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July 1, 2008

KIMBERLY HELLWIG
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BY HAND DELIVERY AND EMAIL

Mr. Michael Monasmith
Siting Project Manager
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

**Re: Carlsbad Energy Center Project (07-AFC-6)
Non-Cancer Acute Health Hazard HRA Remodeling**

Dear Mr. Monasmith:

On behalf of Carlsbad Energy Center LLC, please find enclosed for docketing copies of a letter and corresponding CD-Rom, which was sent to Dr. Steve Moore of the San Diego Air Pollution Control District on June 30, 2008. This correspondence relates to the pending Application for Authority to Construct for the Carlsbad Energy Center Project, including revised gas turbine analysis and modeling.

Copies of the CD-Rom will not be forwarded to those persons or agencies identified on the proof of service. However, we ask that the letter and one (1) CD-Rom is forwarded to Will Walters of your office.

Should you have any questions or concerns regarding this information, please do not hesitate to contact our office.

Respectfully submitted,

A handwritten signature in cursive script that reads "Kimberly J. Hellwig".

Kimberly J. Hellwig
Senior Paralegal

KJH:kjh
Enclosures
cc: See Proof of Service (w/out CD-Rom)

June 30, 2008



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Dr. Steve Moore
Engineering Group
San Diego Air Pollution Control District
10124 Old Grove Road
San Diego, CA 92131

Subject: Application for Authority To Construct for the Proposed Carlsbad Energy Center Project – Revised Gas Turbine Modeling Analysis

Dear Dr. Moore:

On behalf of Carlsbad Energy Center LLC, we are pleased to submit the following air quality modeling results for the new gas turbines proposed as part of the Carlsbad Energy Center Project (CECP). At the request of the SDAPCD, we performed two focused air quality modeling analyses examining impacts during gas turbine startups. For the first analysis, we modeled the 1-hr average NO₂ and CO impacts during a gas turbine startup using a multi-phase modeling approach. For the second analysis, we modeled the acute health risks during a gas turbine startup using toxic air contaminant emission rates provided by the SDAPCD from tests performed at the Palomar Energy Facility. The results of these two modeling analyses are discussed below.

Gas Turbine Startups – One-Hour Average NO₂ and CO Impacts

At the request of the SDAPCD, we performed a modeling analysis examining 1-hr average NO₂ and CO impacts during gas turbine startups with the startup hour broken down into different operating phases in an attempt to model the different dispersion characteristics that occur as the gas turbine load changes during a startup. Consequently, each operating phase contains a unique set of NO_x/CO emission rates and exhaust characteristics. Due to the limited amount of information available from the gas turbine manufacturer regarding emissions during gas turbine startups, we were only able to break the startup hour into the following four phases:

- Phase 1 – startup emissions part 1 (minutes 0 to 12);
- Phase 2 – startup emissions part 2 (minutes 13 to 22);
- Phase 3 – normal operation (minutes 23 to 53); and
- Phase 4 – shutdown (minutes 54 to 60).

As shown above, we included a shutdown phase in this modeling analysis in order to examine the worst-case impacts that could occur if a startup/shutdown event occurred during a single hour. Adding the shutdown phase also increases the number of operating phases examined in this analysis. For each operating phase, the AERMOD model was run assuming the NO_x/CO emission rates and stack characteristic for each phase occurred for the entire hour. The corresponding composite hourly average results were determined by calculating the weighted average of each operating phase impact based on the duration of each phase. For example, since the duration of Phase 1 is 12 minutes, the contribution of Phase 1 to the composite hourly average is based on the ratio of 12 minutes divided by 60 minutes. Enclosed as Attachment 1 are the modeling inputs for each phase. Also enclosed as Attachment 1 are the composite hourly average impact calculations. As in the previous modeling performed for the CECP, the AERMOD model was used for this analysis along with the PVMRM method. The electronic modeling files are included in the enclosed compact disc. The following table summarizes the results of this modeling analysis along with the results of the previous gas turbine startup modeling performed for the project. As shown in Table 1, the multi-phase modeling approach results in lower modeled impacts than the previous modeling performed for the project. As with the previous modeling performed for the project, the multi-phase modeling analysis examined the simultaneous startup of both gas turbines.

