**PREVENTION OF SIGNIFICANT DETERIORATION (PSD)**

**PERMIT SUMMARY**

**September 29, 2015**

**Source ID Number:** 1890231

**Source Name:** Abengoa Bioenergy Biomass of Kansas, LLC

**Source Location:** Township 33 South, Range 37 West, Section 18
Hugoton, Stevens County, Kansas

## I. Area Designation

K.A.R. 28-19-350, et seq., Prevention of Significant Deterioration of Air Quality (PSD), 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. Stevens County, Kansas is an attainment/unclassifiable area for all the criteria pollutants.

## II. Project Description

On September 16, 2011, the KDHE issued a Prevention of Significant Deterioration (PSD) Air Emission Source Construction Permit (C-9600) to Abengoa Bioenergy Biomass of Kansas, LLC (ABBK) for the installation and operation of a biomass-to-ethanol and biomass-to-energy production facility near Hugoton, Kansas. Since issuance of the September 16, 2011 Air Emission Source Construction Permit, ABBK was issued an Air Emission Source Construction Permit on January 22, 2013 (C-10550) that was an appended PSD Air Emission Source Construction Permit to the September 16, 2011 permit for the addition of four (4) emergency spark ignition internal combustion generator engines to the construction project.

On August 26, 2013, KDHE received a Prevention of Significant Deterioration Air Construction Permit Application from ABBK to amend the September 16, 2011 and January 22, 2013 PSD Permits. The *Conforming Prevention of Significant Deterioration, Air Quality Construction Permit Modification Application* dated January, 2014 was submitted by ABBK as a corrected update to the application received on August 26, 2013.

On May 27, 2014, the KDHE issued a PSD Air Emission Source Construction Permit to correct and clarify existing regulatory requirements of the September 16, 2011 (C-9600) Air Emission Source Construction Permit; to authorize two (2) of the four (4) spark ignition internal combustion generator emergency engines previously permitted in the January 22, 2013 (C-10550) Air Emission Source Construction Permit to operate in an unrestricted manner; to incorporate air emission limitations and requirements for new equipment to be installed; to incorporate regulations applicable to Major Sources of Hazardous Air Pollutants (HAPs); and to incorporate a Best Achievable Control Technology (BACT) for Volatile Organic Compounds (VOCs) emission units.

On June 22, 2015, the KDHE received a Prevention of Significant Deterioration Air Construction Permit Application from ABBK for the installation of a temporary natural gas-fired rental boiler. The purpose and scope of this permit is to append the May 27, 2014 permit to include the use of a temporary natural gas-fired rental boiler. ABBK has determined that a 96.6 MMBtu/hr boiler will be required to support the 500 MMBtu/hr biomass-fired stoker boiler (EP-20001) until a permanent 99 MMBtu/hr natural gas-fired temporary rental boiler, is permitted and built, which will be permitted through a separate modification of the May 27, 2014 permit.

The rental boiler is proposed to be installed as a temporary unit. As a temporary unit, when operated as indicated in 40 CFR 60.40c and as defined in 40 CFR 60.41c, Definitions: *Temporary Boiler*, and/or as indicated by 40 CFR 63.7491(j), and as defined in 40 CFR 63.7575, *What definitions apply to this subpart?*: *Temporary Boiler*, the unit would fall under exemptions from the requirements of either 40 CFR 60, Subpart Dc, *Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units* and/or 40 CFR Part 63 Subpart DDDDD, *National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial and Institutional Boilers and Process Heaters.* This permit contains specific limitations which would come into effect should the rental boiler be used in a manner which no longer meets the definition of *Temporary Boiler* contained in one or both regulations.

A BACT determination was conducted as a part of this appended permit application process.

