Draft Engineering Evaluation

Marsh Landing "Black Start" Capability Project

Marsh Landing Generating Station
Antioch, CA

California Energy Commission
Petition for Modification
Docket No. 08-AFC-03C

Bay Area Air Quality Management District
Application 29169

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I. Executive Summary

The California Energy Commission is currently evaluating an application for a change of conditions for the Marsh Landing Generating Station, a 760-MW, natural-gas-fired, simple-cycle merchant power plant owned by Marsh Landing LLC ("Marsh Landing") and operated by a subsidiary of NRG Energy Inc. ("NRG"). NRG has prepared the air permit application on behalf of the applicant, Marsh Landing. In its application, Marsh Landing seeks Commission approval to implement a "black start" capability project at the Marsh Landing facility. The project will involve installing a battery system to allow the facility to start up and begin operating without external assistance from the electrical grid. Adding this black start capability is essential to ensure that grid power can be restored quickly in the event of a regional system outage.

The Energy Commission has exclusive jurisdiction over the Marsh Landing Generating Station under the Warren-Alquist State Energy Resources Conservation and Development Act, Public Resources Code §§ 25000 *et seq*. (Warren-Alquist Act). But the Energy Commission looks to the Air District for assistance in evaluating the potential air impacts of power plant projects within its jurisdiction. The Air District has therefore prepared this Engineering Evaluation to assess how the Marsh Landing black start capability project will comply with applicable air quality regulatory requirements. The Air District will submit its analysis for the Energy Commission to use in assessing NRG's application.

The following sections of this document describe (i) what the black start capability project will require, which will be a brief period of testing after the installation of the battery system followed by periodic readiness testing and potential operation in a black start mode in the event that the facility is called on to help restore power if there is a major system outage; (ii) what the air emissions will be during black-start-related operations; and (iii) how the black-start-related operations will comply with applicable regulatory requirements. The document also contains proposed permit conditions for black-start-related operations to ensure compliance, which the District will suggest be included in the Energy Commission's license conditions for the Marsh Landing Generating Station.

The Air District is publishing this Engineering Evaluation in draft form in order for interested members of the public to review and comment on it. The District will consider any comments received and will incorporate them into the final version for submission to the Energy Commission for use in the Commission decision process. Comments should be directed to Xuna Cai, Senior Air Quality Engineer, 375 Beale Street, Suite 600, San Francisco, CA, 64105, xcai@baaqmd.gov, and must be received by January 31, 2019 in order to be considered.

II. Project Description

A. The Marsh Landing Generating Station

The Marsh Landing Generating Station is a merchant power plant with a nominal generating capacity of 760 MW. The plant uses four natural-gas-fired Siemens SGT6-5000F combustion

turbine generators that burn natural gas to generate electrical power. The plant also includes two natural-gas-fired preheaters (5 MMBtu/hour each), a 779 hp standby diesel generator, and a 300 hp diesel fire pump engine. The plant completed construction in 2013 and has been in operation since that time. Further details about the facility and how it operates can be found in the Energy Commission approval documents for the facility.

B. The Black Start Capability Project

This project will add black start capability to two of the four turbines at the Marsh Landing Generating Station (turbines S-3 and S-4). Starting up the power generating equipment at the plant requires a certain amount of electrical power itself, which is normally provided by the grid. But if the grid is down because of a widespread system outage, the facility will need to provide its own power in order to be able to start up. Being able to do so is called "black start" capability because it allows the facility to start up during a regional power blackout.

Having black start resources in the system is essential to restoring power to the grid in the event of a regional system outage. If some plants are equipped with black start capability and can come online by themselves, they can then provide the power for the remaining generation resources to start up and the system can be restored to normal operations relatively quickly. Quick restoration of power to the grid ensures the continued operation of essential public services for public safety and convenience, and it limits the need to use diesel backup generators in response to a widespread system outage, which have adverse impacts on air quality and public health.

Widespread system outages are rare. There has not been a black start emergency in the Bay Area since 1996, and it is expected that such emergencies will not occur more frequently than once every 20 to 30 years. If and when a black start emergency occurs, however, having the capability to get power generation restored quickly is of utmost importance.

The California Independent System Operator (CAISO) has identified a need for additional black start resources in the greater San Francisco Bay Area in order to enhance system restoration capacity and to ensure that the Bay Area's ability to restore service following a widespread system outage is reasonably consistent with that of other major population centers in the state. This project will help fulfill that need.

CAISO requires black start resources to have a number of attributes, including the ability to start without external power from the grid, to make a minimum number of startups, to operate in stand-alone and parallel modes, to have start-up load pickup capability, and to produce and absorb reactive power. To meet these requirements, NRG is proposing to modify the facility's design to install a lithium-ion Battery Energy Storage System. The Battery Energy Storage System is designed for a duty large enough to start one of the two black-start-designated gas turbines within three hours of a grid-wide blackout. This system would play a vital role in restoring power to the grid in accordance with CAISO requirements.

In the event of a black start emergency, the Battery Energy Storage System would be used to start up a single turbine (either S-3 or S-4) from an offline condition. This turbine would be used to provide for the facility's own power needs including startup of the other black-start designated

turbine, but it would not initially carry any additional load. One turbine would be carrying the facility's own power needs and the other turbine would be maintained in this full-speed-no-load condition, pending further instructions from CAISO or PG&E. The turbine's output would then be increased as CAISO begins starting up other units or adds load to the system. In addition, the turbines may be required to shut down again in the event of load rejection/grid blackout and then begin another black start. It is possible that multiple starts could be required.

Once the turbines are started and CAISO begins to add load, the turbines may be required to operate for some time within a range of 2 to 60 percent as the load throughout the system is balanced. Eventually, as the system begins to recover fully, CAISO would order the turbines to either increase to base load (at or greater than 60%), which is its normal operating scenario in which it will be able to come into compliance with its normal emission limits, or shutdown . This point would mark the end of the black start emergency at Marsh Landing.

The timeframe for system recovery is situation-dependent and cannot be predicted with any specificity in advance of an actual grid emergency and resolution of that emergency. However, the facility could be required to operate S-3 and S-4 for up to 48 hours of full-speed-no-load or low load (below 60%) operation, which represents the scenario with highest emissions. The Air District has based its emissions analyses on this operating scenario. Details of this operating scenario are presented in Appendix A.

Adding black start capability will also require a commissioning period after the Battery Energy Storage System is installed. NRG will use this period to test and adjust the equipment for black start operations. These commissioning activities, which will be limited to no more than 64 hours, will also involve operating both turbines at full-speed-no-load and/or low load, with emissions similar to what will be experienced during an actual black start emergency. In addition, the facility will need to perform readiness testing for the black start, which will take up to a total of 8 hours per year for both turbines combined.

C. Emission Reduction Benefits From Black Start Capability

The addition of black start capability at the Marsh Landing Generating Station is expected to have significant net air quality benefits for the Bay Area in the event of a widespread power outage. The ability for the power grid to be restored quickly in the event of a system-wide outage will reduce the need for emergency backup diesel generators to be used to provide power for critical needs such as hospitals, emergency services, and the like. These users need power at all times, so they will run their backup diesel generators, which have relatively high air pollutant emissions for the amount of power that they generate, until the system is restored. If the system can be restored quickly, the need to use these diesel generators can be reduced and the resulting emissions will be minimized.

Operating S-3 and S-4 at the Marsh Landing facility at no load or low load during black-start-related operations will result in an increase in emissions of some pollutants, however, compared to the plant's normal operations. (Emissions of other pollutants will be reduced compared to normal operation.) The facility is designed for optimal emissions performance at normal loads (at or greater than 60%), and the gas turbines experience greater emissions when operating at no load

or low load. As a result, turbine emissions during black-start-related operations will exceed the emission limits applicable during normal operations for oxides of nitrogen (NOx), carbon monoxide (CO) and precursor organic compounds (POC). Marsh Landing is therefore requesting separate emissions limits to be applicable during black-start-related operations, including commissioning, readiness testing, and black start emergency operations, to allow the facility to engage in these operations. These emission limits will be imposed as specific permit conditions applicable during black-start-related operations.

The increased emissions from black-start-related operations will be infrequent, however, and they will be limited in duration when they do occur. Most of the time, the facility will continue to operate as it has since it was constructed, and normal operations will continue to be subject to the plant's existing permit conditions. The facility's total annual emissions will continue to be influenced primarily by the facility's normal operations throughout the year, not by the black-start-related operations.

Full details of the facility's emissions during black-start-related operations are provided in Section III below.

D. Regulatory Approvals Needed For Adding Black Start Capability

As noted above, under the Warren-Alquist Act, the Energy Commission has plenary jurisdiction over power plants over 50 MW such as the Marsh Landing Generating Station. The Energy Commission issued its initial license for the Marsh Landing facility in 2010. NRG will need to obtain Energy Commission approval for the revised conditions authorizing the black start capability project.

The Energy Commission's exclusive jurisdiction preempts the District's regulatory authority over the Marsh Landing Generating Station. Under the Warren-Alquist Act, once the Energy Commission has licensed a power plant project, no other local or regional public agency can require any permit or approval for the project that conflicts with the Energy Commission's license. Under a Memorandum of Understanding with the Energy Commission, however, the District undertakes the primary enforcement role with respect to air quality issues, as the District has an experienced enforcement staff with the capability and resources to inspect power plant facilities, document compliance, and identify any violations. In order to do so, the District needs to incorporate the Energy Commission's conditions of approval into a District permitting document, which gives the District the legal authority to enforce those conditions under the Health & Safety Code. Accordingly, once the Energy Commission has approved the project, the District will then incorporate the Commission's conditions of approval into Marsh Landing's District permit.[1] This is a ministerial action of simply copying the Energy Commission conditions of approval verbatim into the District permit to allow the District to enforce them. Under the Warren-Alquist Act, the District does not have any authority to alter the Commission's conditions of approval or to prohibit Marsh Landing from implementing the project.

[1] The District will incorporate these permit condition changes under Application No. 29169.

III. Emissions From Black Start Related Operations

This section provides a summary of the emissions of regulated air pollutants and toxic air contaminants that will occur during black-start-related operations, including commissioning activities, readiness testing and black start emergencies. Detailed emission calculations are presented in Appendix A (Regulated Air Pollutant Emission Calculations) and Appendix B (Toxic Air Contaminant Emission Calculations).

Table 1 summarizes the regulated air pollutant emissions from all black-start-related operations. The table shows the emissions rate for black start emergencies in emissions per day as well as total emissions for a 48-hour black start emergency event. The table also shows emissions during the 64-hour commissioning period and the 8-hour annual readiness testing.

Table 1
Regulated Air Pollutant Emissions from Black-Start-Related Operations

Pollutant	Emissions Per Day (lb/day)	Emissions Per Emergency Event (lbs)	Readiness Testing Emissions (lb/year)	Commissioning Emissions (lbs)
Nitrogen Oxides (as NO_2)	8,048	15,869	414	3,311
Carbon Monoxide	100,673	199,789	12,936	103,486
Precursor Organic Compounds	7,422	14,739	1,011	8,089
Particulate Matter (PM_{10}/$PM_{2.5}$)	255	503	15	123
Sulfur Dioxide	174	343	10	84

Table 2 provides a comparison between black start operations and normal facility operations. PM and SO_2 emissions will be lower during black start operations because the turbines will be running at no load or low load and thus not operating at their full capacity. NOx, CO and POC emissions are higher during black start operations because the combustion process is not as efficient at low loads, and because the abatement equipment will not be operating at optimal efficiency, as discussed further in Section IV.A.

Table 2
Comparison of Air Pollutant Emissions:
Black Start vs. Normal Operation

Pollutant	Normal Operations (lb/day)	Black Start Operations (lb/day)
Nitrogen Oxides (as NO_2)	2,941	8,048
Carbon Monoxide	8,378	100,673
Precursor Organic Compounds	693	7,422
Particulate Matter (PM_{10}/$PM_{2.5}$)	864	255
Sulfur Dioxide	596	174

Table 3 summarizes the maximum annual emissions from the combustion turbines at the facility. Black-start-related operations will be in addition to the facility's currently permitted 7,008 hours per year of normal operations, so the total maximum annual emissions once the black start capability is implemented will be the currently permitted maximum annual emissions from normal operations plus the permitted annual emissions from black-start-related operations. Table 3 shows the facility's current annual limits for normal operations, the proposed annual limits for black-start-related operations, and the new total maximum annual emissions from all turbine operations (which is the sum of the limits shown in the preceding two columns).

Table 3
Maximum Permitted Annual Emissions

Pollutant	Current Annual Emissions Limit (tons/year)	Proposed Black Start Annual Emissions Limit (tons/year)	Proposed Total Annual Emissions Limit (tons/year)
Nitrogen Oxides (as NO_2)	78.57	8.14	86.71
Carbon Monoxide	138.57	106.36	244.93
Precursor Organic Compounds	14.21	7.88	22.09
Particulate Matter ($PM_{10}/PM_{2.5}$)	31.54	0.26	31.8
Sulfur Dioxide	4.94	0.18	5.12

Table 4 shows the facility's current annual emission rates, based on its actual, measured emissions from the most recent three years. The facility's actual emission rates constitute its "baseline emissions" for determining applicability of certain District regulations. *See* District Regulation 2-2-603. These regulations are discussed in detail in Section IV.A.

Table 4
Baseline Emissions For Determining Regulatory Applicability

Pollutant	Current Baseline Emissions (tons/year)
Nitrogen Oxides (as NO_2)	2.0
Carbon Monoxide	4.5
Precursor Organic Compounds	0.1
Particulate Matter ($PM_{10}/PM_{2.5}$)	0.8
Sulfur Dioxide	0.2

Table 5 summarizes the toxic air contaminant (TAC) emissions from black-start-related operations and normal operations.

Table 5
Toxic Air Contaminant Emissions from Normal Operations and Black-Start-Related Operations

Toxic Air Contaminant	Normal Operations (lb/hour)	Black Start Operations (lb/hour)
1,3-Butadiene	0.0011	0.0004
Acetaldehyde	3.48	3.58
Acrolein	0.24	0.19
Ammonia	123	N/A
Benzene	0.12	0.07
Benzo(a)anthracene	0.0002	0.0001
Benzo(a)pyrene	0.0001	0.00004
Benzo(b)fluoranthene	0.0001	0.00003
Benzo(k)fluoranthene	0.0001	0.00003
Chrysene	0.0002	0.0001
Dibenz(a,h)anthracene	0.0002	0.0001
Ethylbenzene	0.16	0.09
Formaldehyde	12.43	12.96
Hexane	2.24	0.73
Indeno(1,2,3-cd)pyrene	0.0002	0.0001
Naphthalene	0.014	0.005
Propylene	6.66	2.16
Propylene Oxide	0.41	0.14
Toluene	0.61	0.28
Xylene (Total)	0.23	0.07
Sulfuric Acid Mist	20.77	6.74
Benzo(a)pyrene equivalents	0.0004	0.0001

Because black-start-related operations will be in addition to the currently permitted 7,008 hours per year of normal operations, the facility's maximum permitted annual TAC emissions will be higher than the maximum annual emissions under its existing permit conditions. Maximum annual TAC emissions will be (i) the total emissions assuming a full 7,008 hours of normal operations during the year plus (ii) the emissions associated with black-start-related operations during the year. **Table 6** shows the maximum annual TAC emissions under the current permit conditions

compared to maximum annual TAC emissions under the proposed conditions (with the black start capability added).

Table 6
Maximum Annual Toxic Air Contaminant Emissions:
Current Permit Conditions vs. Proposed New Permit Conditions

Toxic Air Contaminant	Current (lb/year)	Proposed (lb/year)
1,3-Butadiene	1.92	1.94
Acetaldehyde	2,301	2,487
Acrolein	294	304
Ammonia	216,042	216,043
Benzene	201	205
Benzo(a)anthracene	0.34	0.35
Benzo(a)pyrene	0.21	0.21
Benzo(b)fluoranthene	0.17	0.17
Benzo(k)fluoranthene	0.17	0.17
Chrysene	0.38	0.38
Dibenz(a,h)anthracene	0.36	0.36
Ethylbenzene	271	276
Formaldehyde	7,785	8,459
Hexane	3,918	3,956
Indeno(1,2,3-cd)pyrene	0.36	0.36
Naphthalene	25.11	25.36
Propylene	11,664	11,777
Propylene Oxide	723	730
Toluene	1,074	1,088
Xylene (Total)	395	399
Sulfuric Acid Mist	9,097	9,447
Benzo(a)pyrene equivalents	0.69	0.70

The results of the District's health risk assessment with respect to these TAC emissions is discussed in Section IV.B.

IV. Statement of Compliance

The following section summarizes the applicable Rules and Regulations and describes how the facility's black-start-related operations will comply with those requirements. This discussion is intended to provide the Energy Commission with a basis for reviewing the applicable regulatory requirements related to air quality as it considers NRG's application for approval of the black start capability project.

The bulk of the applicable regulatory requirements are in the District's New Source Review rule (Regulation 2, Rule 2). These requirements are discussed in subsection A. The second principal District regulatory requirement applicable to this project is the District's New Source Review of Toxic Air Contaminants rule (Regulation 2, Rule 5), which is discussed in subsection B. Other applicable District regulations and applicable state regulations are discussed in subsections C and D. Subsection E discusses how the California Environmental Quality Act applies to the project.

A. District Regulation 2, Rule 2 – New Source Review

New Source Review is the District's primary air quality permitting program. The New Source Review regulations in District Regulation 2, Rule 2 require an applicant seeking approval for any new source, or any modification to an existing source, to meet stringent requirements to ensure that its emissions are minimized. The primary requirements of New Source Review that are relevant to the proposed black start capability project at the Marsh Landing Generating Station are:

- Section 2-2-301 – Best Available Control Technology Requirement
- Section 2-2-302 – Offset Requirements, Precursor Organic Compounds and Nitrogen Oxides
- Section 2-2-308 – NAAQS Protection Requirement

These requirements are discussed below.[2]

1. Best Available Control Technology (BACT) Determinations

a. BACT Applicability

Per Regulation 2-2-301.2, a modified source must use the Best Available Control Technology (BACT) to control emissions for each District BACT pollutant for which the source is modified as defined in Regulation 2-1-234. The District BACT pollutants are POC, NPOC, NOx, SO_2, PM_{10}, $PM_{2.5}$, and CO as defined in Regulation 2-2-210.

