to mercury in fuel, or to fuel type or to other undetermined reasons, then the operator shall undertake, while using the installed equipment, to establish a consistently achievable emission limitation which can be achieved. Such limitation change shall cause a permit revision in accordance with the EPA's July 5, 1985 memorandum titled "Revised Draft Policy of Permit Modifications and Extensions".

Ambient Air Impact Analysis

The owner or operator of a proposed source or modification must demonstrate that allowable emission increases from the proposed source, 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.

The AERMOD model was used to determine the maximum predicted ground-level concentration for each pollutant and applicable averaging period resulting from various operating loads.

Pollutant emission rates (lb/hour) were selected from the boiler data contained in Table 5-7 and Table 5-8 of Supplemental Information Submission #21, Section 5 and Table 3 of Supplemental Information Submission #22, Section 5a (NOx – 1 hour) of the application to produce worst case dispersion conditions and highest model predicted concentrations (i.e. lowest exhaust temperature, lowest exit velocity, and highest emission rate). Table 5-6 of Supplemental Information Submission #21, Section 5 of the application shows the boiler stack parameters at modeled load levels used in the ambient impact analysis. Five (5) years of meteorological data from 2004-2008, of surface and upper air were used in the modeling.

Tables 5-48 through 5-52 of Supplemental Information Submission #21. Section 5 of the application contain the screening model results for NOx, CO, SO_2, PM_{10}, and $PM_{2.5}$ compared to the modeling significance thresholds (except for the 1-hour NOx).

The SO_2 screening analysis maximum concentrations exceeded the modeling significance thresholds for the 1-hour, the 3-hour and the 24-hour averaging periods. The SO_2 screening analysis was run with various combinations of the unit experiencing maintenance activity. Maintenance activities significantly increase the SO_2 emission rate for that unit. The maximum predicted concentrations were found to be 235.38 micrograms per cubic meter (ug/m^3), 116.1 ug/m^3 and 15.06 ug/m^3 for the 1-hour, 3-hour and 24-hour averaging periods, respectively. The significance levels for SO_2 are 25 and 5 ug/m^3 for the 3-hour and 24-hour (expected to be revoked) averaging periods, respectively (there is an interim significance threshold established by KDHE for the 1-hour SO_2).

The PM_{10} screening analysis maximum concentrations for the active and inactive piles exceeded the modeling significance thresholds for the 24-hour averaging period. The maximum predicted concentrations were found to be 12.28 micrograms per cubic meter (ug/m^3) the 24-hour averaging period. The significance levels for PM_{10} is 5 ug/m^3 for the 24-hour averaging period.

The $PM_{2.5}$ screening analysis maximum concentrations for the active and inactive piles were less than the KDHE established interim modeling significance thresholds for the 24-hour and annual averaging periods. The significance levels for $PM_{2.5}$ are 5 and 1 ug/m^3 for the 24-hour and annual averaging periods, respectively.

Modeled concentrations for annual NOx were less than the modeling significance thresholds. The 1-hour NOx exceeded the interim modeling significance level and immediately went to refined modeling. The annual NOx maximum predicted concentration was 0.23 ug/m^3 compared to significance threshold of 1 ug/m^3 for an annual averaging period. The CO maximum predicted concentration was 72.26 ug/m^3 compared to significance threshold of 2000 ug/m^3 for a 1-hour averaging period. The CO maximum predicted concentration was 20.55 ug/m^3 compared to significance threshold of 500 ug/m^3 for an 8-hour averaging period.

The screening analysis indicated that additional air quality analysis was required to determine whether potential SO_2, NOx, and PM_{10} emissions from the proposed project are expected to cause a significant deterioration of air quality in the Holcomb, Kansas area. A full impact analysis is required to demonstrate compliance with the PSD Class II increment (the whole state of Kansas is designated as a Class II area) and NAAQS.

The refined analyses was done for SO_2 3-hour and 24-hour, PM_{10} 24-hour and the new 1 hour standards (NAAQS only since increments have not been set by the EPA) for NO_2 and SO_2 . The refined analyses for SO_2 3-hour and 24-hour, PM_{10} 24-hour and the new 1 hour standards for NO_2,and SO_2 are documented in “Air Quality Impact Analysis Review” included in this package.

