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SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 1
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

REVISED FINAL DETERMINATION OF COMPLIANCE

COMPANY NAME AND ADDRESS

El Segundo Power, LLC
301 Vista Del Mar
El Segundo, CA 90245

Contact: George L. Piantka, P.E. (760) 710-2156

EQUIPMENT LOCATION

301 Vista Del Mar
El Segundo, CA 90245
SCAQMD ID #115663

EQUIPMENT DESCRIPTION

Section H of the Facility Permit, ID# 115663, Permit to Construct and Temporary Permit to Operate:

Equipment	ID No.	Connected To	Source Type/ Monitoring Unit	Emissions	Conditions
PROCESS 1 – INTERNAL COMBUSTION					
GAS TURBINE, UNIT NO. 9, NATURAL GAS, GENERAL ELECTRIC, MODEL 7FA.05, FAST-START, COMBINED CYCLE, WITH DRY LOW-NOX BURNERS, 2,168 MMBTU/HR HHV @ 41°F, WITH: A/N: 548594 HEAT RECOVERY STEAM GENERATOR (HRSG)	D90	D95, C96	NOx: MAJOR SOURCE	NOx: 2.0 PPMV (4) [RULE 2005, RULE 1703-PSD- BACT]; NOx: 30.88 LB/MMSCF COMMISSIONING (1) [RULE 2012]; NOx: 9.42 LB/MMSCF INTERIM (1) [RULE 2012]; NOx: 15 PPMV (8) NATURAL GAS [40 CFR 60 SUBPART KKKK]; CO: 2.0 PPMV (4) [RULE 1703 PSD-BACT]; CO: 2,000 PPMV (5) [RULE 407];	A63.3, A99.12, A99.13, A195.12, A195.13, A195.14, <u>A195.18</u> A327.1, B61.2, C1.7, D29.10, D29.11, D29.12, D82.6, D82.7, E193.2,

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 2
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Equipment	ID No.	Connected To	Source Type/ Monitoring Unit	Emissions	Conditions
GENERATOR, SERVING UNIT NO. 9, 222 GROSS MW @ 41°F STEAM TURBINE, GENERAL ELECTRIC, MODEL SC GENERATOR, SERVING STEAM TURBINE, 112 GROSS MW @ 41°F.				<u>CO2: 1,000 LBS/GROSS MWH (8)[40 CFR 60 SUBPART KKKK]; CO2: 1,100 LBS/NET MWH (CCR TITLE 20)</u> VOC: 2.0 PPMV (4) [RULE 1303-BACT]; PM10: 9.5 LB/HR (4) [RULE 1303]; PM: 0.1 GR/SCF (5) [RULE 409]; PM: 11 LBS/HR (5) [RULE 475]; PM: 0.01 GR/SCF (5A) [RULE 475]; SO2: 0.06 lb/MMBTU (8)[40 CFR 60 SUBPART KKKK]; SO2: (9)[40 CFR 72 – ACID RAIN]; CH2O: 0.091 PPMV (8) 40 CFR 63 SUBPART YYYY	E193.5, E193.6, <u>E448.3</u> I297.3, K40.5, K67.6
BURNER, DUCT, NATURAL GAS, 268 MMBTU/HR HHV @ 41°F, LOCATED IN THE HRSG OF GAS TURBINE NO. 9 WITH A/N 548594	D95	D90	NOX: MAJOR SOURCE	NOx: 2.0 PPMV (4) [RULE 2005, RULE 1703-PSD-BACT]; NOx: 30.88 LB/MMSCF COMMISSIONING (1) [RULE 2012]; NOx: 9.42 LB/MMSCF INTERIM (1A) [RULE 2012]; NOx: 15 PPMV (8) NATURAL GAS [40 CFR 60 SUBPART KKKK]; CO: 2.0 PPMV (4) [RULE 1703 PSD-BACT]; CO: 2,000 PPMV (5) [RULE 407]; VOC: 2.0 PPMV (4) [RULE 1303-BACT]; PM10: 9.5 1.76 LB/HR (5) [RULE 1303]; PM: 0.1 GR/SCF (5B) [RULE 409]; PM: 11 LBS/HR (5A) [RULE 475]; PM: 0.01 GR/SCF (5C) [RULE 475];	A99.12, A99.13, A195.12, A195.13, A195.14, A327.1, B61.2, C1.7, D29.10, D29.11, D29.12, D82.6, D82.7, E193.2, E193.5, I297.3, I297.7, K40.5, K67.6

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 3
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Equipment	ID No.	Connected To	Source Type/ Monitoring Unit	Emissions	Conditions
				SO₂ : 0.06 lb/MMBTU (8)[40CFR 60 SUBPART KKKK]; SO₂ : (9)[40 CFR 72 – ACID RAIN]; CH₂O : 0.091 PPMV (8) 40 CFR 63 SUBPART YYYY	
CO OXIDATION CATALYST, UNIT NO. 9, BASF, CATALYST VOLUME: 290 FT ³ ; WITH: A/N: 548591	C96	C97, D90			
SELECTIVE CATALYTIC REDUCTION, UNIT NO. 9, CORMETECH, CATALYST VOLUME: 2,050 FT ³ ; WIDTH: <u>29 FT 4 8 IN</u> ; HEIGHT: <u>6 70 FT 4 5 IN</u> ; LENGTH: 1 FT 9 IN; WITH: AMMONIA INJECTION, AQUEOUS AMMONIA A/N: 548591	C97	C96, S99		NH₃ : 5 PPMV (4) [RULE 1303-BACT]	D12.14, D12.15, D12.16, D29.3, E179.7, E179.8, E193.2, E193.7
STACK, SERVING UNIT NO. 9, DIAMETER: 20 FT, HEIGHT: 210 FT, WITH: A/N: 548594	S99	C97			
GAS TURBINE, UNIT NO. 11, NATURAL GAS, ROLLS ROYCE , MODEL TRENT 60, SIMPLE CYCLE, WITH WATER INJECTION, 516 MMBTU/HR @ 78°F, WITH: A/N: 548589 GENERATOR, 57.4 GROSS MW @ 78°F	D100	C106	NOX: MAJOR SOURCE	NO_x : 2.5 PPMV (4) [RULE 2005, RULE 1703-PSD-BACT]; NO_x : 96.58 LB/MMSCF COMMISSIONING (1) [RULE 2012]; NO_x : 16.16 LB/MMSCF INTERIM (1A) [RULE 2012]; NO_x : 25 PPMV (8) NATURAL GAS [40 CFR 60 SUBPART KKKK];	A63.4, A99.14, A99.15, A195.15, A195.16, A195.17, A327.1, B61.2, C1.8, D29.10, D29.11,

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 4
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Equipment	ID No.	Connected To	Source Type/ Monitoring Unit	Emissions	Conditions
				CO: 4.0 PPMV (4) [RULE 1703 PSD-BACT]; CO: 2,000 PPMV (5) [RULE 407]; VOC: 2.0 PPMV (4) [RULE 1303-BACT]; PM10: 9.5 <u>5</u> LB/HR (5) [RULE 1303]; PM: 0.1 GR/SCF (5A [RULE 409]); PM: 11 LBS/HR (5B) [RULE 475]; PM: 0.01 GR/SCF (5C) [RULE 475]; SO₂: 0.06 lb/MMBTU (8)[40CFR 60 SUBPART KKKK]; SO₂: (9)[40 CFR 72 – ACID RAIN]; CH₂O: 0.091 PPMV (8) 40 CFR 63 SUBPART YYYY	D29.12, D82.6, D82.7, E193.2, E193.5, E193.8, <u>E448.2</u> <u>E448.3</u> I297.5, K40.5, K67.6
CO OXIDATION CATALYST, UNIT NO. 11, PEERLESS, CATALYST VOLUME: 420 FT ³ ; WITH: A/N: 548588	C102	C100, D103			
SELECTIVE CATALYTIC REDUCTION, UNIT NO. 11, PEERLESS, CATALYST VOLUME: 1,272 FT ³ ; WIDTH: 19 FT 6 IN; HEIGHT: 33 FT 0 IN; LENGTH: 2 FT 6 IN; WITH: AMMONIA INJECTION AQUEOUS AMMONIA A/N: 548588	C103	C102, S105		NH₃: 5 PPMV (4) [RULE 1303-BACT]	D12.17, D12.18, D12.19, E179.9, E179.10, E193.2, E193.7
STACK, SERVING UNIT NO. 11, DIAMETER: 11.1 FT, HEIGHT: 150 FT, WITH: A/N: 548589	S105	C103			

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 5
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Equipment	ID No.	Connected To	Source Type/ Monitoring Unit	Emissions	Conditions
<p>GAS TURBINE, UNIT NO. 12, NATURAL GAS, ROLLS ROYCE, MODEL TRENT 60, SIMPLE CYCLE, WITH WATER INJECTION, 516</p> <p>MMBTU/HR @ 78°F, WITH:</p> <p>A/N: 548589</p> <p>GENERATOR, 57.4 GROSS MW @ 78°F</p>	D106	C108	NOX: MAJOR SOURCE	<p>NOx: 2.5 PPMV (4) [RULE 2005, RULE 1703-PSD-BACT]; NOx: 96.58 LB/MMSCF COMMISSIONING (1) [RULE 2012]; NOx: 16.16 LB/MMSCF INTERIM (1A) [RULE 2012]; NOx: 25 PPMV (8) NATURAL GAS [40CFR60 SUBPART KKKK];</p> <p>CO: 4.0 PPMV (4) [RULE 1703 PSD-BACT]; CO: 2,000 PPMV (5) [RULE 407];</p> <p>VOC: 2.0 PPMV (4) [RULE 1303-BACT];</p> <p>PM10: 5 LB/HR (5) [RULE 1303]; PM: 0.1 GR/SCF (5A) [RULE 409]; PM: 11 LBS/HR (5B) [RULE 475]; PM: 0.01 GR/SCF (5C) [RULE 475];</p> <p>SO₂: 0.06 lb/MMBTU (8)[40CFR 60 SUBPART KKKK]; SO₂: (9)[40CFR 72 – ACID RAIN];</p> <p>CH₂O: 0.091 PPMV (8) 40 CFR 63 SUBPART YYYY</p>	A63.4, A99.14, A99.15, A195.15, A195.16, A195.17, A327.1, B61.2, C1.8, D29.10, D29.11, D29.12, D82.6, D82.7, E193.2, E193.5, E193.8, <u>E448.2</u> <u>E448.3</u> I297.4, K40.5, K67.6
<p>CO OXIDATION CATALYST, UNIT NO. 12, PEERLESS, CATALYST VOLUME: 420 FT³; WITH:</p> <p>A/N: 548588</p>	C108	C106, D109			
<p>SELECTIVE CATALYTIC REDUCTION, UNIT NO. 12, PEERLESS, CATALYST VOLUME: 1,272 FT³; WIDTH: 19 FT 6 IN; HEIGHT: 33 FT 0 IN; LENGTH: 2 FT 6 IN; WITH:</p>	C109	C108, S111		<p>NH₃: 5 PPMV (4) [RULE 1303-BACT]</p>	D12.17, D12.18, D12.19, E179.9,

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 6
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Equipment	ID No.	Connected To	Source Type/ Monitoring Unit	Emissions	Conditions
A/N: 548588 AMMONIA INJECTION AQUEOUS AMMONIA					E179.10, E193.2, E193.7
STACK, SERVING UNIT 12, DIAMETER: 11 FT, HEIGHT: 150 FT, WITH: A/N: 548589	S111	C109			
BOILER, AUXILIARY, CLEAVER BROOKS, MODEL NB-100D-40, WATERTUBE, NATURAL GAS, 36 MMBTU/HR WITH LOW NOX BURNER WITH A/N: 548593 BURNER, 36 MMBTU/HR, NATURAL GAS, WITH LOW NOX BURNER	D112	<u>C114</u>	NOX: LARGE SOURCE	NOx: 5.0 PPMV (4) [RULE 2005, RULE 1703-PSD- BACT]; CO: 50 PPMV(4) [RULE 1703-PSD BACT]; CO: 2000 PPMV (5) [RULE 407]; CO: <u>100PPMV (4)</u> [RULE 1703-PSD BACT] PM: 0.1 GRAINS/SCF (5) [RULE 409]	A63.4 <u>A63.5,</u> <u>A195.19,</u> <u>A195.20,</u> <u>A195.21,</u> B61.2, C1.9, D29.4, <u>D29.13</u> E193.2, E193.5 <u>E193.9</u> I297.6 K40.4 <u>K40.5</u>
<u>SELECTIVE CATALYTIC REDUCTION, SERVING AUXILIARY BOILER, HALDOR-TOPSOE, MODEL DNX929, VOLUME: 28 FT3; LENGTH: 2 FT 2 IN; WIDTH: 4 FT 6 IN; HEIGHT: 4 FT 6 IN</u> <u>WITH:</u> <u>A/N: 563455</u> <u>AMMONIA INJECTION AQUEOUS AMMONIA</u>	<u>C114</u>	<u>D112</u>		NH3: 5 PPMV (4) [RULE <u>1303-BACT</u>]	D12.20, <u>D12.21,</u> <u>D12.22,</u> <u>E179.11,</u> <u>E179.12,</u> <u>E193.2,</u> <u>E193.7</u>

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 7
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

BACKGROUND

El Segundo Power, LLC operates the existing power generating facility located on a 32.8 acre site at 301 Vista Del Mar Boulevard in the City of El Segundo. The site is located at Township 3 South, Range 15 West, on the Venice U.S. Geological Survey (USGS) quadrangle map. The facility is bordered on the west by Santa Monica Bay, on the east by Vista Del Mar Boulevard, on the north by the Chevron Marine Terminal, and on the south by 45th Street in the city of Manhattan Beach. The facility is designed to provide electricity to the Southern California Edison (SCE) power distribution grid and has been in continuous operation since 1955. The original facility had a total gross electrical output of 1020 MW which consisted of Boilers #1 and #2, each rated at 175 MW, and Boilers #3 and #4 each rated at 335 MW. In 2000, El Segundo Power, LLC submitted applications for Permit to Construct for a proposed 647 MW ocean-water cooled (once-through cooling) power generating facility which consisted of 2 combined cycle gas turbines to replace Boilers #1 and 2. Boilers #1 and #2 were removed from service in December 2002. The proposed new construction resulted in an increase in generating capacity of greater than 50 megawatts. As such, the proposed El Segundo Power Redevelopment (ESPR) project was subject to review and approval from the California Energy Commission (CEC). The ESPR Project was approved by the CEC and El Segundo Power, LLC was issued a CEC License for the proposed ESPR Project in February 2005. The ESPR Project was amended in 2010 to replace the originally selected combined cycle gas turbines with rapid-start combined cycle units by a different manufacturer and to eliminate the once-through cooling. El Segundo Power, LLC decided in addition to the previously removed Boilers #1 and #2, it will also remove Boiler #3 from service prior to the start-up of Gas Turbine Units #5 and #7 as part of the offset strategy to qualify for the Rule 1304(a)(2) modeling and offset exemption on a MW-to-MW basis. The resulting shutdown of Boilers #1, #2, and #3 exceeded the required offsets for the proposed project by 112 MW. As such, the proposed ESPR Project had a zero MW increase. Permits to Construct were issued for the ESPR Project on July 13, 2010. The total present electrical generating capacity for the ESPR Project is 573 MW.

PROPOSED MODIFICATION

In addition to the 573 MW proposed and completed under the ESPR Project, El Segundo Power, LLC is proposing new, further modifications to the facility under the El Segundo Power Facility Modification (ESPFM) Project. The ESPFM Project will consist of the installation and operation of an efficient, state-of-the-art electrical power generation system. The new power generating system will include one combined cycle gas turbine, two simple cycle gas turbines, and an auxiliary boiler and associated air pollution control (APC) equipment. The combined cycle gas turbine will consist of a General Electric (GE) Model 7FA gas turbine and a General Electric Model SC steam turbine. The gas turbine is rated at 222 MW and the steam turbine is rated at 112 MW. The total combined cycle capacity will be 334 MW gross. The simple cycle gas turbines will consist of two Rolls Royce (RR) Trent 60 gas turbines, each rated at 57.4 MW for a total simple cycle capacity of 114.8 MW gross. The total plant capacity of the proposed new power system will be 448.8 MW gross. As with the ESPR Project, the CEC will continue its jurisdiction over the proposed ESPFM Project. El Segundo Power, LLC has also submitted

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 8
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

an amended petition to the CEC to incorporate the proposed facility modifications under the ESPFM Project.

The GE 7FA combined cycle gas turbine and the two RR Trent 60 simple cycle gas turbines will operate exclusively with natural gas. The new power system will include air pollution control equipment for each of the gas turbines. Each gas turbine will be connected to a CO oxidation catalyst followed by a selective catalytic reduction (SCR) unit. The CO oxidation catalyst converts CO to CO₂, in addition to removing some VOC emissions. The SCR injects aqueous ammonia at a given temperature window to react with the combustion exhaust, thus reducing NO_x to nitrogen. The El Segundo facility currently operates a 20,000 gallon permitted (A/N 379904, P/N G20414) 29% aqueous ammonia storage tank and does not plan to build any new ammonia storage tanks. As part of the new power generation system, the ESPFM Project will require a source of steam to utilize the rapid-start capability of the GE 7FA combined cycle gas turbine. The steam will be provided by the proposed auxiliary boiler. The new GE 7FA combined cycle gas turbine will be labeled as Unit #9. The two RR Trent 60 simple cycle gas turbines will be labeled as Units #11 and #12, respectively (The steam turbine portion of the combined cycle system will be designated as Unit 10). In accordance with AQMD Rules 1303 and 1313, El Segundo Power, LLC will remove Boiler #4 from service and surrender the permit within 90 calendar days after the initial startup of the new power generating system. The following table is a summary of the applications submitted by El Segundo Power, LLC. The total processing fees in Table 1 below include fees for regular plus expedited processing. A/Ns 548590 and 548588 receive reduced processing fees (50%) for identical equipment. A/N 563455 is for a proposed SCR catalyst serving the auxiliary boiler. This application was submitted to SCAQMD on May 2, 2014 and deemed complete on June 1, 2014. Table 1 below is amended to include A/N 563455.

Table 1 – Applications Submitted to SCAQMD

Applications	Equipment Description	Processing Fees
548594	GE 7FA Combined Cycle Gas Turbine #9, > 50 MW	\$24,286.86
548589	RR Trent 60 Simple Cycle Gas Turbine #11, > 50 MW	\$24,286.86
548590	RR Trent 60 Simple Cycle Gas Turbine #12, > 50 MW	\$12,143.43
548591	SCR/CO Catalyst for Gas Turbine #9	\$5,160.09
548592	SCR/CO Catalyst for Gas Turbine #11	\$5,160.09
548588	SCR/CO Catalyst for Gas Turbine #12	\$2,580.05
548593	Auxiliary Boiler, 36 MMBTU/hr	\$7,121.79
<u>563455</u>	<u>SCR Catalyst for Auxiliary Boiler</u>	<u>\$5,263.29</u>
548587	Title V/RECLAIM Significant Permit Revision	\$1,789.12
Total processing fee, including 50% fee for Expedited Permit Processing		\$82,528.29 \$87,791.58

El Segundo Power, LLC is a federal Title V and Acid Rain facility. It also participates in the NO_x RECLAIM program (Cycle 1). The facility is currently complying with all federal, state, and local rules and regulations.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 9
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The applications in Table 1 above were submitted on March 19, 2013. The applicant requested expedited permit processing of the applications, and paid the 50% additional fee per Rule 301(u). They were deemed incomplete on April 12, 2013. The SCAQMD requested additional information from the applicant in a letter dated April 12, 2013. The requested additional information has been received and the applications were deemed complete on November 20, 2013.

PROCESS DESCRIPTION

Combined Cycle Generating System (CCGS)

The CCGS will consist of one GE 7FA combined cycle gas turbine generator. The GE 7FA is comprised of a gas turbine and a steam turbine. Each part is connected to a separate electric generator. Combustion air is supplied to the gas turbine through an inlet air filter and associated inlet air ductwork. Evaporative coolers are placed at the air inlet and are turned on during hot weather to improve cycle efficiency. The inlet air is routed through the compressor, and then joins the pre-heated and compressed natural gas supplied through the fuel compressor, in the combustor and starts the combustion process. The high-temperature, high-pressure gas mixture produced in the combustor expands through the turbine blades, driving both the turbine and the electric generator. The GE 7FA will generate a maximum of 222 MW of electricity at 41°F.

The exhaust of the CTG passes through a duct burner (DB) prior to entry into the heat recovery steam generator (HRSG). The exhaust heats the feed water in the front section of the HRSG and convert it into high pressure (HP) superheated steam. The HP steam is delivered to the HP section of the GE SC steam turbine. Steam exiting from the HP section goes to the intermediate section of the HRSG to be heated again. It joins the HRSG's intermediate pressure (IP) steam and enters the steam turbine's IP section. Steam exiting the IP section goes to the last section of the HRSG to be heated one more time. It joins the HRSG's low pressure (LP) steam that enters the steam turbine's LP section. Steam leaving the LP section enters the air-cooled condenser and condenses into water. The condensed water will then join the HRSG's feed water system. The GE SC steam turbine will generate a maximum of 112 MW of electricity at 41°F.

The specifications of the CCGS are provided in Table 2 below. The natural gas provided at El Segundo Power, LLC is California Public Utilities Commission (CPUC) quality natural gas with a higher heating value (HHV) of 1,030 BTU/scf and a lower heating value (LHV) of 929 BTU/scf. The total net heat rate of the CCGS (including duct burner firing) is 6,754 BTU/kWh based on the LHV at 41°F. The total gross power generated by the CCGS is 334 MW at 41°F.

Fast Start

GE's Fast-Start[®] technology will use steam supplied from the auxiliary boiler to keep the CCGS in a continuous state of readiness and to reach its base load quickly while simultaneously reducing both start-up time of the gas turbine and the associated emissions. The auxiliary boiler specifications are listed in Table 4 below.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 10
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Table 2 – CCGS Specifications

PARAMETERS	SPECIFICATIONS
Gas Turbine Manufacturer	General Electric
Model No.	7FA.05 Fast-Start®
Steam Turbine Make & Model	General Electric SC
Fuel Type	California Public Utilities Commission (CPUC) Quality Natural Gas
Gas Turbine Maximum Heat Input	2,168 MMBTU/hr @ 41°F (HHV) 1,955 MMBTU/hr @ 41°F (LHV)
Duct Burner Maximum Heat Input	268 MMBTU/hr @ 41°F (HHV) 242 MMBTU/hr @ 41°F (LHV)
Total Maximum Heat Input	2,436 MMBTU/hr @ 41°F (HHV) 2,197 MMBTU/hr @ 41°F (LHV)
Gas Turbine Maximum Fuel Consumption	2.105 MMSCF/hr @ 41°F
Duct Burner Maximum Fuel Consumption	0.260 MMSCF/hr @ 41°F
Total Maximum Fuel Consumption	2.365 MMSCF/hr ^a @ 41°F
Gross Plant Heat Rate, HHV	7,301 BTU/kWh @ 41°F
Gross Plant Heat Rate, LHV	6,583 BTU/kWh @ 41°F
HRSO Maximum Exhaust Flow	859,000 DSCFM
HRSO Maximum Exhaust Temperature	219°F @ 41°F Ambient
NOx Combustion Control	Dry Low NOx Combustor
Ammonia Injection Rate	435 139.8 lb/hr 29% aqueous NH ₃ at full load @ 41°F
Post Combustion Control	SCR and CO Catalyst
Net Plant Heat Rate, HHV	7,490 BTU/kWh @ 41°F
Net Plant Heat Rate, LHV	6,754 BTU/kWh @ 41°F
GE 7FA Gas Turbine Power Generation	222 MW @ 41°F
Steam Turbine Power Generation	112 MW @ 41°F
Total CCGS Gross Power Generation	334 MW @ 41°F ^b
^a Represents the total maximum fuel consumption of the gas turbine plus the duct burner, based on the HHV and a total maximum heat input of 2,436 MMBTU/hr and 1,030 BTU/scf natural gas heat content. ^b Represents the total power generated from the GE 7FA gas turbine plus the GE SC steam turbine.	

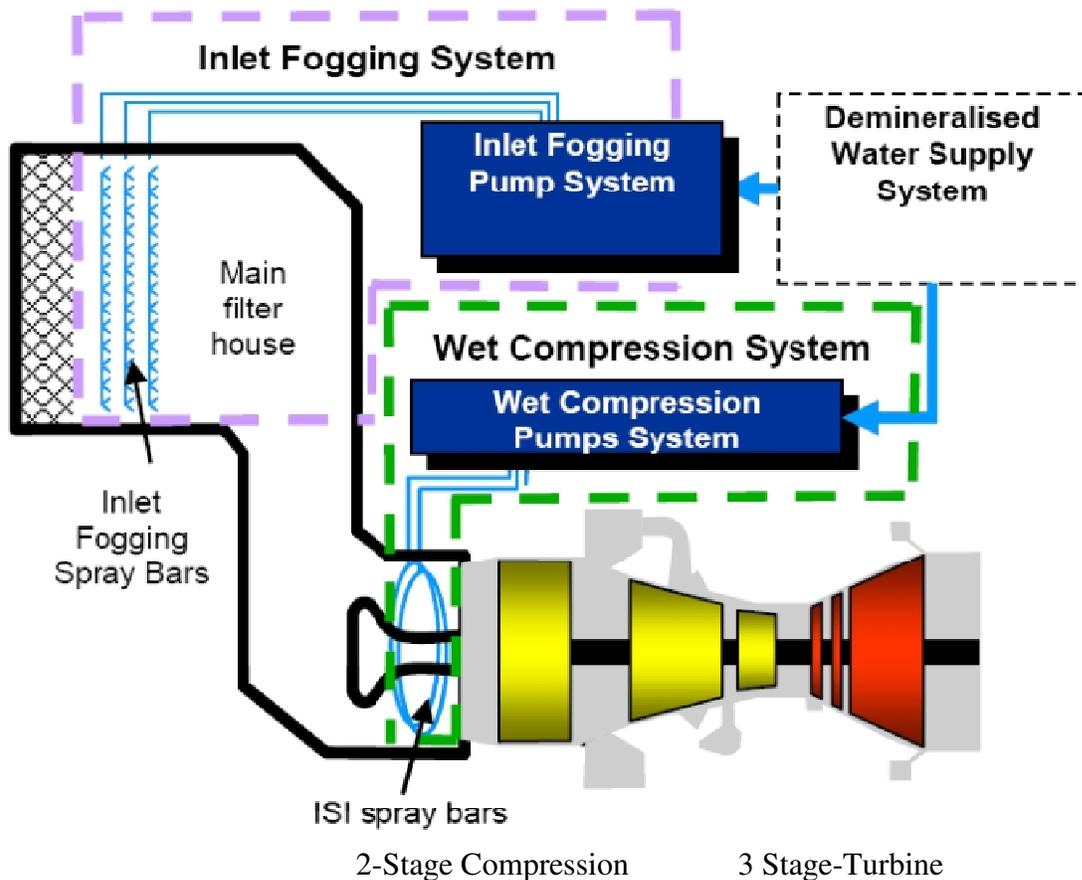
Simple Cycle Generating System (SCGS)

The SCGS will consist of two RR Trent 60 simple cycle gas turbine generators. Each Trent 60 is connected to a separate electric generator. Below is a schematic of the Inlet Spray Inter-cooling (ISI) system as configured on each of the Trent 60 simple cycle gas turbines. The ISI system consists of an inlet fogging system and a wet compression system. A de-mineralized water supply system is used to supply de-mineralized water to both the inlet fogging system and the wet compression system. The ISI system provides performance improvements, while minimizing the additional plant water consumption and auxiliary load when compared to other inlet cooling technologies with comparable performance

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 11
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

enhancement. ISI allows the Trent 60 to maintain maximum rating over an extended operating range and provides considerable power boosts and heat rate improvements at high ambient temperatures. The ISI system provides staged inlet fogging and wet compression water streams to the gas turbine air intake system. The inlet fogging system provides a metered inlet fogging water flow to provide a controlled saturation of the intake with the air flow by three fogging arrays supplied in stages to provide maximum flexibility and control over the ambient temperature range. The wet compression system provides a metered wet compression water flow in three stages via spray rails mounted forward of the gas turbine LP compressor. The ISI operates to optimize unit efficiency and minimize water consumption at lower loads.

Inlet Spray Inter-cooling (ISI) System Overview



The specifications of the SCGS are provided in Table 3 below. The RR Trent 60 gas turbine uses water injection for NO_x control prior to the SCR/CO Catalyst systems. The total net heat rate of the SCGS is 8,458 BTU/kWh based on the LHV at 78°F. Each Trent 60 will generate a maximum of 57.4 MW of electricity at 78°F. The total gross power generated by the SCGS will be ~~42~~ 114.8 MW at 78°F.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 12
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Table 3 – SCGS Specifications

PARAMETERS	SPECIFICATIONS
Gas Turbine Manufacturer	Rolls Royce
Model No.	Trent 60
Fuel Type	CPUC Quality Natural Gas
Maximum Gas Turbine Heat Input	516 MMBTU/hr @ 78°F (HHV)
Maximum Gas Turbine Fuel Consumption	0.501 MMSCF/hr @ 78°F
Maximum Gas Turbine Exhaust Flow	256,795 DSCFM @ 78°F
Maximum Gas Turbine Exhaust Temperature	809°F @ 78°F Ambient
NO _x Combustion Control	Water Injection
Ammonia Injection Rate	47 <u>67.8</u> lb/hr at full load @ 78°F
Post Combustion Control	SCR and CO Catalyst
Net Plant Heat Rate, HHV	9,380 BTU/kWh @ 78°F
Net Plant Heat Rate, LHV	8,458 BTU/kWh @ 78°F
RR Trent 60 Gas Turbine Power Generation	57 <u>57.4</u> MW @ 78°F
Total SCGS Gross Power Generation	112 <u>114.8</u> MW @ 78°F ^c
^c Represents the total power generated from two RR Trent 60 simple cycle gas turbines, each rated at 57.4 MW @78°F	

Table 4 – Auxiliary Boiler Specifications

PARAMETERS	SPECIFICATIONS
Boiler Manufacturer	Cleaver-Brooks
<u>Maximum Heat Input</u>	<u>36 MMBTU/hr</u>
Model No.	D-Type NB-100D-40
Boiler Type	Watertube
Fuel Type	CPUC Quality Natural Gas
Maximum Fuel Consumption	0.035 MMSCF/hr
Maximum Gas Turbine Fuel Consumption	0.501 MMSCF/hr @ 78°F
Maximum Exhaust Flow	6,100 DSCFM
Maximum Exhaust Temperature	300°F
NO _x Combustion Control	Low NO _x Burner
NO _x BACT Concentration at Stack Outlet	5 ppmv @3% O ₂ (<u>post SCR</u>)
CO BACT Concentration at Stack Outlet	50 ppmv @3% O ₂ (At Loads >20%-100%) 100 ppmv @3% O ₂ (At Loads ≤ 20%)

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 13
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Start-Up / Shutdown Schedule

El Segundo Power, LLC has proposed the following start-up / shutdown schedules for both the CCGS and the SSGS shown in Tables 5 and 6 below. For the CCGS, there will be a Fast Start and a Traditional start-up, the main difference being the amount of time needed to bring the GE 7FA gas turbine to full load and into compliance with the BACT limits¹. Each start-up period is assumed predicted to last 1-hour.

Table 4 5 – CCGS Start-Up / Shutdown Schedule

Event	Daily	Monthly	Annually
Fast Start ²	1	47	150
Traditional Start-Up	1	15	50
Shutdown	2	62	200

Table 5 6 – SCGS Start-Up / Shutdown Schedule

Event	Daily	Monthly	Annually
Start-Up	4	60	480
Shutdown	4	60	480

Selective Catalytic Reduction (SCR)

The SCR is a post-combustion control technology to reduce flue gas NO_x emissions. At a given temperature window and with the presence of a specific catalyst ammonia reacts with nitrogen oxides of the combustion flue gas. The reaction converts NO_x into nitrogen and lowers NO_x emissions. A SCR system includes ammonia vaporization and injection equipment, a booster fan for the flue gas, an SCR reactor with catalyst, and instrumentation and control equipment. The new power generating system will use three SCR systems, one for the GE 7FA and one for each of the two Trent 60 gas turbines. The facility will use the existing ammonia storage tank to provide aqueous ammonia.

The GE 7FA gas turbine is equipped with dry low NO_x (DLN) combustors. The NO_x emissions from the GE 7FA are expected to be 9 ppmv on a dry basis at 15% O₂ prior to entry into the SCR unit. The SCR for the GE 7FA is designed to further reduce the gas turbine exhaust NO_x emissions from 9.0 ppmv to 2.0 ppmv on a dry basis at 15% O₂. The SCR catalyst will be manufactured by Cormetech, Inc. The SCR catalyst will operate within an optimal temperature window of approximately 300°F to 750°F to facilitate a heterogeneous reaction between NO_x and ammonia (NH₃). The catalyst in the SCR is expected to be vanadium based on a homogeneous honeycomb titanium support matrix. The life cycle of the SCR modules is expected to be 5 years. After that the SCR catalyst may be returned to

¹ See Appendix A for a more detailed discussion regarding the Fast Start and Traditional Start-Up for the CCGS.

² Fast Start duration is 30 minutes. Therefore, the start-up hour for the Fast Start scenario will include 30 minutes of elevated emissions and 30 minutes of controlled emissions

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 14
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

the vendor for reprocessing. The catalyst warranty is 2.0 ppmvd NO_x dry at 15% O₂, with 5 ppmvd NH₃ slip at 15% O₂ at dry conditions. Table 5 7 below is a summary of the specifications of the SCR catalyst for the CCGS.

Table 5 7 – CCGS SCR Catalyst Data Summary

PARAMETERS	SPECIFICATIONS
Catalyst Manufacturer	Cormetech, Inc.
Catalyst Description	Titanium/Vanadium/Tungsten (Ti-V-W)
Catalyst Volume	2,050 ft ³
Space Velocity	23,000 hr ⁻¹
Ammonia Injection Rate	135 139.8 lb/hr of 29% aqueous NH ₃ at full load
Ammonia Slip	5 ppmvd NH ₃ at 15% O ₂ 1 hour average
Catalyst Life	5 Years
Maximum Operating Temperature	750°F
Stack Outlet NO _x	2.0 ppmvd NO _x at 15% O ₂ 1 hour average

The SCR catalysts for the two RR Trent 60 gas turbines will be identical and are expected to reduce the gas turbine exhaust NO_x emissions from 25 ppmv to 2.5 ppmv, dry at 15% O₂. The SCR catalysts will be manufactured by Peerless. The catalyst material will be vanadium based on a homogeneous honeycomb titanium support matrix. The catalyst model number will be DNX629. The total catalyst volume is 1,272 ft³. The catalyst dimensions will be 33'-0" high by 19'-6" wide by 2'-6" in length. The life cycle of the SCR modules is expected to be 5 years. After that the SCR catalyst may be returned to the vendor for reprocessing. The catalyst warranty is 2.5 ppmvd NO_x at 15% O₂, with 5 ppmvd NH₃ slip at 15% O₂ at dry conditions. The operating range for the SCR catalysts will be 600°F – 1,125°F. Table 6 8 below is a summary of the specifications of the SCR catalyst for the SCGS.

