



South Coast  
Air Quality Management District

Engineering Division  
Application Processing & Calculations

PAGE  
1

PAGES  
32

APPL NO.  
543407-8

DATE  
3/7/2014

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**CHANGE OF CONDITIONS (P/C-P/O)**

**APPLICANT:**

Southern California Edison  
2244 Walnut Grove Ave  
Rosemead, CA 91770

**EQUIPMENT LOCATION:**

12408 6<sup>th</sup> St  
Rancho Cucamonga, CA 91739

**EQUIPMENT DESCRIPTION:**

Section D of the Facility Permit, ID# 149620

Proposed changes or additions are shown in **bold/underline**, proposed deletions are shown in ~~strikethrough~~

| Equipment  | ID No. | Connected To | RECLAIM Source Type/ Monitoring Unit | Emissions and Requirements   | Conditions   |
|--|--------|--------------|--------------------------------------|--|--|
| <b>PROCESS 1: POWER GENERATION</b>   |        |              |                                      |  |  |
| <b>SYSTEM 1: GAS TURBINE</b>   |        |              |                                      |  |  |
| GAS TURBINE, UNIT NO. 1, NATURAL GAS, GENERAL ELECTRIC MODEL LM6000PC SPRINT, SIMPLE CYCLE WITH WATER INJECTION, 505.7 MMBTU/HR, WITH A/N: 499010 <b><u>543407</u></b> | D1     |              |                                      | <b>CO: 6 PPM NATURAL GAS (4) [RULE 1303(a)(1)-BACT]; CO: 2000 PPM (5) [RULE 407]; NOX: 2.5 PPM NATURAL GAS (4) [RULE 1303(a)(1)-BACT]; NOX:25 PPM NATURAL GAS (8) [40 CFR60 SUBPART KKKK]; VOC: 2 PPM NATURAL GAS (4) [RULE 1303(A)(1)-BACT]; PM: 0.1 GR/SCF (5) [RULE 409]; PM: 11 LBS/HR (5) [RULE 475]; PM: 0.01 GR/SCF (5A) [RULE 475]; SOX: 0.060 LBS/MMBTU (8) [40CFR 60 SUBPART KKKK] SO2: (9) [40CFR 72 – ACID RAIN]</b> | A63.1, A63.3, A63.4, A99.1, A99.2, A195.1, A195.2, A195.3, A195.4, A327.1, D12.1, C1.1, C1.3, D29.2, D29.3, D82.1, E57.1, E193.3, K40.1, K67.1 |
| GENERATOR, 49 MW   |        |              |                                      |  |  |
| STACK, DIAMETER: 13 FT, HEIGHT: 80 FT  | S4     |              |                                      |  |  |



**South Coast  
Air Quality Management District**

Engineering Division  
Application Processing & Calculations

|                      |                  |
|----------------------|------------------|
| PAGE<br>2            | PAGES<br>32      |
| APPL NO.<br>543407-8 | DATE<br>3/7/2014 |
| PROCESSED BY<br>CGP  | CHECKED BY       |

| Equipment  | ID No. | Connected To | RECLAIM Source Type/ Monitoring Unit | Emissions and Requirements   | Conditions                               |
|--|--------|--------------|--------------------------------------|--|--|
| <b>PROCESS 1- POWER GENERATION</b>   |        |              |                                      |  |  |
| <b>SYSTEM 1: GAS TURBINE</b>   |        |              |                                      |  |  |
| A/N: 499010 543407   |        |              |                                      |  |  |
| <b>SYSTEM 2: EMERGENCY ENGINE</b>  |        |              |                                      |  |  |
| INTERNAL COMBUSTION ENGINE, EMERGENCY POWER, NATURAL GAS, WAUKESHA, MODEL VGF36 GL/GLD, 924 BHP<br>A/N: 479361 | D5     |              |                                      | NOX: 1.25 GR/BPH (4) [RULE 1303-BACT] CO: 1.75 GR/BPH (4) [RULE 1303-BACT]; VOC (4) 0.45 GR/BPH (4) [RULE 1303-BACT] | A63.3, A63.4, C1.4, D12.5, K67.2, E162.1 |

**BACKGROUND:**

The SCE, Grapeland facility consists of a natural gas fired GE LM6000 combustion turbine generator rated at 49 net MW, associated air pollution control equipment in the form of in-duct oxidation and reduction catalysts, a 10,000 gallon aqueous ammonia storage tank, and an 924 hp emergency internal combustion engine.

The initial permit to construct was issued on March 1, 2007. Construction was completed on the unit in the summer of 2007, and first fire was around July 23 of that year. The permits for the gas turbine and the emergency engine were modified in 2008 to address start up limits, equipment description, and hours of operation. The gas turbine permit was again modified in 2009 to address Cal-ISO black start testing. The SCR/CO catalyst and aqueous ammonia storage tank permits have not been modified since the initial P/C was issued.

Following is the application history:

| Equipment            | A/N    | Description  | Permit Date |
|----------------------|--------|--|-------------|
| Gas Turbine          | 461460 | Initial Permit to Construct  | 3/1/07      |
|                      | 478600 | Change of Condition to address start up limits and equipment description | 12/10/08    |
|                      | 499010 | Change of Conditions to address Cal-ISO testing                          | 3/10/10     |
| SCR/CO Catalyst      | 461462 | Initial Permit to Construct  | 3/1/07      |
| Emergency Engine     | 461461 | Initial Permit to Construct  | 3/1/07      |
|                      | 479361 | Change of Condition to address hours of operation                        | 12/10/08    |
| Ammonia Storage Tank | 461463 | Initial Permit to Construct  | 3/1/07      |

Final Permits to Operate for all the equipment were issued on June 29, 2012.

SCE is now proposing a further modification to the gas turbine permit and requesting the following changes:



**South Coast  
Air Quality Management District**

Engineering Division  
Application Processing & Calculations

|                      |                  |
|----------------------|------------------|
| PAGE<br>3            | PAGES<br>32      |
| APPL NO.<br>543407-8 | DATE<br>3/7/2014 |
| PROCESSED BY<br>CGP  | CHECKED BY       |

1. Allow up to 32 hrs/yr of uncontrolled operation for black start testing, WECC generator modeling, and performance tuning operations (currently the permit allows 18 hrs/yr).
2. Include a condition to specify the annual number of allowable start ups and fuel use based on a 'sliding scale' determination.

The following applications were submitted for this project:

Table A-1 – Project Application Numbers

| A/N    | Submittal Date | Equipment          | Previous A/N |
|--------|----------------|--------------------|--------------|
| 543407 | 10/11/12       | Gas turbine        | 499010       |
| 543408 | 10/11/12       | Black Start Engine | 479361       |
| 534406 | 10/11/12       | Title V            | //////////   |

The Grapeland facility is NOT subject to Reclaim. It is, however, a Title V facility.

**PROCESS DESCRIPTION:**

SCE operates this facility as a peaking plant. The turbine is mainly used in the hot summer months when demand for electricity is highest. The LM6000 Enhanced Sprint turbine is a simple cycle unit, rated at 49 MW output and about 506 mmbtu/hr input. It is fired on natural gas only, and is controlled with water injection into both the low and high pressure compressors, followed by SCR and oxidation catalysts. The table below highlights some operating parameters:

Gas Turbine Data

|                                |                  |
|--------------------------------|------------------|
| Max rated heat input           | 505.68 mmbtu/hr  |
| Max rated power output (gross) | 49 MW            |
| Fuel rate @ maximum load       | 0.4836 mmcf/hr   |
| Exhaust flow @ maximum load    | 15.66 mmcf/hr    |
| Net Plant Heat Rate, LHV       | 9,152 Btu/kw-hr  |
| Net Plant Heat Rate, HHV       | 10,067 Btu/kw-hr |
| Net Plant Efficiency, LHV      | 37%              |

**DISCUSSION:**

Originally, SCE had also requested to increase the daily fuel use limit for the turbine from 4.7 to 8 mmcf/day, to increase the annual fuel use limit from 489 mmscf/yr to 750 mmscf/yr, to increase the allowable start ups per year from 200 to 400, and then use the turbine's NOx CEMS to track emissions to verify the facility was below 4 tpy. Also, SCE asked to use a natural gas heat content of 1020 btu/cf, and to combine the turbine and emergency diesel engine's emission in a bubble (only applies to the Mira Loma, Center and Barre facilities, does not apply to the Grapeland facility since there is no diesel engine).



South Coast  
Air Quality Management District

Engineering Division  
Application Processing & Calculations

PAGE  
4

PAGES  
32

APPL NO.  
543407-8

DATE  
3/7/2014

PROCESSED BY  
CGP

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In a meeting on 5/4/12, AQMD discussed the proposed changes with representatives from SCE. SCE was told that AQMD rules did not allow NOx CEMS data to be used to track annual emissions for purposes of determining emission offset status. The annual emissions for purposes of determining the need for offsets are based on Potential to Emit (PTE) calculations, including the maximum equipment rating and the permitted emissions levels, in this case the heat input rating of 506 mmbtu/hr and the NOx BACT level of 2.5 ppm. SCE was further informed that increasing the daily and/or annual fuel limits to their requested levels would cause the PTE to exceed the offset thresholds for NOx and/or PM10. On the issue of heat content, SCE was informed that AQMD uses a heat content of 1050 btu/cf as a matter of default, and any lower value would have to be substantiated with continuous monitoring or at least regular testing. And finally, the 'bubble' concept would not be allowed because the PTE of the turbine and the engine cannot exceed the 4 tpy thresholds.

The issue of how the PTE of the diesel engine was calculated was discussed. SCE was told that the PTE is currently based on 200 hrs/yr operation (maximum including any emergency operation), but that the PTE calculation could be changed to 20 hrs/yr (maintenance and testing operation only), which would allow higher emissions from the turbine without exceeding the annual emissions cap (only applies to the Mira Loma, Center and Barre facilities, does not apply to the Grapeland facility since there is no diesel engine).

Overall, SCE's initial proposal would have required offsets for NOx and PM10, and inclusion of the facility into RECLAIM. Since SCE indicated they were reluctant to do that, SCE was asked to provide a revised proposal to AQMD which would keep their emissions below the thresholds. On February 13, 2013, SCE provided proposed condition language to incorporate the 'sliding scale' approach to the start ups and fuel use limits. Along the way, they also indicated that they would drop the requests to increase the daily fuel use limit, the use of a different fuel heat content, and the use of CEMS to track emissions for the annual cap purposes.

The issues of increased Cal-ISO/NERC testing, performance tuning, and the annual start ups/fuel use limits are the basis of the following evaluation.

