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Salamy, Jerry/SAC

From: Vicky Lee <VLee1@aqmd.gov>
Sent: Friday, December 18, 2015 5:56 PM
To: stephen.okane@AES.com; Salamy, Jerry/SAC
Cc: John Yee; Andrew Lee
Subject: AES Alamitos--AEC Questions

Stephen and Jerry,

The South Coast Air Quality Management District (SCAQMD) received permit applications for the proposed Amended Alamitos Energy Center (AEC) (Application) on October 23, 2015. On November 20, 2015, SCAQMD deemed the applications incomplete and provided a list of issues identified during the initial completeness review. Thank you for your data request responses, dated December 11, 2015. I performed a preliminary review of your responses and continued to review the application package. Please provide the following additional information. The follow-up questions to your December 11, 2015 response letter retain the same numbering as in the letters, and the new questions start at question no. 22.

Follow-up Questions

9. SCR and CO Oxidation Catalyst Specifications and Guarantees
   b. Simple Cycle
      i. SCR
         dd. The response to bb. was that the maximum allowable pressure drop across the catalyst is 120 inches of water column. For the combined-cycle SCR, the response was that the allowable pressure drop is 1.6 inches water column (9.a.i.bb.). For the auxiliary boiler, the response was that the allowable pressure drop is 1.6 inches water column (9.c.i.aa.). The 120 inches of water column appears to be the pressure drop across a clean catalyst. As the SCR is operated, deposition of particulates on the catalyst increases this pressure drop over time. Please provide the increase in pressure drop due to the deposition that is allowed.

10. Auxiliary Boiler
    e. Commissioning
       iii. Rule 1313(g)(2) requires a permit condition limiting maximum monthly emissions.

            aa. For the initial commissioning month, will normal monthly emissions based on 31 days, two cold starts, four warm starts, and four hot starts, be sufficient?

            bb. If not, please provide the pounds of additional NOx, CO, and VOC emissions that are requested to be added for the commissioning month. Please keep in mind that RTCs and ERCs are based on the highest monthly emissions.

11. Auxiliary Boiler 30-Day Averages
    b. The response to item 11.a. indicated that 26,327 MMBtu/month (exclusive of startups/shutdowns) was used in the 30-day average calculations. Also, the response to item 13.a.ii. indicated that 26,327 MMBtu/month was used in the derivation of the maximum annual heat input of 310,096 MMBtu/yr for the calculation of the air toxic emissions rates.

       Please explain how the 26,327 MMBtu/month was derived by providing an equation, and providing numerical values for the variables in the equation.

    c. Following are my emissions calculations performed pursuant to standard SCAQMD methodology. Please confirm that my understanding of the requested operating schedule and other parameters are correct.

Emissions Calculations for Auxiliary Boiler

Operating schedule per month: 31 days, two cold starts, four warm starts, four hot starts

Cold start: 170 minutes (2.83 hr)
Warm start: 85 minutes (1.42 hr)
Hot start: 25 minutes (0.42 hr)

Normal operating hrs = (31 days)(24 hr) – (2 cold starts)(2.83 hr/cold start) –
(4 warm starts)(1.42 hr/warm start) - (4 hot starts)(0.42 hr/hot start) = 730.98 hr

CO: 50 ppm CO
NOx: 5 ppmv NOx per Rule 1146(c)(1)(F)
ROG, PM, SOx: AER default emission factors for natural gas fired boiler.

CO, lbs/hr = (71,000,000 Btu/hr) (8710 dscf/10^6 Btu) (50 ppm CO per guarantee /10^6)
(20.9/(20.9-3.0)) (28 lbs CO/379 scf) = 2.67 lb/hr

(730.98 hr)(2.67 lb/hr) + (2 cold starts)(4.34 lb/cold start) + (4 warm starts)
(2.17 lb/warm start) + (4 hot starts)(0.64 lb/hot start) = 1971.64 lb/month

lbs/day = (1971.64 lb/month)/(30 days) = 65.72 lb/day
30 DA = 65.72 lb/day

NOx, lbs/hr = (71,000,000 Btu/hr) (8710 dscf/10^6 Btu) (5 ppm per Rule 1146/10^6)
(20.9/(20.9-3.0)) (46 lbs NOx/385 scf) = 0.43 lb/hr

