Preliminary Determination of Compliance

Marsh Landing Generating Station

Contra Costa County, CA

Bay Area Air Quality Management District
Application 18404

March 2010

Brian K Lusher
Senior Air Quality Engineer

Table of Contents

APPENDICES

Tables

1. Introduction

The Bay Area Air Quality Management District (Air District) is issuing a Preliminary Determination of Compliance (PDOC) for the Marsh Landing Generating Station, a proposed 760-megawatt natural gas fired electric power generation facility that would be located near Antioch, CA. The Preliminary Determination of Compliance sets forth the District's preliminary analysis as to how the facility would comply with applicable air quality regulatory requirements, as well as proposed permit conditions to ensure compliance. The Air District is publishing this document for public review and comment, and will review and consider all comments received from the public before deciding whether to issue a Final Determination of Compliance (FDOC) for the proposed project.

The proposed Marsh Landing project is a simple-cycle "peaker" power plant, meaning that it will be used to meet demand for electrical power during short-term "peaks" in demand. The proposed project consists of four Siemens SGT6-5000F simple-cycle gas turbines, two natural gas fired preheaters, and associated equipment. The proposed power plant would operate up to 20% of the year depending on the demand for electricity in the region. The California Independent System Operator (Cal ISO) would be responsible for dispatching the plant to meet electrical demand. The project utilizes simple-cycle turbines that are designed as a firm supply of power for when renewable energy sources such as wind power are not available. The project will provide standby power capacity for grid stability and the plant is using simple-cycle turbines for this purpose. The simple-cycle turbines are well suited for peaking power plants that may not run for an extended period of time since this type of unit does not have a steam turbine that would need to be kept warm to avoid equipment damage.

The Marsh Landing Generating Station would be constructed adjacent to the existing Contra Costa Power Plant, an older facility which is scheduled to be retired when the Marsh Landing Generating Station is complete. While the Contra Costa Power Plant is comprised of seven units, as of 2008, five of the Units have been retired. The remaining two units, Units 6 and 7, were constructed in 1964. Mirant Delta has agreed to retire Contra Costa Units 6 and 7 on April 30, 2013 subject to certain regulatory approvals. The existing Contra Costa Power Plant has a once-through cooling system, which draws cooling water from the San Joaquin River and then discharges it back into the river after use. The new Marsh Landing Generating Station would be a simple-cycle facility that would not use river water for cooling or process water requirements.

The Marsh Landing project would be sited adjacent to the existing Contra Costa Power Plant at 3201 Wilbur Avenue in unincorporated Contra Costa County, near the City of Antioch. The two sites will be operated as separate and independent facilities, although they have the same ultimate corporate parent, Mirant Corporation. Mirant has agreed to retire the Contra Costa Power Plant on April 30, 2013. The proposed Marsh Landing facility is scheduled to start commercial operation on May 1, 2013. More detail about the proposed facility is provided in Section 3 below ("Project Description").

This PDOC describes how the proposed Marsh Landing Generating Station would comply with applicable federal, state, and Air District regulations. These regulations include the Best

Available Control Technology and emission offset requirements of the District New Source Review (NSR) requirements contained in District Regulation 2, Rule 2. This document also includes proposed permit conditions necessary to ensure compliance with applicable rules and regulations, air pollutant emission calculations, and a health risk assessment that estimates the impact of emissions from the project on public health.

This PDOC has been prepared in accordance with District Regulations 2-2-404 through 2-2-406, which set forth the procedural requirements for the issuance of NSR permits, and District Regulations 2-3-403 and 2-3-404, which apply the requirements specifically to power plant permits. The document sets forth the District's reasons and analysis underlying to the District's preliminary determination that the project would comply with all applicable regulatory requirements relating to air quality.

This remainder of this document is organized as follows. Section 2 provides an overview of the legal framework for power plant permitting in California and describes how members of the public can learn about the project and provide input to the District and the California Energy Commission. Section 3 then proceeds to describe the proposed Marsh Landing Generating Station project, and Section 4 details the project's air emissions. Sections 5 and 6 then describe the "Best Available Control Technology" and emissions offset requirements for the project and how the proposed facility would comply with them. Section 7 addresses two federal permitting requirements, the "Prevention of Significant Deterioration" requirement and the "Non-Attainment New Source Review" requirement for fine particulate matter, and explains how this facility is not subject to those requirements. Section 8 presents the results of the Health Risk Screening Analysis the District has conducted for the project, which found that the health risks from the project will be less than significant. Section 9 addresses other applicable legal requirements for the proposed project. Section 10 sets forth the proposed permit conditions for the project. Section 11 concludes with the District's PDOC for the project.

2. The Power Plant Permitting Process and Opportunities for Public Participation

The California Energy Commission (Energy Commission or CEC) is the primary permitting authority for new power plants in California. The California Legislature has granted the Energy Commission exclusive licensing authority for all thermal power plants in California of 50 megawatts or more. (*See* Warren-Alquist State Energy Resources Conservation and Development Act, Cal. Public Resources Code §§ 25000 *et seq.*) This licensing authority supersedes all other local and state permitting authority. The intent behind this system is to streamline the licensing process for new power plants while at the same time providing for a comprehensive review of potential environmental and other impacts.

As the lead permitting agency, the CEC conducts an in-depth review of environmental and other issues posed by the proposed power plant. This comprehensive environmental review is the equivalent of the review required for major projects under the California Environmental Quality Act (CEQA), and the Energy Commission's license satisfies the requirements of CEQA for these projects. This CEQA-equivalent review encompasses air quality issues within the purview of the Air District, and also includes all other types of environmental and other issues, including water quality issues, endangered species issues, and land use issues, among others.

The Air District collaborates with the Energy Commission regarding the air quality portion of its environmental analysis and prepares a "Determination of Compliance" that outlines whether and how the proposed project will comply with applicable air quality regulatory requirements. The Determination of Compliance is used by the Energy Commission to assess air quality issues of the proposed power plant. This document presents the District's Preliminary Determination of Compliance. The District will solicit and consider public input on the Preliminary Determination of Compliance, and then will issue a Final Determination of Compliance for use by the Energy Commission in its CEQA-equivalent environmental review. The CEC will then conduct its environmental review, and at the end of that process it will decide whether to issue a license for the project and under what conditions.

Both the Energy Commission licensing process and the District's Determination of Compliance process relating to air quality issues provide opportunities for public participation. For the District's Determination of Compliance, the District publishes its preliminary determination – the PDOC – and invites interested members of the public to review and comment on it. This public process allows members of the public to review the District's analysis of whether and how the facility will comply with applicable regulatory requirements and to bring to the District's attention any area in which members of the public believe the District may have erred in its analysis. This process helps improve the District's final determination by bringing to the District's attention any areas where interested members of the public disagree with the District's proposal at an early enough stage that the District can correct any deficiencies before making the final determination. The Energy Commission provides similar opportunities for public participation, and publishes its proposed actions for public review and comment before taking any final actions.

At this time, the Air District is at the beginning of this process for the Marsh Landing Generating Station. The Air District is publishing its Preliminary Determination of Compliance (PDOC) for public review and comment, and will consider comments from the public in determining whether to issue a Final Determination of Compliance (FDOC) and on what basis. The District invites all interested parties to comment in writing on any aspect of the Preliminary Determination of Compliance pursuant to District Regulation 2-2-405. Comments should be made in writing and should be directed to Brian Lusher, Senior Air Quality Engineer, Bay Area Air Quality Management District, 939 Ellis Street, San Francisco, CA 94109, (415) 749-4623, blusher@baaqmd.gov. Written comments must be received by April 30, 2010. All comments received during the comment period will be considered by the District and addressed as necessary in any Final Determination of Compliance.

The power plant approval process also provides opportunities for members of the public to participate in person in public hearings regarding this project. The District may hold a public meeting in accordance with Regulation 2, Rule 2, Section 405 to receive verbal comment from the public if there is sufficient reason to do so. Members of the public who would like to request that the District hold a public meeting should make such a request, in writing, to Mr. Lusher at the address set forth in the preceding paragraph prior to the end of the comment period, and should explain the reasons why a public meeting is warranted. Members of the public will also be afforded an opportunity to participate in public hearings regarding the project at the Energy Commission as part of the Commission's environmental review process. The public hearings before the Energy Commission will encompass all aspects of the project, including air quality issues and all other environmental issues.

Interested members of the public are invited to learn more about the project as part of the public review and comment process. Detailed information about the project and how it will comply with applicable regulatory requirements are set forth in the subsequent sections of this document. All supporting documentation, including the permit application and data submitted by the applicant and all other information the District has relied on in its analysis, are available for public inspection at the Communication and Outreach Division Office located on the 5th Floor of District Headquarters, 939 Ellis Street, San Francisco, CA, 94109. This Engineering Evaluation and the supporting documentation are also available on the District's website at www.baaqmd.gov/ The public may also contact Mr. Lusher for further information (see contact information above). **Para obtener información en español, comuníquese con Brenda Cabral en la sede del Distrito, (415) 749-4686,** bcabral@baaqmd.gov.

In addition to the Air District's permitting process involving air quality issues, interested members of the public are also invited to participate in the Energy Commission's licensing proceeding, which addresses other environmental concerns including those that are not related to air quality. For more information, go to the following CEC website: www.energy.ca.gov/sitingcases/marshlanding/index.html. The public may also contact the Energy Commission's Public Adviser's office at:

Public Adviser
California Energy Commission
1516 Ninth Street, MS-12
Sacramento, CA 95814
Phone: 916-654-4489
Toll-Free in California: 1-800-822-6228
E-mail: PublicAdviser@energy.state.ca.us

3. Project Description

The Marsh Landing Generating Station is a proposed 760-megawatt "peaker" power plant to be located adjacent to the existing Contra Costa Power Plant near Antioch, CA. The facility would consist of four Siemens SGT6-5000F natural gas fired simple-cycle combustion turbines with a nominal electrical output of 190 MW. Each set of two turbines will also be equipped with a small natural gas fired preheater, or "dewpoint" heater, that heats the incoming natural gas above the dew point. This section describes the proposed project's function as a simple-cycle "peaker" power plant, describes where it would be located and how it would be operated, and provides details about project ownership and the specific equipment being proposed for the project.

3.1 The Marsh Landing Generating Station: A Simple-Cycle "Peaker" Power Plant

The proposed Marsh Landing Generating Station would be a "peaker" plant, meaning that it is designed to provide electricity to the grid at times of peak demand. Peaking power plants are power plants that generally only run during periods of high demand for electricity, most often during the summertime when air conditioning use is highest and typically in the late afternoon when people are returning from work and many businesses remain open. The proposed power plant would operate up to 20% of the year depending on the demand for electricity in the region. The California Independent System Operator (Cal ISO) would be responsible for dispatching the plant to meet electrical demand.

The proposed project uses a "simple-cycle" design, meaning that it uses natural gas combustion turbines only, without additional generating equipment, to make electricity. This design is different than a "combined-cycle" design, in which waste heat in the turbine exhaust is used to create steam in a heat-recovery steam generator, which powers a steam turbine to generate additional electricity. The simple-cycle design is especially well suited for peaking power plants because the turbines can be started up very quickly when demand requires it. With combined-cycle turbines, startups take longer because the heat recovery boilers and steam turbine take additional time to come up to operating temperature. Simple-cycle turbines are also well suited to peaking applications because peakers, by their nature, are not called upon to run for extended periods of time. This is an important consideration because simple-cycle turbines are inherently less efficient than combined-cycle turbines, which recover some of the heat from the turbine exhaust that would otherwise be wasted. Since peaker plants are operated for a relatively small number of hours per year, this energy penalty – which translates into additional fuel used to generate the same amount of power – is not as much of a concern.

As a peaker plant, the facility will also help to ensure a reliable supply of power as California transitions to a greater supply of renewable power sources such as solar and wind power. As a peaker plant, the project will help provide on-demand standby power capacity for grid stability. The simple-cycle turbines have a very short startup time and can come on-line very quickly to fill in during times when solar energy sources or wind power are not available. As the California Energy Commission has recognized, "some efficient, dispatchable, natural-gas-fired generation will be necessary to integrate renewables into California's electricity system and meet the state's

[Renewable Portfolio Standard] and [Greenhouse Gas] goals."[1] Peaker plants fired by clean-burning natural gas are well suited to filling this need.

The proposed Marsh Landing will function as a replacement for the existing Contra Costa Power Plant (also known as the "Mirant Delta" facility). The existing Contra Costa Power Plant is an older facility which was built in 1964 and is scheduled to be retired when the Marsh Landing facility is complete. The new Marsh Landing facility will replace the existing facility and will use modern state-of-the-art generating equipment. In addition, the new Marsh Landing facility will replace the once-through cooling system at the existing Contra Costa Power Plant, which draws cooling water from the San Joaquin River and then discharges it back into the river after use. The new Marsh Landing facility will be a simple-cycle facility that does not use river water for cooling or process water requirements. Mirant Delta, LLC, the owner of the existing Contra Costa Power Plant, has agreed to have a legally binding permit condition included in its existing permit documents that requires the existing facility to shut down and permanently retire the Units from service on April 30, 2013.[2] The proposed Marsh Landing facility is scheduled to start commercial operation the next day, on May 1, 2013. The interconnection request for the Marsh Landing facility assumes that the Contra Costa Power Plant will retire, and therefore evaluates only the net increase in capacity associated with Marsh Landing. This effectively means that the Marsh Landing facility would take over transmission capacity on the system that is currently utilized by the Contra Costa Power Plant.

3.2 Project Location

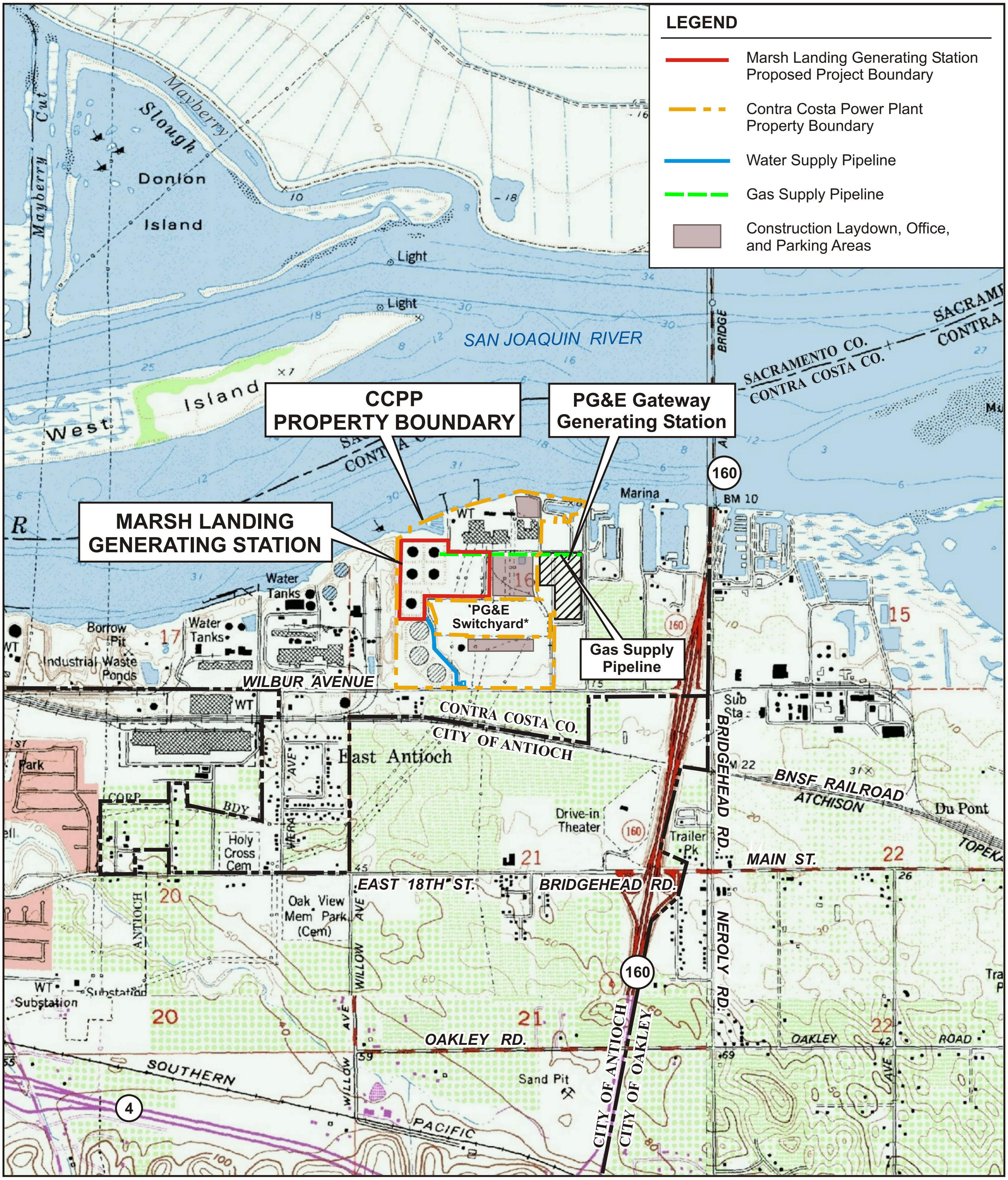
The proposed Marsh Landing facility would be located adjacent to the existing Contra Costa Power Plant on a 27-acre industrial site on Wilbur Avenue, one mile northeast of the City of Antioch, on the southern shore of the San Joaquin River. The project site is located in unincorporated Contra Costa County, although it is in the process of being incorporated into the City of Antioch. Highway 4 and the Antioch Bridge are just east of the site. Immediately south,

---

[1] California Energy Commission, *Final Commission Decision, Avenal Energy, Application for Certification* (08-AFC-01), Kings County (Dec. 16, 2009) p. 112, Finding of Fact no. 23 (available at: www.energy.ca.gov/2009publications/CEC-800-2009-006/CEC-800-2009-006-CMF.PDF).

[2] Mirant Delta, LLC, has agreed to include the following enforceable permit condition in its air permits: "Subject to: (i) receipt of final, non-appealable California Public Utilities Commission approval of the Tolling Agreement for Units 6 and 7 at the Contra Costa Power Plant by and between Mirant Delta, LLC and Pacific Gas and Electric Company and dated as of September 2, 2009, as amended from time to time, without material condition or modification unacceptable to either party thereto in its sole discretion; and (ii) the receipt of all other approvals and consents from the relevant local, state and federal governmental agencies (including but not limited to the California Independent System Operator) necessary for the shutdown and permanent retirement from service of Units 6 and 7; Mirant Delta, LLC will shut down and permanently retire Units 6 and 7 from service at 2400 PDT on April 30, 2013." Mirant Delta, LLC, has agreed that prior to the Air District's issuance of the FDOC for the Marsh Landing facility, Mirant Delta will submit an application for an amendment to its Air District permit to incorporate the foregoing permit condition.

west and east of the site are existing industrial facilities, including a Pacific Gas and Electric Company (PG&E) Substation and the Gateway Generating Station, as well as a recreational marina, open space and additional industrial land uses. The proposed site is currently occupied by five above-ground fuel storage tanks associated with the existing Contra Costa Power Plant site. The proposed project location is identified on the Project Location Map below. An aerial view of the project site and a plot plan of the proposed Marsh Landing facility are also provided.



Source:
USGS Topographic Maps, 7.5 Minute Series:
Antioch North, California, 1978
Antioch South, California, 1980
Jersey Island, California, 1978
Brentwood, California, 1978

* The PG&E Switchyard and PG&E Gateway Project are not part of the Mirant Property.

0 2,000 4,000

Scale in Feet
1:24,000

N

PROJECT LOCATION MAP

September 2009
28067344

Marsh Landing Generating Station
Mirant Marsh Landing, LLC
Contra Costa County, California

URS

REVISED FIGURE 1-1

9/22/09 vsa ..T:\Mirant Contra Costa-Marsh Landing\Graphics\ATC Amendment Sept09\Rev 1-1_proj loc map.cdr

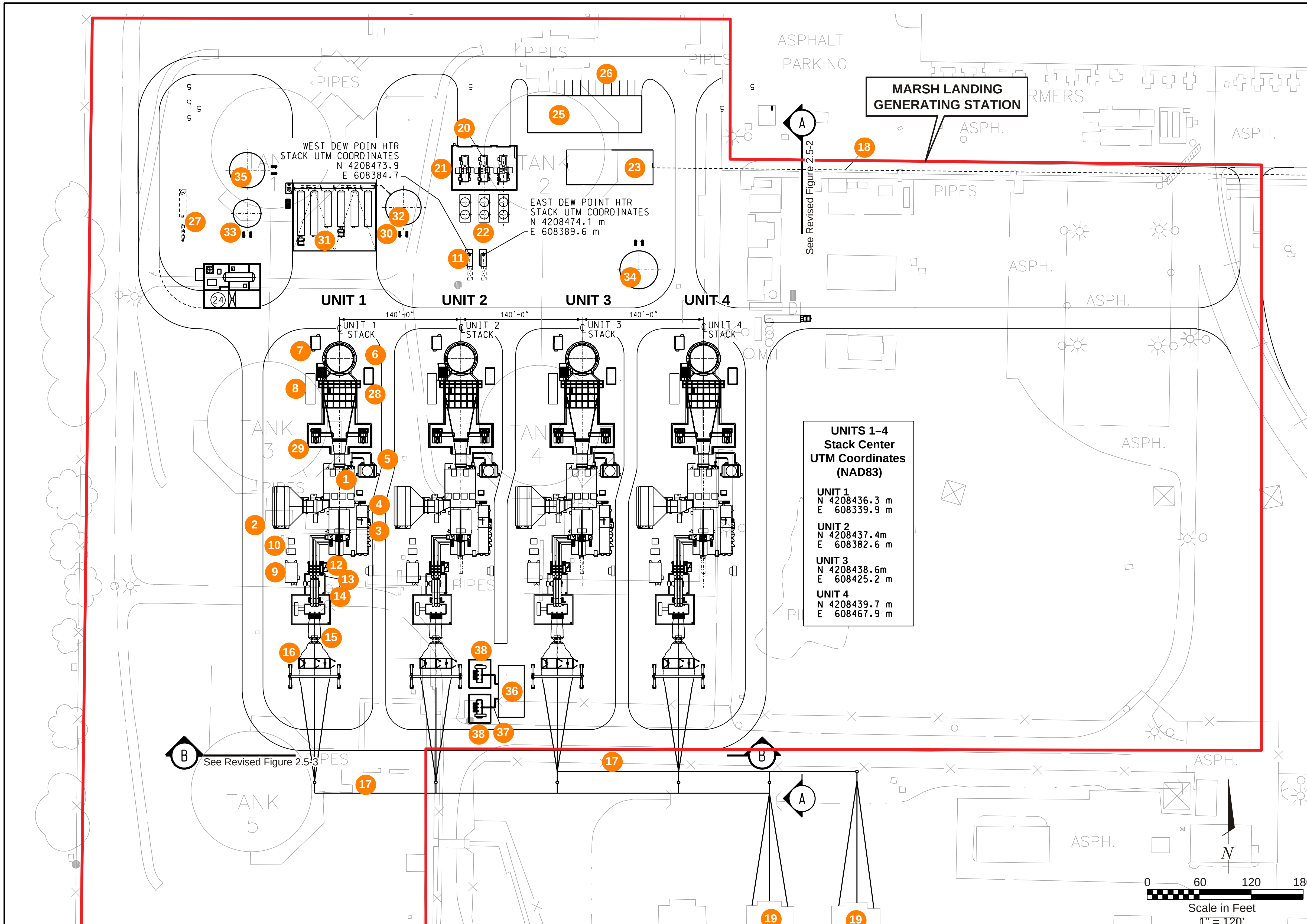
AERIAL VIEW OF PROPOSED PROJECT

September 2009
28067344

Marsh Landing Generating Station
Mirant Marsh Landing, LLC
Contra Costa County, California

URS

REVISED FIGURE 1-2



LEGEND

1 Gas Turbine Enclosure
2 Gas Turbine Inlet Filter
3 Electrical Package
4 Lube Oil Cooler
5 Rotary Air Cooler (Fin-Fan)
6 Continuous Emissions Monitoring
7 SCR
8 Sampling Panel
9 SEE/SFC Tranformers
10 SEE/SFC Package
11 Dew Point Heaters
12 Generator Circuit Breaker
13 Auxiliary Transformer
14 Generator Step Up Transformer
15 Circuit Breaker
16 Air Switch
17 Overhead Power Lines
18 12"-Dia. Natural Gas Line
19 Existing Circuit Breakers
20 Fuel Gas Compressor
21 Fuel Gas Compressor Enclosure
22 Fuel Gas Compressor Fin-Fan Coolers
23 Fuel Gas Metering/Conditioning
24 Ammonia Unloading/Storage Area
25 Control/Admin. Building
26 Parking
27 Oil-Water Separator with Wastewater Sump
28 Ammonia Vaporization Skid
29 Air Blowers
30 Evap Cooler Supply Pumps
31 Water Treatment Trailers
32 Service Water Storage Tank (40' dia. x 32' high)
33 Secondary EC Blend WaterTank (32' dia x 32' high)
34 Wastewater Storage Tank (44' dia x 44' high)
35 Raw Water Storage Tank (40' dia. x 32' high)
36 PDC
37 Non-SEC Bus
38 Auxiliary Transformer

Source:
CH2MHill Lockwood Greene; General Arrangement Marsh Landing Generating Station,
Siemens Simple Cycle SGT6-5000F Equipment Layout;
Drawing No: MR-GA-ML-01-26 (Rev. H, 08/27/09)

GENERAL PLOT PLAN
Marsh Landing Generating Station
Mirant Marsh Landing, LLC
Contra Costa County, California
September 2009
28067344
URS
REVISED FIGURE 2-1

9/22/09 vsa ..T:\Mirant Contra Costa-Marsh Landing\Graphics\ATC Amendment Sept09\Rev 2.-1_plotplan_H.ai

3.3 How The Project Will Operate

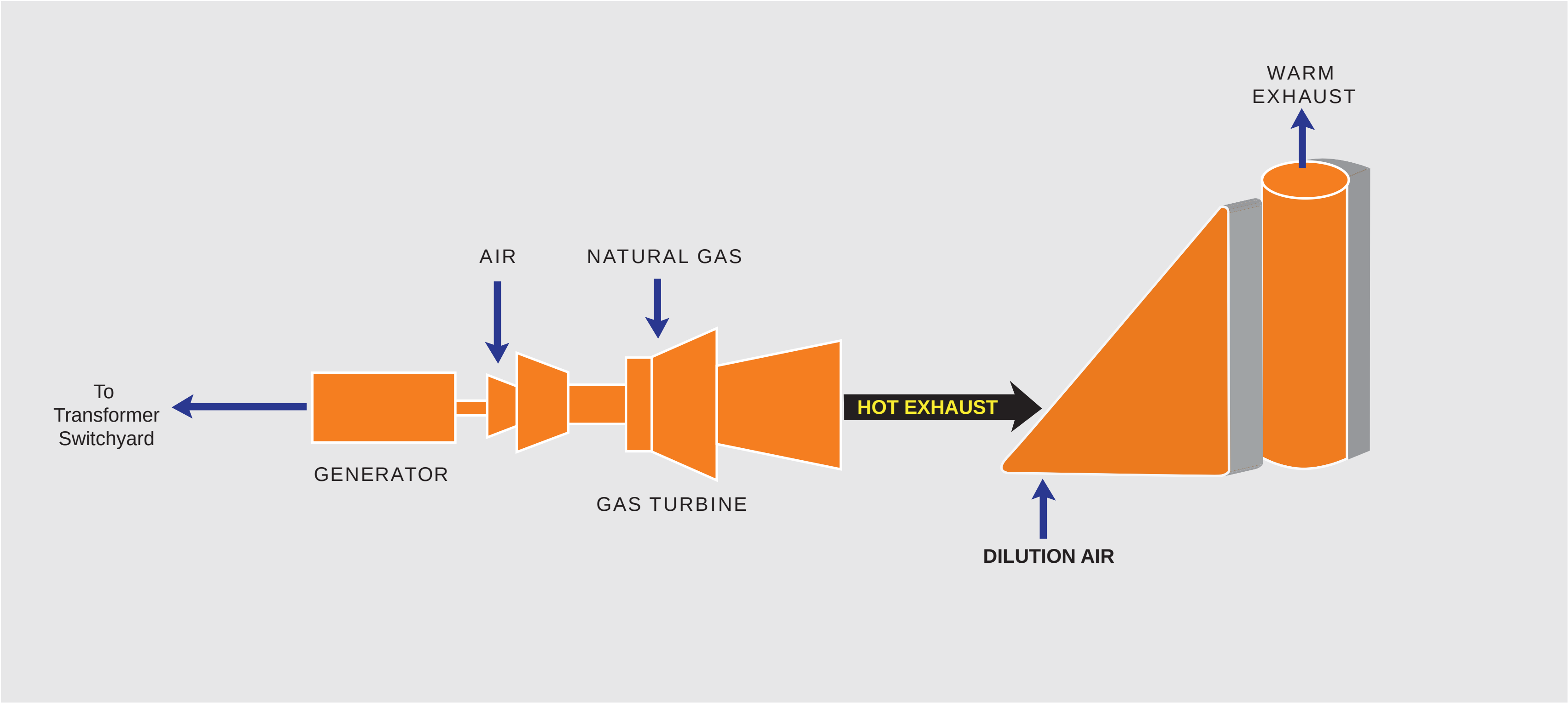
The proposed facility will generate electric power for the grid using simple-cycle combustion turbines. The combustion turbines generate power by burning natural gas, which expands as it burns and turns the turbine blades which in turn rotate an electrical generator to generate electricity. The main components of a turbine consist of a compressor, combustor, and turbine. The compressor compresses combustion air to the combustor where the fuel is mixed with the combustion air and burned. Hot exhaust gases then enter the power turbine where the gases expand across the turbine blades, rotating a shaft to power the electric generator.

After exiting the combustion turbines, the hot exhaust gases are then sent through the post-combustion emissions controls prior to being exhausted at the stack. The proposed post-combustion emissions controls consist of a Selective Catalytic Reduction (SCR) unit to reduce oxides of nitrogen in the exhaust and an oxidation catalyst to reduce organic compounds and carbon monoxide in the exhaust.

SCR injects ammonia into the exhaust stream, which reacts with the NO_x and oxygen in the presence of a catalyst to form nitrogen and water. A small amount of ammonia is not consumed in the reaction and is emitted in the exhaust stream as what is commonly called “ammonia slip”.

An oxidation catalyst oxidizes the carbon monoxide and unburned hydrocarbons in the exhaust gases to form CO_2.

The schematic diagram below illustrates how a simple-cycle gas turbine power plant such as the proposed Marsh Landing Generating Station works.



SIMPLE CYCLE FLOW DIAGRAM

Marsh Landing Generating Station
Mirant Marsh Landing, LLC
Contra Costa County, California

March 2009
28067344

URS

FIGURE 2

3/23/09 vsa ..T:\Mirant Contra Costa-Marsh Landing\Graphics\BAAQMD Mar 09\Fig 2_simple cycle flow dia.ai

3.4 Project Ownership

The Marsh Landing Generating Station would be owned by Mirant Marsh Landing, LLC (Applicant), an indirect wholly owned subsidiary of Mirant Corporation. The adjacent Contra Costa Power Plant is owned by a separate Mirant Corporation subsidiary, Mirant Delta, LLC. Although Mirant Marsh Landing, LLC, and Mirant Delta, LLC, have a common ultimate corporate parent, the two sites will be operated as separate and independent facilities and the District is treating them as separate facilities for purposes of air quality regulations. This issue is described in further detail in Section 7 below.

3.5 Equipment Specifications

The equipment that Mirant has identified for use at the Marsh Landing Generating Station consists of the following:

S-1 Combustion Turbine Generator #1, Siemens SGT6-5000F, Natural Gas Fired, 190 MW, 2202 MMBtu/hr (HHV) maximum rated capacity; abated by A-1 Oxidation Catalyst, and A-2 Selective Catalytic Reduction System (SCR).

S-2 Combustion Turbine Generator #2, Siemens SGT6-5000F, Natural Gas Fired, 190 MW, 2202 MMBtu/hr (HHV) maximum rated capacity; abated by A-3 Oxidation Catalyst, and A-4 Selective Catalytic Reduction System (SCR).

S-3 Combustion Turbine Generator #3, Siemens SGT6-5000F, Natural Gas Fired, 190 MW, 2202 MMBtu/hr (HHV) maximum rated capacity; abated by A-5 Oxidation Catalyst, and A-6 Selective Catalytic Reduction System (SCR).

S-4 Combustion Turbine Generator #4, Siemens SGT6-5000F, Natural Gas Fired, 190 MW, 2202 MMBtu/hr (HHV) maximum rated capacity; abated by A-7 Oxidation Catalyst, and A-8 Selective Catalytic Reduction System (SCR).

S-5 Natural Gas-fired Fuel Preheater, 5 MMBtu/hr (HHV) (Exempt from Air District Permit requirements per Regulation 2, Rule 1, Section 114)

S-6 Natural Gas-fired Fuel Preheater, 5 MMBtu/hr (HHV) (Exempt from Air District Permit requirements per Regulation 2, Rule 1, Section 114)

4. Facility Emissions

This section describes the air pollutant emissions that the Marsh Landing Generating Station will have the potential to emit, as well as the principal regulatory requirements to which the emissions will be subject. Detailed emission calculations, including the derivations of emission factors, are presented in the appendices.

4.1 Criteria Pollutants

4.1.1 Hourly Emissions from Gas Turbines

The Marsh Landing Generating Station's generating equipment – the simple-cycle gas turbines – will have the potential to emit up to the following amounts of regulated air pollutants per hour, as set forth in **Table 1**. These are the maximum emission rates for regulated air pollutants from the project during normal steady-state operations, and will be limited by enforceable permit conditions.

TABLE 1. STEADY-STATE EMISSIONS RATES

Pollutant	One Simple-Cycle Turbine Emissions Rate (lb/hr)
NO_x (as NO_2)	20.83
CO	10.00
POC (as CH_4)	2.90
$PM_{10}/PM_{2.5}$	9.00
SO_x (as SO_2) Maximum[a]	6.21
SO_x (as SO_2) Average[b]	1.41

[a] Maximum SO_x emissions based on 1 grain sulfur per 100 scf of natural gas.
[b] Average SO_x emissions based on 0.25 grains sulfur per 100 scf of natural gas and an average annual firing rate of 1997 MMBtu/hour.

Note that particulate matter from natural gas combustion sources normally has a diameter less than one micron.[3] The particulate matter will therefore be both PM_{10} (particulate matter with a diameter of less than 10 microns) and $PM_{2.5}$ (particulate matter with a diameter of less than 2.5 microns). $PM_{2.5}$ is a subset of particulate matter that has recently come under heightened regulatory scrutiny, and the District is in the process of developing regulations specifically directed to controlling $PM_{2.5}$. Those regulations are not in place yet, but for this facility the District's existing PM_{10} regulations will be equally effective in controlling $PM_{2.5}$ as well because all of the PM emissions from this facility will be both $PM_{2.5}$ and PM_{10}.

[3] *See* AP-42, Table 1.4-2, footnote c, 7/98 (available at www.epa.gov/ttnchie1/ap42/ch01/final/c01s04.pdf).

4.1.2 Emissions During Gas Turbine Startup, Shutdown, and Tuning Operations

Maximum emissions during turbine startups and combustor tuning operations, when the turbines are at low load where they are not as efficient and when emissions control equipment may not be fully operational, are summarized in **Table 2**. (These operating scenarios are discussed in more detail in Sections 5.7, below.) Table 2 shows the startup emissions limits and tuning emission limits for each turbine.

TABLE 2: GAS TURBINE EMISSIONS DURING STARTUP AND TUNING OPERATIONS

Pollutant	Simple-Cycle Startup Emissions Rates (lb/event)[a]	Simple-Cycle Startup (lb/hour)[b]	Simple-Cycle Tuning Emissions Rates (lb/event)[c]	Simple-Cycle Tuning (lb/hour)
NO_x (as NO_2)	18.6	45.1	640	80
CO	216.2	541.3	3600	450
POC (as CH_4)	11.9	28.5	240	30
$PM_{10}/PM_{2.5}$	4.5	9.0	72.0	9.0
SO_x (as SO_2)	3.11	6.21	49.68	6.21

[a] Startups not to exceed 30 minutes.
[b] Worst case hourly emissions assume 2 startups and one shutdown in one hour.
[c] Tuning events not to exceed 8 hours.

Maximum emissions during gas turbine shutdowns (also discussed in detail in Section 5.7) are summarized in **Table 3.**

TABLE 3. MAXIMUM EMISSIONS PER SHUTDOWN

Pollutant	Simple-Cycle Shutdown Emissions Rate (lb/shutdown)[a]
NO_x (as NO_2)	13.1
CO	111.5
POC (as CH_4)	5.4
$PM_{10}/PM_{2.5}$	2.25
SO_x (as SO_2)	1.55

[a] Shutdowns not to exceed 15 minutes.

4.1.3 Daily Facility Emissions

Maximum daily emissions of regulated air pollutants emissions for the Marsh Landing Generating Station are set forth in **Table 4** below. The Table shows emissions both from the Gas Turbines and from the natural gas fired preheaters, which are exempt from District regulatory requirements because of their small size.

These daily emission rates are used to determine what sources at the facility are subject to the requirement to use "Best Available Control Technology" pursuant to District New Source Review regulation (NSR; Regulation 2, Rule 2). Pursuant to District Regulation 2-2-301.1, any new source that has the potential to emit 10 pounds or more per highest day of POC, NO_x, SO_2, PM_{10}, or CO is subject to the BACT requirement for that pollutant.

TABLE 4. MAXIMUM DAILY REGULATED CRITERIA AIR POLLUTANT EMISSIONS FOR FACILITY.

	Pollutant (lb/day)				
Source	**Nitrogen Oxides (as NO_2)**	**Carbon Monoxide**	**Precursor Organic Compounds**	**Particulate Matter (PM_{10})**	**Sulfur Dioxide**
One Simple-Cycle Unit (No Tuning)[a]	577.31	1214.60	119.04	216.0	149.04
Four Simple-Cycle Units (No Tuning)[a]	2309.26	4858.40	476.14	864.00	596.16
Total including equipment exempt from Air District Regulations[b] (No Combustor Tuning)	2313.63	4866.55	476.79	864.70	596.42
One Simple-Cycle Unit Combustor Tuning[c]	1050.67	4734.60	335.84	216.00	149.04
Four Simple-Cycle Units (One Unit Tuning)[d]	2782.62	8378.40	692.94	864.00	596.16
Total including equipment exempt from Air District Regulations[b] (with Combustor Tuning)	2786.99	8386.55	693.59	864.70	596.42

[a] NO_x, POC, CO and PM_{10} emission rates based on three startups and three shutdowns per day, with the balance at normal operations. See Appendices for emissions calculations.

[b] The two natural gas fired preheaters are exempt from Air District Regulations. See District Regulation 2-2-214.

[c] NO_x, POC, CO and PM_{10} emission rates based on three startups and three shutdowns per day, with 8 hours of combustor tuning, and the balance at normal operations. Each turbine allowed 16 hours combustor tuning per year. See Appendix A for emissions calculations.

[d] NO_x, CO and POC maximum daily is based on one simple-cycle unit combustor tuning and three simple-cycle turbines in normal operations.

As Table 4 shows, the gas turbines will emit over 10 pounds per highest day of NO_x, CO, POC, PM_{10}, and SO_2, and are required to use Best Available Control Technology per Regulation 2-2-301 to limit emissions of these pollutants. The Air District's analysis of the Best Available Control Technology emission limits for this equipment is described in Section 5 below.

The remaining equipment at the facility is not subject to the BACT requirement in District Regulation 2, Rule 2. The natural gas fired preheaters are exempt from District permitting per Regulation 2, Rule 1, Section 114. Each preheater will also not emit over 10 pounds per highest day of any pollutant.

4.1.4 Annual Facility Emissions

The maximum annual emissions of regulated air pollutants for the proposed Marsh Landing Generating Station project are set forth in **Table 5** below. Table 5 shows the annual emissions from the facility, both from the gas turbines and from the exempt natural gas preheaters. These emissions reflect the 20 percent annual capacity factor proposed by the applicant. Annual facility emissions are used to determine whether the facility will need to offset its emissions with Emissions Reduction Credits under District Regulations 2-2-202 and 2-2-203. Offsets are required for NO_x and POC emissions over 10 tons per year, and for PM_{10} and SO_2 emissions over 100 tons per year.

TABLE 5. MAXIMUM ANNUAL CRITERIA AIR POLLUTANT EMISSIONS FOR THE FACILITY.

	NO_2 (ton/yr)	**CO (ton/yr)**	**POC (ton/yr)**	**PM_{10} (ton/yr)**	**SO_2 (ton/yr)**
One Simple-Cycle Gas Turbine	17.941	34.643	3.553	7.884	1.235
All Four Simple-Cycle Gas Turbines	71.763	138.572	14.210	31.536	4.941
Total subject to Air District Regulations	71.763	138.572	14.210	31.536	4.941
Total including exempt natural gas preheaters	71.922	138.870	14.234	31.561	4.947

Notes: See Appendices for Emission Calculations.

These annual emissions rates show that the facility will be required to offset its emissions of NO_x and POC under District Regulation 2-2-302, because emissions will be over 10 tons per year (and for NO_x will have to provide credits at a ratio of 1.15 tons of credits per 1 ton of emissions, because emissions will be over 35 tons per year). The facility will not be required to offset its PM_{10} and SO_2 emissions under District Regulation 2-2-303 because emissions will be less than 100 tons per year.

4.2 Toxic Air Contaminants

Toxic Air Contaminants (TACs) are a subset of air pollutants that can be harmful to health and the environment even in very small amounts. **Table 6** provides a summary of the maximum annual facility toxic air contaminant (TAC) emissions from the project.

TABLE 6. MAXIMUM FACILITY TOXIC AIR CONTAMINANT (TAC) EMISSIONS

Toxic Air Contaminant	Project lb/hour	Project lb/year	Acute Risk Screening Trigger Level (lb/hr)	Chronic Risk Screening Trigger Level (lb/yr)
1,3-Butadiene	0.00110	1.92	None	0.63
Acetaldehyde	11.05	2301	None	38
Acrolein	0.595	294	0.0055	14
Ammonia	123	216043	7.1	7700
Benzene	0.221	202	2.9	3.8
Benzo(a)anthracene	0.000195	0.342	None	None
Benzo(a)pyrene	0.000120	0.210	None	0.0069
Benzo(b)fluoranthene	0.000098	0.171	None	None
Benzo(k)fluoranthene	0.000095	0.166	None	None
Chrysene	0.000218	0.381	None	None
Dibenz(a,h)anthracene	0.000203	0.356	None	None
Ethylbenzene	0.282	271	None	43
Formaldehyde	39.98	7785	0.12	18
Hexane	2.24	3920	None	270000
Indeno(1,2,3-cd)pyrene	0.000203	0.356	None	None
Naphthalene	0.0143	25.1	None	None
Propylene	6.66	11664	None	120000
Propylene Oxide	0.413	723	6.8	29
Toluene	0.848	1074	82	12000
Xylene (Total)	0.225	395	49	27000
Sulfuric Acid Mist (H2SO4)	20.77	9097	0.26	39
Benzo(a)pyrene equivalents	0.000394	0.691	None	0.0069
Specified PAHs	0.00113	1.98	None	None

Notes: Emissions from the exempt natural gas fired preheaters are included.
Polycyclic Aromatic Hydrocarbons (PAHs) impacts are evaluated as Benzo(a)pyrene equivalents.
The following compounds are PAHs.

PAHs	Equivalency Factor
Benzo(a)anthracene	0.1
Benzo(a)pyrene	1
Benzo(b)fluoranthrene	0.1

Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenz(a,h)anthracene	1.05
Indeno(1,2,3-cd)pyrene	0.1

Table 6 is also a summary of the emissions used as input data for air pollutant dispersion models used to assess the increased health risk to the public resulting from the project. The ammonia emissions shown are based upon a worst-case ammonia emission concentration of 10 ppmvd @ 15% O_2 from the gas turbine SCR systems. The chronic and acute screening trigger levels shown are per Table 2-5.1 of Regulation 2, Rule 5.

If emissions are above certain established screening levels prescribed in Table 2-5-1 of Regulation 2, Rule 2, a health risk assessment is required. Where no acute trigger level is listed for a TAC, none has been established for that TAC. Based on the information contained in Table 6, a health risk assessment is required by District Regulation 2, Rule 5. The health risk assessment is conducted to determine the potential impact on public health resulting from the worst-case TAC emissions from the project.

The results of the health risk assessment are discussed in full in Section 8 of this document. Briefly, the health risk assessment found a maximum increased cancer risk of 0.03 in one million for the maximally exposed individual near the facility. Under District Regulation 2-5, these carcinogenic risk levels are less than significant because they are less than 1.0 in one million. The highest chronic non-cancer hazard index for the project is 0.003 and the highest acute non-cancer hazard index for the project is 0.3. These non-cancer risks are less than significant under District Regulation 2-5 because they are less than 1.0.

5. Best Available Control Technology (BACT)

The District's New Source Review regulations require the proposed Marsh Landing Generating Station to utilize the "Best Available Control Technology" ("BACT") to minimize air emissions, as discussed in more detail below. This section describes how the BACT requirements will apply to the facility.