Currently, the gas turbine's operation is limited as follows:

|                  |               |
|------------------|---------------|
| Daily Fuel Use   | 4.43 mmcf/day |
| Annual Fuel Use  | 619 mmcf/yr   |
| Annual Start Ups | 200           |

Based on these annual limits, the NOx calculated for the turbine is 7,541 lbs/yr (reference A/N 478600). Total facility NOx is 7,769 including the black start engine. SCE would now like to eliminate this 'single point' annual fuel use/start up limit and instead have a 'multiple point' or 'sliding scale' fuel use/start up limit that would allow the facility the flexibility to start the turbine as much as 350 times/yr, or as few as 100 times per year. The DAILY fuel use limit WILL NOT change.

Based on these annual limits, the NOx calculated for the turbine is 7,540.5 lbs/yr (reference A/N 499010). Total facility NOx is 7,769.5 including the black start engine (reference A/N 478600). SCE would now like to eliminate this 'single point' annual fuel use/start up limit and instead have



**South Coast  
Air Quality Management District**

Engineering Division  
Application Processing & Calculations

PAGE  
5

PAGES  
32

APPL NO.  
543407-8

DATE  
3/7/2014

PROCESSED BY  
CGP

CHECKED BY

a 'multiple point' or 'sliding scale' fuel use/start up limit that would allow the facility the flexibility to start the turbine as much as 350 times/yr, or as few as 100 times per year. The DAILY fuel use limit WILL NOT change.

**EMISSIONS:**

**A. Daily Emissions**

Daily emissions estimates were previously based on 1 start up and shutdown per day. With SCE's request for increased annual starts, there is a likelihood for multiple starts/day. It will be assumed that the unit may start up to 3 times daily now. Based on this, the daily emissions calculations are revised (see Appendix A) and shown versus the previous estimates below:

**Comparison of Current Daily Emissions to Proposed Daily Emissions**

| Pollutant | Current Daily Emission <sup>1</sup><br>lbs/day | Proposed Daily Emissions <sup>2</sup><br>lbs/day | Increase<br>lbs/day |
|-----------|--|--|---------------------|
| NOX       | 50.82  | 68.06  | 17.24               |
| CO        | 65.96  | 74.62  | 8.66                |
| VOC       | 12.14  | 12.92  | 0.78                |
| PM10      | 49.58  | 49.58  | 0                   |
| SOx       | 2.75   | 2.75   | 0                   |
| NH3       | 34.08  | 34.08  | 0                   |

1 based on 1 start per day

2 based on 3 starts per day

**B. Annual Emissions**

Current Annual Emissions are based on 619 mmcf/yr fuel use, and 200 start ups and shutdowns per year. Emissions are summarized as follows (reference A/N 478600):

| Pollutant | Current Emissions    |                                      |
|-----------|----------------------|--------------------------------------|
|           | Turbine Only, lbs/yr | Total Facility <sup>1</sup> , lbs/yr |
| NOx       | 7540.52              | 7769.48                              |
| CO        | 9361.19              | 9681.74                              |
| VOC       | 1697.27              | 1779.70                              |
| PM10      | 6746.87              | 6752.61                              |
| SOx       | 330.00               | 330.34                               |

1 - includes 90 hrs/yr for the black start engine

Revised annual emissions will be based on the following:

1. Cal-ISO/NERC testing, performance tuning operations, and WECC generator modeling



**South Coast  
Air Quality Management District**

Engineering Division  
Application Processing & Calculations

PAGE  
6

PAGES  
32

APPL NO.  
543407-8

DATE  
3/7/2014

PROCESSED BY  
CGP

CHECKED BY

SCE had previously provided an hourly estimated emission rate of 40 lbs/hr for black start testing. According to SCE, for the performance tuning operation and WECC generator modeling, the following emission estimates apply:

| Testing Activity    | Control Level | NOx Emission Rate | Duration |
|---------------------|---------------|-------------------|----------|
|                     |               | lbs/hr            | hrs/yr   |
| performance tuning  | H2O injection | 50                | 4        |
| performance tuning  | H2O injection | 45                | 2        |
| performance tuning  | H2O & NH3 inj | 6                 | 22       |
| black start testing | H2O injection | 40                | 4        |
| WECC*               | H2O injection | 45                | 2        |
| WECC*               | H2O & NH3 inj | 6                 | 8        |

\* the WECC generator modeling is only performed once every 5 years. During the year it is performed, the performance tuning operation will be limited to 18 hrs. Emissions estimates are based on expected NOx concentrations with the given control levels.

| Pollutant | Testing Hourly Emissions | Current Testing 2 hrs/yr | Proposed Testing 32 hrs/yr | Increase |
|-----------|--------------------------|--------------------------|----------------------------|----------|
|           | lbs/hr                   | lbs/yr                   | lbs/yr                     | lbs/yr   |
| NOx       | 40*                      | 80                       | 582*                       | 502      |
| CO        | 15.84                    | 31.68                    | 475.2                      | 443.52   |
| VOC       | 1.15                     | 2.3                      | 34.5                       | 32.2     |
| PM10      | 0.48                     | 0.96                     | 14.4                       | 13.44    |
| SOx       | 0.06                     | 0.12                     | 1.8                        | 1.68     |

\* The NOx emission rate for the performance tuning operation will vary from 50 lbs/hr to 6 lbs/hr, depending on the testing scenario, refer to the table above for a breakdown.

## 2. Start Ups/Shutdowns

SCE has asked for flexibility in the number of start ups allowed per year. Some years the turbine may experience many start up and shutdown events, other years the unit may operate on a more continuous basis. To accommodate their request, a sliding scale start up/annual fuel use limit is proposed. In this scenario, the less start ups used during the year, the more fuel use would be allowed.

Annual NOx emissions for the TURBINE ALONE are estimated using the following calculation, which includes 32 hrs/yr testing (582 lbs/yr):

$$\# \text{ starts/yr} * 10.36 \text{ lbs/start} + \# \text{ shutdowns/yr} * 6.44 \text{ lbs/shutdown} + [(\text{Total annual fuel use}) / 0.4836 \text{ mmscf/hr} - \# \text{ starts/yr} - \# \text{ shutdowns/yr}] * 4.75 \text{ lbs/hr} + 582 \text{ lbs}$$

The following table illustrates how the fuel limit would change depending on the number of starts per year:



**South Coast  
Air Quality Management District**

Engineering Division  
Application Processing & Calculations

PAGE  
7

PAGES  
32

APPL NO.  
543407-8

DATE  
3/7/2014

PROCESSED BY  
CGP

CHECKED BY

**Table 1 Annual Turbine Emissions**

|            |      | Number of Starts |        |        |        |        |        |        |        |        |        |        |
|------------|------|------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|            |      | 100              | 125    | 150    | 175    | 200    | 225    | 250    | 275    | 300    | 325    | 350    |
| Fuel Limit |      | 660              | 640    | 620    | 600    | 580    | 565    | 545    | 530    | 510    | 490    | 470    |
| Emissions  | NOx  | 7794.6           | 7780.7 | 7766.7 | 7752.8 | 7738.9 | 7774.0 | 7760.1 | 7795.2 | 7781.3 | 7767.4 | 7753.4 |
|            | CO   | 10185.7          | 9958.4 | 9731.1 | 9503.9 | 9276.6 | 9121.1 | 8893.8 | 8738.3 | 8511.1 | 8283.8 | 8056.5 |
|            | VOC  | 1839.0           | 1785.1 | 1731.3 | 1677.5 | 1623.6 | 1583.4 | 1529.6 | 1489.4 | 1435.6 | 1381.7 | 1327.9 |
|            | PM10 | 7397.8           | 7174.0 | 6950.3 | 6726.6 | 6502.8 | 6335.0 | 6111.3 | 5943.5 | 5719.7 | 5496.0 | 5272.3 |
|            | SOx  | 411.2            | 398.8  | 386.4  | 374.0  | 361.6  | 352.3  | 339.9  | 330.6  | 318.2  | 305.8  | 293.4  |

*Fuel limit is in mmcf*

Annual emissions for the WHOLE FACILITY are estimated using the following emissions for the black start engine:

**Table 2 Annual Emissions Black Start Engine**

| Pollutant | Black Start Engine <sup>(1)</sup> |
|-----------|-----------------------------------|
| NOx       | 162.6                             |
| CO        | 227.8                             |
| VOC       | 58.9                              |
| PM10      | 4.1                               |
| SOx       | 0.24                              |

*(1) Reference A/N 479361, based on 64 hrs/yr operation*

**Table 3 Annual Emissions Entire Facility**

|            |      | Number of Starts |         |        |        |        |        |        |        |        |        |        |
|------------|------|------------------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|            |      | 100              | 125     | 150    | 175    | 200    | 225    | 250    | 275    | 300    | 325    | 350    |
| Fuel Limit |      | 660              | 640     | 620    | 600    | 580    | 565    | 545    | 530    | 510    | 490    | 470    |
| Emissions  | NOx  | 7957.2           | 7943.3  | 7929.3 | 7915.4 | 7901.5 | 7936.6 | 7922.7 | 7957.8 | 7943.9 | 7930.0 | 7916.0 |
|            | CO   | 10414            | 10186.2 | 9958.9 | 9731.7 | 9504.4 | 9348.9 | 9121.6 | 8966.1 | 8738.9 | 8511.6 | 8284.3 |
|            | VOC  | 1897.9           | 1844.0  | 1790.2 | 1736.4 | 1682.5 | 1642.3 | 1588.5 | 1548.3 | 1494.5 | 1440.6 | 1386.8 |
|            | PM10 | 7401.9           | 7178.1  | 6954.4 | 6730.7 | 6506.9 | 6339.1 | 6115.4 | 5947.6 | 5723.8 | 5500.1 | 5276.4 |
|            | SOx  | 411.5            | 399.1   | 392.9  | 374.2  | 361.8  | 352.5  | 340.1  | 330.8  | 318.4  | 306.0  | 293.6  |

*Fuel limit is in mmcf*

Table 3 includes black start engine emissions based on 64 hrs/yr for maintenance and testing to show the total facility emissions under the new condition:

**Comparison of Current Annual Emissions to Proposed Annual Emissions Turbine Only**

| Pollutant | Current Emissions, lbs/yr | Proposed Emissions, lbs/yr | Difference, lbs/yr |
|-----------|---------------------------|----------------------------|--------------------|
| NOx       | 7540.52                   | 7794.6                     | 254.08             |
| CO        | 9361.19                   | 10185.7                    | 824.51             |
| VOC       | 1697.27                   | 1839.0                     | 141.73             |
| PM10      | 6746.87                   | 7397.8                     | 650.93             |



