Additional Statement of Basis

Draft Federal "Prevention of Significant Deterioration" Permit

Russell City Energy Center

Bay Area Air Quality Management District
Application Number 15487

August 3, 2009

Draft Federal PSD Permit
Additional Statement of Basis and
Solicitation of Further Public Comment
For the Proposed Russell City Energy Center

August 3, 2009

The Bay Area Air Quality Management District ("Air District") is revising its draft Federal PSD Permit for the proposed Russell City Energy Center based on new information received since the initial draft was published in December of 2008. Pursuant to 40 C.F.R. section 124.14(b), the Air District is incorporating this new information into this Federal PSD permit proceeding by:

(1) Issuing a revised draft permit with certain modifications to address new information under 40 C.F.R. section 124.6;

(2) Issuing an additional "Statement of Basis" for the draft permit under 40 C.F.R. sections 124.7 and 124.8[1]; and

(3) Reopening the comment period under 40 C.F.R. section 124.10 to give interested persons an opportunity to comment on the new information and the District's proposed treatment of it; and to give interested persons an opportunity to submit any further comments that they could not reasonably have submitted during the initial comment period.

This document contains the revised draft Federal PSD Permit conditions and the District's Additional Statement of Basis supporting them. The purpose of this Additional Statement of Basis is to briefly set forth additional facts and further factual, legal, methodological and policy questions that the Air District has considered regarding the draft permit since the initial Statement of Basis was issued. The document briefly describes the derivation of the current revisions to the draft permit conditions and the reasons for them. The Additional Statement of Basis provides further documentation regarding the Air District's proposed decision to issue the Federal PSD Permit in order to provide the public a further opportunity to comment on it. The Air District has prepared this Additional Statement of Basis because it has undertaken additional analysis and consideration regarding this proposed project since the initial Statement of Basis was issued. This additional analysis and consideration was undertaken for several reasons, including recent changes in the Federal PSD regulatory environment, additional factual information that has become available since the initial Statement of Basis was prepared, insightful comments received from members of the public during the initial comment period, and further discussions with the project applicant. The Air District believes that this additional analysis and consideration, as well as the revised draft permit conditions that have come out of it, will result in an improved permit.

[1] As with the initial Statement of Basis, the Air District calls this document a "Statement of Basis", but has prepared it in accordance with all of the comprehensive requirements for documenting the agency's analysis contained in 40 C.F.R. Sections 124.7 (statement of basis) and 124.8 (fact sheet). *See* Statement of Basis, p. 3 fn. 1, for further discussion.

The Air District invites all interested members of the public to review the Revised Draft Federal PSD Permit and Additional Statement of Basis and submit comments on the issues raised in them. To assist the public in doing so, the Air District is making a number of materials available so that the public may review them and learn more about the proposed permit. This Additional Statement of Basis, the initial Statement of Basis published in December of 2008, the revised proposed permit conditions, the initial permit application and all subsequent data and information submitted by the applicant, and all other materials supporting the Air District's proposal to issue the Federal PSD Permit are available for public inspection at the Outreach and Incentives Division Office located on the 5th Floor of District Headquarters, 939 Ellis Street, San Francisco, CA, 94109. The Additional Statement of Basis and revised proposed permit conditions, as well as the initial Statement of Basis and initial proposed permit conditions, are also available on the District's website at www.baaqmd.gov. The public may also contact Weyman Lee, P.E., Senior Air Quality Engineer, Bay Area Air Quality Management District, 939 Ellis Street, San Francisco, CA, 94109, (415) 749-4796, weyman@baaqmd.gov, for further information. **Para obtener la información en español, comuníquese con Brenda Cabral en la sede del Distrito, (415) 749-4686, bcabral@baaqmd.gov.**

The Air District invites all interested members of the public to submit written and/or oral comment on any issues raised by this revised Draft Federal PSD Permit and Additional Statement of Basis. Written comment should be directed to Weyman Lee at the contact address provided above, and must be received by September 16, 2009. Oral comments may be submitted at the public hearing the Air District will be holding for this project. The public hearing will be held at Hayward City Hall, 777 B Street, Hayward, CA, 94541, on Wednesday, September 2, 2009, from 6:30 to 9:00 pm. Air District staff will be available from 6:00 to 6:30 to discuss the project informally and answer questions.

