Source ID No. 1770030

C-10309

LARRY

Westar Energy.

RECEIVED
SEP 17 2012
BUREAU OF AIR

September 17, 2012

Mr. Gerald McIntyre
Bureau of Air & Radiation
Kansas Department of Health & Environment
1000 SW Jackson, Suite 310
Topeka, Kansas 66612

**RE: Westar Energy, Inc. Tecumseh Energy Center Unit 8/10 – $NO_x$ Reduction Project Air Permit Application**

Dear Mr. McIntyre:

Westar Energy, Inc. (Westar) is submitting this air quality permit application for modifications to the existing burner and combustion system on Unit 8/10 at the Tecumseh Energy Center, located in Tecumseh, Kansas. The proposed project will result in decreases of $NO_x$ and $CO_2$ emissions, and an increase of CO emissions.

One copy of the air permit application is attached to this letter. In addition, a copy of the proposed draft permit and modeling files are included on CD for your use. A check in the amount of $4,850 is included as required by Kansas Administrative Rules (K.A.R. 28-19-304(b)).

If you have any questions regarding this submittal, please do not hesitate to contact me at (785) 575-1614, or via email at Dan.Wilkus@westarenergy.com.

Sincerely,
WESTAR ENERGY, INC.

Daniel R. Wilkus, P.E.
Director, Air Programs

By endorsement of this check payee acknowledges payment in full for all items listed on the attached remittance advice

Westar Energy

818 Kansas . .enue
Topeka, KS 66612

Wachovia Bank, N.A.
Chapel Hill, NC

66-156/531

CHECK NUMBER
000204805

201
184940116

DATE 08/23/12

PAY THIS AMOUNT ********4,850.00

PAY

Four thousand eight hundred fifty and 00/100 dollars

PAY TO KANSAS DEPT OF HEALTH & ENVIRONMENT
BUR OF AIR & RADIATION TECH SVC

1000 SW JACKSON SUITE 310
TOPEKA, KS 66612-0000

Westar Energy, Inc.

BY [signature]

Treasurer

Accounts Payable

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Westar Energy

| VENDOR NUMBER | BANK NUMBER | CHECK DATE | CHECK NUMBER |
|---|---|---|---|
| 184940116 | 201 | 08/23/12 | 000204805 |

| INVOICE DATE | INVOICE/CREDIT MEMO | AMOUNT | DISCOUNT | NET |
|---|---|---|---|---|
| 08/17/12 | RFP081712 | 4,850.00 | 0.00 | 4,850.00 |
| PERMIT FOR 8/10 LONOX BURNER WO 1200025-02 PROJECT 017067 | | | | |

RECEIVED
SEP 17 2012
BUREAU OF AIR

REORDER 900 - U.S. PATENT NO. 5538290, 5575508, 5641183, 5785353, 5984364, 6030000

CHECK AMOUNT 4,850.00

# INTRODUCTION

Westar Energy, Inc. (Westar) is proposing to undertake an environmentally beneficial project to reduce nitrogen oxide ($NO_X$) emissions at the Tecumseh Energy Center (TEC) located in Tecumseh, Kansas. The project will consist of an upgrade to the existing burner and combustion system on Unit 8/10 (TEC8/10). The facility, which is a major stationary source under the Prevention of Significant Deterioration (PSD) regulations, consists of two pulverized coal-fired boilers. The goal of the project is to further reduce TEC8/10 $NO_X$ emissions, with final achievable $NO_X$ levels dependent on the effectiveness of tuning the upgraded equipment. As is typical with $NO_X$ reduction projects through combustion controls, a balance must be struck between lowering $NO_X$ and increasing carbon monoxide (CO). As a result of this $NO_X$ reduction project, the annual carbon monoxide emissions increase may be above the PSD significance levels. Therefore, the PSD review process for a major modification to an existing major PSD source must be followed for CO emissions. Westar is applying for a permit to upgrade its existing burner and combustion system, pursuant to Kansas Administrative Regulation (K.A.R.) 28-19-300. This application demonstrates that the requested CO level represents the use of Best Available Control Technology (BACT) and that the associated CO emissions will not have a significant impact on ambient air quality.

The Kansas Department of Health and Environment (KDHE) Notification of Construction or Modification form can be found in Appendix A. Emission calculations are presented in Appendix B. Potential emissions associated with the low $NO_X$ project are shown in *Figure 1.1 - Summary of Emissions Changes and PSD Significant Emissions Rates* along with the threshold levels for PSD.

# SECTION 1

# INTRODUCTION

Source ID NO. 1770030
C-10309 Larry

# TABLE OF CONTENTS

# TABLE OF CONTENTS

**Figure 1.1 - Summary of Emissions Changes and PSD Significant Emissions Rates**

| Criteria Pollutant | Baseline Actual Emissions (tpy) | Future Projected Actual Emissions (tpy) | Emission Change (tpy) | PSD SER (tpy) | Major Modification? (Yes/No) |
|---|---|---|---|---|---|
| CO | 152 | 1,929 | 1,777 | 100 | Yes |
| $NO_X$ | 1,838 | 868 | -970 | 40 | No |
| $CO_2$ | 1,122,872 | 1,120,080 | -2,792 | 75,000 | No |

CO is the only pollutant subject to a BACT determination for this project. BACT for CO was determined to be good combustion practices. The associated BACT emission limit has been determined to be 0.4 lb/MMBtu on a 30-day rolling average. This BACT analysis can be found in Appendix C.

An air quality analysis was performed for the new, TEC8/10 CO emission rate. AERSCREEN was the model used for the analysis. The modeling results show that the CO impacts are well below the CO significant impact level (SIL). As such, it has been determined that the project will not have a significant impact on the ambient air surrounding the TEC. This air quality analysis can be found in Appendix D.

A proposed draft KDHE permit can be found in Appendix E.

# SECTION 2

# PROJECT DESCRIPTION

# PROJECT DESCRIPTION

TEC is an existing coal-fired, electric-generating station located in Tecumseh, Kansas. TEC is located in Shawnee County which is currently designated as an attainment/unclassified area for all criteria pollutants in 40 CFR, Part 81.

Westar proposes to upgrade and further enhance the existing TEC8/10 burner and combustion system in order to achieve additional $NO_X$ reduction. The burner system modifications include installation of new low $NO_X$ burners (LNBs), windbox air actuators, windbox dampers, coal feeders, coal piping and coal piping supports to lower $NO_X$ emissions. Westar also proposes the installation of separated overfire air (SOFA) ducting, dampers, and air tips. Additionally, new oxygen probes will be installed. This proposed modification work will henceforth be titled the "Project."

The formation of $NO_X$ during the combustion of fossil fuels is a result of the oxidation of either nitrogen in the combustion air or nitrogen in the fuel. The former is referred to as thermal $NO_X$, while the latter is typically called fuel $NO_X$. During the combustion of coal, a majority of the $NO_X$ formed is fuel $NO_X$. Fuel $NO_X$ is very difficult to prevent as it is not possible to remove nitrogen from the fuel before combustion.

There are two overall approaches to reduce the $NO_X$ emissions from a boiler, pre-combustion control and post-combustion reduction. Pre-combustion control reduces $NO_X$ by preventing its formation by manipulating how combustion is carried out. Post-combustion reduction reduces the $NO_X$ formed in the furnace by the addition of a reagent that reacts chemically with the $NO_X$.

LNBs reduce $NO_X$ by lowering the peak flame temperature and limiting the amount of oxygen available at the burner front. LNBs tend to spread the flame out and elongate combustion. Oxygen is required for the formation of $NO_X$; LNBs limit the availability of oxygen and the $NO_X$ produced is reduced. Lower oxygen levels in the combustion zone create a fuel rich zone that promotes the formation of CO which is undesirable.

# EMISSIONS CALCULATIONS

TEC is considered to be a major source with respect to PSD regulations, as the potential emissions of at least one criteria pollutant exceeds the major source threshold of 100 tons per year (tpy). Major modifications at existing major stationary sources occur when the emissions increase resulting from a project exceed the PSD significant emission rates (SER). This determination is made on a pollutant-by-pollutant basis. The calculation of the annual emissions change associated with the project follows the "actual-to-projected-actual" applicability test outlined in the PSD regulations [40 CFR 52.21(a)(2)(iv)(c)] for existing PSD major stationary sources. Thus, the baseline and projected actual emissions associated with the proposed Project were calculated. Details of the Project emission calculations are presented in Appendix B.

The following PSD pollutants were evaluated: $NO_x$, CO, and $CO_2$. As summarized in *Figure 3.1 - Project Emissions*, the calculated Project emissions increase for CO is greater than the PSD SER. Thus, the Project is a major PSD modification for CO emissions. The Project will result in a decrease in $NO_x$ and $CO_2$ emissions.

**Figure 3.1 - Project Emissions**

| Criteria Pollutant | Baseline Actual Emissions (tpy) | Future Projected Actual Emissions (tpy) | Emission Change (tpy) | PSD SER (tpy) | Major Modification? (Yes/No) |
|---|---|---|---|---|---|
| CO | 152 | 1,929 | 1,777 | 100 | Yes |
| $NO_x$ | 1,838 | 868 | -970 | 40 | No |
| $CO_2$ | 1,122,872 | 1,120,080 | -2,792 | 75,000 | No |

According to 40 CFR 52.21(a)(2)(iv)(c), an emissions increase is determined as the sum of the difference between the projected actual emissions and the baseline emissions. "Baseline actual emissions" is defined in 40 CFR 52.21(b)(i) as the actual emissions during any consecutive 24-month period selected by the Owner during the five-year period prior to start of project construction. A different 24-month period may be selected for each regulated pollutant assessed. The spreadsheet in Appendix B has the historical total monthly emissions from TEC8/10 for CO, $CO_2$, and $NO_X$. The monthly emissions are based on the actual values measured by the continuous emission monitoring (CEM) system on TEC8/10 for $CO_2$ and $NO_X$. The historical CO emissions are those reported to KDHE annually and are based on an AP-42 emission factor.

Projected actual emissions for TEC8/10 are calculated as the product of the future (post-project) emission factors (lb/MMBtu) and projected annual heat input (MMBtu/yr). The post project CO emission factor assumed for this emission change analysis is 0.4 lb/MMBtu. As discussed in Appendix C, this emission level represents the application of BACT for this modification.

# SECTION 4

# REGULATORY REVIEW

# REGULATORY REVIEW

The Project is potentially subject to various Federal and State air regulations. A regulatory review was performed to determine specific applicability of the various regulations. A summary of the review is provided below.

## 4.1 PSD REGULATIONS

TEC is considered to be a major source with respect to PSD regulations as the potential emissions of at least one criteria pollutant exceeds the major source threshold of 100 tpy. Kansas has adopted the Federal PSD regulations (40 CFR 52.21) as in effect July 1, 2007 (K.A.R. 28-19-350). The total new emissions of CO associated with the Project will be above the PSD significance levels; therefore, a PSD major modification permit is required.