A modification is defined in Regulation 2-1-234.1 as a physical change or change in the method of operation that increases the source's daily or annual potential to emit for a given pollutant. Both gas turbines that will be involved in the black start capability project, turbines S-3 and S-4, will undergo a physical change or change in method of operations under the language in Regulation 2-1-234.1 in connection with the project. The black-start-related operations will result in an increase in the daily and/or annual potential to emit for POC, NOx, SO_2, PM_{10}, $PM_{2.5}$, and CO, as shown in the Facility Emissions Section. Both turbines will therefore be subject to the District BACT requirement for these six pollutants.

[2] Note that there are a number of additional requirements in Regulation 2, Rule 2 that apply only to projects at major PSD facilities, including Regulations 2-2-304 through 2-2-307. The Marsh Landing Generating Station is not a major PSD facility because it does not have the potential to emit 250 tons or more of any regulated air pollutant. It is subject to the 250-ton-per-year Major PSD threshold because it is not in any of the 28 categories of facilities listed in Section 169(1) of the Clean Air Act. *See* District Reg. 2-2-224.1.

b. BACT Definition

Per Regulation 2-2-202, the BACT level of emissions control required under Regulation 2-2-301 is defined as the most 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) The most effective control device or technique or most stringent emission limitation that the APCO has determined to be technologically feasible for a source, taking into consideration cost-effectiveness, any ancillary health and environmental impacts, and energy requirements; or

(d) The most effective emission control limitation for the type of equipment comprising such a source that is contained in an approved implementation plan of any state, unless the applicant demonstrates to the satisfaction of the APCO that such limitation is not achievable.

Regulation 2-2-202 also provides that BACT may not be less stringent than any emission control required by any applicable provision of federal, state or District laws, rules or regulations.

The type of BACT described in subparts (a) and (b) of Regulation 2-2-202 must have been demonstrated in practice and approved by a local Air Pollution Control District, CARB, or EPA. This type of BACT is referred to as "achieved in practice" BACT or "BACT 2." The BACT category described in subpart (c) is referred to as "technologically feasible/cost-effective" BACT, and it must be commercially available, demonstrated to be effective and reliable on a full-scale unit, and shown to be cost-effective based on dollars per ton of pollutant abated. This type of BACT is also 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 Air District's BACT Guidelines.

c. BACT Analysis

The following discussions include BACT determinations by pollutant for the Gas Turbines that will be involved in black-start-related operations at the Marsh Landing facility, S-3 and S-4. It should be noted that the addition of black start capability at Marsh Landing will not affect normal operations at the facility. The BACT determinations for this application focus on the operations associated with the black start capability, which include commissioning activities, readiness testing, and black start emergency operations. Normal operations will remain subject to the existing BACT requirements specified in the facility's permit conditions.

As provided in Regulation 2-2-202, the Air District has evaluated what level of BACT emissions controls have been achieved in practice at other similar facilities (BACT 2), and what level of BACT emissions controls may be technologically feasible and cost-effective (BACT 1).

With respect to BACT 2 (achieved-in-practice BACT), the Air District has not found any similar projects to add black start capability using battery storage system to an existing power plant. The Air District reviewed BACT determinations at the EPA RACT/BACT/LAER Clearinghouse, ARB BACT Clearinghouse and recent projects listed by the CEC as approved or under construction and did not find any other projects of this type. As a result, there is no level of BACT control that has been achieved in practice at other similar facilities.

With respect to BACT 1 (technologically feasible and cost-effective BACT), the Air District undertook the following BACT analyses. For each of the pollutants subject to the BACT requirements, the Air District evaluated potential technologies that could be used to reduce emissions of that pollutant during black-start-related operations and considered whether they would be technologically feasible to implement and, if so, they would be cost-effective given the amount by which they could reduce emissions compared to the cost that would be involved to implement them.

NOx

Control Technology Review:

Battery Power for Black Starts: The initial startup of a gas turbine requires a certain amount of electric power. Emissions can be reduced by using a battery storage system instead of a fossil-fuel-fired alternative such as a diesel generator. The battery is kept energized during normal operations using power generated by the facility, and then that power can be used to restart the turbines during black-start conditions. This is an available, feasible and cost-effective control technology, and the applicant has proposed battery use for this project.

Best Work Practices: Emissions from the gas turbines during black-start-related operations can be minimized through the use of best work practices. By following the plant equipment manufacturers' recommendations and CAISO's instructions to restore power to the electricity grid, power plant operators can minimize emissions from black start operations and limit the duration of those operations. Plant operators can use their operational experience with their turbines, emission control devices, and ancillary equipment to optimize their operation. This is an available, feasible and cost-effective control technique.

Dry Low-NOx (DLN) Combustors: DLN Combustors reduce the formation of thermal NOx 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.

DLN combustors are already installed at the turbines at the Marsh Landing facility, but these combustors are optimized for full-load operation during normal operation. At loads less than 50%, the DLN combustor operates at non-optimal fuel and oxygen ratios, which affects the flame

temperature and the ability of the combustor to limit the formation of NOx. Therefore, DLN combustors are not effective at loads less than 50%, whereas the turbines will be operated at full-speed, no-load or low load during black start operations. DLN combustors are therefore not an available control technology for use during black-start operations.

Selective Catalytic Reduction (SCR): SCR involves the reaction of the NOx in the turbine exhaust with ammonia and oxygen in the presence of a catalyst to form nitrogen and water. SCR is a widely used post-combustion NOx control technique on utility-scale gas turbines, usually in conjunction with combustion controls such as DLN.

The Marsh Landing facility is currently equipped with an SCR system for each gas turbine, but it requires a minimum operating temperature in order to function effectively. During black start operations, the turbines will be operated at no load or low load, and their exhaust temperature will be lower than during normal steady-state operations. As a result, the SCR catalyst bed cannot always reach its minimum operating temperature to achieve effective NOx reduction during black-start-related operations. For this reason, SCR is not a feasible control technology for black-start-related operations.

The Air District considered the feasibility of using some kind of auxiliary heating system to heat up the SCR catalyst to allow it to function during black-start-related operations. However, the District has not been able to identify any feasible strategies for doing so. Installing equipment within the exhaust system downstream of the turbines where the SCR catalyst beds are located will increase the back pressure and negatively affect the efficiency of the turbines during normal operation. As a result, the gas turbines will burn more fuel per KW of electricity generated and will therefore produce more emissions of all pollutants over their operating life. Considering that black-start-related operations will be very short and infrequent, emissions from such operations will be much less than the emissions from normal operation. Any reduction in NOx emissions during the small number of hours of black-start-related operations would be greatly outweighed by the increase in emissions that would result from the reduced efficiency during normal operation over the lifespan of the turbines.

BACT Determination for NOx:

Based on the above analysis, the District has determined that the use of a battery power system and best work practices is BACT for NOx for black-start-related operations at the Marsh Landing facility. Based on the use of these BACT technologies, the District is proposing BACT emission limits of (i) 8,048 pounds of NOx per day and (ii) 16,283 pounds of NOx total per year from black-start-related operations. The District is also proposing a limit of 64 hours on commissioning activities to ensure that commissioning emissions are minimized, with an emissions limit of 3,311 pounds of NOx during commissioning activities. These proposed NOx emission limits are based on an analysis of the turbine manufacturer's emission data at various loads and black start operations that utilize best work practices.

CO and POC

Emission control technologies and techniques that are effective to control CO emissions are also effective to address POC emissions. The BACT analysis set forth below therefore addressed both CO and POC.

Control Technology Review:

Battery Power for Black Starts: As explained above in connection with NOx, a battery storage system can be used to provide the initial power to start the turbines instead of a fossil-fuel-fired alternative such as a diesel generator. This will reduce emissions of all pollutants associated with the use of a fossil-fuel-fired alternative, including CO and POC. This is an available, feasible and cost-effective control technology, and the applicant has proposed battery use for this project.

Best Work Practices: CO and POC emissions from the gas turbines during all operations associated with black start capability can be minimized using best work practices as discussed in the NOx BACT analysis above.

Oxidation Catalysts: An oxidation catalyst oxidizes the CO and POC in the turbine exhaust gases to form carbon dioxide and water. Oxidation catalysts are a proven post-combustion control technology widely in use on large gas turbines to abate CO and POC emissions, and an oxidation catalyst system is currently used to abate CO and POC emissions from the turbines at Marsh Landing during steady-state operations. The oxidation catalyst systems will not function at full efficiency during black-start-related operations, however, as operating parameters such as exhaust flow characteristics and backpressure will not be in their optimal range. Given this situation, the oxidation catalyst system is expected to have a reduction efficiency of 45% for CO and 30% for POC during black-start-related operations. The Air District therefore considers the use of an oxidation catalyst is an available and feasible control technology for black-start-related operations, although with reduced reduction efficiencies.

BACT Determination for CO and POC:

Based on the above analysis, the District has determined that the use of a battery power system, best work practices, and an oxidation catalyst is BACT for CO and POC for black-start-related operations at the Marsh Landing facility. Based on these BACT technologies, the District is proposing the following BACT emission limits:

CO: 100,673 pounds per day and 212,725 pounds per year from black-start-related operations;

POC: 7,422 pounds per day and 15,750 pounds per year from black-start-related operations.

With the 64-hour limit on commissioning activities discussed above, the District is also proposing BACT emission limits for commissioning of 103,486 pounds of CO and 8,089 pounds of POC. These proposed CO and POC emission limits are based on an analysis of the turbine manufacturer and oxidation catalyst vendor’s performance data and black start operations that utilize best work practices.

$PM_{10}/PM_{2.5}$

For natural gas combustion turbines, the particulate matter (PM) emissions are primarily condensable PM with less than one micron in diameter, so they are both PM_{10} and $PM_{2.5}$.[3] 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 limits are therefore the same for both PM_{10} and $PM_{2.5}$.

Control Technology Review:

Battery Power for Black Starts: As explained above, a battery storage system can be used to provide the initial power to start the turbines instead of a fossil-fuel-fired alternative such as a diesel generator. This will reduce emissions of all pollutants associated with the use of a fossil-fuel-fired alternative, including PM_{10} and $PM_{2.5}$. This is an available, feasible and cost-effective control technology, and the applicant has proposed battery use for this project.

Best Work Practices: PM emissions from the gas turbines during all operations associated with black start capability can be minimized using best work practices as discussed in the NOx BACT analysis above.

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 low-sulfur natural gas is commercially available and demonstrated for gas turbines.

BACT Determination for $PM_{10}/PM_{2.5}$:

Based on the above analysis, the District has determined that the use of a battery storage system, best work practices, and low-sulfur natural gas are BACT for PM_{10} and $PM_{2.5}$ for black-start-related operations. The District is proposing that for such operations, the Marsh Landing facility will be required to use the pipeline quality natural gas that meets the PG&E Gas Rule 21, Section C standard of less than 1 grain of sulfur per 100 scf, which is the same requirement for normal operations at the facility. Based on the use of these BACT technologies, the District is proposing BACT emission limits of (i) 255 pounds of $PM_{10}/PM_{2.5}$ per day and (ii) 518 pounds of $PM_{10}/PM_{2.5}$ total per year from black-start-related operations. With the 64-hour limit on commissioning activities discussed above, the District is also proposing a BACT emission limit for commissioning of 123 pounds of $PM_{10}/PM_{2.5}$.

[3] *See EPA* AP-42: Compilation of Air Emissions Factors, Chapter 3.1 Stationary Gas Turbines, Table 3.1-2a, 4/00, available at https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s01.pdf.

SO_2

Control Technology Review:

Battery Power for Black Starts: As explained above, a battery storage system can be used to provide the initial power to start the turbines instead of a fossil-fuel fired alternative such as a diesel generator. This will reduce emissions of all pollutants associated with the use of a fossil-fuel-fired alternative, including SO_2. This is an available, feasible and cost-effective control technology, and the application has proposed battery use for this project.

Best Work Practices: SO_2 emissions from the gas turbines during all operations associated with black start capability can be minimized using best work practices as discussed in the NOx BACT analysis above.

Clean-burning fuels: The use of clean-burning fuels, such as natural gas that has only trace amounts of sulfur, will result in minimal SO_2 emissions combustion. The use of low-sulfur natural gas is commercially available and demonstrated for gas turbines.

BACT Determination for SO_2:

Based on the above analysis, the District has determined that the use of a battery storage system, best work practices, and low-sulfur natural gas are BACT for SO_2 for black-start-related operations. The District is proposing that for such operations, the Marsh Landing facility will be required to use the highest quality commercially available natural gas that meets the PG&E Gas Rule 21, Section C standard of less than 1 grain of sulfur per 100 scf, which is the same requirement for normal operations at the facility. Based on the use of these BACT technologies, the District is proposing BACT emission limits of (i) 174 pounds of SO_2 per day and (ii) 354 pounds of SO_2 total per year from black-start-related operations. With the 64-hour limit on commissioning activities discussed above, the District is also proposing BACT emission limits for commissioning of 84 pounds of SO_2.

2. Emission Offsets

NOx and POC Offsets

Pursuant to Regulation 2-2-302, facilities that will have the potential to emit 10 tons per year or more of NOx or POC must offset their emissions of those pollutants. For facilities that will have the potential to emit more than 10 tons per year but less than 35 tons per year of NOx or POC, offsets must be provided at a ratio of 1 to 1. For facilities that will have the potential to emit more than 35 tons per year of NOx or POC, offsets must be provided by the applicant at a ratio of 1.15 to 1.

For facilities that have already provided offsets for their full potential to emit, additional offsets are required for any increase in potential to emit resulting from a subsequent modification. NRG provided offsets for the Marsh Landing Generating Station's full potential to emit NOx and POC

when the plant was initially permitted. Additional offsets are required for the proposed annual emission increase in NOx and POC for black-start-related operations. The offset requirements for this project is summarized in **Table 7** below:

Table 7
Emission Offsets for Black Start Capability Project

Pollutant	Emission Increase (tons/year)	Offset Ratio	Offsets Required (tons/year)
Nitrogen Oxides (as NO_2)	8.142	1.15 to 1	9.363
Precursor Organic Compounds	7.875	1 to 1	7.875

Note: Table 7 shows total annual emissions from black start emergency operations and readiness testing. This total does not include emissions from commissioning activities because commissioning will only occur during 2019 and it is highly unlikely that a black start emergency will occur within 12 months of the end of commissioning activities.

NRG will provide the offsets using its Banking Certificate 1450. The certificate currently has 224.213 tons per year of NOx credit and 5.290 tons per year of POC credit. Because the facility will have the potential to emit more than 10 tons per year but less than 35 tons per year of POC, the District's Small Facility Bank will provide 2.585 tons per year of POC credit.

$PM_{2.5}$, $PM_{10,}$ and SO_2 Offsets

Because the Marsh Landing Generating Station's potential to emit $PM_{2.5}$ PM_{10} and SO_2 does not exceed 100 tons per year, the facility is not subject to the offsets requirements for these pollutants in District Regulation 2-2-303.

3. NAAQS Protection Requirement

District Regulation 2-2-308 requires projects that will result in a significant net increase in emissions to evaluate whether they will cause or contribute to a violation of any National Ambient Air Quality Standard. The addition of black start capability at the Marsh Landing Generating Station will result in a significant increase in emissions of NOx, CO, PM_{10} and $PM_{2.5}$, as calculated pursuant to Regulation 2-2-604, and so the project is subject to the NAAQS Protection Requirement in Regulation 2-2-308.

Regulation 2-2-308 incorporates the exemptions set forth in 40 CFR Section 52.21(i), however. One of these exemptions, in Section 52.21(i)(3), exempts emissions that will be temporary and will not impact any Class I Area or area where an applicable increment is known to be violated. This exemption applies to emissions from black-start-related operations. Commissioning emissions will last no more than 64 hours. Readiness testing will be limited to 8 hours and is expected to occur once every 3 years. And a black start emergency is not expected to last more than 48 hours, and is not expected to occur more frequently than once every 20 or 30 years. In addition, the project is not expected to impact any Class I area or any area where an applicable increment is known to be violated. The project is therefore exempt from the NAAQS protection requirement in Regulation 2-2-308.

B. District Regulation 2, Rule 5 – New Source Review of Toxic Air Contaminants

Regulation 2-5-301 requires any new or modified source of Toxic Air Contaminants (TACs) to apply Best Available Control Technology for Toxics (TBACT) if the cancer risk associated with the source is greater than one in one million, or if the chronic hazard index associated with the source is greater than 0.2. A source is "modified" for purposes of this regulation if it undergoes a physical change, change in the method of operation, or increase in throughput or production that increases its daily or annual TAC emissions. Both of the turbines that will be used for black start capability (S-3 and S-4) are modified sources under this definition, as they will experience increased TAC emissions as a result of black-start-related operations as shown in Tables 5 and 6 above.

Regulations 2-5-301 and 2-5-302 prohibit projects if the project risk or project net risk at any receptor exceeds a cancer risk of ten in one million, or an acute or chronic hazard index of one.

Regulation 2-5-402 requires a Health Risk Assessment if TAC emissions exceed the screening thresholds set forth in Table 2-5-1 in Regulation 2, Rule 5. If TAC emissions are below the screening thresholds, then it is clear that the emissions will not have a significant health risk without the need for more detailed evaluation. If TAC emissions exceed the screening thresholds, a Health Risk Assessment is required to evaluate the extent of the associated risk in more detail.

