CALIFORNIA ENERGY COMMISSION
1516 NINTH STREET
SACRAMENTO, CA 95814-5512

DATE: March 10, 2008

TO: Interested Parties

FROM: Paula David, Compliance Project Manager

SUBJECT: Procter and Gamble Cogeneration Project (93-AFC-2C)
Final Staff Analysis of Proposed Modifications to Upgrade Three Combustion Turbines

On December 6, 2007, Sacramento Cogeneration Authority (SCA) filed a petition with the California Energy Commission to amend the Energy Commission Decision for the Procter and Gamble Cogeneration Project. On February 29, 2008 staff published a Staff Analysis of this proposed change. The air quality analysis has since been revised to incorporate minor corrections to the numeric values in Tables 2 and 4, and related language in conditions of certification AQ-7, AQ-11, AQ-50b, and AQ-51c. A copy of the Final Staff Analysis is enclosed for your information and review.

The Procter and Gamble project is a 164 MW cogeneration power plant located in the City of Sacramento in Sacramento County. The project was certified by the Energy Commission on November 16, 1994, and began commercial operation in 1996.

The proposed modifications will allow SCA to upgrade the two LM6000PA combustion turbines to LM6000PCs. Additionally, Spray Intercooled Turbine and Enhanced Flow and Speed (Sprint/EFS) technology will be added to all three turbines. These upgrades are anticipated to lower the combustion turbines' air pollutant emissions and raise thermal efficiency. Overall facility output is expected to increase by 22 MW (nominal).

Energy Commission staff reviewed the petition and assessed the impacts of this proposal on environmental quality, public health and safety, and proposes revisions to seven conditions of certification: AQ-10 through AQ-14, AQ-16, and AQ-39. In addition, AQ-15 would be deleted, and AQ-50 through AQ-51 added to the current conditions of certification. Three analyses were prepared by technical staff, and are attached to this notice: Air Quality, Visual Resources, and Efficiency and Reliability. It is staff's opinion that, with the implementation of revised conditions, the project will remain in compliance with applicable laws, ordinances, regulations, and standards and that the proposed modifications will not result in a significant adverse direct or cumulative impact to the environment (Title 20, California Code of Regulations, Section 1769).

The amendment petition and staff's analysis has been posted on the Energy Commission's webpage at www.energy.ca.gov/sitingcases. The Energy Commission's Order (if approved) will also be posted on the webpage. Energy Commission staff intends to recommend approval of the petition at the March 12, 2008, Business Meeting of the Energy Commission. If you have comments on this proposed modification, please submit them to me at the address below prior to March 10, 2008.

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Comments may be submitted by fax to (916) 654-3882, or by e-mail to pdavid@energy.state.ca.us. If you have any questions, please contact me at (916) 654-4228.

Enclosure

PROCTER & GAMBLE (93-AFC-2C)

Petition to upgrade the existing GE turbines to Sprint/EFS technology
Final Air Quality Staff Analysis
Prepared by: Joseph M. Loyer
March 7, 2008

INTRODUCTION

In December of 2007, the Sacramento Cogeneration Authority (SCA) petitioned the California Energy Commission (Commission) to replace the Procter & Gamble Cogeneration Project's (Project) two General Electric (GE) LM6000PA turbines with GE LM6000PC Sprint/EFS turbines, and upgrade the existing GE LM6000PC turbine to a Sprint/EFS model turbine. SCA proposes to change several conditions of certification, add several new conditions and delete one condition. An initial air quality analysis was published on February 29, 2008. That analysis has been revised to incorporate minor corrections to the numeric values in Tables 2 and 4, and related language in conditions of certification AQ-7, AQ-11, AQ-50b, and AQ-51c. The Final Staff Analysis is enclosed for your information and review.

LAWS, ORDINANCES, REGULATIONS AND STANDARDS

No laws, ordinances, regulations or standards will affect the petitioned amendment requests.

ANALYSIS

The original project was certified by the Energy Commission (Docket No. 93-AFC-2) in November 1994, and became operational in 1996.

The plant consists of two 42.5 MW GE LM6000PA natural gas-fired combustion turbine generators (CTGs), heat recovery steam generators (HRSG) with natural gas-fired duct burners, and one 35 MW nominal (45 MW maximum) steam turbine generator. The plant also includes one 44 MW natural gas-fired GE LM6000PC simple cycle CTG. The SCA natural gas-fired combined cycle cogeneration plant provides up to 164 MW of electricity to SMUD and provides process steam to the existing Procter & Gamble manufacturing facility located in south Sacramento.

SCA is proposing to replace the LM6000PA combined cycle CTGs with LM6000PC Sprint/EFS turbines and upgrade the LM6000PC CTG to a LM6000PC Sprint/EFS. These modifications are part of a larger effort by the Sacramento Municipal Utility District (SMUD) to improve their greenhouse gas (GHG) emissions foot print. The LM6000PC Sprint/EFS is more efficient and is a slightly higher capacity CTG than the LM6000PA and the LM6000PC.