**Figure 4.1 - Summary of Project Emissions and PSD SER**

| Criteria Pollutant | Baseline Actual Emissions (tpy) | Future Projected Actual Emissions (tpy) | Emission Change (tpy) | PSD SER (tpy) | Major Modification? (Yes/No) |
|---|---|---|---|---|---|
| CO | 152 | 1,929 | 1,777 | 100 | Yes |
| $NO_X$ | 1,838 | 868 | -970 | 40 | No |
| $CO_2$ | 1,122,872 | 1,120,080 | -2,792 | 75,000 | No |

## 4.2 NSPS SUBPART Da - ELECTRIC UTILITY STEAM GENERATING UNITS

TEC8/10 is considered an electric utility steam generating unit, but is not currently subject to New Source Performance Standards (NSPS) regulations (40 CFR 60, Subpart Da). Kansas has adopted the Federal NSPS regulations as in effect July 1, 2008 (K.A.R. 28-19-720). The NSPS, Subpart Da applies to each electric utility steam generating unit with the following characteristics:

1. Capable of combusting more than 250 MMBtu/hr heat input of fossil fuel.

2. Construction, modification, or reconstruction commenced after September 18, 1978.

The definition of modification provided in 40 CFR 60.2 is:

> Any physical change in, or change in the method of operation of, an existing facility which increases the amount of any air pollutant (to which a standard applies) emitted into the atmosphere by that facility or which results in the emissions of any air pollutant (to which a standard applies) into the atmosphere not previously emitted.

As discussed in Section 3 - Emissions Calculations, the only pollutant that experiences an increase in emissions is CO. However, 40 CFR 60, Subpart Da does not include a standard for CO emissions; therefore, the Project is not considered a modification under NSPS.

## 4.3 KANSAS AIR REGULATIONS

Several State regulations have been identified as potentially applicable to the Project. A review of each potentially applicable regulation is provided below.

### 4.3.1 K.A.R. 28-19-300 - Construction Permits and Approvals; Applicability

This regulation requires that anyone who proposes to construct or modify a stationary source or emissions unit shall obtain a construction permit prior to commencing such operations. Westar is applying for a construction permit pursuant to K.A.R. 28-19-300(a)(1) as the increase in CO emissions exceeds 100 tpy.

### 4.3.2 K.A.R. 28-19-513 - Class I Operating Permits; Permit Amendment, Modification or Re-Opening and Changes Not Requiring a Permit Action

This regulation outlines the requirements for amending the Class I Operating Permit resulting from changes at the facility. K.A.R. 28-19-513(d) is the provision for Title V revisions that require significant permit modifications. This Project will require a significant modification to the Title V permit as the Project does not qualify for an administrative amendment, off-permit modification, or a minor permit modification.

# APPENDICES

# APPENDIX A

## KDHE NOTIFICATION OF CONSTRUCTION OR MODIFICATION FORM

# Kansas Department of Health and Environment
## Bureau of Air and Radiation
## Phone (785) 296-1570 Fax (785) 291-3953

# Notification of Construction or Modification

**(K.A.R. 28-19-300 Construction permits and approvals; applicability)**

**Check one: ☒ Applying for a Permit under K.A.R. 28-19-300(a) Applying for an Approval under K.A.R. 28-19-300(b)***

1) Source ID Number: 1770030 C - 10309

Larry

2) Mailing Information:
   Company Name: Westar Energy, Inc.
   Address: 818 Kansas Avenue, P.O. Box 889
   City, State, Zip: Topeka, Kansas 66601

3) Source Location: Westar Energy, Inc.
   Street Address: 2nd and Dupont Road
   City, County, State, Zip: Tecumseh, Kansas 66542
   Section, Township, Range:
   Latitude & Longitude Coordinates:

4) NAICSC/SIC Code (Primary): NAICS: 221112, SIC: 4911

5) Primary Product Produced at the Source: Electrical Generation

6) Would this modification require a change in the current operating permit for your facility? ☒ Yes No

   If no, please explain:

7) Is a permit fee being submitted? : ☒ Yes No
   If yes, please include the facility=s federal employee identification number (FEIN #)

8) Person to Contact at the Site: Mr. Stone Junod Phone: (785) -379-4310
   Title: Environmental Analyst

9) Person to Contact Concerning Permit: Mr. Daniel R. Wilkus, P.E. Phone: (785) 575-1614

   Title: Director, Air Programs

   Email: Dan.Wilkus@westarenergy.com Fax: (785) 575-8039

Please read before signing:

Reporting forms provided may not adequately describe some processes. Modify the forms if necessary. Include a written description of the activity being proposed, a description of where the air emissions are generated and exhausted and how they are controlled. A simple diagram showing the proposed activity addressed in this notification which produces air pollutants at the facility (process flow diagrams, plot plan, etc.) with emission points labeled must be submitted with reporting forms. Information that, if made public, would divulge methods or processes entitled to protection as trade secrets may be held confidential. See the reverse side of this page for the procedure to request information be held confidential. A copy of the Kansas Air Quality Statutes and Regulations will be provided upon request.

Name and Title : Daniel R. Wilkus, P.E. – Director, Air Programs

Address: 818 South Kansas Avenue, Topeka, KS 66601

Signature: [signature] Date: 9/17/2012 Phone: ( 785 ) 575-1614

* If you do not know whether to apply for a permit or an approval, follow approval application procedures.

March 15, 2006
Revision 6

# CALCULATING THE CONSTRUCTION PERMIT APPLICATION FEE

[These requirements are found at K.A.R. 28-19-304(b).]

Calculate the construction permit application fee as follows:

| | |
|---|---|
| Estimated capital cost of the proposed activity for which the application is made, including the total cost of equipment and services to be capitalized. | **Line 1** $ 6,700,000 |
| Multiply by .05% (.0005) | **x** .0005 |
| Total | **Line 2** $ 3,350 |
| **If Line 2 is less than $100, enter $100 on Line 3.**<br>If Line 2 is greater than $4,000, enter $4,000 on Line 3. | |
| Otherwise, copy Line 2 to Line 3. | |
| **Construction permit application fee.**<br>*After adding $1,500 for PSD review. | **Line 3** $ 4,850* Minimum fee is $100 |

Daniel R. Wilkus
(Print)

Certifier of Capital Cost [signature] 9-17-2012
(Signature) Date

K.A.R. 28-19-350 is a complex regulation pertaining to prevention of significant deterioration (PSD). An additional fee of $1,500 will be required if a PSD review is necessary. If you believe the proposed activity in this Notification of Construction or Modification will be subject to the requirements of K.A.R. 28-19-350, contact the Department for further evaluation.

For purposes of construction permit or approval applications, the following are not considered modifications:

1. Routine maintenance or parts replacement.
2. An increase or decrease in operating hours or production rates if:
   a. production rate increases do not exceed the originally approved design capacity of the stationary source or emissions unit; and
   b. the increased potential-to-emit resulting from the change in operating hours or production rates do not exceed any emission or operating limitations imposed as a permit condition.

# APPENDIX B

# PROJECT EMISSIONS CALCULATIONS

**Input Data (TEC8/10)**

| | CO | NOx | CO2 |
|---|---|---|---|
| 2007 Emissions (tons/year) | 149 | 1,839 | 1,074,901 |
| 2008 Emissions (tons/year) | 152 | 1,780 | 1,144,680 |
| 2009 Emissions (tons/year) | 140 | 1,744 | 1,072,138 |
| 2010 Emissions (tons/year) | 123 | 1,442 | 889,162 |
| 2011 Emissions (tons/year) | 106 | 1,414 | 786,786 |

**"Fuel By Month" Spreadsheet Input Data (TEC 8/10)**

| | Coal Heat Input (Million Btus) | Natural Gas Heat Input (Million Btus) |
|---|---|---|
| 2007 Jan | 774,311 | 3,779 |
| 2007 Feb | 935,697 | 3,897 |
| 2007 Mar | 984,645 | 2,898 |
| 2007 Apr | 859,036 | 3,375 |
| 2007 May | 982,023 | 3,458 |
| 2007 Jun | 840,183 | 2,444 |
| 2007 Jul | 984,521 | 2,095 |
| 2007 Aug | 975,992 | 4,106 |
| 2007 Sep | 901,622 | 3,792 |
| 2007 Oct | 873,885 | 6,430 |
| 2007 Nov | 432,937 | 3,892 |
| 2007 Dec | 974,706 | 2,457 |
| **2007 TOTAL** | **10,519,558** | **42,623** |
| 2008 Jan | 1,017,081 | 2,727 |
| 2008 Feb | 890,270 | 4,467 |
| 2008 Mar | 952,084 | 4,715 |
| 2008 Apr | 965,145 | 2,687 |
| 2008 May | 925,937 | 2,284 |
| 2008 Jun | 915,640 | 3,199 |
| 2008 Jul | 958,648 | 2,282 |
| 2008 Aug | 928,438 | 3,673 |
| 2008 Sep | 859,407 | 3,087 |
| 2008 Oct | 821,195 | 3,969 |
| 2008 Nov | 704,668 | 8,223 |
| 2008 Dec | 882,488 | 3,386 |
| **2008 TOTAL** | **10,821,001** | **44,699** |
| 2009 Jan | 936,527 | 4,850 |
| 2009 Feb | 669,157 | 4,347 |
| 2009 Mar | 894,814 | 3,106 |
| 2009 Apr | 755,030 | 3,012 |
| 2009 May | 746,798 | 4,706 |
| 2009 Jun | 845,440 | 2,244 |
| 2009 Jul | 874,047 | 2,236 |
| 2009 Aug | 831,077 | 3,840 |
| 2009 Sep | 777,617 | 3,836 |
| 2009 Oct | 809,737 | 3,839 |
| 2009 Nov | 864,699 | 2,823 |
| 2009 Dec | 929,103 | 2,550 |
| **2009 TOTAL** | **9,934,046** | **41,389** |
| 2010 Jan | 886,522 | 8,124 |
| 2010 Feb | 848,503 | 1,995 |
| 2010 Mar | 755,645 | 1,429 |
| 2010 Apr | 30,179 | 4,558 |
| 2010 May | 756,998 | 2,675 |
| 2010 Jun | 815,909 | 5,596 |
| 2010 Jul | 843,134 | 782 |
| 2010 Aug | 803,933 | 511 |
| 2010 Sep | 610,651 | 7,165 |
| 2010 Oct | 771,789 | 1,852 |
| 2010 Nov | 703,000 | 3,726 |
| 2010 Dec | 811,639 | 10,045 |
| **2010 TOTAL** | **8,637,902** | **48,458** |
| 2011 Jan | 763,314 | 2,326 |
| 2011 Feb | 716,396 | 982 |
| 2011 Mar | 796,449 | 1,688 |
| 2011 Apr | 751,361 | 801 |
| 2011 May | 604,609 | 3,153 |
| 2011 Jun | 823,207 | 3,641 |
| 2011 Jul | 768,050 | 8,078 |
| 2011 Aug | 573,063 | 2,141 |
| 2011 Sep | 149,018 | 5,050 |
| 2011 Oct | 80,936 | 8,156 |
| 2011 Nov | 707,632 | 822 |
| 2011 Dec | 744,210 | 877 |
| **2011 TOTAL** | **7,478,245** | **37,715** |

**Emission Factors (TEC8/10)**

| | CO | NOx | CO2 |
|---|---|---|---|
| 2007 Emission Factor (lb/MMBtu) | 0.028 | 0.350 | 204.362 |
| 2008 Emission Factor (lb/MMBtu) | 0.028 | 0.329 | 211.566 |
| 2009 Emission Factor (lb/MMBtu) | 0.028 | 0.351 | 215.851 |
| 2010 Emission Factor (lb/MMBtu) | 0.028 | 0.334 | 205.875 |
| 2011 Emission Factor (lb/MMBtu) | 0.028 | 0.378 | 210.420 |

