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AES Alamitos, LLC
690 N. Studebaker Road
Long Beach, CA 90803
tel 562 493 7891
fax 562 493 7320

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Ms. Vicky Lee
Air Quality Engineer
Engineering and Compliance
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765

Re: Alamitos Energy Center Air Permit Application Completeness Response (Facility ID 115394)

Dear Ms. Lee:

AES Alamitos, LLC (AES) appreciates the South Coast Air Quality Management District's (SCAQMD) very thorough review of the Alamitos Energy Center (AEC) Permit Application and subsequent responses to previous data requests. This letter provides the information the SCAQMD requested in your December 18, 2015 electronic correspondence. The following information is presented in the same order as requested by the SCAQMD, with the same numbering scheme.

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.

         Response: Based on correspondence with the catalyst manufacturer, the maximum allowable pressure drop across the catalyst provided previously was incorrect. The correct value is 3.0 inches of water column for the simple-cycle selective catalytic reduction (SCR) system.

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?

Response: During the initial commissioning month, the normal monthly emissions based on 31 days, two cold starts, four warm starts, and four hot starts will 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.

Response: See the response to Data Request 10(e)(iii)(aa).

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.

Response: The monthly fuel consumption of 26,327 million British thermal units (MMBtu) does include fuel consumption associated with two cold startups, four warm startups, and four hot startups. This value was calculated as follows:

Maximum Monthly Fuel Consumption (MMBtu/month) = 25,789 MMBtu/month [730.98 Hours per Month[1] x 35.3 MMBtu/hr] + 234.37 MMBtu/month [2 Cold Startups per Month x 170 min/startup / 60 min/hr x 41.36 MMBtu/hr] + 234.37 MMBtu/month [4 Warm Startups per Month x 85 min/startup / 60 min/hr x 41.36 MMBtu/hr] + 68.93 MMBtu/month [4 Hot Startups per Month x 25 min/startup / 60 min/hr x 41.36 MMBtu/hr] = 26,327 MMBtu/month

Please note that the maximum annual fuel consumption of 310,096 MMBtu is not derived from the maximum monthly fuel consumption. The maximum monthly fuel consumption is based on 31 days of operation per month, whereas the maximum annual fuel consumption is based on 365 days of operation per year. To clarify this point, the calculation of the maximum annual fuel consumption is provided below:

Maximum Annual Fuel Consumption (MMBtu/yr) = 303,644 MMBtu/yr [8,603.76 Hours per Year[2] x 35.3 MMBtu/hr] + 2,812.48 MMBtu/yr [24 Cold Startups per Year x 170 min/startup / 60 min/hr x 41.36 MMBtu/hr] + 2,812.48 MMBtu/yr [48 Warm Startups per Year x 85 min/startup / 60 min/hr x 41.36 MMBtu/hr] + 827.20 MMBtu/yr [48 Hot Startups per Year x 25 min/startup / 60 min/hr x 41.36 MMBtu/hr] = 310,096 MMBtu/yr

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)

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[1] Normal operating hours per month are calculated to be 730.98 hours, as described in Data Request 11(c).

[2] Normal operating hours per year are calculated to be 8,603.76, as described in Data Request 25(a)(i)(bb).

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

Response: Your understanding of the operating profile is correct with regards to the number and duration of cold, warm, hot startups, and normal operating hours. However, two discrepancies exist in your calculations. First, two different molar conversion factors are used to calculate carbon monoxide (CO) and nitrogen oxides (NO_X) emissions. Secondly, the above calculations assume the auxiliary boiler is operated at the maximum heat input 24 hours per day, 7 days per week for 30 days. As noted in AES's December 11th response to Data Request 10(b)(i), the auxiliary boiler will be operated at its minimum turndown rate until a combined-cycle turbine start is requested. To be conservative, AES assumed an average hourly fuel consumption of 35.3 million British thermal units per hour (MMBtu/hr) rather than the hourly fuel consumption at minimum turndown rate.

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?

