SECTION 5

CONTROL TECHNOLOGY EVALUATION
Addendum A
Greenhouse Gas BACT

As previously discussed in Section 4 of the CRE application, the proposed CRE facility will be classified as a "major" source under State and Federal Air Quality Regulations. The proposed facility's design must apply Best Available Control Technology (BACT) to the emissions of the following attainment pollutants: SO_2, PM-10, PM-2.5, NO_2, and CO. A BACT analysis was included in Section 5 of the Plan Approval application that was submitted to the PA DEP for review on August 13, 2010. The Crawford County Area is classified as an attainment area for all of the criteria pollutants. On January 2, 2011 the Greenhouse Gas (GHG) Tailoring Rule will take effect. Because GHG emissions from the proposed facility will be greater than the adopted significant levels of CO_2e and the facility has been evaluated for other PSD pollutants, DEP requested in a December 10, 2010 letter a PSD BACT evaluation for GHG emissions under the new federal requirements. The following technology evaluation was conducted to support the BACT requirements for GHG:

5.1 <u>BEST AVAILABLE CONTROL TECHNOLOGY</u>
As discussed in Subsection 4.1.1 of the CRE Plan Approval application, the PSD regulations are applicable to the facility. Since the area of the proposed facility is in attainment for all of the criteria pollutants which have Ambient Air Quality Standards (AAQS), those pollutants listed in Table 4-2 (except NOx and VOC- Ozone Transport Region Pollutants) which are emitted at annual rates equal to or in excess of the significant levels shown are subject to BACT analyses. Under the GHG Tailoring Rule, if a facility is subject to the Federal PSD Rule and if GHG emissions are greater than 75,000 metric tons of CO_2e, a BACT evaluation is needed as part of a new permit application. Because PA DEP will not act on the PSD permit application prior to the January 2nd, 2011 deadline, a BACT analysis was requested by the Department.

The PSD regulations require that BACT be used to control emissions of pollutants that exceed significant levels. BACT is defined in 40 CFR Section 52.21(b) (12) as:

- An emissions limitation (including a visible emission standard) based on the maximum degree of reduction for each pollutant subject to regulation under the Act which would be emitted from any proposed major stationary source or major modification which the Administration, 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 for such pollutants. In no event shall application of Best Available Control Technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR Parts 60 and 61. If the Administrator determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be prescribed instead to satisfy the requirement for the application of best available control technology. Such standard shall, to the degree possible, set forth the emissions reduction achievable by implementation of such design, equipment, work practice, or operation, and shall provide for compliance by means that achieve equivalent results.

A BACT determination is essentially a case-by-case analysis that addresses the technological question of whether a proposed control technique can be considered BACT for the particular application, or whether a more stringent level of emission control should be used. This determination involves an assessment of the availability of applicable technologies capable of sufficiently reducing a specific pollutant emission, and consideration of the economic, energy, and environmental impacts of using each technology. As suggested in the guidance documents for GHG emissions, factors other than Carbon Capture and Storage are suggested as methods to lower CO_2 emissions.

The methodology used in this study to determine BACT follows a "top-down" approach as recommended by the EPA, and remains the generally accepted methodology for determining BACT. A "top-down" BACT analysis contains the following elements:

1. Define the most effective technologies from top to bottom
   For the process in question, determine the most effective control option for a similar or identical source or source category.
2. Determine if each technology is appropriate as BACT.
   Review the appropriateness of each option, considering technical feasibility; energy, environmental, and economic impacts; and other costs.
3. If not BACT, evaluate the next most effective control option.
   Evaluate the next most stringent option, if the first option is either technically, economically, environmentally, or energy infeasible or inappropriate.
4. Continue the process.
   Repeat Steps 2 and 3 until the BACT level under consideration cannot be eliminated.
5. Selection of an emission rate as BACT.