(730.98 hr)(0.43 lb/hr) + (2 cold starts)(4.22 lb/cold start) + (4 warm starts)
(2.11 lb/warm start) + (4 hot starts)(0.62 lb/hot start) = 333.68 lb/month

lbs/day = (333.68 lb/month)/(30 days) = 11.12 lb/day
30 DA = 11.12 lb/day

ROG: Guarantee = 0.003 lb/MMBtu, AES used 0.004 lb/MMBtu for safety margin.
ROG, lbs/hr = (71,000,000 Btu/hr) (0.004 lb/MMBtu /10^6) = 0.28 lb/hr

(730.98 hr)(0.28 lb/hr) + (2 cold starts)(4.69 lb/cold start) + (4 warm starts)
(2.34 lb/warm start) + (4 hot starts)(0.69 lb/hot start) = 226.17 lb/month

lbs/day = (226.17 lb/month)/(30 days) = 7.54 lb/day
30 DA = 7.54 lb/day

For combustion emissions, the standard assumption is PM_{10} = PM.
PM_{10}, lbs/hr = (71,000,000 Btu/hr) (0.0043 lb/MMBtu per guarantee/10^6) = 0.305 lb/hr

(31 days)(24 hr/day)(0.305 lb/hr) = 226.92 lb/month

lbs/day = (226.92 lb/month)/(30 days) = 7.54 lb/day
30 DA = 7.54 lb/day

SOx, lbs/hr = (71,000,000 Btu/hr) (cf/1050 Btu) (0.6 lb SOx AER/10^6 cf) = 0.04 lb/hr

(31 days)(24 hr/day)(0.04 lb/hr) = 29.76 lb/month

lbs/day = (29.76 lb/month)/(30 days) = 0.99 lb/day
30 DA = 0.99 lb/day

12. Turbines Toxic Emissions and Rule 1401 Health Risk Assessment

c. Stack Parameters

Page 5.9-7 indicates the maximum hourly turbine impacts for both the combined-cycle and simple-cycle turbines were predicted using the exhaust parameters for the 65.3 ºF, minimum load case, which represents the turbine exhaust parameters associated with the maximum predicted 1-hour ground-level impact in the dispersion modeling, combined with the maximum possible toxic air contaminant (TAC) emission rates. The annual turbine impacts were also predicted for the 65.3 ºF, minimum load case, which represents the average annual temperature and load scenario resulting in the maximum predicted annual ground-level impact in the dispersion modeling.

The modeling review request memo lists the exhaust temperature and exhaust velocity for both the hourly and annual impacts for each equipment. The above discussion does not provide that information explicitly.

i. Combined-Cycle Turbine

aa. Hourly Impacts

(1) Page 5.9-7 indicates maximum predicted 1-hour ground-level impact is for 65.3 ºF. Do you mean 28 ºF?

(2) Please confirm the stack temperature is 350 ºK and the stack velocity is 12.2 m/sec per Scenario CC03.

bb. Annual Impacts

(1) Please confirm the stack temperature is 350 ºK and the stack velocity is 11.8 m/sec per Scenario CC07.

ii. Simple-Cycle Turbine

aa. Hourly Impacts

(1) Page 5.9-7 indicates maximum predicted 1-hour ground-level impact is for 65.3 ºF. Do you mean 28 ºF?

(2) Please confirm the stack temperature is 749 ºK and the stack velocity is 23.8 m/sec per Scenario CC03.

bb. Annual Impacts

(1) Please confirm the stack temperature is 746 ºK and the stack velocity is 23.6 m/sec per Scenario CC07.

13. Auxiliary Boiler Toxic Emissions and Rule 1401 Health Risk Assessment

a. Toxic Emissions

iii. As discussed in 11.b., above, clarification is requested for the derivation of the 26,327 MMBtu/month.

iv. *Table 13-1—Air Toxic Emission Rates Modeled for AEC Operation: Auxiliary Boiler* does not include propylene. Please provide the hourly and annual emissions for propylene.

v. *Table 13-1* does not include ammonia. Please provide the hourly and annual emissions for ammonia.

b. Rule 1401 Health Risk Assessment

ii. Please confirm propylene and ammonia were included in the HRA.

