Draft Engineering Evaluation

Russell City "Black Start" Capability Project

Russell City Energy Center
Hayward, CA

California Energy Commission
Petition for Modification
Docket No. 01-AFC-07C

Bay Area Air Quality Management District
Application 29348

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Table of Contents

I. Executive Summary

The California Energy Commission is currently evaluating an application for a change of conditions for the Russell City Energy Center, a 600-MW, natural-gas-fired, combined-cycle power plant owned and operated by Russell City Energy Company, LLC, a subsidiary of Calpine Corporation. In its application, Russell City Energy Company, LLC (hereinafter, "Calpine") seeks Commission approval to implement a "black start" capability project at the Russel City 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 Russell City Energy Center 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 Russell City 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 Calpine'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 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 Russell City Energy Center.

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 7, 2019** in order to be considered.

II. Project Description

A. The Russell City Energy Center

The Russell City Energy Center is a merchant power plant with a nominal generating capacity of 600 MW. The plant uses two natural-gas-fired Siemens/Westinghouse 501FD3 combustion turbine generators that burn natural gas to generate electrical power. The gas turbines are each equipped with a supplementally fired heat recovery steam generator, which uses the heat from the

gas turbine exhaust to generate steam (with additional heat provided by duct burners). The steam that is produced powers a steam turbine generator, which generates additional power, increasing the plant's overall efficiency. The plant also includes a 9-cell wet cooling tower and a 300-hp diesel fire pump engine. The plant was built in 2011-2013 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 the Russell City Energy Center. 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, Calpine 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 either of the two gas turbines (S-1 or S-3) 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 from an offline condition. This turbine would be used to provide for the

facility's own power needs, but it would not initially carry any additional load. The 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 turbine 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 turbine is started and CAISO begins to add load, the turbine may be required to operate for some time within a range of 10 to 60 percent as the load throughout the system is balanced. Eventually, as the system begins to recover fully, CAISO would order the turbine to 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. This point would mark the end of the black start emergency event. At this point, CAISO may also request that the second gas turbine be quickly brought online.

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 for up to 48 hours of full-speed-no-load operation, which represents the scenario with highest emissions. This may occur while the facility is operating in bypass mode, i.e., without the steam turbine operating. The Air District has based its emissions analyses on this operating scenario.

Finally, adding black start capability will also require a commissioning period after the Battery Energy Storage System is installed. Calpine 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 20 hours, will also involve operating the turbines at full-speed-no-load and/or low load, with emissions similar to what will be experienced during an actual black start emergency.

C. Emission Reduction Benefits From Black Start Capability

The addition of black start capability at the Russell City Energy Center 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 the Russell City 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 (above 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). Calpine is therefore requesting separate emissions limits to be applicable during black-start-related operations, including commissioning 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. Calpine is not proposing any change in the annual emission limits in its permit.

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 Russell City Energy Center. The Energy Commission issued its initial license for the Russell City facility in 2002, and it has issued several revisions since then. Calpine 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 Russell City Energy Center. 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 Calpine'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 Calpine from implementing the project.

It is also worth noting that when the Russell City Energy Center was initially permitted, it required a federal Prevention of Significant Deterioration (PSD) permit from the U.S. Environmental Protection Agency. As a federal requirement, this PSD permit was not subject to the Warren-

[1] The District will incorporate these permit condition changes under Application No. 29348.

Alquist Act preemption, and so Calpine was required to go through the full PSD permitting process and obtain the PSD permit in addition to the Energy Commission licensing proceeding. The District evaluated the PSD permit application and issued the PSD permit on EPA's behalf pursuant to a delegation agreement between the District and EPA for federal PSD permitting.

The facility is no longer subject to federal PSD requirements separate and apart from the state-law permitting system, however. As of August 31, 2016, EPA approved a revision to the California State Implementation Plan authorizing PSD permitting in the Bay Area to be administered under state law instead of under the federal PSD regulations. In light of this transfer of authority, any PSD issues that may be implicated because of the black start capability project are addressed under the state-law regulatory system described above. PSD permitting in the Bay Area is no longer governed by EPA's federal PSD regulations and procedures. The applicability of PSD requirements to the black start capability project is discussed in detail in Section IV.A. below.

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 and black start emergencies. Detailed emission calculations are presented in Appendix A.

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 20-hour commissioning period.

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

Pollutant	Emissions Per Day (lb/day)	Total Emissions Per Black Start Emergency Event (lbs)	Commissioning Emissions (lbs)
Nitrogen Oxides (as NO_2)	5,760	11,520	4,800
Carbon Monoxide	131,100	137,100	114,000
Precursor Organic Compounds	7,300	14,600	6,084
Particulate Matter ($PM_{10}/PM_{2.5}$)	180	360	150
Sulfur Dioxide	149	298	124
Greenhouse Gases (CO_2e)	3,958,000	11,644,500	3,298,700

Table 2 provides a comparison between black start operations and normal facility operations. The table shows the daily emissions of the two types of operations, in pounds per day. PM, SO_2 and greenhouse gas 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 Daily Air Pollutant Emissions:
Black Start vs. Normal Operation

Pollutant	Normal Operations (lb/day)	Black Start Operations (lb/day)
Nitrogen Oxides (as NO_2)	1,453	5,760
Carbon Monoxide	7,360	131,100
Precursor Organic Compounds	295	7,300
Particulate Matter ($PM_{10}/PM_{2.5}$)	360	180
Sulfur Dioxide	292	149
Greenhouse Gases (as CO_2e)	12,786,900	3,958,000

Maximum annual emissions will not change. The facility will remain subject to the same annual emissions limits that it is currently subject to. Emissions from black-start-related operations will count towards these annual emissions limits. The facility's maximum annual emission rates are shown in **Table 3**.

Table 3
Maximum Facility Annual Emissions

Pollutant	Annual Emissions Limit (tons/year)
Nitrogen Oxides (as NO_2)	127
Carbon Monoxide	330
Precursor Organic Compounds	28.5
Particulate Matter ($PM_{10}/PM_{2.5}$)	71.8
Sulfur Dioxide	12.2
Greenhouse Gases (CO_2e)	2,125,000

Table 4 shows the facility's current annual emission rates, based on its actual, measured emissions from the most recent three years (or in the case of greenhouse gases, a representative 24-month period within the past five 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)	25.10
Carbon Monoxide	63.97
Precursor Organic Compounds	1.27
Particulate Matter ($PM_{10}/PM_{2.5}$)	5.43
Sulfur Dioxide	2.27
Greenhouse Gases (CO_2e)	1,146,000

Table 5 summarizes the toxic air contaminant (TAC) emissions from black-start-related operations. TAC emissions will be lower during black-start-related operations, when the turbines will be running at no load or low load, because they will be operating at less than their full capacity.

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	0.00017	0.00017
Acetaldehyde	1.74	1.69
Acrolein	0.09	0.09
Ammonia	9.67	9.43
Benzene	0.055	0.034
Benzo(a)anthracene	0.000031	0.000030
Benzo(a)pyrene	0.000019	0.000018
Benzo(b)fluoranthene	0.000015	0.000015
Benzo(k)fluoranthene	0.000015	0.000015
Chrysene	0.000031	0.000030
Dibenz(a,h)anthracene	0.000031	0.000030
Ethylbenzene	0.04	0.04
Formaldehyde	6.30	6.11
Hexane	0.35	0.35
Indeno(1,2,3-cd)pyrene	0.000031	0.000030
Naphthalene	0.001	0.001
Propylene	1.05	1.05
Propylene Oxide	0.07	0.06
Toluene	0.13	0.12
Xylene (Total)	0.0047	0.0046
Sulfuric Acid Mist	1.92	0.60

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 Calpine'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. Other applicable District regulations and applicable state regulations are discussed in subsections B and C. Subsection D 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 Russell City Energy Center are:

- Section 2-2-301 – Best Available Control Technology Requirement
- Section 2-2-302 – Offset Requirements, Precursor Organic Compounds and Nitrogen Oxides
- Section 2-2-304 – PSD BACT Requirement
- Section 2-2-305 – PSD Source Impact Analysis Requirement
- Section 2-2-306 – PSD Additional Impacts Analysis Requirements
- Section 2-2-307 – Consideration of Class I Area Impacts
- Section 2-2-308 – NAAQS Protection Requirement
- Section 2-2-402 – Notice to EPA and Federal Land Manger of Receipt of Permit Applications

These requirements are discussed below.

1. Best Available Control Technology (BACT) Determinations

a. District 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 particular pollutant. Both gas turbines at the Russell City Energy Center will be part of the plant performance test during the commission period of the black start capability project, and either turbine may be

operated during a black start emergency event. Therefore, both turbines will undergo a physical change or change in method of operations under the language in Regulation 2-1-234.1.

The black-start-related operations will result in an increase in the daily potential to emit for NOx, CO, and POC, as shown in the Facility Emissions Section. Both turbines will therefore be subject to the District BACT requirement for NOx, CO, and POC.

The project will not increase either the daily or the annual potential to emit for PM_{10}, $PM_{2.5}$, or SO_2, however. The sources therefore will not be modified with respect to these pollutants under Regulation 2-1-234, and as such they are not subject to the District BACT requirement for these pollutants.

b. PSD BACT Applicability

The District's PSD BACT requirement is set forth in Regulation 2-2-304. Under that provision, if a modification is a "PSD Project" as defined in Regulation 2-2-224, it will be subject to federal PSD BACT for each PSD pollutant for which the net increase in emissions will be "significant" as defined in Regulation 2-2-227.1.

Under Regulation 2-2-224, a modification is a "PSD Project" if (i) it will be implemented at a "major" PSD facility, (ii) it will result in a significant increase in emissions, and (iii) it will result in a significant net increase in emissions, taking into account any other recent reductions at the facility. The addition of black start capability at the Russell City Energy Center is a PSD Project under this definition. The facility is a major PSD facility because it is a fossil fuel-fired steam electric plant with a total heat input of more than 250 MMBtu/hour, and it has the potential to emit more than 100 tons per year of two PSD pollutants (NO_2 and CO). And there will be a significant increase and significant net increase of emissions of four PSD pollutants – NO_2, CO, PM_{10}, and Greenhouse Gases (GHG) – under the applicable emissions increase calculation methodology set forth in Regulation 2-2-604. Regulation 2-2-604 calculates the amount of an emissions increase using an "actual-to-potential" test. That is, the regulation calculates the amount of the increase based on the difference the facility's actual emissions baseline before the modification and its maximum potential to emit after the modification based on the facility's permit limits. The facility's maximum permitted emissions are shown in Table 3 above, and its baseline emissions are shown in Table 4. Comparing the facility's baseline emissions in Table 4 to its potential to emit in Table 3 shows that the resulting emissions increase will exceed the "significant" increase thresholds in Regulation 2-2-227.1 for NO_2, CO, PM_{10}, and GHG. The addition of the black start capability will therefore be a PSD Project.

As a PSD Project, the black start capability project will have to implement Federal PSD BACT under Regulation 2-2-304 for each pollutant for which there is a significant net emissions increase, as noted above. Since the net emissions increase will be significant for NO_2, CO, PM_{10}, and GHG, the facility will be required to implement federal PSD BACT for these four pollutants.

c. BACT Definitions

Per Regulation 2-2-202, the BACT level of emissions control required under Regulation 2-2-301, which is usually referred to as "District BACT," 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 District 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.

The federal PSD BACT requirement under Regulation 2-2-304 is similar to the District BACT standard as defined in Regulation 2-2-202. Regulation 2-2-304 incorporates the federal Clean Air Act definition of BACT, which defines BACT as:

> An emission limitation based on the maximum degree of reduction of each pollutant subject to regulation under this chapter emitted from or which results from any major emitting facility, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques for control of each such pollutant.