**South Coast  
Air Quality Management District**  
  
Engineering Division  
Application Processing & Calculations

|                      |                  |
|----------------------|------------------|
| PAGE<br>8            | PAGES<br>32      |
| APPL NO.<br>543407-8 | DATE<br>3/7/2014 |
| PROCESSED BY<br>CGP  | CHECKED BY       |

|     |        |       |      |
|-----|--------|-------|------|
| SOx | 330.00 | 411.2 | 81.2 |
|-----|--------|-------|------|

*The proposed emissions are based on the 100 starts/yr scenario, all other scenario's result in less emissions. The current emissions DO NOT include the black start engine.*

**Comparison of Current Annual Emissions to Proposed Annual Emissions Entire Facility**

| Pollutant | Current Emissions, lbs/yr | Proposed Emissions, lbs/yr | Difference, lbs/yr |
|-----------|---------------------------|----------------------------|--------------------|
| NOx       | 7769.48                   | 7957.2                     | 187.72             |
| CO        | 9681.74                   | 10414                      | 732.26             |
| VOC       | 1779.70                   | 1897.9                     | 118.2              |
| PM10      | 6752.61                   | 7401.9                     | 649.29             |
| SOx       | 330.34                    | 411.5                      | 81.16              |

*Current emissions are based on the turbine + 90 hrs/yr of the black start engine ( current A63.3 limits). The proposed emissions are based on the turbine (100 starts/yr scenario, all other scenario's result in less emissions) + 64 hrs/yr operation of the black start engine.*

**C. Monthly Emissions**

Monthly emissions WILL NOT change as a result of the modifications proposed under this application. Monthly emissions are based on 4.43 mmscf/day fuel use, 30 days of operation with 30 start ups and 30 shutdowns. The monthly emissions limits are shown in the table below:

| Pollutant | Monthly Emissions, lbs/month |
|-----------|------------------------------|
| NOx       | 1524.51                      |
| CO        | 1978.93                      |
| VOC       | 364.07                       |
| PM10      | 1460.23                      |
| SOx       | 80.94                        |

**EVALUATION:**

**RULE 212-Standards for Approving Permits**

The propose modification to the permit under this application does not result in an increase in emission which would exceed the daily thresholds of subdivision (g). there is no school within 1000 feet of the facility, and there is no increase in toxic air contaminants. Therefore, the project is not considered significant under this rule, and no public notice is required.

**RULE 401 – Visible Emissions**

Visible emissions exceeding the limits of the rule are not expected under normal operating conditions.

**RULE 402 – Nuisance**

Nuisance problems are not expected during normal operation.



**South Coast  
Air Quality Management District**

Engineering Division  
Application Processing & Calculations

|                      |                  |
|----------------------|------------------|
| PAGE<br>9            | PAGES<br>32      |
| APPL NO.<br>543407-8 | DATE<br>3/7/2014 |
| PROCESSED BY<br>CGP  | CHECKED BY       |

**RULE 407 – Liquid and Gaseous Air Contaminants**

This rule limits the CO concentration from the turbine to 2000 ppm. Even during black start testing, SCE provided CEMS data from the turbine at the Norwalk facility (ID# 17104) which showed maximum CO concentrations well below 2000 ppm. Continued compliance is anticipated.

**RULE 409 – Combustion Contaminants**

This rule restricts the discharge of contaminants from the combustion of fuel to 0.23 grams per cubic meter (0.1 grain per cubic foot) of gas, calculated to 12% CO<sub>2</sub>, averaged over 15 minutes. The turbine is expected to meet this limit at the maximum firing load based on the calculations shown below.

$$\text{Grain Loading} = [(A \times B)/(C \times D)] \times 7000 \text{ gr/lb}$$

where:

A = PM10 emission rate during normal operation, 5.41 lb/hr

B = Rule specified percent of CO<sub>2</sub> in the exhaust (12%)

C = Percent of CO<sub>2</sub> in the exhaust (approx. 4.29% for natural gas)

D = Stack exhaust flow rate, 15.66 mmscf/hr

$$\begin{aligned} \text{Grain Loading} &= \frac{5.41 \text{ lbs/hr} \times [(7000 \text{ grains/lb}) \times (12/4.29)]}{15.66 \text{ E}+06 \text{ scf/hr}} \\ &= \boxed{0.007 \text{ grains/scf}} \end{aligned}$$

Compliance was also verified through the initial source test. At the 75% load test:

|                 |   |                                    |
|-----------------|---|------------------------------------|
| PM              | = | 1.02 lbs/hr                        |
| Exhaust rate    | = | 233,099 dscfm                      |
| CO <sub>2</sub> | = | 2.76                               |
| Grain loading   | = | 0.013 gr/scf @ 12% CO <sub>2</sub> |

**RULE 431.1 – Sulfur Content of Gaseous Fuels**

The natural gas supplied to the turbine is expected to comply with the 16 ppmv sulfur limit (calculated as H<sub>2</sub>S) specified in this rule. Commercial grade natural gas has an average sulfur content of 4ppm. The applicant will comply with reporting and record keeping requirements as outlined in subdivision (e) of this rule.

**RULE 475 – Electric Power Generating Equipment**

This rule applies to power generating equipment greater than 10 MW installed after May 7, 1976. Requirements are that the equipment meet a limit for combustion contaminants of 11 lbs/hr or 0.01 gr/scf. Compliance is achieved if either the mass limit or the concentration limit is met. Mass PM10 emissions from the turbine are estimated at 5.41 lbs/hr, and 0.002 gr/scf during natural gas firing at maximum firing load (see calculations below). Therefore, compliance is expected.



**South Coast  
Air Quality Management District**  
  
Engineering Division  
Application Processing & Calculations

|                      |                  |
|----------------------|------------------|
| PAGE<br>10           | PAGES<br>32      |
| APPL NO.<br>543407-8 | DATE<br>3/7/2014 |
| PROCESSED BY<br>CGP  | CHECKED BY       |

$$\text{Stack Exhaust Flow} \left( \frac{\text{scf}}{\text{hr}} \right) = F_d \times \frac{20.9}{(20.9 - \%O_2)} \times \text{TFD}$$

where:

Fd: Dry F factor for fuel type, 8710 dscf/MMBtu

O2: Rule specific dry oxygen content in the effluent stream, 3%

TFD: Total fired duty measured at HHV, 506 MMBtu/hr

$$\text{Combustion Particulate} \left( \frac{\text{grain}}{\text{scf}} \right) = \frac{PM_{10}, \text{ lb/hr}}{\text{Stack Exhaust Flow, scf/hr}} \times 7000 \frac{\text{gr}}{\text{lb}}$$

$$\text{Stack flow} = 8710(20.9/5.9) \times 506 = 15.66 \text{ mmscf/hr}$$

$$\text{Combustion particulate} = (5.41/15.66 \text{ E}+06) \times 7000 = \boxed{0.002 \text{ gr/scf}}$$

Compliance was verified through the initial source test, with the maximum mass rate at 1.02 lbs/hr, and a concentration of 0.00183 gr/scf @ 3% O2.

REGULATION XIII – New Source Review

The proposed modification results in higher annual emissions of all pollutants, higher daily maximum emissions for NOx CO, and VOC but no increase in the hourly maximums or monthly totals. The increases are quantified below:

**TURBINE ONLY**

| Pollutant | Current Annual PTE | Proposed Annual PTE | Annual Increase | Current Daily Maximum | Proposed Daily Maximum | Daily Increase |
|-----------|--------------------|---------------------|-----------------|-----------------------|------------------------|----------------|
| NOx       | 7540.52            | 7794.6              | 254.08          | 50.82                 | 68.06                  | 17.24          |
| CO        | 9361.19            | 10185.7             | 824.51          | 65.96                 | 74.62                  | 8.66           |
| VOC       | 1697.27            | 1839.0              | 141.73          | 12.14                 | 12.92                  | 0.78           |
| PM10      | 6746.87            | 7397.8              | 650.93          | 49.58                 | 49.58                  | 0              |
| SOx       | 330.00             | 411.2               | 81.2            | 2.75                  | 2.75                   | 0              |

**ENTIRE FACILITY**

| Pollutant | Current Annual PTE | Proposed Annual PTE | Annual Increase |
|-----------|--------------------|---------------------|-----------------|
| NOx       | 7769.48            | 7957.2              | 187.72          |
| CO        | 9681.74            | 10414               | 732.26          |
| VOC       | 1779.70            | 1897.9              | 118.2           |
| PM10      | 6752.61            | 7401.9              | 649.29          |
| SOx       | 330.34             | 411.5               | 81.16           |



**South Coast  
Air Quality Management District**

Engineering Division  
Application Processing & Calculations

|                      |                  |
|----------------------|------------------|
| PAGE<br>11           | PAGES<br>32      |
| APPL NO.<br>543407-8 | DATE<br>3/7/2014 |
| PROCESSED BY<br>CGP  | CHECKED BY       |

**BACT**

BACT is applicable if there is an increase on a lbs/day basis. Since there is an increase on a lb/day basis for NO<sub>x</sub>, CO, and VOC, but not for PM<sub>10</sub>, or SO<sub>x</sub>, BACT is applicable for NO<sub>x</sub>, CO, and VOC only. The turbine as configured meets the current minor source BACT standards for NO<sub>x</sub> (2.5 ppm @ 15% O<sub>2</sub> dry, 1 hour average), CO (6.0 ppm @ 15% O<sub>2</sub> dry, 1 hour average), and VOC (2.0 ppm @ 15% O<sub>2</sub> dry, 1 hour average). Note that for major sources, current CO BACT for simple cycle turbines is 4.0 ppm. Since the Grapeland facility is a minor source, however, the CO limit of 6.0 ppm is still applicable.

**Offsets**

No offsets are required since there is no increase in the monthly average emissions and the facility will remain below the 4 ton/yr thresholds (29 tpy for CO) of Regulation XIII. The facility continues to qualify for the offset exemption under Rule 1304(d)(2)(A). The following table summarizes the annual emissions for the facility.