Response: The maximum ground-level impact for normalized emission rates (i.e., emission rates that do not vary by load or ambient temperature) occurs at an ambient temperature of 65.3 degrees Fahrenheit (°F) at minimum load (Scenario CC07).

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

Response: The stack temperature for Scenario CC07 is 350 degrees Kelvin (K) and the stack velocity is 11.8 meters per second (m/s).

bb. Annual Impacts

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

Response: This is correct.

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?

Response: The maximum ground-level impact for normalized emission rates (i.e., emission rates that do not vary by load or ambient temperature) occur at an ambient temperature of 107°F at minimum load. However, as this exhaust scenario cannot occur at the same time as the worst-case 1-hour combined-cycle exhaust scenario described above, the scenario resulting in the maximum ground-level impact from the 65.3°F ambient temperature scenarios was chosen (Scenario SC07).

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

Response: The stack temperature for Scenario SC07 is 746 K and the stack velocity is 23.6 m/s.

bb. Annual Impacts

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

Response: It is assumed that the above comment refers to Scenario SC07, not Scenario CC07. The stack temperature for Scenario SC07 is 746 K and the stack velocity is 23.6 m/s.

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.

Response: See the response to Data Request 11(b).

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.

Response: The hourly and annual emissions for propylene are 0.0357 pounds per hour (lb/hr) and 0.0783 tons per year (tpy), respectively, based on a propylene emission factor of 0.53 pounds per million standard cubic foot (lb/MMscf) (0.000505 pounds per million British thermal unit [lb/MMBtu][3]). Detailed calculations can be found in Attachment 13, which contains a revised Table 5.1B.14 from the AEC Air Permit Application.

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

Response: The hourly and annual emissions for ammonia are 0.159 lb/hr and 0.347 tpy, respectively, based on the operating exhaust ammonia limit of 5 parts per million (ppm) at 3 percent oxygen (O_2). See Attachment 13 for detailed calculations.

b. Rule 1401 Health Risk Assessment

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

Response: Propylene and ammonia were not previously included in the health risk assessment (HRA). However, revised versions of *Table 12-2–Health Risk Assessment Summary: Individual Units* and *Table 12-3–Health Risk Assessment Summary: Facility* are presented below, which summarize the excess cancer risk, chronic health index, and acute health index at the point of maximum impact (PMI) locations, as well as the maximum predicted public health impacts for worker, residential, and sensitive receptors. In

[3] Calculated by dividing the lb/MMscf emission factor by the SCAQMD's default gas heat rate of 1,050 million British thermal units per million standard cubic foot (MMBtu/MMscf).

accordance with SCAQMD Rule 1401, the results in Table 12-2R represent the predicted risk for each individual emission unit, while the results in Table 12-3R represent a comparison of the total predicted AEC impact to the SCAQMD California Environmental Quality Act (CEQA) significance thresholds. The revised HARP 2 modeling files used to conduct the health risk assessment are provided with this submission on compact disc.

As shown in Table 12-2R, the combined-cycle gas turbine's (CCGT) predicted impacts exceed the incremental increase in cancer risk threshold of 1 in 1 million; therefore, Best Available Control Technology for Toxics (T-BACT) will be required for these units. The simple-cycle gas turbines (SCGTs) and auxiliary boiler do not trigger the regulatory requirement for T-BACT as their predicted impacts are below the incremental increase in cancer risk threshold of 1 in 1 million. Although not required in all cases, the emission control technologies included in the AEC for all emission sources are considered to be T-BACT. All sources have predicted impacts below the chronic and acute hazard index of 1.0.