## III. Significant Applicable Air Emission Regulations

This proposed source will be 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:

The project is subject to KDHE rules relating to air pollution control. The following significant air quality requirements were determined to be applicable to this source:

A. K.A.R. 28-19-11 Exceptions Due to Breakdown or Scheduled Maintenance – as applied to State regulations K.A.R. 28-19-650

B. KAR 28-19-300, Construction Permits and Approvals; Applicability

C. K.A.R. 28-19-302(a), Construction permits and approvals; additional provisions; construction permits.

D. K.A.R. 28-19-350, Prevention of significant deterioration of air quality which adopts by reference 40 CFR 52.21, Prevention of Significant Deterioration (PSD)

E. K.A.R. 28-19-30 through K.A.R. 28-19-32, Indirect Heating Equipment Emissions

F. K.A.R. 28-19-720, New Source Performance Standards, adopting by reference the following:

1. 40 CFR Part 60 Subpart A, *Standards of Performance for New Stationary Sources – General Provisions*

2. 40 CFR Part 60 Subpart Dc, *Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units.*

G. K.A.R. 28-19-750, Hazardous Air Pollutants, Maximum Achievable Control Technology, which adopts by reference, the following:

40 CFR Part 63, Subpart A, *National Emission Standards for Hazardous Air Pollutants for Source Categories – General Provisions.*

H. 40 CFR Part 63 Subpart DDDDD, *National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial and Institutional Boilers and Process Heaters*

## IV. Air Emissions From the Project

**Table 1. Estimated Operating Emissions**

| | Pollutant Potential to Emit Emissions[1] (tons per year) | | | |
|---|---|---|---|---|
| | Pre- May 27, 2014 Permit | Post-May 27, 2014 Permit | Emission Increase due to Temporary Rental Boiler Unrestricted[2] | Total Facility Emissions (May 27, 2014 Permit Plus Temporary Rental Boiler ) |
| Particulate Matter (PM) | > 250 | 138.8 | 2.10 | 140.9 |
| PM less than or equal to 10 microns ($PM_{10}$) | > 250 | 109.5 | 2.10 | 111.6 |
| PM less than or equal to 2.5 microns ($PM_{2.5}$) | > 250 | 76.5 | 0.53 | 77.03 |
| Oxides of Nitrogen ($NO_x$) | > 250 | 701.9 | 12.70 | 714.6 |
| Carbon Monoxide (CO) | > 250 | 594.0 | 6.39 | 600.39 |
| Sulfur Dioxide ($SO_2$) | > 250 | 504.4 | 0 | 504.4 |
| Volatile Organic Compounds (VOC) | > 250 | 47.9 | 0.09 | 47.99 |
| Lead (Pb) | 0.11 | 0.11 | 0.0002 | 0.11 |
| Sulfuric Acid ($H_2SO_4$) | 67.7 | 6.9 | 0 | 6.9 |
| Hydrogen Chloride (HCl) | 569.5 | 7.2 | 0 | 7.2 |
| Hydrogen Fluoride (HF) | 0.66 | 0.01 | 0 | 0.01 |
| Carbon Dioxide equivalents ($CO_2e$) | > 100,000 | 626,000 | 49,508 | 675,508 |
| Total HAPs | > 25 | 27.7 | 0.78 | 28.48 |

## V. Best Available Control Technology (BACT)

The BACT requirement applies to new affected emission unit and pollutant emitting activity. Individual BACT determinations are performed for each pollutant emitted from the same emission unit. Consequently, the BACT determination must separately address,

[1] Potential-to-emit means the maximum capacity of a stationary source to emit a pollutant under its physical and operational design. Any physical or operational limitation on the capacity of the source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design if the limitation or the effect it would have on emissions is federally enforceable.
[2] Emissions are based on Natcom (Manufacturer) emission factors and operations at 8,760 hours.

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. ABBK was required to prepare a BACT analysis for KDHE's review according to the process described in Attachment A of this permit summary. KDHE's evaluation of the BACT for ABBK is presented in Attachment B.

## VI. Ambient Air Impact Analysis

For the PSD permit that was issued May 27, 2014, the facility provided a dispersion modeling analysis for the project.

For the use of the temporary boiler, a dispersion modeling analysis was not required pursuant to 40 CFR Part 52.21, however, the owner or operator provided a modeling analysis to demonstrate that the use of the temporary boiler unit would not cause or contribute to a NAAQS exceedance. No change in this analysis is expected to occur as a result of the use of the temporary boiler.

## VII. Additional Impacts Analysis

For the PSD permit that was issued May 27, 2014, the facility provided an analysis of the impairment to visibility, and impacts on plants, soils and, vegetation that would occur as a result of the project and to what extent the emissions from the proposed modification impacts the general commercial, residential, industrial and other growth. No change in this analysis is expected to occur as a result of this proposed permit modification.