**Annual PTE Grapeland Facility**

| Pollutant        | Turbine PTE <sup>(1)</sup> | Black Start Engine PTE | Total Emissions |      | Offset Threshold | Exempt |
|------------------|----------------------------|------------------------|-----------------|------|------------------|--------|
|                  | Lbs/yr                     | Lbs/yr                 | Lbs/yr          | tpy  | tpy              |        |
| NO <sub>x</sub>  | 7794.6                     | 162.6                  | 7957.2          | 3.98 | 4                | Yes    |
| CO               | 10185.7                    | 227.8                  | 10414           | 5.21 | 29               | Yes    |
| VOC              | 1839.0                     | 58.9                   | 1897.9          | 0.95 | 4                | Yes    |
| PM <sub>10</sub> | 7397.8                     | 4.1                    | 7401.9          | 3.70 | 4                | Yes    |
| SO <sub>x</sub>  | 411.2                      | 0.24                   | 411.5           | 0.21 | 4                | Yes    |

*(1) based on the 100 starts/yr scenario, all other scenario's result in fewer emissions.*

**Modeling**

Modeling will not be required because SCE already performed modeling for the turbine when the initial permit to construct was issued using a NO<sub>x</sub> and PM<sub>10</sub> annual emission rate equivalent to about 8000 lbs/yr. At that time, SCE modeled a NO<sub>x</sub> annual emission rate of 0.112 g/s, or about 7790 lbs/yr, and showed that the impacts were about 0.02 ug/m<sup>3</sup>, for a total impact (project + background) of 58.3 ug/m<sup>3</sup>. This is well below the federal standard of 100 ug/m<sup>3</sup>. They modeled a PM<sub>10</sub> annual emission rate of 0.11 g/s, or about 7,502 lbs/yr, and daily emission rate of 0.260 g/s, or about 49.9 lbs/day. The predicted impacts were about 0.02 ug/m<sup>3</sup> on an annual basis, and 0.21 ug/m<sup>3</sup> on a daily basis. These impacts are well below the AQMD significant impact limits of 5 ug/m<sup>3</sup> on a 24-hour basis, and 1 ug/m<sup>3</sup> on an annual basis. Reference A/N 461460 for the modeling details. They also performed modeling for the maximum 1-hour and 8-hour averaging periods, and those emission rates are not changing as a result of this application. There are no requirements for modeling daily emission rates.

**RULE 1401 – New Source Review of Toxic Air Contaminants**

Although the proposed modifications result in a potential for the annual fuel use to increase from the current limit of 619 mmscf/yr up to a maximum of 660 mmscf/yr, the original HRA modeling done for the turbine assumed an annual fuel use of about 818 mmscf/yr (reference A/N 461460). The Tier 4 modeling analysis used the California Air Resources Board Hot Spots Analysis and Reporting Program (HARP), which contains the US EPA ISCST3 model and up-to-date OEHHA



South Coast  
Air Quality Management District

Engineering Division  
Application Processing & Calculations

|                      |                  |
|----------------------|------------------|
| PAGE<br>12           | PAGES<br>32      |
| APPL NO.<br>543407-8 | DATE<br>3/7/2014 |
| PROCESSED BY<br>CGP  | CHECKED BY       |

toxicity values. The results of the HRA model showed that the impacts were below the Rule 1401 standards. Therefore, no new modeling will be required for the proposed changes under this application. The modeled emission rates and impacts as determined under A/Ns 461460 and 478600 are shown in Appendix D for reference.

REGULATION XVII – Prevention of Significant Deterioration

PSD applies to a significant increase in emissions from a major stationary source. For a simple cycle power plant, the major source threshold is 250 tons per year based on actual emissions or potential to emit. If the facility is deemed to be major, Rule 1702 further defines a significant emission increase as 40 tpy or more of NO<sub>2</sub> or SO<sub>2</sub> or 100 tons per year or more of CO.

**GHGs**

For an existing source being modified, the major source threshold (for permits issued after 7/1/11) for greenhouse gases (GHGs) is 100,000 tpy CO<sub>2</sub>e and 100 tpy GHGs mass emissions (based on PTE). Once determined to be a major source, the significant increase is defined as 75,000 tpy CO<sub>2</sub>e and > 0 tpy GHG mass, including any decreases from the modification (netting). If the existing source is minor for PSD (including GHGs) before the modification, then an actual or PTE emissions increase from the modification of 100,000 tpy CO<sub>2</sub>e and 100 tpy GHG mass is considered a significant increase. There is no netting allowed for minor sources.

The calculated increases for the modification proposed under this application are below the major source thresholds for all PSD pollutants, including GHGs.

REGULATION XXX – Title V

The SCE Grapeland facility is subject to the Title V requirements because it is an Acid Rain facility [Rule 3001(c)(3)]. The modification proposed under these applications can be considered a de minimis significant permit revision because the increase in the average daily emissions of NO<sub>x</sub> and CO are below the thresholds of 40 lbs/day and 220 lbs/day respectively [Rule 3000(b)(6)]. As a de minimis significant revision, the permit is subject to a 45 day review and comment period by the US EPA.

Federal Regulations

NSPS for Stationary Gas Turbines - 40CFR Part 60 Subpart KKKK

The turbine is subject to Subpart KKKK because the heat input is greater than 10.7 gigajoules per hour (10.14 MMBtu per hour) at peak load, based on the higher heating value of the fuel fired. Actual unit rating is 506E+06 btu/hr (HHV) X 1055 joules/btu = 534 gigajoules/hr. The standards applicable for a turbine between 50 mmbtu/hr and 850 mmbtu/hr are as follows:

NO<sub>x</sub>: 25 ppm at 15% O<sub>2</sub>

SO<sub>x</sub>: 0.90 lbs/MWh discharge, or 0.060 lbs/mmbtu potential SO<sub>2</sub> in the fuel

**Monitoring**

The regulation requires that the fuel consumption and water to fuel ratio be monitored and recorded on a continuous basis, or alternatively, that a NO<sub>x</sub> and O<sub>2</sub> CEMS be installed. For the SO<sub>x</sub> requirement, either a fuel meter to measure input, or a watt-meter to measure output is required, depending on which limit is selected. Also, daily monitoring of the sulfur content of the



South Coast  
Air Quality Management District  
Engineering Division  
Application Processing & Calculations

|                      |                  |
|----------------------|------------------|
| PAGE<br>13           | PAGES<br>32      |
| APPL NO.<br>543407-8 | DATE<br>3/7/2014 |
| PROCESSED BY<br>CGP  | CHECKED BY       |

fuel is required if the fuel limit is selected. However, if the operator can provide supplier data showing the sulfur content of the fuel is less than 20 grains/100cf (for natural gas), then daily fuel monitoring is not required.

#### Testing

An initial performance test is required for both NO<sub>x</sub> and SO<sub>2</sub>. For units with a NO<sub>x</sub> CEMS, a minimum of 9 RATA reference method runs is required at an operating load of +/- 25 percent of 100 percent load. For SO<sub>2</sub>, either a fuel sample methodology or a stack measurement can be used, depending on the chosen limit. Annual performance tests are also required for NO<sub>x</sub> and SO<sub>2</sub>.

Compliance with the requirements of this rule is expected.

#### NESHAPS for Stationary Gas Turbines - 40CFR Part 63 Subpart YYYY

This regulation applies to gas turbines located at major sources of HAP emissions. A major source is defined as a facility with emissions of 10 tpy or more of a single HAP or 25 tpy or more of a combination of HAPs. The largest single HAP emission from the turbine or engine is formaldehyde from the turbine at 507 lbs/yr, or 0.25 tpy. The total combined HAPs from all sources at Grapeland are less than 25 tpy. Therefore, the Grapeland facility is not a major source, and the requirements of this regulation do not apply.

#### 40 CFR Part 64 – Compliance Assurance Monitoring

The CAM regulation applies to emission units at major stationary sources required to obtain a Title V permit, which use control equipment to achieve a specified emission limit. The rule is intended to provide “reasonable assurance” that the control systems are operating properly to maintain compliance with the emission limits. The major source thresholds for the CAM rule, and the Etiwanda facility emissions are summarized as follows:

Table D-9 EPA Major Source Thresholds

| Pollutant        | Threshold (tpy) | Grapeland Emissions (tpy) |
|------------------|-----------------|---------------------------|
| VOC              | 10              | 0.95                      |
| NO <sub>x</sub>  | 10              | 3.98                      |
| SO <sub>x</sub>  | 100             | 0.21                      |
| CO               | 50              | 5.21                      |
| PM <sub>10</sub> | 70              | 3.70                      |

Since the facility is not a major source, the CAM regulations don't apply.

#### 40 CFR Part 72 - (Acid Rain Provisions)

The facility is subject to the requirements of the federal acid rain program. The applicant is also required to monitor SO<sub>2</sub> emissions through use of fuel gas meters and gas constituent analyses, or, if fired with pipeline quality natural gas, as in the case of the Barre facility, a default emission factor of 0.0006 lbs/mmbtu is allowed. SO<sub>2</sub> mass emissions are to be recorded every hour. NO<sub>x</sub> and O<sub>2</sub> must be monitored with CEMS in accordance with the specifications of Part 75. Under this program, NO<sub>x</sub> and SO<sub>x</sub> emissions will be reported directly to the U.S. EPA. Part 75 requires that the CEMS be installed and certified within 90 days of initial startup. Note that Section K of



**South Coast  
Air Quality Management District**

Engineering Division  
Application Processing & Calculations

|                      |                  |
|----------------------|------------------|
| PAGE<br>14           | PAGES<br>32      |
| APPL NO.<br>543407-8 | DATE<br>3/7/2014 |
| PROCESSED BY<br>CGP  | CHECKED BY       |

the permit will include the Acid Rain rule references applicable to this facility, specifically Part 72 and Part 73. Continued compliance is expected.

**RECOMMENDATION:**

It's recommended that the following changes be incorporated into the permit:

1. Modify condition C1.3 to allow a 'sliding scale' of annual fuel use vs. # of start ups, in 25 start intervals. This condition will limit the fuel use based on the number of starts in the previous 12 rolling calendar months. The fuel use limit for each interval is based on the highest number of starts in that interval. This condition will also contain a clause to require the facility to enter into RECLAIM should they at any time ever exceed the fuel use/start up limit.
2. Include a definition of 'start up' in conditions A99.1 and A99.2 to clarify situations where there is a 'turbine trip' and restart.
3. Allow up to 32 hrs/yr total of uncontrolled operation for NERC testing, Cal-ISO required black start testing, and performance tuning. Limit the mass emission limit to a maximum of 50 lbs/hr NOx (other testing scenarios will have lower NOx emission rates, as defined in the condition wording) and 10 lbs/hr CO in lieu of meeting BACT during the testing.
4. Amend Condition A63.3 to account for the increase in annual NOx, CO, VOC, PM10, and SOx based on the 100 start ups/yr scenario.

It is also recommended that the engine application (543408) be canceled. There are no changes being made to the engine permit description or conditions, therefore, the application is not necessary.

On October 1, 2013, SCE requested to add language to permit condition E57.1 pertaining to the temperature of the ammonia/air mixture prior to entering the SCR duct. However, the request was deemed outside of the scope of the original permit application, and SCE was advised to submit a separate application to address the issue.