Table 6 8 – SCGS SCR Catalyst Data Summary

PARAMETERS	SPECIFICATIONS
Catalyst Manufacturer	Peerless
Catalyst Description	Titanium/Vanadium/Tungsten (Ti-V-W) with homogeneous honeycomb structure
Catalyst Volume	1,272 ft ³
Space Velocity	23,580 hr ⁻¹
Ammonia Injection Rate	47 67.8 lb/hr of 29% aqueous NH ₃ at full load
Ammonia Slip	5 ppmvd NH ₃ at 15% O ₂ 1 hour average
Catalyst Life	5 Years
Maximum Operating Temperature	1,125°F
Stack Outlet NO _x	2.5 ppmvd NO _x at 15% O ₂ 1 hour average

CO Oxidation Catalyst

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 15
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The oxidation catalyst is a post-combustion control technology to reduce CO and VOC emissions in the hot exhaust of a combustion source. It is placed immediately downstream of the gas turbine and at the upstream of the SCR catalyst. Carbon monoxide of the combustion flue gas is oxidized to become carbon dioxide with the presence of the oxidation catalyst at a given temperature window. The new power generating system will use three oxidation catalysts, one for one for the GE 7FA and one for each of the two Trent 60 gas turbines.

The oxidation catalyst for the GE 7FA gas turbine is designed to achieve a CO emission level of 2.0 ppmv and a VOC emission level of 2.0 ppmv, dry at 15% O₂. The gas turbine exhaust CO concentration is 4.4 ppmv, dry at 15% O₂, prior to entry into the oxidation catalyst. The oxidation catalyst will be manufactured by BASF. The catalyst dimensions will be 70'-0" high by 25'-0" wide. The following table lists the expected operating parameters of the oxidation catalyst. Table 7 9 below is a summary of the specifications of the oxidation catalyst for the CCGS.

Table 7 9 – CCGS Oxidation Catalyst Summary

PARAMETERS	SPECIFICATIONS
Catalyst Manufacturer	BASF
Catalyst Description	Platinum, corrugated SS substrate
Catalyst Volume	290 ft ³
Space Velocity	218,000 ft ⁻¹ hr ⁻¹
Stack Outlet CO	2.0 ppmvd CO at 15% O ₂ , 1 hour average
Stack Outlet VOC	2.0 ppmvd CO at 15% O ₂ , 1 hour average
Catalyst Life	5 years
Maximum Operating Temperature	1,000°F

The oxidation catalysts for the two RR Trent 60 gas turbines will be identical and are designed to achieve a CO emission level of 4.0 ppmv and a VOC emission level of 2.0 ppmv, dry at 15% O₂. The oxidation catalyst will be manufactured by Peerless. The catalyst reactors will be made of platinum group metals. The total catalyst volume will be 420 ft³. The dimensions of the catalyst will be 33'-0" high by 19'-5" wide. The oxidation catalyst will be operating within an optimal temperature window of approximately 600°F to 1,150°F. The following table lists the expected operating parameters of the oxidation catalyst. Table 8 10 below is a summary of the specifications of the oxidation catalyst for the SCGS.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 16
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Table 8 10 – SCGS Oxidation Catalyst Summary

PARAMETERS	SPECIFICATIONS
Catalyst Manufacturer	Peerless
Catalyst Description	Platinum group metals
Catalyst Volume	420 ft ³
Space Velocity	125,000 ft ⁻¹ hr ⁻¹
Stack Outlet CO	4.0 ppmvd CO at 15% O ₂ , 1 hour average
Stack Outlet VOC	2.0 ppmvd CO at 15% O ₂ , 1 hour average
Catalyst Life	5 years
Maximum Operating Temperature	1,200°F

The SCR catalyst for the auxiliary boiler will be installed downstream of the low NO_x burner and will reduce the exhaust NO_x emissions from 9 ppmv to 5 ppmv, dry at 3% O₂. The SCR catalyst will be manufactured by Haldor-Topsoe. The catalyst material will be vanadium/tungsten based on a homogeneous honeycomb titanium support matrix. The catalyst model number will be DNX929. The total catalyst volume is 28 ft³. The catalyst dimensions will be 2'-2" high by 4'-6" wide by 4'-6" in length. The life cycle of the SCR modules is expected to be 5 years. The SCR warranty is 5 ppmvd NH₃ slip at 3% O₂ at dry conditions. The operating range for the SCR catalyst will be 500°F – 750°F. Table 11 below is a summary of the specifications of the SCR catalyst for the auxiliary boiler.

Table 11 – Auxiliary Boiler SCR Catalyst Summary

<u>PARAMETERS</u>	<u>SPECIFICATIONS</u>
<u>Catalyst Manufacturer</u>	<u>Haldor-Topsoe</u>
<u>Catalyst Description</u>	<u>Titanium/vanadium/tungsten</u>
<u>Catalyst Model No.</u>	<u>DNX929</u>
<u>Catalyst Volume</u>	<u>28 ft³</u>
<u>Space Velocity</u>	<u>14,706 hr⁻¹</u>
<u>Stack Outlet CO</u>	<u>50 ppmvd @3% O₂, 1-hour average (At Loads >20%-100%)</u> <u>100 ppmvd @3% O₂, 1-hour average (At Loads ≤20%)</u>
<u>Stack Outlet NO_x</u>	<u>5.0 ppmvd @3% O₂, 1-hour average</u>
<u>NH₃ Slip</u>	<u>5.0 ppmvd @3% O₂, 1-hour average</u>
<u>Catalyst Life</u>	<u>5 years</u>
<u>NH₃ Injection Rate</u>	<u>5 lb/hr</u>
<u>Maximum Operating Temperature</u>	<u>750°F</u>

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 17
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

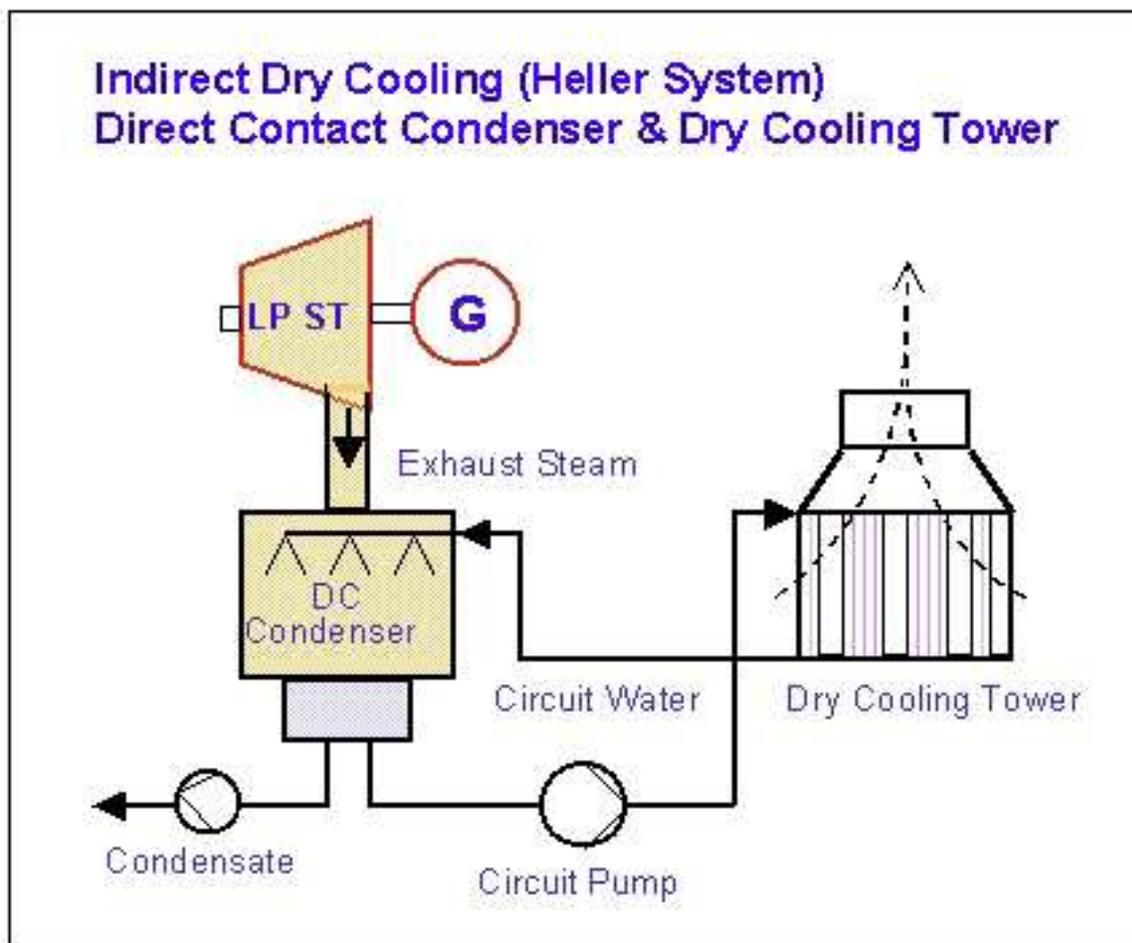
Ammonia Injection Grid and Storage

Aqueous ammonia (ammonium hydroxide at 29 percent nominal concentration by weight) is currently used in the SCR's serving the existing permitted (A/Ns 470652 and 470656) Siemens-Westinghouse Combined Cycle Gas Turbines #5 and #7 to reduce NO_x emissions to 2.0 ppmvd at 15% O₂. The ammonia is stored onsite in a permitted (P/N G20414) 20,000 gallon double walled underground storage tank. Ammonia will continue to be delivered to the site by truck and stored in the existing underground storage tank. Additional ammonia storage tanks are not required for the new power generating system. The vaporized ammonia will be diluted with air and injected into the gas turbine exhaust stream through nozzles for NO_x control. The amount of ammonia introduced into the system will vary depending upon NO_x reduction requirements, but will be approximately a 1.33:1 molar ratio of ammonia to NO_x for the CCGS and 1:1 molar ratio of ammonia to NO_x for the SCGS. Expected maximum ammonia use is about 18.7 gallons per hour for the CCGS, and 9.1 gallons per hour for each of the SCGS gas turbines. The estimated annual ammonia usage is 102,183 gallons for the CCGS assuming the annual capacity factor of 100%. The estimated annual ammonia usage for the auxiliary boiler is 5,258 gallons per year. The estimated annual ammonia usage is 43,527 gallons per CTG for the SCGS assuming the annual capacity factor of 55%. The new power system total ammonia usage is expected to be ~~189,237~~ 194,495 gallons per year.

Heller System[®] Dry-Cooling

Cooling for the CCGS will utilize indirect cooling in which cooled condensate is circulated in a closed system that uses air as the secondary cooling medium. Exhaust steam from the steam turbine is condensed by direct contact with cooled condensate. Water from the direct contact jet condenser is divided into two streams. One water stream which is equal to the amount of condensate from the steam cycle, is pumped forward to be heated again in the HRSG. The second water stream is pumped to a dry cooling tower where it is cooled in non-evaporative water-to-air heat exchangers. The cooled water is then returned to the condenser where it is sprayed into and mixed with the exhaust stream. The steam condenses on the surface of the droplets and collects in the hotwell. The heat transfer between air and cooling water is achieved with convection rather than evaporation as in wet cooling systems. An additional advantage is that the Heller System does not require water to be replenished and consumes approximately 97 percent less water than wet cooling systems with minimal impact on plant performance. An illustrative schematic is provided below:

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 18
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY



Stacks

The GE 7FA gas turbine and associated SCR/CO catalyst system uses a 210-foot tall, 20-foot diameter stack. The base elevation for the stack is 20 feet. The RR Trent 60 gas turbines and associated SCR/CO catalyst systems will each be equipped with their own individual 150-foot tall, 11.1 foot diameter stack. The base elevation for the SCGS stacks is 20 feet.

CAPACITY FACTOR

Operation of the CCGS is forecasted to be up to 60 percent capacity factor annually, including up to 200 startups per year and 200 shutdowns per year. The operation of the SCGS is forecasted to be up to 55 percent capacity factor annually, including 480 hours per year for startups and shutdowns per unit.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 19
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

COMPLIANCE HISTORY

A review of the facility's compliance history in the last five years shows the following violations were issued to El Segundo Power, LLC:

- Notice to Comply (NC) #D03510 was issued on June 30, 2009 to ensure that missing data procedures are followed per 40 CFR 75 Subpart D, Section E when calculating substitute data. The facility was in compliance as of August 4, 2009.
- NC #D03513 was issued on August 4, 2009 to ensure that missing data procedures are followed per Rule 2012 Appendix A, Chapter 2, Section E when calculating substitute data. The facility was in compliance as of August 27, 2009.
- NC #D03517 was issued on December 23, 2009 to ensure that blended refinery-natural gas is sampled and analyzed for sulfur content at least once per month or once per batch per permit condition D90.1. The facility was in compliance as of January 5, 2010.
- NC #E01066 was issued to the facility on December 22, 2010 to provide any/all records for asbestos removal and demolition of both Boiler Unit #1 and Unit #2. The NC required the facility to also provide a list of company(s) involved in asbestos and demolition work on both Boiler Unit #1 and Boiler Unit #2. The facility was in compliance as of February 17, 2010.
- NOV #P53962 was issued to the facility on December 22, 2010 conducting the demolition of retired Boiler Unit #1 and Boiler Unit #2 without proper demolition notification. The NOV was also issued for excessive fugitive dust remaining visible in the atmosphere beyond the property line of the emission source. The facility is currently in compliance.
- NC #D20374 was issued on January 14, 2011 to submit copies of all contracts in which El Segundo Power, LLC allows access to and operation of their equipment by NRG El Segundo Operations, Inc., to verify who the operator is per Rule 203(a) ref. Rule 209. The facility is currently in compliance.
- NC #E00716 was issued on May 26, 2011 to report daily total emissions within 96-hour extension due to system failure and follow correct missing data procedures (MDP) in reporting daily total emissions when report is late. In addition, the facility was required to submit monthly emission reports aggregating NOx emissions from all major sources. The facility was in compliance as of June 10, 2011.
- Notice of Violation (NOV) #P52179 was issued to the facility on August 12, 2011 for failure to comply with the permit condition in which Devices D11 and D13 (Boiler Unit #3 and Boiler Unit #4, respectively) exceeded the NOx emission limit of 7 ppmv. This NOV was closed on March 26, 2013.
- NOV #P52185 was issued to the facility on May 8, 2012 for failure to comply with permit conditions D12.3, D12.5, and D12.6, which required the facility to conduct calibrations once every 12 months. This NOV was closed on March 26, 2013.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 20
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

RETIREMENT OF BOILERS #3 & #4

Current SCAQMD policy for any facility wishing to seek exemption from the modeling and offset exemptions of Rule 1304(a)(2), is for the SCAQMD to require the submittal of and subsequent approval of a formal retirement plan for each affected unit prior to the construction of any new project. El Segundo Power, LLC is seeking an exemption from the modeling and offset requirements for the proposed ESPFM Project under the Utility Steam Boiler Replacement exemption of Rule 1304(a)(2). Therefore, El Segundo Power, LLC is was required to submit a formal retirement plan to the SCAQMD for both Boiler Units #3 and #4.

Boiler #3 has been permanently retired from service and Boiler #4 is currently in service at the facility and each was installed in the 1960s. Both of the boilers were originally designed to operate either with natural gas, refinery gas, or fuel oil. Currently, El Segundo Power, LLC is no longer accepting refinery gas from the Chevron facility and therefore Boiler #4 is no longer burning refinery gas and is restricted to natural gas or fuel oil firing. The current specifications of each boiler are shown below:

Boiler #3:

Steam rate: 2,490,000 lb/hour
Fuel: Natural Gas, Fuel Oil
Manufacturer: Combustion Engineering
Heat input: 3,350 MMBTU/hr, equipped with 24 burners
Power output: 335 MW (gross)

Boiler #4:

Steam rate: 2,490,000 lb/hour
Fuel: Natural Gas, Fuel Oil
Manufacturer: Combustion Engineering
Heat input: 3,350 MMBTU/hr, equipped with 24 burners
Power output: 335 MW (gross)

As part of the offset package for the ESPR Project in which Gas Turbine Combined Cycle Units #5 and #7 (Devices D67 and D68) were issued Permits to Construct under A/Ns 470652 and 470656, El Segundo Power, LLC is required by Facility Permit Condition E193.3 to surrender the Permit to Operate (P/N F14448) for Boiler Unit #3 within 90 days of the initial start-up Gas Turbine Combined Cycle Units 5 and 7. The initial start-up date for Gas Turbine Unit #5 was April 24, 2013. The initial start-up date for Gas Turbine Unit #7 was April 9, 2013. El Segundo Power, LLC has permanently retired Boiler Unit #3 from service. The Permit to Operate for Boiler #3 was surrendered to the SCAQMD on July 23, 2013. The surrender of Permit to Operate for Boiler #3 provided a reduction of 335 MW of electrical generating capacity; of which 223 MW of that capacity was used as part of the offset package for the ESPR Project. The remaining 112 MW of electrical generating capacity reduced from the retirement of Boiler #3 will be used to partially offset emissions from the proposed ESPFM

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 21
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Project. SCAQMD policy requires that retirement of utility boilers must result in the equipment being permanently inoperable and therefore must consist of the following minimum conditions:

1. Each of the burners currently attached to the boiler must be removed from the boiler in their entirety. This not only includes the main burner assembly, but also all of the associated igniters, electronic or other ignition devices (if applicable), fuel nozzles, V-cones and well as any other devices related to the burner structure or operation.
2. A significant portion of each of the fuel supply lines which supply natural gas to the boiler/burner assembly must be disconnected from the boiler/burner assembly, including all fuel lines which are accessible. In addition, each of these fuel lines remaining sections must be filled with a suitable amount of concrete to prevent delivery of fuel. In addition, all remaining fuel lines sections leading to the boiler must be flanged so as to render the lines incapable of accepting fuel.
3. The boiler feedwater pump must be disconnected and removed from the system so as to ensure that the boiler is not capable of receiving feedwater.

~~El Segundo Power, LLC will provide a revised retirement plan for Boiler #3 which will address and incorporate in sufficient detail, the requirements in items 1, 2, and 3 above, prior to issuance of Permits to Construct for the ESPFM Project.~~

Boiler Unit #4 is currently in operation and, in accordance with the California State Water Resources Board's Once-Through Cooling (OTC) policy, is scheduled to be permanently retired by December 31, 2015, or within 90 days of the initial start-up of the proposed ESPFM Project, whichever occurs sooner. The retirement of Boiler Unit #4 will result in a reduction in 335 MW of electrical generating capacity which will be used to partially offset emissions from the proposed ESPFM Project. El Segundo Power, LLC will provide a retirement plan for Boiler #4 which will address and incorporate in sufficient detail the requirements listed in items 1,2, and 3 above.

The next three pages show the process flow diagrams for the CCGS, the SCGS and the layout of the El Segundo Power, LLC site.

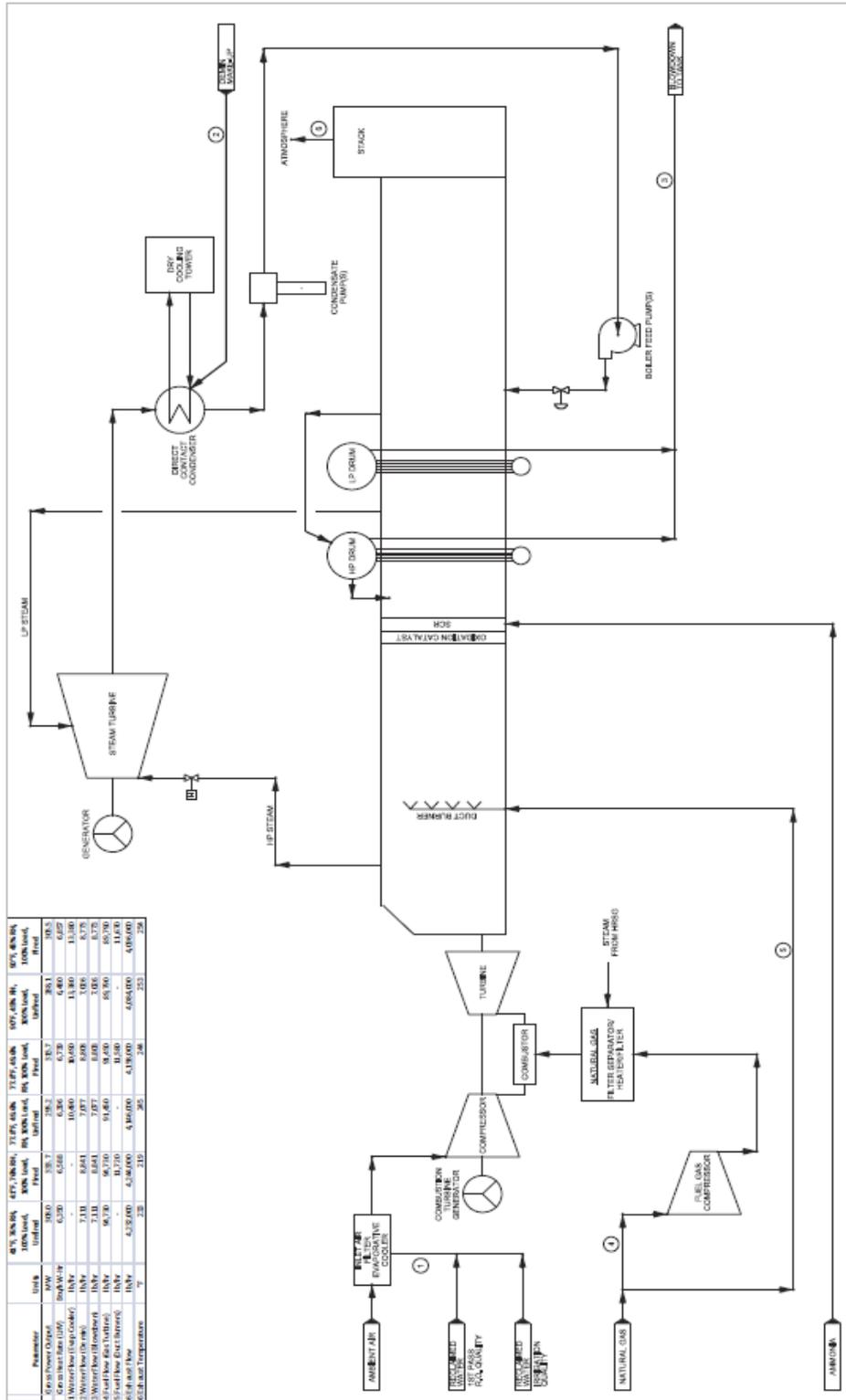


FIGURE 2-4
GE 1x1 TFA CC Fast Process Flow Diagram
Heat & Material Balance
Prepared by: [Name]
Date: 06/23/2015
Checked by: [Name]
City: Berkeley, CA

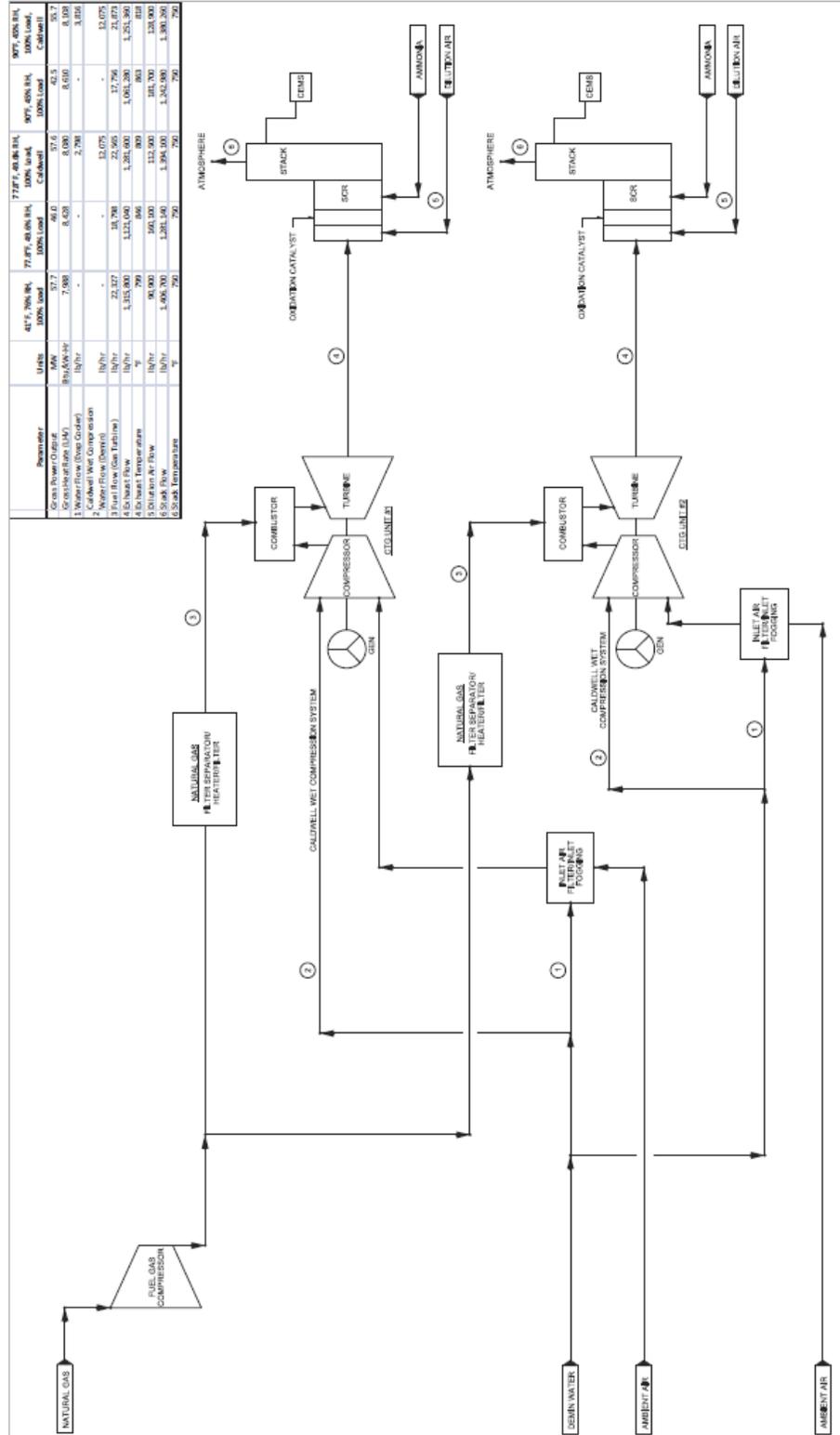


FIGURE 2-6
Royco Trinit 60 Process Flow Diagram
Heat & Material Balance
As of 2015 Project to Amend O&M Contract
Diagrams, CA

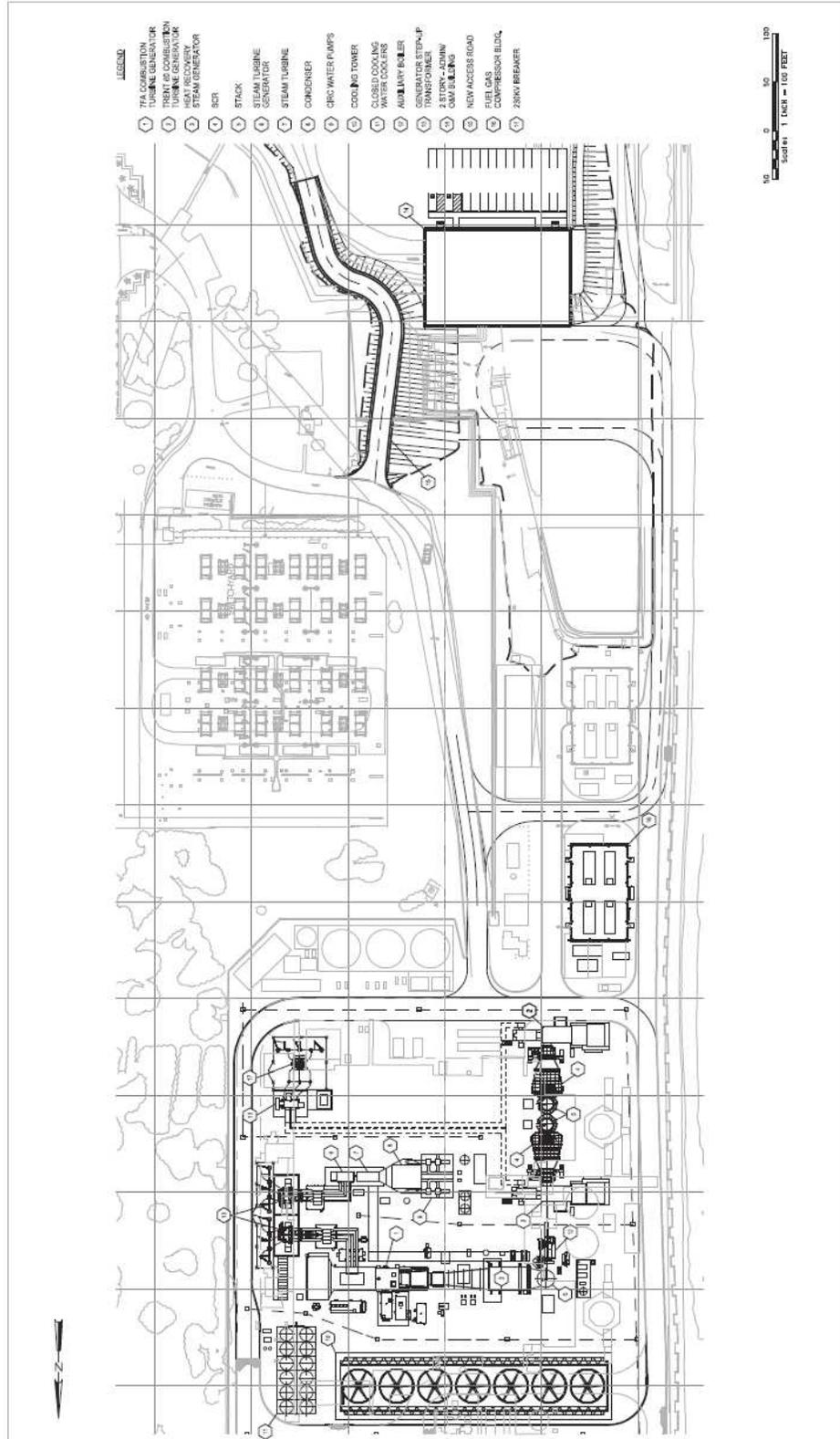


FIGURE 1-2D
 Site Plan - Sheet 2
 Steam Plant at Site 2
 April 2013 Prepared by Michael A. ...
 El Segundo, California



SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 25
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

EMISSIONS

NEW POWER GENERATING SYSTEM

Emissions of criteria pollutants, hazardous air pollutants, and greenhouse gas pollutants from the new power generating system are calculated in the Appendices. A summary of the emissions is provided below.

Criteria Pollutant Emissions

Detailed emissions calculation are included in the Appendices A, B, and C. The potential to emit, the daily maximum emissions, the monthly total emissions, and the annual emissions are shown in ~~the next four tables~~ Tables 12 through 15 below.

Table 12 – Criteria Pollutants Potential to Emit – 30 Day Averages

Equipment	NOx	CO	VOC	PM10	SOx
Unit 9 – GE 7FA ⁽¹⁾ (lb/day)	1,429.90	1,276.67	234.50	248.33	98.83
Unit 9 – Duct Burner ⁽³⁾ (lb/day)	48.67	29.68	17.03	42.83	3.79 <u>4.50</u>
Unit 11 – RR Trent 60 ⁽²⁾ (lb/day)	417.75	1,118.56	100.31	96.63 <u>73.03</u>	6.51 <u>5.18</u>
Unit 12 – RR Trent 60 ⁽²⁾ (lb/day)	417.75	1,118.56	100.31	96.63 <u>73.03</u>	6.51 <u>5.18</u>
Auxiliary Boiler ⁽⁴⁾ (lb/day)	1.44	8.22 <u>8.38</u>	0.63	1.89	0.13 <u>0.15</u>

(1) Page 90, Table A-14, Appendix A, includes turbine commissioning

(2) Page 100, Table B-13, Appendix B, includes turbine commissioning

(3) Page 104, Table C-1, Appendix C

(4) Page 106, Table C-2 3, Appendix C

Table-2 13– Maximum Daily Emissions – Normal Operation

	NOx	CO	VOC	PM10	SOx	NH3
Unit 9 – GE 7FA ⁽¹⁾ (lb/day)	536.07	1,308.77	232.84	228.00	28.32 <u>34.95</u>	392.40
Unit 9 – Duct Burner ⁽³⁾ (lb/day)	48.67	29.68	17.03	42.83	3.79 <u>4.50</u>	N/A
Unit 11– RR Trent 60 ⁽²⁾ (lb/day)	239.2	686.12	73.09	120.0	6.9 <u>8.27</u>	84.72
Unit 12– RR Trent 60 ⁽²⁾ (lb/day)	239.2	686.12	73.09	120.0	6.9 <u>8.27</u>	84.72

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 26
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Auxiliary Boiler ⁽⁴⁾ (lb/day)	1.44	8.22	0.63	1.89	0.13 <u>0.15</u>	N/A
New Equipment Total (lb/day)	1,064.60	2,719.52	396.35	512.36	47.17 <u>56.18</u>	561.84
New Equipment Total (ton/day)	0.533	1.36	0.198	0.256	0.024 <u>0.028</u>	0.281

- (1) Page 87, Table A-8, Appendix A, includes turbine commissioning
(2) Page 96, Table B-7, Appendix B, includes turbine commissioning
(3) Page 104, Table C-1, Appendix C
(4) Page 106, Table C-2 3, Appendix C

Table-3 14 – Monthly Total Emissions – Normal Operation

	NOx	CO	VOC	PM10	SOx	NH3
Unit 9 – GE 7FA ⁽¹⁾ (lb/month)	16,093.00	38,300.00	7,035.00	6,937.00	831.00 <u>1,064.00</u>	11,934.00
Unit 9 – Duct Burner ⁽³⁾ (lb/month)	1,460.00	890.60	511.00	1,284.80	113.80 <u>135.05</u>	N/A
Unit 11 – RR Trent 60 ⁽²⁾ (lb/month)	3,969.82	10,663.12	1,202.60	2,199.60	130.18 <u>152.85</u>	1,376.42
Unit 12 – RR Trent 60 ⁽²⁾ (lb/month)	3,969.82	10,663.12	1,202.60	2,199.60	130.18 <u>152.85</u>	1,376.42
Auxiliary Boiler ⁽⁴⁾ (lb/month)	44.21 <u>43.15</u>	251.47	19.34	58.03	3.94 <u>4.61</u>	N/A
New Equipment Total (lb/month)	25,536.11 <u>25,535.79</u>	60,781.70	9,960.20	12,666.90	1,242.81 <u>1,509.36</u>	14,686.84
New Equipment Total (ton/month)	12.77	30.39	4.98	6.33	0.621 <u>0.755</u>	7.34

- (1) Page 88, Table A-9, Appendix A
(2) Page 97, Table B-8, Appendix B
(3) Page 104, Table C-1, Appendix C
(4) Page 106, Table C-2 3, Appendix C

Table-4 15 – Annual Emissions – Normal Operation

	NOx	CO	VOC	PM10	SOx	NH3
Unit 9 – GE 7FA ⁽¹⁾ (ton/year)	53.43	78.60	20.89	25.92	3.295 <u>4.027</u>	41.33
Unit 9 – Duct Burner ⁽³⁾ (ton/year)	5.45	3.33	1.91	4.80	0.426 <u>0.504</u>	N/A
Unit 11 – RR Trent 60 ⁽²⁾ (ton/year)	18.94	45.63	5.66	12.00	0.70 <u>0.84</u>	7.76
Unit 12 – RR Trent 60 ⁽²⁾ (ton/year)	18.94	45.63	5.66	12.00	0.70 <u>0.84</u>	7.76

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 27
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Auxiliary Boiler ⁽⁴⁾ (ton/year)	0.26 <u>0.25</u>	1.48	0.11	0.34	0.02 <u>0.03</u>	N/A
New Equipment Total (ton/year)	97.01	174.64	34.17	54.99	5.34 <u>6.24</u>	56.85

- (1) Page ~~80~~ 89, Table A-~~13~~ 14, Appendix A
(2) Page ~~88~~ 98, Table B-11, Appendix B
(3) Page ~~93~~ 104, Table C-1, Appendix C
(4) Page ~~94~~ 106, Table C-~~2-3~~, Appendix C

Hazardous Air Pollutants (HAP) Emissions

Hazardous air pollutants emissions from the new power generating system are calculated in Appendix D. A summary is provided in ~~the next table~~ Table 16 below

Table ~~5~~ 16 – Hazardous Air Pollutants Emissions per Year

	HAP (tons/year)
Unit 9 – GE 7FA + DB	8.35
Unit 11 – RR Trent 60	1.57
Unit 12 – RR Trent 60	1.57
Auxiliary Boiler	0.08
Project Total	11.57

Greenhouse Gas (GHG) Emissions

Greenhouse gas emissions from the new power generating system are calculated in Appendix E. The summary is provided in ~~the next table~~ Table 17 below.