## VIII. Key Steps in the 'Top-Down' BACT Analysis

The four steps in the 'Top-Down' BACT Analysis are presented in Attachment A.

## IX. BACT Analysis for PSD Permit

A BACT analysis was submitted for the project. The project will include one (1) temporary rental boiler rated at 96.6 MMBtu/hr. Although the use of the rental boiler is proposed as temporary (less than 12 months), it has the potential to operate 8,760 hours per year and this will be considered for emission evaluation and BACT. The temporary rental boiler will fire natural gas only and will be utilized to produce steam when the biomass boiler (EP-20001) is unavailable and will not be operated after the installation and startup of a proposed 99 MMBtu/hr natural gas-fired boiler that will be permitted in a separate PSD permit modification of the existing PSD permit dated May 27, 2014.

A. $NO_x$ BACT Review

1. Identify Available Control Options

Control options were evaluated for natural gas-fired boilers/heaters of the similar size. The ranges of emission rates overlap and show no indication of consistency to differentiate one over another in performance and are summarized in **Table 2**

**Table 2 Summary of Feasible $NO_x$ Control Technologies.**

| $NO_x$ Technology | Emission Rates |
|---|---|
| Dry Low-$NO_x$ Burner (LNB) | 0.009 lb/MMBtu to 0.2 lb/MMBtu |
| Selective catalytic reduction (SCR) | 0.009 lb/MMBtu to 0.057 lb/MMBtu |

2. Eliminate Technically Infeasible Control Options

There are no control options that are technically infeasible to eliminate.

3. Rank Technically Feasible Options

The technically feasible $NO_x$ control technologies for the 96.6 MMBtu/hr temporary rental boiler are ranked by control effectiveness in **Table 3**.

**Table 3 Ranking of $NO_x$ Control Technologies**

| Control Technology | Reduction (%) | Controlled Emission Level (lb/MMBtu) |
|---|---|---|
| SCR | 90% | 0.057 |
| Dry LNB and Good Combustion Practices | Not applicable (baseline) | 0.030 |

a. Good combustion practices, also called combustion control, include operational and design elements to control the amount and distribution of excess air in the flue gas to ensure enough oxygen is present for complete combustion. **Good combustion practices is considered baseline for the temporary rental boiler and is technically feasible.**

b. Dry LNB technology reduces combustion temperatures, thereby reducing NOx. In a conventional combustor, the air and fuel are introduced at an approximately stoichiometric ratio, and air/fuel mixing occurs at the flame front where diffusion of fuel and air reaches the combustible limit. A lean premixed combustor design

premixes the fuel and air prior to combustion. Premixing produces a homogenous air/fuel mixture, which minimizes localized fuel-rich pockets that produce elevated combustion temperatures and higher NOx emissions. A lean air-to-fuel ratio approaching the lean flammability limit is maintained, and the excess air serves as a heat sink to lower combustion temperatures, which lowers NOx formation. A pilot flame is used to maintain combustion stability in this fuel-lean environment. **Dry low-$NO_x$ burners are available on temporary rental boilers and are considered both baseline and technically feasible for the temporary rental boiler.**

c. SCR systems are used to reduce $NO_x$ emissions as a post combustion control system and an SCR with removal efficiency for $NO_x$ of 90 percent has been identified for use on the size of the boiler to be used for the project. **SCR is available and considered technically feasible for the temporary rental boiler.**

4. Evaluate Technically Feasible Control Options

**Table 4** summarizes the evaluation of the feasible control technologies.

**Table 4 Summary of $NO_x$ Control Technologies**

| $NO_x$ Technology | Evaluation Status |
|---|---|
| Good combustion practices | Evaluated and Considered as Baseline |
| Dry Low-$NO_x$ Burner (LNB) | Evaluated and Considered as Baseline |
| Selective Catalytic Reduction (SCR) | Evaluated and Eliminated |

a. The capital costs associated with an SCR system for the temporary rental boiler were supplied in Table 1-4 and 1-5 of the BACT Analysis in the *Prevention of Significant Deterioration Air Quality Construction Permit Modification Application* dated June 22, 2015. The overall initial capital cost of installing an SCR system on the temporary rental boiler is approximately $380,000. The annualized costs associated with an SCR system are shown in Table 1-5 of the *Prevention of Significant Deterioration Air Quality Construction Permit Modification Application* dated June 22, 2015. On an annual basis, the SCR system would cost $269,472, which results in a cost per ton of $NO_x$ removed of $23,588, while removing only 11.4 tons of $NO_x$ per year.