The permit to construct can be issued at the end of the EPA 45 day review and comment period, and subject to the conditions as listed in the following section.

**CONDITIONS:**

Proposed changes or additions are shown in **bold/underline**, proposed deletions are shown in ~~strikethrough~~.

A63.1

The operator shall limit emission from this equipment as follows:

| CONTAMINANT | EMISSION LIMIT                          |
|-------------|---|
| NOx         | <b><u>1525 LBS IN ANY ONE MONTH</u></b> |
| PM10        | <b><u>1460 LBS IN ANY ONE MONTH</u></b> |



South Coast  
Air Quality Management District

Engineering Division  
Application Processing & Calculations

PAGE  
15

APPL NO.  
543407-8

PROCESSED BY  
CGP

PAGES  
32

DATE  
3/7/2014

CHECKED BY

|     |                           |
|-----|---------------------------|
| CO  | 1979 LBS IN ANY ONE MONTH |
| SOx | 81 LBS IN ANY ONE MONTH   |
| VOC | 364 LBS IN ANY ONE MONTH  |

The operator shall calculate the monthly emission limit(s) by using fuel use data and the following emission factors: VOC: 3.15 lbs/mmcf, PM10: 11.19 lbs/mmcf, and SOx: 0.62 lbs/mmcf.

Compliance with the NOx and CO emission limits shall be verified through CEMS data. If CO CEMS data is not available, CO emissions shall be calculated using fuel usage and a factor of 14.35 lbs/mmcf during normal operations, 8.58 lbs/hr during any start up hour, and 7.69 lbs/hr during any shutdown hour. The operator shall use the appropriate missing data procedures if NOx data is not available.

If a CEMS calibration occurs within 60 minutes of a start up, NOx emissions for the calibration period shall be calculated using the actual duration of the calibration in minutes times a factor of 0.0792 lb/min, and shall only occur when the NOx emissions average for the five minutes immediately before calibration are at or below BACT levels.

[Rule 1303 – Offsets]

A63.3

The operator shall limit emission from this equipment as follows:

| CONTAMINANT | EMISSION LIMIT                            |
|-------------|---|
| NOx         | <del>7769</del> 7957 LBS IN ANY ONE YEAR  |
| PM10        | <del>6753</del> 7402 LBS IN ANY ONE YEAR  |
| CO          | <del>9682</del> 10414 LBS IN ANY ONE YEAR |
| SOx         | <del>330</del> 412 LBS IN ANY ONE YEAR    |
| VOC         | <del>1780</del> 1898 LBS IN ANY ONE YEAR  |

THIS CONDITION APPLIES AFTER THE 1<sup>st</sup> 12 MONTHS OF OPERATION, and the limits apply to the total emissions from the turbine plus the engine.

The operator shall calculate the annual emission limit(s) by using fuel use data and the following emission factors for the turbine: VOC: 3.15 lbs/mmcf, PM10: 11.19 lbs/mmcf, and SOx: 0.62 lbs/mmcf.

The operator shall calculate the annual emission limit(s) by using hourly operation data and the following emission factors for the engine: NOx: 2.54 lbs/hr, CO: 3.56 lbs/hr, VOC: 0.92 lbs/hr, PM10: 0.064 lbs/hr, SOx: 0.0038 lbs/hr.

Compliance with the NOx and CO emission limits shall be verified through CEMS data. If CO CEMS data is not available, CO emissions shall be calculated using fuel usage and a factor of 14.35 lbs/mmcf during normal operations, 8.58 lbs/hr during any start up hour, or any hour in which there is both a start up and a shutdown, and 7.69



**South Coast  
Air Quality Management District**

Engineering Division  
Application Processing & Calculations

|                      |                  |
|----------------------|------------------|
| PAGE<br>16           | PAGES<br>32      |
| APPL NO.<br>543407-8 | DATE<br>3/7/2014 |
| PROCESSED BY<br>CGP  | CHECKED BY       |

lbs/hr during any shutdown hour. The operator shall use the appropriate missing data procedures if NOx data is not available.

If a CEMS calibration occurs within 60 minutes of a start up, NOx emissions for the calibration period shall be calculated using the actual duration of the calibration in minutes times a factor of 0.0792 lb/min, and shall only occur when the NOx emissions average for the five minutes immediately before calibration are at or below BACT levels.

For the purpose of this condition, the yearly emission limit shall be defined as a period of twelve (12) consecutive months determined on a rolling basis with a new 12 month period beginning on the first day of each calendar month.

[Rule 1303 – Offsets]

**A63.4**

The operator shall limit emission from this equipment as follows:

| CONTAMINANT | EMISSION LIMIT    |
|-------------|-------------------|
| NOx         | 55 LBS IN ANY DAY |

The purpose of this condition is to ensure that the facility emissions are below the CEQA thresholds, and the limit is based on the total emissions from the turbine and the black start generator. The operator shall keep records on the NOx daily emissions.

The 55 lbs/day limit shall not apply when the unit undergoes CAL-ISO required black start testing, performance tuning, and WECC required generator modeling which shall not occur more than once per 12 month period. During CAL-ISO required black start testing these periods, the daily total NOx from all operations shall not exceed 90 lbs/day.

[CEQA, Rule 212]

**A99.1**

The 2.5 PPM NOx emission limits shall not apply during, start-up, shutdown, an emergency electrical grid system blackout when the turbine is used to re-start another major electric generating station, and during CAL-ISO required testing, performance tuning, and WECC required generator modeling. Each start-up shall not exceed 15 min. Each shutdown shall not exceed 10 min. There shall be no more than ~~200~~ **350** start-ups/yr.

NOx emissions for the 60 minutes beginning with a start shall not exceed 10.36 lbs, and for the 60 minutes ending with a shutdown 6.44 lbs.

In the case of a start during an emergency electrical grid system blackout, total NOx shall not exceed 28.23 lbs/hr.

In case of a turbine shutdown which occurs less than 75 minutes from a start up, for determination of compliance with the start up and shutdown limits only, the emissions calculated for the shutdown 60 minute period shall not include any of the first 15



South Coast  
Air Quality Management District

Engineering Division  
Application Processing & Calculations

PAGE  
17

APPL NO.  
543407-8

PROCESSED BY  
CGP

PAGES  
32

DATE  
3/7/2014

CHECKED BY

minutes of the start up, and the emissions calculated for the start up 60 minute period shall not include any of the last 10 minutes of the shutdown.

A shutdown is defined as a reduction in turbine load ending in a period of zero fuel flow. The hour which includes a shutdown is defined as the 60 minutes counted back from the period of zero fuel flow.

**A start up is defined as whenever the turbine begins combusting fuel after a period of zero fuel flow. If the turbine does not complete its full start up sequence, and is restarted, the restart is defined as a separate start up.**

**During performance tuning, NOx emissions shall not exceed 50 lbs/hr for no more than 4 hrs in any one calendar year (including the start up and shut down hours) while the turbine is being operated without ammonia injection.**

**During performance tuning, NOx emissions shall not exceed 45 lbs/hr for no more than 2 hrs in any calendar year (including start up and shut down hours) while the turbine is being operated without ammonia injection.**

**During black start testing, NOx emissions shall not exceed 40 lbs/hr for no more than 4 hrs in any calendar year (including start up and shut down hours) including unsuccessful attempts.**

**During performance tuning, NOx emissions shall not exceed 6 lbs/hr for no more than 22 hrs in any calendar year (not including start up and shut down hours).**

**In any one calendar year, the total time of turbine operation for testing activities shall be no more than 32 hours. In any one calendar year, there shall be no more than 1 completed successful black start test. The black start testing hours (including unsuccessful attempts) shall not exceed 4 hours per calendar year.**

**The unit performance tuning activities shall not exceed 28 hours except during the calendar year when the turbine will be operated to perform WECC required generator modeling which will take place once every 5 calendar years for 10 hours.**

**During WECC required generator modeling, the NOx emission rate shall not exceed 6 lbs/hr (not including start up and shut down hours) for 8 hours, and 45 lbs/hr (including start up and shut down hours) for 2 hours. During a calendar year in which the WECC generator modeling is performed, turbine operation time for unit performance tuning activities shall not exceed to 18 hours for the calendar year.**

**The operator shall maintain all records demonstrating compliance with this permit condition.**

[Rule 1303(a) – BACT, Rule 1303(b)(1) – Modeling, Rule 1303(b)(2) - Offsets]



South Coast  
Air Quality Management District  
Engineering Division  
Application Processing & Calculations

|                      |                  |
|----------------------|------------------|
| PAGE<br>18           | PAGES<br>32      |
| APPL NO.<br>543407-8 | DATE<br>3/7/2014 |
| PROCESSED BY<br>CGP  | CHECKED BY       |

A99.2

The 6.0 PPM CO emission limits shall not apply during, start-up, shutdown, an emergency electrical grid system blackout when the turbine is used to re-start another major electric generating station, and during CAL-ISO required testing **performance tuning, and WECC required generator modeling**. Each start-up shall not exceed 15 min. Each shutdown shall not exceed 10 min. There shall be no more than 200 ~~300~~ **350** start-ups/yr.

CO emissions for the 60 minutes beginning with a start, or a start and a shutdown, shall not exceed 8.58 lbs, and for the 60 minutes ending with a shutdown 7.69 lbs.

During CAL-ISO required testing **and performance tuning**, CO emissions shall not exceed 5 **10** lbs/hr. In any one calendar year, there shall be no more than **32** ~~1~~ **completed successful test, and no more than 2** hours of total test time (including any aborted test time).

In case of a turbine shutdown which occurs less than 75 minutes from a start up, for determination of compliance with the start up and shutdown limits only, the emissions calculated for the shutdown 60 minute period shall not include any of the first 15 minutes of the start up, and the emissions calculated for the start up 60 minute period shall not include any of the last 10 minutes of the shutdown.

A shutdown is defined as a reduction in turbine load ending in a period of zero fuel flow. The hour which includes a shutdown is defined as the 60 minutes counted back from the period of zero fuel flow.

**A start up is defined as whenever the turbine begins combusting fuel after a period of zero fuel flow. If the turbine does not complete its full start up sequence, and is restarted, the restart is defined as a separate start up.**

[Rule 1303(a) – BACT, Rule 1303(b)(1) – Modeling, Rule 1303(b)(2) - Offsets]

A195.1

The 2.5 PPMV NOX emission limit(s) is averaged over 60 minutes at 15 percent O2, dry.

[Rule 1303(a) – BACT, Rule 1303(b)(1) – Modeling, Rule 1303(b)(2) - Offsets]

A195.2

The 6.0 PPMV CO emission limit(s) is averaged over 60 minutes at 15 percent O2, dry.