The main important difference between District BACT and federal PSD BACT is that federal PSD BACT involves a cost-effectiveness analysis in all cases, which means that there is no "achieved-in-practice" requirement.

d. BACT Analysis

The following discussions include BACT determinations by pollutant for the gas turbines at the Russell City Energy Center for black-start-related operations. It should be noted that the addition of black start capability at the facility will not affect the normal operation of the plant. The BACT determinations for this application focus on the operations associated with the black start capability, which include commissioning activities for the black start capability 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 compare to the cost that would be involved to implement them.

NOx

The following discussion outlines the Air District's BACT analysis for NOx, which is a District BACT pollutant, and for NO_2, which is a PSD pollutant. As the analysis is the same for both, the discussion below simply refers to NOx in evaluating BACT for these two related pollutants.

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 capability 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 NO_x through (1) "lean combustion" that uses excess air to reduce the primary combustion temperature; (2) reduced combustor residence time to limit exposure in a high temperature environment; (3) "lean premixed combustion" that reduces the peak flame temperature by mixing fuel and air in an initial stage to produce a lean and uniform fuel/air mixture that is delivered to a secondary stage where combustion takes place; and/or (4) two-stage rich/lean combustion using a primary fuel-rich combustion stage to limit the amount of oxygen available to combine with nitrogen and then a secondary lean burn-stage to complete combustion in a cooler environment.

DLN combustors are already installed at the turbines at Russell City, 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 is therefore not an available control technology for use during black-start operations.

Selective Catalytic Reduction (SCR): SCR involves the reaction of the NO_x 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 NO_x control technique on utility-scale gas turbines, usually in conjunction with combustion controls such as DLN.

The Russell City Energy Center is currently equipped with an SCR system, but it requires high operating temperatures 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 much lower than during normal steady-state operations. As a result, the SCR catalyst bed is not likely to reach its minimum operating temperature, and it will not be possible to achieve effective NOx reduction. For this reason, SCR is not a feasible control technology for black-start-related operations.

The Air District has 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 turbine will burn more fuel per KW of electricity generated and will therefore produce more emissions of all pollutants over the operating life of the turbine. Considering that a black start emergency is expected to occur once every 20 to 30 years and the commissioning for black start capability is a one-time event, emissions from black-start-related 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 Russell City Energy Center. Based on the use of these BACT technologies, the District is proposing BACT emission limits of (i) 5,760 pounds of NOx per day during black-start-related operations (including project commissioning and black starts) and (ii) 11,520 pounds of NOx in total during a black start emergency event. The District is also proposing a limit of 20 hours on commissioning activities to ensure that commissioning emissions are minimized, with an emissions limit of 4,800 pounds of NOx during commissioning activities. These proposed NOx emission limits are based on an analysis of gas turbine start-up emission data at the Russell City facility 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 the Russell City Energy Center during steady-state operations.

The efficiency of the oxidation catalyst is temperature dependent, however, and it will therefore not be as effective during black start operations when the turbines' exhaust temperature will be much lower than during normal steady-state operation (i.e. at greater than 60% load). For the first 23 hours of a black start emergency event, the gas turbine exhaust will not be hot enough to adequately heat the oxidation catalyst to its optimum temperature. After 23 hours, the oxidation catalyst will be expected to reach a temperature where CO and POC control will be effective. Over an 48-hour black start emergency event, this is equivalent to an average CO reduction rate of 46%.

The Air District therefore considers this an available and feasible control technology for black-start-related operations, but only after the initial 23 hours of such operations. There are no feasible strategies for using an auxiliary heating system to increase the catalyst bed temperature, as discussed above in connection with the NOx BACT analysis.

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 (after the first 23 hours) is BACT for CO and POC for black-start-related operations at the Russell City Energy Center. Based on these BACT technologies, the District is proposing the following BACT emission limits:

CO: 131,100 pounds per day and 137,100 pounds per black start emergency event;

POC: 7,300 pounds per day and 14,600 pounds per black start emergency event.

With the 20-hour limit on commissioning activities discussed above, the District is also proposing BACT emission limits for commissioning of 114,000 pounds of CO and 6,080 pounds of POC. These proposed CO and POC emission limits are based on an analysis of gas turbine start-up emission data at the Russell City facility and black start operations that utilize best work practices.

PM_{10}

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}. This is an available, feasible and cost-effective control technology, and the applicant has proposed battery use for this project.

Best Work Practices: PM_{10} 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_{10} during combustion. The use of low-sulfur natural gas is commercially available and demonstrated for gas turbines.

BACT Determination for PM_{10}:

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} for black-start-related operations. The District is proposing that the facility will be required to use the pipeline quality natural gas during such operations that meets the PG&E Gas Rule 21, Section C standard of less than 1 grain of sulfur per 100 scf. The District is also proposing that such operations will be subject

to the same PM_{10} mass emission limits that apply during steady-state operations, which are (i) 7.5 pounds per hour or 0.0036 pounds per MMBTU of natural gas fired, and (ii) 360 pounds per day.

GHG

Control Technology Review:

Battery Power for Black Starts: As explained in connection with the other pollutants analyzed, a battery storage system can be used to provide the initial power to start the turbines instead of a fossil-fuel-fired alternative, which will reduce the amount of greenhouse gases generated. This is an available, feasible and cost-effective control technology, and the application has proposed battery use for this project.

Best Work Practices: The best work practices as previously described will minimize the extent and duration of black-start-related operations, which will limit the amount of fuel burned and greenhouse gases generated.

Carbon Capture and Sequestration (CCS): CCS is a process to capture, compress, transport, and sequester carbon dioxide (CO_2) to reduce GHG emissions. Capturing CO_2 can involve solvent-, sorbent-, and membrane-based capture technologies. The sequestration component of CCS can be achieved by injecting CO_2 into geologic formations like depleted oil and gas reservoirs, or industrial materials, such as concrete. The Air District evaluated the potential for using CCS at the Russell City Energy Center when the facility was originally permitted, but found that it would not be feasible, for two reasons. First, CCS technology is not sufficiently developed to require as BACT for a large, commercial-scale power plant such as this one. And second, even if the technology were sufficiently mature, there are no appropriate sequestration sites in the area that could be used sequester the plant's CO_2 emissions. The District has reviewed the situation and has not found any changed circumstances that would suggest that CCS can now be feasibly implemented.

BACT Determination for GHG:

Based on the above analysis, the District has determined that the use of a battery storage system and best work practices is BACT for GHG for the black start capability project at the Russell City Energy Center. The District is proposing a BACT emission limit of 11,644,500 pounds of CO_2e during a black start emergency event. With the 20-hour limit on commissioning activities discussed above, the District is also proposing a BACT emission limit for commissioning of 3,298,700 pounds of CO_2e.

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 35 tons per year of NOx or POC, offsets must be provided by the applicant at a ratio of 1.15 to 1.0.

For facilities that have already provided offsets for their full potential to emit, additional offsets are not required for any future modification unless the modification increases the potential to emit. Calpine provided offsets for the Russell City Energy Center's full potential to emit NOx and POC when the plant was initially permitted. Because the addition of black start capability will not increase the facility's annual potential to emit, no additional offsets required.

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

Because the Russell City Energy Center'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. Air Quality Impact Analysis Requirements

The District's New Source Review rule contains a number of requirements for evaluating the impacts from a new or modified source on ambient air quality, as well as other related impacts. These requirements include:

(i) Section 2-2-305, which requires PSD Projects to evaluate whether they will cause or contribute to any violation of an applicable California or National Ambient Air Quality Standard or PSD increment;

(ii) Section 2-2-306, which requires PSD Projects to evaluate the impacts from the project and any associated growth on visibility, soils, and vegetation; and

(iii) Section 2-2-308, which requires all 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.

All three of these provisions incorporate the exemptions set forth in 40 CFR Section 52.21(i), however. One of these exemptions, in Section 52.21(i)(3), exempts projects from the air quality impact analysis requirements where the emissions from the project will be temporary and will not impact any Class I Area or area where an applicable increment is known to be violated.

The addition of black start capability at the Russell City Energy Center will constitute a PSD Project, and it will result in a significant net increase in several pollutants, as noted above. But the emissions from all black start related activities, including commissioning and emergency operations, will be temporary. Commissioning emissions will last no more than 20 hours, and a black start emergency is not expected to last more than 48 hours, once every 20 or 30 years. In addition, the project is not expected to impact any Class I area as discussed in subsection A.4. below, and it is not expected to impact any area where an applicable increment is known to be violated. The project is therefore exempt from the air quality impact analysis requirements in Regulations 2-2-305, 2-2-306, and 2-2-308.

4. Consideration of Class I Area Impacts

Because this project is a PSD Project, it is subject to the Consideration of Class I Area Impacts requirement in District Regulation 2-2-307. This provision requires the applicant to prepare an analysis of the potential for adverse impacts on air-quality-related values (including visibility) in any Class I Area. (Class I Areas are areas such as national parks that have been identified for a heightened level of protection.) The analysis is then submitted to the Federal Land Manager with responsibility for administering the Class I Area involved for the Federal Land Manager's independent review and analysis.

Calpine prepared a Class I Area analysis to determine the potential for impacts to air-quality-related values and submitted it to the National Park Service, the Federal Land Manager with responsibility for the Point Reyes National Seashore, the only Class I Area within the District. The analysis shows that there is no potential for adverse impacts on any air-quality-related values. The District will consider any input received from the Federal Land Manager during the comment period the District is providing on this draft Engineering Evaluation, and it will incorporate that input into the final version of the Engineering Evaluation provided to the Energy Commission.

B. Other Applicable District Rules and Regulations

In addition to the New Source Review requirements in District Regulation 2, Rule 2, 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 Russell City Energy Center has been operating since 2013 without causing any public nuisance, and it is expected to continue operating that way.

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

There will be no increase in TAC emissions from black-start-related operations at the Russell City Energy Center. In fact, compared to normal operations, hourly TAC emissions will be lower during black-start-related operations for all TACs, as shown in Table 5. Therefore, the gas turbines are not being modified for purposes of the District's TAC regulations, as defined in Regulation 2-5-214, and a health risk assessment is not required for this application.

Regulation 2, Rule 6: Major Facility Review

The Russell City Energy Center 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 November 23, 2016. Calpine 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, Calpine has submitted an application to revise its Title V operating permit accordingly.

Regulation 2, Rule 7: Acid Rain

The Russell City gas turbines are subject to the requirements of Title IV of the federal Clean Air Act. The applicable requirements are specified in Russell City'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 2016, and it is expected to continue to comply with them after the addition of black start capability.

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 0.016 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 which 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 continue to be limited by permit condition to 5 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 which would result in ground level SO_2 concentrations in excess of 0.5 ppm continuously for 3 consecutive minutes, 0.25 ppm averaged over 60 consecutive minutes, or 0.05 ppm averaged over 24 hours. Section 302 (General Emission Limitation) prohibits SO_2 emissions in excess of 300 ppmv (dry). With maximum projected SO_2 emissions of < 1 ppmv, the gas turbines 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 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 15 ppm @ 15% O_2 for new or modified natural gas turbines with a heat input greater than 850 MMBtu/hour, and Section 60.4350(h) sets forth a 30 unit operating day rolling average basis for assessing excess emissions from combined-cycle turbines. The gas turbines will comply with this limit because the NOx concentration at the stack will be no greater than 10 ppm @ 15% O_2 averaged over 30 unit operating days, which includes up to 48 hours of black start emergency operation as the worst case scenario. See Appendix A for the NOx emission concentration calculation for Subpart KKKK. 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 a facility from monitoring the total sulfur content of the fuel if the facility uses a current, valid contract to demonstrate that the natural gas burned at the facility is 20 grains of sulfur or less per 100 standard cubic feet. The facility will continue to comply with this limit because they will burn only natural gas with a sulfur content of less than 1 grain per 100 scf.

