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January 14, 2009

Mr. Jagmeet Kahlon
San Joaquin Valley APCD
4800 Enterprise Way
Modesto, CA 95356-8718

Re: Application for Certification for the NCPA Lodi Energy Center
Demonstration of Compliance with District Rule 4703

Dear Mr. Kahlon:

In our telephone conversation on Tuesday, January 6, 2009, you asked for additional information to support our request for a 6-hour period for cold gas turbine startups for the proposed new GE 7FA turbine at NCPA Lodi Energy Center in Lodi. This additional information is required to demonstrate compliance with District Rule 4703, Section 5.3.3.

The two-hour limit on the duration of a startup or shutdown in Section 5.3.1 of Rule 4703 is not sufficient for the proposed configuration of one GE 7FA turbine with fired heat recover steam generator (HRSG) and steam turbine. The proposed equipment will require up to approximately 6 hours to achieve compliance with Rule 4703, depending on the steam turbine temperature at the time the startup is initiated. A startup is defined as the period beginning with turbine initial firing and ending when the turbine exhaust meets the permitted NOx and CO concentrations. The justification for these longer startup times complies with the rule requirements outlined below. Each section of rule language is followed by our response.

Section 5.3.3.2.1 – A clear identification of the control technologies or strategies to be utilized [to minimize emissions]:

The control technologies and strategies to be utilized to minimize emissions during the startup period are as follows:

- "Rapid Response" technology, including an auxiliary boiler to preheat fuel and provide steam turbine sealing steam prior to CTG startup.
- Dry low-NOx combustors in the CTG.
- Oxidation catalyst in the HRSG.
- SCR in the HRSG.
- Good combustion practices.
- Upon startup, the ammonia injection upstream of the SCR catalyst will be started as soon as the catalyst and ammonia injection system warm to their minimum operating temperatures as specified by the SCR vendor.

Section 5.3.3.2.2 – A description of what physical conditions prevail during the period that prevent the controls from being effective:

The combined-cycle equipment startup duration depends on how fast the high-pressure steam drum and the steel walls of the steam turbine can be warmed to operating temperature without generating stress cracks or otherwise damaging the equipment. During a cold startup, in which the CTG/HRSG have been shut down for more than 72 hours, the HRSG and steam turbine parts are at ambient temperature and there is a great deal of thermal mass that must be heated. Once the high-pressure steam drum is heated, steam developed in the HRSG from the heated turbine exhaust is admitted into the steam turbine at a controlled temperature to heat it as rapidly as possible without causing stress cracking. The steam temperature is controlled by limiting the load on the gas turbine. At the lower load points, the gas turbine is tuned for combustion stability and not for emissions performance, so uncontrolled emissions at low loads are much higher than uncontrolled emissions at typical operating loads (above about 50%). The allowable rate of temperature increase at the steam turbine is the limiting factor in determining how quickly the gas turbine can achieve higher loads. This, in turn, limits how quickly the gas turbine combustor can be brought up to this minimum load point, and this latter step is necessary for the unit to be able to comply with the limits of Rule 4703.

Section 5.3.3.2.3 – A reasonably precise estimate as to when the physical conditions will have reached a state that allows for the effective control of emissions:

Startup information provided by the turbine and HRSG vendors indicates that for a cold startup, a minimum of 4 hours is required for the unit to come into compliance with the limits of Rule 4703. Experience at other combined cycle gas turbine power plants has shown that up to 6 hours may be required under some circumstances. Because NCPA is proposing to use "Rapid Response" technology for this project, we expect that startups of the new LEC gas turbine will be shorter than those experienced for other projects. The Rapid Response package, which includes a modified HRSG design and an auxiliary boiler, is designed to allow faster heating of the HRSG and earlier startup of the steam turbine, significantly reducing startup times. However, because no Rapid Response configuration plants have yet been built or operated, no in-use operating data are yet available to allow observation and evaluation of the actual times required for a unit to come into compliance during a startup. Therefore, NCPA is conservatively assuming that the times required for startups of the LEC will be the same as those for conventional Frame 7-based combined cycle turbine plants.

Section 5.3.3.2.4 – A detailed list of activities to be performed during the period and a reasonable explanation for the length of time needed to complete each activity:

Specific activities may vary among different HRSG and steam turbine vendors. However, example activities that occur upon initiation of the startup sequence are listed below. Approximate times refer to requirements for a cold startup.