[Rule 1303(a) – BACT, Rule 1303(b)(1) – Modeling, Rule 1303(b)(2) - Offsets]

A195.3

The 2.0 PPMV VOC emission limit(s) is averaged over 60 minutes at 15 percent O2, dry.

[Rule 1303(a) – BACT, Rule 1303(b)(1) – Modeling, Rule 1303(b)(2) - Offsets]

A195.4

The 25 PPMV NOX emission limit(s) is averaged over 4 hours rolling at 15 percent O2, dry.

[40 CFR60 Subpart KKKK]

A327.1



South Coast  
Air Quality Management District

Engineering Division  
Application Processing & Calculations

PAGE  
19

APPL NO.  
543407-8

PROCESSED BY  
CGP

PAGES  
32

DATE  
3/7/2014

CHECKED BY

For the purpose of determining compliance with District Rule 475, combustion contaminants emissions may exceed the concentration limit or the mass emission limit listed, but not both limits at the same time.

[Rule 475]

D12.1

The operator shall install and maintain a(n) flow meter to accurately indicate the fuel usage being supplied to the turbine.

The operator shall also install and maintain a device to continuously record the parameter being measured.

The measuring device or gauge shall be accurate to within plus or minus 5 percent. It shall be calibrated once every twelve months.

[Rule 1303(b)(2) – Offset]

C1.1

The operator shall limit the fuel usage to no more than 4.43 mmcf in any one day.

The operator shall maintain records in a manner approved by the District to demonstrate compliance with this condition.

[Rule 1303(b)(2) – Offset]

C1.3

The operator shall limit the fuel usage to no more than ~~619~~ 470 mmcf in any one year.

**The operator may increase the annual fuel use, if the turbine Start Ups are 325 or less, in accordance with the following:**

**If the Start Ups over the previous 12 months are equal to or less than 325, but more than 300, then the fuel use limit for that 12 month period shall not exceed 490 mmcf**

**If the Start Ups over the previous 12 months are equal to or less than 300, but more than 275, then the fuel use limit for that 12 month period shall not exceed 510 mmcf**

**If the Start Ups over the previous 12 months are equal to or less than 275, but more than 250, then the fuel use limit for that 12 month period shall not exceed 530 mmcf**

**If the Start Ups over the previous 12 month period are equal to or less than 250, but more than 225, then the fuel use limit for that 12 month period shall not exceed 545 mmcf**

**If the Start Ups over the previous 12 month period are equal to or less than 225, but more than 200, then the fuel use limit for that 12 month period shall not exceed 565 mmcf**



South Coast  
Air Quality Management District  
  
Engineering Division  
Application Processing & Calculations

|                      |                  |
|----------------------|------------------|
| PAGE<br>20           | PAGES<br>32      |
| APPL NO.<br>543407-8 | DATE<br>3/7/2014 |
| PROCESSED BY<br>CGP  | CHECKED BY       |

**If the Start Ups over the previous 12 month period are equal to or less than 200, but more than 175, then the fuel use limit for that 12 month period shall not exceed 580 mmscf**

**If the Start Ups over the previous 12 month period are equal to or less than 175, but more than 150, then the fuel use limit for that 12 month period shall not exceed 600 mmscf**

**If the Start Ups over the previous 12 month period are equal to or less than 150, but more than 125, then the fuel use limit for that 12 month period shall not exceed 620 mmscf**

**If the Start Ups over the previous 12 month period are equal to or less than 125, but more than 100, then the fuel use limit for that 12 month period shall not exceed 640 mmscf**

**If the Start Ups over the previous 12 month period are equal to or less than 100, then the fuel use limit for that 12 month period shall not exceed 660 mmscf**

The operator shall maintain records in a manner approved by the District to demonstrate compliance with this condition and the records shall be made available upon AQMD request.

~~The yearly emission limit shall be defined as a period of twelve (12) consecutive months determined on a rolling basis with a new 12 month period beginning on the first day of each calendar month.~~

**The number of start ups and the fuel use shall be determined on a twelve (12) consecutive month rolling basis, with a new 12 month period beginning on the first day of each calendar month.**

**The data acquisition system shall record the number of start ups per month.**

**Exceeding the fuel use and start up limits for any 12 month period, as defined in this condition, shall require the operator to supply emission offsets and submit an application(s) to enter this facility into RECLAIM.**

[Rule 1303(b)(2) – Offset]

D29.2

The operator shall conduct source test(s) for the pollutant(s) identified below.

| Pollutant to be tested | Required Test Method(s)                        | Averaging Time | Test Location     |
|------------------------|--|----------------|-------------------|
| NH3 emissions          | District method 207.1 and 5.3 or EPA method 17 | 1 hour         | Outlet of the SCR |



**South Coast  
Air Quality Management District**

Engineering Division  
Application Processing & Calculations

PAGE  
21

PAGES  
32

APPL NO.  
543407-8

DATE  
3/7/2014

PROCESSED BY  
CGP

CHECKED BY

The test shall be conducted and the results submitted to the District within 45 days after the test date. The AQMD shall be notified of the date and time of the test at least 7 days prior to the test.

The test shall be conducted at least quarterly during the first twelve months of operation and at least annually thereafter. The NO<sub>x</sub> concentration, as determined by the CEMS, shall be simultaneously recorded during the ammonia slip test. If the CEMS is inoperable, a test shall be conducted to determine the NO<sub>x</sub> emissions using District Method 100.1 measured over a 60 minute averaging time period.

The test shall be conducted to demonstrate compliance with the Rule 1303 concentration limit

[Rule 1303(a)(1) – BACT]

**D29.3**

The operator shall conduct source test(s) for the pollutant(s) identified below.

| Pollutant to be tested | Required Test Method(s)  | Averaging Time                   | Test Location     |
|------------------------|--------------------------|----------------------------------|-------------------|
| SOX emissions          | Approved District method | District approved averaging time | Fuel Sample       |
| VOC emissions          | Approved District method | 1 hour                           | Outlet of the SCR |
| PM10 emissions         | Approved District method | District approved averaging time | Outlet of the SCR |

The test shall be conducted at least once every three years.

The test shall be conducted to determine the oxygen levels in the exhaust. In addition, the tests shall measure the fuel flow rate (CFH), the flue gas flow rate, and the turbine generating output in MW.

The test shall be conducted in accordance with AQMD approved test protocol. The protocol shall be submitted to the AQMD engineer no later than 45 days before the proposed test date and shall be approved by the AQMD before the test commences. The test protocol shall include the proposed operating conditions of the turbine during the tests, the identity of the testing lab, a statement from the testing lab certifying that it meets the criteria of Rule 304, and a description of all sampling and analytical procedures.

The test shall be conducted when this equipment is operating at 100 percent load.

The test shall be conducted for compliance verification of the BACT VOC 2.0 ppmv limit.

For natural gas fired turbines only, an alternative to AQMD Method 25.3 for the purpose of demonstrating compliance with VOC BACT as determined by CARB and



South Coast  
Air Quality Management District

Engineering Division  
Application Processing & Calculations

|                      |                  |
|----------------------|------------------|
| PAGE<br>22           | PAGES<br>32      |
| APPL NO.<br>543407-8 | DATE<br>3/7/2014 |
| PROCESSED BY<br>CGP  | CHECKED BY       |

AQMD, may be the following: a) Triplicate stack gas samples are extracted directly into Summa canisters, maintaining a final canister pressure between 400-500 mm Hg absolute, b) Pressurization of the Summa canisters is done with zero gas analyzed/certified to containing less than 0.05 ppmv total hydrocarbons as carbon, and c) Analysis of Summa canisters is per unmodified EPA Method TO-12 (with preconcentration) or the canister analysis portion of AQMD Method 25.3 with a minimum detection limit of 0.3 ppmvC or less and reported to two significant figures, and (d) The temperature of the Summa canisters when extracting samples for analysis is not to be below 70 degrees Fahrenheit.

The use of this alternative method for VOC compliance determination does not mean that it is more accurate than unmodified AQMD Method 25.3, nor does it mean that it may be used in lieu of AQMD Method 25.3 without prior approval, except for the determination of compliance with the BACT level of 2.0 ppmv VOC calculated as carbon set by CARB for natural gas fired turbines.

[Rule 1303(a)(1) – BACT, Rule 1303(b)(2) – Offset]

D82.1

The operator shall install and maintain a CEMS to measure the following parameters:

NOx and CO concentration in ppmv

Concentrations shall be corrected to 15 percent oxygen on a dry basis. The CEMS shall be installed and operating no later than 90 days after initial startup of the turbine, in accordance with an approved AQMD Rule 218 CEMS plan application. The operator shall not install the CEMS prior to receiving initial approval from AQMD.

The CEMS will convert the actual NOx and CO concentrations to mass emission rates (lbs/hr) and record the hourly emission rates on a continuous basis.

The CEMS shall be installed and operated to measure the NOx and CO concentration over a 15 minute, or more frequent, averaging time period.

The CEMS shall convert the actual CO concentrations to mass emission rates (lbs/hr) using the equation below and record the hourly emission rates on a continuous basis.

CO Emission Rate, lbs/hr =  $K * C_{co} * F_d [20.9 / (20.9\% - \%O_2 d)] [(Q_g * HHV) / 10E6]$ ,  
where

- K =  $7.267 * 10^{-8}$  (lbs/scf)/ppm
- C<sub>co</sub> = ~~Average of 4 consecutive 15 min. average~~ CO concentrations, ppm
- F<sub>d</sub> = 8710 dscf/MMBTU natural gas
- %O<sub>2</sub>, d = Hourly average % by volume O<sub>2</sub> dry, corresponding to C<sub>co</sub>
- Q<sub>g</sub> = Fuel gas usage during the hour, scf/hr
- HHV = Gross high heating value of the fuel gas, BTU/scf



**South Coast  
Air Quality Management District**  
  
Engineering Division  
Application Processing & Calculations

|                      |                  |
|----------------------|------------------|
| PAGE<br>23           | PAGES<br>32      |
| APPL NO.<br>543407-8 | DATE<br>3/7/2014 |
| PROCESSED BY<br>CGP  | CHECKED BY       |

When the measured O<sub>2</sub> concentration is > 19 percent, a default of 19 percent O<sub>2</sub> shall be used in the calculation of NO<sub>x</sub> and CO mass emissions.

[Rule 1303(a)(1) – BACT, Rule 1303(b)(2) – Offset]

**E57.1**

The operator shall vent this equipment to the SCR and the oxidation catalysts whenever the turbine is in operation.

Ammonia injection shall commence once the exhaust temperature into the SCR catalyst has reached 540 degrees F.