C. State Requirements

The Russell City Energy Center is also subject to several state requirements related to air quality.

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

The Russell City Energy Center is subject to the Air Toxic "Hot Spots" Program contained in the California Health and Safety Code Section 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 Russell City Energy Center 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, except to the extent that emissions may be slightly lower because the plant will not be operating at full load during black-start-related operations and will therefore not be burning as much fuel as during normal operations.

D. 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 Calpine'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 Calpine'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 Calpine's Title V permit is also exempt under Public Resources Code Section 21080.24.

V. Permit Conditions

There are two permit conditions in effect for the Russell City Energy Center: Permit Condition #23763, which is a permit condition imposed by the Air District through the Air District's authority to construct and permit to operate for the facility issued under Air District Regulation 2; and Permit Condition #26117, which is a permit condition imposed by the Air District acting on behalf of the US Environmental Protection Agency through the federal PSD Permit issued under the federal PSD regulations in Section 52.21 of Title 40 of the Code of Federal Regulations.

Emission limits and operational limits for black-start-related operations will be added to the existing permit conditions for S-1 and S-3, Combustion Gas Turbines. The changes to permit conditions are shown in the underline/strikeout format below:

Air District Permit Condition

CONDITION #23763

(A) Definitions:

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
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
MM BTU:	million British thermal units
Gas Turbine Warm and Hot Start-up Mode:	The lesser of the first 180 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 19(b) and 19(d)
Gas Turbine Cold Start-up Mode:	The lesser of the first 360 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 19(b) and 19(d)
Gas Turbine Shutdown Mode:	The lesser of the 30- 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 19(b) through 19(d) until termination of fuel flow to the Gas Turbine
Gas Turbine Combustor	

Tuning Mode:	The period of time, not to exceed 360 minutes, 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 during the tuning operation.
Gas Turbine Cold Start-up:	A gas turbine start-up that occurs more than 48 hours after a gas turbine shutdown
Gas Turbine Hot Start-up:	A gas turbine start-up that occurs within 8 hours of a gas turbine shutdown
Gas Turbine Warm Start-up:	A gas turbine start-up that occurs between 8 hours and 48 hours of a gas turbine shutdown
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 (combined exhaust of S-1 Gas Turbine and S-3 HRSG duct burners), P-2 (combined exhaust of S-2 Gas Turbine and S-4 HRSG duct burners), 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 RCEC 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

RCEC:	Russell City Energy Center
CO_2E:	Combined emissions of CO_2, CH_4, and N_2O, expressed in terms of the amount of CO_2 emissions that would have the equivalent impact on global climate change.
Black Start Emergency Operation:	Operation of a gas turbine 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.
Black Start Emergency Event:	The duration of black start emergency operation from initial ignition of a gas turbine after declaration of a black start emergency by the CAISO or PG&E until conclusion of the emergency as determined by the CAISO or PG&E.
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 RCEC.

(B) Applicability:

Conditions 1 through 11 shall only apply during the commissioning period as defined above. Unless otherwise indicated, Conditions 12 through 49 shall apply after the commissioning period has ended. Conditions 50 through 54 shall apply at all times.

A. Conditions for the Commissioning Period

1. The owner/operator of the RCEC shall minimize emissions of carbon monoxide and nitrogen oxides from S-1 & S-3 Gas Turbines and S-2 & S-4 Heat Recovery Steam Generators (HRSGs) to the maximum extent possible during the commissioning period.

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-3 Gas Turbines combustors and S-2 & S-4 Heat Recovery Steam Generators duct burners to minimize the emissions of carbon monoxide and nitrogen oxides.

3. At the earliest feasible opportunity in accordance with the recommendations of the equipment manufacturers and the construction contractor, owner/operator shall install, adjust, and operate the A-2 & A-4 Oxidation Catalysts and A-1 & A-3 SCR Systems to minimize the emissions of carbon monoxide and nitrogen oxides from S-1 & S-3 Gas Turbines and S-2 & S-4 Heat Recovery Steam Generators.

4. The owner/operator of the RCEC 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-3 Gas Turbines describing the procedures to be followed during the commissioning of the gas turbines, HRSGs, and

steam 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-3) and HRSGs (S-2 & 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 or S-3) sooner than 28 days after the District receives the commissioning plan.

5. During the commissioning period, the owner/operator of the RCEC shall demonstrate compliance with conditions 7, 8, 9, and 10 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 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-3), HRSGs (S-2 & 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.

6. The owner/operator shall install, calibrate, and operate the District-approved continuous monitors specified in condition 5 prior to first firing of the Gas Turbines (S-1 & S-3) and Heat Recovery Steam Generators (S-2 & 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.

7. The owner/operator shall not fire the S-1 Gas Turbine and S-2 Heat Recovery Steam Generator without abatement of nitrogen oxide emissions by A-1 SCR System and/or abatement of carbon monoxide emissions by A-2 Oxidation Catalyst for more than 300 hours during the commissioning period. Such operation of S-1 Gas Turbine and S-2 HRSG 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 300 firing hours without abatement shall expire.

8. The owner/operator shall not fire the S-3 Gas Turbine and S-4 Heat Recovery Steam Generator without abatement of nitrogen oxide emissions by A-3 SCR System and/or

abatement of carbon monoxide emissions by A-4 Oxidation Catalyst for more than 300 hours during the commissioning period. Such operation of S-3 Gas Turbine and S-4 HRSG 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 300 firing hours without abatement shall expire.

9. The total mass emissions of nitrogen oxides, carbon monoxide, precursor organic compounds, PM_{10} and $PM_{2.5}$, and sulfur dioxide that are emitted by the Gas Turbines (S-1 & S-3), Heat Recovery Steam Generators (S-2 & S-4) and S-6 Fire Pump Diesel Engine during the commissioning period shall accrue towards the consecutive twelve-month emission limitations specified in condition 23.

10. The owner/ operator shall not operate the Gas Turbines (S-1 & S-3) and Heat Recovery Steam Generators (S-2 & S-4) in a manner such that the combined pollutant emissions from these sources 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-3).

NO_x (as NO_2)	4,805 pounds per calendar day	400 pounds per hour
CO	20,000 pounds per calendar day	5,000 pounds per hour
POC (as CH_4)	495 pounds per calendar day	
$PM_{2.5}/PM_{10}$	413 pounds per calendar day	
SO_2	298 pounds per calendar day	

11. No less than 90 days after startup, the Owner/Operator shall conduct District and CEC approved source tests to determine compliance with the emission limitations specified in condition 19. 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 and shall include at least one cold start, one warm start, and one hot start. 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 condition. 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.

B. Conditions for the Gas Turbines (S-1 & S-3) and the Heat Recovery Steam Generators (HRSGs; S-2 & S-4)

12. The owner/operator shall fire the Gas Turbines (S-1 & S-3) and HRSG Duct Burners (S-2 & 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 through 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 RCEC. In the event that the rolling 12-month annual average sulfur content exceeds 0.25 grain per 100 standard cubic feet, a reduced annual heat input rate may be utilized to calculate the maximum projected annual emissions. The reduced annual heat input rate shall be subject to District review and approval. (BACT for SO_2 and ~~PM_{10}~~/ $PM_{2.5}$)

13. The owner/operator shall not operate the units such that the combined heat input rate to each power train consisting of a Gas Turbine and its associated HRSG (S-1 & S-2 and S-3 & S-4) exceeds 2,238.6 MM BTU (HHV) per hour. (PSD for NO_x)
14. The owner/operator shall not operate the units such that the combined heat input rate to each power train consisting of a Gas Turbine and its associated HRSG (S-1 & S-2 and S-3 & S-4) exceeds 53,726 MM BTU (HHV) per day. (PSD for PM_{10}/ $PM_{2.5}$)

15. The owner/operator shall not operate the units such that the combined cumulative heat input rate for the Gas Turbines (S-1 & S-3) and the HRSGs (S-2 & S-4) exceeds 35,708,858 MM BTU (HHV) per year. (Offsets)

16. The owner/operator shall not fire the HRSG duct burners (S-2 & S-4) unless its associated Gas Turbine (S-1 & S-3, respectively) is in operation. (BACT for NO_x)

17. The owner/operator shall ensure that the S-1 Gas Turbine and S-2 HRSG are abated by the properly operated and properly maintained A-1 Selective Catalytic Reduction (SCR) System and A-2 Oxidation Catalyst System whenever fuel is combusted at those sources and the A-1 SCR catalyst bed has reached minimum operating temperature. (BACT for NO_x, POC and CO)

18. The owner/operator shall ensure that the S-3 Gas Turbine and S-4 HRSG are abated by the properly operated and properly maintained A-3 Selective Catalytic Reduction (SCR) System and A-4 Oxidation Catalyst System whenever fuel is combusted at those sources and the A-3 SCR catalyst bed has reached minimum operating temperature. (BACT for NO_x, POC and CO)

19. The owner/operator shall ensure that the Gas Turbines (S-1 & S-3) and HRSGs (S-2 & S-4) comply with requirements (a) through (h) under all operating scenarios, including duct burner firing mode. Requirements (a) through (h) do not apply during ~~a~~ gas turbine start-ups, combustor tuning operations, ~~or~~ shutdowns, commissioning activities for black start capability, or black start emergency operations. (BACT, PSD, and Regulation 2, Rule 5)
    (a) Nitrogen oxide mass emissions (calculated as NO_2) at P-1 (the combined exhaust point for S-1 Gas Turbine and S-2 HRSG after abatement by A-1 SCR System) shall not exceed 16.5 pounds per hour or 0.00735 lb/MM BTU (HHV) of natural gas fired. Nitrogen oxide mass emissions (calculated as NO_2) at P-2 (the combined exhaust point

for S-3 Gas Turbine and S-4 HRSG after abatement by A-3 SCR System) shall not exceed 16.5 pounds per hour or 0.00735 lb/MM BTU (HHV) of natural gas fired. (PSD for NOx)

(b) The nitrogen oxide emission concentration at emission points P-1 and P-2 each shall not exceed 2.0 ppmv, on a dry basis, corrected to 15% O_2, averaged over any 1-hour period. (BACT for NO_x)

(c) Carbon monoxide mass emissions at P-1 and P-2 each shall not exceed 10 pounds per hour or 0.0045 lb/MM BTU of natural gas fired, averaged over any 1-hour period. (PSD for CO)

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

(e) Ammonia (NH_3) emission concentrations at P-1 and P-2 each shall not exceed 5 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 A-2 and A-4 SCR Systems. The correlation between the gas turbine and HRSG heat input rates, A-2 and A-4 SCR System ammonia injection rates, and corresponding ammonia emission concentration at emission points P-1 and P-2 shall be determined in accordance with permit condition 29 or District approved alternative method. (Regulation 2-5)

(f) Precursor organic compound (POC) mass emissions (as CH_4) at P-1 and P-2 each shall not exceed 2.86 pounds per hour or 0.00128 lb/MM BTU of natural gas fired. (BACT)

(g) Sulfur dioxide (SO_2) mass emissions at P-1 & P-2 each shall not exceed 6.21 pounds per hour or 0.0028 lb/MM BTU of natural gas fired. (BACT)

(h) Particulate matter (PM_{10} and $PM_{2.5}$) mass emissions at P-1 & P-2 each shall not exceed 7.5 pounds per hour or 0.0036 lb PM_{10}/ $PM_{2.5}$ per MM BTU of natural gas fired. (BACT)

20. The owner/operator shall ensure that the regulated air pollutant mass emission rates from each of the Gas Turbines (S-1 & S-3) during a start-up or shutdown do not exceed the limits established below. The owner/operator shall not operate both of the Gas Turbines (S-1 & S-3) in Startup Mode at the same time. (PSD, CEC Conditions of Certification)

