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DOCKET	
11-AFC-1	
DATE	AUG 22 2011
RECD.	AUG 22 2011

August 22, 2011

VIA EMAIL

Mr. Eric Solorio, Siting Project Manager
California Energy Commission
1516 Ninth Street
Sacramento, California 95814

Re: Pio Pico Energy Center Project (11-AFC-01)
Correspondence with San Diego Air Quality Management District Related to Air Quality

Dear Mr. Solorio:

On behalf of Applicant Pio Pico Energy Center LLC, please find enclosed for docketing correspondence between the San Diego Air Quality Management District and Applicant's air quality technical consultants. Such correspondence is submitted for inclusion in the evidentiary record for this proceeding.

Please do not hesitate to contact me directly if you have any questions regarding this submittal.

Respectfully submitted,

Melissa A. Foster

MAF:kjh
Enclosures
cc: See Proof of Service List

70852436.1 0042399-00001

Steve Hill

From: Steve Hill
Sent: Monday, June 06, 2011 5:45 PM
To: 'Desiena, Ralph'
Cc: Moore, Steve; Reeve, Bill
Subject: RE: Meteorological Data Filling Procedures

Ralph:

I already have a description of how ozone data substitution was performed.

Can you describe the NO2 data substitution procedure? Was it identical to the ozone data procedure? Or did we simply use the highest same-hour data point from the month, and not bother with data substitution?

FYI, here is what I have on ozone:

<u>For missing ozone concentration data:</u>

1) Fill any single missing hour with the maximum of the:
   a. Preceding hour
   b. Succeeding hour
   c. Same hour of day on previous day
   d. Same hour of day on succeeding day

If there is missing data for either c and/or d, use only the maximum of the available data to fill the missing hour (both a and b are guaranteed to be present since only single missing hours are filled in this step). Note that the most likely scenario for both c and d to be missing is for years when the monitor is calibrated at the same hour each day. In this case, the 30-day rolling average (see step 2) for that hour will also not be available.

2) For hours that are not filled by step 1 (all periods with more than one hour missing), fill the missing hour with the maximum for that hour of day for a 30-day rolling period centered on the hour (ie., for the 15 preceding days and the 15 succeeding days). Note that 30-day rolling period will extend into the preceding and succeeding year at the start or end, respectively, of the modeling period.

3) For hours not filled by step 2, fill the missing data with the maximum of the 30-day rolling period for the preceding or succeeding hour.

4) Any hours not filled by steps 1–3, are likely periods with more than a month of missing data for all hours. These will be filled on a case-by-case basis.

From: Desiena, Ralph [mailto:Ralph.Desiena@sdcounty.ca.gov]
Sent: Wednesday, June 01, 2011 2:09 PM
To: Steve Hill
Cc: Moore, Steve; Desiena, Ralph; Reeve, Bill
Subject: Meteorological Data Filling Procedures

Steve,

The 2008 AERMET data was reprocessed when it was discovered that the NWS TD-3505 data set supplied to the District by NCDC was incomplete, terminating on 11/23/08.

After acquiring a complete file for 2008 from NCDC we re-processed the data, forwarded to you and requested that year be re-modeled.

Our procedure for filling Onsite Surface Data files(Otay Mesa Monitoring Site) is to interpolate data gaps up to 4 hours. Our filling procedure follows EPA guidance presented in the memo, " Procedures for Substituting Values for Missing NWS Meteorological Data for Use in Regulatory Air Quality Models", written by Dennis Atkinson and Russell Lee in 1992.

Larger gaps in the Onsite data files are filled with NWS data (Brown Field Airport) when merged with the TD-3505 data.

Onsite data is greater than 98% complete for Otay Mesa for the years 2004, 2006, 2007 and 2008.

Onsite data is greater than 90 % complete for 2005, which meters EPA requirements for modeling.

Please let me know if further information is required for your CEC response.

Regards,

Ralph

Ralph DeSiena
Air Pollution Meteorologist
San Diego County Air Pollution Control
10124 Old Grove Rd.
San Diego, CA 92131
858-586-2772 fax 858-586-2759
www.sdapcd.org

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tel 212-564-3796 fax 212.564.4802 www.eif.com

June 29, 2011

Steven Moore
Senior Air Pollution Control Engineer
San Diego Air Pollution Control District
10124 Old Grove Road
San Diego, CA 92131-1649

Subject: Proposed Pio Pico Energy Center Project
SDAPCD Rule 20.3(e)(1) Statewide Compliance Certification

Dear Dr. Moore:

This is the compliance certification for the Pio Pico Energy Center project (PPEC) as required by SDAPCD Rule 20.3(e)(1). Pio Pico Energy Center, LLC is the applicant for this project. Pio Pico Energy Center, LLC does not own or operate any other major stationary sources in California. A fund managed by EIF Management, LLC (EIF) indirectly owns PPEC. Other funds managed by EIF also indirectly own, control, and/or operate two Major Source facilities in California, namely, Burney Forest Power, and Panoche Energy Center.

Certification

Any and all facilities owned or operated by Pio Pico Energy Center, LLC, or by the funds managed by EIF Management, LLC in the State of California are in compliance or are on a schedule for compliance with all applicable emission limitations and standards under the federal Clean Air Act.

If you have any questions or need additional information, please contact David Jenkins at (317) 431-1004.

Respectfully,

Keith E. Derman,
Sr. Vice President

Energy Investors Funds
One Penn Plaza, Suite 4200
250 West 34th Street
New York, NY 10119

cc: Gary Chandler, PPEC
David Jenkins, PPEC
Maggie Fitzgerald, URS
Melissa Foster, Stoel Rives
Steve Hill, Sierra Research

Gary Rubenstein

From: Steve Hill
Sent: Wednesday, July 20, 2011 3:19 PM
To: Nguyen, Camqui
Cc: Moore, Steve; Gary Rubenstein; McKinsey, John A.
Subject: RE: Pio Pico Energy Center

From the AFC:

3.5.4.2 Performance Data and Plant Efficiency

Each CTG will generate approximately 100MW under most ambient conditions. The PPEC plant will be limited to a maximum capacity factor of 46 percent, which is equivalent to 4,000 hours per year for each CTG.

The full-load performance of each CTG on a typical day (70 degrees °F and 57 percent relative humidity) is as follows:

□ Power Output 102.4.7MW at the generator terminals

□ Fuel Flow 808 million British thermal units per hour (MMBtu/hr) low heating value (LHV), or 39,203 pounds per hour (lb/hr)

□ Heat Rate 7,894 British thermal units per kilowatt hour (Btu/kWh) LHV

Auxiliary power loads for CTG auxiliaries and for the balance of plant equipment will reduce the net electrical power output transmitted from the generator terminals to the transmission grid. The project operating characteristics during season (i.e., Winter, Spring/Fall, and Summer) and peak periods are provided on the heat and mass balance diagrams presented on Figures 3.5-2A through 3.5-2D, and key characteristics are summarized in Table 3.5-2, Seasonal Heat and Mass Balances. Annual operating characteristics (per CTG and total plant) are presented in Table 3.5-3, Design Condition Annual Operating Characteristics.

TABLE 3.5-2
SEASONAL HEAT AND MASS BALANCES

	Winter	Spring/Fall	Summer	Peak
Conditions				
Ambient Dry Bulb, °F	59	70	80	93
Relative Humidity, %	60	57	38	22
Performance				
CTG Output (each), MW	104.3	102.4	101.0	99.3
Heat Rate, Btu/kWh, LHV	7,856	7,894	7,926	7,964
Fuel Flow, MMBtu/hr, LHV	819	808	800	791
NO_x Water Injection, lb/hr	26,358	25,255	24,910	24,472
CT Exhaust Flow, klb/hr	1,708	1,685	1,669	1,650

°F = degrees Fahrenheit
klb/hr = kilo pound per hour
lb/hr= pound per hour
LHV= lower heating value
MW = megawatts

TABLE 3.5-3
DESIGN CONDITION ANNUAL OPERATING CHARACTERISTICS

	Winter (per CTG)	Spring Fall (per CTG)	Summer (per CTG)	Peak (per CTG)	Total Annual (Per CTG)	Total Annual Plant (3 CTGs)
Operating Hours	1,100	1,600	1,000	300	4,000	4,000
Fuel Consumption[1], MMBtu, LHV	900,900	1,292,800	800,000	237,300	3,231,000	9,693,000
Net Electrical Energy Produced[1], MWhr	114,730	163,840	101,000	29,790	409,360	1,228,080

MMBtu = One million Btu
MWhr = Megawatt-hour
LHV = lower heating value
[1] Assumes 500 startups and shutdowns per year.

From the response to CEC's Data Requests, filed last week:

DATA REQUEST 14

COMMENT: Please provide the heat rate information for the proposed combustion turbines (in AFC Facility Description, Figure 3.5-2A to 3.5-2D) in terms of higher heating value, to better facilitate comparisons with other power plant data used by staff in determining greenhouse gas impacts.

