

## DOCKETED

<b>Docket Number:</b>	13-AFC-01
<b>Project Title:</b>	Alamitos Energy Center
<b>TN #:</b>	214373
<b>Document Title:</b>	Additional Determination of Compliance Revisions
<b>Description:</b>	Proposed revisions based on voluntary reduction of CO emission rate for combined-cycle gas turbines
<b>Filer:</b>	Elyse Engel
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<b>Submitter Role:</b>	Applicant Consultant
<b>Submission Date:</b>	11/4/2016 3:49:20 PM
<b>Docketed Date:</b>	11/4/2016



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November 4, 2016

Subject: Alamos Energy Center Determination of Compliance Revisions (Facility ID 115394)

Dear Ms. Lee,

AES Alamos Energy, LLC (AES) appreciates the efforts by the South Coast Air Quality Management District (SCAQMD) in preparing the Alamos Energy Center’s (AEC) Final Determination of Compliance (FDOC). As the FDOC is prepared, AES would like to voluntarily propose revisions to the carbon monoxide (CO) emission rate from the General Electric 7FA.05 combined-cycle gas turbines (CCGT). In the Supplemental Application for Certification (SAFC), AES proposed a CO emission rate of 2 parts per million by volume, dry basis (ppmvd), corrected to 15 percent oxygen, for the CCGTs. AES would instead like to reduce the proposed CO emission rate to 1.5 ppmvd, corrected to 15 percent oxygen. Lowering the CCGT CO emission rate has the effect of lowering CO emissions from the overall AEC project; therefore, the conclusions made in the SAFC and Preliminary Determination of Compliance regarding significance should remain unchanged or improve and air dispersion modeling of the lower CO emissions should not be required. In addition, the change to the CCGT CO emission rate will not alter the start-up and shutdown emissions. An emission guarantee from the oxidation catalyst vendor will be provided as soon as negotiations are concluded.

To facilitate your incorporation of this change into the FDOC, AES has identified text and calculations within the Determination of Compliance that will require revision. The proposed revisions are provided below for your consideration and use.

Page 1, Section H – The CO emission limit presented in the 5<sup>th</sup> column for Gas Turbine, No. CCGT-1 should be listed as 1.5 ppmv instead of 2 ppmv.

Page 3, Section H – The CO emission limit presented in the 5<sup>th</sup> column for Gas Turbine, No. CCGT-2 should be listed as 1.5 ppmv instead of 2 ppmv.

Pages 19 and 20, Condition A63.2 – This condition should be revised as follows:

A63.2 The operator shall limit emissions from this equipment as follows:

CONTAMINANT	EMISSIONS LIMIT
CO	Less than or equal to 95,023 LBS IN ANY CALENDAR MONTH
VOC	Less than or equal to 13,314 LBS IN ANY CALENDAR MONTH
PM10	Less than or equal to 6324 LBS IN ANY CALENDAR MONTH
SOx	Less than or equal to 3616 LBS IN ANY CALENDAR MONTH

CO	Less than or equal to <del>190,753</del> <b>180,544</b> LBS IN ANY ONE YEAR
VOC	Less than or equal to 52,668 LBS IN ANY ONE YEAR
PM10	Less than or equal to 39,440 LBS IN ANY ONE YEAR
SOx	Less than or equal to 7435 LBS IN ANY ONE YEAR

For the purposes of this condition, the above emission limits shall be based on the emissions from a single turbine.

[...]

The following emission factors shall be used to demonstrate compliance with the monthly emission limits.

For commissioning, the emission factors shall be as follows: CO, 61.19 lb/mmcf; VOC, 8.86 lb/mmcf; PM10, 5.11 lb/mmcf; and SOx, 2.92 lb/mmcf.

For normal operation, the emission factors shall be as follows: CO, ~~16.32~~**15.28** lb/mmcf; VOC, 4.70 lb/mmcf; PM10, 3.92 lb/mmcf; and SOx, 2.24 lb/mmcf.

[...]