5.1 Introduction

District Regulation 2-2-301 requires that the Marsh Landing Generating Station use the Best Available Control Technology to control NO_x, CO, POC, PM_{10}, and SO_x emissions from sources that will have the potential to emit over 10 pounds per highest day of each of those pollutants. Pursuant to Regulation 2-2-206, BACT is defined as the more stringent of:

(a) "The most effective control device or technique which has been successfully utilized for the type of equipment comprising such a source; or

(b) The most stringent emission limitation achieved by an emission control device or technique for the type of equipment comprising such a source: or

(c) Any emission control device or technique determined to be technologically feasible and cost-effective by the APCO, or

(d) The most effective emission control limitation for the type of equipment comprising such a source which the EPA states, prior to or during the public comment period, is contained in an approved implementation plan of any state, unless the applicant demonstrates to the satisfaction of the APCO that such limitations are not achievable. Under no circumstances shall the emission control required be less stringent than the emission control required by any applicable provision of federal, state or District laws, rules or regulations."

The type of BACT described in definitions (a) and (b) must have been demonstrated in practice and is referred to as "BACT 2". This type of BACT is termed "achieved in practice". The BACT category described in definition (c) is referred to as "technologically feasible/cost-effective" and it must be commercially available, demonstrated to be effective and reliable on a full-scale unit, and shown to be cost-effective on the basis of dollars per ton of pollutant abated. This is referred to as "BACT 1". BACT specifications (for both the "achieved in practice" and "technologically feasible/cost-effective" categories) for various source categories have been compiled in the BAAQMD BACT Guideline.

The simple-cycle turbines are subject to BACT under the District's New Source Review regulations (Regulation 2, Rule 2, Section 301) for NO_x, CO, POC, PM_{10}, and SO_x because each unit will have the potential to emit more than 10 pounds per highest day of those pollutants. The following sections provide the basis for the District BACT analyses for this equipment.

5.2 Best Available Control Technology for Oxides of Nitrogen (NO_x)

Oxides of Nitrogen (NO_x) are a byproduct of the combustion of an air-and-fuel mixture in a high-temperature environment. NO_x is formed when the heat of combustion causes the nitrogen molecules in the combustion air to dissociate into individual nitrogen atoms, which then combine with oxygen atoms to form nitric oxide (NO) and nitrogen dioxide (NO_2). This reaction primarily forms NO (95% to 98%) and only a small amount of NO_2 (2% to 5%), but the NO eventually oxidizes and converts to NO_2 in the atmosphere. NO_2 is a reddish-brown gas with detectable odor at very low concentrations. NO and NO_2 are generally referred to collectively as "NO_x".[4] NO_x is a precursor to the formation of ground-level ozone, the principal ingredient in smog.

The Air District has examined technologies that may be effective to control NO_x emissions in two general areas: combustion controls that will minimize the amount of NO_x created during combustion; and post-combustion controls that can remove NO_x from the exhaust stream after combustion has occurred.

Combustion Controls

The formation of NO_x during combustion is highly dependent on the primary combustion zone temperature, as the formation of NO_x increases exponentially with temperature. There are therefore three basic strategies to reduce thermal NO_x in the combustion process:

- Reduce the peak combustion temperature
- Reduce the amount of time the air/fuel mixture spends exposed to the high combustion temperature
- Reduce the oxygen level in the primary combustion zone

It should be noted, however, that techniques that control NO_x by reducing combustion temperatures may involve a trade-off with the formation of other pollutants. Reducing combustion temperatures to limit NO_x formation can decrease combustion efficiency, resulting in increased byproducts of incomplete combustion such as carbon monoxide and unburned hydrocarbons. (Unburned hydrocarbons from natural gas combustion consist of methane, ethane and precursor organic compounds.) The Air District prioritizes NO_x reductions over carbon monoxide and POC emissions, however, because the Bay Area is not in compliance with applicable ozone standards, but does comply with carbon monoxide standards. The Air District therefore requires applicants to minimize NO_x emissions to the greatest extent feasible, and then

[4] NO_x can also be formed when a nitrogen-bound hydrocarbon fuel is combusted, resulting in the release of nitrogen atoms from the fuel (fuel NO_x) and NO_x can be formed by organic free radicals and nitrogen in the earliest stages of combustion (prompt NO_x). Natural gas does not contain significant amounts of fuel-bound nitrogen, therefore thermal NO_x is the primary formation mechanism for natural gas fired gas turbines. References to NO_x formation during combustion in this analysis refer to "thermal NO_x", NO_x formed from nitrogen in the combustion air.

optimize CO and POC emissions for that level of NO_x control. This is a trade-off that must be kept in mind when selecting appropriate emissions control technologies for these pollutants.

The Air District has identified the following available combustion control technologies for reducing NO_x emissions from the combustion turbines.

Steam/Water Injection: Steam or water injection was one of the first NO_x control techniques utilized on gas turbines. Water or steam is injected into the combustion zone to act as a heat sink, lowering the peak flame temperature and thus lowering the quantity of thermal NO_x formed. The injected water or steam exits the turbine as part of the exhaust. The lower peak flame temperature can also reduce combustion efficiency and prevent complete combustion, however, and so carbon monoxide and POC emissions can increase as water/steam-to-fuel ratios increase. In addition, the injected steam or water may cause flame instability and can cause the flame to quench (go out). Water/steam injection in the combustion turbines used in conjunction with Low-NO_x burners can achieve NO_x emissions as low as 25 ppm @ 15% O_2.[5]

Dry Low-NO_x Combustors: Another technology that can control NO_x without water/steam injection is Dry Low-NO_x combustion technology. Dry Low-NO_x Combustors reduce the formation of thermal NO_x through (1) "lean combustion" that uses excess air to reduce the primary combustion temperature; (2) reduced combustor residence time to limit exposure in a high temperature environment; (3) "lean premixed combustion" that reduces the peak flame temperature by mixing fuel and air in an initial stage to produce a lean and uniform fuel/air mixture that is delivered to a secondary stage where combustion takes place; and/or (4) two-stage rich/lean combustion using a primary fuel-rich combustion stage to limit the amount of oxygen available to combine with nitrogen and then a secondary lean burn-stage to complete combustion in a cooler environment. Dry Low-NO_x combustors can achieve NO_x emissions as low as 9 ppm.[6]

Catalytic Combustors: Catalytic combustors, marketed under trade names such as XONON™, use a catalyst to allow the combustion reaction to take place with a lower peak flame temperature in order to reduce thermal NO_x formation. XONON™ uses a flameless catalytic combustion module followed by completion of combustion (at lower temperatures) downstream of the catalyst. Catalytic combustors such as XONON™ have not been demonstrated on large-scale utility gas turbines such as the Siemens F Class or GE Frame 7FA. The technology has been successfully demonstrated in a 1.5 megawatt simple-cycle pilot facility, and it is commercially available for turbines rated up to 10 megawatts, but it is not currently available for turbines of the size proposed for the Marsh Landing.

---

[5] M. Schorr, J. Chalfin, GE Power Systems, "Gas Turbine NOx Emissions Approaching Zero – Is it Worth the Price?", 9/99, pg. 2

[6] J. Kovac, :Advanced SGT6-5000F Development", Power-Gen International 2008-Orlando, Florida, Siemens Energy Inc., See pg 8.

Post-Combustion Controls

The Air District has identified the following post-combustion controls that can remove NO_x from the emissions stream after it has been formed.

Selective Catalytic Reduction (SCR): Selective catalytic reduction injects ammonia into the exhaust stream, which reacts with the NO_x and oxygen in the presence of a catalyst to form nitrogen and water. NO_x conversion is sensitive to exhaust gas temperature, and performance can be limited by contaminants in the exhaust gas that may mask or poison the catalyst. A small amount of ammonia is not consumed in the reaction and is emitted in the exhaust stream as what is commonly called "ammonia slip". The SCR catalyst requires replacement periodically. SCR is a widely used post-combustion NO_x control technique on utility-scale gas turbines, usually in conjunction with combustion controls.

Selective non-catalytic reduction (SNCR): Selective non-catalytic reduction involves injection of ammonia or urea with proprietary conditioners into the exhaust gas stream without a catalyst. SNCR technology requires gas temperatures in the range of 1400° to 2100° F[7] and is most commonly used in boilers because combustion turbines do not have exhaust temperatures in that range. Selective non-catalytic reduction (SNCR) requires a temperature window that is higher than the exhaust temperatures from utility combustion turbine installations.

EMx™: EMx™ (formerly SCONOx™) is a catalytic oxidation and absorption technology that uses a two-stage catalyst/absorber system for the control of NO_x, CO, VOC and optionally SO_x emissions for gas turbine applications. A coated catalyst oxidizes NO to NO_2, CO to CO_2, and VOCs to CO_2 and water, and the NO_2 is then absorbed onto the catalyst surface where it is chemically converted to and stored as potassium nitrates and nitrites. A proprietary regenerative gas is periodically passed through the catalyst to desorb the NO_2 from the catalyst and reduce it to elemental nitrogen (N_2). No ammonia is used by the EMx™ process. The EMx™ catalyst requires replacement periodically. EMx™ has been successfully demonstrated on several small combustion turbine projects up to 45 megawatts, and the manufacturer has claimed that it can be effectively scaled up and made available for utility-scale turbines. The District is not aware of any EMx™ installations for the following applications: simple-cycle gas turbine, a peaking unit, or on a gas turbine of this size (190 MW).

[7] NSCR discussion is from Institute of Clean Air Companies website: www.icac.com/i4a/pages/index.cfm?pageID=3399.

Proposed BACT for NO_x for Simple-Cycle Gas Turbines

Combustion Controls

The Applicant has proposed the use of Dry Low-NO_x combustors as BACT for the simple-cycle gas turbines. Dry Low-NO_x combustors are technologically feasible and commonly used at facilities of this type, and they are the most effective technology available for NO_x control. This emissions control technology therefore satisfies the District's BACT requirement.

Post-Combustion Controls

The Applicant has proposed the use of Selective Catalytic Reduction (SCR) as BACT for the simple-cycle gas turbines.

Selective Catalytic Reduction (SCR) can achieve NO_x emissions of 2.5 ppm for simple-cycle turbines. This is the most effective level of control that can be achieved by post combustion controls. There is no NO_x emissions data for a EMx™ installation on a gas turbine of this size and in peaking service. EMx™ may also be able to achieve NO_x emissions of 2.5 ppm for simple-cycle turbines. If the applicant had proposed EMx™ as the post-combustion NO_x controls, then the District would consider the technology as BACT for the simple-cycle gas turbines.

In addition to NO_x, the District also compared the potential ancillary environmental impacts inherent in SCR and EMx™ to determine whether EMx™ should be considered more "effective" for purposes of the BACT analysis. In particular, the District evaluated the potential impacts from ammonia emissions that would occur from using SCR. The use of SCR will result in ammonia emissions because some of the ammonia used in the reaction to convert NO_x to nitrogen and water does not get reacted and remains in the exhaust stream. The excess or unreacted ammonia emissions are known as "ammonia slip". Ammonia is a toxic chemical that can irritate or burn the skin, eyes, nose, and throat, and it also has the potential for reacting with nitric acid under certain atmospheric conditions to form particulate matter (Secondary PM).

With respect to the potential toxic impacts from ammonia slip emissions, the Air District has conducted a health risk assessment using air dispersion modeling to evaluate the potential health impacts of all toxics emissions from the facility, including ammonia slip. This assessment showed an acute hazard index of 0.3 and a chronic hazard index of 0.003. (*See* Health Risk Assessment in the Appendices.) A hazard index under 1.0 is considered less than significant. This minimal additional toxic impact of the ammonia slip resulting from the use of SCR is not significant and is not a sufficient reason to eliminate SCR as a control alternative.

The District also considered the potential environmental impact that may result from the use of SCR involves ammonia transportation and storage. The proposed facility will utilize aqueous ammonia in a 19% (by weight) solution for SCR ammonia injection, which will be transported to the facility and stored on-site in tanks. The transportation and storage of ammonia presents a risk of an ammonia release in the event of a major accident. These risks will be addressed in a number of ways under safety regulations and sound industry safety codes and standards. These safety measures include the Risk Management Plan requirement pursuant to the California Accidental Release Prevention Program, which must include an off-site consequences analysis and appropriate mitigation measures; a requirement to implement a Safety Management Plan (SMP) for delivery of ammonia and other liquid hazardous materials; a requirement to instruct vendors delivering hazardous chemicals, including aqueous ammonia, to travel certain routes; a requirement to install ammonia sensors to detect the occurrence of any potential migration of ammonia vapors offsite; a requirement to use an ammonia tank that meets specific standards to reduce the potential for a release event; and a requirement to conduct a "Vulnerability Assessment" to address the potential security risk associated with storage and use of aqueous ammonia onsite. With these safeguards in place, the risks from catastrophic ammonia releases from SCR systems can be mitigated to a less than significant level. The Energy Commission will also be evaluating these risks further through its CEQA-equivalent environmental review process and will impose mitigating conditions as necessary to ensure that the risks are less than significant. For all of these reasons, the potential environmental impact from aqueous ammonia transportation and storage does not justify the elimination of SCR as a control alternative.

Finally, the District also evaluated the potential for ammonia slip to have ancillary impacts on secondary particulate matter. Secondary particulate matter in the Bay Area is mostly ammonium nitrate.[8] The District has historically believed that ammonia was not a significant contributor to secondary particulate matter because the Bay Area is "nitric-acid limited". This means that the formation of ammonium nitrate is constrained by the amount of nitric acid in the atmosphere and not driven by the amount of ammonia in the atmosphere. Where an area is nitric acid limited, emissions of additional ammonia will not contribute to secondary particulate matter formation because there is not enough nitric acid for it to react with.

The District has recently started reconsidering the extent to which this situation is correct, however. This further evaluation has generally confirmed (preliminarily at least) that the Bay Area is in fact nitric-acid limited, although it has shown that secondary particulate formation mechanisms are highly complex and that the District's historical assumptions that ammonia emissions play no role whatsoever in secondary PM formation may, in hindsight, have been overly simplistic. The focus of the Air District's further evaluation has been a computer modeling exercise designed to predict what $PM_{2.5}$ levels will be around the Bay Area, given certain assumptions about emissions of $PM_{2.5}$ and its precursors, about regional atmospheric chemistry, and about prevailing meteorological conditions. This information was used to create a computer model of regional $PM_{2.5}$ formation in the Bay Area from which predictions can be drawn about how emissions of $PM_{2.5}$ precursors will impact regional ambient $PM_{2.5}$ concentrations. The Air District's report on its computer modeling exercise has not been finalized, but the draft report concludes that regional ammonium nitrate buildup is limited by nitric acid, not by ammonia.[9] The draft report does find that the amount of available nitric acid is not uniform but varies in different locations around the Bay Area, and consequently the

[8] *See* BAAQMD, Draft Report, *Fine Particulate Matter Data Analysis and Modeling in the Bay Area* (Draft, Oct. 1, 2009), at p. 8 (Draft PM2.5 Modeling Report). The Air District anticipates issuing a final report in the near future.
[9] Draft PM2.5 Modeling Report at p. E-3 & p. 30.

potential for ammonia emissions to impact $PM_{2.5}$ formation varies around the Bay Area. Specifically, according to the draft report, the model predicts that a reduction of 20% in total ammonia emissions throughout the Bay Area would result in changes in ambient $PM_{2.5}$ levels of between 0% and 4%, depending on the availability of nitric acid, leaving open the potential that ammonia restrictions could form a useful part of a regional strategy to reduce $PM_{2.5}$.[10] The draft report therefore restates the general conclusion that the Bay Area is nitric-acid limited, although it finds that reductions in the region's ammonia inventory could potentially achieve reductions in $PM_{2.5}$ concentrations in areas that may have sufficient available nitric acid.[11] (The draft report cautions that its assumptions regarding the availability of nitric acid may be misleading, however, because of the preliminary nature of the ammonia emissions inventory used for modeling.) Notably, the model also predicts that the Antioch area where the facility would be located has low levels of available nitric acid, in the vicinity of 0.25 ppb.[12]

The District does not believe that these indications from its draft $PM_{2.5}$ data and modeling analysis provide a sufficient basis to disqualify SCR as a BACT technology at Marsh Landing based on its potential for ammonia slip emissions. As the report itself notes, the District's work in this area is still at a preliminary stage and it is difficult to draw any firm conclusion about secondary PM formation from it at this time. Moreover, secondary particulate formation is a highly complex atmospheric process, making it especially difficult to estimate how a specific facility's ammonia slip emissions might impact ambient PM levels. The District therefore notes the results of its recent work on secondary particulate matter and will be conducting additional work in this area going forward, but has concluded that there is not enough conclusive evidence at this stage that this facility could have a significant particulate matter impacts because of ammonia slip emissions from the SCR system on which to base a BACT determination.

In addition, the District notes that secondary PM formation from ammonia slip is a cold-weather phenomenon that occurs only in the winter. This is because ammonium nitrate volatilizes at higher temperatures and only exists in a particulate phase in cold weather.[13] Moreover, the times when the Bay Area experiences problems with high ambient PM levels in the air are during the winter months (primarily November through February). The Marsh Landing facility will be a peaker plant, however, which operates during periods of peak demand which normally occur during the hot summer months, when air conditioning use is heavy. The District therefore concludes that potential secondary PM formation from ammonia slip would not be a significant concern at Marsh Landing because the facility will operate primarily in weather conditions where ammonium nitrate secondary PM cannot form, and at times of the year when PM pollution is less of a concern.

---

[10] Draft PM2.5 Modeling Report at pp. E-3 – E-4.
[11] Draft PM2.5 Modeling Report at p. 30.
[12] Draft PM2.5 Modeling Report, Figure 17, p. 31.
[13] Draft PM2.5 Modeling Report at p. 10.

The District also notes that capital cost for EMx™ are significantly higher than that of SCR. Based on information provided by Emerachem (EMx™ manufacturer) in 2008[14] the capital cost for a F-Class gas turbine EMx™ system would be $18,700,000 and SCR would be $7,900,000.

Finally, the District also notes that although the manufacturer claims that EMx™ can be effectively scaled up from the smaller turbines on which it has demonstrated to the larger turbines at the proposed Marsh Landing facility, earlier attempts to demonstrate the technology in practice have not been without problems. For example, the first attempt to scale the technology up from very small turbines (~5 MW) to the 50-MW range was at the Redding Power Plant Unit #5, a 45-MW combined-cycle facility in Shasta County, CA. The Shasta County Air Quality Management District evaluated EMx™ at that facility under a demonstration NO_x limit of 2.0 ppm (equivalent to what SCR can achieve for a combined-cycle unit). After three years of operation, the Shasta County AQMD evaluated whether the facility was meeting this demonstration limit with EMx™, and concluded that "Redding Power is not able to reliably and continuously operate while maintaining the NO_x demonstration limit of 2.0 ppmvd @ 15% O_2."[15] Although the manufacturer maintains that such problems have been overcome, concerns remain about how consistently the technology would be able to perform if it is further scaled up to 190-MW turbines, especially where it would be the first time the technology would be tried on turbines of this size.

These concerns would be further compounded by the fact that Marsh Landing will be a simple-cycle peaker plant, not a combined-cycle or cogeneration facility like other facilities where EMx™ has been installed. As simple-cycle turbines, the Marsh Landing turbines will have an exhaust temperature that is higher than seen at other facilities that the District is aware of currently using EMx™. The proposed Marsh Landing turbines will operate at temperatures in the range of 750°F to 1000°F, which raises concerns about how easily EMx™ could be applied at Marsh Landing. Furthermore, EMx™ requires steam as part of the catalyst regeneration process. Unlike combined-cycle and cogeneration facilities, simple-cycle facilities like Marsh Landing do not have any steam production. And there is an additional concern involving the damper systems that would be required with EMx™ to ensure proper regeneration gas distribution. Peaker plants require more rapid startups and more frequent load changes than combined-cycle and cogeneration plants, and to the District's knowledge the effectiveness and longevity of these damper systems has not been demonstrated under these conditions.

Given the uncertainties that still remain in understanding how secondary PM formation is impacted by ammonia slip, the significant additional cost that would be necessary to implement EMx™, and the concern that scaling EMx™ up to fit this facility could involve significant implementation problems, the District has concluded that EMx™ should not be required here as a BACT technology. If an applicant proposed the use of EMx™ as BACT for NO_x emissions, then

---

[14] Attachment in an email dated 9/8/08 from Jeff Valmus of Emerachem to Weyman Lee BAAQMD. Please see pdf file, EMx BACT economic analysis (final)-09072008.pdf.

[15] Letter from R. Bell, Air Quality District Manager, Shasta County Air Quality Management District, to R. Bennett, Safety & Environmental Coordinator, Redding Electric Utility, June 23, 2005.

the District would be willing to consider EMx™ as a BACT control technology for gas turbines. However, the District has not found sufficient basis to require it to be used as BACT instead of SCR.

Based on this review, the District has concluded that SCR meets the District's BACT requirement. The proposed project would therefore comply with BACT for NO_x.

Determination of BACT emissions limit for NO_x for Simple-Cycle Gas Turbines

The District is also proposing to establish a BACT emissions limit in the permit of 2.5 ppm (averaged over one hour), which is the most stringent limit that has been achieved in practice at any other similar facility and is the most stringent limit that would be technologically feasible.

To determine the most stringent emissions limit that has been achieve in practice, the District evaluated other similar simple-cycle natural gas fired turbines. Common simple-cycle gas turbine units proposed for use for intermediate peaking and peaking power in California are General Electric LMS-100 gas turbines (100 MW) and LM6000 gas turbines (49 MW). Both of these gas turbines are smaller than the 190 MW capacity of the simple-cycle gas turbines proposed for the proposed Marsh Landing Generating Station, but they operate in a similar fashion and are appropriate for comparison with this facility. Numerous projects have been permitted with the LMS-100 gas turbines. The LM6000 gas turbines have been installed at numerous sites across the State to provide peaking power.

The District reviewed the NO_x emissions limits of power plants using large turbines in a simple-cycle mode abated by SCR systems. The District also reviewed BACT determinations at the EPA RACT/BACT/LAER Clearinghouse, ARB BACT Clearinghouse and recent projects undergoing CEC licensing. Some of the LMS100 simple-cycle gas turbine permits and LM6000 simple-cycle gas turbine permits with NO_x limits are shown in the Table below.

TABLE 7. NO_X EMISSION LIMITS FOR LARGE SIMPLE-CYCLE POWER PLANTS USING SCR

Facility	NO_x (ppmvd @ 15% O_2)
Los Esteros Critical Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	5.0 (3-hr)
Panoche Energy Center, SJVAPCD GE LMS100 Gas Turbines, 100 MW each	2.5 (1-hr)
Walnut Creek Energy Park, SCAQMD GE LMS100 Gas Turbines, 100 MW each	2.5 (1-hr)
Sun Valley Energy Project, SCAQMD GE LMS100 Gas Turbines, 100 MW each	2.5 (1-hr)
CPV Sentinel Energy Project, SCAQMD GE LMS100 Gas Turbines, 100 MW each	2.5 (1-hr)
Lambie Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	2.5 (1-hr)
Riverview Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	2.5 (1-hr)
Wolfskill Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	2.5 (1-hr)
Goosehaven Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	2.5 (1-hr)
San Francisco Electric Reliability Project, BAAQMD GE LM6000 Gas Turbines, 49 MW each	2.5 (1-hr)

Notes: GE LMS100 gas turbines (100 MW) and GE LM6000 gas turbines (49 MW) are smaller than the Marsh Landing simple-cycle gas turbines (190 MW).

As the Table shows, emissions of 2.5 ppm NO_x averaged over 1-hour is the most stringent emission limitation that has been determined to be achievable at any similar facility using SCR for NO_x control.

The District examined only simple-cycle turbines in this review because simple-cycle turbines operate differently than combined-cycle turbines and cannot achieve the same NO_x emissions performance as combined-cycle turbines, which are typically capable of meeting a 2.0 ppm limit. Simple-cycle turbines have higher exhaust gas temperatures than combined-cycle turbines because they do not use a heat recovery steam boiler, which removes some of the heat from the exhaust and reduces the exhaust gas temperature. For this facility, the turbine exhaust temperatures from the simple-cycle turbines will exceed 1000 degrees F, according to the permit application. These high exhaust temperatures can damage a standard SCR catalyst. As a result, simple-cycle turbines must use less-efficient high-temperature SCR catalysts, or must introduce a large amount of dilution air to cool the exhaust if they use a standard SCR catalyst. Both of these approaches lead to less efficient SCR performance as compared to a combined-cycle operation. High-temperature catalysts typically have a lower NO_x conversion efficiency as compared to conventional SCR catalysts operating at a lower operating temperature. These catalysts have NO_x conversion efficiency below 90% at elevated temperatures above 800ºF,[16] whereas standard catalysts have NO_x conversion efficiencies of greater than 90% at 600 to 700ºF.[17] Dilution air fans can be used to cool the exhaust prior to entering the SCR system, but this approach has its own drawbacks. The introduction of dilution air may cool the exhaust into the appropriate temperature window, but there may be exhaust hot spots that lower catalyst NO_x conversion rates. Optimum SCR performance requires uniform temperature profile, flow profile, and NO_x concentration profile across the SCR catalyst face, and introducing large amounts of dilution air disrupts this uniformity. Changing turbine loads also tends to disrupt this uniformity, which makes controlling NO_x more difficult with the simple-cycle peaking turbines proposed for the Marsh Landing facility. The facility will operate in a load-following mode some of the time and this would mean non-steady-state operation where the exhaust temperature, flowrate, and NO_x concentration all vary as the turbine load is changing. For all of these reasons, the District has concluded that the NO_x emissions performance that can be achieved with combined-cycle turbines would not be achievable for simple-cycle turbines. The District has therefore reviewed only simple-cycle turbines in evaluating what emissions limits have been achieved in practice by other facilities. As shown in Table 7, 2.5 ppm is the most stringent emissions limitation that has been achieved by such facilities.

The Air District has therefore determined that 2.5 ppm, averaged over 1-hour, is the BACT emission limit for NO_x for the simple-cycle gas turbines. The Air District is also proposing corresponding hourly, daily and annual mass emissions limits. Compliance with the NO_x permit limits will be demonstrated on a continuous basis using a Continuous Emissions Monitor.

This proposed BACT emissions limit is consistent with the Air District's BACT Guidelines for this type of equipment. District BACT Guideline 89.1.3 does not specify BACT 1 (technologically feasible and cost-effective) for NO_x for a simple-cycle gas turbine with a rated output $\geq$ 40 MW. District BACT Guideline 89.1.3 does specify BACT 2 (achieved in practice) as 2.5 ppmvd @ 15% O_2 averaged over one hour, typically achieved through the use of High Temperature Selective Catalytic Reduction (SCR) with ammonia injection in conjunction with steam or water injection.

Finally, the Marsh Landing Generating Station is capable of quick starts and also rapidly changing loads to meet electrical system needs. The simple-cycle gas turbines will have the ability to change loads at rates exceeding 25 MW per minute. It is difficult for the NO_x control system to respond to these rapid changes in load (greater than 25 MW per minute). Therefore, the District is proposing a transient load condition that would allow the facility to meet an alternate permit limit of 2.5 ppm NO_x averaged over 3 hours for any transient hour with a change in load exceeding 25 MW per minute. Please see Section 5.7 for additional discussion.

[16] BASF, High Temperature SCR for simple-cycle gas turbine applications, 2007.
[17] BASF, NOxCat™ VNX SCR Catalyst for natural gas turbines and stationary engines, 2009.

5.3 Best Available Control Technology for Carbon Monoxide (CO)

Carbon monoxide is a colorless odorless gas that is a product of incomplete combustion. The District is proposing a BACT permit limit of 2.0 ppm CO (averaged over one hour). A 2.0 ppm BACT limit for this facility would be lower than what has been achieved in practice with other similar simple-cycle turbines, and would be the lowest emissions limit that would be technologically feasible and cost-effective. This emissions rate will be achieved through the use of good combustion practices and an oxidation catalyst, which are the most stringent available controls.

The District began its BACT analysis by evaluating the most effective control device and/or technique that has been achieved in practice at similar facilities, or is technologically feasible and cost-effective, pursuant to the District's definition of BACT in Regulation 2-2-206. As with NO_x, the Air District has examined both combustion controls to reduce the amount of carbon monoxide generated and post-combustion controls to remove carbon monoxide from the exhaust stream.

<u>Combustion Controls</u>

Carbon monoxide is formed by incomplete combustion. Incomplete combustion occurs when there is not enough air to fully combust the fuel, and when the air and fuel are not properly mixed due to poor combustor tuning. Maximizing complete combustion by ensuring an adequate air/fuel mixture with good mixing will reduce carbon monoxide emissions by preventing its formation in the first place.

Increasing combustion temperatures can also promote complete combustion, but doing so will increase NO_x emissions due to thermal NO_x formation as described in the previous section. The Air District prioritizes NO_x control over carbon monoxide control because the Bay Area is not in compliance with the federal standards for ozone, which is formed by NO_x emissions reacting with other pollutants in the atmosphere. The Air District therefore does not favor increasing combustion temperatures to control carbon monoxide. Instead, the Air District favors approaches that reduce NO_x to the lowest achievable rate and then optimize carbon monoxide emissions for that level of NO_x emissions.

Good Combustion Practices: The Air District has identified good combustion practices as an available combustion control technology for minimizing carbon monoxide formation during combustion. Good combustion practices utilize "lean combustion" – large amount of excess air – to produce a cooler flame temperature to minimize NO_x formation, while still ensuring good air/fuel mixing with excess air to achieve complete combustion, thus minimizing CO emissions. These good combustion practices can be used with the low-NO_x combustion technology selected for minimizing NO_x emissions (Dry Low-NO_x Combustors).

Post-Combustion Controls

The Air District has also identified two post-combustion technologies to remove carbon monoxide from the exhaust stream.

Oxidation Catalysts: An oxidation catalyst oxidizes the carbon monoxide in the exhaust gases to form CO_2. Oxidation catalysts are a proven post-combustion control technology widely in use on large gas turbines to abate CO and POC emissions.

EMx™: EMx™, described above in the NO_2 discussion, is a multimedia control technology that abates CO and POC emissions as well as NO_x. EMx™ technology uses a catalyst to oxidize carbon monoxide emissions to form CO_2, and is therefore also an oxidation catalyst. However, it is not a stand-alone oxidation catalyst since the EMx™ is also a NO_x reduction device. Hence, it is identified as a device separate from the oxidation catalyst. EMx™ has been demonstrated on a 45 MW Alstom GTX 100 combined-cycle gas turbine at the Redding Electric Municipal Plant in Redding, CA, and the manufacturer has indicated that it could feasibly be scaled up to larger size gas turbines as discussed above in the NO_x BACT analysis. The District is not aware of any EMx™ installations on simple-cycle gas turbines, peaker units, or gas turbines of this size (190 MW).

Oxidation catalysts are capable of maintaining carbon monoxide below 2 ppmvd @ 15% O_2 (1-hour average), depending on load and combustor tuning (as emissions from the gas turbines vary greatly depending on these factors).[18] This is the most effective level of control that can be achieved by post combustion controls. There is no CO emissions data for EMx™ installation on a gas turbine of this size and in peaking service. EMx™ may also be able to achieve CO emissions of 2 ppm for simple-cycle turbines. If an applicant proposed the use of EMx™ as BACT for CO emissions, then the District would be willing to consider EMx™ as a BACT control technology for gas turbines. The Air District has determined that the use of good combustion practices and the use of an Oxidation Catalyst is BACT for simple-cycle gas turbines.

Based on the foregoing analysis, the Air District has determined that the proposed combination of good combustion practices to reduce the formation of carbon monoxide during combustion and an oxidation catalyst to remove carbon monoxide from the gas turbines exhaust satisfies the BACT requirement.

---

[18] Please see the BASF Quote supplied by URS Corporation dated May 29, 2009. Quote is for combined-cycle turbines and indicates CO may be controlled to below 2 ppm for catalyst bed size or 0.9 ppm for another bed size. District believes that the 2.0 ppm level of control may be technically feasible for simple-cycle gas turbines. It is not known if 0.9 ppm level of control is possible for simple-cycle gas turbines (back pressure issues are possible). See discussion of whether 0.9 ppm limit would be cost effective in the Section below.

Determination of BACT Emissions Limit for Carbon Monoxide (CO) for Simple-Cycle Gas Turbines

The District is also proposing a CO BACT limit of 2.0 ppm, which is more stringent than what has been achieved in practice at other similar simple-cycle facilities and is the most stringent limit that is technologically feasible and cost-effective.

To establish what level of emissions performance has been achieved in practice for this type of facility, the Air District reviewed the CO emissions limits of other large simple-cycle power plants using oxidation catalyst systems. As with the NO_x comparison set forth in Table 7 above, the District reviewed BACT determinations for CO at the EPA RACT/BACT/LAER Clearinghouse, ARB BACT Clearinghouse and recent projects undergoing CEC licensing.

TABLE 8. CO EMISSION LIMITS FOR LARGE SIMPLE-CYCLE POWER PLANTS USING OXIDATION CATALYSTS

Facility	**CO (ppmvd @ 15% O_2)**
Panoche Energy Center, SJVAPCD GE LMS100 Gas Turbines, 100 MW each	6 (3-hr)
Walnut Creek Energy Park, SCAQMD GE LMS100 Gas Turbines, 100 MW each	6 (1-hr)
Sun Valley Energy Project, SCAQMD GE LMS100 Gas Turbines, 100 MW each	6 (1-hr)
CPV Sentinel Energy Project, SCAQMD GE LMS100 Gas Turbines, 100 MW each	6 (1-hr)
Lambie Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	6 (3-hr)
Riverview Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	6 (3-hr)
Wolfskill Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	6 (3-hr)
Goosehaven Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	6 (3-hr)
Los Esteros Critical Energy Facility, BAAQMD GE LM6000 Gas Turbines, 49 MW each	4 (3-hr)
San Francisco Electric Reliability Project, BAAQMD GE LM6000 Gas Turbines, 49 MW each	4 (3-hr)

CO permit limit of 4 ppm was the lowest for a simple-cycle gas turbine abated by an oxidation catalyst. The District therefore determined that 4 ppm (3-hour average) is the most stringent emission limitation that has been achieved in practice for this type of facility.

These BACT emissions rates are consistent with the District's BACT Guidelines for this type of equipment. District BACT Guideline 89.1.3 specifies BACT 2 (achieved in practice) for CO for simple-cycle gas turbines with a rated output of $\geq$ 40 MW as a CO emission concentration of $\leq$ 6.0 ppmvd @ 15% O_2 and the use of an oxidation catalyst. This BACT specification is based upon several GE LM6000 gas turbine permits in the Bay Area. BACT 1 (technologically feasible/cost-effective) is currently not specified.

The District also considered whether it would be technically feasible and cost-effective to require the proposed facility to meet an emission limit below the 4.0 ppm that has been achieved by other similar facilities. The District has concluded that the facility should be able to achieve a limit of 2.0 ppm (averaged over one hour), which is consistent with what combined-cycle facilities can typically achieve. As previously discussed, the simple-cycle gas turbines utilize dry low NO_x combustors and are very similar to many combined cycle gas turbines projects. The primary difference is the lack of a heat recovery steam generator and the higher stack exhaust temperatures. The SCR performance may be negatively impacted by the higher exhaust temperatures, but the oxidation catalyst performance will be not be adversely impacted by the higher exhaust temperatures. The 5000 F simple-cycle gas turbines are therefore expected to be able to meet a 2.0 ppm CO permit limit that many combined cycle plants throughout the nation meet.

The District then considered whether it would be technically feasible and cost-effective to require the proposed facility to meet an emission limit below the 2.0 ppm achieved for combined-cycle facilities. The District found that although it may be technically feasible to do so, it would not be cost-effective to do so under the District's BACT cost-effectiveness guidelines given the large costs involved. Additionally, a larger catalyst capable of meeting a CO permit limit below 2 ppm may have other implementation problems such as a high back pressure which could adversely impact turbine operating performance and efficiency.

The Air District evaluated information from the applicant on the costs[19] and emissions reduction benefits of installing a larger oxidation catalyst capable of consistently maintaining emissions below 0.9 ppm. Based on these analyses, the cost of achieving a 0.9 ppm permit limit would be an additional $68,500 per year (above what it would cost to achieve a 2.0 ppm limit), and the additional reduction in CO emissions would be approximately 4.3 tons per year, making an incremental cost-effectiveness value of over $15,900 per ton of additional CO reduction.[20] Moreover, the total cost of achieving a 0.9 ppm CO limit (as opposed to the incremental costs of going from 2.0 ppm to 0.9 ppm) would be over $387,200 per year, and the total emission reductions of a 0.9 ppm limit would be 31.7 tons per year, resulting in a total (or "average") cost effectiveness value of over $12,200.[21] Based on these high costs (on a per-ton basis) and the relatively little additional CO emissions benefit to be achieved (on a per-dollar basis), requiring a 0.9 ppm CO permit limit cannot reasonably be justified as a BACT limit. Requiring controls to meet a 0.9 ppm limit would be far more expensive, on a per-ton basis, than what other similar facilities are required to achieve. The Air District has not adopted its own cost-effectiveness

[19] Please see the BASF Quote supplied by URS Corporation dated May 29, 2009.
[20] *See* Spreadsheet, CO Incremental 031610 BASF, prepared by Brian Lusher BAAQMD.
[21] *See* Spreadsheet, CO Average 031610 BASF, prepared by Brian Lusher, BAAQMD.

guidelines for CO,[22] but a review of other districts in California found none that consider additional CO controls appropriate as BACT where the total (average) cost-effectiveness will be greater than $400 per ton, or where the incremental cost-effectiveness will be over $1,150 per ton.[23]

The District has therefore determined that BACT for CO for this facility is the use of good combustion practice with abatement by an oxidation catalyst, and a permit limit of 2 ppmvd @ 15% O_2 averaged over 1-hour. This proposed BACT limit for CO is based on a review of the feasible BACT CO control technologies, a review of comparable permit limits for simple-cycle gas turbines, and the fact that CO emissions from a utility-scale simple-cycle gas turbine equipped with dry low NO_x combustors should be equivalent to a similar utility-scale combined-cycle gas turbine. The proposed 2 ppmvd @ 15% O_2 permit limit for CO is the lowest that the District is aware of for a simple-cycle gas turbine. CO exhaust gas concentrations will be continuously monitored by a continuous emissions monitor while the turbines are in operation.

5.4 Best Available Control Technology for Precursor Organic Compounds (POC)

The Precursor Organic Compound (POC) emissions from the simple-cycle gas turbines are subject to District BACT requirements since the potential to emit exceeds 10 pounds POC per highest day. The emissions of POC from combustion sources are products of incomplete combustion like CO emissions. Emissions control techniques for CO are also applicable to POC emissions from combustions sources. The appropriate BACT control device or technique for CO is therefore also the BACT control device or technique for POC.

The Air District has reviewed the available control technologies in the BACT analysis for CO (equally applicable to POC) and determined that good combustion practice and abatement using an oxidation catalyst are the BACT technologies for controlling POC from the proposed simple-cycle combustion turbines at Marsh Landing.

There currently is no BACT 1 (technologically feasible/cost-effective) specification for POC for the simple-cycle turbines in the District BACT guidelines. Currently, District BACT Guideline 89.1.3 specifies BACT 2 (achieved in practice) for POC for simple-cycle gas turbines with an output rating $\geq$ 40 MW as 2.0 ppmv, dry @ 15% O_2, which is typically achieved through the use of an oxidation catalyst. This is based upon several LM6000 gas turbine permits which were

[22] Bay Area Air Quality Management District Best Available Control Technology (BACT) Guideline, § 1, Policy and Implementation Procedure, available at: http://hank.baaqmd.gov/pmt/bactworkbook/default.htm.

[23] *Cf.* South Coast Air Quality Management District, *Best Available Control Technology Guidelines*, August 17, 2000, revised July 14, 2006, pg. 29; available at: www.aqmd.gov/bact Part A - Policy and Procedures for Major Polluting Facilities; Memorandum, David Warner, Director of Permit Services, to Permit Services Staff, Subject: "Revised BACT Cost Effectiveness Thresholds", May 14, 2008; available at: www.valleyair.org/busind/pto/bact/bactidx.htm May 2008 updates to BACT cost effectiveness thresholds (Final Staff Report).

originally permitted with a POC emission limits in pound per hour or pounds per million Btu equivalent to 2.0 ppmvd @ 15% O_2.

The District then evaluated what the appropriate BACT emission limit should be for POC. The District reviewed permit limits from similar facilities, as summarized in **Table 9**.

TABLE 9. POC EMISSION LIMITS FOR LARGE SIMPLE-CYCLE GAS TURBINES

Facility	**POC (ppmvd @ 15% O_2)**
Panoche Energy Center, SJVAPCD GE LMS100 Gas Turbines, 100 MW each	2 (3-hr)
Walnut Creek Energy Park, SCAQMD GE LMS100 Gas Turbines, 100 MW each	2 (1-hr)
Sun Valley Energy Project, SCAQMD GE LMS100 Gas Turbines, 100 MW each	2 (1-hr)
CPV Sentinel Energy Project, SCAQMD GE LMS100 Gas Turbines, 100 MW each	2 (1-hr)
Lambie Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	2 (1-hr)
Riverview Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	2 (1-hr)
Wolfskill Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	2 (1-hr)
Goosehaven Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	2 (1-hr)
Los Esteros Critical Energy Facility, BAAQMD GE LM6000 Gas Turbines, 49 MW each	2 (1-hr)
San Francisco Electric Reliability Project, BAAQMD GE LM6000 Gas Turbines, 49 MW each	2 (1-hr)

The Air District has reviewed the POC permit emissions limits for similar facilities shown in Table 9 and determined that 2.0 ppm is the lowest emissions limit that has been achieved in practice for a utility-scale simple-cycle gas turbine abated by an oxidation catalyst.

The District then considered whether a lower limit below 2.0 ppm would be feasible at this facility. The District expects the Marsh Landing simple-cycle units that are equipped with dry low NO_x combustors and are abated by an oxidation catalyst to meet the same limits as many new combined-cycle gas turbine projects. The District has determined that a POC emissions limit corresponding to 1 ppmvd @ 15% O_2 averaged over one hour is the most stringent BACT permit limit applied to a simple-cycle gas turbine. The simple-cycle gas turbines will be limited to 2.9 lb/hour or 0.00132 lb/MMBtu in the permit conditions; these values correspond to 1 ppmvd @ 15% O_2.

The Air District has therefore determined that BACT for the simple-cycle gas turbines for POC is the use of good combustion practice and abatement with an oxidation catalyst to achieve a permit limit for each gas turbine of 2.9 lb per hour or 0.00132 lb/MMBtu.

5.5 Best Available Control Technology for Particulate Matter (PM)

For emissions of particulate matter (PM), the District is proposing to require Dry Low-NO_x Combustors, the use of PUC-quality low-sulfur natural gas, and good combustion practices as BACT control technologies. The District is also proposing a BACT PM emissions limit of 9.0 lb/hr, which corresponds to an emission rate of 0.0041 pounds per MMBtu of natural gas burned (lb/MMBtu). This emissions limit is based on a review of permit limits and emissions data from other similar simple-cycle natural gas fired combustion turbines. The District's proposed BACT determination is explained below.[24]

Control Technology Review:

As with the other pollutants addressed above, control technologies for PM can be grouped into two categories: (1) combustion controls, and (2) post-combustion controls.

Combustion Controls

- **Good Combustion Practice:** The Air District has identified good combustion practices as an available combustion control technology for minimizing unburned hydrocarbon formation during combustion. Good combustion will ensure proper air/fuel mixing to achieve complete combustion, thus minimizing emissions of unburned hydrocarbons that can lead to formation of PM at the stack.

- **Clean-burning fuels:** The use of clean-burning fuels, such as natural gas that has only trace amounts of sulfur that can form particulates, will result in minimal formation of PM during combustion. The use of natural gas is commercially available and demonstrated for the Marsh Landing Generating Station gas turbines.

[24] This facility is subject to BACT requirements for PM_{10} only. $PM_{2.5}$, a subset of PM_{10}, is regulated under federal requirements in 40 C.F.R. Section 52.21 (PSD) and 40 C.F.R. Part 51, Appendix S (Non-Attainment NSR). The facility is not subject to PSD or $PM_{2.5}$ Non-Attainment NSR permit requirements under Section 52.21 or Appendix S because the facility is not a "major facility" for the purposes of these regulations. The District is therefore not conducting a PSD permitting analysis or an Appendix S permitting analysis for $PM_{2.5}$. For a detailed discussion of the applicability of these federal requirements for $PM_{2.5}$, see Section 7 below. The District notes, however, that for combustion turbines essentially all of the PM emissions are less than one micron in diameter, so it is both PM_{10} and $PM_{2.5}$. (*See* AP-42, Table 1.4-2, footnote c, 7/98 (available at www.epa.gov/ttnchie1/ap42/ch01/final/c01s04.pdf). Moreover, the same emissions control technologies that will be effective for PM_{10} for this facility will also be similarly effective for $PM_{2.5}$. The District's BACT analysis and emissions limit for PM_{10} will also therefore effectively be a BACT limit on $PM_{2.5}$ emissions as well, even though the facility is not subject to the federal $PM_{2.5}$ BACT requirements as discussed in Section 7.

- **Dry Low-NO_x Combustor:** The use of a Dry Low-NO_x Combustor provides efficient combustion to ensure complete combustion thereby minimizing the emissions of unburned fuel that can form condensable PM. Dry Low-NO_x Combustors are in wide use on utility scale natural gas fired gas turbines.