RESPONSE: Please see the table below.

	Heat Rates, MMBTU/Hr			
	One Turbine		Three Turbines	
Figure	LHV	HHV	LHV	HHV
3.5-2A	808	896	2424	2687
3.5-2B	800	887	2400	2661
3.5-2C	791	877	2373	2631
3.5-2C	819	908	2457	2724

Basis: Fuel HHV:LLV ratio of 1.109

From: Nguyen, Camqui [mailto:Camqui.Nguyen@sdcounty.ca.gov]
Sent: Wednesday, July 20, 2011 3:02 PM
To: Steve Hill
Cc: Moore, Steve
Subject: RE: Pio Pico Energy Center

Steve,

Could you provide the thermal efficiency of this turbine? Thanks,

Camqui Nguyen
San Diego APCD
(858) 586-2747

From: Steve Hill [mailto:SHill@sierraresearch.com]
Sent: Wednesday, July 13, 2011 12:08 PM
To: Nguyen, Camqui
Cc: Moore, Steve
Subject: RE: Pio Pico Energy Center

1. Section 5.2.4-4 of the AFC indicates that the annual operational emissions from each of the three CTGs were estimated based on 4,000 hours per year of normal operation plus emissions from 500 startups and 500 shutdowns events for each CTG. However, Table G-3.3 of Appendix G indicates 3335 hours/year on baseload operation, instead of 4,000 hours/year.

RESPONSE: The proposed operating scenario involves 4,333 hours of operation per year. This is 4,000 hours of baseload operation plus 500 startup/shutdown events (which total 333 operating hours) per turbine. Startup and shutdown each takes much less than one hour. Table G-3.3 shows 3,333 hours of baseload operation, 500 1-hour startup periods (comprising 30 minutes of startup plus 30 minutes of baseload), and 500 1-hour shutdown periods (comprising 49 minutes of baseload operation and 11 minutes of shutdown) for a total of 4,333 operating hours.

2. Table 5.2-19 of the AFC indicates that the VOC emission for shutdown is 3 lbs/event. However, Table G-3.5 of Appendix G indicates that the VOC shutdown emission is 4.67 lbs.

RESPONSE: Table 5.2-19 is correct. The VOC emissions for shutdown is 3 lb/event. Table G-3.5 is incorrect.

3. Could you explain the difference between short-term and long-term SO2 emissions?

RESPONSE: There are two differences: the sulfur content of the fuel, and the inclusion of non-operating hours in the annual average. The maximum fuel sulfur content, which is used for short-term emission calculations, is 0.75 grains/dscf fuel. The expected annual average content, used for long-term calculations, is 0.25 grains/dscf fuel. In calculating annual average emission rate, the hours of operation are multiplied by the lower emission rate to get annual emissions, then divided by the total hours in the year to get the emission rate.

From: Nguyen, Camqui [mailto:Camqui.Nguyen@sdcounty.ca.gov]
Sent: Wednesday, July 13, 2011 11:21 AM
To: Steve Hill
Cc: Moore, Steve
Subject: Pio Pico Energy Center

Good morning Steve,

I am assisting Steve Moore with evaluating the Pio Pico Energy Center project. I would like to verify with you the following information regarding the project emissions:

1. Section 5.2.4-4 of the AFC indicates that the annual operational emissions from each of the three CTGs were estimated based on 4,000 hours per year of normal operation plus emissions from 500 startups and 500 shutdowns events for each CTG. However, Table G-3.3 of Appendix G indicates 3335 hours/year on baseload operation, instead of 4,000 hours/year.
2. Table 5.2-19 of the AFC indicates that the VOC emission for shutdown is 3 lbs/event. However, Table G-3.5 of Appendix G indicates that the VOC shutdown emission is 4.67 lbs.
3. Could you explain the difference between short-term and long-term SO2 emissions?

I would appreciate your assistance with this. Please contact me if there is any question.

Sincerely,

Camqui Nguyen
Associate Air Pollution Control Engineer
San Diego Air Pollution Control District
(858) 586-2747
Fax (858) 586-2601

Gary Rubenstein

From: Steve Hill
Sent: Friday, July 22, 2011 2:37 PM
To: Nguyen, Camqui
Cc: Moore, Steve; Gary Rubenstein; McKinsey, John A.; David Jenkins (djenkins@apexpowergroup.com)
Subject: RE: Pio Pico Energy Center

Camqui:

For simple cycle units without heat recovery, compliance is demonstrated on a 4-hour rolling average basis (40 CFR 60.4350(f)(1)):

The ppm during startup and shutdown can be calculated as follows:

	Startup	Shutdown	Normal
Exhaust flow, DSCFM	236,320	236,320	236,320
Oxygen content, %	14.2	14.2	14.2
Exhaust flow, DSCFM @ 15% O2	267,829	267,829	267,829
NOx emissions, lb/event	22.54	6	4.92
event duration, hr	0.50	0.18	1
NOx emission rate, lb/hr	45.08	32.73	4.92
ppm	23.1	16.8	2.5

		Quarter hours/4 hour period			4 hour average
		S/U	S/D	Normal	NOx, ppm
0	startup/shutdown	0	0	16	2.5
1	startup/shutdown	2	1	13	6.0
2	startup/shutdown	4	2	10	9.5
3	startup/shutdown	6	3	7	12.9
4	startup/shutdown	8	4	4	16.4

From: Nguyen, Camqui [mailto:Camqui.Nguyen@sdcounty.ca.gov]
Sent: Friday, July 22, 2011 11:40 AM
To: Steve Hill
Cc: Moore, Steve; Gary Rubenstein; McKinsey, John A.
Subject: RE: Pio Pico Energy Center

Steve,

Could you provide the NOx emission concentration in ppm during startups and shutdowns? to calculate the average NOx emission concentration over 30 day period for NSPS. Thanks,

Steve Hill

From:	Steve Hill
Sent:	Tuesday, August 02, 2011 6:18 PM
To:	'Kehetian, Michael'
Cc:	Moore, Steve; Ralph DeSiena; Gary Rubenstein; David Jenkins (djenkins@apexpowergroup.com); Maggie_Fitzgerald@urscorp.com; McKinsey, John A.; Hellwig, Kimberly J.; Foster, Melissa A. (mafoster@stoel.com); Eric Walther
Subject:	RE: Pio Pico HRA Follow-Up Review

Here are the responses to your questions:

Question/Request 1.
ARBs Sub-Chronic Lead Exposure:
I had thought lead exposure was initially included in the HRA files, however, the 30-day modeling as would be specifically performed for the HRA portion appears to be missing.

RESPONSE: The maximum one-hour lead impact is 5.49E-07 ug/cu m (See Table 5.16-6 of the AFC). This value is 5 orders of magnitude lower than ARBs High Exposure Scenario Approval Level of 0.12 ug/m3. The 30-day average is necessarily even lower. Therefore the information in Table 5.16-6 demonstrates compliance with the ARB requirement.

. **Question 2.**
Emissions – Startup (factors are a VOC ratio of normal operations). The worst-case though is said to be using the VOC shutdown ratio factors? I understand the factors below are for startup and a ratio of normal operations. However, as reported, the worst-case hourly is said to be using the shutdown ratio factors.

RESPONSE: The table of emissions to which you refer is the maximum hourly emission rate of each pollutant for a single turbine. It was calculated by scaling the normal hourly emission rate for each pollutant by the ratio of VOC emissions during startup OR shutdown, whichever is higher, to VOC emissions during normal operations. As you point out, the VOC emissions during an hour including a shutdown are higher than the VOC emissions during an hour including a startup. The emissions in the table, which were used in the HRA, are for a shutdown.

Question 3.
The worst-case release parameters for normal operations are reported to be for Cold Low (as is the case and understood for startup/shutdown, commissioning, and 8-hour). However, the worst-case output release parameters for normal operations in the actual data files are for Cold Peak. I will report Cold Peak as the worst-case only for normal operations since this is the result in the modeling but just want to inform and/or clarify.
Release Parameters – Normal Operations (Worst-Case, Cold Peak)

Release Parameter	**Value**
Stack Height (ft)	100
Stack Diameter (ft)	14.5
Temperature deg F	754
Exhaust Velocity (fps)	91.81

RESPONSE: We confirm that the above release parameters are correct for all of the special cases (startup, shutdown, commissioning). These release parameters result in the highest unit impacts (i.e., highest ground level concentration for a given mass emission rate).

The Cold Low operating scenario does not result in the highest operating impact, however, because overall emissions are much lower during those conditions. Cold Peak operation results in maximum impacts for normal operations because of the increased total emissions.

Please do not hesitate to contact us if we can assist you in your review.