CONSTRUCTION

SCA proposes to upgrade the LM6000 units as part of the scheduled maintenance cycle where possible. The CTGs would be removed from the project site, by crane and truck, for maintenance (they have been so removed more than three times apiece since initiating operations). The CTGs would be sent to the manufacturer's depot and be fitted with additional equipment to inject water and new monitoring controls added. The upgraded CTGs would then be shipped back to the facility, installed in the same turbine compartment and connected to the same infrastructure, but with an added pump skid and conveyance piping.

Each LM6000 upgrade would consist of the following steps:

- Mobilize temporary spare LM6000 to P&G Facility site.
- Shut down the existing LM6000 unit, allow cooling, and dismantling part of enclosure.
- Disconnect fuel, controls and water piping.
- Load the existing LM6000 on a 45-foot flatbed trailer.
- Install the spare LM6000 at P&G Facility site, connect, test and bring to operation.
- The existing LM6000 is transported by road to the out-of-state service facility.
- The existing LM6000 is upgraded by installation of new variable inlet guide vanes, new controls and air and water injection manifold and spray nozzles, exhaust diffuser, new mid shaft and stator. The upgrade takes approximately 6 to 8 weeks.
- The upgraded LM6000 is returned by flatbed truck to P&G Facility.
- The spare LM6000 is removed from service and disconnected, and the enclosure partly dismantled.
- The spare turbine is lifted from the bearing races to a flatbed trailer, or installed in place of the second existing turbine.
- The upgraded LM6000 is lifted into bearing races, connected to existing and added equipment and commissioned for operation.

The upgrade for the first combined cycle turbine is proposed to be executed in spring 2008, with second combined cycle turbine to be upgraded in the fall of 2008 and the simple cycle turbine in the fall of 2009.

The associated construction emissions with this proposed procedure is minimal and thus not expected to produce a significant impact on the ambient air quality.

COMMISSIONING

The commissioning period begins when all mechanical, electrical, and control systems are installed and individual system startup has been completed, or when the gas turbine is first fired, whichever occurs first. The commissioning period ends when the plant has completed initial performance testing and is available for commercial operation.

The commissioning activities include all testing, adjustment, tuning and calibration activities recommended by the equipment manufacturers and the construction contractor to ensure safe and reliable operation of the gas turbines and heat recovery steam generators.

At the earliest feasible opportunity, in accordance with the recommendations of the equipment manufacturer and the construction contractor, the CTGs will be tuned to minimize emissions.

SCA does not except the emission rates during the commissioning period to exceed 21.4 lb/hr of NOx or 16.8 lb/hr of CO. While SCA estimates that it is possible to exceed the operational NOx concentration limits in Conditions AQ-13 and AQ-14, they agree to comply with all other hourly (with the exception of NOx and CO), daily, and quarterly operational emission limits.

Based on the modeling provided by SCA, the maximum expected impact from the commissioning emissions are provided in AIR QUALITY Table 1. This table shows that the commissioning activities are not expected to cause or contribute to an exceedance of the 1-hour ambient air quality standards and thus are not expected to cause a significant impact.

AIR QUALITY Table 1
Maximum Expected Impacts from Commissioning Activities

Pollutant	Averaging Time	Expected Impact (ug/m^3)	Background Concentrations (ug/m^3)	Maximum Expected Impacts (ug/m^3)	Ambient Air Quality Standard (ug/m^3)	Percent of Ambient Air quality Standard
NO_2	1-hour	48.5	97.8	146.3	470	31%
CO	1-hour	38.1	9,140	9,178	23,000	40%

SCA estimates that the commissioning of the CTGs can be completed within approximately 10 days. The short term emission increase (over normal operational emissions) is thus unlikely, in staff's opinion, to cause impacts on any long term ambient air quality standards. Therefore if SCA complies with the proposed emission limits and commissioning duration, it is unlikely that the Project commissioning emissions would result in a significant impact on the ambient air quality. In order to enforce the emission limits proposed by SCA, staff proposes to add conditions of certification AQ-50 and AQ-51.

OPERATION

SCA Proposed Emission Limits (AQ-10 through -14)

SCA has proposed modification to the Project hourly, daily and quarterly emission limits. These modifications are based on vendor guarantees, facility design criteria and established emission calculation procedure. SCA proposes to decrease the Project NOx emissions from 5 ppm (@ 15% O_2 averaged over three hours) to 2.5 ppm (@ 15% O_2 averaged over three hours). SCA proposes to increase the Project CO and SOx emissions; however, since these changes are small they do not trigger the offset requirements in the Sacramento Metropolitan Air Quality Management District (SMAQMD) New Source Review rules. The proposed modifications to the Project

hourly emission limits are shown in AIR QUALITY Table 2. The proposed modifications to the Project daily emissions limits are shown in AIR QUALITY Table 3 and the proposed changes to the Project quarterly emission limits are shown in AIR QUALITY Table 4.