Monthly Emissions (tons) (TEC8/10)

| | CO | NOx | CO2 |
|---|---|---|---|
| 2007 Jan | 11.01 | 137.76 | 82308 |
| 2007 Feb | 13.30 | 152.61 | 97364 |
| 2007 Mar | 13.98 | 156.40 | 100785 |
| 2007 Apr | 12.21 | 155.94 | 89771 |
| 2007 May | 13.95 | 193.48 | 98742 |
| 2007 Jun | 11.93 | 173.52 | 84400 |
| 2007 Jul | 13.97 | 186.97 | 99068 |
| 2007 Aug | 13.87 | 178.21 | 101144 |
| 2007 Sep | 12.82 | 165.10 | 91977 |
| 2007 Oct | 12.45 | 146.89 | 92608 |
| 2007 Nov | 6.18 | 63.40 | 43123 |
| 2007 Dec | 13.84 | 128.48 | 93611 |
| **2007 TOTAL** | **149.52** | **1838.76** | **1074901** |
| **2007 AEI Total** | **149.52** | **1838.80** | **1074901** |
| | | | |
| 2008 Jan | 14.35 | 127.98 | 96689 |
| 2008 Feb | 12.59 | 111.15 | 84565 |
| 2008 Mar | 13.46 | 132.03 | 95069 |
| 2008 Apr | 13.62 | 136.96 | 101486 |
| 2008 May | 13.07 | 143.49 | 100464 |
| 2008 Jun | 12.93 | 155.33 | 97197 |
| 2008 Jul | 13.53 | 179.31 | 101504 |
| 2008 Aug | 13.12 | 167.59 | 97027 |
| 2008 Sep | 12.14 | 158.13 | 94357 |
| 2008 Oct | 11.61 | 160.84 | 93653 |
| 2008 Nov | 10.02 | 136.23 | 81239 |
| 2008 Dec | 12.47 | 170.89 | 101430 |
| 2008 TOTAL | **152.91** | **1779.92** | **1144680** |
| **2008 AEI Total** | **152.91** | **1779.92** | **1144680** |
| | | | |
| 2009 Jan | 13.27 | 194.49 | 108470 |
| 2009 Feb | 9.49 | 125.32 | 75656 |
| 2009 Mar | 12.66 | 141.09 | 98408 |
| 2009 Apr | 10.69 | 127.90 | 84397 |
| 2009 May | 10.59 | 126.11 | 80516 |
| 2009 Jun | 11.96 | 130.96 | 88835 |
| 2009 Jul | 12.36 | 136.85 | 95792 |
| 2009 Aug | 11.77 | 150.47 | 90326 |
| 2009 Sep | 11.02 | 143.49 | 83331 |
| 2009 Oct | 11.47 | 143.45 | 82847 |
| 2009 Nov | 12.24 | 152.58 | 89108 |
| 2009 Dec | 13.14 | 171.00 | 94452 |
| 2009 TOTAL | **140.67** | **1743.70** | **1072138** |
| **2009 AEI Total** | **140.18** | **1743.70** | **1072138** |
| | | | |
| 2010 Jan | 12.70 | 176.21 | 92940 |
| 2010 Feb | 12.08 | 155.02 | 84328 |
| 2010 Mar | 10.76 | 151.82 | 76545 |
| 2010 Apr | 0.48 | 3.93 | 2559 |
| 2010 May | 10.79 | 123.88 | 75022 |
| 2010 Jun | 11.66 | 124.32 | 79957 |
| 2010 Jul | 11.99 | 137.60 | 91625 |
| 2010 Aug | 11.43 | 126.63 | 90257 |
| 2010 Sep | 8.76 | 70.68 | 59299 |
| 2010 Oct | 10.99 | 117.95 | 78386 |
| 2010 Nov | 10.04 | 114.64 | 71765 |
| 2010 Dec | 11.65 | 139.03 | 86480 |
| 2010 TOTAL | **123.34** | **1441.69** | **889162** |
| **2010 AEI Total** | **123.34** | **1441.69** | **889162** |
| | | | |
| 2011 Jan | 10.88 | 125.45 | 78958 |
| 2011 Feb | 10.19 | 125.02 | 76401 |
| 2011 Mar | 11.34 | 133.69 | 83511 |
| 2011 Apr | 10.69 | 145.11 | 82911 |
| 2011 May | 8.63 | 125.27 | 66960 |
| 2011 Jun | 11.74 | 167.39 | 85654 |
| 2011 Jul | 11.01 | 159.67 | 78901 |
| 2011 Aug | 8.17 | 135.21 | 59608 |
| 2011 Sep | 2.18 | 36.87 | 16721 |
| 2011 Oct | 1.25 | 10.05 | 6461 |
| 2011 Nov | 10.07 | 116.48 | 75982 |
| 2011 Dec | 10.59 | 133.60 | 74717 |
| 2011 TOTAL | **106.73** | **1413.82** | **786786** |
| **2011 AEI Total** | **106.28** | **1413.81** | **786786** |

## Baseline Actual Emission (BAE)

| | Coal Heat Input | | Gas Heat Input | |
|---|---|---|---|---|
| | Monthly Heat Input (Mbtu/mo) | 24-Month Rolling Avg. (Mbtu/yr) | Monthly Heat Input (Mbtu/mo) | 24-Month Rolling Avg. (Mbtu/yr) |
| 2007 Jan | 7.74E+05 | 3.87E+05 | 3.78E+03 | 1.89E+03 |
| 2007 Feb | 9.36E+05 | 8.55E+05 | 3.90E+03 | 3.84E+03 |
| 2007 Mar | 9.85E+05 | 1.35E+06 | 2.90E+03 | 5.29E+03 |
| 2007 Apr | 8.59E+05 | 1.78E+06 | 3.38E+03 | 6.97E+03 |
| 2007 May | 9.82E+05 | 2.27E+06 | 3.46E+03 | 8.70E+03 |
| 2007 Jun | 8.40E+05 | 2.69E+06 | 2.44E+03 | 9.93E+03 |
| 2007 Jul | 9.85E+05 | 3.18E+06 | 2.10E+03 | 1.10E+04 |
| 2007 Aug | 9.76E+05 | 3.67E+06 | 4.11E+03 | 1.30E+04 |
| 2007 Sep | 9.02E+05 | 4.12E+06 | 3.79E+03 | 1.49E+04 |
| 2007 Oct | 8.74E+05 | 4.56E+06 | 6.43E+03 | 1.81E+04 |
| 2007 Nov | 4.33E+05 | 4.77E+06 | 3.89E+03 | 2.01E+04 |
| 2007 Dec | 9.75E+05 | 5.26E+06 | 2.46E+03 | 2.13E+04 |
| 2008 Jan | 1.02E+06 | 5.77E+06 | 2.73E+03 | 2.27E+04 |
| 2008 Feb | 8.90E+05 | 6.21E+06 | 4.47E+03 | 2.49E+04 |
| 2008 Mar | 9.52E+05 | 6.69E+06 | 4.72E+03 | 2.73E+04 |
| 2008 Apr | 9.65E+05 | 7.17E+06 | 2.69E+03 | 2.86E+04 |
| 2008 May | 9.26E+05 | 7.64E+06 | 2.28E+03 | 2.98E+04 |
| 2008 Jun | 9.16E+05 | 8.09E+06 | 3.20E+03 | 3.14E+04 |
| 2008 Jul | 9.59E+05 | 8.57E+06 | 2.28E+03 | 3.25E+04 |
| 2008 Aug | 9.28E+05 | 9.04E+06 | 3.67E+03 | 3.43E+04 |
| 2008 Sep | 8.59E+05 | 9.47E+06 | 3.09E+03 | 3.59E+04 |
| 2008 Oct | 8.21E+05 | 9.88E+06 | 3.97E+03 | 3.79E+04 |
| 2008 Nov | 7.05E+05 | 1.02E+07 | 8.22E+03 | 4.20E+04 |
| 2008 Dec | 8.82E+05 | 1.07E+07 | 3.39E+03 | 4.37E+04 |
| 2009 Jan | 9.37E+05 | 1.08E+07 | 4.85E+03 | 4.42E+04 |
| 2009 Feb | 6.69E+05 | 1.06E+07 | 4.35E+03 | 4.44E+04 |
| 2009 Mar | 8.95E+05 | 1.06E+07 | 3.11E+03 | 4.45E+04 |
| 2009 Apr | 7.55E+05 | 1.05E+07 | 3.01E+03 | 4.43E+04 |
| 2009 May | 7.47E+05 | 1.04E+07 | 4.71E+03 | 4.50E+04 |
| 2009 Jun | 8.45E+05 | 1.04E+07 | 2.24E+03 | 4.49E+04 |
| 2009 Jul | 8.74E+05 | 1.04E+07 | 2.24E+03 | 4.49E+04 |
| 2009 Aug | 8.31E+05 | 1.03E+07 | 3.84E+03 | 4.48E+04 |
| 2009 Sep | 7.78E+05 | 1.02E+07 | 3.84E+03 | 4.46E+04 |
| 2009 Oct | 8.10E+05 | 1.02E+07 | 3.84E+03 | 4.35E+04 |
| 2009 Nov | 8.65E+05 | 1.04E+07 | 2.82E+03 | 4.30E+04 |
| 2009 Dec | 9.29E+05 | 1.04E+07 | 2.55E+03 | 4.30E+04 |
| 2010 Jan | 8.87E+05 | 1.03E+07 | 8.12E+03 | 4.57E+04 |
| 2010 Feb | 8.49E+05 | 1.03E+07 | 2.00E+03 | 4.45E+04 |
| 2010 Mar | 7.56E+05 | 1.02E+07 | 1.43E+03 | 4.29E+04 |
| 2010 Apr | 3.02E+04 | 9.73E+06 | 4.56E+03 | 4.38E+04 |
| 2010 May | 7.57E+05 | 9.64E+06 | 2.68E+03 | 4.40E+04 |
| 2010 Jun | 8.16E+05 | 9.59E+06 | 5.60E+03 | 4.52E+04 |
| 2010 Jul | 8.43E+05 | 9.53E+06 | 7.82E+02 | 4.44E+04 |
| 2010 Aug | 8.04E+05 | 9.47E+06 | 5.11E+02 | 4.29E+04 |
| 2010 Sep | 6.11E+05 | 9.35E+06 | 7.17E+03 | 4.49E+04 |
| 2010 Oct | 7.72E+05 | 9.32E+06 | 1.85E+03 | 4.38E+04 |
| 2010 Nov | 7.03E+05 | 9.32E+06 | 3.73E+03 | 4.16E+04 |
| 2010 Dec | 8.12E+05 | 9.29E+06 | 1.00E+04 | 4.49E+04 |
| 2011 Jan | 7.63E+05 | 9.20E+06 | 2.33E+03 | 4.37E+04 |
| 2011 Feb | 7.16E+05 | 9.22E+06 | 9.82E+02 | 4.20E+04 |
| 2011 Mar | 7.96E+05 | 9.17E+06 | 1.69E+03 | 4.13E+04 |
| 2011 Apr | 7.51E+05 | 9.17E+06 | 8.01E+02 | 4.02E+04 |
| 2011 May | 6.05E+05 | 9.10E+06 | 3.15E+03 | 3.94E+04 |
| 2011 Jun | 8.23E+05 | 9.09E+06 | 3.64E+03 | 4.01E+04 |
| 2011 Jul | 7.68E+05 | 9.04E+06 | 8.08E+03 | 4.30E+04 |
| 2011 Aug | 5.73E+05 | 8.91E+06 | 2.14E+03 | 4.22E+04 |
| 2011 Sep | 1.49E+05 | 8.59E+06 | 5.05E+03 | 4.28E+04 |
| 2011 Oct | 8.09E+04 | 8.23E+06 | 8.16E+03 | 4.49E+04 |
| 2011 Nov | 7.08E+05 | 8.15E+06 | 8.22E+02 | 4.39E+04 |
| 2011 Dec | 7.44E+05 | 8.06E+06 | 8.77E+02 | 4.31E+04 |