Additional Impact Analysis:

Sunflower Electric Power Corporation was required to provide an analysis of the impairment to visibility, and impacts on plants, soils and, vegetation that would occur as a result of this project and to what extent the emissions from the proposed modification impacts the general commercial, residential, industrial and other growth.

Visibility Impairment Analysis

Sunflower Electric Power Corporation conducted a visibility degradation analysis for the NO_x and particulate matter emissions from the proposed modification. Sunflower Electric Power Corporation used the document "Workbook for Plume Visual Impact Screening and Analysis", EPA 450/4-88-015, September 1988, and the EPA approved dispersion modeling procedure "VISCREEN" for guidance. A visibility analysis is performed for Class I (visibility-sensitive) areas located within 100 kilometers of a proposed facility. There are no Class I areas in Kansas. Refer to the “Air Quality Impact Analysis Review” Section VIII for an in-depth review of the Class I analysis performed in 2006.

In accordance with KDHE guidance, a visibility impairment analysis was also conducted at the nearest sensitive area, Scott Lake, located approximately 80 kilometers to the north of the plant. A Level-1 visibility impairment analysis was performed for Scott Lake and for the city of Holcomb. The composite worst case hourly emission rate over all modes of operation for NOx and PM from the modifications were input into the model, along with the most conservative meteorological conditions. Scott Lake and the city of Holcomb's models indicate the potential for exceedances of color change and perceptibility values. However, no criteria have ever been established for Class II areas. It is unclear how much Class I criteria should be applied to other areas.

Impacts on 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 Electric Power Corporation determined that the proposed facility and the associated increases of NO_2, SO_2, CO, PM_{10}, $PM_{2.5}$, VOC /ozone, trace elements, and acid gases 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 NOx, SO_2, CO, PM_{10}, $PM_{2.5}$, VOC /ozone, trace elements, and acid gases 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. At the Holcomb Generating Station, vegetation is disturbance-tolerant weedy species. Turf grass is planted in lawn areas.

The impact of NOx on vegetation is discussed in detail in Part 7.0 Section 1.5.1 of the permit application. The most significant effects from NOx are not with the toxicity of gases themselves, but the secondary pollutants that are produced when NOx reacts with airborne hydrocarbons and/or water. NOx air dispersion modeling was conducted to estimate the vegetation impacts from predicted NOx ground level concentrations. NOx may under certain circumstances deleteriously impact vegetation. Typical leaf injury responses include interveinal

necrotic blotches. Injury thresholds vary by species and dose, and would be in the range of 3760 ug/m^3 for four hours for tobacco to 7380 ug/m^3 for tomatoes, beans, and sunflowers. Short term fumigations of 1-hour, 20-hours, and 48-hours at NOx concentrations of 940 to 38,000 ug/m^3, 470 ug/m^3, and 3000 to 5000 ug/m^3, respectively, have been shown to deter photosynthesis of a number of herbaceous (tomato, oats, alfalfa) and woody plants. Long term exposures of phytotoxic doses of NOx ranged from 280 to 560 ug/m^3. All the above listed concentrations are greater than the annual and estimated hourly and 24-hour NOx emissions modeled to occur in the vicinity of the facility. From these results it can be concluded that the NOx emissions from this facility will not have an adverse affect on the vegetation in the area.

The impact of CO on vegetation is discussed in detail in Part 7.0 Section 1.5.2 of the permit application. Concentrations of CO are not typically detrimental to vegetation, and have not been found to produce detrimental effects on plants at concentrations below 114,500 ug/m^3 for exposures from one to three weeks (see references in application). Therefore, the NAAQS were used for comparison with modeled concentrations to predict any CO effects on vegetation. Modeling results indicate that H2 will not exceed the NAAQS for CO.