Pollutant	**Cold Start-Up Combustor Tuning**	**Hot Start-Up**	**Warm Start-Up**	**Shutdown**
	lb/start-up	**lb/start-up**	**lb/start-up**	**lb/shutdown**
NO_x (as NO_2)	480.0	95	125	40
CO	2514	891	2514	100
POC (as CH_4)	83	35.3	79	16

21. The owner/operator shall not perform combustor tuning on Gas Turbines more than once every rolling 365-day period for each S-1 and S-3. The owner/operator shall notify the District no later than 7 days prior to combustor tuning activity. (Offsets, Cumulative Emissions)

22. The owner/operator shall not allow total combined emissions from the Gas Turbines and HRSGs (S-1, S-2, S-3 & S-4), S-5 Cooling Tower, and S-6 Fire Pump Diesel Engine, including emissions generated during gas turbine start-ups, combustor tuning, and shutdowns to exceed the following limits during any calendar day, except on days when commissioning activities for black start capability or black start emergency operations occur:

(a) 1,453 pounds of NO_x (as NO_2) per day (Cumulative Emissions)
(b) 1,225 pounds of NO_x per day during ozone season from June 1 to September 30. (CEC Condition of Certification)
(c) 7,360 pounds of CO per day (PSD)
(d) 295 pounds of POC (as CH_4) per day (Cumulative Emissions)
(e) 413 pounds of PM_{10} and $PM_{2.5}$ per day (PSD)
(f) 292 pounds of SO_2 per day (BACT)

23. The owner/operator shall not allow cumulative combined emissions from the Gas Turbines and HRSGs (S-1, S-2, S-3 & S-4), S-5 Cooling Tower, and S-6 Fire Pump Diesel Engine, including emissions generated during gas turbine start-ups, combustor tuning operations, ~~and~~ shutdowns, commissioning activities for black start capability, and black start emergency operations, to exceed the following limits during any consecutive twelve-month period:

(a) 127 tons of NO_x (as NO_2) per year (Offsets, PSD)
(b) 330 tons of CO per year (Cumulative Increase, PSD)
(c) 28.5 tons of POC (as CH_4) per year (Offsets)
(d) 71.8 tons of PM_{10} and $PM_{2.5}$ per year (Cumulative Increase, PSD)
(e) 12.2 tons of SO_2 per year (Cumulative Increase, PSD)

24. The owner/operator shall not allow sulfuric acid emissions (SAM) from stacks P-1 and P-2 combined to exceed 7 tons in any consecutive 12-month period. (Basis: PSD)

25. The owner/operator shall not allow the maximum projected annual toxic air contaminant emissions (per condition 28) from the Gas Turbines and HRSGs (S-1, S-2, S-3 & S-4) combined to exceed the following limits:

formaldehyde	10,912 pounds per year
benzene	226 pounds per year
Specified polycyclic aromatic hydrocarbons (PAHs)	1.8 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. (Regulation 2, Rule 5)

26. The owner/operator shall demonstrate compliance with conditions 13 through 16, 19(a) through 19(d), 20, 22(a), 22(b), 23(a),23(b), 53 by using properly operated and maintained continuous monitors (during all hours of operation including gas turbine start-up, combustor tuning, shutdown, and black start emergency operations) for all of the following parameters:
    (a) Firing Hours and Fuel Flow Rates for each of the following sources: S-1 & S-3 combined, S-2 & S-4 combined.
    (b) Oxygen (O_2) concentration, Nitrogen Oxides (NO_x) concentration, and Carbon Monoxide (CO) concentration at exhaust points P-1 and P-2.
    (c) Ammonia injection rate at A-1 and A-3 SCR Systems

    The owner/operator shall record all of the above parameters 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-3 combined, S-2 & S-4 combined.
    (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 and P-2.

    For each source, source grouping, or exhaust point, the owner/operator shall record the parameters specified in conditions 26(d) and 26(e) at least once every 15 minutes (excluding normal calibration periods). As specified below, the owner/operator shall calculate and record the following data:
    (f) total Heat Input Rate for every clock hour.
    (g) on an hourly basis, the cumulative total Heat Input Rate for each calendar day for the following: each Gas Turbine and associated HRSG combined and all four sources (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 associated HRSG combined and all four sources (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 and associated HRSG combined.
    (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 all four sources (S-1, S-2, S-3 and S-4) combined.
    (1-520.1, 9-9-501, BACT, Offsets, NSPS, PSD, Cumulative Increase)
27. To demonstrate compliance with conditions 19(f), 19(g), 19(h), 22(c), 22(d),-22(e), 23(c), 23(d), 23(e),-the owner/operator shall calculate and record on a daily basis, the Precursor Organic Compound (POC) mass emissions, Fine Particulate Matter (PM_{10} and $PM_{2.5}$) 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 condition 26, actual Gas Turbine start-up times, actual Gas Turbine shutdown times, and CEC and District-approved emission factors developed pursuant to source testing under condition 30 to calculate these emissions. The owner/operator shall present the calculated emissions in the following format:

(a) For each calendar day, POC, PM_{10} and $PM_{2.5}$, and SO_2 emissions, summarized for each power train (Gas Turbine and its respective HRSG combined) and all four sources (S-1, S-2, S-3 & S-4) combined

(b) on a monthly basis, the cumulative total POC, PM_{10} and $PM_{2.5}$, and SO_2 mass emissions, for each year for all four sources (S-1, S-2, S-3 & S-4) combined

(Offsets, PSD, Cumulative Increase)

28. To demonstrate compliance with Condition 25, 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 35,708,858 MM BTU/year and the highest emission factor (pounds of pollutant per MM BTU of heat input) determined by any source test of the S-1 and S-3 Gas Turbines and/or S-2 and S-4 Heat Recovery Steam Generators. 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. (Regulation 2, Rule 5)

29. Within 90 days of start-up of the RCEC, the owner/operator shall conduct a District-approved source test on exhaust point P-1 or P-2 to determine the corrected ammonia (NH_3) emission concentration to determine compliance with condition 19(e). The source test shall determine the correlation between the heat input rates of the gas turbine and associated HRSG, A-2 or A-4 SCR System ammonia injection rate, and the corresponding NH_3 emission concentration at emission point P-1 or P-2. The source test shall be conducted over the expected operating range of the turbine and HRSG (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 condition 19(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. (Regulation 2, Rule 5)

30. Within 90 days of start-up of the RCEC and on an annual basis thereafter, the owner/operator shall conduct a District-approved source test on exhaust points P-1 and P-2 while each Gas Turbine and associated Heat Recovery Steam Generator are operating at maximum load to determine compliance with Conditions 19(a), 19(b), 19(c), 19(d), 19(f), 19(g),-and 19(h) and while each Gas Turbine and associated Heat Recovery Steam Generator are operating at minimum load to determine compliance with Conditions 19(c) and 19(d), and to verify the accuracy of the continuous emission monitors required in condition 26. 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 particulate matter (PM_{10} and $PM_{2.5}$) 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. (BACT, offsets)

31. 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 the total PM_{10} and $PM_{2.5}$ 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. (BACT)

32. Within 90 days of start-up of the RCEC and on a biennial basis (once every two years) thereafter, the owner/operator shall conduct a District-approved source test on exhaust point P-1 or P-2 while the Gas Turbine and associated Heat Recovery Steam Generator are operating at maximum allowable operating rates to demonstrate compliance with Condition 25. 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 condition 25 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	≤ 6.4 pounds/year and 2.9 pounds/hour
Formaldehyde	≤ 30 pounds/year and 0.21 pounds/hour
Specified PAHs	≤ 0.011 pounds/year

(Regulation 2, Rule 5)

33. The owner/operator shall calculate the SAM emission rate using the total heat input for the sources and the highest results of any source testing conducted pursuant to condition 34. If this SAM mass emission limit of condition #24 is exceeded, the owner/operator must utilize air dispersion modeling to determine the impact (in $\mu g/m^3$) of the sulfuric acid mist emissions pursuant to Regulation 2-2-306. (PSD)

34. Within 90 days of start-up of the RCEC and on an annual basis thereafter, the owner/operator shall conduct a District-approved source test on exhaust points P-1 and P-2 while each gas turbine and HRSG duct burner is operating at maximum heat input rates to demonstrate compliance with the SAM emission rates specified in condition 24. 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. (PSD)

35. The owner/operator of the RCEC 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. (Regulation 2-6-502)

36. The owner/operator of the RCEC 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. (Regulation 2-6-501)

37. The owner/operator of the RCEC 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. (Regulation 2-1-403)

38. The owner/operator shall ensure that the stack height of emission points P-1 and P-2 is each at least 145 feet above grade level at the stack base. (PSD, Regulation 2-5)

39. The Owner/Operator of RCEC 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. (Regulation 1-501)

40. Within 180 days of the issuance of the Authority to Construct for the RCEC, 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 conditions 29, 30, 32, 34, and 43. The owner/operator shall conduct all source testing and monitoring in accordance with the District approved procedures. (Regulation 1-501)

41. Pursuant to BAAQMD Regulation 2, Rule 6, section 404.1, the owner/operator of the RCEC shall submit an application to the BAAQMD for a major facility review permit within 12 months of completing construction as demonstrated by the first firing of any gas turbine or HRSG duct burner. (Regulation 2-6-404.1)

42. Pursuant to 40 CFR Part 72.30(b)(2)(ii) of the Federal Acid Rain Program, the owner/operator of the Russell City Energy Center shall submit an application for a Title IV operating permit to the BAAQMD at least 24 months before operation of any of the gas turbines (S-1, S-3, S-5, or S-7) or HRSGs (S-2, S-4, S-6, or S-8). (Regulation 2, Rule 7)
43. The owner/operator shall ensure that the Russell City Energy Center complies with the continuous emission monitoring requirements of 40 CFR Part 75. (Regulation 2, Rule 7)

C. Permit Conditions for Cooling Towers

44. The owner/operator shall properly install and maintain the S-5 cooling tower to minimize drift losses. The owner/operator shall equip the cooling towers with high-efficiency mist eliminators with a maximum guaranteed drift rate of 0.0005%. The maximum total dissolved solids (TDS) measured at the base of the cooling towers or at the point of return to the wastewater facility shall not be higher than 6,200 ppmw (mg/l). The owner/operator shall sample and test the cooling tower water at least once per day to verify compliance with this TDS limit. (PSD)

45. The owner/operator shall perform a visual inspection of the cooling tower drift eliminators at least once per calendar year, and repair or replace any drift eliminator components which are broken or missing. Prior to the initial operation of the Russell City Energy Center, the owner/operator shall have the cooling tower vendor's field representative inspect the cooling tower drift eliminators and certify that the installation was performed in a satisfactory manner. Within 60 days of the initial operation of the cooling tower, the owner/operator shall perform an initial performance source test to determine the PM_{10} and $PM_{2.5}$ emission rate from the cooling tower to verify compliance with the vendor-guaranteed drift rate specified in condition 44. The CEC CPM may require the owner/operator to perform source tests to verify continued compliance with the vendor-guaranteed drift rate specified in condition (PSD)

D. Permit Conditions for S-6 Fire Pump Diesel Engine

46. The owner/operator shall not operate S-6 Fire Pump Diesel Engine more than 50 hours per year for reliability-related activities. ("Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection (e)(2)(A)(3) or (e)(2)(B)(3), offsets)

47. The owner/operator shall operate S-6 Fire Pump Diesel Engine only for the following purposes: to mitigate emergency conditions, for emission testing to demonstrate compliance with a District, state or Federal emission limit, or for reliability-related activities (maintenance and other testing, but excluding emission testing). Operating hours while mitigating emergency conditions or while emission testing to show compliance with District, state or Federal emission limits is not limited. ("Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection (e)(2)(A)(3) or (e)(2)(B)(3))

48. The owner/operator shall operate S-6 Fire Pump Diesel Engine only when a non-resettable totalizing meter (with a minimum display capability of 9,999 hours) that measures the

hours of operation for the engine is installed, operated and properly maintained. ("Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection (e)(4)(G)(1), cumulative increase)

49. Records: The owner/operator shall maintain the following monthly records in a District-approved log for at least 60 months from the date of entry. Log entries shall be retained on-site, either at a central location or at the engine's location, and made immediately available to the District staff upon request.
    a. Hours of operation for reliability-related activities (maintenance and testing).
    b. Hours of operation for emission testing to show compliance with emission limits.
    c. Hours of operation (emergency).
    d. For each emergency, the nature of the emergency condition.
    e. Fuel usage for each engine(s).
    (Basis: "Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection (e)(4)(I), cumulative increase)

E. Permit Conditions for the Gas Turbines (S-1 & S-3) During Black-Start-Related Operations

50. Commissioning Activities for Black Start Capability: The owner/operator shall perform commissioning activities for black start capability at S-1 and S-3 for no more than 20 hours combined. The owner/operator shall not perform these activities at S-1 and S-3 simultaneously. Upon completion of these activities, the owner/operator shall provide written notice to the District Engineering and Enforcement Divisions. (Basis: BACT)

51. Emission Limits for Commissioning Activities for Black Start Capability: The owner/operator shall not operate the Gas Turbines (S-1 & S-3) in a manner such that the combined pollutant emissions from these sources will exceed the following limits when performing commissioning activities for black start capability.