Table ~~6~~ 17 – Greenhouse Gas Emissions from the New Equipment

	Daily CO ₂ e (tons/day)	Monthly CO ₂ e (tons/month)	Annual CO ₂ e (tons/year)
Unit 9 – GE 7FA + DB	3,413.00 <u>3,415.76</u>	90,426.20 <u>100,822.09</u>	763,683.51 <u>764,191.45</u>
Unit 11 – RR Trent 60	722.87 <u>723.35</u>	12,801.79 <u>12,810.30</u>	140,999.49 <u>141,093.27</u>
Unit 12 – RR Trent 60	722.87 <u>723.35</u>	12,801.79 <u>12,810.30</u>	140,999.49 <u>141,093.27</u>
Auxiliary Boiler	50.34 <u>50.37</u>	1,560.39 <u>1,562.25</u>	18,402.54 <u>18,414.83</u>
ESPFM Project Total	4,909.08 <u>4,912.83</u>	117,590.17 <u>128,004.94</u>	1,064,085.03 <u>1,064,792.82</u>

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 28
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

RULES EVALUATION

California Environmental Quality Act (CEQA)

The California Energy Commission (CEC) is the lead agency for the ESPFM Project (00-AFC-14C), and will be addressing CEQA compliance. CEC's process will fully evaluate all air quality impacts for the entire project. It is anticipated that the CEC will amend its decision dated February 2, 2005 to address the changes proposed under the ESPFM Project.

40CFR Part 60 Subpart GG – Standards of Performance for Stationary Gas Turbines

Subpart GG applies to the stationary gas turbines that have a heat input of greater than 10.7 gigajoules per hour. However, gas turbines that are subject to the requirements of Subpart KKKK are exempted from this subpart. The new gas turbines are subject to Subpart KKKK, and are exempted from this subpart.

40CFR Part 60 Subpart KKKK – Standards of Performance for Stationary Combustion Turbines

Subpart KKKK applies to gas turbines that are installed after February 18, 2005 and have a heat input greater than 10.7 gigajoules per hour (10 MMBtu/hr). Both the GE 7FA and the RR Trent 60 gas turbines will be subject to this regulation.

This regulation requires the gas turbines to meet NO_x and SO₂ emission limits, which are determined based on the turbine's heat input rate and fuel type. NO_x limits are provided in Table 1 of the subpart. The NO_x limit is 25 ppmv for new natural gas fired turbines that are less than 850 MMBtu/hr, 15 ppmv if the heat input is greater than 850 MMBtu/hr. The SO₂ standard is 110 ng/J, or 0.9 lb/MWh for units located in a continental area. The GE 7FA turbine will have a NO_x limit of 2.0 ppmv, and a SO₂ limit equivalent to 0.0067 lb/MWh (~~1.26~~ 1.49 lb/222 MWh). The RR Trent 60 gas turbines will have a NO_x limit of 2.5 ppmv, and a SO₂ limit equivalent to 0.0056 lb/MWh (~~0.30~~ 0.36 lb/57.4 MWh). Compliance with the emission limits are expected.

In addition to the emission limits, Subpart KKKK requires continuous monitoring of the unit operation to ensure compliance. For units that use SCR and water injection to control NO_x emissions, it is required to install a CEMS, and to conduct a performance test within 60 days of installation. The operator is required to measure fuel sulfur content unless it can demonstrate that the total sulfur in natural gas is less than 20 grains per 100 standard cubic feet (0.2 grain/scf). El Segundo Power, LLC will install a NO_x CEMS for each gas turbine in accordance with the SCAQMD Rule 2012. The installation of the CEMS satisfies the requirements for NO_x monitoring. El Segundo Power, LLC will prepare and issue all reports as required and maintain all appropriate records. The pipeline natural gas will have sulfur content below 16 ppmv, which is equivalent to 0.01 grains/scf, as it is subject to Rule 431.1. Thus, compliance with monitoring requirements are expected.

40CFR Part 63 Subpart YYYY – NESHAP for Gas Turbines

EPA has promulgated the National Emission Standards for Hazardous Air Pollutant (NESHAP) for various types of operation. NESHAP applies to facilities that are major sources of hazardous air

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 29
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

pollutants. A major source facility is defined as having a single HAP emissions greater than 10 tons/year, or total HAP emissions greater than 25 tons/year. Based on the calculation of Appendix D-4, with the installation of the new power generating system the facility total HAP emissions will be approximately 26.55 tons per year. Thus, El Segundo Power, LLC is a major source facility, and is subject to the requirements of this subpart. §63.6100 of 40CFR Part 63 Subpart YYYY requires gas turbines to comply with a formaldehyde emission limit in Table 1 of 91 ppbvd measured at 15% O₂. In addition, §63.6100 of 40CFR 63 Subpart YYYY requires an operating limitation in Table 2 such that the operator of the equipment maintain the 4-hour rolling average of the catalyst inlet temperature within the range suggested by the catalyst manufacturer. The applicable equipment will be conditioned to comply with these requirements.

40 CFR Part 64 – Compliance Assurance Monitoring (CAM)

The CAM regulation applies to major stationary sources, which use control equipment to achieve a specified emission limit. The rule is intended to provide “reasonable assurance” that the control systems are operating properly to maintain compliance with the emission limits. The turbines are major sources for NO_x, CO, and VOC emissions, and will be subject to a BACT limit for each of these pollutants. NO_x and CO BACT limits are met with added equipment, i.e., SCR and oxidation catalyst. Thus, this subpart rule applies to NO_x and CO emissions. For each of the three gas turbines El Segundo Power, LLC will install a continuous emission monitoring system (CEMS) for NO_x and another one for CO. The NO_x CEMS will be certified in accordance with Rule 2012 requirements and the CO CEMS will be certified in accordance with Rule 218 requirements. The CEMSs are equivalent to the Acid Rain CEM and are considered as a continuous compliance determination method, which allows an exemption to the CAM rule per Part 64.2(b)(vi).

The VOC emissions will not be controlled by any specific control device. Although VOC emissions may be slightly reduced by the oxidation catalyst, VOC BACT emission limits are expected to be achieved through the combustion process. The operator will conduct periodic testing to verify VOC emission limits are achieved. Therefore CAM does not apply to this pollutant.

~~This subpart also applies to the VOC emissions because the VOC BACT limit is achieved with the help of the oxidation catalyst. The oxidation catalyst is effective. The catalyst effectiveness dependent upon the catalyst temperature when operating temperature is between 300°F and 750°F for the CCGS, and between 600°F and 1,125°F for the SCGS. In addition the operator will conduct periodic source testing. The catalyst effectiveness is dependent upon the catalyst temperature. There will be a temperature gauge that monitors exhaust temperature continuously and records on the hourly basis. In addition the operator will conduct periodic source testing. Compliance is expected.~~

40 CFR Part 72 – Acid Rain

El Segundo Power, LLC currently has SO₂ allocations under the acid rain program, allocated to their Boilers 1 through 4 in Facility Permit Condition F18.1. The acid rain program is similar to RECLAIM in that facilities are required to cover SO₂ emissions with “SO₂ Allowances” (similar to RTCs), or purchase of SO₂ on the open market. The facility is also required to monitor SO₂ emissions through use of fuel gas meters and gas constituent analysis (use of emission factors is also acceptable in certain cases) or with the use of exhaust gas CEMS. The ~~Seattergood~~ El Segundo facility will comply with the monitoring requirements of the acid rain provisions with the use of gas meters in conjunction with

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 30
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

natural gas default sulfur data as allowed by the Acid Rain regulations (Appendix D to 40 CFR Part 75). If additional SO₂ credits are needed, El Segundo Power, LLC will obtain the credits from the SO₂ trading market. Based on the above, compliance with this rule is expected.

RULE 212 – Standards for Approving Permits

The facility is not located within 1,000 feet of a school and the MICR for each gas turbine is less than 1 in a million. Thus, this project is not subject to the public notification requirements under Rule 212(c)(1) and (c)(3). However, this project is subject to Rule 212(c)(2) and Rule 212(g) public notice requirements because the daily maximum CO, NO_x, PM₁₀, and VOC emissions from the project will all exceed the emissions thresholds specified in subdivision (g) of this rule. The District will prepare the public notice and it will contain sufficient information to fully describe the project. In accordance with subdivision (d) of this rule, the applicant will be required to distribute the public notice to each address within ¼ mile radius of the project.

Subdivision (g) requires that the public notification and comment process include all applicable provisions of 40 CFR Part 51, Section 51.161(b) and 40 CFR Part 124, Section 124.10. The minimum requirements specified in the above documents are included in paragraphs (g)(1), (g)(2), and (g)(3).

In accordance with paragraph (g)(1) of this rule, the District ~~will make~~ made the following information available for public inspection at the El Segundo Public Library located at 111 West Mariposa Avenue, El Segundo during the 30-day comment period: public notice, project information submitted by the applicant, and the District's permit to construct evaluation.

In accordance with paragraph (g)(2) of this rule, the public notice ~~will be~~ was published in ~~a newspaper which serves the area that will be impacted by the project~~ the Daily News Los Angeles on December 26, 2013. The public notice was also distributed to all addresses within a one-quarter mile radius of the project site on January 21, 2014. No comments from the general public were received.

In accordance with paragraph (g)(3) of this rule, the public notice ~~will be~~ was mailed to the following persons on January 10, 2014: the applicant, the EPA Region IX Administrator, the ARB, the chief executives of the city and county where the project will be located, the regional land use planning agency, and the state and federal land managers whose lands may be affected by the emissions from the proposed project. ~~After the public notice is published, there will be a 30-day period for submittal of public comments.~~ The 30-day public notice period expired on February 10, 2014. SCAQMD received written comments from EPA, CEC, and the applicant. The comments were addressed and incorporated into the FDOC as appropriate.

RULE 218 – Continuous Emission Monitoring

This rule applies to the CO CEMS, which is required to verify CO emission levels from each gas turbine. El Segundo Power, LLC is required to submit an “Application for CEMS” for CO CEMS for each turbine and required to adhere to retention of records requirements and reporting requirements once approval to operate CO CEMS is granted. Compliance with this rule is expected.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 31
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

RULE 401 – Visible Emissions

Visible emissions from the three gas turbines and the auxiliary boiler are not expected since each will be fired exclusively with pipeline quality natural gas and each device will use BACT. Compliance with this rule is expected.

RULE 402 – Nuisance

Nuisance problems are not expected under normal operating conditions of the gas turbines and the auxiliary boiler. Compliance is anticipated.

RULE 407 – Liquid and Gaseous Air Contaminants

This rule limits SO₂ emissions to 500 ppm for equipment not subject to the gaseous fuel sulfur emission concentration limits of 431.1. It limits CO emissions to 2,000 ppm. Since gas turbines will be subject to Rule 431.1 and are expected to comply with Rule 431.1, the sulfur limit does not apply. Compliance with the CO limit of this rule is expected since the equipment is subject to the BACT CO emission limit of no more than 2 ppmv for the CCGS and no more than 4 ppmv for the SCGS. The auxiliary boiler will comply with a CO emission limit of 50 ppmv. Compliance with CO will also be verified through the CEMS data for the gas turbines.

RULE 409 – Combustion Contaminants

This rule applies to the gas turbines and auxiliary boiler. This rule limits combustion generated PM emissions to 0.1 gr/dscf at 12% CO₂.

The following operation data are used to determine PM loading for the CCGS:

PM = 9.5 lbs/hr
CO₂ = 4.82% in the exhaust
Exhaust flow = 51.55 MMSCF/hr

$$PM = \frac{9.5 * 7000 * 12 / 4.82}{51.55 * 10^6} = 0.003 \text{ grains/dscf}$$

The following operation data are used to determine PM loading for the SCGS:

PM = 5.0 lbs/hr
CO₂ = 3.43% in the exhaust
Exhaust flow = 15.41 MMSCF/hr

$$PM = \frac{5.0 * 7000 * 12 / 3.43}{15.41 * 10^6} = 0.008 \text{ grains/dscf}$$

The following operation data are used to determine PM loading for the auxiliary boiler:

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 32
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

PM = 0.3 lbs/hr

CO₂ = 12% in the exhaust

Exhaust flow = 6,100 DSCFM = 0.37 MMSCF/hr

$$PM = \frac{0.3 * 7000 * 12 / 12}{0.37 * 10^6} = 0.006 \text{ grains/dscf}$$

Compliance is demonstrated for the CCGS, the SCGS, and the auxiliary boiler.

RULE 431.1 – Sulfur Content of Gaseous Fuel

This rule requires that ~~natural gas~~ the sulfur content of natural gas, calculated as H₂S shall be less than 16 ppmv. The natural gas fuel that El Segundo Power, LLC will use is pipeline quality natural gas. Pipeline quality natural gas is certified to ~~has~~ have a sulfur content less than 1.0 gr per 100 scf, or about 16 ppmv. Compliance is expected.

RULE 475 – Electric Power Generating Equipment

This rule applies to power generating equipment greater than 10 MW installed after May 7, 1976. This rule limits combustion contaminants as PM to be either less than 11 lbs/hour, or less than 0.01 gr/dscf. For natural gas fired gas turbine engines almost all PM emissions are PM10 emissions. As calculated in the Rule 409 evaluation PM10 emissions are 0.003 gr/dscf for the CCGS turbine, and 0.008 gr/dscf for the SCGS gas turbines. Since they both are less than 0.01 gr/dscf compliance is expected.

Regulation XIII – New Source Review for Non-RECLAIM Pollutants

New emissions sources are subject to the requirements of New Source Review (NSR). This regulation applies to non-attainment criteria pollutants that include VOC and PM10. CO and NO₂ are reviewed under PSD because they are attainment pollutants. NO_x is also reviewed under RECLAIM. NSR includes requirements of Best Available Control Technology (BACT), modeling analysis, and offset. NH₃ is subject to BACT requirements only.

Best Available Control Technology (BACT)

BACT is defined in SCAQMD Rule 1301 as the most stringent emission limitation or control technique which:

- Has been achieved in practice for such category or class of source; or
- Is contained in any State Implementation Plan (SIP) approved by the US EPA for such category or class of source. A specific limitation or control technique shall not apply if the owner or operator of the proposed source demonstrates to the satisfaction of the Executive Officer that such limitations or control technique is not presently achievable; or
- Is any other emission limitation or control technique, found by the Executive Officer or designee to be technologically feasible for such class or category of sources or for a specific source, and cost effective as compared to measures as listed in the Air Quality Management Plan (AQMP) or rules adopted by the District Governing Board.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 33
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

This definition of BACT is consistent with the federal LAER definition with the exception of the cost effectiveness clause.

CCGS

BACT/LAER for the CCGS combined cycle gas turbine is determined by following the above definitions:

VOC: A review of recently issued combined cycle gas turbines permits nationwide indicates that the most stringent VOC emission limit for combined cycle gas turbines is 2.0 ppmv based on 1-hour average, dry at 15% O₂. In 2013 LADWP was permitted with a VOC BACT limit at 2.0 ppmv based on a 1-hour average. In 2011 the Lower Colorado River facility in Texas was permitted with a VOC BACT limit at 2.0 ppmv based on 3-hour average. The 2.0 ppmv limit based on 1-hour average is consistent with SCAQMD's BACT requirement for combined cycle gas turbines.

The following is the SCAQMD determined BACT/LAER limits:

VOC: 2.0 ppmv, dry at 15% O₂, 1-hour average.

El Segundo Power, LLC has proposed to use the same emission limits for the GE 7FA combined cycle gas turbine. Thus, the BACT/LAER requirement is met. Compliance will be ensured through testing, monitoring and reporting requirements.

The SCR's BACT requirement is to meet the NH₃ slip limit of 5 ppmv. El Segundo Power, LLC has proposed to limit the NH₃ slip limit to 5 ppmv. Compliance is expected.

SCGS

BACT/LAER for the SCGS gas turbines are also determined by following the above definitions:

VOC: A review of recently issued simple cycle gas turbines permits nationwide indicates that the most stringent VOC emission limit is 2.0 ppmv based on 1-hour average, dry at 15% O₂. The recently permitted simple cycle gas turbines at the LADWP Haynes and Scattergood Generating Stations as well as the gas turbines permitted at the City of Riverside are permitted at 2.0 ppmv based on a 1-hour average. The 2.0 ppmv limit is consistent with SCAQMD's BACT requirement for simple cycle gas turbine generators.

The following is the SCAQMD determined BACT/LAER limits:

VOC: 2.0 ppmv, dry at 15% O₂, 1-hour average.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 34
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

El Segundo Power, LLC has proposed to use the same emission limits for the RR Trent 60 simple cycle gas turbines. Thus, the BACT/LAER requirement is met. Compliance will be ensured through testing, monitoring and reporting requirements.

The SCR's BACT requirement is to meet the NH₃ slip limit of 5 ppmv. El Segundo Power, LLC has proposed to limit the NH₃ slip limit to 5 ppmv. Compliance is expected.

Auxiliary Boiler

SCAQMD's BACT/LAER determination for a natural gas fired auxiliary boiler is based on the use of pipeline quality natural gas for both VOC and PM₁₀. El Segundo Power, LLC will use pipeline quality natural gas with this boiler. Compliance is expected.

Modeling Analysis

PM₁₀ was designated as an federal attainment pollutant in the SCAB on June 26, 2013. However, PM₁₀ remains non-attainment at the state level and will be evaluated under NSR as well. As such, modeling analysis is required for PM₁₀ emissions per Rule 1303(b). Modeling analysis for VOC is not required. Rule 1303 requires that through modeling, the applicant must substantiate that the project does not exceed the most stringent ambient air quality standard for attainment pollutants or cause a significant change in air quality concentration for non-attainment pollutants. CO is currently in attainment at the federal and state levels. Therefore, the CO emissions from the proposed project will be addressed under Regulation XVII – Prevention of Significant Deterioration (PSD).

Maximum project impacts from PM₁₀ emissions were determined by using the AERMOD model, version 12345. The representative meteorological data used in the model are from the Los Angeles International Airport. Modeling analysis were performed for startup, shutdown, commissioning, and normal operations. El Segundo Power, LLC submitted the air quality modeling analysis in March 2013 to the District for review. The District found the analysis acceptable for Rule 1303 requirements. Modeling on an individual equipment basis is currently being conducted by the applicant and the results will be forwarded to SCAQMD when completed.

A variety of operating scenarios of the three gas turbines and the auxiliary boiler are modeled to determine the worst air quality impact for PM₁₀. The applicant provided a modeling analysis which accounts for air quality impacts which may occur during gas turbine commissioning, start-up, and normal operations. It should also be noted that the applicant performed the impact analysis to address the cumulative maximum impacts from all sources at the El Segundo site, including the existing gas turbines units 5 and 7 as well as the proposed new equipment for the ESPFM Project. As such, the modeling analysis accounts for the impacts expected during the worst-case operating scenario, as required under SCAQMD New Source Review. The applicant has determined that the peak 24-hour and annual PM₁₀ impacts from the proposed project occur during the turbine commissioning period. The next table shows the maximum impacts from the modeling results and the applicable PM₁₀ emissions standards.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 35
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Table 7 – New Source Review Modeling – PM10 Emissions

Pollutants	Averaging Time	ESPFM Model Results ($\mu\text{g}/\text{m}^3$)	Significant Change Threshold ($\mu\text{g}/\text{m}^3$)	Significant (Yes/No)
PM10	24-hour	1.8 1.2	2.5	No
	Annual	0.3	1.0	No

Both the 24-hour average and the annual average PM10 emissions are below the respective significant change thresholds.

El Segundo Power, LLC submitted the air quality modeling analysis in March 2013 to the SCAQMD for review. The SCAQMD found the analysis acceptable for Rule 1303 requirements.

Offsets

Rule 1303(b)(2) requires that all increases in emissions be offset unless exempt from offset requirements pursuant to Rule 1304.

Rule 1304(a)(2) - Electric Utility Steam Boiler Replacement states that if the electric utility boilers are replaced by the combined cycle gas turbines, intercooled, or other advanced gas turbines, then the project will be exempt from emission offsets unless there is a basin-wide electricity generation capacity increase on a per-utility basis. If there is an increase in basin-wide capacity, only the increased capacity must be offset. The GE 7FA gas turbine is a combined cycle gas turbine. The two RR Trent 60 gas turbines are simple cycle gas turbines. ~~SCAQMD Rule 1135 defines advanced combustion sources as those which emit NO_x at no greater than 0.10 lb/net MWH on a daily average basis, excluding commissioning, start-up and shutdown periods, if the source is located within the South Coast Air Basin.~~ The SCAQMD defines APPROVED ALTERNATIVE OR ADVANCED COMBUSTION RESOURCE as an alternative resource or advanced combustion resource which is approved by the Executive Officer. SCAQMD defines an alternative resource or an advanced combustion resource as one which (A) Displaces boiler capacity existing in the District on or after July 19, 1991; and (B) Emits NO_x at no more than 0.10 pound per net megawatt-hours (MWH) on a daily average basis if the resource is located within the District, or no more than 0.05 pound per net MWH on a daily average basis if the resource is located outside the District; for cogeneration facilities, the daily NO_x emission per MWH shall be calculated after deducting 0.013 pound of NO_x for each million BTU of useful thermal energy produced which is not used for electric power generation; and (C) Commences operation on or after July 19, 1991; and (D) Is proven to the satisfaction of the Executive Officer that the net megawatt-hours obtained or conserved are real, quantifiable, and enforceable. The proposed RR Trent 60 simple cycle gas turbines will emit 0.091 lb/net MWH under baseload conditions, as shown in Table ~~40-B-14, Appendix B page 94.~~ Therefore, the two RR Trent 60 simple cycle gas turbines qualify as advanced gas turbines, and replacement of Boilers #3 and #4 with Trent 60 simple cycle gas turbines is allowed by Rule 1304(a)(2) and qualifies for the emission offset exemption.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 36
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The language of this exemption allows for offset and modeling exemptions on a MW-to-MW basis. The evaluation for offset exemption using the MW to MW calculation is based on the difference in gross MW of the new equipment and the stated permit values of MW of the equipment being removed from service. The purpose was to facilitate the removal of older and less efficient boiler/steam turbine technology with cleaner gas turbine technology at the utilities. Since the advent of RECLAIM, the exemption was expanded to include modifications conducted for compliance with Reg. XX rules.

The CCGS has a combined power rating of 334 gross megawatts at 41°F . The SCGS has a combined power rating of ~~442~~ 114.8 gross megawatts at 78°F. The total power generating capacity will be ~~447~~ 448.8 MW. Boiler #3 was retired from service with 112 MW of unused credits. These credits will be combined with the 335 MW from the permanent retirement of Boiler #4 for a total of 447 MW, ~~which will completely offset the emissions from the ESPFM Project.~~ The installation of the new Units 9, 11, and 12 (448.8 MW) and the subsequent removal from service of Boilers #3 and #4 (447 MW) will result in a potential increase of 1.8 MW of electricity produced. However, the applicant has elected to accept a condition for the facility which will limit the total gross electrical output at the facility to 1,020 MW. As such, there will be no increase in gross electrical output as a result of the ESPR and ESPFM projects as compared to the electric utility steam boiler output at this facility prior to the boiler repowering. The new power generating system therefore qualifies for the Rule 1304(a)(2) exemption. The facility does not have to provide emission reduction credits for this project. However, the auxiliary boiler is not exempt under Rule 1304(a)(2) and is required to provide the following offsets from the open market as shown in Table 8 16: NRG will use existing ERCs to fund the required offsets shown below.

Table 8 16 – Required Offsets:

Auxiliary Boiler	VOC	PM10	SO _x
30 Day Average, lb/day	0.63	1.89	0.13 <u>0.15</u>
1.2 Offset Factor	1.2	1.2	1.2
Required Offsets, <u>lb/day</u>	1	2	None <u>0</u>

Rule 1304.1 – Electrical Generating Fee for Use of Offset Exemption

This rule requires electrical generating facilities which use the specific offset exemption described in Rule 1304(a)(2) – Electric Utility Steam Boiler Replacement to pay fees for up to the full amount of offsets provided by the SCAQMD. El Segundo Power, LLC will be required to demonstrate compliance with the specific requirements of this rule prior to the issuance of the Permits to Construct for the ESPFM Project.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 37
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

RULE 1325 – Federal PM2.5 New Source Review Program

This rule applies to major polluting facilities, major modifications to a major polluting facility, or any modifications to an existing facility that would constitute a major polluting facility in and of itself. A major polluting facility is defined as a facility which has actual emissions, or a potential to emit of greater than 100 tons per year. A major polluting facility is required to comply with the following requirements:

- Use of LAER
- Offset PM2.5 emissions at the offset ratio of 1.1:1
- Certification of compliance of emission limits
- Conduct an alternative analysis of the project

As shown in Appendix F, the total PM2.5 potential to emit resulting from the addition of the GE Combined Cycle Gas Turbine, the two RR Trent 60 Simple Cycle Gas Turbines, the Auxiliary Boiler, and the subsequent retirement of Boilers #3 and #4 will not result in an emissions increase above the 100 ton/year threshold. Therefore, El Segundo Power, LLC will continue to be a non-major polluting facility for PM2.5. The detailed calculations are included in the Appendix F.1. Since Rule 1325 is not yet SIP approved, a detailed PM2.5 analysis is shown on page 61 under 40 CFR 51 Appendix S.

RULE 1401 – New Source Review for Toxic Air Contaminants

This rule specifies limits for maximum individual cancer risk (MICR), cancer burden, and acute and chronic hazard index (HI) from new permit units, relocations, or modifications to existing permits which emit toxic air contaminants (TAC).

Rule 1401 requirement levels are as follows:

MICR, without T-BACT:	≤ 1 in 1 million (1.0×10^{-6})
MICR, with T-BACT:	≤ 10 in 1 million (1.0×10^{-5})
Cancer Burden:	≤ 0.5
Maximum Chronic Hazard Index:	≤ 1.0
Maximum Acute Hazard Index:	≤ 1.0

El Segundo Power, LLC performed a Health Risk Assessment (HRA) for the cumulative impact of the proposed project using the HARP Model (version 1.4f). The results include the facility-wide HRA from existing gas turbines #5 and #7 and the proposed gas turbines #9, #11, #12, and the 36 MMBTU/hr auxiliary boiler. The results are presented below in Table 9 17:

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 38
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Table 9 17– Facility-wide HRA

Risk Parameter ^a	Residential ^b	Commercial	Rule 1401 Thresholds
MICR	0.31EE-6	0.06EE-6	1EE-6
HIA (Case 1) ^c	1.3EE-2	N/A	1.0
HIA (Case 2) ^c	0.9EE-2	N/A	1.0
HIC	6.7EE-3	N/A	1.0
^a MICR=Maximum Individual Cancer Risk; HIA=Acute Hazard Index; HIC=Chronic Hazard Index ^b Residential impacts for MICR; maximum impact for other health risks ^c Acute impact modeling scenarios: Case 1: All Gas Turbines in operation, Auxiliary Boiler not operating; Case 2: Units 11 and 12 and Auxiliary Boiler operating, Unit 9 not operating			

Results of the analysis show that the highest estimated MICR is 0.31 in a million, which is below the Rule 1401 threshold of 1 in a million. The highest estimated acute hazard index is 0.0013, less than the rule threshold of 1.0. In addition, the highest estimated chronic hazard index is 0.0067, which is also less than the rule threshold of 1.0. Thus, the CCGS and the SCGS gas turbines will be in compliance with Rule 1401.

The District has reviewed the Rule 1401 modeling analysis conducted by El Segundo Power, LLC. The District considers the modeling approach and methodology are to be consistent with SCAQMD Rule 1401. The modeling results are acceptable.

Regulation XVII – Prevention of Significant Deterioration – Criteria Pollutants

The SCAQMD and the EPA has entered into an agreement on July 25, 2007 that SCAQMD is re-delegated a partial PSD authority. SCAQMD is authorized to issue new and modified PSD permits in accordance with SCAQMD’s Regulation XVII.

The SCAB is in attainment for NO₂, SO₂, CO, and PM10 emissions. Therefore, this regulation applies to NO₂, SO₂, CO, and PM10 emissions.

BACT applies to all projects that have emission increases. BACT requirements for NO₂, CO and SO₂ are evaluated in this section.

- NO₂ – The requirement is consistent with the NO_x BACT emission limits. The limit is 2.0 ppmvd, 1-hour average at 15% O₂ for the CCGS gas turbine, and 2.5 ppmvd, 1-hour average at 15% O₂ for the SCGS gas turbine. Use of the SCR for control of NO_x emissions is considered BACT for combustion gas turbines. The Auxiliary Boiler ~~is required to~~ will comply with a 5 ppmvd limit measured at 3% O₂ (See Rule 2005 BACT Analysis for additional details). Compliance is expected.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 39
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

- SO₂ – The requirement is to use pipeline quality natural gas. El Segundo Power, LLC will use pipeline quality natural gas for the Gas Turbines and Auxiliary Boiler. Compliance is expected.
- CO – The most stringent emission limit is 2.0 ppmvd based on 1-hour average at 15% O₂ for a combined cycle gas turbine, 4.0 ppmvd based on 1-hour average at 15% O₂ for a simple cycle gas turbine. Therefore, the BACT limit is set at 2 ppmvd for the CCGS and 4 ppmv for the SCGS. El Segundo Power, LLC has proposed the same emission limits. The Auxiliary Boiler is required to comply with a 50 ppmvd CO emission limit measured at 3% O₂. The applicant submitted a performance warranty from the SCR manufacturer (Cleaver Brooks) dated April 22, 2014 stating that the auxiliary boiler will comply with the CO BACT emission limit of 50 ppmv at 3% O₂, at boiler loads greater than 20% and 100 ppmv at 3% O₂, at boiler loads less than or equal to 20%. Compliance is expected.
- PM10 – Use of natural gas with a sulfur content (calculated as H₂S) less than 1 grain per 100 scf. The project will use pipeline quality natural gas. Compliance is expected.

In addition to the BACT requirement, a PSD Analysis is required for a significant increase of emissions. El Segundo Power, LLC is a major source per PSD definitions. The repower project will be considered a modification to the existing major source. A significant increase, defined as an increase of 40 tons/year of either NO₂ or SO₂ or 100 tons/year of CO emissions, would trigger the PSD analysis requirement. The repower project's potential emissions are compared with the existing emissions in ~~the next two tables~~ Tables 18 and 19 below.

Table ~~10~~ 18 – Potential to Emit of the New Equipment

Pollutant	CCGS ⁽¹⁾	SCGS ⁽²⁾ (two units)	Auxiliary Boiler	Duct Burner	Total
CO (tons/year)	78.60	45.63 <u>91.26</u>	1.56 <u>1.48</u>	3.33	129.12 <u>174.64</u>
NO ₂ (tons/year)	53.43	18.94 <u>37.88</u>	0.45 <u>0.25</u>	5.45	78.27 <u>97.01</u>
SO ₂ (tons/year)	3.30 <u>4.03</u>	0.70 <u>1.68</u>	0.22 <u>0.03</u>	0.426 <u>0.504</u>	4.65 <u>6.24</u>
PM10 (tons/year)	<u>25.92</u>	<u>24</u>	<u>0.34</u>	<u>4.80</u>	<u>55.06</u>

(1) Page 90, Table A-12, Appendix A

(2) Page 99, Table B-11, Appendix B

Table ~~11~~ 19 – Emission Change Summary

Pollutant	New Power System (tons/yr)	Significance Threshold (tons/yr)	PSD Analysis Required (Yes/No)
CO	129.12 <u>174.64</u>	100	Yes
NO ₂	78.27 <u>97.01</u>	40	Yes
SO ₂	4.65 <u>6.24</u>	40	No
PM10	<u>55.06</u>	<u>25</u>	<u>Yes</u>

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 40
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

PSD analysis is required for NO₂, CO and PM10.

The following analyses are required for a facility having a significant emission increase under Rule 1703.

- Modeling to determine impacts of the project on National and State AAQS and increases over the baseline concentration [1703(a)(3)(C)].
- Analysis of ambient air quality in the impact area [1703(a)(3)(D)].
- Analysis of project impacts on visibility, soil, and vegetation [1703(a)(3)(E)].