- Initiate gas turbine firing up to the low load hold point, which is determined by the metal temperature of the steam turbine at the HP steam and hot reheat inlets.
- Monitor temperature and water level in high pressure (HP), intermediate pressure (IP), and low pressure (LP) steam drums.
- Place the drum level controls in automatic mode after water level is at specified height.
- The gas turbine is held at the low-load point to control steam temperature throughout the following activities:
  - Drain valves on the HRSG and piping connecting to the steam turbine (STG) open to vent steam while pressure builds in the HRSG steam drums and piping connecting to the STG.
  - As the cold piping warms, steam is condensed. The condensate blows out through the open drain valves.
  - Pressure in the steam piping and HRSG drums is controlled by bypassing the STG and dumping steam to the condenser provided that acceptable condenser vacuum has been established.
  - The drain valves remain open until the steam piping is hot and condensation of the steam ceases. The steam must be dry prior to admission to the STG. This process takes approximately 1 hour depending upon ambient conditions and the temperature of the equipment at startup.
  - Hot reheat steam is initially admitted only to the IP section of the STG, and the STG speed is held at approximately 3,000 rpm for 20 minutes while the STG is monitored for vibrations that can occur as the rotor slowly warms.
  - If vibrations are within acceptable limits, the STG load may be increased to 10% over a period of approximately 10 minutes.
  - STG load is held at 10% for approximately 30 minutes while the metal continues to warm.
  - The HP steam inlet valves open and allow the STG load to increase to 15% to 25% over a period of approximately 10 minutes.
  - STG load is held while the inlet valves open and establish pressure control at the HP steam inlet.
- Gas turbine load may now be increased to base load over a period of approximately 40 minutes to produce more steam and increase steam turbine load.

Section 5.3.3.2.5 – A description of the material process flow rates and system operating parameters, etc., the operator plans to evaluate during the process optimization; and an explanation of how the activities and process flow affect the operation of the emissions control equipment:

The startup duration depends on the allowable ramp rate of the steam temperature to the steam turbine, which depends on the acceptable rate of increase of the metal temperature of the hot reheat and HP steam bowls at the steam turbine inlets. The maximum steam temperature is set by applying an allowable differential above the metal temperature. The differential is determined by the steam turbine supplier, and is imposed by the supplier's control system to avoid damage to the

steam turbine from thermal stress. The control system limits gas turbine load to control the steam temperature. Any manual override of the gas turbine load limit by the operator reduces the life expectancy of the steam turbine.

In addition, the time prior to initiation of ammonia flow to the SCR system depends on the temperature of the SCR catalyst. The catalyst bed is warmed by the exhaust flow from the gas turbine. The total mass of metal and water in the HRSG tubes, piping, and drums removes heat from the gas turbine exhaust as it warms. This extends the time required to heat the SCR catalyst to the minimum temperature at which ammonia may be injected upstream of the catalyst bed to begin reducing NOx to N_2. The steam turbine and SCR catalyst temperatures are all monitored by the plant control system, and the turbine ramp rate and SCR initiation sequence are governed by the equipment/system manufacturer's recommended procedures.

Section 5.3.3.2.6 – The basis for the requested additional duration:

The description of activities above demonstrates that the minimum time required for a cold startup of the plant as currently configured is approximately 4 hours. This startup time is contingent upon all of the activities being performed in time to support subsequent activities. Any delay in preparation of the supporting systems will result in a corresponding delay in startup and/or loading of the gas turbine. To be confident that the startup time allowed is adequate and will not be exceeded, and based on experience at other facilities, 2 hours are added to the above minimum startup time to account for possible delays.

Because Rapid Response technology is being proposed for this project, NCPA expects to be able to accomplish startups in less than the 6 hours requested as a permit limit. However, as discussed in the permit application, the lack of real-world operating experience for Rapid Response configuration plants requires NCPA to be conservative in assumptions regarding plant performance to ensure that the project can be operated in compliance with all permit conditions at all times.

I hope this provides the additional information you require to complete your review of the proposed project. If you have any questions or require additional information, please do not hesitate to call.

Sincerely,

Gabriel McCaulley

for Nancy Matthews

cc: Ed Warner, NCPA
Rod Jones, CEC Siting Project Manager
Andrea Grenier, Grenier and Associates
Scott Galati, Galati Blek
Sarah Madams, CH2M Hill