The estimated emissions for 12 TACs in this project will be above the respective trigger levels in Table 2-5-1. For each of these 12 TACs, **Table 8** shows the project's emissions and the associated screening thresholds from Table 2-5-1. Acute risk depends on short-term exposures, so the project emissions are compared with the screening thresholds based on hourly emission rates. Chronic risk depends on long-term exposures, so the project emissions are compared with the screening thresholds based on annual emission rates

Table 8
Project Toxic Air Contaminant Emissions and
Screening Thresholds for Requiring A Health Risk Assessment

Toxic Air Contaminant	Acute Risk		Chronic Risk	
	Project Emissions (lb/hour)	Screening Threshold (lb/hour)	Project Emissions (lb/year)	Screening Threshold (lb/year)
1,3-Butadiene	0.001	1.5	1.94	0.48
Acetaldehyde	3.58	1.0	2,487	29
Acrolein	0.24	0.0055	304	14
Ammonia	123	7.1	216,043	7700
Benzene	0.12	0.06	205	2.9
Benzo(a)pyrene	0.0001	-	0.21	0.0033
Ethylbenzene	0.16	-	276	33
Formaldehyde	12.96	0.12	8,459	14

Toxic Air Contaminant	Acute Risk		Chronic Risk	
	Project Emissions (lb/hour)	Screening Threshold (lb/hour)	Project Emissions (lb/year)	Screening Threshold (lb/year)
Hexane	2.24	-	3,956	270,000
Naphthalene	0.014	-	25.36	2.4
Propylene	6.66	-	11,777	120,000
Propylene Oxide	0.41	6.8	730	22
Toluene	0.61	82	1,088	12,000
Xylene (Total)	0.23	49	399	27,000
Sulfuric Acid Mist	20.77	0.26	9,447	39
Benzo(a)pyrene equivalents	0.0004	-	0.70	0.0033

Since TAC emissions will exceed the screening thresholds set forth in Table 2-5-1, the District undertook a health risk assessment (HRA) for this project. The results of the HRA are summarized in **Table 9**, with full details provided in Appendix C.

Table 9
Health Risk Assessment Results

	Max. Cancer Risk	Max. Non-Cancer Health Risk	
		Chronic HI	Acute HI
Reg. 2-5 Maximum Risk Limits	10 in 10^6	1	1
Reg. 2-5 TBACT Risk Thresholds	1 in 10^6	0.2	-
Marsh Landing Health Risks	0.033 in 10^6	0.0023	0.063

As shown in Table 9, the HRA indicates that the maximum cancer risk associated with the Marsh Landing Generating station after black start capability is implemented, including the risk from normal operations and from black-start-related operations, is 0.033 in a million. This means that if one million people were exposed to this level of risk over an entire lifetime, 0.033 additional cancers would be expected to develop. These results are very similar to the results of the HRA that was conducted for the facility when it was initially permitted, indicating that the addition of black start capability will not substantially change the cancer risk associated with the plant. Moreover, a cancer risk of 0.033 in a million is well below the risk level of 1 in a million at which the District's TBACT requirement would be triggered for cancer risk, and even farther below the maximum allowable project risk limit of 10 in a million.

For non-cancer health risks, the HRA indicates that the maximum chronic risk (the risk of long-term health effects) was measured at a hazard index of 0.0023, and the maximum acute risk (the risk of short-term health effects) was measured at a hazard index of 0.063. At 0.0023 and 0.063, respectively, the hazard index for both chronic and acute health impacts means that TAC exposures

are well below the level at which health impacts would be expected to occur.[4] Again, these results are similar to the results of the HRA that was conducted for the facility when it was initially permitted, indicating that the addition of black start capability will not significantly alter the facility risk with respect to non-cancer health impacts. Moreover, a chronic hazard index of 0.0023 is well below the risk level of 0.2 at which the District's TBACT requirement would be triggered for non-cancer health risk.

These project risks are below all of the project risk limits in District Regulation 2-5-302 (a cancer risk of 10 in a million; a chronic hazard index of 1; and an acute hazard index of 1). Therefore, the proposed addition of black start capability at the Marsh Landing facility will be in compliance with District Regulation 2, Rule 5.

C. Other Applicable District Rules and Regulations

In addition to the requirements in District Regulation 2, Rule 2, and Regulation 2, Rule 5, there are a number of other District regulations applicable to the black start capability project. These are discussed below.

Regulation 1, Section 301: Public Nuisance

None of the proposed black-start-related operations 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. The Marsh Landing Generating Station has been operating since 2013 without causing any public nuisance, and it is expected to continue operating that way.

Regulation 2, Rule 6: Major Facility Review

The Marsh Landing Generating Station is a Major Facility for purposes of the Title V Major Facility Review operating permit requirements in Regulation 2, Rule 6. The facility has a Title V operating permit, the current version of which was issued on January 18, 2018. NRG will need to obtain a revision to its Title V operating permit to incorporate the revised emission limits applicable during black-start-related operations. Pursuant to Regulation 2-6-404.3, NRG has submitted an application to revise its Title V operating permit accordingly.

Regulation 2, Rule 7: Acid Rain

The Marsh Landing gas turbines are subject to the requirements of Title IV of the federal Clean Air Act. The applicable requirements are specified in Marsh Landing's Title V permit, Standard Condition L. The facility has been in compliance with these requirements since the issuance of the initial Title V permit in 2015, and it is expected to continue to comply with them after the addition of black start capability.

[4] The hazard index quantifies the level of risk as a proportion of the level of TAC exposure at which health effects are anticipated (with a built-in margin of safety). An exceedance of a hazard index of 1 is an indication of the erosion of the margin of safety for exposure to that TAC.

Regulation 6, Rule 1: Particulate Matter and Visible Emissions

Black-start-related operations are expected to comply with Regulations 6-1-301 and 6-1-302, which prohibit visible emissions exceeding 20% opacity or darker than No. 1 on the Ringelmann Chart. Black-start-related operations are similar in many ways to other situations in which the turbines are started up from an offline condition (although black-start-related operations will last for significantly longer period of time than normal startups). The facility has operated since 2013 without any problems complying with the Regulation 6-1 opacity limits during startups, and black-start-related operations are not expected to be any different.

Black-start-related operations are also expected to comply with Regulation 6-1-310.1, which requires total suspended particulate emissions to be less than 0.15 grains per dry standard cubic foot of exhaust gas volume. As calculated in accordance with Regulation 6-310.3, turbine emissions are not expected to exceed 0.01 gr/dscf @ 6% O_2. See Appendix A for grain loading calculations.

Regulation 7: Odorous Substances

Regulation 7-302 prohibits the discharge of odorous substances that remain odorous beyond the facility property line after dilution with four parts odor-free air. The facility has not experienced any odor problems since commencing operations in 2013, and black-start-related operations are not expected to change this situation. Regulation 7-302 also limits ammonia emissions to 5000 ppm. The turbines' SCR systems will not be able to be used during black-start-related operations because their catalyst beds will not be at a sufficiently high temperature, as explained in subsection A, and so there will be no ammonia slip emissions during these operations. Moreover, once the catalyst beds reach their minimum operating temperature and ammonia injection can be started, ammonia slip emissions from the gas turbines will each continue to be limited by permit condition to 10 ppmvd @ 15% O_2. For these reasons, 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" per Regulation 8-2-110 since natural gas will be fired exclusively at those sources.

Regulation 9, Rule 1: Inorganic Gaseous Pollutants – Sulfur Dioxide

This regulation establishes emission limits for SO_2 from all sources and applies to the combustion sources at this facility. Section 301 (Limitations on Ground Level Concentrations) prohibits emissions that 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 are not expected to cause ground level SO_2 concentrations in excess of the limits specified in Regulation 9-1-301 and should easily comply with section 302. The turbines have operated since 2013 without any problems complying with these provisions, and they are not expected to have any problems

complying during black-start-related operations. Indeed, SO_2 emissions are expected to be lower during black-start-related operations, as compared to normal operations, as shown in Table 2.

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

Regulation 9-9-301 sets forth a limit on NOx emissions of 5 ppmvd @ 15% O_2 or 0.15 lb/MWhr. This limit does not apply during turbine startups, however. Regulation 9-9 does not specify any emission limits that are applicable during black-start-related operations, during which the turbine will be started up and gradually brought up to normal operating conditions at full load. Startup emissions emission limits are governed by the BACT requirements in the District's New Source Review regulation, Regulation 2, Rule 2, as addressed above in Section IV.A.1.

Regulation 10: Standards of Performance for New Stationary Sources

Regulation 10 incorporates by reference the provisions of EPA's New Source Performance Standards (NSPSs) in 40 CFR Part 60. The applicable NSPS for stationary combustion turbines is in 40 CFR Part 60, Subpart KKKK. Section 60.4320(a) sets forth a NOx emissions limit of 96 ppm @ 15% O_2 for turbine with greater than 30 MW output operating at below 75% of peak load. The gas turbines will continue to comply with this limit because the NOx concentration at the stack is estimated to be no greater than 45 ppm @ 15% O_2 at below 75% of peak load according to the turbine manufacturer's emission data. NOx emissions from the turbines at the Marsh Landing facility are monitored by Continuous Emission Monitors at all times to verify compliance.

In addition, Section 60.4330(a)(2) sets forth a sulfur emission limit of 0.060 lb of SO_2/MMBtu, and Section 4365(a) exempts the facility from the requirement to monitor the total sulfur content of its fuel because it has a current, valid contract demonstrating that the natural gas it burns is 20 grains of sulfur or less per 100 standard cubic feet. The facility's natural gas is limited to a sulfur content of less than 1 grain per 100 scf.

D. State Requirements

The Marsh Landing Generating Station is also subject to several state requirements related to air quality.

California Health and Safety Code Sections 44300 *et seq*.

The Marsh Landing Generating Station is subject to the Air Toxic "Hot Spots" Program contained in California Health and Safety Code Sections 44300 *et seq*. The facility prepares inventory plans and reports as required. Addition of black start capability will not affect this requirement in any way.

Title 17, California Code of Regulations Sections 95100 to 95133

The Marsh Landing Generating Station is subject to the Mandatory Greenhouse Gas Emissions Reporting regulation. The facility is required to submit a greenhouse gas emissions data report and verification opinion to the California Air Resources Board each year. Addition of black start

capability will not affect this requirement in any way. Black start operations are not expected to change the facility's annual greenhouse gas emissions significantly.

E. California Environmental Quality Act

The California Environmental Quality Act (CEQA) requires California public agencies to avoid or minimize any significant adverse environmental impacts associated with any discretionary permitting or other approval of a project. The Energy Commission's approval of NRG's application for modification of its license to add the black start capability will be a discretionary approval, and so the Commission will be required to evaluate the potential for any significant adverse impacts under CEQA, and to mitigate or avoid any such impacts. The Energy Commission will comply with these CEQA requirements through its CEQA-equivalent certified regulatory program in accordance with CEQA Guidelines Section 15251(j) and Public Resources Code Sections 21080.5 and 25523.

Once the Energy Commission has approved the modification, the Air District will then incorporate the revised conditions from the Energy Commission's license into NRG's District permit conditions, as explained in Section II.D. above. This incorporation of the Commission's conditions is a ministerial action that is exempt from CEQA under Public Resources Code Section 21080(b)(1) and CEQA Guidelines Section 15268. Under the Warren-Alquist Act, the Energy Commission has plenary authority over power plant projects, and the District does not have any discretion to disapprove a project that the Energy Commission has approved or to alter the Commission's conditions of approval. The District's only action is to copy the Energy Commission conditions verbatim into a District permit to give the District legal authority to enforce those conditions as District permit conditions. This ministerial action is exempt from CEQA. Consideration of potential environmental impacts will occur at the Energy Commission approval stage, where the Commission has the discretion over whether and how to approve the project.

In addition, revision to NRG's Title V permit is also exempt under Public Resources Code Section 21080.24.

V. Permit Conditions

Emission limits and operational limits for black-start-related operations will be added to the existing permit conditions for S-3 and S-4, Combustion Gas Turbines. The changes to permit conditions are shown in the underline/strikeout format below:

CONDITION #24732

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 (Separate from Commissioning Activities for Black Start Capability)
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.
Black Start Emergency Operation:	Operation of Gas Turbine S-3 and/or S-4 and associated equipment as directed by the California Independent System Operator (CAISO) and/or Pacific Gas and Electric Company (PG&E) to restore power to the grid in the event of a system outage in accordance with the CAISO's or PG&E's system restoration plan, including operation of a turbine after termination of the Black Start Instruction until either (i) the turbine is shut down (up to a maximum of 30 minutes following termination of the Black Start Instruction) or (ii) the turbine achieves an output of 120 Megawatts (up to a maximum of 60 minutes following termination of the Black Start Instruction).
Commissioning Activities for Black Start Capability:	All performance testing and adjustment activities associated with the initial installation of the battery energy storage system specifically designed for black start capability at MLGS.
Readiness Testing for Black Start Capability:	All testing activities of Gas Turbines S-3 and/or S-4 associated with the battery energy storage system except for Commissioning Activities for Black Start Capability at MLGS.

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 each during the commissioning period. The owner/operator shall operate the facility such that simultaneous commissioning of no more than two gas turbines will occur without abatement of nitrogen oxides and CO by its SCR system and oxidation catalyst system. 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 of each turbine, the Owner/Operator shall conduct District and CEC approved source tests for that turbine 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 but excluding heat input rate during readiness testing for black start capability, commissioning activities for black start capability, and black start emergency operations. (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, readiness testing for black start capability, commissioning activities for black start capability, and black start emergency operations). (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 (i). Requirements (a) through (f) do not apply during ~~a~~ gas turbine start-ups, combustor tuning operations, ~~or~~ shutdowns, readiness testing for black start capability, commissioning activities for black start capability, or black start emergency operations~~.~~. (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. The APCO may require the installation on one exhaust point (P-1, P-2, P-3, or P-4, at the owner/operator's discretion) of a CEM designed to monitor ammonia concentrations if the APCO determines that a commercially available CEM has been proven to be accurate and reliable and that an adequate Quality Assurance/Quality Control protocol for the CEM has been established. The District or another agency must establish a District approved Quality Assurance/Quality Control protocol prior to the ammonia CEM being a requirement of this part. The ammonia CEM shall be used to demonstrate compliance with the ammonia emission limit contained in this Part for the gas turbine being monitored. The gas turbine with the ammonia CEM shall still be

subject to the emission testing requirements in Part 27. (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**.** These requirements do not apply during readiness testing for black start capability, commissioning activities for black start capability, or black start emergency operations. (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)	36.4	45.1	15.1
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, but excluding emissions generated during readiness testing for black start capability, commissioning activities for black start capability, and black start emergency operations, 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) 2468 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, but excluding emissions generated during readiness testing for black start capability, commissioning activities for black start capability, and black start emergency operations, to exceed the following limits during any calendar day on which a tuning event occurs:

(a) 2941 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, but excluding emissions generated during readiness testing for black start capability, commissioning activities for black start capability, and black start emergency operations, to exceed the following limits during any consecutive twelve-month period:

(a) 78.57 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	8,4597~~,785~~ pounds per year
benzene	2052~~2~~ pounds per year
Specified polycyclic aromatic hydrocarbons (PAHs)	2.001~~.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), 41, 42, 43, 44(a), 44(b), 45(a), and 45(b) by using properly operated and maintained continuous monitors (during all hours of operation including gas turbine start-ups, combustor tuning operations, ~~and~~ shutdowns , readiness testing for black start capability, commissioning activities for black start capability, and black start emergency operations ~~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 and 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:
    Note: The required data in (f) thru (k) shall exclude any data during readiness testing for black start capability, commissioning activities for black start capability, and black start emergency operations.
    (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.

(l) 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 during readiness testing for black start capability, commissioning activities for black start capability, and black start emergency operations for S-3 and S-4.

~~(k)~~(m) On a monthly basis, the cumulative total NO_x mass emissions (as NO_2) and cumulative total CO mass emissions during readiness testing for black start capability, commissioning activities for black start capability, and black start emergency operations, for the previous consecutive twelve-month period for sources 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), 20(c), 20(d), 20(e), 21(c), 21(d), 21(e), 22(c), 22(d), 22(e), 41, 42, 43, 44(c), 44(d), 44(e), 45(c), 45(d), and 45(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: The emissions calculated in (a) and (b) shall exclude any data during readiness testing for black start capability, commissioning activities for black start capability, and black start emergency operations.

(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 (12-month rolling average) for S-1, S-2, S-3, and S-4 combined.

(c) For each calendar day, POC, PM_{10}, and SO_2 emissions during readiness testing and commissioning activities for black start capability and black start emergency operations, summarized for S-3 and S-4.

~~(b)~~(d) On a monthly basis, the cumulative total POC, PM_{10}, and SO_2 mass emissions

during readiness testing and commissioning activities for black start capability and black start emergency operations, for each year (12-month rolling average) for S-3 and S-4combined.

(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 each corresponding 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 each corresponding exhaust point 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 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 the first MLGS SGT6-5000F gas turbine 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	≤ ~~2.9~~3.8 pounds/year and 0.06~~2.9~~ pounds/hour
Formaldehyde	≤ 1~~4~~8 pounds/year and 0.12 pounds/hour
Specified PAHs	≤ 0.003369 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 ~~□~~µg/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 first two 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 or 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)

41. Commissioning Activities for Black Start Capability: The owner/operator shall perform commissioning activities for black start capability at S-3 and S-4 for no more than 64 hours combined. Upon completion of these activities, the owner/operator shall provide written notice to the District Engineering and Enforcement Divisions. (Basis: BACT)

42. Emission Limits for Commissioning Activities for Black Start Capability: The owner/-operator shall not operate Gas Turbines S-3 and S-4 in a manner such that the combined pollutant emissions from these sources exceeds the following limits when performing commissioning activities for black start capability.