| | Calculated CO Emissions | | | | |
|---|---|---|---|---|---|
| | Monthly Emissions (tons/mo) | 24-Month Rolling Avg. (tons/yr) | Maximum 24-Month Rolling Avg. (tons/yr) | Associated Coal Heat Input (Mbtu/yr) | Associated Gas Heat Input (Mbtu/yr) |
| 2007 Jan | 11.01 | | | | |
| 2007 Feb | 13.30 | | | | |
| 2007 Mar | 13.98 | | | | |
| 2007 Apr | 12.21 | | | | |
| 2007 May | 13.95 | | | | |
| 2007 Jun | 11.93 | | | | |
| 2007 Jul | 13.97 | | | | |
| 2007 Aug | 13.87 | | | | |
| 2007 Sep | 12.82 | | | | |
| 2007 Oct | 12.45 | | | | |
| 2007 Nov | 6.18 | | | | |
| 2007 Dec | 13.84 | | | | |
| 2008 Jan | 14.35 | | | | |
| 2008 Feb | 12.59 | | | | |
| 2008 Mar | 13.46 | | | | |
| 2008 Apr | 13.62 | | | | |
| 2008 May | 13.07 | | | | |
| 2008 Jun | 12.93 | | | | |
| 2008 Jul | 13.53 | | | | |
| 2008 Aug | 13.12 | | | | |
| 2008 Sep | 12.14 | | | | |
| 2008 Oct | 11.61 | | | | |
| 2008 Nov | 10.02 | | | | |
| 2008 Dec | 12.47 | 151.21 | | | |
| 2009 Jan | 13.27 | 152.34 | 152.34 | 1.08E+07 | 4.42E+04 |
| 2009 Feb | 9.49 | 150.44 | | | |
| 2009 Mar | 12.66 | 149.78 | | | |
| 2009 Apr | 10.69 | 149.02 | | | |
| 2009 May | 10.59 | 147.34 | | | |
| 2009 Jun | 11.96 | 147.35 | | | |
| 2009 Jul | 12.36 | 146.55 | | | |
| 2009 Aug | 11.77 | 145.50 | | | |
| 2009 Sep | 11.02 | 144.60 | | | |
| 2009 Oct | 11.47 | 144.11 | | | |
| 2009 Nov | 12.24 | 147.14 | | | |
| 2009 Dec | 13.14 | 146.79 | | | |
| 2010 Jan | 12.70 | 145.96 | | | |
| 2010 Feb | 12.08 | 145.71 | | | |
| 2010 Mar | 10.76 | 144.35 | | | |
| 2010 Apr | 0.48 | 137.78 | | | |
| 2010 May | 10.79 | 136.65 | | | |
| 2010 Jun | 11.66 | 136.01 | | | |
| 2010 Jul | 11.99 | 135.24 | | | |
| 2010 Aug | 11.43 | 134.40 | | | |
| 2010 Sep | 8.76 | 132.71 | | | |
| 2010 Oct | 10.99 | 132.40 | | | |
| 2010 Nov | 10.04 | 132.41 | | | |
| 2010 Dec | 11.65 | 132.01 | | | |
| 2011 Jan | 10.88 | 130.81 | | | |
| 2011 Feb | 10.19 | 131.16 | | | |
| 2011 Mar | 11.34 | 130.50 | | | |
| 2011 Apr | 10.69 | 130.49 | | | |
| 2011 May | 8.63 | 129.51 | | | |
| 2011 Jun | 11.74 | 129.41 | | | |
| 2011 Jul | 11.01 | 128.73 | | | |
| 2011 Aug | 8.17 | 126.93 | | | |
| 2011 Sep | 2.18 | 122.51 | | | |
| 2011 Oct | 1.25 | 117.40 | | | |
| 2011 Nov | 10.07 | 116.31 | | | |
| 2011 Dec | 10.59 | 115.04 | | | |
| | | | 152 | 10,751,388 | 44,197 |

| | Calculated NOx Emissions | | | | |
|---|---|---|---|---|---|
| | Monthly Emissions (tons/mo) | 24-Month Rolling Avg (tons/yr) | Maximum 24-Month Rolling Avg (tons/yr) | Associated Coal Heat Input (Mbtu/yr) | Associated Gas Heat Input (Mbtu/yr) |
| 2007 Jan | 137.76 | | | | |
| 2007 Feb | 152.61 | | | | |
| 2007 Mar | 156.40 | | | | |
| 2007 Apr | 155.94 | | | | |
| 2007 May | 193.48 | | | | |
| 2007 Jun | 173.52 | | | | |
| 2007 Jul | 186.97 | | | | |
| 2007 Aug | 178.21 | | | | |
| 2007 Sep | 165.10 | | | | |
| 2007 Oct | 146.89 | | | | |
| 2007 Nov | 63.40 | | | | |
| 2007 Dec | 128.48 | | | | |
| 2008 Jan | 127.98 | | | | |
| 2008 Feb | 111.15 | | | | |
| 2008 Mar | 132.03 | | | | |
| 2008 Apr | 136.96 | | | | |
| 2008 May | 143.49 | | | | |
| 2008 Jun | 155.33 | | | | |
| 2008 Jul | 179.31 | | | | |
| 2008 Aug | 167.59 | | | | |
| 2008 Sep | 158.13 | | | | |
| 2008 Oct | 160.84 | | | | |
| 2008 Nov | 136.23 | | | | |
| 2008 Dec | 170.89 | 1,809.34 | | | |
| 2009 Jan | 194.49 | 1,837.70 | 1,837.70 | 1.08E+07 | 4.42E+04 |
| 2009 Feb | 125.32 | 1,824.05 | | | |
| 2009 Mar | 141.09 | 1,816.40 | | | |
| 2009 Apr | 127.90 | 1,802.37 | | | |
| 2009 May | 126.11 | 1,768.69 | | | |
| 2009 Jun | 130.96 | 1,747.41 | | | |
| 2009 Jul | 136.85 | 1,722.35 | | | |
| 2009 Aug | 150.47 | 1,708.48 | | | |
| 2009 Sep | 143.49 | 1,687.68 | | | |
| 2009 Oct | 143.45 | 1,685.96 | | | |
| 2009 Nov | 152.58 | 1,740.55 | | | |
| 2009 Dec | 171.00 | 1,781.81 | | | |
| 2010 Jan | 176.21 | 1,785.92 | | | |
| 2010 Feb | 155.02 | 1,807.85 | | | |
| 2010 Mar | 151.82 | 1,817.75 | | | |
| 2010 Apr | 3.93 | 1,751.24 | | | |
| 2010 May | 123.88 | 1,741.43 | | | |
| 2010 Jun | 124.32 | 1,725.93 | | | |
| 2010 Jul | 137.60 | 1,705.07 | | | |
| 2010 Aug | 126.63 | 1,684.59 | | | |
| 2010 Sep | 70.68 | 1,640.87 | | | |
| 2010 Oct | 117.95 | 1,619.42 | | | |
| 2010 Nov | 114.84 | 1,608.63 | | | |
| 2010 Dec | 139.03 | 1,592.70 | | | |
| 2011 Jan | 125.45 | 1,558.18 | | | |
| 2011 Feb | 125.02 | 1,558.03 | | | |
| 2011 Mar | 133.69 | 1,554.33 | | | |
| 2011 Apr | 145.11 | 1,562.94 | | | |
| 2011 May | 125.27 | 1,562.52 | | | |
| 2011 Jun | 167.39 | 1,580.74 | | | |
| 2011 Jul | 159.67 | 1,592.14 | | | |
| 2011 Aug | 135.21 | 1,584.51 | | | |
| 2011 Sep | 36.87 | 1,531.20 | | | |
| 2011 Oct | 10.05 | 1,464.50 | | | |
| 2011 Nov | 116.48 | 1,446.45 | | | |
| 2011 Dec | 133.60 | 1,427.75 | | | |
| | | | 1,838 | 10,751,388 | 44,197 |

| | Calculated CO2 Emissions | | | | |
|---|---|---|---|---|---|
| | Monthly Emissions (tons/mo) | 24-Month Rolling Avg. (tons/yr) | Maximum 24-Month Rolling Avg. (tons/yr) | Associated Coal Heat Input (Mbtu/yr) | Associated Gas Heat Input (Mbtu/yr) |
| 2007 Jan | 82308.26 | | | | |
| 2007 Feb | 97364.40 | | | | |
| 2007 Mar | 100784.99 | | | | |
| 2007 Apr | 89770.70 | | | | |
| 2007 May | 98741.67 | | | | |
| 2007 Jun | 84400.04 | | | | |
| 2007 Jul | 99067.76 | | | | |
| 2007 Aug | 101144.06 | | | | |
| 2007 Sep | 91977.04 | | | | |
| 2007 Oct | 92607.94 | | | | |
| 2007 Nov | 43123.34 | | | | |
| 2007 Dec | 93611.30 | | | | |
| 2008 Jan | 96689.30 | | | | |
| 2008 Feb | 84565.48 | | | | |
| 2008 Mar | 95068.72 | | | | |
| 2008 Apr | 101486.30 | | | | |
| 2008 May | 100464.20 | | | | |
| 2008 Jun | 97197.00 | | | | |
| 2008 Jul | 101503.80 | | | | |
| 2008 Aug | 97026.60 | | | | |
| 2008 Sep | 94356.71 | | | | |
| 2008 Oct | 93652.78 | | | | |
| 2008 Nov | 81239.18 | | | | |
| 2008 Dec | 101430.30 | 1,109,790.91 | | | |
| 2009 Jan | 108470.20 | 1,122,871.89 | 1,122,871.89 | 1.08E+07 | 4.42E+04 |
| 2009 Feb | 75655.62 | 1,112,017.50 | | | |
| 2009 Mar | 98408.20 | 1,110,829.10 | | | |
| 2009 Apr | 84397.00 | 1,108,142.26 | | | |
| 2009 May | 80516.08 | 1,099,029.46 | | | |
| 2009 Jun | 88835.00 | 1,101,246.94 | | | |
| 2009 Jul | 95792.00 | 1,099,609.07 | | | |
| 2009 Aug | 90326.08 | 1,094,200.08 | | | |
| 2009 Sep | 83331.20 | 1,089,877.15 | | | |
| 2009 Oct | 82846.55 | 1,084,996.46 | | | |
| 2009 Nov | 89107.50 | 1,107,988.54 | | | |
| 2009 Dec | 94452.10 | 1,108,408.94 | | | |
| 2010 Jan | 92940.30 | 1,106,534.44 | | | |
| 2010 Feb | 84327.90 | 1,106,415.65 | | | |
| 2010 Mar | 76545.03 | 1,097,153.81 | | | |
| 2010 Apr | 2558.68 | 1,047,690.00 | | | |
| 2010 May | 75022.30 | 1,034,969.05 | | | |
| 2010 Jun | 79957.00 | 1,026,349.05 | | | |
| 2010 Jul | 91625.23 | 1,021,409.77 | | | |
| 2010 Aug | 90256.50 | 1,018,024.72 | | | |
| 2010 Sep | 59298.56 | 1,000,495.64 | | | |
| 2010 Oct | 78386.28 | 992,862.39 | | | |
| 2010 Nov | 71764.56 | 988,125.08 | | | |
| 2010 Dec | 86479.80 | 980,649.83 | | | |
| 2011 Jan | 78958.31 | 965,893.89 | | | |
| 2011 Feb | 76400.90 | 966,266.53 | | | |
| 2011 Mar | 83511.25 | 959,818.05 | | | |
| 2011 Apr | 82911.40 | 958,075.25 | | | |
| 2011 May | 66959.62 | 951,297.02 | | | |
| 2011 Jun | 85653.60 | 949,706.32 | | | |
| 2011 Jul | 78801.46 | 941,261.05 | | | |
| 2011 Aug | 59607.87 | 925,901.94 | | | |
| 2011 Sep | 16720.94 | 892,596.81 | | | |
| 2011 Oct | 6461.21 | 854,404.15 | | | |
| 2011 Nov | 75982.10 | 847,841.45 | | | |
| 2011 Dec | 74716.88 | 837,973.84 | | | |
| | | | 1,122,872 | 10,751,388 | 44,197 |