Therefore, any control of $NO_x$ by add-on controls would result in costs that would not be economical. **An SCR is not proposed as BACT for the temporary rental boiler because it is not economically feasible.**

b. Dry low-$NO_x$ burners are technically feasible and can achieve an emission rate of 0.030 lb.MMBtu for $NO_x$. There are no significant incremental energy, environmental, or economic impacts associated with these controls.

5. Establish BACT

Dry low-$NO_x$ burners are selected as BACT for $NO_x$ from the temporary rental boiler at an emission rate of 0.030 lb/MMBtu.

B. CO BACT Review

1. Identify Available Control Options

The RBLC does not list add-on controls in the BACT determinations for control of CO emissions from boilers of similar size as the temporary rental boiler.

Good combustion control is considered baseline for the natural gas-fired unit, which will help control emissions of CO from the temporary rental boiler.

Independent research indicates one control device vendor could install a CO catalyst system on a temporary rental boiler of this size. Therefore, an oxidation catalyst system as add on control for CO was evaluated.

2. Eliminate Technically Infeasible Control Options

Of the control device identified, it is not technically infeasible to eliminate.

3. Rank and Evaluate Technically Feasible Options

Only one control technology is evaluated for the control of CO emissions. Good combustion practice is considered to be baseline for the boiler.

**Table 5 Ranking of CO Control Technologies**

| Control Technology | Reduction (%) | Controlled Emission Level (lb/MMBtu) |
|---|---|---|
| Oxidation Catalyst | 80 % | 0.003 |

| Control Technology | Reduction (%) | Controlled Emission Level (lb/MMBtu) |
|---|---|---|
| Good combustion practices | Not applicable (baseline) | 0.015 |

The CO catalyst system is an add-on control that converts CO and VOC to carbon dioxide (CO2) by use of a catalyst.

Although greater CO emission control can be obtained with the use of an oxidation catalyst, the control cost analysis performed indicates its use would be considered economically infeasible.

The control cost for an oxidation catalyst system for the temporary rental boiler is displayed in Tables 1-6 and 1-7 in the *Prevention of Significant Deterioration Air Quality Construction Permit Modification Application* dated June 22, 2015. An oxidation catalyst system for this size boiler would require an initial capital cost of $50,000. The annual costs of operating this CO catalyst system would be $52,467. On an annual basis, only 5.11 tons per year of CO along with 0.04 tons per year of VOC would be removed at a cost of $10,185 per ton of pollutants removed. **Therefore, an oxidation catalyst for control of CO emissions from the temporary rental boiler is not considered BACT.**

4. Establish BACT

Combustion control was selected as BACT for CO from the temporary rental boiler at an emission rate of 0.015 lb/MMBtu.

C. $SO_2$ BACT Review

1. Identify Available Control Options

The RBLC does not list add-on controls in the BACT determinations for control of $SO_2$ emissions from boilers of similar size as the temporary rental boiler.

Good combustion control and low sulfur fuel are considered baseline for the natural gas-fired unit, which will help control emissions of $SO_2$ from the temporary rental boiler.

2. Eliminate Technically Infeasible Control Options

Add-on controls identified for larger units than the temporary rental boiler would be technically infeasible for this size of boiler.

3. Rank and Evaluate Technically Feasible Control Options

The only technically feasible control option is combustion control for $SO_2$.

4. Establish BACT

Combustion control was selected as BACT for SO2 from the temporary rental boiler at an emission rate of 0.0006 lb/MMBtu.

D. VOC BACT Review

1. Identify Available Control Options

The RBLC does not list add-on controls in the BACT determinations for control of VOC emissions from the temporary rental boiler. Good combustion control will help control emissions of VOC from the temporary rental boiler.

2. Eliminate Technically Infeasible Control Options

There are no control options that are technically infeasible to eliminate.