NO_x (as NO_2)…...3,311 pounds;
CO……...103,486 pounds;
POC (as CH_4)…..8,089 pounds;
$PM_{10}/PM_{2.5}$……..123 pounds;
SO_2……..84 pounds.
(Basis: BACT)

43. When performing any commissioning activities for black start capability at S-3 and S-4, the owner/operator of the MLGS shall demonstrate compliance with conditions 41 and 42 through the use of properly operated and maintained continuous emission monitors and data recorders for the following parameters:

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

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. 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: BACT)

44. Daily Emission Limits for Black Start Operations: The owner/operator shall not allow total combined emissions from readiness testing for black start capability and black start emergency operations at Gas Turbines S-3 and S-4 to exceed the following limits during any consecutive 24-clock hour period:

(a) NO_x (as NO_2)…...8,048 pounds per day;
(b) CO……...100,673 pounds per day;
(c) POC (as CH_4)…...7,422 pounds per day;
(d) $PM_{10}/PM_{2.5}$…….255 pounds per day;
(e) SO_2……...174 pounds per day.
(Basis: BACT)

45. Annual Emission Limits for Readiness Testing for Black Start Capability: The owner/operator shall not allow emissions from readiness testing for black start capability at Gas Turbines S-3 and S-4 to exceed the following limits during any consecutive twelve-month period:

(a) NO_x (as NO_2)…...414 pounds per year;

(b) CO……....12,936 pounds per year;
(c) POC (as CH_4)…...1,011 pounds per year;
(d) $PM_{10}/PM_{2.5}$……15 pounds per year;
(e) SO_2……....10 pounds per year.
(Basis: BACT)

46. Annual Emission Limits for Black Start Operations: The owner/operator shall not allow total combined emissions from readiness testing for black start capability and black start emergency operations at Gas Turbines S-3 and S-4 to exceed the following limits during any consecutive twelve-month period:
(a) NOx (as NO_2)……16,283 pounds per year (Basis: BACT; Offsets);
(b) CO…….212,725 pounds per year (Basis: BACT; Cumulative Increase);
(c) POC (as CH_4)……15,750 pounds per year (Basis: BACT; Offsets);
(d) $PM_{10}/PM_{2.5}$……518 pound per year (Basis: BACT; Cumulative Increase);
(e) SO_2……354 pounds per year (Basis: BACT; Cumulative Increase)

47. In the event that total emissions from commissioning activities, readiness testing for black start capability, and black start emergency operations exceed (a) 16,283 pounds of NOx and/or (b) 15,750 pounds of POC during any 12-month period that includes commissioning activities, the owner/operator shall submit additional offset credits for the excess emissions according to the procedures set forth in District Regulation 2-2-302.1 through 302.4. (Basis: Regulation 2-2-302).

VI. Conclusions and Recommendation

The District has preliminarily concluded that the proposed black start capability project at the Marsh Landing Generating Station, which involves the following permitted sources, complies with all applicable District rules and regulations. The District intends to submit this analysis to the California Energy Commission for the Commission to use in evaluating NRG's Petition for Modification of the facility's Energy Commission license. The District will recommend that the Energy Commission impose the permit conditions and BACT requirements discussed previously as conditions of approval.

S-3 Combustion Turbine Generator #3, Siemens SGT6-5000F, 2202 MMBtu/hr maximum rated capacity; natural gas fired only; abated by A-5 Oxidation Catalyst and A-6 Selective Catalytic Reduction System.

S-4 Combustion Turbine Generator #4, Siemens SGT6-5000F, 2202 MMBtu/hr maximum rated capacity; natural gas fired only; abated by A-7 Oxidation Catalyst and A-8 Selective Catalytic Reduction System.

The District is publishing this Draft Engineering Evaluation for public review and comment. The District will publish a notice inviting written public comment in a newspaper of general circulation in the area of Marsh Landing Generating Station, and it will make the document available on the District's website and in hard copy at the District's headquarters. The public inspection and

comment period will end 30 days after the date of such publication. Written comments on this document should be directed to:

Xuna Cai
Engineering Division, Application 29169
Bay Area Air Quality Management District
375 Beale Street, Suite 600
San Francisco, CA 94105

Appendix A

Regulated Air Pollutant Emission Calculations

The following physical constants and standard conditions were utilized to derive the criteria-pollutant emission factors used to calculate criteria pollutant and toxic air contaminant emissions.

standard temperature[a]:	70°F
standard pressure[a]:	14.7 psia
molar volume:	386.8 dscf/lb-mol
ambient oxygen concentration:	20.95%
oxygen concentration of permit standard:	15.00%
dry flue gas factor[b]:	8743 dscf/MMBtu
natural gas heating value:	1020 Btu/dscf
NO_2 molecular weight:	46.01 lbs/lbmol
CO molecular weight:	28.01 lbs/lbmol
POC molecular weight:	16.04 lbs/lbmol
SO_2 molecular weight:	64.07 lbs/lbmol

[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 various operating conditions during all black-start-related operations at Marsh Landing Generating Station (MLGS).

Table A-1

Operating Conditions During Black-Start-Related Operations

Operating Condition	Description
Start/FSNL	The process from startup of the turbine to full-speed-no-load (FSNL) operation.
Island Mode	The turbine is carrying all MLGS plant loads at 4.5 MW.
Shutdown (first 6 minutes)	The first 6-minute of a shutdown. Emissions are expected.
FSNL	The turbine is operated at either FSNL or low load (less than 60%).
Shutdown (last 9 minutes)	The turbine is in cool-down conditions duirng the last 9-minute of shutdown. There is no fuel input, so no emission is expected.
On Turnning Gear	The turbine is on turning gear with no fuel input and no emission is expected.

Table A-2 summarizes the regulated air pollutant emission factors that were used to calculate mass emission rates for one gas turbine during black-start-related operations at MLGS.

Table A-2
Regulated Air Pollutant Emission Factors
During Testing, Commissioning, and Black Start Operation

Pollutant	Emission Factor (lbs/MMBtu)
Nitrogen Oxides (as NO_2)	0.11/0.17
Carbon Monoxide	4.08

Pollutant	Emission Factor (lbs/MMBtu)
Precursor Organic Compounds	0.27
Particulate Matter (PM_{10} / $PM_{2.5}$)	0.0041
Sulfur Dioxide	0.0028

Basis for the above emission factors

- The uncontrolled emission factors in lbs/MMBtu for Nitrogen Oxide (NOx), Carbon Monoxide (CO), and Precusor Organic Compounds (POC) are calculated as follows:

$$Emission\ Factor = \frac{\left(C_d \frac{ppm}{10^6}\right) \cdot \left(MW \frac{lb}{lbmol}\right) \cdot \left(F_d \frac{dscf}{MMBtu}\right)}{\left(MV \frac{dscf}{lbmol}\right)} \cdot \frac{(20.9\% - 0.0\%)}{(20.9\% - O_{2_d}\%)}$$

Where:

C_d = pollutant concentration, dry basis (ppm)

MW = molar weight of pollutant (lb/lbmol)

MV = molar volume of pollutant (dscf/lbmol)

F_d = dry flue gas factor (dscf/MMBtu)

O_{2d} = oxygen concentration of permit standard, dry basis (%)

- For NOx emissions under Start/FSNL, Island Mode, and Shutdown (first 6 minutes) conditions,

  NOx = (30 ppm/10^6) (46.01 lb/lbmol) (8743 dscf/MMBtu) (lbmol/386.8 dscf) (20.9%) / (20.9% - 15%)

  = 0.11 lb/MMBtu

- For NOx emissions under FSNL condition,

  NOx = (45 ppm/10^6) (46.01 lb/lbmol) (8743 dscf/MMBtu) (lbmol/386.8 dscf) (20.9%) / (20.9% - 15%)

  = 0.17 lb/MMBtu

- For CO emissions under all conditions,

  CO = (2800 ppm/10^6) (28.01 lb/lbmol) (8743 dscf/MMBtu) (lbmol/386.8 dscf) (20.9%) / (20.9% - 15%)

  = 6.28 lb/MMBtu

- Johnson-Mathey has provided data that indicate the oxidation catalyst will function in the range of 45 to 50 percent in the firing range of the black-start-related operations. The more conservative value of 45 percent was used to estimate the controlled CO emissions:

  Controlled CO = (6.28 lb/MMBtu) (1-45%) = 4.08 lb/MMBtu

- For POC emissions under all conditions,

  POC = (300 ppm/10^6) (16.04 lb/lbmol) (8743 dscf/MMBtu) (lbmol/386.8 dscf) (20.9%) / (20.9% - 15%)

  = 0.385 lb/MMBtu

- Johnson-Mathey has provided data that indicate the oxidation catalyst will function in the range of 30 to 45 percent in the firing range of the black-start-related operations. The more conservative value of 30 percent was used to estimate the controlled POC emissions:

  Controlled POC = (0.385 lb/MMBtu) (1-30%) = 0.27 lb/MMBtu

- Particulate Matter (PM) emission factor is equvalent to the current limit for PM emissions in permit condition.
- The emission factor for Sulfur Dioxide (SOx) as SO2 assumes 1 gr/100 scf in fuel gas, which is the same as the current limit for SOx emissions in permit condition:

$$Emission\ Factor = \left(\frac{1\ grain\ S}{100\ scf}\right) \cdot \left(\frac{1\ lb}{7{,}000\ grain}\right) \cdot \left(\frac{1\ scf}{1{,}020\ Btu}\right) \cdot \left(\frac{10^6\ Btu}{1\ MMBtu}\right) \cdot \left(\frac{64\ lb\ SO_2}{32\ lb\ S}\right)$$

SOx = 0.0028

Table A-3 summarizes the regulated air pollutant emission rates during Testing, Commissioning, and/or Black Start Operation

Table A-3
Regulated Air Pollutant Emission Rates

Pollutant	Start/FSNL	Island Mode (4.5 MW)	Shutdown (first 6 minutes)	FSNL[a]
Fuel Input (MMBtu/hour)	584	583	584	583 to 1345
	Emission Rates (lb/minute)			
NOx (as NO_2)	1.08	1.07	1.08	2.91
CO	33.63	33.55	33.63	35.69
POC	2.63	2.63	2.63	2.63
PM (PM_{10} / $PM_{2.5}$)	0.04	0.04	0.04	0.09
SO_2	0.03	0.03	0.03	0.06

[a] Full Speed No Load (FSNL) or load condition between FSNL and 60% load. Emission rate corresponds to the highest emission rate on a pollutant specific basis between FSNL and 60% load.

Basis for the above emission rates

- The emission rates in lbs/minute are calculated as follows:
  Emission Rate = Emission Factor * Fuel Input / 60

- [a]During FSNL/low load operating conditions, the highest emission rate occurs at the following load:
  NOx: Fuel Input = 1053 MMBtu/hour at 35% load;
  CO: Fuel Input = 620 MMBtu/hour at 5% load;
  POC: Fuel Input = 584 MMBtu/hour at FSNL;
  PM and SO_2: Fuel Input = 1345 MMBtu/hour at 55% load.

Grain Loading Calculations

The following stack data will be used to calculate the grain loading at standard conditions for full-speed-no-load gas turbine operation to determine compliance with BAAQMD Regulation 6-1-310.1:

Maximum PM_{10} mass emission rate = 0.09 lb/minute
Flow rate = 2,276,879 lb/hr @ 16.56% O_2 and 645°F
Moisture content = 4.12% by volume

Converting flow rate to standard conditions:
(2,276,879 lb/hr)(1 hr/60 min)(385.3 cf/lb mol)(1 mol/28.4) = 514,836 acfm
(514,836 acfm)([70 + 460 °R]/[645 + 460 °R])(1 – 4.12%) = 236,761 dscfm

Converting to grains/dscf:
(0.09 lb PM_{10}/min)(7000 gr/lb)/(236,761 dscfm) = 0.003 gr/dscf

Converting to 6% O_2 basis:
(0.003 gr/dscf)[(20.9% - 6%)/(20.9% – 16.56%)] = 0.01 gr/dscf @ 6% O_2

Table A-4 summarizes the operating conditions used to model each hour of Testing and Commissioning for the primary and secondary units. Turbine 3 and 4 are considered the primary and secondary units, respectfully, for modeling this scenario. During each hour of Black Start readiness testing or commissioning the two designated black start units (i.e., Turbines 3 and 4) will have overlapping run hours. The testing period consists of two units operating simultaneously during each hour. Black Start readiness and reliability testing has been assumed to be up to five (5) hours per year. During the first year, commissioning operations have been assumed to consist of up to 40 hours, which is equivalent to 64 hours of turbine operations per year for both turbines combined.

Table A-4
Operating Conditions During Each Hour of Testing and Commissioning

Primary Unit (Turbine 3)		
Start Time	**End Time**	**Operating Condition**
0:01:00	0:15:00	Start/FSNL
0:16:00	0:45:00	Island Mode (4.5MW)
0:46:00	1:00:00	Shutdown (first 6 min) / Shutdown (last 9 min)
Secondary Unit (Turbine 4)		
Start Time	**End Time**	**Operating Condition**
0:01:00	0:25:00	On Turning Gear
0:26:00	0:45:00	Start/FSNL
0:46:00	1:00:00	Shutdown (first 6 min) / Shutdown (last 9 min)

Table A-5 summarizes the operating conditions during Black Start Operation for Turbines 3 and 4. The primary turbine (T3) has three start ups and three shut downs per day for the 48 hours of Black Start Emergency Operations. The secondary turbine (T4) has four start ups and three shut downs during the first day of operation. T4 then has three start ups and three shut downs during

the second day of operation. After a maximum of 48 hours, Black Start Emergency Operations will revert to normal permitted operations.

Table A-5
Operating Conditions During Black Start Operations
For the Primary and Secondary Unit

Primary Unit (Turbine 3)		
Start Time	**End Time**	**Operating Condition**
0:01:00	0:10:00	Start/FSNL
0:11:00	1:00:00	Island Mode (4.5MW)
1:01:00	11:45:00	FSNL (or load condition between FSNL and MECL that maximizes stack emissions)
5:46:00	6:00:00	Shutdown (first 6 min) / Shutdown (last 9 min)
6:01:00	6:10:00	Start/FSNL
11:46:00	12:00:00	Shutdown (first 6 min) / Shutdown (last 9 min)
12:01:00	12:10:00	Start/FSNL
12:11:00	23:45:00	FSNL (or load condition between FSNL and MECL that maximizes stack emissions)
23:46:00	0:00:00	Shutdown (first 6 min) / Shutdown (last 9 min)
0:01:00	0:10:00	Start/FSNL
0:11:00	11:45:00	FSNL (or load condition between FSNL and MECL that maximizes stack emissions)
5:46:00	6:00:00	Shutdown (first 6 min) / Shutdown (last 9 min)
6:01:00	6:10:00	Start/FSNL
11:46:00	12:00:00	Shutdown (first 6 min) / Shutdown (last 9 min)
12:01:00	12:10:00	Start/FSNL
12:11:00	23:45:00	FSNL (or load condition between FSNL and MECL that maximizes stack emissions)
23:46:00	0:00:00	Shutdown (first 6 min) / Shutdown (last 9 min)
Secondary Unit (Turbine 4)		
Start Time	**End Time**	**Operating Condition**
0:01:00	0:20:00	On Turning Gear
0:21:00	0:30:00	Start/Trip from FSNL
0:31:00	0:50:00	Coast to Turning Gear
0:51:00	1:00:00	Start/Trip from FSNL
1:01:00	11:45:00	FSNL (or load condition between FSNL and MECL that maximizes stack emissions)
5:46:00	6:00:00	Shutdown (first 6 min) / Shutdown (last 9 min)
6:01:00	6:10:00	Start/FSNL
11:46:00	12:00:00	Shutdown (first 6 min) / Shutdown (last 9 min)
12:01:00	12:10:00	Start/FSNL
12:11:00	23:45:00	FSNL (or load condition between FSNL and MECL that maximizes stack emissions)
23:46:00	0:00:00	Shutdown (first 6 min) / Shutdown (last 9 min)
0:01:00	0:10:00	Start/FSNL
0:11:00	11:45:00	FSNL (or load condition between FSNL and MECL that maximizes stack emissions)
5:46:00	6:00:00	Shutdown (first 6 min) / Shutdown (last 9 min)
6:01:00	6:10:00	Start/FSNL
11:46:00	12:00:00	Shutdown (first 6 min) / Shutdown (last 9 min)
12:01:00	12:10:00	Start/FSNL
12:11:00	23:45:00	FSNL (or load condition between FSNL and MECL that maximizes stack emissions)
23:46:00	0:00:00	Shutdown (first 6 min) / Shutdown (last 9 min)

Table A-6 summarizes the regulated air pollutant emissions during Testing, Commissioning, and/or Black Start Operation

Table A-6
Regulated Air Pollutant Emissions from Black-Start-Related Operations

Pollutant	Maximum Daily Emission (lb/day)	Commissioning Emission (lbs)	Readiness Testing Annual Emission (lb/yr)	Black Start Emergency (lbs)
NO_X (as NO_2)	8,048	3,311	414	15,869
CO	100,673	103,486	12,936	199,789
POC	7,422	8,089	1,011	14,739
PM (PM_{10}/$PM_{2.5}$)	255	123	15	503
SO_2	174	84	10	343

Basis for the above emission calculations:

- Emissions from each type of black-start-related operations are the sum of minute-by-minute (lb/minute) emissions under the operation senarios outlined in Table A-4 and Table A-5.
- The maximum daily emission for each pollutant is based on Black Start Emergency Operation, when two turbines are operating simultaneously for 24 hours.

Table A-7 summarizes the project emission increase for the black start capability project according to the emission calculation procedures in the District Regulation 2-2-604.2 and the baseline emissions calculation procedures in the District Regulation 2-2-603.

Table A-7
Regulated Air Pollutant Emission Increase in the Black Start Capability Project

Pollutant	Annual Potential to Emit (tons/year)	Baseline Emission (tons/year)	Project Emission Increase (tons/year)	Significant Threshold (tons/year)
NOx (as NO_2)	86.7	2.0	84.7	40.0
CO	245.0	4.5	240.5	100.0
POC	22.09	0.1	22.08	40.0
PM (PM_{10} / $PM_{2.5}$)	31.8	0.8	31.0	15.0
SOx	5.12	0.2	4.9	40.0

Basis for the above emission calculations:

- Annual potential to emit for each pollutant is the current facility-wide emission limits in the permit condition plus Black Start Emergency Operation and Readiness Testing.
- Baseline emissions for NOx and CO are based on MLGS's CEM emission data from October 2015 to September 2018.