<u>Post-Combustion Controls</u>

- **Electrostatic precipitators:** Electrostatic precipitators are used on solid fuel boilers and incinerators to remove PM from the exhaust. Electrostatic precipitators use a high-voltage direct-current corona to electrically charge particles in the gas stream. The suspended particles are attracted to collecting electrodes and deposited on collection plates. Particles are collected and disposed of by mechanically rapping the electrodes and plates and dislodging the particles into collection hoppers.

- **Baghouses:** Baghouses are used to collect PM by drawing the exhaust gases through a fabric filter. Particulates collect on the outside of filter bags that are periodically shaken to release the particulates into hoppers.

Good combustion practice, clean-burning fuels, and Dry Low-NO_x Combustors are common control devices/techniques that are technically feasible for simple-cycle natural gas fired combustion turbines and are often used to control emissions from sources of this type. The District has therefore determined that these technologies are achieved-in-practice and are technically feasible and cost-effective for the Marsh Landing project.

With respect to the add-on controls – electrostatic precipitators and baghouses – these control devices are not achieved-in-practice for natural gas fired combustion turbines and are not technically feasible here. These devices are normally used on solid-fuel fired sources or others with high PM emissions, and are not used in natural gas fired applications which have inherently low PM emissions. The District is not aware of any natural gas fired combustion turbine that has ever been required to use add-on controls such as these. The District also reviewed the EPA BACT/LAER Clearinghouse and confirmed that EPA has no record of any post-combustion particulate controls that have been required for natural gas fired gas turbines. The District has therefore determined that these control devices are not achieved-in-practice for purposes of the BACT analysis.

The District has also determined that these devices would not be technologically feasible/cost-effective here, for similar reasons. If add-on control equipment was installed it would create significant back pressure that would significantly reduce the efficiency of the plant and would cause more emissions per unit power produced. Moreover, these devices are designed to be applied to emissions streams with far higher particulate emissions, and they would have very little effect on the low-PM emissions streams from this facility in further reducing PM emissions.[25] It takes an emissions stream with a much higher grain loading for these types of

---

[25] For example, if a baghouse were installed on the turbines, the turbine exhaust at the *inlet* to the baghouse would contain less PM than is normally seen in baghouse *output*, after abatement. PM

abatement devices to operate efficiently. This low level of abatement efficiency (if any) also means that these types of control devices would not be cost-effective, even if they could feasibly be applied to this type of source. For all of these reasons, post-combustion particulate control equipment is not technologically feasible/cost effective for the proposed Marsh Landing turbines.

The District has therefore determined that low-sulfur natural gas and Dry Low-NO_x combustors with Good Combustion Practice are the BACT control technologies for the proposed Marsh Landing facility. For low-sulfur fuel, the highest quality commercially available natural gas is natural gas that meets the California Public Utilities Commission (PUC) regulatory standard of less than 1.0 grains of sulfur per 100 scf. This PUC standard is maximum sulfur content at any point in time.[26] The Air District is therefore proposing a BACT limit for fuel sulfur content of 1.0 grains of sulfur per 100 scf for maximum daily emissions.

This proposed BACT determination is consistent with guidance from the California Air Resources Board in setting BACT for natural gas fired gas turbines.[27] This proposed BACT determination is also consistent with District BACT Guideline 89.1.3, which specifies BACT for PM_{10} for simple-cycle gas turbines with rated output of $\geq$ 40 MW as the exclusive use of clean-burning natural gas with a maximum sulfur content of $\leq$ 1.0 grains per 100 scf.

Determination of Applicable PM BACT Emissions Limitation:

The District's BACT regulations require the District to implement BACT either as a control device or technique (Regulation 2-2-206.1 and 2-2-206.3) or as an emission limitation (Regulation 2-2-206.3 and 2-2-206.4). Here, in addition to the determination of what control devices/techniques are BACT for this proposed facility, the District is also proposing to implement a numerical PM BACT emission limitation based on the most stringent emission limitation achieved for a natural gas fired simple-cycle combustion turbine facility such as this one pursuant to District Regulation 2-2-206.2. The District is proposing a PM emissions limit of 9.0 lb/hr, which corresponds to 0.0041 lb/MMBtu of natural gas burned. This limit also corresponds to emissions of 216 pounds per day (per turbine), and 0.0023 grains per dry standard cubic foot (6% O_2) or 0.00092 grains per dry standard cubic foot (15% O_2). This proposed emissions limit would be more stringent than any other PM emission limitation achieved in practice by any other similar natural gas fired simple-cycle combustion turbine source.

---

emissions from a baghouse are normally in the range 0.0013 to 0.01 grains per standard cubic foot (*see BAAQMD BACT/TBACT Workbook*, Section 11: Miscellaneous Sources), whereas PM emissions from the proposed Marsh Landing turbines would be 0.00092 gr/dscf (@ 15% O_2).

[26] The 1.0 grain per 100 scf PUC standard is the maximum sulfur content of the gas at any point in time. The actual average content is expected to be less than 0.25 grains per 100 scf. The District has based its calculations of annual emissions on this 0.25 grain per 100 scf average sulfur content. Note that a portion of the sulfur contained in natural gas is intentionally added as an odorant to allow for the detection of leaks which would be a safety concern.

[27] Guidance for Power Plant Siting and Best Available Control Technology, California Air Resources Board, Stationary Source Division, September 1999, pg. 34.

To evaluate whether this proposed limit satisfies the BACT requirement, the District compared it with emission limits and performance data from other natural gas fired simple-cycle combustion turbines. **Table 10** below presents PM permit limits for projects similar to the simple-cycle gas turbines proposed for the Marsh Landing Project in descending order by emission rate in lb/MMBtu. Please note that many of the projects in Table 10 are for turbines that are 100 MW or smaller in size. These projects have lower emissions rates in terms of pounds per hour because of their smaller size. To provide a meaningful comparison with the proposed Marsh Landing facility, whose gas turbines would be 190 MW, Table 10 lists the facilities' emissions limits in lb/MMBtu.

TABLE 10. RECENT BACT PM_{10} PERMIT LIMITS FOR LARGE SIMPLE-CYCLE GAS TURBINES

Facility	**PM_{10} (lb/hr)**	**Size (MMBtu/hr)**	**PM_{10} (lb/MMBtu)**
CPV Sentinel Energy Project, SCAQMD GE LMS100 Gas Turbines, 100 MW each	6.0	875.7	0.0069
Panoche Energy Center, SJVAPCD GE LMS100 Gas Turbines, 100 MW each	6.0	909.7	0.0066
Walnut Creek Energy Park, SCAQMD GE LMS100 Gas Turbines, 100 MW each	6.0	904	0.0066
Sun Valley Energy Project, SCAQMD GE LMS100 Gas Turbines, 100 MW each	6.0	904	0.0066
Lambie Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	3.0	500	0.0060
Riverview Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	3.0	500	0.0060
Wolfskill Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	3.0	500	0.0060
Goosehaven Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	3.0	500	0.0060
Gilroy Energy Center, BAAQMD GE LM6000 Gas Turbines, 49 MW each	2.5	467.6	0.0053
Los Esteros Critical Energy Facility, BAAQMD GE LM6000 Gas Turbines, 49 MW each	2.5	472.6	0.0053
San Francisco Electric Reliability Project, BAAQMD GE LM6000 Gas Turbines, 49 MW each	2.5	487.3	0.0051
Renaissance Power LLC, MI-0267, Westinghouse 501F Gas Turbines, 215 MW each	9.0	1900 to 2107	0.0043 to 0.0047
Proposed Marsh Landing Generating Station, BAAQMD, Siemens SGT6-5000F Gas Turbines, 190 MW each	9.0	2202	0.0041

Notes: 1. Renaissance Power has a nominal capacity of 1900 MMBtu/hour, which gives an emission rate of 0.0047 lb/MMBtu. The facility is located in Michigan, however, and at times it operates in very cold temperatures. It therefore has a maximum firing rate at -5°F of 2107 MMBtu/hour, which gives an emission rate of 0.0043. The Marsh Landing facility will be located near Antioch, which will not experience such extreme operating conditions.

2. Please note the lb/MMBtu values are not the permit limits and simply allow comparison of limits for different sized units.

3. All of these projects except Renaissance Power are abated by an oxidation catalyst and an SCR system.

Based on this review of permit limits for similar simple-cycle natural gas fired turbines, the District has determined that no facility has achieved a permit limit that is more stringent than the 9.0 lb/hr limit the District is proposing here, which corresponds to 0.0041 lb/MMBtu.

The District also reviewed PM source test data for a number of comparable facilities. The first data set is for GE LM6000 simple-cycle gas turbines abated by an oxidation catalyst and SCR and is shown in the Table below. The second data set is for the Renaissance Power[28] facility, which utilizes Westinghouse 501F simple-cycle gas turbines with no oxidation catalyst or SCR abatement equipment.

[28] Please see file, Ren Power stack test.pdf. File contains letter to Ms. April Lazzaro of Michigan DEQ dated February 7, 2008 from Renaissance Power, LLC regarding 2007 stack testing results.

TABLE 11. SUMMARY OF GENERAL ELECTRIC LM-6000 SIMPLE-CYCLE GAS TURBINE PARTICULATE EMISSIONS DATA.

Facility	Test Date	Source	PM lb/hour	PM FH lb/hour	PM BH lb/hour	Front %	Back %	Reported PM lb/MMBtu
Creed Energy Center	1/31/2003	S-1	2.18	1.05	1.13	48.2	51.8	0.0047
Creed Energy Center	7/6/2006	S-1	1.363	0.553	0.81	40.6	59.4	0.0028
Creed Energy Center	5/7/2009	S-1	0.6746	0.1948	0.4798	28.9	71.1	0.0012
Lambie Energy Center	1/16/2003	S-1	1.9	0.56	1.34	29.5	70.5	0.0042
Lambie Energy Center	5/5/2006	S-1	2.104	1.429	0.674	67.9	32.0	0.0039
Lambie Energy Center	5/11/2009	S-1	0.83	0.3488	0.4807	42.0	57.9	0.0016
Los Esteros Energy	7/26-7/27/05	S-1	2.266	1.016	1.25	44.8	55.2	0.0042
Los Esteros Energy	7/26-7/27/05	S-2	0.896	0.363	0.533	40.5	59.5	0.0016
Los Esteros Energy	7/28/2005	S-3	1.44	0.578	0.862	40.1	59.9	0.0025
Los Esteros Energy	7/27-7/29/05	S-4	0.915	0.326	0.589	35.6	64.4	0.0016
Los Esteros Energy	9/8/2006	S-1	0.775	0.307	0.468	39.6	60.4	0.0015
Los Esteros Energy	9/8/2006	S-2	0.871	0.331	0.54	38.0	62.0	0.0015
Los Esteros Energy	9/6-9/7/06	S-3	1.805	0.398	1.407	22.0	78.0	0.0033
Los Esteros Energy	9/6-9/7/06	S-4	0.904	0.318	0.586	35.2	64.8	0.0017
Los Esteros Energy	7/25-7/26/07	S-1	1.672	0.967	0.705	57.8	42.2	0.0030
Los Esteros Energy	7/25-7/26/07	S-2	1.429	0.541	0.888	37.9	62.1	0.0025
Los Esteros Energy	7/24-7/25/07	S-3	1.456	0.666	0.79	45.7	54.3	0.0025
Los Esteros Energy	7/24-7/25/07	S-4	1.646	0.973	0.673	59.1	40.9	0.0027
Los Esteros Energy	5/29-5/30/07	S-1	1.4145	0.6957	0.7189	49.2	50.8	0.0026
Los Esteros Energy	5/28-5/29/07	S-2	0.9769	0.3191	0.6578	32.7	67.3	0.0018
Los Esteros Energy	5/28-5/29/07	S-3	1.49	0.4393	1.0555	29.5	70.8	0.0027
Los Esteros Energy	5/29-5/30/07	S-4	2.21	1.345	0.8629	60.9	39.0	0.0041
Los Esteros Energy	5/13/2009	S-1	1.16	0.4811	0.68	41.5	58.6	0.0020
Los Esteros Energy	5/14-5/15/09	S-2	0.969	0.4702	0.4983	48.5	51.4	0.0018
Los Esteros Energy	5/14-5/15/09	S-3	0.864	0.4082	0.4561	47.2	52.8	0.0016
Los Esteros Energy	5/13-5/14/09	S-4	1.04	0.3226	0.7186	31.0	69.1	0.0019
Riverview	5/8/2009	S-1	1.469	0.789	0.68	53.7	46.3	0.0030
Wolfskill	6/2/2004	S-1	2.15	1.3	0.85	60.5	39.5	0.0047
Wolfskill	7/5/2006	S-1	1.9	0.582	1.319	30.6	69.4	0.0034
Wolfskill	5/4/2009	S-1	0.81	0.29	0.52	35.8	64.2	0.0010
Gilroy Energy Center	7/19/2005	S-3	1.9					0.0029
Gilroy Energy Center	7/21/2005	S-4	1.7					0.0022
Gilroy Energy Center	7/21/2005	S-5	1					0.0016
Gilroy Energy Center	5/23/2006	S-3	1.69					0.0020
Gilroy Energy Center	5/24/2006	S-4	0.95					0.0010
Gilroy Energy Center	5/22/2006	S-5	1.41					0.0020
Gilroy Energy Center	5/23/2007	S-3	1.6	0.6132	0.9856	38.3	61.6	0.0030
Gilroy Energy Center	5/24/2007	S-4	1.25	0.5443	0.7016	43.5	56.1	0.0019
Gilroy Energy Center	5/25/2007	S-5	1.6	0.6769	0.9193	42.3	57.5	0.0027
Goosehaven	1/23/2003	S-1	2.44					0.0047
Goosehaven	7/6/2006	S-1	2.438	1.327	1.112	54.4	45.6	0.0040
Goosehaven	5/6/2009	S-1	0.9716	0.1481	0.8235	15.2	84.8	0.0017
							Average	0.0026
							Maximum	0.0047

Notes: All of these facilities use an oxidation catalyst to reduce CO emissions and an SCR system to reduce NO_x emissions, as the proposed Marsh Landing facility will.

TABLE 12. SUMMARY OF RENAISSANCE POWER SIMPLE-CYCLE GAS TURBINE PARTICULATE EMISSIONS DATA.

Unit	Test Date	Particulate Emissions (lb/hour)	Reported Particulate Emissions (lb/MMBtu)
Turbine 1	7/10/07	7.91	0.0044
Turbine 2	7/16/07	8.04	0.0044
Turbine 3	8/1/07	6.19	0.0035
Turbine 4	7/18/07	6.58	0.0037

Notes: Renaissance Power has higher NO_x and CO limits and is not equipped with this abatement equipment. That facility can therefore achieve slightly lower PM emissions, as the abatement equipment can result in additional PM emissions as discussed below. The proposed PM emissions limit for Marsh Landing is consistent with the Renaissance facility, even with these PM emissions advantages for Renaissance.

The data from these facilities shows that PM emissions from sources of this type can be highly variable. Although in many cases turbines of this type will emit less than 0.0041 lb/MMBtu of PM. The data shows that it would not be possible to impose a limit below 9.0 lb/hr for the Marsh Landing project (corresponding to 0.0041 lb/MMBtu). The facility would not be able to consistently meet a permit limit below 9.0 lb/hr for PM as an enforceable not-to-exceed permit limit. The District therefore concludes that better emissions performance has not been achieved in practice or shown to be technically feasible for this type of equipment.

Finally, the District also evaluated recently-permitted combined-cycle facilities, some of which have been permitted with limits below 9.0 lb/hr and below the 0.0041 lb/MMBtu emissions rate that this limit corresponds to. In particular, the District has recently issued a federal "Prevention of Significant Deterioration" (PSD) permit with a BACT limit of 7.5 lb/hr for the Russell City Energy Center, a 600-MW combined-cycle natural gas fired facility. The 7.5 lb/hr PSD BACT limit the District established for Russell City corresponds to an emissions rate of 0.0034 lb/MMBtu, which is lower than the proposed limit here which corresponds to 0.0041 lb/MMBtu.[29]

The District has concluded that simple-cycle turbines of the type that will be used at the proposed Marsh Landing facility cannot achieve PM emissions as low as combined-cycle turbines such as those used at Russell City and other similar facilities, for several reasons. Simple-cycle turbines have a higher exhaust temperature than combined-cycle turbines, which use a heat recovery boiler to recover some of the waste heat in the turbine exhaust in order to generate additional power. In order for the Marsh Landing to use a standard SCR catalyst, the facility must use dilution air to cool the gas turbine exhaust prior to abatement by the oxidation

[29] *See* Russell City Energy Center PSD Permit (2/4/2010) Condition Part 19(h) available at: www.baaqmd.gov/Home/Divisions/Engineering/Public%20Notices%20on%20Permits/2010/020410%2015487/Russell%20City%20Energy%20Center.aspx.

catalyst and SCR. It should be noted that even with the large amount of dilution air that is added to the exhaust prior to abatement, the catalyst temperatures are still significantly higher for the simple-cycle units when compared to combined cycle units.

This difference impacts the amount of PM emitted in the exhaust stream in two ways. First, the dilution air that is added to the exhaust may contain a certain amount of entrained PM, and this PM is ultimately emitted in the exhaust at the outlet of the abatement equipment. The applicant has indicated that it will need to add up to 2.1 million pounds per hour of dilution air, which could add significant amounts of PM to the system exhaust.

Second, the higher exhaust temperatures seen by the oxidation catalyst and SCR system in simple-cycle facilities cause more PM to be formed in the abatement equipment compared with lower-temperature combined-cycle facilities. Data supplied by the applicant's catalyst vendors indicates that the increased catalyst temperatures may cause the conversion of SO_2 to SO_3 in the exhaust stream to increase from 5 to 10 percent for typical combined-cycle exhaust temperatures to as much as 40 to 50 percent for a simple-cycle system with dilution air for exhaust cooling.[30] This additional SO_3 will then convert to H_2SO_4 or ammonium sulfate salts, which add to the mass of particulate matter contained in the facility's exhaust stream. For both of these reasons, PM emissions from simple-cycle turbines equipped with oxidation catalysts and SCR systems for NO_x and CO control will inherently have higher PM emissions than combined-cycle turbines. This additional PM can have a substantial impact on PM emissions relative to the PM that is generated by combustion of natural gas in the turbine, since clean-burning natural gas generates very little PM by itself.

The impact of these differences between simple-cycle and combined-cycle turbines can be seen in test data from the different types of equipment. As summarized in Table 11 above, 8 out of the 42 source test results for GE LM6000 simple-cycle turbines show PM emissions that would exceed the 0.0034 lb/MMBtu emissions rate used in establishing the Russell City Energy Center permit limit. Such an emissions rate would not be achievable for the simple-cycle Marsh Landing turbines, and the District has concluded that it is not achieved in practice for purposes of the PM BACT analysis.

In summary, the District has determined that the use of low sulfur natural gas and Dry Low-NO_x combustors with Good Combustion Practice is BACT for PM. The District is also proposing a PM BACT emissions limit of 9.0 lb/hour, based on a review of permit limits and source test data from other simple-cycle gas turbines.

5.6 Best Available Control Technology for Sulfur Dioxide (SO_2)

The potential emissions of SO_2 from the simple-cycle gas turbines exceed 10 lb per highest day for each turbine. These sources are therefore subject to District BACT requirements for SO_2.

[30] Memorandum from Applicant to the District dated February 3, 2010, Subject: Revised Analysis of Expected Sulfate Formation at MLGS (See PM White Paper for BAAQMD 020310).

There are two primary mechanisms used to reduce SO_2 emissions from combustion sources: (i) reduce the amount of sulfur in the fuel, and (ii) remove the sulfur from the combustion exhaust gases.

Limiting the amount of sulfur in the fuel is a common practice for natural gas fired power plants. Such plants in California are typically required to combust only California PUC grade natural gas with a sulfur content of less than 1 grain per 100 standard cubic feet (scf). This control technique has been achieved in practice at other facilities, and it is technologically feasible and cost-effective. The District is therefore proposing to require the use of PUC-grade natural gas with a sulfur content of less than 1 grain/100 scf as a BACT control technique for SO_2.

Add-on controls that remove sulfur from the combustion exhaust, such as flue gas desulfurization, are not feasible for natural gas fired power plants and have not been used at such facilities. These types of control devices are typically installed on coal fired power plants that burn fuels with much higher sulfur contents. There are two main types of SO_2 post-combustion control technologies: wet scrubbing and dry scrubbing. Wet scrubbers use an alkaline solution to remove the SO_2 from the exhaust gases and may remove up to 90% of the SO_2 from the exhaust stream. Dry scrubbers use an SO_2 sorbent injected as a powder or slurry to remove the SO_2 and the SO_2 and sorbent are removed by a particulate control device. The abatement efficiencies vary with different types of dry scrubbing technologies, but are generally lower than efficiencies for wet scrubbing technologies. These technologies are not feasible for combustion sources burning low sulfur content natural gas. The SO_x concentrations in the natural gas combustion exhaust gases are too low (less than 1 ppm) for the scrubbing technologies to work effectively or be technologically feasible and cost effective. These control technologies require much higher sulfur concentrations in the combustion exhaust gases to become feasible as a control technology. For this reason, they have not been used at natural gas fired power plants such as the proposed Marsh Landing facility. As these control technologies have not been achieved in practice at other similar facilities and are not technologically feasible here, the District is not proposing to require them as BACT for this facility.

Fuel sulfur limits are therefore the only feasible SO_2 control technology for natural gas combustion sources, and the District is proposing to require this technology as BACT. The District is proposing BACT permit limits based on the PUC natural gas specification of a maximum of 1 grain of sulfur per 100 scf of natural gas. The permit limits are based on maximum sulfur content of the fuel and are expressed in units of pounds per hour, pounds per unit of natural gas burned (MMBtu), and pounds per day of SO_2. The emission calculations are shown in the Appendix A.

This proposed BACT determination is consistent with the District's BACT Guidelines for SO_2. District BACT Guideline 89.1.3 specifies BACT 2 ("achieved in practice") for SO_2 for simple-cycle gas turbines with an output rating of $\geq$ 40 MW as the exclusive use of clean-burning natural gas with a sulfur content of $\leq$ 1.0 grains per 100 scf.

5.7 Best Available Control Technology For Startups, Shutdowns, Combustor Tuning, and Transient Load Conditions

Startup and shutdown periods are a normal part of the operation of natural gas-fired power plants. They involve emissions rates that are greater than emissions during steady-state operation and that are highly variable. Emissions are greater during startup and shutdown for several reasons. One reason is that during startup and shutdown, the turbines are not operating at full load where they are most efficient. Another reason is that the exhaust temperatures are lower than during steady-state operations. Post-combustion emissions control systems such as the SCR catalyst and oxidation catalyst do not function optimally at lower temperatures, and so there may be partial or no abatement for NO_x, carbon monoxide and precursor organic compounds for a portion of the startup period.[31] Thus, emissions can be minimized by reducing the duration of the startup sequence and by reducing emissions during the startup sequence.

Simple-cycle turbines have inherently low startup emissions because they can quickly come up to full load. This is one reason that they are used to provide peaking load duty with the capability to rapidly accelerate to synchronous speed, synchronize with the grid, ramp up to 100 percent load, and then down to zero load. Simple-cycle turbines are different in this respect than combined-cycle turbines, which incorporate a heat-recovery steam boiler that recovers some of the waste heat in the turbine exhaust to create steam to generate additional power. The combined-cycle system requires additional steam-generating components, and it takes additional time for this equipment to come up to full operating temperature. Nevertheless, simple-cycle turbines still have startup and shutdown periods in which they are not capable of complying with their steady-state emissions limits.

In addition, the simple-cycle gas turbines may need to perform combustor tuning. This is a regular plant equipment maintenance procedure in which testing, adjustment, tuning, and calibration operations are performed, as recommended by the equipment manufacturer, to insure safe and reliable steady-state operation, and to minimize NO_x and CO emissions. The SCR and oxidation catalyst may not be fully operational during the tuning operation. The applicant has requested that the proposed facility be allowed to conduct up to two 8-hour tuning operations per year per turbine.

Finally, the Marsh Landing Generating Station will be designed for quick starts and also rapidly changing loads to meet electrical system needs. The simple-cycle gas turbines will have the ability to change loads at rates exceeding 25 MW per minute. It is difficult for the NO_x control system to respond to these rapid changes in load (greater than 25 MW per minute). NO_x emissions from the gas turbines are controlled post-combustion using ammonia injection at the selective catalytic reduction unit. The amount of ammonia to be injected is determined based on turbine operating conditions and the NO_x concentration at the stack exhaust. There is an optimal amount of ammonia based on the incoming NO_x and the ammonia injection system provides a

[31] Note that emission rates of particulate matter and sulfur oxides are not affected by startups and shutdowns and will be the same as for full load operation as during startup and shutdown periods (9 lb/hour for particulate matter, 6.21 lb/hour for SO_x maximum, 1.55 lb/hour SO_x annual average).

slight excess to ensure the NO_x emissions are minimized while ammonia slip levels are also minimized. The gas turbine can change operating conditions much more rapidly than the ammonia injection system can respond due to the lag time in the ammonia injection control system and the NO_x continuous emission monitor. This control system lag and continuous emission monitor lag time make meeting the 2.5 ppm NO_x permit limit averaged over one hour much more difficult when the gas turbine is changing loads at rates exceeding 25 MW per minute.

Because emissions are greater during startups, shutdowns, combustor tuning periods, and periods of transient load than during steady-state operation, the BACT limits established in the previous sections for steady-state operations are not technically feasible during these periods. The District is therefore establishing separate BACT limits representing the most stringent emissions limits that have are achieved-in-practice or technologically feasible/cost-effective for this type of facility. To do so, the Air District has conducted an additional BACT analysis specifically for startups, shutdowns, combustor tuning periods, and periods of transient load.

Control Devices and Techniques to Limits Startup, Shutdown, Tuning, and Transient-Load Emissions:

The only available approach to reducing startup, shutdown, tuning and transient-load emissions from simple-cycle turbines is to use best work practices. By following the plant equipment manufacturers' recommendations, power plant operators can limit the duration of each startup, shutdown, and tuning event to the minimum duration achievable. Plant operators also use their own operational experience with their particular turbines and ancillary equipment to optimize startup, shutdown, and tuning emissions. There is no other available control technology or technique beyond implementing best work practices that can further reduce startup, shutdown, tuning, or transient-load emissions from simple-cycle turbines.[32]

[32] The lack of additional control technologies for simple-cycle turbines is different than with combined-cycle turbines. For combined-cycle turbines, there have been several technological advances that have recently been developed, or are currently under development, that will allow those types of turbines to start up more quickly and with fewer emissions. These include startup procedures that heat up the additional steam-generating equipment used in combined-cycle turbines more quickly, allowing them to reach their optimal operating temperature more quickly; and advances that reduce emissions at lower loads where combined-cycle turbines must operate for extended periods while waiting for the equipment to heat up. These types of advances are not applicable to simple-cycle turbines. Simple-cycle turbines do not have any additional steam generating equipment that needs to be warmed up; and they ramp up very quickly to full load at rates as high as 30 MW per minute and do not spend any significant time operating at lower loads during startups.

<u>Determination of BACT Emissions Limit for Startups, Shutdowns, Tuning Events, and Transient Load Conditions:</u>

The District is proposing time limits and numerical emissions limits for startups, shutdowns, combustor tuning events, and periods of transient load to implement the BACT requirement here. The proposed limits for each operating scenario are outlined below.

Startups

Using best work practices, the facility should be able to complete a typical startup in 11 minutes, based on information provided by the gas turbine manufacturer. Emissions during a typical startup are expected to be 12 pounds of NOx, 213 pounds of CO, and 11 pounds of POC.[33] Typical startup emissions are summarized in **Table 13**.

TABLE 13. SIMPLE-CYCLE GAS TURBINE TYPICAL STARTUP EMISSION ESTIMATES

Pollutant	Typical Startup - Estimated Emissions (pounds per turbine per startup)
NO_x (as NO_2)	12
CO	213
POC	11

Typical startup emissions are minimal due to the short duration of the typical start time and due to the quick turbine ramp rate that minimizes low-load operation during startup. But these emission estimates are not guaranteed emission rates for every startup. Moreover, startup emissions are highly variable, and it is expected that some startups will take longer than 11 minutes. A number of factors influence startup duration and can lead to longer startup times, including: allowance for the CEM system lag of several minutes to relay compliant NOx and CO CEM readings, allowance for the ammonia injection rate to stabilize with NOx concentration, allowance for the oxidation and SCR catalysts time to reach normal operating temperature, and allowance for the adjustment of dilution air required to maintain optimum catalyst temperatures. The District estimates over the 30-year life of the facility that a given startup may take as long as 30 minutes to allow the gas turbine and post combustion controls to reach steady-state operation. The District is therefore proposing to establish the not-to-exceed BACT limit for startups at 30 minutes to provide an adequate compliance margin that allows the operators to make appropriate adjustments to system controls in response to system operational conditions. This is the shortest time limit that the turbines can reasonably be expected to meet under all operating conditions over the life of the equipment. Individual startups may be shorter than this proposed 30-minute limit, but an enforceable BACT permit limit must provide 30 minutes to allow an adequate margin of compliance to ensure that the equipment can consistently meet the limit.

[33] See Appendix D Siemens Emission Estimates.

In addition, the District has conservatively estimated the emissions that would result from a 30-minute startup at 18.6 pounds of NOx, 216.2 pounds of CO, and 11.9 pounds of POC, which the District is proposing as BACT limits on the emissions from startups. The District calculated these emission rates by taking the emissions performance that the manufacturer estimates the turbines could achieve in a typical startup as summarized in Table 13, and then assuming that emissions were within the steady-state emission limits during the remaining 19 minutes of the 30-minute startup period. This is a conservative limit because if a startup takes longer than the manufacturer's estimate of 11 minutes, emissions will exceed the steady-state limits during the remaining 19 minutes.

Using this conservative approach, the District calculated maximum emission rates for startups as set forth in **Table 14** below:

TABLE 14. PROPOSED STARTUP EMISSION LIMITS FOR A 30 MINUTE STARTUP

Pollutant	**Maximum Startup Emissions (pounds per turbine per startup)**
NO_x (as NO_2)	18.6
CO	216.2
POC	11.9

In addition, in order to protect hourly air quality standards, the District is also proposing an additional hourly limit for operating hours during which startups occur. This limit is based on a reasonable need for the facility to start up twice in a one-hour period, which is not unforeseeable given the facility's operation as a peaker facility. The District is basing this proposed limit on two startups with a typical emissions profile as summarized in Table 13 above (lasting 11 minutes each), one shutdown with a typical emissions profile as summarized in Table 16 below (lasting 6 minutes), and the remainder of the hour with emissions within the steady-state BACT emissions limits. These maximum hourly emissions for hours with startups are summarized in **Table 15** below.

TABLE 15. MAXIMUM HOURLY PERMIT LIMITS FOR HOURS WITH STARTUPS

Pollutant	**Maximum Startup Emissions (lb/hour)[b]**
NO_x (as NO_2)	45.1
CO	541.3
POC	28.5

The Air District has concluded that using best work practices, the proposed simple-cycle gas turbines will be able to meet the startup permit limits shown above. The basis for these limits is emissions information provided by the gas turbine supplier Siemens.

Shutdowns

Siemens, the gas turbine manufacturer, supplied the following emission estimates for a typical shutdown occurring over 6 minutes.[34]

TABLE 16. SIMPLE-CYCLE GAS TURBINES SHUTDOWN EMISSION ESTIMATES

Pollutant	Typical Shutdown - Estimated Emissions (pounds per turbine per shutdown)
NO_x (as NO_2)	10
CO	110
POC	5

The Air District proposes to have maximum pound-per-event limits for shutdowns. The District estimates over the 30-year life of the facility that a given shutdown may take as long as 15 minutes to allow the gas turbine time to ramp down from full load operation and allow time for the turbine to decelerate after fuel flow stops. Each shutdown would be limited to a maximum of 15 minutes for a worst-case shutdown.

The District then conservatively estimated the emissions during a 15-minute shutdown using an approach similar to the approach for estimating maximum startup emissions above. The District conservatively assumed that emissions that the typical shutdown emissions as summarized in Table 16 occur would over the first 6 minutes of the shutdown, and that the rest of the 15 minute shutdown period had emissions at normal steady-state emissions rates. These are the worst-case pound-per-event values for the simple-cycle gas turbines during a shutdown.

TABLE 17. SIMPLE-CYCLE GAS TURBINES PROPOSED SHUTDOWN PERMIT LIMITS

Pollutant	Maximum Startup Emissions (pounds per turbine per startup)
NO_x (as NO_2)	13.1
CO	111.5
POC	5.4

Thus, the Air District has concluded that using best work practices, the proposed simple-cycle gas turbines will be able to meet the permit limits shown above in Table 14, Table 15 and Table 17.

[34] See Appendix D Siemens Emission Estimates.

Tuning Events

Turbine tuning is required to maintain the gas turbines in optimal operating condition. Tuning events for the simple-cycle gas turbines are expected to take up to 8 hours to complete, may involve operation at low loads where emissions efficiency is compromised, and may require operation without fully operational pollution control equipment such as the SCR system. Tuning events are expected to occur relatively infrequently, and will be limited to two events per year for each gas turbine. The emissions rates provided for tuning events are higher than for normal operations. The applicant and the gas turbine vendor Siemens estimate the tuning emissions will remain below the levels shown in **Table 18**.[35] The NO_x emission rate is based on 9 ppm after SCR abatement and corresponds to 80 lb/hour of NO_x. This NO_x estimate assumes the gas turbine will emit NO_x at a maximum of 15 ppm unabated during tuning and that the SCR would never let the NO_x concentration exceed 9 ppm. The CO concentration was estimated to be a maximum of 55.8 ppm during tuning and this corresponds to an emission rate of 450 lb/hour. The POC concentration was estimated to be a maximum of 10.7 ppm during tuning and this corresponds to an emission rate of 30 lb/hour. The Air District is proposing to require emissions during tuning events to comply with the permit limits shown in Table 18 below.

TABLE 18. SIMPLE-CYCLE GAS TURBINES COMBUSTOR TUNING PERMIT LIMITS

Pollutant	**MaximumPer Turbine (lb/hour)**
NO_x (as NO_2)	80
CO	450
POC	30

Transient Loads

As noted above, the simple-cycle turbines at the proposed Marsh Landing facility will need the capability to ramp up and down quickly in order to serve transient demand. Fast ramping makes it more difficult for the SCR system to control NOx emissions to very low levels. The District is therefore proposing a transient load condition that would allow the facility to meet an alternate permit limit of 2.5 ppm NO_x averaged over 3 hours for any transient hour with a change in load exceeding 25 MW per minute, instead of the one-hour averaging time used for normal operations. This longer averaging time will allow for short-term spikes in turbine emissions resulting from high turbine ramp rates.

Conclusion

The Air District is proposing stringent emission limits for startups, shutdowns, tuning events, and transient load conditions that can reasonably be achieved by the proposed Marsh Landing

[35] Word Attachment (Reply to BAAQMD as amended2.doc) to Email from Mark Strehlow of URS to Brian Lusher of BAAQMD dated 10/13/09.

Generating Station, based on a review of the gas turbine supplier's emission estimates. Emissions from specific startup, shutdown and tuning events may be significantly less than the proposed not-to-exceed permit limits, given the great variability of such events. The District is proposing to require the limits described above as the enforceable BACT limits to ensure that emissions are minimized to the greatest extent feasible while ensuring that the limits are achievable under all operating circumstances.

5.8 Best Available Control Technology During Commissioning of Simple-Cycle Gas Turbines

The simple-cycle gas turbines and associated equipment are highly complex and have to be carefully tested, adjusted, tuned and calibrated after the facility is constructed. These activities are generally referred to as "commissioning" of the facility. During the commissioning period, each of the combustion turbine generators needs to be fine-tuned at zero load, partial load, and full load to optimize its performance. The dry-low NO_x combustors also need to be tuned to ensure that the turbines run efficiently while meeting both the performance guarantees and emission guarantees. In addition, the selective catalytic reduction (SCR) systems and oxidation catalysts need to be installed and tuned.

The simple-cycle gas turbines will not be able to meet the stringent BACT limits for normal operations during the commissioning period, for a number of reasons. First, the SCR systems and oxidation catalysts cannot be installed immediately when the turbines are initially started up. There may be oils or lubricants in the equipment from the manufacture and installation of the equipment, which would damage the catalysts if they were installed immediately. Instead, the turbines need to be operated without the SCR systems and oxidation catalysts for a period of time to burn off any impurities that may be left in the equipment. In addition, once all of the pollution control equipment is installed, it needs to be tuned in order to achieve optimum emissions performance. Until the equipment is tuned, it will not be able to achieve the very high levels of emissions reductions reflected in the stringent BACT limits for normal operations.

Because the BACT limits established for normal operations are not technically feasible during the commissioning period, these limits are not BACT for this phase of the facility's operation. Alternate BACT limits must therefore be specified for this mode of operation. To do so, the Air District has conducted an additional BACT analysis specifically for the required commissioning activities.

The only control technology available for limiting emissions during commissioning is to use best work practices to minimize emissions as much as possible during commissioning, and to expedite the commissioning process so that compliance with the stringent BACT limits for normal operations can be achieved as quickly as possible. There are no add-on control devices or other technologies that can be installed for commissioning activities.

To implement best work practices as an enforceable BACT requirement, the Air District is proposing conditions that will require the simple-cycle gas turbines to minimize emissions to the maximum extent possible during commissioning. The Air District is also proposing numerical emissions limits based upon the equipment manufacturer's best estimates of uncontrolled emissions at the operating loads that the simple-cycle gas turbines will experience during commissioning (See **Table 20** for Siemens' Commissioning Estimates).[36] The proposed permit conditions will limit emissions to below the following levels:

TABLE 19. COMMISSIONING PERIOD EMISSIONS LIMITS FOR ONE SIMPLE-CYCLE GAS TURBINE

Air Pollutant	**Proposed Commissioning Period Emissions Limits for One Simple-Cycle Gas Turbine**	
NO_2	3,063 lb/day	188 lb/hr
Carbon Monoxide	33,922 lb/day	2,405 lb/hr
POC	2,008 lb/day	
PM_{10}	235 lb/day	
SO_2	149 lb/day	

Notes: Please see Table 20 for manufacturer's commissioning emission estimates. NO_2 daily maximum assumes 8 hours of gas turbine testing at 40% load and 16 hours of gas turbine load test. CO, POC, and PM daily maximum assumes 8 hours initial gas turbine testing, 8 hours gas turbine testing at 40% load, and 8 hours gas turbine load test.

Commissioning emissions will also be subject to the annual emissions limits applicable to normal operations. All emissions from commissioning activities will be counted towards the facility's annual limits. Because commissioning is a relatively short-term period, the facility should be able to stay within those limits over the course of the entire year. Counting commissioning emissions towards the annual limits will also provide an additional incentive for the facility operator to minimize emissions as much as possible.

The Air District is also proposing permit conditions to minimize the duration of commissioning activities. The proposed conditions require the facility to tune the combustion turbine to minimize emissions at the earliest feasible opportunity; and to install, adjust and operate the SCR systems and oxidation catalysts at the earliest feasible opportunity. The Air District is also proposing to cap the total amount of time that each turbine can operate partially abated and/or without the SCR systems and oxidation catalysts at 232 hours. This limit represents the shortest amount of time in which the facility can reasonably complete the required commissioning activities without jeopardizing safety and equipment warranties. The proposed 232-hour limit is based on the following estimates from Siemens of the time it will take for each specific commissioning activity.

[36] See Appendix D Siemens Emission Estimates.

TABLE 20. COMMISSIONING SCHEDULE FOR A SINGLE SIMPLE-CYCLE GAS TURBINE

Activity	Duration (hours)	GT Load (%)	Modeling Load (%)	Total Emissions			
				NO_X (lb)	CO (lb)	VOC (lb)	PM_{10} (lb)
CTG Testing (Full Speed No Load, FSNL, Excitation Test, Dummy Synch Checks)	8	0	0	339	19,240	1,181	71
CTG 1 Testing at 40% load	8	0-40	40	1,507	11,662	636	91
CTG 1 Load Test	68	50-100	50-101	6,615	25,673	1,620	624
Install Emissions Test Equipment	0	0	0	0	0	0	0
Emissions Tuning/Drift Testing	24	50-100	100	1,988	5,344	286	234
RATA/Pre-performance Testing/Source Testing/Drift Testing	60	100	100	4,970	13,360	715	585
Remove emissions test equipment/install performance test equipment, followed by Water Wash & Performance preparation	0	0	0	0	0	0	0
Performance Testing	40	100	100	3,035	5,628	328	365
CAISO Certification	12	50-100	100	994	2,672	143	117
CAISO Certification if required	12	100	100	994	2,672	143	117
Total Hours	232						

Notes:
SO_X emission during commissioning will not be higher than normal operation
CTG = combustion turbine generator
FSNL = full speed, no load
GT = gas turbine

Compliance with these proposed conditions for the commissioning period will be monitored by Continuous Emissions Monitors that the applicant will be required to install before any commissioning work begins, and through a written commissioning plan laying out all commissioning activities in advance, which the applicant will be required to submit to the Air District for review and approval.

6. Requirement to Offset Emissions Increases

District regulations require that new facilities must provide Emission Reduction Credits (ERCs) to offset the increases in air emissions that they will cause. ERCs are generated when old facilities sources are shut down, or when sources are controlled below regulatory limits. The emissions reductions granted by the District are used to offset the increases from new facilities, so that there will be no overall increase in emissions from facilities subject to this offset program.

Pursuant to Regulation 2-2-302, federally enforceable emission offsets are required for POC and NO_x emission increases from permitted sources at facilities which will emit 10 tons per year or more on a pollutant-specific basis. For facilities that will emit more than 35 tons per year of NO_x offsets must be provided by the applicant at a ratio of 1.15 to 1.0. Pursuant to Regulation 2-2-302.2, POC offsets may be used to offset emission increases of NO_x.

The applicable offset ratios and the quantity of offsets required are summarized in **Table 21**.

6.1 POC Offsets

Because the proposed Marsh Landing facility will emit less than 35 tons of POC per year from permitted sources, the POC emissions must be offset at a ratio of 1.0 to 1.0 pursuant to District Regulation 2-2-302. The facility will be required to provide offsets for 14.21 tons per year of POC emissions. The applicant has identified ERCs available for it to use sufficient to offset this level of POC emissions.

6.2 NO_x Offsets

Because the proposed Marsh Landing facility will emit greater than 35 tons per year of NO_x) from permitted sources, the NO_x emissions must be offset at a ratio of 1.15 to 1.0 pursuant to District Regulation 2-2-302. The facility will emit up to 71.763 tons/yr of NO_x, and will therefore be required to provide offsets for 82.527 tons per year of NO_x emissions. The applicant has identified ERCs available for it to use sufficient to offset this level of NO_x emissions.

6.3 PM_{10} Offsets

Because the total PM_{10} emissions from permitted sources will not exceed 100 tons per year, the proposed Marsh Landing facilities is not required to offset its PM_{10} emissions under District Regulation 2-2-303.

6.4 SO_2 Offsets

Pursuant to Regulation 2-2-303, emission reduction credits are not required for the SO_2 emission increases associated with this project since the facility's SO_2 emissions will not exceed 100 tons per year. Regulation 2-2-303 allows for the voluntary offsetting of SO_2 emission increases of less than 100 tons per year. The applicant has opted not to provide such emission offsets.

6.5 Offset Package

Table 21 summarizes the offset obligation of the proposed Marsh Landing Generating Station. The emission reduction credits presented in Table 21 exist as federally-enforceable, banked emission reduction credits that have been reviewed for compliance with District Regulation 2, Rule 4, "Emissions Banking", and were subsequently issued as banking certificates by the District under the certificates cited in the Tables below. If the quantity of offsets issued under any certificate exceeded 35 tons per year for any pollutant, the application was required to fulfill the public notice and public comment requirements of District Regulation 2-4-405. Accordingly, such applications were reviewed by the California Air Resources Board, U.S. EPA, and adjacent air pollution control districts to insure that all applicable federal, state, and local regulations were satisfied.

As indicated below, Mirant is in possession of valid emission reduction credits to offset the emission increases from the permitted sources for the Marsh Landing project.

TABLE 21. EMISSION REDUCTION CREDITS IDENTIFIED BY MIRANT (TON/YR)

	POC[b]	NO_x[c]
Valid Emission Reduction Credits[a]	77.97	485.73
Permitted Source Emission Limits	14.210	71.763
Offsets Required	14.210[c]	82.527[d]

[a]From Banking Certificates 756, 831, 863, 918 (See Table below)

[c]Reflects applicable offset ratio of 1.0:1.0 pursuant to Regulation 2-2-302

[d]Reflects applicable offset ratio of 1.15:1.0 pursuant to Regulation 2-2-302

TABLE 22. CERTIFICATES HELD BY MIRANT (TON/YR)

Certificate	756	831	863	918	Total
NO_x	1.173	66.060	247.500	171.000	485.733
POC	0.390	72.280	5.300	0.000	77.970
PM_{10}	6.443	202.530	25.270	0.000	234.243

TABLE 23. LOCATION OF CERTIFICATES HELD BY MIRANT

Current Certificate	Original Certificate	Company	Location	Original Issue Dates
#756	394	Hudson ICS	San Leandro	4/97
#831	35	Crown Zellerbach Corporation	Antioch	6/84
#831	240	Crown Zellerbach Corporation	Antioch	7/93
#831	106	Crown Zellerbach Corporation	Antioch	3/90
#863	73	P G & E	Martinez	7/87
#863	89	P G & E	Martinez	7/87
#918	35	Crown Zellerbach Corporation	Antioch	6/84
#918	240	Crown Zellerbach Corporation	Antioch	7/93
#918	106	Crown Zellerbach Corporation	Antioch	3/90

Note: The numbers of each certificate change with each transaction in the emissions bank. Certificate numbers below are the original certificate number when the emission reduction was generated.