--Steve Hill

From: Kehetian, Michael [mailto:Michael.Kehetian@sdcounty.ca.gov]
Sent: Monday, August 01, 2011 2:33 PM
To: Steve Hill; Eric Walther
Cc: Moore, Steve; Ralph DeSiena
Subject: Pio Pico HRA Follow-Up Review

Steve and Eric,

I'm in the final stages of the review and have a few questions (one request) to complete and summarize in the preliminary report.

Question/Request 1.
ARBs Sub-Chronic Lead Exposure:
I had thought lead exposure was initially included in the HRA files, however, the 30-day modeling as would be specifically performed for the HRA portion appears to be missing.

Here is the simplest fast-track approach to show results are below the worst-case approval level.

Calculate the 30-day emissions rate using total annual lead emissions.
30-day emissions rate g/s = [(lead lbs/yr)*(454 g/lb)] / [(30 days/yr)*(24 hrs/day)*(3600 sec/hr)].

The above emissions rate may then be entered directly into the model (g/s) using the monthly averaging period and the result is ground level concentration (ug/m3).
If the result at the PMI is less than ARBs High Exposure Scenario Approval Level of 0.12 ug/m3 then there is no need to refine and proceed further.

Question 2.
Emissions – Startup (factors are a VOC ratio of normal operations). The worst-case though is said to be using the VOC shutdown ratio factors? I understand the factors below are for startup and a ratio of normal operations. However, as reported, the worst-case hourly is said to be using the shutdown ratio factors.

Toxic Air Contaminant	Emission Factor Controlled (lb/MMBtu)	Emissions (lb/hr)
ACETALDEHYDE	2.00E-05	5.10E-02
ACROLEIN	3.21E-06	8.18E-03
AMMONIA	6.87E-03	6.12E+00
BENZENE	5.99E-06	1.53E-02
BUTADIENE, 1,3-	2.15E-07	5.49E-04
ETHYL BENZENE	1.60E-05	4.08E-02
FORMALDEHYDE	4.50E-04	1.15E+00

HEXANE-N	1.27E-04	3.24E-01
NAPHTHALENE	6.53E-07	1.66E-03
PAHs		
ACENAPHTHENE	9.32E-09	2.38E-05
ACENAPTHYENE	7.21E-09	1.84E-05
ANTHRACENE	1.66E-08	4.23E-05
BENZO[a]ANTHRACENE	1.11E-08	2.83E-05
BENZO[a]PYRENE	6.82E-09	1.74E-05
BENZO[e]PYRENE	2.67E-10	6.80E-07
BENZO[b]FLUORANTHENE	5.54E-09	1.41E-05
BENZO[k]FLUORANTHENE	5.40E-09	1.38E-05
BENZO[g,h,i]PERYLENE	6.72E-09	1.71E-05
CHRYSENE	1.24E-08	3.15E-05
DIBENZ[a,h]ANTHRACENE	1.15E-08	2.94E-05
FLUORANTHENE	2.12E-08	5.40E-05
FLUORENE	2.85E-08	7.25E-05
INDENO(1,2,3-cd)PYRENE	1.15E-08	2.94E-05
PHENANTHRENE	1.54E-07	3.93E-04
PYRENE	1.36E-08	3.48E-05
PROPYLENE	3.78E-04	9.64E-01
PROPYLENE OXIDE	1.45E-05	3.70E-02
TOLUENE	6.53E-05	1.66E-01
XYLENES	3.20E-05	8.17E-02

Question 3.
The worst-case release parameters for normal operations are reported to be for Cold Low (as is the case and understood for startup/shutdown, commissioning, and 8-hour). However, the worst-case output release parameters for normal operations in the actual data files are for Cold Peak. I will report Cold Peak as the worst-case only for normal operations since this is the result in the modeling but just want to inform and/or clarify.

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Release Parameter	Value
Stack Height (ft)	100
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Temperature deg F	754
Exhaust Velocity (fps)	91.81

Please let me know if you need further assistance with the above.

Thanks again,
Michael Kehetian
858-586-2737

[redacted]

From: Steve Hill [SHill@sierraresearch.com]
Sent: Tuesday, August 16, 2011 1:32 PM
To: Foster, Melissa A.
Subject: FW: Meteorological Data Filling Procedures
Attachments: CECP AQIA Addendum & Appendices 1-hour Federal NO2 SO2 032911.pdf

Expires: Friday, June 04, 2021 12:00 AM

Email with the District

From: Moore, Steve [mailto:Steve.Moore@sdcounty.ca.gov]
Sent: Tuesday, June 07, 2011 1:16 PM
To: Steve Hill
Cc: Desiena, Ralph
Subject: RE: Meteorological Data Filling Procedures

Steve,

Here is the procedure used to fill the NO2 data for hour-by-hour analysis (it's in Appendix B). If you are filling the background with one of EPA's suggested conservative procedures (e.g., maximum monthly value for that hour-of-day), you still may need the filling procedure since there may be no data at all for the standard monitor calibration hour of day.

Thanks.

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

858-586-2750

Celebrating 50 years of air quality progress!

From: Steve Hill [mailto:SHill@sierraresearch.com]
Sent: Tuesday, June 07, 2011 9:42 AM
To: Desiena, Ralph
Cc: Moore, Steve; Reeve, Bill
Subject: RE: Meteorological Data Filling Procedures

Ralph:

I already have a description of how ozone data substitution was performed.

Can you describe the NO2 data substitution procedure? Was it identical to the ozone data procedure? Or did we simply use the highest same-hour data point from the month, and not bother with data substitution?

FYI, here is what I have on ozone:

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If there is missing data for either c and/or d, use only the maximum of the available data to fill the missing hour (both a and b are guaranteed to be present since only single missing hours are filled in this step). Note that the most likely scenario for both c and d to be missing is for years when the monitor is calibrated at the same hour each day. In this case, the 30-day rolling average (see step 2) for that hour will also not be available.

2) For hours that are not filled by step 1 (all periods with more than one hour missing), fill the missing hour with the maximum for that hour of day for a 30-day rolling period centered on the hour (ie., for the 15 preceding days and the 15 succeeding days). Note that 30-day rolling period will extend into the preceding and succeeding year at the start or end, respectively, of the modeling period.

3) For hours not filled by step 2, fill the missing data with the maximum of the 30-day rolling period for the preceding or succeeding hour.

4) Any hours not filled by steps 1–3, are likely periods with more than a month of missing data for all hours. These will be filled on a case-by-case basis.

From: Desiena, Ralph [mailto:Ralph.Desiena@sdcounty.ca.gov]
Sent: Wednesday, June 01, 2011 2:09 PM
To: Steve Hill
Cc: Moore, Steve; Desiena, Ralph; Reeve, Bill
Subject: Meteorological Data Filling Procedures

Steve,

The 2008 AERMET data was reprocessed when it was discovered that the NWS TD-3505 data set supplied to the District by NCDC was incomplete, terminating on 11/23/08.

After acquiring a complete file for 2008 from NCDC we re-processed the data, forwarded to you and requested that year be re-modeled.

Our procedure for filling Onsite Surface Data files(Otay Mesa Monitoring Site) is to interpolate data gaps up to 4 hours. Our filling procedure follows EPA guidance presented in the memo, " Procedures for Substituting Values for Missing NWS Meteorological Data for Use in Regulatory Air Quality Models", written by Dennis Atkinson and Russell Lee in 1992.

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Onsite data is greater than 90 % complete for 2005, which meters EPA requirements for modeling.

Please let me know if further information is required for your CEC response.

Regards,

Ralph

Ralph DeSiena
Air Pollution Meteorologist
San Diego County Air Pollution Control
10124 Old Grove Rd.
San Diego, CA 92131
858-586-2772 fax 858-586-2759
www.sdapcd.org

AIR QUALITY IMPACT ANALYSIS

REPORT

ADDENDUM 1

NEW FEDERAL NO_2 AND SO_2 STANDARDS

CARLSBAD ENERGY CENTER PROJECT
APPLICATION 985745

MARCH 29, 2011

Prepared For
Mechanical Engineering
San Diego Air Pollution Control District
10124 Old Grove Road
San Diego, California 92131

Prepared By
Ralph DeSiena

Monitoring and Technical Services
San Diego Air Pollution Control District
10124 Old Grove Road
San Diego, California 92131

1.0 INTRODUCTION

The San Diego Air Pollution Control District (SDAPCD or District) issued an Air Quality Impact Assessment (AQIA) review report on September 24, 2008 and a final revised review report on July 27, 2009, which is included in the District's Final Determination of Compliance (FDOC) for the Carlsbad Energy Center Project. This addendum discusses additional modeling and review performed by the SDAPCD to determine compliance with the recently implemented new federal Ambient Air Quality Standards (AAQSs)for nitrogen dioxide (NO_2) and sulfur dioxide (SO_2).