- Baseline emissions for POC, PM and SOx are based on MLGS's source testing data from October 2015 to September 2018.

- The project emission increase is the difference between the new annual potential to emit and baseline emission for each pollutant according to the District Regulation 2-2-604.2.

- The significant thresholds are from the District Regulation 2-2-227.2.

Appendix B

Toxic Air Contaminant Emission Calculations

Table B-1: Toxic Air Contaminant Emission Factors (lb/MMBtu)

Toxic Air Contaminant	CATEF	SDAPCD	Startup/Shutdown /Black Start
1,3-Butadiene	1.25E-07	-	1.25E-07
Acetaldehyde	1.34E-04	1.25E-03	1.25E-03
Acrolein	1.85E-05	6.75E-05	6.75E-05
Ammonia*	1.40E-02	-	1.40E-02
Benzene	1.30E-05	2.51E-05	2.51E-05
Benzo(a)anthracene	2.22E-08	2.21E-08	2.22E-08
Benzo(a)pyrene	1.36E-08	1.36E-08	1.36E-08
Benzo(b)fluoranthene	1.11E-08	-	1.11E-08
Benzo(k)fluoranthene	1.08E-08	-	1.08E-08
Chrysene	2.47E-08	2.21E-08	2.47E-08
Dibenz(a,h)anthracene	2.30E-08	2.21E-08	2.30E-08
Ethylbenzene	1.75E-05	3.20E-05	3.20E-05
Formaldehyde	8.99E-04	4.54E-03	4.54E-03
Hexane	2.54E-04	-	2.54E-04
Indeno(1,2,3-cd)pyrene	2.30E-08	2.21E-08	2.30E-08
Naphthalene	1.63E-06	1.02E-06	1.63E-06
Propylene	7.56E-04	-	7.56E-04
Propylene Oxide	4.69E-05	-	4.69E-05
Toluene	6.96E-05	9.63E-05	9.63E-05
Xylene (Total)	2.56E-05	3.41E-06	2.56E-05

- The emission factors are from the engineering evaluation for Application 18404 when the Marsh Landing facility was initially permitted in 2010.
- CATEF = California Air Toxics Emission Factors Database maintained by the California Air Resources Board.
- 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
- CATEF emission factors are used to estimate emissions from steady state operation in normal operations.
- Startup/Shutdown/Black Start emission factors are the higher valus of the CATEF and SDAPCD emission factors, and are used to estimate emissions from startups and shutdowns in normal operations and from all black-start-related operations.
- *Ammonia emission factor is based on the permit limit of 10 ppm @ 15% O2 in the permit condition:

Ammonia (lb/MMBtu) = (ppm limit) x (1/Molar Volume) x Molecular Weight x F_d x 20.9/(20.9 - %O2)
= (10E-06) x (1/386.8 dscf/lb-mol) x (17 lb/lb-mol) x (8743 dscf/MMBtu) x 20.9/(20.9 - 15)
= 0.014 lb/MMBtu

where ppm limit = 10 ppm at 15% O2 in the permit condition;
Molar Volume = 386.8 dscf/lb-mol at 14.7 psia and 70 °F;
Molecular Weight = 17 lb/lb-mol for NH_3;
F_d = 8743 dscf/MMBtu for natural gas at 70 °F.

Sulfuric Acid Mist Emission Estimate

Note: The calculaton method is adopted from the engineering evaluation for Application 18404 when the Marsh Landing facility was initially permitted in 2010.

To calculate maximum hourly emissions:

Assumptions:
Maximum Sulfur Content of Natural Gas = 1 grain / 100 scf
SO2 convertion to Sulfuric Acid (H_2SO_4) = 55%

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
lb H2SO4/MMBtu = 0.0028 lb SO2/MMBtu x 98/64 x 0.55 = 0.00236 lb H2SO4/MMBtu

To calculate annual emissions:

Assumptions:
Aversage Sulfur Content of Natural Gas = 0.25 grain / 100 scf
SO2 convertion to Sulfuric Acid (H_2SO_4) = 55%

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 = 0.000590 lb H2SO4/MMBtu

Table B-2: TAC Emissions from Black Start - Readiness Testing

Toxic Air Contaminant	EF (lb/MMBtu)	Per Turbine Firing Rate (MMBtu/hour)	Total Firing Rate (MMBtu/year)	Hourly Emissions (lb/hour)	Annual Emissions (lb/year)
1,3-Butadiene	1.25E-07	1428	11424	3.56E-04	1.42E-03
Acetaldehyde	1.25E-03			3.58E+00	1.43E+01
Acrolein	6.75E-05			1.93E-01	7.72E-01
Ammonia	-			-	-
Benzene	2.51E-05			7.17E-02	2.87E-01
Benzo(a)anthracene	2.22E-08			6.33E-05	2.53E-04
Benzo(a)pyrene	1.36E-08			3.89E-05	1.56E-04
Benzo(b)fluoranthene	1.11E-08			3.16E-05	1.27E-04
Benzo(k)fluoranthene	1.08E-08			3.08E-05	1.23E-04
Chrysene	2.47E-08			7.06E-05	2.82E-04
Dibenz(a,h)anthracene	2.30E-08			6.58E-05	2.63E-04
Ethylbenzene	3.20E-05			9.13E-02	3.65E-01
Formaldehyde	4.54E-03			1.30E+01	5.19E+01
Hexane	2.54E-04			7.25E-01	2.90E+00
Indeno(1,2,3-cd)pyrene	2.30E-08			6.58E-05	2.63E-04
Naphthalene	1.63E-06			4.65E-03	1.86E-02
Propylene	7.56E-04			2.16E+00	8.64E+00
Propylene Oxide	4.69E-05			1.34E-01	5.35E-01
Toluene	9.63E-05			2.75E-01	1.10E+00
Xylene (Total)	2.56E-05			7.31E-02	2.92E-01
Sulfuric Acid Mist (H2SO4)	2.36E-03			6.74E+00	2.70E+01
Benzo(a)pyrene equivalents	-			1.28E-04	5.11E-04

- Per turbine firing rate is the firing rate at 60% load which corresponds to the worse case TAC emissions.
- Total firing rate is based on 8 hours of testing operation at 60% load for two turbines combined.
- Hourly emissions are based on two turbines operating simutaneouly.
- Ammonia emission is zero assuming SCR is not operating.
- Benzo(a)pyrene equivalents emissions are calculated according to District Regulation 2-5, Table 2-1-1, Footnote 8.

Table B-3: TAC Emissions from Black Start – Black Start Emergency Operation

Toxic Air Contaminant	EF (lb/MMBtu)	Per Turbine Firing Rate (MMBtu/hour)	Total Firing Rate (MMBtu/year)	Hourly Emissions (lb/hour)	Annual Emissions (lb/year)
1,3-Butadiene	1.25E-07	1428	137088	3.56E-04	1.71E-02
Acetaldehyde	1.25E-03			3.58E+00	1.72E+02
Acrolein	6.75E-05			1.93E-01	9.26E+00
Ammonia				-	-
Benzene	2.51E-05			7.17E-02	3.44E+00
Benzo(a)anthracene	2.22E-08			6.33E-05	3.04E-03
Benzo(a)pyrene	1.36E-08			3.89E-05	1.87E-03
Benzo(b)fluoranthene	1.11E-08			3.16E-05	1.52E-03
Benzo(k)fluoranthene	1.08E-08			3.08E-05	1.48E-03
Chrysene	2.47E-08			7.06E-05	3.39E-03
Dibenz(a,h)anthracene	2.30E-08			6.58E-05	3.16E-03
Ethylbenzene	3.20E-05			9.13E-02	4.38E+00
Formaldehyde	4.54E-03			1.30E+01	6.22E+02
Hexane	2.54E-04			7.25E-01	3.48E+01
Indeno(1,2,3-cd)pyrene	2.30E-08			6.58E-05	3.16E-03
Naphthalene	1.63E-06			4.65E-03	2.23E-01
Propylene	7.56E-04			2.16E+00	1.04E+02
Propylene Oxide	4.69E-05			1.34E-01	6.42E+00
Toluene	9.63E-05			2.75E-01	1.32E+01
Xylene (Total)	2.56E-05			7.31E-02	3.51E+00
Sulfuric Acid Mist (H2SO4)	2.36E-03			6.74E+00	3.24E+02
Benzo(a)pyrene equivalents	-			1.28E-04	6.14E-03

- Per turbine firing rate is the firing rate at 60% load which corresponds to the worse case TAC emissions.
- Total firing rate is based on up to a black start emgency that can last up to 48-hours and two turbines are operating simutaneouly.
- Hourly emissions are based on two turbines operating simutaneouly.
- Ammonia emission is zero assuming SCR is not operating.
- Benzo(a)pyrene equivalents emissions are calculated according to District Regulation 2-5, Table 2-1-1, Footnote 8.

Table B-4: TAC Emissions from Normal Operation - Based Load for 1752 hours/year/turbine

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 4 Turbines lb/hour	Total 4 Turbines 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	-			9.86E-05	1.73E-01	3.94E-04	6.91E-01

- Per turbine firing rate is the firing rate at 100% load.
- Formaldehyde emissions reflect 50% destruction efficiency due to oxidation catalyst.
- Benzo(a)pyrene equivalents emissions are calculated according to District Regulation 2-5, Table 2-1-1, Footnote 8.

Table B-5: TAC Emissions from Normal Operation - Based Load for 1704.7 hours/year/turbine

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 4 Turbines lb/hour	Total 4 Turbines 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	-			9.86E-05	1.68E-01	3.94E-04	6.72E-01

- Per turbine firing rate is the firing rate at 100% load.
- Formaldehyde emissions reflect 50% destruction efficiency due to oxidation catalyst.
- Benzo(a)pyrene equivalents emissions are calculated according to District Regulation 2-5, Table 2-1-1, Footnote 8.

Table B-6: TAC Emissions from Normal Operation - Startup Events for 30.6 hours/year/turbine

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 4 Turbines 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	-			1.03E-05	1.71E-03	6.84E-03

- Per turbine firing rate is the average starup firing rate.
- Typical startup time is about 11 minutes.
- Benzo(a)pyrene equivalents emissions are calculated according to District Regulation 2-5, Table 2-1-1, Footnote 8.

Table B-7: TAC Emissions from Normal Operation - Shutdown Events for 16.7 hours/year/turbine

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 4 Turbines 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	-			4.93E-06	8.23E-04	3.29E-03

- Per turbine firing rate is the average shutdown firing rate.
- Typical startup time is about 6 minutes.
- Benzo(a)pyrene equivalents emissions are calculated according to District Regulation 2-5, Table 2-1-1, Footnote 8.

Table B-8: TAC Emissions from Normal Operation - Maximum Hourly Emissions

Toxic Air Contaminant	Startup (11min) Per Turbine lb/event	Shutdown (6 min) Per Turbine lb/event	Base load Per Turbine lb/hour	Startup+Base load Per Turbine lb/hour	Shutdown+Base load Per Turbine lb/hour	1 Startup+1 Shutdown+Baseload Per Turbine lb/hour	2 Startup+1 Shutdow+Base load Per Turbine lb/hour	Max. Hourly Per Turbine lb/hour	Max. Hourly 4 Turbines 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	1.10E-03
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	3.48E+00
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	2.41E-01
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	1.23E+02
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	1.18E-01
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	1.95E-04
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	1.20E-04
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	9.76E-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	9.50E-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	2.18E-04
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	2.03E-04
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	1.56E-01
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	1.24E+01
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	2.24E+00
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	2.03E-04
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	1.43E-02
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	6.66E+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	4.13E-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	6.13E-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	2.25E-01
Sulfuric Acid Mist (H2SO4)			5.19E+00					5.19E+00	2.08E+01
Benzo(a)pyrene equivalents	1.03E-05	4.93E-06	9.86E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.86E-05	3.94E-04

Table B-9: Project TAC Emissions - Maximum Hourly Emissions

Toxic Air Contaminant	Normal Operation Max. Hourly lb/hour	Black Start Max. Hourly lb/hour	Overall Max. Hourly lb/hour
1,3-Butadiene	1.10E-03	3.56E-04	1.10E-03
Acetaldehyde	3.48E+00	3.58E+00	3.58E+00
Acrolein	2.41E-01	1.93E-01	2.41E-01
Ammonia	1.23E+02	N/A	1.23E+02
Benzene	1.18E-01	7.17E-02	1.18E-01
Benzo(a)anthracene	1.95E-04	6.33E-05	1.95E-04
Benzo(a)pyrene	1.20E-04	3.89E-05	1.20E-04
Benzo(b)fluoranthene	9.76E-05	3.16E-05	9.76E-05
Benzo(k)fluoranthene	9.50E-05	3.08E-05	9.50E-05
Chrysene	2.18E-04	7.06E-05	2.18E-04
Dibenz(a,h)anthracene	2.03E-04	6.58E-05	2.03E-04
Ethylbenzene	1.56E-01	9.13E-02	1.56E-01
Formaldehyde	1.24E+01	1.30E+01	1.30E+01
Hexane	2.24E+00	7.25E-01	2.24E+00
Indeno(1,2,3-cd)pyrene	2.03E-04	6.58E-05	2.03E-04
Naphthalene	1.43E-02	4.65E-03	1.43E-02
Propylene	6.66E+00	2.16E+00	6.66E+00
Propylene Oxide	4.13E-01	1.34E-01	4.13E-01
Toluene	6.13E-01	2.75E-01	6.13E-01
Xylene (Total)	2.25E-01	7.31E-02	2.25E-01
Sulfuric Acid Mist (H2SO4)	2.08E+01	6.74E+00	2.08E+01
Benzo(a)pyrene equivalents	3.94E-04	1.28E-04	3.94E-04

Table B-10: TAC Emissions from Normal Operation - Maximum Annual Emissions

Toxic Air Contaminant	Base load (1704.7 Hour) Per Turbine lb/year	Startup (30.6 hours) Per Turbine lb/year	Shutdown (16.7 Hours) Per Turbine lb/year	Base load (1704.7)+Startup+Shutdown Per Turbine lb/year	Base load (1752 Hours) Per Turbine lb/year	Maximum Annual Per Turbine lb/year	Total 4 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

Table B-11: Project TAC Emissions – Maximum Annual Emissions

Toxic Air Contaminant	Normal Operation 4 Turbines lb/year	Black Start 2 Turbines lb/year	Total for HRA lb/year
1,3-Butadiene	1.92E+00	1.85E-02	1.940E+00
Acetaldehyde	2.30E+03	1.86E+02	2.487E+03
Acrolein	2.94E+02	1.00E+01	3.035E+02
Ammonia	2.16E+05	0.00E+00	2.160E+05
Benzene	2.01E+02	3.73E+00	2.052E+02
Benzo(a)anthracene	3.42E-01	3.29E-03	3.452E-01
Benzo(a)pyrene	2.10E-01	2.02E-03	2.123E-01
Benzo(b)fluoranthene	1.71E-01	1.65E-03	1.726E-01
Benzo(k)fluoranthene	1.66E-01	1.60E-03	1.680E-01
Chrysene	3.81E-01	3.67E-03	3.849E-01
Dibenz(a,h)anthracene	3.56E-01	3.42E-03	3.590E-01
Ethylbenzene	2.71E+02	4.75E+00	2.756E+02
Formaldehyde	7.78E+03	6.74E+02	8.459E+03
Hexane	3.92E+03	3.77E+01	3.956E+03
Indeno(1,2,3-cd)pyrene	3.56E-01	3.42E-03	3.590E-01
Naphthalene	2.51E+01	2.42E-01	2.536E+01
Propylene	1.17E+04	1.12E+02	1.178E+04
Propylene Oxide	7.23E+02	6.96E+00	7.301E+02
Toluene	1.07E+03	1.43E+01	1.088E+03
Xylene (Total)	3.95E+02	3.80E+00	3.987E+02
Sulfuric Acid Mist (H2SO4)	9.10E+03	3.50E+02	9.447E+03
Benzo(a)pyrene equivalents	6.91E-01	6.65E-03	6.975E-01

Appendix C

Health Risk Assessment

INTEROFFICE MEMORANDUM
October 19, 2018

TO: Xuna Cai **Via:** Daphne Y. Chong
FROM: Ted Hull

SUBJECT: **Results of Health Risk Assessment (HRA) for Marsh Landing Generating Station (Antioch, CA), Black Start Capability Project, Plant #19169, Application #029169**

SUMMARY: Per your request, a health risk assessment (HRA) was performed for the above referenced permit application. The HRA estimates the health risk resulting from toxic air contaminant (TAC) emissions associated with the Black Start Capability* commissioning and readiness testing project. Project emissions include an evaluation of: Normal Operations (1704.7 hrs/yr), Startup (30.6 hrs/yr), and Shutdown (16.7 hrs/yr) for each of the (4) Combustion Turbines at the facility; and Black Start related emissions for (2) of the turbines. Black Start emissions include Commissioning (64 hrs/yr) Readiness Testing (8 hrs/yr), and (1) potential Black Start Emergency Event (48 hrs/yr). The total annual emissions for the HRA are the sum of normal operating emissions (including startups and shutdowns) for (4) turbines; and Black Start related emissions for (2) turbines. Maximum hourly emissions are the highest 1-hour emissions from any of the evaluated operating scenarios.

Results from the HRA indicate that the maximum cancer risk for the project is **0.033 in a million**, the chronic hazard index (HI) is **0.0023**, and the acute HI is **0.063**. In accordance with Regulation 2-5-302 these are acceptable project risks.

* Black Start Capability refers to the ability of a power plant to begin operating generating equipment and delivering electrical power to the grid without external electrical power assistance.

EMISSIONS – HEALTH RISK ASSESSMENT: The TAC emissions used in the HRA are the maximum annual and 1-hour emissions discussed above and provided in your spreadsheet. Project TAC emissions for each of the (4) turbines* at the facility are summarized below.