As part of this analysis CRE reviewed EPA's October 2010 document **"Available and Emerging Technologies for Reducing Greenhouse Gas Emissions from Coal-Fired Electric Generating Units".** This document was prepared by the Sector Policies and Programs Division, Office of Air Quality Planning and Standards. Although this document was prepared for coal fired utilities it is the closest guidance document available to address GHG emissions from CFB combustion which utilizes TDF. Because of the bio-fuel content of TDF and because of the low moisture content the efficiency of a TDF fired CFB is greater than for its coal counterpart.

This submittal will be one of the first GHG Tailoring Rule submittals in Pennsylvania. In accordance with EPA guidance documents regarding the performance of top-down BACT analysis, a permit applicant is required to evaluate alternative control options that are technically and economically achievable through the review of similar sources. For purposes of this permit application, the definition of a facility similar to the proposed project is one using CFB technology for combustion in an electric-steam unit capacity.

The Clean Air Act and EPA's implementing regulations require a new stationary source to apply BACT to each pollutant regulated under the Act that the source has potential to emit in significant amounts (40 CFR Section 52.21). BACT is defined to establish the emission limitation corresponding to the maximum degree of reduction for a regulated pollutant as determined by the permitting authority on a case-by-case basis, with proper consideration given to energy, environmental and economic impacts and other costs [42 U.S.C. Section 7479(3)]. As stated above under the GHG Tailoring Rule a source is subject to a BACT review if the facility is a major source subject to PSD review for other criteria pollutants and if the GHG CO_2e is greater than 75,000tpy (metric). A possible control technology should only be evaluated under the BACT analysis for a particular source if it is applicable to the source, and if associated emission limitations are achievable by the source. In other words, the BACT analysis is to be based upon consideration of similar sources.

EPA has consistently supported the position that facilities that utilize distinct fuel sources are not "similar facilities" for purposes of the BACT analysis. *See, e.g.*, In re: Inter-Power of New York, Inc., 1994 PSD LEXIS 3 (March 16, 1994). This being the case, it is difficult to assess various emission limitations because of the lack of similar units combusting TDF. Using the above considerations as a guide, GHG emissions proposed for this project are most appropriately compared with other CFB facilities. Nevertheless a review of numerous proposed GHG technologies was conducted for this submittal.

5.1 Greenhouse Gases (GHG) Emissions

GHG emissions from the combustion of TDF will occur through the combustion of the carbon in TDF and the disassociation of CO_2 from limestone in the CFB process. Maximum CO_2 emissions are estimated as follows:

TDF:
TDF provided to the CFB will have a carbon content of approximately 69%. Assuming a TDF firing rate of 900tpd, 621tpd of carbon will be consumed in the process. In a typical CFB operation there is approximately 2 – 3% unburned carbon. For this estimate we have used a conservative estimate of 2% which equates to 608tpd (25.36tph) of carbon being combusted. CO_2 emissions from this process can then be estimated to be 92.8tph and 812,928tpy based on a 365 day operating schedule.

Limestone:
Additional CO_2 emissions will from the disassociation of limestone from $CaCO_3$ to CaO and CO_2 in the combustion process. Approximately 44% of the limestone will be converted to CO_2 that will be used to collect sulfur in the process. It is estimated that 10,920lbs/hr of limestone will be fed into the CFB units. Given a 44% conversion rate would lead to a CO_2 emission rate of 2.4tph and 21,024tpy. This assumes that all of the limestone is converted to CaO and is a conservative estimate.

CH_4 emissions:
In order to make this estimate the default factors for tires in 40 CFR Part 98 Table C-2 to Subpart C were used. The factor is 0.032kg/MM Btu x 1050MM Btu/hr. = 33.6kg/hr. x 8760hrs/yr. = 294.336metric tons/yr = 329.65tons x 21 = 6,923tpy CO_2(e).