Page 21, Condition A195.9 – This condition should be revised as follows:

A195.9 The ~~2.0~~**1.5** PPMV CO emission limit(s) is averaged over 1 hour, dry basis at 15 percent oxygen. This limit shall not apply to turbine commissioning, startup, and shutdown periods.

Page 75, 1<sup>st</sup> Paragraph – This paragraph should be revised as follows:

The CO oxidation catalyst, located between the HRSG and the SCR, will be used to control CO and VOC emissions. The catalyst will reduce CO emissions from 7 – 8 ppm to **21.5** ppmv, all 1-hr averages, dry basis at 15% O<sub>2</sub>. The catalyst will reduce the VOC from approximately 2.2 ppm to 2 ppmv, all 1-hour averages, dry basis at 15% O<sub>2</sub>.

Page 75, Table 5 – The specification reported for CO at the stack outlet should be 1.5 ppmvd at 15% O<sub>2</sub> instead of 2.0 ppmvd at 15% O<sub>2</sub>.

Page 76, Table 7 – The warranted emission level reported for CO should be 1.5 ppmvd at 15% O<sub>2</sub> instead of 2.0 ppmvd at 15% O<sub>2</sub>.

Page 91, Table 15 – The row titled CO, 2.0 ppmvd (dry, 15% O<sub>2</sub>) BACT, lb/hr should be revised as shown below:

**Table 15 – Combined-Cycle Turbine Operating Scenarios**

Case No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
CO, <del>2.0</del> <b>1.5</b> ppmvd (dry, 15% O <sub>2</sub> ) BACT, lb/hr	<del>10.0</del> <b>7.53</b>	<del>7.92</del> <b>5.94</b>	<del>6.09</del> <b>4.57</b>	<del>9.93</del> <b>7.44</b>	<del>9.88</del> <b>7.41</b>	<del>7.67</del> <b>5.76</b>	<del>5.77</del> <b>4.33</b>	<del>9.50</del> <b>7.13</b>	<del>8.58</del> <b>6.44</b>	<del>6.87</del> <b>5.15</b>	<del>5.51</del> <b>4.13</b>	<del>9.94</del> <b>7.46</b>	<del>7.74</del> <b>5.81</b>	<del>5.78</del> <b>4.34</b>

Page 97, 2<sup>nd</sup> Paragraph – The last sentence of this paragraph should be revised as follows:

NOx is controlled to 2.0 ppmvd, CO to ~~2.0~~**1.5** ppmvd, and VOC to 2.0 ppmvd, all 1-hr averages, at 15% O<sub>2</sub>.

Page 98, Table 18 – This table should be revised as follows:

**Table 18 – Combined-Cycle Turbine Maximum Daily Emissions**

Pollutants	No. of Normal Operating Hr	Normal Operation Emission Rate, lb/hr	No. of Cold Startups	Lb/cold Startup	No. of Warm Startups	Lb/Warm Startup	No. of Shutdowns	Lbs/Shutdown	Maximum Daily Emissions lb/day
NOx	21	16.5	2	61	0	17	2	10	488.50
CO	21	<del>10.0</del> <b>7.53</b>	2	325	0	137	2	133	<del>1126.00</del> <b>1074.13</b>
VOC	21	5.75	2	36	0	25	2	32	256.75
PM <sub>10</sub> /PM <sub>2.5</sub>	21	8.50	2	8.50	0	4.25	2	4.25	204.00
SOx	21	4.86	2	4.86	0	2.43	2	2.43	116.64

Page 102, Table 21 – This table should be revised as follows:

**Table 21 – Combined-Cycle Turbine Maximum Monthly Emissions, Normal Operations**

Pollutants	No. of Normal Operating Hours	Normal Operation Emission Rate, lb/hr	No. of Cold Startups	lb/cold startup	No. of Warm Startups	lb/warm startup	No. of Hot Startups	lb/hot startup	No. of Shutdowns	lbs/shutdown	Maximum Monthly Emissions lb/month (tons/month)
NOx	674.5	16.5	15	61	12	17	35	17	62	10	13,463.25 (6.73)
CO	674.5	<del>10.0</del> <b>7.53</b>	15	325	12	137	35	137	62	133	<del>26,305.00 (13.15)</del> <b>24,638.99 (12.32)</b>
VOC	674.5	5.75	15	36	12	25	35	25	62	32	7577.38 (3.79)
PM <sub>10</sub> /PM <sub>2.5</sub>	674.5	8.50	15	8.50	12	4.25	35	4.25	62	4.25	6324.00 (3.16)
SOx	674.5	4.86	15	4.86	12	2.43	35	2.43	62	2.43	3615.84 (1.81)

