DOCKETED

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TN #:	202627
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Description:	6/27/14
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Organization:	Locke Lord LLP
Submitter Role:	Applicant Representative
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Locke Lord LLP
Attorneys & Counselors

500 Capitol Mall, Suite 1800
Sacramento, CA 95814
Telephone: 916-930-2500
Fax: 916-930-2501
www.lockelord.com

John A. McKinsey
Direct Telephone: 916-930-2527
Direct Fax: 916-720-0443
jmckinsey@lockelord.com

June 27, 2014

VIA E-FILING AND HAND-DELIVERY

Carlsbad Energy Center Project Petition to Amend (07-AFC-06C)
Mike Monasmith, Staff Project Manager
California Energy Commission
1516 Ninth Street, MS-2000
Sacramento, CA 95814-5512

Re: Carlsbad Energy Center Project Petition to Amend (07-AFC-06C)
Supplemental Information Regarding Project Owner's Application for Authority to Construct

Dear Mr. Monasmith:

Carlsbad Energy Center LLC's ("**Project Owner**") representative provided the enclosed letter and compact disk containing modeling data to the San Diego County Air Pollution Control District (the "**Air District**") yesterday. These items contain supplemental information requested by the Air District on May 29, 2014, in relation to Project Owner's application for Authority to Construct the amended Carlsbad Energy Center Project (07-AFC-06C) ("**CECP**"), as proposed to the California Energy Commission in TN Nos. 202287-1, 202287-2 and 202287-3. Due to the sizes and configurations of the enclosed modeling files, Project Owner has provided this information on compact disk. Please contact me or Tom Andrews at Sierra Research if there are questions.

Locke Lord LLP

By: _____
John A. McKinsey
Attorneys for Carlsbad Energy Center LLC

JAM: awph

Enclosures (compact disks to be hand-delivered)

sierra research

1801 J Street
Sacramento, CA 95811
Tel: (916) 444-6666
Fax: (916) 444-8373

Ann Arbor, MI
Tel: (734) 761-6666
Fax: (734) 761-6755

June 26, 2014

Steven Moore
Senior Air Pollution Control Engineer
San Diego County Air Pollution Control District
10124 Old Grove Road
San Diego, CA 92131

Subject: ATC Application for Amended CECP

Dear Mr. Moore:

On behalf of Carlsbad Energy Center LLC, Sierra Research is pleased to submit the following responses to the information requested in Section A of the SDAPCD's May 29, 2014 letter regarding the Authority to Construct (ATC) application package for the Amended Carlsbad Energy Center Project (CECP).

Request 1: For Table 5.1B2, turbine operating parameters for 50% load and at sync-idle load (a fuel heat input rate of approximately 129 MMBtu, higher heating value) such as those already provided for 100% and 25% load.

Response: The LMS 100 GE gas turbine performance runs for the 50% load and sync-idle load are provided in Attachment 1.

Request 2: A detailed description of the reverse osmosis and polishing demineralization processes, including the types of equipment to be used and key operating parameters necessary to determine their performance, and the design basis for the removal efficiency of total dissolved solids and arsenic, cadmium, hexavalent chromium, copper, manganese, mercury, selenium, nickel, lead, sulfates, and fluorides from the input reclaimed and sea water streams. The analysis must include the expected concentrations of total dissolved solids and arsenic, cadmium, hexavalent chromium, copper, manganese, mercury, selenium, nickel, lead, sulfates, and fluorides for the inlet reclaimed and sea water and supporting documentation for these inlet concentrations; the expected concentrations of the inlet species in the reverse osmosis product water; the expected concentrations of the inlet species in the polishing demineralization product water; any regulatory limits on the inlet concentrations in the inlet water supply; and any vendor or other specification for the concentrations of contaminants in the combustion turbine injection water.

Response: The detailed description of the reverse osmosis and polishing demineralization processes proposed for the Amended CECP is included in Attachment 2. The analysis of the expected concentrations of total dissolved solids and metals in the inlet reclaimed water and sea water and the controlled concentrations prior

to use by the gas turbines is included in Attachment 3. This analysis also shows that the controlled concentrations will meet the GE specifications.

Request 3: The detailed supporting calculations for the baseline emissions in Tables 5.1B-7-1 through 5.1B-7-7 for the EPS Unit Nos. 1–5 and the peaking combustion turbine, including the minute-by-minute continuous emission monitoring system (CEMS) data for operating time, NOx emissions, and fuel flow data for each unit, as applicable, in Excel spreadsheet or other electronic spreadsheet format acceptable by the District.

Response: The Excel spreadsheet with the detailed baseline emission calculations (including CEMS data) for EPS Units 1-5 and the peaking combustion turbine is included in the enclosed compact disc.

Request 4: Documentation such as the vendor guarantees, source tests, or any other information supporting the proposed 3.5 pound per hour particulate matter emission level proposed as BACT for the gas turbine engines including, but not limited to, any limitations on achieving such an emission level, such as air inlet filter cleaning requirements and water quality for the combustion turbine water injection.

Response: Please see the GE performance runs for the LMS 100 gas turbines provided in the ATC application package for this project (ATC application package, Appendix 5.1B, Table 5.1B-2) that show the 3.5 lbs/hr PM_{10} emission level. GE is now treating its performance runs as equivalent to the letters it previously issued regarding expected emission levels for a given make/model machine.

Request 5: Minimum operating temperature for ammonia injection for the selective catalytic reduction (SCR) catalyst.

Response: According to GE, the minimum ammonia injection temperature for the SCR catalyst is approximately 540 °F.

Request 6: The maximum continuous and maximum intermittent operating temperature that the SCR catalyst can sustain without incurring significant damage to the catalyst.

Response: According to GE, the maximum continuous SCR catalyst operating temperature without incurring significant damage is approximately 870 °F and the maximum intermittent operating temperature without incurring significant damage is approximately 932 °F.

Request 7: The following additional modeling scenarios to ensure that the potential worst-case emission air quality impacts have been identified:

a. For PM_{10} and $PM_{2.5}$, 24-hour impacts for operation at 50% load and at sync-idle load

   Response: Included in Attachment 4 is a summary of the screening level results for the previous air quality modeling done for the Amended CECP. This summary also includes the screening level results for the 50% load and sync-idle load cases for the new gas turbines. As shown by this summary, the maximum $PM_{10}/PM_{2.5}$ 24-hour impacts for the 50%

operating load cases are lower than the maximum operating case (i.e., hot ambient, 25% load, see ATC Application Package, Table 5.1E-3) previously modeled for the Project. Therefore, there is no need to perform any further 24-hour $PM_{10}/PM_{2.5}$ modeling for the 50% load case.

As shown in Attachment 4, the sync-idle load screening level $PM_{10}/PM_{2.5}$ 24-hour impacts are higher than the maximum operating case previously modeled. Therefore, a revised $PM_{10}/PM_{2.5}$ 24-hour refined modeling analysis was performed for the commissioning phase for the new gas turbines (only period with prolonged sync-idle operation). As with the previous commissioning phase modeling performed for the Project, the analysis assumes all six new gas turbines are undergoing commissioning simultaneously with the existing Units 1-5 and the peaker gas turbine also operating. While it would be very unlikely that all six new units would be operating in the sync-idle load simultaneously, this analysis accounts for this event. As shown in Attachment 5, the revised commissioning modeling results do not change the conclusion reached for the previous modeling analysis—during commissioning activities, the results indicate that the Amended CECP will not cause or contribute to violations of state or federal air quality standards, with the exception of the annual state $PM_{10}/PM_{2.5}$ standards and annual federal $PM_{2.5}$ standard (existing background concentrations already exceed state/federal standards). The detailed modeling files are included in the enclosed compact disc.

b. For NO_2 and CO, 1-hour impacts for operation at sync-idle load

Response: Included in Attachment 4 is a summary of the screening level modeling results for the previous modeling done for the Amended CECP, including the impacts for the 50% load and sync-idle load cases. As shown by this summary, the maximum 1-hour NO_2 and CO impacts for the 50% operating load and the sync-idle load cases are lower than the maximum operating case (i.e., commissioning impacts) previously modeled for this project. Therefore, there is no need to perform any further NO_2 and/or CO 1-hour modeling for the 50% load and/or sync-idle cases.

c. Maximum acute toxic impacts, from shoreline fumigation

Response: Included in Attachment 6 are the maximum acute toxic impact results based on fumigation and shoreline fumigation for normal operation, startups/shutdowns, and commissioning. As shown by these results, the maximum acute impacts are below the SDAPCD significant threshold. The detailed modeling files are included in the enclosed compact disc.