Pollutant	CAS Number	Emissions (Each Turbine)	
		lb/hour	lb/year
1,3-Butadiene	106990	2.74E-04	4.85E-01
Acetaldehyde	75070	8.96E-01	6.22E+02
Acrolein	107028	6.01E-02	7.59E+01
Ammonia	7664417	3.08E+01	5.40E+04
Benzene	71432	2.96E-02	5.13E+01
Ethyl Benzene	100414	3.89E-02	6.89E+01
Formaldehyde	50000	3.24E+00	2.11E+03
Hexane	110543	5.59E-01	9.89E+02
Naphthalene	91203	3.58E-03	6.34E+00
Propylene	115071	1.66E+00	2.94E+03
Propylene Oxide	75569	1.03E-01	1.83E+02
Toluene	108883	1.53E-01	2.72E+02
Xylenes	1330207	5.63E-02	9.97E+01
Sulfuric Acid	7664939	5.19E+00	2.36E+03
PAHs-w/o (as B(a)P equivalents)	1151	9.86E-05	1.74E-01

The HARP2 Air Dispersion Modeling and Risk Tool (ADMRT) was used to evaluate risk in the following categories: (1) Cancer Risk and (2) Chronic Hazard Index for Residential and Off-site Worker receptors; and (3) Acute Hazard Index for the maximally exposed receptor. Chronic exposure assumptions assume source operation as described above averaged into annual exposure concentrations. Acute exposure risk assumes a maximum hourly emission rate. Dispersion modeling for the ADMRT is based on unit emission rates of 1.0 grams per second for each source and determines 1-hour and annual average unit concentrations in micrograms per meter per gram per second (X/Q).

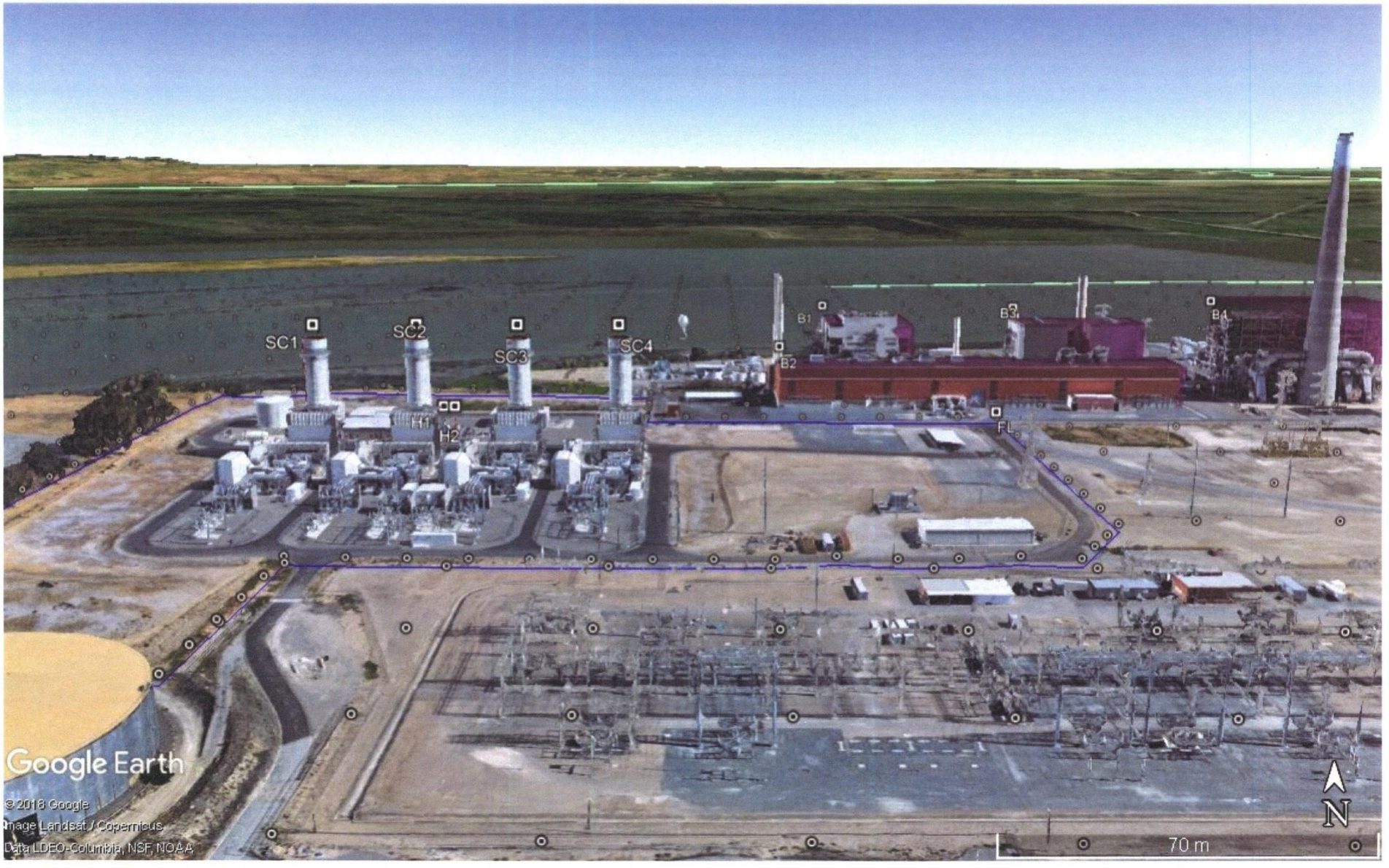
* Black Start emissions, which occur only in (2) turbines (SC3 and SC4) were averaged across all four turbines to simplify the HRA. Modeling of individual stacks for 1-hour average shows that each source has the same maximum receptor location and that the concentration impacts vary by no more than 0.1% between the four sources. It is therefore concluded that minor stack averaging does not have a significant impact for this project.

MODELING: The AERMOD air dispersion computer model was used to estimate the annual average and maximum 1-hour pollutant concentrations from the modeled sources. Model runs were made with 3 consecutive years of Contra Costa Power AERMOD ready meteorological data sets (2013-2015) prepared by BAAQMD meteorology staff. This is on-site meteorological data for the Marsh Landing Generating Station. Upper air data was taken from the Oakland International Airport station. Land use parameters including surface roughness length, albedo, and Bowen ratio were evaluated using the USEPA AERSURFACE tool. The model is referenced in NAD 83 UTM coordinates and uses terrain data from 30m resolution USGS NED files. The model includes all 4 Combustion turbines at the site: SC1, SC2, SC3, and SC4.

HEALTH RISK: Health risk estimates were calculated in accordance with the BAAQMD's Air Toxics NSR Program HRA Guidelines, dated December 2016. Estimates of residential risk assume potential exposure to annual average TAC concentrations occur 350 days per year, for 30 years. In addition, residential risk estimates assume a 95th percentile breathing rate for age groups younger than two years old, and 80th percentile breathing rate for age groups that are older than or equal to two years of age. Risk estimates for offsite workers assume potential exposure occurs 8 hours per day, 250 days per year, for 25 years. For offsite workers, the 95th percentile 8-hour breathing rate based on moderate activity was assumed. Residential cancer risk estimates include age sensitivity factors (ASFs) and fraction of time at home (FAH) adjustments. The ASFs are age-specific weighting factors used in calculating cancer risks from exposures of infants, children and adolescents, to reflect their anticipated special sensitivity to carcinogens. Since worker exposure assumptions are based on a continuously operating source, a Worker Adjustment Factor (WAF) is added in cases where source operation is not continuous to account for higher than estimated coincident exposure to source emissions. The estimated health risks for this permit application are presented in the table below.

Receptor	NAD 83 UTM Coordinates (meters)		Cancer Risk (in a million)	Chronic HI	Acute HI
	Easting (x)	Northing (y)			
Resident	610,723.5	4,206,840	0.033	0.0023	NA
Worker (WAF = 1.0)	609,823.5	4,207,540	0.0027	0.0023	NA
PMI (Max 1-hour)	600,923.5	4,200,940	NA	NA	0.063

Student risk values were not calculated because there are no K-12 schools within 1,000 feet of the source.


SC1
SC2
SC3
SC4
B1
B2
B3
B4
H1
H2
FL
Google Earth
© 2018 Google
Image Landsat / Copernicus
Data LDEO-Columbia, NSF, NOAA
70 m
N


Contours
0.004
0.008
0.012
0.016
0.02
0.024
0.028
0.032
Winter Island
Kimball Island
West Island
Antioch
Worker
Resident
Oakley
Marsh Landing G.S.
P#19169
A#029169
Resident: UTM (610,723.5 / 4,206,840)
- Cancer: 0.033 in a million
- Chronic HI: 0.0023
Worker: UTM (609,823.5 / 4,207,540)
- Cancer: 0.0027 in a million
- Chronic HI: 0.0023
Google Earth
N


Contours
0.01
0.02
0.03
0.04
0.05
0.06
Winter Island
Browns Island
Kimball Island
West Island
Jersey Island
Antioch Bridge
150
Pittsburg
Antioch
Bridgehead
Oakley
Sand Hill
Marsh Landing G.S.
P#19169
A#029169
PMI (1-hour): UTM (600,923.5 / 4,200,940)
- Acute HI: 0.083
PMI (1-hour)
Stewartville
Google Earth
5 km
N

Health Risk Analysis
Facility = Marsh Landing Generating Station, P#19169
Application #029169
Contributions at Highest Receptor

Residential Cancer Risk

"HARP - HRACalc v17023 10/18/2018 12:31:36 PM - Cancer Risk - Input File: C:\HRSA - New\P#19169\A#029169\MLGS\hra\ResCa(2)HRAInput.hra

REC	GRP	NETID	X	Y	CONC	POLID	POLABBR	RISK_SUM	SCENARK	DETAILS	INH_RISK	SOIL_RISI	DERMAL_	MMILK_RI	WATER_F	FISH_RISI	CROP_RI	BEEF_RIS	DAIRY_RI	PIG_RISK	CHICKEN_	EGG_RISI
2627	ALL		610723.5	4206840	3.55E-07	106990	1,3-Butadi	1.44E-10	30YrCance	*	1.44E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	0.000455	75070	Acetaldehy	3.08E-09	30YrCance	*	3.08E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	5.55E-05	107028	Acrolein	0.00E+00	30YrCance	*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	0.039503	7664417	NH3	0.00E+00	30YrCance	*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	3.75E-05	71432	Benzene	2.54E-09	30YrCance	*	2.54E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	5.04E-05	100414	Ethyl Benz	2.97E-10	30YrCance	*	2.97E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	0.001547	50000	Formaldeh	2.20E-08	30YrCance	*	2.20E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	0.000723	110543	Hexane	0.00E+00	30YrCance	*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	4.64E-06	91203	Naphthaler	3.76E-10	30YrCance	*	3.76E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	0.002153	115071	Propylene	0.00E+00	30YrCance	*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	0.000134	75569	Propylene	1.17E-09	30YrCance	*	1.17E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	0.000199	108883	Toluene	0.00E+00	30YrCance	*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	7.29E-05	1330207	Xylenes	0.00E+00	30YrCance	*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	0.001727	7664939	Sulfuric Ac	0.00E+00	30YrCance	*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	1.28E-07	1151	PAHs-wlo	3.57E-09	30YrCance	*	2.37E-10	2.09E-09	1.84E-10	1.05E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
								3.31E-08													

Residential Chronic HI

"HARP - HRACalc v17023 10/18/2018 12:39:54 PM - Chronic Risk - Input File: C:\HRSA - New\P#19169\A#029169\MLGS\hra\ResCh(2)HRAInput.hra

REC	GRP	NETID	X	Y	CONC	POLID	POLABBR	SCENARIO	CV	CNS	IMMUN	KIDNEY	GILV	REPRO/DI	RESP	SKIN	EYE	BONE/TEI	ENDO	BLOOD	ODOR	GENERAL
2627	ALL		610723.5	4206840	3.55E-07	106990	1,3-Butadi	NonCancer(	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.77E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	0.000455	75070	Acetaldehy	NonCancer(	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.25E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	5.55E-05	107028	Acrolein	NonCancer(	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	0.039503	7664417	NH3	NonCancer(	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.98E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	3.75E-05	71432	Benzene	NonCancer(	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E-05	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	5.04E-05	100414	Ethyl Benz	NonCancer(	0.00E+00	0.00E+00	0.00E+00	2.52E-08	2.52E-08	2.52E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.52E-08	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	0.001547	50000	Formaldeh	NonCancer(	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.72E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	0.000723	110543	Hexane	NonCancer(	0.00E+00	1.03E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	4.64E-06	91203	Naphthaler	NonCancer(	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.15E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	0.002153	115071	Propylene	NonCancer(	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.18E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	0.000134	75569	Propylene	NonCancer(	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.45E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	0.000199	108883	Toluene	NonCancer(	0.00E+00	6.63E-07	0.00E+00	0.00E+00	0.00E+00	6.63E-07	6.63E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	7.29E-05	1330207	Xylenes	NonCancer(	0.00E+00	1.04E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-07	0.00E+00	1.04E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	0.001727	7664939	Sulfuric Ac	NonCancer(	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.73E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2627	ALL		610723.5	4206840	1.28E-07	1151	PAHs-wlo	NonCancer(	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
									0.00E+00	8.71E-07	0.00E+00	2.52E-08	2.52E-08	8.86E-07	2.27E-03	0.00E+00	1.04E-07	0.00E+00	2.52E-08	1.25E-05	0.00E+00	0.00E+00

PMI (1-hour) Acute HI

"HARP - HRACalc v17023 10/18/2018 2:19:50 PM - Acute Risk - Input File: C:\HRSA - New\P#19169\A#029169\MLGS\hra\PMI(2)HRAInput.hra

REC	GRP	NETID	X	Y	CONC	POLID	POLABBR	SCENARIO	CV	CNS	IMMUN	KIDNEY	GILV	REPRO/DI	RESP	SKIN	EYE	BONE/TEI	ENDO	BLOOD	ODOR	GENERAL
5132	ALL		609923.5	4200940	0.000184	106990	1,3-Butadi	NonCancerA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.79E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+03	0.00E+00	0.00E+00
5132	ALL		609923.5	4200940	0.601484	75070	Acetaldehy	NonCancerA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-03	0.00E+00	1.28E-03	0.00E+00	0.00E+00	0.00E+03	0.00E+00	0.00E+00
5132	ALL		609923.5	4200940	0.040367	107028	Acrolein	NonCancerA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.61E-02	0.00E+00	1.61E-02	0.00E+00	0.00E+00	0.00E+03	0.00E+00	0.00E+00
5132	ALL		609923.5	4200940	20.69482	7664417	NH3	NonCancerA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.47E-03	0.00E+00	6.47E-03	0.00E+00	0.00E+00	0.00E+03	0.00E+00	0.00E+00
5132	ALL		609923.5	4200940	0.019851	71432	Benzene	NonCancerA	0.00E+00	0.00E+00	7.35E-04	0.00E+00	0.00E+00	7.35E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.35E-04	0.00E+00	0.00E+00
5132	ALL		609923.5	4200940	0.026098	100414	Ethyl Benz	NonCancerA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5132	ALL		609923.5	4200940	2.175681	50000	Formaldeh	NonCancerA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.96E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5132	ALL		609923.5	4200940	0.375347	110543	Hexane	NonCancerA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5132	ALL		609923.5	4200940	0.002406	91203	Naphthaler	NonCancerA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5132	ALL		609923.5	4200940	1.117346	115071	Propylene	NonCancerA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5132	ALL		609923.5	4200940	0.069273	75569	Propylene	NonCancerA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.23E-05	2.23E-05	0.00E+00	2.23E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5132	ALL		609923.5	4200940	0.102894	108883	Toluene	NonCancerA	0.00E+00	2.78E-06	0.00E+00	0.00E+00	0.00E+00	2.78E-06	2.78E-06	0.00E+00	2.78E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5132	ALL		609923.5	4200940	0.037825	1330207	Xylenes	NonCancerA	0.00E+00	1.72E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.72E-06	0.00E+00	1.72E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5132	ALL		609923.5	4200940	3.485386	7664939	Sulfuric Ac	NonCancerA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.90E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5132	ALL		609923.5	4200940	6.62E-05	1151	PAHs-wlo	NonCancerA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
									0.00E+00	4.50E-06	7.35E-04	0.00E+00	0.00E+00	7.61E-04	5.30E-02	0.00E+00	8.35E-02	0.00E+00	0.00E+00	7.35E-04	0.00E+00	0.00E+00

Health Risk Analysis
Facility = Marsh Landing Generating Station, P#19169
Application #029169
Contributions at Highest Receptor

Worker Cancer Risk

*HARP - HRACalc v17023 10/18/2018 2:17:46 PM - Cancer Risk - Input File: C:\HRSA - New\P#19169\A#029169\MLGS\hra\WkrCa(2)\HRAInput.hra

REC	GRP	NETID	X	Y	CONC	POLID	POLABBR	RISK_SUM	SCENARIO	DETAILS	INH_RISK	SOIL_RISK	DERMAL_	MMILK_RI	WATER_F	FISH_RISK	CROP_RIS	BEEF_RIS	DAIRY_RI	PIG_RISK	CHICKEN_	EGG_RISK
3003	ALL		609823.5	4207540	3.56E-07	106990	1,3-Butadi	1.20E-11	25YrCancr	*	1.20E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	0.000456	75070	Acetaldehy	2.57E-10	25YrCancr	*	2.57E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	5.57E-05	107028	Acrolein	0.00E+00	25YrCancr	*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	0.039612	7664417	NH3	0.00E+00	25YrCancr	*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	3.76E-05	71432	Benzene	2.12E-10	25YrCancr	*	2.12E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	5.05E-05	100414	Ethyl Benz	2.47E-11	25YrCancr	*	2.47E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	0.001551	50000	Formaldeh	1.83E-09	25YrCancr	*	1.83E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	0.000725	110543	Hexane	0.00E+00	25YrCancr	*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	4.65E-06	91203	Naphthalen	3.14E-11	25YrCancr	*	3.14E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	0.002159	115071	Propylene	0.00E+00	25YrCancr	*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	0.000134	75569	Propylene	9.79E-11	25YrCancr	*	9.79E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	0.0002	108883	Toluene	0.00E+00	25YrCancr	*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	7.31E-05	1330207	Xylenes	0.00E+00	25YrCancr	*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	0.001732	7664939	Sulfuric Ac	0.00E+00	25YrCancr	*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	1.28E-07	1151	PAHs-w/o	1.86E-10	25YrCancr	*	2.07E-11	8.84E-11	7.66E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
								2.65E-09														