Table 1 Multi-Phase Gas Turbine Startup Modeling Results Simultaneous Startup of Both Gas Turbines ($\mu\text{g}/\text{m}^3$)		
	Previous Startup Modeling Results^a	Multi-Phase Startup Modeling Results
NO ₂ (1-hour average)	80.4	70.0
CO (1-hour average)	1133.8	1128.6

^aCEC Data Responses - Set 2A, Carlsbad Energy Center Project, June 2008, Table 5.1-27.

Gas Turbine Startups – Acute Health Risk Analysis

At the request of the SDAPCD, we performed a modeling analysis examining acute health risks during gas turbine startups using toxic air contaminant emission rates derived from a recent compliance test performed at the Palomar Energy Facility. The compliance test¹ was conducted on the natural gas-fired gas turbine Unit CT-2 at the Palomar Energy Center on October 2007. The compliance test was a short-duration test of only one hour during a gas turbine startup instead of the normally required three test runs of one hour each. The Palomar Energy Center test results showed higher emission factors for acetaldehyde, acrolein, benzene, and formaldehyde compared to the EPA-approved²

¹ Delta Air Quality Services, Incorporated. *Cold Start Up Emissions from CT-2 at the Palomar Energy Center*, Document No. R026220, November 2007.

² USEPA. *Compilation of Air Pollutant Emission Factors, Volume 1 – Stationary Point and Area Sources, Chapter 3.1- Stationary Gas Turbines*, Table 3.1-3, April 2000.

emission factors used in the previous health risk assessment performed for the CECP. While we do not believe that the limited amount of data available from a single 1-hr test performed at the Palomar Energy Facility are sufficient to accurately characterize startup emissions for the new units proposed for CECP, we performed the requested analysis to be responsive to the request from the SDAPCD.

As with the previous health risk assessment performed for the CECP, the gas turbine startup analysis was performed using a combination of the HARP and AERMOD models. The modeling inputs for this analysis are included in Attachment 2 and the electronic modeling files are included in the enclosed compact disc. Table 2 summarizes the results of this modeling analysis along with the results of the previous gas turbine startup modeling performed for the project. As shown in the table, the new modeling approach results in higher acute impacts than the previous modeling performed for the project. However, the revised modeling results remain below significance levels.

The new gas turbine startup acute impact modeling analysis was performed using the current Office of Environmental Health Hazard Assessment (OEHHA) reference exposure levels (RELs). The OEHHA is considering changing several of these RELs. If the gas turbine startup acute impact analysis was performed with the proposed new RELs, the acute impact of 0.83 shown on Table 2 would be reduced by approximately 71% to a level of approximately 0.24.

Table 2		
Gas Turbine Startup Modeling Results		
Simultaneous Startup of Both Gas Turbines		
Acute Health Hazard Index		
	Previous Startup Modeling Results^a	Revised Startup Modeling Results
Point of Maximum Impact	0.089	0.83
Maximally Exposed Individual Resident	0.036	0.34
Maximally Exposed Individual Worker	0.020	0.19
Significance Level	1.0	1.0

^a CEC Data Responses - Set 2A, Carlsbad Energy Center Project, June 2008, Table 5.9-6.

If you have any questions regarding this application package, please contact me at (916) 444-6666.

Sincerely,

A handwritten signature in black ink, appearing to read 'Tom Andrews', with a long horizontal flourish extending to the right.