Request 8: The following additional data for the proposed fire-pump engine and emergency engine:

a. Proposed model year and EPA family for each proposed engine with certified emission rates for each family

Response: The emergency fire-pump and generator engine vendor specification sheets were include in the ATC application package, Appendix 5.1B, Tables 5.1B-9 and 5.1B-10, respectively. As shown on Table 5.1B-9, the emergency fire-pump engine specifications were for a 2013 model year engine, EPA engine family DJDXL09.0114. While not shown on the vendor specification sheet provided for the emergency generator engine, this engine is also a 2013 model year engine, EPA engine family EXCPXL15.2HZA. With regards to certified emission rates for each EPA engine family, the most current EPA certified emission rates for the make/model emergency engines proposed for the Amended CECP are summarized in Attachment 7. While 2013 engine model year emission factors were used in the ATC application package, the EPA certified emission factors shown in Attachment 7 are for 2014 model year engines. It should be noted that depending on the time required for the District and CEC to approve this application, 2014 model engines may no longer available when the project is approved. In that event, the applicant will use comparable newer model engines, and will notify the District and CEC appropriately.

b. Information, including any relevant local, state, or federal laws, ordinances and regulations or other operational limitations, that [provides] support for the assumption of 50% load during engine testing along with use of 100% load emission factors for calculating potential to emit.

Response: The emergency fire-pump/generator engine emission estimates provided in the ATC application package were associated with the periodic operation of these engines for routine testing/maintenance purposes. During these routine tests, the engines will be operated at low load (50% load or less). Therefore, the emission calculations in the ATC application package assume that the engines would be operated at 50% load for one hour per day periodically during the year. The annual emission calculations in the ATC application package assumed that the engines are operated at 50% load for 200 hours of operation per year (the maximum allowed for emergency engines under the CARB ATCM, NSPS Subpart IIII, Rule 69.4, and Rule 69.4.1). These emission calculations were done using the 100% load emission factors provided on the vendor specification sheets.

It is our understanding that the District would like these calculations revised using the emission factors based on EPA certification test results. It is also our understanding that the District would like the annual emission estimates for both a 50 operating hour case (maximum allowed for testing/maintenance under CARB ATCM/NSPS Subpart IIII for emergency engines) and a 200 operating hour case (maximum allowed for all modes of operation including emergency operation under CARB ATCM, NSPS Subpart IIII, Rule 69.4, and Rule 69.4.1 for emergency engines). The revised daily and annual emission estimates are provided in Attachment 8.

c. Breakdown of the 200 operating hours per year per engine based on whether the operation is defined as emergency or non-emergency use under each applicable rule including District rules 69.4 and 69.4.1, the ATCM for Stationary Diesel Compression Ignition Engines (17 CCR 93115), and NSPS subpart IIII, and whether the required amount of non-emergency operation will classify either engine as non-emergency under each respective rule

Response: The 200 operating hours per year per engine analyzed in the ATC permit application package are the total operating hours per engine for all modes of operation including testing/maintenance and emergency operation. The non-emergency engine operation will be limited to 50 hours per year per engine. The limits of 50 hours/200 hours per year are allowed under CARB ATCM, NSPS Subpart IIII, and District rules 69.4 and 69.4.1 for emergency engines.

d. Rule analyses for the State Air Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines (17 CCR 93115)

Response: As discussed above, the proposed fire-pump and generator engines qualify as emergency engines under the CARB ATCM. Outlined below is a summary of the applicable requirements under the CARB ATCM and compliance with respect to each requirement.

- Emission standard for new generator engine (§ 93115.6.a.3.A.1.b) - …certified to new nonroad CI engine emission standards for 2007 and later model year engines as specified under CFR Part 60, Subpart IIII**.** [*Response*: As discussed above, the proposed engine will be certified to current 2014 model year EPA Tier 4i nonroad CI engine requirements. This complies with the applicable CFR Part 60, Subpart IIII requirements for emergency engines.]

- Emission standard for new firepump engine (§ 93115.6.a.4.A.1.b) - …meet the new firepump engine certification requirements/emission standards required by CFR Part 60, Subpart IIII, §60.4202(d). [*Response*: As discussed above, the proposed engine will be certified to EPA Tier 3 nonroad CI engine requirements. This complies with the applicable CFR Part 60, Subpart IIII, §60.4202(d) requirements.]

- Operating limit for new generator engine (§ 93115.6.a.3.A.1.c) - …not operate more than 50 hours per year for maintenance and testing purposes. [*Response*: As discussed above, the engine will not be operated for more than 50 hours per year for testing/maintenance purposes.]

- Operating limit for new firepump engine (§ 93115.6.a.4.A.1.c) – …not operate more than the number of hours necessary to comply with the testing requirements of the National Fire Protection Association (NFPA) 25 – "Standard for the Inspection, Testing,

and Maintenance of Water-Based Fire Protection Systems." [*Response*: The NFPA 25 regulations (Section 8.3.2) require a weekly test of the firepump engine operation. The proposed firepump engine testing of 50 hours per year used in the ATC application package does not exceed this requirement.]

e. If the potential to emit for NOx, VOC, SOx, or PM_{10} during non-emergency operation, including maintenance and testing exceeds 10 lb/day for either engine, a BACT analysis must be submitted for that engine, including analysis of alternative technologies such as natural gas fired engines.

Response: As shown in the ATC application package, Appendix 5.1B, Table 5.1B-13 and in the revised emission estimates in Attachment 8, the daily emissions for engine testing are below 10 lbs/day for each engine for each pollutant.

Request 9: Comparison of thermal efficiencies for similar available simple cycle combustion turbine engines to justify the claim that the proposed simple cycle combustion turbines have the highest thermal efficiency of all available turbines. The comparison should include both maximum thermal efficiency, and thermal efficiency at expected typical operating conditions.

Response: The summary of the heat rates for the similar available simple cycle combustion turbines are shown in Attachment 9. As shown by this summary, the heat rate for the LMS 100 units proposed for the Amended CECP is at the lower end of these heat rates. This supports the claim that the proposed units have the highest thermal efficiency of the available simple cycle machines.

If you have any questions or need any additional information, please do not hesitate to contact me at 916-273-5139.

Sincerely,

Tom Andrews
Principal Engineer

Attachments

ATTACHMENT 1

GE GAS TURBINE PERFORMANCE RUNS

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN
Predicted Intercooler Performance not to be utilized for Balance of Plant design. Please contact GE.

GE Power & Water

Performance By: **Kessler, Daniel**
Project Info: **NRG Carlsbad - Avg. Ambient Load Sweep R0**

Engine: **LMS100 PA**
Deck Info: **G0179E - 8k1.scp**
Generator: **BDAX 82-445ER 60Hz, 13.8kV, 0.9PF (EffCurve#: 35404; CapCurve#: 35407)**
Fuel: **Site Gas Fuel#900-4103, 20598 Btu/lb,LHV**

Date: **2/1/2014**
Time: **3:44:53 PM**
Version: **3.9.8**

Case #	**106**	
Ambient Conditions		
Dry Bulb, °F	60.3	
Wet Bulb, °F	56.4	
RH, %	79.1	
Altitude, ft	20.9	
Ambient Pressure, psia	14.685	
Engine Inlet		
Comp Inlet Temp, °F	60.3	
RH, %	79.1	
Conditioning	NONE	
Tons(Chilling) or kBtu/hr(Heating)	0	
Pressure Losses		
Inlet Loss, inH20	3.40	
Exhaust Loss, inH20	5.90	
Partload %	**50**	
kW, Gen Terms	**54420**	
Est. Btu/kW-hr, LHV	**9436**	
Guar. Btu/kW-hr, LHV	**–**	
Fuel Flow		
MMBtu/hr, LHV	513.5	
lb/hr	24930	
Fuel Flow (Margined)		
MMBtu/hr, LHV	526.3	
MMBtu/hr, HHV	583.5	
lb/hr	25553	
NOx Control	**Water**	
Water Injection		
lb/hr	10705	
Temperature, °F	100.0	
Intercooler	**Dry Fin Fan**	
Humidification	OFF	
IC Heat Extraction, btu/s	16182	
KOD Water Extraction, lb/s	0.0	
Exhaust Parameters		
Temperature, °F	900.0	
lb/sec	348.3	
lb/hr	1253895	1
Energy, Btu/s- Ref 0 °R	112187	
Cp, Btu/lb-R	0.2723	