2.0 PROJECT DESCRIPTION

NRG Energy, Inc. is proposing to remove three of the five existing boilers at the Encina Power Station (Units 1, 2 and 3) and install two new Siemens Rapid Response SGT6-5000F Combined Cycle (R2C2) combustion turbine generators (CTGs) and an emergency engine powering a fire pump. The gas turbines will be equipped with steam power augmentation and evaporative cooling. Each gas turbine is followed by a heat recovery steam generator (HRSG) and condensing steam turbine generator. The two units will provide a total nominal generating capacity of 558 MW net.

3.0 AIR QUALITY IMPACT ANALYSIS

As discussed in the District's 2009 revised final review report, dispersion modeling was conducted for normal, startup/shutdown and commissioning period emissions of NO_2, CO, SO_2, and PM_{10} and $PM_{2.5}$. The applicant and their consultant (Sierra Research) worked closely with the District in developing modeling and analysis procedures in support of demonstrating compliance with all applicable NSR requirements. Modeling was performed in order to determine whether emissions during these time periods would impact the state and/or federal ambient air quality standards applicable at that time for all criteria pollutants.

Subsequent to the District's 2009 revised final report, EPA announced new federal 1-hour standards for SO_2 and NO_2. The new NO_2 standard is the 3-year average of the 98^{th} percentile daily maximum 1-hour concentrations and shall not exceed 100 ppbv, which is equivalent to 188 $\mu g/m^3$ at standard temperature and pressure (STP). The new SO2 standard is the 3-year average of the 99^{th} percentile daily maximum 1-hour concentrations and shall not exceed 75 ppbv, which is equivalent to 196 $\mu g/m^3$ at STP. For purposes of determining compliance based on an AQIA, these standards are applied on a receptor-specific basis including the background (i.e., 98^{th} or 99^{th} percentiles are calculated for each receptor individually and compliance is based on the highest value that occurs at any receptor).

Sierra Research of Sacramento, California, provided an AQIA on behalf of CECP to demonstrate compliance with the recently promulgated NO_2 standard. However, because of the issues involved in determining compliance with this newly promulgated standard and the evolution in the modeling methodologies used by the District and other agencies to address compliance determinations with respect to this standard, the District performed supplemental AQIA modeling to determine compliance with the new standard. The supplemental modeling was based on the receptor grid and meteorology used by Sierra

Research in their submittal, which had previously been approved by the District. The District also evaluated the same operating modes as Sierra Research except for certain changes as noted below. The District's conclusion regarding compliance with the federal 1-hour NO_2 standard is based on this supplemental modeling.

3.1 MODELING METHODOLOGIES

No additional modeling for determination of compliance with the new SO_2 standard was deemed necessary due to the fact that both predicted facility impacts and background SO_2 concentrations are very low and compliance could be determined from previous modeling results based on the worst-case project impact added to the maximum background (see Section 4.3 below).

The basic modeling methodology prior to post processing used for this determination of compliance with the new NO_2 standard was as described in Section 3.1 of the District's AQIA final review report. The same methodology was used here with the exception that updated AERMOD Version 09292 was used in place of Version 06341. In addition, the same stack parameters were used that were indentified in the final review report as providing the worst-case 1-hour project impacts for the various operating modes. However, additional modeling and a post processing procedure were required for determination of compliance with the new NO_2 1-hour standard. This additional modeling and post processing is further discussed in Section 4.0, Air Quality Impact Analysis Results.

NO_2 emissions for six operating modes were modeled to determine compliance with the new federal standard for NO_2. The operating modes are described in Table 3-1. Although the District based its determination of compliance on the modeled project impacts (i.e., the new equipment only), the impacts for the project and the remaining existing equipment after the project completion were included to inform the decisions of other regulatory agencies.

In place of the four phase startup that Sierra Research used, a constant emission rate of approximately 11.96 g/s for each turbine and the same release parameters for commissioning for each turbine for the entire hour (i.e., approximately, a release temperature of 447.6 K, a release velocity of 12.24 m/s, and an NO2 to NOx ratio of 0.4—see below) were used. The emission rate is based on the FDOC conditions for maximum allowed emissions during a startup and shutdown hour and is slightly higher than Sierra's average for the hour. Using the commissioning release parameters for the entire hour is also somewhat conservative in comparison to Sierra's release parameters. The modeling also included the emergency fire pump engine emissions in the modeling of startup and shutdown emission impacts even though it is relatively unlikely that the fire pump would be operated during a startup.

TABLE 3-1
SUPPLEMENTAL NO_2 MODELING SCENARIOS

Operation Mode	Equipment Included
Normal Operation , New Equipment Only	2 New Gas Turbines, Fire Pump
Normal Operations, New Equipment plus Existing Equipment	2 New Gas Turbines, Fire Pump, Boiler Units 4 and 5, and Peaking Turbine
Commissioning, New Equipment Only	2 New Gas Turbines
Commissioning, New Equipment plus Existing Equipment	2 New Gas Turbines, Boiler Units 4 and 5, and Peaking Turbine
Startup, New Equipment Only	2 New Gas Turbines, Fire Pump
Startup, New Equipment plus Existing Equipment	2 New Gas Turbines, Fire Pump, Boiler Units 4 and 5, and Peaking Turbine

The initial in-stack ratio of NO_2 to total NOx (NO_2/NOx) used in the analysis is given in Table 3-2 (see also Appendix C). This differs from the Sierra Research submittal which used 10% NO_2/NOx for the emergency fire pump engine and the peaking turbine since information on the NO2/NOx ratio for this equipment was not readily available at time of their submittal and the accepted default value at that time was 10%.

TABLE 3-2
SUPPLEMENTAL NO_2 MODELING ASSUMED IN-STACK NO_2 Ratio

Operation Mode	Equipment Included	NO_2/NOx, %
Normal Operation , New Equipment Only	2 New Gas Turbines Fire Pump Engine	25 16
Normal Operations, New Equipment plus Existing Equipment	2 New Gas Turbines Fire Pump Engine Boiler Units 4 and 5 Peaking Turbine	25 16 10 19
Commissioning, New Equipment Only	2 New Gas Turbines	40
Commissioning, New Equipment plus Existing Equipment	2 New Gas Turbines Boiler Units 4 and 5 Peaking Turbine	40 10 19
Startup and Shutdown, New Equipment Only	2 New Gas Turbines Fire Pump Engine	40 16
Startup and Shutdown, New Equipment plus Existing Equipment	2 New Gas Turbines Fire Pump Engine Boiler Units 4 and 5 Peaking Turbine	40 16 10 19

3.2 METEOROLOGICAL DATA USED FOR DISPERSION MODELING

Meteorological data used for modeling NO2 to determine compliance with the new federal 1-hour NO_2 standard was as described in Section 3.2 of the District's AQIA final review report.

4.0 AIR QUALITY IMPACT ANALYSIS RESULTS

4.1 FEDERAL 1-HOUR NO_2 AND SO_2 STANDARDS

In accordance with San Diego Air Pollution Control District New Source Review procedures and modeling methodologies, maximum predicted 1-hour concentrations associated with new equipment operations were determined for NO_2 and SO_2 during normal, startup/shutdown and commissioning operations. For NO_2, the Plume Volume Molar Ratio Method (PVMRM) method, which estimates conversion of the nitric oxide (NO) component of NOx to NO_2 by its reaction with ozone after exiting the stack, was selected as part of the modeling procedure to predict ground level NO_2 concentrations. As an initial screening procedure, the maximum predicted concentrations occurring during any of the operating conditions modeled were added to worst-case background concentrations for comparison to the new federal 1-hour NO_2 and SO_2.standards.

For NO_2, the worst-case background concentrations were determined from the review of 3 years (2004–2006) of monitoring data taken from the District's Camp Pendleton Monitoring Station. For SO_2, the San Diego monitoring station was used. These stations are deemed to be most representative of air quality in the facility area for NO_2 and SO_2, respectively. Table 4-1 summarizes the worst-case background concentrations.

TABLE 4-1
MAXIMUM BACKGROUND CONCENTRATIONS[a], PROJECT AREA,2004-2006
(μg/m^3)—REVISED JUNE 25, 2009

Pollutant	Averaging Time	2004	2005	2006
NO_2 (Camp Pendleton)	1-hour	**186**	145	152
	Annual	**23**	23	21
SO_2 (San Diego)	1-hour	**110**	105	89
	3-hour	52	68	**79**
	24-hour	**24**	24	24
	Annual	**10**	8	10

Source: California Air Quality Data, California Air Resources Board website; EPA AIRData website. Reported values have been rounded to the nearest tenth of a μg/m^3.
Notes:
a. Bolded values are the highest during the three years and are used to represent background concentrations.