The impact of particulate matter and trace element on vegetation is discussed in detail in Part 7.0 Section 1.5.3 of the permit application. Sources of particulate due to the proposed project include material handling activities, unloading, conveyance, drop points, storage piles, and movement of heavy equipment on unpaved roads. The emission sources are low height and low velocity, so they contribute to very localized deposition of PM_{10} and $PM_{2.5}$. Coal combustion has wider dispersion. PM_{10} and $PM_{2.5}$ sources can potentially affect vegetation in several ways. Emissions may physically block plant and tree stomates, or may affect leaf adsorption and reflectance (which hinders heat exchange and photosynthesis). Trace elements in PM_{10} and $PM_{2.5}$ may be toxic to plants. The physical effects of PM_{10} and $PM_{2.5}$ are acted on by wind, rain, and the toxicity is determined mostly by soil and plant characteristics. Plant toxicity from trace elements is mainly based on the interaction between soil and plants and occurs from plant uptake of trace elements deposited in the soil. The concentration of PM_{10} and $PM_{2.5}$ have been compared to the NAAQS for predicting the physical / non-toxicity affects on vegetation. EPA has stated that "for most types of soil and vegetation, ambient concentrations of criteria pollutants below the secondary national ambient air quality standards (NAAQS) will not result in harmful effects" (see reference in permit application). The maximum predicted off-site concentrations (see Figures H-16 through H-19 of the permit application) are well below the maximum allowable NAAQS, and therefore are not expected to negatively impact vegetation.

The impact of sulfur dioxide is discussed in detail in Part 7.0 Section 1.5.4 of the permit application. SO_2 emissions come from combustion of coal in the proposed boilers. Many factors contribute to vegetation effects of SO_2, including atmospheric conditions. SO_2 impacts are analyzed primarily through dispersion modeling to predict ground level concentrations from the proposed project. Short and long term exposures may have detrimental effects on many plant species, and several studies have been conducted studying the effects of SO_2 on vegetation (see application for references). Symptoms of SO_2 injury in leaves are interveinal necrotic blotches in angiosperms and red brown banding in gymnosperms. A number of the plant species studied

include those in the Holcomb area. Injury threshold concentrations vary by species and dose: 131-5240 ug/m^3 for 8-hours, 393-3930 ug/m^3 for 2-hours, 1310 ug/m^3 for 4 hours. SO_2 modeled concentrations were significantly lower for the proposed project at 216.9 ug/m^3 for 3-hours, 21.2 ug/m^3 for 24-hours. Long term exposures in the range 43-1198 ug/m^3 had some negative effects, but SO_2 modeled concentrations were significantly lower at 0.649 ug/m^3 (see references in application). Boilers in this project are utilizing BACT to minimize SO_2 emissions, complying with the NAAQS and state and federal regulations, and have emissions below damage thresholds available in referenced literature. Adverse vegetation effects have been avoided to the maximum extent possible.

The impact of VOCs and ozone is discussed in detail in Part 7.0 Section 1.5.5 of the permit application. VOCs result primarily from products of incomplete combustion during the combustion of coal. VOC does not have a NAAQS level for comparison, therefore, the one-hour and 8-hour NAAQS for ozone are considered. Ozone is formed in a photochemical reaction with the precursors NOx (impacts previously discussed) and VOCs. Ozone is not directly emitted. Background concentrations of ozone range from 145-155 ug/m^3 (approximately 74-79 ppb) in the western and central areas of Kansas. These concentrations do not injure plants. Chronic exposures to concentrations of greater than or equal to 196 ug/m^3 of ozone can negatively affect vegetation, and reduction in growth and photosynthesis of trees can occur at ozone levels of less than 200 ug/m^3 (see application for references). To determine the contribution H2 would have on local or regional ambient ozone concentrations, photoreactive modeling runs would need to be performed to estimate the ozone impacts resulting from VOC and NOx emissions from this project. It is unlikely that concentrations in the vicinity of the plant would exceed NAAQS levels. The 8-hour NAAQS for ozone is 75 ppb, making the potential contribution of H2 to ozone levels in the immediate area negligible.

The synergistic effects of pollutants on vegetation are discussed in detail in the permit application Part 7.0 Section 1.5.6. Air pollutants can act together to cause injury to or decrease the functioning of plants. Concentrations of pollutants in studies referenced are substantially higher than those occurring as a result of this project. Consequently, no synergistic effects of the air pollutants are expected to inhibit vegetation at or near the Holcomb Generating Station.

Impacts on 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 NOx deposition on soil can be beneficial and detrimental to soils depending on its composition. Given the low emission levels and the sandy soils in the vicinity of the project, H2 should not significantly impact these soils.