Estimated Maximum Emissions (at GT Exhaust) *	
NOx ppmvd Ref 15% O2	25
NOx as NO2, lb/hr	53
CO ppmvd Ref 15% O2	113
CO, lb/hr	147
VOC, ppmvd Ref 15% O2	2.0
VOC, lb/hr	1.49
PM-10, lb/hr	3.5

** Gas Fuel Sulfur contents of </+ 0.25 grains/ 100 scf*

Estimated Maximum Emissions (at Stack) *	
NOx ppmvd Ref 15% O2	2.5
NOx as NO2, lb/hr	5.3
CO ppmvd Ref 15% O2	4.0
CO, lb/hr	5.2
VOC, ppmvd Ref 15% O2	2.0
VOC, lb/hr	1.5
NH3, ppmvd Ref 15% O2	5.0
NH3, lb/hr	4.0
PM-10, lb/hr	3.5

** Gas Fuel Sulfur contents of </+ 0.25 grains/ 100 scf*

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN
Predicted Intercooler Performance not to be utilized for Balance of Plant design. Please contact GE.

GE Power & Water

Performance By: **Kessler, Daniel**
Project Info: **NRG Carlsbad - Avg. Ambient Load Sweep R0**

Engine: **LMS100 PA**
Deck Info: **G0179E - 8k1.scp**
Generator: **BDAX 82-445ER 60Hz, 13.8kV, 0.9PF (EffCurve#: 35404; CapCurve#: 35407)**
Fuel: **Site Gas Fuel#900-4103, 20598 Btu/lb,LHV**

Date: **2/1/2014**
Time: **3:44:53 PM**
Version: **3.9.8**

Case #	**106**
Exh Wght % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS) (GT Exhaust)	
AR	1.2405
N2	72.7586
O2	14.7063
CO2	5.3556
H20	5.9346
SO2	0.0000
CO	0.0015
HC	0.0001
NOX	0.0028
Exh Mole % Dry (NOT FOR USE IN ENVIRONMENTAL PERMITS) (GT Exhaust)	
AR	0.9675
N2	80.9174
O2	14.3190
CO2	3.7914
H20	0.0000
SO2	0.0000
CO	0.0016
HC	0.0003
NOX	0.0028
Exh Mole % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS) (GT Exhaust)	
AR	0.8774
N2	73.3857
O2	12.9862
CO2	3.4385
H20	9.3080
SO2	0.0000
CO	0.0015
HC	0.0002
NOX	0.0025

Aero Energy Fuel Number	**900-4103 (Steve Rose Sample 59F)**	
	Volume %	**Weight %**
Hydrogen	0.0000	0.0000
Methane	95.8700	91.1296
Ethane	1.8080	3.2212
Ethylene	0.0000	0.0000
Propane	0.3360	0.8779
Propylene	0.0000	0.0000
Butane	0.1220	0.4201
Butylene	0.0000	0.0000
Butadiene	0.0000	0.0000
Pentane	0.0430	0.1838
Cyclopentane	0.0000	0.0000
Hexane	0.0260	0.1328
Heptane	0.0000	0.0000
Carbon Monoxide	0.0000	0.0000
Carbon Dioxide	1.1130	2.9025
Nitrogen	0.6820	1.1321
Water Vapor	0.0000	0.0000
Oxygen	0.0000	0.0000
Hydrogen Sulfide	0.0000	0.0000
Ammonia	0.0000	0.0000
Btu/lb, LHV	20598	
Btu/scf, LHV	918.4	
Btu/scf, HHV	1018.2	
Btu/lb, HHV	22836	
Fuel Temp, °F	59.0	
NOx Scalar	0.978	
Specific Gravity	0.58	
Wobbe	52.834	

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN
Predicted Intercooler Performance not to be utilized for Balance of Plant design. Please contact GE.

GE Power & Water

Performance By: **Vu, Christopher**
Project Info: **NRG Carlsbad - Avg. Ambient Load Sweep R0**

Engine: **LMS100 PA**
Deck Info: **G0179E - 8k1.scp**
Generator: **BDAX 82-445ER 60Hz, 13.8kV, 0.9PF (EffCurve#: 35404; CapCurve#: 35407)**
Fuel: **Site Gas Fuel#900-4103, 20598 Btu/lb,LHV**

Date: **2/6/2014**
Time: **3:44:53 PM**
Version: **3.9.8**

Case #	**305**
Ambient Conditions	
Dry Bulb, °F	44.5
Wet Bulb, °F	42.6
RH, %	86.1
Altitude, ft	20.9
Ambient Pressure, psia	14.685
Engine Inlet	
Comp Inlet Temp, °F	44.5
RH, %	86.1
Conditioning	NONE
Tons(Chilling) or kBtu/hr(Heating)	0
Pressure Losses	
Inlet Loss, inH20	5.00
Exhaust Loss, inH20	10.00
Partload %	**50**
kW, Gen Terms	**53835**
Est. Btu/kW-hr, LHV	**9504**
Guar. Btu/kW-hr, LHV	**–**
Fuel Flow	
MMBtu/hr, LHV	511.6
lb/hr	24840

Fuel Flow (Margined)	
MMBtu/hr, LHV	524.4
MMBtu/hr, HHV	581.4
lb/hr	25461

NOx Control	**Water**
Water Injection	
lb/hr	11423
Temperature, °F	100.0
	Dry Fin
Intercooler	**Fan**
Humidification	OFF
IC Heat Extraction, btu/s	14391
KOD Water Extraction, lb/s	0.0
Exhaust Parameters	
Temperature, °F	800.5
lb/sec	348.9
lb/hr	1256096
Energy, Btu/s- Ref 0 °R	112149
Cp, Btu/lb-R	0.2716

Estimated Maximum Emissions (at GT Exhaust) *	
NOx ppmvd Ref 15% O2	25
NOx as NO2, lb/hr	53
CO ppmvd Ref 15% O2	113
CO, lb/hr	146
VOC, ppmvd Ref 15% O2	2.0
VOC, lb/hr	1.48
PM-10, lb/hr	3.5

** Gas Fuel Sulfur contents of </+ 0.25 grains/ 100 scf*

Estimated Maximum Emissions (at Stack) *	
NOx ppmvd Ref 15% O2	2.5
NOx as NO2, lb/hr	5.3
CO ppmvd Ref 15% O2	4.0
CO, lb/hr	5.2
VOC, ppmvd Ref 15% O2	2.0
VOC, lb/hr	1.5
NH3, ppmvd Ref 15% O2	5.0
NH3, lb/hr	3.9
PM-10, lb/hr	3.5

** Gas Fuel Sulfur contents of </+ 0.25 grains/ 100 scf*

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN
Predicted Intercooler Performance not to be utilized for Balance of Plant design. Please contact GE.

GE Power & Water

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Fuel: **Site Gas Fuel#900-4103, 20598 Btu/lb,LHV**

Date: **2/6/2014**
Time: **3:44:53 PM**
Version: **3.9.8**

Case #	**305**
Exh Wght % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS) (GT Exhaust)	
AR	1.2442
N2	72.9754
O2	14.8133
CO2	5.3274
H20	5.6353
SO2	0.0000
CO	0.0014
HC	0.0001
NOX	0.0028

Exh Mole % Dry (NOT FOR USE IN ENVIRONMENTAL PERMITS) (GT Exhaust)	
AR	0.9672
N2	80.8931
O2	14.3760
CO2	3.7591
H20	0.0000
SO2	0.0000
CO	0.0016
HC	0.0003
NOX	0.0028

Exh Mole % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS) (GT Exhaust)	
AR	0.8815
N2	73.7310
O2	13.1032
CO2	3.4263
H20	8.8538
SO2	0.0000
CO	0.0014
HC	0.0002
NOX	0.0025

Aero Energy Fuel Number	**900-4103 (Steve Rose Sample 59F)**	
	Volume %	**Weight %**
Hydrogen	0.0000	0.0000
Methane	95.8700	91.1296
Ethane	1.8080	3.2212
Ethylene	0.0000	0.0000
Propane	0.3360	0.8779
Propylene	0.0000	0.0000
Butane	0.1220	0.4201
Butylene	0.0000	0.0000
Butadiene	0.0000	0.0000
Pentane	0.0430	0.1838
Cyclopentane	0.0000	0.0000
Hexane	0.0260	0.1328
Heptane	0.0000	0.0000
Carbon Monoxide	0.0000	0.0000
Carbon Dioxide	1.1130	2.9025
Nitrogen	0.6820	1.1321
Water Vapor	0.0000	0.0000
Oxygen	0.0000	0.0000
Hydrogen Sulfide	0.0000	0.0000
Ammonia	0.0000	0.0000
Btu/lb, LHV	20598	
Btu/scf, LHV	918.4	
Btu/scf, HHV	1018.2	
Btu/lb, HHV	22836	
Fuel Temp, °F	59.0	
NOx Scalar	0.978	
Specific Gravity	0.58	
Wobbe	52.834	

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN
Predicted Intercooler Performance not to be utilized for Balance of Plant design. Please contact GE.