N_2O emissions:
In order to make this estimate the factors for tires in 40 CFR Part 98 Table C-2 to Subpart C. The factor is 0.0042kg/MM Btu x 1050MM Btu/hr. = 4.41kg/hr. x 8760hrs/yr. = 38.63metric tons/yr. = 43.27tpy x 310 = 13,413tpy CO_2(e). Although we are aware that N_2O emissions are higher in CFB facilities, a study on a CFB in Finland has indicated that N_2O emissions from a CFB are reduced by using lime such as in the CFB lime scrubber that will be used in this project along with the use of an RSCR system which will also be used. This study indicates that N_2O can be reduced as much as 90%.

Total CO_2 emissions:
As a conservative estimate total CO_2emissions are estimated to be:

Table 5.1

GHG	TPH	TPY	GHG(e)TPH	GHG(e) TPY
CO_2	92.8	812,928	92.8	812,928
CO_2 from Limestone	2.4	21,024	2.4	21,024
CH_4	0.037	329.65	0.79	6,923
N_2O	0.005	43.27	1.53	13,413
SF_6	Neg.	0.0015	0.004	36
			97.52	854,324

5.2 BACT for Greenhouse Gas (GHG) Emissions

As part of this project CRE has chosen Circulating Fluidized Bed (CFB) combustion as appropriate for the combustion of TDF. CFB combustion offers a variety of benefits over other forms of combustion and CFBs' have been proven to be very reliable units. The CFBs chosen for this project will be designed by Sumitomo Heavy Industries, Inc. (SHI) of Japan. Sumitomo is a licensee of Foster Wheeler, North America and was selected as the CFB supplier because of its design and experience with TDF. The combustion temperature in CFBs is approximately 1600°F which is significantly lower than traditional PC boilers which have an average combustion temperature of approximately 2500°F. This results in lower NO_x formation and the ability to capture SO_2 with limestone injection into the furnace. Even though the combustion temperature in the CFB is low, the circulation of hot particles provides efficient heat transfer to the furnace walls and allows longer residence time for carbon combustion and limestone reaction. This results in good combustion efficiencies and less unburned carbon compared to other combustion units such as PC units. Atmospheric CFB units have proven to be very reliable for TDF combustion. Calcium in the limestone combines with SO_2 gas to form calcium sulfate and sulfate solids, and solids exit the combustion chamber and flow into a hot cyclone. The cyclone separates the solids from the gases, and the solids are recycled for combustor temperature control. Heat in the fuel gas exiting the hot cyclone is recovered in a series of heat recovery sections of the boiler to produce steam. The superheated steam leaving the boiler then enters a steam turbine which produces electricity. As part of this project CRE is also actively pursuing other industries that can use the excess steam that will be generated. By locating this facility in the Keystone Regional Industrial Park in Greenwood Township, Crawford County there is a number of sites available that can attract industries that can use the steam. This would make the project a Combined Heat and Power (CHP) facility and increase the efficiency of the CFB units.

As part of the technology evaluation for this project other technologies were investigated and determined to not be appropriate for TDF combustion. Other technologies such as IGCC are outside the scope of BACT because it would represent a change in the basic design and business purpose of this project.

The development of effective and commercially viable CO_2 control technologies for Electric Generating Units (EGUs) is currently receiving widespread attention world-wide. Most CO_2 control technologies are in the research and development phase. A few technologies are showing some promise but not ready for a commercial applications. In developing a Best Available Control Technology (BACT) US EPA is suggesting two approaches: 1) Carbon Capture and Storage and 2) Energy Efficiency. Both of these approaches are discussed below:

5.2a Carbon Capture and Storage

Carbon capture and storage (CCS) involves the separation and capture of CO_2 from flue gas. It also requires pressurization of the captured CO_2, transportation through a pipeline (similar to how we now pump natural gas), and injection and long term geologic storage. As part of the BACT analysis a number of carbon capture and storage projects were evaluated. Most of the technologies evaluated are in various stages of development. Some of the technologies are being demonstrated on a slip stream or pilot scale while others are still in the laboratory stage of development. All of the projects being reviewed are being heavily funded by either the US Department of Energy (DOE) or other government agencies. Almost all of the technologies reviewed use solvents, solid sorbents, or membrane-based technologies for separating and capturing CO_2. Another project that is being worked on is oxy-combustion where a highly concentrated CO_2 stream will be produced and directly stored. None of these technologies are at a stage of development that they can be applied to the proposed CRE facility. Additionally, if the CO_2 can be captured the next question is what to do with it? Current thoughts are that it will be transported through pipelines and stored in geologic formations such as oil and gas reservoirs, un-minable coal reserves or underground saline formations. Although there have been some discussions in Pennsylvania about developing state lands for carbon storage not much movement or progress has been made on this front. Some of the projects reviewed for this analysis include:

1. Future Gen (Meredosia, Illinois) - This coal-fired project involves oxy-combustion and storage in deep saline aquifers. This project received a $1 billion dollar award from the government to develop this project. Additionally others are being asked to contribute to this project. A site for storage has not yet been determined.
2. AEP Alstom (Mountaineer Station, New Haven WV) – This coal-fired plant is a pilot project that plans on post combustion capture with chilled ammonia and sequestering CO_2 into the

Mt. Simon Sandstone formation (a deep saline formation below the site). This pilot operation is being funded by the US DOE, AEP and Alstom. A 10-year scale-up project for the site with an additional $334 million cost is being funded by DOE.

3. Tampa Electric Big Bend Station (Ruskin Florida) – This coal-fired project plans on using Siemens POSTCAP technology which utilizes an amino acid salt formulation as a solvent for CO_2 absorption. A small pilot operation is scheduled for 2013.
4. Southern Company Plant, Barry Power Station (Mobile Alabama) – This coal-fired project will use post-combustion control with chilled ammonia technology developed by Mitsubishi Heavy Industries. Sequestration in the Citronelle Oil Field is planned. This is a small project being funded by a $295 million grant from the US DOE. The MHI process requires lower energy consumption than other technologies. There have been problems securing funding for this project but recent reports indicate that it is on schedule. Southern Company has reported that it has recovered CO_2 from one of its power plants in Georgia in September 2010. Additional process improvements are needed before this technology can be scaled up to commercial operation.
5. Summit Power Group (Midland-Odessa, West Texas) – This is a joint venture between Summit Power, Flour and Siemans. This coal project is being funded by US DOE and also received $100 million from the American Recovery Act. Plans are to sequester up to 3 million tons per year of CO_2 into the Permian Basin. As part of this project the participants are looking at pumping CO_2 into old oils wells and are expecting to recover residual oil that remains in the wells (ROR). It is thought that other by-products from this process will be used in commercial products. Commencement of construction is not scheduled until sometime in 2011.
6. Transalta (Keephills Power Plant, Edmonton, Alberta, Canada) – This post combustion coal project will use chilled ammonia with sequestration into a saline solution. This project is being heavily funded by the Canadian government and has received a $431 million award and an additional $5 million for front-end engineering. The CO_2 will be injected approximately 8000 feet below the surface.
7. RWE Goldenbergwerk (Hurth, Germany) – This project is being done by RWE Power, BASF and the Linde Group. This CO_2 capture project is not scheduled for commercial operation until 2015 and is projected to cost $2.6 billion. RWE is investigating suitable storage locations.
8. ENDESA and CIUDEN (El Bierzo, Spain) – this coal-fired project will use Oxy-Fuel and flex burn CFB technology with storage in a saline aquifer. This project is being heavily funded by the EU with a cost of over $300 million.
9. It has been suggested that in IGCC units pre-combustion CO_2 capture is less expensive than post combustion capture. Even if this is the case a need for sequestration would also be required. We view this in a similar manner to oxy-firing which reduces the amount of gases handled.

In addition to the above-mentioned and other carbon capture and storage projects there are a number of other technologies that are being investigated. Other storage methods such as ocean storage are also being discussed. Technologies such as using algae growth are also being evaluated and are mostly in the experimental stages.