(a) NO_x (as NO_2):	4,800 pounds;
(b) CO:	114,000 pounds;
(c) POC (as CH_4):	6,080 pounds;
(d) $PM_{2.5}/PM_{10}$:	150 pounds;
(e) SO_2:	124 pounds;
(f) GHG:	3,298,700 pounds CO_2E.

. (Basis: BACT)

52. Monitoring and Recordkeeping for Commissioning Activities for Black Start Capability: The owner/operator of the RCEC shall demonstrate compliance with conditions 50 and 51 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)

53. Daily Emission Limits: The owner/operator shall not allow total combined emissions from the Gas Turbines (S-1 & S-3) to exceed the following limits during any calendar day when commissioning activities for black start capability or ~~a~~ black start emergency operations occur:

(a) NO_x (as NO_2):	5,760 pounds per day
(b) CO:	131,100 pounds per day
(c) POC (as CH_4):	7,300 pounds per day
(d) $PM_{2.5}/PM_{10}$:	360 pounds per day
(e) SO_2:	292 pounds per day
~~(a)~~(f) GHG:	12,786,900 pounds CO_2E per day

(Basis: BACT)

54. Emission Limits for Black Start Emergency Events: The owner/operator shall not allow total combined emissions from the Gas Turbines (S-1 & S-3) to exceed the following limits during a black start emergency event:

(a) NO_x (as NO_2):	11,520 pounds
(b) CO:	137,100 pounds
(c) POC (as CH_4):	14,600 pounds
(d) $PM_{2.5}/PM_{10}$:	360 pounds
(e) SO_2:	298 pounds
(f) GHG:	11,644,500 pounds CO_2E

(Basis: BACT)

Federal PSD Permit Condition

CONDITION #26117

The permit conditions set forth below in plain type are the conditions of the federal Prevention of Significant Deterioration ("PSD") Permit issued by the Bay Area Air Quality Management District ("District") for the Russell City Energy Center pursuant to 40 C.F.R. section 52.21 and the Delegation Agreement between the District and Region 9 of the United States Environmental Protection Agency. Conditions set forth in ~~strikethrough~~ type are not conditions of the PSD permit. These conditions are conditions of the related District Authority to Construct issued for the facility. They are set forth here only for convenience in comparing the two permits and are not part of the PSD permit.

(A) Definitions:

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

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
MM BTU:	million British thermal units
Gas Turbine Warm and Hot Start-up Mode:	The lesser of the first 180 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 19(b) and 19(d)
Gas Turbine Cold Start-up Mode:	The lesser of the first 360 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 19(b) and 19(d)
Gas Turbine Shutdown Mode:	The lesser of the 30 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 19(b) through 19(d) until termination of fuel flow to the Gas Turbine
Gas Turbine Combustor Tuning Mode:	The period of time, not to exceed 360 minutes, 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 during the tuning operation.
Gas Turbine Cold Start-up:	A gas turbine start-up that occurs more than 48 hours after a gas turbine shutdown
Gas Turbine Hot Start-up:	A gas turbine start-up that occurs within 8 hours of a gas turbine shutdown
Gas Turbine Warm Start-up:	A gas turbine start-up that occurs between 8 hours and 48 hours of a gas turbine shutdown
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 (combined exhaust of S-1 Gas Turbine and S-3 HRSG duct burners), P-2 (combined exhaust of S-2 Gas Turbine and S-4 HRSG duct burners), 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 RCEC construction contractor to insure safe and reliable steady state operation of the gas turbines, heat recovery steam generators, steam turbine, and associated electrical delivery systems during the commissioning period
Commissioning Period:	The Period shall commence when all mechanical, electrical, and control systems are installed and individual system start-up has been completed, or when a gas turbine is first fired, whichever occurs first. The period shall terminate when the plant has completed performance testing, is available for commercial operation, and has initiated sales to the power exchange.
Precursor Organic Compounds (POCs):	Any compound of carbon, excluding methane, ethane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate
CEC CPM:	California Energy Commission Compliance Program Manager
RCEC:	Russell City Energy Center
CO_2E:	Combined emissions of CO_2, CH_4, and N_2O, expressed in terms of the amount of CO_2 emissions that would have the equivalent impact on global climate change.
Black Start Emergency Operation:	Operation of a gas turbine 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.
Black Start Emergency Event:	The duration of black start emergency operation from initial ignition of a gas turbine after declaration of a black start emergency by the CAISO or PG&E until conclusion of the emergency as determined by the CAISO or PG&E.
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 RCEC.

(B) Applicability:

Conditions 1 through 11 shall only apply during the commissioning period as defined above. Unless otherwise indicated, Conditions 12 through 49 shall apply after the

commissioning period has ended. Conditions 50 through 61 shall apply at all times.

A. Conditions for the Commissioning Period

1. The owner/operator of the RCEC shall minimize emissions of carbon monoxide and nitrogen oxides from S-1 & S-3 Gas Turbines and S-2 & S-4 Heat Recovery Steam Generators (HRSGs) to the maximum extent possible during the commissioning period.

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-3 Gas Turbines combustors and S-2 & S-4 Heat Recovery Steam Generators duct burners to minimize the emissions of carbon monoxide and nitrogen oxides.

3. At the earliest feasible opportunity in accordance with the recommendations of the equipment manufacturers and the construction contractor, owner/operator shall install, adjust, and operate the A-2 & A-4 Oxidation Catalysts and A-1 & A-3 SCR Systems to minimize the emissions of carbon monoxide and nitrogen oxides from S-1 & S-3 Gas Turbines and S-2 & S-4 Heat Recovery Steam Generators.

4. The owner/operator of the RCEC 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-3 Gas Turbines describing the procedures to be followed during the commissioning of the gas turbines, HRSGs, and steam 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-3) and HRSGs (S-2 & 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 or S-3) sooner than 28 days after the District receives the commissioning plan.

5. During the commissioning period, the owner/operator of the RCEC shall demonstrate compliance with conditions 7, 8, 9, and 10 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 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-3), HRSGs (S-2 & 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.

6. The owner/operator shall install, calibrate, and operate the District-approved continuous monitors specified in condition 5 prior to first firing of the Gas Turbines (S-1 & S-3) and Heat Recovery Steam Generators (S-2 & 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.

7. The owner/operator shall not fire the S-1 Gas Turbine and S-2 Heat Recovery Steam Generator without abatement of nitrogen oxide emissions by A-1 SCR System and/or abatement of carbon monoxide emissions by A-2 Oxidation Catalyst for more than 300 hours during the commissioning period. Such operation of S-1 Gas Turbine and S-2 HRSG 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 300 firing hours without abatement shall expire.

8. The owner/operator shall not fire the S-3 Gas Turbine and S-4 Heat Recovery Steam Generator without abatement of nitrogen oxide emissions by A-3 SCR System and/or abatement of carbon monoxide emissions by A-4 Oxidation Catalyst for more than 300 hours during the commissioning period. Such operation of S-3 Gas Turbine and S-4 HRSG 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 300 firing hours without abatement shall expire.

9. The total mass emissions of nitrogen oxides, carbon monoxide, precursor organic compounds, PM_{10} and $PM_{2.5}$, and sulfur dioxide that are emitted by the Gas Turbines (S-1 & S-3), Heat Recovery Steam Generators (S-2 & S-4) and S-6 Fire Pump Diesel Engine during the commissioning period shall accrue towards the consecutive twelve-month emission limitations specified in condition 23.
10. The owner/ operator shall not operate the Gas Turbines (S-1 & S-3) and Heat Recovery Steam Generators (S-2 & S-4) in a manner such that the combined pollutant emissions from these sources 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-3).

NO_x (as NO_2)	4,805 pounds per calendar day	400 pounds per hour
CO	20,000 pounds per calendar day	5,000 pounds per hour
~~POC (as CH_4)~~	~~495 pounds per calendar day~~	
$PM_{2.5}/PM_{10}$	413 pounds per calendar day	
~~SO_2~~	~~298 pounds per calendar day~~	

11. No less than 90 days after startup, the Owner/Operator shall conduct District and CEC approved source tests to determine compliance with the emission limitations specified in condition 19. 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 and shall include at least one cold start, one warm start, and one hot start. 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 condition. 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.

B. Conditions for the Gas Turbines (S-1 & S-3) and the Heat Recovery Steam Generators (HRSGs; S-2 & S-4)

12. The owner/operator shall fire the Gas Turbines (S-1 & S-3) and HRSG Duct Burners (S-2 & 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 through 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 RCEC. In the event that the rolling 12-month annual average sulfur content exceeds 0.25 grain per 100 standard cubic feet, a reduced annual heat input rate may be utilized to calculate the maximum projected annual emissions. The reduced annual heat input rate shall be subject to District review and approval. (BACT for ~~SO_2 and~~ PM_{10}/ $PM_{2.5}$)
13. The owner/operator shall not operate the units such that the combined heat input rate to each power train consisting of a Gas Turbine and its associated HRSG (S-1 & S-2 and S-3 & S-4) exceeds 2,238.6 MM BTU (HHV) per hour. (PSD for NO_x)

14. The owner/operator shall not operate the units such that the combined heat input rate to each power train consisting of a Gas Turbine and its associated HRSG (S-1 & S-2 and S-3 & S-4) exceeds 53,726 MM BTU (HHV) per day. (PSD for PM_{10}/ $PM_{2.5}$)

15. The owner/operator shall not operate the units such that the combined cumulative heat input rate for the Gas Turbines (S-1 & S-3) and the HRSGs (S-2 & S-4) exceeds 35,708,858 MM BTU (HHV) per year. (Offsets)

16. The owner/operator shall not fire the HRSG duct burners (S-2 & S-4) unless its associated Gas Turbine (S-1 & S-3, respectively) is in operation. (BACT for NO_x)

17. The owner/operator shall ensure that the S-1 Gas Turbine and S-2 HRSG are abated by the properly operated and properly maintained A-1 Selective Catalytic Reduction (SCR) System and A-2 Oxidation Catalyst System whenever fuel is combusted at those sources and the A-1 SCR catalyst bed has reached minimum operating temperature. (BACT for NO_x, ~~POC~~ and CO)