AIR QUALITY Table 2
Proposed Modification to Hourly Emission Limits
(Units in lbs/hr)

	Existing		Proposed Modifications	
Pollutant	CTG + Duct Burner (each)	Simple Cycle CTG	CTG + Duct Burner (each	Simple Cycle CTG
NOx	9.72	8.22	5.37	4.60
CO	4.2	3.3	7.85	6.73
SOx	0.32	0.27	0.35	0.30

AIR QUALITY Table 3
Proposed Modification to Daily Emission Limits
(Units in lbs/day)

	Existing			Proposed Modifications		
Pollutant	CTG + Duct Burner (each)	Simple Cycle CTG	Total Emissions	CTG + Duct Burner (each	Simple Cycle CTG	Total Emissions
NOx	233	203.8	697.3	144.9	120.3	437.7
CO	113.4	85.1	482.7	197.3	163.9	729.3
SOx	7.7	6.5	23.7	8.4	7.2	25.8

AIR QUALITY Table 4
Proposed Modification to Quarterly Emission Limits
(Units in lbs/quarter)

	Existing				Proposed Modifications			
Pollutant	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4
NOx	49,051	49,590	50,128	50,128	28,993	29,305	29,618	29,618
CO	29,758	30,082	30,407	30,407	48,994	49,535	50,075	50,075
SOx	1,722	1,741	1,760	1,760	1,901	1,923	1,944	1,944

SCA Proposed Deletion of Condition AQ-15 and Modification to AQ-16

SCA is proposing to delete condition of certification AQ-15 and modify condition AQ-16 due to a recent rule amendment at the SMAQMD (Rule 411). With that rule amendment, boilers larger than 20 MMBtu/hr and fired on gaseous fuels became subject to a nitrogen oxides (NOx) limit of 9 ppmvd at 3% O_2 with exceptions for periods of startup and shutdown. For SCA's auxiliary boiler rated at 108.7 MMBtu/hr, Rule 411 required full compliance with the 9 ppmvd NOx limit no later than October 27, 2007. SCA determined that existing boiler equipment and operational practices were adequate to assure full compliance with amended Rule 411. As such, SCA accepted revised permit conditions from SMAQMD in the form of Permit to Operate No. 12318(Rev03) issued April 3, 2007.

Condition AQ-15 regulated the boiler NOx emission to no more than 30 ppm when operated under 25 percent load and AQ-16 regulate the boiler NOx emissions to no more than 9 ppm while operating over 25 percent load. The amended SMAQMD Rule 411 restricts the boiler to 9 ppm under all operational conditions. Staff agrees with the proposed deletion of AQ-15 and the modifications to AQ-16, shown below.

AQ-16 The auxiliary boiler shall not emit more than 9 ppmvd nitrogen oxides at 3% O2 averaged over any consecutive three hour period ~~any load equal to or greater than 25 percent~~ **except during periods of startup and shutdown. Startup is defined as the period of time, not to exceed two hours, in which the auxiliary boiler is brought to its operating temperature and pressure immediately after a period in which the gas flow is shut off for a continuous period of 30 minutes or longer. Shutdown is defined as the period of time, not to exceed two hours, in which the auxiliary boiler is cooled from its normal operating temperature.**

Verification: The project owner shall maintain appropriate emission data records as required by Condition AQ-8.

SCA Proposed Modification to AQ-39

In order to be more consistent with current SMAQMD practices, SCA proposes the following minor modifications to condition AQ-39, which will allow SCA to perform the required annual source test any time during the year in addition to other minor changes. Staff finds that this proposal is consistent with SMAQMD practices and the original Commission Decision.

AQ-39 A NOx, ROC, CO, PM10, and ammonia source test of the auxiliary boiler, each of the combined cycle combustion turbines with duct fired HRSG, and the simple cycle combustion turbine shall be performed annually ~~during the first calendar quarter~~.

a. The project owner shall submit a test plan to the Air Pollution Control Officer for approval at least 30 days before the source test is to be performed.

b. The Air Pollution Control Officer shall be notified at least 7 days prior to the emission testing date.

c ~~b~~. During the test(s), all of the turbines and HRSGs are to be operated at their maximum total firing capacities. The auxiliary boiler must also be tested at its maximum firing capacity.

d ~~c~~. The turbines are also to be tested at 50 percent load for CO and ROC.

e ~~d~~. The source test results shall be submitted to the Air Pollution Control Officer within **60** ~~30~~ days from the completion of the source test(s).

f ~~e~~. The Air Pollution Control Officer may waive the annual PM10 **and/or ROC** source test requirement if, in the Air Pollution Control Officer's sole judgment, prior test results indicate an adequate compliance margin has been maintained.

MITIGATION OF PROPOSED EMISSION INCREASES

SCA is proposing to increase the Project emissions of CO and SOx. However, these proposed emission increases are not substantial enough to trigger New Source Review requirements for offsets at the SMAQMD. The proposed emission increases of CO will not cause or contribute to an exceedance of the ambient air quality standards for CO, as shown in AIR QUALITY Table 5. Therefore, it is unlikely that the proposed Project CO emission increased will result in a significant air quality impact.