As required by this regulation, the District sent the PSD analysis and modeling materials to the following affected officials:

Gerardo Rios, US EPA, Region IX
 John Notar, Federal Land Manager, National Park Service (NPS)
 Mike McCorison, Air Quality Specialist, USDA Forest Services

Final permit action regarding PSD is dependent on comments received from the NPS and the USDA Forest Service. Final comments from the Federal Land Managers is pending.

The following methodology was used in performing the PSD analysis for NO₂ and CO.

1. Determine whether pre-construction monitoring is required

Preconstruction monitoring is required if the air quality impacts are greater than the following amounts:

NO₂: 14 µg/m³, annual average
 CO: 575 µg/m³, 8-hour average

The applicant submitted modeling results that showed the maximum NO₂ impact of 0.50 µg/m³ annual average and a maximum CO impact of 12.2 µg/m³ 8-hour average. Since these levels do not exceed the preconstruction monitoring thresholds, preconstruction monitoring is not required.

2. Assessment of significance under PSD

The air quality impacts are considered significant if they exceed the following amounts:

NO₂: 7.5 µg/m³, 1-hour average
 NO₂: 1.0 µg/m³, annual average
 CO: 2,000 µg/m³, 1-hour average
 CO: 500 µg/m³, annual average
 PM10: 5.0 µg/m³, 24-hour average

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 41
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The 1-hour NO₂ average significant impact level (SIL) limit was recently suggested by the EPA. The facility modeled the entire new power system as one emission group. The modeled impacts are shown below in Table ~~12-20~~:

Table ~~12-20~~ – Modeled Impacts

Pollutant	Averaging Period	Maximum Impact, $\mu\text{g}/\text{m}^3$	PSD SIL $\mu\text{g}/\text{m}^3$	Exceedance (Yes/No)
NO ₂	1-hour	23.1 <u>25.2^a</u>	7.5	Yes
	Annual	0.5	1.0	No
CO	1-hour	109.0 <u>160.0</u>	2,000	No
	8-hour	12.2	500	No
PM ₁₀	24-hour	1.8 <u>1.2</u>	5.0	No

^aReported results reflect start-up conditions

The 1-hour NO₂ average impact for the ESPFM Project exceeds the PSD SIL of 7.5 $\mu\text{g}/\text{m}^3$ based on a 1-hour average. Therefore, a cumulative impact analysis is required to demonstrate that the ESPFM Project will not cause a new or make significantly worse, an existing 1-hour NO₂ violation of the National Ambient Air Quality Standards (NAAQS). On July 31, 2013, the applicant submitted a cumulative impact analysis which included the impacts from the existing Units #5 and #7 of the El Segundo Power Redevelopment Project, Chevron Refinery, and the LADWP Scattergood Generating Station. At the request of the SCAQMD and CEC staff, the impacts from the AES Redondo Beach and the ExxonMobil Refinery facilities as well as the impacts from simultaneous start-up of the three proposed turbines of the ESPFM Project were included in the cumulative modeling analysis. The inclusion of the impacts from these sources resulted in no effect on the cumulative impact results. Dispersion modeling using AERMOD and its output option MAXDCONT shows that the peak contribution from the ESPFM Project to a modeled violation of the 1-hour NO₂ NAAQS is 3.38 $\mu\text{g}/\text{m}^3$ which is less than the SIL and thus insignificant. Therefore, the proposed ESPFM Project will not cause a new, or make significantly worse, an existing 1-hour NO₂ violation of the NAAQS.

Each of the proposed devices will be fired with CPUC grade pipeline quality natural gas. Modeling analysis is not required as there is not a national ambient air quality standard (NAAQS) for PM₁₀. An air quality impact analysis is required to determine PM₁₀ significance under PSD. Air quality impacts are considered significant if they exceed the PM₁₀ threshold of 5.0 $\mu\text{g}/\text{m}^3$. The facility modeled the entire new power system as one group to assess the worst case operating scenario and maximum impacts. The maximum modeled impacts of PM₁₀ are 1.2 $\mu\text{g}/\text{m}^3$, which is below the PSD Significant Impact Level (SIL) for PM₁₀. Therefore no cumulative impact analysis is required for PM₁₀.

The applicant also conducted dispersion modeling for NO₂ and CO for the auxiliary boiler during the expected 80 hour auxiliary boiler commissioning period. The applicant used AERMOD version 14134 which is the current EPA approved model. Meteorological data from Los Angeles International Airport (LAX) monitoring station was used for the background levels. The applicant also used the OLM option to model the conversion of NO_x to NO₂. The maximum emissions from the commissioning of the

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 42
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

auxiliary boiler will occur when the Trent 60 simple cycle gas turbines (Units 11 and 12) are operating concurrently with the auxiliary boiler.

The peak 1-hour and 8-hour CO project impacts during commissioning plus the worst case background are 3,915 µg/m³ and 3,145 µg/m³, respectively. These impacts are less than the state 1-hour and state/federal 8-hour CO standards of 23,000 µg/m³ and 10,000 µg/m³, respectively.

The peak 1-hour NO₂ project impacts during commissioning plus the worst case background is 282.5 µg/me, which is less than the state 1-hour NO₂ standard of 339 µg/m³. The NO₂ impacts are not compared to the federal 1-hour standard since commissioning is a one-time event and the form of the standard allows for emissions due to commissioning to be excluded.

Therefore, the project will comply with the modeling requirements for PSD. Based on the above analysis, the project has demonstrated compliance with the PSD analysis for NO₂, CO, and PM₁₀.

The District modeling staff has reviewed the applicant's approach and methodology with respect to the cumulative impact analysis and has determined that the approach and methodology are acceptable. The results of the cumulative impact analysis are shown in the table below in Table 13-21.

Table 13-21– Cumulative Impact Analysis*

Modeling Results: Maximum 1-hour Average NO ₂ Impacts					
Combustion Sources	Maximum 1-hour Average NO ₂ Concentration, µg/m ³				
	2005	2006	2007	2008	2009
ESP Units 9, 11,& 12	24.1	23.5	24.4	25.1	24.5
ESP Units 5 & 7	1.8	1.7	1.8	1.9	1.8
All 5 ESP Units	24.4	23.6	24.67	25.2	24.8
Chevron Refinery	691.1	546.5	688.4	523.3	709.8
LADWP Scattergood	5.7	5.6	5.7	5.7	5.9
AES Redondo Beach	2.2	2.2	2.2	2.2	2.2
Background [†]	109.6	109.6	109.6	109.6	109.6
All Sources+ Background	753.1	619.7	750.5	618.9	771.8

*Table 13 shows the maximum result in the project impact area for each individual category of combustion source for each calendar year of meteorological data. The maximum impacts from all sources do not occur at the same place and time. As a result, the maximum overall impacts (All Sources + Background) are less than the sum of the individual impacts.

[†] The background concentration for each hour is based on a seasonal daily profile provided by the District. Each hour of the profile is the 3rd highest measured value for that clock hour and season. The background concentration was not adjusted to account for the modeled impact of existing sources. (i.e. Chevron) at the monitoring site.

3. Determine Visibility and Soil Impacts in Class I areas

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 43
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The impacts were analyzed on Class I areas that are within 100 kilometers of the project site. The following Class I areas are within 100 km of the ESPFM Project:

- San Gabriel Wilderness Area (53 km)
- Cucamonga Wilderness Area (78 km)

The area impacted by the project is heavily industrialized and has no vegetation of commercial or recreational value. Minimal vegetation exists within the facility. The results of the Class I PSD increment analysis showed that the model predicted concentrations are well below the EPA proposed Class I significance thresholds. Both the San Gabriel and Cucamonga Wilderness Areas are located at a distance greater than 50 km from the ESPFM Project site. Therefore, no further modeling was required for PSD increment analysis. Table 22 below is a table which shows the projected impacts on soil and vegetation of all criteria pollutants are below the secondary national ambient air quality standards.

Table 22 – Maximum Modeled Impacts for Proposed New Units^a (µg/m³)

<u>Pollutant</u>	<u>Averaging Period</u>	<u>Maximum Impact</u>	<u>Background Concentration</u>	<u>Total Impact</u>	<u>Federal Secondary Standard</u>
<u>NO₂</u>	<u>Annual</u>	<u>0.5</u>	<u>24.5</u>	<u>25</u>	<u>100</u>
<u>SO₂</u>	<u>3-hr</u>	<u>2.3^c</u>	<u>67.6^d</u>	<u>69.9</u>	<u>1,300</u>
<u>PM₁₀</u>	<u>24-hr</u>	<u>1.2^b</u>	<u>52</u>	<u>53.8</u>	<u>150</u>
<u>PM_{2.5}</u>	<u>24-hr</u>	<u>1.2^b</u>	<u>30^e</u>	<u>31.8</u>	<u>35</u>
	<u>Annual</u>	<u>0.3</u>	<u>12.8</u>	<u>13.1</u>	<u>15</u>

^a Modeled Impacts from Ambient Air Quality Impact Analysis (April 2013), Table 5
^b Maximum Impacts occur under commissioning conditions
^c Maximum Impacts occur under fumigation conditions
^d The California Air Resources Board no longer publishes 3-hour average SO₂ concentrations. Therefore, the 1-hour average background is used as a conservative estimate of 3-hour average background.
^e Background concentration reflects 3-year average of the 98th percentile values based on form of standard

The visibility impact analysis required by Rules 1703(a)(3)(E) requires assessment of the impairment to visibility in the area surrounding the project (Class II Visibility Impairment Analysis). The applicant has conducted a Class II Visibility Impairment Analysis for the four Class II State Parks (Dockweiler State Beach, Will Rogers State Historic Park, Kenneth Hahn State Historic Park, and Santa Monica State Beach) within the 20 km from the ESPFM Project site. SCAQMD Modeling staff have reviewed the applicant's analysis and have determined that the approach and methodology are acceptable. SCAQMD analyzed the project's impacts on visibility in Class II areas. There are currently no thresholds for visibility impacts on Class II areas. The project utilized the criteria and thresholds for Class I areas which is conservative. Visibility impacts are based on the calculation of two factors – plume contrast and color contrast (ΔE) of the plume when compared to the sky and terrain backgrounds. For Class I areas, the criteria used are based on a perceptibility threshold of 0.05 (absolute value) for contrast and 2.0 for ΔE. The applicant identified four Class II areas in the project vicinity – Dockweiler State Beach (0.9 km away), Kenneth Hahn State Recreation Area (12 km away), Santa Monica Beach

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 44
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

State parkb(11 km away), and Will Rogers State Historic Park (17.8 km away). Using Level 1 VISCREEN analysis, the plume contrast is exceeded at Dockweiler State Beach and ΔE is exceeded at all four Class II areas, thus a Level 2 VISCREEN analysis was performed. The Level 2 visibility analysis was performed for the four state parks within 20 km of the proposed project. Plume visibility impacts above the Class I thresholds are possible at three of the four state parks as follows: Dockweiler State Beach, Kenneth Hahn State Recreational Area, and Santa Monica Beach State Park. No additional permitting actions are required as the visibility analysis is for informational purposes only. Table 23 below shows the Class II impacts in comparison to the Class I limits for the four state parks.

Table 23 – ESPFM Impacts on Visibility in Class II Areas (Level 1 Screening INSIDE Class II Area)

<u>DOCKWEILER STATE BEACH</u>					<u>Delta E</u>		<u>Contest</u>	
<u>Background</u>	<u>Theta</u>	<u>Azi</u>	<u>Dist</u>	<u>Alpha</u>	<u>Class I Criterion</u>	<u>Plume</u>	<u>Class I Criterion</u>	<u>Plume</u>
<u>Sky</u>	<u>10</u>	<u>167</u>	<u>6</u>	<u>2</u>	<u>2</u>	<u>11.020*</u>	<u>0.05</u>	<u>127*</u>
<u>Sky</u>	<u>140</u>	<u>167</u>	<u>6</u>	<u>2</u>	<u>2</u>	<u>6.329*</u>	<u>0.05</u>	<u>-0.121*</u>
<u>Terrain</u>	<u>10</u>	<u>84</u>	<u>0.9</u>	<u>84</u>	<u>2</u>	<u>40.566*</u>	<u>0.05</u>	<u>0.089</u>
<u>Terrain</u>	<u>140</u>	<u>84</u>	<u>0.9</u>	<u>84</u>	<u>2</u>	<u>4.891*</u>	<u>0.05</u>	<u>0.013</u>
<u>WILL ROGERS STATE HISTORIC PARK</u>					<u>Delta E</u>		<u>Contest</u>	
<u>Background</u>	<u>Theta</u>	<u>Azi</u>	<u>Dist</u>	<u>Alpha</u>	<u>Class I Criterion</u>	<u>Plume</u>	<u>Class I Criterion</u>	<u>Plume</u>
<u>Sky</u>	<u>10</u>	<u>97</u>	<u>18.6</u>	<u>72</u>	<u>2</u>	<u>0.758</u>	<u>0.05</u>	<u>0.009</u>
<u>Sky</u>	<u>140</u>	<u>97</u>	<u>18.6</u>	<u>72</u>	<u>2</u>	<u>0.457</u>	<u>0.05</u>	<u>-0.008</u>
<u>Terrain</u>	<u>10</u>	<u>84</u>	<u>17.8</u>	<u>84</u>	<u>2</u>	<u>2.493*</u>	<u>0.05</u>	<u>0.015</u>
<u>Terrain</u>	<u>140</u>	<u>84</u>	<u>17.8</u>	<u>84</u>	<u>2</u>	<u>0.203</u>	<u>0.05</u>	<u>0.003</u>
<u>KENNETH HAHN STATE HISTORIC PARK</u>					<u>Delta E</u>		<u>Contest</u>	
<u>Background</u>	<u>Theta</u>	<u>Azi</u>	<u>Dist</u>	<u>Alpha</u>	<u>Class I Criterion</u>	<u>Plume</u>	<u>Class I Criterion</u>	<u>Plume</u>
<u>Sky</u>	<u>10</u>	<u>106</u>	<u>13</u>	<u>62</u>	<u>2</u>	<u>0.955</u>	<u>0.05</u>	<u>0.011</u>
<u>Sky</u>	<u>140</u>	<u>106</u>	<u>13</u>	<u>62</u>	<u>2</u>	<u>0.596</u>	<u>0.05</u>	<u>-0.01</u>
<u>Terrain</u>	<u>10</u>	<u>84</u>	<u>12</u>	<u>84</u>	<u>2</u>	<u>3.917*</u>	<u>0.05</u>	<u>0.02</u>
<u>Terrain</u>	<u>140</u>	<u>84</u>	<u>12</u>	<u>84</u>	<u>2</u>	<u>0.29</u>	<u>0.05</u>	<u>0.003</u>
<u>SANTA MONICA STATE BEACH</u>					<u>Delta E</u>		<u>Contest</u>	
<u>Background</u>	<u>Theta</u>	<u>Azi</u>	<u>Dist</u>	<u>Alpha</u>	<u>Class I Criterion</u>	<u>Plume</u>	<u>Class I Criterion</u>	<u>Plume</u>
<u>Sky</u>	<u>10</u>	<u>146</u>	<u>16</u>	<u>22</u>	<u>2</u>	<u>1.85</u>	<u>0.05</u>	<u>0.021</u>
<u>Sky</u>	<u>140</u>	<u>146</u>	<u>16</u>	<u>22</u>	<u>2</u>	<u>1.045</u>	<u>0.05</u>	<u>-0.02</u>
<u>Terrain</u>	<u>10</u>	<u>84</u>	<u>11</u>	<u>84</u>	<u>2</u>	<u>4.316*</u>	<u>0.05</u>	<u>0.021</u>
<u>Terrain</u>	<u>140</u>	<u>84</u>	<u>11</u>	<u>84</u>	<u>2</u>	<u>0.316</u>	<u>0.05</u>	<u>0.004</u>

* Value is above Class I Threshold

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 45
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Rule 1714 – Prevention of Significant Deterioration for Greenhouse Gases, Gas Turbines

This rule establishes preconstruction review requirements for greenhouse gases (GHG). The provisions of this rule apply only to GHGs defined as an aggregate group of six GHGs: carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆).

This rule is consistent with federal PSD rule as defined in 40 CFR Part 52.21. Several specific sections of the 40 CFR Part 52.21 are excluded by this rule. This rule requires the owner or operator of a new major source or a major modification to obtain a PSD permit prior to commencing construction.

DETERMINE GHG PSD APPLICABILITY

EPA has developed the PSD and Title V Permitting Guidance Document for Greenhouse Gases (March 2011). For permits issued on or after July 1, 2011 PSD applies to GHGs if:

- The source is otherwise subject to PSD (for another regulated NSR pollutant), and
- The source has a GHG PTE equal to or greater than 75,000 TPY CO₂e, or
- Source has a GHG PTE* equal to or greater than
100,000 TPY CO₂e, and
100/250 TPY mass basis

El Segundo Power, LLC is an existing PSD major source because of its NO_x and CO emissions. The new power system will have more than 75,000 tons per year CO₂e emissions, as calculated in Appendix E. Therefore, the project is subject to the GHG PSD analysis.

PSD BACT ANALYSIS

EPA has recommended the 5-step “top-down” process to determine BACT for GHGs.

1. Identify all available control options
2. Eliminate technically infeasible options
3. Ranking of controls
4. Economic, energy, and environmental impacts
5. Selecting BACT

The step-by-step BACT analysis is conducted.

*On June 23, 2014, the US Supreme Court issued its decision that EPA may not treat GHG’s as an air pollutant for purposes of determining whether a source is a major source required to obtain a PSD or Title V permit.

Step 1 Identify All Available Control Options

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 46
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The available CO₂ control technologies, as determined by EPA and Department of Energy, are:

- A. Carbon Capture and Sequestration (CCS)
- B. Lower Emitting Alternative Technology
- C. Thermal Efficiency

The technologies are described and discussed in the next sections.

A. Carbon Capture and Sequestration (CCS)

CCS is a process that captures, transports, and sequesters CO₂ emissions.

Capturing of CO₂ Emissions

Combustion flue gas may be processed for the purpose of separation and capture of carbon dioxide. Amine-based solvent systems are available in commercial use for scrubbing CO₂ from industrial flue gases and process gases. Solid sorbents are also available to capture CO₂ from flue gas through chemical adsorption or physical adsorption. However, based on a recent similar analysis conducted for LADWP Scattergood Generating Station, commercially available systems are not presently available to process flue gas from a commercial power plant.

Transportation of CO₂ Emissions

Once captured, CO₂ would have to be transported to a storage site. For geologic sequestration, a pipeline is typically used to transport the CO₂ as a critical fluid to the sequestration location. The Technical Advisory Committee for the California Carbon Capture and Storage Review Panel stated in the August 2010 report that there are no existing CO₂ pipelines in California. In addition, there are no CO₂ pipeline projects underway in California.

Sequestration of CO₂ Emissions

There are several sequestration approaches.

Geologic Sequestration

Under geologic sequestration the captured CO₂ is compressed and transported to a sequestration location. CO₂ is injected into underground at high pressure, and remains a supercritical fluid underground. Over time the CO₂ can dissolve into surrounding water and rocks, creating solid carbonate minerals.

There are several geologic formations identified in California that might provide a suitable site for geologic sequestration. Several sites near the ESPFM Project may be the old petroleum production area

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 47
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

in Long Beach, a formation in the Lower San Joaquin Valley, and possibly a site located in Ventura County. While these sites may eventually prove to be suitable, the geotechnical analyses needed to confirm their suitability have not been conducted. In addition, there are no available pipelines to transport captured CO₂ to the sequestration site.

Ocean Storage

In lieu of injecting CO₂ underground as in geologic sequestration, ocean storage is accomplished by injecting CO₂ into the ocean water typically at depth of greater than 1,000 meters. CO₂ is expected to dissolve or form into a horizontal lens which would delay the dissolution of CO₂ into the surrounding environment.

Mineral Carbonation

Mineral carbonation is the reaction of CO₂ with metal oxides to form metal carbonates. Metal oxides are abundant in silicate minerals and in waste streams. The natural reaction of CO₂ with metal oxides is a very slow process. The reaction time can be increased by enhancing the purity of these metal oxides. Large scale production of metal oxides to meet the demand of electrical generation is very energy and cost intensive.

B. Lower Emitting Alternative Technology

Lower emitting alternative technologies for energy generation are available on the demand side. If demand for energy is reduced a utility's generation capacity can be reduced, thus lowering GHG emissions.

Demand-side resource programs include both energy efficiency, aimed at reducing total energy consumption, and demand response, aimed at reducing peak demand or shifting demand from peak to off-peak periods. Demand response programs include increasing the efficiency of El Segundo Power, LLC's system capabilities such that energy is dispatched to more effectively track actual demand, and agreements with commercial and industrial customers to curtail load during peak periods. No additional lower emitting alternative technologies are feasible to incorporate into the project without fundamentally changing the business purpose of the Project.

C. Thermal Efficiency

Power generation through fossil fuel combustion is a chemical reaction process. The thermal efficiency is defined as the ratio of the net power produced and the heating values of the fuel. The plant efficiency varies from 30% to over 60%, depending on many factors. The heat rate, measured in Btu/kWh, is generally used as a thermal efficiency indicator. The thermal efficiency is at the highest when the reaction is at stoichiometric, and at the time when CO₂ emissions are the highest.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 48
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The following factors affect the thermal efficiency of a power plant:

- Thermal dynamic cycle selection, combined cycle versus simple cycle
- Combustion turbine performance, compression ration and turbine design temperature
- Combustion turbine startup time, load transition time
- Steam turbine startup time, load following time
- Fuel selection

The repower project is proposing to combust natural gas, the lowest emitting fossil fuel available. It includes a combined cycle generation system (CCGS) and a simple cycle generation system (SCGS). The CCGS has a higher cycle thermal efficiency than the simple cycle systems. Energy is recovered in the heat recovery steam generator (HRSG) and is used to generate power in the steam turbine generator (STG). The purpose of the Fast Start Process (Fast Start[®]) is to minimize emissions during startup and increase the efficiency of the power plant. El Segundo Power, LLC plans to use the CCGS in the base load operation. The SCGS compliments the CCGS by providing demand-following capability. The two RR Trent 60 units have the some of the highest thermal efficiencies (48%) among the simple cycle gas turbine generators. Although new power generating system would emit GHG emissions, the high thermal efficiency of the new power generating equipment and the system build-out of renewable resources in California would result in a net cumulative reduction of GHG emissions from new and existing fossil resources.

With the adoption of Senate Bill 2 on April 12, 2011, California’s Renewable Portfolio Standard (RPS) was increased from 20 percent by 2010 to 33 percent by 2020. To meet the new RPS requirements, the amount of dispatchable, high-efficiency, natural gas generation used as regulation resources, fast ramping resources, or load following or supplemental energy dispatches will have to be significantly increased. The construction of the ESPFM Project will aid in the effort to meet California’s RPS standard. Finally, the operation of the new power generating system will enhance the overall efficiency of El Segundo Power, LLC’s electricity system operation and thereby reduce GHG emissions.

Step 2 Eliminate Technically Infeasible Options

The second step for the BACT analysis is to eliminate technically infeasible options from the control technologies identified in Step 1. For each option that was identified, a technology evaluation was conducted to determine the technical feasibility. The technology is feasible only when the technology is available and applicable. A technology that is not commercially available for the scale of the project is also considered infeasible. An available technology is applicable if it can reasonably be installed and operated on the proposed project.

A. Carbon Capture and Sequestration (CCS)

The technical feasibility of each step of the CCS is discussed below.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 49
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Carbon Capture Technology

Solvent-based capture technology for a commercial scale power plant has only been demonstrated for a fraction of the flue gas. A solvent-based carbon capture process is currently judged to be technologically infeasible for a commercial power plant application.

Sorbent-based capture technology can be used for post-combustion capture of CO₂. However, the technology has not been demonstrated on combined-cycle gas turbine power plants. A sorbent-based carbon capture process is currently judged to be technologically infeasible for a natural gas-fired commercial power plant application.

Membrane-based capture technology is commercially available in the chemical industry for CO₂ removal but has not been demonstrated in practice for power generation applications. A membrane-based carbon capture process is currently judged to be technologically infeasible for a commercial power plant application.

CO₂ Transportation

The basic technologies required for CO₂ transportation (i.e., pipeline, tanker truck, ship) are in commercial use today for a number of applications and can be considered commercially available for liquid CO₂.

CO₂ Sequestration

Geologic sequestration has been demonstrated on a pilot scale. However, a number of significant technical issues remain to be resolved before the technology can be applied to a successful commercial scale application at a specific site. At this moment the technical feasibility for geological sequestration for the new power generating system cannot be determined. Therefore CCS using geological sequestration cannot be demonstrated to be technically feasible in practice for the new power generating system.

Ocean storage and its ecological impacts are still in the research phase. It is not commercially available.

Mineral carbonation is technically feasible, as reaction chemistry is well understood. However, the sequestration of CO₂ through mineral carbonation has not been demonstrated on a commercial scale.

Summary of CCS Feasibility

In summary, the post-combustion carbon capture technologies are still in the developmental stage or pilot scale projects. These technologies would not be considered commercially available for the project size of a full-scale commercial power plant. In addition, there are no comprehensive standards in place defining requirements for long term sequestration. Therefore, CCS is not yet demonstrated in practice

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 50
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

for a commercial-scale, natural gas fired power plant such as the ESPFM Project. In consideration of the uncertainty in the technical feasibility of CCS and its emergence as a promising technology, CCS is carried forward in this BACT analysis as a potential GHG control technology. However, substantial evidence demonstrates that CCS is not yet demonstrated as technically feasible for the ESPFM project.

B. Lower Emitting Alternative Technology

As discussed previously, any of the commercially available low GHG-emitting technologies that could be implemented, are not feasible for this site and would fundamentally alter the business purpose of the emission source. As such, lower emitting alternative technology was not considered as part of the BACT analysis.

C. Thermal Efficiency

The California Senate Bill (SB) 1368 requires the California Public Utilities Commission (CPUC) to establish a GHG emission performance standard for all baseload utilities by February 1, 2007. The California Energy Commission (CEC) was required to establish a similar standard for local publicly owned utilities by June 30, 2007. The CEC has established a GHG performance standard of 1,100 pounds of CO₂ per net MWh for baseload publicly owned electrical utilities. The California Legislature in Assembly Bill (AB) 1613 (2007), as amended by AB 2791 (2008), established a CO₂ Emission Performance Standard (EPS) for combined heat and power facilities of 1,100 lbs CO₂/MWh. In 2010, the CEC promulgated its regulation to implement AB 1613 in its Guidelines for Certification of Combined Heat and Power Systems Pursuant to the Waste Heat and Carbon Emissions Reduction Act (CEC 2010b).

The EPA released a prepublication version of a proposed rule on March 27, 2012 to establish, a new source performance standard (NSPS) for GHG emissions from fossil fuel-fired electric generating units. ~~This standard~~ The March 27, 2012 proposed rule was replaced in its entirety by the January 8, 2014 CFR publication of proposed GHG standards of performance. The January 8, 2014 standard will require the new fossil fuel-fired power plants to meet an output based standard (based on gross output power) of 1,000 lb CO₂/MWh on an average annual basis. This standard will apply to ~~combined cycle~~ generating systems with a heat capacity of greater than 850 MMBTU/hr. ~~The proposed rule exempts simple cycle generating systems such as the SCGS. At this moment the proposed rule has not been finalized by EPA.~~

The CCGS will meet the California GHG emission performance standard of 1,100 pounds of CO₂ per net megawatt hour. As calculated in Appendix E, using a conservative annual operating schedule that includes startup, normal operation, shutdown and a low load factor of 45%, the CCGS will emit CO₂ at a rate of 967.10 lb CO₂ per net megawatt hour. The GHG emissions will be 876.89 lbs CO₂ per net megawatt hour when the load factor improves to 100%. Therefore, the GHG emissions is expected to be at 967-877 pounds CO₂ per net MWh if the CCGS operates between the load factor of 45%-100%. This is below the 1,100 lbs CO₂ per net MWh California standard. This emission metric is also

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 51
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

consistent with the emission limit established as GHG BACT for the Lower Colorado River Authority (LCRA) Thomas C. Ferguson Power Plant of 918 lb CO₂/MWh source-wide net output.

~~The SCGS is not subject to the 1,000 lbs CO₂ per gross MWh EPA standard or the 1,100 lbs CO₂ per net MWh California standard because it is not a baseload combined cycle generating system. On January 8, 2014, the USEPA proposed new Standards of Performance for new electric power plants (Federal Register, Volume 79, No. 5). The proposed NSPS states that simple cycle stationary combustion turbines selling less than 33% of their potential electric output to the grid and less than 219,000 net MWh on a 3 year rolling average period would be exempt from complying with the proposed emission limit of 1,100 lb CO₂/MWh. The expected GHG emissions from each of the Trent 60 simple cycle units range from 1,502 – 1,113 lbs CO₂/MWh depending on load factors, and the proposed capacity factor for each combustion turbine will be approximately 55%, meaning that the Trent 60s as proposed cannot comply with the proposed NSPS. The applicant has addressed this issue and has agreed to limit the capacity factor of each Trent 60 to less than 33% and produce less than 219,000 net MWh on a 3 year rolling average period. Each Trent 60 will be conditioned to have a capacity factor of less than 33% and produce less than 219,000 net MWh on a 3 year rolling average. Therefore, the Trent 60s will be exempt from the new NSPS.~~

~~The RR Trent 60 is an advanced simple cycle gas turbine generator that incorporates water injection at the compression stage to promote enhanced energy efficiency. The heat rate of the RR Trent 60 is approximately 8,400 – 9,400 Btu/kWh well below the 9,000–10,000 Btu/kWh range of typical simple cycle gas turbines. Consequently the GHG emissions are the lowest among simple cycle gas turbine generators. The GHG performance metrics calculations are included in the Appendix F. The power plant operations include normal operation, startup operation, and shutdown operation.~~

~~The use of an advanced commercially available simple cycle gas turbine such as the Trent 60 combined with good combustion operation and maintenance to maintain optimum efficiency, is determined to be BACT for GHG for the ESPFM Project.~~

The thermal efficiency for the new power generating system achieved by the state-of-the-art technologies is a technically feasible alternative for reducing GHG emissions from a fossil-fuel fired low efficiency power plant. In conclusion the combustion process inherent in the new power generating system is achieved in practice and is eligible for consideration under Step 3 of the BACT analysis.

Step 3 - Rank Remaining Control Technologies

While carbon capture and sequestration (CCS) was determined to be technically infeasible for the ESPFM Project, this option is carried forward in the BACT analysis to Step 3. The rank order of control, starting from the most effective control (1) to the least effective control (2), is as follows:

1. CCS
2. Thermal efficiency

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 52
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The control effectiveness is discussed below.

A. Carbon Capture and Sequestration (CCS)

Post-combustion capture systems being developed are expected to be capable of capturing more than 90 percent of flue gas CO₂. At an assumed control efficiency of 90 percent, this would be equivalent to an emission rate of 10 percent of the California EPS, or approximately 110 lb CO₂/MWh. This makes CCS the top-ranked technology on a theoretical basis. However, as discussed in Step 2, CCS was found to be technically infeasible for the ESPFM Project. In addition, the above assumed CO₂ control efficiency does not take into account the parasitic loss associated with operation of the CCS system and the increased CO₂ emissions that will occur to replace the parasitic energy loss.

B. Thermal Efficiency

Thermal efficiency is capable of lowering GHG emissions, but the potential is much less than CCS on a theoretic basis. As discussed in Section 2, the new power generating system already incorporates increased thermal efficiency in its design by incorporation of state-of-the-art combustion turbines with the addition of RPS startup capability. Since the parasitic load is already relatively low at this facility, further increases to thermal efficiency are not achievable without changing basic objectives of the power project, if at all, and hence are not required by EPA guidelines for GHG BACT.

Step 4 – Evaluating the Most Effective Controls

Step 4 of the BACT analysis is to evaluate the most effective control. This step involves the consideration of energy, environmental, and economic impacts associated with each control technology. The top-down approach requires that the evaluation begin with the most effective technology.

A. Carbon Capture and Sequestration (CCS)

Because CCS is considered technically infeasible to apply for the ESPFM Project it is not evaluated under this step.

B. Thermal Efficiency

The database review of BACT determinations described above identified six facilities with natural gas-fired combustion turbines for which a GHG BACT analysis was done:

- EPA issued the PSD Permit for the Palmdale Hybrid Power Project in October 2011. This project consists of a hybrid of natural gas fired combined cycle generating system (two GE 7FA

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 53
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

combustion gas turbines and one shared steam turbine) integrated with solar thermal generating system. Based on EPA’s analysis CCS was eliminated as a control option because it is deemed economically infeasible.

- EPA issued the PSD Permit for the Lower Colorado River Authority (LCRA) Project in November 2011. This project consists of a natural gas fired combined cycle generating system with two GE 7FA combustion gas turbines and a shared steam turbine. Based on the review of the available control technologies for GHG emissions, EPA concluded that BACT for LCRA was the use of new thermally efficient combustion turbines with applicable GHG emission limit.
- The Bay Area Air Quality Management District issued a GHG BACT determination for the Calpine Russell City Energy Center in 2010. According to a presentation by Calpine, thermal efficiency was the only feasible combustion control technology considered as CCS was determined to be not commercially available. Thermal efficiency was found to be the top level of control feasible for a combined-cycle power plant, and hence was the technology selected at GHG BACT for Russell City.
- EPA issued the PSD Permit for the Pio Pico Energy Center Project in November 2012. The project consists of three simple cycle GE LMS100 generators. EPA concluded that BACT was the use of new thermally efficient combustion gas turbines with applicable GHG emission limits.
- SCAQMD issued the PSD Permits for the LADWP Scattergood Generating Station in 2013. The project consists of one GE 7FA combined cycle gas turbine and two simple cycle GE LMS100 generators. EPA concluded that BACT was the use of new thermally efficient combustion gas turbines with applicable GHG emission limits.
- SCAQMD issued the PSD Permit for the City of Pasadena in 2013. The project consists of one LM6000 combined cycle gas turbine. EPA concluded that BACT was the use of new thermally efficient combustion gas turbines with applicable GHG emission limits

As demonstrated by the EPA permits thermal efficiency is the most cost effective control technology for GHG emissions from power plants. In addition, the GE 7FA combustion turbine and the RR Trent 60 combustion turbine are acceptable for GHG PSD permits under the BACT thermal efficiency requirement.

Step 5 – Select BACT

Based on the above analysis, thermal efficiency is the only technically and economically feasible alternative for CO₂/GHG emissions control for the ESPFM Project. The current design of the facility meets the BACT requirement for GHG emission reductions.