GE Power & Water

Performance By: **Vu, Christopher**
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Fuel: **Site Gas Fuel#900-4103, 20598 Btu/lb,LHV**

Date: **2/6/2014**
Time: **3:44:53 PM**
Version: **3.9.8**

Case #	**406**
Ambient Conditions	
Dry Bulb, °F	96.0
Wet Bulb, °F	74.1
RH, %	36.0
Altitude, ft	20.9
Ambient Pressure, psia	14.685
Engine Inlet	
Comp Inlet Temp, °F	96.0
RH, %	36.0
Conditioning	NONE
Tons(Chilling) or kBtu/hr(Heating)	0
Pressure Losses	
Inlet Loss, inH20	5.00
Exhaust Loss, inH20	10.00
Partload %	**50**
kW, Gen Terms	**47186**
Est. Btu/kW-hr, LHV	**10019**
Guar. Btu/kW-hr, LHV	**–**
Fuel Flow	
MMBtu/hr, LHV	472.8
lb/hr	22952

Fuel Flow (Margined)	
MMBtu/hr, LHV	484.6
MMBtu/hr, HHV	537.2
lb/hr	23525

NOx Control	**Water**
Water Injection	
lb/hr	9652
Temperature, °F	100.0
	Dry Fin
Intercooler	**Fan**
Humidification	OFF
IC Heat Extraction, btu/s	15425
KOD Water Extraction, lb/s	0.0
Exhaust Parameters	
Temperature, °F	870.1
lb/sec	310.9
lb/hr	1119168
Energy, Btu/s- Ref 0 °R	106581
Cp, Btu/lb-R	0.2763

Estimated Maximum Emissions (at GT Exhaust) *	
NOx ppmvd Ref 15% O2	25
NOx as NO2, lb/hr	49
CO ppmvd Ref 15% O2	113
CO, lb/hr	135
VOC, ppmvd Ref 15% O2	2.0
VOC, lb/hr	1.37
PM-10, lb/hr	3.5

** Gas Fuel Sulfur contents of </+ 0.25 grains/ 100 scf*

Estimated Maximum Emissions (at Stack) *	
NOx ppmvd Ref 15% O2	2.5
NOx as NO2, lb/hr	4.9
CO ppmvd Ref 15% O2	4.0
CO, lb/hr	4.8
VOC, ppmvd Ref 15% O2	2.0
VOC, lb/hr	1.4
NH3, ppmvd Ref 15% O2	5.0
NH3, lb/hr	3.6
PM-10, lb/hr	3.5

** Gas Fuel Sulfur contents of </+ 0.25 grains/ 100 scf*

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN
Predicted Intercooler Performance not to be utilized for Balance of Plant design. Please contact GE.

GE Power & Water

Performance By: **Vu, Christopher**
Project Info: **NRG Carlsbad - Avg. Ambient Load Sweep R0**

Engine: **LMS100 PA**
Deck Info: **G0179E - 8k1.scp**
Generator: **BDAX 82-445ER 60Hz, 13.8kV, 0.9PF (EffCurve#: 35404; CapCurve#: 35407)**
Fuel: **Site Gas Fuel#900-4103, 20598 Btu/lb,LHV**

Date: **2/6/2014**
Time: **3:44:53 PM**
Version: **3.9.8**

Case #	**406**
Exh Wght % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS) (GT Exhaust)	
AR	1.2344
N2	72.3983
O2	14.3576
CO2	5.5219
H20	6.4831
SO2	0.0000
CO	0.0017
HC	0.0001
NOX	0.0029

Exh Mole % Dry (NOT FOR USE IN ENVIRONMENTAL PERMITS) (GT Exhaust)	
AR	0.9687
N2	81.0247
O2	14.0677
CO2	3.9338
H20	0.0000
SO2	0.0000
CO	0.0019
HC	0.0003
NOX	0.0029

Exh Mole % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS) (GT Exhaust)	
AR	0.8705
N2	72.8098
O2	12.6414
CO2	3.5350
H20	10.1387
SO2	0.0000
CO	0.0017
HC	0.0003
NOX	0.0026

Aero Energy Fuel Number	**900-4103 (Steve Rose Sample 59F)**	
	Volume %	**Weight %**
Hydrogen	0.0000	0.0000
Methane	95.8700	91.1296
Ethane	1.8080	3.2212
Ethylene	0.0000	0.0000
Propane	0.3360	0.8779
Propylene	0.0000	0.0000
Butane	0.1220	0.4201
Butylene	0.0000	0.0000
Butadiene	0.0000	0.0000
Pentane	0.0430	0.1838
Cyclopentane	0.0000	0.0000
Hexane	0.0260	0.1328
Heptane	0.0000	0.0000
Carbon Monoxide	0.0000	0.0000
Carbon Dioxide	1.1130	2.9025
Nitrogen	0.6820	1.1321
Water Vapor	0.0000	0.0000
Oxygen	0.0000	0.0000
Hydrogen Sulfide	0.0000	0.0000
Ammonia	0.0000	0.0000

Btu/lb, LHV	20598
Btu/scf, LHV	918.4
Btu/scf, HHV	1018.2
Btu/lb, HHV	22836
Fuel Temp, °F	59.0
NOx Scalar	0.978
Specific Gravity	0.58
Wobbe	52.834

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN
Predicted Intercooler Performance not to be utilized for Balance of Plant design. Please contact GE.

GE Power & Water

Performance By: **Vu, Christopher**
Project Info: **NRG Carlsbad - Avg. Ambient Load Sweep R0**

Engine: **LMS100 PA**
Deck Info: **G0179E - 8k1.scp**
Generator: **BDAX 82-445ER 60Hz, 13.8kV, 0.9PF (EffCurve#: 35404; CapCurve#: 35407)**
Fuel: **Site Gas Fuel#900-4103, 20598 Btu/lb,LHV**

Date: **2/6/2014**
Time: **3:44:53 PM**
Version: **3.9.8**

Case #	**311**
Ambient Conditions	
Dry Bulb, °F	44.5
Wet Bulb, °F	42.6
RH, %	86.1
Altitude, ft	20.9
Ambient Pressure, psia	14.685
Engine Inlet	
Comp Inlet Temp, °F	44.5
RH, %	86.1
Conditioning	NONE
Tons(Chilling) or kBtu/hr(Heating)	0
Pressure Losses	
Inlet Loss, inH20	5.00
Exhaust Loss, inH20	10.00
Partload %	**0**
kW, Gen Terms	**--**
Est. Btu/kW-hr, LHV	**--**
Guar. Btu/kW-hr, LHV	**--**
Fuel Flow	
MMBtu/hr, LHV	112.8
lb/hr	5474
Fuel Flow (Margined)	
MMBtu/hr, LHV	115.6
MMBtu/hr, HHV	128.1
lb/hr	5611
NOx Control	**Water**
Water Injection	
lb/hr	0
Temperature, °F	100.0
	Dry Fin
Intercooler	**Fan**
Humidification	OFF
IC Heat Extraction, btu/s	939
KOD Water Extraction, lb/s	0.0
Exhaust Parameters	
Temperature, °F	982.3
lb/sec	111.9
lb/hr	402777
Energy, Btu/s- Ref 0 °R	40782
Cp, Btu/lb-R	0.2721

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN
Predicted Intercooler Performance not to be utilized for Balance of Plant design. Please contact GE.