3. Evaluate Technically Feasible Control Options

Good combustion practices include operational and design elements to control the amount and distribution of excess air in the flue gas to ensure enough oxygen is present for complete combustion.

Good combustion practices are a technically feasible method of controlling VOC emissions from the proposed temporary rental boiler.

4. Rank Technically Feasible Options

The only technically feasible control option is combustion control for VOC.

5. Establish BACT

Good combustion practices were selected as BACT for VOC from the temporary rental boiler at an emission rate of 0.00019 lb/MMBtu.

E. $PM/PM_{10}/PM_{2.5}$ BACT Review

1. Identify Available Control Options

The RBLC does not list any control strategies other than good combustion practices and low ash fuel (natural gas). No add-on controls were identified for significant removal of $PM/PM_{10}/PM_{2.5}$ from the temporary rental boiler exhaust.

2. Eliminate Technically Infeasible Control Options

There are no add-on control options identified as technically feasible.

3. Evaluate Technically Feasible Control Options

The only technically feasible control option is combustion control for $PM/PM_{10}/PM_{2.5}$.

4. Rank Technically Feasible Options Establish BACT

Since add-on controls are not feasible on such a small gas-fired unit, combustion control was selected as BACT for $PM/PM_{10}/PM_{2.5}$ from the temporary rental boiler at an emission rate of 0.010 lb/MMBtu.

F. GHG BACT Review

1. Identify Available Control Options

Good combustion practices, good engineering practices and use of clean fuels (natural gas) were identified as control options. No add-on controls were identified for removal of GHG from the temporary rental boiler exhaust.

2. Eliminate Technically Infeasible Control Options

There are no add-on control options identified as technically feasible.

3. Evaluate Technically Feasible Control Options

The only technically feasible control option for GHG are operational controls, as follows:

a. Use clean fuels (exclusive use of natural gas).

b. Maintain the unit according to the manufacturer's specifications and to operate the unit in the most efficient manner possible (i.e., good combustion practices).

c. Tune the unit according to the manufacturer's specifications.

4. Rank Technically Feasible Options and Establish BACT

Since add-on controls are not feasible on such a small gas-fired unit, all three operational controls will be employed as BACT. BACT for GHG from the temporary rental boiler at an emission rate of 49,508 tons CO2e/yr.

**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 THE PROPOSED BACT SUBMITTED BY ABBK FOR A 96.6 MMBTU/HR NATURAL GAS-FIRED TEMPORARY BOILER**

## PROPOSED BACT OPTIONS

KDHE reviewed the BACT analysis provided by ABBK to determine the appropriate control of emissions from the proposed addition of the 96.6 MMBtu/hr temporary rental boiler.

The following represents the KDHE's evaluation of the proposed BACT submitted by ABBK supported by a summary of the analysis done for each control option. Please refer to the *Abengoa Bioenergy Biomass of Kansas, LLC Prevention of Significant Deterioration Air Quality Construction Permit Application Update* dated June 22, 2015 for a more thorough evaluation of possible BACT.

## I. BACT Analysis for $NO_x$, CO, VOC, $SO_2$ and $PM/PM_{10}/PM_{2.5}$

The project will include one (1) temporary rental boiler rated at 96.6 MMBtu/hr. Although the use of the rental boiler is proposed as temporary (less than 12 months), it has the potential to operate 8,760 hours per year. The temporary rental boiler will fire natural gas only and will be utilized to produce steam when the biomass boiler (EP-20001) is unavailable and will not be operated after the installation and startup of a proposed 99 MMBtu/hr natural gas-fired boiler that will be permitted in a separate PSD permit modification of the existing PSD permit dated May 27, 2014.

### A. $NO_x$ BACT Review

#### 1. Identify Available Control Options

Control options were evaluated for natural gas-fired boilers/heaters of the similar size. The ranges of emission rates overlap and show no indication of consistency to differentiate one over another in performance and are summarized in **Table B-1**

**Table B-1 Summary of Feasible $NO_x$ Control Technologies.**

| $NO_x$ Technology | Emission Rates |
|---|---|
| Dry Low-$NO_x$ Burner (LNB) | 0.009 lb/MMBtu to 0.2 lb/MMBtu |

| $NO_x$ Technology | Emission Rates |
|---|---|
| Selective catalytic reduction (SCR) | 0.009 lb/MMBtu to 0.057 lb/MMBtu |

2. Eliminate Technically Infeasible Control Options

The control options presented are technically feasible to include in the further BACT analysis.