SCAQMD conducted the GHG BACT analysis following the EPA’s guidance document “PSD and Title V Permitting Guidance for Greenhouse Gases”. The procedure outlined in this document requires a five step “top-down” analysis to evaluate each of the possible control strategies for use and to require

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 54
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

the most effective control strategy to reduce emissions of GHGs. It is EPA's opinion and SCAQMD's understanding that BACT should not be required to regulate the applicant's purpose or objective of the proposed facility. The purpose of the project is to provide power to the electrical grid on both a base load and peak load demand basis. The applicant therefore proposed the use of a combined cycle gas turbine to serve the baseload demand and two simple cycle gas turbines to provide for both the peak load demand and the complete black start capability for the site. The simple cycle gas turbines are ideal for rapid and frequent start-ups. The applicant anticipates the peak load and black start demands may call for up to 480 start-ups and 480 shutdowns per year. Although a combined cycle gas turbine such as the GE model 7FA proposed for the project is more efficient than a simple cycle unit, it is simply not designed for this type of operation. The simple cycle units selected for this project can start-up and achieve full power in 30 minutes or less. The combined cycle gas turbine, in order to achieve superior thermal efficiency must wait for the steam turbine to come on-line. If the combined cycle unit were to bypass the steam turbine for the purpose of a quick start-up, it essentially becomes a simple cycle unit and therefore loses any advantage it has in thermal efficiency. Therefore the combined cycle unit is eliminated in the BACT analysis as technically infeasible for serving peak demand and black start operations.

SCAQMD's GHG BACT analysis concluded that the highest thermal efficiency is GHG BACT for both combined cycle gas turbines and simple cycle gas turbines. As such the PDOC included a review several recently issued EPA permits which included the Lower Colorado River Authority in Texas (11/2011) and the Pio Pico Energy Center in California (11/2012). SCAQMD noted that it was EPA's opinion that the GE 7FA meets the requirements of GHG BACT for combined cycle gas turbines and that the GE LMS100, a gas turbine very similar to the proposed RR Trent 60 simple cycle gas turbine, meets the requirements for GHG BACT for simple cycle units. The RR Trent 60 has a thermal efficiency of 42%, comparable to that of the LMS100 and the Alstom SC13C2.

In addition, SCAQMD calculated the projected annual GHG emissions on the net generated megawatt basis. For the combined cycle GE 7FA gas turbine with the proposed annual operating schedule, the effective CO₂e emissions range from 0.44 to 0.48 ton per net megawatt-hour. The emissions are below the 1,100 pounds per net megawatt-hour limit that California specifies for baseload combined cycle gas turbines (SB 1368). The emissions are also below the 1,000 pound per gross megawatt-hour limit proposed by EPA. As such SCAQMD has concluded that the GE 7FA combined cycle gas turbine and the RR Trent 60 simple cycle gas turbines will comply with the EPA's GHG BACT requirements.

The BACT limit shall be applicable to the entire operation conditions. Therefore, BACT is determined based on the facility proposed annual operating scenarios that take into consideration of load factor, equipment degradation over time, and operating hours. The detailed calculations are included in Appendix E.

Based on calculations of Appendix E the GE 7FA combined cycle generating system is expected to generate 967 lbs of CO₂ per net megawatt hours at 45% load, or 877 lbs of CO₂ per net megawatt hours at 100% load. Because BACT must apply at all loads the applicable BACT limit is set at ~~50~~ 45% load, to be 967 lb/_{net}MWh. This limit ensures compliance with the California law SB1368 limit of 1,100 lb/_{net}MWh, and compliance with the proposed federal limit of 1,000 lb/_{gross}MWh for base load

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 55
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

combined cycle generators. The equipment will also be subject to the CO₂ emission limit of ~~763,684~~ 764,191 tons per year. Compliance will be based on a 12-month rolling average as determined by using emission factors and fuel usage.

Based on calculations of Appendix E the RR Trent 60 simple cycle generating system is expected to generate 1,503 lbs of CO₂ per net megawatt hours at 55% load, or 1,114 lbs of CO₂ per net megawatt hours at 100% load. Because BACT must apply at all loads the applicable BACT limit is set at 55% load, to be 1,503 lb/_{net}MWh. The equipment will also be subject to the CO₂ emission limit of ~~140,998~~ 141,092 tons per year. Compliance will be based on a 12-month rolling average as determined by using emission factors and fuel usage.

Based on the above analysis, the ESPFM Project is expected to comply with the GHG PSD requirements.

Other PSD Requirements

In addition to the BACT requirement the PSD requirements generally include air quality modeling, ambient monitoring, and additional impact analysis. The modeling analysis shall demonstrate that there will be no violations of any NAAQS or PSD increments. However, because there are currently no NAAQS or PSD increments established for GHGs, the modeling analysis requirement would not apply for GHGs even if PSD is triggered for GHGs. EPA does not require monitoring for GHGs in accordance with Section 52.21(i)(5)(iii) and Section 51.166(i)(5)(iii), and EPA does not require impact analysis from GHGs in the nearby Class I areas. ~~In addition, no offsets are required for CO because this pollutant is in attainment in the South Coast Air Basin.~~

Rule 2005 – NSR for RECLAIM Pollutants

This regulation applies to NO_x emissions.

1. BACT

CCGS

For a combined cycle combustion turbine the most stringent NO_x emissions limit is 2.0 ppmv, 15% O₂, dry, 1-hour average. The El Segundo Power Redevelopment (ESPR) Project has two Siemens-Westinghouse combined cycle gas turbines that were permitted at 2.0 ppmv in 2010. The use of SCR combined with dry low NO_x combustion technology will ensure that the gas turbine meets the 2.0 ppmv NO_x limit.

SSGS

For a simple cycle combustion turbine the most stringent NO_x emissions limit is 2.5 ppmv, 15% O₂, dry, 1-hour average. The Walnut Creek Energy Park has 5 GE LMS100 simple cycle gas turbines that were permitted at 2.5 ppmv in 2011. The ESPFM Project will use a SCR control system in conjunction with water injection to meet the 2.5 ppmv NO_x limit.

Auxiliary Boiler

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 56
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

LAER requirements for natural gas fired watertube boilers is 5 ppmv NOx and 50 ppmv CO, each measured at 3% O2, dry basis. The 5 ppmv NOx determination was based on Rule 1146 BARCT requirements for Group I and II Units which are greater than 20 MMBTU/hr. Furthermore, two similar watertube boilers permitted at LAC/USC Medical Center in August 2012, both of which are in current operation, are using a low NOx burner and an SCR unit to achieve LAER of 5 ppmv NOx and 50 ppmv CO (tested in compliance at loads greater than 30%). The auxiliary boiler will be equipped with a dry low NOx burner and external control consisting of an SCR unit designed by Cleaver Brooks to achieve the 5 ppmv NOx emission limit. The applicant has submitted a performance warranty from Cleaver Brooks dated April 22, 2014 stating that the auxiliary boiler will comply with both the 5 ppmv NOx emission limit and the 50 ppmv CO emission limit at boiler loads greater than 20%. A 100 ppmv emission limit will be achieved at boiler loads less than or equal to 20%. Therefore, the auxiliary boiler will comply with LAER.

2. MODELING

The facility is located in the South Coast air basin, which is in attainment of NO₂ emissions. Thus, Rule 2005(c)(1)(B) requires the facility to demonstrate, through modeling analysis, that the proposed NOx emission sources will not cause a violation of the most stringent ambient air quality standards. There are two air quality standards for NO₂, the newly adopted 1-hour federal standard of 100 ppb (188 µg/m³) based on 98th percentile of the last three year average, and annual California standard of 30 ppb (56 µg/m³). The background air quality data from the Los Angeles International Airport Station are used in the modeling analysis. At this station, the 1-hour average background concentration is 129.7 µg/m³ based on the 3-year average 98th percentile, and the highest annual average background concentration is 24.5 µg/m³. The maximum project impacts of NO_x emissions were determined using the AERMOD model. Although the rule requires modeling analysis of NOx emissions impact from each individual permitted unit, El Segundo Power, LLC elected to model the impact from the entire new equipment as a group. The equipment group, which include the three turbines and the auxiliary boiler, are assumed operating concurrently and emitting NOx emissions collectively. This modeling approach is more stringent, and it satisfies the requirement of this rule. Results from the modeling analysis indicate that the highest 1-hour impact occurs when all three turbines are in the startup stage. The highest annual impact occurs when all three turbines are operating at full capacities, and the auxiliary boiler operating 8,760 hours per year. Table 14 24 provides a summary of the modeling results submitted to SCAQMD with the application package.

Table 7 24 – NOx Emissions Modeling Results

	Background (µg/m ³) ^(a)	Modeling Impacts (µg/m ³)	Total NOx (µg/m ³)	Air Quality Standard (µg/m ³)	Violation
1-hour 98 th percentile	129.7	20.9 63.9	150.6	188	No
Annual	24.5	0.6	25.1	56	No

a – Background concentration was measured at Los Angeles International Airport Meteorological Station for years 2009, 2010, and 2011

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 57
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The modeling results demonstrate that the proposed NOx emission sources will not cause a violation of the most stringent ambient air quality standards.

3. OFFSET (RTC)

The facility is required to demonstrate that it holds sufficient RTCs to offset the annual emission increase for the first year of operation using a 1-to-1 offset ratio. Furthermore, Rule 2005(b)(2)(B) states that the RTCs must comply with the zone requirements of Rule 2005(e). The repower project is expected to undergo commissioning operation in Year 2014. Since the facility is located in Zone 1, RTCs may only be obtained from Zone 1. The total NOx RTC requirements of the repower project for the 1st year of operation is ~~183,989~~ ~~242,084~~ 242,139 lbs. This requirement is based on the emissions from the commissioning, and based on the annual operating schedule provided by El Segundo Power, LLC. After the 1st year the project will require ~~144,736~~ 194,036 lbs of NOx RTC per year. It is lower than the 1st year requirement since the emissions from the commissioning are not included. Compliance with the offset requirement is expected.

4. Additional Requirements for Major Sources

Rule 2005 requires that a major source also comply with the following:

- A) Certify that all major sources in the state under control of the applicant are in compliance with all applicable federal emissions standards.
- B) Submit an analysis of alternative sites, sizes, production processes, and environmental control techniques for the proposed source.
- C) Compliance with CEQA
- D) Protection of Visibility

El Segundo Power, LLC certifies in the permit application that all major sources under their control in the state currently comply with federal regulations. An alternative analysis under the California Environmental Quality Act (CEQA) process is being performed as part of the AFC. The minimum distance between the project site and the nearest Class I area (San Gabriel Wilderness Area) is 54 km, which is greater than the maximum distance requirement of 29 kilometers. Thus, no visibility analysis is required for the ESPFM Project. Thus, the above three requirements have been met for the ESPFM Project.

Rule 2012 – Monitoring Recording and Record Keeping for RECLAIM

El Segundo Power, LLC is currently in compliance with all monitoring, record-keeping, and reporting requirements of NO_x RECLAIM. The new gas turbine generators will be classified as major sources

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 58
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

for RECLAIM purposes. As such each turbine will be provided with a NO_x CEMS and a fuel meter, and emissions will be reported through a remote terminal unit (RTU) on a daily basis. The CEMS will be installed within 12 months from the date of installation of the turbines. Thus, the operation of the new turbines will be in compliance with Rule 2012.

Regulation XXX – Title V Operating Permit

El Segundo Power, LLC is a federal Title V facility and is subject to Title V requirements. The addition of the new turbines is considered a Significant Permit Revision as defined in Rule 3000.

The facility is was required to provide public notification of the repower project. EPA ~~will~~ was also be provided with this information for their review comments (45 day review period). The Title V public notice will be combined with Rule 212 notice, which is was also required for this project.

Rule 3006 requires that the notice contain the following:

- (i) The identity and location of the affected facility.
- (ii) The name and mailing address of the facility’s contact person.
- (iii) The identity and address of the SCAQMD as the permitting authority processing the permit.
- (iv) The activity or activities involved in the permit action.
- (v) The emissions change involved in any permit revision.
- (vi) The name, address, and telephone number of a person whom interested persons may contact to review additional information including copies of the proposed permit, the application, all relevant supporting materials, including compliance documents as defined in paragraph (b)(5) of Rule 3000, and all other materials available to the Executive Officer that are relevant to the permit decision.
- (vii) A brief description of the public comment procedures provided.
- (viii) The time and place of any proposed permit hearing that may be held or a statement of the procedures to request a proposed permit hearing if one has not already been requested.

Each of the above criteria was incorporated into the Rule 212/3006 Pubic Notice which was distributed on January 10, 2014.

40 CFR 60 Subpart D – Standards of Performance for Fossil Fuel Fired Steam Generators

This regulation applies to fossil fuel fired steam generating units which are rated at greater than 250 MMBTU/hr (73 MW) and which commenced construction after August 17, 1971. The auxiliary boiler is a new construction however it is rated at 36 MMBTU/hr. Therefore, this regulation does not apply to the auxiliary boiler.

40 CFR 60 Subpart Da – Standards of Performance for Electric Utility Steam Generating Units

This regulation applies to electric utility steam generating units which are rated at greater than 250 MMBTU/hr (73 MW) and which commenced construction after September 18, 1978. The auxiliary

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 59
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

boiler is a new construction however it is rated at 36 MMBTU/hr and does not generate electricity. Therefore, this regulation does not apply to the auxiliary boiler.

40 CFR 60 Subpart Db – Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units

This subpart applies to any industrial, commercial or institutional steam generating unit that commences construction, modification, or reconstruction after June 19, 1984, and that has a heat input capacity from fuels combusted in the steam generating unit of greater than 29 megawatts (MW) (100 million British thermal units per hour (MMBTU/hr)). The auxiliary boiler is a new construction and is rated at 36 MMBTU/hr. Therefore, this regulation does not apply to the auxiliary boiler.

40 CFR 51 – Appendix S – Emission Offset Interpretive Ruling

This appendix sets forth EPA's Interpretive Ruling on the preconstruction review requirements for stationary sources of air pollution (not including indirect sources) under 40 CFR subpart I and section 129 of the Clean Air Act Amendments of 1977, Public Law 95-95. Since this project is located in the South Coast Air Basin (SOCAB) that is designated as moderate non-attainment for PM2.5 and Rule 1325 is not currently SIP-approved, the requirements of NSR for PM2.5 and the precursor pollutants must be implemented through Appendix S. Thus, all SCAQMD permit applications for facilities with PM2.5 emissions must be evaluated for compliance with PM2.5 requirements that are included in Appendix S. This ruling applies to any new major polluting facility, major modifications to a major polluting facility, and any modification to an existing facility that would constitute a major polluting facility in and of itself, located in areas federally designated pursuant to Title 40 of the Code of Federal Regulations (40 CFR) 81.305 as non-attainment for PM2.5. With respect to major modifications, this ruling applies on a pollutant-specific basis to those pollutants for which (1) the source is major, (2) the modification results in a significant increase, and (3) the modification results in a significant net emission increase.

Definitions

For the purpose of this ruling, the following definitions shall apply:

- (1) POTENTIAL TO EMIT means the maximum capacity of a stationary source to emit a pollutant under its physical and operational design. Any physical or operational limitation on the capacity of the source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design only if the limitation or the effect it would have on emissions is federally enforceable. Secondary emissions do not count in determining the potential to emit of a stationary source.
- (2) MAJOR POLLUTING FACILITY means, on a pollutant specific basis, any emissions source located in areas federally designated pursuant to 40 CFR 81.305, as non-attainment for the South Coast Air Basin, which has actual emissions of, or the potential to emit, 100 tons or more per year of PM2.5, or its precursors. A facility is considered to be a major polluting facility only for the specific pollutant(s) with a potential to emit of 100 tons per year or more.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 60
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

- (3) SIGNIFICANT means in reference to a net emissions increase or the potential of a source to emit any of the following pollutants, a rate of emissions that would equal or exceed any of the following rates:

Nitrogen Oxides: 40 tons per year
Sulfur Dioxide: 40 tons per year
PM2.5: 10 tons per year

Requirements

Facilities which are subject to this ruling are required to comply with the following requirements for PM2.5 and the precursor pollutants:

- (A) LAER is employed for the new or relocated source or for the actual modification to an existing source; and
- (B) Emission increases shall be offset at an offset ration of 1.1:1 for PM2.5 and the ratio required in Regulation XIII or Rule 2005 for NOx and SO2 as applicable, and;
- (C) Certification is provided by the owner/operator that all major sources, as defined in the jurisdiction where the facilities are located, that are owned or operated by such person, (or any entity controlling, controlled by, or under common control with such person) in the State of California are subject to emission limitations and are in compliance or are on a schedule for compliance with all applicable emission limitations and standards under the Clean Air Act;

Table 25 below is a summary of the Appendix S applicability for the ESPFM Project.

Table 25 – Appendix S Applicability

	<u>NOx</u>	<u>SO2</u>	<u>PM2.5</u>
<u>El Segundo Power, LLC Potential to Emit, TPY (ESPFM + ESP)</u>	<u>174.67</u>	<u>12.65</u>	<u>106.86</u>
<u>Major Source for Particular Pollutant?</u>	<u>Yes, PTE is greater than 100 TPY</u>	<u>No, PTE is less than 100 TPY</u>	<u>No, Condition F2.1 limits PTE to < 100 TPY</u>
<u>El Segundo Power, LLC Actual Emissions (2013 Reporting Year)</u>	<u>52.27</u>	<u>2.04</u>	<u>24.54</u>
<u>ESPFM Project Potential to Emit, TPY</u>	<u>97.01</u>	<u>6.24</u>	<u>55.06</u>
<u>Net Emission Increase (ESPFM PTE – ESP actual)</u>	<u>44.74</u>	<u>4.20</u>	<u>30.52</u>
<u>If ESP is a major facility for a particular pollutant, does the ESPFM Project result in a net significant emission increase?</u>	<u>Yes, net increase is greater than 40 TPY</u>		
<u>If ESP is not a major facility for a particular pollutant, does the ESPFM</u>		<u>No, net increase is less than 100</u>	<u>No, net increase is less than 100</u>

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 61
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

<u>Project constitute a modification that would constitute a major polluting facility in and of itself?</u>		<u>TPY</u>	<u>TPY</u>
<u>Appendix S Applicable?</u>	<u>Yes</u>	<u>No</u>	<u>No</u>

Appendix S is applicable to NOx. The ESPFM Project constitutes a major modification because the net NOx increase is greater than 40 TPY. The proposed CCGS and SSGS turbines will comply with federal LAER for NOx as discussed in the Rule 2005(c)(1)(A) – BACT analysis section. NOx emissions from the ESPFM Project will be offset through the shutdown of Boilers #3 and #4 through the securing of RECLAIM Trading Credits (RTCs). The facility has provided statewide compliance certification stating that owner/operator that all major sources, as defined in the jurisdiction where the facilities are located, that are owned or operated by such person, (or any entity controlling, controlled by, or under common control with such person) in the State of California are subject to emission limitations and are in compliance or are on a schedule for compliance with all applicable emission limitations and standards under the Clean Air Act.

RECOMMENDATION

Based on the engineering evaluation the new equipment is expected to comply with all federal, state, and local rules and regulations. It is recommended that the District approve the proposed project and issue permits to construct after 1) the 30-day public comment period, 2) the 45-day EPA review period, and 3) CEC’s approval of the proposed AFC. The permits will be subject to the following conditions.

CONDITIONS

Facility Conditions

F2.1 The operator shall limit emissions from this facility as follows:

<u>Contaminant</u>	<u>Emissions Limit</u>
PM	Less than 100 tons in any one year

For the purpose of this condition, the PM emission limit shall be applicable to particulate matter with an aerodynamic diameter of 2.5 microns or less.

The operator shall not operate any of the new Gas Turbines No. 5, 7, 9, 11, 12, existing Boiler No. 4, or the Auxiliary Boiler unless it demonstrates compliance with this limit.

For purposes of demonstrating compliance with the 100 ton per year limit the operator shall determine the PM2.5 emissions for each of the sources at the facility by calculating a 12-month rolling average using the following formula:

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 62
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

$$\text{PM2.5} = (\text{FF1} * \text{EF1} + \text{FF2} * \text{EF2} + \text{FF3} * \text{EF3} + \text{FF4} * \text{EF4} + \text{FF5} * \text{EF5} + \text{FF6} * \text{EF6} + \text{FF7} * \text{EF7}) / 2000$$

Where PM2.5 = PM2.5 emissions in tons per year

FF1 = Monthly fuel use for Gas Turbine Unit 5 in mmscf. EF1 = 4.66 lb/mmscf.

FF2 = Monthly fuel use for Gas Turbine Unit 7 in mmscf. EF2 = 4.66 lb/mmscf.

FF3 = Monthly fuel use for Gas Turbine Unit 9 in mmscf. EF3 = 4.51 lb/mmscf.

FF4 = Monthly fuel use for Gas Turbine Unit 11 in mmscf. EF4 = 9.98 lb/mmscf.

FF5 = Monthly fuel use for Gas Turbine Unit 12 in mmscf. EF5 = 9.98 lb/mmscf.

FF6 = Monthly fuel use for the Auxiliary Boiler in mmscf. EF6 = 6.80 lb/mmscf.

FF7 = Monthly fuel use for Boiler No. 4 in mmscf. EF7 = 5.15 lb/mmscf.

Any changes to these emission factors must be approved in advance by the District in writing and be based on unit specific source tests performed using District approved testing protocol.

El Segundo Power, LLC shall submit written reports of the monthly PM2.5 compliance demonstrations required by this condition. The report submittal shall be included with the semi-annual Title V report as required under Rule 3004(a)(4)(f). Records of the monthly PM2.5 compliance demonstration shall be maintained on site for at least five years and made available upon SCAQMD request.

~~The operator shall calculate the emissions limits(s) by using the calendar monthly fuel use data and the following emission factors: PM2.5: 4.09 4.51 lb/mmscf for the GE 7FA Combined Cycle Gas Turbine; 9.98 lb/mmscf for Trent 60 Simple Cycle Gas Turbines; 8.82 6.80 lb/mmscf for Auxiliary Boiler; 4.66 lb/mmscf for Gas Turbines No. 5 and No. 7 and 22.11 5.16 lb/mmscf for existing Boiler No. 4.~~

For purposes of this condition, any one year shall be defined as a period of twelve (12) consecutive months determined on a rolling basis with a new 12 month period beginning on the first day of each calendar month.

[Rule 1325, 40 CFR 51 Appendix S]

F52.1 The facility is subject to the applicable requirements of the following rules or regulations(s):

The facility shall submit a detailed retirement plan for the permanent shutdown of Boiler #4 (Device D13) describing in detail the steps and schedule that will be taken to render Boiler #4 permanently ~~in operable~~ inoperable. The retirement plan shall be submitted to SCAQMD within 60 days after the permits to construct for Gas Turbine Units 9, 11, and 12 are issued.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 63
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The retirement plan must be approved in writing by SCAQMD. El Segundo Power, LLC shall not commence any construction of the ESPFM Project including Gas Turbine Units 9,11, and 12, Steam Turbine Unit 10, SCR/CO Catalysts for Gas Turbines 9, 11, and 12, and the Auxiliary Boiler before the retirement plan is approved in writing by SCAQMD. If SCAQMD notified El Segundo Power, LLC that the plan is not approvable, El Segundo Power, LLC shall submit a revised plan addressing SCAQMD’s concerns within 30 days.

El Segundo Power, LLC shall provide SCAQMD by December 31, 2015 with a notarized statement that Boiler #4 is permanently shut down and that any re-start or operation of the unit shall require new Permit to Construct and be subject to all requirements of nonattainment new source review and the prevention of significant deterioration program.

El Segundo Power, LLC shall notify SCAQMD 30 days prior to the implementation of the approved retirement plan for permanent shut down of Boiler #4, or advise SCAQMD as soon as practicable should El Segundo Power, LLC undertake permanent shutdown prior to December 31, 2015.

El Segundo Power, LLC shall cease operation of Boiler #4 within 90 calendar days for the first fire of Gas Turbine Unit 9 (Device D90), Unit 11 (Device D100) , or Unit 12 (Device D106), whichever occurs first.

[Rule 1304(a) – Modeling and Offsets]

F52.2 This facility is subject to the applicable requirements of the following rules or regulation(s):

For the circuit breakers serving Units 9, 10, 11 and 12 the facility shall install, operate, and maintain enclosed-pressure SF6 circuit breakers with a maximum annual leakage rate of 1.0% by weight. The circuit breakers shall be equipped with a 10% by weight leak detection system. The leak detection system shall be calibrated in accordance with manufacturer’s specifications. The manufacturer’s specifications and records of all calibrations shall be maintained on site.

The total CO2e emissions from the circuit breakers serving Units 9, 10, 11 and 12 shall not exceed 81 tons per calendar year.

[Rule 1714]

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 64
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Device Conditions of the New Equipment

A63.3 The operator shall limit emissions from this equipment as follows:

CONTAMINANT	EMISSIONS LIMIT
CO	Less than or equal to 39,191 LBS IN ANY CALENDAR MONTH
VOC	Less than or equal to 7,546 LBS IN ANY CALENDAR MONTH
PM10	Less than or equal to 8,222 LBS IN ANY CALENDAR MONTH
SOx	Less than or equal to 945 <u>1,199</u> LBS IN ANY CALENDAR MONTH

The above limits apply after the equipment has been fully ~~is~~ commissioned.

The operator shall calculate the emission limit(s) by using the calendar monthly fuel use data and the following emission factors: VOC: 2.92 lbs/mmscf, PM10: 4.51 lbs/mmscf, SOx: ~~0.60~~ 0.71 lbs/mmscf.

The operator shall calculate the emission limits for CO after the CO CEMS certification based upon readings from the SCAQMD certified CEMS. In the event the CO CEMS is not operating or the emissions exceed the valid upper range of the analyzer, the emissions shall be calculated by using monthly fuel use data and the following factors: natural gas commissioning: 22.52 lbs/mmscf, normal operation: 13.86 lbs/mmscf.

[Rule 1303, Rule 1703 – PSD]

A63.4 The operator shall limit emissions from this equipment as follows:

CONTAMINANT	EMISSIONS LIMIT
CO	Less than or equal to 10,663 LBS IN ANY CALENDAR MONTH
VOC	Less than or equal to 1,203 LBS IN ANY CALENDAR MONTH
PM10	Less than or equal to 2,200 LBS IN ANY CALENDAR MONTH
SOx	Less than or equal to 430 <u>153</u> LBS IN ANY CALENDAR MONTH

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 65
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The above limits apply after the equipment has been fully ~~is~~ commissioned. The above limits apply to each turbine individually.

The operator shall calculate the emission limit(s) by using the calendar monthly fuel use data and the following emission factors: VOC: 2.66 lbs/mmscf, PM10: 9.98 lbs/mmscf, SOx: ~~0.60~~ 0.71 lbs/mmscf.

The operator shall calculate the emission limits for CO after the CO CEMS certification based upon readings from the SCAQMD certified CEMS. In the event the CO CEMS is not operating or the emissions exceed the valid upper range of the analyzer, the emissions shall be calculated by using monthly fuel use data and the following factors: natural gas commissioning: 258.44 lbs/mmscf, normal operation: 9.30 lbs/mmscf.

[Rule 1303, Rule 1703 – PSD]

A63.5 The operator shall limit emissions from this equipment as follows:

CONTAMINANT	EMISSIONS LIMIT
CO	Less than or equal to 251 LBS IN ANY CALENDAR MONTH
VOC	Less than or equal to 19 LBS IN ANY CALENDAR MONTH
PM10	Less than or equal to 58 LBS IN ANY CALENDAR MONTH
SOx	Less than or equal to 5 LBS IN ANY CALENDAR MONTH

The above limits apply after the equipment has been fully ~~is~~ commissioned.

The operator shall calculate the emission limit(s) by using the calendar monthly fuel use data and the following emission factors: VOC: 1.44 lbs/mmscf, CO: 22.66 lb/mmscf; PM10: 6.80 lbs/mmscf, SOx: 0.71 lbs/mmscf.

~~The operator shall calculate the emission limits for CO after the CO CEMS certification based upon readings from the SCAQMD certified CEMS. In the event the CO CEMS is not operating or the emissions exceed the valid upper range of the analyzer, the emissions shall be calculated by using monthly fuel use data and the following factors: natural gas commissioning: 45.35 lbs/mmscf, normal operation: 22.66 lbs/mmscf.~~

[Rule 1303, Rule 1703 – PSD]

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 66
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

A99.12 The 30.88 lbs/mmescf NOx emission limit(s) shall only apply during the turbine commissioning period to report RECLAIM emissions.

[Rule 2012]

A99.13 The 9.42 lbs/mmescf NOx emission limit(s) shall only apply during the interim period after turbine commissioning to report RECLAIM emissions.

[Rule 2012]

A99.14 The 96.58 lbs/mmescf NOx emission limit(s) shall only apply during the turbine commissioning period to report RECLAIM emissions.

[Rule 2012]

A99.15 The 16.16 lbs/mmescf NOx emission limit(s) shall only apply during the interim period after turbine commissioning to report RECLAIM emissions.

[Rule 2012]

A195.12 The 2.0 PPMV NOx emission limit(s) is averaged over 1 hour, dry basis at 15 percent oxygen. This limit shall not apply to commissioning, fast start-ups, traditional startups, and shutdown periods. The commissioning period shall not exceed 800 hours.

Following the commissioning period, a fast start-up shall not exceed 30 minutes. Following the commissioning period, a traditional start-up shall not exceed 60 minutes. Following the commissioning period, a shutdown shall not exceed 30 minutes. Following the commissioning period, the gas turbine shall be limited to a maximum of 200 total start-ups per year, and a maximum of 50 traditional start-ups per year.

For the purposes of this condition, the beginning of start-up occurs at initial fire in the combustor and the end of start-up occurs when the BACT levels are achieved. If during start-up the process is aborted and the turbine is restarted, then the start-up and restart will count as one start-up, provided the total time for the start-up does not exceed 30 operating minutes for a fast start-up and 60 operating minutes for a traditional start-up.

An operating minute is defined as a minute when the turbine is burning fuel.

Written records of commissioning, fast-start-ups, traditional start-ups, and shutdowns shall be maintained and made available upon request from the Executive Officer. The operator shall maintain records in a manner approved by the District to demonstrate compliance with this condition.

[Rule 2005 – BACT, Rule XVII – PSD]

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 67
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

A195.13 The 2.0 PPMV CO emission limit(s) is averaged over 1 hour, dry basis at 15 percent oxygen. This limit shall not apply to commissioning, fast start-ups, traditional startups, and shutdown periods. The commissioning period shall not exceed 800 hours.

Following the commissioning period, a fast start-up shall not exceed 30 minutes. Following the commissioning period, a traditional start-up shall not exceed 60 minutes. Following the commissioning period, a shutdown time shall not exceed 30 minutes. Following the commissioning period, the gas turbine shall be limited to a maximum of 200 total start-ups per year, and a maximum of 50 traditional start-ups per year.

For the purposes of this condition, the beginning of start-up occurs at initial fire in the combustor and the end of start-up occurs when the BACT levels are achieved. If during start-up the process is aborted and the turbine is restarted, then the start-up and restart will count as one start-up, provided the total time for the start-up does not exceed 30 operating minutes for a fast start-up and 60 operating minutes for a traditional start-up.

An operating minute is defined as a minute when the turbine is burning fuel.

Written records of commissioning, fast-start-ups, traditional start-ups, and shutdowns shall be maintained and made available upon request from the Executive Officer. The operator shall maintain records in a manner approved by the District to demonstrate compliance with this condition.

[Rule XVII – PSD]

A195.14 The 2.0 PPMV VOC emission limit(s) is averaged over 1 hour, dry basis at 15 percent oxygen. This limit shall not apply to commissioning, fast start-ups, traditional startups, and shutdown periods. The commissioning period shall not exceed 800 hours.

Following the commissioning period, a fast start-up shall not exceed 30 minutes. Following the commissioning period, a traditional start-up shall not exceed 60 minutes. Following the commissioning period, a shutdown time shall not exceed 30 minutes. Following the commissioning period, the gas turbine shall be limited to a maximum of 200 total start-ups per year, and a maximum of 50 traditional start-ups per year.

For the purposes of this condition, the beginning of start-up occurs at initial fire in the combustor and the end of start-up occurs when the BACT levels are achieved. If during start-up the process is aborted and the turbine is restarted, then the start-up and restart will count as one start-up, provided the total time for the start-up does not exceed 30 operating minutes for a fast start-up and 60 operating minutes for a traditional start-up.

An operating minute is defined as a minute when the turbine is burning fuel.

Written records of commissioning, fast-start-ups, traditional start-ups, and shutdowns shall be maintained and made available upon request from the Executive Officer. The operator

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 68
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

shall maintain records in a manner approved by the District to demonstrate compliance with this condition.

[Rule 1303 – BACT]

A195.15 The 2.5 PPMV NO_x emission limit(s) is averaged over 1 hour, dry basis at 15 percent oxygen. This limit shall not apply to commissioning, start-ups, and shutdown periods. The commissioning period shall not exceed 206 hours.

Following the commissioning period, a start-up shall not exceed 30 minutes. Following the commissioning period, a shutdown time shall not exceed 20 minutes. Following the commissioning period, the gas turbine shall be limited to a maximum of 480 total start-ups per year.

For the purposes of this condition, the beginning of start-up occurs at initial fire in the combustor and the end of start-up occurs when the BACT levels are achieved. If during start-up the process is aborted and the turbine is restarted, then the start-up and restart will count as one start-up, provided the total time for the start-up does not exceed 30 operating minutes. An operating minute is defined as a minute when the turbine is burning fuel.

Written records of commissioning, ~~fast start-ups, traditional~~ start-ups, and shutdowns shall be maintained and made available upon request from the Executive Officer. The operator shall maintain records in a manner approved by the District to demonstrate compliance with this condition.

[Rule 2005 – BACT, Rule XVII – PSD]

A195.16 The 4.0 PPMV CO emission limit(s) is averaged over 1 hour, dry basis at 15 percent oxygen. This limit shall not apply to commissioning, start-ups, and shutdown periods. The commissioning period shall not exceed 206 hours.

Following the commissioning period, a start-up shall not exceed 30 minutes. Following the commissioning period, a shutdown time shall not exceed 20 minutes. Following the commissioning period, the gas turbine shall be limited to a maximum of 480 total start-ups per year.

For the purposes of this condition, the beginning of start-up occurs at initial fire in the combustor and the end of start-up occurs when the BACT levels are achieved. If during start-up the process is aborted and the turbine is restarted, then the start-up and restart will count as one start-up, provided the total time for the start-up does not exceed 30 operating minutes. An operating minute is defined as a minute when the turbine is burning fuel.

Written records of commissioning, ~~fast start-ups, traditional~~ start-ups, and shutdowns shall be maintained and made available upon request from the Executive Officer. The operator shall maintain records in a manner approved by the District to demonstrate compliance with this condition.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 69
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

[Rule XVII – PSD]

A195.17 The 2.0 PPMV VOC emission limit(s) is averaged over 1 hour, dry basis at 15 percent oxygen. This limit shall not apply to commissioning, start-ups, and shutdown periods. The commissioning period shall not exceed 206 hours.

Following the commissioning period, a start-up shall not exceed 30 minutes. Following the commissioning period, a shutdown time shall not exceed 20 minutes. Following the commissioning period, the gas turbine shall be limited to a maximum of 480 total start-ups per year.