## Appendix B
## Post Project Emission Factors

| | | CO lb/MMBtu | NOx lb/MMBtu |
|---|---|---|---|
| TEC8/10 | Stack Emissions | 0.4 | 0.18 |

| | FUTURE PROJECTED HEAT INPUT MMBtu/yr |
|---|---|
| TEC8/10 | 9,646,171 |

**EMISSION CHANGE CALCULATION (TPY)**

| | CO | NOx | CO2 |
|---|---|---|---|
| Future Projected | 1,929.2 | 868.2 | 1,120,080.1 |
| Total Baseline Emission | 152.3 | 1,837.7 | 1,122,872 |
| Emission Increase | 1,776.9 | (969.5) | (2,792) |
| PSD Significant Emission Level | **100** | **40** | **75,000** |
| Major Modification? | **Yes** | **No** | **No** |

## Appendix B
## Project Emissions Calculations

TEC is proposing to install low NOx systems on Unit 8/10. Combusted carbon in the boilers will either become carbon monoxide (CO) or carbon dioxide (CO2). As a result of this project CO emissions will increase therefore CO2 emissions will decrease. From the previously submitted calculations, the CO emission increase is 1,777 tons/yr. Based on the following calculations the corresponding decrease in CO2 is 2,792 tons:

| | Molecular Weight |
|---|---|
| C | 12.011 |
| O | 15.999 |
| CO | 28.01 |
| CO2 | 44.009 |

Increase in CO = 1777 tons/yr

$$\frac{1776.89\ \text{tons(CO)}}{\text{yr}} \cdot \frac{1\ \text{ton*mol(CO)}}{28.01\ \text{tons(CO)}} \cdot \frac{1\ \text{ton*mol(CO2)}}{1\ \text{ton*mol(CO)}} \cdot \frac{44.009\ \text{tons(CO2)}}{1\ \text{ton*mol(CO2)}} = \frac{2792\ \text{tons(CO2)}}{\text{yr}}$$

The only change in CO2 emissions for this project is caused by the increase in CO emissions. So the Future Projected CO2 emissions will equal the Baseline CO2 emissions plus the CO2 emission decrease due to the increase in CO emissions. From the previously submitted calculations the CO2 baseline is 1,120,768 tons/yr.

| | | |
|---|---|---|
| Baseline CO2 Emissions | | 1,122,872 tons/yr |
| CO2 emissions from the decrease in CO | - | 2792 tons/yr |
| Future Projected CO2 Emissions | = | 1,120,080 tons/yr |

| | |
|---|---|
| Emissions Change | -2,792 tons/yr |
| PSD Significant Emission Level | 75,000 tons/yr |
| Major Modification? | No |

# APPENDIX C

# BACT ANALYSIS

# BACT ANALYSIS

## C.1 INTRODUCTION

Any major stationary source or major modification subject to PSD must conduct an analysis to ensure the implementation of BACT. The requirement to conduct a BACT analysis can be found in the Clean Air Act itself, in the Federal regulations implementing the PSD program, in the regulations governing federal approval of State PSD programs, and in the State Implementation Plans (SIP) of the various states. BACT is defined as:

> "...an emission limitation (including a visible emissions standard) based on the maximum degree of reduction for each pollutant subject to regulation under the Clean Air Act which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant."[1]

The BACT requirement applies for a given pollutant to each individual new or physically modified emission unit when the project, on a facility-wide basis, has a significant emissions increase for that pollutant. Individual BACT determinations are performed on a unit-by-unit, pollutant-by-pollutant basis. As detailed in *Figure C.1 - Project Emissions Increase and PSD SER*, the Project at TEC warrants a BACT analysis for CO.

**Figure C.1 - Project Emissions Increase and PSD SER**

| | $NO_X$ | CO | $CO_2$ |
|---|---|---|---|
| Project Emissions Change (tpy) | -969.5 | 1,776.9 | -2,792 |
| Significant Emission Rate (tpy) | 40 | 100 | 75,000 |
| **PSD Triggered?** | **No** | **Yes** | **No** |

[1]40 CFR §52.21(j).

On December 1, 1987, the United States Environmental Protection Agency (U.S. EPA) Assistant Administrator for Air and Radiation issued a memorandum that implemented certain program initiatives to improve the effectiveness of the PSD program within the confines of existing regulations and State implementation plans. Among the initiatives was a "top-down" approach for determining BACT. In brief, the top-down process requires that all available control technologies be ranked in descending order of control effectiveness. The most stringent or "top" control option is *per se* BACT unless the applicant demonstrates, and the permitting authority in its informed opinion agrees, that the control in question is not technically feasible. For a technology to be considered technically feasible, it must be commercially available and proven effective on a unit of similar size and operating parameters. For the remaining control technologies that are considered technically feasible, energy, environmental, and/or economic impacts may justify the conclusion that the most stringent control option is not achievable in that case. Upon careful and considered elimination of the most stringent control option based upon energy, environmental, and/or economic considerations, the next most stringent alternative is evaluated in the same manner. This process continues until BACT is selected.

The five steps in a BACT evaluation can be summarized as follows:

1. Identify potentially applicable control technologies.
2. Eliminate technically infeasible control technologies.
3. Rank the remaining control technologies based upon emission reduction potential.
4. Evaluate the ranked controls based on energy, environmental, and/or economic considerations.
5. Select BACT.

## C.2 BACKGROUND ON CO FORMATION

CO is emitted from the boiler as a result of the incomplete combustion of fuel. This incomplete combustion results in a loss of boiler efficiency. It is desirable to minimize CO emissions as much as possible in order to increase boiler efficiency and reduce fuel use.

Modifications to burner/combustion systems which are designed to minimize $NO_X$ emissions (as is a goal of this Project) typically result in increased CO emissions. Low $NO_X$ systems are designed to limit availability of oxygen in order to limit the $NO_X$ that is produced. When oxygen is limited, the carbon has less available oxygen to bond to, resulting in increased CO emissions and decreased $CO_2$ emissions. Modern, low emitting retrofits of the burner and combustion system design are intended to simultaneously minimize formation of CO and $NO_X$ emission. The goal is to strike a balance between the lowest $NO_X$ possible (a goal of this Project) while at the same time keeping CO emissions to a minimum to meet BACT and to maintain acceptable fuel and boiler efficiency.

## C.3 TEC8/10 CO EMISSIONS

Westar is planning to install a low $NO_X$ system on TEC8/10 consisting of LNBs, SOFA, and associated equipment and ductwork.

The goal of the Project is to reduce TEC8/10 $NO_X$ emissions with final achievable $NO_X$ levels dependant on the effectiveness of tuning the upgraded equipment. As is typical with $NO_X$ reduction projects using combustion controls, a balance must be struck between lowering $NO_X$ and increasing CO. While the Project will decrease emissions of $NO_X$, it may cause a subsequent increase in CO emissions. A BACT review for the CO emissions is summarized below.

## C.4 CO BACT ANALYSIS

### C.4.1 Carbon Monoxide Control Technology/Feasibility

CO can be reduced through pre-combustion approaches and post-combustion approaches as described in the following paragraphs.

CO is emitted from the boiler as a result of incomplete combustion of fuel and loss of boiler efficiency. Therefore, there is a desire by boiler operations to minimize CO emissions as much as possible in order to increase efficiency and reduce fuel use. The most direct approach for reducing CO emissions is to maximize combustion efficiency through good combustion practices (GCP) while at the same time minimizing $NO_X$ formation. This involves parametric monitoring and controlling the operating parameters of the boilers to ensure continual operation as close to optimum (i.e., minimum emission) conditions as possible.

Catalytic oxidation is the most efficient post-combustion CO control technology available. A CO oxidation catalyst system works to reduce CO emissions by allowing the boiler exhaust gases to pass through a reactor containing catalyst material. The catalytic material typically used is a precious metal such as platinum or palladium. The catalyst oxidizes CO to carbon dioxide. The catalyst also oxidizes other gases in the boiler exhaust passing through the reactor such as volatile organic compounds and sulfur dioxide. The exhaust gas temperature must be greater than 500 to 600 degrees F for this CO catalytic reaction to take place with acceptable effectiveness. On a typical coal-fired utility boiler, exhaust gases are above the 500 to 600 degrees F temperature threshold between the exit of the economizer and the inlet to the air heater. The exhaust gas from TEC8/10 is in the range of 900 degrees F at this point. Although the capital costs of installing the additional ductwork and relocating major pieces of equipment would be excessive, retrofitting a catalytic reactor is within the range of engineering possibilities. Reheating of the exhaust gas after the air heater is also an engineering possibility, but also at a very high cost. However, as is demonstrated below, use of a CO oxidation catalyst on a coal-fired boiler is not feasible due to high acid gas formation and a lack of catalyst product available for this application.

The technical feasibility of adding a CO oxidation catalyst system to TEC8/10 was previously investigated to confirm the conclusion of the CO BACT analysis that this technology is currently not technically feasible for coal-fired boilers. This investigation included discussions with two separate vendors of catalyst systems and assessing a CO oxidation catalyst installation on a boiler in California. Based on this investigation, a clear conclusion is made that installation and use of a CO oxidation catalyst on coal-fired boilers such as TEC8/10 is technically infeasible. The main reason for this infeasibility is the high level of sulfur trioxide and sulfuric acid mist formation resulting from the oxidation of sulfur dioxide found in the boiler exhaust gas. The high level of sulfuric acid would lead to rapid and destructive corrosion of ducts and equipment downstream of the catalyst. The high levels of sulfur trioxide would lead to higher opacity levels and a visible, blue plume from the stack. In addition, current catalyst technology has not been designed for the higher particulate and sulfur dioxide levels found in coal-fired applications. Vendors do not have available catalyst material for coal-fired applications.