Since SO_2 modeled predicted impacts and monitored backgrounds are relatively low for the project area, simply adding the predicted 1-hour impact to the maximum 1-hour monitored background concentration is sufficient to determine compliance with the new standard (see Table 4-3). Therefore, no additional modeling to determine yearly 99th percentile values was deemed to be necessary.

However, for NO_2, simply adding the worst-case monitored 1-hour NO_2 concentration in the three-year period to the maximum hourly modeled project impact indicated there was the possibility that the new federal standard could be exceeded. Also, as a second level screening procedure, the three-year average 98th percentile monitored background in the modeling period (2003–2005) was added to the maximum modeled 1-hour NO_2 concentration. This also indicated there was the possibility that the new federal standard could be exceeded. Therefore, additional modeling was required to produce the output files necessary for post processing that adds hourly NO_2 background monitored concentrations to the modeled impacts on an hour-by-hour basis in the modeling period to determine the 98th percentile values for each year. Temporally pairing the project impacts and the monitored background concentrations on an hour-by-hour basis is consistent with District policy regarding other pollutants and ambient air quality standards.

Ozone (O_3) and NO_2 background concentration data from the Camp Pendleton Monitoring Station were used for these calculations. Consistent with past policy, the District based its conclusion on data that did not have missing background values filled by estimates of the missing value (see Appendix A for a discussion). However, to inform the decisions of other regulatory agencies, the District also evaluated the effect of filling the missing background data. The missing data was filled as in the draft interim screening procedure for filling ozone and NO_2 background data (see Appendices A and B for a discussion and the details of the filling procedures).

The model impacts and background were both expressed in parts per billion by volume (ppbv) to be consistent with the standard's form based on concentration per unit volume. Hourly model impacts were converted from micrograms per cubic meter ($\mu g/m_3$) to ppbv using a reference pressure based on the altitude of the stack exit and the hourly filled temperature for the Camp Pendleton monitoring station.

The District developed an interim post-processing procedure that provided a conservatively high calculation of 98th percentile of the daily maximum hourly high values (8th high value of background concentration plus project impacts in this case). The interim post processing extracts the maximum daily maximum hourly high values for all receptors for each day in each year and then determines the 8th high value from these maximums for each year. Thus, the post-processing procedure determines the global 98th percentile of the daily maximum values and not the 98th percentile on a receptor-specific basis as would be allowed by the standard. This procedure results in conservatively high 98th percentile values (see Appendix D). A comparison of the results for one case (startup/shutdown with new and existing equipment and filled background data) with the results of a refined post processing procedure implemented with software that does calculate the 98th percentile on a receptor-specific basis indicates that the District post processor calculation of the 98th percentile is biased high by about 9 ppbv for this AQIA. The refined post processor was kindly provided by the San Joaquin Valley Unified Air Pollution Control District at the District's request.

The results of the supplemental modeling for 1-hour NO_2 impacts, including background during normal operations, startup/shutdowns and commissioning compared with the new federal 1-Hour NO_2 Ambient Air Quality Standard are provided in Tables 4-2A and 4-2B for unfilled and filled background data, respectively.

Table 4-3 provides a summary of the proposed project modeled maximum SO_2 impacts, including worst-case ambient background concentrations, compared with the new federal 1-Hour Ambient Air Quality Standard. Conservatively, the maximum 1-hour SO_2 predicted impact rather than the 3-year average of the 99th percentile impact was used for this analysis.

TABLE 4-2A
SUPPLEMENTAL NO_2 MODELING RESULTS, UNFILLED BACKGROUND

Operation Mode	Total Impact[a] (ppb)	Federal Standard (ppb)
Normal Operation , New Equipment Only	85.7	100
Normal Operations, New Equipment plus Existing Equipment	88.4	100
Commissioning, New Equipment Only	79.9	100
Commissioning, New Equipment plus Existing Equipment	87.8	100
Startup, New Equipment Only	86.0	100
Startup, New Equipment plus Existing Equipment	88.3	100

Notes:
a. Maximum three year average (2003-2005) of 98[th] percentile of daily maximum one-hour NO_2 total impacts (modeled impact plus monitored background).

TABLE 4-2B
SUPPLEMENTAL NO_2 MODELING RESULTS, FILLED BACKGROUND

Operation Mode	Total Impact[a] (ppb)	Federal Standard (ppb)
Normal Operation , New Equipment Only	89.5	100
Normal Operations, New Equipment plus Existing Equipment	91.3	100
Commissioning, New Equipment Only	81.0	100
Commissioning, New Equipment plus Existing Equipment	88.3	100
Startup, New Equipment Only	89.7	100
Startup, New Equipment plus Existing Equipment	92.0	100

Notes:
a. Maximum three year average (2003-2005) of 98[th] percentile of daily maximum one-hour NO_2 total impacts (modeled impact plus monitored background).

TABLE 4-3
MAXIMUM PROPOSED PROJECT 1-HOUR SO_2 IMPACTS

Pollutant	Maximum Project Impact ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	State Standard ($\mu g/m^3$)	Federal Standard ($\mu g/m^3$)
SO_2	4.3	110	114	650	196

4.2 STATE 1-HOUR AND FEDERAL AND STATE ANNUAL NO_2 STANDARDS

Because the change in in-stack NO2/NOx and the slightly different modeling scenarios, which could lead to higher modeled impacts, the district revisited the AQIA with respect to the state 1-hour NO_2 standard and state and federal annual NO_2 standards. Table 4.4 shows the results for the state 1-hour NO_2 standard. As in the final review report the determination of compliance is based on the maximum background in 2004-2006 and the maximum modeled impact in each case.

TABLE 4-4
SUPPLEMENTAL NO_2 MODELING RESULTS, STATE 1-HOUR NO_2 STANDARD,

Operation Mode	Maximum Project Impact (µg/m³)	Background (µg/m³)	Total Impact (µg/m³)	State Standard (µg/m³)
Normal Operation , New Equipment Only	133.2	186	319.2	338
Normal Operations, New Equipment plus Existing Equipment	133.2	186	319.2	338
Commissioning, New Equipment Only	127.5	186	313.5	338
Commissioning, New Equipment plus Existing Equipment	134.6	186	320.6	338
Startup, New Equipment Only	133.2	186	319.2	338
Startup, New Equipment plus Existing Equipment	133.2	186	319.2	338

The District did not deem it necessary to remodel the annual NO_2 impact because of the relatively small increase in project maximum hourly impacts compared to the final review report, about 5%; the extremely low annual project impact determined in the final review report, 0.1 µg/m³; and the low worst-case annual average background concentration of 23 µg/m³ compared to the state and federal standards of 56 and 100 ug/m³, respectively.

5.0 CONCLUSION

The results of the AQIA indicate that the proposed facility operations including commissioning and startup/shutdowns will not cause or contribute to an exceedance of the new federal 1-Hour Ambient Air Quality Standards for NO_2 and SO_2. The District also affirms its conclusions in the July 29, 2009, final review report regarding the project's compliance with all other state and federal ambient air quality standards including the state1-hour and the state and federal annual Ambient Air Quality Standards for NO_2.

Appendix A

NO_2 and O_3 Missing Data Discussion

1.0. Sufficiency of Available Background Concentration Data for NO_2 and O_3

Compliance with the federal 1-hour nitrogen dioxide (NO_2) standard is determined by averaging the 98th percentile daily maximums of the 1-hour NO_2 concentrations at each receptor for each year over a three-year period. The 98th percentile is equivalent to the 8th highest daily 1-hour maximum for 351 or more creditable daily samples per year. For NO_2 background data for years 2003–2005 from the Camp Pendleton Monitoring Station used in the Carlsbad Energy Center Project (CECP) modeling, the number of creditable daily samples ranged from 354 to 362 based on EPA criteria for a creditable sample. Therefore, the 8th highest daily maximum is equivalent to the 98th percentile.

For a source of emissions not already considered in the background, the modeled impacts from the source at each receptor are added to the background NO_2 concentrations to determine the 98th percentile combination of source impacts and background concentrations in each year modeled. The background ozone (O_3) concentration is needed for the modeling as well as the NO_2 concentration because NOx emitted from combustion emission sources is comprised of both nitric oxide (NO) and NO_2. There are no ambient air quality standards for NO. However, NO is converted to NO_2 in the atmosphere by:

$$NO + O_3 \rightarrow NO_2 + O_2$$

Background NO_2 and O_3 concentrations vary with emissions, meteorology, and atmospheric photochemistry. As a result, both NO_2 and O_3 concentrations in the atmosphere have strong diurnal and seasonal dependencies. The same considerations apply to the modeled emission impacts from operations of the source that are added to the background concentration to determine compliance with the standard, although the source's emissions are often assumed to be fixed at the maximum emission rate. In addition, background emissions and atmospheric chemistry themselves are significantly affected by meteorology (e.g., temperature).