The above projects as well as many others are currently in the pilot testing and experimental phase and not ready for commercial development. Additionally, all of these projects are heavily funded by government grants and the Recovery Act. CRE has discussed the various control options with a few technology vendors and have been told that although some look promising on a on a small scale application pricing is not yet available. The two most promising technologies are amine scrubbing and Oxy-firing and collection. Even if a technology becomes available some sort of sequestration will be needed. One form of sequestration would be into geologic formations. Although CO_2 has been placed into storage, long term storage is a relatively new concept that has not yet been proven. There are many technical and legal issues that need to be resolved before any of these technologies become commercially available. Although there have been discussions about using State Lands in Pennsylvania to sequester CO_2 emissions, there have not been any actions taken by the State to further this idea. For this evaluation we have determined that capture and sequestration is currently not technically or commercially available. Other technologies that capture CO_2 are currently in the experimental stage and are not yet commercially or technically available. Even when/if collection becomes technically feasible sequestration options must be available before this becomes a commercial operation. Other applications have stated and we concur that this technology will not be available until 2025 or later.

Conclusions:

Carbon capture and sequestration along with other technologies such as algae growth are currently not technically, commercially or economically available and cannot be considered as a viable technology in this BACT evaluation. Because the facility will be well controlled with a CFB scrubber, fabric filter and Regenerative Selective Catalytic Reduction (RSCR) it will be carbon capture ready if and when viable control and sequestration options become available.

5.2b **Efficiency Improvements**

For this energy project CRE has selected CFB technology using TDF as a fuel source. The facility as planned will generate 98MW of gross power and 90MW of net power. The parasitic load on the facility will be on the order of 9%. In order to maximize plant efficiency a high efficient steam turbine will be purchased. Additional measures such as variable speed motors, etc. will be used in an attempt to maximize power output. Preliminary design characteristics indicate:

- Expected Boiler Efficiency – 86% (Efficiency supplied by Sumitomo Heavy Industries, the Boiler Supplier)
- Expected Turbine Efficiency – 80% (Efficiency provided by both Siemens Steam Turbine Division and by General electric. These are the two preferred suppliers.)
- Expected Plant Efficiency – 30% (Efficiency calculations made based on Plant Cycle calculations done by Tri-Mont Engineering Company, the engineer of record for the CRE plant design.)
- Expected Plant Parasitic Load – 9,000 to 9,500 kW (Parasitic Load based on calculations performed by Tri-Mont Engineering Company, the engineer of record for the CRE plant design.)
    - ID,FD Booster Fans – 1,800kW/boiler
    - Cooling Tower Fans – 500kW
    - Boiler Feed Pumps – 1,100kW
    - TDF Shredding – 2,700kW
    - Circulating Water Pumps – 900kW
    - Miscellaneous Equipment – 1,500Kw – 2,300kW

Because of its high heating value TDF is a good alternative to other fuels. TDF, when combusted, produces about the same amount of energy as oil, 25-50% more energy than coal, and 100-200% more energy than wood. Over the last decade more facilities have looked at using TDF because it is cheaper than coal, produces cleaner emissions, and has a low moisture content. Millions of scrap tires are generated each year in the United States and there is an ample supply to support the CRE facility. EPA estimates in their CISWI report that the GHG emission rate associated with the combustion of scrap tires is approximately 0.09 metric tons of CO_2(e) per MM Btu of heat input. This corresponds nicely to the above calculations which indicate an emission rate of 0.093 short tons or 0.0844 metric tons per MM Btu of heat input (1050MM Btu/hr.), Factoring in a parasitic load of 9% brings the net generation to 0.093tons of CO_2(e) per million Btu's of heat input. According to EPA estimates the GHG potential for coal, natural gas, distillate oil and residual oil are approximately 0.094, 0.053, 0.073 and 0.079 metric tons of CO_2(e) per million Btu's of heat input.