Tom Andrews
Senior Engineer

Enclosures

cc: Tim Hemig, Carlsbad Energy Center LLC
George L. Piantka, Carlsbad Energy Center LLC
John McKinsey, Stoel
Will Walters, CEC
Michael Monasmith, CEC
CEC Dockets Office (07-AFC-6)

ATTACHMENT 1

GAS TURBINE STARTUPS
1-HR NO₂ AND CO MODELING INPUTS

Table 1.1 Gas Turbine Hourly Startup/Shutdown Emissions (per GT) - Per Phase																			
Operating Phase	Duration (minutes)	NOx Emissions (lbs/hr)	CO Emissions (lbs/hr)	NOx Emissions (lbs)	CO Emissions (lbs)	Compliance Adjustment Factor	Adjusted NOx Emissions (lbs)		Adjusted CO Emissions (lbs)		Exhaust Parameters(5)		Stack Temp deg K						
							NOx Emissions (lbs)	CO Emissions (lbs)	NOx Emissions (g/sec)	CO Emissions (g/sec)	Stack Diam feet	Stack Diam meters		Stack flow wscfm	Stack flow m3/sec	Stack Vel ft/sec	Stack Vel m/sec	Stack Temp deg F	
Phase 1 - Startup Emissions (Part 1)(1)	12	N/A	N/A	13.65	265.46	2	27.30	530.83	17.20	334.49	21.30	6.49	858.818	405	40	12	346	448	
Phase 2 - Startup Emissions (Part 2)(2)	10	68.10	9.21	11.35	1.54	2	22.70	3.07	17.16	2.32	21.30	6.49	1,458,766	688	68	21	361	456	
Phase 3 - Normal Operating Emissions(3)	31	15.13	9.21	7.82	4.76	2	15.64	9.52	3.81	2.32	21.30	6.49	1,458,766	688	68	21	361	456	
Phase 4 - Shutdown Emissions(4)	7	N/A	N/A	10.00	135.00	2	20.00	270.00	21.60	291.60	21.30	6.49	858.818	405	40	12	346	448	
Total =	60			47.82	406.76		85.64	813.52											

Notes:

- (1) Duration of this phase along with NOx and CO emissions are from information provided by Siemens. See September 12, 2007 permit application for CECP, Table 5.1B-8. According to Table 5.1B-8, footnote 1, the 22 minute startup time includes 10 minutes with the gas turbine at 100% heat. Consequently, during the first 12 minutes the gas turbine goes from zero to 100% load.
- (2) Duration of this phase along with NOx and CO emissions are from information provided by Siemens. See September 12, 2007 permit application for CECP, Table 5.1B-8. Per footnote 1 of Table 5.1B-8, the last 10 minutes of the 22 minute startup period has the gas turbine operating at 100% load. Consequently, during this period the DLN combustor is in low NOx mode at 9 ppmv @ 15% O2. Consequently, the hourly NOx emission shown are for 100% gas turbine load and 9 ppm NOx. Also, during this period the oxidation catalyst is achieving full control per Table 5.1B-8, footnote 5. Therefore, the hourly CO emissions shown are for 100% gas turbine load and 2.0 ppm @ 15% O2.
- (3) Based on NOx and CO emissions for base load operation. See September 12, 2007 permit application for CECP, Table 5.1B-1B.
- (4) Duration of this phase along with NOx and CO emissions are from information provided by Siemens. See September 12, 2007 permit application for CECP, Table 5.1B-8.
- (5) For startup phase part 1 and the shutdown phase, the exhaust characteristics are based on 50% gas turbine load levels. For startup phase part 2 and normal operating phase, the exhaust characteristics are based on 100% gas turbine load levels. See September 12, 2007 permit application for CECP, Table 5.1D-2, for stack characteristics at different gas turbine loads.

