COMMONWEALTH OF PENNSYLVANIA
Department of Environmental Protection
October 24, 2011
814/332-6940
Fax: 814/332-6117

SUBJECT: EPA Comment and Response Document
Crawford Renewable Energy, LLC
Greenwood Township, Crawford County

TO: File AQ/Fac/Permit/20-305A
APS ID: 727342 Auth ID: 845235

FROM: Hubert Thomas Flaherty HTF
New Source Review
Air Quality Control
Northwest Regional Office

THROUGH: Edward Orris, P.E. EO
Environmental Engineer Manager
Air Quality Control
Northwest Regional Office

John F. Guth JFG
Regional Program Manager
Air Quality Control
Northwest Regional Office

This is in response to EPA comments received on August 10, 2011. The Department's responses are as follows:

Comments on Applicability:

1. The other pollutants that exceed their respective significant emission rates will be noted in the memo.

2. The NO_x emission rates for both #/mmbtu and tpy under the table for the boilers have been revised to show the correct emission numbers. Those are the same as what was presented in the facility-wide table.

Comments on the BACT/LAER:

3. The Department believes that CRE has chosen the most stringent proven technology available for this project. The technical review memo (TRM) will be revised to show that the Department believes that the chosen technology is the most stringent proven technology. Comment response #4 will further explain why the Department does not believe that the

"UltraCat" technology is a proven technology and should not be considered BACT for this project.

4. CRE has reviewed all of the information provided by EPA in regards to the low density ceramic filtration process being marketed by Tri-Mer. The low density ceramic technology known as "UltraCat" has been developed specifically for high temperature operations to allow NO_x reduction by UltraCat's embedded SCR catalyst compounds. CRE's supplier, Babcock Power Environment Inc. (BPE)—the leading supplier of SCR's and scrubbers in the United States—has advised us that Tri-Mer's technology is fundamentally flawed for this application. The UltraCat system operates as a hot, ~650°F, filtration system to allow its embedded SCR catalyst to reduce NO_X. While this appears to be a clever "2 for 1" arrangement, it cannot function as an effective particulate removal system for heavy metals (Pb, Hg, Ni), and it cannot function as the particulate removal system for a circulating dry scrubber that provides high removals of acids gases (SO_2, SO_3, HCl). Heavy metals are effectively removed only at flue gas temperatures typically less than 300°F, because at around 300°F heavy metals have condensed to their solid phase allowing them to be caught in a fabric filter. Additionally, these trace metal vapors would quickly and irreversibly poison any SCR catalyst and result in very high emissions levels of these metals. Acid gas scrubbing with a semi-dry scrubber, such as BPE's Circulating Dry Scrubber (CDS), requires that the scrubber controls the flue gas temperature to less than 300°F with water injection so that the hydrated lime reagent can capture up to 95% of the SO_2 and up to 99% of the HCl. A CDS minimizes the amount of hydrated lime injected for high removal performance and locks the acid gases in stable calcium compounds. In contrast, Tri-Mer's approach to use dry sorbent injection (DSI) requires the use of sodium sorbents (trona, sodium bicarbonate) at high injection rates to achieve high acid gas removals, which results in large quantities of less stable, water soluble acid/sodium compounds. Intregating an SCR with a high temperature PM control on a flue gas stream creates additional problems with condensable particulate matter emissions. Introducing ammonia (urea) in to a flue gas stream containing high levels of SO_2 and HCl will form significant amounts of ammonium compounds (ammonium bisulfate, ammonium chloride), which will condense downstream in the stack or atmosphere. BPE does not recommend, nor would it guarantee any emissions performance using the UltraCat approach promoted by Tri-Mer. BPE believes that the technology chosen by CRE will be more effective and produce lower emissions than the ceramic technology. In fact the ceramic control technology is similar to the technology chosen by CRE except for the fact that the ceramic filter technology would replace the fabric filter and RSCR system being proposed by CRE. CRE also believes that the Turbosorp fluidized bed scrubber that will be installed prior to the fabric filter will perform better than the Sorbent Injection and Ammonia Injection prior to the ceramic filter. Upon doing a literature review Tri-Mer indicates that for applications below 400°F that do not have temperature excursions or hot materials that pose a fire hazard to bags an advanced fabric filter design is less costly and ceramic filters would

not be suggested. BPE is providing the following responses for the specific pollutants mentioned in the EPA comments:

a. NO_x - As stated in the application the maximum inlet temperature entering the fabric filter will be 350°F and that the outlet temperature is expected to be approximately 250°F. The starting point for NO_x control in the ceramic tube SCR application is 350°F. In fact in the site specific data provided by Tri-Mer to US EPA suggests an operating temperature range between 450°F to 650°F for NO_x control. In order to obtain similar NO_x control the exhaust gas would have to be heated prior to the ceramic filtration system. CRE believes that the RSCR system will provide better or equivalent NO_x control for this process. Because neither RSCR technology has not yet been applied to a CFB system conservative emission estimates were made to assume worst case emissions in the application.
b. PM/PM-10/PM-2.5 – Based on the information provided and a review of the ceramic filter technology we believe that a fabric filter will provide better control than the low density ceramic filter for the reasons suggested above which includes heavy metals and condensable particulate. The collection mechanism for both a fabric filter and a ceramic filter are the same. Collection is enhanced by the buildup of a dust cake on either the bags or the ceramic filter. Cleaning in both control systems is done through pulse jet technology. Actually in the company literature it clearly states that the ceramic filter is superior to an electrostatic precipitator (ESP) but there are no claims that it is better than a fabric filter.
c. SO_2 – Based on the information provided to EPA the guaranteed performance for SO_2 control is 90%. In the CRE application the proposed SO_2 control is 95% removal in the Turbosorp scrubber and fabric filter which is better than the ceramic filter technology. This is most likely due to the fact that the B & W Turbosorp scrubber performs better than sorbent injection and the ceramic filter. We would suspect that if a fluidized bed scrubber was placed prior to the ceramic filter that an equivalent control would be realized based on comments above.

Overall as was stated in the application CRE feels that the proposed technology will produce the same if not better performance than the ceramic filter technology. It should also be pointed out that this ceramic filter technology has been designed primarily for high temperature installations and even in their own literature suggests that a fabric filter is preferable for low temperature operations. The other portions of control are similar to what is being proposed by CRE. In fact the operation of the RSCR allows for additional control in the ceramic beds being used in the RSCR system. If the ceramic technology were to be applied it would require re-heat to temperatures that would allow for sufficient NO_x removal. Because there is no regenerative control the amount of gas used to heat the exhaust gas would be significantly greater than the RSCR technology that is being proposed. Although

EPAs preliminary estimates indicate that this technology may produce lower emissions the information presented by the vendor indicates that emissions at best would be similar to what is being proposed by CRE. In fact CRE believes that the use of a Turbosorp scrubber will enhance SO_2 control, condensable PM control and HAPs both metallic and organic. Based on comments by BPE (above), the Department believes that the selected technology is better than the UltraCat technology and the selected technology has a proven track record whereas the UltraCat technology suggested by EPA is not a proven technology.

5. That was a typo and the reference to NO_x has been corrected to show SO_x reductions.

6. In the application it was stated that thermal oxidation and catalytic oxidation were not deemed to be technically available for a CFB operation. Because material is re-injected into the combustion zone from the in-line cyclones the CFB is a very effective combustion practice. Due to catalyst fouling a catalytic operation is not feasible. Having to re-heat the stack gas to 1500°F for thermal oxidation would increase emissions of NO_x, condensable PM or PM-2.5. Because of the combustion practices used in CFB technology and the nature of the flue gas, neither thermal oxidation nor catalytic oxidation is technically feasible. Finally there are no CFBs that utilize post combustion practices to further reduce CO emissions.

7. The proposed project is not major for VOC and the heading has been revised to show that the review was for BAT purposes only.

8. That was a typo and the reference to NO_x has been deleted.

9. The CEMs is only for PM compliance. PM10/2.5 monitoring will entail the CAM requirements for the boilers. Those include monitoring the scrubber for pressure drop and gas flow rate to ensure proper operation and monitoring the baghouse for pressure drop, temperature, and bag leak detection system. The source will be tested, initially and annually thereafter for at least 3 years with the facility requesting to opt out of testing. Those tests will allow the facility to ensure that the parameters they are monitoring as part of the CAM plan are being continuously met.

Comments on GHG BACT:

10. The facilities in Japan and Korea are not 100% fired by TDF but a combination of TDF, sewage sludge and other materials. Based on this CRE felt that the method used to predict GHG emissions in the GHG BACT submittal using the carbon content of TDF and limestone along with the EPA default factors in Table C-2 of 40 CFR Part 98 for CH_4 and N_2O provides a better estimate than what can be estimated using numbers from these overseas facilities. Additionally, these facilities are not controlled to the extent that CRE has proposed (less SO_2 control and no NO_x control) which means less limestone usage etc. The application contains default emission factors for CH_4 and N_2O for tires as provided in EPAs GHG reporting Rule in Table C-2 in subpart B of 40 CFR Part 98. For CO_2 emissions CRE used the carbon content of TDF to predict CO_2 emissions. All other assumptions made were based

on standard combustion practices that would apply to any fuel being fired in a CFB. A conservative unburned carbon % was used to try and fine tune CO_2 emissions.