For the purposes of this condition, the beginning of start-up occurs at initial fire in the combustor and the end of start-up occurs when the BACT levels are achieved. If during start-up the process is aborted and the turbine is restarted, then the start-up and restart will count as one start-up, provided the total time for the start-up does not exceed 30 operating minutes. An operating minute is defined as a minute when the turbine is burning fuel.

Written records of commissioning, ~~fast start-ups, traditional~~ start-ups, and shutdowns shall be maintained and made available upon request from the Executive Officer. The operator shall maintain records in a manner approved by the District to demonstrate compliance with this condition.

[Rule 1303 – BACT]

A195.18 The 1,100 lbs/net MW-hr CO2 emission limit(s) is averaged over 12 rolling months. This limit only applies if the capacity factor of the unit is 60% or greater on an annual basis.

[CCR Title 20]

A195.19 The 5 ppmv NOx emission limit(s) is averaged over 1 hour, dry basis, at 3 percent oxygen.

This limit shall not apply to boiler commissioning, start-up and shutdown periods. The commissioning period shall not exceed 80 operating hours. Following the commissioning period, the limit shall apply at all times when the SCR catalyst inlet temperature is in excess of 500 degrees F.

[Rule 2005 – BACT, Rule XVII – PSD]

A195.20 The 50 ppmv CO emission limit(s) is averaged over 1 hour, dry basis, at 3 percent oxygen.

This limit shall not apply to boiler commissioning, start-up and shutdown periods, and when the boiler load is less than or equal to 20 percent. The commissioning period shall not exceed 80 operating hours. Following the commissioning period, a start-up shall not exceed 120 minutes and a shutdown shall not exceed 60 minutes.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 70
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

[Rule XVII – PSD]

A195.21 The 100 ppmv CO emission limit(s) is averaged over 1 hour, dry basis, at 3 percent oxygen.

This limit shall apply to boiler when the boiler load is greater than 10 percent and less than or equal to 20 percent. This limit shall not apply to boiler commissioning, start-up and shutdown periods. The commissioning period shall not exceed 80 operating hours. Following the commissioning period, a start-up shall not exceed 120 minutes and a shutdown shall not exceed 60 minutes.

[Rule XVII – PSD]

A327.1 For the purpose of determining compliance with District Rule 475, combustion contaminant emissions may exceed the concentration limit or the mass emission limit listed, but not both limits at the same time.

[Rule 475]

B61.2 The operator shall not use natural gas containing the following specified compounds:

Compound	Range	Grain per 100 scf
H2S	greater than	0.25

This concentration limit is an annual average based on monthly samples of natural gas composition or gas supplier composition. The gaseous fuel sample shall be tested using District Method 307-91 for total sulfur calculated as H2S.

[Rule 1303(b)(2)-Offset]

C1.7 The operator shall limit the number of startups to no more than 62 in any one calendar month.

The number of traditional start-ups shall not exceed 15 per calendar month.

The total number of ~~traditional~~ start-ups shall not exceed ~~4~~ 2 per day. The number of traditional start-ups shall not exceed 1 per day.

The NOx emissions during a fast start-up shall not exceed 36 lbs. NOx emissions during a traditional start-up shall not exceed 62 lbs.

For the purpose of this condition, the beginning of startup occurs at initial fire in the combustor and the end of startup occurs when the BACT levels are achieved. If during

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 71
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

startup the process is aborted and the turbine is re-started, then the start-up and re-start will count as one start up, provided the total time for the start-up does not exceed 30 operating minutes for a fast start-up or 60 operating minutes for a traditional start-up. ~~is defined as "one start-up". In this case the start-up shall not exceed one hour.~~

An operating minute is defined as a minute when the turbine is burning fuel.

The requirements of this condition do not apply during the initial commissioning period.

The operator shall maintain records in a manner approved by the District, to demonstrate compliance with this condition.

[Rule 1303, Rule 1703 – PSD, Rule 2005]

C1.8 The operator shall limit the number of start-ups to no more than 60 in any one calendar month.

The total number of start-ups shall not exceed 4 per day.

NOx emissions during a start-up shall not exceed 28 lbs. ~~The beginning of startup occurs at initial fire in the combustor and the end of startup occurs when the BACT levels are achieved. If during startup the process is aborted the process will count as one startup.~~

For the purposes of this condition, the beginning of startup occurs at initial fire in the combustor and the end of startup occurs when the BACT levels are achieved. If during startup the process is aborted and the turbine is re-started, then the start-up and re-start will count as one start up, provided the total time for the start-up does not exceed 30 operating minutes. An operating minute is defined as a minute when the turbine is burning fuel.

The requirements of this condition do not apply during the initial commissioning period.

The operator shall maintain records in a manner approved by the District, to demonstrate compliance with this condition.

[Rule 1703 – PSD, Rule 2005– Offset]

C.1.9 The operator shall limit the fuel usage to no more than 0.82 MM cubic feet per day.

[Rule 1303(a)(1) – BACT, Rule 2005]

D12.14 The operator shall install and maintain a(n) flow meter to accurately indicate the flow rate of the total hourly throughput of injected ammonia.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 72
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The operator shall also install and maintain a device to continuously record the parameter being measured.

The measuring device or gauge shall be accurate to within plus or minus 5 percent. It shall be calibrated once every twelve months.

The ammonia injection rate shall not exceed ~~435~~ 139.8 lb/hr

[Rule 2005– BACT, Rule 1703- PSD]

- D12.15 The operator shall install and maintain a(n) temperature gauge to accurately indicate the temperature in the exhaust at the inlet to the SCR reactor.

The operator shall also install and maintain a device to continuously record the parameter being measured.

The measuring device or gauge shall be accurate to within plus or minus 5 percent. It shall be calibrated once every twelve months.

The temperature shall ~~be~~ remain between 300 degrees F and 650 degrees F.

The temperature limitations of this condition do not apply during turbine start-up and shutdown periods, and do not apply during the commissioning period.

[Rule 2005– BACT, Rule 1703- PSD]

- D12.16 The operator shall install and maintain a(n) pressure gauge to accurately indicate the differential pressure across the SCR catalyst bed in inches of water column.

The operator shall also install and maintain a device to continuously record the parameter being measured.

The measuring device or gauge shall be accurate to within plus or minus 5 percent. It shall be calibrated once every twelve months.

The pressure drop across the catalyst shall remain between 1 inch of water column and 4 inches of water column.

[Rule 2005– BACT, Rule 1703- PSD]

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 73
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

D12.17 The operator shall install and maintain a(n) flow meter to accurately indicate the flow rate of the total hourly throughput of injected ammonia.

The operator shall also install and maintain a device to continuously record the parameter being measured.

The measuring device or gauge shall be accurate to within plus or minus 5 percent. It shall be calibrated once every twelve months.

The ammonia injection rate shall not exceed ~~47~~ 67.8 lb/hr

[Rule 2005– BACT, Rule 1703- PSD]

D12.18 The operator shall install and maintain a(n) temperature gauge to accurately indicate the temperature in the exhaust at the inlet to the SCR reactor.

The operator shall also install and maintain a device to continuously record the parameter being measured.

The measuring device or gauge shall be accurate to within plus or minus 5 percent. It shall be calibrated once every 12 months.

The temperature shall ~~be~~ remain between 600°F and 1,125°F.

The temperature limitations of this condition do not apply during turbine start-up and shutdown periods, and do not apply during the commissioning period.

[Rule 2005– BACT, Rule 1703- PSD]

D12.19 The operator shall install and maintain a(n) pressure gauge to accurately indicate the differential pressure across the SCR catalyst bed in inches water column.

The operator shall also install and maintain a device to continuously record the parameter being measured.

The measuring device or gauge shall be accurate to within plus or minus 5 percent. It shall be calibrated once every twelve months.

The pressure drop across the catalyst shall remain between 1 inch of water column and 12 inches of water column.

[Rule 2005– BACT, Rule 1703- PSD]

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 74
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

D12.20 The operator shall install and maintain a(n) flow meter to accurately indicate the flow rate of the total hourly throughput of injected ammonia.

The operator shall also install and maintain a device to continuously record the parameter being measured.

The measuring device or gauge shall be accurate to within plus or minus 5 percent. It shall be calibrated once every twelve months.

The ammonia injection rate shall not exceed 5 lb/hr.

[Rule 2005– BACT, Rule 1703- PSD]

D12.21 The operator shall install and maintain a(n) temperature gauge to accurately indicate the temperature in the exhaust at the inlet to the SCR reactor.

The operator shall also install and maintain a device to continuously record the parameter being measured.

The measuring device or gauge shall be accurate to within plus or minus 5 percent. It shall be calibrated once every twelve months.

The temperature shall be between 500°F and 750°F.

The temperature limitations of this condition do not apply during boiler start-up and shutdown periods, and do not apply during the commissioning period.

[Rule 2005– BACT, Rule 1703- PSD]

D12.22 The operator shall install and maintain a(n) pressure gauge to accurately indicate the differential pressure across the SCR catalyst bed in inches water column.

The operator shall also install and maintain a device to continuously record the parameter being measured.

The measuring device or gauge shall be accurate to within plus or minus 5 percent. It shall be calibrated once every twelve months.

The pressure drop across the catalyst shall remain between 1 inch of water column and 12 inches of water column.

[Rule 2005– BACT, Rule 1703- PSD]

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 75
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

D29.10 The operator shall conduct source test(s) for the pollutant(s) identified below.

Pollutant(s) to be tested	Required Test Method(s)	Avg. Time	Test Location
NOx emissions	District Method 100.1	1 hour	Outlet of the SCR serving this equipment
CO emissions	District Method 100.1	1 hour	Outlet of the SCR serving this equipment
SOx emissions	AQMD Laboratory Method 307-91	District Approved Avg. Time	Fuel Sample
VOC emissions	District Method 25.3	1 hour	Outlet of the SCR serving this equipment
PM10 emissions	District Method 5.1	District Approved Avg. Time	Outlet of the SCR serving this equipment
PM2.5 emissions	EPA Method 201A and 202	District Approved Avg. Time	Outlet of the SCR serving this equipment
NH3 emissions	District Method 207.1 and 5.3 or EPA Method 17	1 hour	Outlet of the SCR serving this equipment

The test shall be conducted after District approval of the source test protocol, but no later than 180 days after initial start-up. The District shall be notified of the date and time of the test at least 10 days prior to the test.

The test shall be conducted to determine the oxygen levels in the exhaust. In addition, the tests shall measure the fuel flow rate (CFH), the flue gas flow rate. The combined gas turbine and steam turbine generating output in MW shall also be recorded.

The test shall be conducted in accordance with a District approved source test protocol. The protocol shall be submitted to the SCAQMD engineer no later than ~~90~~ 60 days before the proposed test date and shall be approved by the District before the test commences.

The test protocol shall include the proposed operating conditions of the gas turbine during the tests, the identity of the testing lab, a statement from the testing lab certifying that it meets the criteria of Rule 304, and a description of all sampling and analytical procedures.

For natural gas fired turbines only, an alternative to AQMD Method 25.3 for the purpose of demonstrating compliance with BACT as determined by CARB and AQMD, may be the following:

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 76
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

a) Triplicate stack gas samples are extracted directly into Summa canisters, maintaining a final canister pressure between 400-500 mm Hg absolute, b) Pressurization of the Summa canisters is done with zero gas analyzed/certified to containing less than 0.05 ppmv total hydrocarbons as carbon, and

c) Analysis of Summa canisters is per unmodified EPA Method TO-12 (with preconcentration) or the canister analysis portion of AQMD Method 25.3 with a minimum detection limit of 0.3 ppmvC or less and reported to two significant figures, and (d) The temperature of the Summa canisters when extracting samples for analysis is not to be below 70 F.

The use of this alternative method for VOC compliance determination does not mean that it is more accurate than unmodified AQMD Method 25.3, nor does it mean that it may be used in lieu of AQMD Method 25.3 without prior approval, except for the determination of compliance with the BACT level of 2.0 ppmv VOC calculated as carbon set by CARB for natural gas fired turbines. The test results must be reported with two significant digits.

The test shall be conducted when this equipment is operating at loads of 100 and 75 percent of maximum load for the NOx, CO, VOC, and ammonia tests. The PM10 and PM2.5 test shall be conducted when this equipment is operating at 100 percent of maximum load.

For the purposes of this condition, alternative test method may be allowed for each of the above pollutants upon concurrence of AQMD, EPA, and CARB.

[Rule 1303 – BACT, Rule 1303 – Offsets, Rule 2005 – BACT, Rule 2005 - Offsets, Rule 1401, Rule 1703 – PSD]

D29.11 The operator shall conduct source test(s) for the pollutant(s) identified below.

Pollutant(s) to be tested	Required Test Method(s)	Avg. Time	Test Location
SOx emissions	AQMD Laboratory Method 307-91	District Approved Avg. Time	Fuel Sample
VOC emissions	District Method 25.3	1 hour	Outlet of the SCR serving this equipment
PM10 emissions	District Method 5.1	District Approved Avg. Time	Outlet of the SCR serving this equipment

The test(s) shall be conducted at least once every three years.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 77
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The test shall be conducted and the results submitted to the District within 60 days after the test date. The SCAQMD shall be notified of the date and time of the test at least 10 days prior to the test.

The test shall be conducted when the gas turbine is operating at 100 percent of maximum load.

For natural gas fired turbines only, an alternative to AQMD Method 25.3 for the purpose of demonstrating compliance with BACT as determined by CARB and AQMD, may be the following:

- a) Triplicate stack gas samples are extracted directly into Summa canisters, maintaining a final canister pressure between 400-500 mm Hg absolute, b) Pressurization of the Summa canisters is done with zero gas analyzed/certified to containing less than 0.05 ppmv total hydrocarbons as carbon, and
- c) Analysis of Summa canisters is per unmodified EPA Method TO-12 (with preconcentration) or the canister analysis portion of AQMD Method 25.3 with a minimum detection limit of 0.3 ppmvC or less and reported to two significant figures, and (d) The temperature of the Summa canisters when extracting samples for analysis is not to be below 70 F.

The use of this alternative method for VOC compliance determination does not mean that it is more accurate than unmodified AQMD Method 25.3, nor does it mean that it may be used in lieu of AQMD Method 25.3 without prior approval, except for the determination of compliance with the BACT level of 2.0 ppmv VOC calculated as carbon set by CARB for natural gas fired turbines. The test results must be reported with two significant digits.

The test shall be conducted to demonstrate compliance with the Rule 1303 concentration and/or monthly emissions limit.

For the purposes of this condition, alternative test method may be allowed for each of the above pollutants upon concurrence of AQMD, EPA, and CARB.

[Rule 1303 – BACT, Rule 1303 – Offsets]

[Device subject to this condition: D96, D104, D110]

D29.12 The operator shall conduct source test(s) for the pollutant(s) identified below.

Pollutant(s) to be tested	Required Test Method(s)	Avg. Time	Test Location
NH3 emissions	District Method 207.1 and 5.3 or EPA Method 17	1 hour	Outlet of the SCR serving this equipment

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 78
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The test shall be conducted and the results submitted to the District within 60 days after the test date. The SCAQMD shall be notified of the date and time of the test at least 10 days prior to the test.

The test shall be conducted at least quarterly during the first twelve months of operation and at least annually thereafter. The NOx concentration, as determined by the certified CEMS, shall be simultaneously recorded during the ammonia slip test. If the CEMS is inoperable or not yet certified, a test shall be conducted to determine the NOx emissions using District Method 100.1 measured over a 60 minute averaging time period.

The test shall be conducted to demonstrate compliance with the Rule 1303 concentration limit.

[Rule 1303 – BACT]

D29.13 The operator shall conduct source test(s) for the pollutant(s) identified below.

Pollutant(s) to be tested	Required Test Method(s)	Avg. Time	Test Location
NOx emissions	District Method 100.1	1 hour	Outlet of the SCR serving this equipment
CO emissions	District Method 100.1	1 hour	Outlet of the SCR serving this equipment
PM10 emissions	District Method 5.1	District Approved Avg. Time	Outlet of the SCR serving this equipment

The test shall be conducted after District approval of the source test protocol, but no later than ~~the later of~~ 180 days after initial start up ~~the de-rate project~~. The District shall be notified of the date and time of the test at least 10 days prior to the test.

The test shall be conducted to determine compliance with the BACT emission limits. NOx and CO concentrations shall be corrected to 3% excess O2, dry. In addition, the tests shall measure the fuel flow rate (CFH), the flue gas flow rate, oxygen level in the flue gas. ~~The steam turbine generator output in MW shall also be recorded.~~

The test shall be conducted in accordance with a District approved source test protocol. The protocol shall be submitted to the AQMD engineer no later than 60 days before the proposed test date and shall be approved by the District before the test commences. The test protocol shall include the proposed operating conditions of the ~~turbine boiler~~ during the tests, the identity of the testing lab, a statement from the testing lab certifying that it meets the criteria of Rule 304, and a description of all sampling and analytical procedures.

The test shall be conducted when this equipment is operating at maximum, average, and minimum loads. ~~of 100 and 75 percent of maximum load.~~

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 79
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Minimum load shall be defined as between 10 and 20 percent to show compliance with the 100 ppmv CO limit.

Test results shall be submitted to AQMD within 60 days of the completion of the tests.

[Rule 1303 – BACT, Rule 1303 – Offsets, Rule 2005 – BACT, Rule 2005 - Offsets, Rule 1401, Rule 1703 – PSD]

D82.6 The operator shall install and maintain a CEMS to measure the following parameters:

CO concentration in ppmv

Concentrations shall be corrected to 15 percent oxygen on a dry basis.

The CEMS shall be installed and operated to measure CO concentrations over a 15 minute averaging time period.

The CEMS shall be installed and operated no later than 90 days after initial start-up of the turbine, and in accordance with an approved SCAQMD Rule 218 CEMS plan application. The operator shall not install the CEMS prior to receiving initial approval from SCAQMD. Within two weeks of the turbine start-up, the operator shall provide written notification to the District of the exact date of start-up.

The CEMS would convert the actual CO concentrations to mass emission rates (lbs/hr) using the equation below and record the hourly emission rates on a continuous basis.

CO Emission Rate, lbs/hr = $K * C_{co} * F_d [20.9 / (20.9\% - \%O_2 d)] [(Q_g * HHV) / 10^6]$, where

$K = 7.267 * 10^{-8}$ (lb/scf)/ppm

C_{co} = Average of four consecutive 15 min. average CO concentration, ppmv

F_d = 8710 dscf/MMBTU natural gas

$\%O_2 d$ = Hourly average % by vol. O₂ dry, corresponding to C_{co}

Q_g = Fuel gas usage during the hour, scf/hr

HHV = Gross high heating value of fuel gas, BTU/scf

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 80
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

[Rule 1703 – PSD]

D82.7 The operator shall install and maintain a CEMS to measure the following parameters:

NOx concentration in ppmv

Concentrations shall be corrected to 15 percent oxygen on a dry basis.

The CEMS shall be installed and operated no later than 90 days after initial start-up of the turbine, and in accordance with an approved SCAQMD REG XX CEMS plan application. The operator shall not install the CEMS prior to receiving initial approval from SCAQMD. Within two weeks of the initial start-up, the operator shall provide written notification to the District of the exact date of start-up.

Rule 2012 provisional RATA testing shall be completed and submitted to the SCAQMD within 90 days of the conclusion of the turbine commissioning period. During the interim period between the initial start-up and the provisional certification date of the CEMS, the operator shall comply with the monitoring requirements of Rule 2012(h)(2) and 2012(h)(3).

[Rule 2012, Rule 2005-BACT, Rule 1703-PSD]

E179.7 For the purpose of the following condition number(s) continuously record shall be defined as recording at least once every hour and shall be calculated upon the average of the continuous monitoring for that hour.

Condition no. D12.14

[Rule 1303 – BACT, Rule 2005– BACT, Rule 1703-PSD]

E179.8 For the purpose of the following condition number(s) continuously record shall be defined as recording at least once every hour and shall be calculated upon the average of the continuous monitoring for that month.

Condition no. D12.15

Condition no. D12.16

[Rule 1303 – BACT, Rule 2005– BACT]

E179.9 For the purpose of the following condition number(s) continuously record shall be defined as recording at least once every hour and shall be calculated upon the average of the continuous monitoring for that hour.

Condition no. D12.17

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 81
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

[Rule 1303 – BACT, Rule 2005– BACT, Rule 1703-PSD]

E179.10 For the purpose of the following condition number(s) continuously record shall be defined as recording at least once every hour and shall be calculated upon the average of the continuous monitoring for that month.

Condition no. D12.18

Condition no. D12.19

[Rule 1303 – BACT, Rule 2005– BACT]

E179.11 For the purpose of the following condition number(s) continuously record shall be defined as recording at least once every hour and shall be calculated upon the average of the continuous monitoring for that hour.

Condition no. D12.20

[Rule 1303 – BACT, Rule 2005– BACT]

E179.12 For the purpose of the following condition number(s) continuously record shall be defined as recording at least once every hour and shall be calculated upon the average of the continuous monitoring for that month.

Condition no. D12.21

Condition no. D12.22

[Rule 1303 – BACT, Rule 2005– BACT]

E193.2 The operator shall upon completion of construction, operate and maintain this equipment according to the following specifications:

In accordance with all air quality mitigation measures stipulated in the final California Energy Commission decision for the 00-AFC-14C project.

[CEQA]

E193.5 The operator shall operate and maintain this equipment according to the following requirements:

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 82
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The operator shall vent this equipment to the oxidation catalyst and SCR control system whenever the gas turbine is in operation after initial commissioning.

The operator shall provide the SCAQMD with written notification of the initial startup date.

[Rule 1303 – BACT, Rule 2005– BACT, Rule 1703-PSD]

E193.6 The operator shall operate and maintain this equipment according to the following requirements:

The operator shall record the total net power generated in a calendar month in megawatt-hours.

The operator shall calculate and record greenhouse gas emissions of each calendar month using the following formula:

$$GHG = \del{60.139} \underline{60.179} * FF$$

Where, GHG is the greenhouse gas emissions in tons of CO₂e and FF is the monthly fuel usage in millions standard cubic feet.

The operator shall calculate and record the GHG emissions in pounds per net megawatt-hours on the 12-month rolling average. The GHG emissions from this equipment shall not exceed ~~878,679~~ 764,191 tons per year. The GHG emissions shall not exceed ~~967~~ 968 lbs per net megawatt-hours.

The operator shall maintain records in a manner approved by the District to demonstrate compliance with this condition. The records shall be made available to SCAQMD upon request.

[Rule 1714]

E193.7 The operator shall locate and operate this equipment according to the following requirements:

The operator shall calculate and continuously record the NH₃ slip concentration using the following:

$$NH_3 \text{ (ppmvd)} = [a-b*(c*1.2)/1,000,000]*1,000,000/b,$$

where a=NH₃ injection rate (lb/hr)/17(lb/lb-mol), b= dry exhaust flow rate (scf/hr)/(385.5 scf/lb-mol), c = change in measured NO_x across the SCR, ppmvd at 15 percent O₂.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 83
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The operator shall install a NOx analyzer to measure the SCR inlet NOx ppm accurate to within +/- 5 percent calibrated at least once every 12 months. The operator shall use the method described above or another alternative method approved by the Executive Officer.

The ammonia slip calculation procedures described above shall not be used for compliance determination or emission information determination without corroborative data using an approved reference method for the determination of ammonia. The ammonia slip calculation procedure shall be in-effect no later than 90 days after initial startup of the turbine equipment.

[Rule 1303 – BACT]

E193.8 The operator shall operate and maintain this equipment according to the following requirements:

The operator shall record the total net power generated in a calendar month in megawatt-hours.

The operator shall calculate and record greenhouse gas emissions of each calendar month using the following formula:

$$GHG = \del{60.139} \underline{60.179} * FF$$

Where, GHG is the greenhouse gas emissions in tons of CO2e and FF is the monthly fuel usage in millions standard cubic feet.

The operator shall calculate and record the GHG emissions in pounds per net megawatt-hours on the 12-month rolling average. The GHG emissions from this equipment shall not exceed ~~140,998~~ 141,093 tons per year. The GHG emissions shall not exceed ~~1,503~~ 1,544 lbs per net megawatt-hours.

The operator shall maintain records in a manner approved by the District to demonstrate compliance with this condition. The records shall be made available to SCAQMD upon request.

[Rule 1714]

E193.9 The operator shall operate and maintain this equipment according to the following requirements:

The operator shall vent this equipment to the CO oxidation catalyst and SCR control system whenever the auxiliary boiler is in operation.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 84
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The operator shall provide the SCAQMD with written notification of the initial startup date.

[Rule 1303 – BACT, Rule 2005– BACT, Rule 1703-PSD]

E448.2 The operator shall comply with the following requirements:

This equipment shall not supply ~~either~~ one-third or more of its potential electrical output ~~or~~ and more than 219,000 MWh net electrical output to a utility distribution system on a 3 year rolling average basis.

The operator shall record and maintain written records of the amount of electricity supplied to the utility distribution system expressed as a percentage of the total potential electrical output of the turbine, and shall provide such records to the Executive Officer upon request.

The operator shall record and maintain written records of the net electrical output of the turbine to a utility distribution system, expressed in net MWh, and shall provide such records to the Executive Officer upon request.

[40 CFR 63 Subpart KKKK]

E448.3 The operator shall comply with the following requirements:

The total ~~maximum amount of~~ electricity produced output on a gross basis from combined cycle gas turbine devices D67, D68, gas turbine device D90, and their corresponding steam turbines, simple gas turbine devices D100 and device D106 shall not exceed ~~447 MWh~~ 1,020 MW.

The gross electrical output shall be measured at the two generators serving each of the two Siemens SGT6-5000F combined cycle gas turbines, the two generators serving the GE 7FA combined cycle gas turbine, and the two individual generators serving each of the two Trent 60 simple cycle gas turbines.

The monitoring equipment shall meet ANSI Standard No. C12 or equivalent, and have an accuracy of +/- 0.2 percent. The gross electrical output from the generators shall be recorded at the CEMS DAS over a 15 minute averaging time period.

The operator shall record and maintain written records of the maximum amount of electricity produced from this equipment and shall make such records available to the Executive Officer upon request.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 85
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The operator shall maintain records for a minimum of five years, in a manner approved by the SCAQMD to demonstrate compliance with this condition.

[Rule 1303 – Offset, Rule 2005]

I297.3 This equipment shall not be operated unless the facility holds 131,919 pounds of NOx RTCs in its allocation account to offset the annual emissions increase for the first year of operation. RTCs held to satisfy this condition may be transferred only after one year from the initial start of operation. If the hold amount is partially satisfied by holding RTCs that expire midway through the hold period, those RTCs may be transferred upon their respective expiration dates. This hold amount is in addition to any other amount of RTCs required to be held under other condition(s) stated in this permit.

[Rule 2005]

I297.4 This equipment shall not be operated unless the facility holds 46,675 pounds of NOx RTCs in its allocation account to offset the annual emissions increase for the first year of operation. RTCs held to satisfy this condition may be transferred only after one year from the initial start of operation. If the hold amount is partially satisfied by holding RTCs that expire midway through the hold period, those RTCs may be transferred upon their respective expiration dates. This hold amount is in addition to any other amount of RTCs required to be held under other condition(s) stated in this permit.

[Rule 2005]

I297.5 This equipment shall not be operated unless the facility holds 46,675 pounds of NOx RTCs in its allocation account to offset the annual emissions increase for the first year of operation. RTCs held to satisfy this condition may be transferred only after one year from the initial start of operation. If the hold amount is partially satisfied by holding RTCs that expire midway through the hold period, those RTCs may be transferred upon their respective expiration dates. This hold amount is in addition to any other amount of RTCs required to be held under other condition(s) stated in this permit.

[Rule 2005]

I297.6 This equipment shall not be operated unless the facility holds ~~524~~ 564 pounds of NOx RTCs in its allocation account to offset the annual emissions increase for the first year of operation. RTCs held to satisfy this condition may be transferred only after one year from the initial start of operation. If the hold amount is partially satisfied by holding RTCs that expire midway through the hold period, those RTCs may be transferred upon their respective expiration dates. This hold amount is in addition to any other amount of RTCs required to be held under other condition(s) stated in this permit.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 86
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

[Rule 2005]

I297.7 This equipment shall not be operated unless the facility holds 16,307 pounds of NOx RTCs in its allocation account to offset the annual emissions increase for the first year of operation. RTCs held to satisfy this condition may be transferred only after one year from the initial start of operation. If the hold amount is partially satisfied by holding RTCs that expire midway through the hold period, those RTCs may be transferred upon their respective expiration dates. This hold amount is in addition to any other amount of RTCs required to be held under other condition(s) stated in this permit.

[Rule 2005]

K40.5 The operator shall provide to the District a source test report in accordance with the following specifications:

Source test results shall be submitted to the District no later than ~~90~~ 60 days after the source test was conducted.

Emission data shall be expressed in terms of concentration (ppmv), corrected to 15 percent oxygen (dry basis), mass rate (lbs/hr), and lbs/MM cubic feet. In addition, solid PM emissions, if required to be tested, shall also be reported in terms of grains per DSCF.

All exhaust flow rates shall be expressed in terms of dry standard cubic feet per minute (DSCFM) and dry actual cubic feet per minute (DACFM).

All moisture concentration shall be expressed in terms of percent corrected to 15 percent oxygen.

Source test results shall also include the oxygen levels in the exhaust, the fuel flow rate (CFH), the flue gas temperature, and the generator power output (MW) under which the test was conducted.

[Rule 1303 – Offsets, Rule 1303 – BACT, Rule 2005, Rule 1703]

K67.6 The operator shall keep records, in a manner approved by the District, for the following parameter(s) or item(s):

Natural gas fuel use during the commissioning period

[Rule 2012]

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 87
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

APPENDIX A – CCGS CRITERIA POLLUTANT EMISSIONS

1. EMISSIONS FROM START-UP

The start-up process is defined when the gas turbine starts and when it reaches the designated operation load and achieves compliance with the BACT emission limits. During this process the SCR and the oxidation catalyst are not fully operational until their temperatures reach the operating temperature windows. Two types of start-ups have been identified for the GE 7FA Combined Cycle Gas Turbine.

Fast Start®

The Fast Start technology incorporates an auxiliary boiler to keep the CCGS in a state of readiness and to provide a source of steam to reduce the start-up time of the CCGS. Fast-Start duration is 30 minutes. NO_x, CO, and VOC emissions during Fast Start are provided by GE. GE provided the following parameters and emissions rates of a Fast Start process

Fast Start duration:	30 minutes
Heat input:	728 MMBTU in LHV
LHV:	929.4 BTU/SCF
Fuel usage:	0.784 MMSCF

Table A-1 Fast Start Emissions

Event	Time (min)	NO _x (lbs)	CO (lbs)	VOC (lbs)	PM10 (lbs) ¹	SO _x (lbs) ²
Fast Start Emissions	30	36.0	153.0	14.0	4.75	0.47 <u>0.56</u>

¹ PM10 = 9.5 lb/hr provided by GE. PM10 = 9.5*30/60 = 4.75 lbs

² SO_x emissions are calculated with the emission factor of ~~0.6~~ 0.71 lb/mmcf and fuel usage of 0.784 mmcf, based on a sulfur content of 4 ppmv = 0.25 grains/100 scf.

SO_x EF = (0.25 grains/100 scf)*(10⁴ 100 scf/MMSCF)*(1 lb/7,000 grains)*(2 lb SO₂/lb S) = 0.71 lb/MMSCF

Traditional Start

NO_x, CO, and VOC emissions during a Traditional Start-up are provided by GE.

Traditional Start-up duration is 60 minutes. GE provided the following parameters and emissions rates of a Fast Start process:

Traditional Start duration:	60 minutes
Heat input:	1,563 MMBTU in LHV
LHV:	929.4 BTU/SCF
Fuel usage:	1.682 MMSCF

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 88
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Table A-2 Traditional Start-up Emissions

	Time (min)	NOx (lbs)	CO (lbs)	VOC (lbs)	PM10 (lbs) ³	SOx (lbs) ⁴
Traditional Start Emissions	60	62.3	291.0	23.3	9.5	1.009 <u>1.194</u>

³ PM10 = 9.5 lb/hr provided by GE

⁴ SOx emissions are calculated with the emission factor of ~~0.6~~ 0.71 lb/mm scf and fuel usage of 1.682 mm scf

2. EMISSIONS FROM SHUTDOWN

A shutdown is the process of bringing down the load of the gas turbine to zero. NOx, CO, and VOC emissions during a shutdown are provided by GE. PM10 and SOx emissions are not affected during a shutdown and are assumed to be equal to normal operations. Shutdown duration is 30 minutes. GE provided the following parameters and emissions rates of a Shutdown process

Shutdown duration: 30 minutes
Heat input: 765 MMBTU in LHV
LHV: 929.4 BTU/SCF
Fuel usage: 0.823 MMSCF

Table A-3 Shutdown Emissions

Event	Time (min)	NOx (lbs)	CO (lbs)	VOC (lbs)	PM10 (lbs) ⁵	SOx (lbs) ⁶
Shutdown Emissions	30	28.5	316.5	31.5	4.75	0.49 <u>0.58</u>

⁵ PM10 = 9.5 lb/hr provided by GE

⁶ SOx emissions are calculated with the emission factor of ~~0.6~~ 0.71 lb/mm scf and fuel usage of 0.823 mm scf

3. EMISSIONS FROM BASE LOAD OPERATION

Base load operation is when the GE 7FA reaches its generating capacity and when the emissions are subject to BACT limits. The BACT emission limits are:

NOx = 2.0 ppmv at 15% O₂, dry
CO = 2.0 ppmv at 15% O₂, dry
VOC = 2.0 ppmv at 15% O₂, dry
NH₃ = 5.0 ppmv at 15% O₂, dry

Particulate matter and SOx emissions are calculated using:

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 89
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

PM10 = 9.5 lbs/hr
SO_x = ~~0.6~~ 0.71 lbs/MMSCF

The applicant included performance runs and calculated emissions from base load operation at three ambient temperatures, 41°F, 78°F, and 90°F. These temperatures represent the coldest, average, and hottest monthly average ambient temperatures at the facility location. The results indicate that the highest amount of emissions occur when operating at cold peak scenario with the duct burner in operation and an ambient temperature of 41°F. Thus, the results of 41°F are selected for potential to emit (PTE) determinations.

At 41°F the GE 7FA combustion gas turbine has the following fuel parameters:

Heat Input:	1,955 MMBTU/hr, LHV 2,168 MMBTU/hr, HHV
Fuel Flow:	2.105 MMscf/hr
LHV:	929 BTU/scf
HHV:	1,030 BTU/scf
Exhaust:	1,236,686 ACFM
Water Content:	9.06%
Oxygen Content, dry:	12.54%
Exhaust Temperature:	219°F, or 377°K

The exhaust flow rate is converted to standard conditions, dry, and with 15% O₂. The standard condition is defined as 15 °C, or 288 °K.