Page 102, Table 22 – This table should be revised as follows:

**Table 22 – Combined-Cycle Turbine Normal Operating Emission Factors – Monthly Limits**

Pollutants	Maximum Monthly Emissions, lb/month	Emission Factors, lb/mmcf
NOx	13,463.25	8.35
CO	<del>26,305.00</del> <b>24,638.99</b>	<del>16.32</del> <b>15.28</b>
VOC	7577.38	4.70
PM <sub>10</sub>	6324.0	3.92
SOx	3615.84	2.24

Page 103, Table 23 – This table should be revised as follows:

**Table 23 – Combined-Cycle Turbine Maximum Monthly Emissions and Thirty-Day Averages**

Pollutants	Maximum Commissioning Month Emissions, lb/month (lb/day)	Maximum Normal Operating Month Emissions, lb/month (lb/day)	Maximum Monthly Emissions, lb/month	30-Day Averages, lb/day
NOx	14,293.5 lb/month (476.45 lb/day)	13,463.25 lb/month (448.78 lb/day)	14,294	476.45
CO	95,023.2 lb/month (3167.44 lb/day)	<del>26,305.00</del> <b>24,638.99</b> lb/month ( <del>876.83</del> <b>821.3</b> lb/day)	95,023	3167.44
VOC	13,314.0 lb/month (443.8 lb/day)	7577.38 lb/month (252.58 lb/day)	13,314	443.8
PM <sub>10</sub>	1411 lb/month (47.03 lb/day)	6324.0 lb/month (210.8 lb/day)	6324	210.8
SOx	809 lb/month (27.0 lb/day)	3615.84 lb/month (120.53 lb/day)	3616	120.53

Page 103, Paragraph Below Table 23 – This paragraph should be revised as follows:

Condition A63.2 will limit CO emissions to 95,023 lb/month, VOC to 13,314 lb/month, PM<sub>10</sub> to 6324 lb/month, SOx to 3616 lb/month. The commissioning emission factors are 61.18 lb/mmcf for CO, 8.86 lb/mmcf for VOC, 5.11 lb/mmcf for PM<sub>10</sub>, and 2.92 lb/mmcf for SOx from *Table 20*. The normal operating emission factors are ~~16.32~~**15.28** lb/mmcf for CO, 4.70 lb/mmcf for VOC, 3.92 lb/mmcf for PM<sub>10</sub>, and 2.24 lb/mmcf for SOx from *Table 22*.

Page 104, Table 24 – This table should be revised as follows:

**Table 24 – Combined-Cycle Turbine Maximum Annual Emissions, Commissioning Year**

Pollutants	Commissioning Year Emissions, lb/yr (tpy)
NOx	(27,597 lb/commissioning) + (13,463.25 lb/month)(6 normal operating months) = 108,377 lb/yr (54.19 tpy)
CO	(101,328 lb/commissioning) + ( <del>26,305.00</del> <b>24,638.99</b> lb/month)(6 normal operating months) = <del>259,158.00</del> <b>249,161.94</b> lb/yr ( <del>129.58</del> <b>124.58</b> tpy)
VOC	(14,682 lb/commissioning) + (7577.38 lb/month)(6 normal operating months) = 60,146.28 lb/yr (30.07 tpy)
PM <sub>10</sub>	(8,466 lb/commissioning) + (6324.0 lb/month)(6 normal operating months) = 46,410.0 lb/yr (23.21 tpy)
SOx	(4,841 lb/commissioning) + (3615.84 lb/month)(6 normal operating months) = 26,536.04 lb/yr (13.27 tpy)

Page 105, Table 25 – This table should be revised as follows:

**Table 25 – Combined-Cycle Turbine Maximum Annual Emissions, Normal Operating Year**

Pollutants	No. of Normal Operating Hours	Normal Operation Emission Rate, lb/hr	No. of Cold Startups	lb/cold startup	No. of Warm Startups	lb/warm startup	No. of Hot Startups	lb/hot startup	No. of Shutdowns	lb/shutdown	Maximum Annual Emissions lb/yr (tpy)
NOx	4100	16.3	80	61	88	17	332	17	500	10	83,850 (41.93 tpy)
CO	4100	<del>9.93</del> <b>7.44</b>	80	325	88	137	332	137	500	133	<del>190,753.0 (95.38 tpy)</del> <b>180,544.0 (90.27 tpy)</b>
VOC	4100	5.68	80	36	88	25	332	25	500	32	52,668 (26.33 tpy)
PM <sub>10</sub> /PM <sub>2.5</sub>	4100	8.50	80	8.50	88	4.25	332	4.25	500	4.25	39,440 (19.72 tpy)
SOx	4100	1.60	80	1.62	88	0.81	332	0.81	500	0.81	7434.80 (3.72)

Page 106, New Source Review (NSR) Database Entries – The CO calculations should be revised as follows:

$$R2 = (3167.44 \text{ lb/day})(\text{day}/24 \text{ hr}) = 131.98 \text{ lb/hr}$$

$$R1 = (131.98 \text{ lb/hr})(7.08 \text{ ppm uncontrolled}/\underline{21.5} \text{ ppm controlled per case 1}) = \del{467.21} \underline{622.95} \text{ lb/hr}$$

$$30\text{-DA} = 3167.44 \text{ lb/day}$$

Page 141, Table 43 – This table should be revised as follows:

**Table 43 – Facility Maximum Monthly Emissions, Normal Operations**

Equipment	Tons/Month						
	NOx	CO	VOC	PM <sub>10</sub> / PM <sub>2.5</sub>	SOx	NH <sub>3</sub>	CO <sub>2e</sub>
Combined-Cycle Turbine	6.73	<del>13.15</del> <b>12.32</b>	3.79	3.16	1.81		50,925.87
Combined-Cycle Turbine	6.73	<del>13.15</del> <b>12.32</b>	3.79	3.16	1.81		50,925.87
Circuit Breakers for Combined-Cycle Turbine Power Block							1.45
Simple-Cycle Turbine	3.49	4.15	0.99	2.32	0.60		10,074.12
Simple-Cycle Turbine	3.49	4.15	0.99	2.32	0.60		10,074.12
Simple-Cycle Turbine	3.49	4.15	0.99	2.32	0.60		10,074.12
Simple-Cycle Turbine	3.49	4.15	0.99	2.32	0.60		10,074.12
Circuit Breakers for Simple-Cycle Turbine Power Block							4.76
Auxiliary Boiler	0.057	0.30	0.051	0.057	0.016		922.72
SCR/CO Catalyst for Combined-Cycle Turbine						2.92	
SCR/CO Catalyst for Combined-Cycle Turbine						2.92	
SCR/CO Catalyst for Simple-Cycle Turbine						0.60	
SCR/CO Catalyst for Simple-Cycle Turbine						0.60	
SCR/CO Catalyst for Simple-Cycle Turbine						0.60	
SCR/CO Catalyst for Simple Cycle Turbine						0.60	
SCR for Auxiliary Boiler						0.018	
Ammonia Tank for Combined-Cycle Turbines						0	
Ammonia Tank for Simple-Cycle Turbines						0	
Oil/Water Separator for Combined-Cycle Turbines			0.0000075				
Oil/Water Separator for Simple-Cycle Turbines			0.0000011				
Facility Total	27.48	<del>43.20</del> <b>41.54</b>	11.59	15.66	6.04	8.26	143,077.15

Page 141, Table 44 – This table should be revised as follows:

**Table 44 – Facility Maximum Daily Emissions, Normal Operations**

	Tons/Day						
	NOx	CO	VOC	PM <sub>10</sub> /PM <sub>2.5</sub>	SOx	NH <sub>3</sub>	CO <sub>2e</sub>
Facility Total	0.92	<del>1.44</del> <b>1.38</b>	0.39	0.52	0.20	0.28	4769.24