Biomass Fraction

TDF can have a biomass fraction of between 17 and 30%. According to a French study by Aliapur, used passenger tires have a biomass content of between 17 and 20% while truck tires have a biomass fraction between 28 and 30%. For this application we are assuming a 20% biomass fraction. Because of their biomass fraction, TDF produces less fossil carbon dioxide than other fuel sources. Using a 20% biomass fraction would reduce fossil CO_2 emissions by 18.5tph and 162,060tpy based on a 365 day operating schedule. When reporting GHG emissions it is important to also calculate carbon-neutral CO_2. To do this CRE will take random samples and use ASTM method D6866 to determine the bio-mass fraction. Taking bio-mass into consideration would reduce fossil CO_2(e) to 78.72tons/hr. (97.52 – 18.8) or 0.075 short tons per MM Btu's of heat input (0.068 metric tons of CO_2(e) per MM Btu of heat input). Using this as a benchmark indicates that the fossil GHG potential for scrap tires is lower than coal, distillate and residual oil and only trails the use of natural gas.

Moisture Content

When a high-moisture-content fuel is combusted, there is a considerable amount of energy and heat lost in heating the water to the vaporization point and then vaporizing it. This raises the heat rate of the EGU and lowers the efficiency. Because there is a minimal amount of moisture in TDF the heating values are higher than other fuels such as wood or coal and thus the efficiency of the unit is higher.

Transportation

Most of the scrap tires and TDF will be delivered to the facility by rail as opposed to trucks. Using rail delivery is a more efficient than truck delivery of tires and TDF.

SF_6 emissions

Since the 1980s CF_6 has been used extensively in electrical power systems as a dielectric medium (insulator) and interrupter (arc quencher) in medium and high voltage gas insulated switchgear. This includes switches, stand-alone gas insulated equipment, and any combination of electrical disconnects, fuses, electrical transmission lines, transformers and/or circuit breakers used to isolate gas insulated electrical equipment. There are a number of advantages of using SF_6 in these applications because it is non-flammable, non-corrosive, to internal switchgear components, it thermal properties make it an excellent arc suppressant and it is non-toxic. Because the GHG potential for SF_6 is 23,900 times that of CO_2 it is important to keep any emissions of CF_6 to a minimum. To the extent that CF_6 will be used in the electrical equipment, CRE as part of this application will agree to participate in the EPA's voluntary SF_6 reduction program. This includes having a leak detection and repair program established as part of the routine maintenance program. As part of this analysis CRE also identified SF_6 alternatives such as oil or air blast and concluded that SF_6 alternatives would require more land, generate more noise, and have a greater risk of releasing dielectric fluid. To this extent we have chosen the leak detection program as BACT for this portion of the project. Breakers with leak detection will minimize emissions to less than 3 lbs/yr. or 36tpy of CO_2(e)

Boiler Type

For this project CRE has selected CFB technology supplied by SHI. This selection was made based on SHI's knowledge of TDF combustion and their experience with these units in Japan, Korea and other countries. The CFB technology chosen is more efficient and less energy intensive than other solid fuel based technologies. We also evaluated the use of pressurized fluid-bed combustion (PFBC) technologies and have determined that they are not yet suitable for CRE's needs. Although there are a couple of successful demonstrations of this technology in Japan, Spain, Sweden and other countries this technology has not taken hold and a number of these plants have been shut down. A more advanced second-generation PFBC is currently in the testing phases. This process includes a combustion turbine and a heat recovery and steam generation (HRSG) system which drives a conventional steam turbine. This technology is still not ready for commercial development. An experimental unit has been tested in the Pittsburgh area using various grades of coal. This unit requires a slurry feed and would increase moisture into the system and reduce efficiency. This process would also increase the parasitic load required to further reduce the size of TDF being fed to the units.