3. Rank Technically Feasible Options

The technically feasible $NO_x$ control technologies for the 96.6 MMBtu/hr temporary rental boiler are ranked by control effectiveness in **Table B-2**.

**Table B-2 Ranking of $NO_x$ Control Technologies**

| Control Technology | Reduction (%) | Controlled Emission Level (lb/MMBtu) |
|---|---|---|
| SCR | 90% | 0.057 |
| Dry LNB and Good Combustion Practices | Not applicable (baseline) | 0.030 |

a. KDHE concurs that good combustion practices is considered baseline for the temporary rental boiler and is technically feasible.

b. KDHE concurs that dry low-$NO_x$ burners are available on temporary rental boilers and are considered both baseline and technically feasible for the temporary rental boiler.

c. KDHE concurs that SCR is available and considered technically feasible for the temporary rental boiler.

4. Evaluate Technically Feasible Control Options

**Table B-3** summarizes the evaluation of the feasible control technologies.

**Table B-3 Summary of $NO_x$ Control Technologies**

| $NO_x$ Technology | Evaluation Status |
|---|---|
| Good combustion practices | Evaluated and Considered |

| $NO_x$ Technology | Evaluation Status |
|---|---|
| | as Baseline |
| Dry Low-$NO_x$ Burner (LNB) | Evaluated and Considered as Baseline |
| Selective Catalytic Reduction (SCR) | Evaluated and Eliminated |

a. The capital costs associated with an SCR system for the temporary rental boiler were supplied in Table 1-4 and 1-5 of the BACT Analysis in the *Prevention of Significant Deterioration Air Quality Construction Permit Modification Application* dated June 22, 2015. The overall initial capital cost of installing an SCR system on the temporary rental boiler is approximately $380,000. The annualized costs associated with an SCR system are shown in Table 1-5 of the *Prevention of Significant Deterioration Air Quality Construction Permit Modification Application* dated June 22, 2015. On an annual basis, the SCR system would cost $269,472, which results in a cost per ton of $NO_x$ removed of $23,588, while removing only 11.4 tons of $NO_x$ per year. Therefore, any control of $NO_x$ by add-on controls would result in costs that would not be economical.

**KDHE concurs that an SCR is not economically feasible and therefore can be eliminated from further BACT consideration.**

b. KDHE concurs that dry low-$NO_x$ burners are technically feasible for the project and that there are no significant incremental energy, environmental, or economic impacts associated with this control technology.

5. Establish BACT

Dry low-$NO_x$ burners are selected as BACT for $NO_x$ from the temporary rental boiler at an emission rate of 0.030 lb/MMBtu.

B. CO BACT Review

1. Identify Available Control Options

Add-on controls in the BACT determinations for control of CO emissions from boilers of similar size as the temporary rental boiler were not identified in the RBLC.

The owner or operator indicated that their research indicates one control device vendor could install a CO catalyst system on a temporary rental boiler of this size. Therefore, an oxidation catalyst system as add on control for CO was evaluated.

2. Eliminate Technically Infeasible Control Options

No controls were identified as technically infeasible.

3. Rank and Evaluate Technically Feasible Options

Only one control technology was evaluated for the control of CO emissions. Good combustion practice is considered to be baseline for the boiler.

**Table B-4 Ranking of CO Control Technologies**

| Control Technology | Reduction (%) | Controlled Emission Level (lb/MMBtu) |
|---|---|---|
| Oxidation Catalyst | 80 % | 0.003 |
| Good combustion practices | Not applicable (baseline) | 0.015 |

The control cost for an oxidation catalyst system for the temporary rental boiler is displayed in Tables 1-6 and 1-7 in the *Prevention of Significant Deterioration Air Quality Construction Permit Modification Application* dated June 22, 2015. An oxidation catalyst system for this size boiler would require an initial capital cost of $50,000. The annual costs of operating this CO catalyst system would be $52,467. On an annual basis, only 5.11 tons per year of CO along with 0.04 tons per year of VOC would be removed at a cost of $10,185 per ton of pollutants removed.