Worker Chronic HI

*HARP - HRACalc v17023 10/18/2018 2:18:44 PM - Chronic Risk - Input File: C:\HRSA - New\P#19169\A#029169\MLGS\hra\WkrCh(2)\HRAInput.hra

REC	GRP	NETID	X	Y	CONC	POLID	POLABBR	SCENARIO	CV	CNS	IMMUN	KIDNEY	GILV	REPROVDI	RESP	SKIN	EYE	BONE/TEE	ENDO	BLOOD	ODOR	GENERAL
3003	ALL		609823.5	4207540	3.56E-07	106990	1,3-Butadi	NonCance	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.78E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	0.000456	75070	Acetaldehy	NonCance	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.26E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	5.57E-05	107028	Acrolein	NonCance	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.59E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	0.039612	7664417	NH3	NonCance	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.98E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	3.76E-05	71432	Benzene	NonCance	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E-05	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	5.05E-05	100414	Ethyl Benz	NonCance	0.00E+00	0.00E+00	0.00E+00	2.53E-08	2.53E-08	2.53E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.53E-08	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	0.001551	50000	Formaldeh	NonCance	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.72E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	0.000725	110543	Hexane	NonCance	0.00E+00	1.04E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	4.65E-06	91203	Naphthalen	NonCance	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.17E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	0.002159	115071	Propylene	NonCance	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.20E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	0.000134	75569	Propylene	NonCance	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.46E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	0.0002	108883	Toluene	NonCance	0.00E+00	6.65E-07	0.00E+00	0.00E+00	0.00E+00	6.65E-07	6.65E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	7.31E-05	1330207	Xylenes	NonCance	0.00E+00	1.04E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-07	0.00E+00	1.04E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	0.001732	7664939	Sulfuric Ac	NonCance	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.73E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3003	ALL		609823.5	4207540	1.28E-07	1151	PAHs-w/o	NonCance	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
									0.00E+00	8.73E-07	0.00E+00	2.53E-08	2.53E-08	8.68E-07	2.27E-03	0.00E+00	1.04E-07	0.00E+00	2.53E-08	1.25E-05	0.00E+00	0.00E+00

Marsh Landing Generating Station
Plant No. 19169
Application No. 29169
BAAQMD September 2018

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	Non-Black Start	Black Start		
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 Four Turbines lb/year	Total Two Turbines lb/year	Total for HRA lb/year	HRA Total Per Turbine 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	1.85E-02	1.940E+00	4.85E-01
Acetaldehyde	5.04E+02	4.80E+01	2.31E+01	5.75E+02	5.18E+02	5.75E+02	2.30E+03	1.86E+02	2.487E+03	6.22E+02
Acrolein	6.96E+01	2.58E+00	1.24E+00	7.34E+01	7.15E+01	7.34E+01	2.94E+02	1.00E+01	3.035E+02	7.59E+01
Ammonia	5.26E+04	5.35E+02	2.57E+02	5.33E+04	5.40E+04	5.40E+04	2.16E+05	0.00E+00	2.160E+05	5.40E+04
Benzene	4.89E+01	9.59E-01	4.61E-01	5.04E+01	5.03E+01	5.04E+01	2.01E+02	3.73E+00	2.052E+02	5.13E+01
Benzo(a)anthracene	8.32E-02	8.47E-04	4.07E-04	8.44E-02	8.55E-02	8.55E-02	3.42E-01	3.29E-03	3.452E-01	8.63E-02
Benzo(a)pyrene	5.12E-02	5.21E-04	2.51E-04	5.19E-02	5.26E-02	5.26E-02	2.10E-01	2.02E-03	2.123E-01	5.31E-02
Benzo(b)fluoranthene	4.16E-02	4.23E-04	2.04E-04	4.22E-02	4.27E-02	4.27E-02	1.71E-01	1.65E-03	1.726E-01	4.32E-02
Benzo(k)fluoranthene	4.05E-02	4.12E-04	1.98E-04	4.11E-02	4.16E-02	4.16E-02	1.66E-01	1.60E-03	1.680E-01	4.20E-02
Chrysene	9.27E-02	9.44E-04	4.54E-04	9.41E-02	9.53E-02	9.53E-02	3.81E-01	3.67E-03	3.849E-01	9.62E-02
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	3.42E-03	3.590E-01	8.97E-02
Ethylbenzene	6.59E+01	1.22E+00	5.88E-01	6.77E+01	6.77E+01	6.77E+01	2.71E+02	4.75E+00	2.756E+02	6.89E+01
Formaldehyde	1.69E+03	1.73E+02	8.35E+01	1.95E+03	1.74E+03	1.95E+03	7.78E+03	6.74E+02	8.459E+03	2.11E+03
Hexane	9.53E+02	9.70E+00	4.67E+00	9.68E+02	9.80E+02	9.80E+02	3.92E+03	3.77E+01	3.956E+03	9.89E+02
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	3.42E-03	3.590E-01	8.97E-02
Naphthalene	6.11E+00	6.22E-02	2.99E-02	6.20E+00	6.28E+00	6.28E+00	2.51E+01	2.42E-01	2.536E+01	6.34E+00
Propylene	2.84E+03	2.89E+01	1.39E+01	2.88E+03	2.92E+03	2.92E+03	1.17E+04	1.12E+02	1.178E+04	2.94E+03
Propylene Oxide	1.76E+02	1.79E+00	8.62E-01	1.79E+02	1.81E+02	1.81E+02	7.23E+02	6.96E+00	7.301E+02	1.83E+02
Toluene	2.61E+02	3.68E+00	1.77E+00	2.67E+02	2.69E+02	2.69E+02	1.07E+03	1.43E+01	1.088E+03	2.72E+02
Xylene (Total)	9.61E+01	9.78E-01	4.70E-01	9.75E+01	9.87E+01	9.87E+01	3.95E+02	3.80E+00	3.987E+02	9.97E+01
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	3.50E+02	9.447E+03	2.36E+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	6.65E-03	6.975E-01	1.74E-01
Specified PAHs	4.82E-01	4.91E-03	2.36E-03	4.89E-01	4.95E-01	4.95E-01	1.98E+00	1.91E-02	2.001E+00	5.00E-01

This spreadsheet summarizes emissions for Normal Operations (1704.7 hours/year), Startup (30.6 hours/year), Shutdown (16.7 hours/year), and Black Start Related Activities.
The maximum value for Total Per Turbine compares the value that includes Startups and Shutdowns to the value that assumes continuous operation for 1752 hours per year.
The Non-Black Start Total Foour Turbines annual emissions are based on the maximum value calculated.

The Black Start Total Two Turbines Annual Emissions are sum of Black Start Testing Annual Emission and Emissions from 48-hour Black Start Emergnecy Operation.
The Total Annual Emissions for HRA are the sum of Non-Black Start Total Four Turbines Annual Emissions and Black Start Two Turbines Annual Emissions.

Marsh Landing Generating Station
Plant No. 19169
Application No. 29169
BAAQMD September 2018

Maximum Hourly Toxic Air Contaminant Emissions

Toxic Air Contaminant	Non-Black Start Hourly lb/hour	Black Start Hourly lb/hour	Max. Hourly lb/hour	HRA Total Per Turbine lb/hour
1,3-Butadiene	1.10E-03	3.56E-04	1.10E-03	2.74E-04
Acetaldehyde	3.48E+00	3.58E+00	3.58E+00	8.96E-01
Acrolein	2.41E-01	1.93E-01	2.41E-01	6.01E-02
Ammonia	1.23E+02	N/A	1.23E+02	3.08E+01
Benzene	1.18E-01	7.17E-02	1.18E-01	2.96E-02
Benzo(a)anthracene	1.95E-04	6.33E-05	1.95E-04	4.88E-05
Benzo(a)pyrene	1.20E-04	3.89E-05	1.20E-04	3.00E-05
Benzo(b)fluoranthene	9.76E-05	3.16E-05	9.76E-05	2.44E-05
Benzo(k)fluoranthene	9.50E-05	3.08E-05	9.50E-05	2.37E-05
Chrysene	2.18E-04	7.06E-05	2.18E-04	5.44E-05
Dibenz(a,h)anthracene	2.03E-04	6.58E-05	2.03E-04	5.07E-05
Ethylbenzene	1.56E-01	9.13E-02	1.56E-01	3.89E-02
Formaldehyde	1.24E+01	1.30E+01	1.30E+01	3.24E+00
Hexane	2.24E+00	7.25E-01	2.24E+00	5.59E-01
Indeno(1,2,3-cd)pyrene	2.03E-04	6.58E-05	2.03E-04	5.07E-05
Naphthalene	1.43E-02	4.65E-03	1.43E-02	3.58E-03
Propylene	6.66E+00	2.16E+00	6.66E+00	1.66E+00
Propylene Oxide	4.13E-01	1.34E-01	4.13E-01	1.03E-01
Toluene	6.13E-01	2.75E-01	6.13E-01	1.53E-01
Xylene (Total)	2.25E-01	7.31E-02	2.25E-01	5.63E-02
Sulfuric Acid Mist (H2SO4)	2.08E+01	6.74E+00	2.08E+01	5.19E+00
Benzo(a)pyrene equivalents	3.94E-04	1.28E-04	3.94E-04	9.86E-05
Specified PAHs	1.13E-03	3.67E-04	1.13E-03	2.83E-04

HARP2 - HRACalc (dated 17023) 10/18/2018 12:31:36 PM - Output Log

GLCs loaded successfully
Pollutants loaded successfully
Pathway receptors loaded successfully
****
RISK SCENARIO SETTINGS

Receptor Type: Resident
Scenario: Cancer
Calculation Method: Derived

****
EXPOSURE DURATION PARAMETERS FOR CANCER

Start Age: -0.25
Total Exposure Duration: 30

Exposure Duration Bin Distribution
3rd Trimester Bin: 0.25
0<2 Years Bin: 2
2<9 Years Bin: 0
2<16 Years Bin: 14
16<30 Years Bin: 14
16 to 70 Years Bin: 0

****
PATHWAYS ENABLED

NOTE: Inhalation is always enabled and used for all assessments. The remaining pathways are only used for cancer and noncancer chronic assessments.

Inhalation: True
Soil: True
Dermal: True
Mother's milk: True
Water: False
Fish: False
Homegrown crops: False
Beef: False
Dairy: False
Pig: False
Chicken: False
Egg: False

****
INHALATION

Daily breathing rate: RMP

Worker Adjustment Factors
Worker adjustment factors enabled: NO

Fraction at time at home
3rd Trimester to 16 years: OFF
16 years to 70 years: ON

****
SOIL & DERMAL PATHWAY SETTINGS

Deposition rate (m/s): 0.02
Soil mixing depth (m): 0.01
Dermal climate: Mixed

****
TIER 2 SETTINGS
Tier2 not used.

****

Calculating cancer risk
Cancer risk breakdown by pollutant and receptor saved to: C:\HRSA - New\P#19169\A#029169\MLGS\hra\ResCa(2)CancerRisk.csv
Cancer risk total by receptor saved to: C:\HRSA - New\P#19169\A#029169\MLGS\hra\ResCa(2)CancerRiskSumByRec.csv
HRA ran successfully

```
HARP2 - HRACalc (dated 17023) 10/18/2018 12:39:54 PM - Output Log

GLCs loaded successfully
Pollutants loaded successfully
Pathway receptors loaded successfully
**********
RISK SCENARIO SETTINGS

Receptor Type: Resident
Scenario: NCChronic
Calculation Method: Derived

**********
EXPOSURE DURATION PARAMETERS FOR CANCER
**Exposure duration are only adjusted for cancer assessments**

**********
PATHWAYS ENABLED

NOTE: Inhalation is always enabled and used for all assessments.  The remaining pathways are only used for cancer
and noncancer chronic assessments.

Inhalation: True
Soil: True
Dermal: True
Mother's milk: True
Water: False
Fish: False
Homegrown crops: False
Beef: False
Dairy: False
Pig: False
Chicken: False
Egg: False

**********
INHALATION

Daily breathing rate: LongTerm24HR

**Worker Adjustment Factors**
Worker adjustment factors enabled: NO

**Fraction at time at home**
NOTE: Exposure duration (i.e., start age, end age, ED, & FAH) are only adjusted for cancer assessments.

**********
SOIL & DERMAL PATHWAY SETTINGS

Deposition rate (m/s): 0.02
Soil mixing depth (m): 0.01
Dermal climate: Mixed

**********
TIER 2 SETTINGS
Tier2 not used.

**********

Calculating chronic risk
Chronic risk breakdown by pollutant and receptor saved to: C:\HRSA -
New\P#19169\A#029169\MLGS\hra\ResCh(2)NCChronicRisk.csv
Chronic risk total by receptor saved to: C:\HRSA - New\P#19169\A#029169\MLGS\hra\ResCh(2)NCChronicRiskSumByRec.csv
HRA ran successfully
```

```
HARP2 - HRACalc (dated 17023) 10/18/2018 2:17:46 PM - Output Log

GLCs loaded successfully
Pollutants loaded successfully
Pathway receptors loaded successfully
**********
RISK SCENARIO SETTINGS

Receptor Type: Worker
Scenario: Cancer
Calculation Method: Derived

**********
EXPOSURE DURATION PARAMETERS FOR CANCER

Start Age: 16
Total Exposure Duration: 25

Exposure Duration Bin Distribution
3rd Trimester Bin: 0
0<2 Years Bin: 0
2<9 Years Bin: 0
2<16 Years Bin: 0
16<30 Years Bin: 0
16 to 70 Years Bin: 25

**********
PATHWAYS ENABLED

NOTE: Inhalation is always enabled and used for all assessments.  The remaining pathways are only used for cancer
and noncancer chronic assessments.

Inhalation: True
Soil: True
Dermal: True
Mother's milk: False
Water: False
Fish: False
Homegrown crops: False
Beef: False
Dairy: False
Pig: False
Chicken: False
Egg: False

**********
INHALATION

Daily breathing rate: Moderate8HR

**Worker Adjustment Factors**
Worker adjustment factors enabled: NO

**Fraction at time at home**
3rd Trimester to 16 years: OFF
16 years to 70 years: OFF

**********
SOIL & DERMAL PATHWAY SETTINGS

Deposition rate (m/s): 0.02
Soil mixing depth (m): 0.01
Dermal climate: Mixed

**********
TIER 2 SETTINGS
Tier2 not used.

**********

Calculating cancer risk
Cancer risk breakdown by pollutant and receptor saved to: C:\HRSA -
New\P#19169\A#029169\MLGS\hra\WkrCa(2)CancerRisk.csv
Cancer risk total by receptor saved to: C:\HRSA - New\P#19169\A#029169\MLGS\hra\WkrCa(2)CancerRiskSumByRec.csv
HRA ran successfully
```

```
HARP2 - HRACalc (dated 17023) 10/18/2018 2:18:44 PM - Output Log

GLCs loaded successfully
Pollutants loaded successfully
Pathway receptors loaded successfully
**********
RISK SCENARIO SETTINGS

Receptor Type: Worker
Scenario: NCChronic
Calculation Method: Derived

**********
EXPOSURE DURATION PARAMETERS FOR CANCER
**Exposure duration are only adjusted for cancer assessments**

**********
PATHWAYS ENABLED

NOTE: Inhalation is always enabled and used for all assessments.  The remaining pathways are only used for cancer
and noncancer chronic assessments.

Inhalation: True
Soil: True
Dermal: True
Mother's milk: False
Water: False
Fish: False
Homegrown crops: False
Beef: False
Dairy: False
Pig: False
Chicken: False
Egg: False

**********
INHALATION

Daily breathing rate: Moderate8HR

**Worker Adjustment Factors**
Worker adjustment factors enabled: NO

**Fraction at time at home**
NOTE: Exposure duration (i.e., start age, end age, ED, & FAH) are only adjusted for cancer assessments.

**********
SOIL & DERMAL PATHWAY SETTINGS

Deposition rate (m/s): 0.02
Soil mixing depth (m): 0.01
Dermal climate: Mixed

**********
TIER 2 SETTINGS
Tier2 not used.

**********

Calculating chronic risk
Chronic risk breakdown by pollutant and receptor saved to: C:\HRSA -
New\P#19169\A#029169\MLGS\hra\WkrCh(2)NCChronicRisk.csv
Chronic risk total by receptor saved to: C:\HRSA - New\P#19169\A#029169\MLGS\hra\WkrCh(2)NCChronicRiskSumByRec.csv
HRA ran successfully
```

```
HARP2 - HRACalc (dated 17023) 10/18/2018 2:19:50 PM - Output Log

GLCs loaded successfully
Pollutants loaded successfully
Pathway receptors loaded successfully
**********
RISK SCENARIO SETTINGS

Receptor Type: Worker
Scenario: NCAcute
Calculation Method: Derived

**********
EXPOSURE DURATION PARAMETERS FOR CANCER
**Exposure duration are only adjusted for cancer assessments**

**********
PATHWAYS ENABLED

NOTE: Inhalation is always enabled and used for all assessments.  The remaining pathways are only used for cancer
and noncancer chronic assessments.

Inhalation: True
Soil: False
Dermal: False
Mother's milk: False
Water: False
Fish: False
Homegrown crops: False
Beef: False
Dairy: False
Pig: False
Chicken: False
Egg: False

**********
INHALATION

Daily breathing rate: Moderate8HR

**Worker Adjustment Factors**
Worker adjustment factors enabled: NO

**Fraction at time at home**
NOTE: Exposure duration (i.e., start age, end age, ED, & FAH) are only adjusted for cancer assessments.

**********
TIER 2 SETTINGS
Tier2 not used.

**********

Calculating acute risk
Acute risk breakdown by pollutant and receptor saved to: C:\HRSA -
New\P#19169\A#029169\MLGS\hra\PMI(2)NCAcuteRisk.csv
Acute risk total by receptor saved to: C:\HRSA - New\P#19169\A#029169\MLGS\hra\PMI(2)NCAcuteRiskSumByRec.csv
HRA ran successfully
```