Certificate 394 was generated from the shutdown of two wood fired boilers.

Certificate 35 was generated from the shutdown of two gas/oil-fired boilers.

Certificate 240 was generated from the shutdown of: two oil fired lime kilns, wood waste boiler, and a black liquor recovery boiler.

Certificate 106 was generated from the shutdown of a black liquor recovery furnace.

Certificate 73 and 89 were generated from the shutdown of three gas/oil fired power plant boilers.

7. Federal Permit Requirements

In addition to the Bay Area Air Quality Management District permit requirements in District Regulation 2, Rule 2 and Regulation 2, Rule 3, there are two federal permitting programs that apply to major facilities: (i) the federal "Prevention of Significant Deterioration" (PSD) requirements under 40 C.F.R. section 52.21; and (ii) the "Non-Attainment New Source Review" (Non-Attainment NSR) requirements for $PM_{2.5}$ sources set forth in Appendix S of 40 C.F.R. Part 51. The District has analyzed these requirements for the proposed Marsh Landing Generating Station and has determined that neither of these permit requirements applies to this facility because it will not be a major source under either of those programs. The District is therefore not proposing to issue a PSD permit for this facility or to include Appendix S $PM_{2.5}$ Non-Attainment NSR requirements in the permit.

7.1 Federal "Prevention of Significant Deterioration" Program

7.1.1 Applicability of the "Prevention of Significant Deterioration" Requirements

The federal PSD program applies to "major" stationary sources, which are defined as new sources that emit more than 250 tons per year of any PSD pollutant.[37] PSD pollutants are regulated pollutants for which the Bay Area is not in violation of the National Ambient Air Quality Standard (NAAQS) for that pollutant. For the Bay Area, PSD pollutants include carbon monoxide, PM_{10}, and SO_2, among others. Facilities that exceed the federal PSD "major source" threshold for any of these pollutants must apply for and obtain PSD permits before they can commence construction. Although PSD permits are federal permits issued under the authority of EPA Region 9, the District conducts the PSD analysis and issues PSD permits on behalf of EPA Region 9 pursuant to a Delegation Agreement between the District and EPA Region 9.[38]

The proposed Marsh Landing Generating Station will not emit more than 250 tons per year of any PSD pollutant, and will not be a "major source" subject to federal PSD requirements. The Air District is therefore not proposing to issue a federal PSD permit for this facility.

---

[37] *See* 40 C.F.R. § 52.21(b)(1)(i)(b). Note that for 28 specific types of sources, a lower PSD applicability threshold of 100 tons applies pursuant to 40 C.F.R. § 52.21(b)(1)(i)(a). Simple-cycle combustion turbines of the type proposed for the Marsh Landing Generating Station are not in any of the categories subject to the 100 ton threshold specified in Section 52.21(b)(1)(i)(a).

[38] The District also has incorporated PSD requirements from the federal PSD regulations into its NSR Rule in Regulation 2, Rule 2. The substance of these requirements in Regulation 2, Rule 2 track the federal requirements.

In reaching this conclusion, the District has considered whether the facility should be treated as a "modification" to the existing Contra Costa Power Plant, which is adjacent to the proposed Marsh Landing project location, because the PSD applicability thresholds are different for modifications than for new sources. A "major" facility[39] needs to obtain a federal PSD permit for any "major modification", which is defined as any change in the facility that results in an increase in emissions of any PSD pollutant above certain "significant" emission rates defined in 40 CFR 52.21(b)(23).[40] The Marsh Landing Generating Station will have the potential to emit PSD pollutants above these "significant" emission rates, and so if the new Marsh Landing facility is treated as a "modification" to the existing Contra Costa Power Plant, then the PSD requirements apply and the "modification" will have to have a PSD permit before it can be built.

The question of whether the new Marsh Landing facility will be a "modification" to the existing Contra Costa Power Plant depends on whether the two power plants taken together are one single "facility" for purposes of PSD regulation. If they are both part of the same "facility", then the construction of the new Marsh Landing Generating Station would be a "modification" to that "facility". The federal PSD regulations define a "facility" as:

> [A]ll of the pollutant-emitting activities which belong to the same industrial grouping, are located on one or more contiguous or adjacent properties, and are under the control of the same person (or persons under common control) except the activities of any vessel. Pollutant-emitting activities shall be considered as part of the same industrial grouping if they belong to the same "Major Group" (i.e., which have the same first two digit code) as described in the Standard Industrial Classification Manual, 1972, as amended by the 1977 Supplement (U.S. Government Printing Office stock numbers 4101–0066 and 003–005–00176–0, respectively).

(*See* Title 40 CFR § 52.21(b)(6).[41]) The proposed Marsh Landing Generating Station would be in the same SIC Major Group and would be located on adjacent properties, and so the question of whether they would be a single "facility" depends on whether they are under the control of the same person (or persons under common control).

The proposed Marsh Landing Generating Station would be owned and operated by Mirant Marsh Landing, LLC, and the Contra Costa Power Plant is owned and operated by Mirant Delta, LLC. These companies are separate corporations, although they are both ultimately owned by Mirant Corporation, their parent corporation. Despite this common ultimate corporate parent, however,

[39] The Contra Costa Power Plant is a "major source" because it was built before current regulatory requirements were adopted and, as a result, has no annual emission limits. The facility's actual emissions have been well below the "major source" thresholds set forth in Section 52.21(b)(1). *See* Letter dated November 3rd, 2009 from David Farabee of Pillsbury Winthrop Shaw Pittman LLP to Allan Zabel, Senior Counsel, Office of Regional Counsel, U.S. EPA Region IX, and to Alexander Crockett, Assistant Counsel, Bay Area Air Quality Management District, attachment 2.

[40] *See* 40 C.F.R. § 52.21(b)(2) (defining "major modification").

[41] The District has a substantively identical definition of "facility" in its District Regulation 2-2-215.

the facilities will be operated independently. The facilities will have separate control rooms, independent connections to the PG&E natural gas pipeline system, and separate water supplies. Each facility also will have its own independent connection to the electric transmission system, a separate wastewater discharge connection, and separate contracts regarding the sale of its power output. The facilities will also be subject to separate financing arrangements, and these financing arrangements will restrict inter-company dealings between Mirant Delta, LLC, and Mirant Marsh Landing, LLC, (the owners of the two facilities) to terms no more favorable than would be expected with an unaffiliated third party. In addition, none of the operations of either facility will depend in any way on the other, and the facilities are in fact not scheduled to operate commercially at the same time. Mirant Delta, LLC, the owner of the existing Contra Costa Power Plant, has agreed to have a legally binding permit condition included in its existing permit documents that requires the existing facility to shut down and permanently retire the Units from service on April 30, 2013.[42] The proposed Marsh Landing facility is scheduled to start commercial operation the next day, on May 1, 2013. The interconnection request for the Marsh Landing facility assumes that the Contra Costa Power Plant will retire, and therefore evaluates only the net increase in capacity associated with Marsh Landing. This effectively means that the Marsh Landing facility will take over transmission capacity on the system that is currently utilized by the Contra Costa Power Plant.

EPA has interpreted independent operations such as these not to be a single "facility" for purposes of PSD permitting under 40 C.F.R. Section 52.21. Since the federal PSD program is EPA's program and the District is required to follow EPA's guidance in interpreting the PSD regulations under Section VII.1. of the Delegation Agreement, the District is proposing to treat the proposed Marsh Landing facility as a separate facility from the existing Contra Costa Power Plant.

[42] Mirant Delta, LLC, has agreed to include the following enforceable permit condition in its air permits: "Subject to: (i) receipt of final, non-appealable California Public Utilities Commission approval of the Tolling Agreement for Units 6 and 7 at the Contra Costa Power Plant by and between Mirant Delta, LLC and Pacific Gas and Electric Company and dated as of September 2, 2009, as amended from time to time, without material condition or modification unacceptable to either party thereto in its sole discretion; and (ii) the receipt of all other approvals and consents from the relevant local, state and federal governmental agencies (including but not limited to the California Independent System Operator) necessary for the shutdown and permanent retirement from service of Units 6 and 7; Mirant Delta, LLC will shut down and permanently retire Units 6 and 7 from service at 2400 PDT on April 30, 2013." Mirant Delta, LLC, has agreed that prior to the Air District's issuance of the FDOC for the Marsh Landing facility, Mirant Delta will submit an application for an amendment to its Air District permit to incorporate the foregoing permit condition.

The District is therefore not proposing to issue a federal PSD permit for the Marsh Landing Generating Station. EPA Region 9 has reviewed the situation and has concurred that it is appropriate to treat the two facilities as separate for purposes of PSD permitting.[43]

The District also notes that treating the Marsh Landing facility as not subject to federal PSD review is consistent with the spirit of the PSD program as applying to only to "major" facilities. The existing Contra Costa Power Plant is considered a "major" facility under the PSD regulations only because it does not have annual emissions limits as a result of its age (it was built in 1964 before modern air pollution control laws were enacted). Its actual emissions are in fact well below the PSD "major" source threshold.[44] If these actual emissions rates were permit limits, then the facility would not be "major" and the new Marsh Landing facility would not be a modification to a "major" source even if the facilities were considered as a single common entity. In addition, the Marsh Landing facility is intended to be a replacement for the existing facility, not an addition to it. They are not anticipated to operate at the same time, and so as a practical matter, it is appropriate to consider their emissions as separate and not to aggregate them for permitting purposes. Furthermore, as discussed in more detail below, the District has evaluated the substantive requirements of the PSD permit program (which in many ways are similar to applicable requirements of District regulations), and has not found any area in which the Marsh Landing facility would be inconsistent with PSD permitting even if it were required here. In particular, the District has evaluated what the air quality impacts of the Marsh Landing facility would be using computer models and has found that it would not cause or contribute to any violation of any National Ambient Air Quality Standard for any PSD pollutant. For all of these reasons, the District concurs that it is appropriate not to require federal PSD permitting review for the proposed Marsh Landing Generating Station.

7.1.2 <u>Protection of National Ambient Air Quality Standards</u>

Although the District has concluded that the Marsh Landing Generating Station is not subject to PSD requirements because it is not a "major" source as defined in the PSD regulations, the District has nevertheless conducted a PSD air quality impacts analysis for the facility as would be required if the facility were in fact a "major" source. Even though it is not legally required

---

[43] *See* Letter dated January 8th, 2010 from Gerardo C. Rios of U.S. EPA Region IX to Brian Bateman of Bay Area Air Quality Management District. EPA Region 9 sent this letter to the District in response to a request by Mirant for review of the ownership situation of these two facilities and concurrence by EPA Region 9 that they should be treated as separate "facilities" for purposes of the PSD applicability requirements. *See* Letter from D. Farabee, Pillsbury Winthrop Shaw Pittman LLP, to A. Zabel, EPA Region 9, and A. Crockett, BAAQMD, Nov. 3, 2009. That letter included a White Paper outlining various EPA precedents interpreting the definition of "facility". The District incorporates that analysis of EPA's precedents, as well as EPA's concurrence with Mirant's approach for this specific facility, in this PDOC analysis.

[44] *See* Letter dated November 3rd, 2009 from David Farabee of Pillsbury Winthrop Shaw Pittman LLP to Allan Zabel, Senior Counsel, Office of Regional Counsel, U.S. EPA Region IX, and to Alexander Crockett, Assistant Counsel, Bay Area Air Quality Management District, attachment 2.

under the federal PSD program, the District has undertaken this analysis anyway, for several reasons. First, Mirant's initial application for this project was for a facility that would have been "major" under the PSD program, and so the District initially started considering this analysis as legally required. Mirant subsequently made changes to the project design, so that the project as currently proposed is not major, but the District decided to go forward and complete the analysis anyway. Second, even though the facility will not be "major" and therefore not subject to PSD permitting, questions addressed in the PSD air quality impact analysis will likely be relevant in the context of the CEC's CEQA-equivalent environmental review. For example, even though this project is not subject to PSD, it still will be relevant in the CEQA context whether the facility will cause or contribute to a violation of any National Ambient Air Quality Standard, which is one of the issues addressed in the PSD analysis. The District is therefore providing this information here so that it can be used by the Energy Commission in its licensing process. And third, the information may be of interest to members of the public interested in learning more about this project and what it will entail. The District is therefore providing this analysis for reasons of public information as well.

The Air District has reviewed and verified the ambient air quality impact analysis submitted by the applicant for the proposed Marsh Landing Generating.

The results of this analysis are presented in the Summary of Air Quality Impact Analysis for the Marsh Landing Generating Station, set forth in Appendix B. The analysis used sophisticated EPA-approved air pollution models to evaluate the ambient air impacts from air pollutant emissions from the proposed facility. The analysis found that the emissions from the proposed facility would not cause or contribute to air pollution in violation of any applicable National Ambient Air Quality Standard or applicable PSD increment. The analysis examined the potential for impacts to visibility, soils and vegetation resulting from air emissions from the proposed facility and found no significant impacts. The analysis also examined the potential for associated growth from the facility and found that there would be no significant associated growth. The analysis examined the potential for impacts to "Class I" areas, which are areas of special natural, scenic, recreational, or historic value (such as national parks). The analysis found that there would be no significant impact to Class I areas. Full details are set forth in Appendix B. Based on this analysis, the proposed facility would comply with the air quality impacts analysis requirements in 40 CFR 52.21(k) through (o) if these requirements were applicable to the facility.

7.2 Non-Attainment NSR for $PM_{2.5}$

The Bay Area has recently been designated as "non-attainment" of the National Ambient Air Quality Standard for $PM_{2.5}$ (24-hour average).[45] Areas classified as non-attainment are subject to the "Non-Attainment New Source Review" (Non-Attainment NSR) requirements of the federal Clean Air Act. The Clean Air Act requires states to develop Non-Attainment NSR regulations to implement this requirement within 3 years of a non-attainment designation, and the District will be doing so for $PM_{2.5}$ in the months and years to come. In the interim, while the District is working on its own $PM_{2.5}$ Non-Attainment NSR regulations, Non-Attainment NSR for $PM_{2.5}$ is governed by the federal Non-Attainment NSR rule in EPA's Clean Air Implementation Rule, which is set forth in Appendix S of 40 C.F.R. Part 51 ("Appendix S").

Non-Attainment NSR under Appendix S is a federal permit program and is implemented under the federal regulations set forth in Appendix S. It is not a state law permitting program and it is not implemented under the requirements of District regulations established pursuant to the California Health & Safety Code. The Environmental Protection Agency has determined that the District can impose conditions in its District permits (Authority to Construct and Permit to Operate) that will allow a facility to establish compliance with the federal Non-Attainment NSR requirements for $PM_{2.5}$.[46,47] If the District includes requirements in its District permits pursuant to District Regulation 2-1-403 (Permit Conditions) that satisfy the applicable $PM_{2.5}$ Non-Attainment NSR requirements of Appendix S for a source, EPA has determined that it will treat those conditions as satisfying the federal Appendix S requirements for that source.

---

[45] EPA promulgated National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$ in 1997 (with an update in 2006), and began designating certain regions of the country as non-attainment with those Standards starting in 2005. EPA made a determination as to the region's attainment status with respect to $PM_{2.5}$, which it published on November 13, 2009. EPA determined that the Bay Area is in attainment of the $PM_{2.5}$ NAAQS for the annual standard, and is non-attainment for the 24-hour standard. The EPA's non-attainment determination for the $PM_{2.5}$ 24-hour standard became effective on December 14, 2009 (See Federal Register Friday November 13, 2009, Air Quality Designations for the 2006 24-Hour Fine Particle ($PM_{2.5}$) National Ambient Air Quality Standards).

[46] Letter dated 10/28/09 from Jack Broadbent of BAAQMD to Deborah Jordan U.S. EPA Region IX, Re: Guidance on "Appendix S" Non-Attainment NSR Permitting for $PM_{2.5}$ Source During $PM_{2.5}$ Transition Period.

[47] Letter dated 12/9/09 from Deborah Jordan U.S. EPA Region IX to Jack Broadbent of BAAQMD, Re: Guidance on "Appendix S" Non-Attainment NSR Permitting for $PM_{2.5}$ Source During $PM_{2.5}$ Transition Period.

Under Appendix S, Non-Attainment NSR requirements for $PM_{2.5}$ apply to facilities with $PM_{2.5}$ emissions of more than 100 tons per year. (*See* 40 CFR 51, Appendix S, II.A.4(i)(a) (establishing 100 tpy threshold for regulation of Major Stationary Sources).[48]) The proposed Marsh Landing Generating Station would emit less than 100 tons per year of $PM_{2.5}$, so the Appendix S Non-Attainment NSR requirements do not apply for this facility. The District is therefore not proposing to include conditions in the permit for compliance with Appendix S for $PM_{2.5}$.

[48] The facility will emit less than 100 tons per year of direct $PM_{2.5}$ emissions and less than 100 tons per year of any $PM_{2.5}$ precursors, as defined in Appendix S II.A.31(iii). (*See* Preliminary Determination of Compliance, Table 5).

8. Health Risk Screening Analyses

Pursuant to the BAAQMD Risk Management Regulation 2, Rule 5, a health risk screening must be conducted to determine the potential impact on public health resulting from the worst-case emissions of toxic air contaminants (TACs) from the proposed Marsh Landing project. The potential TAC emissions (both carcinogenic and non-carcinogenic) from the Marsh Landing project are summarized in Table 6 in Section 4.2. **Table 24** presents the Health Risk Assessment Results for the Marsh Landing project. In accordance with the requirements of District Regulation 2, Rule 5 and California Office of Health Hazard Assessment (OEHHA) guidelines, the impact on public health due to the emission of these compounds was assessed utilizing EPA-approved air pollutant dispersion models.

TABLE 24. HEALTH RISK ASSESSMENT RESULTS

Receptor	Cancer Risk (risk in one million)	Chronic Non-Cancer Hazard Index	Acute Non-Cancer Hazard Index
Maximum Values	0.03	0.003	0.3

The health risk assessment performed by the applicant has been reviewed and verified by the District Toxics Evaluation Section and found to be in accordance with guidelines adopted by Cal/EPA's Office of Environmental Health Hazard Assessment (OEHHA), the California Air Resources Board (CARB), and the California Air Pollution Control Officers Association (CAPCOA). Pursuant to BAAQMD Regulation 2, Rule 5, the increased carcinogenic risk attributed to this project will not be significant since it is less than 1.0 in one million. The chronic hazard index and the acute hazard index attributed to the emission of non-carcinogenic air contaminants is each less than significant since each is less than 1.0. Therefore, the proposed Marsh Landing facility will be in compliance with District Regulation 2, Rule 5. Please see Appendix C (Memo dated February 24, 2010 prepared by Jane Lundquist, Air Toxics Section) for further discussion.

9. Other Applicable Requirements

The following section summarizes the applicable District, state and federal rules and regulations and describes how the Marsh Landing Generating Station will comply with those requirements.

9.1 Applicable District Rules and Regulations

Regulation 1, Section 301: Public Nuisance

None of the project's sources of air contaminants are expected to cause injury, detriment, nuisance, or annoyance to any considerable number of persons or the public with respect to any impacts resulting from the emission of air contaminants regulated by the District.

Regulation 2, Rule 1, Sections 301 and 302: Authority to Construct and Permit to Operate

Pursuant to Sections 2-1-301 and 2-1-302, the applicant has submitted an application to the District to obtain an Authority to Construct and Permit to Operate for all regulated sources at the proposed Marsh Landing facility. Those permits will be issued after the CEC completes its licensing process.

Regulation 2, Rule 2: New Source Review

The primary requirements of New Source Review that apply to the proposed Marsh Landing facility are Section 2-2-301; "Best Available Control Technology Requirement", Section 2-2-302; "Offset Requirements, precursor organic compounds and Nitrogen Oxides, NSR", Section 2-2-303, "Offset Requirement, PM_{10} and sulfur dioxide, NSR".

Regulation 2, Rule 2, Section 301: BACT

The District has performed a BACT analysis for NO_x, CO, POC, PM_{10} and SO_x as shown in Section 5. The proposed Marsh Landing Generating Station meets the BACT requirements under Section 2-2-301.

Regulation 2, Rule 2: Sections 302 and 303

The District has presented the offsets for the project for NO_x, POC, and PM_{10} as shown in Section 6. The proposed Marsh Landing Generating Station meets the offset requirements under Sections 2-2-302 and 2-2-303.

Regulation 2, Rule 2: Sections 304, 305, 306 and 414

The Prevention of Significant Deterioration (PSD) requirements in District Regulation 2, Rule 2 (Sections 304, 305, 306, and 308) are intended to implement the federal PSD requirements in 40 C.F.R. Section 52.21 and track those federal requirements. The proposed Marsh Landing Generating Station will not be subject to PSD requirements. Those requirements are discussed in detail in Section 7 above.

Regulation 2, Rule 3: Power Plants

Pursuant to Section 2-3-304, this Preliminary Determination of Compliance is subject to the public notice, public comment, and public inspection requirements contained in Sections 2-2-406 and 407. This document presents the Preliminary Determination of Compliance for the project. The District will consider all comments received during the comment period prior to issuing any Final Determination of Compliance for the project. The Final Determination of Compliance will be relied upon by the CEC in their licensing amendment proceeding. If the CEC grants a license to the project, then the District will issue an Authority to Construct.

Regulation 2, Rule 5: New Source Review of Toxic Air Contaminants

A risk screening analysis was performed to estimate the health risk resulting from the toxic air contaminant (TAC) emissions from the proposed Marsh Landing Generation Station. Results from this analysis indicate that the maximally exposed individual cancer risk is estimated at 0.03 in a million, the chronic non-cancer hazard index at 0.003 in a million, and acute non-cancer hazard index at 0.3 in million. Therefore the proposed Marsh Landing Generating Station will be in compliance the requirements of Section 2-5-301. Furthermore, the emission controls (abatement by an oxidation catalyst) are toxic best available control technology (TBACT).

Regulation 2, Rule 6: Major Facility Review

Pursuant to Section 404.1, the owner/operator of the Marsh Landing Generating shall submit an application to the District for a major facility review permit within 12 months after the facility becomes subject to Regulation 2, Rule 6. Pursuant to Sections 2-6-212.1 and 2-6-218, the Marsh Landing will become subject to Regulation 2, Rule 6, upon completion of construction as demonstrated by first firing of the gas turbines.

Regulation 2, Rule 7: Acid Rain

The Marsh Landing gas turbine units will be subject to the requirements of Title IV of the federal Clean Air Act. The requirements of the Acid Rain Program are outlined in 40 CFR Part 72. The specifications for the type and operation of continuous emission monitors (CEMs) for pollutants that contribute to the formation of acid rain are given in 40 CFR Part 75. District Regulation 2, Rule 7 incorporates by reference the provisions of 40 CFR Part 72.

40 CFR Part 72, Subpart A - Acid Rain Program

Part 72, Subpart A, establishes general provisions and operating permit program requirements for sources and affected units under the Acid Rain program, pursuant to Title IV of the Clean Air Act. The gas turbines are affected units subject to the program in accordance with 40 CFR Part 72, Subpart A, Section 72.6(a).

40 CFR Part 72, Subpart C – Acid Rain Permit Applications

Part 72, Subpart C, requires that the applicant submit a complete Acid Rain Permit application 24 months prior to first firing of the gas turbines.

40 CFR Part 73 – Sulfur Dioxide Allowance System

Part 73 establishes the sulfur dioxide allowance system for tracking, holding, and transferring allowances. Prior to operation of the gas turbines the applicant will be required to obtain adequate SO_2 allowances.

40 CFR Part 75 – Continuous Emission Monitoring

Part 75 contains the continuous emission monitoring requirements for units subject to the Acid Rain program. The applicant will be required to meet the Part 75 requirements for monitoring, recordkeeping and reporting of SO_2, NO_x, and CO_2 emissions. The applicant will also need to meet Part 75 requirement for monitoring, recordkeeping, and reporting volumetric flowrate and opacity.

Regulation 6, Rule 1: Particulate Matter – General Requirements

Through the use of dry low-NO_x burner technology and proper combustion practices, the combustion of natural gas at the gas turbines and natural gas fired preheaters are not expected to result in visible emissions. Specifically, the facility's combustion sources are expected to comply with Sections 301 (Ringelmann No. 1 Limitation), 302 (Opacity Limitation) with visible emissions not to exceed 20% opacity, and 310 (Particulate Weight Limitation) with particulate matter emissions of less than 0.15 grains per dry standard cubic foot of exhaust gas volume. As calculated in accordance with Section 310, the grain loading resulting from the operation of each gas turbine is 0.00092 gr/dscf @ 15% O_2 (0.0033 gr/dscf @ 0% O_2). See Appendix A for simple-cycle gas turbine grain loading calculations.

Particulate matter emissions associated with the construction of the facility are exempt from District permit requirements, but are subject to Regulation 6, Rule 1. However, the California Energy Commission will impose requirements for construction activities such as the use of water and/or chemical dust suppressants to minimize PM_{10} emissions and prevent visible particulate emissions.

Regulation 7: Odorous Substances

Section 302 prohibits the discharge of odorous substances which remain odorous beyond the facility property line after dilution with four parts odor-free air. Section 303 limits ammonia emissions to 5000 ppm. Because the ammonia slip emissions from the simple-cycle units will be limited by permit condition to 10 ppmvd @ 15% O_2 respectively, the facility is expected to comply with the requirements of Regulation 7.

Regulation 8: Organic Compounds

The gas turbines are exempt from Regulation 8, Rule 2, "Miscellaneous Operations" Section 110 since natural gas will be fired exclusively at those sources.

The use of solvents for cleaning and maintenance at the Marsh Landing Generating Station is expected to be at a level that is exempt from permitting in accordance with Regulation 2, Rule 1, Section 118. The facility may utilize less than 20 gallons per year of solvent for wipe cleaning per Section 118.9 and remain exempt from permitting requirements. The facility may also utilize a cold cleaner for maintenance cleaning as long as the unit meets the exemption set forth in Section 118.4. The facility may also perform solvent cleaning and preparation using aerosol cans meeting the exemption set forth in Section 118.10. Any solvent usage exceeding the amounts in Section 118 would require a permit. In addition, any solvent usage in excess of a toxic air contaminant trigger level contained in Regulation 2, Rule 5 would require a permit.

Regulation 9: Inorganic Gaseous Pollutants

Regulation 9, Rule 1, Sulfur Dioxide

This regulation establishes emission limits for sulfur dioxide from all sources and applies to the combustion sources at this facility. Section 301 (Limitations on Ground Level Concentrations) prohibits emissions which would result in ground level SO_2 concentrations in excess of 0.5 ppm continuously for 3 consecutive minutes, 0.25 ppm averaged over 60 consecutive minutes, or 0.05 ppm averaged over 24 hours. Section 302 (General Emission Limitation) prohibits SO_2 emissions in excess of 300 ppmv (dry). With maximum projected SO_2 emissions of < 1 ppmv, the gas turbines and natural gas fired preheaters are not expected to cause ground level SO_2 concentrations in excess of the limits specified in Section 301 and should easily comply with Section 302.

Regulation 9, Rule 7, Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters

The simple-cycle gas turbines are not subject to Regulation 9, Rule 7 requirements.

The natural gas fired preheaters are subject to Regulation 9, Rule 7 requirements. The preheaters are expected to comply with the NO_x emission limit of 30 ppm @ 3% O_2 contained in Section 301.1.

The preheaters are expected to comply with the NO_x emission limit of 30 ppm @ 3% O_2 and the CO emission limit of 400 ppm @ 3% O_2 contained in Section 307.1. The preheaters are required to comply with this limit as specified in the compliance schedule contained in Section 308. The preheaters will meet the emission limits of Section 307.1 upon startup and will satisfy the schedule requirements contained in Section 308 (January 1, 2011 is the earliest effective date).

The preheaters are not subject to Sections 311 and 312.

The preheaters will be required to meet the tune up requirements of Section 313, the registration requirements of 404, and the demonstration of compliance with emission standards contained in Section 405. The facility is expected to meet the recordkeeping requirements contained in Section 503 and follow the tune-up procedures contained in Section 604.

Regulation 9, Rule 9, Nitrogen Oxides from Stationary Gas Turbines

Because each of the combustion gas turbines will be limited by permit condition to NO_x emissions of 2.5 ppmvd @ 15% O_2, respectively, they will comply with the NO_x limitation in Section 301.2 of 5 ppmvd @ 15% O_2 or 0.15 lb/MW-hr.

9.2 Regulation 10: Standards of Performance for New Stationary Sources

Generally Regulation 10 incorporates by reference the provisions of Title 40 CFR Part 60. However, the District has not sought delegation of the New Source Performance Standard (NSPS) contained in Subpart KKKK. Subpart KKKK "Standards of Performance for Stationary Gas Turbines" applies to this facility. The gas turbines will comply with all applicable standards and limits required by these regulations. The applicable emission limitations are summarized below:

TABLE 25. NEW SOURCE PERFORMANCE STANDARDS FOR SIMPLE-CYCLE GAS TURBINES

Source	Requirement	Emission Limitation	Compliance Demonstration
Gas Turbines	Subpart KKKK	0.43 lb NO_x/MW-hr, or 15 ppm NO_x as NO_2 @ 15%O_2; 0.9 lb SO_2/MW-hr, or 0.06 lb SO_2/MMBtu maximum No CO limit in Subpart KKKK No PM limit in Subpart KKKK	2.5 ppm NO_x as NO_2 @ 15%O_2 Permit Limit; 0.0028 lb/MMBtu of SO_2 Permit Limit

40 CFR Part 60 Subpart KKKK

Section 60.4375 requires submittal of reports of excess emissions and monitoring of downtime for all periods of unit operation, including startup, shutdown, and malfunction. The applicant is expected to maintain adequate records for Subpart KKKK reporting requirements. The gas turbines will be equipped with continuous emissions monitors for NO_x. An annual NO_x emission test will not be required for Subpart KKKK as long as a compliant CEM is used to monitor emissions.

No sulfur content monitoring of the natural gas is required by Subpart KKKK if the facility demonstrates the fuel meets the sulfur content requirements contained in Section 60.4365 using the information required by Section 60.4365(a).

40 CFR Part 63 Subpart YYYY

Subpart YYYY contains the National Emission Standards for Hazardous Air Pollutants (NESHAPs) for Stationary Combustion Turbines. This regulation has been stayed (Federal Register; April 7, 2004, Volume 69, Number 67) for a combustion turbine that is a lean premix gas fired unit or a diffusion flame gas fired unit.

The emissions standards contained in Subpart YYYY have been stayed for natural gas fired combustion turbines. If a gas fired combustion turbine was subject to Subpart YYYY, then it would still need to comply with the Initial Notification requirements in Section 63.6145.

Subpart YYYY does not apply to the Marsh Landing gas turbines since the facility is not a major source of Hazardous Air Pollutants (HAPs). The Marsh Landing emits less than the major HAP thresholds of 10 tons/year of any single HAP, or 25 tons/year of aggregate HAP. Please note that ammonia and sulfuric acid are not considered HAPs.

9.3 State Requirements

The proposed Marsh Landing Generating Station will be subject to the Air Toxic "Hot Spots" Program contained in the California Health and Safety Code Section 44300 et seq. The facility will be required to prepare inventory plans and reports as required.

9.4 Greenhouse Gases

Climate change poses a significant risk to the Bay Area with such impacts such as rising sea levels, reduced runoff from snow pack in the Sierra Nevada, increased air pollution, impacts to agriculture, increased energy consumption, and adverse changes to sensitive ecosystems. The generation of electricity from burning natural gas produces air emissions known as greenhouse gases (GHGs) in addition to the criteria air pollutants. GHGs are known to contribute to the warming of the earth's atmosphere. These include primarily carbon dioxide, nitrous oxide (N_2O, not NO or NO_2, which are commonly known as NO_x or oxides of nitrogen), and methane (unburned natural gas). Also included are sulfur hexafluoride (SF6) from transformers, and hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) from refrigeration/chillers.

The California Global Warming Solutions Act of 2006 (AB32) requires the California Air Resources Board (ARB) to adopt a statewide GHG emissions limit equivalent to the statewide GHG emissions levels in 1990 to be achieved by 2020. To achieve this, ARB has a mandate to adopt rules and regulations to achieve the maximum technologically feasible and cost-effective GHG emission reductions.

The ARB is expected to adopt early action GHG reduction measures in the near future to reduce greenhouse gas emissions by 2020. ARB has adopted regulations requiring mandatory GHG emissions reporting. The facility is expected to report all GHG emissions to meet ARB requirements.

The facility will also be required to report GHG emissions to CARB, the District, and US EPA. In 2008, the District placed a fee on GHG emissions from large stationary sources of GHGs.

The GHG emissions estimates for Marsh Landing are shown below.

TABLE 26. MARSH LANDING GHG EMISSIONS

GHG	Fuel Usage MMBtu/year	Emission Factor (kg CO2/MMBtu)	Emission Factor (g CH4/MMBtu)	Emission Factor (g N2O/MMBtu)	GHG (metric tons/year)	Global Warming Potential	CO2 equivalents (metric tons/year)
Gas Turbines							
CO2	13994976	52.87			739914	1	739914.4
CH4	13994976		0.9		12.60	21	264.5
N2O	13994976			0.1	1.40	310	433.8
Fuel Gas Preheaters							
CO2	17520	52.87			926	1	926.3
CH4	17520		0.9		0.02	21	0.3
N2O	17520			0.1	0.00	310	0.5
Circuit Breakers							
SF6					0.001160	23,900	27.7
Total							741540

Emission Factors from REGULATION FOR THE MANDATORY REPORTING OF GREENHOUSE GAS EMISSIONS, Appendix A
Title 17 California Code of Regulations, Subchapter 10 Article 2, Sections 95100 to 95133

CO2 Emission Factor from Table 4 Appendix A-6 for Natural Gas with a heat content between 1000 Btu/scf and 1025 Btu/scf
CH4 Emission Factor from Table 6 Appendix A-9
N2O Emission Factor from Table 6 Appendix A-9
Global Warming Potentials from Table 2 Appendix A-4

Applicant estimates SF6 emissions for 6 circuit breakers at 0.425 lb/yr per unit (based on 0.5% leak rate for 85 lb SF6 per unit)

Each SF6 circuit breaker would be equipped with leak detection to minimize emissions.

SF6 = 6 x 0.425 lb/year per unit = 2.55 lb/year of SF6, 1.16 kg/year, 0.00116 metric tons/year of SF6

Marsh Landing has the potential to emit 741,540 metric tons/year of CO_2 equivalents using the ARB Mandatory Reporting Rule calculation methodology.

The Marsh Landing simple-cycle gas turbines will have a gross electrical efficiency of 37.8% at 59ºF and a relative humidity of 60%.[49] The Marsh Landing simple-cycle gas turbines will have a heat rate of 9,050 (LHV) Btu/KW-hr at 59ºF and a relative humidity of 60% (See Appendix D pg. 3, Case 10).

The EPA Administrator has recently stated that by April of 2010, the Administrator will take actions to ensure that no stationary sources will be required to get a Clean Air Act permit to cover GHG emissions in calendar year 2010.[50] In addition, in the first half of 2011, only sources required by non-GHG emissions to obtain a permit under the Clean Air Act will need to address their GHG emission in their permit applications. Therefore, the Marsh Landing Generating Station is not required to address GHG emissions under the Clean Air Act at this time.

As the lead agency under the CEQA-equivalent process, the CEC will be required to quantify and assess GHG emissions from the Marsh Landing Generating Station to evaluate the facility's compliance with applicable laws, ordinances, regulations and standards, and the potential impacts and benefits associated with adding Marsh Landing Generating Station to the electricity system.

9.5 Environmental Justice

The District is committed to implementing its permit programs in a manner that is fair and equitable to all Bay Area residents regardless of age, culture, ethnicity, gender, race, socioeconomic status, or geographic location in order to protect against the health effects of air pollution. The District has worked to fulfill this commitment in the current permitting action.

The emissions from the proposed project will not cause or contribute to any significant public health impacts in the community. As described in detail above, the District has undertaken a detailed review of the potential public health impacts of the emissions authorized under the proposed permitting action, and has found that they will involve no significant public health risks. The District has found that the maximum lifetime cancer risk associated with the facility is 0.03 in one million, and that the maximum chronic Hazard Index would be 0.003 and the maximum acute Hazard Index would be 0.3. These risk levels are far below what the District, EPA, or any other public health agency considers to be significant. The District anticipates that there will be no significant impacts due to air emissions related to the Marsh Landing after all of the mitigations required by District Rules and the California Energy Commission are implemented. The District does not anticipate an adverse impact on any community due to air emissions from the Marsh Landing and therefore there is no disparate adverse impact on any Environmental Justice community located near the facility.

---

[49] See email dated 2/22/10 from John Lague of URS to Brian Lusher of BAAQMD (022210 Email from Lague to Lusher.pdf).
[50] Letter dated February 22, 2010 from Lisa Jackson to Senator Rockefeller, Letter summarizes EPA proposals on regulating green house gases.

10. Proposed Permit Conditions

The District is proposing the following permit conditions to ensure that the project complies with all applicable District, state, and federal Regulations. The proposed conditions would limit operational parameters such as fuel use, stack gas emission concentrations, and mass emission rates. The permit conditions specify abatement device operation and performance levels. To aid enforcement efforts, conditions specifying emission monitoring, source testing, and record keeping requirements are included. Furthermore, pollutant mass emission limits (in units of lb/hr and lb/MMBtu of natural gas fired) will insure that daily and annual emission rate limitations are not exceeded.

To provide maximum operational flexibility, no limitations are being proposed on the type or quantity of gas turbine start-ups or shutdowns. Instead, the facility would be required to comply with daily and annual (consecutive twelve-month) mass emission limits at all times. Compliance with CO and NO_x limitations would be verified by continuous emission monitors (CEMs) that will be in operation during all turbine operating modes, including start-up, shutdown, combustor tuning, and transient conditions. Compliance with POC, SO_2, and PM_{10} mass emission limits would be verified by annual source testing.

In addition to permit conditions that apply to steady-state operation of each gas turbine power train, the District is proposing conditions that govern equipment operation during the initial commissioning period when the gas turbine power trains will operate without their SCR systems and/or oxidation catalysts in place. Commissioning activities include, but are not limited to, the testing of the gas turbines, and adjustment of control systems. Parts 1 through 10 of the proposed permit conditions for the simple-cycle gas turbines apply to this commissioning period and are intended to minimize emissions during the commissioning period.

Proposed Marsh Landing Generating Station Permit Conditions

Definitions:

Hour	Any continuous 60-minute period
Clock Hour:	Any continuous 60-minute period beginning on the hour
Calendar Day:	Any continuous 24-hour period beginning at 12:00 AM or 0000 hours
Year:	Any consecutive twelve-month period of time
Rolling 3-hour period:	Any consecutive three-clock hour period, not including start-up or shutdown periods
Heat Input:	All heat inputs refer to the heat input at the higher heating value (HHV) of the fuel, in BTU/scf
Firing Hours:	Period of time during which fuel is flowing to a unit, measured in minutes
MMBtu:	million British thermal units
Gas Turbine Start-up Mode:	The lesser of the first 30 minutes of continuous fuel flow to the Gas Turbine after fuel flow is initiated or the period of time from Gas Turbine fuel flow initiation until the Gas Turbine achieves two consecutive CEM data points in compliance with the emission concentration limits of conditions 17(b) and 17(d).
Gas Turbine Shutdown Mode:	The lesser of the 15 minute period immediately prior to the termination of fuel flow to the Gas Turbine or the period of time from non-compliance with any requirement listed in Conditions 17(b) and 17(d) until termination of fuel flow to the Gas Turbine
Gas Turbine Combustor Tuning Mode:	The period of time, not to exceed 8 hours, in which testing, adjustment, tuning, and calibration operations are performed, as recommended by the gas turbine manufacturer, to insure safe and reliable steady-state operation, and to minimize NO_x and CO emissions. The SCR and oxidation catalyst are not operating at their design control effectiveness during the tuning operation.
Transient Hour:	A transient hour is any clock hour during which the change in gross electrical output produced by the gas turbine exceeds 25 MW per minute for one minute or longer during any period that is not part of a startup, shutdown, or combustor tuning period.
Specified PAHs:	The polycyclic aromatic hydrocarbons listed below shall be considered to be Specified PAHs for these permit conditions. Any emission limits for Specified PAHs refer to the sum of the emissions for all six of the following compounds Benzo[a]anthracene Benzo[b]fluoranthene Benzo[k]fluoranthene Benzo[a]pyrene Dibenzo[a,h]anthracene

Indeno[1,2,3-cd]pyrene

Corrected Concentration:	The concentration of any pollutant (generally NO_x, CO, or NH_3) corrected to a standard stack gas oxygen concentration. For emission points P-1 (exhaust of S-1 Gas Turbine), P-2 (exhaust of S-2 Gas Turbine) P-3 (exhaust of S-3 Gas Turbine), P-4 (exhaust of S-4 Gas Turbine), the standard stack gas oxygen concentration is 15% O_2 by volume on a dry basis
Commissioning Activities:	All testing, adjustment, tuning, and calibration activities recommended by the equipment manufacturers and the MLGS construction contractor to insure safe and reliable steady-state operation of the gas turbines, heat recovery steam generators, steam turbine, and associated electrical delivery systems during the commissioning period
Commissioning Period:	The Period shall commence when all mechanical, electrical, and control systems are installed and individual system start-up has been completed, or when a gas turbine is first fired, whichever occurs first. The period shall terminate when the plant has completed performance testing, is available for commercial operation, and has initiated sales to the power exchange.
Precursor Organic Compounds (POCs):	Any compound of carbon, excluding methane, ethane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate
CEC CPM:	California Energy Commission Compliance Program Manager
MLGS:	Marsh Landing Generating Station
Total Particulate Matter	The sum of all filterable and all condensable particulate matter.

SGT6-5000F Simple-Cycle Gas Turbines

Applicability:

Parts 1 through 10 of this condition shall only apply during the commissioning period as defined above. Unless otherwise indicated, Parts 11 through 40 of this condition shall apply after the commissioning period has ended.

Conditions for the Commissioning Period for SGT6-5000F Gas Turbines

1. The owner/operator of the MLGS shall minimize emissions of carbon monoxide and nitrogen oxides from S-1, S-2, S-3 and S-4 Gas Turbines to the maximum extent possible during the commissioning period. (Basis: BACT, Regulation 2, Rule 2, Section 409)

2. At the earliest feasible opportunity in accordance with the recommendations of the equipment manufacturers and the construction contractor, the owner/operator shall tune the S-1, S-2, S-3

and S-4 Gas Turbines combustors to minimize the emissions of carbon monoxide and nitrogen oxides. (Basis: BACT, Regulation 2, Rule 2, Section 409)

3. At the earliest feasible opportunity in accordance with the recommendations of the equipment manufacturers and the construction contractor, the owner/operator shall install, adjust, and operate the A-1, A-3, A-5 and A-7 Oxidation Catalysts and A-2, A-4, A-6 and A-8 SCR Systems to minimize the emissions of carbon monoxide and nitrogen oxides from S-1, S-2, S-3, and S-4 Gas Turbines. (Basis: BACT, Regulation 2, Rule 2, Section 409)

4. The owner/operator of the MLGS shall submit a plan to the District Engineering Division and the CEC CPM at least four weeks prior to first firing of S-1, S-2, S-3, and S-4 Gas Turbines describing the procedures to be followed during the commissioning of the gas turbines. The plan shall include a description of each commissioning activity, the anticipated duration of each activity in hours, and the purpose of the activity. The activities described shall include, but not be limited to, the tuning of the Dry-Low-NO_x combustors, the installation and operation of the required emission control systems, the installation, calibration, and testing of the CO and NO_x continuous emission monitors, and any activities requiring the firing of the Gas Turbines (S-1, S-2, S-3 & S-4) without abatement by their respective oxidation catalysts and/or SCR Systems. The owner/operator shall not fire any of the Gas Turbines (S-1, S-2, S-3 or S-4) sooner than 28 days after the District receives the commissioning plan. (Basis: Regulation 2, Rule 2, Section 419)

5. During the commissioning period, the owner/operator of the MLGS shall demonstrate compliance with Parts 7, 8, 9, and 10 through the use of properly operated and maintained continuous emission monitors and data recorders for the following parameters and emission concentrations:

    firing hours
    fuel flow rates
    stack gas nitrogen oxide emission concentrations,
    stack gas carbon monoxide emission concentrations
    stack gas oxygen concentrations.