**Table 1-2
Gas Turbine Startups - Multiphase Approach - 1-hr CO Modeling Results**

	Phase Duration (Mins)	2003 Met. Set		2004 Met. Set		2005 Met. Set	
		CO 1hr Impact (ug/m3)	CO 1hr Impact weighted average (ug/m3)	CO 1hr Impact (ug/m3)	CO 1hr Impact weighted average (ug/m3)	CO 1hr Impact (ug/m3)	CO 1hr Impact weighted average (ug/m3)
Operating Phase							
Phase 1 - Startup Emissions (Part 1)	12	3699.62	739.92	3600.26	720.05	3255.53	651.11
Phase 2 - Startup Emissions (Part 2)	10	18.10	3.02	15.21	2.53	16.66	2.78
Phase 3 - Normal Operating Emissions	31	18.10	9.35	15.21	7.86	16.66	8.61
Phase 4 - Shutdown Emissions	7	3225.28	376.28	3138.66	366.18	2838.13	331.12
Minutes in 1 hour =	60		1128.58		1096.62		993.60
Total =							

**Table 1-3
Gas Turbine Startups - Multiphase Approach - 1-hr NO2 Modeling Results**

	Phase Duration (Mins)	2003 Met. Set		2004 Met. Set		2005 Met. Set	
		NO2 1hr Impact (ug/m3)	NO2 1hr Impact weighted average (ug/m3)	NO2 1hr Impact (ug/m3)	NO2 1hr Impact weighted average (ug/m3)	NO2 1hr Impact (ug/m3)	NO2 1hr Impact weighted average (ug/m3)
Operating Phase							
Phase 1 - Startup Emissions (Part 1)	12	106.98	21.40	119.70	23.94	121.67	24.33
Phase 2 - Startup Emissions (Part 2)	10	92.41	15.40	82.28	13.71	96.40	16.07
Phase 3 - Normal Operating Emissions	31	26.76	13.83	22.48	11.62	23.05	11.91
Phase 4 - Shutdown Emissions	7	134.36	15.68	140.48	16.39	152.00	17.73
Minutes in 1 hour =	60		66.30		65.66		70.04
Total =							

ATTACHMENT 2

GAS TURBINE STARTUPS
ACUTE HEALTH ANALYSIS INPUTS

Table 2-1
Carlsbad Energy Center
Maximum Hourly TAC Emissions From the Gas Turbines during Startups

Pollutant	Emission Factor ⁽¹⁾ lb/MMscf	1 Turbine Max. Hourly Emissions lbs/hr (each)	2 Turbines Max. Hourly Emissions lbs/hr	Hourly Emission Rate Per Turbine g/sec (each)
Ammonia	5 ppmv slip	1.40E+01	2.80E+01	1.77E+00
Propylene	7.71E-01	1.58E+00	3.16E+00	1.99E-01
Hazardous Air Pollutants (HAPs)				
Acetaldehyde	1.28E+00	2.63E+00	5.26E+00	3.31E-01
Acrolein	6.89E-02	1.41E-01	2.82E-01	1.78E-02
Benzene	2.56E-02	5.24E-02	1.05E-01	6.60E-03
1,3-Butadiene	4.39E-04	8.99E-04	1.80E-03	1.13E-04
Ethylbenzene	3.26E-02	6.67E-02	1.33E-01	8.41E-03
Formaldehyde	4.63E+00	9.48E+00	1.90E+01	1.19E+00
Hexane	2.59E-01	5.30E-01	1.06E+00	6.68E-02
Naphthalene	1.66E-03	3.40E-03	6.80E-03	4.28E-04
PAHs (listed individually below)	1.31E-04	2.68E-04	5.36E-04	3.38E-05
Benzo(a)anthracene	2.26E-05			
Benzo(a)pyrene	1.39E-05			
Benzo(b)fluoranthrene	1.13E-05			
Benzo(k)fluoranthrene	1.10E-05			
Chrysene	2.52E-05			
Dibenz(a,h)anthracene	2.35E-05			
Indeno(1,2,3-cd)pyrene	2.35E-05			
Propylene oxide	2.96E-02	6.06E-02	1.21E-01	7.63E-03
Toluene	1.33E-01	2.72E-01	5.45E-01	3.43E-02
Xylene	6.53E-02	1.34E-01	2.67E-01	1.68E-02

1) Acetaldehyde, acrolein, benzene and formaldehyde emission factors are from Steve Moore of the SDAPCD, based on the October 22, 2007 source test. Other factors except for PAHs, hexane and propylene are from AP-42, Table 3.1-3, 4/00. Individual PAHs, hexane and propylene are CATEF mean results (i.e., not in AP-42).

