# RESPONSES TO BAAQMD 9/23/10 E-MAIL

1. For the gas turbines:

a. Will the facility accept the startup limits initially proposed in the April 7, 2010 Supplemental Filing (Table 5.1-6)?

**CCGS Response:** Yes, provided the startup time limits remain as proposed in our draft conditions (i.e. 30 minutes for hot and warm starts and 90 minutes for cold start).

b. Will the facility accept a facility-wide PM10 limit of 63.78 TPY (0.0036 lb/MMBtu*35,397,277 MMBtu/year = 63.715 TPY/both turbines) (63.715 TPY/turbines + 0.060 TPY/boiler + 0.003 TPY/diesel engine = 63.78 TPY total)?

**CCGS Response:** Yes, under the following conditions:

1. The permit will not include any shorter-term limits that are based on the 0.0036 lb/MMBtu emissions rate.
2. PM10 emissions will be tracked by fuel use.
3. The emissions rate (lb/MMBtu) used will be based on the average of the past 4 source tests (or less assuming less than 4 source tests have been performed).
4. We will have the option of performing PM10 source tests more frequently than once per year, which can be used as part of the compliance demonstration.

c. A technological feasibility and cost-effective analysis (total/average and incremental) for limiting to NOx to below 2.0 ppm.

**CCGS Response:** See Attachment 1.

d. The basis for the cost-effectiveness analyses for CO and POC (total/average and incremental) from the gas turbines provided previously. Please provide documentation for each assumed cost and the vendor quote for the capital cost and explain what "auxiliary equipment" includes.

**CCGS Response:** See Attachment 2. The cost-effectiveness analysis has been revised to account for additional costs that were missing from the previous analysis. For instance, the previous purchased equipment cost was for the catalyst and rack only and did not included the added HRSG casing to house the catalyst. In addition, several of the cost factors previously used were overly conservative and thus have been increased to reflect more realistic values.

e. A detailed explanation of the shutdown process, including the estimated times for each step. Is a shutdown limit of 30 min feasible? Is it possible to

perform the purge cycle after shutdown to significantly reduce shutdown emissions? Please explain the steps of a purge cycle.

**CCGS Response:** See Attachment 3 for detailed explanations of the shutdown process and purge cycle.

The shutdown cycle, from minimum emissions compliance load to flame out, is expected to be completed within 30 minutes. Assuming the BAAQMD would deem it necessary to include a permit condition limiting the shutdown time, CCGS had previously proposed a limit of 60 minutes, thus providing some margin. If the BAAQMD can justify the necessity of limiting shutdowns to 30 minutes, be advised that the project should be capable of meeting such a limit.

As described in Attachment 3, the purge cycle is, in fact, performed after shutdown. Shutdown emissions could potentially be reduced by eliminating the second low load hold. The second low load hold is designed to reduce the temperature of the HRSG in a controlled manner prior to introducing relatively cool purge air. Instead, the HRSG could be allowed to cool naturally. The shortcoming of this alternative is that it would take a number of hours for the HRSG to cool down naturally, during which, the plant would not be able to offer 10-minute capacity into the market. This limitation would not only have a negative impact on the project economics, but will also have an indirect negative impact on air quality if a less efficient plant with higher emissions (i.e. peaker) were to instead provide the same 10-minute capacity.

f. An explanation about what combustor tuning involves (what activities are done, why are emissions higher during tuning, what steps are taken to minimize emissions during tuning?). Please provide documentation regarding the basis of the proposed tuning limits, how many hours and how many times per year tuning is necessary and why. Can tuning emissions be limited to the equivalent of a cold start limit at a conventional combined cycle plant?

**CCGS Response:** See Attachment 4 for an explanation of combustor tuning.

Emissions are higher during tuning as operating adjustments are varied in order to determine the most efficient operation with the lowest emissions. The optimum settings often cannot be precisely determined without varying a given setting either side of optimum. Since tuning emissions will accumulate against the total annual emissions for the plant, there is an incentive to minimize emissions during tuning. Steps to minimize emissions during tuning include:

- Operation of the SCR and oxidation catalyst during tuning
- To the extent practical, minimizing the duration of tuning activities at specific low loads where emissions spikes occur