GE Power & Water

Performance By: **Vu, Christopher**
Project Info: **NRG Carlsbad - Avg. Ambient Load Sweep R0**

Engine: **LMS100 PA**
Deck Info: **G0179E - 8k1.scp**
Generator: **BDAX 82-445ER 60Hz, 13.8kV, 0.9PF (EffCurve#: 35404; CapCurve#: 35407)**
Fuel: **Site Gas Fuel#900-4103, 20598 Btu/lb,LHV**

Date: **2/6/2014**
Time: **3:44:53 PM**
Version: **3.9.8**

Case #	**311**
Exh Wght % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS) (GT Exhaust)	
AR	1.2639
N2	74.1224
O2	17.5561
CO2	3.6541
H20	3.3996
SO2	0.0000
CO	0.0017
HC	0.0001
NOX	0.0020
Exh Mole % Dry (NOT FOR USE IN ENVIRONMENTAL PERMITS) (GT Exhaust)	
AR	0.9560
N2	79.9520
O2	16.5790
CO2	2.5090
H20	0.0000
SO2	0.0000
CO	0.0019
HC	0.0002
NOX	0.0019
Exh Mole % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS) (GT Exhaust)	
AR	0.9044
N2	75.6388
O2	15.6846
CO2	2.3736
H20	5.3947
SO2	0.0000
CO	0.0018
HC	0.0002
NOX	0.0018

Aero Energy Fuel Number	**900-4103 (Steve Rose Sample 59F)**	
	Volume %	**Weight %**
Hydrogen	0.0000	0.0000
Methane	95.8700	91.1296
Ethane	1.8080	3.2212
Ethylene	0.0000	0.0000
Propane	0.3360	0.8779
Propylene	0.0000	0.0000
Butane	0.1220	0.4201
Butylene	0.0000	0.0000
Butadiene	0.0000	0.0000
Pentane	0.0430	0.1838
Cyclopentane	0.0000	0.0000
Hexane	0.0260	0.1328
Heptane	0.0000	0.0000
Carbon Monoxide	0.0000	0.0000
Carbon Dioxide	1.1130	2.9025
Nitrogen	0.6820	1.1321
Water Vapor	0.0000	0.0000
Oxygen	0.0000	0.0000
Hydrogen Sulfide	0.0000	0.0000
Ammonia	0.0000	0.0000
Btu/lb, LHV	20598	
Btu/scf, LHV	918.4	
Btu/scf, HHV	1018.2	
Btu/lb, HHV	22836	
Fuel Temp, °F	59.0	
NOx Scalar	0.978	
Specific Gravity	0.58	
Wobbe	52.834	

ATTACHMENT 2

RECLAIMED WATER AND SEE WATER PROCESS DESCRIPTIONS

Reclaimed Water and Sea Water Process Descriptions – Amended CECP

Reclaimed Water Process Description: Reclaimed water exits the process water storage tank and is pumped through a set of ultra-filtration (UF) modules for suspended solids and sediments removal. The effluent is then treated with an anti-scalant and biocide reagent prior to entering the cartridge filters (CF) for additional solids removal. Upon exiting the cartridge filters the water is pumped through the first pass reverse osmosis (RO) membranes. The permeate from the first pass RO is then either sent to the mix tank for mixing with raw water for use in the evaporative coolers or pumped through the second pass RO membranes. Second pass RO permeate then passes through mixed bed polishing vessels to further reduce minerals, and is then stored in the 250,000 gallon demineralized water storage tank. The second pass RO reject water is recycled by reinjecting upstream of the first pass RO. The polishing vessels are taken off-site for regeneration.

Sea Water Process Description: Sea water exits the water storage tank and is pumped through a set of multi-media filters (MMF) for solids removal. The effluent is then treated with an anti-scalant and biocide reagent prior to entering the cartridge filters (CF) for additional solids removal. Upon exiting the cartridge filters the water is pumped through the first pass reverse osmosis (RO) membranes. Because of the higher salinity of the sea water, a two-stage RO system is utilized. The permeate from the first pass RO is stored in a 40,000 gallon service water tank, where it is stored for use in the combustion turbine evaporative cooler or it is pumped through the second pass RO membranes. Second pass RO permeate then passes through mixed bed polishing vessels to further reduce minerals, and is then stored in the 250,000 gallon demineralized water storage tank. The second pass RO reject water is recycled by reinjecting upstream of the first pass RO. The polishing vessels are taken off-site for regeneration.

Key Parameters Indicating System Function: Some of the values used to determine system function are pressure differential across filters (ultra-filtration, multi-media and cartridge) as well as RO membranes. These values will be used in conjunction with manufacturer recommendations to replace or flush filters as necessary. Adequate biocide injection is confirmed by sampling for biological growth. An anti-scalant is injected prior to the RO membranes to help prevent the precipitation of salts on the membranes. Conductivity measurements between RO stages and before and after polishing will indicate system performance, as well as regeneration intervals on the mixed bed polishing units. Additional measurements will include suction and discharge pressures for all pumps, as well as variable frequency drive (VFD) function for each motor controlled by VFD.

ATTACHMENT 3

WATER ANALYSIS

TABLE 3A

Reclaimed Water (Note 1)

		Reverse Osmosis Treatment		Mixed Bed Ion-Exchange Treatment			
Constituents / Concentrations	Expected concentrations in the input reclaimed water (avg)	Design Basis of Single Stage RO Removal Efficiency (%)	Expected concentrations of the inlet species in the Reverse Osmosis product water (avg)	Design Basis of Polishing Demin Removal Efficiency (%)	Expected concentrations of the inlet species in the polishing demineralizer product water (avg)	Regulatory limits of the inlet concentrations for the reclaimed water supply	Vendor specifications for the concentrations of contaminants in the combustion turbine injection water (Note 3)
Total Dissolved Solids (mg/l) (salinity)	996 (monthly avg of 12/13 thru 1/14)	>98	<20	>99	0.08	1100 (12-mo. Avg.)	
Specific Cond. (µmhos/cm)	1860 (sample date 4/15-16, 2014)	>98	<38	>99	<1.0	Not Specified	TDS - 5 mg/L, max
Arsenic (µg/L)	4 (Est)	>98	<0.8	>99	< Method Detection Limit	Not Specified	TSS - 5 mg/L, max
Cadmium (µg/L)	<5	>98	<0.1	>99	< Method Detection Limit	Not Specified	Conductivity - µS/cm at 25 degC - <1.0
Hexavalent chromium	Not provided	N/A	N/A	>99	< Method Detection Limit	Not Specified	Sod + Potassium, ppm, max - 0.2
Chromium, total (µg/L)	<5	>98	<0.01	>99	< Method Detection Limit	Not Specified	Silica (SiO2), mg/L, max - 0.5
Copper (µg/L)	<3 (Est)	>98	<0.06	>99	< Method Detection Limit	Not Specified	Sulfates, mg/L, max - 0.5
Manganese (µg/L)	80	>98	<1.6	>99	< Method Detection Limit	Not Specified	
Mercury (µg/L)	<0.2	>98	<0.2	>99	< Method Detection Limit	Not Specified	
Selenium (µg/L)	<5	>98	<0.01	>99	< Method Detection Limit	Not Specified	
Nickel (µg/L)	<3 (Est)	>98	<0.06	>99	< Method Detection Limit	Not Specified	
Lead (µg/L)	<5	>98	<0.01	>99	< Method Detection Limit	Not Specified	
Sulfates (mg/L)	221	>98	<5.0	>99	< Method Detection Limit	350 (12-mo. Avg.)	
Fluorides (mg/L)	0.81	>98	<0.02	>99	< Method Detection Limit	Not Specified	
pH (SU)	6.5 to 8.4 (avg. 7.6)	N/A	5.4	N/A	5.4	6.5 - 8.5	
Note: Sample Analysis provided by Carlsbad Recycling Facility dated July 2-3, 2013							

Notes (Table 3A):

Note 1: Source: Carlsbad Water Recycling Facility, WQ Data Base

Note 3: Source: Requirements for Water and Steam Purity for Injection in Aero Derivative Gas Turbines, General Electric Doc # MID-TD-0000-3, June 2010