HARP Project Summary Report 10/19/2018 9:30:46 AM

PROJECT INFORMATION
HARP Version: 18159
Project Name: MLGS
Project Output Directory: C:\HRSA - New\P#19169\A#029169\MLGS
HARP Database: NA

FACILITY INFORMATION
Origin
X (m):608423.5
Y (m):4208439.5
Zone:10
No. of Sources:0
No. of Buildings:0

EMISSION INVENTORY
No. of Pollutants:60
No. of Background Pollutants:0

Emissions

ScrID	StkID	ProID	PolID	PolAbbrev	Multi	Annual Ems (lbs/yr)	MaxHr Ems (lbs/hr)	MWAF
SC1	0	0	106990	1,3-Butadiene	1	0.484969671	0.000274171	1
SC1	0	0	75070	Acetaldehyde	1	621.8071724	0.896	1
SC1	0	0	107028	Acrolein	1	75.88641485	0.060133288	1
SC1	0	0	7664417	NH3	1	54010.656	30.828	1
SC1	0	0	71432	Benzene	1	51.29849018	0.029570614	1
SC1	0	0	100414	Ethyl Benzene	1	68.88907294	0.038876889	1
SC1	0	0	50000	Formaldehyde	1	2114.666527	3.241	1
SC1	0	0	110543	Hexane	1	989.0326353	0.559135294	1
SC1	0	0	91203	Naphthalene	1	6.338973647	0.003583647	1
SC1	0	0	115071	Propylene	1	2944.185953	1.664452941	1
SC1	0	0	75569	Propylene Oxide	1	182.5318918	0.103191765	1
SC1	0	0	108883	Toluene	1	272.1148565	0.153276471	1
SC1	0	0	1330207	Xylenes	1	99.66699529	0.056345294	1
SC1	0	0	7664939	Sulfuric Acid	1	2361.856488	5.192	1
SC1	0	0	1151	PAHs-w/o	1	0.174386692	9.86E-05	1
SC2	0	0	106990	1,3-Butadiene	1	0.484969671	0.000274171	1
SC2	0	0	75070	Acetaldehyde	1	621.8071724	0.896	1
SC2	0	0	107028	Acrolein	1	75.88641485	0.060133288	1
SC2	0	0	7664417	NH3	1	54010.656	30.828	1
SC2	0	0	71432	Benzene	1	51.29849018	0.029570614	1
SC2	0	0	100414	Ethyl Benzene	1	68.88907294	0.038876889	1
SC2	0	0	50000	Formaldehyde	1	2114.666527	3.241	1
SC2	0	0	110543	Hexane	1	989.0326353	0.559135294	1
SC2	0	0	91203	Naphthalene	1	6.338973647	0.003583647	1
SC2	0	0	115071	Propylene	1	2944.185953	1.664452941	1
SC2	0	0	75569	Propylene Oxide	1	182.5318918	0.103191765	1
SC2	0	0	108883	Toluene	1	272.1148565	0.153276471	1
SC2	0	0	1330207	Xylenes	1	99.66699529	0.056345294	1
SC2	0	0	7664939	Sulfuric Acid	1	2361.856488	5.192	1
SC2	0	0	1151	PAHs-w/o	1	0.174386692	9.86E-05	1
SC3	0	0	106990	1,3-Butadiene	1	0.484969671	0.000274171	1
SC3	0	0	75070	Acetaldehyde	1	621.8071724	0.896	1
SC3	0	0	107028	Acrolein	1	75.88641485	0.060133288	1
SC3	0	0	7664417	NH3	1	54010.656	30.828	1
SC3	0	0	71432	Benzene	1	51.29849018	0.029570614	1
SC3	0	0	100414	Ethyl Benzene	1	68.88907294	0.038876889	1
SC3	0	0	50000	Formaldehyde	1	2114.666527	3.241	1

POLLUTANT HEALTH INFORMATION
Health Database: C:\HARP2\Tables\HEALTH17320.mdb
Health Table Version: HEALTH18232
Official: True

PolID	PolAbbrev	InhCancer	OralCancer	AcuteREL	InhChronicREL	OralChronicREL	InhChronic8HRREL
106990	1,3-Butadiene	0.6		660	2		9
75070	Acetaldehyde	0.01		470	140		300
107028	Acrolein			2.5	0.35		0.7
7664417	NH3			3200	200		
71432	Benzene	0.1		27	3		3
100414	Ethyl Benzene	0.0087			2000		
50000	Formaldehyde	0.021		55	9		9
110543	Hexane				7000		
91203	Naphthalene	0.12			9		
115071	Propylene				3000		
75569	Propylene Oxide	0.013		3100	30		
108883	Toluene			37000	300		
1330207	Xylenes			22000	700		
7664939	Sulfuric Acid			120	1		
1151	PAHs-w/o	3.9	12				

```
**BEE-Line Software:  (Version 11.11) data input file
**  Model: AERMOD.EXE     Input File Creation Date: 9/20/2018  Time: 5:07:00 PM
NO ECHO




  BEE-Line AERMOD "BEEST" Version ****

  Input File - C:\HRSA - New\P#19169\A#029169\Project_3yrs_OTHER.DTA

 Output File - C:\HRSA - New\P#19169\A#029169\Project_3yrs_OTHER.LST

    Met File - C:\HRSA - New\AERMET-New\CC_POWER_2013_2015.SFC

 ************************************
 *** SETUP Finishes Successfully ***
 ************************************
```

*** MODELOPTs: RegDFAULT CONC ELEV NODRYDPLT NOWETDPLT RURAL

*** 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.
**Other Options Specified:
TEMP_Sub - Meteorological data includes TEMP substitutions
**Model Assumes No FLAGPOLE Receptor Heights.
**The User Specified a Pollutant Type of: OTHER
**Model Calculates 1 Short Term Average(s) of: 1-HR
and Calculates PERIOD Averages

**This Run Includes: 4 Source(s); 4 Source Group(s); and 8599 Receptor(s)
with: 4 POINT(s), including
0 POINTCAP(s) and 0 POINTHOR(s)
and: 0 VOLUME source(s)
and: 0 AREA type source(s)
and: 0 LINE source(s)
and: 0 OPENPIT source(s)
and: 0 BUOYANT LINE source(s) with 0 line(s)

**Model Set To Continue RUNning After the Setup Testing.
**The AERMET Input Meteorological Data Version Date: 18081

**Output Options Selected:
Model Outputs Tables of PERIOD Averages by Receptor
Model Outputs Tables of Highest Short Term Values by Receptor (RECTABLE Keyword)
Model Outputs External File(s) of High Values for Plotting (PLOTFILE Keyword)
Model Outputs Separate Summary File of High Ranked Values (SUMMFILE Keyword)

**NOTE: The Following Flags May Appear Following CONC Values: c for Calm Hours
m for Missing Hours
b for Both Calm and Missing Hours

**Misc. Inputs: Base Elev. for Pot. Temp. Profile (m MSL) = 3.00 ; Decay Coef. = 0.000 ; Rot. Angle = 0.0
Emission Units = GRAMS/SEC ; Emission Rate Unit Factor = 0.10000E+07
Output Units = MICROGRAMS/M**3

```
**Approximate Storage Requirements of Model =       5.6 MB of RAM.
**Input Runstream File:          Project_3yrs_OTHER.DTA
**Output Print File:             Project_3yrs_OTHER.LST

**File for Summary of Results:   C:\HRSA - New\P#19169\A#029169\Project_3yrs_OTHER.SUM

                                        *** 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   0.10000E+01  608338.0 4208437.0       4.8    50.29   672.04    14.97     9.55    NO       NO    NO
 SC2             0   0.10000E+01  608381.1 4208438.5       3.8    50.29   672.04    14.97     9.55    NO       NO    NO
 SC3             0   0.10000E+01  608423.5 4208439.5       3.1    50.29   672.04    14.97     9.55    NO       NO    NO
 SC4             0   0.10000E+01  608466.2 4208440.9       2.9    50.29   672.04    14.97     9.55    NO       NO    NO

                                   *** SOURCE IDs DEFINING SOURCE GROUPS ***

SRCGROUP ID                                             SOURCE IDs
-----------                                             ----------

  SC1        SC1        ,
  SC2        SC2        ,
  SC3        SC3        ,
  SC4        SC4        ,

                                        *** METEOROLOGICAL DAYS SELECTED FOR PROCESSING ***
                                                           (1=YES; 0=NO)

          1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
          1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
          1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
          1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
          1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
          1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
          1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1 1
          1 1 1 1 1 1 1 1 1 1  1 1 1 1 1

            NOTE:  METEOROLOGICAL DATA ACTUALLY PROCESSED WILL ALSO DEPEND ON WHAT IS INCLUDED IN THE DATA FILE.
```

*** UPPER BOUND OF FIRST THROUGH FIFTH WIND SPEED CATEGORIES ***
(METERS/SEC)

1.54, 3.09, 5.14, 8.23, 10.80,

*** UP TO THE FIRST 24 HOURS OF METEOROLOGICAL DATA ***

Surface file: CC_POWER_2013_2015.SFC Met Version: 18081
Profile file: CC_POWER_2013_2015.PFL
Surface format: FREE
Profile format: FREE
Surface station no.: 23254 Upper air station no.: 23230
Name: CONCORD/BUCHANAN, CA Name: UNKNOWN
Year: 2013 Year: 2013

First 24 hours of scalar data

YR	MO	DY	JDY	HR	HO	U*	W*	DT/DZ	ZICNV	ZIMCH	M-O LEN	Z0	BOWEN	ALBEDO	REF WS	WD	HT	REF TA	HT
13	01	01	1	01	-3.9	0.080	-9.000	-9.000	-999.	54.	11.9	0.36	0.94	1.00	1.60	118.	20.0	275.6	20.0
13	01	01	1	02	-1.4	0.047	-9.000	-9.000	-999.	25.	6.7	0.43	0.94	1.00	0.90	257.	20.0	275.4	20.0
13	01	01	1	03	-999.0	-9.000	-9.000	-9.000	-999.	-999.	-99999.0	0.22	0.94	1.00	0.00	0.	20.0	274.9	20.0
13	01	01	1	04	-1.8	0.056	-9.000	-9.000	-999.	32.	8.6	0.03	0.94	1.00	1.80	332.	20.0	275.5	20.0
13	01	01	1	05	-1.1	0.043	-9.000	-9.000	-999.	22.	6.7	0.03	0.94	1.00	1.40	327.	20.0	276.6	20.0
13	01	01	1	06	-0.4	0.031	-9.000	-9.000	-999.	13.	6.3	0.43	0.94	1.00	0.60	252.	20.0	276.8	20.0
13	01	01	1	07	-3.4	0.065	-9.000	-9.000	-999.	40.	7.3	0.03	0.94	1.00	2.10	326.	20.0	276.5	20.0
13	01	01	1	08	-2.4	0.056	-9.000	-9.000	-999.	32.	6.5	0.03	0.94	0.74	1.80	328.	20.0	276.2	20.0
13	01	01	1	09	0.0	0.009	-9.000	-9.000	-999.	6.	2.1	0.03	0.94	0.38	0.30	285.	20.0	276.9	20.0
13	01	01	1	10	49.4	0.057	0.557	0.005	127.	32.	-1.0	0.03	0.94	0.26	0.40	274.	20.0	278.4	20.0
13	01	01	1	11	82.5	0.121	0.854	0.005	275.	101.	-2.0	0.03	0.94	0.21	1.20	301.	20.0	279.6	20.0
13	01	01	1	12	101.2	0.200	1.263	0.008	728.	215.	-7.2	0.03	0.94	0.20	2.40	349.	20.0	280.9	20.0
13	01	01	1	13	102.3	0.227	1.359	0.008	895.	259.	-10.4	0.05	0.94	0.19	2.60	22.	20.0	282.1	20.0
13	01	01	1	14	88.5	0.224	1.307	0.007	922.	254.	-11.6	0.05	0.94	0.20	2.60	25.	20.0	282.9	20.0
13	01	01	1	15	58.3	0.165	1.145	0.007	940.	162.	-7.1	0.05	0.94	0.24	1.80	17.	20.0	283.4	20.0
13	01	01	1	16	14.7	0.171	0.726	0.007	944.	170.	-31.1	0.05	0.94	0.32	2.20	31.	20.0	283.4	20.0
13	01	01	1	17	-0.3	0.020	-9.000	-9.000	-999.	77.	2.5	0.05	0.94	0.57	0.60	37.	20.0	282.9	20.0
13	01	01	1	18	-0.4	0.026	-9.000	-9.000	-999.	16.	3.8	0.43	0.94	1.00	0.50	248.	20.0	280.6	20.0
13	01	01	1	19	-999.0	-9.000	-9.000	-9.000	-999.	-999.	-99999.0	0.22	0.94	1.00	0.00	0.	20.0	278.9	20.0
13	01	01	1	20	-1.8	0.051	-9.000	-9.000	-999.	28.	6.9	0.27	0.94	1.00	1.10	202.	20.0	277.8	20.0
13	01	01	1	21	-0.4	0.023	-9.000	-9.000	-999.	9.	3.1	0.27	0.94	1.00	0.50	196.	20.0	277.8	20.0
13	01	01	1	22	-0.3	0.019	-9.000	-9.000	-999.	6.	2.0	0.03	0.94	1.00	0.60	318.	20.0	277.0	20.0
13	01	01	1	23	-999.0	-9.000	-9.000	-9.000	-999.	-999.	-99999.0	0.22	0.94	1.00	0.00	0.	20.0	275.5	20.0
13	01	01	1	24	-0.1	0.010	-9.000	-9.000	-999.	2.	1.1	0.05	0.94	1.00	0.30	26.	20.0	275.4	20.0

First hour of profile data

YR	MO	DY	HR	HEIGHT	F	WDIR	WSPD	AMB_TMP	sigmaA	sigmaW	sigmaV
13	01	01	01	20.0	1	118.	1.60	275.7	29.4	-99.00	0.72

F indicates top of profile (=1) or below (=0)

*** THE SUMMARY OF MAXIMUM PERIOD (26280 HRS) RESULTS ***
** CONC OF OTHER IN MICROGRAMS/M**3 **

GROUP ID		AVERAGE CONC	RECEPTOR (XR, YR, ZELEV, ZHILL, ZFLAG)	OF TYPE	NETWORK GRID-ID
SC1	1ST HIGHEST VALUE IS	0.01277 AT (609523.50, 4207640.00, 16.75, 16.75, 0.00)	DC		
	2ND HIGHEST VALUE IS	0.01276 AT (609723.50, 4207540.00, 6.85, 6.85, 0.00)	DC		
	3RD HIGHEST VALUE IS	0.01275 AT (609823.50, 4207440.00, 6.87, 6.87, 0.00)	DC		
SC2	1ST HIGHEST VALUE IS	0.01276 AT (609923.50, 4207440.00, 6.97, 6.97, 0.00)	DC		
	2ND HIGHEST VALUE IS	0.01275 AT (609523.50, 4207740.00, 14.11, 14.11, 0.00)	DC		
	3RD HIGHEST VALUE IS	0.01275 AT (609823.50, 4207540.00, 6.73, 6.73, 0.00)	DC		
SC3	1ST HIGHEST VALUE IS	0.01277 AT (609823.50, 4207540.00, 6.73, 6.73, 0.00)	DC		
	2ND HIGHEST VALUE IS	0.01276 AT (609523.50, 4207740.00, 14.11, 14.11, 0.00)	DC		
	3RD HIGHEST VALUE IS	0.01276 AT (609923.50, 4207440.00, 6.97, 6.97, 0.00)	DC		
SC4	1ST HIGHEST VALUE IS	0.01276 AT (610023.50, 4207440.00, 6.85, 6.85, 0.00)	DC		
	2ND HIGHEST VALUE IS	0.01276 AT (609823.50, 4207540.00, 6.73, 6.73, 0.00)	DC		
	3RD HIGHEST VALUE IS	0.01275 AT (609723.50, 4207640.00, 6.81, 6.81, 0.00)	DC		

*** THE SUMMARY OF HIGHEST 1-HR RESULTS ***
** CONC OF OTHER IN MICROGRAMS/M**3 **

GROUP ID		AVERAGE CONC	DATE (YYMMDDHH)	RECEPTOR (XR, YR, ZELEV, ZHILL, ZFLAG)	OF TYPE	NETWORK GRID-ID
SC1	HIGH 1ST HIGH VALUE IS	1.33070	ON 14120703: AT (600923.50, 4200940.00, 307.58, 1077.83, 0.00)	DC		
SC2	HIGH 1ST HIGH VALUE IS	1.33442	ON 14120703: AT (600923.50, 4200940.00, 307.58, 1077.83, 0.00)	DC		
SC3	HIGH 1ST HIGH VALUE IS	1.33417	ON 14120703: AT (600923.50, 4200940.00, 307.58, 1077.83, 0.00)	DC		
SC4	HIGH 1ST HIGH VALUE IS	1.32860	ON 14120703: AT (600923.50, 4200940.00, 307.58, 1077.83, 0.00)	DC		

*** Message Summary : AERMOD Model Execution ***

--------- Summary of Total Messages --------
A Total of 0 Fatal Error Message(s)
A Total of 0 Warning Message(s)
A Total of 1121 Informational Message(s)
A Total of 26280 Hours Were Processed
A Total of 1013 Calm Hours Identified
A Total of 108 Missing Hours Identified (0.41 Percent)

******** FATAL ERROR MESSAGES ********
*** NONE ***

******** WARNING MESSAGES ********
*** NONE ***

****
*** AERMOD Finishes Successfully ***
****