The proposed tuning limits are based on the cold start emissions totals applied on a “per hour” basis such that the peak hourly emissions rates during tuning would not exceed those during a

cold start. CCGS is requesting up to two tuning events per gas turbine per year with the duration of each tuning event not to exceed 8 hours. GE's model-based controls should be able to adequately tune the gas turbines during normal operations and within the normal operations emissions limits for seasonal variations in temperature and unit degradation. Thus, tuning events where the emissions need to exceed the normal operations emissions limits should be infrequent (e.g. twice per year, or less). While it may or may not be practical to limit tuning emissions to the equivalent of a cold start limit for a "conventional combined cycle power plant", we can safely assume that it will not be necessary to operate at the peak hourly emissions rates over the full 8 hours. If the BAAQMD deems it necessary to limit the total emissions during each 8 hour tuning event, CCGS proposes to limit the total emissions to 50% of the maximum hourly rate times the 8-hour duration, or:

- $NO_X$ – 384 lbs
- CO – 1440 lbs
- POC – 268 lbs

2. For the Auxiliary Boiler:

a. The basis for the cost-effectiveness analysis previously provided for NOx from the auxiliary boiler and supporting documentation.

**CCGS Response:** CCGS proposes to establish a daily NOx limit of 9.8 lbs/day. As such, per BAAQMD Rule No. 2-2-301, BACT will not apply to the auxiliary boiler.

b. Will the facility accept a limit of 9.8 lb/day of CO including all modes of operation (normal operation/startup/shutdown/tuning/commissioning)?

**CCGS Response:** Yes.

c. The basis of emissions estimates (including normal operation/startup/shutdown/tuning/commissioning). Please also explain why emissions are higher during startups, shutdowns, and tuning.

**CCGS Response:** The emissions rates during normal operation were based on the following:

- $NO_X$ – 7 ppmvd @ 3% $O_2$ per BAAQMD
- CO – 10 ppmvd @ 3% $O_2$ per BAAQMD
- POC – 5 ppmvd @ 3% $O_2$ per auxiliary boiler manufacturer guarantee
- PM10 – emissions factor of 0.007 lb/MMBtu (HHV)
- $SO_2$ – maximum sulfur content of 1 gr/100scf

The startup emissions were based on the following:

- $NO_X$ – 1 hour at three times the normal operations emissions rate

- CO – 1 hour at three times the normal operations emissions rate
- POC – 1 hour at three times the normal operations emissions rate
- PM10 – 1 hour at the normal operations emissions rate
- $SO_2$ – 1 hour at the normal operations emissions rate

The shutdown emissions were based on the following:

- $NO_X$ – 15 minutes at three times the normal operations emissions rate
- CO – 15 minutes at three times the normal operations emissions rate
- POC – 15 minutes at three times the normal operations emissions rate
- PM10 – 15 minutes at the normal operations emissions rate
- $SO_2$ – 15 minutes at the normal operations emissions rate

The startup and shutdown emissions rates of three times the emissions rates normal operations were a result of good engineering judgment, recognizing the following:

- The normal operating emissions rates are applicable only to a range of 25 to 100% load. Startups and shutdowns need to include the range from 0 to 25% load which is outside the range covered by the manufacturer's guarantees.
- Startups and shutdowns are transient operations where air and fuel control devices are not operating under steady-state conditions.
- In the event an oxidation catalyst is required, the catalyst will not be at the optimum operating temperature when the boiler starts.

Commissioning emissions were based on the following:

- $NO_X$ – 24 hours at twice the startup hourly emissions rate
- CO – 24 hours at twice the startup hourly emissions rate
- POC – 24 hours at twice the startup hourly emissions rate
- PM10 – 24 hours at the normal operations emissions rate
- $SO_2$ – 24 hours at the normal operations emissions rate

d. Will it be a watertube or firetube boiler? Can you provide manufacturer's specs for potential boilers the facility may use?

**CCGS Response:** The auxiliary boiler will likely be of a watertube design. The auxiliary boiler will be part of our EPC contractor's scope. As such, the manufacturer of the auxiliary boiler has not yet been identified. The EPC contractor will be required to provide an auxiliary boiler meeting our specification requirements which will include our proposed emissions limits. Rentech and Indeck are two potential auxiliary boiler manufacturers who provided CCGS

budgetary quotes. Both these manufacturers quoted “O”-type watertube boilers. The following websites include general information for these types of packaged boilers.

http://www.rentechboilers.com/products/watertube_boilers.php

http://www.indeck.com/O_series_boilers.htm

http://www.neboiler.com/o-type.htm