Two major vendors of oxidation catalyst were previously contacted to discuss the feasibility of adding their systems to a coal-fired utility boiler. The vendors contacted were Engelhard Corporation of Iselin, New Jersey (Englehard) and Ceram Environmental, Inc. of Overland Park, Kansas (Ceram). The representative from Engelhard stated that they do not offer a CO oxidation catalyst system for particulate gas streams such as coal-fired applications. One reason cited for this is that the higher particulate levels of the gas stream would quickly plug the catalyst material, rendering it ineffective. The representative indicated that their catalyst material would become plugged in a matter of days, necessitating a unit shutdown for cleaning or replacement. Natural gas-fired applications (such as combustion turbines and gas-fired boilers) do not have this problem because of the near absence of particulate in the boiler exhaust. Note that Engelhard is the vendor that supplied the CO oxidation catalyst for a gas-fired boiler in California with a successfully installed catalyst on a utility boiler. Another reason cited by Engelhard is that there would be a high oxidation conversion rate of sulfur dioxide to sulfur trioxide which would lead to unacceptably high levels of sulfuric acid in the downstream exhaust gas system. Natural gas-fired applications do not have this problem because of the very low amounts of fuel sulfur.

The representative from Ceram stated that application of a CO oxidation catalyst on a coal-fired boiler is technically infeasible due to the high amounts of sulfuric acid that would form downstream of the catalyst. The catalyst would oxidize a relatively high percentage of the sulfur dioxide to sulfur trioxide. These higher levels of sulfur trioxide would lead to opacity problems and a visible, blue plume. A utility in Indiana experienced excessive sulfur trioxide formation and a significant blue plume problem after retrofitting a selective catalytic reduction (SCR) system to reduce nitrogen oxides. The Ceram representative stated that the conversion rate of sulfur dioxide to sulfur trioxide resulting from a CO oxidation catalyst would be significantly greater than the rate from the SCR catalyst. This sulfur trioxide would also react with moisture in the exhaust gas to form sulfuric acid. The representative stated that even with a low sulfur coal application, the amounts of sulfuric acid formed would result in rapid and destructive corrosion of most downstream ducts and equipment, making this an infeasible control alternative.

There has been installation of oxidation catalysts to two existing utility boilers in Huntington Beach, California. These boilers are each 225 MW in capacity and are natural gas fired. The oxidation catalyst was installed with an SCR system at a location downstream of the economizer and before the air heater. The design CO emission level is 5 ppmvd (at 3-percent oxygen). The oxidation catalyst application has been operating successfully. Of most important note regarding this application of oxidation catalyst is that these boilers are natural gas fired. The exhaust gas from natural gas-fired boilers contains only very small amounts of particulate and sulfur dioxide which allows the catalyst to be feasible for application to these units. As confirmed by representatives from Engelhard and Ceram, the higher levels of particulate and sulfur dioxide associated with coal firing render the application of oxidation catalyst infeasible.

## C.5 CO BACT FOR SIMILAR PROJECTS

A review of the RACT/BACT/LAER Clearinghouse (RBLC) database as well as a review of recent PSD permits that have been issued for coal-fired boiler projects was performed to determine the CO BACT control technologies and emission limits established for other coal-fired boilers. *Figure C.2 - Summary of RBLC/Recent Permits* presents a summary of the findings. As shown, the results are organized by the CO emission level (lowest to highest) and data rows for boilers which are not relevant to the Project BACT level are indicated.

Westar has gained significant recent experience with $NO_X$ tuning their other tangentially fired boilers (at Jeffery Energy Center (JEC) and TEC) which burn very similar coal. The results of this experience have shown the further $NO_X$ reductions are generally attainable as CO emissions are allowed to rise. Westar's conclusion is that the lowest practical $NO_X$ levels can be achieved while the CO emissions levels are less than 0.4 lb/MMBtu. Given the

Project goal of lowest practical $NO_X$ and the importance of achieving these low $NO_X$ emissions while having the flexibility to adjust parameters to achieve this low $NO_X$, a reasonable CO emission limit which strikes this balance is 0.4 lb/MMBtu. This is similar to the BACT determination approach recently approved for the Westar JEC Unit 3 LNB project.

# Figure C.2 - Summary of RBLC/Recent Permits

| Number | Company Name | Plant Name | City/State | Unit | Boiler Type | Permit No | Permit Date | NOx Control Technology | CO Control Technology | CO BACT CO Limit | Notes on Relevancy of CO BACT Limit to TEC8/10 BACT Determination |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Texas Municipal Power Agency | Gibbons Creek Steam Electric Station | Anderson, TX | Boiler | Tangential-fired | 5699 AND PSDTX18M2 | 10/28/11 | TLN3 Separated Over-fire Air | GCP | 0.12 (30-day) | |
| 2 | Coleto Creek | Coleto Creek Power Station | Fannin, TX | Boiler Unit 2 | supercritical, pulverized coal | PSDTX1118 | 5/3/10 | LNB/OFA | GCP | 0.12 (30-day) | Not relevant. The boiler type is not the same as Westar's boiler. |
| 3 | Consumers Energy | Karn Weadock Generating Complex | Essexville, MI | Boiler | Supercritical | 341-07 | 12/29/09 | LNB/OFA SCR | GCP | 0.125 (24-hr) | Not relevant. The boiler type is not the same as Westar's boiler. |
| 4 | Orlando Utilites Commission | Stanton Energy Center | FL | Unit 2 | Wall-fired | 0950137-015-AC | 2/7/08 | LNB/OFA | GCP | 0.15 (30-day) | |
| 5 | Minnesota Power Division of Allete INC. | Boswell Energy Center | Cohasset, MN | Boiler 4 | Tangential-fired | 06100004-005 | 4/28/10 | LNB/SOFA | Not technically feasible/CEMS | 0.15 (30-day) | |
| 6 | Associated Electric Cooperative | Norborne Power Plant | Norborne, MO | Main Boiler | Supercritical | 022008-010 | 2/22/08 | LNB/OFA SCR | GTP | 0.15 (30-day) | Not relevant. The boiler type is not the same as Westar's boiler. |
| 7 | Board of Public Utilities | Nearman Creek Station | Kansas City, KS | Unit 1 | Wall-fired | None | 4/14/11 | LNB/OFA | GCP | 0.17 | |
| 8 | Orlando Utilites Commission | Stanton Energy Center | FL | Unit 1 | Wall-fired | 0950137-015-AC | 2/7/08 | LNB/OFA | GCP | 0.18 | |
| 9 | Interstate Power and Light Company | Lansing Station | Lansing, IA | Boiler 3 | Unknown | 73-A-132P-S2 | 3/31/08 | LNB/OFA | GCP | 0.25 | Not relevant. The boiler type is unknown there is not enough information to draw a conclusion. |
| 10 | Westar Energy, Inc. | Tecumseh Energy Center | Tecumseh, KS | Boiler 7/9 | Tangential-fired | None | 3/18/08 | LNB/SOFA | GCP | 0.25 | |
| 11 | Westar Energy, Inc. | Jeffrey Energy Center | St. Mary's, KS | Unit 1 | Tangential-fired | None | 2/29/08 | LNB/SOFA | GCP | 0.25 | |
| 12 | Westar Energy, Inc. | Jeffrey Energy Center | St. Mary's, KS | Unit 2 | Tangential-fired | None | 2/29/08 | LNB/SOFA | GCP | 0.25 | |
| 13 | Duke Power Company LLC | Dan River Steam Station | Eden, NC | Unit 1 | Tangential-fired | None | 7/24/06 | LNB/SOFA | GCP | 0.25 | |
| 14 | Duke Power Company LLC | Dan River Steam Station | Eden, NC | Unit 2 | Tangential-fired | None | 7/24/06 | LNB/SOFA | GCP | 0.25 | |
| 15 | Duke Power Company LLC | Dan River Steam Station | Eden, NC | Unit 3 | Tangential-fired | None | 7/24/06 | LNB/SOFA | GCP | 0.25 | |
| 16 | Interstate Power and Light Company | M.L. Kapp Station | Cedar Rapids, IA | Boiler 2 | Tangential-fired | 78-A-157P-S8 | 1/11/08 | LNB/OFA | GCP | 0.289 | |
| 17 | Consumers Energy | Tes Filer City Station | Filer City, MI | Boiler | | 264-09 | 6/25/10 | Over-fired air | | 0.3 (24-hr) | Not relevant. The boiler type is unknown there is not enough information to draw a conclusion. |
| 18 | Southwestern Public Service Company | Harrington Station | Amarillo, TX | Unit 1 Boiler | Tangential-fired | PSDTX631M1 | 1/15/10 | LNB/OFA | GCP | 0.33 (30-day) | |
| 19 | NRG Texas Power LLC | Limestone Electric Generating Station | Jowett, TX | Boiler Units 1 and 2 | Tangential-fired | PSDTX371M4 | 2/1/10 | LNB/SOFA | GCP | 0.33 | |
| 20 | Southwestern Public Searvice Company | Tolk Station Power Plant | Sudan, TX | Boiler Unit 1 | Tangential-fired | PSDTX50M2 | 3/23/11 | | N | 0.34 | |
| 21 | Portland General Electric | Boardman Power Plant | OR | Unit 1 | Wall-fired | 25-0016-ST-01 | 12/10/10 | LNB/OFA | GCP | 0.35 (30-day) | |
| 22 | Westar Energy, Inc. | Jeffrey Energy Center | St. Mary's, KS | Unit 3 | Tangential-fired | None | 3/1/12 | LNB/SOFA/Smartburn Control System | GCP | 0.4 | |
| 23 | MidAmerican Energy Company | George Neal South | Salix, IA | Boiler 4 | Wall-fired | 05-A-655-P | 9/28/05 | LNB/OFA | GCP | 0.42 | |
| 24 | MidAmerican Energy Company | Louisa Generating Station | Muscatine, IA | Louisa Boiler | Wall-fired | 05-A-031-P | 3/1/05 | LNB/OFA | GCP | 0.42 | |
| 25 | MidAmerican Energy Company | Council Bluffs Energy Center | Council Bluffs, IA | Boiler 3 | Wall-fired | 75-A-357-P4 | 9/15/06 | LNB/OFA | GCP | 0.42 | |
| 26 | Board of Public Utilities | Quindaro Station | Kansas City, KS | Unit 2 | Wall-fired | None | 4/14/11 | LNB/OFA | GCP | 0.42 | |
| 27 | Nebraska Public Power District | Gerald Gentleman Station | Sutherland, NE | Unit 2 | Wall-fired | Unknown | 5/1/10 | LNB/OFA | GCP | 0.50 | |
| 28 | Nebraska Public Power District | Gerald Gentleman Station | Sutherland, NE | Unit 1 | Wall-fired | CP06-0001 | 8/18/06 | LNB/OFA | GCP | 0.5 (30-day) | |
| 29 | MidAmerican Energy Company | Council Bluffs Energy Center | Council Bluffs, IA | Boiler 2 | Wall-fired | 72-A-173-P2 | 3/7/08 | LNB/OFA | GCP | 0.54 | |
| 30 | Nebraska Public Power District | Sheldon Station | Sheldon, NE | Unit 2 | Cyclone | Unknown | 7/11/07 | OFA | GCP | 1.26 | Not relevant. Boiler is a cyclone boiler. The design characteristics of cyclone boiler are such that they are not conducive to the same type of low-NOx combustion systems that are applied to wall and tangential-fired boilers. |
| 31 | MidAmerican Energy Company | George Neal North | Sergeant Bluff, IA | Boiler 1 | Cyclone | 05-A-878-P | 12/9/05 | OFA | GCP | 1.26 (3-hr) | Not relevant. Boiler is a cyclone boiler. The design characteristics of cyclone boiler are such that they are not conducive to the same type of low-NOx combustion systems that are applied to wall and tangential-fired boilers. |
| 32 | MidAmerican Energy Company | George Neal North | Sergeant Bluff, IA | Boiler 2 | Wall-fired | 07-A-951-P | 9/5/07 | LNB/OFA | GCP | 1.63 (3-hr) | |

## C.6 CONCLUSION OF CO BACT

The only control deemed feasible for CO is GCP. Thus, the BACT analysis for CO establishes GCP as BACT for CO. In order to provide the needed flexibility for achieving high levels of $NO_X$ reductions for this project, Westar proposes a CO BACT emissions limit of 0.4 lb/MMBtu on a 30-day rolling average. This BACT limit is in line with other recent and relevant BACT limits.