TABLE 12-2R
Health Risk Assessment Summary: Individual Units [a]

Risk [b]	AEC CCGT-1	AEC CCGT-2	AEC SCGT-1	AEC SCGT-2	AEC SCGT-3	AEC SCGT-4	Auxiliary Boiler
Cancer Risk at the PMI [c] (per million)	0.67	0.67	0.053	0.054	0.054	0.053	0.051
Cancer Risk at the MEIR [c] (per million)	0.48	0.46	0.048	0.048	0.047	0.047	0.015
Cancer Risk at a Sensitive Receptor [c] (per million)	0.47	0.48	0.022	0.023	0.026	0.026	0.010
Cancer Risk at the MEIW [d] (per million)	0.024	0.024	0.0019	0.0019	0.0019	0.0019	0.0015
Chronic Hazard Index at the PMI	0.0017	0.0017	0.00014	0.00014	0.00014	0.00014	0.00016
Chronic Hazard Index at the MEIR	0.0012	0.0012	0.00012	0.00012	0.00012	0.00012	0.000047
Chronic Hazard Index at a Sensitive Receptor	0.0012	0.0012	0.000057	0.000058	0.000066	0.000068	0.000032
Chronic Hazard Index at the MEIW	0.0017	0.0017	0.00014	0.00014	0.00014	0.00014	0.00016
Acute Hazard Index at the PMI	0.0066	0.0067	0.0024	0.0039	0.0024	0.0024	0.00049
Acute Hazard Index at the MEIR	0.0066	0.0066	0.0017	0.0017	0.0017	0.0017	0.00032
Acute Hazard Index at a Sensitive Receptor	0.0058	0.0053	0.0015	0.0015	0.0015	0.0016	0.00010
Acute Hazard Index at the MEIW	0.0066	0.0067	0.053	0.0039	0.0024	0.0024	0.00049

[a] The results in Table 12-2R represent the predicted excess risk for each individual emission unit in accordance with SCAQMD Rule 1401.

[b] A source with an excess cancer risk less than 1 in 1 million individuals is considered to be less than significant. A source with an excess cancer risk less than 10 in 1 million is considered less than significant if T-BACT is installed. A chronic or acute hazard index less than 1.0 for each source is considered to be a less-than-significant health risk.

[c] Cancer risk values are based on the Draft Risk Management Policy (RMP) methodology.

[d] Cancer risk values are based on the Office of Environmental Health Hazard Assessment (OEHHA) Derived methodology.

Notes:

MEIR = maximum exposed individual resident

MEIW = maximum exposed individual worker

A risk analysis was also performed to evaluate the potential facility-wide impacts. The potential health impacts at the PMI, maximum exposed individual resident (MEIR), maximum exposed individual worker (MEIW), and maximum exposed sensitive receptor resulting from AEC operation are summarized in Table 12-3R. It should be noted that the maximum impacts reported in Table 12-3R represent the maximum predicted impacts at one receptor from all sources combined. In contrast, the maximum impacts reported for each individual source in Table 12-2R may occur at different receptors. Therefore, the AEC totals in Table 12-2R are not directly additive and should not be directly compared to the results presented in Table 12-3R.

TABLE 12-3R
Health Risk Assessment Summary: Facility [a]

Risk [b]	Receptor Number	Receptor Coordinates (UTM, m)		Value
		Easting	Northing	
Cancer Risk at the PMI [c] (per million)	681	398450	3736900	1.4
Cancer Risk at the MEIR [c] (per million)	688	398800	3736900	1.1
Cancer Risk at a Sensitive Receptor [c] (per million)	19405	397913	3737192	1.0
Cancer Risk at the MEIW [d] (per million)	681	398450	3736900	0.052
Chronic Hazard Index at the PMI	681	398450	3736900	0.0036
Chronic Hazard Index at the MEIR	688	398800	3736900	0.0028
Chronic Hazard Index at a Sensitive Receptor	19405	397913	3737192	0.0026
Chronic Hazard Index at the MEIW	681	398450	3736900	0.0036
Acute Hazard Index at the PMI	597	397900	3736750	0.019
Acute Hazard Index at the MEIR	769	397700	3737100	0.018
Acute Hazard Index at a Sensitive Receptor	19405	397913	3737192	0.017
Acute Hazard Index at the MEIW	597	397900	3736750	0.019

[a] The results in Table 12-3R represent the combined predicted risk for all seven combustion units operating simultaneously.