[Rule 1303(a)(1) – BACT, Rule 1303(b)(2) – Offset]

**E193.1**

The operator shall upon completion of construction, operate and maintain this equipment according to the following specifications:

In accordance with all mitigation measures stipulated in the Negative Declaration prepared for this project (CEQA State Clearinghouse No. 2006121109).

[CEQA]

**K40.1**

The operator shall provide to the District a source test report in accordance with the following specifications:

Source test results shall be submitted to the District no later than 60 days after the source test was conducted.

Emission data shall be expressed in terms of concentration (ppmv) corrected to 15 percent oxygen (dry basis), mass rate (lb/hr), and lb/MMCF. In addition, solid PM emissions, if required to be tested, shall also be reported in terms of grains/DSCF. All exhaust flow rate shall be expressed in terms of dry standard cubic feet per minute (DSCFM) and dry actual cubic feet per minute. All moisture concentration shall be expressed in terms of percent corrected to 15 percent oxygen.

Source test results shall also include the oxygen levels in the exhaust, fuel flow rate (CFH), the flue gas temperature, and the generator power output (MW) under which the test was conducted.

[Rule 1303(a)(1) – BACT, Rule 1303(b)(2) – Offset]

**K67.1**

The operator shall keep records in a manner approved by the District, for the following parameter(s) or item(s):

Date and time of each start-up and shutdown

CEMS minute data during the 60 minute periods which include a start up or a shutdown

[Rule 1303(b)(2) - Offsets]



Appendix A  
Emission Calculations

|                          |        |          |
|--------------------------|--------|----------|
| Data:                    |        |          |
| Fuel Use Rate            | 0.4836 | mmcf/hr  |
| Fuel Use Daily Limit     | 4.43   | mmcf/day |
| Fuel Use Annual Limit    | 619    | mmcf/yr  |
| Max Heat Input           | 505.68 | mmbtu/hr |
| Calculated Max Exhaust   | 15.66  | mmcf/hr  |
| Natural Gas Heat Content | 1050   | btu/cf   |

Normal Operation Emission Rates

| Pollutant | Controlled Emission Rates (lbs/hr) | Source       |
|-----------|------------------------------------|--------------|
| NOX       | 4.75                               | Method 19    |
| CO        | 6.94                               | Method 19    |
| PM10      | 5.41                               | Applicant    |
| VOC       | 1.32                               | Method 19    |
| SOx       | 0.0006 lbs/mmbtu                   | AP-42        |
| NH3       | 5 ppm                              | Manufacturer |

Example calculations:

NOx:

exhaust = 506 mmbtu/hr X 8710 cf/mmbtu X 3.54 = 15.66 mmcf/hr  
emissions = 15.66 cf/hr (2.5 ppm) (46 lbs/lb-mol)/379 cf/lb-mol = 4.75 lbs/hr

Start Up Emission Rates

| Pollutant | Emission Rate (lbs/hr) | Source       |
|-----------|------------------------|--------------|
| NOX       | 10.36                  | Applicant    |
| CO        | 8.58                   | Manufacturer |
| VOC       | 1.34                   | Manufacturer |
| PM10      | 5.41                   | Applicant    |
| SOx       | 0.30                   | AP-42        |

Shutdown Emission Rates



**South Coast  
Air Quality Management District**

Engineering Division  
Application Processing & Calculations

PAGE  
25

PAGES  
32

APPL NO.  
543407-8

DATE  
3/7/2014

PROCESSED BY  
CGP

CHECKED BY

| Pollutant | Emission Rate (lbs/hr) | Source       |
|-----------|------------------------|--------------|
| NOX       | 6.44                   | Manufacturer |
| CO        | 7.69                   | Manufacturer |
| VOC       | 1.33                   | Manufacturer |
| PM10      | 5.41                   | Manufacturer |
| SOx       | 0.30                   | AP-42        |

**Controlled and Uncontrolled Emission Rates for Normal Operation**

| Pollutant | Uncontrolled Concentration | Controlled Concentration | Uncontrolled Emission Rate (lbs/hr) | Controlled Emission Rate (lbs/hr) | Uncontrolled Emission Factor (lbs/mmcf) <sup>(1)</sup> | Controlled Emission Factor (lbs/mmcf) <sup>(1)</sup> |
|-----------|----------------------------|--------------------------|-------------------------------------|-----------------------------------|--|--|
| NOX       | 63                         | 2.5                      | 126.00                              | 4.75                              | 260.55   | 9.82   |
| CO        | 40                         | 6.0                      | 48.80                               | 6.94                              | 100.92   | 14.35  |
| VOC       | 3.0                        | 2.0                      | 1.99                                | 1.32                              | 4.12   | 2.73   |
| PM10      | //////////                 | //////////               | 5.41                                | 5.41                              | 11.19  | 11.19  |
| SOx       | //////////                 | //////////               | 0.30                                | 0.30                              | 0.62   | 0.62   |
| NH3       | 5.0                        | 5.0                      | 3.72                                | 3.72                              | 7.69   | 7.69   |

Hourly fuel use = 0.4836 mmcf

**Daily Emissions**

Fuel Use = 4.43 mmcf/day (permit limit)

Current daily emissions are based on 1 start up per day, as follows:

| Pollutant | Uncontrolled Emissions lbs/day | Controlled Emissions <sup>(1)</sup> lbs/day |
|-----------|--------------------------------|---|
| NOX       | 1154.22                        | 50.82                                       |
| CO        | 447.07                         | 65.96                                       |
| VOC       | 18.25                          | 12.14                                       |
| PM10      | 49.58                          | 49.58                                       |
| SOx       | 2.75                           | 2.75  |
| NH3       | 34.08                          | 34.08                                       |

(1) Assumes 1 start per day

**Sample calculations:**

**Uncontrolled NOx:**

4.43 mmcf/day X 260.55 lbs/mmcf = 1154.22 lbs

**Controlled NOx:**



**South Coast  
Air Quality Management District**

Engineering Division  
Application Processing & Calculations

PAGE  
26

PAGES  
32

APPL NO.  
543407-8

DATE  
3/7/2014

PROCESSED BY  
CGP

CHECKED BY

$$10.36 \text{ lbs} + 6.44 \text{ lbs} + (4.43 \text{ mmcf} - 2 \times 0.4836 \text{ mmcf}) \times 9.82 \text{ lbs/mmcf} = 50.82 \text{ lbs}$$

1 start

Proposed daily emissions will be based on 3 starts per day, as follows:

| Pollutant | Uncontrolled Emissions<br>lbs/day | Controlled Emissions <sup>(1)</sup><br>lbs/day |
|-----------|-----------------------------------|--|
| NOX       | 1154.22                           | 68.06  |
| CO        | 447.07                            | 74.62  |
| VOC       | 18.25                             | 12.92  |
| PM10      | 49.58                             | 49.58  |
| SOx       | 2.75                              | 2.75   |
| NH3       | 34.08                             | 34.08  |

(1) Assumes 3 starts per day

Sample calculations:

Uncontrolled NOx:

$$4.43 \text{ mmcf/day} \times 260.56 \text{ lbs/mmcf} = 1154.28 \text{ lbs}$$

Controlled NOx:

$$3 \times 10.36 \text{ lbs} + 3 \times 6.44 \text{ lbs} + (4.43 \text{ mmcf} - 6 \times 0.4386 \text{ mmcf}) \times 9.82 \text{ lbs/mmcf} = 68.06 \text{ lbs} \quad 3 \text{ starts}$$

Controlled PM10:

$$4.43 \text{ mmcf/day} \times 11.19 \text{ lbs/mmcf} = 49.58 \text{ lbs}$$

Comparison of Current Daily Emissions to Proposed Daily Emissions

| Pollutant | Current Daily Emissions<br>lbs/day | Proposed Daily Emissions<br>lbs/day | Increase |
|-----------|------------------------------------|-------------------------------------|----------|
| NOX       | 50.82                              | 68.06                               | 17.24    |
| CO        | 65.96                              | 74.62                               | 8.66     |
| VOC       | 12.14                              | 12.92                               | 0.78     |
| PM10      | 49.58                              | 49.58                               | 0        |
| SOx       | 2.75                               | 2.75                                | 0        |
| NH3       | 34.08                              | 34.08                               | 0        |



**South Coast  
Air Quality Management District**

Engineering Division  
Application Processing & Calculations

PAGE  
27

PAGES  
32

APPL NO.  
543407-8

DATE  
3/7/2014

PROCESSED BY  
CGP

CHECKED BY

**Monthly Emissions**

Includes 30 start ups, 30 shutdowns and the remaining hours at high load operation.

**Monthly Emissions**

Fuel Use = 132.9 mmcf/month

| Pollutant | Controlled Emissions<br>30 SU/SD | 30 Day<br>Average |
|-----------|----------------------------------|-------------------|
|           | lbs/month                        | lbs/day           |
| NOX       | 1524.51                          | 21*               |
| CO        | 1978.93                          | 65.96             |
| VOC       | 364.07                           | 12.14             |
| PM10      | 1460.23                          | 21*               |
| SOx       | 80.94                            | 2.70              |

\* Monthly emissions are calculated assuming daily fuel use of 4.43 mmcf/day and 1 start/shutdown per day, for 30 days. The NSR 30 Day average emissions for NOx and PM10 are entered as 21 because of the facility exemption.