18. The owner/operator shall ensure that the S-3 Gas Turbine and S-4 HRSG are abated by the properly operated and properly maintained A-3 Selective Catalytic Reduction (SCR) System and A-4 Oxidation Catalyst System whenever fuel is combusted at those sources and the A-3 SCR catalyst bed has reached minimum operating temperature. (BACT for NO_x, ~~POC~~ and CO)

19. The owner/operator shall ensure that the Gas Turbines (S-1 & S-3) and HRSGs (S-2 & S-4) comply with requirements (a) through (h) under all operating scenarios, including duct burner firing mode. Requirements (a) through (h) do not apply during ~~a~~ gas turbine start-ups, combustor tuning operations, ~~or~~ shutdowns, commissioning activities for black start capability, or black start emergency operations. (BACT, PSD~~, and Regulation 2, Rule 5~~)
    (a) Nitrogen oxide mass emissions (calculated as NO_2) at P-1 (the combined exhaust point for S-1 Gas Turbine and S-2 HRSG after abatement by A-1 SCR System) shall not exceed 16.5 pounds per hour or 0.00735 lb/MM BTU (HHV) of natural gas fired. Nitrogen oxide mass emissions (calculated as NO_2) at P-2 (the combined exhaust point for S-3 Gas Turbine and S-4 HRSG after abatement by A-3 SCR System) shall not exceed 16.5 pounds per hour or 0.00735 lb/MM BTU (HHV) of natural gas fired.
    (b) The nitrogen oxide emission concentration at emission points P-1 and P-2 each shall not exceed 2.0 ppmv, on a dry basis, corrected to 15% O_2, averaged over any 1-hour period. (BACT for NO_x)
    (c) Carbon monoxide mass emissions at P-1 and P-2 each shall not exceed 10 pounds per hour or 0.0045 lb/MM BTU of natural gas fired, averaged over any 1-hour period. (PSD for CO)
    (d) The carbon monoxide emission concentration at P-1 and P-2 each shall not exceed 2.0 ppmv, on a dry basis, corrected to 15% O_2 averaged over any 1-hour period. (BACT for CO)
    ~~(e) Ammonia (NH_3) emission concentrations at P-1 and P-2 each shall not exceed 5 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 A-2 and A-4 SCR Systems. The correlation between the gas turbine and HRSG heat input rates, A-2 and A-4 SCR System ammonia injection rates, and corresponding ammonia emission concentration at emission points P-1 and P-2 shall be determined in accordance with permit condition 29 or District approved alternative method. (Regulation 2-5)~~
    ~~(f) Precursor organic compound (POC) mass emissions (as CH_4) at P-1 and P-2 each shall not exceed 2.86 pounds per hour or 0.00128 lb/MM BTU of natural gas fired. (BACT)~~
    ~~(g) Sulfur dioxide (SO_2) mass emissions at P-1 & P-2 each shall not exceed 6.21 pounds per hour or 0.0028 lb/MM BTU of natural gas fired. (BACT)~~
    (h) Particulate matter (PM_{10} and $PM_{2.5}$) mass emissions at P-1 & P-2 each shall not exceed 7.5 pounds per hour or 0.0036 lb PM_{10}/ $PM_{2.5}$ per MM BTU of natural gas fired. (BACT)

20. The owner/operator shall ensure that the regulated air pollutant mass emission rates from each

of the Gas Turbines (S-1 & S-3) during a start-up or shutdown do not exceed the limits established below. The owner/operator shall not operate both of the Gas Turbines (S-1 & S-3) in Startup Mode at the same time. (PSD, CEC Conditions of Certification)

Pollutant	Cold Start-Up Combustor Tuning	Hot Start-Up	Warm Start-Up	Shutdown
	lb/start-up	lb/start-up	lb/start-up	lb/shutdown
NO_x (as NO_2)	480.0	95	125	40
CO	2514	891	2514	100
~~POC (as CH_4)~~	~~83~~	~~35.3~~	~~79~~	~~16~~

21. The owner/operator shall not perform combustor tuning on Gas Turbines more than once every rolling 365 day period for each S-1 and S-3. The owner/operator shall notify the District no later than 7 days prior to combustor tuning activity. (Offsets, Cumulative Emissions)

22. The owner/operator shall not allow total combined emissions from the Gas Turbines and HRSGs (S-1, S-2, S-3 & S-4), S-5 Cooling Tower, and S-6 Fire Pump Diesel Engine, including emissions generated during gas turbine start-ups, combustor tuning, and shutdowns to exceed the following limits during any calendar day, except on days when commissioning activities for black start capability or black start emergency operations occur:
    (a) 1,453 pounds of NO_x (as NO_2) per day (Cumulative Emissions)
    ~~(b) 1,225 pounds of NO_x per day during ozone season from June 1 to September 30. (CEC Condition of Certification)~~
    (c) 7,360 pounds of CO per day (PSD)
    ~~(d) 295 pounds of POC (as CH_4) per day (Cumulative Emissions)~~
    (e) 413 pounds of PM_{10} and $PM_{2.5}$ per day (PSD)
    ~~(f) 292 pounds of SO_2 per day (BACT)~~

23. The owner/operator shall not allow cumulative combined emissions from the Gas Turbines and HRSGs (S-1, S-2, S-3 & S-4), S-5 Cooling Tower, and S-6 Fire Pump Diesel Engine, including emissions generated during gas turbine start-ups, combustor tuning operations, ~~and~~ shutdowns, commissioning activities for black start capability, and black start emergency operations to exceed the following limits during any consecutive twelve-month period:
    (a) 127 tons of NO_x (as NO_2) per year (Offsets, PSD)
    (b) 330 tons of CO per year (Cumulative Increase, PSD)
    ~~(c) 28.5 tons of POC (as CH_4) per year (Offsets)~~
    (d) 71.8 tons of PM_{10} and $PM_{2.5}$ per year (Cumulative Increase, PSD)
    ~~(e) 12.2 tons of SO_2 per year (Cumulative Increase, PSD)~~

24. The owner/operator shall not allow sulfuric acid emissions (SAM) from stacks P-1 and P-2 combined to exceed 7 tons in any consecutive 12-month period. (Basis: PSD)

~~25. The owner/operator shall not allow the maximum projected annual toxic air contaminant emissions (per condition 28) from the Gas Turbines and HRSGs (S-1, S-2, S-3 & S-4) combined~~

~~to exceed the following limits:~~

~~formaldehyde~~	~~10,912 pounds per year~~
~~benzene~~	~~226 pounds per year~~
~~Specified polycyclic aromatic hydrocarbons (PAHs)~~	~~1.8 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. (Regulation 2, Rule 5)~~

26. The owner/operator shall demonstrate compliance with conditions 13 through 16, 19(a) through 19(d), 20, 22(a), 22(b), 23(a) and 23(b) by using properly operated and maintained continuous monitors (during all hours of operation including gas turbine start-up, combustor tuning, and shutdown periods) for all of the following parameters:
    (a) Firing Hours and Fuel Flow Rates for each of the following sources: S-1 & S-3 combined, S-2 & S-4 combined.
    (b) Oxygen (O_2) concentration, Nitrogen Oxides (NO_x) concentration, and Carbon Monoxide (CO) concentration at exhaust points P-1 and P-2.
    ~~(c) Ammonia injection rate at A-1 and A-3 SCR Systems~~

    The owner/operator shall record all of the above parameters 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-3 combined, S-2 & S-4 combined.
    (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 and P-2.

    For each source, source grouping, or exhaust point, the owner/operator shall record the parameters specified in conditions 26(d) and 26(e) at least once every 15 minutes (excluding normal calibration periods). As specified below, the owner/operator shall calculate and record the following data:
    (f) total Heat Input Rate for every clock hour.

(g) on an hourly basis, the cumulative total Heat Input Rate for each calendar day for the following: each Gas Turbine and associated HRSG combined and all four sources (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 associated HRSG combined and all four sources (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 and associated HRSG combined.

(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 all four sources (S-1, S-2, S-3 and S-4) combined.

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

27. To demonstrate compliance with conditions ~~19(f), 19(g),~~ 19(h), ~~22(d),~~ 22(e), ~~22(f)~~ ~~23(e),~~ 23(d), ~~23(e),~~ the owner/operator shall calculate and record on a daily basis, the ~~Precursor Organic Compound (POC) mass emissions,~~ Fine Particulate Matter (PM_{10} and $PM_{2.5}$) 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 condition 26, actual Gas Turbine start-up times, actual Gas Turbine shutdown times, and CEC and District-approved emission factors developed pursuant to source testing under condition 30 to calculate these emissions. The owner/operator shall present the calculated emissions in the following format:

(a) For each calendar day, ~~POC,~~ PM_{10} and $PM_{2.5}$~~, and SO_2~~ emissions, summarized for each power train (Gas Turbine and its respective HRSG combined) and all four sources (S-1, S-2, S-3 & S-4) combined

(b) on a monthly basis, the cumulative total ~~POC,~~ PM_{10} and $PM_{2.5}$~~, and SO_2~~ mass emissions, for each year for all four sources (S-1, S-2, S-3 & S-4) combined

(Offsets, PSD, Cumulative Increase)

~~28. To demonstrate compliance with Condition 25, 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 35,708,858 MM BTU/year and the highest emission factor (pounds of pollutant per MM BTU of heat input) determined by any source test of the S-1 and S-3 Gas Turbines and/or S-2 and S-4 Heat Recovery Steam Generators. 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. (Regulation 2, Rule 5)~~

~~29. Within 90 days of start-up of the RCEC, the owner/operator shall conduct a District-approved source test on exhaust point P-1 or P-2 to determine the corrected ammonia (NH_3) emission~~

~~concentration to determine compliance with condition 19(e). The source test shall determine the correlation between the heat input rates of the gas turbine and associated HRSG, A-2 or A-4 SCR System ammonia injection rate, and the corresponding NH_3 emission concentration at emission point P-1 or P-2. The source test shall be conducted over the expected operating range of the turbine and HRSG (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 condition 19(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. (Regulation 2, Rule 5)~~

30. Within 90 days of start-up of the RCEC and on an annual basis thereafter, the owner/operator shall conduct a District-approved source test on exhaust points P-1 and P-2 while each Gas Turbine and associated Heat Recovery Steam Generator are operating at maximum load to determine compliance with Conditions 19(a), 19(b), 19(c), 19(d), ~~19(f), 19(g),~~ and 19(h) and while each Gas Turbine and associated Heat Recovery Steam Generator are operating at minimum load to determine compliance with Conditions 19(c) and 19(d), and to verify the accuracy of the continuous emission monitors required in condition 26. 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 particulate matter (PM_{10} and $PM_{2.5}$) 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. (BACT, offsets)

31. 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 the total PM_{10} and $PM_{2.5}$ 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. (BACT)

~~32. Within 90 days of start-up of the RCEC and on a biennial basis (once every two years) thereafter, the owner/operator shall conduct a District-approved source test on exhaust point P-1 or P-2 while the Gas Turbine and associated Heat Recovery Steam Generator are operating at maximum allowable operating rates to demonstrate compliance with Condition 25. 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 condition 25 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 ≤ 6.4 pounds/year and 2.9 pounds/hour~~
~~Formaldehyde ≤ 30 pounds/year and 0.21 pounds/hour~~
~~Specified PAHs ≤ 0.011 pounds/year~~
~~(Regulation 2, Rule 5)~~

33. The owner/operator shall calculate the SAM emission rate using the total heat input for the sources and the highest results of any source testing conducted pursuant to condition 34. If this SAM mass emission limit of condition #24 is exceeded, the owner/operator must utilize air dispersion modeling to determine the impact (in $\mu g/m^3$) of the sulfuric acid mist emissions pursuant to Regulation 2-2-306. (PSD)

34. Within 90 days of start-up of the RCEC and on an annual basis thereafter, the owner/operator shall conduct a District-approved source test on exhaust points P-1 and P-2 while each gas turbine and HRSG duct burner is operating at maximum heat input rates to demonstrate compliance with the SAM emission rates specified in condition 24. 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. (PSD)