TABLE 3B							
Sea Water (Note 2)							
Constituents / Concentrations (avg)	Expected concentrations in the input seawater (avg)	Design Basis of Two Stage RO Removal Efficiency (%)	Expected concentrations of the inlet species in the reverse osmosis product water (avg)	Design Basis of Polishing Demin Removal Efficiency (%)	Expected concentrations of the inlet species in the polishing demineralizer product water (avg)	Regulatory limits of the inlet concentrations for the seawater supply	Vendor specifications for the concentrations of contaminants in the combustion turbine injection water (Note 3)
Total dissolved solids (mg/l)	33,500	>98	<670	>99	0.08	Not Applicable	TDS - 5 mg/L, max TSS - 5 mg/L, max Conductivity - µS/cm at 25 degC - <1.0 Sod + Potassium, ppm, max - 0.2 Silica (SiO2), mg/L, max - 0.5 Sulfates, mg/L, max - 0.5
Specific Cond (µmhos/cm)	50,033	>98	<1000	>99	<1.0		
Arsenic (µg/L)	1.3	>98	<0.03	>99	< Method Detection Limit		
Cadmium (µg/L)	0.021	>98	<MDL	>99	< Method Detection Limit		
Hexavalent chromium	Not Provided	N/A	N/A	>99	< Method Detection Limit		
Chromium, total (µg/L)	0.5	>98	<0.01	>99	< Method Detection Limit		
Copper (µg/L)	0.38	>98	<0.008	>99	< Method Detection Limit		
Manganese (µg/L)	6.28	>98	<0.13	>99	< Method Detection Limit		
Mercury (µg/L)	0.079	>98	<0.002	>99	< Method Detection Limit		
Selenium (µg/L)	<MDL	>98	<MDL	>99	< Method Detection Limit		
Nickel (µg/L)	0.26	>98	By AvanTech	>99	< Method Detection Limit		
Lead (µg/L)	0.071	>98	<0.0014	>99	< Method Detection Limit		
Sulfates (mg/L)	2572	>98	<133	>99	< Method Detection Limit		
Fluorides (Mg/L)	2.1	>98	<0.4	>99	< Method Detection Limit		
pH (SU)	7.6	N/A	5.4	N/A	5.4		

Notes (Table 3B):

Note 2: Source: Poseidon Resources Corp., Draft Scope Book for EPC of Carlsbad Seawater Dessalination Project, Appendix A, January 2006

Note 3: Source: Requirements for Water and Steam Purity for Injection in Aero Derivative Gas Turbines, General Electric Doc # MID-TD-0000-3, June 2010

ATTACHMENT 4

REVISED SCREENING LEVEL AIR QUALITY MODELING INPUTS/OUTPUTS

Table 3.1E-2 (Revised 6/24/14)
CECP Amendment
Screening Modeling Inputs
(per Gas Turbine)

Case	Amb Temp deg F	Stack height feet	Stack Height meters	Stack Diam feet	Stack Diam meters	Stack flow wacfm	Stack flow m3/sec	Stack Vel ft/sec	Stack Vel m/sec	Stack Temp deg F	Stack Temp deg K
Cold 100% Load	44.5	90.0	27.43	13.5	4.11	1,012,885	478.09	117.94	35.95	763.7	679.65
Cold 25% Load	44.5	90.0	27.43	13.5	4.11	524,635	247.63	61.09	18.62	856.7	731.32
Hot 100% Load w/Evap.	96.0	90.0	27.43	13.5	4.11	985,287	465.07	114.72	34.97	813.1	707.09
Hot 100% load w/o Evap.	96.0	90.0	27.43	13.5	4.11	948,559	447.73	110.45	33.66	821.1	711.54
Hot 25% Load	96.0	90.0	27.43	13.5	4.11	499,004	235.53	58.10	17.71	920.2	766.59
Avg. 100% Load w/Evap.	60.3	90.0	27.43	13.5	4.11	1,023,515	483.11	119.18	36.32	779.1	688.21
Avg. 100% Load w/o Evap.	60.3	90.0	27.43	13.5	4.11	1,022,475	482.62	119.05	36.29	781.7	689.65
Avg. 25% Load	60.3	90.0	27.43	13.5	4.11	523,114	246.91	60.91	18.57	854.2	729.93
Commissioning		90.0	27.43	13.5	4.11	523,114	246.91	60.91	18.57	854.2	729.93
Startup/Shutdown/Startup		90.0	27.43	13.5	4.11	523,114	246.91	60.91	18.57	854.2	729.93
Cold 50% Load	44.5	90.0	27.43	13.5	4.11	692,949	327.08	80.69	24.59	800.5	700.09
Hot 50% Load	96.0	90.0	27.43	13.5	4.11	647,396	305.58	75.38	22.98	870.1	738.76
Avg. 50% Load	60.3	90.0	27.43	13.5	4.11	689,606	325.50	80.30	24.47	800.0	699.82
Sync-Idle Load		90.0	27.43	13.5	4.11	256,837	121.23	29.91	9.12	982.3	801.09
	NOx lb/hr	**CO lb/hr**	**PM10 lb/hr**	**SOx lb/hr**		**NOx g/sec**	**CO g/sec**	**PM10 g/sec**	**SOx g/sec**		
Cold 100% Load	8.90	8.60	3.50	2.04		1.121	1.084	0.441	0.257		
Cold 25% Load	3.40	3.40	3.50	0.79		0.428	0.428	0.441	0.100		
Hot 100% Load w/Evap.	8.30	8.10	3.50	1.91		1.046	1.021	0.441	0.241		
Hot 100% load w/o Evap.	8.10	7.80	3.50	1.85		1.021	0.983	0.441	0.234		
Hot 25% Load	3.20	3.10	3.50	0.74		0.403	0.391	0.441	0.093		
Avg. 100% Load w/Evap.	9.00	8.70	3.50	2.07		1.134	1.096	0.441	0.260		
Avg. 100% Load w/o Evap.	9.00	8.80	3.50	2.07		1.134	1.109	0.441	0.261		
Avg. 25% Load	3.50	3.40	3.50	0.79		0.441	0.428	0.441	0.100		
Commissioning	90.00	247.7	3.5	2.07		11.340	31.206	0.441	0.261		
Startup/Shutdown/Startup	28.24	17.3	3.5	2.07		3.558	2.181	0.441	0.261		
Cold 50% Load	5.30	5.2	3.5	1.22		0.668	0.655	0.441	0.154		
Hot 50% Load	4.90	4.8	3.5	1.13		0.617	0.605	0.441	0.142		
Avg. 50% Load	5.30	5.2	3.5	0.41		0.668	0.655	0.441	0.052		
Sync-Idle Load	47.08	114.6	3.5	0.27		5.933	14.438	0.441	0.034		

Table 3.1E-3 (Revised 6/24/14)
CECP Amendment
Screening Level Modeling Impacts
(Combined Impacts for Six Gas Turbines)

Operating Mode	Conc. (ug/m3) NO2 1-hr	Conc. (ug/m3) SO2 1-hr	Conc. (ug/m3) CO 1-hr	Conc. (ug/m3) SO2 3-hr	Conc. (ug/m3) CO 8-hr	Conc. (ug/m3) SO2 24-hr	Conc. (ug/m3) PM10 24-hr	Conc. (ug/m3) NO2 Annual	Conc. (ug/m3) SO2 Annual	Conc. (ug/m3) PM10 Annual
Cold 100% Load	20.512	4.701	19.821	2.990	7.116	0.595	1.021	0.215	0.049	0.084
Cold 25% Load	11.794	2.754	11.794	1.526	3.927	0.324	1.430	0.110	0.026	0.113
Hot 100% Load w/Evap.	19.106	4.398	18.645	2.798	6.694	0.557	1.020	0.200	0.046	0.084
Hot 100% load w/o Evap.	19.037	4.358	18.332	2.759	6.574	0.551	1.039	0.199	0.046	0.086
Hot 25% Load	11.281	2.609	10.928	1.443	3.629	0.306	1.449	0.104	0.024	0.114
Avg. 100% Load w/Evap.	20.462	4.699	19.780	2.999	7.109	0.596	1.009	0.215	0.049	0.084
Avg. 100% Load w/o Evap.	20.453	4.706	19.999	3.003	7.188	0.597	1.009	0.215	0.049	0.084
Avg. 25% Load	12.184	2.764	11.836	1.531	3.939	0.325	1.434	0.113	0.026	0.113
Commissioning	313.296	7.208	862.144	3.993	286.896	0.848	1.434			
Startup/Shutdown/Startup	98.291	7.208	60.264	3.993	20.054	0.848	1.434			
Cold 50% Load	15.223	3.515	14.935	2.077	4.902	0.409	1.168			
Hot 50% Load	14.381	3.319	14.088	1.937	4.622	0.388	1.202			
Avg. 50% Load	15.279	1.180	14.991	0.696	4.920	0.137	1.174			
Sync-Idle Load	250.687	1.436	610.079	0.885	217.020	0.178	2.309			