   The monitored parameters shall be recorded at least once every 15 minutes (excluding normal calibration periods or when the monitored source is not in operation) for the Gas Turbines (S-1, S-2, S-3, and S-4). The owner/operator shall use District-approved methods to calculate heat input rates, nitrogen dioxide mass emission rates, carbon monoxide mass emission rates, and NO_x and CO emission concentrations, summarized for each clock hour and each calendar day. The owner/operator shall retain records on site for at least 5 years from the date of entry and make such records available to District personnel upon request. (Basis: Regulation 2, Rule 2, Section 419)

6. The owner/operator shall install, calibrate, and operate the District-approved continuous monitors specified in Part 5 prior to first firing of the Gas Turbines (S-1, S-2, S-3 and S-4). After first firing of the turbines, the owner/operator shall adjust the detection range of these continuous emission monitors as necessary to accurately measure the resulting range of CO and NO_x emission concentrations. The type, specifications, and location of these monitors shall be subject to District review and approval. (Basis: Regulation 2, Rule 2, Section 419)

7. The owner/operator shall not fire S-1, S-2, S-3, or S-4 Gas Turbine without abatement of nitrogen oxide emissions by the corresponding SCR System A-2, A-4, A-6, or A-8 and/or abatement of carbon monoxide emissions by the corresponding Oxidation Catalyst A-1, A-3, A-5, or A-7 for more than 232 hours during the commissioning period. Such operation of any Gas Turbine (S-1, S-2, S-3, S-4) without abatement shall be limited to discrete commissioning activities that can only be properly executed without the SCR system and/or oxidation catalyst in place. Upon completion of these activities, the owner/operator shall provide written notice to the District Engineering and Enforcement Divisions and the unused balance of the 232 firing hours without abatement shall expire. (Basis: BACT, Regulation 2, Rule 2, Section 409)

8. The total mass emissions of nitrogen oxides, carbon monoxide, precursor organic compounds, PM_{10}, and sulfur dioxide that are emitted by the Gas Turbines (S-1, S-2, S-3, and S-4) during the commissioning period shall accrue towards the consecutive twelve-month emission limitations specified in Part 22. (Basis: Regulation 2, Rule 2, Section 409)

9. The owner/ operator shall not operate the Gas Turbines (S-1, S-2, S-3, and S-4) in a manner such that the pollutant emissions from each gas turbine will exceed the following limits during the commissioning period. These emission limits shall include emissions resulting from the start-up and shutdown of the Gas Turbines (S-1, S-2, S-3, S-4). (Basis: BACT, Regulation 2, Rule 2, Section 409)

NO_x (as NO_2)	3,063 pounds per calendar day	188 pounds per hour
CO	33,922 pounds per calendar day	2,405 pounds per hour
POC (as CH_4)	2,008 pounds per calendar day	
PM_{10}	235 pounds per calendar day	
SO_2	149 pounds per calendar day	

10. Within 90 days after startup, the Owner/Operator shall conduct District and CEC approved source tests to determine compliance with the emission limitations specified in Part 17. The source tests shall determine NO_x, CO, and POC emissions during start-up and shutdown of the gas turbines. The POC emissions shall be analyzed for methane and ethane to account for the presence of unburned natural gas. The source test shall include a minimum of three start-up and three shutdown periods. Thirty working days before the execution of the source tests, the Owner/Operator shall submit to the District and the CEC Compliance Program Manager (CPM) a detailed source test plan designed to satisfy the requirements of this Part. The District and the CEC CPM will notify the Owner/Operator of any necessary modifications to the plan within 20 working days of receipt of the plan; otherwise, the plan shall be deemed approved. The Owner/Operator shall incorporate the District and CEC CPM comments into the test plan. The Owner/Operator shall notify the District and the CEC CPM within seven (7) working days prior to the planned source testing date. The owner/operator shall submit the source test results to the District and the CEC CPM within 60 days of the source testing date. (Basis: Regulation 2, Rule 2, Section 419)

Conditions for the SGT6-5000F Simple-Cycle Gas Turbines (S-1, S-2, S-3, and S-4)

11. The owner/operator shall fire the Gas Turbines (S-1, S-2, S-3, and S-4) exclusively on PUC-regulated natural gas with a maximum sulfur content of 1 grain per 100 standard cubic feet. To demonstrate compliance with this limit, the operator of S-1, S-2, S-3 and S-4 shall sample and analyze the gas from each supply source at least monthly to determine the sulfur content of the gas. PG&E monthly sulfur data may be used provided that such data can be demonstrated to be representative of the gas delivered to the MLGS. (Basis: BACT for SO_2 and PM_{10})

12. The owner/operator shall not operate the units such that the heat input rate to each Gas Turbine (S-1, S-2, S-3, and S-4) exceeds 2,202 MMBtu (HHV) per hour. (Basis: BACT for NO_x)

13. The owner/operator shall not operate the units such that the heat input rate to each Gas Turbine (S-1, S-2, S-3, and S-4) exceeds 52,848 MMBtu (HHV) per day. (Basis: Cumulative Increase for PM_{10})

14. The owner/operator shall not operate the units such that the combined cumulative heat input rate for the Gas Turbines (S-1, S-2, S-3, and S-4) exceeds 13,994,976 MMBtu (HHV) per year. (Basis: Offsets)

15. The owner operator shall not operate S-1, S-2, S-3, and S-4 such that the combined hours for all four units exceeds 7,008 hours per year (excluding operations necessary for maintenance, tuning, and testing). (Basis: Offsets, Cumulative Increase)

16. The owner/operator shall ensure that the each Gas Turbine (S-1, S-2, S-3, S-4) is abated by the properly operated and properly maintained Selective Catalytic Reduction (SCR) System A-2, A-4, A-6 or A-8 and Oxidation Catalyst System A-1, A-3, A-5, or A-7 whenever fuel is combusted at those sources and the corresponding SCR catalyst bed (A-2, A-4, A-6 or A-8) has reached minimum operating temperature. (Basis: BACT for NO_x, POC and CO)

17. The owner/operator shall ensure that the Gas Turbines (S-1, S-2, S-3, S-4) comply with requirements (a) through (j). Requirements (a) through (f) do not apply during a gas turbine start-up, combustor tuning operation or shutdown. (Basis: BACT and Regulation 2, Rule 5)
    a) Nitrogen oxide mass emissions (calculated as NO_2) at each exhaust point P-1, P-2, P-3, and P-4 (exhaust point for S-1, S-2, S-3 and S-4 Gas Turbine after abatement by A-2, A-4, A-6 and A-8 SCR System) shall not exceed 20.83 pounds per hour or 0.00946 lb/MMBtu (HHV) of natural gas fired. Limits are averaged over one hour except during transient hours where a 3-clock hour average is calculated as the average of the transient hour, the clock hour immediately prior to the transient hour and the clock hour immediately following the transient hour. (Basis: BACT for NO_x)
    b) The nitrogen oxide emission concentration at each exhaust point P-1, P-2, P-3 and P-4 shall not exceed 2.5 ppmv, on a dry basis, corrected to 15% O_2, averaged over any 1-hour period except during periods with a transient hour. Limits are averaged over one hour except during transient hours where a 3-clock hour average is calculated as the

average of the transient hour, the clock hour immediately prior to the transient hour and the clock hour immediately following the transient hour. (Basis: BACT for NO_x)

c) Carbon monoxide mass emissions at each exhaust point P-1, P-2, P-3, and P-4 shall not exceed 10.0 pounds per hour or 0.00454 lb/MMBtu of natural gas fired, averaged over any 1-hour period. (Basis: BACT for CO)

d) The carbon monoxide emission concentration at each exhaust point P-1, P-2, P-3, and P-4 shall not exceed 2.0 ppmv, on a dry basis, corrected to 15% O_2 averaged over any 1-hour period. (Basis: BACT for CO)

e) Ammonia (NH_3) emission concentrations at each exhaust point P-1, P-2, P-3, and P-4 shall not exceed 10 ppmv, on a dry basis, corrected to 15% O_2, averaged over any rolling 3-hour period. This ammonia emission concentration shall be verified by the continuous recording of the ammonia injection rate to each SCR System A-2, A-4, A-6, and A-8. The correlation between the gas turbine heat input rates, A-2, A-4, A-6, and A-8 SCR System ammonia injection rates, and corresponding ammonia emission concentration at emission points P-1, P-2, P-3 and P-4 shall be determined in accordance with Part 27 or District approved alternative method. (Basis: Regulation 2, Rule 5)

f) Precursor organic compound (POC) mass emissions (as CH_4) at each exhaust point P-1, P-2, P-3, and P-4 shall not exceed 2.9 pounds per hour or 0.00132 lb/MMBtu of natural gas fired. (Basis: BACT for POC)

g) Sulfur dioxide (SO_2) mass emissions at each exhaust point P-1, P-2, P-3, and P-4 shall not exceed 6.21 pounds per hour or 0.0028 lb/MMBtu of natural gas fired. (Basis: BACT for SO_2)

h) Particulate matter with an aerodynamic diameter equal to or less than 10 microns (PM_{10}) mass emissions at each exhaust point P-1, P-2, P-3, and P-4 shall not exceed 9.0 pounds per hour. (Basis: BACT for PM_{10})

i) Total particulate matter mass emissions at each exhaust point P-1, P-2, P-3, and P-4 shall not exceed 9.0 pounds per hour. (Basis: Regulation 2, Rule 2, Section 419)

18. The owner/operator shall ensure that the regulated air pollutant mass emission rates from each of the Gas Turbines (S-1, S-2, S-3, and S-4) during a start-up or shutdown does not exceed the limits established below. Startups shall not exceed 30 minutes. Shutdowns shall not exceed 15 minutes. (Basis: BACT Limit for Non-Normal Operation)

Pollutant	**Maximum Emissions Per Startup**	**Maximum Emissions During Hour Containing a Startup**	**Maximum Emissions Per Shutdown**
	(lb/startup)	**(lb/hour)**	**(lb/shutdown)**
NO_x (as NO_2)	18.6	45.1	13.1
CO	216.2	541.3	111.5
POC (as CH_4)	11.9	28.5	5.4

19. The owner/operator shall not perform combustor tuning on each Gas Turbine (S-1, S-2, S-3, or S-4) more than twice every consecutive 12 month period. Each tuning event shall not exceed 8 hours. Combustor tuning shall only be performed on one gas turbine per day. The owner/operator shall notify the District no later than 7 days prior to combustor tuning activity. The emissions during combustor tuning from each gas turbine shall not exceed the limits established below. (Basis: Offsets, Cumulative Increase)

Pollutant	**Combustor Tuning lb/hour**
NO_x (as NO_2)	80
CO	450
POC (as CH_4)	30

20. The owner/operator shall not allow total combined emissions from the Gas Turbines (S-1, S-2, S-3, and S-4), including emissions generated during gas turbine start-ups, and shutdowns to exceed the following limits during any calendar day (except for days during which combustor tuning events occur, which are subject to Paragraph 21 below):
    (a) 2,309 pounds of NO_x (as NO_2) per day (Basis: Cumulative Increase)
    (b) 4,858 pounds of CO per day (Basis: Cumulative Increase)
    (c) 476 pounds of POC (as CH_4) per day (Basis: Cumulative Increase)
    (d) 864 pounds of PM_{10} per day (Basis: Cumulative Increase)
    (e) 596 pounds of SO_2 per day (Basis: Cumulative Increase)

21. The owner/operator shall not allow total combined emissions from the Gas Turbines (S-1, S-2, S-3, and S-4), including emissions generated during gas turbine start-ups, shutdowns, and combustor tuning events to exceed the following limits during any calendar day on which a tuning event occurs:
    (a) 2,783 pounds of NO_x (as NO_2) per day (Basis: Cumulative Increase)
    (b) 8,378 pounds of CO per day (Basis: Cumulative Increase)
    (c) 693 pounds of POC (as CH_4) per day (Basis: Cumulative Increase)
    (d) 864 pounds of PM_{10} per day (Basis: Cumulative Increase)
    (e) 596 pounds of SO_2 per day (Basis: Cumulative Increase)

22. The owner/operator shall not allow cumulative combined emissions from the Gas Turbines (S-1, S-2, S-3, and S-4), including emissions generated during gas turbine start-ups, combustor tuning, shutdowns, and malfunctions to exceed the following limits during any consecutive twelve-month period:
    (a) 71.76 tons of NO_x (as NO_2) per year (Basis: Offsets)
    (b) 138.57 tons of CO per year (Basis: Cumulative Increase)
    (c) 14.21 tons of POC (as CH_4) per year (Basis: Offsets)
    (d) 31.54 tons of PM_{10} per year (Basis: Cumulative Increase)
    (e) 4.94 tons of SO_2 per year (Basis: Cumulative Increase)

23. The owner/operator shall not allow the maximum projected annual toxic air contaminant emissions (per Part 26) from the Gas Turbines (S-1, S-2, S-3, S-4) combined to exceed the following limits:

formaldehyde	7,785 pounds per year
benzene	202 pounds per year
Specified polycyclic aromatic hydrocarbons (PAHs)	1.98 pounds per year

unless the following requirement is satisfied:

The owner/operator shall perform a health risk assessment to determine the total facility risk using the emission rates determined by source testing and the most current Bay Area Air Quality Management District approved procedures and unit risk factors in effect at the time of the analysis. The owner/operator shall submit the risk analysis to the District and the CEC CPM within 60 days of the source test date. The owner/operator may request that the District and the CEC CPM revise the carcinogenic compound emission limits specified above. If the owner/operator demonstrates to the satisfaction of the APCO that these revised emission limits will not result in a significant cancer risk, the District and the CEC CPM may, at their discretion, adjust the carcinogenic compound emission limits listed above. (Basis: Regulation 2, Rule 5)

24. The owner/operator shall demonstrate compliance with Parts 12 through 15, 17(a) through 17(e), 18 (NO_x, and CO limits), 19 (NO_x and CO limits), 20(a), 20(b), 21(a), 21(b), 22(a) and 22(b) by using properly operated and maintained continuous monitors (during all hours of operation including gas turbine start-up, combustor tuning, and shutdown periods). The owner/operator shall monitor for all of the following parameters:
    (a) Firing Hours and Fuel Flow Rates for each of the following sources: S-1, S-2, S-3, and S-4
    (b) Oxygen (O_2) concentration, Nitrogen Oxides (NO_x) concentration, and carbon monoxide (CO) concentration at exhaust points P-1, P-2, P-3 and P-4.
    (c) Ammonia injection rate at A-2, A-4, A-6 and A-8 SCR Systems

    The owner/operator shall record all of the above parameters at least every 15 minutes (excluding normal calibration periods) and shall summarize all of the above parameters for each clock hour. For each calendar day, the owner/operator shall calculate and record the total firing hours, the average hourly fuel flow rates, and pollutant emission concentrations.

    The owner/operator shall use the parameters measured above and District-approved calculation methods to calculate the following parameters:
    (d) Heat Input Rate for each of the following sources: S-1, S-2, S-3, and S-4
    (e) Corrected NO_x concentration, NO_x mass emission rate (as NO_2), corrected CO concentration, and CO mass emission rate at each of the following exhaust points: P-1, P-2, P-3 and P-4.

For each source, exhaust point, the owner/operator shall record the parameters specified in Parts 24(d) and 24(e) at least once every 15 minutes (excluding normal calibration periods). As specified below, the owner/operator shall calculate and record the following data:

(f) total Heat Input Rate for every clock hour and the average hourly Heat Input Rate for every rolling 3-hour period.

(g) on an hourly basis, the cumulative total Heat Input Rate for each calendar day for the following: each Gas Turbine and for S-1, S-2, S-3 and S-4 combined.

(h) the average NO_x mass emission rate (as NO_2), CO mass emission rate, and corrected NO_x and CO emission concentrations for every clock hour.

(i) on an hourly basis, the cumulative total NO_x mass emissions (as NO_2) and the cumulative total CO mass emissions, for each calendar day for the following: each Gas Turbine and for S-1, S-2, S-3 and S-4 combined.

(j) For each calendar day, the average hourly Heat Input Rates, corrected NO_x emission concentration, NO_x mass emission rate (as NO_2), corrected CO emission concentration, and CO mass emission rate for each Gas Turbine.

(k) on a monthly basis, the cumulative total NO_x mass emissions (as NO_2) and cumulative total CO mass emissions, for the previous consecutive twelve month period for sources S-1, S-2, S-3, and S-4 combined.

(Basis: 1-520.1, 9-9-501, BACT, Offsets, NSPS, Cumulative Increase)

25. To demonstrate compliance with Parts 17(f), 17(g), 17(h), 17(i), 17(j), 20(c), 20(d), 20(e), 21(c), 21(d), 21(e), 22(c), 22(d), 22(e), the owner/operator shall calculate and record on a daily basis, the precursor organic compound (POC) mass emissions, fine particulate matter (PM_{10}) mass emissions (including condensable particulate matter), and sulfur dioxide (SO_2) mass emissions from each power train. The owner/operator shall use the actual heat input rates measured pursuant to Part 24, actual Gas Turbine start-up times, actual Gas Turbine shutdown times, and CEC and District-approved emission factors developed pursuant to source testing under Part 28 to calculate these emissions. The owner/operator shall present the calculated emissions in the following format:

(a) For each calendar day, POC, PM_{10}, and SO_2 emissions, summarized for each power train (Gas Turbine) and S-1, S-2, S-3, and S-4 combined

(b) on a monthly basis, the cumulative total POC, PM_{10}, and SO_2 mass emissions, for each year for S-1, S-2, S-3, and S-4 combined.

(Basis: Offsets, Cumulative Increase)

26. To demonstrate compliance with Part 23, the owner/operator shall calculate and record on an annual basis the maximum projected annual emissions of: Formaldehyde, Benzene, and Specified PAH's. The owner/operator shall calculate the maximum projected annual emissions using the maximum annual heat input rate of 13,994,976 MMBtu/year for S-1, S-2, S-3, and S-4 combined and the highest emission factor (pounds of pollutant per MMBtu of heat input) determined by the most recent of any source test of the S-1, S-2, S-3, or S-4 Gas Turbines. If the highest emission factor for a given pollutant occurs during minimum-load turbine operation, a reduced annual heat input rate may be utilized to calculate the maximum projected annual emissions to reflect the reduced heat input rates during gas turbine start-up and minimum-load operation. The reduced annual heat input rate shall be subject to District review and approval. (Basis: Regulation 2, Rule 5)

27. Within 90 days of start-up of each of the MLGS SGT6-5000F units, the owner/operator shall conduct a District-approved source test on exhaust point P-1, P-2, P-3, or P-4 to determine the corrected ammonia (NH_3) emission concentration to determine compliance with Part 17(e). The source test shall determine the correlation between the heat input rates of the gas turbine, A-2, A-4, A-6, or A-8 SCR System ammonia injection rate, and the corresponding NH_3 emission concentration at emission point P-1, P-2, P-3, or P-4. The source test shall be conducted over the expected operating range of the turbine (including, but not limited to, minimum and full load modes) to establish the range of ammonia injection rates necessary to achieve NO_x emission reductions while maintaining ammonia slip levels. The owner/operator shall repeat the source testing on an annual basis thereafter. Ongoing compliance with Part 17(e) shall be demonstrated through calculations of corrected ammonia concentrations based upon the source test correlation and continuous records of ammonia injection rate. The owner/operator shall submit the source test results to the District and the CEC CPM within 60 days of conducting the tests. (Basis: Regulation 2, Rule 5)

28. Within 90 days of start-up of each of the MLGS SGT6-5000F units and on an annual basis thereafter, the owner/operator shall conduct a District-approved source test on exhaust points P-1, P-2, P-3 and P-4 while each Gas Turbine is operating at maximum load to determine compliance with Parts 17(a), 17(b), 17(c), 17(d), 17(f), 17(g), 17(h), 17(i) and 17(j) and while each Gas Turbine is operating at minimum load to determine compliance with Parts 17(c), and 17(d) and to verify the accuracy of the continuous emission monitors required in Part 24. The owner/operator shall test for (as a minimum): water content, stack gas flow rate, oxygen concentration, precursor organic compound concentration and mass emissions, nitrogen oxide concentration and mass emissions (as NO_2), carbon monoxide concentration and mass emissions, sulfur dioxide concentration and mass emissions, methane, ethane, and total particulate matter emissions including condensable particulate matter. The owner/operator shall submit the source test results to the District and the CEC CPM within 60 days of conducting the tests. (Basis: BACT, Offsets)

29. The owner/operator shall obtain approval for all source test procedures from the District's Source Test Section and the CEC CPM prior to conducting any tests. The owner/operator shall comply with all applicable testing requirements for continuous emission monitors as specified in Volume V of the District's Manual of Procedures. The owner/operator shall notify the District's Source Test Section and the CEC CPM in writing of the source test protocols and projected test dates at least 7 days prior to the testing date(s). As indicated above, the Owner/Operator shall measure the contribution of condensable PM (back half) to any measurement of the total particulate matter or PM_{10} emissions. However, the Owner/Operator may propose alternative measuring techniques to measure condensable PM such as the use of a dilution tunnel or other appropriate method used to capture semi-volatile organic compounds. The owner/operator shall submit the source test results to the District and the CEC CPM within 60 days of conducting the tests. (Basis: BACT, Regulation 2, Rule 2, Section 419)

30. Within 90 days of start-up of each of the MLGS SGT6-5000F gas turbines and on a biennial basis (once every two years) thereafter, the owner/operator shall conduct a District-approved source test on one of the following exhaust points P-1, P-2, P-3 or P-4 while the Gas Turbine

is operating at maximum allowable operating rates to demonstrate compliance with Part 23. The owner/operator shall also test the gas turbine while it is operating at minimum load. If three consecutive biennial source tests demonstrate that the annual emission rates calculated pursuant to Part 26 for any of the compounds listed below are less than the BAAQMD trigger levels, pursuant to Regulation 2, Rule 5, shown, then the owner/operator may discontinue future testing for that pollutant:

Benzene	≤	3.8 pounds/year and 2.9 pounds/hour
Formaldehyde	≤	18 pounds/year and 0.12 pounds/hour
Specified PAHs	≤	0.0069 pounds/year

(Basis: Regulation 2, Rule 5)

31. The owner/operator shall calculate the sulfuric acid mist (SAM) emission rate using the total heat input for the sources and the highest results of any source testing conducted pursuant to Part 32. If this SAM mass emission limit of Part 33 is exceeded, the owner/operator must utilize air dispersion modeling to determine the impact (in $\mu g/m^3$) of the sulfuric acid mist emissions pursuant to Regulation 2, Rule 2, Section 306. (Basis: Regulation 2, Rule 2, Section 306)

32. Within 90 days of start-up of each of the MLGS SGT6-5000F gas turbines and on an annual basis thereafter, the owner/operator shall conduct a District-approved source test on two of the four exhaust points P-1, P-2, P-3 and P-4 while each gas turbine is operating at maximum heat input rates to demonstrate compliance with the SAM emission rates specified in Part 33. The owner/operator shall test for (as a minimum) SO_2, SO_3, and H_2SO_4. The owner/operator shall submit the source test results to the District and the CEC CPM within 60 days of conducting the tests. (Basis: Regulation 2, Rule 2, Section 306, and Regulation 2, Rule 2, Section 419)

33. The owner/operator shall not allow sulfuric acid emissions (SAM) from stacks P-1, P-2, P-3, P-4 combined to exceed 7 tons in any consecutive 12 month period. (Basis: Regulation 2, Rule 2, Section 306, and Regulation 2, Rule 2, Section 419)

34. The owner/operator shall ensure that the stack height of emission points P-1, P-2, P-3 and P-4 is each at least 165 feet above grade level at the stack base. (Basis: Regulation 2, Rule 5)

35. The owner/operator of the MLGS shall submit all reports (including, but not limited to monthly CEM reports, monitor breakdown reports, emission excess reports, equipment breakdown reports, etc.) as required by District Rules or Regulations and in accordance with all procedures and time limits specified in the Rule, Regulation, Manual of Procedures, or Enforcement Division Policies & Procedures Manual. (Basis: Regulation 2, Rule 1, Section 403)

36. The owner/operator of the MLGS shall maintain all records and reports on site for a minimum of 5 years. These records shall include but are not limited to: continuous monitoring records (firing hours, fuel flows, emission rates, monitor excesses, breakdowns, etc.), source test and analytical records, natural gas sulfur content analysis results, emission calculation records, records of plant upsets and related incidents. The owner/operator shall make all records and reports available to District and the CEC CPM staff upon request. (Basis: Regulation 2, Rule 1, Section 403, Regulation 2, Rule 6, Section 501)

37. The owner/operator of the MLGS shall notify the District and the CEC CPM of any violations of these permit conditions. Notification shall be submitted in a timely manner, in accordance with all applicable District Rules, Regulations, and the Manual of Procedures. Notwithstanding the notification and reporting requirements given in any District Rule, Regulation, or the Manual of Procedures, the owner/operator shall submit written notification (facsimile is acceptable) to the Enforcement Division within 96 hours of the violation of any permit condition. (Basis: Regulation 2, Rule 1, Section 403)

38. The Owner/Operator of MLGS shall provide adequate stack sampling ports and platforms to enable the performance of source testing. The location and configuration of the stack sampling ports shall comply with the District Manual of Procedures, Volume IV, Source Test Policy and Procedures, and shall be subject to BAAQMD review and approval, except that the facility shall provide four sampling ports that are at least 6 inches in diameter in the same plane of each gas turbine stack (P-1, P-2, P-3, P-4). (Basis: Regulation 1, Section 501)

39. Within 180 days of the issuance of the Authority to Construct for the MLGS, the Owner/Operator shall contact the BAAQMD Technical Services Division regarding requirements for the continuous emission monitors, sampling ports, platforms, and source tests required by Parts 10, 27, 28, 30 and 32. The owner/operator shall conduct all source testing and monitoring in accordance with the District approved procedures. (Basis: Regulation 1, Section 501)

40. The owner/operator shall ensure that the MLGS complies with the continuous emission monitoring requirements of 40 CFR Part 75. (Basis: Regulation 2, Rule 7)

11. Preliminary Determination

The APCO has made a preliminary determination that the proposed Marsh Landing Generating Station power plant, which is composed of the permitted sources listed below, complies with all applicable District, state and federal air quality rules and regulations. The following sources will be subject to the permit conditions and BACT and offset requirements discussed previously.

S-1 Combustion Turbine Generator (CTG) #1, Siemens SGT6-5000F, Natural Gas Fired, 190 MW, 2202 MMBtu/hr (HHV) maximum rated capacity; abated by A-1 Oxidation Catalyst, and A-2 Selective Catalytic Reduction System (SCR).

S-2 Combustion Turbine Generator (CTG) #2, Siemens SGT6-5000F, Natural Gas Fired, 190 MW, 2202 MMBtu/hr (HHV) maximum rated capacity; abated by A-3 Oxidation Catalyst, and A-4 Selective Catalytic Reduction System (SCR).

S-3 Combustion Turbine Generator (CTG) #3, Siemens SGT6-5000F, Natural Gas Fired, 190 MW, 2202 MMBtu/hr (HHV) maximum rated capacity; abated by A-5 Oxidation Catalyst, and A-6 Selective Catalytic Reduction System (SCR).

S-4 Combustion Turbine Generator (CTG) #4, Siemens SGT6-5000F, Natural Gas Fired, 190 MW, 2202 MMBtu/hr (HHV) maximum rated capacity; abated by A-7 Oxidation Catalyst, and A-8 Selective Catalytic Reduction System (SCR).

S-5 Natural Gas-fired Fuel Preheater, 5 MMBtu/hr (HHV) (Exempt from Air District Permit requirements per Regulation 2, Rule 1, Section 114)

S-6 Natural Gas-fired Fuel Preheater, 5 MMBtu/hr (HHV) (Exempt from Air District Permit requirements per Regulation 2, Rule 1, Section 114)

This document is subject to the public notice, public comment, and public inspection requirements of District Regulations 2-2-405 and 2-2-406. Accordingly, a notice inviting written public comment will be published in a newspaper of general circulation in the area of the proposed Marsh Landing Generating Station and mailed to certain entities. The public inspection and comment period will be at least 30 days in duration and will start the date of such publication. Written comments on this document should be directed to:

Brian K. Lusher
Senior Air Quality Engineer
Bay Area Air Quality Management District
939 Ellis Street
San Francisco CA 94109
blusher@baaqmd.gov

12. Glossary of Acronyms

AAQS	Ambient Air Quality Standard
ARB	Air Resource Board
BTU	British Thermal Unit
BAAQMD	Bay Area Air Quality Management District
BACT	Best Available Control Technology
Cal ISO	California Independent System Operator
CAISO	California Independent System Operator
CARB	California Air Resources Board
CEC	California Energy Commission
CEM	Continuous Emission Monitor
CEQA	California Environmental Quality Act
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CPUC	California Public Utilities Commission
CTG	Combustion Turbine Generator
EO/APCO	Executive Officer/Air Pollution Control Officer
EPA	Environmental Protection Agency
ERC	Emission Reduction Credit
FDOC	Final Determination of Compliance
FSNL	Full Speed No Load
GE	General Electric Company
GHG	Greenhouse Gases
GT	Gas Turbine
MW	Megawatt
NH_3	Ammonia
N_2	Nitrogen
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NSR	New Source Review
O_2	Oxygen
LAER	Lowest Achievable Emissions Rate
LLC	Limited Liability Company
MLGS	Marsh Landing Generating Station
MMBtu	Million Btu
NAAQS	National Ambient Air Quality Standard
PAH	Polycyclic Aromatic Hydrocarbon
PDOC	Preliminary Determination of Compliance
PG&E	Pacific Gas & Electric Company
PM_{10}	Particulate Matter less than 10 Microns in Diameter
$PM_{2.5}$	Particulate Matter less than 2.5 Microns in Diameter
POC	Precursor Organic Compounds

ppmvd	Parts Per Million by Volume, Dry
PSD	Prevention of Significant Deterioration
PUC	Public Utilities Commission
RACT	Reasonably Available Control Technology
RATA	Relative Accuracy Test Audit
SCAQMD	South Coast Air Quality Management District
SNCR	Selective Non-catalytic Reduction
SCR	Selective Catalytic Reduction
SJVAPCD	San Joaquin Valley Air Pollution Control District
SO_2	Sulfur Dioxide
SO_x	Sulfur Oxides
TAC	Toxic Air Contaminant
TBACT	Toxics Best Available Control Technology
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds

Appendix A

Emission Calculations

The following physical constants and standard conditions were utilized to derive the criteria-pollutant emission factors used to estimate and verify criteria pollutant and toxic air contaminant emissions submitted in the permit application. The criteria emission calculations were prepared by the applicant's consultant and are based on a combustion model. The District has verified these values using the calculations shown below. For the toxic air contaminants the District revised the calculation submitted by the applicant.

standard temperature[a]:	70°F
standard pressure[a]:	14.7 psia
molar volume:	386.8 dscf/lbmol
ambient oxygen concentration:	20.95%
dry flue gas factor[b]:	8743 dscf/MM Btu
natural gas higher heating value:	1020 Btu/dscf

[a] BAAQMD standard conditions per Regulation 1, Section 228.

[b] F-factor is based upon the assumption of complete stoichiometric combustion of natural gas. In effect, it is assumed that all excess air present before combustion is emitted in the exhaust gas stream. Value shown reflects the typical composition and heat content of utility-grade natural gas in San Francisco bay area.

Table A-1 summarizes the regulated air pollutant emission factors that were used to calculate mass emission rates for each source. All units are pounds per million Btu of natural gas fired based upon the high heating value (HHV). All emission factors are after abatement by applicable control equipment.

TABLE A-1
CONTROLLED REGULATED AIR POLLUTANT EMISSION FACTORS FOR GAS TURBINES AND HRSGS

Pollutant	Source Simple-Cycle Gas Turbine	
	lb/MM Btu	lb/hr
Nitrogen Oxides (as NO_2)	0.009460	20.83
Carbon Monoxide	0.004541	10.0
Precursor Organic Compounds	0.001317	2.9
Particulate Matter (PM_{10})	0.00363	9.0
Sulfur Dioxide	0.00282	6.21
Sulfur Dioxide (Annual Average)[c]	0.000705	1.41

[a] based upon stack concentration of 2.5 ppmvd NO_x @ 15% O_2 that reflects the use of dry low-NO_x combustors at the CTG and abatement by the Selective Catalytic Reduction Systems with ammonia injection.
[b] based upon the permit condition emission limit of 2 ppmvd CO @ 15% O_2 that reflects abatement by oxidation catalysts.
[c] based upon firing rate of 1997 MMBtu/hour (100% Load, 59ºF)

REGULATED AIR POLLUTANTS

NITROGEN OXIDE EMISSION FACTORS

The combined NO_x emissions from the simple-cycle gas turbines will be 2.5 ppmv, dry @ 15% O_2. This concentration is converted to a mass emission factor as follows:

(2.5 ppmvd)(20.95 - 0)/(20.95 - 15) = 8.80 ppmv NO_x, dry @ 0% O_2

$(8.80/10^6)$(1 lbmol/386.8 dscf)(46 lb NO_2/lbmol)(8743 dscf/MM Btu)

= **0.00915 lb NO_2/MM Btu**

Calculations shown below are based on emission factors submitted by the applicant.

The NO_x(as NO_2) mass emission rate based upon the maximum firing rate of the simple-cycle gas turbine is calculated as follows:

(0.00946 lb/MM Btu)(2202 MM Btu/hr) = **20.83 lb NO_x(as NO_2)/hr**

CARBON MONOXIDE EMISSION FACTORS

The CO emissions from the simple-cycle gas turbines will be conditioned to a maximum controlled CO emission limit of 2 ppmv, dry @ 15% O_2 during all operating modes except gas turbine start-up, shutdown and combustor tuning. The emission factor corresponding to this emission concentration is calculated as follows:

(2 ppmv)(20.95 - 0)/(20.95 - 15) = 7.04 ppmv, dry @ 0% O_2

($7.04/10^6$)(lbmol/386.8 dscf)(28 lb CO/lbmol)(8743 dscf/MM Btu)

= **0.00446 lb CO/MM Btu**

Calculations shown below are based on emission factors submitted by the applicant.

The CO maximum mass emission rate based upon the maximum firing rate of the simple-cycle gas turbine is calculated as follows:

(0.00454 lb/MM Btu)(2202 MM Btu/hr) = **10.0 lb CO/hr**

PRECURSOR ORGANIC COMPOUND (POC) EMISSION FACTORS

The POC emissions from the simple-cycle gas turbines will be conditioned to a maximum controlled emission limit of 1 ppmv, dry @ 15% O_2 during all operating modes except gas turbine start-up and shutdown. The POC emission factor corresponding to this emission concentration is calculated as follows:

(1 ppmv)(20.95 - 0)/(20.95 - 15) = 3.52 ppmv, dry @ 0% O_2

($3.52/10^6$)(lbmol/386.8 dscf)(16 lb CH_4/lbmol)(8743 dscf/MM Btu)
= **0.00127 lb POC/MM Btu**

Calculations shown below are based on emission factors submitted by the applicant.

The POC mass emission rate based upon the maximum firing rate of the simple-cycle gas turbine is calculated as follows:

(0.00132 lb/MM Btu)(2202 MM Btu/hr) = **2.9 lb POC/hr**

PARTICULATE MATTER (PM_{10}) EMISSION FACTORS

The District has determined a PM_{10} emission rate of 9.0 lb/hour corresponds to BACT for the simple-cycle gas turbines. This emission rate corresponds to 0.0041 lb per MMBtu.

SULFUR DIOXIDE EMISSION FACTORS

The SO_2 emission factor is based upon annual average natural gas sulfur content of 0.25 grains per 100 scf and a higher heating value of 1020 Btu/scf.

The sulfur emission factor is calculated as follows:
SO_2 lb/hr

Natural Gas 1 grains of S/100 scf for Maximum Hourly

SO_2 = (1 gr/100 scf)(lb/7000 gr)(1/1020 BTU/scf)(1 x 10E6 Btu/MMBtu)(64 lb SO_2/32 lb S) = 0.002801 lb/MMBtu

Natural Gas 0.25 grains of S/100 scf for Annual Average

SO_2 = (0.25 gr/100 scf)(lb/7000 gr)(1/1020 BTU/scf)(1 x 10E6 Btu/MMBtu)(64 lb SO_2/32 lb S) = 0.0007 lb/MMBtu

Calculations shown below are based on emission factors submitted by the applicant.

Max Hourly SO_2

The corresponding SO_2 emission rate for the simple-cycle gas turbine firing:

(0.00282 lb SO_2/MM Btu)(2202 MM Btu/hr) = 6.21 lb/hr

Annual Average SO_2

The corresponding SO_2 emission rate for the simple-cycle gas turbine firing:

(0.000705 lb SO_2/MM Btu)(1997 MM Btu/hr) = 1.41 lb/hr

Plant No. 19169
Application No. 18404
BAAQMD February 2010

Simple Cycle Gas Turbines

Siemens Provided the Following Information to estimate emissions from the four Simple Cycle Gas Turbines

	Average	Total lbs per event		
Mode	Time (min)	NOx	CO	POC
Startup	11	12	213	11
Shutdown	6	10	110	5

Startup Emissions from Worst Case 30 minute Startup

One Typical Startup 11 minutes, Balance of 30 min period at Full Load (19 minutes)

Pollutant	Maximum (lb/event)	Average Startup (lb/event)	Winter Extreme lb/hour
NOx	18.6	12	20.83
CO	216.2	213	10.01
POC	11.9	11	2.90
PM10/PM2.5	4.5		9.00
SO2	3.11		6.21

Startup Emissions for Worst Case Hour Period

2 Typical Startups (11 min each), Shutdown (6 min), Balance Full Load (32 minutes)

Pollutant	Maximum lb/hr	Start lb/event	Shutdown lb/event	Winter Extreme lb/hour
NOx	45.1	12	10	20.83
CO	541.3	213	110	10.01
POC	28.5	11	5	2.90
PM10/PM2.5	9.0			9.00
SO2	6.21			6.21

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Simple Cycle Gas Turbines

Simens Provided the Following Information to estimate emissions from the four Simple Cycle Gas Turbines

	Average	Total lbs per event		
Mode	Time (min)	NOx	CO	POC
Startup	11	12	213	11
Shutdown	6	10	110	5

Shutdown Emissions from Worst Case 15 minute Shutdown

Shutdown Limit 15 minutes (6 minute Typical Shutdown, 9 minutes Full Load Operation)

Pollutant	Maximum lb/event	Shutdown lb/event	Winter Extreme lb/hour
NOx	13.1	10	20.83
CO	111.5	110	10.01
POC	5.4	5	2.90
PM10/PM2.5	2.25		
SO2	1.55		

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Maximum Hourly Emission Rates (Normal Operation) for Simple Cycle Gas Turbines

	Winter Extreme: 20 deg. F			Average: 59 deg. F			Summer Design: 94 deg. F		
	100% Load	75% Load	60% Load	100% Load	75% Load	60% Load	100% Load	75% Load	60% Load
Evaporative Cooling	Off	Off	Off	Off	Off	Off	On	Off	Off
NOx (lb/hr)	20.83	16.39	13.89	18.89	15.00	12.78	16.94	13.89	11.67
CO (lb/hr)	10.00	8.00	6.80	9.00	7.50	6.20	8.50	6.50	5.80
VOC (lb/hr)	2.90	2.30	1.93	2.60	2.10	1.80	2.40	1.90	1.63
PM10/PM2.5 (lb/hr)	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
SO2 (lb/hr) Maximum	6.21	4.90	4.17	5.63	4.51	3.84	5.08	4.11	3.52
SO2 (lb/hr) Average	1.55	1.23	1.04	1.41	1.13	0.96	1.27	1.03	0.88

Notes:
lb per hour emission rates estimated by Siemens using combustion modeling program.
BAAQMD adjusted PM emissions to a maximum of 9 lb/hour, stack gas emission rate
Maximum SO2 based on 1 grain sulfur per 100 scf of natural gas.
Annual Average based on 0.25 grain sulfur per 100 scf of natural gas.

Plant No. 19169
Application No. 18404
BAAQMD February 2010

Simple Cycle Turbine Emissions

Condition	Hours	NOx (lb/hr)	NOx lb/year	CO (lb/hr)	CO lb/year	POC (lb/hr)	POC lb/year	PM10/PM2.5 (lb/hr)	PM10/PM2.5 lb/year	SO2 (lb/hr)	SO2 lb/year
Yearly Average: 60 deg. F	1705	18.89	32207.45	9.00	15345.00	2.6	4433.00	9	15345.00	1.41	2404.05
	event	(lb/event)		(lb/event)		(lb/event)		(lb/event)		(lb/event)	
Startup	167	12	2004.00	213	35571.00	11	1837.00		275.6		43.2
Shutdown	167	10	1670.00	110	18370.00	5	835.00		150.3		23.5
Total			35881.45		69286.00		7105.00		15770.90		2470.75
Total One Turbine (tons/year)			17.941		34.643		3.553		7.885		1.235
Total All Simple Cycle Units (tons)			71.763		138.572		14.210		31.542		4.942

PM from Startups = 167 events x 11 min/start x 1 hour/60 min x 9 lb/hour =275.6 lb
PM from Shutdowns = 167 events x 6 min/shutdown x 1 hour/60 min x 9 lb/hour = 150.3 lb

SO2 from Startups = 167 events x 11 min/start x 1 hour/60 min x 1.41 lb/hour = 43.2 lb
SO2 from Shutdowns = 167 events x 6 min/shutdown x 1 hour/60 min x 1.41 lb/hour = 23.5 lb

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Simple Cycle Gas Turbine Maximum Daily Emissions for Normal Operations

Condition	**Hours**	**NOx Emissions (lb/hr)**	**NOx Emissions lb/day**	**CO Emissions (lb/hr)**	**CO Emissions lb/day**	**POC Emissions (lb/hr)**	**POC Emissions lb/day**	**PM10/PM2.5 Emissions (lb/hr)**	**PM10/PM2.5 Emissions lb/day**
Winter Extreme 20 deg. F	23.15	20.83	482.21	10	231.50	2.9	67.14	9	208.35
	event	(lb/event)		(lb/event)		(lb/event)		(lb/event)	
Startup	3	18.6	55.80	216.2	648.60	11.9	35.70		4.95
Shutdown	3	13.1	39.30	111.5	334.50	5.4	16.20		2.70
Total			577.31		1214.60		119.04		216.00
Total Four Simple Cycle Units			2309.26		4858.40		476.14		864.00

PM from Startups = 3 events x 11 min/start x 1 hour/60 min x 9 lb/hour = 4.95 lb
PM from Shutdowns = 3 events x 6 min/start x 1 hour/60 min x 9 lb/hour = 2.7 lb

SO_2 lb/day = 6.21 lb/hour x 24 hour/day = 149.04 One Unit, 596.16 Four Units

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Simple Cycle Turbine Maximum Daily Emissions with Combustor Tuning

Condition	Hours	NOx Emissions (lb/hr)	NOx Emissions lb/day	CO Emissions (lb/hr)	CO Emissions lb/day	POC Emissions (lb/hr)	POC Emissions lb/day	PM10/PM2.5 Emissions (lb/hr)	PM10/PM2.5 Emissions lb/day
Winter Extreme 20 deg. F	15.15	20.83	315.57	10	151.50	2.9	43.94	9	136.35
	event	(lb/event)		(lb/event)		(lb/event)		(lb/event)	
Startup	3	18.6	55.80	216.2	648.60	11.9	35.70		4.95
Shutdown	3	13.1	39.30	111.5	334.50	5.4	16.20		2.70
Tuning	8	80	640.00	450	3600.00	30	240.00	9	72.00
Total One Simple Cycle Unit Tuning			1050.67		4734.60		335.84		216.00
Total One Simple Cycle Unit No Tuning			577.31		1214.60		119.04		216.00
Total Four Simple Cycle Units (One Tuning)			2782.62		8378.40		692.94		864.00

PM from Startups = 3 events x 11 min/start x 1 hour/60 min x 9 lb/hour = 4.95 lb
PM from Shutdowns = 3 events x 6 min/start x 1 hour/60 min x 9 lb/hour = 2.7 lb

SO2 lb/day = 6.21 lb/hour x 24 hour/day = 149.04 One Unit, 596.16 Four Units

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Grain Loading Calculation for 5000F Simple Cycle Gas Turbines

PM-10/PM2.5 Maximum Emission Rate 9.0 lb/hr
Firing Rate 2202 MMBtu/hr
F-factor 8743 dscf/MMBtu
lb = 7000 grains
Corrected O2 Concentration 15% for gas turbine
Ambient Air O2 Concentration 20.9%

At 15%O2

grains/dscf = (9.0 lb/hr x 7000 grains/lb)/(2202 MMBtu/hr x (8743 dscf/MMBtu x 20.9/(20.9 - 15))

grains/dscf = 0.00092

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Simple Cycle Unit Heater

	ppm	lb/MMBtu	Firing Rate MMBtu/hr	lb/hour	lb/day	hours/year	lb/year	ton/year
NOx	15	0.018	5	0.091	2.18	1752	159.46	0.080
CO	46	0.034	5	0.170	4.08	1752	297.66	0.149
POC	6.4	0.0027	5	0.014	0.32	1752	23.66	0.012
PM10/PM2.5		0.0029	5	0.015	0.35	1752	25.40	0.013
SO2		0.0007	5	0.004	0.08	1752	6.13	0.003

Natural Gas 1020 Btu/scf

POC, PM10, and SO2 Emission Factors from Applicants Dew Point Heater Vendor

Both Heaters

	lb/day	lb/year	ton/year
NOx	4.37	318.92	0.159
CO	8.15	595.31	0.298
POC	0.65	47.33	0.024
PM10/PM2.5	0.70	50.81	0.025
SO2	0.17	12.26	0.006

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Commissioning Emissions

Activity	Duration (hours)	GT Load (%)	Modeling Load (%)	Total Emission			
				NO_X (lb)	CO (lb)	VOC (lb)	PM10/PM2.5 (lb)
CTG Testing (Full Speed No Load,	8	0	0	339	19,240	1,181	71
CTG 1 Testing at 40% load	8	0 - 40	40	1,507	11,662	636	91
CTG 1 Load Test	68	50 - 100	50-101	6,615	25,673	1,620	624
Install Emissions Test Equipment	0	0	0	0	0	0	0
Emissions Tuning/Drift Testing	24	50 - 100	100	1,988	5,344	286	234
RATA/Pre-performance	60	100	100	4,970	13,360	715	585
Remove emissions test	0	0	0	0	0	0	0
Performance Testing	40	100	100	3,035	5,628	328	365
CAISO Certification	12	50 - 100	100	994	2,672	143	117
CAISO Certification if required	12	100	100	994	2,672	143	117
Total	232			20442	86251	5052	2204
Total Hours with Contingency (Total Hours x 1.1)	255						

Total (tons)		10.22	43.13	2.53	1.10

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Toxic Air Contaminant	Project lb/hour	Project lb/year	Acute Risk Screening Trigger Level (lb/hr)	Chronic Risk Screening Trigger Level (lb/yr)
1,3-Butadiene	0.00110	1.92	None	0.63
Acetaldehyde	11.05	2301	None	3.8
Acrolein	0.595	294	0.0055	14
Ammonia	123	216043	7.1	7700
Benzene	0.221	202	2.9	3.8
Benzo(a)anthracene	0.000195	0.342	None	None
Benzo(a)pyrene	0.000120	0.210	None	0.0069
Benzo(b)fluoranthene	0.000098	0.171	None	None
Benzo(k)fluoranthene	0.000095	0.166	None	None
Chrysene	0.000218	0.381	None	None
Dibenz(a,h)anthracene	0.000203	0.356	None	None
Ethylbenzene	0.282	271	None	43
Formaldehyde	39.98	7785	0.12	18
Hexane	2.24	3920	None	270000
Indeno(1,2,3-cd)pyrene	0.000203	0.356	None	None
Naphthalene	0.0143	25.1	None	None
Propylene	6.66	11664	None	120000
Propylene Oxide	0.413	723	6.8	29
Toluene	0.848	1074	82	12000
Xylene (Total)	0.225	395	49	27000
Sulfuric Acid Mist (H2SO4)	20.77	9097	0.26	39
Benzo(a)pyrene equivalents	0.000394	0.691	None	0.0069
Specified PAHs	0.00113	1.98		

Notes:
Emissions from the exempt natural gas fired preheaters are included.
PAH impacts are evaluated as Benzo(a)pyrene equivalents.