35. The owner/operator of the RCEC 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. (Regulation 2-6-502)

36. The owner/operator of the RCEC 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. (Regulation 2-6-501)

37. The owner/operator of the RCEC 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. (Regulation 2-1-403)

38. The owner/operator shall ensure that the stack height of emission points P-1 and P-2 is each at least 145 feet above grade level at the stack base. (PSD, Regulation 2-5)

39. The Owner/Operator of RCEC 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. (Regulation 1-501)

40. Within 180 days of the issuance of the Authority to Construct for the RCEC, 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 conditions 29, 30, 32, 34, and 43. The owner/operator shall conduct all source testing and monitoring in accordance with the District approved procedures. (Regulation 1-501)

41. Pursuant to BAAQMD Regulation 2, Rule 6, section 404.1, the owner/operator of the RCEC shall submit an application to the BAAQMD for a major facility review permit within 12 months of completing construction as demonstrated by the first firing of any gas turbine or HRSG duct burner. (Regulation 2-6-404.1)

42. Pursuant to 40 CFR Part 72.30(b)(2)(ii) of the Federal Acid Rain Program, the owner/operator of the Russell City Energy Center shall submit an application for a Title IV operating permit to the BAAQMD at least 24 months before operation of any of the gas turbines (S-1, S-3, S-5, or S-7) or HRSGs (S-2, S-4, S-6, or S-8). (Regulation 2, Rule 7)

43. The owner/operator shall ensure that the Russell City Energy Center complies with the continuous emission monitoring requirements of 40 CFR Part 75. (Regulation 2, Rule 7)

C. Permit Conditions for Cooling Towers

44. The owner/operator shall properly install and maintain the S-5 cooling tower to minimize drift losses. The owner/operator shall equip the cooling towers with high-efficiency mist eliminators with a maximum guaranteed drift rate of 0.0005%. The maximum total dissolved solids (TDS) measured at the base of the cooling towers or at the point of return to the wastewater facility shall not be higher than 6,200 ppmw (mg/l). The owner/operator shall sample and test the cooling tower water at least once per day to verify compliance with this TDS limit. (PSD)

45. The owner/operator shall perform a visual inspection of the cooling tower drift eliminators at least once per calendar year, and repair or replace any drift eliminator components which are broken or missing. Prior to the initial operation of the Russell City Energy Center, the owner/operator shall have the cooling tower vendor's field representative inspect the cooling tower drift eliminators and certify that the installation was performed in a satisfactory manner. Within 60 days of the initial operation of the cooling tower, the owner/operator shall perform an initial performance source test to determine the PM_{10} and $PM_{2.5}$ emission rate from the cooling tower to verify compliance with the vendor-guaranteed drift rate specified in condition 44. The CEC CPM may require the owner/operator to perform source tests to verify continued compliance with the vendor-guaranteed drift rate specified in condition (PSD)

D. Permit Conditions for S-6 Fire Pump Diesel Engine

46. The owner/operator shall not operate S-6 Fire Pump Diesel Engine more than 50 hours per year for reliability-related activities. ("Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection (e)(2)(A)(3) or (e)(2)(B)(3), offsets)

47. The owner/operator shall operate S-6 Fire Pump Diesel Engine only for the following purposes: to mitigate emergency conditions, for emission testing to demonstrate compliance with a District, state or Federal emission limit, or for reliability-related activities (maintenance and other testing, but excluding emission testing). Operating hours while mitigating emergency conditions or while emission testing to show compliance with District, state or Federal emission limits is not limited. ("Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection (e)(2)(A)(3) or (e)(2)(B)(3))

48. The owner/operator shall operate S-6 Fire Pump Diesel Engine only when a non-resettable totalizing meter (with a minimum display capability of 9,999 hours) that measures the hours of operation for the engine is installed, operated and properly maintained. ("Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection (e)(4)(G)(1), cumulative increase)

49. Records: The owner/operator shall maintain the following monthly records in a District-approved log for at least 60 months from the date of entry. Log entries shall be retained on-site, either at a central location or at the engine's location, and made immediately available to the District staff upon request.
    a. Hours of operation for reliability-related activities (maintenance and testing).
    b. Hours of operation for emission testing to show compliance with emission limits.
    c. Hours of operation (emergency).
    d. For each emergency, the nature of the emergency condition.
    e. Fuel usage for each engine(s).

    (Basis: "Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection (e)(4)(I), cumulative increase)

E. Greenhouse Gas PSD Permit Conditions.

The following conditions shall apply at all times, and are based on the owner/operator's agreement to be subject to enforceable BACT permit limits for greenhouse gas emissions as a condition for receiving a Federal PSD Permit.

Conditions for the Gas Turbines (S-1 & S-3) and the Heat Recovery Steam Generators (HRSGs; S-2 & S-4)

50. The owner/operator shall not emit more than 242 metric tons of CO_2E from the S-1 & S-3 Gas Turbines and S-2 & S-4 Heat Recovery Steam Generators (HRSGs) per hour. (Basis: Voluntary Greenhouse Gas BACT Requirement)

51. The owner/operator shall not emit more than 5,802 metric tons of CO_2E from the S-1 & S-3 Gas Turbines and S-2 & S-4 Heat Recovery Steam Generators (HRSGs) per day. (Basis: Voluntary Greenhouse Gas BACT Requirement)

52. The owner/operator shall not emit more than 1,928,182 metric tons of CO_2E from the S-1 & S-3 Gas Turbines and S-2 & S-4 Heat Recovery Steam Generators (HRSGs) per year. (Basis: Voluntary Greenhouse Gas BACT Requirement)

53. The owner/operator shall maintain the S-1 & S-3 Gas Turbines such that the heat rate of each turbine does not exceed 7,730 Btu/kWhr. (Basis: Voluntary Greenhouse Gas BACT Requirement)

54. The owner/operator shall maintain the following monthly records in a District-approved log for at least 60 months from the date of entry. Log entries shall be retained on-site, either at a central location or at each circuit breaker's location, and made immediately available to the District staff upon request.
    a. Hourly, daily, and annual heat input.
    b. Hourly, daily, and annual greenhouse gas emissions, expressed in metric tons of CO_2E and calculated by multiplying the hourly, daily, and annual heat input by an emissions factor of 119.0 pounds of CO_2E per MMBtu of heat input.

    (Basis: Voluntary Greenhouse Gas BACT Requirement)

55. Within 90 days of start-up of the RCEC and on an annual basis thereafter, the owner/operator shall conduct a District-approved heat rate performance test on exhaust points P-1 and P-2 while each Gas Turbine is operating at maximum load to determine compliance with Condition 53. The owner/operator shall conduct this heat rate performance test according to the requirements of the American Society of Mechanical Engineers Performance Test Code on Overall Plant Performance, ASME PTC 46-1996. (Basis: Voluntary Greenhouse Gas BACT Requirement)

Conditions for S-6 Fire Pump Diesel Engine

56. The owner/operator shall not emit more than 7.6 metric tons CO_2E from the S-6 Fire Pump Diesel Engine per rolling 12-month period during operation subject to Condition 46. (Basis: Voluntary Greenhouse Gas BACT Requirement)
57. The owner/operator shall operate S-6 Fire Pump Diesel Engine only when a non-resettable totalizing fuel meter for the engine is installed, operated and properly maintained. (Basis: Voluntary Greenhouse Gas BACT Requirement)
58. The owner/operator shall maintain the following monthly records in a District-approved log for at least 60 months from the date of entry. Log entries shall be retained on-site, either at a central location or at each circuit breaker's location, and made immediately available to the District staff upon request.
    a. Monthly fuel usage.
    b. Monthly greenhouse gas emissions, expressed in metric tons of CO_2E and calculated by multiplying the amount of fuel used per month by an emissions factor of 21.7 pounds of

CO_2E per gallon of fuel used.
(Basis: Voluntary Greenhouse Gas BACT Requirement)

Conditions for S-7 through S-11 Circuit Breakers

59. The owner/operator shall not emit more than 39.3 metric tons of CO_2E from the S-S-7 through S-11 circuit breakers per rolling 12-month period. (Basis: Voluntary Greenhouse Gas BACT Requirement)

60. The owner/operator shall maintain the following monthly records in a District-approved log for at least 60 months from the date of entry. Log entries shall be retained on-site, either at a central location or at each circuit breaker's location, and made immediately available to the District staff upon request.
    a. Amount of dielectric fluid added to the circuit breakers for each month of facility operation.
    b. Greenhouse gas emissions from the circuit breakers for each month of facility operation, expressed in metric tons of CO_2E and calculated by multiplying the amount of dielectric fluid added by an emissions factor of 10.84 metric tons of CO_2E per pound of dielectric fluid added during the month.

    (Basis: Voluntary Greenhouse Gas BACT Requirement)

61. The owner/operator shall install and maintain a leak detection system on the circuit breakers that signals an alarm in the facility's control room in the event that any circuit breaker loses more than 10% of its dielectric fluid. The owner/operator shall promptly respond to any alarm, investigate the circuit breaker involved, and fix any leak-tightness problems that caused the alarm. (Basis: Voluntary Greenhouse Gas BACT Requirement)

F. Permit Conditions for the Gas Turbines (S-1 & S-3) During Black-Start-Related Operations

62. Commissioning Activities for Black Start Capability: The owner/operator shall perform commissioning activities for black start capability at S-1 and S-3 for no more than 20 hours combined. The owner/operator shall not perform these activities at S-1 and S-3 simultaneously. Upon completion of these activities, the owner/operator shall provide written notice to the District Engineering and Enforcement Divisions. (Basis: BACT)

63. Emission Limits for Commissioning Activities for Black Start Capability: The owner/operator shall not operate the Gas Turbines (S-1 & S-3) in a manner such that the combined pollutant emissions from these sources will exceed the following limits when performing commissioning activities for black start capability.

(g) NO_x (as NO_2):	4,800 pounds
(h) CO:	114,000 pounds
~~(i) POC (as CH_4):~~	~~6,080 pounds~~
(j) $PM_{2.5}/PM_{10}$:	150 pounds
~~(k) SO_2:~~	~~124 pounds~~

(l) GHG: 3,298,700 pounds CO_2E

. (Basis: BACT)

64. Monitoring and Recordkeeping for Commissioning Activities for Black Start Capability: The owner/operator of the RCEC shall demonstrate compliance with conditions 50 and 51 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)

65. Daily Emission Limits: The owner/operator shall not allow total combined emissions from the Gas Turbines (S-1 & S-3) to exceed the following limits during any calendar day when commissioning activities for black start capability or black start emergency operations occur:

(g) NO_x (as NO_2): 5,760 pounds per day
(h) CO: 131,100 pounds per day
~~(i) POC (as CH_4): 7,300 pounds per day~~
(j) $PM_{2.5}/PM_{10}$: 360 pounds per day
~~(k) SO_2: 292 pounds per day~~
(l) GHG: 12,786,900 pounds CO_2E per day

(Basis: BACT)

66. Emission Limits for Black Start Emergency Events: The owner/operator shall not allow total combined emissions from the Gas Turbines (S-1 & S-3) to exceed the following limits during a black start emergency event:

(g) NO_x (as NO_2): 11,520 pounds
(h) CO: 137,100 pounds
~~(i) POC (as CH_4): 14,600 pounds~~
(j) $PM_{2.5}/PM_{10}$: 360 pounds
~~(k) SO_2: 298 pounds~~
(l) GHG: 11,644,500 pounds CO_2E

(Basis: BACT)

VI. Conclusions and Recommendation

The District has preliminarily concluded that the proposed black start capability project at the Russell City Energy Center, 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 Calpine'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-1 Combustion Turbine Generator #1, Westinghouse 501F, 2,038.6 MMBtu/hr maximum rated capacity, natural gas fired only; abated by A-1 Selective Catalytic Reduction System and A-2 Oxidation Catalyst

S-3 Combustion Turbine Generator #2, Westinghouse 501F, 2,038.6 MMBtu/hr maximum rated capacity, natural gas fired only; abated by A-3 Selective Catalytic Reduction System and A-4 Oxidation Catalyst

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 Russell City Energy Center, 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 29348
Bay Area Air Quality Management District
375 Beale Street, Suite 600
San Francisco, CA 94105

Appendix A

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 dry standard cubic feet/lb-mol
ambient oxygen concentration:	20.9%
dry flue gas factor[b]:	8740 dscf/MM Btu
natural gas heating value:	1020 Btu/dscf

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

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

Table A-1 summarizes the regulated air pollutant emission factors that were used to calculate mass emission rates for one gas turbine during black-start-related operations at RCEC.