Consistent with existing District policy for other pollutants in air quality impact assessments (AQIAs), the District finds that the most appropriate way to address the diurnal and seasonal dependence is to examine a sufficiently large number of periods with matching meteorology, background concentrations, and source emissions. For evaluating the NO_2 impacts of the CECP with respect to the federal 1-hour standard, the District's standard three-year modeling period was used (in this case, the years 2003–2005). This period includes approximately 25,000 separate hours where background concentrations were available for both O_3 and NO_2 at the Camp Pendleton monitoring station, determined to be the most representative monitoring station for background O_3 and NO_2 for this project. Table A-1 shows the background data availability by year.

Table A-1. Availability of Hourly O_3 and NO_2 Background Concentration Data.

Year	O_3	NO_2	O_3 & NO_2
2003	0.977	0.975	0.974
2004	0.983	0.975	0.973
2005	0.935	0.932	0.931

The drop in data availability in 2005 is due to the District increasing calibrations of the monitoring equipment to once per day, which causes one hour of missing data for each day.

The District examined the potential impact of missing O_3 and NO_2 data on assessing the air quality impacts with respect to the 1-hour federal NO_2 standard. Since the 8th high daily NO_2 maximums from the AQIA (modeled impact plus backgrounds) are less than the standard (100 ppbv) for each year, the District notes that the potential impact of missing background concentrations are only potentially significant if inclusion of the sum of the missing background and modeled project impacts would cause the 8th highest sum overall to exceed the standard. In the case of the CECP, the District estimates that, if all the missing data were available, the probability of significantly affecting the results of the AQIA for any year is less than 10^{-3}. The District believes this a conservatively high estimate of the probability because, even if the standard were exceeded in one year, compliance might still be demonstrated based on the 3-year average and NO_2 background concentration levels continue to decrease in the District. In addition, the modeling considered the emergency fire pump engine to be operating on every hour of the modeling period, which greatly overestimates its likely contribution to the 8th highest daily maximum NO_2 concentration since, aside from actual emergencies, it is only allowed to operate 50 hours per year for maintenance and testing purposes.

Thus, the District has concluded that basing the AQIA only on the available data is sufficient without attempting to fill missing O_3 and NO_2 background concentration data. However, as discussed below, the District analyzed the effect of filling the missing O3 and NO_2 background values with a draft interim screening filling procedure developed by the District in order to address potential concerns of other regulatory agencies.

2.0. Ozone and Nitrogen Dioxide Background Concentration Filling

The draft interim screening O_3 and NO_2 filling procedures recommended by the District are given in Appendix B. The O_3 and NO_2 filling procedure used the existing data available at the representative modeling station rather than substitution of data from an additional monitoring station(s).

To address hour-of-day and seasonal effects, both the O_3 and NO_2 single hour filling procedures are based on filling the data with the maximum value from the immediately adjacent clock-hours (either on the same day or immediately adjacent days). For multiple missing hours, each missing clock-hour was filled using the maximum value within the 30-day period centered on the missing hour for either the missing clock-hour or, if this data was not available, the preceding or succeeding clock hour. Additionally, for filling multiple hours of missing NO_2 background concentrations, the maximum filled background value was not allowed to exceed the 98th percentile maximum background (design value for the standard) for the year. This assures that compliance is based on the same design value that the District attainment status is based on and prevents a situation where filling the background NO_2 data could by itself lead to an exceedance of the standard.

Maximum values were used to fill the missing concentrations to limit underestimates of background concentrations during peaks. As a result, the procedure overestimates the missing background concentrations for most hours. The performance of the filling procedure was evaluated by applying the procedure to the existing O_3 and NO_2 data for 2003–2005 from the Camp Pendleton Monitoring Station. The performance analysis consisted of assuming that a given hour was missing in the data (either as a single missing hour or part of a multiple missing hour period), filling that hour per the procedure, and then comparing the results to the actual data. The results are shown in Tables A-2–A-5. Results for one alternative procedure for single missing hours (interpolation) and one alternative procedure for multiple missing hours (use of the maximum on preceding and succeeding days for a missing clock hour) are also presented.

As can be seen, in comparison to the draft procedure, interpolation provides the most unbiased estimate during missing single hours in general but significantly underestimates concentrations on the hours of daily maxima. It is also apparent that the draft interim screening filling procedures used are biased significantly high for single missing hours in general and are also biased high for multiple missing hours on the hours of daily maxima in general. However, the procedure for a single missing hour is nearly an unbiased estimate for the hours of daily maxima.

One characteristic of conservative filling procedures is that they are likely to significantly distort the upper tail of the AQIA results (i.e., the eight highest daily maxima each year) upon which regulatory decisions for the federal 1-hour NO_2 standard are based. In this case, 1–3 of the highest eight daily maxima for each year, depending on the scenario and year, were hours with filled O_3 or NO_2 background data although only about 4% of the background data over the modeled 3-year period was filled. The filled hours included in the highest eight hours were overwhelming dominated by hours filled with the multiple-hour filling procedure, which is considerably more conservative (and also considerably more unlikely to actually occur) than the single hour procedure.

Table A-2. Performance of the Draft Interim Screening O_3 Background Filling Procedure for All Hours Compared to Two Alternate Procedures.

	Single Missing Hour	Multiple Missing Hours	Alternative A, for Single Missing Hours[a]	Alternative B, for Multiple Missing Hours[b]
Analysis Period				
Total Period, hr	26304	26304	26304	26304
Analyzed, hr[c]	24232	25384	24232	25374
Fraction of Hours:				
Overestimated	0.883	0.966	0.454	0.670
Underestimated	0.058	0.028	0.460	0.288
Accurate	0.059	0.006	0.087	0.042
Residuals, ppbv[d]				
Mean	9.3	25.2	0.0	5.7
Maximum	78.0	95.0	49.0	78.0
Minimum	-22.0	-34.0	-37.0	-52.0
Percentile Levels				
0.95	31.0	50.0	6.5	30.0
0.5	6.0	24.0	0.0	4.0
0.05	-1.0	3.0	-6.0	-14.0

[a]Alternative A fills single hours by interpolation between immediately adjacent hours.

[b]Alternative B fills multiple missing hours with the maximum for that clock hour on the immediately preceding and succeeding days.

[c]Hours not analyzed were hours that had either missing O_3 values for that hour in the data set or, for single hours, missing adjacent hours, which would make that hour part of a multiple missing hour period.

[d]Positive values indicated overestimates and negative values indicate underestimates.

Table A-3. Performance of Draft Interim Screening O_3 Background Filling Procedure at Daily Maxima Compared to Two Alternate Procedures.

	Single Missing Hour	Multiple Missing Hours	Alternative A, for Single Missing Hours[a]	Alternative B, for Multiple Missing Hours[b]
Analysis Period				
Total Period, hr	1481	1527	1481	1527
Analyzed, hr[c]	1474	1520	1474	1520
Fraction of Hours:				
Overestimated	0.377	0.886	0.003[e]	0.361
Underestimated	0.365	0.095	0.941	0.582
Accurate	0.258	0.019	0.056	0.057
Residuals, ppbv[d]				
Mean	1.7	15.2	-3.4	-2.7
Maximum	46.0	69.0	2.5	46.0
Minimum	-17.0	-34.0	-35.5	-45.0
Percentile Levels				
0.95	13.0	38.0	0.0	13.0
0.5	0.0	14.5	-2.5	-2.0
0.05	-4.0	-4.0	-10.5	-22.0

[a]Alternative A fills single hours by interpolation between immediately adjacent hours.

[b]Alternative B fills multiple missing hours with the maximum for that clock hour on the immediately preceding and succeeding days.

[c]Hours not analyzed were hours that had either missing O_3 values for that hour in the data set or, for single hours, missing adjacent hours, which would make that hour part of a multiple missing hour period.

[d]Positive values indicated overestimates and negative values indicate underestimates.

[e]It is possible for interpolation based on the immediately preceding and succeeding hours to overestimate calendar-day maxima that occur in the first or last hour of a calendar day.

Table A-4. Performance of Draft Interim Screening NO_2 Background Filling Procedure for All Hours Compared to Two Alternate Procedures.

	Single Missing Hour	Multiple Missing Hours	Alternative A, for Single Missing Hours[a]	Alternative B, for Multiple Missing Hours[b]
Analysis Period				
Total Period, hr	26304	26304	26304	26304
Analyzed, hr[c]	24101	25266	24101	25254
Fraction of Hours:				
Overestimated	0.835	0.962	0.464	0.628
Underestimated	0.075	0.029	0.387	0.261
Accurate	0.089	0.009	0.150	0.111
Residuals, ppbv[d]				
Mean	6.4	19.5	0.0	3.6
Maximum	88.0	78.0	44.0	88.0
Minimum	-58.0	-57.0	-62.5	-76.0
Percentile Levels				
0.95	23.0	53.0	5.5	21.0
0.5	4.0	16.0	0.0	2.0
0.05	-1.0	1.0	-6.0	-9.0

[a]Alternative A fills single hours by interpolation between immediately adjacent hours.