The proposed emission increase for SOx emission will not cause or contribute to an exceedance of the SOx ambient air quality standards, as shown in AIR QUALITY Table 5. However, SOx emissions are a precursor pollutant to secondary PM2.5 formation and may contribute to existing exceedances of the PM2.5 ambient air quality standards.

The PM2.5 emission impacts shown in AIR QUALITY Table 5 are a combination of PM2.5 emissions from the Project as measured by an emission source test (April 2001) and the contribution from SO_2 Project emissions to secondary PM2.5 formation, assuming 75% conversion to be overly conservative (see Appendix A for calculations).

AIR QUALITY Table 5
Expected Maximum Project Impacts from Proposed Emission Increases

Pollutant	Averaging Time	Expected Maximum Impact (ug/m^3)	Background Concentration (ug/m^3)	Total Impact (ug/m^3)	Ambient Air Quality Standard (ug/m^3)	Percent of AAQS (%)
SO_2	1-hour	0.41	26	26.4	655	4%
	24-hour	0.07	8.0	8.1	105	8%
	Annual	0.009	2.6	2.6	80	3%
CO	1-hour	17.8	9,140	9,160	23,000	40%
	8-hour	9.6	4,630	4,640	10,000	46%
PM2.5	24-hour	0.23	59.0	59.2	65	91%
	Annual	0.03	12.9	12.93	12	108%

AIR QUALITY Table 5 shows that it is possible that the Project SOx emission may contribute to an exceedance of the ambient air quality standards for PM2.5. The Project

PM10 emissions (of which PM2.5 emissions are a subset) were offset by the surrender of PM10 emission reduction credits (ERCs) in August of 1996. The Commission Decision reached the conclusion that the ERCs surrendered for the PM10 emission impacts of the Project were sufficient to mitigate those impacts. The current emissions source test plus 75% percent of the SO_2 conversion to PM2.5 is approximately equal to the current Project PM10 emission limit. Therefore, the proposed Project SOx emission increases, while having the potential to cause a significant impact, are fully mitigated by the PM10 ERCs that SCA has already surrendered. Therefore, it is unlikely that the proposed Project SOx emission increase will result in a significant air quality impact.

CONCLUSION

Staff has analyzed the proposed changes and concludes that there are no new or additional significant impacts associated with approval of the petition. Staff concludes that the proposed changes are based on information that was not available during the original licensing process. Staff concludes that the proposed language retains the intent of the original Commission Decision and conditions of certification. Staff recommends the deletion of condition of certification AQ-15, following modifications to conditions AQ-10, through -16, and -39, and the addition of conditions AQ-50 and -51.

PROPOSED MODIFICATIONS TO CONDITIONS OF CERTIFICATION

Staff has proposed modification to the air quality conditions of certification as shown below. (Note: deleted text is in ~~strikethrough~~, new text is **bold and underlined**)

AQ-10 Emission**s** at the SCA Cogeneration facility, on a pound per hour basis, shall not exceed the following limits averaged over a three hour period, not including start-ups **and shutdowns** as defined in conditions **AQ-16**, **AQ**-22 and **AQ**-24.

Prior to CTG upgrade to PC Sprint/EFS

Pollutant	Units	CTG + Duct Burner (each)	Simple Cycle CTG	Auxiliary Boiler	Cooling Tower
NOx	lb/hr	9.72	8.22	1.15	--
*CO	lb/hr	4.2	3.3	7.12	--
ROC	lb/hr	1.8	1.18	0.41	--
SOx	lb/hr	0.32	0.27	0.08	--
PM10	lb/hr	3.3	2.5	0.54	0.29

* The CO emissions from the combustion turbines were taken at a different temperature scenario which represented a worst case continuous operation Condition.

Following CTG upgrade to PC Sprint/EFS

Pollutant	Units	CTG + Duct Burner (each)	Simple Cycle CTG	Auxiliary Boiler	Cooling Tower
NOx	lb/hr	5.37	4.60	1.15	--
CO	lb/hr	7.85	6.73	7.12	--
ROC	lb/hr	1.8	1.18	0.41	--
SOx	lb/hr	0.35	0.30	0.08	--
PM10	lb/hr	3.3	2.5	0.54	0.29

The ~~District~~ **SMAQMD**, in agreement with the project owner, may choose to decrease the above hourly emission limits to correspond to the source test results pursuant to Condition AQ-38.

Verification: The project owner shall maintain appropriate emission data records as required by Condition AQ-8 and submit source test reports required under Condition AQ-38.

AQ-11 Emission**s** at the SCA Cogeneration facility, ~~from the following equipment listed below,~~ on a pounds per calendar **day** basis, shall not exceed the following limits.