[b] A facility with an excess cancer risk less than 10 in 1 million individuals is considered to be less than significant. A chronic or acute hazard index less than 1.0 for the facility is considered to be a less-than-significant health risk.

[c] Cancer risk values are based on the Draft RMP methodology.

[d] Cancer risk values are based on the OEHHA Derived methodology.

Notes:

m = meter(s)

UTM = Universal Transverse Mercator

As shown in Table 12-3R, predicted impacts for the AEC are below the significance thresholds of 10 in 1 million for excess cancer risk and chronic and acute hazard index of 1.0. Therefore, the predicted health risks associated with the AEC will be less than significant.

Because the predicted cancer risk, per individual unit, is greater than 1 in 1 million, the cancer burden was calculated for each census block receptor consistent with SCAQMD guidance[4]. The cancer burden for the AEC was estimated at 1.8×10^{-9}, which is well below the significance threshold of 0.5. Therefore, the AEC will not significantly increase cancer burden in the vicinity of the project site.

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.

Response: For each combined-cycle turbine, 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.

Response: For each simple-cycle turbine, 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.

Response: For the auxiliary boiler, 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."

[4] SCAQMD. 2015. *Supplemental Guidelines for Preparing Risk Assessments for the Air Toxics "Hot Spots" Information and Assessment Act (AB2588)*. June.

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.

Response: The emission rate of 12.3 lb/hr is based on the maximum potential emission rate, combining emissions from commissioning with the maximum annual operating emission rate which occurs when each turbine is operating at 100 percent load with inlet air cooling (Scenario CC04). The emissions scenario resulting in the worst-case modeled impacts for annual NO_X is Scenario CC07 with an emission rate of 9.12 lb/hr, where both combined-cycle turbines are operating at minimum load. Calculation for the emission rate of 9.12 lb/hr; calculation of this value is shown in the response to Data Request 23(a)(ii).

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*.

Response: As stated in the previous response, the emissions scenario resulting in the worst-case modeled impacts for annual NO_X is Scenario CC07, where both combined-cycle turbines are operating at minimum load. The total NO_X emissions for this operating scenario is 26.2 tpy per turbine. Adding this with the commissioning emission total of 13.8 tpy per turbine results in a combined operation and commissioning emission rate of 40 tpy per turbine. Converting this value to lb/hr produces an emission rate of 9.12 lb/hr (40 tpy x 2,000 pounds per ton [lb/ton] / 8,760 hours per year).

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

Response: The purpose of Table 5.1-12 is to present the maximum potential emission rates during commissioning, and does not directly relate to the dispersion modeling analysis.

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*.

Response: The total NO_X emissions for this operating scenario (Scenario CC04) is 40.2 tpy per turbine. Adding this with the commissioning emission total of 13.8 tpy per turbine results in a combined operation and commissioning emission rate of 54 tpy per turbine. Converting this value to lb/hr produces an emission rate of 12.3 lb/hr (54 tpy x 2,000 lb/ton / 8,760 hours per year).

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*.

Response: For commissioning of the combined-cycle turbines, a total of three scenarios were modeled, as listed below:

- Two General Electric (GE) Frame 7FA.05s at 10 percent load with auxiliary boiler operation
- Two GE Frame 7FA.05s at 40 percent load with auxiliary boiler operation
- Two GE Frame 7FA.05s at 80 percent load with auxiliary boiler operation