[b]Alternative B fills multiple missing hours with the maximum for that clock hour on the immediately preceding and succeeding days.

[c]Hours not analyzed were hours that had either missing NO_2 values for that hour in the data set or, for single hours, missing adjacent hours, which would make that hour part of a multiple missing hour period.

[d]Positive values indicated overestimates and negative values indicate underestimates.

Table A-5. Performance of Draft Interim Screening NO_2 Background Filling Procedure at Daily Maxima Compared to Two Alternate Procedures.

	Single Missing Hour	Multiple Missing Hours	Alternative A, for Single Missing Hours[a]	Alternative B, for Multiple Missing Hours[b]
Analysis Period				
Total Period, hr	1250	1313	1250	1313
Analyzed, hr[c]	1242	1305	1242	1305
Fraction of Hours:				
Overestimated	0.385	0.847	0.023	0.352
Underestimated	0.486	0.134	0.951	0.605
Accurate	0.130	0.019	0.026	0.044
Residuals, ppbv[d]				
Mean	0.2	12.6	-7.5	-4.4
Maximum	49.0	68.0	4.0	49.0
Minimum	-58.0	-57.0	-62.5	-76.0
Percentile Levels				
0.95	14.0	37.0	-0.5	14.0
0.5	0.0	12.0	-5.5	-2.0
0.05	-10.0	-8.8	-20.5	-28.0

[a]Alternative A fills single hours by interpolation between immediately adjacent hours.

[b]Alternative B fills multiple missing hours with the maximum for that clock hour on the immediately preceding and succeeding days.

[c]Hours not analyzed were hours that had either missing NO_2 values for that hour in the data set or, for single hours, missing adjacent hours, which would make that hour part of a multiple missing hour period.

[d]Positive values indicated overestimates and negative values indicate underestimates.

[e]It is possible for interpolation based on the immediately preceding and succeeding hours to overestimate calendar-day maxima that occur in the first or last hour of a calendar day.

Appendix B

DRAFT Interim Screening Filling Procedures for

NO_2 and O_3

1.0 Screening Procedure for Filling Missing Ozone Ambient Concentrations in AQIA Modeling

Below is a screening procedure for filling missing hours monitored ambient ozone concentrations for purposes of Air Quality Impact Analysis (AQIA) modeling to determine compliance with the federal1-hour NO_2 standard. The data should be filled in the units reported by the District monitoring (ppmv) and then converted to units of $\mu g/m^3$ for use in AERMOD based on the ambient temperature reported by the monitor and, optionally, ambient pressure. The ambient temperature data gaps can be filled by standard meteorological data filling procedures such as linearly interpolation between the end points for one, two, or three hours of missing data and data substitution from an alternative temperature monitor(s) for longer gaps (also filled by linear interpolation for up to three hours, if necessary). Ambient pressure data gaps can be filled in the same manner as temperature.

For missing ozone concentration data:

1) Fill any single missing hour with the maximum of the:

    a. Preceding hour
    b. Succeeding hour
    c. Same hour of day on previous day
    d. Same hour of day on succeeding day

    If there is missing data for either c and/or d, use only the maximum of the available data to fill the missing hour (both a and b are guaranteed to be present since only single missing hours are filled in this step). Note that the most likely scenario for both c and d to be missing is for years when the monitor is calibrated at the same hour each day. In this case, the 30-day rolling average (see step 2) for that hour will also not be available.

2) For hours that are not filled by step 1(all periods with more than one hour missing), fill the missing hour with the maximum for that hour of day for a 30-day rolling period centered on the hour (i.e., for the 15 preceding days and the 15 succeeding days). Note that 30-day rolling period will extend into the preceding and succeeding year at the start or end, respectively, of the modeling period.

3) For hours not filled by step 2, fill the missing data with the maximum of the 30-day rolling period for the preceding or succeeding hour.

4) Any hours not filled by steps 1–3, are likely periods with more than a month of missing data for all hours. These will be filled on a case-by-case basis.

2.0 Screening Procedure for Filling Missing NO_2 Ambient Concentrations in AQIA Modeling

Below is a screening procedure for filling missing hours monitored ambient nitrogen dioxide (NO_2) concentrations for purposes of Air Quality Impact Analysis (AQIA) modeling to determine compliance with the federal1-hour NO_2 standard. The data should be filled in the units reported by the District monitoring (ppmv).

For missing NO_2 concentration data:

1) Fill any single missing hour with the maximum of the:

    a. Preceding hour
    b. Succeeding hour
    c. Same hour of day on previous day
    d. Same hour of day on succeeding day

    If there is missing data for either c and/or d, use only the maximum of the available data to fill the missing hour (both a and b are guaranteed to be present since only single missing hours are filled in this step). Note that the most likely scenario for both c and d to be missing is for years when the monitor is calibrated at the same hour each day. In this case, the 30-day rolling average (see step 2) for that hour will also not be available.

2) For hours that are not filled by step 1(all periods with more than one hour missing), fill the missing hour with the maximum for that hour of day for a 30-day rolling period centered on the hour (i.e., for the 15 preceding days and the 15 succeeding days). Note that 30-day rolling period will extend into the preceding and succeeding year at the start or end, respectively, of the modeling period.

3) For hours not filled by step 2, fill the missing data with the maximum of the 30-day rolling period for the preceding or succeeding hour.

4) Any hours not filled by steps 1–3, are likely periods with more than a month of missing data for all hours. These will be filled on a case-by-case basis.

5) Check all filled hours for which the filled concentration is higher than the maximum monitored concentration recorded for that day (for a complete day of missing data, the maximum monitored concentration is considered zero for purposes of this comparison). If the filled concentration is higher than the appropriate nth highest daily maximum monitored concentration for the calendar year for determining compliance with federal 1-hour standard (e.g., for 351 or more days of valid data, the 8^{th} highest daily maximum is

the appropriate value), then replace filled concentration with the appropriate nth highest daily maximum to fill that hour. Note: This prevents the filling procedure from changing the nth highest daily maximum for the year.

Appendix C

In-Stack NO_2/NOx

NOx emitted from combustion emission sources is comprised of both nitric oxide (NO) and nitrogen dioxide (NO_2). Impacts from an emission source include impacts from both directly emitted NO_2 and from NO converted to NO_2 in the atmosphere by ozone. The amount NO_2 directly emitted at the exit of the stack is determined by the total NOx emitted and the in-stack NO_2 to NOx ratio (NO_2/NOx). The directly emitted NO_2 can be important for periods with low ozone levels or when impacts are relatively close to the source and there is little time for conversion of emitted NO to NO_2.

Except for the two new combined cycle turbines previous analyses of the project's air quality impacts were based on a default in-stack NO_2/NOx of 0.1, which is the default used by the AERMOD modeling software. Consideration of the new federal 1-hour NO_2 standard has raised the awareness of the need to use ratios different from the default in some situations and support the NO_2/NOx used in modeling exercises.

The District based the in-stack NO_2/NOx, 0.25, used to model the new, large combined cycle turbines for normal operations on several annual source tests conducted at another large combined cycle facility. For startup and commissioning, the in-stack ratio, 0.4, was based on the approximate maximum ratio the District has observed during startups of the same large combined cycle turbine. These ratios were used in the previous modeling documented in the 2009 final review report for CECP demonstrating compliance with the state 1-hour NO_2 standard and the state and federal annual NO_2 standards. The default in-stack NO_2/NOx of 0.1 was used for the rest of the equipment because, it was standard procedure at the time and no information had been developed by the District to support a different ratio.

For determining compliance with federal 1-hour NO_2 standard, NO_2/NOx ratios for the auxiliary equipment (new emergency fire pump engine and existing peaking turbine) were developed and used in the AQIA. For the new emergency fire pump engine, an in-stack NO_2/NOx of 0.16 was used based on the average of two source tests the District has conducted on emergency fire pump engines. For the existing peaking turbine, an in-stack ratio of 0.19 was used based on the average of 10 source tests of the existing peaking turbine at the facility.

Due to a lack of source test information for NO_2 (as opposed to NOx), an in-stack NO_2/NOx of 0.1 was retained for the two existing utility boilers since the default value was originally derived from source tests on this type of equipment. However, preliminary results from a recent source test of one of the two boilers indicate an in-stack NO_2/NOx of less than 0.05.

To check the sensitivity of the results to the auxiliary equipment in-stack NO_2/NOx, the District conducted two additional modeling runs, the results of which are shown in Table C-1. The emergency engine NO_2/NOx is likely the most important contributor to the result sensitivity since its emissions dominate the impacts from the new equipment (see Table C-2) and its relatively low level release makes the in-stack NO_2/NOx more important. However, since this engine is limited to only 50 hours per year of operation it is likely its impacts are greatly overestimated as a practical matter by the modeling which assumed it was operating every hour of the year (except during commissioning when it was assumed not to be operated).