Prior to CTG upgrade to PC Sprint/EFS

Pollutant	Units	Combined Cycle CTG with Supp. Fuel (each)	Simple Cycle CTG	Cooling Tower	Auxiliary Boiler	Total Emissions
NOx	lb/day	233	203.8		27.6	697.3
CO	lb/day	113.4	85.1		170.8	482.7
ROC	lb/day	43.2	28.3		9.8	124.5
SOx	lb/day	7.7	6.5		1.8	23.7
PM10	lb/day	79.2	60	7	13.1	238.5

Following CTG upgrade to PC Sprint/EFS

Pollutant	Units	Combined Cycle CTG with Supp. Fuel (each)	Simple Cycle CTG	Cooling Tower	Auxiliary Boiler	Total Emissions
NOx	lb/day	144.9	120.3		27.6	437.7
CO	lb/day	197.3	163.9		170.8	729.3
ROC	lb/day	43.2	28.3		9.8	124.5
SOx	lb/day	8.4	7.2		1.8	25.8
PM10	lb/day	79.2	60	7	13.1	238.5

The ~~District~~ **SMAQMD**, in agreement with the project owner may choose to decrease the above daily emission limits to correspond to the source test results pursuant to Condition 38.

Verification: The project owner shall maintain appropriate emission data records as required by Condition AQ-8.

AQ- 12 Emissions at the entire P&G Cogeneration project shall not exceed the following limits on a quarterly basis.

Prior to CTG upgrade to PC Sprint/EFS

Quarter	Unit	NOx	CO	ROC	SOx	PM10
Qtr 1	lb/qtr	49,051	29,758	8,287	1,722	17,220
Qtr 2	lb/qtr	49,590	30,082	8,380	1,741	17,411
Qtr 3	lb/qtr	50,128	30,407	8,472	1,760	17,603
Qtr 4	lb/qtr	50,128	30,407	8,472	1,760	17,603

Following First CTG upgrade to PC Sprint/EFS

Quarter	Unit	NOx	CO	ROC	SOx	PM10
Qtr 1	lb/qtr	41,207	37,041	8,287	1,791	17,220
Qtr 2	lb/qtr	41,658	37,447	8,380	1,811	17,411
Qtr 3	lb/qtr	42,110	37,852	8,472	1,831	17,603
Qtr 4	lb/qtr	42,110	37,852	8,472	1,831	17,603

Following Second CTG upgrade to PC Sprint/EFS

Quarter	Unit	NOx	CO	ROC	SOx	PM10
Qtr 1	lb/qtr	33,363	44,324	8,287	1,860	17,220
Qtr 2	lb/qtr	33,727	44,811	8,380	1,881	17,411
Qtr 3	lb/qtr	34,091	45,298	8,472	1,901	17,603
Qtr 4	lb/qtr	34,091	45,298	8,472	1,901	17,603

Following Final CTG upgrade to PC Sprint/EFS

Quarter	Unit	NOx	CO	ROC	SOx	PM10
Qtr 1	lb/qtr	28,993	48,994	8,287	1,901	17,220
Qtr 2	lb/qtr	29,305	49,535	8,380	1,923	17,411
Qtr 3	lb/qtr	29,618	50,075	8,472	1,944	17,603
Qtr 4	lb/qtr	29,618	50,075	8,472	1,944	17,603

The ~~District~~ **SMAQMD**, in agreement with the applicant, may choose to decrease the above ~~daily~~ **quarterly** emission limits to correspond to the source test results pursuant to Condition 38.

Verification: The project owner shall maintain appropriate emission data records as required by Condition AQ-8.

AQ-13 The combined cycle combustion turbines and their associated duct burner HRSGs shall not emit more than 5 ppmvd nitrogen oxides at 15 percent O2 each, averaged over any consecutive three hour period, excluding start-ups as defined in Condition 22 **prior to upgrading to the PC Sprint/EFS**.

The combined cycle combustion turbines and their associated duct burner HRSGs shall not emit more than 2.5 ppmvd nitrogen oxides at 15 percent O2 each, averaged over any consecutive three hour period,

excluding start-ups as defined in Condition 22 after upgrading to the PC Sprint/EFS.

Verification: The project owner shall maintain appropriate emission data records as required by Condition AQ-8.

AQ-14 The simple cycle combustion turbine shall not emit more than 5 ppmvd nitrogen oxides at 15 percent O2, averaged over any consecutive three hour period, excluding start-ups as defined in Condition 24 **prior to upgrading to the PC Sprint/EFS**.

The simple cycle combustion turbine shall not emit more than 2.5 ppmvd nitrogen oxides at 15 percent O2, averaged over any consecutive three hour period, excluding start-ups as defined in Condition 24 after upgrading to the PC Sprint/EFS.

Verification: The project owner shall maintain appropriate emission data records as required by Condition AQ-8.

AQ-15 **Deleted** ~~The auxiliary boiler shall not emit more than 30 ppmvd nitrogen oxides at 3% O2, averaged over any consecutive three hour period for any load below 25%.~~

~~**Verification:** The project owner shall maintain appropriate emission data records as required by Condition AQ-8.~~

AQ-16 The auxiliary boiler shall not emit more than 9 ppmvd nitrogen oxides at 3% O2 averaged over any consecutive three hour period ~~any load equal to or greater than 25 percent~~ **except during periods of startup and shutdown. Startup is defined as the period of time, not to exceed two hours, in which the auxiliary boiler is brought to its operating temperature and pressure immediately after a period in which the gas flow is shut off for a continuous period of 30 minutes or longer. Shutdown is defined as the period of time, not to exceed two hours, in which the auxiliary boiler is cooled from its normal operating temperature.**

Verification: The project owner shall maintain appropriate emission data records as required by Condition AQ-8.