- 2) Single turbine maximum heat input (MMBtu/hr) = 2087
- 3) Natural gas heat content (Btu/scf high heating value, HHV) = 1019.3
- 4) Maximum single turbine hourly fuel flow (MMscf/hr) = 2.0474
- 5) Maximum turbine annual operating time (hours) = 4100
- 6) Maximum single turbine annual fuel flow (MMscf/yr) = 8394.5

Table 2-2
Calculation of HHI Modeling Inputs for Gas Turbines During Startups

Carlsbad Energy Center

Compound	Max Hourly Emissions Per Turbine g/s	HARP Acute HI (per $\mu\text{g}/\text{m}^3$)	Acute HHI Model Input (g/s per $\mu\text{g}/\text{m}^3$)	Modeled Contribution to Acute HHI ⁽¹⁾
Ammonia	1.7660	3.13E-04	5.53E-04	4.32E-03
Propylene	0.1989	--	--	--
Acetaldehyde	3.31E-01	--	--	--
Acrolein	1.78E-02	5.26E+00	9.35E-02	7.31E-01
Benzene	6.60E-03	7.69E-04	5.07E-06	3.97E-05
1,3-Butadiene	1.13E-04	--	--	--
Ethylbenzene	8.41E-03	--	--	--
Formaldehyde	1.19E+00	1.06E-02	1.27E-02	9.90E-02
Hexane	6.68E-02	--	--	--
Naphthalene	4.28E-04	--	--	--
PAHs (listed individually below)	3.38E-05	--	--	--
<i>Benzo(a)anthracene</i>				
<i>Benzo(a)pyrene</i>				
<i>Benzo(b)fluoranthrene</i>				
<i>Benzo(k)fluoranthrene</i>				
<i>Chrysene</i>				
<i>Dibenz(a,h)anthracene</i>				
<i>Indeno(1,2,3-cd)pyrene</i>				
Propylene oxide	7.63E-03	3.23E-04	2.46E-06	1.93E-05
Toluene	3.43E-02	2.70E-05	9.26E-07	7.24E-06
Xylene	1.68E-02	4.55E-05	7.66E-07	5.99E-06
		Total =	1.07E-01	8.34E-01

1) Based on modeled non-cancer acute HHI from both CTG (-) = **0.83416**

**BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT
COMMISSION OF THE STATE OF CALIFORNIA**

**APPLICATION FOR CERTIFICATION
FOR THE *CARLSBAD ENERGY CENTER
PROJECT***

**Docket No. 07-AFC-6 PROOF OF
SERVICE
(Revised 4/1/2008)**

**Correspondence and CD-Rom to San Diego Pollution Control District re Revised Air Modeling for the
Carlsbad Energy Center Project**

CALIFORNIA ENERGY COMMISSION
Attn: Docket No. 07-AFC-6
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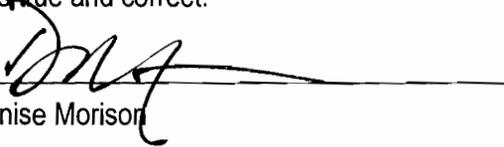
DECLARATION OF SERVICE

I, Denise Morison, declare that on July 1, 2008, I deposited copies of the attached document in the United States mail at Sacramento, California, with first-class postage thereon fully prepaid and addressed to those identified on the Proof of Service list above.

OR

Transmission via electronic mail was consistent with the requirements of California Code of Regulations, title 20, sections 1209, 1209.5, and 1210. All electronic copies were sent to all those identified on the Proof of Service list above.

I declare under penalty of perjury that the foregoing is true and correct.


Denise Morison