11. The emissions from the combustion of natural gas during startup have been accounted for in the use of burning TDF at all time as the emissions from the burning of TDF are more than when burning with natural gas. Therefore, the GHG BACT analysis is actually more conservative than if they had accounted for the burning of natural gas.

12. The BACT analysis has been revised to include the GHG emissions from the fire pump and there is no emergency generator. The GHG emissions from the fire pump are deemed inconsequential (2.13 metric tons) when compared to the boilers. The emissions have been estimated as follows: the emergency fire pump will consume 10.4 gallons per hour of ultra-low sulfur diesel fuel and based on 20 hours per year of operation the total fuel consumed on an annual basis will be approximately 208 gallons. Using EPA default factors in Table C-1 to subpart C of 40 CFR Part 98 GHG emissions from the emergency fire pump can be estimated as follows:

    208 gallons/yr. x 0.138 mm Btu/gallon = 28.704 mm Btu/yr.
    CO_2 = 28.704 mmbtu/yr. x 73.96 kg CO_2/mmbtu = 2122.94 kg/yr. = 2.12 metric tons CO_2
    CH_4 = 28.704 mmbtu/yr. x 0.003 kg CH_4/mmbtu = 0.086 kg/yr. x 21 = 1.8 kg CO_2(e) = 0.0018 metric tons CO_2(e)
    N_2O = 28.704 mmbtu/yr. x 0.0006 kg N_2O/mmbtu = 0.017 kg/yr. x 310 =5.34 kg CO_2(e) = 0.0053 metric tons
    TOTAL CO_2(e) = 2.13 metric tons CO_2(e)

13. The carbon neutral limits will be removed from the plan approval.

14. See comment response #4 for the Department's response.

15. The emission standard value listed (0.99516 short tons/MW-hr) is based on total GHG emissions as stated. As currently permitted, the CO_2 CEMs will measure only emissions from the boilers. The appropriate fuel factors will be used to account for any non-CO_2 GHGs in order to show compliance with the BACT limit expressed as $CO_{2(}e)$. Appropriate emission factors for calculating GHG emissions not captured by the CEMs, such as the fire pump, will be utilized. Compliance with the total GHG limit will be shown by using data from the CEMs for the boilers and by using appropriate emission factors for all other sources.

Comments on the Air Quality Analysis:

16. The United States Environmental Protection Agency (USEPA) provided a recommended interim significant impact level (SIL) for the 1-hour nitrogen dioxide (NO_2) National Ambient Air Quality Standard (NAAQS) in a June 29, 2010 memorandum from Stephen D. Page, "Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program". Likewise, the USEPA provided a recommended interim SIL for the 1-hour sulfur dioxide (SO_2) NAAQS in an August 23,

2010 memorandum from Stephen D. Page, "Guidance Concerning the Implementation of the 1-hour SO_2 NAAQS for the Prevention of Significant Deterioration Program." The PADEP established both of these interim SILs for use in air quality analyses required by the PADEP's Prevention of Significant Deterioration (PSD) program in a December 1, 2010 memorandum. Since these interim SILs are not reflected in a promulgated regulation, the USEPA memoranda state that to support their application in each instance, a permitting authority that utilizes these SILs as part of an ambient air quality analysis should include in the permit record the analyses reflected in these memoranda and the referenced documents to demonstrate that a modeled air quality impact is *de minimis*, and thereby would not be considered to cause or contribute to a modeled violation of the NAAQS. The 1-hour NO_2 and 1-hour SO_2 air quality impacts due to Crawford Renewable Energy's (CRE) proposed emissions are estimated by the model to be less than the interim 1-hour NO_2 and 1-hour SO_2 Class II area SILs, respectively, recommended by the USEPA and the PADEP. For the technical reasons stated in the USEPA memoranda, CRE's 1-hour NO_2 and 1-hour SO_2 air quality impacts represent *de minimis* impacts on the 1-hour NO_2 NAAQS and 1-hour SO_2 NAAQS; therefore, a cumulative demonstration for the 1-hour NO_2 NAAQS and 1-hour SO_2 NAAQS is not necessary. There are no 1-hour PSD increment standards for NO_2 and SO_2. To formally clarify the 1-hour NO_2 and 1-hour SO_2 SILs utilized in the CRE air quality analysis for PSD, the PADEP is amending the permit record by issuing a revised summary memorandum for the PSD air quality analysis on October 3, 2011.

17. According to CRE's plan approval application, the proposed stack height of each of the cooling tower's eight cells is 19.81 meters; therefore, the correct values were entered in the model. The proposed stack height of the cooling tower cells listed in Table 3A of the PADEP's summary memorandum, dated June 13, 2011, is incorrect. To correct this error, the PADEP is issuing a revised summary memorandum for the CRE PSD air quality analysis on October 3, 2011.