$1,236,686 * 288 / 377 = 944,736$ SCFM, wet
 $944,736 * (1-9.06\%) = 859,143$ SCFM, dry
 $859,143 * (20.9\% - 12.54\%) / (20.9\% - 15\%) = 1,217,362$ DSCFM @ 15% O₂
 $1,217,362 * 60 = 73.04$ MMSCFH, dry @ 15% O₂

Concentration factors are converted to mass emission factors using the following equations:

Mass emissions in lb-mole/hr = Concentration * Exhaust / 379.5 scf/lb-mol
Mass emissions in lb/hr = lb-mol/hr * molecular weight

The next table shows the mass emission rates.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 90
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Table A-4 – Base Load Operation Emissions

	NOx	CO	VOC	PM	SOx	NH3
Concentration in ppmv	2.0	2.0	2.0	N/A	N/A	5.0
Molecular Weight	46	28	16	N/A	N/A	17
Mass in lb-mol/hr	0.385	0.385	0.385	N/A	N/A	0.962
Mass in lb/hr	17.71	10.78	6.16	9.5	1.26 <u>1.49</u>	16.35
Mass in lb/mmscf	8.41	5.12	2.92	4.51	0.6 <u>0.71</u>	7.77

4. EMISSIONS FROM COMMISSIONING

Process Description

The GE 7FA must first be commissioned to the desired performance before they begin commercial service. The commissioning is a dedicated process that is mandated by the turbine manufacturer. El Segundo Power, LLC provided a 71 day multi-step commissioning process for the 7FA gas turbine. GE estimates that it will take 800 hours to accomplish the commissioning.

The following table describes the commissioning process.

Table A-5 Commissioning Schedule

Activity	Duration (hr)	Load (MW)	Fuel Usage MMSCF	SCR (Y/N)
GT Testing (FSNL-50%)	16	105	15.33	N
Steam Blows	96	105	126.18	N
Establish Steam Purity	160	210	328.30	N
Establish Vacuum	32	105	42.06	N
By-Pass Valve Tuning	108	105-210	164.66	N
SCR Ammonia System Commissioning	16	210	34.80	Y
STG Load & Trip Test	44	105-210	73.22	Y
Drift Test	144	210	310.36	Y
Emission Test/RATA	32	210	70.64	Y
Performance/Reliability Test	80	210	176.35	Y
SCE 72 Hour Test	72	210	151.60	Y

Emission Calculations

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 91
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Emissions of the commissioning process are provided by GE. The following table shows detailed emissions of each process.

Table A-6 GE 7FA Commissioning Emissions

Activity	Duration (hr)	Fuel Usage MMSCF	NOx (lbs)	CO (lbs)	VOC (lbs)	PM10 (lbs)	SOx (lbs)
GT Testing (FSNL-50%)	16	15.33	801.67	327.62	56.60	153.95	32.85 - <u>10.95</u>
Steam Blows	96	126.18	6,237.96	1,976.39	392.94	920.89	257.84 - <u>85.95</u>
Establish Steam Purity	160	328.30	16,929.00	5,138.80	1,205.80	1,542.50	703.50 - <u>234.50</u>
Establish Vacuum	32	42.06	2,162.54	469.20	136.66	305.74	90.12 - <u>30.04</u>
By-Pass Valve Tuning	108	164.66	7,707.83	3,058.37	645.89	1,041.66	352.86 - <u>117.62</u>
SCR Ammonia System Commissioning	16	34.80	764.58	1,435.82	207.58	161.22	74.60 - <u>24.87</u>
STG Load & Trip Test	44	73.22	1,594.69	3,076.01	450.98	436.20	156.97 - <u>52.32</u>
Drift Test	144	310.36	5,566.55	8,957.17	1,534.98	1,485.68	665.19 - <u>221.73</u>
Emission Test/RATA	32	70.64	848.75	2,752.28	418.47	340.10	151.43 - <u>50.48</u>
Performance/Reliability Test	80	176.35	2,062.85	4,465.04	846.61	884.11	377.90 - <u>125.97</u>
SCE 72 Hour Test	72	151.60	1,450.08	1,978.96	537.39	738.92	324.70 - <u>108.23</u>
TOTALS	800	1,493.50	46,126	33,636	6,433	8,011	3,188-<u>1,063</u>

The average emission factors during the commissioning are calculated in the next table. Total fuel consumption is 1,493.50 MMSCF

Table A-7 Emission Factors – Commissioning

	NOx	CO	VOC
Emissions during Commissioning (lb)	46,126	33,636	6,433
Fuel Consumption, MMSCF	1,493.50	1,493.50	1,493.50
Emission Factor (lb/MMSCF)	30.88	22.52	4.31

In accordance with RECLAIM rules the NOx emission factor of 30.88 lb/MMSCF will be used to report NOx emissions during the commissioning period.

5. MAXIMUM DAILY EMISSIONS

During normal operation the maximum daily emissions can be calculated by assuming the gas turbine has one Fast Start lasting 30 minutes (plus 30 minutes at normal emission rates), one Traditional Start lasting 60 minutes at, two shutdowns each lasting 60 minutes, and continued operation at 100% load for the remaining 20 hours of a day. The emissions are calculated and shown in the next table.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 92
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Table A-8 Maximum Daily Emissions – Normal Operation

	NOx	CO	VOC	PM10	SOx
1 Fast Start (lbs)	36.00	153.0	14.10	4.75	0.47 <u>0.56</u>
1 Traditional Start (lbs)	62.30	291.00	23.30	9.50	1.009 <u>1.194</u>
2 Shutdowns (lbs)	57.00	633.00	63.0	9.50	0.98 <u>1.16</u>
Emission Factor – Normal Operation (lb/hr)	17.71	10.78	6.16	9.50	1.26 <u>1.49</u>
Normal operation emissions for 21.5 hours (lbs)	380.77	231.77	132.44	204.25	25.20 <u>32.04</u>
Daily total (lbs)	536.07	1,308.77	232.84	228.00	28.32 <u>34.95</u>

Maximum daily emissions of ammonia occur when the gas turbine is operating at 100% base load for 24 hours a day.

$$\text{NH}_3 = 24 * 16.35 = 392.40 \text{ lbs/day}$$

6. MONTHLY EMISSIONS

The following hypothetical monthly operating schedule is proposed:

Monthly schedule: 730 hours (30.42 days), base load operation that includes 47 Fast Starts, 15 Traditional Start-ups, and 62 shutdowns.

Excluding the startups and shutdowns the base load operation duration is:

$$(30.42*24*60 - 47*30 - 15*60 - 62*30)/60 = 660.58 \text{ hours}$$

Emissions generated from this operating scheduled is calculated and presented in the next table.

Table A-9 Monthly Total Emissions – Normal Operation

	NOx	CO	VOC	PM10	SOx	NH3
Fast Start – 47 events (lbs)	1,692	7,191	663	223	22 <u>26</u>	0
Traditional Start-ups – 15 events (lbs)	935	4,365	350	143	15 <u>18</u>	0

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 93
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Shutdowns – 62 events (lbs)	1,767	19,623	1,953	295	30 <u>36</u>	0
Base load operation (lbs)	11,699	7,121	4,069	6,276	764 <u>984</u>	9,908
Monthly total (lbs/month)	16,093	38,300	7,035	6,937	831 <u>1,064</u>	11,934

Total fuel consumption in a month is:

$$\underline{GE\ 7FA} = 47 * 0.784 + 15 * 1.682 + 62 * 0.823 + 660.58 * 2.105 = 1,503.62\ \text{MMSCF}$$

$$\underline{DB} = 660.58 * 0.26 = 171.75\ \text{MMSCF}$$

Equivalent emission factors are:

Table A-10 Average Emission Factors – Normal Operation

	NO _x	CO	VOC	PM10	SO _x	NH ₃
Average Emission Factor (lbs/mmscf)	10.70	25.47	4.67	4.61	0.60 <u>0.71</u>	8.59

The First Month

The first month of operation includes only commissioning. It is assumed that the operation comprises an entire month (744 hours) of commissioning and no baseload operation. The total commissioning period is to last for 800 hours. Therefore, the emissions from the first month will be 744/800 of the total amounts in Table A-6 above.

Table A-11 1st Month Total Emissions

	NO _x	CO	VOC	PM10	SO _x
Commissioning – 744 hours (lbs)	42,897	31,282	5,983	7,450	2,965 <u>989</u>

7. YEARLY EMISSIONS

The following annual operating schedule is proposed:

Annual schedule: 5,456 total hours that includes 150 Fast Starts, 50 Traditional startups, and 200 shutdowns.

Excluding the startups and shutdowns, the base load operation duration is:

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 94
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

$$5,456 - 150*30/60 - 50*60/60 - 200*30/60 = 5,231 \text{ hours}$$

Emissions generated from this operating scheduled is calculated and presented in the next table.

Table A-12 Annual Emissions – Normal Operation

	NOx	CO	VOC	PM10	SOx	NH3
Fast Start – 150 events (lbs)	5,400	22,950	2,100	713	71 <u>84</u>	N/A
Traditional startups – 50 events (lbs)	3,115	14,550	1,165	475	50 <u>60</u>	N/A
Shutdowns – 200 events (lbs)	5,700	63,300	6,300	950	98 <u>116</u>	N/A
Base load operation – 5,231 hours (lbs/yr)	92,641	56,390	32,223	49,695	6,371 <u>7,794</u>	82,666
Total (lbs/yr)	106,856	157,190	41,788	51,833	6,590 <u>8,054</u>	82,666
Total (tons/yr)	53.43	78.60	20.89	25.92	3.295 <u>4.027</u>	41.33

Annual fuel usage of the above operation schedule:

$$GE7FA = 150*0.784 + 50*1.682 + 200*0.823 + 5,231*2.105 = 11,337.56 \text{ MMSCF (100\% load)}$$

$$GE7FA = 150*0.784 + 50*1.682 + 200*0.823 + 5,231*1.281 = 7,065.03 \text{ MMSCF (45\% load)}$$

$$DB = 5,231*0.26 = 1,361.08 \text{ MMSCF}$$

First Year Operation

The first year includes the commissioning process. It includes 800 hours of commissioning and 5,456 – 800 = 4,656 hours of normal operations. Therefore, the emissions during normal operation for the first year will be 4,656/5,456 of the amounts in Table A-12 above and are shown in Table A-13 below:

Table A-13 First Year Emissions

	NOx	CO	VOC	PM10	SOx
Commissioning – 800 hours (lbs)	46,126	33,636	6,433	8,011	3,188 <u>1,063</u>
Normal Operations, 4,656 hours (lbs)	91,188	134,142	35,661	44,233	5,624 <u>6,873</u>
Total (lbs)	137,314	167,778	42,094	52,244	8,812 <u>10,061</u>

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 95
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

8. EMISSIONS DURING THE INTERIM PERIOD

The interim period is defined as a period up to one year from the start of operation until the NO_x CEMS is certified. Even though the NO_x CEMS is not yet certified during the interim period, it is believed that after commissioning the SCR would be operating properly. Therefore, the NO_x emissions are calculated based on 2.0 ppmv.

The emission factor is calculated by using the annual operational average of Table A-13. Fuel usage after the commissioning period is:

$$\text{Fuel} = 11,337.56 * 4,656/5,456 = 9,675.16 \text{ MMSCF}$$

The effective emission factor for the interim period, not including the commissioning period, is:

$$\text{NO}_x = 91,188/9,675.16 = 9.42 \text{ lbs/MMSCF}$$

$$\text{CO} = 134,142/9,675.16 = 13.86 \text{ lb/MMSCF}$$

9. POTENTIAL TO EMIT AND RTC REQUIREMENT

The potential to emit (PTE) is calculated based on the 30-day average of the highest monthly emissions of Tables A-8 and A-10, as shown in Table A-15 below:

Table A-14 – CCGS PTE of Criteria Pollutants

	NO _x	CO	VOC	PM10	SO _x
Highest Monthly Total (lbs/month)	42,897	38,300	7,035	7,450	2,965 <u>989</u>
30-Day Average (lbs/day)	1,429.90	1,276.67	234.50	248.33	98.83 <u>32.97</u>

The RECLAIM Trading Credits (RTC) requirement is calculated based on annual NO_x emissions. As determined in Tables A-13 and A-14 the first year requirement is 137,314 lbs (CTG) + 10,912 lbs (DB) = 148,226 lbs and the years after the first year is 106,856 lbs (CTG) + 10,912 lbs (DB) = 117,768 lbs.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 96
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

APPENDIX B – SCGS CRITERIA POLLUTANTS EMISSIONS

1. EMISSIONS FROM START-UPS

The startup process is defined as the time between initial start-up of a Trent 60 gas turbine and when it reaches the designated operation load and achieves compliance with the emission limits. During this process the SCR and the oxidation catalyst are not fully operational until their temperatures reach the operating temperature windows. El Segundo Power, LLC has specified that the startup process for each of the Trent 60 Simple Cycle Gas Turbines will take 30 minutes. GE provided the following parameters and emissions rates of a startup of each Trent 60 gas turbine.

Startup duration:	30 minutes
Heat input:	181 MMBTU (LHV)
LHV:	929.4 BTU/scf
Fuel usage:	0.194 MMSCF

Table B-1 Startup Emissions – Each Trent 60 Gas Turbine

Event	Time (min)	NOx (lbs)	CO (lbs)	VOC (lbs)	PM10 (lbs) ⁷	SOx (lbs) ⁸
Start-up	30	28.0	87.5	6.7	2.5	0.116 <u>0.138</u>

⁷ PM10 = 5.0 lb/hr provided by GE. PM10 = 5.0*30/60 = 2.5 lbs

⁸ SOx emissions are calculated with the emission factor of ~~0.6~~ 0.71 lb/mm scf and fuel usage of 0.194 mm scf. based on a sulfur content of 4 ppmv = 0.25 grains/100 scf.

$$\text{SOx EF} = (0.25 \text{ grains}/100 \text{ scf}) * (10^4 \text{ 100 scf}/\text{MMSCF}) * (1 \text{ lb}/7,000 \text{ grains}) * (2 \text{ lb SO}_2/\text{lb S}) = 0.71 \text{ lb}/\text{MMSCF}$$

2. EMISSIONS FROM SHUTDOWN

The shutdown is the process of reducing the gas turbine load to zero. It typically takes 20 minutes to conduct a shutdown process for the RR Trent 60 gas turbine. GE provided the following parameters and emission factors.

Shutdown duration:	20 minutes
Heat input:	91 MMBTU (LHV)
LHV:	929.4 BTU/scf
Fuel usage:	0.098 MMSCF

Table B-2 Shutdown Emissions – Each Trent 60 Gas Turbine

Event	Time (min)	NOx (lbs)	CO (lbs)	VOC (lbs)	PM10 (lbs) ⁹	SOx (lbs) ¹⁰
Shutdown	20	7.1	60.0	4.7	1.67	0.059 <u>0.070</u>

⁹ PM10 = 5.0 lb/hr provided by GE. PM10 = 5.0*20/60 = 1.67 lbs

¹⁰ SOx emissions are calculated with the emission factor of ~~0.6~~ 0.71 lb/mm scf and fuel usage of 0.098 mm scf.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 97
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

3. EMISSIONS FROM BASE LOAD OPERATION

Base load operation is when the gas turbine reaches its generating capacity and when the emissions are subject to BACT limits. The emission limits are:

NO_x = 2.5 ppmv at 15% O₂, dry
CO = 4.0 ppmv at 15% O₂, dry
VOC = 2.0 ppmv at 15% O₂, dry
NH₃ = 5.0 ppmv at 15% O₂, dry

Particulate matter and SO_x emissions are calculated using:

PM₁₀ = 5.0 lbs/hr
SO_x = ~~0.6~~ 0.71 lbs/MMSCF

The applicant calculated emissions from normal operation at three ambient temperatures, 90°F, 78°F, and 41°F. These temperatures represent the hottest, average, and coldest monthly average ambient temperatures at the facility location. The results indicate that the highest amount of emissions occur when operating at the mild base (cooler) scenario an ambient temperature of 78°F. Thus, the results of 78°F at mild base (cooler) conditions are selected for potential to emit (PTE) determinations.

At 78°F the RR Trent 60 Gas Turbine has the following fuel parameters:

Heat Input:	516 MMBTU/hr
Fuel Flow:	0.501 MMSCF/hr
Exhaust:	701,728 ACFM
Exhaust Water Content:	8.41%
Exhaust Oxygen Content:	14.99%
Exhaust Temperature:	809°F or 705°K

The exhaust mass flow rate is converted to at standard conditions, dry, and with 15% excess oxygen. The standard condition is defined at 15°C, or 288°K.

$701,728 * 288 / 705 = 286,663$ SCFM, wet
 $286,663 * (1-8.41\%) = 262,555$ SCFM, dry
 $262,555 * (20.9\% -14.99\%)/(20.9\% -15\%) = 263,000$ DSCFM @ 15% O₂
 $263,000 * 60 = 15.78$ MMSCFH, dry @ 15% O₂

Concentration factors are converted to mass emission factors using the following equations:

Mass emissions in lb-mole/hr = Concentration * Exhaust / 379.5 scf/lb-mole
Mass emissions in lb/hr = lb-mole/hr * molecular weight

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 98
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

The next table shows the mass emission rates.

Table B-3 Base Load Operation Emissions – Each Turbine

	NO _x	CO	VOC	PM	SO _x	NH ₃
Concentration in ppmv	2.5	4.0	2.0	N/A	N/A	5.0
Molecular Weight	46	28	16	N/A	N/A	17
Mass in lb-moles/hr	0.104	0.166	0.083	N/A	N/A	0.208
Mass in lb/hr	4.78	4.65	1.33	5.0	0.30 <u>0.36</u>	3.53
Mass in lb/mmscf	9.54	9.30	2.66	9.98	0.60 <u>0.71</u>	7.05

4. EMISSIONS FROM COMMISSIONING

Process Description

The gas turbines must first be commissioned to the desired performance before they begin regular service. Commissioning is a dedicated process that is generally prescribed by the turbine manufacturer. The manufacturer-recommended commissioning schedule will be an 8-step process that will take a total of 206 hours to accomplish for each of the Trent 60 gas turbines. The following table describes the commissioning process for the Trent 60 gas turbines.

Table B-4 Trent 60 Turbine Commissioning Schedule

Commissioning Activity	Process	Duration, (hours)	GT Load, MW	SCR (Y/N)
First Fire and Idle Running	Step #1	18	FSNL	N
Synchronization of the Unit	Step #2	16	FSNL	N
Tuning – Baseload Running	Step #3	64	45.8	N
Commissioning of Inlet Fogging and ISI	Step #4	24	22.9	N
SCR Tuning	Step #5	24	45.8	Y
RATA Test	Step #6	12	45.8	Y
Performance Test	Step #7	24	45.8	Y
24-hr Reliability Test	Step #8	24	45.8	Y
TOTAL		206		

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 99
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Emissions Calculations

Emissions of the commissioning process are provided by RR. ~~SOx emissions are calculated using 0.6 lb/MMSCF.~~ The following table shows detailed emissions of each process.

Table B-5 Natural Gas Commissioning Summary

Process	Duration (hours)	Heat Input (MMBTU) LHV	Fuel (MMSCF)	NOx (lbs)	CO (lbs)	VOC (lbs)	PM10 (lbs)	SOx (lbs)
Step #1	18	12,158	13.1	1,141	6,234	870	199 <u>91</u>	27 <u>6</u>
Step #2	16	9,442	10.2	705	3,174	237	121 <u>79</u>	10 <u>6</u>
Step #3	64	34,211	36.8	4,941	13,270	848	684 <u>320</u>	38 <u>23</u>
Step #4	24	12,223	13.1	806	3,855	253	131 <u>119</u>	13 <u>9</u>
Step #5	24	9,959	10.7	2,405	658	73	266 <u>120</u>	11 <u>9</u>
Step #6	12	4,818	5.2	92	172	21	67 <u>58</u>	5 <u>4</u>
Step #7	24	9,636	10.4	184	343	42	134 <u>115</u>	11 <u>9</u>
Step #8	24	9,474	10.2	148	181	25	127 <u>118</u>	10 <u>9</u>
Total	206		109.7	10,421	27,886	2,370	1,729 <u>1,021</u>	126 <u>74</u>

The average emission factors during the commissioning is calculated in the next table.

Table B-6 Emission Factors – Commissioning

	NOx	CO
Emissions during Commissioning, lb	10,421	27,886
Fuel Consumption, MMSCF	107.9	107.9
Emission Factor (lb/MMSCF)	96.58	258.44

In accordance with RECLAIM rules the NOx emission factor of 96.58 lb/MMSCF will be used to report NOx emissions during the commissioning period.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 100
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

5. MAXIMUM DAILY EMISSIONS

During normal operation the maximum daily emissions can be calculated by assuming the gas turbine has 4 startups lasting 4*30 minutes (2.00 hours), four shutdowns lasting 4*20 minutes (1.33 hours), and continued operation at 100% load for the remaining 20.67 hours of a day. The emissions are calculated and shown in the next table. PM10 and SOx emissions are based on 5 lb/hr and ~~0.3~~ 0.36 lb/hr, respectively. Table B-7 below shows the maximum daily emissions from each Trent 60 simple cycle gas turbine.

Table B-7 Maximum Daily Emissions – Normal Operation, Per Turbine

	NOx	CO	VOC	PM10	SOx
4 Startup emissions (lbs)	112.0	350.0	26.8	10.0	0.46 <u>0.55</u>
4 Shutdown emissions (lbs)	28.4	240.0	18.8	6.68	0.24 <u>0.28</u>
Emission factor – base load operation (lb/hr)	4.78	4.65	1.33	5.0	0.30 <u>0.36</u>
Emissions (lbs)– base load operation for 20.67 hours	98.80	96.12	27.49	103.35	6.20 <u>7.44</u>
Daily total (lbs/day)	239.2	686.12	73.09	120.0	6.9 <u>8.27</u>

For ammonia the maximum daily emissions occur when the gas turbine is operating at 100% base load for 24 hours a day.

$$\text{NH}_3 = 24 * 3.53 = 84.72 \text{ lbs/day}$$

6. MONTHLY EMISSIONS

Once the Trent 60 gas turbines start commercial operation El Segundo Power, LLC expects the units may operate continuously at full load in some days and at partial load in other days. A hypothetical monthly operating schedule is presented, assuming base load continuous operation with a maximum of 60 start-ups and 60 shutdowns per month.

The following monthly operating schedule for each Trent 60 gas turbine is proposed:

Monthly schedule: 440 hours (18.33 days), normal operation that includes 60 Start ups, and 60 shutdowns.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 101
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Excluding the startups and shutdowns the base load operation duration calculated below. The monthly emissions from each Trent 60 gas turbine are calculated and summarized in the next table.

$$\text{Base Load Duration} = (18.33 \times 24 \times 60 - 60 \times 30 - 60 \times 20) / 60 = 389.92 \text{ hours}$$

Table B-8 Monthly Total Emissions – Normal Operation, per Turbine

	NO _x	CO	VOC	PM10	SO _x	NH ₃
Startups – 60 events (lbs)	1,680	5,250	402	150	6.96 8.28	N/A
Shutdowns – 60 events (lbs)	426	3,600	282	100	3.54 4.20	N/A
Base load operation – 389.92 hours (lbs)	1,863.82	1,813.13	518.59	1,949.60	119.68 140.37	1,376.42
Monthly total (lbs/month)	3,969.82	10,663.12	1,202.60	2,199.60	130.18 152.85	1,376.42

Monthly Fuel Consumption (per turbine):

$$Q = 60 \times 0.194 + 60 \times 0.098 + 389.92 \times 0.501 = 212.87 \text{ MMSCF/month}$$

The equivalent emission factors are:

Table B-9 Emission Factors – Normal Operation

	NO _x	CO	VOC
Average Emission Factor (lbs/mmscf)	18.65	50.09	5.65

The First Month

The first month operation includes commissioning. It is assumed that the month includes 206 hours of commissioning and 234 hours of normal operation. The load factor is assumed to be 100%. The emissions from normal operation is assumed to be 234/440 of the monthly totals in Table B-8. The next table calculates the monthly total emissions.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 102
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Table B-10 Monthly Emissions– First Month, per Turbine

	NOx	CO	VOC	PM10	SOx
Commissioning – 206 hours (lbs)	10,421	27,886	2,370	1,729 <u>1,021</u>	126 <u>74</u>
Normal Operation, – 234 hours (lbs)	2,111.22	5,670.84	639.56	1,169.79	69.23 <u>81.29</u>
Monthly total (lbs)	12,532.22	33,556.84	3,009.56	2,898.79 <u>2,190.79</u>	195.23 <u>155.29</u>

Fuel usage for the first month:

$$Q = 62.49 + 13.29*(4*0.194+4*0.098+20.67*0.501) = 215.64 \text{ MMSCF}$$

7. YEARLY EMISSIONS

The following annual operating schedule is proposed:

Annual schedule: 4,800 total hours of normal operation that includes 480 startups and 480 shutdowns.

Excluding the startups and shutdowns the base load operation duration is:

$$4,800 - 480*30/60 - 480*20/60 = 4,400 \text{ hours}$$

Emissions generated from this operating schedule are calculated and presented in the next table.

Table B-11 Annual Emissions – Normal Operation, per Turbine

	NOx	CO	VOC	PM10	SOx	NH3
Startups – 480 events (lbs)	13,440	42,000	3,216	1,200	56 <u>66</u>	N/A
Shutdowns – 480 events (lbs)	3,408	28,800	2,256	802	28 <u>34</u>	N/A
Base load operation 4,400 hours (lbs)	21,032	20,460	5,852	22,000	1,320 <u>1,584</u>	15,532
Total (lbs)	37,880	91,260	11,324	24,002	1,404 <u>1,684</u>	15,532
Total (tons/year)	18.94	45.63	5.66	12.00	0.70 <u>0.84</u>	7.76

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 103
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Annual Fuel Consumption:

$$Q = 480 \cdot 0.194 + 480 \cdot 0.098 + 4,400 \cdot 0.501 = 2,344.56 \text{ MMSCF}$$

First year operation

The first year includes the commissioning process. It includes 206 hours of commissioning and 4,594 hours of normal operation. The emissions from normal operation is assumed to be 4,594/4,800 of the annual emissions calculated in Table B-11.

Table B-12 First Year Emissions – per Turbine

	NOx	CO	VOC	PM10	SOx
Commissioning – 206 hours (lbs)	10,421	27,886	2,370	1,729 <u>1,021</u>	126 <u>74</u>
Normal Operation – 4,594 hours (lbs)	36,254.31	87,335.82	10,837.07	22,969.91	1,343.63 <u>1,611.73</u>
Total (lbs)	46,675.31	115,221.82	13,207.07	24,698.91 <u>23,990.91</u>	1,469.63 <u>1,737.73</u>

8. EMISSIONS DURING THE INTERIM PERIOD

The interim period is defined as a period up to one year from the start of operation until the NOx CEMS is certified. Even though the NOx CEMS is not yet certified during the interim period, it is believed that after commissioning the SCR would be operating properly. Therefore, the NOx emissions are calculated based on 2.5 ppmv.

The equivalent emission factor is calculated using the propose annual operating schedule. Fuel usage after the commissioning period is:

$$\text{Fuel} = 2,344.56 \cdot 4594/4800 = 2,243.94 \text{ MMSCF}$$

The effective emission factor for the interim period, not including the commissioning period, is:

$$\text{NOx} = 36,254.31/2,243.94 = 16.16 \text{ lbs/MMSCF}$$

$$\text{CO} = 87,335.82/2,243.94 = 38.92 \text{ lb/MMSCF}$$

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 104
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

9. POTENTIAL TO EMIT AND RTC REQUIREMENT

The potential to emit (PTE) is calculated based on the 30-day average of the highest monthly emissions.

Table B-13 SCGS PTE – Each Turbine

	NO _x	CO	VOC	PM10	SO _x
Highest Monthly Total (lbs/month)	12,532.22	33,556.84	3,009.56	2,898.79 <u>2,190.79</u>	495.23 <u>155.29</u>
30-Day Average (lbs/day)	417.75	1,118.56	100.31	96.63 <u>73.03</u>	6.51 <u>5.18</u>

The RECLAIM Trading Credits (RTC) requirement is calculated based on annual NO_x emissions. As determined in Tables B-11 and B-12 the first year requirement of each of the SCGS turbines is 46,675 lbs and the years after the first year is 37,880 lbs.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 105
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

10. RR TRENT 60 NOx EMISSIONS – lb/net MWH

Electrical Output (per turbine) = 55 net MW

Average net Electricity Production = 50.61 MW

Table B-14 – NOx Emissions in lb/net MW-hr

Event	Duration (hr)	Emissions (lb)	Turbine Net MW	Average Emissions lb/net MW-hr
Baseload	1.0	2.40	2.29	
	1.0	4.78	55.0	
	1.0	4.78	55.0	
	1.0	4.78	55.0	
	1.0	4.78	55.0	
	1.0	4.78	55.0	
	1.0	4.78	55.0	
	1.0	4.78	55.0	
	1.0	4.78	55.0	
	1.0	4.78	55.0	
	1.0	4.78	55.0	
	1.0	4.78	55.0	
	1.0	4.78	55.0	
	1.0	4.78	55.0	
	1.0	4.78	55.0	
	1.0	4.78	55.0	
	1.0	4.78	55.0	
	1.0	4.78	55.0	
	1.0	4.78	2.29	
	TOTAL	24	111	

NOx Emissions = (111 lb/24 hr)/50.61 MW = 0.091 lb/net MWH

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 106
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

APPENDIX C – DUCT BURNER AND AUXILIARY BOILER EMISSIONS

Duct Burner

The Duct Burner is assumed to be in simultaneous operation with the CCGS, and is located upstream of the CO catalyst and SCR systems. The emissions from the Duct Burner will therefore be controlled to BACT limits.

NO_x = 2.0 ppmv at 15% O₂, dry
CO = 2.0 ppmv at 15% O₂, dry
VOC = 2.0 ppmv at 15% O₂, dry

Particulate matter and SO_x emissions are calculated using:

PM10 = 0.0066 lb/MMBTU
SO_x = ~~0.6~~ 0.71 lbs/MMSCF

The applicant calculated emissions from normal operation at three ambient temperatures, 90°F, 78°F, and 41°F. These temperatures represent the hottest, average, and coldest monthly average ambient temperatures at the facility location. The results indicate that the highest amount of emissions occur when operating at an ambient temperature of 41°F. Thus, the results of 41°F at scenario are selected for potential to emit (PTE) determinations.

At 41°F the Duct Burner has the following fuel parameters:

Heat Input: 268 MMBTU/hr
Fuel Flow: 0.260 MMSCF/hr

Assumptions:

Specific Molar Volume, SMV= 379.5 scf/lb-mole
F-Factor for Natural Gas, F_d = 8,710 dscf/MMBTU

Emissions (lb/MMBTU) = (ppmvd/10⁶)*MW*F_d*(1/SMV)*(20.9/5.9)
Emissions (lb/hr) = 268 MMBTU/hr* lb/MMBTU

The next table shows the mass emission rates.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 107
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Table C-1 Duct Burner Emissions

	NOx	CO	VOC	PM	SOx
Concentration, ppmvd	2.0	2.0	2.0	N/A	N/A
Molecular Weight, MW	46	28	16	N/A	N/A
Mass in lb/MMBTU	0.00748	0.00455	0.00260	N/A	N/A
Mass in lb/hr	2.00	1.22	0.70	1.76	0.156 <u>0.185</u>
Mass in lb/month	1,460.00	890.60	511.00	1,284.80	113.80 <u>135.05</u>
Mass in lb/year	10,912.00	6,656.32	3,819.20	9,602.56	851.14 <u>1,009.36</u>
Mass in ton/year	5.45	3.33	1.91	4.80	0.426 <u>0.504</u>
30 Day Average, lb/day	48.67	29.68	17.03	42.83	3.79 <u>4.50</u>
Mass in lb/mmscf	7.69	4.69	2.69	6.76	0.60 <u>0.71</u>

Auxiliary Boiler

El Segundo Power, LLC plans to commission the auxiliary boiler for a maximum of 80 hours prior to normal operation. The estimated emissions during the 80 hour commissioning period (provided by the applicant) are shown in Table C-2 below.

Table C-2 Auxiliary Boiler Commissioning Summary

<u>Process</u>	<u>Duration (hours)</u>	<u>Fuel Use (MMBTU)</u>	<u>NOx (lbs)</u>	<u>CO (lbs)</u>	<u>VOC (lbs)</u>	<u>PM10 (lbs)</u>	<u>SOx (lbs)</u>
<u>First Burner light-off</u>	<u>24</u>	<u>5.55</u>	<u>13.4</u>	<u>19.2</u>	<u>0.48</u>	<u>0.24</u>	<u>0.96</u>
<u>Conditioning</u>	<u>24</u>	<u>2.78</u>	<u>6.72</u>	<u>9.6</u>	<u>0.24</u>	<u>0.24</u>	<u>0.48</u>
<u>Fuel/air ratio set-up</u>	<u>24</u>	<u>27.8</u>	<u>34.6</u>	<u>125.3</u>	<u>3.36</u>	<u>1.92</u>	<u>6.48</u>
<u>Downloading to CCS/SCR of operating curves</u>	<u>8</u>	<u>20.0</u>	<u>5.76</u>	<u>41.8</u>	<u>1.12</u>	<u>0.64</u>	<u>2.16</u>
<u>Totals</u>	<u>80</u>	<u>56.13</u>	<u>60.4</u>	<u>195.9</u>	<u>5.20</u>	<u>3.04</u>	<u>10.1</u>

EF during commissioning:

Fuel usage = 56.13 MMBTU*1 scf /1,030 BTU = 0.054 MMSCF

CO = 195.9 lb/80 hr*1hr/0.054 MMSCF = 45.35 lb/MMCSF

The Auxiliary Boiler will operate at 25% load except during periods when the CCGS starts-up for 20 minutes each day, when it will operate at 100% load. The applicant has assumed that the Auxiliary

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 108
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Boiler will operate for 24 hr/day, 7 days/week. The auxiliary boiler has the following concentration limits as provided by Cleaver Brooks:

NO_x = 5 ppmvd at 3% O₂, dry
CO = ~~3~~50 ppmvd at 3% O₂, dry

PM₁₀, VOC, and SO_x emissions are calculated using:

PM₁₀ = 0.3 lb/hr
VOC = 0.1 lb/hr
SO_x = ~~0.6~~ 0.71 lbs/MMSCF

Heat Input: 36 MMBTU/hr
Fuel Flow: 0.034 MMSCF/hr
Molecular Weight, lb/lb-mole
Specific Molar Volume, SMV = 379.5 scf/lb-mole
F-Factor for Natural Gas, F_d = 8,710 dscf/MMBTU

Emissions (lb/MMBTU) = (ppmvd/10⁶)*MW*F_d*(1/SMV)*(20.9/17.9)

The auxiliary boiler will operate at 100% load for 20 minutes (0.33 hours) and 25% load for the remainder of the day (23.67 hours). The mass emission rates in lb/hr below are provided by Cleaver Brooks. The Auxiliary Boiler emissions are shown in Table C-2 below:

NO_x = ~~0.4~~ 0.222 lb/hr*(0.33/24) + ~~0.4~~ 0.222 lb/hr*(23.67/24)(0.25) = ~~0.104~~ 0.058 lb/hr
CO = 1.3 lb/hr*(0.33/24) + 1.3 lb/hr*(23.67/24)(0.25) = 0.338 lb/hr
VOC = 0.1 lb/hr * (0.33/24) + 0.1 lb/hr * (23.67/24)(0.25) = 0.026 lb/hr
PM₁₀ = 0.3 lb/hr * (0.33/24) + 0.3 lb/hr * (23.67/24)(0.25) = 0.078 lb/hr
SO_x = ~~0.0204~~ 0.024 lb/hr*(0.33/24) + ~~0.0204~~ 0.024 lb/hr*(23.67/24)(0.25) = ~~0.0053~~ 0.0062 lb/hr

Table C-3 Auxiliary Boiler Emissions (Normal Operations)

	NO _x	CO	VOC	PM ₁₀	SO _x ¹¹
Concentration, ppmvd	5	30 <u>50</u>	3.21	N/A	N/A
Molecular Weight, MW	46	28	16	N/A	N/A
Mass in lb/MMBTU	0.006	0.022	0.0014	N/A <u>0.0066</u>	N/A
EF in lb/mmscf	<u>6.18</u>	<u>22.66</u>	<u>1.44</u>	<u>6.80</u>	<u>0.71</u>
Mass in lb/hr	0.059 <u>0.058</u>	0.338	0.026	0.078	0.0053 <u>0.0062</u>
Mass in lb/month	44.21 <u>43.15</u>	251.47	19.34	58.03	3.94 <u>4.61</u>
Mass in lb/year	520.59 <u>508.08</u>	2,960.88	227.76	683.28	46.43 <u>54.31</u>

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 109
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Mass in tons/yr	0.26 <u>0.25</u>	1.48	0.11	0.34	0.02 <u>0.03</u>
30 Day Average, lb/day	1.44	8.22 <u>8.38</u>	0.63	1.89	0.13 <u>0.15</u>

¹¹ SO_x = 0.6 0.71 lb/MMSCF*0.034 MMSCF/hr = ~~0.0204~~ 0.024 lb/hr @ 100% load

The first month operation includes commissioning. It is assumed that the month includes 80 hours of commissioning and 744-80 = 664 hours of normal operation. The emissions from normal operation are assumed to be 664/744 of the monthly totals in Table C-3. The next table calculates the first month's total emissions including commissioning.