The stack parameters for each unit included in the modeled scenarios are presented in Table 5.1C.1 of the Air Permit Application. Stack parameters presented include source coordinates, elevation, stack height, temperature, exit velocity, and stack diameter. The short-term and annual emission rates in grams per second (g/s) and lb/hr for each unit included in the modeled scenarios are presented in Table 5.1C.2 of the Air Permit Application. These emission rates are the highest unabated emissions expected during commissioning. Only NO_X and CO were specifically modeled for the short-term averaging periods for commissioning because sulfur oxides (SO_X), particulate matter with aerodynamic diameter less than or equal to 10 microns (PM_{10}), and particulate matter with aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$) are not emitted in amounts greater than normal operating rates. For these pollutants, the highest short-term emission rates and resulting maximum air quality impact result from normal operating conditions were used to represent commissioning impacts. In other words, operational modeling results for short-term SO_X, PM_{10}, and $PM_{2.5}$ impacts were used as the conservative value for commissioning impacts. Additionally, short-term modeling was only included for NO_X and CO for scenarios where the emission rates were not captured by another commissioning or operation scenario modeled. NO_X, PM_{10}, and $PM_{2.5}$ were modeled for annual averaging periods, and the emission rates account for normal operations following commissioning activities. The building parameters included in the modeled scenarios are presented in Table 5.1C.3 of the Air Permit Application. The building parameters for the three GE Frame 7FA.05 commissioning scenarios include the presence of existing Alamitos Generating Station (AGS) Units 1-6 in addition to those of the GE Frame 7FA.05s. The results for each modeled scenario are presented in Table 5.1C.4 of the Air Permit Application. As with the emission rates, these results are sorted by short-term and annual averaging periods. As noted, impacts for the GE Frame 7FA.05 scenarios include operation of the auxiliary boiler.

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.

Response: The emission rate of 3.65 lb/hr is based on the maximum potential emission rate, combining emissions from commissioning with the maximum annual operating emission rate which occurs when each turbine is operating at 100 percent load with inlet air cooling (Scenario SC04). Scenario SC07 resulted in the worst-case *modeled* impacts for annual NO_X, with an emission rate of 2.95 lb/hr, where both simple-cycle turbines are operating at minimum load.

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*.

Response: As stated above, Scenario SC07 results in the worst-case modeled impacts for annual NO_X (both simple-cycle turbines operated at minimum load). The total NO_X emissions for emissions scenario SC07 is 10.0 tpy per turbine. Adding this value to the commissioning emission total of 2.86 tpy per turbine results in a combined operation and commissioning emission rate of 12.9 tpy per turbine. Converting this value to an hourly emission rate yields 2.95 lb/hr (12.9 tpy x 2,000 lb/ton / 8,760 hours per year).

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

Response: The purpose of Table 5.1-13 is to present the maximum potential emissions during commissioning, and does not directly relate to the dispersion modeling analysis.

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*.

Response: The total NO_X emissions for this operating scenario (Scenario SC04) is 13.1 tpy per turbine. Adding this with the commissioning emission total of 2.86 tpy per turbine results in a combined operation and commissioning emission rate of 16.0 tpy per turbine. Converting this value to lb/hr produces an emission rate of 3.65 lb/hr (16.0 tpy x 2,000 lb/ton / 8,760 hours per year).

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.

Response: 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*.

Response: For commissioning of the simple-cycle turbines, a total of three scenarios were modeled, as listed below:

- Four GE LMS 100PBs at 5 percent load with operation of two GE Frame 7FA.05s and the auxiliary boiler
- Four GE LMS 100PBs at 75 percent load with operation of two GE Frame 7FA.05s and the auxiliary boiler
- Four GE LMS 100PBs at 100 percent load with operation of two GE Frame 7FA.05s and the auxiliary boiler

The stack parameters for each unit included in the modeled scenarios are presented in Table 5.1C.1 of the Air Permit Application. Stack parameters presented include source coordinates, elevation, stack height, temperature, exit velocity, and stack diameter. The short-term and annual emission rates in g/s and lb/hr for each unit included in the modeled scenarios are presented in Table 5.1C.2 of the Air Permit Application. These emission rates are the highest unabated emissions expected during commissioning. Only NO_X and CO were modeled for the short-term averaging periods because SO_X, PM_{10}, and $PM_{2.5}$ are not emitted in amounts greater than normal operating rates. In other words, operational modeling results for short-term SO_X, PM_{10}, and $PM_{2.5}$ impacts were used as the conservative value for commissioning impacts. Additionally, short-term modeling was only included for NO_X and CO for scenarios where the emission rates were not captured by another commissioning or operation scenario modeled. NO_X, PM_{10}, and $PM_{2.5}$ were modeled for annual averaging periods, and the emission rates account for operation following commissioning activities. The building parameters included in the modeled scenarios are presented in Table 5.1C.3 of the Air Permit Application. The building parameters for the three GE LMS 100PB commissioning scenarios include the presence of the two GE Frame 7FA.05s and existing AGS Units 1-6, in addition to those of the GE LMS 100PBs. The results for each modeled scenario are presented in Table 5.1C.4 of the Air Permit Application. As with the emission rates, these results are sorted by short-term and annual averaging periods. As noted, impacts for the GE LMS 100PB scenarios include operation of the auxiliary boiler and two GE Frame 7FA.05s at the worst-case operating conditions.