AQ-39 A NOx, ROC, CO, PM10, and ammonia source test of the auxiliary boiler, each of the combined cycle combustion turbines with duct fired HRSG, and the simple cycle combustion turbine shall be performed annually ~~during the first calendar quarter~~.

a. The project owner shall submit a test plan to the Air Pollution Control Officer for approval at least 30 days before the source test is to be performed.

b. The Air Pollution Control Officer shall be notified at least 7 days prior to the emission testing date.

c ~~b~~. During the test(s), all of the turbines and HRSGs are to be operated at their maximum total firing capacities. The auxiliary boiler must also be tested at its maximum firing capacity.

d ~~c~~. The turbines are also to be tested at 50 percent load for CO and ROC.

e ~~d~~. The source test results shall be submitted to the Air Pollution Control Officer within **60** ~~30~~ days from the completion of the source test(s).

f e. The Air Pollution Control Officer may waive the annual PM10 **and/or ROC** source test requirement if, in the Air Pollution Control Officer's sole judgment, prior test results indicate an adequate compliance margin has been maintained.

Verification: The project owner shall submit a test plan to the Air Pollution Control Officer for approval at least 30 days before the source tests are to be performed. The source test results shall be submitted to the Air Pollution Control Officer and the Commission CPM within **60** ~~30~~ days from the completion of the source tests.

AQ-50 As each combustion turbine is upgraded to a PC Sprint/EFS turbine, the owner/operator shall engage in a period of commissioning as defined within this condition.

a. The commissioning period shall begin when all mechanical, electrical and control systems are installed and individual system startup has been completed, or when the gas turbine is first fired, whichever occurs first.

b. The commissioning period shall end when the unit has completed initial performance testing as required in AQ-51 and is available for commercial operation.

c. Commissioning activities include, but are not limited to, all testing, adjustments, tuning and calibration activities recommended by the equipment manufacturers and the construction contractor to ensure safe reliable operation of the gas turbines, heat recovery steam generators, emission control equipment and other ancillary equipment.

d. During the commissioning period, hourly NOx emissions shall not exceed 21.4 lbs/hr and hourly CO emissions shall not exceed 16.8 lbs/hr.

e. The NOx concentration emission limits in conditions AQ-13 and AQ-14 shall not apply during the commissioning period.

f. The hourly emission limits as specified in condition AQ-10, with the exception of the NOx and CO emission limits, shall remain effective during the commissioning period.

g. The daily and quarterly emission limits as specified in conditions AQ-11 and AQ-12 shall remain effective during the commissioning period.

h. During the commissioning period, compliance with all emission limits, as indicated in this condition, shall be demonstrated through the use of properly installed, operated and maintained continuous emissions monitors and recorders.

Verification: The owner/operator shall notify the Commission CPM at least 10 days prior to start of commissioning activities. The owner/operator shall collect and record all necessary information to verify the emission limits as specified within this condition. No later than 60 days following the completion of commissioning, the owner/operator shall submit a report for approval to the Commission CPM demonstrating compliance with all emission limits as specified within this condition.

AQ-51 Within 60 days of completion of each turbine's upgrade to a PC Sprint/EFS turbine, a NOx, ROC, CO, PM10, ammonia and CEMS accuracy source test shall be performed. A successful completion of this start-up test can qualify as the annual compliance test required in condition AQ-39.

a. The project owner shall submit a test plan to the Air Pollution Control Officer for approval at least 30 days before the source test is to be performed.

b. The Air Pollution Control Officer shall be notified at least 7 days prior to the emission testing date.

c. During the test(s), all of the turbines and HRSGs are to be operated at their maximum total firing capacities.

d. The turbines are also to be tested at 50 percent load for CO and ROC.

e. The source test results shall be submitted to the Air Pollution Control Officer within 60 days from the completion of the source test(s).

Verification: The project owner shall submit a test plan to the Air Pollution Control Officer for approval at least 30 days before the source tests are to be performed. The source test results shall be submitted to the Air Pollution Control Officer and the Commission CPM within 60 days from the completion of the source tests.

APPENDIX A

STAFF EMISSION AND IMPACT CALCULATIONS

SOX EMISSION IMPACT ON PM2.5 AMBIENT AIR QUALITY STANDARDS.

Appendix A Table 1, below, shows the SO_2 emissions and modeled impacts based on the original modeling provided during the licensing case for the Project. The table shows SO_2 emissions, units and their respective air quality impacts in the first three columns. The ratio column is the ratio between SO_2 emissions and impacts.