**Sample Calculation:**

**NOx:**

$$30(10.36 \text{ lbs}) + 30(6.44 \text{ lbs}) + 30(4.43 - 2 \times 0.4836 \text{ mmcf}) \times 9.82 \text{ lbs/mmcf} = 1524.51 \text{ lbs}$$

**Annual Emissions**

Annual fuel use and the number of starts up will vary. Emissions on an annual basis are calculated as follows:

$$[\text{START UPS} \times \text{START up emissions rate}] + [\text{SHUTDOWNS} \times \text{SHUTDOWN emission rate}] + [\text{NORMAL hours} \times \text{NORMAL emission rate}] + \text{testing/tuning emissions}$$

Where:

- START UPS = (# of starts)
- SHUTDOWNS = (# shutdowns)
- NORMAL hours = (Total Annual Fuel Use)/0.4836 mmcf/hr – START UPS – SHUTDOWNS
- Testing/tuning = based on 32 hrs/yr

Testing/tuning emissions were provided by SCE as follows:

|  |   |            |
|--|---|------------|
| 50 lbs/hr * 4hrs/yr (performance tuning)   | = | 200 lbs/yr |
| 45 lbs/hr * 2 hrs/yr (performance tuning)  | = | 90 lbs/yr  |
| 6 lbs/hr * 22 hrs/yr (performance tuning)  | = | 132 lbs/yr |
| 40 lbs/hr * 4 hrs/yr (black start testing) | = | 160 lbs/yr |
|  |   | -----      |
|  |   | 582 lbs/yr |

For NOx, the equation then becomes:



**South Coast  
Air Quality Management District**

Engineering Division  
Application Processing & Calculations

PAGE  
28

PAGES  
32

APPL NO.  
543407-8

DATE  
3/7/2014

PROCESSED BY  
CGP

CHECKED BY

# starts/yr \* 10.36 lbs/start + # shutdowns/yr\* 6.44 lbs/shutdown + [(Total annual fuel use)/0.4836 - # starts/yr - # shutdown/yr]\* 4.75 lbs/hr + 582 lbs

Example:

200 starts/yr, fuel limit of 580 mmcf

$$200 * 10.36 + 200 * 6.44 + [(580 / 0.4836) - 200 - 200] * 4.75 + 582 = 7,738.9 \text{ lbs}$$



**South Coast  
Air Quality Management District**  
  
Engineering Division  
Application Processing & Calculations

|                      |                  |
|----------------------|------------------|
| PAGE<br>29           | PAGES<br>32      |
| APPL NO.<br>543407-8 | DATE<br>3/7/2014 |
| PROCESSED BY<br>CGP  | CHECKED BY       |

Appendix B

Application Fees

SCE submitted applications for all 4 peaker plants. Fees are broken down as follows:

Barre 51475

| A/N                         | Submittal Date | Equip       | Bcat      | Fee Sch  | Fee             |
|-----------------------------|----------------|-------------|-----------|----------|-----------------|
| 535915                      | 4/10/12        | Gas turbine | 013008/81 | D        | \$3,252.87      |
| 534356                      | 3/27/12        | Title V     | 555007    | //////// | 912.44          |
| Expedited Permit Processing |                |             |           |          | 1,626.44        |
| <b>Total</b>                |                |             |           |          | <b>5,791.75</b> |

Center 17104

| A/N                         | Submittal Date | Equip         | Bcat      | Fee Sch  | Fee             |
|-----------------------------|----------------|---------------|-----------|----------|-----------------|
| 543402                      | 10/11/12       | Gas turbine   | 013008/81 | D        | \$3,252.87      |
| 543403                      | 10/11/12       | Emergency ICE | 043002    | B        | 1,098.98        |
| 543405                      | 10/11/12       | Emergency ICE | 043901    | B        | 1,098.98        |
| 543401                      | 10/11/12       | Title V       | 555007    | //////// | 912.44          |
| Expedited Permit Processing |                |               |           |          | 2,725.42        |
| <b>Total</b>                |                |               |           |          | <b>9,088.69</b> |

Grapeland 149620

| A/N                         | Submittal Date | Equip         | Bcat      | Fee Sch  | Fee             |
|-----------------------------|----------------|---------------|-----------|----------|-----------------|
| 543407                      | 10/11/12       | Gas turbine   | 013008/81 | D        | \$3,252.87      |
| 543408                      | 10/11/12       | Emergency ICE | 043002    | B        | 1,098.98        |
| 543406                      | 10/11/12       | Title V       | 555007    | //////// | 912.44          |
| Expedited Permit Processing |                |               |           |          | 2,175.93        |
| <b>Total</b>                |                |               |           |          | <b>7,440.22</b> |

Mira Loma 51003

| A/N                         | Submittal Date | Equip         | Bcat      | Fee Sch  | Fee              |
|-----------------------------|----------------|---------------|-----------|----------|------------------|
| 543410                      | 10/11/12       | Gas turbine   | 013008/81 | D        | \$3,252.87       |
| 543412                      | 10/11/12       | Emergency ICE | 043002    | B        | 1,098.98         |
| 543413                      | 10/11/12       | Emergency ICE | 043902    | B        | 1,098.98         |
| 543414                      | 10/11/12       | Emergency ICE | 043002    | B        | 1,098.98         |
| 543409                      | 10/11/12       | Title V       | 555007    | //////// | 912.44           |
| Expedited Permit Processing |                |               |           |          | 3,274.91         |
| <b>Total</b>                |                |               |           |          | <b>10,737.16</b> |

Total = \$33,057.82

Total submitted = 22,180.44 + 17,034.56 = \$39,215.00



**South Coast  
Air Quality Management District**  
  
Engineering Division  
Application Processing & Calculations

|                      |                  |
|----------------------|------------------|
| PAGE<br>30           | PAGES<br>32      |
| APPL NO.<br>543407-8 | DATE<br>3/7/2014 |
| PROCESSED BY<br>CGP  | CHECKED BY       |

Appendix C

Health Risk Assessment

TAC Emission Rates

| Pollutant       | AP-42 Emission Factor (lbs/mmbtu) | Max Short Term Emissions (lbs/hr) | Annual Emissions (lbs/yr) |
|-----------------|-----------------------------------|-----------------------------------|---------------------------|
| 1,3 Butadiene   | 4.30E-07                          | 2.17E-04                          | 3.07E-01                  |
| Acetaldehyde    | 4.00E-05                          | 2.02E-02                          | 2.86E+01                  |
| Acrolein        | 6.40E-06                          | 3.24E-03                          | 4.57E+00                  |
| Benzene         | 1.50E-05                          | 7.59E-03                          | 1.07E+01                  |
| Ethylbenzene    | 3.20E-05                          | 1.62E-02                          | 2.29E+01                  |
| Formaldehyde    | 7.10E-04                          | 3.59E-01                          | 5.07E+02                  |
| Naphthalene     | 1.30E-06                          | 6.57E-04                          | 9.28E-01                  |
| PAH             | 2.20E-06                          | 1.11E-03                          | 1.57E+00                  |
| Propylene Oxide | 2.90E-05                          | 1.47E-02                          | 2.07E+01                  |
| Toluene         | 1.30E-04                          | 6.57E-02                          | 9.28E+01                  |
| Xylene          | 6.40E-05                          | 3.24E-02                          | 4.57E+01                  |
| Ammonia         | ////////                          | 3.72E+00                          | 5.25E+03                  |

Notes

- (1) Emissions factors from AP-42 Section 3.1, Table 3.1-3, 4/00 with no reduction for oxidation catalyst, ammonia is based on 5 ppm slip.
- (2) lbs/hr calculated based on 506 mmbtu/hr max heat input
- (3) Annual emissions based on about 1690 hrs/yr operation, which is about 818 mmcf/yr max at a fuel rate of 0.4836 mmcf/hr (this was the original estimated fuel use rate)

Model Results

| Receptor        | Cancer Risk (per million) | Chronic Hazard Index | Acute Hazard Index |
|-----------------|---------------------------|----------------------|--------------------|
| Residential     | 0.16                      | 4.13E-04             | 5.16E-03           |
| Off-site worker | 0.02                      | 9.01E-04             | 5.16E-03           |

(1) The acute hazard index shown in the table reflects the updated model results from A/N 478600 for the increase in maximum heat input from 467 mmbtu/hr to 506 mmbtu/hr



**South Coast  
Air Quality Management District**

Engineering Division  
Application Processing & Calculations

PAGE  
31

APPL NO.  
543407-8

PROCESSED BY  
CGP

PAGES  
32

DATE  
3/7/2014

CHECKED BY

**Appendix D**

**Greenhouse Gases**

Out of the six GHG pollutants:

- carbon dioxide, CO<sub>2</sub>,
- methane, CH<sub>4</sub>,
- nitrous oxide, N<sub>2</sub>O
- hydrofluorocarbons, HFCs
- perfluorocarbons, PFCs
- sulfur hexafluoride, SF<sub>6</sub>

Only the first 3 are emitted by combustion sources. Sulfur hexafluoride can be emitted by circuit breakers.

The following emission factors and global warming potential (GWP) will be used in the calculations:

**GHG Emission Factors**

| GHG              | Emission Factor, natural gas |          | GWP |
|------------------|------------------------------|----------|-----|
|                  | kg/mmbtu                     | lbs/mmcf |     |
| CO <sub>2</sub>  | 53.02                        | 120,160  | 1.0 |
| CH <sub>4</sub>  | 1.0E-03                      | 2.27     | 21  |
| N <sub>2</sub> O | 1.0E-04                      | 0.227    | 310 |

The emission factors in kg/mmbtu are converted to lbs/mmcf assuming the default HHV of 1028 btu/cf from 40 CFR98 Subpart C Table C-1. 1 kg = 2.2046 lbs.

CO<sub>2</sub> equivalent (CO<sub>2</sub>e) is calculated using the following equation:

$$\text{CO}_2\text{e} = \text{CO}_2 + 21 \cdot \text{CH}_4 + 310 \cdot \text{N}_2\text{O}$$

Or, using fuel consumption (F):

$$\text{CO}_2\text{e} = 120,160 \cdot F + 2.27 \cdot 21 \cdot F + 0.227 \cdot 310 \cdot F = 120,278 \cdot F \text{ (in lbs)}$$

$$\text{CO}_2\text{e} = 60.139 \cdot F \text{ (in tons)}$$

**Maximum GHG PTE**

$$\text{Turbine rating} = 506 \text{ mmbtu/hr}$$



**South Coast  
Air Quality Management District**

Engineering Division  
Application Processing & Calculations

PAGE  
32

PAGES  
32

APPL NO.  
543407-8

DATE  
3/7/2014

PROCESSED BY  
CGP

CHECKED BY

**GHG PTE**

| Pollutant  | Hourly <sup>1</sup><br>tons | Daily <sup>2</sup><br>tons | Annual                       |                               |                  |
|------------|-----------------------------|----------------------------|------------------------------|-------------------------------|------------------|
|            |                             |                            | Current <sup>3</sup><br>tons | Proposed <sup>4</sup><br>tons | Increase<br>tons |
| CO2        | 29.56                       | 266.15                     | 37,189.52                    | 39,652.8                      | 2,463.28         |
| CH4        | 5.58E-04                    | 0.005                      | 0.70                         | 0.75                          | 0.05             |
| N2O        | 5.58E-05                    | 0.0005                     | 0.070                        | 0.075                         | 0.00             |
| Total Mass | 29.57                       | 266.16                     | 37,190.29                    | 39,653.63                     | 2,463.34         |
| CO2e       | 29.59                       | 266.41                     | 37,226.05                    | 39,691.8                      | 2,465.75         |

*1 Hourly GHGs based on turbine rating of 506 mmbtu/hr*

*2 Daily GHGs based on permit limit of 4.43 mmcf/day*

*3 Current annual GHGs based on permit limit of 619 mmcf/yr*

*4 Proposed annual GHG based on permit limit of 660 mmcf/yr*