25. Normal Operation of Facility

a. Auxiliary Boiler Emission Rates

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. NO_2 for annual averaging period

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.*

Response: The annual averaging period emission rate for nitrogen dioxide (NO_2) was based on 8,760 hours of total operation, 24 cold startups, 48 warm startups, and 48 hot startups.

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.

Response: Your understanding of the operating profile is correct with regards to the number and duration of cold, warm, and hot startups. Your understanding of the normal operating hours is also correct, which deducts the duration of cold, warm, and hot startups from the total possible operating hours per year. However, the above calculation assumes the auxiliary boiler is operated at the maximum heat input 24 hours per day, 7 days per week for 30 days. As noted in AES's December 11th response to Data

Request 10(b)(i), the auxiliary boiler will be operated at its minimum turndown rate until a combined-cycle turbine start is requested. To be conservative, AES assumed an average hourly fuel consumption of 35.3 MMBtu/hr. The corrected calculation is provided below.

[(8603.76 hr)(0.21 lb/hr[5]) + (24 cold starts)(4.22 lb/cold start) + (48 warm starts)(2.11 lb/warm start) + (48 hot starts)(0.62 lb/hot start)] ÷ 8,760 hr = 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.

Response: The daily emission rate for sulfur dioxide (SO_2) was based on 31 days of operation, two cold startups, four warm startups, and four hot startups, 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 0.025 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.

Response: The 24-hour average SO_2 emission rate is calculated using the maximum monthly fuel consumption of 26,327 MMBtu, as follows:

24-hour Average SO_2 Emission Rate (lb/hr) = 26,327 MMBtu/month / 30 days/month / 24 hours/day x 0.00068 lb SO_2/MMBtu = 0.025 lb SO_2/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.*

Response: The daily emission rates for $PM_{10}/PM_{2.5}$ were based on 31 days of operation, two cold startups, four warm startups, and four hot startups, 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.

Response: The 24-hour average $PM_{10}/PM_{2.5}$ emission rate is calculated using the maximum monthly fuel consumption of 26,327 MMBtu, as follows:

[5] Calculated as 35.3 MMBtu/hr x 0.006 lb NO_2/MMBtu, as taken from Table 5.1B.11 of the Air Permit Application.

24-hour Average $PM_{10}/PM_{2.5}$ Emission Rate (lb/hr) = 26,327 MMBtu/month / 30 days/month / 24 hours/day x 0.0043 lb $PM_{10}/PM_{2.5}$/MMBtu = 0.16 lb $PM_{10}/PM_{2.5}$/hr

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

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.*

Response: The annual emission rates for $PM_{10}/PM_{2.5}$ were based on 365 days of operation, 24 cold startups, 48 warm startups, and 48 hot startups, 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.