Table C-1. Auxiliary Equipment, In-Stack NO_2/NOx Sensitivity, Unfilled Background.

Operation Mode	Auxiliary Equipment	NO_2/NOx	Project Impact Plus Background, 98^{th} Percentile, ppbv	Maximum Project Impact, $\mu g/m^3$
Normal Operations, New Equipment	Emergency Engine	0.21[a]	86.5	135.2
Normal Operations, New Equipment	Emergency Engine	0.16[b]	85.7	133.2
Normal Operations, New Plus Existing Equipment	Emergency Engine	0.16[b]	91.3	133.2
	Peaking Turbine	0.19[b]		
Normal Operations, New Plus Existing Equipment	Emergency Engine	0.1[c]	90.5	129.5
	Peaking Turbine	0.1[c]		

[a]Highest value of two District source tests of diesel emergency fire pump engines used to calculated the average value used in the air quality impact analysis. Another recent source test of a diesel emergency fire pump engine indicated an in-stack NO_2/NOx of about 0.18 for that engine. Review of source tests on other diesel powered engines without add-on emission controls did not indicate any in-stack NO_2/NOx greater than 0.21.

[b]Average value of District source tests.

[c]Default value.

Table C-2. Emergency Engine Impacts.

Operation Mode	NO_2/NOx	Project Impact 98th Percentile, ppbv	Maximum Project Impact, μg/m^3
Startup and Shutdown, New Equipment, with Emergency Engine	0.16	86.0	133.2
Startup and Shutdown, New Equipment, w/o Emergency Engine	N/A	71.9	86.6

Based on the information, the District finds that the in-stack NO_2/NOx ratios used in the modeling are an adequate basis for its compliance determination.

Appendix D

Hour-by-Hour Pairing

District Interim Hour-by-Hour Pairing Methodology Used to Determine Compliance with the Federal 1-Hour NO_2 Standard

Nomenclature

A_{rhd} is the model impact for the *r*th receptor in the *h*th hour of the *d*th day in a year.

B_{hd} is the NO_2 background for the *h*th hour of the *d*th day in a year.

C_{rhd} is the sum of the model impact and background for the *r*th receptor in the *h*th hour of the *d*th day in a year.

$C(max\text{-}avg)_{(8)}$ is the maximum among all the receptors of the 3-year average of the 8^{th} highest daily maximum of model impact plus the background for each hour of the day calculated at each receptor.

Other intermediate variables and variables for the District's intermediate procedure are defined below. For clarity, a prime ( ) is used to denote the District interim method when necessary.

Refined Methodology (Not Used for the Carlsbad Energy Center Project Determination)

1) Calculate C_{rhd} for each receptor for each hour in each day.

   $C_{rhd} = A_{rhd} + B_{hd}$

2) Find the maximum impact for the day at each receptor, $C(max)_{rd}$.

   $C(max)_{rd} = \max(C_{rhd})$ over all *h*.

3) From the daily maximums, calculate the 8^{th} high daily maximum at each receptor for the year, $C_{r(8)}$.

   $C_{r(8)}$ = the 8^{th} largest $C(max)_{rd}$ over all *d*.

4) Average the 8^{th} high daily maximums for the year at each receptor over three years.

   $C(avg)_{r(8)} = \text{avg}(C_{r(8)})$ over all three years.

5) Find the maximum 3-year average 8^{th} high daily maximum among all the receptors.

   $C(max\text{-}avg)_{(8)} = \max(C(avg)_{r(8)})$ over all *r*.

6) Compare the maximum 3-year average 8^{th} high impact from among all the receptors, $C(max\text{-}avg)_{(8)}$, to the standard to determine compliance.

Screening Hourly-by-Hour Pairing Methodology (Used for the Carlsbad Energy Center Project Determination)

The screening methodology was used because for much of the review period the District did not have a post-processor that it considered able to perform the calculations of the refined analysis in a manner acceptable to the District and because the interim procedure facilitated dealing with the evolving nature of the methodology being used to determine compliance (e.g., gap filling) without continuous post-processor reruns. The intermediate procedure calculations beyond the first step can be carried out with a large spreadsheet.

1) Find the maximum model impact for each hour of the day among all the receptors, $A\ (max)_{hd}$.

   $A\ (max)_{hd} = \max(A_{rhd})$ over all r.

2) Find the maximum model plus background impact for each hour of the day among all the receptors, $C\ (max)_{hd}$.

   $C\ (max)_{hd} = A\ (max)_{hd} + B_{hd}$

   Since the background is assumed representative for all receptors, and hence is a constant for each hour, steps 1 and 2 are equivalent to finding the maximum of $A_{rhd} + B_{hd}$ among all the receptors in each hour.

3) From the hourly maximum impacts among all the receptors, determine the daily maximum impacts, $C\ (max)_d$.

   $C\ (max)_d = \max(C\ (max)_{hd})$ over all h.

4) From the daily maximums calculate the 8th highest daily maximum for the year, $C_{(8)}$.

   $C_{(8)}$ = the 8th largest $C\ (max)_d$ over all d.

5) Average the 8th highest daily maximums for each year over three years.

   $C\ (avg)_{(8)} = \text{avg}(C_{(8)})$ over all three years.

6) Compare the 3-year average, $C\ (avg)_{(8)}$, to the standard to determine compliance.

Note that:

$$C\ (max)_d \geq C(max)_{rd}$$

since $C\ (max)_d$ is the maximum for the day among all the receptors. Thus $C\ (max)_d$ only equals $C(max)_{rd}$ at one receptor for each day.

Also:

$C_{(8)} \geq C_{r(8)}$ for all r in each year.

In fact, except for the unlikely possibility of ties in the top eight values of $C(max)_{rd}$ among receptors, the only case when $C_{(8)}$ equals $C_{r(8)}$ is if the top eight daily highs in a year among all the receptors all occur at the same receptor—a very unlikely possibility. In all other cases, $C_{(8)}$ is larger than $C_{r(8)}$.

It follows that:

$C(avg)_{(8)} \geq C(avg)_{r(8)}$ for all r.

and

$C(avg)_{(8)} \geq C(max\text{-}avg)_{(8)}$

$C(avg)_{(8)}$ is guaranteed to be at least equal to $C(max\text{-}avg)_{(8)}$. Moreover, $C(avg)_{(8)}$ is almost always going to be greater than $C(max\text{-}avg)_{(8)}$, because, except for the unlikely possibility for ties in $C(max\text{-}avg)_{(8)}$ among the receptors, the only case when $C(avg)_{(8)}$ can equal $C(max\text{-}avg)_{(8)}$ is if $C(max\text{-}avg)_{(8)}$ in each of the three years occurs at the same receptor. Therefore, the District's screening hour-by-hour pairing methodology in general gives a conservatively high estimate of the value used to determine compliance.

From: Steve Hill
Sent: Thursday, August 18, 2011 2:51 PM
To: 'Nguyen, Camqui'
Cc: Moore, Steve; David Jenkins (djenkins@apexpowergroup.com); Gary Rubenstein
Subject: RE: Pio Pico Energy Center

The SCR inlet flue gas temperature must be equal to or above the limit temperature of 570 degrees F before ammonia may be injected. Maximum allowable gas temperature into the SCR catalyst is 870 degrees F.

--Steve

From: Nguyen, Camqui [mailto:Camqui.Nguyen@sdcounty.ca.gov]
Sent: Wednesday, August 17, 2011 1:37 PM
To: Steve Hill
Cc: Moore, Steve
Subject: RE: Pio Pico Energy Center

Steve,

Could you clarify on what the ammonia injection temperature would be? The combustion gases exit the turbine at 770°F and then pass through the SCR system? Would this also be the ammonia injection temperature? Thanks,

Camqui Nguyen
San Diego ACPD
(858) 586-2747

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APPLICATION FOR CERTIFICATION FOR THE *PIO PICO ENERGY CENTER, LLC*	Docket No. 11-AFC-1 PROOF OF SERVICE (Revised 5/12/11)

Pio Pico Energy Center, LLC
Letter to Eric Solorio, Siting Project Manager, California Energy Commission, dated August 22, 2011 re Applicant's Correspondence with San Diego Air Quality Management District Related to Air Quality

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DECLARATION OF SERVICE

I, Judith M. Warmuth, declare that on August 22, 2011, I deposited copies of the aforementioned document in the United States mail at 500 Capitol Mall, Suite 1600, Sacramento, California 95814, with first-class postage thereon fully prepaid and addressed to those identified on the Proof of Service list above.

AND/OR

Transmission via electronic mail, personal delivery and first class U.S. mail were 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.

Judith M. Warmuth