Growth in Commercial, Residential and Industrial activity

This modification at the Holcomb facility will stimulate an increase in the local labor force during the construction phase in the Holcomb area, but the increase will be temporary, short lived, and will not result in permanent/significant commercial and residential growth occurring in the vicinity of the Holcomb. During the construction phase of H2, approximately 1,400 people will be employed for various periods of time and in various capacities. Of those, approximately 90 percent will be in the construction sector with the balance in other disciplines such as engineering, consulting, technical services, and procurement. A large work force with the requisite construction skills is not available in the local area. Skilled workers are available in the larger metropolitan areas including Kansas City, Amarillo, Denver, Wichita and Topeka. Because an adequate pool of needed workers is not available within reasonable commuting distance of the site, we expect that most construction personnel will make use of local rental units.

Operation of the facility will require approximately 75 additional employees over current staffing levels. Most of these positions would be recruited locally (within 50 miles of the facility). A portion of the new employees, estimated to be less than half, could choose to relocate with a subsequent increase in permanent residences to areas nearer the facility. These new residences are not anticipated to add appreciably to air emissions in the vicinity of the facility.

No new local industrial facilities related to H2 is anticipated. An increase in commercial activity related to transportation of coal and lime to the facility and removal of by-products materials (bottom ash) would occur; however, any emissions increases would be from mobile sources and are not part of this analysis. Therefore, H2 is not anticipated to have sustainable negative impacts to the area based on collateral growth.

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 SUNFLOWER ELECTRIC POWER CORPORATION HOLCOMB UNITS 2 PROPOSED BACT OPTIONS

Sunflower Electric Power Corporation evaluated the BACT analysis to control emissions from Holcomb Unit 2 boiler and the auxiliary boiler and emergency diesel generator/fire pump. The Holcomb boiler will fire sub-bituminous coal and low sulfur bituminous coal. The proposed operating scenario for the Holcomb boiler includes the firing of coal for 8760 hours per year. The auxiliary boiler will fire pipeline quality natural gas and operation is based on a 10% annual utilization. The diesel generator and fire pump will operate (other than for testing) only during periods of emergency. For this analysis, each diesel generator is assumed to operate 500 hours annually.

NOx BACT for the Holcomb PC boiler

Nitrogen dioxide control methods were divided into two categories: 1) In-combustor NOx formation control and in-combustor control with post-combustion controls. The different types of emission controls reviewed by Sunflower Electric Power Corporation are as follows:

In Combustor type:

Low NOx burners (LNB) and Over-fire Air (OFA)

In Combustor with post Combustion:

LNB and OFA plus Selective Catalytic Reduction (SCR) (60% reduction)
LNB and OFA plus Selective Catalytic Reduction (SCR) (72% reduction)
LNB and OFA plus Selective Catalytic Reduction (SCR) (80% reduction)

Low NOx combustion systems are designed to reduce the availability of oxygen in the primary combustion zone. This is achieved by staged combustion using LNB in combination with OFA. LNB operation involves decreasing the amount of air introduced into the primary combustion zone, thereby creating a fuel-rich, reducing environment and lowering the temperature, both of which generally suppress NOx formation. OFA further reduces NOx formation by introducing the remaining air required for combustion through separate ports at higher elevations in the boiler, again at lower temperatures, thus limiting production of additional NOx.

The SCR process consists of injecting ammonia (NH_3) into the boiler fuel gas and passing the flue gas through a catalyst bed where the NOx and NH_3 react to form nitrogen and water vapor. Typically, a SCR reactor is located between the economizer and the air heater in order to ensure the optimum operating temperature. The ammonia is injected after the economizer and prior to the catalyst bed. The actual performance of a SCR system varies significantly depending on the volume of catalyst, SCR inlet NOx level, operating temperature,

age of the catalyst and the level of ammonia slip that is technically acceptable. The major difference in these designs (varying percent reduction between options) is the volume of catalyst in the SCR. An area of concern with SCR control is the use of ammonia in conjunction with a catalyst bed to control NOx. There are some unreacted ammonia emissions, which increase with catalyst age, and these emissions pose some environmental concerns.

Please refer to the BACT analysis presented in Part 4 of the application for a more thorough evaluation of possible BACT.

KDHE reviewed the EPA's BACT/LAER/RACT Clearing house and other recently permitted facilities and noted the BACT emission limits of other pulverized coal fired boilers nationwide. Data indicated that recent installation of pulverized coal fired boilers utilized LNB/OFA with SCRs. The PSD regulations requires BACT which requires the source to evaluate the control options for economic feasibility along with the impact on environment and energy use. The economic analysis was conducted according to EPA's guidance document. Installation of an SCR will cost Sunflower Electric Power Corporation between $1,689 and $1,663 per ton of NOx removed. Use of anhydrous ammonia is not environmentally beneficial because of "ammonia slippage" which is unavoidable due to the imperfect distribution of the reagent and catalyst deactivation.