# APPENDIX D

# AIR QUALITY ANALYSIS

# AIR QUALITY ANALYSIS

An air dispersion modeling analysis was conducted to determine the maximum CO impacts resulting from the proposed $NO_X$ Reduction Project.

## D.1 SELECTION OF MODEL

AERSCREEN is a screening dispersion model approved and recommended by the U.S. EPA for evaluating ambient air impacts.[1] AERSCREEN is based on the U.S. EPA preferred/recommended model, AERMOD, which is used for evaluating impacts attributable to emissions from industrial facilities in the near-field (i.e., source receptor distances of less than 50 km). The AERMOD modeling system is composed of three modular components: AERMAP, the terrain preprocessor; AERMET, the meteorological preprocessor; and AERMOD, the control module and modeling processor. There are also two additional components associated with AERMET, including AERMINUTE and AERSURFACE.

Per the U.S. EPA's AERSCREEN User's Guide, AERSCREEN is an interactive command-prompt application that interfaces with MAKEMET for generating the meteorological matrix. It also interfaces with AERMAP and BPIPPRM to automate the processing of terrain and building information, and interfaces with the AERMOD model utilizing the SCREEN option to perform the modeling runs.

The BREEZE® AERSCREEN, Version 1.3.1 software and BREEZE® AERMOD, Version 7.6 developed by Trinity Consultants was used to develop the model data files for AERSCREEN. These software programs incorporate the current regulatory versions of AERSCREEN (11126), AERMOD (12060), AERMAP (11103), BPIPPRM (04274), and MAKEMET (11126).

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[1]Per U.S. EPA Memorandum titled "AERSCREEN released as the EPA Recommended Screening Model", April 11, 2011.

## D.2 METEOROLOGICAL DATA

The MAKEMET program in AERSCREEN generates meteorological conditions based on user-specified surface characteristics, ambient temperatures, minimum wind speed, and anemometer height. The suggested default values of MAKEMET were used for the minimum temperature (250 K), maximum temperature (310 K), minimum wind speed (0.5 m/s), and the anemometer height (10 meters). The selected surface profile was conservatively set to "grassland"; in addition, the climate profile was set to "average" precipitation. The proposed surface profile of "grassland" is based on the aerial image in *Figure D.1 - 1-km and 3-km Radius Aerial Imagery of Facility* below which indicates that grasslands and cultivated lands are the dominate land cover in the one kilometer area surrounding TEC. Since grasslands have a lower surface roughness value than cultivated land (pasture/row crop/short grains),[2] it has been proposed to use the more conservative surface profile for this project.

### D.2.1 Dispersion Coefficients

The U.S. EPA's Auer land use classification was used to determine whether rural or urban dispersion coefficients should be used in AERSCREEN. The land use type within a 3 kilometer radius around the facility was evaluated to determine if the area is predominantly rural or urban. If 50 percent or more of the land use is rural then the rural option is selected, otherwise the urban option is selected. The aerial image provided below indicates that the area surrounding the facility is predominately (greater than 50 percent) rural, thus the rural option was selected in AERSCREEN.

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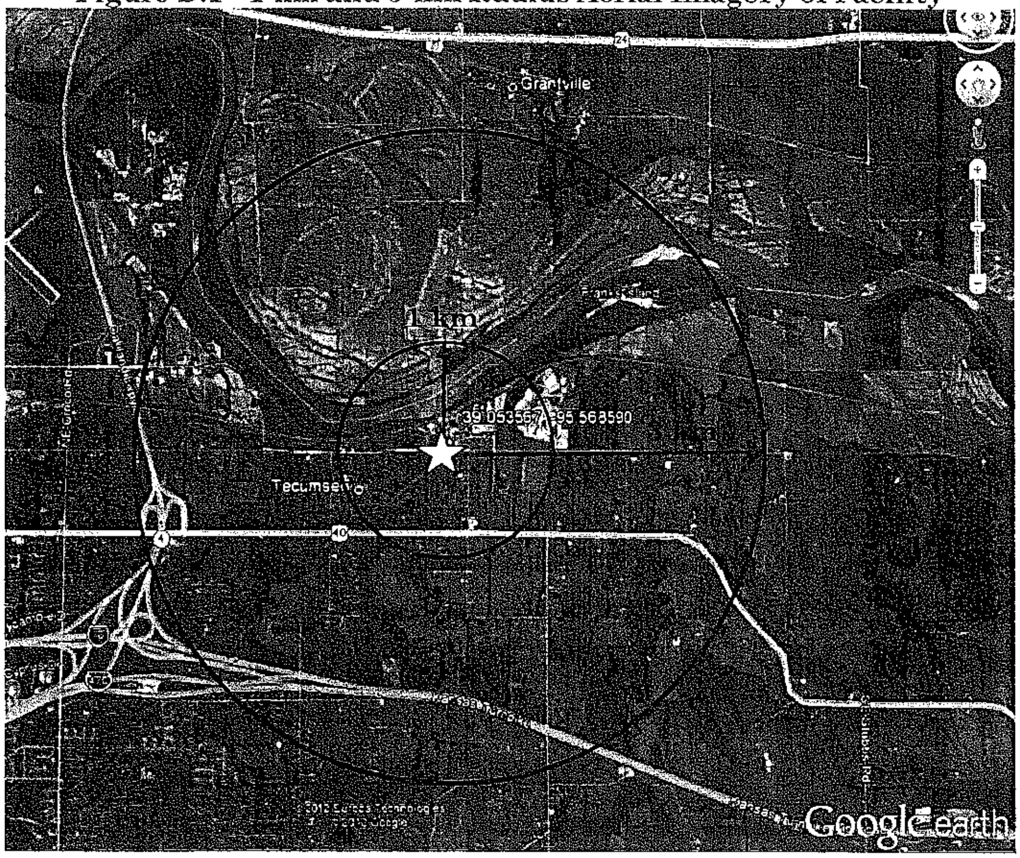
[2] U.S EPA AERSURGACE User's Guide, Table A-3. EPA-454/B-08-001. January 2008

Figure D.1 - 1-km and 3-km Radius Aerial Imagery of Facility




## D.3 RECEPTORS AND TERRAIN

### D.3.1 Receptor Grids

Ground-level concentrations were calculated at 25-meter intervals extending from the minimum distance to the fenceline (140 meters) out to 5 kilometers, and 50-meter intervals from 5 kilometers to 10 kilometers. A receptor was located in each of the 36 10-degree flow sectors.

### D.3.2 Terrain Elevations

AERMAP was used to interpolate elevations for each AERSCREEN-generated receptor based on National Elevation Data (NED) obtained from the United States Geological Survey (USGS). The USGS NED consisted of arrays of 1/3 arc second (approximately

10 meter) spaced elevations. The source elevation of 878 feet (267.61 meters) was based on the average AERMAP derived value for the source and buildings at the facility. In order to import elevations using AERMAP, the source location and datum must be provided. TEC8/10 is located at 277,752 meters east and 4,325,861 meters north in Universal Transverse Mercator (UTM) Zone 15, Datum NAD83.

## D.4 BUILDING DOWNWASH AND GEP STACK HEIGHT ANALYSIS

40 CFR §51, Appendix W - *Guideline on Air Quality Models*[3] requires an evaluation of the potential for physical structures (e.g. buildings) to affect the dispersion of emissions from stacks due to the downwash effect of structures on plumes released from stacks. Calculations for determining direction-specific downwash parameters were performed using the BREEZE®-AERMOD, Version 7.6 software, developed by Trinity. This software incorporates the algorithms of the U.S. EPA-sanctioned Building Profile Input Program with Plume Rise Model Enhancement (BPIP-PRIME). All dominant building structures that are within five times the lesser of the structure height or projected width from TEC8/10 stack were included in the evaluation.

## D.5 LOAD ANALYSIS AND MODELED PARAMETERS

The AERSCREEN analysis was completed to confirm that TEC8/10 will not result in impacts greater than the modeling significant levels (MSLs). The modeling analysis was performed for 100-percent, 75-percent, and 50-percent loads. *Figures D.2 - CO Modeled Emissions Rates and D.3 - CO Modeled Stack Parameters* summarize the emission rates and stack parameters for the various loads.

[3] U.S. EPA, Office of Air Quality Planning and Standards, *Federal Register* Vol. 70 / No. 216, pp. 68,218-68,261, 40 CFR 51, Appendix W, *Revision to Guideline on Air Quality Models*, November 9, 2005.

Figure D.2 - CO Modeled Emission Rates

| Load | Heat Input (MMBtu/hr) | CO BACT Limit (lb/MMBtu) | Potential Emissions (lb/hr) | Baseline Emissions (lb/hr)* | Emission Increase (lb/hr) |
|---|---|---|---|---|---|
| 100% | 1911 | 0.4 | 764.4 | 34.78 | 729.62 |
| 75% | 1433.25 | 0.4 | 573.3 | 34.78 | 538.52 |
| 50% | 955.5 | 0.4 | 382.2 | 34.78 | 347.42 |
| | *The baseline rate is the hourly average of the project's annual baseline rate of 152.3 tpy. | | | | |

Figure D.3 - CO Modeled Stack Parameters

| | Load | Stack Height (ft) | Stack Diameter (ft) | Exhaust Flow Rate (acfm) | Exhaust Velocity (ft/s) | Exhaust Temperature (F) |
|---|---|---|---|---|---|---|
| TEC8/10 | 100% | 211 | 11.5 | 566,131 | 90.84 | 314 |
| | 75% | 211 | 11.5 | 461,735 | 74.09 | 300 |
| | 50% | 211 | 11.5 | 394,219 | 63.26 | 277 |

## D.6 SUMMARY OF MODEL RESULTS

*Figure D.4 - Modeling Results* summarizes the maximum CO concentrations predicted for the Project for 100-percent, 75-percent, and 50-percent loads. All modeling input and output files, building downwash files, and terrain data have been provided electronically as part of this application submittal.

Figure D.4 - Modeling Results

| Averaging Period | Maximum Impact (μg/m³) | | | Modeling Significant Level (μg/m³) |
|---|---|---|---|---|
| | 100% Load | 75% Load | 50% Load | |
| One-Hour | 266.6 | 229.7 | 163.9 | 2,000 |
| Eight-Hour | 239.9 | 206.7 | 147.5 | 500 |

As shown, the changes to the CO one-hour and eight-hour modeled impacts for all three loads are not significant, as they are well below the CO modeling significant levels (MSLs). As such, it has been determined that the project will not have a significant impact on the ambient air surrounding the TEC.