ATTACHMENT 5

REVISED REFINED COMMISSIONING AIR QUALITY MODELING RESULTS

TABLE 5.1-32 (Revised 6/24/14)

Modeled Maximum Proposed Project Impacts (Commissioning Period)

Pollutant	Averaging Time	Maximum Project Impact[d] (µg/m³)	Background (µg/m³)	Total Impact (µg/m³)	State Standard (µg/m³)	Federal Standard (µg/m³)
NO_2	1-hour	176.9	152.4	329	339	—
	98th percentile	137.6	105.3[a]	152	—	188
SO_2	1-hour	7.6	34.1	42	655	—
	99th percentile	7.6	35.8[c]	43	—	196
	24-hour	1.0	7.9	9	105	—
CO	1-hour	868.9	5,040	5,909	23,000	40,000
	8-hour	297.6	4,238	4,536	10,000	10,000
PM_{10}	24-hour	~~2.0~~ 2.8	43	~~45~~ 46	50	150
$PM_{2.5}$	24-hour	~~2.0~~ 2.8	26[b]	~~28~~ 29	—	35

[a]1-hour NO_2 background concentration is shown as the 98th percentile as that is the basis of the federal standard.
[b]24-hr $PM_{2.5}$ background concentration reflects 3-year average of the 98th percentile values based on form of standard.
[c]1-hr SO_2 background concentration reflects 3-year average of the 99th percentile values based on form of standard.
[d]Includes impacts from existing EPS units.

ATTACHMENT 6

REVISED ACUTE IMPACT MODELING RESULTS

TABLE 5.9-4 (Revised 6/24/14)
Summary of Potential Health Risks

Receptor	Carcinogenic Risk [a] (per million)	Cancer Burden	Acute Health Hazard Index	Chronic Health Hazard Index
New Equipment Normal Operation (gas turbines/emergency engines)				
Maximally Exposed Individual (MEI) at PMI	2.9		2.7×10^{-2}	1.5×10^{-3}
MEI at PMI Shoreline Fumigation	N/A		4.4×10^{-2}	N/A
MEI at PMI Fumigation	N/A		1.4×10^{-2}	N/A
Maximally Exposed Individual Resident (MEIR)	7.8×10^{-2}	0	1.6×10^{-2}	4.7×10^{-4}
Maximally Exposed Individual Worker [b] (MEIW)	4.5×10^{-1}		2.7×10^{-2}	—
Gas Turbine Startups/Shutdowns				
MEI (acute impact only)	N/A	N/A	9.0×10^{-2}	N/A
MEI (acute impact only) Shoreline Fumigation	N/A	N/A	1.6×10^{-1}	N/A
MEI (acute impact only) Fumigation	N/A	N/A	2.1×10^{-2}	N/A
Gas Turbine Commissioning Period (includes impacts for existing Encina units)				
MEI (acute impact only)	N/A	N/A	7.8×10^{-2}	N/A
MEI (acute impact only) Shoreline Fumigation	N/A	N/A	1.4×10^{-1}	N/A
MEI (acute impact only) Fumigation	N/A	N/A	1.9×10^{-2}	N/A
Gas Turbine Long-Term Commissioning Case				
MEI (cancer risk/chronic impacts only)	7.4×10^{-3}	0	n/a	9.0×10^{-5}
Significance Level	10	1.0	1.0	1.0

[a] Based on High Point Method which results in the maximum cancer risk.

[b] The worker is assumed to be exposed at the work location 8 hours per day, instead of 24, 245 days per year, instead of 365, and for 40 years, instead of 70.

ATTACHMENT 7

REVISED HOURLY EMISSION CALCULATIONS FOR EMERGENCY ENGINES

Table 5.1B-7 (Revised 6/24/14)
CECP Amendment
Emergency Firepump Engine

Rating (bhp) =	327				
Fuel =	Diesel				
Fuel Consumption (gal/hr) =	14.8				
Exhaust Temperature (F) =	842				
Exhaust Diameter (inches) =	6				
Exhaust Flow Rate (acfm) =	1,867				
Exhaust Velocity (ft/sec) =	158				
	NOx	**CO**	**VOC**	**PM10**	**SOx**
Emission Factor (g/bhp-hr) =	2.83	0.67	0.07	0.10	0.00
Hourly Emissions (lbs/hr)(1) =	1.02E+00	2.42E-01	2.69E-02	3.49E-02	1.77E-03

Notes:
(1) Assumes testing at 50% load.

Table 5.1B-8 (Revised 6/24/14)
CECP Amendment
Emergency Generator Engine

Rating (bhp) =	779				
Fuel =	Diesel				
Fuel Consumption (gal/hr) =	35.9				
Exhaust Temperature (F) =	1263				
Exhaust Diameter (inches) =	5.5				
Exhaust Flow Rate (acfm) =	3,185				
Exhaust Velocity (ft/sec) =	322				
	NOx	**CO**	**VOC**	**PM10**	**SOx**
Emission Factor (g/bhp-hr) =	2.24	0.67	0.07	0.05	0.00
Hourly Emissions (lbs/hr)(1) =	1.92E+00	5.76E-01	6.40E-02	4.48E-02	4.21E-03

Notes:
(1) Assumes testing at 50% load.

Rating Specific Emissions Data - John Deere Power Systems

Nameplate Rating Information

Clarke Model	JW6H-UFADF0
Power Rating (BHP / kW)	327 / 244
Certified Speed (RPM)	1760

Rating Data

Rating	6090HFC47A
Certified Power (kW)	315
Rated Speed	1760
Vehicle Model Number	Clarke Fire Pump

Units	g/kW-hr	g/hp-hr
NOx	3.5	2.6
HC	0.1	0.1
NOx + HC	3.7	2.7
Pm	0.14	0.11
CO	0.9	0.7

Certificate Data

Engine Model Year	2014
EPA Family Name	EJDXL09.0114
EPA JD Name	450HAB
EPA Certificate Number	EJDXL09.0114-013
CARB Executive Order	Not Applicable
Parent of Family	6090HFG84A

Units	g/kW-hr
NOx	3.8
HC	0.1
NOx + HC	3.9
Pm	0.13
CO	0.9

* The emission data listed is measured from a laboratory test engine according to the test procedures of 40 CFR 89 or 40 CFR 1039, as applicable. The test engine is intended to represent nominal production hardware, and we do not guarantee that every production engine will have identical test results. The family parent data represents multiple ratings and this data may have been collected at a different engine speed and load. Emission results may vary due to engine manufacturing tolerances, engine operating conditions, fuels used, or other conditions beyond our control.