New Questions

22. Number of Startups per Day

The number of startups and shutdowns per day are limited by permit condition.

a. Footnote a to *Table 5.1-31--AEC CCGT Emission Rates and Operating Scenarios Corresponding to the Highest Predicted AERMOD Impacts* on pages 5.1-30 and 5.1-31 indicates that the 8-hour CO

emission rate is based on one cold start-up, one warm startup, two shutdown events, and operating at minimum load for the remaining hours. The implication is that the maximum daily startups are two. For each combined-cycle turbine, please confirm the maximum number of startups are two per day.

b. Footnote a to *Table 5.1-32--AEC SCGT Emission Rates and Operating Scenarios Corresponding to the Highest Predicted AERMOD Impacts* on pages 5.1-31 and 5.1-32 indicates that the 8-hour CO emission rate is based on two start-up events, two shutdown events, and operating at minimum load for the remaining hours. The implication is that the maximum daily startups are two. For each simple-cycle turbine, please confirm the maximum number of startups are two per day.

c. Footnote a to *Table 5.1-33—Auxiliary Boiler Emission Rates and Stack Parameters* on page 5.1-33 indicates that the 8-hour CO emission rate is based on one cold start-up event and operating at the maximum firing rate for the remaining hours. The implication is that the maximum daily startups are one. For the auxiliary boiler, please confirm the maximum number of startups is one per day.

23. Commissioning of Combined-Cycle Turbines Modeling

a. In *Table 5.1C.2—Commissioning Emission Rates* in *Appendix 5.1C*, the annual NO_2 emission rate used is 9.12 lb/hr.

The 9.12 lb/hr is from the "Combined Commissioning and Operation" parameters and emission rates in *Table 5.1-29—AEC CCGT Commissioning Dispersion Modeling Scenarios* on page 5.1-29. Footnote b to the table explains for the "Combined Commissioning and Operation," the "[e]mission rates, stack exit velocity, and stack temperature for the combined annual commissioning and operation are based on the operational load resulting in the highest modeled impact of NOx, PM_{10}, and $PM_{2.5}$."

From *Table 5.1-12—GE 7FA.05 Turbine Commissioning Emission Rate* on page 5.1-14, the "Annual Average Hourly, lb/hr (per turbine)" for NOx is 12.3 lb/hr. Footnote c to the table explains for the "Annual Average Hourly, lb/hr (per turbine)," the "Annual average hourly emissions for evaluating annual impacts are based on the sum of total commissioning emissions and annual operation emissions per turbine, divided by 8,760."

i. The only discrepancy between *Tables 5.1-29* and *5.1-12* are the annual NOx rates. Please explain why the 9.12 lb/hr was used for modeling instead of the 12.3 lb/hr.

ii. Please provide emissions calculation for the 9.12 lb/hr, which includes numerical values for the variables and the case no. from T*able 5.1B.3*.

iii. If not appropriate for modeling, please explain the purpose for presenting the 12.3 lb/hr in *Table 5.1-12.*

iv. Please provide emissions calculation for the 12.3 lb/hr, which includes numerical values for the variables and the case no. from T*able 5.1B.3*.

b. To expedite the modeling review, please provide an explanation of how the modeling was performed for the commissioning of the combined-cycle turbines. The explanation is to include, but not be limited, to reference to *Tables 5.1C.1 – 5.1C.5* in *Appendix 5.1C*.

24. Commissioning of Simple-Cycle Turbines Modeling

a. In *Table 5.1C.2—Commissioning Emission Rates* in *Appendix 5.1C*, the annual NO_2 emission rate used is 2.95 lb/hr.

The 2.95 lb/hr is from the "Combined Commissioning and Operation" parameters and emission rates in *Table 5.1-30—AEC SCGT Commissioning Dispersion Modeling Scenarios* on page 5.1-29. Footnote b to the table explains for the "Combined Commissioning and Operation," the "[e]mission rates, stack exit velocity, and stack temperature for the combined annual commissioning and operation are based on the operational load resulting in the highest modeled impact of NOx, PM_{10}, and $PM_{2.5}$."