Response: The annual average $PM_{10}/PM_{2.5}$ emission rate is calculated using the maximum annual fuel consumption of 310,096 MMBtu, as follows:

Annual Average $PM_{10}/PM_{2.5}$ Emission Rate (lb/hr) = 310,096 MMBtu/yr / 365 days/yr / 24 hr/day x 0.0043 lb $PM_{10}/PM_{2.5}$/MMBtu = 0.15 lb $PM_{10}/PM_{2.5}$/hr

b. <u>Combined-Cycle Turbine Loads</u>

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.*

Response: Load scenarios designated as maximum load for the combined-cycle turbines refer to a 100 percent operating load for the low (28°F), average (65.3°F), and high (107°F) ambient temperatures. Load scenarios designated as average load refer to a 75 percent operating load for the low, average, and high ambient temperatures. Load scenarios designated as minimum load refer to 45 percent load, 44 percent load, and 48 percent load for the low, average, and high ambient temperatures, respectively. The data can also be found in Table 5.1B.3 of the Air Permit Application, under the subheading “CTG Load Level (percent of Base Load)”, with “BASE” used to represent the 100 percent load scenarios.

c. <u>Simple-Cycle Turbine Emission Rates</u>

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. <u>NO_2 for 1-hr and 1-hr (federal) averaging periods</u>

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.*

Response: The maximum hourly emission rate for NO_2 is based on a startup event (30 minutes), a shutdown event (13 minutes), and the balance of the hour (17 minutes) at steady-state operation.

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.

Response: The maximum hourly emission rate for NO_2 is calculated by summing the following emissions: 16.6 pounds (30-minute startup) + 3.12 pounds (13-minute shutdown) + 1.47 pounds (17 minutes of steady-state operation in Scenario SC03) = 21.2 lb/hr total.

ii. <u>CO for 1-hr averaging period</u>

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.*

Response: It is assumed the above comment refers to the maximum hourly CO emission rate. The maximum hourly emission rate for CO is based on a startup event (30 minutes), a shutdown event (13 minutes), and the balance of the hour (17 minutes) at steady-state operation.

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.

Response: The maximum hourly emission rate for CO is calculated by summing the following emissions: 15.4 pounds (30-minute startup) + 28.1 pounds (13-minute shutdown) + 1.43 pounds (17 minutes of steady-state operation in Scenario SC03) = 44.9 lb/hr total.

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.

Response: Facility impacts include the operation of the two combined-cycle turbines, four simple-cycle turbines, and the auxiliary boiler.

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*.

Response: A load analysis was conducted wherein numerous scenarios were modeled to evaluate low, average, and high combined- and simple-cycle turbine loads for low, average, and high ambient temperatures. This load analysis was conducted to demonstrate compliance with both the federal and state ambient air quality standards, and included operation of the auxiliary boiler. The load analysis results are presented in Table 5.1C.8a of the Air Permit Application, and were used to select the worst-case impacts for each criteria pollutant and corresponding averaging period presented in Table 5.1-38 of the Air Permit Application. Below, Table 25-1 presents the emissions/exhaust scenarios leading to the worst-case impacts for each criteria pollutant. In all cases, the modeled stack parameters, emission rates, and building parameters were taken from Table 5.1C.5, Table 5.1C.6, and Table 5.1C.7, respectively, of the Air Permit Application.

TABLE 25-1
AEC Operation Impacts Analysis – Exhaust Scenario Contributing to the Maximum Modeled Impacts

Pollutant	Averaging Time	Emissions/Exhaust Scenario
CO	1-hour	CC03/SC03/AB
	8-hour	CC03/SC03/AB
NO_2	1-hour (max)	CC03/SC03/AB
	1-hour (98th percentile)	CC03/SC03/AB
	Annual	CC07/SC07/AB
SO_2	1-hour (max)	CC02/SC01/AB
	1-hour (99th percentile)	CC06/SC05/AB
	3-hour	CC06/SC05/AB
	24-hour	CC06/SC05/AB
PM_{10}	24-hour	CC07/SC07/AB
	Annual	CC07/SC07/AB
$PM_{2.5}$	24-hour (98th percentile)	CC07/SC07/AB
	Annual	CC07/SC07/AB

To demonstrate compliance with SCAQMD Rule 2005, each combustion unit was modeled individually using the stack parameters, emission rates, and building parameters from Table 5.1C.5, Table 5.1C.6, and Table 5.1C.7, respectively, of the Air Permit Application. The particular operational scenario selected for each combustion unit was chosen based on the load analysis results. In other words, only the parameters from the operational scenarios leading to the worst-case 1-hour state, 1-hour federal, and annual NO_X impacts were used, as presented in Table 25-1 above. The results for each modeled scenario are presented in Table 5.1C.8b of the Air Permit Application. These results were used to identify the maximum impacts presented in Table 5.1-39 of the Air Permit Application.