	Equivalency Factor
Benzo(a)anthracene	0.1
Benzo(a)pyrene	1
Benzo(b)fluoranthrene	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenz(a,h)anthracene	1.05
Indeno(1,2,3-cd)pyrene	0.1

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Maximum Hourly Toxic Air Contaminant Emissions

			Commissioning	Noncommissioning	Maximum	Maximum
Toxic Air Contaminant	**EF lb/MMBtu**	**Per Turbine Firing Rate MMBtu/hour**	**Per Turbine lb/hour**	**Per Turbine lb/hour**	**Per Turbine lb/hour**	**All Turbines lb/hour**
1,3-Butadiene	1.25E-07	2202	2.74E-04	2.74E-04	2.74E-04	1.10E-03
Acetaldehyde	1.25E-03		2.76E+00	8.71E-01	2.76E+00	1.11E+01
Acrolein	6.75E-05		1.49E-01	6.01E-02	1.49E-01	5.95E-01
Ammonia	1.40E-02		3.08E+01	3.08E+01	3.08E+01	1.23E+02
Benzene	2.51E-05		5.53E-02	2.96E-02	5.53E-02	2.21E-01
Benzo(a)anthracene	2.22E-08		4.88E-05	4.88E-05	4.88E-05	1.95E-04
Benzo(a)pyrene	1.36E-08		3.00E-05	3.00E-05	3.00E-05	1.20E-04
Benzo(b)fluoranthene	1.11E-08		2.44E-05	2.44E-05	2.44E-05	9.76E-05
Benzo(k)fluoranthene	1.08E-08		2.37E-05	2.37E-05	2.37E-05	9.50E-05
Chrysene	2.47E-08		5.44E-05	5.44E-05	5.44E-05	2.18E-04
Dibenz(a,h)anthracene	2.30E-08		5.07E-05	5.07E-05	5.07E-05	2.03E-04
Ethylbenzene	3.20E-05		7.04E-02	3.89E-02	7.04E-02	2.82E-01
Formaldehyde	4.54E-03		1.00E+01	3.11E+00	1.00E+01	4.00E+01
Hexane	2.54E-04		5.59E-01	5.59E-01	5.59E-01	2.24E+00
Indeno(1,2,3-cd)pyrene	2.30E-08		5.07E-05	5.07E-05	5.07E-05	2.03E-04
Naphthalene	1.63E-06		3.58E-03	3.58E-03	3.58E-03	1.43E-02
Propylene	7.56E-04		1.66E+00	1.66E+00	1.66E+00	6.66E+00
Propylene Oxide	4.69E-05		1.03E-01	1.03E-01	1.03E-01	4.13E-01
Toluene	9.63E-05		2.12E-01	1.53E-01	2.12E-01	8.48E-01
Xylene (Total)	2.56E-05		5.63E-02	5.63E-02	5.63E-02	2.25E-01
Sulfuric Acid Mist (H2SO4)			5.19E+00	5.19E+00	5.19E+00	2.08E+01
Benzo(a)pyrene equivalents	4.36E-08		9.86E-05	9.86E-05	9.86E-05	3.94E-04
Specified PAHs			2.83E-04	2.83E-04	2.83E-04	1.13E-03

Commissioning Hours Limited by Permit Condition to 232 hours/year

	Equivalency Factor
Benzo(a)anthracene	0.1
Benzo(a)pyrene	1
Benzo(b)fluoranthrene	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenz(a,h)anthracene	1.05
Indeno(1,2,3-cd)pyrene	0.1

Ammonia lb/MMBtu = ppm x 1/molar volume x MW x Fd x 20.9/(20.9 - %O2)

ppm = 10 ppm @15%O2 limit
molar volume = 386.8 dscf/lbmol @ 14.696 psia, 70 deg. F
MW = molecular weight, lb/lb-mol
Fd = 8743 dscf/MMBtu for Natural Gas @ 70 deg. F

Ammonia lb/MMBtu = 10 E-06 ft3 of NH3/ft3 stack gas x 1/386.8 dscf/lb-mol x 17 lb/lb-mol x 8743 dscf/MMBtu x 20.9/(20.9 - 15)
Ammonia lb/MMBtu = 0.014

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Toxic Air Contaminant Emissions for Commissioning Period

			Commissioning	Commissioning
Toxic Air Contaminant	**EF lb/MMBtu**	**Per Turbine Firing Rate MMBtu/hour**	**Per Turbine lb/hour**	**Per Turbine lb/year**
1,3-Butadiene	1.25E-07	2202	2.74E-04	6.36E-02
Acetaldehyde	1.25E-03		2.76E+00	6.41E+02
Acrolein	6.75E-05		1.49E-01	3.45E+01
Ammonia	1.40E-02		3.08E+01	7.15E+03
Benzene	2.51E-05		5.53E-02	1.28E+01
Benzo(a)anthracene	2.22E-08		4.88E-05	1.13E-02
Benzo(a)pyrene	1.36E-08		3.00E-05	6.96E-03
Benzo(b)fluoranthene	1.11E-08		2.44E-05	5.66E-03
Benzo(k)fluoranthene	1.08E-08		2.37E-05	5.51E-03
Chrysene	2.47E-08		5.44E-05	1.26E-02
Dibenz(a,h)anthracene	2.30E-08		5.07E-05	1.18E-02
Ethylbenzene	3.20E-05		7.04E-02	1.63E+01
Formaldehyde	4.54E-03		1.00E+01	2.32E+03
Hexane	2.54E-04		5.59E-01	1.30E+02
Indeno(1,2,3-cd)pyrene	2.30E-08		5.07E-05	1.18E-02
Naphthalene	1.63E-06		3.58E-03	8.31E-01
Propylene	7.56E-04		1.66E+00	3.86E+02
Propylene Oxide	4.69E-05		1.03E-01	2.39E+01
Toluene	9.63E-05		2.12E-01	4.92E+01
Xylene (Total)	2.56E-05		5.63E-02	1.31E+01
Sulfuric Acid Mist (H2SO4)			5.19E+00	1.20E+03
Benzo(a)pyrene equivalents	4.36E-08		9.86E-05	2.29E-02
Specified PAHs			2.83E-04	6.56E-02

Commissioning Hours Limited by Permit Condition to 232 hours/year

	Equivalency Factor
Benzo(a)anthracene	0.1
Benzo(a)pyrene	1
Benzo(b)fluoranthrene	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenz(a,h)anthracene	1.05
Indeno(1,2,3-cd)pyrene	0.1

Ammonia lb/MMBtu = ppm x 1/molar volume x MW x Fd x 20.9/(20.9 - %O2)

ppm = 10 ppm @15%O2 limit
molar volume = 386.8 dscf/lbmol @ 14.696 psia, 70 deg. F
MW = molecular weight, lb/lb-mol
Fd = 8743 dscf/MMBtu for Natural Gas @ 70 deg. F

Ammonia lb/MMBtu = 10 E-06 ft3 of NH3/ft3 stack gas x 1/386.8 dscf/lb-mol x 17 lb/lb-mol x 8743 dscf/MMBtu x 20.9/(20.9 - 15)
Ammonia lb/MMBtu = 0.014

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Toxic Air Contaminant Emissions Maximum Hourly from Startup and Shutdown Events

	Startup 11 min	Shutdown 6 min	Normal	SU balance Normal	SD balance Normal	1 SU, 1 SD balance Normal	2 SU, 1 SD balance Normal	Maximum All Cases
Toxic Air Contaminant	**Per Turbine lb/event**	**Per Turbine lb/event**	**Per Turbine lb/hour**	**Max. Hourly Per Turbine lb/hour**	**Max. Hourly Per Turbine lb/hour**	**Max. Hourly Per Turbine lb/hour**	**Max. Hourly Per Turbine lb/hour**	**Worst Case Max. Hourly Per Turbine lb/hour**
1,3-Butadiene	2.85E-05	1.37E-05	2.74E-04	2.52E-04	2.60E-04	2.39E-04	2.17E-04	2.74E-04
Acetaldehyde	2.87E-01	1.38E-01	2.96E-01	5.29E-01	4.04E-01	6.37E-01	8.71E-01	8.71E-01
Acrolein	1.55E-02	7.44E-03	4.08E-02	4.88E-02	4.42E-02	5.21E-02	6.01E-02	6.01E-02
Ammonia	3.21E+00	1.54E+00	3.08E+01	2.84E+01	2.93E+01	2.68E+01	2.44E+01	3.08E+01
Benzene	5.75E-03	2.76E-03	2.87E-02	2.92E-02	2.86E-02	2.91E-02	2.96E-02	2.96E-02
Benzo(a)anthracene	5.07E-06	2.44E-06	4.88E-05	4.49E-05	4.63E-05	4.25E-05	3.86E-05	4.88E-05
Benzo(a)pyrene	3.12E-06	1.50E-06	3.00E-05	2.76E-05	2.85E-05	2.61E-05	2.37E-05	3.00E-05
Benzo(b)fluoranthene	2.54E-06	1.22E-06	2.44E-05	2.25E-05	2.32E-05	2.12E-05	1.93E-05	2.44E-05
Benzo(k)fluoranthene	2.47E-06	1.19E-06	2.37E-05	2.19E-05	2.26E-05	2.07E-05	1.88E-05	2.37E-05
Chrysene	5.66E-06	2.72E-06	5.44E-05	5.01E-05	5.17E-05	4.74E-05	4.30E-05	5.44E-05
Dibenz(a,h)anthracene	5.28E-06	2.54E-06	5.07E-05	4.67E-05	4.82E-05	4.42E-05	4.01E-05	5.07E-05
Ethylbenzene	7.32E-03	3.52E-03	3.86E-02	3.89E-02	3.83E-02	3.85E-02	3.88E-02	3.89E-02
Formaldehyde	1.04E+00	5.00E-01	9.91E-01	1.85E+00	1.39E+00	2.25E+00	3.11E+00	3.11E+00
Hexane	5.81E-02	2.80E-02	5.59E-01	5.15E-01	5.31E-01	4.87E-01	4.42E-01	5.59E-01
Indeno(1,2,3-cd)pyrene	5.28E-06	2.54E-06	5.07E-05	4.67E-05	4.82E-05	4.42E-05	4.01E-05	5.07E-05
Naphthalene	3.73E-04	1.79E-04	3.58E-03	3.30E-03	3.40E-03	3.12E-03	2.84E-03	3.58E-03
Propylene	1.73E-01	8.32E-02	1.66E+00	1.53E+00	1.58E+00	1.45E+00	1.32E+00	1.66E+00
Propylene Oxide	1.07E-02	5.16E-03	1.03E-01	9.50E-02	9.80E-02	8.98E-02	8.17E-02	1.03E-01
Toluene	2.20E-02	1.06E-02	1.53E-01	1.47E-01	1.49E-01	1.42E-01	1.36E-01	1.53E-01
Xylene (Total)	5.86E-03	2.82E-03	5.63E-02	5.19E-02	5.35E-02	4.91E-02	4.46E-02	5.63E-02
Sulfuric Acid Mist (H2SO4)			5.19E+00					5.19E+00
Benzo(a)pyrene equivalents	1.03E-05	4.93E-06	9.86E-05	9.08E-05	9.37E-05	8.58E-05	7.80E-05	9.86E-05
Specified PAHs	2.94E-05	1.41E-05	2.83E-04	2.60E-04	2.69E-04	2.46E-04	2.24E-04	2.83E-04

	Equivalency Factor
Benzo(a)anthracene	0.1
Benzo(a)pyrene	1
Benzo(b)fluoranthrene	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenz(a,h)anthracene	1.05
Indeno(1,2,3-cd)pyrene	0.1

Ammonia lb/MMBtu = ppm x 1/molar volume x MW x Fd x 20.9/(20.9 - %O2)

ppm = 10 ppm @15%O2 limit
molar volume = 386.8 dscf/lbmol @ 14.696 psia, 70 deg. F
MW = molecular weight, lb/lb-mol
Fd = 8743 dscf/MMBtu for Natural Gas @ 70 deg. F

Ammonia lb/MMBtu = 10 E-06 ft3 of NH3/ft3 stack gas x 1/386.8 dscf/lb-mol x 17 lb/lb-mol x 8743 dscf/MMBtu x 20.9/(20.9 - 15)
Ammonia lb/MMBtu = 0.014

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Toxic Air Contaminant Emissions Maximum Annual Emissions

	1704.7 hour/year	30.6 hours/year	16.7 hours/year	Summation Normal, SU, SD	Normal Operation 1752 hours/year	Maximum Value	
Toxic Air Contaminant	**Normal Oper. Per Turbine lb/year**	**Startup Per Turbine lb/year**	**Shutdown Per Turbine lb/year**	**Total Per Turbine lb/year**	**Total Per Turbine lb/year**	**Total Per Turbine lb/year**	**Total All Turbines lb/year**
1,3-Butadiene	4.67E-01	4.76E-03	2.29E-03	4.74E-01	4.80E-01	4.80E-01	1.92E+00
Acetaldehyde	5.04E+02	4.80E+01	2.31E+01	5.75E+02	5.18E+02	5.75E+02	2.30E+03
Acrolein	6.96E+01	2.58E+00	1.24E+00	7.34E+01	7.15E+01	7.34E+01	2.94E+02
Ammonia	5.26E+04	5.35E+02	2.57E+02	5.33E+04	5.40E+04	5.40E+04	2.16E+05
Benzene	4.89E+01	9.59E-01	4.61E-01	5.04E+01	5.03E+01	5.04E+01	2.01E+02
Benzo(a)anthracene	8.32E-02	8.47E-04	4.07E-04	8.44E-02	8.55E-02	8.55E-02	3.42E-01
Benzo(a)pyrene	5.12E-02	5.21E-04	2.51E-04	5.19E-02	5.26E-02	5.26E-02	2.10E-01
Benzo(b)fluoranthene	4.16E-02	4.23E-04	2.04E-04	4.22E-02	4.27E-02	4.27E-02	1.71E-01
Benzo(k)fluoranthene	4.05E-02	4.12E-04	1.98E-04	4.11E-02	4.16E-02	4.16E-02	1.66E-01
Chrysene	9.27E-02	9.44E-04	4.54E-04	9.41E-02	9.53E-02	9.53E-02	3.81E-01
Dibenz(a,h)anthracene	8.65E-02	8.81E-04	4.24E-04	8.78E-02	8.89E-02	8.89E-02	3.56E-01
Ethylbenzene	6.59E+01	1.22E+00	5.88E-01	6.77E+01	6.77E+01	6.77E+01	2.71E+02
Formaldehyde	1.69E+03	1.73E+02	8.35E+01	1.95E+03	1.74E+03	1.95E+03	7.78E+03
Hexane	9.53E+02	9.70E+00	4.67E+00	9.68E+02	9.80E+02	9.80E+02	3.92E+03
Indeno(1,2,3-cd)pyrene	8.65E-02	8.81E-04	4.24E-04	8.78E-02	8.89E-02	8.89E-02	3.56E-01
Naphthalene	6.11E+00	6.22E-02	2.99E-02	6.20E+00	6.28E+00	6.28E+00	2.51E+01
Propylene	2.84E+03	2.89E+01	1.39E+01	2.88E+03	2.92E+03	2.92E+03	1.17E+04
Propylene Oxide	1.76E+02	1.79E+00	8.62E-01	1.79E+02	1.81E+02	1.81E+02	7.23E+02
Toluene	2.61E+02	3.68E+00	1.77E+00	2.67E+02	2.69E+02	2.69E+02	1.07E+03
Xylene (Total)	9.61E+01	9.78E-01	4.70E-01	9.75E+01	9.87E+01	9.87E+01	3.95E+02
Sulfuric Acid Mist (H2SO4)	2.21E+03	2.25E+01	1.08E+01	2.25E+03	2.27E+03	2.27E+03	9.10E+03
Benzo(a)pyrene equivalents	1.68E-01	1.71E-03	8.23E-04	1.71E-01	1.73E-01	1.73E-01	6.91E-01
Specified PAHs	4.82E-01	4.91E-03	2.36E-03	4.89E-01	4.95E-01	4.95E-01	1.98E+00

This spreadsheet summarizes emissions for Normal Operations (1704.7 hours/year), Startup (30.6 hours/year), and Shutdown (16.7 hours/year)
The spreadsheet compares the value that includes Startups and Shutdowns to the value that assumes continuous operation for 1752 hours per year.
The annual emissions are based on the maximum value calculated.

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Toxic Air Contaminant Emissions from Normal Operations (1752 hours/year)

Toxic Air Contaminant	EF lb/MMBtu	Per Turbine Firing Rate MMBtu/hour	Per Turbine Firing Rate MMBtu/year	Per Turbine lb/hour	Per Turbine lb/year	Total CT lb/hour	Total CT lb/year
1,3-Butadiene	1.25E-07	2202	3857904	2.74E-04	4.80E-01	1.10E-03	1.92E+00
Acetaldehyde	1.34E-04			2.96E-01	5.18E+02	1.18E+00	2.07E+03
Acrolein	1.85E-05			4.08E-02	7.15E+01	1.63E-01	2.86E+02
Ammonia	1.40E-02			3.08E+01	5.40E+04	1.23E+02	2.16E+05
Benzene	1.30E-05			2.87E-02	5.03E+01	1.15E-01	2.01E+02
Benzo(a)anthracene	2.22E-08			4.88E-05	8.55E-02	1.95E-04	3.42E-01
Benzo(a)pyrene	1.36E-08			3.00E-05	5.26E-02	1.20E-04	2.10E-01
Benzo(b)fluoranthene	1.11E-08			2.44E-05	4.27E-02	9.76E-05	1.71E-01
Benzo(k)fluoranthene	1.08E-08			2.37E-05	4.16E-02	9.50E-05	1.66E-01
Chrysene	2.47E-08			5.44E-05	9.53E-02	2.18E-04	3.81E-01
Dibenz(a,h)anthracene	2.30E-08			5.07E-05	8.89E-02	2.03E-04	3.56E-01
Ethylbenzene	1.75E-05			3.86E-02	6.77E+01	1.55E-01	2.71E+02
Formaldehyde	4.50E-04			9.91E-01	1.74E+03	3.96E+00	6.94E+03
Hexane	2.54E-04			5.59E-01	9.80E+02	2.24E+00	3.92E+03
Indeno(1,2,3-cd)pyrene	2.30E-08			5.07E-05	8.89E-02	2.03E-04	3.56E-01
Naphthalene	1.63E-06			3.58E-03	6.28E+00	1.43E-02	2.51E+01
Propylene	7.56E-04			1.66E+00	2.92E+03	6.66E+00	1.17E+04
Propylene Oxide	4.69E-05			1.03E-01	1.81E+02	4.13E-01	7.23E+02
Toluene	6.96E-05			1.53E-01	2.69E+02	6.13E-01	1.07E+03
Xylene (Total)	2.56E-05			5.63E-02	9.87E+01	2.25E-01	3.95E+02
Sulfuric Acid Mist (H2SO4)	5.90E-04			1.30E+00	2.27E+03	5.19E+00	9.10E+03
Benzo(a)pyrene equivalents	4.48E-08			9.86E-05	1.73E-01	3.94E-04	6.91E-01
Specified PAHs				2.83E-04	4.95E-01	1.13E-03	1.98E+00

Formaldehyde emissions reflect 50% destruction efficiency due to oxidation catalyst.

	Equivalency Factor
Benzo(a)anthracene	0.1
Benzo(a)pyrene	1
Benzo(b)fluoranthrene	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenz(a,h)anthracene	1.05
Indeno(1,2,3-cd)pyrene	0.1

Ammonia lb/MMBtu = ppm x 1/molar volume x MW x Fd x 20.9/(20.9 - %O2)

ppm = 10 ppm @15%O2 limit
molar volume = 386.8 dscf/lbmol @ 14.696 psia, 70 deg. F
MW = molecular weight, lb/lb-mol
Fd = 8743 dscf/MMBtu for Natural Gas @ 70 deg. F

Ammonia lb/MMBtu = 10 E-06 ft3 of NH3/ft3 stack gas x 1/386.8 dscf/lb-mol x 17 lb/lb-mol x 8743 dscf/MMBtu x 20.9/(20.9 - 15)
Ammonia lb/MMBtu = 0.014

This Spreadsheet calculates TAC emissions for turbines operating normally for 1752 hours/year with no startups or shutdowns.

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Toxic Air Contaminant Emissions from Normal Operations (1704.7 hours/year)

Toxic Air Contaminant	EF lb/MMBtu	Per Turbine Firing Rate MMBtu/hour	Per Turbine Firing Rate MMBtu/year	Per Turbine lb/hour	Per Turbine lb/year	Total CT lb/hour	Total CT lb/year
1,3-Butadiene	1.25E-07	2202	3753749.4	2.74E-04	4.67E-01	1.10E-03	1.87E+00
Acetaldehyde	1.34E-04			2.96E-01	5.04E+02	1.18E+00	2.02E+03
Acrolein	1.85E-05			4.08E-02	6.96E+01	1.63E-01	2.78E+02
Ammonia	1.40E-02			3.08E+01	5.26E+04	1.23E+02	2.10E+05
Benzene	1.30E-05			2.87E-02	4.89E+01	1.15E-01	1.96E+02
Benzo(a)anthracene	2.22E-08			4.88E-05	8.32E-02	1.95E-04	3.33E-01
Benzo(a)pyrene	1.36E-08			3.00E-05	5.12E-02	1.20E-04	2.05E-01
Benzo(b)fluoranthene	1.11E-08			2.44E-05	4.16E-02	9.76E-05	1.66E-01
Benzo(k)fluoranthene	1.08E-08			2.37E-05	4.05E-02	9.50E-05	1.62E-01
Chrysene	2.47E-08			5.44E-05	9.27E-02	2.18E-04	3.71E-01
Dibenz(a,h)anthracene	2.30E-08			5.07E-05	8.65E-02	2.03E-04	3.46E-01
Ethylbenzene	1.75E-05			3.86E-02	6.59E+01	1.55E-01	2.63E+02
Formaldehyde	4.50E-04			9.91E-01	1.69E+03	3.96E+00	6.76E+03
Hexane	2.54E-04			5.59E-01	9.53E+02	2.24E+00	3.81E+03
Indeno(1,2,3-cd)pyrene	2.30E-08			5.07E-05	8.65E-02	2.03E-04	3.46E-01
Naphthalene	1.63E-06			3.58E-03	6.11E+00	1.43E-02	2.44E+01
Propylene	7.56E-04			1.66E+00	2.84E+03	6.66E+00	1.13E+04
Propylene Oxide	4.69E-05			1.03E-01	1.76E+02	4.13E-01	7.04E+02
Toluene	6.96E-05			1.53E-01	2.61E+02	6.13E-01	1.05E+03
Xylene (Total)	2.56E-05			5.63E-02	9.61E+01	2.25E-01	3.84E+02
Sulfuric Acid Mist (H2SO4)	5.90E-04			1.30E+00	2.21E+03	5.19E+00	8.85E+03
Benzo(a)pyrene equivalents	4.48E-08			9.86E-05	1.68E-01	3.94E-04	6.72E-01
Specified PAHs				2.83E-04	4.82E-01	1.13E-03	1.93E+00

Formaldehyde emissions reflect 50% destruction efficiency due to oxidation catalyst.

	Equivalency Factor
Benzo(a)anthracene	0.1
Benzo(a)pyrene	1
Benzo(b)fluoranthrene	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenz(a,h)anthracene	1.05
Indeno(1,2,3-cd)pyrene	0.1

Ammonia lb/MMBtu = ppm x 1/molar volume x MW x Fd x 20.9/(20.9 - %O2)

ppm = 10 ppm @15%O2 limit
molar volume = 386.8 dscf/lbmol @ 14.696 psia, 70 deg. F
MW = molecular weight, lb/lb-mol
Fd = 8743 dscf/MMBtu for Natural Gas @ 70 deg. F

Ammonia lb/MMBtu = 10 E-06 ft3 of NH3/ft3 stack gas x 1/386.8 dscf/lb-mol x 17 lb/lb-mol x 8743 dscf/MMBtu x 20.9/(20.9 - 15)
Ammonia lb/MMBtu = 0.014

Maximum Normal Firing Rate = 2202 MMBtu/hour
Normal MMBtu/year = 2202 MMBtu/hour x 1704.7 hour/year = 3,753,749.4

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Toxic Air Contaminant Emissions from Startup Events (30.6 hour/year)

Toxic Air Contaminant	EF lb/MMBtu	Per Turbine Firing Rate MMBtu/hour	Per Turbine Firing Rate MMBtu/year	Average Per Turbine lb/event	Per Turbine lb/year	Total CT lb/year
1,3-Butadiene	1.25E-07	1249	38219.4	2.85E-05	4.76E-03	1.90E-02
Acetaldehyde	1.25E-03			2.87E-01	4.80E+01	1.92E+02
Acrolein	6.75E-05			1.55E-02	2.58E+00	1.03E+01
Ammonia	1.40E-02			3.21E+00	5.35E+02	2.14E+03
Benzene	2.51E-05			5.75E-03	9.59E-01	3.84E+00
Benzo(a)anthracene	2.22E-08			5.07E-06	8.47E-04	3.39E-03
Benzo(a)pyrene	1.36E-08			3.12E-06	5.21E-04	2.08E-03
Benzo(b)fluoranthene	1.11E-08			2.54E-06	4.23E-04	1.69E-03
Benzo(k)fluoranthene	1.08E-08			2.47E-06	4.12E-04	1.65E-03
Chrysene	2.47E-08			5.66E-06	9.44E-04	3.78E-03
Dibenz(a,h)anthracene	2.30E-08			5.28E-06	8.81E-04	3.52E-03
Ethylbenzene	3.20E-05			7.32E-03	1.22E+00	4.89E+00
Formaldehyde	4.54E-03			1.04E+00	1.73E+02	6.94E+02
Hexane	2.54E-04			5.81E-02	9.70E+00	3.88E+01
Indeno(1,2,3-cd)pyrene	2.30E-08			5.28E-06	8.81E-04	3.52E-03
Naphthalene	1.63E-06			3.73E-04	6.22E-02	2.49E-01
Propylene	7.56E-04			1.73E-01	2.89E+01	1.16E+02
Propylene Oxide	4.69E-05			1.07E-02	1.79E+00	7.16E+00
Toluene	9.63E-05			2.20E-02	3.68E+00	1.47E+01
Xylene (Total)	2.56E-05			5.86E-03	9.78E-01	3.91E+00
Sulfuric Acid Mist (H2SO4)	5.90E-04			1.35E-01	2.25E+01	9.01E+01
Benzo(a)pyrene equivalents	4.36E-08			1.03E-05	1.71E-03	6.84E-03
Specified PAHs				2.94E-05	4.91E-03	1.96E-02

Typical Startup is approximately 11 minutes

	Equivalency Factor
Benzo(a)anthracene	0.1
Benzo(a)pyrene	1
Benzo(b)fluoranthrene	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenz(a,h)anthracene	1.05
Indeno(1,2,3-cd)pyrene	0.1

Ammonia lb/MMBtu = ppm x 1/molar volume x MW x Fd x 20.9/(20.9 - %O2)

ppm = 10 ppm @15%O2 limit
molar volume = 386.8 dscf/lbmol @ 14.696 psia, 70 deg. F
MW = molecular weight, lb/lb-mol
Fd = 8743 dscf/MMBtu for Natural Gas @ 70 deg. F

Ammonia lb/MMBtu = 10 E-06 ft3 of NH3/ft3 stack gas x 1/386.8 dscf/lb-mol x 17 lb/lb-mol x 8743 dscf/MMBtu x 20.9/(20.9 - 15)
Ammonia lb/MMBtu = 0.014

Startup Average Firing Rate = 1249 MMBtu/hour
Annual Startup MMBtu/year = 1249 MMBtu/hour x 30.6 hours/year = 38,219.4

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Toxic Air Contaminant Emissions from Shutdown Events (16.7 hours/year)

Toxic Air Contaminant	EF lb/MMBtu	Per Turbine Firing Rate MMBtu/hour	Per Turbine Firing Rate MMBtu/year	Average Per Turbine lb/event	Per Turbine lb/year	Total CT lb/year
1,3-Butadiene	1.25E-07	1101	18386.7	1.37E-05	2.29E-03	9.16E-03
Acetaldehyde	1.25E-03			1.38E-01	2.31E+01	9.23E+01
Acrolein	6.75E-05			7.44E-03	1.24E+00	4.97E+00
Ammonia	1.40E-02			1.54E+00	2.57E+02	1.03E+03
Benzene	2.51E-05			2.76E-03	4.61E-01	1.85E+00
Benzo(a)anthracene	2.22E-08			2.44E-06	4.07E-04	1.63E-03
Benzo(a)pyrene	1.36E-08			1.50E-06	2.51E-04	1.00E-03
Benzo(b)fluoranthene	1.11E-08			1.22E-06	2.04E-04	8.15E-04
Benzo(k)fluoranthene	1.08E-08			1.19E-06	1.98E-04	7.93E-04
Chrysene	2.47E-08			2.72E-06	4.54E-04	1.82E-03
Dibenz(a,h)anthracene	2.30E-08			2.54E-06	4.24E-04	1.69E-03
Ethylbenzene	3.20E-05			3.52E-03	5.88E-01	2.35E+00
Formaldehyde	4.54E-03			5.00E-01	8.35E+01	3.34E+02
Hexane	2.54E-04			2.80E-02	4.67E+00	1.87E+01
Indeno(1,2,3-cd)pyrene	2.30E-08			2.54E-06	4.24E-04	1.69E-03
Naphthalene	1.63E-06			1.79E-04	2.99E-02	1.20E-01
Propylene	7.56E-04			8.32E-02	1.39E+01	5.56E+01
Propylene Oxide	4.69E-05			5.16E-03	8.62E-01	3.45E+00
Toluene	9.63E-05			1.06E-02	1.77E+00	7.08E+00
Xylene (Total)	2.56E-05			2.82E-03	4.70E-01	1.88E+00
Sulfuric Acid Mist (H2SO4)	5.90E-04			6.49E-02	1.08E+01	4.34E+01
Benzo(a)pyrene equivalents	4.36E-08			4.93E-06	8.23E-04	3.29E-03
Specified PAHs				1.41E-05	2.36E-03	9.45E-03

Typical Shutdown is approximately 6 minutes

	Equivalency Factor
Benzo(a)anthracene	0.1
Benzo(a)pyrene	1
Benzo(b)fluoranthrene	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenz(a,h)anthracene	1.05
Indeno(1,2,3-cd)pyrene	0.1

Ammonia lb/MMBtu = ppm x 1/molar volume x MW x Fd x 20.9/(20.9 - %O2)

ppm = 10 ppm @15%O2 limit
molar volume = 386.8 dscf/lbmol @ 14.696 psia, 70 deg. F
MW = molecular weight, lb/lb-mol
Fd = 8743 dscf/MMBtu for Natural Gas @ 70 deg. F

Ammonia lb/MMBtu = 10 E-06 ft3 of NH3/ft3 stack gas x 1/386.8 dscf/lb-mol x 17 lb/lb-mol x 8743 dscf/MMBtu x 20.9/(20.9 - 15)
Ammonia lb/MMBtu = 0.014

Shutdown Average Firing Rate = 1101 MMBtu/hour
Annual Shutdown MMBtu/year = 1101 MMBtu/hour x 16.7 hours/year = 18,386.7

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Toxic Air Contaminant	CATEF EF lb/MMBtu			SDAPCD EF lb/MMscf		SDAPCD EF lb/MMBtu	Startup EF lb/MMBtu	
1,3-Butadiene	1.25E-07	CATEF					1.25E-07	CATEF
Acetaldehyde	1.34E-04	CATEF		1.28E+00	SDAPCD	1.25E-03	1.25E-03	SDAPCD
Acrolein	1.85E-05	CATEF		6.89E-02	SDAPCD	6.75E-05	6.75E-05	SDAPCD
Ammonia	1.40E-02	Permit Limit					1.40E-02	Permit Limi
Benzene	1.30E-05	CATEF		2.56E-02	SDAPCD	2.51E-05	2.51E-05	SDAPCD
Benzo(a)anthracene	2.22E-08	CATEF	ND	2.25E-05	SDAPCD	2.21E-08	2.22E-08	CATEF
Benzo(a)pyrene	1.36E-08	CATEF	ND	1.39E-05	SDAPCD	1.36E-08	1.36E-08	SDAPCD
Benzo(b)fluoranthene	1.11E-08	CATEF					1.11E-08	CATEF
Benzo(k)fluoranthene	1.08E-08	CATEF					1.08E-08	CATEF
Chrysene	2.47E-08	CATEF	ND	2.25E-05	SDAPCD	2.21E-08	2.47E-08	CATEF
Dibenz(a,h)anthracene	2.30E-08	CATEF	ND	2.25E-05	SDAPCD	2.21E-08	2.30E-08	CATEF
Ethylbenzene	1.75E-05	CATEF		3.26E-02	SDAPCD	3.20E-05	3.20E-05	SDAPCD
Formaldehyde	8.99E-04	CATEF		4.63E+00	SDAPCD	4.54E-03	4.54E-03	SDAPCD
Hexane	2.54E-04	CATEF					2.54E-04	CATEF
Indeno(1,2,3-cd)pyrene	2.30E-08	CATEF	ND	2.25E-05	SDAPCD	2.21E-08	2.30E-08	CATEF
Naphthalene	1.63E-06	CATEF		1.04E-03	SDAPCD	1.02E-06	1.63E-06	CATEF
Propylene	7.56E-04	CATEF					7.56E-04	CATEF
Propylene Oxide	4.69E-05	CATEF					4.69E-05	CATEF
Toluene	6.96E-05	CATEF		9.82E-02	SDAPCD	9.63E-05	9.63E-05	SDAPCD
Xylene (Total)	2.56E-05	CATEF		3.48E-03	SDAPCD	3.41E-06	2.56E-05	CATEF
Sulfuric Acid Mist (H2SO4)								
Benzo(a)pyrene equivalents	4.48E-08	Calculated					4.48E-08	Calculated
Specified PAHs								

	Equivalency Factor
Benzo(a)anthracene	0.1
Benzo(a)pyrene	1
Benzo(b)fluoranthrene	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenz(a,h)anthracene	1.05
Indeno(1,2,3-cd)pyrene	0.1

1) CATEF = California Air Toxics Emission Factors Database maintained by the California Air Resources Board
2) SDAPCD = San Diego Air Pollution Control District Emission Factors developed by source testing
of Palomar GE Frame 7FA turbine during the 1st hour of a cold startup.
Data from Carlsbad Energy Center Final Determination of Compliance, Appendix B, August 4, 2009, SDAPCD
3) ND = Non Detect, Emission Factor is one half of the detection limit.
4) Natural Gas Higher Heating Value = 1020 Btu/scf
5) Startup Emission Factors are the highest value of the CATEF or SDAPCD Emission Factors.

CATEF Gas Turbine TAC Emission Factors

ID	System Type	Material Type	SCC	APC Device	Other Description	CAS	Substance	Max Emission factor	Mean	Median	Unit	lb/MMBtu
4544	Turbine	Natural gas	20200203	None	None	106-99-0	1,3-Butadiene	1.33E-04	1.27E-04	1.24E-04	lbs/MMcf	1.25E-07
4569	Turbine	Natural gas	20200203	None	None	75-07-0	Acetaldehyde	5.11E-01	1.37E-01	5.38E-02	lbs/MMcf	1.34E-04
4574	Turbine	Natural gas	20200203	None	None	107-02-8	Acrolein	6.93E-02	1.89E-02	1.09E-02	lbs/MMcf	1.85E-05
4586	Turbine	Natural gas	20200203	None	None	71-43-2	Benzene	4.72E-02	1.33E-02	1.01E-02	lbs/MMcf	1.30E-05
4594	Turbine	Natural gas	20200203	None	None	56-55-6	Benzo(a)anthracene	1.34E-04	2.26E-05	3.61E-06	lbs/MMcf	2.22E-08
4599	Turbine	Natural gas	20200203	None	None	50-32-8	Benzo(a)pyrene	9.16E-05	1.39E-05	2.57E-06	lbs/MMcf	1.36E-08
4604	Turbine	Natural gas	20200203	None	None	205-99-2	Benzo(b)fluoranthene	6.72E-05	1.13E-05	2.87E-06	lbs/MMcf	1.11E-08
4619	Turbine	Natural gas	20200203	None	None	207-08-9	Benzo(k)fluoranthene	6.72E-05	1.10E-05	2.87E-06	lbs/MMcf	1.08E-08
4624	Turbine	Natural gas	20200203	None	None	218-01-9	Chrysene	1.50E-04	2.52E-05	4.99E-06	lbs/MMcf	2.47E-08
4629	Turbine	Natural gas	20200203	None	None	53-70-3	Dibenz(a,h)anthracene	1.34E-04	2.35E-05	3.03E-06	lbs/MMcf	2.30E-08
4634	Turbine	Natural gas	20200203	None	None	100-41-4	Ethylbenzene	5.70E-02	1.79E-02	9.74E-03	lbs/MMcf	1.75E-05
4649	Turbine	Natural gas	20200203	None	None	50-00-0	Formaldehyde	6.87E+00	9.17E-01	1.12E-01	lbs/MMcf	8.99E-04
4654	Turbine	Natural gas	20200203	None	None	110-54-3	Hexane	3.82E-01	2.59E-01	2.19E-01	lbs/MMcf	2.54E-04
4659	Turbine	Natural gas	20200203	None	None	193-39-5	Indeno(1,2,3-cd)pyrene	1.34E-04	2.35E-05	2.87E-06	lbs/MMcf	2.30E-08
4664	Turbine	Natural gas	20200203	None	None	91-20-3	Naphthalene	7.88E-03	1.66E-03	9.26E-04	lbs/MMcf	1.63E-06
4679	Turbine	Natural gas	20200203	None	None	115-07-1	Propylene	2.00E+00	7.71E-01	5.71E-01	lbs/MMcf	7.56E-04
4684	Turbine	Natural gas	20200203	None	None	75-56-9	Propylene Oxide	5.87E-02	4.78E-02	4.48E-02	lbs/MMcf	4.69E-05
4694	Turbine	Natural gas	20200203	None	None	108-88-3	Toluene	1.68E-01	7.10E-02	5.91E-02	lbs/MMcf	6.96E-05
4709	Turbine	Natural gas	20200203	None	None	1330-20-7	Xylene (Total)	6.26E-02	2.61E-02	1.93E-02	lbs/MMcf	2.56E-05

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

H2SO4 Estimate

Worst Case lb/hr

1 grain Sulfur/100 scf

lb S/MMBtu = 1 grain S/100 scf x lb/7000 grains x scf/1020 Btu x 1E06 Btu/MMBtu = 0.0014 lb S/MMBtu

lb SO2/MMBtu = 0.0014 lb S/MMBtu x 64/32 = 0.0028 lb SO2/MMBtu

Worst Case lb/hour assume 55% SO2 converts to H2SO4

lb H2SO4/MMBtu = 0.0028 lb SO2/MMBtu x 98/64 x 0.55 = 0.002358 lb H2SO4/MMBtu

Simple Cycle Turbine lb/hr H2SO4 = 2202 MMBtu/hour x 0.002358 lb H2SO4/MMBtu = 5.192 lb/hour per turbine

Annual Average assume 55% SO2 converts to H2SO4

0.25 grain Sulfur/100 scf

lb S/MMBtu = 0.25 grain S/100 scf x lb/7000 grains x scf/1020 Btu x 1E06 Btu/MMBtu = 0.00035 lb S/MMBtu

lb SO2/MMBtu = 0.00035 lb S/MMBtu x 64/32 = 0.0007 lb SO2/MMBtu

Worst Case Annual Average lb/hour assume 55% SO2 converts to H2SO4

lb H2SO4/MMBtu = 0.0007 lb SO2/MMBtu x 98/64 x 0.55 = 0.0005895 lb H2SO4/MMBtu

Simple Cycle Turbine lb/hr H2SO4 = 2202 MMBtu/hour x 0.0005895 lb H2SO4/MMBtu = 1.298 lb/hour per turbine, 1752 hours/year

Total H2SO4 = 4 x (1.298 lb/hour x 1752 hour/year) = 9096 lb/year, 4.55 ton/year

Marsh Landing Generating Station
Plant No. 19169
Application No. 18404
BAAQMD February 2010

Simple Cycle Unit Heater

	lb/MMscf	lb/MMBtu	Firing Rate MMBtu/hr	lb/hour	lb/day	hours/year	lb/year	ton/year
Benzene	2.10E-03	2.06E-06	5	1.03E-05	2.47E-04	1752	1.80E-02	9.02E-06
Formaldehyde	7.50E-02	7.35E-05	5	3.68E-04	8.82E-03	1752	6.44E-01	3.22E-04
Toluene	3.40E-03	3.33E-06	5	1.67E-05	4.00E-04	1752	2.92E-02	1.46E-05

Natural Gas 1020 Btu/scf
Notes: Emission Factors AP-42 Section 1.4 (7/98)
Benzene lb/hour = 5 MMBtu/hour x 2.1E-03 lb/MMscf x (1/1020 Btu/scf) = 1.03 E-05

Both Heaters

	lb/hour	lb/day	lb/year	ton/year
Benzene	2.06E-05	4.94E-04	3.61E-02	1.80E-05
Formaldehyde	7.35E-04	1.76E-02	1.29E+00	6.44E-04
Toluene	3.33E-05	8.00E-04	5.84E-02	2.92E-05

Memorandum
September 7, 2005

To: Engineering Division Staff

From: Brian Bateman
Director of Engineering

Subject: Emission Factors for Toxic Air Contaminants from Miscellaneous Natural Gas Combustion Sources

---

This memorandum serves to provide guidelines on the emission factors to use to calculate toxic air contaminant (TAC) emissions from miscellaneous natural gas combustion sources. When site specific or source category specific emission factors are not available, the following emission factors shall be used to calculate TAC emissions from miscellaneous natural gas combustion sources:

TAC Emission Factors for Miscellaneous Natural Gas Combustion		
TAC	Emission Factor, lbs/Mscf	Emission Factor, lbs/therms *
Benzene	2.1 E-6	2.06 E-7
Formaldehyde	7.5 E-5	7.35 E-6
Toluene	3.4 E-6	3.33E-7

* based on 1020 Btu/scf

These emission factors are taken from AP42 Table 1.4-3, Emission Factors for Speciated Organic Compounds from Natural Gas Combustion, and are those for which a reasonable number of sources had been tested and the tests were performed using sound methodology. AP42 emission factors for PAHs are not used because they are based on single tests in which the speciated PAH emissions were found to be below detection levels. AP42 emission factors for metal emissions are not used because they are based on a small number of tests and have poor EPA data quality ratings. CATEF factors are not used because there was inadequate data, the data quality was poor, or the quality of AP42 data was better. Based on the data from their websites, neither Ventura nor San Diego APCD use metal emission factors and except for naphthalene, neither uses any other speciated or benzo(a)pyrene equivalent PAH emission factor.