SO_2 BACT for the Holcomb PC boiler

Emissions of SO_2 can be controlled by limiting sulfur content in the fuel or by post-combustion flue gas desulfurization (FGD) system. Sunflower Electric Power Corporation is utilizing low sulfur coal with an average sulfur content of 0.5%. In addition, FGD systems were evaluated as part of the BACT analysis. The FGD systems evaluated were as follows:

Wet FGD (94% removal)
Dry FGD (93% removal)
Dry FGD (91% removal)

Wet FGD has the potential to achieve the lowest emissions among the available technologies. However, wet FGD is not normally applied to PRB coals. In addition, wet FGD is less effective in controlling total particulates, PM_{10}, fine particulates and HAPs than dry FGD since the absorbers in a wet FGD system are located downstream of the particulate control equipment. The maximum ground concentration for all pollutants (including sulfuric acid mist), except SO_2, will be 5 to 10 percent higher with a wet FGD compared with a dry FGD because a wet FGD has lower stack temperatures and velocities. An important issue, especially for facilities located in Western Kansas, is the increase in the amount of water necessary for the wet FGD system. Lastly, the energy required to operate the wet FGD is approximately 2.0% of the proposed unit's generation, almost twice as much energy required for a dry FGD system.

As stated earlier, dry FGD systems are better at controlling pollutants other than SO_2. This is because the particulate control device is located downstream of the dry FGD. The cost of

the dry FGD varies between $1324/ton (91% reduction) and $1294/ton (93% reduction) compared with $1410/ton for the wet FGD. However, an incremental cost of over $11,164 per additional ton of SO_2 removed was estimated for a wet FGD compared to a dry FGD.

While the wet FGD can provide the lowest emissions from Holcomb, significant environmental considerations, economics and technological suitability argue for the selection of dry FGD with a 92% reduction of SO_2 as BACT for Holcomb.

$PM/PM_{10}/PM_{2.5}$ BACT for the Holcomb PC boiler

The control option analyzed for particulate control were as follows:

Fabric filter (99.81% reduction)
Electrostatic precip0itator (ESP) (99.76% reduction)

A fabric filter is the preferred particulate control device for location downstream of the spray dryer in the dry FGD system because the passage of the flue gas through the dust cake on the bags provides enhance removal of SO_2. Although the capital cost of the ESP is higher than the fabric filter, the total annualized cost of installing and operating a fabric filter is somewhat higher. Since the fabric filter has a higher collection rate and aids in the removal of SO_2, it was selected as BACT for particulate control.

CO BACT for the Holcomb PC boiler

Over-fire air can provide an element of Carbon Monoxide (CO) control as it allows further burn-out of the pollutant. Otherwise, the best identified to control CO emissions from a coal-fired boiler is through the use of appropriate combustion control techniques. Control technologies such as CO catalysts are not available for use on a solid fuel-fired boiler. Catalytic reduction for CO is also not technically feasible because ash in the gas stream will destroy the catalyst after a very short period of operation. Combustion controls to achieve CO emissions of 0.12 lb/MmBtu should be considered BACT for Holcomb.

VOC BACT for the Holcomb PC boiler

Volatile Organic Compounds (VOC) controls consist of combustion controls. Good combustion practices can insure limits of 0.003 lb/MmBtu for Holcomb.

BACT for the Auxiliary boiler

Nitrogen oxides and sulfur dioxide were analyzed for control under BACT. The auxiliary boiler is a 200 MmBtu/hr, natural gas fired unit used to provide steam for the main unit during periods of startup and shutdown or during periods of very inclement weather. The boiler will be equipped with low-NOx burners. In order to avoid the limitations of 40 CFR 60 subpart Db, this unit shall be restricted to operate less than 10% of it full load capability annually. The

BACT for sulfur dioxide shall be the burning of only pipeline quality natural gas.

BACT for the Emergency Diesel Generator and fire pump

The diesel generator and fire pump will operate (other than for testing) only during periods of internal plant electrical emergencies and fires. For this analysis, each diesel generator is assumed to operate 500 hours annually, burn ultra low sulfur diesel fuel (15 ppm S) and be equipped with a standard catalytic converter.