ENGINE_FAMILY	MANUFACTURER	CERTIFICATE_NUMBER	ISSUE_DATE	COMMERCE_INTRODUCTION_DATE	APPLICABLE_TIER	Steady State NMHC	Steady State NOX	Steady State NMHC+NOX	Steady State CO	Steady State PM	ENGINE_MODEL
ECPXL15.2HZA	CATERPILLAR (CPX)	ECPXL15.2HZA-015	30-SEP-2013	01-DEC-2013	I = Interim Tier 4	0.10	3.00		0.9	0.07	C15

ATTACHMENT 8

REVISED DAILY AND ANNUAL EMISSION LEVELS FOR EMERGENCY ENGINES

Table 5.1B-13 (Revised 6/24/14)
CECP Amendment
Daily Emissions

Daily Emission Rates, lbs/day (Commissioning Period)													
	Operating	Hourly Emission Rate (lbs/hr)						Daily Emissions (lbs/day)					
	Hours	NOx	CO	VOC	PM10	SOx	NH3	NOx	CO	VOC	PM10	SOx	NH3
GT Normal Operation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GT Startups	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GT Shutdowns	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GT Commissioning	various	various	various	various	various	various	various	1,080.0	2,971.0	181.0	84.0	49.7	160.8
Single GT Total =								**1,080.0**	**2,971.0**	**181.0**	**84.0**	**49.7**	**160.8**
Six GT Total =								**6,480.0**	**17,826.0**	**1,086.0**	**504.0**	**298.2**	**964.8**
Emergency Firepump Engine	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Emergency Generator Engine	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Natural Gas Compressors	24									0.3			
Total New Equipment =								**6,480.0**	**17,826.0**	**1,086.3**	**504.0**	**298.2**	**964.8**
Total Emergency Engines =								**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Daily Emission Rates, lbs/day (Non-Commissioning Period)													
	Operating	Hourly Emission Rate (lbs/hr)						Daily Emissions (lbs/day)					
	Hours	NOx	CO	VOC	PM10	SOx(1)	NH3(1)	NOx	CO	VOC	PM10	SOx	NH3
GT Normal Operation	16	9.00	8.80	2.50	3.50	2.07	6.70	144.0	140.8	40.0	56.0	33.1	107.2
GT Startups	4	19.95	12.53	3.46	3.50	2.07	6.70	79.8	50.1	13.8	14.0	8.3	26.8
GT Shutdowns	4	7.65	10.29	4.36	3.50	2.07	6.70	30.6	41.2	17.4	14.0	8.3	26.8
Single GT Total =								**254.4**	**232.1**	**71.3**	**84.0**	**49.7**	**160.8**
Six GT Total =								**1,526.4**	**1,392.6**	**427.6**	**504.0**	**298.2**	**964.8**
Emergency Firepump Engine	1	1.02	0.24	0.03	0.03	0.00		1.0	0.2	0.0	0.0	0.0	
Emergency Generator Engine	1	1.92	0.58	0.06	0.04	0.00		1.9	0.6	0.1	0.0	0.0	
Natural Gas Compressors	24									0.3			
Total New Equipment =								**1,529.3**	**1,393.5**	**428.0**	**504.1**	**298.2**	**964.8**
Total Emergency Engines =								**2.9**	**0.8**	**0.1**	**0.1**	**0.0**	

Notes:

(1) Set startup/shutdown hourly emission rate to 100% load normal emission level to determine worst case daily emissions for AQ modeling purposes.

Table 5.1B-15 (Revised 6/24/14)
CECP Amendment
Annual Emissions - Non-Commissioning Year

	Hours per Year	NOx (lbs/hr)	CO (lbs/hr)	VOC (lbs/hr)	PM10 (lbs/hr)	SOx(1) (lbs/hr)	NH3(1) (lbs/hr)	NOx (lbs/year)	CO (lbs/year)	VOC (lbs/year)	PM10 (lbs/year)	SOx (lbs/year)	NH3 (lbs/year)
Single GT Start-Up	400	19.95	12.53	3.46	3.50	0.69	2.60	7,980	5,013	1,383	1,400	276	1,040
Single GT Normal Operation	1,900	9.00	8.80	2.50	3.50	0.69	6.70	17,100	16,720	4,750	6,650	1,311	12,730
Single GT Shutdown	400	7.65	10.29	4.36	3.50	0.69	2.60	3,060	4,117	1,743	1,400	276	1,040
Single GT Total =	**2,700**							**28,140**	**25,851**	**7,877**	**9,450**	**1,864**	**14,810**
Six GT Total =								**168,840**	**155,104**	**47,260**	**56,700**	**11,181**	**88,860**
Emergency Firepump Engine	200	1.02	0.24	0.03	0.03	0.00		204	48	5	7	0	
Emergency Generator Engine	200	1.92	0.58	0.06	0.04	0.00		384	115	13	9	1	
Natural Gas Compressors										103			
Total New Equipment Annual Emissions (lb/year) =								**169,428**	**155,268**	**47,381**	**56,716**	**11,182**	**88,860**
Total New Equipment Annual Emissions (tons/year) =								**84.7**	**77.6**	**23.7**	**28.4**	**5.6**	**44.4**
Total Gas Turbines Annual Emissions (tons/year) =								**84.4**	**77.6**	**23.6**	**28.4**	**5.6**	**44.4**
Total Emergency Engines Annual Emissions (tons/year) =								**0.3**	**0.1**	**0.0**	**0.0**	**0.0**	
Total Gas Compressors Annual Emissions (tons/year) =										**0.1**			

Notes:

(1) Set hourly startup/shutdown emission rate to 100% load normal emission level to determine worst case annual emissions for AQ modeling purposes.

Table 5.1B-15 (Revised 6/24/14)
CECP Amendment
Annual Emissions - Non-Commissioning Year

	Hours per Year	NOx (lbs/hr)	CO (lbs/hr)	VOC (lbs/hr)	PM10 (lbs/hr)	SOx(1) (lbs/hr)	NH3(1) (lbs/hr)	NOx (lbs/year)	CO (lbs/year)	VOC (lbs/year)	PM10 (lbs/year)	SOx (lbs/year)	NH3 (lbs/year)
Single GT Start-Up	400	19.95	12.53	3.46	3.50	0.69	2.60	7,980	5,013	1,383	1,400	276	1,040
Single GT Normal Operation	1,900	9.00	8.80	2.50	3.50	0.69	6.70	17,100	16,720	4,750	6,650	1,311	12,730
Single GT Shutdown	400	7.65	10.29	4.36	3.50	0.69	2.60	3,060	4,117	1,743	1,400	276	1,040
Single GT Total =	**2,700**							**28,140**	**25,851**	**7,877**	**9,450**	**1,864**	**14,810**
Six GT Total =								**168,840**	**155,104**	**47,260**	**56,700**	**11,181**	**88,860**
Emergency Firepump Engine	50	1.02	0.24	0.03	0.03	0.00		51	12	1	2	0	
Emergency Generator Engine	50	1.92	0.58	0.06	0.04	0.00		96	29	3	2	0	
Natural Gas Compressors										103			
Total New Equipment Annual Emissions (lb/year) =								**168,987**	**155,145**	**47,367**	**56,704**	**11,181**	**88,860**
Total New Equipment Annual Emissions (tons/year) =								**84.5**	**77.6**	**23.7**	**28.4**	**5.6**	**44.4**
Total Gas Turbines Annual Emissions (tons/year) =								**84.4**	**77.6**	**23.6**	**28.4**	**5.6**	**44.4**
Total Emergency Engines Annual Emissions (tons/year) =								**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	
Total Gas Compressors Annual Emissions (tons/year) =								**0.1**					

Notes:

(1) Set hourly startup/shutdown emission rate to 100% load normal emission level to determine worst case annual emissions for AQ modeling purposes.

ATTACHMENT 9

SUMMARY OF HEAT RATES FOR SIMPLE-CYCLE GAS TURBINES

Summary of Heat Rates for Simple Cycle Gas Turbines - Amended CECP

Project	Turbine Make/Model	Heat Rate (HHV)	Reference	Document Link
Sentinel Energy Project	Eight GE LMS 100 simple cycle units	8,876Btu/kWh	Sentinel Energy Project, Amendment to Permit to Construct/Permit to Operate, GE performance runs, Case 100, guaranteed heat rate, October 30, 2009.	http://docketpublic.energy.ca.gov/PublicDocuments/Regulatory/Non%20Active%20AFC's/07-AFC-3%20Sentinel/2009/October/TN%2054001%2010-30-09%20Applicant's%20Air%20Permit%20Application%20Amendment%20to%20SCAQMD.pdf
TID Almond 2 Power Plant	Three GE LM6000 simple cycle units	9,835 Btu/kWh	TID Almond 2 CEC staff assessment, page 4.1-65, April 2010, CEC Document CEC-700-2010-011-REV	http://www.energy.ca.gov/2010publications/CEC-700-2010-011/CEC-700-2010-011.PDF
Walnut Creek Energy Project	Five GE LMS 100 simple cycle units	9,000 Btu/kWh	Walnut Creek Energy Park, Application for Certification Section 8.01, 11/2005	http://www.energy.ca.gov/sitingcases/walnutcreek/documents/applicant/afc/Section%208.01%20Air%20Quality.pdf
Amended CECP	Six GE LMS 100 simple cycle units	8,770 Btu/kWh	Amended CECP PTA, Air Quality Appendix 5.1B, April 2014, operating case 100	