Appendix A Table 1

	SO2 Emissions	Emission Units	SO2 Impacts	Ratio	SO2 as PM2.5 Impacts 75% Conversion	Impacts from Direct PM2.5	Total PM2.5 Impact
1-hour	1	lbs/hr	0.41	0.41	–	–	–
24-hour	24	lbs/day	0.07	0.002916667	0.108396094	0.1218	0.230196
Annual	7413	lbs/year	0.009	1.21408E-06	0.013936641	0.01210677	0.026043

Staff assumed that the conversion rate of SO_2 to PM2.5 was approximately 75%. This is an extremely conservative assumption; it is unlikely that the conversion rate is significantly larger than 25%. The conversion ratio was determined by comparing the molecular weight of SO_2 to that of $(NH_4)_2 SO_4$ (PM2.5) and assuming a 75% conversion (see Appendix A Table 2, below). Staff converted the SO_2 impacts into PM2.5 impacts by using this conversion ratio.

Appendix A Table 2

Ratio of SO2 to PM2.5

	SO2	PM2.5 ((NH4)2 SO4)
Mole. Weight.	64	132.14

Percent Conversion	Ratio
0	0
5	0.103234375
10	0.20646875
15	0.309703125
20	0.4129375
30	0.61940625
50	1.03234375
75	**1.548515625**
100	2.0646875

Element	Mole. Weight.
N	14.008
H	1.008
S	32.06
O	16

Staff then determined the PM2.5 (as PM10) emissions from a source test result on file at the Energy Commission for the Project (April 2001). From that source test, it was determined that the project PM10 emissions were approximately 1.74 lbs/hr. Staff assumed a 24 hour operation for the daily emission rate and 5731 hour operation for the annual rate. Using the ratio method and the SO_2 modeling, staff calculated the PM2.5 direct impacts by multiplying the "Ratio" in Appendix A Table 1 by the PM10 emission rates (both daily and annual) in Appendix A Table 3, below. Adding the Direct PM2.5 Impacts to the SO_2 as PM2.5 impacts gives the Total PM2.5 Impacts in the Appendix A Table 1.

Appendix A Table 3

	PM10 Source Test(4/01)	
	1.74	lbs/hr
24 hr/day	41.76	lbs/day
5731 hr/year	9971.94	lbs/year
24-hour	0.1218	ug/m3
Annual	0.01210677	ug/m3

Appendix A Table 4, below, shows the relative statistics that were developed for use in the text of the staff assessment.

Appendix A Table 4

Total PM2.5 Emissions		% SO2	% Direct
1-hour	3.289	62.78%	52.91%
24-hour	78.924	62.78%	52.91%
Annual	21451.086	71.35%	46.49%

PM10 Emission Limit	
3.3	lbs/hr
Percent of Limit	
100%	

PROCTER & GAMBLE COGENERATION PROJECT (93-AFC-2C)

Request to Upgrade Combustion Turbine Generators
Efficiency and Reliability Staff Analysis
Prepared by: Erin Bright and Steve Baker
December 2007

INTRODUCTION

The Sacramento Cogeneration Authority (SCA) has petitioned to modify three combustion turbine generators currently in operation, upgrading from two LM6000PA units and one LM6000PC peaker unit to three LM6000PC Sprint/EFS units. The upgrade will provide an additional 16MW of base load power output and increase peaker capacity by an additional 5MW, bringing the maximum plant output from 164MW to 185MW.

LAWS, ORDINANCES, REGULATIONS AND STANDARDS (LORS) COMPLIANCE

No LORS apply to project efficiency or reliability.

ANALYSIS

Efficiency

The GE LM6000PA and GE LM6000PC turbines currently in use at the PG&E facility are nominally rated to 39.8 and 41.9 percent maximum full load efficiency lower heating value (LHV) at International Organization for Standardization (ISO) conditions, respectively [GTW, 1995]. The proposed GE LM6000PC Sprint/EFS turbines are nominally rated to 40.5 percent maximum full load efficiency LHV at ISO conditions [GTW, 2007]. The requested upgrade will improve the efficiencies of the turbines used in the combined cycle power block and, by correlation, the efficiency of the power block. The simple cycle peaker unit will suffer a small loss of efficiency that is not significant compared to the improved power output and emissions reduction that the upgrade will provide.

Reliability

The proposed turbines will require a minimal amount of additional natural gas, which is inconsequential compared to the fuel supply source described in the original certification.

The additional water for nitrogen oxide control that is required by the PC Sprint/EFS upgrade will result in an insubstantial increase in water usage for the project; the total project water usage will remain under the maximum usage allotted in the original certification.

CONCLUSIONS AND RECOMMENDATIONS

The requested modification would result in overall improvement to power plant efficiency and would not present adverse impacts on reliability. No conditions of certification are proposed.

REFERENCES

GTW 1995 – Gas Turbine World 1995 Performance Specs. December 1994 pp
GTW 2007 – Gas Turbine World 2007 Performance Specs. December 2006, pp. 14-23

PROCTER & GAMBLE COGENERATION PROJECT (93-AFC-2C)
Petition for Post Certification Project Modification
LM6000 Fleet Upgrade
Visible Plume Staff Analysis
Prepared by: William Walters, P.E.
February 25, 2008

INTRODUCTION

The proposed LM6000 fleet upgrade will cause changes in the operation of the cooling tower and changes to the exhaust parameters of the gas turbines/HRSGs. Staff has evaluated the impact of these changes on visible plume formation.