BFB:SBL:jhl

Appendix B

PSD Modeling Results

OFFICE MEMORANDUM

March 22, 2010

TO: Brian Lusher

VIA: Glen Long
Scott Lutz
Barry Young
Brenda Cabral

FROM: Jane Lundquist

SUBJECT: Mirant Marsh Landing Generating Station, Antioch, Ca., Plant # 19169, PSD Modeling Analysis, Permit Application # 18404

I have reviewed the September 2009 modeling analysis prepared by URS and submitted by Mirant Marsh Landing, LLC for the Marsh Landing Generating Station Project. This project has been changed from two combined cycle turbines and two simple cycle turbines to four simple cycle turbines. With the elimination of the heat recovery steam generators, the project is not a fossil fuel-fired steam electric plant and is not a "major" stationary source under the federal PSD regulations because project emissions are less than 250 tons per year of any regulated pollutant.

However, at your request, an air quality impact analysis was performed in accordance with Sections 52.21(k)-(o) of Title 40 of the Code of Federal Regulations and Section 414 of the District's NSR Rule (Regulation 2, Rule 2) using EPA-approved models and calculation procedures. Based upon the information provided in the URS report and your emission estimates, my analysis shows that the proposed project would not cause or contribute to a violation of any applicable ambient air quality standards for any PSD pollutant. Attached is my report.

SUMMARY OF AIR QUALITY IMPACT ANALYSIS FOR THE MIRANT MARSH LANDING GENERATING STATION

March 22, 2010

Background

Mirant Marsh Landing, LLC has submitted permit application (# 18404) for the Marsh Landing Generating Station (MLGS) in Antioch, California. The proposed MLGS will be a 760 MW facility designed to provide peaking power and is expected to operate at a maximum of 20 percent annual capacity factor. The MLGS will consist of four natural gas-fired Siemens 5000F simple cycle (SC) gas turbines and two natural gas-fired fuel preheaters. The MLGS will be constructed wholly within the existing Contra Costa Power Plant site. The proposed project will result in an increase in PSD-regulated air pollutant emissions of nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter ($PM_{2.5}$ and PM_{10}), and carbon monoxide (CO).

Air Quality Impact Analysis Requirements

Requirements for air quality impact analysis are given in the Code of Federal Regulations 40 CFR Section 52.21(k)-(o) and related authorities. The Bay Area Air Quality Management District has also adopted regulations on performing air quality impact analysis in its New Source Review (NSR) Rule: Regulation 2, Rule 2. These regulations provide additional guidance on performing air quality impact analyses, but do not override the EPA regulations. In the case of any inconsistency between Air District Regulation 2, Rule 2 and 40 CFR Section 52.21, the federal regulations are controlling.

The worst-case annual criteria pollutant emission increases for the MLGS project are listed in Table 1, along with the corresponding significant emission rates above which an air quality impact analysis is required.

Table 1 Comparison of Proposed Project's Worst-Case Annual Emissions to Significant Emission Rates for Air Quality Impact Analysis

Pollutant	Proposed Project's Emissions (tons/year)	PSD "Major Source" Threshold Emission Rate (tons/year)	EPA PSD Significant Emission Rates for Major Stationary Sources (tons/year)	Air Quality Impact Modeling Required? (yes/no)
NO_2	71.9	250	40	no
SO_2	7.9	250	40	no
PM_{10}	31.6	250	15	no
$PM_{2.5}$	31.6	250	10	no
CO	138.9	250	100	no

As of December 14, 2009, the San Francisco Bay Area was designated non-attainment for the 2006 24-hour $PM_{2.5}$ National Ambient Air Quality Standard. As such, PSD analysis for $PM_{2.5}$ is not applicable for the 24-hour $PM_{2.5}$ standard. However, to be conservative, an analysis of 24-hour $PM_{2.5}$ impacts has been included in this analysis. As shown in Table 1, the proposed project emissions do not exceed the PSD "major source" threshold level for any of the regulated pollutants and an air quality impact analysis is not required. However, at the request of the permit engineer, an air quality impact has been investigated for all pollutants emitted in quantities larger than the EPA PSD significant emission rates. The proposed project SO_2 emissions are below the PSD significant emission rate; thus, an air quality impact analysis was not conducted for the emissions of SO_2. The MLGS project emissions of NO_2, $PM_{2.5}$, PM_{10}, and CO exceed the PSD significant emission rates and an air quality impact analysis was therefore performed for these pollutants. The detailed requirements for an air quality impact analysis for these pollutants are given in 40 CFR Section 52.21, District Regulation 2, Rule 2 and EPA guidance documents.

The PSD Regulations also contain requirements for certain additional impact analyses associated with air pollutant emissions. An applicant for a permit that requires an air quality impact analysis must also, according to 40 CFR Section 52.21(o) and Section 2-2-417 of the District's NSR Rule, provide an analysis of the impact of the source and source-related growth on visibility, soils and vegetation.

Air Quality Impact Analysis Summary

The required contents of an air quality impact analysis are specified in EPA's NSR Workshop Manual and Section 2-2-414 of the District's NSR Rule. According to subsection 2-2-414.1 and the NSR Workshop Manual, if the maximum air quality impacts of a new or modified stationary source do not exceed significant impact levels for air quality impacts, as defined in Section 2-2-233 and the NSR Workshop Manual, no further analysis is required. In September 2007, EPA proposed three different 24-hour and annual average significant impact levels for $PM_{2.5}$.[1] The $PM_{2.5}$ levels have not been promulgated and EPA does not have plans to finalize them until May 2010. The District has reviewed EPA's methodology underlying each of its alternative proposed significant impact levels and has concluded that the lowest of the three proposed significant impact levels is the most appropriate measure of significance for each averaging period for comparison purposes.

Consistent with EPA regulations, it is assumed that emission increases will not cause or contribute to a violation of an ambient air quality standard (AAQS), or cause or contribute to an exceedance of a PSD increment, if the resulting maximum air quality impacts are less than specified significance levels. If the maximum impact for a particular pollutant is predicted to exceed the significant impact level, a full impact analysis is required involving estimation of

[1] Prevention of Significant Deterioration (PSD) for Particulate Matter Less than 2.5 Micrometers ($PM_{2.5}$) – Increments, Significant Impact Levels (SILs) and Significant Monitoring Concentration (SMC)"; Proposed Rule, Federal Register, Volume 72, Number 183, pages 54111-54156, September 21, 2007

background pollutant concentrations and, if applicable, a PSD increment consumption analysis. EPA also requires an analysis of any PSD source that may impact a Class I area.

Air Quality Modeling Methodology

Maximum ambient concentrations of NO_2, $PM_{2.5}$, PM_{10} and CO were estimated for various plume dispersion scenarios using established modeling procedures. The plume dispersion scenarios addressed include simple terrain impacts (for receptors located below stack height), complex terrain impacts (for receptors located at or above stack height), impacts due to building downwash, impacts due to inversion breakup fumigation, and impacts due to shoreline fumigation.

Emissions from each of the four 5000F turbines will be exhausted from separate 31.3-feet diameter, 165-feet tall exhaust stacks. Emissions from each of the two fuel preheaters will be exhausted from separate 8 inch diameter, 26-feet tall exhaust stacks. Initial screening model runs for the turbines were made for various operating conditions to determine the worst-case operating conditions that yielded the highest concentrations of NO_2, $PM_{2.5}$, PM_{10} and CO; three different operating loads and three different ambient conditions were evaluated. The worst-case operating conditions found for the SC turbines were then used to model the maximum predicted impacts of the proposed project. Model runs were made for each of the following scenarios to determine the maximum predicted 1-hour, 8-hour, 24-hour and annual average pollutant concentrations: worst-case normal operating conditions, turbine startup, inversion break-up fumigation and shoreline fumigation.[2] The pollutants emitted, averaging period evaluated, operating scenario description and emission rates used in the modeling for each source are shown in Table 2, on the next page.

The EPA guideline models AERMOD (version 09292) SCREEN3 model (version 96043) were used to determine air quality impacts during worst-case normal operation, inversion breakup fumigation and shoreline fumigation conditions. An Auer land use analysis of the facility and its surroundings showed that the area within 3 kilometers is considered rural. Using the rural land use option, F stability and a stack height wind speed of 2.5 m/s, the SCREEN3 model was run for each source and TIBL factor 2 through 6 to determine inversion breakup fumigation and shoreline fumigation. Because the area is classified as rural, the AERMOD model option of increased surface heating due to the urban heat island was not selected.

Meteorological data was available from the station located on site at the Contra Costa Power Plant (CCP). The site was divided into 5 sectors: 62°-150°, 150°-182°, 182°-243°, 243°-274°and 274°-62° for determining surface characteristics. Surface moisture conditions for the determination of Bowen ratio was obtained from the Antioch Pump Plant 3 climate station.

---

2 Commissioning is the original startup of the turbines and only occurs during the initial operation of the equipment after installation. Commissioning emissions are temporary emissions that are not subject to the Air Quality Impact Analysis requirement. EPA only requires an analysis of commissioning activity impacts if it is shown that the emissions impact a Class I area or an area where a PSD increment is known to be violated. 40 CFR Section 52.21(i)(3).

These data were processed with EPA's AERSURFACE (version 08009) to determine a set of surface characteristics in accordance with EPA's January 2008 "AERMOD Implementation Guide." Five years (2000, 2001, 2002, 2004 and 2005) of CCP meteorological data, Oakland Airport upper air data, Concord/Buchannan Airport cloud cover data, and the set of surface characteristics were processed with EPA's AERMET (version 06341). AERMOD model runs were made using the no urban areas option and the five years of AERMET processed meteorological data. The Plume Volume Molar Ratio Method was used to convert NO_x impacts into NO_2 impacts. Hourly ozone monitoring data for the same period as the AERMET-processed meteorological data (2000, 2001, 2002, 2004 and 2005) was obtained from the District's Bethel Island monitoring station located approximately 10 km east of the project site. Because the exhaust stacks do not exceed Good Engineering Practice (GEP) stack height, ambient impacts due to building downwash were evaluated using the Building Profile Input Program for PRIME [BPIPPRM (version 04274)]. Stack and building parameters used in the analysis are those provided by the applicant. Complex terrain impacts were also considered. Elevation data from USGS digital elevation maps were processed in AERMAP (version 06341).

Table 2
Source Emission Rates Used in the Modeling Analysis for Various Scenarios and Pollutant Averaging Times

Pollutant	Averaging Period	Scenario: description	SC Turbine Emission Rate w/o tuning, lbs/hr	SC Turbine tuning Emission Rate, lbs/hr	SC Fuel Preheater Emission Rate, lbs/hr
NO_2	1-hour	STARTUP & TUNING: 1 SC turbine tuning and 3 SC turbines with 2 startups, 1 shutdown and rest of hour at normal operation; fuel preheaters at maximum operating rates	45.1	80.0	0.091
CO	1-hour	STARTUP: All SC turbines with 2 startups, 1 shutdown and rest of hour at normal operation; fuel preheaters at maximum operating rates	541.3	450	0.170
CO	8-hour	STARTUP: All SC turbines with 2 startups, 1 shutdown and rest of hour at normal operation; fuel preheaters at maximum operating rates – this occurs for each of the 8 hours	541.3	450	0.170
$PM_{2.5}/PM_{10}$	24-hour	STARTUP & TUNING: 1-SC turbine tuning; all SC turbines with 3 startups, 3 shutdown, rest of period at normal operations; fuel preheaters at maximum operating rates	9.0	9.0	0.015
NO_2	Annual	All SC turbines operate annually 1705 hours at 60°F, with 167 startups and 167 shutdowns (1752 hours total); fuel preheaters operate 1752 hours at maximum operating rates	4.1	4.1	0.018
$PM_{2.5}/PM_{10}$	Annual	All SC turbines operate annually 1705 hours at 60°F, with 167 startups and 167 shutdowns (1752 hours total); fuel preheaters operate 1752 hours at maximum operating rates	1.8	1.8	0.0029

a. Start-up occurs when a turbine is brought from idle status to power production.
b. All four turbines are conservatively assumed to start in the same hour.
c. SC turbine NO_2 emission rates during tuning are higher than during startup and shutdown. The scenario modeled for 1-hour average NO_2 includes one SC turbine tuning.
d. SC turbine CO emission rates during startup and shutdown are higher than during tuning. The scenario modeled for 1-hour and 8-hour average CO involves all SC turbines starting up and shutting down.

Air Quality Modeling Results

The maximum predicted ambient impacts determined from the modeling are summarized in Table 3 for the averaging periods for which AAQS and PSD Increments have been set. Also shown in Table 3 are the corresponding significant air quality impact levels listed in the NSR

Workshop Manual, Section 2-2-233 of the District's NSR Rule, and the most conservative of the draft proposed 2007 significant air quality impact levels for $PM_{2.5}$.

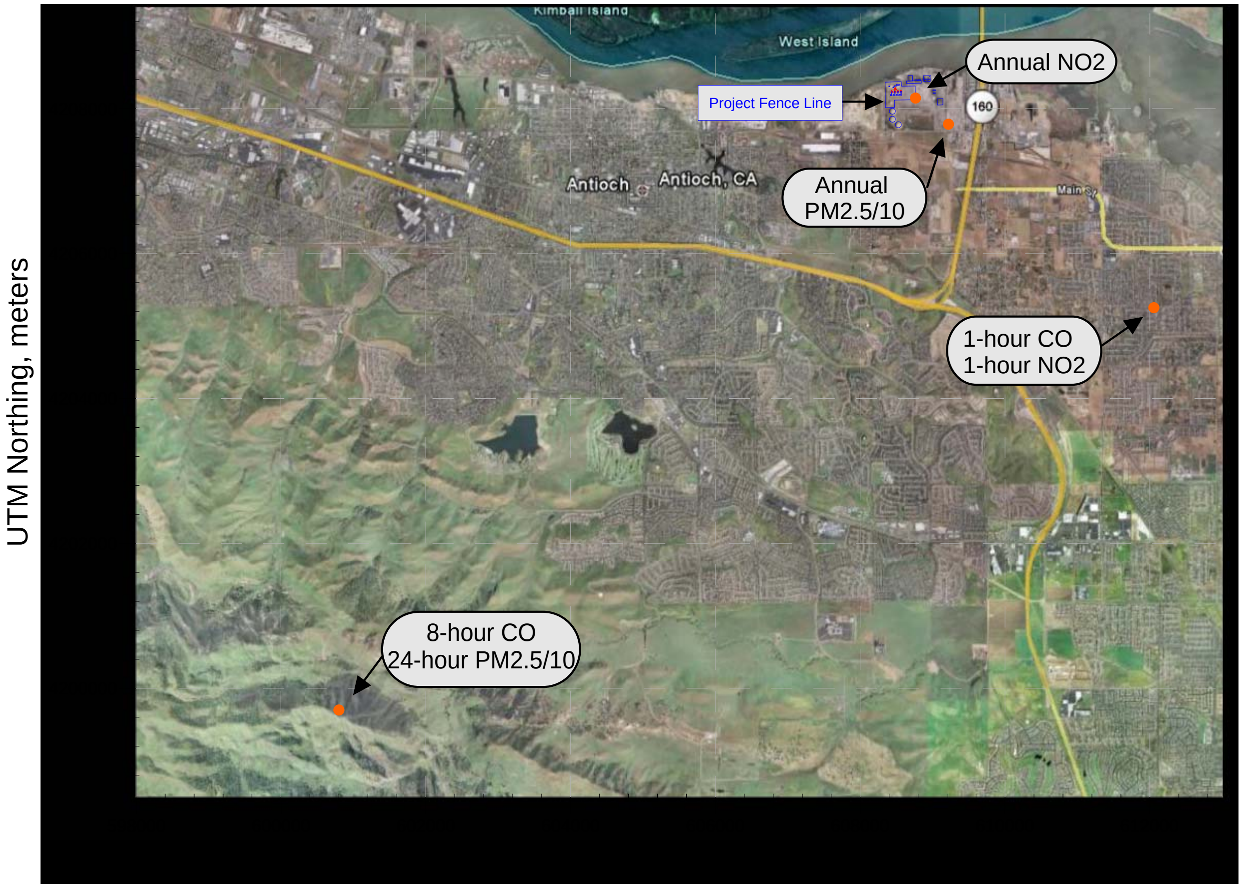
Table 3
Maximum Predicted Ambient Impacts of the Proposed Project and
PSD Class II Significant Air Quality Impact Levels

Pollutant	Averaging Period	Operating Case	Maximum Modeled Impact, $\mu g/m^3$	Significant Air Quality Impact Level (SIL) [a], $\mu g/m^3$	SIL exceeded? (yes/no)
NO_2	1-hour	Normal w/startup & tuning	41	19	yes
NO_2	1-hour	Inversion Break-up Fumigation	11	19	no
NO_2	1-hour	Shoreline Fumigation	64	19	yes
NO_2	annual	Maximum Operation	0.08	1.0	no
CO	1-hour	Normal w/startup & tuning	464	2,000	no
CO	1-hour	Inversion Break-up Fumigation	96	2,000	no
CO	1-hour	Shoreline Fumigation	576	2,000	no
CO	8-hour	Normal w/startup & tuning	187	500	no
CO	8-hour	Inversion Break-up Fumigation	19	500	no
CO	8-hour	Shoreline Fumigation	82	500	no
PM_{10}	24-hour	Normal w/startup & tuning	1.1	5	no
PM_{10}	24-hour	Inversion Break-up Fumigation	0.2	5	no
PM_{10}	24-hour	Shoreline Fumigation	0.4	5	no
PM_{10}	annual	Normal Operation	0.02	1	no
$PM_{2.5}$	24-hour	Normal w/startup & tuning	1.1	1.2	no
$PM_{2.5}$	24-hour	Inversion Break-up Fumigation	0.2	1.2	no
$PM_{2.5}$	24-hour	Shoreline Fumigation	0.4	1.2	no
$PM_{2.5}$	annual	Normal Operation	0.02	0.3	no

a. EPA recently adopted a rule establishing a new one-hour NO_2 National AAQS. The effective date of the final rule is April 12, 2010. No federal significant air quality impact level (SIL) has yet been established for one-hour average NO_2 concentrations. The one-hour average NO_2 SIL listed above is from District Regulation 2-2-233 and was established to determine compliance with the California AAQS.

In accordance with the NSR Workshop Manual and Section 2-2-414 of the District's NSR Rule, further analysis is required only for those pollutants and averaging times with modeled impacts above the significant air quality impact levels. As shown in Table 3, the 1-hour average NO_2 impact would require further analysis to determine that the emission increases from the proposed project would not cause or contribute to an AAQS violation or an exceedance of a PSD increment. However, no PSD increment has been established for the 1-hour average NO_2. Thus, the 1-hour average NO_2 impact is evaluated only to determine if a National AAQS violation would occur. Figure 1 shows the locations of the maximum modeled impacts. (Note that the PSD analysis applies only for the National AAQS, but this analysis evaluates the potential for a California AAQS violation as well because this project will be reviewed for compliance with the California AAQS by the California Energy Commission.)

Figure 1 Location of Project Maximum Impacts



Impact Area

The geographical area, or impact area, for which the analysis for the NAAQS is carried out is defined as the circular area that includes all receptor locations where the proposed project causes a significant ambient impact (equal to or exceeding the significant air quality impact level (SIL)). A federal SIL has not yet been established for one-hour average NO_2 concentrations. However, the one-hour average CO SIL is five percent of the one-hour CO NAAQS. Applying this percentage to the one-hour NO_2 NAAQS results in a value of 9 $\mu g/m^3$; this value was used as the NO_2 SIL to establish the impact area. Nearby sources that could have a significant impact in the project impact area should also be modeled. The following nearby new and proposed facilities were identified as sources that should be modeled: Gateway Generating Station, Willow Pass Generating Station and Oakley Generating Station. The MLGS project and these three new and proposed generating stations were then modeled with the dispersion model AERMOD as described under the section *Air Quality Modeling Methodology* above. The Pittsburg and Bethel Island monitoring stations are also within the MLGS project impact area.

Background Air Quality Levels

A PSD full impacts analysis evaluates the proposed project's impacts in connection with background concentrations and contributions from other nearby sources. Guidance in EPA's NSR Workshop Manual allows the use of background data from existing regional monitoring sites if the site is representative of air quality of the area and the following criteria are considered: monitor location, quality of data and currentness of data. The proposed project site is located mid-way between the Bethel Island monitoring station and the Pittsburg monitoring station. The District-operated Pittsburg monitoring station, which is located east of the project and has the higher NO_2 concentrations of the two stations, was analyzed for representativeness of background NO_2 concentrations. A comparison of grid cell emissions, within a 5 mile radius of the Pittsburg monitoring station and within a 5 mile radius of the proposed project site, show that NO_2 emissions in the Pittsburg monitoring station area are almost 2 times higher than the emissions in the proposed project area. We can reasonably assume that background ambient concentrations are similar, if not lower, at the proposed project site than at the Pittsburg monitoring station location. The Pittsburg monitoring station is a currently operated site and meets all EPA ambient monitoring data requirements ("Ambient Monitoring Guidelines for Prevention of Significant Deterioration", EPA-450/4-87-007, May 1987). Therefore, representativeness and all three criteria have been met. One-hour average NO_2 concentrations recorded at the Pittsburg monitoring station, which is within the MLGS project impact area, represent impacts from existing sources.

In order to determine that the project will not cause an exceedance of an AAQS, the proposed project's NO_2 impact is added to the background concentrations and compared to the AAQS. The California AAQS for one-hour average NO_2 is based on the maximum one-hour average concentration. The highest one-hour average NO_2 concentration recorded at the Pittsburg monitoring station during the period from 2004 to 2008 was 110 $\mu g/m^3$; this value is used as the background concentration to determine whether or not the proposed project will cause an exceedance of the California AAQS. The National AAQS for one-hour average NO_2 is based on the three-year average of the 98^{th} percentile of the annual distribution of daily maximum one-hour average concentration. The highest three-year average of the 98^{th} percentile of the annual distribution of daily maximum one-hour average NO_2 concentrations recorded at the Pittsburg monitoring station during the periods from 2005 to 2007 and from 2006 to 2008 was 83 $\mu g/m^3$; this value is used as the background concentration to determine whether or not the proposed project will cause an exceedance of the National AAQS.

Ambient Air Quality Standard Modeling Comparison

The maximum modeled one-hour NO_2 impact added to the maximum background concentrations is compared to the ambient air quality standards in Table 4. The proposed project will not cause or contribute to an exceedance of the California AAQS for one-hour average NO_2 or of the National AAQS for one-hour average NO_2 based on the three-year average of the 98^{th} percentile of the annual distribution of daily maximum one-hour average concentrations.

Table 4
Proposed Project One-hour NO_2 Ambient Air Quality Levels and California and National AAQS

Standard	Maximum Modeled Impact [a], $\mu g/m^3$	Maximum Background, $\mu g/m^3$	Maximum Project Impact Plus Maximum Background, $\mu g/m^3$	AAQS, $\mu g/m^3$
California	41	110	152	338
National	95	83	178	188

a. To determine that the California AAQS would not be exceeded, only the impact due to NO_2 emissions from the proposed MLGS is considered. To determine that the National AAQS would not be exceeded, the combined impact due to NO_2 emissions from the proposed MLGS as well as the Gateway Generating Station, the Willow Pass Generating Station and the Oakley Generating Station is considered. For the California AAQS, the table shows the maximum one-hour NO_2 concentration due to the emissions from MLGS only. For the National AAQS the table shows the maximum one-hour NO_2 concentration due to the emissions from the four generating stations combined.

PSD Increment Consumption Analysis

Although the impact from the proposed project exceeds the PSD significant air quality impact levels for 1-hour NO_2, the EPA has not established a PSD increment for this pollutant and averaging period; thus, no PSD increment consumption analysis is required for this project.

Class I Area Impact Analysis

In accordance with the NSR Workshop Manual, an impact analysis must be performed for any PSD source within 100 km of a Class I area which increases air pollutant concentrations by 1 $\mu g/m^3$ or more (24-hour average) inside the Class I area. EPA has proposed three options for the Class I Significant Impact Levels (SILs) for $PM_{2.5}$ in the Proposed Rule for $PM_{2.5}$ (see footnote 1). Table 5 presents the most conservative SILs proposed. The nearest Class I area is the Point Reyes National Seashore, located roughly 82 km to the west of the project. The results of an impact analysis using AERMOD modeling of the maximum 24-hour average NO_2, $PM_{10}/PM_{2.5}$ and CO concentrations within 50 km of the proposed MLGS facility area are shown in Table 5. Since pollutant concentrations decrease with distance away from the source, the proposed project impacts at the Point Reyes National Seashore, which is 32 km further away, will be less that the maximum model impacts at 50km. All impacts are below the corresponding SIL; therefore, a Class I PSD increment consumption analysis is not required.

Table 5
Maximum Predicted Ambient Impacts of Proposed Project at the Point Reyes National Seashore, Class I Area

Pollutant	Averaging Period	Maximum Modeled Class I Impact, $\mu g/m^3$	Significant Air Quality Impact Level (SIL), $\mu g/m^3$	SIL exceeded? (yes/no)
NO_2	24-hour	0.12	1.0	no
$PM_{10}/PM_{2.5}$	24-hour	0.041	0.07	no
	annual	0.02	0.04	no
CO	24-hour	0.40	1.0	no

Additional Impacts Analysis

The EPA NSR Workshop Manual and Section 2-2-417 of the District's NSR Rule requires that all PSD analysis include an additional impacts analysis which assesses the impacts on soils, vegetation, and visibility caused by any increase in emissions of any regulated pollutant from the source and associated growth.

Visibility Impairment Analysis

Visibility impacts were assessed using EPA's VISCREEN (version 88341) visibility screening model. The Level I analysis shows that the proposed project will not cause any impairment of visibility at Point Reyes National Seashore, the nearest Class I area.

Soils and Vegetation Analysis

The following soil and vegetation inventory excerpt is from the Impacts to Soils and Vegetation document submitted by the applicant:

> The Marsh Landing Generating Station (MLGS) site has been historically used as a power plant since 1952 and is surrounded by other industrial and commercial uses. Much of the area is developed, lacking natural soils, vegetation and habitat.
>
> Many of the soils found in the vicinity of the project are hydric (high moisture) soils associated with the floodplains, marshes and wetlands adjacent to the San Joaquin River. Delhi Sands cover most of the project site and surrounding area (including the areas of the proposed water lines and treatment facility at Bridgehead Lift Station). Delhi Sands while not hydric soils, are typically associated with floodplains and alluvial fans. The remaining areas are largely mucky soils, which are high in organic material content and associated with the shoreline marshes. Soil types present offsite include: Joice Muck, Shima Muck, Sycamore Silty Clay Loam, Zamora Silty Clay Loam, Fluvaquents, Gazwell Mucky Clay, Medisaprists, Rindge Muck and Rindge Mucky Silt Loam, and Xeropsamments. Absent from this area are nutrient-poor soil types such as are associated with rock outcroppings found in other, higher elevations in the Bay Area. Therefore, potential deposition of nitrogen-based nutrients from the air will not cause a significant increase in the nutritive properties of the local soils.
>
> Natural vegetation communities within a one-mile radius around the project site include: freshwater wetlands, riparian woodland, woodlands, stabilized interior dunes, tidal marshes, and annual grassland. The majority of the area south of the project site however consists of disturbed/ruderal grasslands, agriculture, landscaping, and developed areas. Several special-status species are known to occur near the project site. Federal special-status plants that are known to occur or could potentially occur within one mile of the project area include the Antioch Dunes Evening Primrose (*Oenothera deltoides* ssp. *howellii*) and the Contra Costa Wallflower (*Erysimum capitatum* ssp. *angustatum*). Neither of these plants occurs on the project site.

EPA has established a screening procedure for determining impacts to plants, soils and animals (EPA 450/2-81-078, "A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals," December 1980). Table 3.1 of this EPA guidance document lists screening concentrations for various pollutants. The screening concentrations represent minimum concentrations at which adverse growth effects or tissue injuries have been reported in the scientific literature. A comparison of the maximum concentrations that may result from the proposed MLGS project and the screening concentrations from the EPA document are shown Table 6 on the next page. The maximum concentrations that may result from the proposed MLGS project are calculated by summing the maximum modeled impact and the maximum background concentration.

Table 6
Comparison of Maximum Project Concentrations to
the National Ambient Air Quality Standard and the EPA Screening Concentrations

Pollutant	Averaging Period	Maximum Background Conc., μg/m^3	Maximum Modeled Impact, μg/m^3	Maximum Conc. (impact plus background) μg/m^3	Screening Conc.,[a] μg/m^3	Screening Averaging Period
NO_2	1-hour	116	64	180	3,760	4 & 8 hour
NO_2	1-hour	116	64	180	564	1 month
NO_2	annual	23	0.09	23	94	1 year
CO	1-hour	4,753	576	5,329	-	-
CO	8-hour	2,226	187	2,413	1,800,000	1-week
PM_{10}	24-hour	84	1.1	85	-	-
PM_{10}	annual	21.7	0.02	22	-	-
$PM_{2.5}$	24-hour	74	1.1	75	-	-
$PM_{2.5}$	annual	11	0.02	11	-	-

[a]EPA 450/2-81-078, "A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals," December 1980.

The maximum 1-hour average NO_2 concentration, including background, was compared to the screening concentrations with 4-hour, 8-hour and 1-month averaging periods. Likewise, the maximum 8-hour average CO concentration, including background, was compared to the screening concentration with a 1-week averaging period. This conservative comparison shows that maximum predicted NO_2 and CO concentrations are below the EPA screening concentrations and thus, below concentrations at which adverse growth effects or tissue injuries have been reported in the scientific literature.

The deposition of airborne particulates ($PM_{2.5}$, PM_{10}) can affect vegetation through either physical or chemical mechanisms. Physical mechanisms include the blocking of stomata so that normal gas exchange is impaired, as well as potential effects on leaf adsorption and reflectance of solar radiation. Deposition rates of 365 g/m^2/year have been shown to cause damage to fir trees, but rates of 274 g/m^2/year and 400-600 g/m^2/year did not damage vegetation at other sites (Lerman, S.L. and E.F. Darley. 1975. Particulates, pp. 141-158. In: Responses of plants to air pollution, edited by J.B. Mudd and T.T. Kozlowski. Academic Press. New York.) The maximum annual predicted concentration for $PM_{2.5}$, PM_{10} emissions from the MLGS is 0.02 μg/m^3. Assuming a deposition velocity of 2 cm/sec (worst-case deposition velocity, as recommended by the California Air Resources Board [CARB]), this concentration converts to an annual deposition rate of 0.01 g/m^2/year, which is several orders of magnitude below that which is expected to result in injury to vegetation (i.e., 365 g/m^2/year). The maximum annual average $PM_{2.5}$, PM_{10} background concentration was 21.7 μg/m^3. The total annual average $PM_{2.5}$, PM_{10} concentration, project plus background, is 22 μg/m^3. Using the same 2 cm/sec deposition velocity yields a total estimated particulate deposition rate of 14 g/m^2/year. This total is still 26 times less than levels expected to result in plant injury.

Maximum project NO_2, CO, PM_{10} and $PM_{2.5}$ concentrations would be less than the threshold levels at which scientific studies have shown a potential for negative impacts on soils and vegetation; thus, pollutant emissions from the proposed MLGS project are not expected to have any adverse soils and vegetative impacts.

Growth Analysis

The applicant has prepared the following growth analysis:

> According to the Federal PSD Regulation 40 CFR section 52.21(o), a growth induced air quality impact analysis on emissions from "general commercial, residential, industrial and other growth associated with the project" is required under PSD.
>
> Growth induced impacts associated with this project are caused by the growth necessity in local infrastructure to accommodate the project. This growth may include but is not limited to additional residential housing, schools, retail suppliers, and additional local business or industry to provide materials and support services for the facility.
>
> The Marsh Landing Generating Station (MLGS) would occupy approximately 27 acres within the western portion of the Contra Costa Power Plant (CCPP) property. The project will occupy an already developed industrial site dedicated to electricity generation. Therefore, there will be little or no associated industrial, commercial, or residential growth as a result of this project. In addition, the electrical generating capacity from the project will be connected into a regional electrical supply grid and therefore the proposed project does not stimulate local growth.
>
> The applicant estimates that operation and maintenance of the project would require 20 skilled full-time employees (Marsh Landing Generating Station AFC (08-AFC-3), May 2008, Table 2.8-1). To the extent practicable, the applicant has committed to give local preference in hiring and procurements. Therefore, there will be no significant impact on local employment associated with the operation and maintenance of the project.
>
> Based on the location, electricity distribution, and estimated workforce of the proposed project, no significant growth is expected to result from the proposed project.

CONCLUSIONS

The results of the air quality impact analysis indicate that the proposed project would not cause or contribute to a violation of any PSD or California AAQS (NO_2, CO, PM_{10} and $PM_{2.5}$). This analysis was based on EPA-approved models and calculation procedures and was performed in accordance with 40 CFR Section 52.21, Section 2-2-414 of the District's NSR Rule, and related guidance.

Appendix C

Health Risk Assessment Results

INTEROFFICE MEMORANDUM
February 24, 2010

TO: Brian K. Lusher Via: Scott B. Lutz
FROM: Jane H. Lundquist Daphne Y. Chong

SUBJECT: Revised Health Risk Assessment for Mirant Marsh Landing Generating Station, Antioch, Plant #19169, Application #18404

At your request, a revised health risk screening analysis was performed for the above referenced application to reflect your updated estimate of sulfuric acid emissions from the project. The analysis estimates the incremental health risk resulting from toxic air contaminant (TAC) emissions from the following natural gas-fired equipment: four simple cycle turbines and two fuel preheaters. Results from the analysis indicate that, for this project, the maximum incremental cancer risk is estimated at **0.03 in a million**, the chronic hazard index is **0.003**, and the acute hazard index is **0.3**. In accordance with the District's Regulation 2, Rule 5, these risk levels are considered acceptable.

EMISSIONS: TAC emission rates used in this analysis are those you provided in your "Marshlanding Amendment TAC Final 021810" spreadsheet. Table 1 shows the emission rates for a simple cycle turbine

Table 1 - Simple Cycle Turbine TAC Emission Rates per Turbine

	Max. Annual Emission Rate		Max. Hourly Emission Rate	
Toxic Air Contaminant	lbs/yr	g/s	lbs/hr	g/s
1,3-Butadiene	4.80E-01	6.91E-06	2.74E-04	3.45E-05
Acetaldehyde	5.75E+02	8.27E-03	2.76E+00	3.48E-01
Acrolein *	7.34E+01	1.06E-03	1.49E-01	1.87E-02
Ammonia	5.40E+04	7.77E-01	3.08E+01	3.88E+00
Benzene	5.04E+01	7.24E-04	5.53E-02	6.96E-03
Benz[a]anthracene	8.55E-02	1.23E-06	4.88E-05	6.15E-06
Benzo[a]pyrene	5.26E-02	7.56E-07	3.00E-05	3.78E-06
Benzo[b]fluoranthene	4.27E-02	6.15E-07	2.44E-05	3.07E-06
Benzo[k]fluoranthene	4.16E-02	5.98E-07	2.37E-05	2.99E-06
Chrysene	9.53E-02	1.37E-06	5.44E-05	6.85E-06
Dibenz[a,h]anthracene	8.89E-02	1.28E-06	5.07E-05	6.39E-06
Ethyl benzene	6.77E+01	9.74E-04	7.04E-02	8.87E-03
Formaldehyde	1.95E+03	2.80E-02	1.00E+01	1.26E+00
Hexane	9.80E+02	1.41E-02	5.59E-01	7.05E-02
Indeno[1,2,3-cd]pyrene	8.89E-02	1.28E-06	5.07E-05	6.39E-06
Naphthalene	6.28E+00	9.03E-05	3.58E-03	4.52E-04
Propylene	2.92E+03	4.19E-02	1.66E+00	2.10E-01
Propylene oxide	1.81E+02	2.60E-03	1.03E-01	1.30E-02
Toluene	2.69E+02	3.86E-03	2.12E-01	2.67E-02
Xylenes (mixed)	9.87E+01	1.42E-03	5.63E-02	7.10E-03
Sulfuric acid	2.27E+03	3.27E-02	5.19E+00	6.54E-01

* Note: Currently, CARB does not have certified emission factors or an analytical test method for acrolein. Until the tools needed to implement and enforce acrolein emission limits are available, the District will not conduct a HRSA for acrolein emissions.

Table 2 shows the annual TAC emission rates for a fuel preheater; emission are based on maximum operation rates for 1752 hours per year.

Table 2 - Natural Gas Fuel Pre-Heater, each per Heater

	Max. Annual Emission Rate		Max. Hourly Emission Rate	
Toxic Air Contaminant	lbs/yr	g/s	lbs/hr	g/s
Benzene	1.80E-02	2.59E-07	1.03E-05	1.30E-06
Formaldehyde	6.44E-01	9.26E-06	3.68E-04	4.63E-05
Toluene	2.92E-02	4.20E-07	1.67E-05	2.10E-06

The health values used in calculating the health risk is shown Table 3.

Table 3 – TAC Health Risk Values

Toxic Air Contaminant	Resident Cancer Unit Risk Factor, $(ug/m^3)^{-1}$	Worker Cancer Unit Risk Factor, $(ug/m^3)^{-1}$	Chronic REL, ug/m^3	Acute REL, ug/m^3
1,3-Butadiene	1.7E-04	3.4E-05	2.0E+01	na
Acetaldehyde	2.9E-06	5.7E-07	1.4E+02	4.7E+02
Ammonia	na	na	2.0E+02	3.2E+03
Benzene	2.9E-05	5.7E-06	6.0E+01	1.3E+03
Benz[a]anthracene	1.7E-03	6.0E-04	na	na
Benzo[a]pyrene	1.7E-02	6.0E-03	na	na
Benzo[b]fluoranthene	1.7E-03	6.0E-04	na	na
Benzo[k]fluoranthene	1.7E-03	6.0E-04	na	na
Chrysene	1.7E-04	6.0E-05	na	na
Dibenz[a,h]anthracene	6.5E-03	2.2E-03	na	na
Ethyl benzene	2.5E-06	5.0E-07	2.0E+03	na
Formaldehyde	6.1E-06	1.2E-06	9.0E+00	5.5E+01
Hexane	na	na	7.0E+03	na
Indeno[1,2,3-cd]pyrene	1.7E-03	6.0E-04	na	na
Naphthalene	3.5E-05	6.9E-06	9.0E+00	na
Propylene	na	na	3.0E+03	na
Propylene oxide	3.8E-06	7.4E-07	3.0E+01	3.1E+03
Toluene	na	na	3.0E+02	3.7E+04
Xylenes (mixed)	na	na	7.0E+02	2.2E+04
Sulfuric acid	na	na	1.0E+00	1.2E+02

Note: The Unit Risk Factor (URF) are derived from HARP for each receptor (residential and worker) and includes exposure adjustments based on the continuous operation of the source. The URF for polycyclic aromatic hydrocarbons, which are TACs that have multipathway effects, includes the impacts from soil ingestion and dermal adsorption pathways.

Weighted emissions were calculated and used as model emissions inputs so that the modeled results are in terms of cancer risk, chronic hazard index and acute hazard index. The weighted emissions for cancer risk include an age sensitivity factors (1.7 for the residential receptor and 1.0 for the worker receptor). The weighted emissions for chronic and acute hazard indices were conservatively estimated, summing all weighted emissions regardless of the target organ that is affected by the TAC. Table 4 shows the health value weighted-emissions for each TAC as well as the sum for the simple cycle turbine inputs and for the fuel preheater inputs.

Table 4 – Health Value Weighted Emission Inputs

Toxic Air Contaminant	Resident Cancer Risk Weighted Emissions x 1E6	Worker Cancer Risk Weighted Emissions x 1E6	Chronic HQ Weighted Emissions	Acute HQ Weighted Emissions
1,3-Butadiene	2.04E-03	2.37E-04	3.45E-07	0.00E+00
Acetaldehyde	4.08E-02	4.73E-03	5.91E-05	7.41E-04
Ammonia	0.00E+00	0.00E+00	3.88E-03	1.21E-03
Benzene	3.57E-02	4.14E-03	1.21E-05	5.36E-06
Benz[a]anthracene	3.45E-03	7.38E-04	0.00E+00	0.00E+00
Benzo[a]pyrene	2.12E-02	4.54E-03	0.00E+00	0.00E+00
Benzo[b]fluoranthene	1.72E-03	3.69E-04	0.00E+00	0.00E+00
Benzo[k]fluoranthene	1.68E-03	3.59E-04	0.00E+00	0.00E+00
Chrysene	3.85E-04	8.23E-05	0.00E+00	0.00E+00
Dibenz[a,h]anthracene	1.41E-02	2.83E-03	0.00E+00	0.00E+00
Ethyl benzene	4.17E-03	4.84E-04	4.87E-07	0.00E+00
Formaldehyde	2.89E-01	3.36E-02	3.11E-03	2.29E-02
Hexane	0.00E+00	0.00E+00	2.01E-06	0.00E+00
Indeno[1,2,3-cd]pyrene	3.59E-03	7.67E-04	0.00E+00	0.00E+00
Naphthalene	5.34E-03	6.20E-04	1.00E-05	0.00E+00
Propylene	0.00E+00	0.00E+00	1.40E-05	0.00E+00
Propylene oxide	1.66E-02	1.93E-03	8.67E-05	4.19E-06
Toluene	0.00E+00	0.00E+00	1.29E-05	7.22E-07
Xylenes (mixed)	0.00E+00	0.00E+00	2.03E-06	3.23E-07
Sulfuric acid	0.00E+00	0.00E+00	9.58E-03	9.92E-04
SC Turbine Inputs (sum):	**4.40E-01**	**5.54E-02**	**4.29E-02**	**3.78E-02**
Benzene	1.28E-05	1.48E-06	4.32E-09	9.98E-10
Formaldehyde	9.58E-05	1.11E-05	1.03E-06	8.42E-07
Toluene	0.00E+00	0.00E+00	1.40E-09	5.68E-11
Fuel Preheater Inputs (sum):	**1.09E-04**	**1.26E-05**	**1.04E-06**	**8.43E-07**

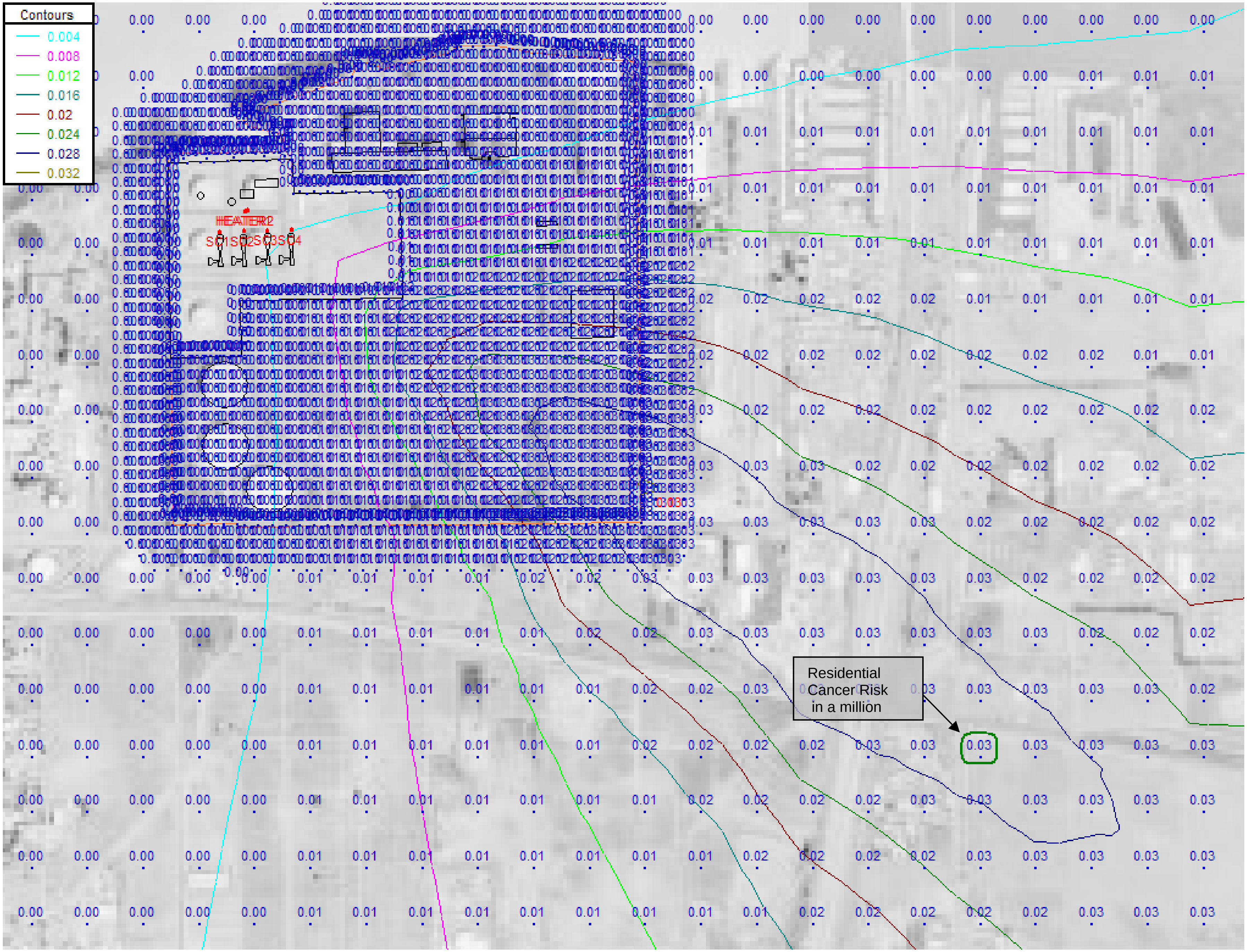
1. For each source, the sum of the URF-weighted emissions is entered into the model so that cancer risk in a million is the dispersion model result.
   Cancer Risk Model Emission Input = Sum of [(Annual average emission rate, g/s) * (URF, (ug/m3)-1) * (Age Sensitivity Factor: 1.7 for resident, 1.0 for worker)* 1 E6]
2. For each source, the sum of the inverse chronic REL-weighted emissions is entered into the model so that chronic hazard index is the dispersion model result. Since the REL-weighted emissions are summed regardless of the target organ affected, the chronic hazard index will be conservatively estimated.
   Chronic Hazard Index Model Emission Input = Sum of [(Annual average emission rate, g/s) / (chronic REL, (ug/m3))]
3. For each source, the sum of the inverse acute REL-weighted emissions is entered into the model so that acute hazard index is the dispersion model result. Since the REL-weighted emissions are summed regardless of the target organ affected, the acute hazard index will be conservatively estimated.
   Acute Hazard Index Model Emission Input = Sum of [(One-hour average emission rate, g/s) / (acute REL, (ug/m3))]

MODELING: AERMOD model runs were executed to estimate the chronic and acute health risks. The meteorological data, terrain data, source and building parameters that were used in the PSD analysis for this project were also used in this risk assessment.