## D.7 ADDITIONAL IMPACTS ANALYSIS

In accordance with 40 CFR 52.21(o), the owner or operator of a proposed major source or major modification shall analyze the effects of the project on visibility, soils, and vegetation in the surrounding area and any affected Class I areas. The owner or operator must also evaluate the effects of commercial, residential, industrial, and other growth associated with the new source or modification. In accordance with these requirements, an analysis of additional impacts resulting from the Project follows.

## D.8 VISIBILITY

Pollutants that are typically evaluated for their impact on visibility as part of PSD permitting include PM, $NO_X$, $SO_2$, and VOC. Since CO is the only pollutant that will increase as a result of the proposed project, a visibility analysis is not necessary.

## D.9 SOIL AND VEGETATION IMPACTS

CO is not known to harm soils, as there is no deposition of CO onto soil. The project will actually decrees $NO_X$ emissions, providing a benefit to the surrounding area.

The land cover of the area surrounding TEC was analyzed using the 2005 Kansas Land Cover Patterns (available at http://www.kars.ku.edu/maps/klcp2005/). This tool shows the primary land cover in the immediate area around TEC is urban open land/urban residential or woodland and water. This local area is surrounded by land used for agriculture and grassland.

The primary NAAQS for criteria pollutants were developed to provide adequate protection of human health, while the secondary standards were designed to protect the general welfare, i.e., man-made and natural materials, including soils and vegetation. EPA guidance on new source review supports this by stating:

> For most types of soils and vegetation, ambient concentrations of criteria pollutants below the secondary NAAQS will not result in harmful effects.[4]

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[4]U.S. EPA, Office of Air Quality Planning and Standards. *New Source Review Workshop Manual (Draft)*, Research Triangle Park, NC. October 1990. p. D.5.

Carbon monoxide has not been found to adversely affect plants at concentrations below 114,500 μg/m$^3$ for exposures from one to three weeks (USEPA 1976). There are no reports of measured CO level producing any adverse effects on plants (EPA 600/P-99/001F). In its most recent review of the CO NAAQS, EPA concluded that "the currently available scientific information with respect to non-climate welfare effects, including ecological effects and impacts to vegetation, does not support the need for a CO secondary standard" (76 FR 54294).

Since there are no secondary NAAQS standards for CO, the modeled concentrations are compared to the primary NAAQS standards.

The results of the air quality analysis presented in the beginning of this Appendix demonstrate that the maximum ambient air impacts due to the increase in CO emissions from the project are under the applicable MSLs, which are lower than the NAAQS. Thus, the proposed project should not result in harmful effects to soils or vegetation.

## D.10 GROWTH IMPACTS

The elements of a growth impact analysis include:

1. A projection of the associated industrial, commercial, and residential source growth that will occur in the area due to the source.
2. An estimate of the air emissions generated by the above associated industrial, commercial, and residential growth.

There will be no associated growth due to the 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.

# APPENDIX E

# PROPOSED DRAFT KDHE PERMIT

Bureau of Air
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Topeka, KS 66612-1366

Kansas

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Robert Moser, MD, Acting Secretary
Department of Health & Environment
Sam Brownback, Governor

# AIR EMISSIONS SOURCE CONSTRUCTION PERMIT

Source ID No.: 1770030

Effective Date:

Source Name: Westar Energy, Inc., Tecumseh Energy Center

NAICS Code: 221112, Fossil Fuel Electric Power Generation

SIC Code: 4911, Electric Services

Source Location: 2nd and Dupont Road
Tecumseh, Kansas 66542

Mailing Address: 818 S. Kansas Avenue, P.O. Box 889
Topeka, Kansas 66601

Contact Person: Mr. Daniel R. Wilkus, P.E.
Director, Air Programs
Telephone: (785) 575-1614
Dan.Wilkus@westarenergy.com

**This permit is issued pursuant to K.S.A. 65-3008 as amended.**

## I. Description of Activity Subject to Air Pollution Control Regulations

Westar Energy, Inc. is proposing to make certain modifications to the existing burner and combustion system on the Unit 8/10 boiler at the Tecumseh Energy Center (TEC), located near Tecumseh, Kansas. The burner and combustion system modifications include installation of new low $NO_X$ burners (LNBs), windbox air actuators, windbox dampers, coal feeders, coal piping and coal piping support, the installation of separated overfire air (SOFA) ducting, dampers, and air tips, and boiler tuning. This project will result in an overall decrease in $NO_X$ emissions. As a result of lowering $NO_X$ emissions there may be an increase in carbon monoxide (CO) emissions. With the increase in CO emissions a decrease in carbon dioxide ($CO_2$) emissions is anticipated.

Emissions of $NO_X$, CO, and $CO_2$ were evaluated for this permit review. Due to the increase in CO emissions in excess of the major modification thresholds, the proposed modification will be subject to the requirements of 40 CFR 52.21, Prevention of Significant Deterioration (PSD) as adopted under K.A.R. 28-19-350. TEC 8/10 is an affected source subject to Title IV of the Federal Clean Air Act, Acid Deposition Control. The proposed project does not constitute a modification or reconstruction for the purpose of determining applicability of New Source Performance Standard (NSPS) requirements. This project is subject to K.A.R. 28-19-300 (Construction permits and approvals; applicability) because the increase in potential-to-emit of CO exceeds 100 tons per year.

An air dispersion modeling impact analysis and a Best Available Control Technology (BACT) determination were conducted as part of the construction permit application process.

## II. Significant Applicable Air Regulations

The proposed activity is subject to certain Kansas regulations relating to air pollution control. The following air quality regulations were determined to be applicable to this project:

K.A.R. 28-19-300 Construction permits and approvals; applicability

K.A.R. 28-19-350 Prevention of significant deterioration of air quality

## III. Air Emission Unit Technical Specifications

The following equipment or equivalent is approved:

The low $NO_X$ system modifications include installation of new LNBs, windbox air actuators, windbox dampers, coal feeders, coal piping and coal piping support, the installation of separated overfire air (SOFA) ducting, dampers, and air tips, and boiler tuning.

## IV. Air Emissions Estimates from the Proposed Activity

| Pollutant Type | Baseline Actual (tons per year) | Projected Actual (tons per year) | Change in Emissions (tons per year) |
|---|---|---|---|
| CO | 152 | 1,929 | 1,777 |
| $NO_X$ | 1,838 | 868 | -970 |
| $CO_2$ | 1,122,872 | 1,120,080 | -2,792 |

## V. Air Emission Limitations

The emission limitation established in this permit applies to TEC Unit 8/10 at all times, including startup, shutdown and malfunction, except as provided in section "VI. Monitoring, Recordkeeping and Reporting, E. Malfunction" of this permit.

A. The thirty (30) day rolling average emission rate of CO shall not exceed 0.4 lb/MMBtu.

B. The purpose of the project is to reduce the $NO_X$ emissions from Unit 8/10. In the event difficulties are encountered demonstrating compliance with the CO limit while optimizing $NO_X$ emissions, the Owner or Operator may request a revision to the CO limit. The revision will be subject to KDHE approval and may require a public notice and comment period.

## VI. Monitoring, Recordkeeping and Reporting

A. Compliance with the CO BACT limit shall be demonstrated with a continuous emission monitoring system (CEMS). The CO CEMS shall be installed, certified, operated, maintained, and quality assured according to 40 CFR 60, Appendix B, Performance Specification 4A (PS4A) and 40 CFR 60, Appendix F (Quality Assurance/Quality Control) within 180 days after startup.

B. Provide a report of the CEMS certification within 30 days after certification is completed.

C. Reports of excess emissions shall be submitted semi-annually in accordance with the requirements in 60.7(c). The summary report referenced in 60.7(c) and defined in 60.7(d) applies to the CO CEMS downtime only and is not applicable to an exceedance of the CO limit established in the document.

D. Records shall be kept on site for two (2) years in accordance with 60.7(f).

E. Malfunction:

The Owner or Operator must notifiy KDHE by telephone, facsimile, or electronic mail transmission with two (2) working days following the discovery of any failure of air pollution control equipment, process equipment, or of the failure of any process to operate in a normal manner which results in an increase in emission above the allowable emission limit stated in section "V. Air Emission Limitations" of this permit, a written notification shall be submitted with ten (10) days of the event.

The written notification shall include a description of the malfunctioning equipment or abnormal operation, the date of the initial malfunction, the period of time over which emissions were increased due to the failure, the cause of the failure, the estimated resultant emissions in excess of those allowed in "Air Emission Limitations," and the methods utilized to mitigate emissions and restore normal operations. Compliance with this malfunction notification shall not automatically absolve the owner or operator of liability for the excess emissions resulting from such event.

The following criteria will be used by KDHE to evaluate whether emissions from a malfunction are excluded in determining compliance with the emission rate contained herein:

1. The excess emission were caused by a sudden, unavoidable breakdown of technology, beyond the control of the owner or operator;
2. The excess emissions did not stem from any activity or event that could have been foreseen and avoided, or planned for, and could not have been avoided by better operation and maintenance practices;
3. To the maximum extent practicable, the air pollution control equipment or processes were maintained and operated in a manner consistent with good practices for minimizing emissions;
4. Repairs were made in an expeditious fashion when the operator knew or should have known that applicable emission limitations were being exceeded. Off-shift labor and overtime must have been utilized, the the extent practicable, to ensure that such repairs were made as expeditiously as practicable.
5. The amount and duration of the excess emissions (including any bypass) were minimized to the maximum extent practicable during periods of such emissions;
6. All possible steps were taken to minimize the impact of the excess emissions on ambient air quality;
7. All emission monitoring systems were kept in operation if at all possible;
8. The owner or operator's actions in response to the excess emissions were documented by properly signed, contemporaneous operating logs, or other relevant evidence;
9. The excess emissions were not part of a recurring pattern indicative of inadequate design, operation, or maintenance; and
10. The owner or operator properly and promptly notified the appropriate regulatory authority.

## VII. Notifications

Notify the Northeast District Office within 30 days after construction is complete so that an evaluation may be conducted.

## VIII. General Provisions

A. This document shall become void if the construction or modification has not commenced within 18 months of the effective date, or if the construction or modification is interrupted for a period of 18 months or longer.

B. A construction permit or approval must be issued by KDHE prior to commencing any construction or modification of equipment or processes which results in an increase of potential-to-emit equal to or greater than the thresholds specified by K.A.R. 28-19-300.

C. Upon presentation of credentials and other documents as may be required by law, representatives of KDHE (including authorized contractors of KDHE) shall be allowed to:

1. enter upon the premises where a regulated facility or activity is located or conducted or where records must be kept under conditions of this document;

2. have access to and copy, at reasonable times, any records that must be kept under conditions of this document;

3. inspect at reasonable times, any facilities, equipment (including monitoring and control equipment) practices or operations regulated or required under this document; and

4. sample or monitor, at reasonable times, for the purposes of assuring compliance with this document or as otherwise authorized by the Secretary of KDHE, any substances or parameters at any location.

D. The emission unit or stationary source which is the subject of this document shall be operated in compliance with all applicable requirements of the Kansas Air Quality Act and the Federal Clean Air Act.

E. This document is subject to periodic review and amendment as deemed necessary to fulfill the intent and purpose of the Kansas Air Quality Statutes and Regulations.

F. This document does not relieve the facility of the obligation to obtain other approvals, permits, licenses or documents of sanction which may be required by other federal, state or local government agencies.

**Permit Engineer**

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Date Signed