Page 142, Table 54 – This table should be revised as follows:

**Table 45 – Facility Maximum Annual Emissions, Normal Operations**

Equipment	Tons/Year						
	NOx	CO	VOC	PM <sub>10</sub> / PM <sub>2.5</sub>	SOx	NH <sub>3</sub>	CO <sub>2e</sub>
Combined-Cycle Turbine	41.93	<del>95.38</del> <u>90.27</u>	26.33	19.72	3.72		611,110.39
Combined-Cycle Turbine	41.93	<del>95.38</del> <u>90.27</u>	26.33	19.72	3.72		611,110.39
Circuit Breakers for Combined-Cycle Turbine Power Block							17.44
Simple-Cycle Turbine	13.13	18.86	3.76	7.35	0.64		120,889.39
Simple-Cycle Turbine	13.13	18.86	3.76	7.35	0.64		120,889.39
Simple-Cycle Turbine	13.13	18.86	3.76	7.35	0.64		120,889.39
Simple-Cycle Turbine	13.13	18.86	3.76	7.35	0.64		120,889.39
Circuit Breakers for Simple-Cycle Turbine Power Block							57.11
Auxiliary Boiler	0.68	3.60	0.61	0.68	0.19		11,072.68
SCR/CO Catalyst for Combined-Cycle Turbine						35.0	
SCR/CO Catalyst for Combined-Cycle Turbine						35.0	
SCR/CO Catalyst for Simple-Cycle Turbine						7.16	
SCR/CO Catalyst for Simple-Cycle Turbine						7.16	
SCR/CO Catalyst for Simple-Cycle Turbine						7.16	
SCR/CO Catalyst for Simple Cycle Turbine						7.16	
SCR for Auxiliary Boiler						0.21	
Ammonia Tank for Combined-Cycle Turbines						0	
Ammonia Tank for Simple-Cycle Turbines						0	
Oil/Water Separator for Combined-Cycle Turbines			0.00009				
Oil/Water Separator for Simple-Cycle Turbines			0.000013				
Facility Total	137.06	<del>269.80</del> <u>259.58</u>	68.31	69.52	10.19	98.85	1,716,925.57

Page 147, 2<sup>nd</sup> Paragraph – This paragraph should be revised as follows:

This rule limits the gas turbines to 2000 ppmv CO. The CO emissions from the combined-cycle turbines will be controlled by an oxidation catalyst to the BACT/LAER limit of ~~21.5~~ ppmvd at 15% O<sub>2</sub>. The CO emissions from the simple-cycle turbines will be controlled by an oxidation catalyst to the BACT/LAER limit of 4 ppmvd at 15% O<sub>2</sub>. The auxiliary boiler is expected to comply with the BACT/LAER limit of 50 ppmv CO.



Pages 155 and 156, Table 48 – This table should be revised as follows:

**Table 48 – Combined-Cycle Gas Turbine BACT/LAER Requirements, Proposed and Guaranteed Emissions Levels**

	NOx	CO	VOC	PM <sub>10</sub> /SOx	NH <sub>3</sub>
SCAQMD Combined-Cycle Gas Turbine BACT/LAER Limits	2.0 ppmvd at 15% O <sub>2</sub> , 1-hr average	2.0 ppmvd at 15% O <sub>2</sub> , 1-hr average	2.0 ppmvd at 15% O <sub>2</sub> , 1-hr average	PUC quality natural gas with sulfur content ≤ 1 grain/100 scf	5.0 ppmvd at 15% O <sub>2</sub> , 1-hr average
AES Proposed BACT/LAER	2.0 ppmvd at 15% O <sub>2</sub> , 1-hr average	<del>2.0</del> <b>1.5</b> ppmvd at 15% O <sub>2</sub> , 1-hr average	Original—1.0 ppmvd at 15% O <sub>2</sub> , 1-hr average Revised—2.0 ppmvd at 15% O <sub>2</sub> , 1-hr average based on SCAQMD Method 25.3	PUC quality natural gas with sulfur content ≤ 1 grain/100 scf	5 ppmvd at 15% O <sub>2</sub>
<del>Noter/Eriksen</del> <b>TBD</b> Guarantees	2 ppmvd at 15% O <sub>2</sub>	<del>2.0</del> <b>1.5</b> ppmvd at 15% O <sub>2</sub>	1 ppmvd at 15% O <sub>2</sub>	PUC quality natural gas with sulfur content ≤ 1 grain/100 scf	5 ppmvd at 15% O <sub>2</sub>
Compliance?	Yes	Yes	Yes	Yes	Yes