**KDHE concurs that an oxidation catalyst for control of CO emissions from the temporary rental boiler is not economically feasible and can be removed from further BACT consideration.**

4. Establish BACT

Combustion control was selected as BACT for CO from the temporary rental boiler at an emission rate of 0.015 lb/MMBtu.

C. $SO_2$ BACT Review

1. Identify Available Control Options

Add-on controls in the RBLC were not found for control of $SO_2$ emissions from boilers of similar size as the temporary rental boiler.

Good combustion control and low sulfur fuel are considered baseline for the natural gas-fired unit, which will help control emissions of $SO_2$ from the temporary rental boiler.

2. Eliminate Technically Infeasible Control Options

Add-on controls identified for larger units than the temporary rental boiler would be technically infeasible for this size of boiler.

3. Rank and Evaluate Technically Feasible Control Options

KDHE concurs that the only technically feasible control option is combustion control for $SO_2$.

4. Establish BACT

Good combustion practice/combustion control was selected as BACT for $SO_2$ from the temporary rental boiler at an emission rate of 0.0006 lb/MMBtu.

D. VOC BACT Review

1. Identify Available Control Options

The oxidation catalyst would have had a secondary benefit of controlling VOC as a control for CO, but it was eliminated based on cost feasibility.

The RBLC did not list add-on controls for control of VOC emissions from boilers of similar size to the temporary rental boiler.

Good combustion control will help control emissions of VOC from the temporary rental boiler.

2. Eliminate Technically Infeasible Control Options

There are no control options to evaluate and eliminate.

3. Evaluate Technically Feasible Control Options

Good combustion practices are the only technically feasible method of controlling VOC emissions from the proposed temporary rental boiler.

4. Rank Technically Feasible Options

**KDHE concurs that the only technically feasible control option is combustion control for VOC.**

5. Establish BACT

Good combustion practices were selected as BACT for VOC from the temporary rental boiler at an emission rate of 0.00019 lb/MMBtu.

E. $PM/PM_{10}/PM_{2.5}$ BACT Review

1. Identify Available Control Options

The RBLC does not list any control strategies other than good combustion practices and low ash fuel (natural gas). No add-on controls were identified for significant removal of $PM/PM_{10}/PM_{2.5}$ from the temporary rental boiler exhaust.

2. Eliminate Technically Infeasible Control Options

There were no add-on control options identified as technically feasible.

3. Evaluate Technically Feasible Control Options

The only technically feasible control option is combustion control for $PM/PM_{10}/PM_{2.5}$.

4. Rank Technically Feasible Options Establish BACT

**KDHE concurs that add-on controls are not feasible on such a small gas-fired unit and combustion control is the only feasible BACT option.**

5. Establish BACT

Combustion control was selected as BACT for $PM/PM_{10}/PM_{2.5}$ from the temporary rental boiler at an emission rate of 0.010 lb/MMBtu.

F. GHG BACT Review

1. Identify Available Control Options

Good combustion practices, good engineering practices and use of clean fuels (natural gas) were identified as control options. No add-on controls were identified for removal of GHG from the temporary rental boiler exhaust.

2. Eliminate Technically Infeasible Control Options

There were no add-on control options identified as technically feasible.

3. Evaluate Technically Feasible Control Options

Technically feasible control options for GHG are operational controls, as follows:

a. Use clean fuels (exclusive use of natural gas).

b. Maintain the unit according to the manufacturer's specifications and to operate the unit in the most efficient manner possible (i.e., good combustion practices).

c. Tune the unit according to the manufacturer's specifications.

4. Rank Technically Feasible Options and Establish BACT

**KDHE concurs that add-on controls are not feasible on such a small temporary gas-fired unit.**

5. Establish BACT

Operational controls, including use clean fuels (exclusive use of natural gas); maintaining the unit according to the manufacturer's specifications and to operate the unit in the most efficient manner possible (i.e., good combustion practices); and tuning the unit according to the manufacturer's specifications will be employed as BACT for GHG from the temporary rental boiler at an emission rate of 49,508 tons $CO_2e$/yr.