From *Table 5.1-13—GE LMS-100 Turbine Commissioning Emission Rate* on pate 5.1-15, the "Annual Average Hourly, lb/hr (per turbine)" for NOx is 3.65 lb/hr. Footnote c explains for the "Annual Average Hourly, lb/hr (per turbine)," the "Annual average hourly emissions for evaluating annual impacts are based on the sum of total commissioning emissions and annual operation emissions per turbine, divided by 8,760."

i. The only discrepancy between *Tables 5.1-30* and *5.1*-13 are the annual NOx rates. Please explain why the 2.95 lb/hr was used for modeling instead of the 3.65 lb/hr.

ii. Please provide emissions calculation for the 2.95 lb/hr, which includes numerical values for the variables and the case no. from T*able 5.1B.7*.

iii. If not appropriate for modeling, please explain the purpose for presenting the 3.65 lb/hr in *Table 5.1-13.*

iv. Please provide emissions calculation for the 3.65 lb/hr, which includes numerical values for the variables and the case no. from T*able 5.1B.7*.

b. On page 5.1-37, footnote a to *Table 5.1-37—AEC SCGT Commissioning Impacts Analysis-Maximum Modeled Impacts Compared to the Ambient Air Quality Standards* indicates that maximum modeled concentrations include impacts from commissioning of four GE LMS-100 turbines and operation of two GE 7FA.05 turbines and the auxiliary boiler. Page 5.1-28 indicates that all four simple cycle turbines would be undergoing simultaneous commissioning activities while <u>both combined-cycle turbines were operating in cold-start mode</u>. Page 5.1-37 indicates, however, that the two combined-cycle turbines were simultaneously operating <u>with the steady state emissions presented in *Table 5.1-31*</u>.

i. *Table 5.1C.2—Commissioning Emission Rates* shows the 1-hour NO_2, 1-hr CO, and 8-hr CO for the combined-cycle turbines are from *Table 5.1-31*. Please confirm that both combined-cycle turbines were <u>not</u> assumed to be operating in cold-start mode for all averaging periods.

Please confirm the emission rates for each pollutant and corresponding averaging period from *Table 5.1-31* were used for the simultaneous modeling of the combined cycle turbines.

c. To expedite the modeling review, please provide an explanation of how the modeling was performed for the commissioning of the simple-cycle turbines. The explanation is to include, but not be limited, to references to *Tables 5.1C.1 – 5.1C.5* in *Appendix 5.1C*.

25. <u>Normal Operation of Facility</u>

a. <u>Auxiliary Boiler Emission Rates</u>

On page 5.1-33, *Table 5.1-33—Auxiliary Boiler Emission Rates and Stack Parameters* presents the emission rates for each pollutant and averaging period.

i. <u>NO_2 for annual averaging period</u>

aa. Please confirm the annual averaging period emission rate for NO_2 was based on 8,760 hours of total operation, 24 cold starts, 48 warm starts, 48 hot starts, as indicated in footnote a to *Table 5.1-33.*

bb. *Table 5.1*-33 shows the annual averaging emission rate is 0.23 lb/hr NO_2.

Following are my calculations for the emission rate:

Normal operating hours = 8760 hr - (24 cold starts)(2.83 hr/cold start, based on 170 min) – (48 warm starts)(1.42 hr/warm start, based on 85 min)
- (48 hot starts)(0.42 hr/hot start, based on 25 min) = 8603.76 hr

[(8603.76 hr)(0.43 lb/hr from my emissions calculations) + (24 cold starts)(4.22 lb/cold start) + (48 warm starts)(2.11 lb/warm start) + (48 hot starts)(0.62 lb/hot start)] ÷ 8760 hr = 0.45 lb/hr

Please explain why the NO_2 emission rate is 0.23 lb/hr.

ii. SO_2 for 24-hr averaging period

aa. Please confirm the daily emission rate for SO_2 were based on 31 days of operation, 2 cold starts, 4 warm starts, 4 hot starts, averaged over 30 days, as indicated in footnote a to *Table 5.1-33.* Typically, the 24-hr emission rate is based on maximum emissions for a 24-hour day, but CH2M Hill's method would yield higher emissions.

bb. *Table 5.1*-33 shows the 24-hr averaging period emission rate is 0.025 lb/hr.

Following are my calculations for the emission rate:

[(31 days)(24 hr/day)(0.04 lb/hr from my emissions calculations)] ÷ [(30 days)(24 hr/day)] = 0.05 lb/hr

Please explain why the SO_2 emission rate is 0.025 lb/hr.

iii. $PM_{10}/PM_{2.5}$ for 24-hr averaging period

aa. Please confirm the daily emission rates for $PM_{10}/PM_{2.5}$ were based on 31 days of operation, 2 cold starts, 4 warm starts, 4 hot starts, averaged over 30 days, as indicated in footnote a to *Table 5.1-33.*

bb. *Table 5.1*-33 shows the 24-hr averaging period emission rate is 0.16 lb/hr.

