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Ms. Anita Lee
U.S. EPA, Region 9
75 Hawthorne Street
San Francisco, CA 94105

Subject: Additional Best Available Control Technology (BACT) Information for the Application for Prevention of Significant Deterioration (PSD) Permit for Victorville 2 Hybrid Power Project (VV2)

Dear Ms. Lee:

You recently contacted Ms. Sara Head of ENSR and requested that a lower BACT emission rate of 50 ppm for CO be considered for the proposed VV2 auxiliary boiler and HTF heater. You subsequently requested that the VV2 Project provide a full "top down" BACT analysis for NOx emissions from these units. This letter responds to those two requests.

The City of Victorville is proposing to install a natural gas-fired, 35 MMBtu/hour auxiliary boiler and a 40 MMBtu/hour heater at the VV2 Project. The auxiliary boiler is primarily designed to shorten the duration of startups of the combustion turbines as part of GE's Rapid Start Process technology and the boiler will operate less than 500 hours per year. The heater is used for freeze protection of the heat transfer fluid (HTF) in the solar field, and will be used up to 1,000 hours a year.

It's my understanding that the request for a lower carbon monoxide (CO) limit was due to EPA evaluation of the Colusa Project, which had indicated that a 50 ppm emission rate was achievable for a boiler, although with a somewhat higher (15 ppm) nitrogen oxide (NOx) emission rate than that proposed by VV2. Inland Energy and ENSR have researched your request, and we have concluded that auxiliary boilers and heaters in this size range and duty-cycle that can meet both a 9 ppm NOx and a 50 ppm CO limit are available. Therefore, we agree that these levels meet BACT for the VV2 auxiliary boiler and HTF heater.

Your second request was that a full "top down" BACT evaluation of the boiler and heater be provided. We believe that the BACT evaluation provided in the initial PSD permit application with respect to NOx emissions already meets this requirement. The VV2 Project concluded that the choice of the ultra-low-NOx burners for NOx control, as opposed to the use of Selective catalytic reduction (SCR), met BACT for this Project. You specifically mentioned in your message to Sara that a cost evaluation for SCR on the boiler was needed. In the initial PSD application, SCR systems for the boiler and heater were not rejected due to cost effectiveness, but rather, were rejected due to infeasibility for this type of use. As noted in the PSD application, the VV2 boiler and heater will generally operate in the range of 300 - 350 ^{o}F, while the minimum temperature for the effective operation of an SCR system is 550 ^{o}F. Therefore, SCR is infeasible for these units and we do not believe that a cost analysis for an SCR system is necessary. Additional discussion of this conclusion is provided below.

SCR is known to successfully control NOx to very low concentrations in large boilers, furnaces and combustion turbines; although there was no evidence that this technology has been applied to boilers and heaters in the size range proposed for this Project. The units proposed for Victorville are small, low pressure units that cannot achieve the temperatures needed for SCR operation, and high pressure boiler/heater would not be suitable for this Project. Based on the BACT databases reviewed for boilers and heaters with similar heat rates, SCR is not used for NOx control on boilers and heaters in this size range, as evidenced by the large number of applications cited that use low-NOx or ultra-low-NOx burner technologies, and none that cite SCR.

Although SCR is not feasible for this Project, to further illustrate that there would not be any emissions reduction to the overall NOx emissions due to the warm up period of an SCR control system on a boiler and the brief use each day, consider the following example:

> SCR is not effective until it reaches its operating temperature, which could be as long as 30 minutes or more following first-fire of the boiler, particularly with a modern high-efficiency boiler which is designed to optimize heat transfer. The water in the boiler is a substantial heat sink, and it is unlikely that the SCR would reach the minimum operating temperature at which it is effective until the boiler begins to generate steam. Given that the boiler will typically operate less than two hours per day (only used to assist with the startup of the steam turbine), the warm-up period (during which the SCR is ineffective) comprises a substantial portion of the daily operating period.
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> A boiler is fundamentally different than simple cycle combustion turbines that have warm-up periods of less than 15 minutes. A simple cycle turbine has no heat sink, so the SCR can begin to heat up immediately. And, although it is possible that a combustion turbine would be operated two hours per day or less, it is unlikely that would be the planned method of operation. A combined cycle power plant that uses a heat recovery steam generator (HRSG) for steam generation and SCR for NOx control typically has a "cold" start-up time (during which emissions controls are assumed to ineffective) of four hours or more. This long duration for start up is due in part to the time required to generate steam in the HRSG which affects the SCR catalyst temperature.

The lowest emission rate achieved in practice for any boiler identified in the BACT database review is 5.0 ppmv at 3 percent excess oxygen (see BACT determination for SCAQMD Application No. 427061, July 2006). This boiler is many times larger than the one proposed for VV2, and probably achieves NOx concentrations lower than what could be attained in smaller boilers; however, the emissions information is still useful for illustration purposes. The BACT determination for this equipment, and most other determinations identified in the database review, did not provide information on the uncontrolled NOx emission rate; however, SCR with ammonia injection is commonly assumed to achieve roughly 90 percent reductions in NOx concentrations. Assuming that is the case, the uncontrolled NOx concentration would be approximately 50 ppmv. For the VV2 project, with one-half hour of warm-up during which the SCR is ineffective, followed by 1-1/2 hours of controlled operation, the weighted average NOx concentration over the two hour period would be 16.25 ppmv. If the SCR control efficiency is assumed to be only 80 percent, the weighted average NOx concentration over the two hour period would be 10 ppmv. In either case, the weighted average NOx concentration exceeds the 9 ppmv proposed for the Project using ultra-low-NOx burners.

While the above example was for the boiler, much the same would be true for the HTF heater that would be used only during winter nights when freeze protection is needed.

Finally, SCR requires additional power for operations (additional blower horsepower is required to overcome the pressure drop in the catalyst bed) and requires the use of aqueous or anhydrous ammonia as the reducing agent. Ammonia is also emitted from the SCR operation as unreacted “ammonia slip”.

Conclusion

The EPA top-down BACT evaluation methodology allows that options may be eliminated from consideration because they are demonstrated to be technically infeasible or have unacceptable energy, economic, or environmental impacts on a case-by-case (site-specific) basis. As discussed, the BACT database review demonstrates that SCR has not been used on boilers and heaters in this size range. Given the site-specific operating conditions of limited daily hours of operation, SCR would not appear to offer a lower emission rate than other technologies. Therefore, due to the additional energy requirements, the need to use and the additional emissions of a hazardous material, the lack of evidence that SCR is used on boilers or heaters in this size range, and the ineffectiveness over a substantial portion of the daily operating period, SCR is determined to be infeasible for this application.

The applicant has proposed the use of the highest ranked control technology following the elimination of infeasible options. Therefore, an ultra-low-NOx burner with a stack NOx concentration of 9 ppmv at 3 percent excess oxygen is still recommended as BACT for the boiler and HTF heater.

Please let me or Sara Head, ENSR (805-388-3775) know if you have any questions about this response to your request for information on the VV2 Project PSD application. We look forward to reviewing the proposed PSD permit when issued in the near-term.

Sincerely yours,

Thomas M. Barnett
Executive Vice President

cc: John Kessler, CEC
Jon Roberts, Victorville
Alan DeSalvio, MDAQMD
Sara Head, ENSR
Michael Carroll, Latham & Watkins