Combined Heat and Power Plant (CHP)
A significant amount of energy released during the combustion process is lost during the steam condensation cycle due to heat transfer into the cooling water. A CHP plant on the other hand uses the thermal energy produced in the process. CHP facilities are commonly called cogeneration facilities. Operating an EGU in a CHP mode allows recovery of some of the heat that would otherwise be rejected into the cooling water, improving the overall efficiency and energy utilization. By locating this facility in the Keystone Industrial Park, CRE hopes that the installation of this facility will enhance other industries to locate close to the site to utilize the excess steam that will be produced. CRE is also exploring other activities such as greenhouses, etc. to be located near the facility so that an additional portion of excess steam can be utilized. Although CRE cannot commit to these activities at the present time, we feel that having the ability to provide low cost steam for heating and cooling could generate interest in this industrial park which has been sitting vacant for years.

Other Considerations
As part of this project CRE has considered other energy-saving technologies such as solar and wind aided generation. Because of the lack of direct sunlight in the area solar cells are not viable at this time. CRE is also looking into various wind projects that may enhance generation at this location. This will be further evaluated as part of this project. Wind projects are currently only effective if they are well subsidized. Many of these projects are currently suffering because the subsidies no longer exist. A wind project in conjunction with a power plant project may however be self sufficient and will be further analyzed.

CRE will also work with the local community to educate and develop various energy efficiency projects.

Conclusions:

CRE believes that using TDF (biomass content of greater than 20%) low-moisture fuel and CFB technology along with the ability to have a CHP project addresses the energy efficiency portion of this BACT analysis. Taking into consideration the bio-mass portion TDF combustion reduces the GHG potential to 0.068 metric tons/MM Btu's of heat input.

5.2c Other Considerations
CRE is not opposed to using this facility to test various forms of carbon capture such as algae growth, etc. Projects such as these are all being heavily funded by various government entities. If adequate funding is made available, CRE would be willing to use this facility to conduct some of the pilot testing. There is enough land available in the industrial park to support these activities.

5.3 BACT Determination
CRE believes that the use of CFB technology, the utilization of TDF (which has a biomass content of approximately 20%) and the possibility of using the excess steam from the plant as part of a CHP project represent BACT for this facility. Estimated BACT emission rates are proposed as follows:

a. A BACT emission rate of 97.52tph and 854,324tpy is being proposed. This corresponds to a metric ton emission rate of 88.52tph and 775,555tpy.
b. A corresponding emission rate based on a plant output of 90 MW would be 1.08 short tons per MW-hr. (net) and 0.984 metric tons per MW-hr. (net).
c. A corresponding emission rate based on a plant (gross) output of 98 MW would be 0.99516 short tons per MW-hr. and 0.9034 metric tons per MW-hr.
d. A Carbon Neutral BACT emission rate (CO_2 emissions – CO_2 biomass emissions) of 78.72tph and 689,578tpy is being proposed. This corresponds to a metric rate of 71.46tph and 626,007tpy.

e. A corresponding carbon neutral emission rate based on a plant output of 90MW would be 0.874 short tons per MW-hr. (net) and 0.794 metric tons per MW-hr. (net).
f. A corresponding carbon neutral emission rate based on a plant (gross) output of 98 MW would be 0.803 tons per MW-hr. and 0.729 metric tons per MW-hr.
g. Other BACT considerations:
    a. Facility will implement plant operation computer software to optimize plant efficiency.
    b. Facility will use efficient adjustable-speed/variable frequency drives for high HP motors.
    c. The facility will implement a SF_6 leak detection program to minimize SF_6 leaks.
    d. The facility will utilize a high efficiency steam turbine.
    e. The facility will follow a Water Treatment Program for boiler water and cooling water to increase thermal efficiency.
    f. The facility will develop a site specific Preventive Maintenance Program to maintain plant operating efficiency.
    g. In addition to the major equipment, the facility will incorporate engineering best design principals to maximize efficiency for the following equipment to reduce the heat rate:
        i. Air Heater
        ii. Feed-water Heater
        iii. Ash blower
        iv. Condenser
        v. Cooling Tower
    h. To the extent possible CRE will seek out other uses of excess steam for heating and cooling.