AES would also like to clarify that the AEC's combined-cycle and simple-cycle turbines are exempt from the modeling requirements of SCAQMD Rules 1303. SCAQMD Rule 1304(a)(2) provides an exemption from the dispersion modeling requirements of SCAQMD Rule 1303(b)(1) and the offset requirement of SCAQMD Rule 1303(b)(2) for projects like the AEC that are classified by SCAQMD's rules as "Electric Utility Steam Boiler Replacement," defined in pertinent part as the replacement of electric utility steam boiler(s) with combined cycle or advanced gas turbines. Therefore, SCAQMD Rule 1304(a)(2) expressly provides that an SCAQMD Rule 1303, Appendix A-2 review is not required as part of this air quality impacts analysis.

Please let me or Jerry Salamy know if you have any additional questions.

Sincerely,

Stephen O'Kane
Vice-President
AES Southland Development, LLC
AES Alamitos, LLC
AES Alamitos Energy, LLC

Attachments

cc: Jennifer Didlo/AES
Jeff Harris/ESH
Jerry Salamy/CH2M HILL

Attachment 13
Revised Auxiliary Boiler Air Toxics Emissions

Alamitos Energy Center
Table 5.1B.14R
Auxiliary Boiler: Summary of Operation Emissions – Air Toxics
January 2016

Assumptions:

Total Operations:	8,760	hrs/yr
Gas Heat Content:	1,050	MMBtu/MMscf
Maximum Hourly Heat Input:	70.8	MMBtu/hr (HHV)
Maximum Annual Heat Input [a]:	310,096	MMBtu/yr (HHV)

lb/MMBtu

Proposed Project	**Emission Factors**		**Emissions**		
Compound	**lb/MMscf [b]**	**lb/MMBtu [b]**	**lb/hr**	**lb/yr**	**tpy**
Ammonia [c]	5 ppm	-	1.59E-01	6.94E+02	3.47E-01
Benzene	5.80E-03	5.52E-06	3.91E-04	1.71E+00	8.56E-04
Formaldehyde	1.23E-02	1.17E-05	8.29E-04	3.63E+00	1.82E-03
PAHs	1.00E-04	9.52E-08	6.74E-06	2.95E-02	1.48E-05
Naphthalene	3.00E-04	2.86E-07	2.02E-05	8.86E-02	4.43E-05
Acetaldehyde	3.10E-03	2.95E-06	2.09E-04	9.16E-01	4.58E-04
Acrolein	2.70E-03	2.57E-06	1.82E-04	7.97E-01	3.99E-04
Propylene	5.30E-01	5.05E-04	3.57E-02	1.57E+02	7.83E-02
Toluene	2.65E-02	2.52E-05	1.79E-03	7.83E+00	3.91E-03
Xylene	1.97E-02	1.88E-05	1.33E-03	5.82E+00	2.91E-03
Ethylbenzene	6.90E-03	6.57E-06	4.65E-04	2.04E+00	1.02E-03
Hexane	4.60E-03	4.38E-06	3.10E-04	1.36E+00	6.79E-04
TOTAL HAPs				**24.2**	**0.012**
TOTAL TACs				**6.70**	**0.0034**

Notes:

[a] The auxiliary boiler will operate at the maximum hourly firing rate and will have two cold starts, four warm starts, and four hot starts per month.

[b] Provided by SCAQMD in letter dated 11/20/2015. Units of lb/MMBtu calculated by dividing lb/MMscf by the gas heat rate.

[c] Based on the operating exhaust NH_3 limit of 5 ppmv @ 3% O_2 and an F-factor of 8,710.