LAWS, ORDINANCES, REGULATIONS AND STANDARDS (LORS) COMPLIANCE

There are no LORS related to visual plumes.

ANALYSIS

Gas Turbine/HRSG Visual Plume Impact

Staff has reviewed the information provided by the project owner in the Amendment Petition and has determined that the modification may cause a slight increase in visible plume formation from the two gas turbine/HRSGs, but that the increase would be well below staff's initial significance criteria for plume frequency. The information used in staff's visible plume impact review included the gas turbine outlet information provided in Appendix A of the Amendment Petition and additional information provided by the project owner (SCA 2007, Hudson 2008), and modeling results from the similar Pico Power Project (now called the Donald Von Raesfeld Power Plant Project). The specific exhaust attribute comparison for the LM6000PA water injected turbines to the new LM6000PC Sprint water injected gas turbines is as follows:

> Exhaust Temperature – Approximately equivalent ranging from 225 to 250F
> Exhaust Volume – 4% percent higher for the new LM6000PC Sprint gas turbines
> Water injection – 15,037 lb/hr higher in the new LM6000PC Sprint gas turbines
> Exhaust Moisture Content – Increases from 9.0% (by volume) to ~12.0%

The most important change in the exhaust conditions is the large increase in exhaust moisture content due to the additional 15,027 lb/hr of water injection used in the LM6000PC Sprint.

The exhaust conditions are very similar to that of the Pico Power Project which did not have modeled plume frequencies greater than staff initial significance thresholds. The differences in the San Jose meteorological conditions used to model the Pico Power Plant and Sacramento meteorological conditions are minimal, with the Sacramento conditions, on average, being a bit warmer and dryer (i.e. less plume conducive) than the San Jose meteorological conditions.

Staff concludes that the gas turbine plume frequency will likely increase but will not exceed staff's 20 percent frequency significance threshold.

Cooling Tower Visual Plume Impact

The gas turbine upgrade will increase the steam turbine output and consequently increase the heat rejection load to the cooling tower. The project owner has estimate an increase of 1.4 MW at the steam turbine when operating a full load. This increase, assuming a steam turbine efficiency of 35 percent, would result in a heat rejection increase of 2.6 MW. The cooling tower is designed for a heat rejection load of 138.5 MW, and actual heat rejection load would be some fraction of the design heat rejection load that depending on turbine load, duct firing, and chiller operation can vary significantly. Regardless, a maximum full load increase of 2.6 MW of heat rejection is relatively small in comparison to the normal full load heat rejection load, less than a 5 percent increase even when the chillers and duct burners are off, so this increase in heat rejection load should not significantly alter the cooling tower operation and plume potential.

There could be a slight increase in the potential or extent of ground fogging events that occur under during cold and wet conditions with very high winds. Ground fogging can cause traffic impacts due to obstruction of view, particularly at intersections. However, this project's cooling tower is relatively small and the nearest roads are all within industrial areas. The nearest well-traveled public roads are more than 700 meters from the cooling tower. Staff reviewed the ground fogging modeling results for the Roseville Energy Project's cooling tower that is 1/3rd larger than the Procter and Gamble cooling tower. Based on the configuration of the Procter and Gamble cooling tower (north to south) and the comparative ground fogging results from the larger Roseville Energy Project cooling tower, the major roads and intersections surrounding the site are not expected to be impacted by the occasional ground fogging events.

CONCLUSIONS AND RECOMMENDATIONS

The proposed gas turbine upgrade will increase visible plume potential from both the gas turbine/HRSG exhausts and the cooling tower exhausts. However, the gas turbine/HRSG exhaust plume frequency should remain below current staff significance criteria. The increased heat load to the cooling tower is estimated to be less than 2 percent of current heat load; therefore, the cooling tower visible plumes are not expected to increase in frequency or size significantly from existing conditions.

Additionally, no public complaints regarding the visible plumes from this facility are known to have been received by the Energy Commission. Staff considers the absence of complaints in this analysis because visible plumes are generally based on aesthetic significance criteria rather than a health and safety based significance criteria. Ground fogging is the only potential health and safety based impact from the proposed project amendment, and staff concludes that ground fogging should not impact major roads and intersections in the area.

Therefore, staff concludes that there will be an adverse but less than significant impact from the increased visible plumes resulting from the proposed gas turbine upgrade.

PROPOSED MODIFICATIONS TO CONDITIONS OF CERTIFICATION

None.

REFERENCES

Sacramento Cogeneration Authority (SCA). 2007. Petition for Post Certification Project Modification – LM6000 Fleet Upgrade. December 2007.

Hudson. 2008. Record of Communication between Kevin Hudson, Sacramento Municipal Utilities District, and William Walters, Aspen Environmental Group, February.