Page 156, 1<sup>st</sup> Paragraph – This paragraph should be revised as follows:

Condition nos. A195.8, A195.9, and A195.10 provide that the BACT limits of 2.0 ppmvd NOx, ~~2.0~~ **1.5** ppmvd CO, and 2.0 ppmvd ROG, respectively, shall not apply during commissioning, startup, and shutdown periods.

Page 209, Table 71 – This table should be revised as follows:

**Table 71 – Prevention of Significant Deterioration Applicability**

	CO	NOx	SO <sub>2</sub>	PM <sub>10</sub>
Alamitos Generating Station Potential to Emit, TPY ( <i>Table 13</i> )	21,871.86	635.6	49.56	627.0
Major Source?	Yes, PTE is 100 tpy or more for CO, NOx, and PM <sub>10</sub> . If a source is a major source for any one regulated pollutant, it is considered to be a major source for all regulated pollutants.			
Alamitos Generating Station (AGS) Actual Emissions (2013 & 2014 Avg), TPY ( <i>Table 14</i> )	287.90	47.47	4.68	10.91
Alamitos Energy Center (AEC) Potential to Emit, TPY = Emissions Increase ( <i>Table 45</i> )	<del>269.80</del> <b>259.58</b>	137.06	10.19	69.52
Does the AEC result in a significant emissions increase?	Yes, increase is greater than 100 tpy.	Yes, increase is greater than 40 tpy.	No, increase is less than 40 tpy.	Yes, increase is greater than 15 tpy.
Net Emissions Increase (AEC PTE – AGS actual)	<del>-18.10</del> <b>-28.32</b>	89.59	5.51	58.61
Does the AEC result in a net significant emissions increase?	No, there is a net decrease.	Yes, net increase is greater than 40 tpy.	No, net increase is less than 40 tpy.	Yes, net increase is greater than 15 tpy.
PSD Applicable?	No	Yes	No	Yes

Page 222, 1<sup>st</sup> Paragraph – This paragraph should be revised as follows:

The use of oxidation catalyst is considered a feasible technology for reducing CO emissions to 21.5 ppmvd for combined-cycle turbines and to 4 ppmvd for simple-cycle turbines, when firing natural gas.

Page 224, Last Paragraph – The last sentence of this paragraph should be revised as follows:

Pg. 4.1-26 of the PSA indicates CO emission concentrations would be limited to 2.0 ppmvd, which is ~~the same as~~ **greater than what is** proposed for the AEC combined-cycle turbines.

Page 226, 4<sup>th</sup> Paragraph – This paragraph should be revised as follows:

Based on a review of the available control technologies for CO emissions from natural gas-fired combined-cycle turbines, the conclusion is that BACT using good combustion practice and oxidation catalyst to control CO emissions to 2.0 ppm (1-hour average) during normal operation. This is ~~the same as~~ **greater than** the BACT proposed by AES.

Page 282, Last Paragraph – The last full sentence of this paragraph should be revised as follows:

The CO emissions are ~~129.58~~ **124.58** tpy (commissioning year), which is higher than the 50 tpy threshold.

Should you have any questions regarding these proposed revisions, please do not hesitate to call me at 916-286-0207. We appreciate your attention to this matter and look forward to receipt of the draft FDOC issued by the SCAQMD.

Regards,



Jerry Salamy  
Program Manager  
CH2M HILL Engineers, Inc.

cc: Stephen O'Kane/AES  
Jeffrey Harris/ESH  
Keith Winstead/CEC