Table A-1
Regulated Air Pollutant Emission Factors

Pollutant	lb/min	lb/hr
Nitrogen Oxides (as NO_2)	4	240
Carbon Monoxide (1st 23-hour)	95	5,700
Carbon Monoxide (after 23 hours)	4	240
Precursor Organic Compounds	5.07	304
Particulate Matter (PM_{10} / $PM_{2.5}$)	-	7.5
Sulfur Dioxide	-	6.2
Greenhouse Gases (CO_2E)	-	164,934

Basis for the above emission factors:

- Nitrogen Oxide (NOx) emission factor in lb/minute is derived from CEM data collected during cold starts at RCEC. The value also includes assumed compliance margin based on the facility's experience of the turbine startup operation.

- Carbon Monoxide (CO) emission factor in lb/minute for the 1st 23-hour operation during a black start emergency operation is derived from CEM data collected during cold starts at RCEC. The value also includes assumed compliance margin based on the facility's experience of the turbine startup operation. After the 1st 23 -hour period, from operation experience, the facility assumed the CO catalyst can reach a temperature where CO control will be effective.

- Precursor Organic Compounds (POCs) emission factor in lb/minute is based on the emission data from the original equipment manufacturer from 0% to 60% load.

- Particulate Matter (PM) emission factor in lb/hour is the same as the current limit for PM emissions specified in the permit condition.

- Sulfur Dioxide (SOx) emission factor in lb/hour is the same as the current limit for SOx emissions in permit condition.

- Greenhouse Gases (GHG) emission factor in lb/hour is based on the GHG emission factor of 119 lb of CO_2E/MMBtu and the fuel rate of 1386 MMBtu/hour at 60% load operation.

- 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:

PM_{10} mass emission rate = 7.5 lb/hr
Flow rate = 2,798,113 lb/hr @ 18.3% O_2 and 563°F
Moisture content = 2.99% by volume

Converting flow rate to standard conditions:
(2,798,113 lb/hr)(1 hr/60 min)(385.3 cf/lb mol)(1 mol/28.4) = 632,918 acfm
(632,918 acfm)([70 + 460 °R]/[563 + 460 °R])(1 – 2.99%) = 318,395.5 dscfm

Converting to grains/dscf:
(7.5 lb PM_{10}/hr)(1 hr/60 min)(7000 gr/lb)/(318,395.5 dscfm) = 0.0027 gr/dscf

Converting to 6% O_2 basis:
(0.002748 gr/dscf)[(20.9% - 6%)/(20.9% – 18.3%)] = 0.016 gr/dscf @ 6% O_2

- The following data will be used to calculate the maximum NOx concentration at 15% O_2 to determine compliance with the NOx emission standard in 40 CFR Part 60, Subpart KKKK:

Maximum NOx mass emission rate during black-related operations = 240 lb/hr
Maximum Black Start Emergency Operation Duration = 48 hours = 2 days
Fuel Input during full speed no load operation = 450 MMBtu/hour
NOx emission concentration during normal steady state operations as permit limit = 2 ppm @ 15% O_2
Applicable Rolling Average Basis in Subpart KKKK = 30 unit operating days

Converting NOx mass emission rate to ppm @ 15% O_2:
(240 lb/hr) (hr/450 MMBtu) = 0.53 lb/MMBtu
(0.53 lb/MMBtu) (386.8 dscf/lb mol) (MMBtu/8740 dscf) (lb mol/ 46.01 lb) [(20.9% – 15%)/(20.9% – 0%)] = 144 ppm

Averaging over 30 unit operating days:
(144 ppm x 2 days + 2 ppm x 28 days) / (30 days) = 11 ppm

Table A-2 summarizes the regulated air pollutant emissions from different black-start-related operations.

Table A-2
Regulated Air Pollutant Emissions from Black-Start-Related Operations

Pollutant	Emission Factor	Daily Emission	A Black Start Emergency Operation Event	Black Start Commissioning
	(lb/hr)	(lb/day)	(lb/event)	(lb/event)
NOx (as NO_2)	240	5,760	11,520	4,800
CO	5,700/240	131,100	137,100	114,000
POC	304	7,301	14,600	6,084
PM (PM_{10} / $PM_{2.5}$)	7.5	180	360	150
SOx	6.2	149	298	124
GHG (CO_2E)	164,934	3,958,416	11,644,483*	3,298,680

Basis for the above emission calculations:

- The daily emission for each pollutant is based on a continuous operation of 24 hours at one turbine. The applicant proposed to operate only one turbine at any given time during black start emergency operations and commissioning activities. For CO, the higher emission factor of 5700 lb/hour is used.

- The emissions from a black start emergency operation event is based on a continuous operation of 48 hours of one turbine. For CO, emissions from the first 23-hours is based on the higher emission factor of 5700 lb/hour; emissions after the first 23-hours is based on the lower emission factor of 240 lb/hour.

- The emissions from commissioning activities for black start capability is based a total of 20 operation hours for both gas turbines combined.

*Note: During a black start emergency event, depending on the situations, CAISO may direct the facility to drop load again after reaching base load (at or greater than 60%) operation. For the purpose of setting a compliance limit, the GHG emission limit for a black start emergency event is calculated based on one turbine's fuel rate at 100% load as shown below:
GHG Limit = (2038.6 MMBtu/hr)(119 lb of CO_2E/MMBtu)(48 hr/event) = 11,644,483 lb of CO_2E / event

Table A-3 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-3
Regulated Air Pollutant Emission Increase in the Black Start Capability Project

Pollutant	Annual Potential to Emit	Baseline Emission	Project Emission Increase	Significant Threshold
	(tons/year)	(tons/year)	(tons/year)	(tons/year)
NOx (as NO_2)	127.00	25.10	101.90	40
CO	330.00	63.97	266.03	100
POC	28.50	1.27	27.23	40
PM (PM_{10} / $PM_{2.5}$)	71.80	5.43	66.37	15/10
SOx	12.20	2.27	9.93	40.00
GHG (CO_2E)	2,125,821	1,146,070	979,751	75,000

Basis for the above emission calculations:

- Annual potential to emit for each pollutant is the current facility-wide emission limits in the permit condition because the applicant proposed not to change the annual emission limits after the black start capability project. There is no separate annual emission limits for S-1 or S-3 in the permit condition.

- Baseline emissions for NOx and CO are based on RCEC's CEM emission data from October 2015 to September 2018.

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

- Baseline emissions for GHG are derived from RCEC's fuel usages from January 2013 to September 2018. According to the District Regulation 2-2-603.2.2.3, the fuel usages in a period of 24-consecutive months out of the 5-year period (i.e. from November 2013 to October 2015) are selected to calculate the baseline emissions for GHG.

- The project emission increase is the difference between the 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.

Table A-4 summarizes the toxic air contaminant emission factors that were used to calculate mass emission rates during black-start-related operations at RCEC.

Table A-4
Toxic Air Contaminant Emission Factors for the Black Start Capability Project

Toxic Air Contaminant	Emission Factor	Basis
	(lb/MMBtu)	
1,3-Butadiene	1.25E-07	CATEF
Acetaldehyde	1.22E-03	SDAPCD
Acrolein	6.56E-05	SDAPCD

Toxic Air Contaminant	Emission Factor	Basis
Ammonia	6.80E-03	Permit Limit
Benzene	2.44E-05	SDAPCD
Benzo(a)anthracene	2.14E-08	SDAPCD
Benzo(a)pyrene	1.32E-08	SDAPCD
Benzo(b)fluoranthene	1.11E-08	CATEF
Benzo(k)fluoranthene	1.08E-08	CATEF
Chrysene	2.14E-08	SDAPCD
Dibenz(a,h)anthracene	2.14E-08	SDAPCD
Ethylbenzene	3.10E-05	SDAPCD
Formaldehyde	4.41E-03	SDAPCD
Hexane	2.54E-04	CATEF
Indeno(1,2,3-cd)pyrene	2.14E-08	SDAPCD
Naphthalene	9.90E-07	SDAPCD
Propylene	7.56E-04	CATEF
Propylene Oxide	4.69E-05	CATEF
Toluene	8.84E-05	SDAPCD
Xylene (Total)	3.31E-06	SDAPCD
Sulfuric Acid Mist (H2SO4)	4.30E-04	Fuel S Content

Basis for the above emission factors:

- 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

- For TACs that are not identified in the SDAPCD source test, CATEF is used to calculate the emissions.

- Ammonia emission factor is based on the permit limit of 5 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)

= (5E-06) x (1/386.8 dscf/lb-mol) x (17 lb/lb-mol) x (8743 dscf/MMBtu) x 20.9/(20.9 - 15)

= 0.007 lb/MMBtu

where ppm limit = 5 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 (SAM) emission factor is based on the maximum sulfur (S) content in PG&E's natural gas and the assumption of up to 10% conversion from sulfur to SAM:

SAM (lb/MMBtu) = 10% x (S Content) x (1/Natural Gas Heating Value) x (MWof S)/(MW of SAM)
= (10%) x (1 grain S/100 scf) (1 lb/7000 grains) (scf/1020 Btu) x (1E6 Btu/MMBtu) (98/32)
= 4.3E-4 lb/MMBtu

Table A-5 summarizes the hourly toxic air contaminant emissions during black-start-related operations at RCEC.

Table A-5
Toxic Air Contaminant Emissions for the Black Start Capability Project

Toxic Air Contaminant	Emission Factor	Hourly Emission
	(lb/MMBtu)	(lb/hr)
1,3-Butadiene	1.25E-07	1.73E-04
Acetaldehyde	1.22E-03	1.69E+00
Acrolein	6.56E-05	9.10E-02
Ammonia	6.80E-03	9.43E+00
Benzene	2.44E-05	3.38E-02
Benzo(a)anthracene	2.14E-08	2.97E-05
Benzo(a)pyrene	1.32E-08	1.84E-05
Benzo(b)fluoranthene	1.11E-08	1.54E-05
Benzo(k)fluoranthene	1.08E-08	1.49E-05
Chrysene	2.14E-08	2.97E-05
Dibenz(a,h)anthracene	2.14E-08	2.97E-05
Ethylbenzene	3.10E-05	4.30E-02
Formaldehyde	4.41E-03	6.11E+00
Hexane	2.54E-04	3.52E-01
Indeno(1,2,3-cd)pyrene	2.14E-08	2.97E-05
Naphthalene	9.90E-07	1.37E-03
Propylene	7.56E-04	1.05E+00
Propylene Oxide	4.69E-05	6.50E-02
Toluene	8.84E-05	1.23E-01
Xylene (Total)	3.31E-06	4.59E-03

Toxic Air Contaminant	Emission Factor	Hourly Emission
Sulfuric Acid Mist (H2SO4)	4.30E-04	5.96E-01

Basis for the above emission calculations:

- Hourly TAC emissions are based on one turbine's firing rate at 60% load (i.e.1386 MMBtu/hour).