HEALTH RISK: The health risk assessment was performed in accordance with the California Office of Environmental Health Hazard Assessment (OEHHA) guidelines. The health risk results are presented below.

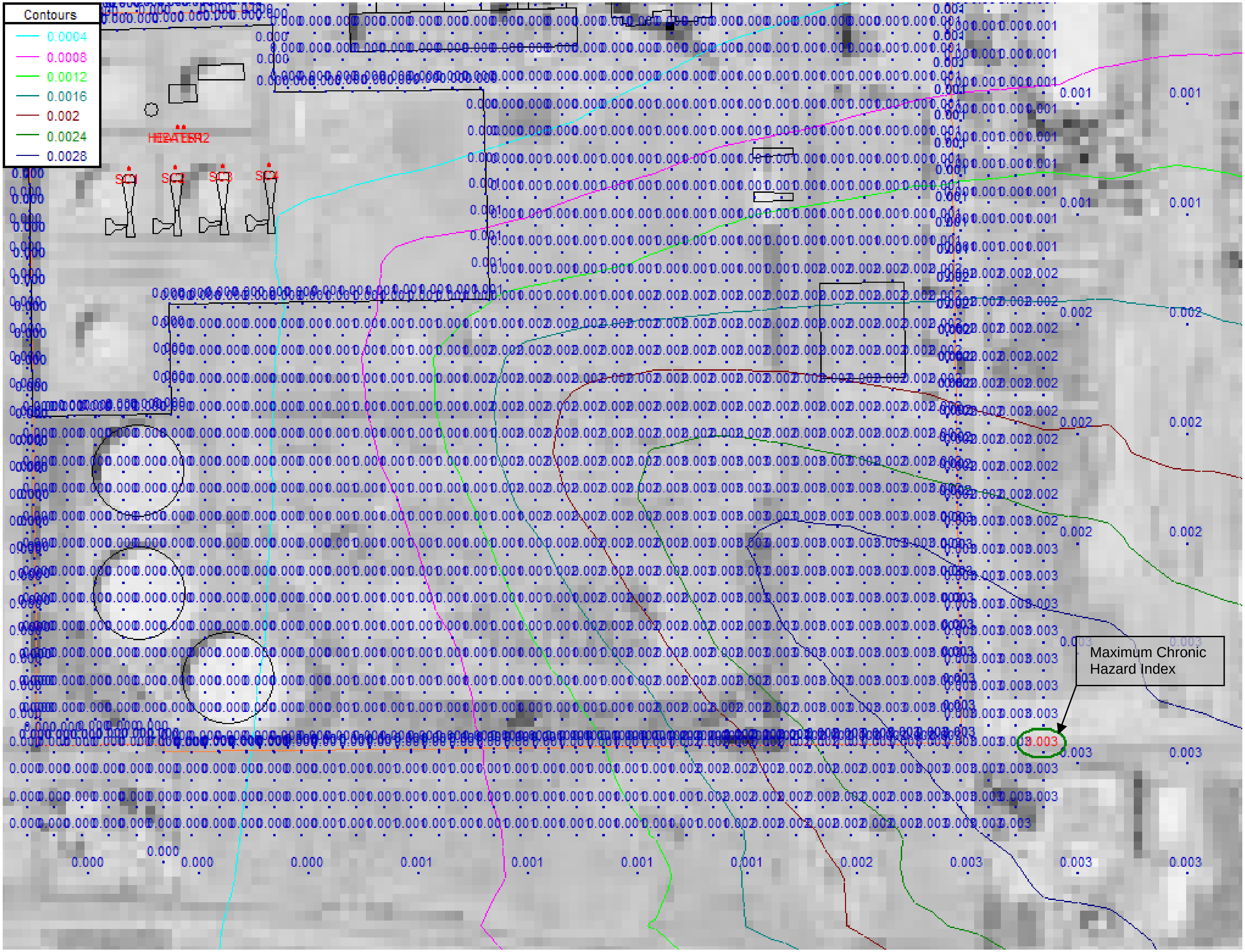
Receptor	Cancer Risk in a million	UTM_E	UTM_N	Met. Year
Resident	0.029	609800	4207300	2002
Worker	0.0041	609269	4207710	2002
Max. Chronic HI	0.0031	609269	4207710	2002
Max. Acute HI	0.26	601000	4199675	2000

Marsh Landing Generating Station P19169 A18404 Cancer Risk w/ASF f Residential Cancer Risk in a million C:\riskscreens\p19169\a18404_2009Fall\CancerResident_2002_CANCRRES.GRF



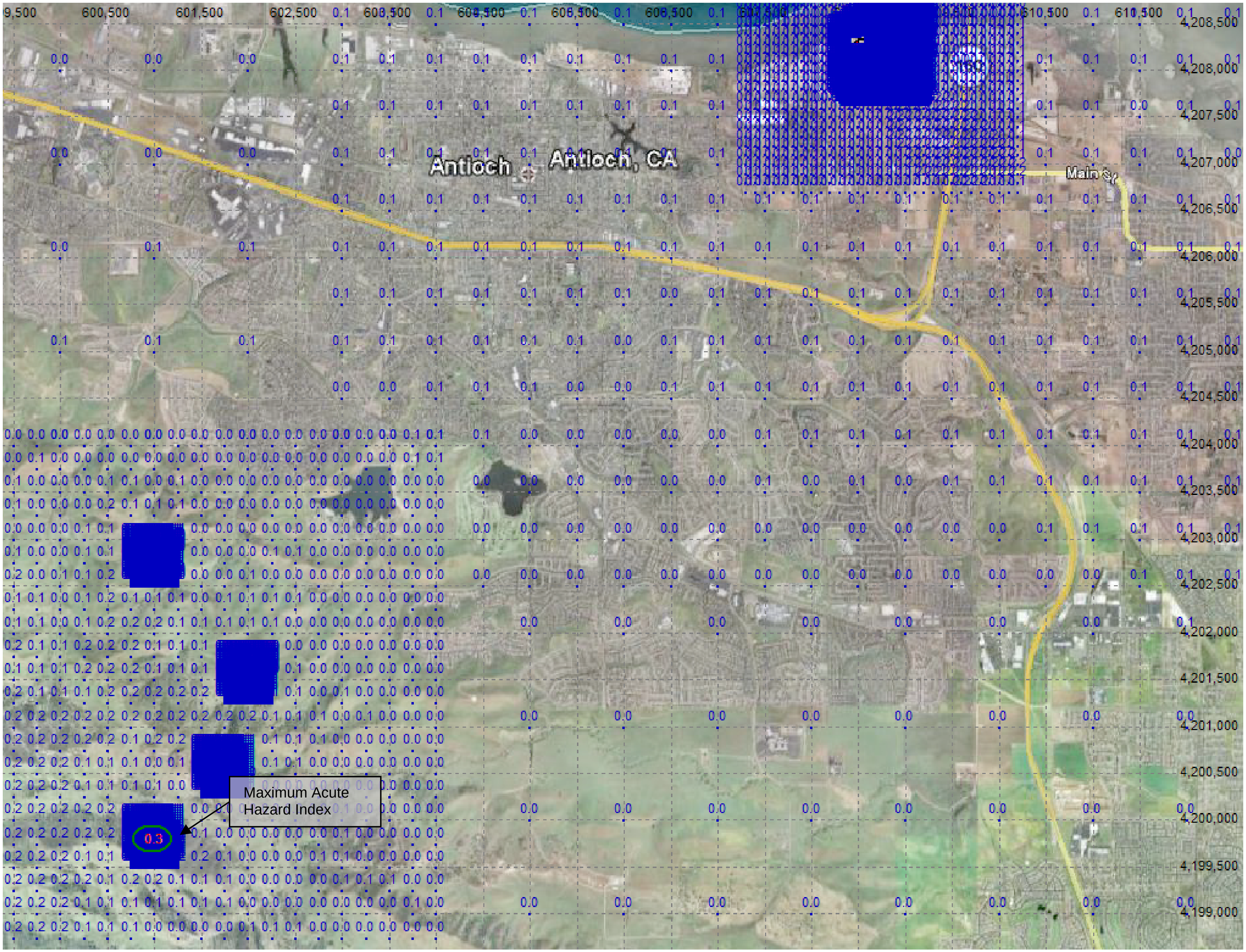
Scale: 1" = 210.0 Meters PERIOD VALUES FOR GROUP: ALL Max = 0.03249 (609243.8, 4207735)

Marsh Landing Generating Station P19169 A18404 Acute Hazard Index   Chronic Hazard Index   C:\riskscreens\p19169\a18404_2010Feb\HazardIndex_2002_CHRON_HI.GRF



Scale: 1" = 106.5 Meters   ANNUAL VALUES FOR GROUP: ALL   Max = 0.00311 (609268.8, 4207710)

Marsh Landing Generating Station P19169 A18404 Acute Hazard Index with Commissioning Emissions for All Four SC Turbines C:\riskscreens\p19169\a18404_2010Feb\HazardIndex_2000_ACUTE_HI.GRF



Scale: 1" = 1247.7 Meters HIGH 1ST HIGH 1-HR VALUES FOR GROUP: ALL Max = 0.25697 (601000, 4199675)

Input File - C:\riskscreens\p19169\a18404_2009Fall\CancerResident_2002_CANCRRES.DTA
Output File - C:\riskscreens\p19169\a18404_2009Fall\CancerResident_2002_CANCRRES.LST
Met File - C:\riskscreens\p19169\metdata\Marsh_Landing_1k_02ccpmet.SFC

*** AERMOD - VERSION 09292 ***   *** Marsh Landing Generating Station P19169 A18404 Cancer Risk w/ASF f ***   01/12/10
*** SIMPLE CYCLE TURBINES ***   15:44:09

*** MODEL SETUP OPTIONS SUMMARY ***

**Model Is Setup For Calculation of Average CONCentration Values.
-- DEPOSITION LOGIC --
**NO GAS DEPOSITION Data Provided.
**NO PARTICLE DEPOSITION Data Provided.
**Model Uses NO DRY DEPLETION. DRYDPLT = F
**Model Uses NO WET DEPLETION. WETDPLT = F
**Model Uses RURAL Dispersion Only.
**Model Uses Regulatory DEFAULT Options:
1. Stack-tip Downwash.
2. Model Accounts for ELEVated Terrain Effects.
3. Use Calms Processing Routine.
4. Use Missing Data Processing Routine.
5. No Exponential Decay.
**Model Assumes No FLAGPOLE Receptor Heights.
**Model Calculates PERIOD Averages Only
**This Run Includes: 6 Source(s); 9 Source Group(s); and 6913 Receptor(s)
**Misc. Inputs: Base Elev. for Pot. Temp. Profile (m MSL) = 3.00 ; Decay Coef. = 0.000 ; Rot. Angle = 0.0

*** POINT SOURCE DATA ***

SOURCE ID	NUMBER PART. CATS.	EMISSION RATE (GRAMS/SEC)	X (METERS)	Y (METERS)	BASE ELEV. (METERS)	STACK HEIGHT (METERS)	STACK TEMP. (DEG.K)	STACK EXIT VEL. (M/SEC)	STACK DIAMETER (METERS)	BLDG EXISTS	URBAN SOURCE	CAP/ HOR	EMIS RATE SCALAR VARY BY
SC1	0	0.44000E+00	608436.1	4208240.6	5.1	50.29	672.04	14.97	9.55	YES	NO	NO	
SC2	0	0.44000E+00	608478.7	4208241.7	4.4	50.29	672.04	14.97	9.55	YES	NO	NO	
SC3	0	0.44000E+00	608521.4	4208242.9	3.9	50.29	672.04	14.97	9.55	YES	NO	NO	
SC4	0	0.44000E+00	608564.0	4208244.0	3.6	50.29	672.04	14.97	9.55	YES	NO	NO	
HEATER1	0	0.10900E-03	608480.9	4208278.2	4.4	7.93	486.33	15.27	0.20	YES	NO	NO	
HEATER2	0	0.10900E-03	608485.8	4208278.4	4.3	7.93	486.33	15.27	0.20	YES	NO	NO	

*** SOURCE IDs DEFINING SOURCE GROUPS ***

GROUP ID	SOURCE IDs
ALL	SC1 , SC2 , SC3 , SC4 , HEATER1 , HEATER2 ,
HEATERS	HEATER1 , HEATER2 ,
SCS	SC1 , SC2 , SC3 , SC4 ,
SC1	SC1 ,
SC2	SC2 ,
SC3	SC3 ,
SC4	SC4 ,
HEATER1	HEATER1 ,
HEATER2	HEATER2 ,

*** THE PERIOD (8784 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***
INCLUDING SOURCE(S): SC1 , SC2 , SC3 , SC4 , HEATER1 , HEATER2 ,
*** DISCRETE CARTESIAN RECEPTOR POINTS ***
** CONC OF CANCRRES IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC		X-COORD (M)	Y-COORD (M)	CONC
608600.00	4207200.00	0.00532		608700.00	4207200.00	0.00651
608800.00	4207200.00	0.00777		608900.00	4207200.00	0.00903
609000.00	4207200.00	0.01030		609100.00	4207200.00	0.01171
609200.00	4207200.00	0.01347		609300.00	4207200.00	0.01573
609400.00	4207200.00	0.01849		609500.00	4207200.00	0.02148
609600.00	4207200.00	0.02427		609700.00	4207200.00	0.02650
609800.00	4207200.00	0.02792		609900.00	4207200.00	0.02850
610000.00	4207200.00	0.02836		610100.00	4207200.00	0.02767
610200.00	4207200.00	0.02662		607300.00	4207300.00	0.00306
607400.00	4207300.00	0.00296		607500.00	4207300.00	0.00284
607600.00	4207300.00	0.00272		607700.00	4207300.00	0.00258
607800.00	4207300.00	0.00246		607900.00	4207300.00	0.00236
608000.00	4207300.00	0.00231		608100.00	4207300.00	0.00233
608200.00	4207300.00	0.00247		608300.00	4207300.00	0.00278
608400.00	4207300.00	0.00333		608500.00	4207300.00	0.00417
608600.00	4207300.00	0.00527		608700.00	4207300.00	0.00655
608800.00	4207300.00	0.00791		608900.00	4207300.00	0.00927
609000.00	4207300.00	0.01074		609100.00	4207300.00	0.01256
609200.00	4207300.00	0.01500		609300.00	4207300.00	0.01811
609400.00	4207300.00	0.02159		609500.00	4207300.00	0.02487
609600.00	4207300.00	0.02747		609700.00	4207300.00	0.02892
609800.00	4207300.00	0.02940	residential cancer	609900.00	4207300.00	0.02903
610000.00	4207300.00	0.02808	risk in a million	610100.00	4207300.00	0.02678
610200.00	4207300.00	0.02533		607300.00	4207400.00	0.00301
607400.00	4207400.00	0.00293		607500.00	4207400.00	0.00282
607600.00	4207400.00	0.00269		607700.00	4207400.00	0.00255
607800.00	4207400.00	0.00243		607900.00	4207400.00	0.00228
608000.00	4207400.00	0.00219		608100.00	4207400.00	0.00217
608200.00	4207400.00	0.00227		608300.00	4207400.00	0.00256
608400.00	4207400.00	0.00313		608500.00	4207400.00	0.00401
608600.00	4207400.00	0.00521		608700.00	4207400.00	0.00660
608800.00	4207400.00	0.00807		608900.00	4207400.00	0.00960
609000.00	4207400.00	0.01145		609100.00	4207400.00	0.01402
609200.00	4207400.00	0.01752		609300.00	4207400.00	0.02159
609400.00	4207400.00	0.02547		609500.00	4207400.00	0.02838
609600.00	4207400.00	0.03003		609700.00	4207400.00	0.03028
609800.00	4207400.00	0.02961		609900.00	4207400.00	0.02834
610000.00	4207400.00	0.02677		610100.00	4207400.00	0.02512
610200.00	4207400.00	0.02354		607300.00	4207500.00	0.00293
607400.00	4207500.00	0.00286		607500.00	4207500.00	0.00276

```
  Input File - C:\riskscreens\p19169\a18404_2009Fall\Chronic20091214_2002_CANCRWRK.DTA
 Output File - C:\riskscreens\p19169\a18404_2009Fall\Chronic20091214_2002_CANCRWRK.LST
    Met File - C:\riskscreens\p19169\metdata\Marsh_Landing_1k_02ccpmet.SFC

*** AERMOD - VERSION 09292 ***    *** Marsh Landing Generating Station  P19169  A18404 Chronic Health Risk ***        12/14/09
                                   *** SIMPLE CYCLE TURBINES                                                ***        13:38:40
                                            ***     MODEL SETUP OPTIONS SUMMARY       ***
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 **Model Is Setup For Calculation of Average CONCentration Values.
   --  DEPOSITION LOGIC  --
 **NO GAS DEPOSITION Data Provided.
 **NO PARTICLE DEPOSITION Data Provided.
 **Model Uses NO DRY DEPLETION.  DRYDPLT  =  F
 **Model Uses NO WET DEPLETION.  WETDPLT  =  F
 **Model Uses RURAL Dispersion Only.
 **Model Uses Regulatory DEFAULT Options:
         1. Stack-tip Downwash.
         2. Model Accounts for ELEVated Terrain Effects.
         3. Use Calms Processing Routine.
         4. Use Missing Data Processing Routine.
         5. No Exponential Decay.
 **Model Assumes No FLAGPOLE Receptor Heights.
 **Model Calculates PERIOD Averages Only
 **This Run Includes:      6 Source(s);       9 Source Group(s); and    6913 Receptor(s)
 **Misc. Inputs:  Base Elev. for Pot. Temp. Profile (m MSL) =     3.00 ;  Decay Coef. =    0.000     ;  Rot. Angle =     0.0


                                                          *** POINT SOURCE DATA ***
                     NUMBER EMISSION RATE                              BASE      STACK   STACK    STACK     STACK    BLDG   URBAN  CAP/  EMIS RATE
    SOURCE            PART. (GRAMS/SEC)      X          Y         ELEV.     HEIGHT  TEMP.   EXIT VEL. DIAMETER  EXISTS SOURCE HOR   SCALAR
      ID              CATS.                (METERS)  (METERS)  (METERS)  (METERS) (DEG.K)  (M/SEC)   (METERS)                         VARY BY
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
   SC1               0   0.55400E-01  608436.1 4208240.6     5.1     50.29   672.04    14.97      9.55    YES     NO    NO
   SC2               0   0.55400E-01  608478.7 4208241.7     4.4     50.29   672.04    14.97      9.55    YES     NO    NO
   SC3               0   0.55400E-01  608521.4 4208242.9     3.9     50.29   672.04    14.97      9.55    YES     NO    NO
   SC4               0   0.55400E-01  608564.0 4208244.0     3.6     50.29   672.04    14.97      9.55    YES     NO    NO
   HEATER1           0   0.12600E-04  608480.9 4208278.2     4.4      7.93   486.33    15.27      0.20    YES     NO    NO
   HEATER2           0   0.12600E-04  608485.8 4208278.4     4.3      7.93   486.33    15.27      0.20    YES     NO    NO


                                                *** THE SUMMARY OF MAXIMUM PERIOD (  8784 HRS) RESULTS ***
                                            ** CONC OF CANCRWRK IN MICROGRAMS/M**3                                       **
                                                                                                                NETWORK
GROUP ID                              AVERAGE CONC                RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)  OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
ALL      1ST HIGHEST VALUE IS       0.00408 AT (  609243.80,  4207735.00,     3.71,      3.71,     0.00)  DC          Worker cancer risk in a million
HEATERS  1ST HIGHEST VALUE IS       0.00041 AT (  608763.00,  4208169.40,     2.74,      2.74,     0.00)  DC
SCS      1ST HIGHEST VALUE IS       0.00401 AT (  609300.00,  4207700.00,     4.06,      4.06,     0.00)  DC
SC1      1ST HIGHEST VALUE IS       0.00101 AT (  609243.80,  4207685.00,     4.22,      4.22,     0.00)  DC
SC2      1ST HIGHEST VALUE IS       0.00101 AT (  609243.80,  4207710.00,     3.96,      3.96,     0.00)  DC
SC3      1ST HIGHEST VALUE IS       0.00101 AT (  609268.80,  4207735.00,     3.71,      3.71,     0.00)  DC
SC4      1ST HIGHEST VALUE IS       0.00102 AT (  609268.80,  4207760.00,     3.66,      3.66,     0.00)  DC
HEATER1  1ST HIGHEST VALUE IS       0.00021 AT (  608715.80,  4208120.90,     2.74,      2.74,     0.00)  DC
HEATER2  1ST HIGHEST VALUE IS       0.00021 AT (  608763.00,  4208169.40,     2.74,      2.74,     0.00)  DC
```

```
  Input File - C:\riskscreens\p19169\a18404_2010Feb\HazardIndex_2002_CHRON_HI.DTA
 Output File - C:\riskscreens\p19169\a18404_2010Feb\HazardIndex_2002_CHRON_HI.LST
    Met File - C:\riskscreens\p19169\metdata\Marsh_Landing_1k_02ccpmet.SFC

*** AERMOD - VERSION 09292 ***    *** Marsh Landing Generating Station  P19169  A18404 Acute Hazard Index  ***        02/23/10
                                   *** SIMPLE CYCLE TURBINES                                                ***        18:05:54

                                            ***     MODEL SETUP OPTIONS SUMMARY       ***
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 **Model Is Setup For Calculation of Average CONCentration Values.
   --  DEPOSITION LOGIC  --
 **NO GAS DEPOSITION Data Provided.
 **NO PARTICLE DEPOSITION Data Provided.
 **Model Uses NO DRY DEPLETION.  DRYDPLT  =  F
 **Model Uses NO WET DEPLETION.  WETDPLT  =  F
**Model Uses RURAL Dispersion Only.
**Model Uses Regulatory DEFAULT Options:
         1. Stack-tip Downwash.
         2. Model Accounts for ELEVated Terrain Effects.
         3. Use Calms Processing Routine.
         4. Use Missing Data Processing Routine.
         5. No Exponential Decay.
**Model Assumes No FLAGPOLE Receptor Heights.
**Model Calculates ANNUAL Averages Only
**This Run Includes:      6 Source(s);       9 Source Group(s); and    6913 Receptor(s)
**Misc. Inputs:  Base Elev. for Pot. Temp. Profile (m MSL) =     3.00 ;  Decay Coef. =    0.000     ;  Rot. Angle =     0.0
```

*** POINT SOURCE DATA ***

SOURCE ID	NUMBER PART. CATS.	EMISSION RATE (GRAMS/SEC)	X (METERS)	Y (METERS)	BASE ELEV. (METERS)	STACK HEIGHT (METERS)	STACK TEMP. (DEG.K)	STACK EXIT VEL. (M/SEC)	STACK DIAMETER (METERS)	BLDG EXISTS	URBAN SOURCE	CAP/ HOR	EMIS RATE SCALAR VARY BY
SC1	0	0.42900E-01	608436.1	4208240.6	5.1	50.29	672.04	14.97	9.55	YES	NO	NO	
SC2	0	0.42900E-01	608478.7	4208241.7	4.4	50.29	672.04	14.97	9.55	YES	NO	NO	
SC3	0	0.42900E-01	608521.4	4208242.9	3.9	50.29	672.04	14.97	9.55	YES	NO	NO	
SC4	0	0.42900E-01	608564.0	4208244.0	3.6	50.29	672.04	14.97	9.55	YES	NO	NO	
HEATER1	0	0.10400E-05	608480.9	4208278.2	4.4	7.93	486.33	15.27	0.20	YES	NO	NO	
HEATER2	0	0.10400E-05	608485.8	4208278.4	4.3	7.93	486.33	15.27	0.20	YES	NO	NO	

*** THE SUMMARY OF MAXIMUM ANNUAL RESULTS AVERAGED OVER   1 YEARS ***
** CONC OF CHRON_HI IN MICROGRAMS/M**3 **

GROUP ID		AVERAGE CONC		XR	YR	ZELEV	ZHILL	ZFLAG	OF TYPE	NETWORK GRID-ID	
ALL	1ST HIGHEST VALUE IS	0.00311	AT	609300.00	4207700.00	4.06	4.06	0.00	DC		Max. Chronic Hazard Index
HEATERS	1ST HIGHEST VALUE IS	0.00003	AT	608763.00	4208169.40	2.74	2.74	0.00	DC		
SCS	1ST HIGHEST VALUE IS	0.00310	AT	609300.00	4207700.00	4.06	4.06	0.00	DC		
SC1	1ST HIGHEST VALUE IS	0.00078	AT	609243.80	4207685.00	4.22	4.22	0.00	DC		
SC2	1ST HIGHEST VALUE IS	0.00078	AT	609243.80	4207710.00	3.96	3.96	0.00	DC		
SC3	1ST HIGHEST VALUE IS	0.00079	AT	609268.80	4207735.00	3.71	3.71	0.00	DC		
SC4	1ST HIGHEST VALUE IS	0.00079	AT	609268.80	4207760.00	3.66	3.66	0.00	DC		
HEATER1	1ST HIGHEST VALUE IS	0.00002	AT	608715.80	4208120.90	2.74	2.74	0.00	DC		
HEATER2	1ST HIGHEST VALUE IS	0.00002	AT	608763.00	4208169.40	2.74	2.74	0.00	DC		

```
  Input File - C:\riskscreens\p19169\a18404_2010Feb\HazardIndex_2000_ACUTE_HI.DTA
 Output File - C:\riskscreens\p19169\a18404_2010Feb\HazardIndex_2000_ACUTE_HI.LST
    Met File - C:\riskscreens\p19169\metdata\Marsh_Landing_1k_00ccpmet.SFC

*** AERMOD - VERSION 09292 ***    *** Marsh Landing Generating Station  P19169  A18404 Acute Hazard Index  ***        02/23/10
                                   *** SIMPLE CYCLE TURBINES                                                   ***        13:35:26
                                            ***     MODEL SETUP OPTIONS SUMMARY       ***
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
**Model Is Setup For Calculation of Average CONCentration Values.
  --  DEPOSITION LOGIC  --
 **NO GAS DEPOSITION Data Provided.
 **NO PARTICLE DEPOSITION Data Provided.
 **Model Uses NO DRY DEPLETION.  DRYDPLT  =  F
 **Model Uses NO WET DEPLETION.  WETDPLT  =  F
**Model Uses RURAL Dispersion Only.
**Model Uses Regulatory DEFAULT Options:
         1. Stack-tip Downwash.
         2. Model Accounts for ELEVated Terrain Effects.
         3. Use Calms Processing Routine.
         4. Use Missing Data Processing Routine.
         5. No Exponential Decay.
**Model Assumes No FLAGPOLE Receptor Heights.
**Model Calculates  1 Short Term Average(s) of:   1-HR
**This Run Includes:      6 Source(s);       9 Source Group(s); and    6913 Receptor(s)
**Misc. Inputs:  Base Elev. for Pot. Temp. Profile (m MSL) =     3.00 ;  Decay Coef. =    0.000     ;  Rot. Angle =     0.0


                                                         *** POINT SOURCE DATA ***
                    NUMBER EMISSION RATE                           BASE     STACK   STACK    STACK     STACK    BLDG   URBAN  CAP/   EMIS RATE
    SOURCE           PART.  (GRAMS/SEC)      X          Y          ELEV.    HEIGHT  TEMP.   EXIT VEL. DIAMETER  EXISTS SOURCE HOR    SCALAR
      ID             CATS.                (METERS)  (METERS)  (METERS) (METERS) (DEG.K)   (M/SEC)   (METERS)                         VARY BY
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
   SC1                0  0.37800E-01  608436.1 4208240.6     5.1    50.29   672.04    14.97     9.55    YES     NO    NO
   SC2                0  0.37800E-01  608478.7 4208241.7     4.4    50.29   672.04    14.97     9.55    YES     NO    NO
   SC3                0  0.37800E-01  608521.4 4208242.9     3.9    50.29   672.04    14.97     9.55    YES     NO    NO
   SC4                0  0.37800E-01  608564.0 4208244.0     3.6    50.29   672.04    14.97     9.55    YES     NO    NO
   HEATER1            0  0.84300E-06  608480.9 4208278.2     4.4     7.93   486.33    15.27     0.20    YES     NO    NO
   HEATER2            0  0.84300E-06  608485.8 4208278.4     4.3     7.93   486.33    15.27     0.20    YES     NO    NO


                                                       *** THE SUMMARY OF HIGHEST  1-HR RESULTS ***
                                          ** CONC OF ACUTE_HI IN MICROGRAMS/M**3                                   **
                                                           DATE                                                                    NETWORK
GROUP ID                                AVERAGE CONC      (YYMMDDHH)             RECEPTOR  (XR, YR, ZELEV, ZHILL, ZFLAG)    OF TYPE  GRID-ID
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
ALL      HIGH  1ST HIGH VALUE IS       0.25697  ON 00122907: AT (  601000.00,  4199675.00,   368.00,  1084.00,    0.00)  DC  Max. Acute Hazard Index
SC1      HIGH  1ST HIGH VALUE IS       0.06452  ON 00122907: AT (  600975.00,  4199675.00,   370.33,  1084.00,    0.00)  DC
SC2      HIGH  1ST HIGH VALUE IS       0.06438  ON 00122907: AT (  601000.00,  4199675.00,   368.00,  1084.00,    0.00)  DC
SC3      HIGH  1ST HIGH VALUE IS       0.06417  ON 00122907: AT (  601000.00,  4199675.00,   368.00,  1084.00,    0.00)  DC
SC4      HIGH  1ST HIGH VALUE IS       0.06391  ON 00122907: AT (  601000.00,  4199675.00,   368.00,  1084.00,    0.00)  DC
HEATER1  HIGH  1ST HIGH VALUE IS       0.00045  ON 00102321: AT (  608493.80,  4208410.00,     2.64,     2.64,    0.00)  DC
HEATER2  HIGH  1ST HIGH VALUE IS       0.00045  ON 00102321: AT (  608506.20,  4208440.00,     2.34,     2.34,    0.00)  DC
```

Appendix D

Siemens Emission Estimates

SIEMENS

Estimated Commissioning Schedule; Startup/Shutdown, Running and Total Emissions and Fuel Use
SGT6-5000F(4) Simple Cycle (9 ppm ULN) on Natural Gas @ 59 °F

GT 1					Startup/Shutdown					Running					Total				
Day	Activity	Duration (hr)	GT Load (%)	Modeling Load (%)	NO_x	CO	VOC	PM	FUEL	NO_x	CO	VOC	PM	FUEL	NO_x	CO	VOC	PM	FUEL
1	CTG Testing (Full Speed No Load, FSNL, Excitation Test, Dummy Synch Checks)	8	0	0	5	305	19	1	2156	333	18935	1162	70	133935	339	19240	1181	71	136091
2	CTG 1 Testing @ 40% load (4)	8	0-40	40	112	2222	95	9	30453	1396	9441	541	81	370011	1507	11662	636	91	400464
3	CTG 1 Load Test (4)	16	50	50	143	2397	106	11	41384	1768	6457	493	128	843361	1911	8854	599	139	884745
4	CTG 1 Load Test (4)	16	50	50	143	2397	106	11	41384	1768	6457	493	128	843361	1911	8854	599	139	884745
5	CTG 1 Load Test (4)	12	75	75	177	2451	112	16	75245	628	170	24	96	832063	805	2621	136	112	907309
6	CTG 1 Load Test (4)	12	100	100	209	2460	113	20	118014	785	212	30	97	1039668	994	2672	143	117	1157682
7	CTG 1 Load Test (4)	12	100	100	209	2460	113	20	118014	785	212	30	97	1039668	994	2672	143	117	1157682
8	No Operation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Install Emissions Test Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	Emissions Tuning/Drift Testing	12	50-100	100	209	2460	113	20	118014	785	212	30	97	1039668	994	2672	143	117	1157682
11	Emissions Tuning/Drift Testing	12	50-100	100	209	2460	113	20	118014	785	212	30	97	1039668	994	2672	143	117	1157682
12	RATA / Pre-performance Testing/Source Testing/Drift Testing	12	100	100	209	2460	113	20	118014	785	212	30	97	1039668	994	2672	143	117	1157682
13	RATA / Pre-performance Testing/Source Testing/Drift Testing	12	100	100	209	2460	113	20	118014	785	212	30	97	1039668	994	2672	143	117	1157682
14	RATA / Pre-performance Testing/Source Testing/Drift Testing	12	100	100	209	2460	113	20	118014	785	212	30	97	1039668	994	2672	143	117	1157682
15	RATA / Pre-performance Testing/Source Testing/Drift Testing	12	100	100	209	2460	113	20	118014	785	212	30	97	1039668	994	2672	143	117	1157682
16	RATA / Pre-performance Testing/Source Testing/Drift Testing	12	100	100	209	2460	113	20	118014	785	212	30	97	1039668	994	2672	143	117	1157682
17	Remove Emisssions Test Equipment/ install performance test equipment if not already installed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	No Operation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	Water Wash & Performance preparation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	Water Wash & Performance preparation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	Performance Testing	24	100	100	209	2460	113	20	118014	1570	425	61	195	2079335	1779	2885	174	215	2197349
22	Performance Testing	16	100	100	209	2460	113	20	118014	1047	283	41	130	1386223	1256	2743	154	150	1504238
23	CALISO Certification	12	50-100	100	209	2460	113	20	118014	785	212	30	97	1039668	994	2672	143	117	1157682
24	CALISO Certification if required	12	100	100	209	2460	113	20	118014	785	212	30	97	1039668	994	2672	143	117	1157682
	Total GT operation hours	232																	

	NO_x	CO	VOC	PM	FUEL
Pounds	20,442	86,251	5,057	2,208	19,649,441
Tons	10.22	43.13	2.53	1.10	9,825

Notes:

1. Gas turbine is assumed to ramp at 3 MW per minute.
2. Assumes pre-operational chemical cleaning of steam and watersides per SPGI recommendations.
3. Assumes single fuel (natural gas) operation of gas turbine.
4. Commissioning acivites may require gas turbine to hold at loads less than the modeled load.
5. Information reported by a Continuous Emissions Monitoring System may be calculated differently.
6. Data calculated at 59 °F.
7. Please be advised that the information contained in this transmittal has been prepared and is being transmitted per customer request specifically for information purposes only. Such information is not intended to be used for evaluation of plant design and/or performance relative to contractual commitments. Data included in any permit application or Environmental Impact Statement are strictly the customer's responsibility.

A

SIEMENS

Total Estimated Startup and Shutdown Emissions and Fuel Use
SGT6-5000F(4) 9 ppm ULN in Simple Cycle Operation at 59 °F on Natural Gas

Mode	~ Time	Total Pounds per Event				
	(minutes)	NO_X	CO	VOC	PM	Fuel Use
Startup	11	12	213	11	1	6,638
Shutdown	6	10	110	5	1	5,905

General Notes

1.) All data is ESTIMATED, NOT guaranteed and is for ONE unit.
2.) Gas fuel must be in compliance with Siemens fuel specifications.
3.) Emissions are at the exhaust stack outlet and exclude ambient air contributions.
4.) Emissions are based on new and clean conditions.
5.) NO_X as NO_2.
6.) VOC consist of total hydrocarbons excluding methane and ethane and are expressed in terms of methane (CH_4).
7.) Particulates are per US EPA Method 5/202 (front and back half).
8.) Estimated fuel use data is based on a heating value of 22,356 Btu/lb_m (HHV) and will be different for different heating values.
9.) Please be advised that the information contained in this transmittal has been prepared and is being transmitted per customer request specifically for information purposes only. Such information is not intended to be used for evaluation of plant design and/or performance relative to contractual commitments. Data included in any permit application or Environmental Impact Statement is strictly the customer's responsibility. Siemens is available to review permit application data upon request.

Startup Emissions Notes

1.) Estimated startup (SU) data are from gas turbine (GT) ignition through 100% load.
2.) Estimated SU and shutdown (SD) data are based on the assumed times noted above and will be higher for longer times.
3.) Estimated SU and SD data are based on the ambient temperature noted above and will be higher at lower ambient temperatures.
4.) Total SU time includes 5 minutes from turning gear to synchronization.
5.) SD assumes 100% load to FSNL with no cooldown at FSNL.
6.) Continuous Emissions Monitoring System (CEMS) may calculate emissions differently.
7.) Operator actions do not extend startup or shutdown.
8.) It is assumed that there is no restriction from the interconnected utility for loading the GT from synchronization to 100% load within the SU times considered.

SIEMENS

Mirant

Estimated SGT6-5000F(4) Gas Turbine Performance
Simple Cycle / Ultra Low NOx Combustor
SGen6-1000A / 0.85 Power Factor

SITE CONDITIONS:	CASE 1	CASE 2	CASE 3	CASE 4	CASE 5	CASE 6	CASE 7	CASE 8	CASE 9	CASE 10	CASE 11	CASE 12
FUEL TYPE	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
LOAD LEVEL	BASE	75%	60%	BASE	75%	60%	BASE	75%	60%	BASE	75%	60%
NET FUEL HEATING VALUE, Btu/lbm (LHV)	20,670	20,670	20,670	20,670	20,670	20,670	20,670	20,670	20,670	20,670	20,670	20,670
GROSS FUEL HEATING VALUE, Btu/lbm (HHV)	22,931	22,931	22,931	22,931	22,931	22,931	22,931	22,931	22,931	22,931	22,931	22,931
EVAPORATIVE COOLER STATUS/EFFECTIVENESS	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
AMBIENT DRY BULB TEMPERATURE, °F	20.0	20.0	20.0	75.0	75.0	75.0	94.0	94.0	94.0	59.0	59.0	59.0
AMBIENT WET BULB TEMPERATURE, °F	19.3	19.3	19.3	63.7	63.7	63.7	70.9	70.9	70.9	51.5	51.5	51.5
AMBIENT RELATIVE HUMIDITY, %	90%	90%	90%	54%	54%	54%	32%	32%	32%	60%	60%	60%
BAROMETRIC PRESSURE, psia	14.691	14.691	14.691	14.691	14.691	14.691	14.691	14.691	14.691	14.691	14.691	14.691
COMPRESSOR INLET TEMPERATURE, °F	20.0	20.0	20.0	75.0	75.0	75.0	94.0	94.0	94.0	59.0	59.0	59.0
INLET PRESSURE LOSS, inches of water (Total)	4.5	2.9	2.3	3.9	2.7	2.1	3.7	2.6	2.0	4.1	2.8	2.2
EXHAUST PRESSURE LOSS, inches of water (Total)	8.66	5.69	4.44	6.94	4.83	3.79	6.36	4.49	3.52	7.45	5.11	4.00
EXHAUST PRESSURE LOSS, inches of water (Static)	5.8	3.8	3.0	4.7	3.2	2.5	4.3	3.0	2.3	5.0	3.4	2.7
INJECTION FLUID	-	-	-	-	-	-	-	-	-	-	-	-
INJECTION RATIO	-	-	-	-	-	-	-	-	-	-	-	-
COMBUSTION TURBINE PERFORMANCE:												
GROSS POWER OUTPUT, kW	224,110	168,080	134,470	187,490	140,620	112,500	172,980	129,740	103,790	198,870	149,150	119,320
GROSS HEAT RATE, Btu/kWh (LHV)	8,855	9,315	9,915	9,185	9,860	10,525	9,395	10,135	10,840	9,050	9,660	10,305
GROSS HEAT RATE, Btu/kWh (HHV)	9,820	10,335	11,000	10,190	10,935	11,675	10,420	11,245	12,030	10,040	10,720	11,430
FUEL FLOW, lbm/hr	95,970	75,730	64,490	83,310	67,060	57,280	78,590	63,600	54,430	87,070	69,690	59,470
INJECTION RATE, lbm/hr	-	-	-	-	-	-	-	-	-	-	-	-
HEAT INPUT, mmBtu/hr (LHV)	1,984	1,565	1,333	1,722	1,386	1,184	1,624	1,315	1,125	1,800	1,441	1,229
HEAT INPUT, mmBtu/hr (HHV)	2,201	1,737	1,479	1,910	1,538	1,313	1,802	1,459	1,248	1,997	1,598	1,364
EXHAUST TEMPERATURE, °F	1,065	1,065	1,065	1,105	1,105	1,105	1,123	1,123	1,122	1,090	1,090	1,091
EXHAUST FLOW, lbm/hr	4,366,477	3,547,986	3,136,246	3,863,230	3,229,818	2,860,343	3,677,383	3,095,213	2,745,451	4,021,343	3,336,206	2,953,373
EXHAUST FLOW, MACFM	2.85	2.31	2.04	2.60	2.17	1.92	2.50	2.10	1.87	2.67	2.22	1.96
STATIC EXCITATION LOSS, kW	489	308	234	361	246	195	320	225	182	397	263	207
EXHAUST GAS COMPOSITION (BY % VOL):												
OXYGEN	12.54	12.77	13.06	12.47	12.77	13.04	12.52	12.82	13.09	12.54	12.82	13.10
CARBON DIOXIDE	3.86	3.75	3.62	3.77	3.63	3.51	3.74	3.60	3.47	3.79	3.66	3.54
WATER	7.77	7.56	7.30	8.83	8.57	8.33	8.90	8.63	8.40	8.32	8.07	7.82
NITROGEN	74.93	75.02	75.12	74.04	74.14	74.24	73.96	74.06	74.15	74.45	74.55	74.65
ARGON	0.90	0.90	0.90	0.89	0.89	0.89	0.88	0.89	0.89	0.89	0.89	0.89
MOLECULAR WEIGHT	28.46	28.47	28.49	28.34	28.35	28.37	28.33	28.34	28.36	28.39	28.41	28.43
NET EMISSIONS: Based on 21T5620 test methods												
NOx, ppmvd @ 15% O2	9	9	9	9	9	9	9	9	9	9	9	9
NOx, lbm/hr as NO2	75	59	50	65	52	45	61	50	42	68	54	46
CO, ppmvd @ 15% O2	4	4	10	4	4	10	4	4	10	4	4	10
CO, lbm/hr	20	16	34	18	14	30	17	13	29	18	15	31
VOC, ppmvd @ 15% O2 as CH4	1.0	1.0	3.0	1.0	1.0	3.0	1.0	1.0	3.0	1.0	1.0	3.0
VOC, lbm/hr as CH4	2.9	2.3	5.8	2.5	2.0	5.2	2.4	1.9	4.9	2.6	2.1	5.4
PARTICULATES, lbm/hr	9	8	8	8	8	8	8	8	8	8	8	8

NOTES:

- Performance is based on new and clean condition.
- All data is estimated and not guaranteed.
- Data included in any permit application or Environmental Impact Statement are strictly the responsibility of the Owner. SIEMENS is available to review permit application data upon request.
- Gross power output is at the generator terminals, minus excitation losses. It does not include ECONOPAC™ auxiliary load losses.
- Estimated GT Performance values are dependent upon receiving test tolerances equal to measurement uncertainty calculated in accordance with ASME PTC 19.1-1998.
- Emission flowrates are calculated based on the maximum achievable exhaust flow. For further details on flowrate calculation contact SIEMENS.
- VOC's consist of total unburned hydrocarbons excluding methane and ethane. The concentration is expressed in terms of methane.
- Exhaust volumetric flow rate is at the exit to the ECONOPAC stack.
- Gas fuel composition is 95.05% CH_4, 2.643% C_2H_6, 0.345% C_3H_8, 0.052% iC_4H_{10}, 0.064% nC_4H_{10}, 0.018% iC_5H_{12}, 0.013% nC_5H_{12}, 0.059% C_6H_{14}, 0.664% CO_2, 1.091% N_2 and 0.2 grains of sulfur per 100 SCF.
- Gas fuel must be in compliance with the SIEMENS Gas Fuel Spec (ZDX555-DC01-MBP-2500-01).
- Particulates are per US EPA Method 5/202 (front and back half).
- Average temperature of the gas fuel is 59 °F. Sensible heat of the fuel is not included in the fuel heating values.
- Maximum exhaust temperature is 1200 °F for base and part load.