Following are my calculations for the emission rate:

[(31 days)(24 hr/day)(0.305 lb/hr from my emissions calculations)] ÷ [(30 days)(24 hr/day)] = 0.32 lb/hr

Please explain why the $PM_{10}/PM_{2.5}$ emission rate is 0.16 lb/hr.

iv. $PM_{10}/PM_{2.5}$ for annual averaging period

aa. Please confirm the annual emission rates for $PM_{10}/PM_{2.5}$ were based on 8,760 hours of total operation, 24 cold starts, 48 warm starts, 48 hot starts, as indicated in footnote a to *Table 5.1-33.*

bb. *Table 5.1*-33 shows the annual averaging period emission rate is 0.15 lb/hr.

Following are my calculations for the emission rate:

[(8760 hr/yr)(0.305 lb/hr from my emissions calculations)] ÷ 8760 hr = 0.31 lb/hr

Please explain why the $PM_{10}/PM_{2.5}$ emission rate is 0.15 lb/hr.

b. Combined-Cycle Turbine Loads

i. On pages 5.1-30 and 5.1-31, *Table 5.1-31—AEC CCGT Emission Rates and Operating Scenarios Corresponding to the Highest Predicted AERMOD Impacts* indicates the "Operating Load (%)" is minimum or average for each averaging period. I see this operating load designation is from *Table 5.1B.3—Combined-Cycle: GE 7FA.05 Performance Data* in *Appendix 5.1B*, which refers to the "CTG load (as % of emissions compliant load range)" as max, average, or min. Please translate the maximum, average, and minimum loads to percentage loads to allow comparison against the approximate percentage CTG loads in *Table 5.1B.24—Combined-Cycle: GHG BACT Analysis.*

c. Simple-Cycle Turbine Emission Rates
On page 5.1-31 and 5.1-32, *Table 5.1-32—AEC SCGT Emission Rates and Operating Scenarios Corresponding to the Highest Predicted AERMOD Impacts* presents the emission rates for the pollutants/averaging periods.

i. NO_2 for 1-hr and 1-hr (federal) averaging periods
aa. Please confirm the hourly emission rate for NO_2 was based on 60 minutes of a start-up event, as indicated in footnote a to *Table 5.1-32.*

bb. *Table 5.1*-32 shows the 1-hour averaging period emission rate is 21.2 lb/hr.

Following are my calculations for the emission rate:

Normal operating hours = 1 hr – (0.5 hr/startup, based on 30-minutes) (1 startup) = 0.5 hr

(16.6 lb/startup) + (0.5 hr) (5.18 lb/hr from Case 3) = 19.19 lb/hr

Please explain why the NO_2 emission rate is 21.2 lb/hr.

ii. CO for 1-hr averaging period
aa. Please confirm the hourly emission rate for NO_2 was based on 60 minutes of a start-up event, as indicated in footnote a to *Table 5.1-32.*

bb. *Table 5.1*-32 shows the 1-hour averaging period emission rate is 44.9 lb/hr.

Following are my calculations for the emission rate:

Normal operating hours = 1 hr – (0.5 hr/startup, based on 30-minutes) (1 startup) = 0.5 hr

(15.4 lb/startup) + (0.5 hr)(5.04 lb/hr from Case 3) = 17.92 lb/hr

Please explain why the CO emission rate is 44.9 lb/hr.

d. Page 5.1-38 presents *Table 5.1-38--AEC Operation Impacts Analysis—Maximum Modeled Impacts Compared to the Ambient Air Quality Standards*. Please confirm the facility impact analysis includes the simultaneous operation of the two combined-cycle turbines, the four simple-cycle turbines, and the auxiliary boiler, because that is not stated in the Application.

e. To expedite the modeling review, please provide an explanation of how the modeling was performed for the normal operation of the facility for the purposes of Rule 1303 and 2005. The explanation is to include, but not be limited, to references to *Tables 5.1C.5 – 5.1C.8b* in *Appendix 5.1C*.

I will be out of the office for the next two weeks. John Yee is scheduled to be in next week, and Andrew Lee the following week. Happy Holidays!

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