Table C-4 Auxiliary Boiler Emissions (First Month)

	<u>NO_x</u>	<u>CO</u>	<u>VOC</u>	<u>PM10</u>	<u>SO_x</u>
<u>Commissioning – 80 hours (lbs)</u>	<u>60.40</u>	<u>195.90</u>	<u>5.20</u>	<u>3.04</u>	<u>10.10</u>
<u>Normal Operation, – 664 hours (lbs)</u>	<u>38.51</u>	<u>224.43</u>	<u>17.26</u>	<u>51.79</u>	<u>3.99</u>
<u>Monthly total (lbs)</u>	<u>98.91</u>	<u>420.33</u>	<u>22.46</u>	<u>54.83</u>	<u>14.09</u>

The first year of operation includes commissioning. It includes 80 hours of commissioning and 8,760 – 80 = 8,680 hours of normal operation. The emissions from normal operation is assumed to be 8,680/8,760 of the annual emissions calculated in Table C-3.

Table C-5 Auxiliary Boiler Emissions (First Year)

	<u>NO_x</u>	<u>CO</u>	<u>VOC</u>	<u>PM10</u>	<u>SO_x</u>
<u>Commissioning – 80 hours (lbs)</u>	<u>60.40</u>	<u>195.90</u>	<u>5.20</u>	<u>3.04</u>	<u>10.10</u>
<u>Normal Operation – 8,680 hours (lbs)</u>	<u>503.44</u>	<u>2,933.84</u>	<u>225.68</u>	<u>677.04</u>	<u>53.81</u>
<u>Total (lbs)</u>	<u>563.84</u>	<u>3,129.74</u>	<u>230.88</u>	<u>680.08</u>	<u>63.91</u>

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 110
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

APPENDIX D –TAC and HAP EMISSIONS

The equipment is expected to generate hazardous air pollutants (HAP) emissions. The HAP emissions are subject to the federal NESHAP regulation. Some of the HAP pollutants are considered toxic air contaminants (TAC). The TAC emissions are subject to SCAQMD Rule 1401.

1. CCGS

HAP and TAC emissions are calculated under a variety of operating parameters. The following worst-case operating scenario includes simultaneous operation of the GE 7FA Gas Turbine and the Duct Burner, including start-ups and shutdowns, and results in the highest amount of HAP and TAC emissions. The TAC and HAP emissions are shown in the next two tables.

Annual hours of operation:	5,406 hours
Maximum Firing Rate:	2,436.1 MMBTU/hr (GE 7FA+DB)
Ambient temperature:	41°F
Load Factor:	100% base load
Fuel flow rate:	2.365 MMSCF/hr (GE 7FA+DB)
Annual total fuel usage:	12,785.19 MMSCF/year

Table D-1 TAC Emissions – CCGS

TAC Pollutants	Aix Toxic CAS Number	Emission Factor (lb/MMSCF)	Emission Rate (lb/hr)	Annual Emissions (tons/year)
Ammonia	7664417	N/A	1.34E+01	44.50
1,3-Butadiene	106990	4.39E-04	1.04E-03	0.00
Acetaldehyde	75070	4.08E-02	9.65E-02	0.26
Acrolein	107028	6.53E-03	1.54E-02	0.04
Benzene	71432	1.22E-02	2.90E-02	0.08
Ethylbenzene	100414	3.26E-02	7.72E-02	0.21
Formaldehyde	50000	7.24E-01	1.71E+00	4.63
Propylene	115071	7.71E-01	1.82E+00	4.93
Propylene Oxide	75569	2.96E-02	7.00E-02	0.19
Toluene	108883	1.33E-01	3.14E-01	0.85
Xylenes	1330207	6.53E-02	1.54E-01	0.42
Benzo(a)anthracene	56556	2.26E-05	5.35E-05	0.00
Benzo(a)pyrene	50328	1.39E-05	3.29E-05	0.00
Benzo(b)fluoranthene	205992	1.13E-05	2.67E-05	0.00
Benzo(k)fluoranthene	207089	1.10E-05	2.60E-05	0.00
Chrysene	218019	2.52E-05	5.96E-05	0.00
Diebenz(a,h)anthracene	53703	2.35E-05	5.56E-05	0.00
Indeno(1,2,3-cd)pyrene	193395	2.35E-05	5.56E-05	0.00
Naphthalene	91203	1.33E-03	3.14E-03	0.01
Total TAC Emissions Per Year				56.12

Table D-2 HAP Emissions – CCGS

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 111
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

HAP Pollutants	Aix Toxic CAS Number	Emission Factor (lb/MMSCF)	Emission Rate (lb/hr)	Annual Emissions (tons/year)
1,3-Butadiene	106990	4.39E-04	1.04E-03	0.00
Acetaldehyde	75070	4.08E-02	9.65E-02	0.26
Acrolein	107028	6.53E-03	1.54E-02	0.04
Benzene	71432	1.22E-02	2.90E-02	0.08
Ethylbenzene	100414	3.26E-02	7.72E-02	0.21
Formaldehyde	50000	7.24E-01	1.71E+00	4.63
Hexane	110543	2.59E-01	6.13E-01	1.66
Propylene Oxide	75569	2.96E-02	7.00E-02	0.19
Toluene	108883	1.33E-01	3.14E-01	0.85
Xylenes	1330207	6.53E-02	1.54E-01	0.42
Anthracene	120127	3.38E-05	8.00E-05	0.00
Benzo(a)anthracene	56556	2.26E-05	5.35E-05	0.00
Benzo(a)pyrene	50328	1.39E-05	3.29E-05	0.00
Benzo(b)fluoranthene	205992	1.13E-05	2.67E-05	0.00
Benzo(k)fluoranthene	207089	1.10E-05	2.60E-05	0.00
Chrysene	218019	2.52E-05	5.96E-05	0.00
Indeno(1,2,3-cd)pyrene	193395	2.35E-05	5.56E-05	0.00
Naphthalene	91203	1.33E-03	3.14E-03	0.01
Diebenz(a,h)anthracene	53703	2.35E-05	5.56E-05	0.00
Total HAP Emissions Per Year				8.35

2. SCGS

Tables D-3 and D-4 below represent the HAP and TAC emissions from a single Trent 60 Gas Turbine. HAP and TAC emissions are calculated under a variety of operating parameters. The following operating scenario generates the highest amount of HAP and TAC emissions:

Annual hours of operation:	4,800 hours
Maximum Firing Rate:	516 MMBTU/hr
Ambient temperature:	78°F
Load Factor:	100% base load
Fuel flow rate:	0.501MMSCF/hr
Annual total fuel usage:	2,404.80 MMSCF/year

Table D-3 TAC Emissions – SCGS

TAC Pollutants	Aix Toxic	Emission	Emission Rate	Annual
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SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 112
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

	Case Number	Factor (lb/MMSCF)	(lb/hr)	Emissions (tons/year)
Ammonia	7664417	N/A	1.99E-00	8.43
1,3-Butadiene	106990	4.39E-04	2.2E-04	0.00
Acetaldehyde	75070	4.08E-02	2.04E-02	0.05
Acrolein	107028	6.53E-03	3.27E-03	0.01
Benzene	71432	1.22E-02	6.13E-03	0.01
Ethylbenzene	100414	3.26E-02	1.64E-02	0.04
Formaldehyde	50000	7.24E-01	1.30E-01	0.31
Propylene	115071	7.71E-01	3.86E-01	0.93
Propylene Oxide	75569	2.96E-02	1.48E-02	0.04
Toluene	108883	1.33E-01	6.64E-02	0.16
Xylenes	1330207	6.53E-02	3.27E-02	0.08
Benzo(a)anthracene	56556	2.26E-05	1.13E-05	0.00
Benzo(a)pyrene	50328	1.39E-05	6.96E-06	0.00
Benzo(b)fluoranthene	205992	1.13E-05	5.66E-06	0.00
Benzo(k)fluoranthene	207089	1.10E-05	5.51E-06	0.00
Chrysene	218019	2.52E-05	1.26E-05	0.00
Diebenz(a,h)anthracene	53703	2.35E-05	1.18E-05	0.00
Indeno(1,2,3-cd)pyrene	193395	2.35E-05	1.18E-05	0.00
Naphthalene	91203	1.33E-03	6.64E-04	0.00
Total TAC Emissions Per Year				10.06

Table D-4 HAP Emissions – SCGS

HAP Pollutants	Aix Toxic Case Number	Emission Factor (lb/MMSCF)	Emission Rate (lb/hr)	Annual Emissions (tons/year)
1,3-Butadiene	106990	4.39E-04	2.2E-04	0.00
Acetaldehyde	75070	4.08E-02	2.04E-02	0.05
Acrolein	107028	6.53E-03	3.27E-03	0.01
Benzene	71432	1.22E-02	6.13E-03	0.01
Ethylbenzene	100414	3.26E-02	1.64E-02	0.04
Formaldehyde	50000	7.24E-01	1.30E-01	0.87
Hexane	110543	2.59E-01	1.30E-01	0.31
Propylene Oxide	75569	2.96E-02	1.48E-02	0.04
Toluene	108883	1.33E-01	6.64E-02	0.16
Xylenes	1330207	6.53E-02	3.27E-02	0.08
Anthracene	120127	1.39E-05	2.2E-04	0.00
Benzo(a)anthracene	56556	4.39E-04	2.04E-02	0.00
Benzo(a)pyrene	50328	4.08E-02	3.27E-03	0.00
Benzo(b)fluoranthene	205992	1.13E-05	5.66E-06	0.00
Benzo(k)fluoranthene	207089	1.10E-05	5.51E-06	0.00
Chrysene	218019	2.52E-05	1.26E-05	0.00
Indeno(1,2,3-cd)pyrene	193395	2.35E-05	1.18E-05	0.00

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 113
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Naphthalene	91203	1.33E-03	6.64E-04	0.00
Diebenz(a,h)anthracene	53703	2.35E-05	1.18E-05	0.00
Total HAP Emissions Per Year				1.57

3. AUXILIARY BOILER

The TAC and HAP emissions are calculated based on the parameters listed below. The combined TAC and HAP emissions are calculated in Table D-5.

Annual hours of operation:	8,760 hours
Maximum Firing Rate:	36 MMBTU/hr
Fuel flow rate:	0.0349 MMSCF/hr
Annual total fuel usage:	306 MMSCF/year

Table D-5 TAC and HAP Emissions – Auxiliary Boiler

TAC/HAP Pollutants	Aix Toxic Case Number	Emission Factor (lb/MMSCF)	Emission Rate (lb/hr)	Annual Emissions (tons/year)
Ammonia	7664417	N/A	5.00E-00 8.10E-02	21.9 0.35
Benzene	71432	5.80E-03	2.03E-04	0.00
Formaldehyde	50000	1.23E-02	4.30E-04	0.00
PAHs (including naphthalene)	107028	4.00E-04	1.40E-05	0.00
Naphthalene	91203	3.00E-04	1.05E-05	0.00
Acetaldehyde	75070	3.10E-03	1.08E-04	0.00
Acrolein	1070208	2.70E-03	9.44E-05	0.00
Propylene	115071	5.30E-01	1.85E-02	0.08
Hexane	110543	4.60E-03	1.61E-04	0.00
Toluene	108883	2.65E-02	9.26E-04	0.00
Xylenes	1330207	1.97E-02	6.89E-04	0.00
Ethyl Benzene	100414	6.90E-03	2.41E-04	0.00
Total TAC+HAP Emissions Per Year				21.98 0.43

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 114
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

4. EXISTING CTG UNITS 5 & 7

Tables D-6 below represents the estimated HAP emissions from existing combined cycle Gas Turbine Units 5 and 7. HAP emissions are calculated under a variety of operating parameters. The following operating scenario generates the highest amount of HAP emissions:

Annual hours of operation: 5,456 hours
Maximum Firing Rate: 2,096 MMBTU/hr
Ambient temperature: 78°F
Fuel flow rate: 2.0395 MMSCF/hr
Annual total fuel usage: 11,127.51 MMSCF/year

HAP Pollutants	Aix Toxic Case Number	Emission Factor (lb/MMSCF)	Emission Rate (lb/hr)	Annual Emissions (tons/year)
1,3-Butadiene	106990	4.39E-04	8.95E-04	0.002
Acetaldehyde	75070	4.08E-02	8.32E-02	0.227
Acrolein	107028	6.53E-03	1.33E-02	0.036
Benzene	71432	1.22E-02	2.48E-02	0.068
Ethylbenzene	100414	3.26E-02	6.64E-02	0.181
Formaldehyde	50000	7.24E-01	1.48E+00	4.037
Hexane	110543	2.59E-01	0.53E-00	1.446
Propylene Oxide	75569	2.96E-02	6.03E-02	0.164
Toluene	108883	1.33E-01	0.27E+00	0.737
Xylenes	1330207	6.53E-02	0.13E+00	0.355
Anthracene	120127	1.39E-05	2.83E-05	0.000
Benzo(a)anthracene	56556	4.39E-04	8.95E-04	0.002
Benzo(a)pyrene	50328	4.08E-02	8.32E-02	0.227
Benzo(b)fluoranthene	205992	1.13E-05	2.30E-05	0.000
Benzo(k)fluoranthene	207089	1.10E-05	2.24E-05	0.000
Chrysene	218019	2.52E-05	5.14E-05	0.000
Indeno(1,2,3-cd)pyrene	193395	2.35E-05	4.79E-05	0.001
Naphthalene	91203	1.33E-03	2.71E-03	0.007
Diebenz(a,h)anthracene	53703	2.35E-05	4.79E-05	0.001
Total HAP Emissions Per Year				7.491

Therefore, the total HAP emissions from Gas Turbines 5 and 7 (identical units) is
HAP = 7.491 * 2 = 14.98 tons/year

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 115
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

4. FACILITY TOTAL

The proposed ESPFM Project will consist of the following equipment:

One GE 7FA Combined Cycle Gas Turbine (CCGS)	8.35 tons/year
Two RR Trent 60 Simple Cycle Gas Turbines (SCGS)	3.15 tons/year
Existing Gas Turbines 5 & 7	14.98 tons/year
One Auxiliary Boiler	0.08 tons/year

The facility total HAP emissions are 26.55 tons/year.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 116
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

APPENDIX E – GREENHOUSE GAS (GHG) EMISSIONS

GHG POTENTIAL TO EMIT

The following six greenhouse gases (GHG) are considered:

Carbon Dioxide, CO₂,
Methane, CH₄,
Nitrous Oxide, N₂O
Hydrofluorocarbons, HFCs
Perfluorocarbons, PFCs
Sulfur Hexafluoride, SF₆

The first three gases, CO₂, CH₄, and N₂O, are emitted from the operation of combustion sources. EPA has published the emission factors for natural gas combustion based on the high heating value (HHV):

CO₂, ~~53.02~~ 53.06 kg/MMBTU
CH₄, 1.0 x 10⁻³ kg/MMBTU
N₂O, 1.0 x 10⁻⁴ kg/MMBTU

The emissions factors are associated with the assumption of natural gas HHV of 1,030 MMBTU/scf. The emissions factors are converted to lb/MMSCF:

CO₂, ~~120,160~~ 120,234 lb/MMSCF
CH₄, 2.27 lb/MMSCF
N₂O, 0.227 lb/MMSCF

~~In~~ Table A-1 to Subpart A of 40 CFR Part 98 – Global Warming Potentials were revised as of January 1, 2014 for the CH₄ and N₂O as follows: the GWP for CO₂ is 1, the GWP for CH₄ is ~~24~~ 25 and the GWP for N₂O is ~~310~~ 298. Therefore, the total GHG emissions in terms of CO₂e are calculated as:

$$\text{CO}_2\text{e} = \text{CO}_2 + 24 \cdot 25 \cdot \text{CH}_4 + 310 \cdot 298 \cdot \text{N}_2\text{O}$$

CO₂e emissions can also be expressed as a function of fuel usage, F

$$\text{CO}_2\text{e} = 120,160 \cdot F + 2.27 \cdot 21 \cdot F + 0.227 \cdot 310 \cdot F = 120,278 \cdot F \text{ (lb/MMSCF)}$$

$$\text{CO}_2\text{e} = 60.139 \cdot F \text{ (tons/MMSCF)}$$

$$\text{CO}_2\text{e} = 120,234 \cdot F + 2.27 \cdot 25 \cdot F + 0.227 \cdot 298 \cdot F = 120,358 \cdot F \text{ (lb/MMSCF)}$$

$$\text{CO}_2\text{e} = 60.179 \cdot F \text{ (tons/MMSCF)}$$

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 117
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

GHG emissions from the CCGS and the SCGS are calculated accordingly.

1. CCGS (GE 7FA + ~~Duet~~ Burner)

The daily maximum GHG emissions is calculated as follows:

$$Q = 24 * \del{2.365} \underline{2.105} \text{ MMSCF} = \del{56.76} \underline{50.52} \text{ MMSCF/day}$$

$$\text{Daily maximum} = \del{60.139} \underline{60.179} * \del{56.76} \underline{50.52} = \del{3,413} \underline{3,040} \text{ tons/day}$$

The monthly GHG emissions is calculated based on the monthly fuel usage of 1,503.62 MMSCF

$$\text{Monthly total} = \del{60.139} \underline{60.179} * 1,503.62 = \del{90,426.20} \underline{90,486.35} \text{ tons/month}$$

The annual fuel usage has been calculated to be 11,337.56 MMSCF. The corresponding GHG emissions are:

$$\text{Annual total} = \del{60.139} \underline{60.179} * 11,337.56 = \del{681,829.52} \underline{682,283.02} \text{ tons/year.}$$

2. SCGS (Two RR Trent 60 Gas Turbines)

For each RR Trent 60 gas turbine the daily maximum GHG emissions is calculated based on the daily fuel usage of $24 * 0.501 \text{ MMSCF} = 12.02 \text{ MMSCF/day}$.

$$\text{Daily maximum} = \del{60.139} \underline{60.179} * 12.02 = \del{722.87} \underline{723.35} \text{ tons/day}$$

For each RR Trent 60 gas turbine the monthly GHG emissions is calculated based on the monthly fuel usage of 212.87 MMSCF.

$$\text{Monthly total} = \del{60.139} \underline{60.179} * \del{641.2} \underline{212.87} = \del{12,801.79} \underline{12,810.30} \text{ tons/month}$$

For each RR Trent 60 gas turbine the annual fuel usage has been calculated to be 2,344.56 MMSCF. The corresponding GHG emissions:

$$\text{Annual total} = \del{60.139} \underline{60.179} * 2,344.56 = \del{140,999.49} \underline{141,093.28} \text{ tons/year}$$

The total GHG emissions from the two GE LMS100 gas turbines are:

$$\del{140,999.49} \underline{141,093.28} * 2 = \del{281,998.99} \underline{282,186.55} \text{ tons/year}$$

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 118
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

3. Auxiliary Boiler

EPA has published the emission factors for natural gas combustion based on the high heating value (HHV):

CO₂, ~~53.02~~ 53.06 kg/MMBTU
 CH₄, 1.0 x 10⁻³ kg/MMBTU
 N₂O, 1.0 x 10⁻⁴ kg/MMBTU

The emissions factors are associated with the assumption of natural gas HHV of 1,030 MMBTU/scf. The emissions factors are converted to lb/MMSCF:

CO₂, ~~120,160~~ 120,234 lb/MMSCF
 CH₄, 2.27 lb/MMSCF
 N₂O, 0.227 lb/MMSCF

The fuel usage has been calculated to be 306 MMSCF/year, 25.96 MMSCF/month and 0.837 MMSCF/day for the auxiliary boiler. The GHG emissions are calculated below.

~~CO₂e = 120,160 * 306 + 2.27 * 21 * 306 + 0.227 * 310 * 306 = 18,402.54 tons/year~~
~~CO₂e = 120,160 * 25.96 + 2.27 * 21 * 25.96 + 0.227 * 310 * 25.96 = 1,560.39 tons/month~~
~~CO₂e = 120,160 * 0.837 + 2.27 * 21 * 0.837 + 0.227 * 310 * 0.837 = 50.34 tons/day~~

CO₂e = 120,234 * 306 + 2.27 * 25 * 306 + 0.227 * 298 * 306 = 18,414.83 tons/year
CO₂e = 120,234 * 25.96 + 2.27 * 25 * 25.96 + 0.227 * 298 * 25.96 = 1,562.25 tons/month
CO₂e = 120,234 * 0.837 + 2.27 * 25 * 0.837 + 0.227 * 298 * 0.837 = 50.37 tons/day

4. Circuit Breakers (SF6)

The use of SF6 in the circuit breakers, is another GHG emissions consideration. The applicant provided expected SF6 GHG emissions for the amount of SF6 in the circuit breakers which were calculated to be around 85 tons CO₂e/year. Condition F52.2 will include a CO₂e annual limit for SF6 to enforce the BACT requirements for the circuit breakers.

TOTALS:

The combined total GHG emissions from the CCGS (including duct burner), SCGS, ~~and~~ the auxiliary boiler and the circuit breakers are:

~~CO₂e: 681,829.52 + 281,998.99 + 18,402.54 = 982,231.05 tons/year~~

CO₂e: 764,191.45 + 282,186.55 + 18,414.83 + 85.00 = 1,064,877.83 tons/year

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 119
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

GHG BACT Analysis

In order to determine the CO₂e in lbs/MWh the total power generation in megawatt hours has to be calculated.

Combined Cycle Generation System (CCGS)

The following annual operating schedule is proposed for the CCGS:

Total Hours of Operation:	5,456 hours
Total number of Fast Start-ups:	150
Total number of Traditional Start-ups:	50
Total number of Shutdowns:	200

As previously determined, the net baseload operation, excluding startups and shutdowns, is 5,231 hours per year.

Power generated by the CCGS is provided by GE as shown in the Tables E-1 and E-2 below. The conditions at 100% load include operation of the duct burner.

Table E-1 – Power Generated by the CCGS

GE 7FA Baseload Conditions	100% load	45% load
Fast Start-ups, times per year	150	150
Traditional Start-ups, times per year	50	50
Shutdowns, times per year	200	200
Base load operation, hours per year	5,231	5,231
CTG power output, net kW ⁽¹⁾	222,000	222,000
ST power output, net kW ⁽¹⁾	112,000	112,000
CCGS power output, net kW	324,000	159,000
CCGS heat rate, net (Btu/kw-h, LHV)	6,754	7,480
Fuel input (mmBtu/hr, HHV) ⁽¹⁾	2,436	1,319
GE 7FA fuel usage, per year (mmscf)	11,337.56	7,065.03
Duct Burner fuel usage, per year (mmscf)	1,361.08	N/A
Total fuel usage, per year (mmscf)	12,698.64	7,065.03

(1) GE provided information

Power generated during the Fast Start-up, Traditional Start-up, Shutdown, and Base load operation are calculated.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 120
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Fast Start-up

A Fast Start-up takes 30 minutes.

GE 7FA Fast Start-up	Totals Over 30 Minute Period
Fast-Start-up fuel usage, MMBTU	728
CTG heat rate, Btu/kw-hour	7,072
Net power output, kw-hour	103,000

Traditional Start-up

A Traditional Start up takes 60 minutes.

GE 7FA Traditional Start-up	Totals Over 60 Minute Period
Traditional Start-up fuel usage, MMBTU	1,563
CTG heat rate, Btu/kw-hour	7,041
Net power output, kw-hour	222,000

Shutdown

A shutdown takes 30 minutes.

GE 7FA Shutdown	Totals Over 30 Minute Period
Shutdown fuel usage, MMBTU	765
CTG heat rate, Btu/kw-hour	7,496
Net power output, kw-hour	102,000

Power Generation per Year

Total power generated by the CCGS in megawatt-hour is shown in Table E-2 below:.

Table E-2 – Annual Power Generation for the CCGS

Parameter	100% Load	45% Load
Fast Start-ups per year	150	150
Traditional Start-ups per year	50	50
Shutdowns per year	200	200
Base load operation (hours per year)	5,231	5,231
Power output per Fast-Start-up, MWh	103	103
Power output per Traditional startup, MWh	222	222
Power output per shutdown, MWh	102	102
Power output per base load hour, MWh	324	159

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 121
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Power output, Fast-Start-up total, MWh	15,450	15,450
Power output, Traditional Start-up total, MWh	11,100	11,100
Power output, shutdown total, MWh	20,400	20,400
Power output, base load total, MWh	1,694,844	831,729
CCGS power generation in a year, MWh	1,741,794	878,679

Based on annual fuel consumption the CO₂e emissions are calculated as follows:

$$\text{CO}_2\text{e} = \cancel{60.139} \underline{60.179} * \text{Fuel Usage}$$

$$\text{CO}_2\text{e} = \cancel{60.139} \underline{60.179} * 12,698.64 = \cancel{763,683.51} \underline{764,191.45} \text{ tons/year (100\% load)}$$

$$\text{CO}_2\text{e} = \cancel{60.139} \underline{60.179} * 7,065.03 = \cancel{424,883.83} \underline{425,166.44} \text{ tons/year (45\% load)}$$

Parameter	100% Load	45% Load
CO ₂ e emissions (tons/year)	763,683.51 <u>764,191.45</u>	424,884 <u>425,166.44</u>
CCGS power generation, MWh per year	1,741,794	878,679
CO ₂ e, tons/net MWh	0.438	0.484
CO ₂ e, lbs /net MWh	876.89 <u>877.47</u>	967.10 <u>967.74</u>

Simple Cycle Generating System (SCGS)

Because the SCGS consists of two identical Trent 60 gas turbines the GHG BACT analysis is conducted on one Trent 60 unit.

The following annual operating schedule is proposed for the SCGS:

Total hours of operation:	4,800 hours
Total number of startups:	480
Total number of shutdowns:	480

The net baseload operation, excluding startups and shutdowns, is 4,400 hours.

RR Trent 60 Baseload Conditions	100% load	55% load
Startups, times per year	480	480
Shutdowns, times per year	480	480
Base load operation, hours per year	4,400	4,400
CTG power output, net kW	55,000	22,000
CTG power output, gross kW	57,000	23,000
SCGS heat rate, net (Btu/kw-h, LHV)	8,321	11,842
Fuel input (MMBTU/hr, LHV)	466	264
Fuel input (MMBTU/hr, HHV)	516	292
Total fuel usage per year (mmscf)	2,344.56	1,385.36

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 122
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Startup

A startup takes 30 minutes.

Trent 60 Start-up	Totals Over 30 Minute Period
Start-up fuel usage, MMBTU	181
CTG heat rate, Btu/kw-hour	9,504
Net power output, kw-hour	18,700

Shutdown

A shutdown takes 20 minutes.

Trent 60 Shutdown	Totals Over 20 Minute Period
Shutdown fuel usage, MMBTU	91
CTG heat rate, Btu/kw-hour	18,299
Net power output, kw-hour	4,670

Power Generation per Year

Total power generated by the one Trent 60 gas turbine in net megawatt-hours is calculated in Table A-3 below. The total operating hours are assumed to be 4,800 hours per year.

Table A-3 – Annual Power Generation for the SCGS

Parameter	100% load	55% load
Startups per year	480	480
Shutdowns per year	480	480
Base load operation (hours per year)	4,400	4,400
Power output per startup, MWh	18.7	18.7
Power output per shutdown, MWh	4.67	4.67
Power output per base load hour, MWh	55	22
Power output, startup total, MWh	8,976	11,842
Power output, shutdown total, MWh	2,241	2,241
Power output, base load total, MWh	242,000	96,800
Power generation in a year, net MWh	253,217	110,883

Based on annual fuel consumption the CO₂e emissions are calculated as follows:

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 123
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

CO₂e = ~~60.139~~ 60.179 * Fuel Usage

CO₂e = ~~60.139~~ 60.179 * 2,344.56 = ~~140,998.29~~ 141,093.27 tons/year

CO₂e = ~~60.139~~ 60.179 * 1,385.36 = ~~83,292.51~~ 83,369.57 tons/year

Parameter	100% load	55% load
Total fuel usage, per year (mmscf)	2,344.56	1,385.36
CO ₂ e emissions (tons/year)	140,998.29 <u>141,093.27</u>	83,292.51 <u>83,369.57</u>
Net power generation, MWh per year	253,217	110,883
CO ₂ e, tons/MWh, net	0.557	0.751
CO ₂ e, lbs/net MWh	1,113.66	1,502.84

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 124
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

APPENDIX F – RULE 1325 PM2.5 EMISSIONS

The repower project has emission increases of PM2.5 from the installation of the new CCGS and SCGS gas turbines and the auxiliary boiler. The PM2.5 emissions are calculated as shown below:

CCGS: 51,833 lbs/year, as calculated in Table A-132
 SCGS #1: 24,002 lbs/year, as calculated in Table B-11
 SCGS #2: 24,002 lbs/year, as calculated in Table B-11
 The Auxiliary Boiler: ~~540~~ 683 lbs/year, as calculated in Table C-2

Total PM2.5 emissions from the new equipment:

PM2.5 = 51,833 + 24,002*2 + ~~540~~ 683 = ~~100,377~~ 100,520 lbs/year
 PM2.5 = ~~50.19~~ 50.26 tons/year = 275 lb/day (based on 365 days per year)

Offset liability is calculated at the ratio of 1.1 to 1.

$$275 * 1.1 = 302.51 \text{ lb/day, or } 303 \text{ lb/day}$$

El Segundo Power, LLC would be required to provide 303 pounds per day of federally enforceable PM2.5 emission reduction credits, if the offset requirement is triggered.

FACILITY TOTAL PM2.5 EMISSIONS

During the previous Title V Facility Permit modification in 2010, the El Segundo Power, LLC's facility total PM2.5 potential to emit (PTE) was determined to be 51.8 tons per year. At that time, the facility elected to become a synthetic minor source for PM2.5 by accepting a permit condition to remain below 100 tons/year of PM2.5. (See Facility Permit Condition F2.1).

$$\begin{aligned} \text{Boiler \#3 PM2.5 PTE} &= 0.0066 \text{ lb/MMBTU} * 3,350 \text{ MMBTU/hr} * 8,760/2,000 * 112/335 \\ &= 32.37 \text{ tons/yr} \end{aligned}$$

$$\begin{aligned} \text{Boiler \#4 PM2.5 PTE} &= 0.0066 \text{ lb/MMBTU} * 3,350 \text{ MMBTU/hr} * 8,760/2,000 \\ &= 96.84 \text{ tons/yr} \end{aligned}$$

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 125
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

Facility PM2.5 PTE:

Parameter	PM2.5, tons/year
Existing Facility PTE	+51.8
ESPFM PTE	+ 50.19 <u>55.06</u>
Boiler #3 Retirement	(32.37)
Boiler #4 Retirement	(96.84)
Major Source Threshold	100
Major Source (Yes/No)	No

The new facility PM2.5 PTE does not exceed 100 tons per year. Therefore, the facility is not a major source for PM2.5 and no offsets are required.

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT <i>ENGINEERING DIVISION</i> APPLICATION PROCESSING AND CALCULATIONS	PAGES 126	PAGE 126
	APPL. NO. 548587-94	DATE Rev 06/23/2015
	PROCESSED BY CA	CHECKED BY

APPENDIX G – RECLAIM TRADING CREDIT REQUIREMENT

In accordance with Rule 2005 the facility is required to set aside sufficient RECLAIM Trading Credits (RTC) to cover the NOx emissions from the first year operation. The anticipated annual NOx emissions from the repower project is tabulated below.

	GE 7FA	<u>Duct Burner</u>	Trent 60	Trent 60	Auxiliary Boiler
NOx	148,226 <u>131,919</u>	<u>16,307</u>	46,675	46,675	<u>563</u>

The total RTC requirements are:

RTC, 1st year = ~~242,088~~ 242,139 lb/year

After the first year the anticipated annual NOx emissions are:

	GE 7FA	<u>Duct Burner</u>	Trent 60	Trent 60	Auxiliary Boiler
NOx	117,786 <u>104,812</u>	<u>12,956</u>	37,880	37,880	521 <u>508</u>

The total RTC requirements are:

RTC, subsequent years = ~~194,067~~ 194,036 lb/year

Present NOx allocation compared to 1994 initial NOx allocation

Present NOx Allocation (lb/yr)	1994 Initial NOx Allocation (lb/yr)	< 1994 Initial NOx Allocation (Yes/No)
279,164	1,483,304	Yes

Since the present NOx allocation is less than the 1994 initial NOx allocation, no NSR holds are required after the first year. Therefore, Condition I297 without the subsequent year NSR hold requirements will be used.