The Air District also invites all interested members of the public to submit written and/or oral comment on any issues regarding the initial draft permit and statement of basis that were published in December of 2008 that members of the public were not able to comment on during the initial comment period (which closed on February 6, 2009). To the extent that members of the public have comments regarding the initial draft permit and statement of basis that they could not reasonably have made during the initial comment period (for example, because of evidence or information that was not reasonably ascertainable during the initial comment period, because of changes in regulatory requirements since that time, *etc.*), the Air District invites them to be submitted during this additional comment period (either in writing addressed to Mr. Lee or orally at the public hearing) so that the Air District can consider them before making a final decision on the proposed permit.

Members of the public who submitted comments during the initial comment period on the initial draft permit and statement of basis **do not** need to re-submit their comments to the Air District. The Air District has taken all comments previously received during the comment period under consideration and will consider and respond to them before making a final decision on the proposed permit. Persons who submitted comments earlier may of course provide additional comments during the current comment period on any relevant issues.

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ADDITIONAL STATEMENT OF BASIS

The Air District's additional analysis and consideration of the Federal PSD requirements as they apply to the proposed Russell City Energy Center are described in this section. This additional analysis builds on and refines the analysis set forth in the initial Statement of Basis issued in December of 2008, which is incorporated herein by reference. The draft PSD Permit conditions based on this analysis are set forth at the end of this document.

I. PROPOSAL TO ISSUE FEDERAL PSD PERMIT FOR RUSSELL CITY ENERGY CENTER

At the outset, the Air District wishes to clarify that it is now proposing to issue a new Federal PSD Permit for the Russell City Energy Center, not an amendment to an existing Federal PSD Permit as the District originally proposed. The Air District has reviewed the permitting record since it issued its original proposal in light of comments received during the initial comment period. Based on this review, the District has concluded that when the facility was initially permitted in 2002, the District did not issue a final Federal PSD Permit along with its state-law Authority to Construct, as is the District's normal practice. The record indicates that the District did not finalize the Federal PSD Permit at the time it issued the Authority to Construct because EPA Region 9 had not completed its Endangered Species Act consultation with the US Fish & Wildlife Service. The project applicant subsequently withdrew its plans to build the facility at the original location, however, and so the consultation was never finalized and the Federal PSD Permit was never issued.

The Air District is therefore revising its initial proposal to issue an "Amended Federal PSD Permit". The Air District is now proposing to issue a new Federal PSD Permit for this facility, since no final PSD Permit has yet been issued. The Air District has reviewed its analysis in the initial Statement of Basis and has concluded that this analysis supports the issuance of all elements of the permit as a new permit, because the Air District treated the facility's permit application, in substance, as an application for a new permit rather than as an application for an amendment. In evaluating the project for compliance with Federal PSD requirements, the Air District did not rely in any way on the analysis prepared for the initial permit. To the contrary, the Air District made clear in the Statement of Basis that it was evaluating the entire project for compliance with the Federal PSD requirements, not just elements that were changing since the initial permitting. As the Air District explained in the Statement of Basis, it analyzed both the amendments to the proposed project as well as the elements that were not being changed, and concluded "[t]he analysis of the elements that are not being amended shows that the conditions from the initial permit that are not being changed meet current applicable legal standard for Federal PSD Permit, and that they would *comply with current PSD requirements even if they were being proposed anew at this time*." (Statement of Basis at p. 7 (emphasis added).) The detailed analyses provided in the Statement of Basis support this conclusion. The Air District evaluated all of the equipment at the project from scratch to ensure that it meets current BACT standards as is required for a new permit application. The District similarly conducted an Air Quality Impacts Analysis (and related analyses) from scratch for the entire project, using the most current information and modeling techniques, as is required for a new project. Those

analyses, along with the additional review and analysis described in this document, fully support the issuance of a new Federal PSD Permit as the District is now proposing to do.

The Air District provides this discussion to clarify in the record at this point that it is proposing to issue a new permit, not an amendment to an existing PSD permit. To the extent that there were any issues involving the District's proposal that any members of the public refrained from commenting on during the initial comment period because they understood the proposed permit to be an amendment and not a new permit, the Air District invites the public to submit any such comments for the District's consideration at this time.

II. ISSUES REGARDING THE POWER GENERATION EQUIPMENT PROPOSED FOR THIS FACILITY

The Air District has conducted further analysis regarding the electrical generating equipment that the applicant proposes to use at the Russell City Energy Center and whether it is appropriate for this facility under the Federal PSD regulations. These issues are discussed below.

A. Currentness of Combustion Turbine Technology

The District received a number of comments regarding the type of electrical generating equipment the applicant intends to use at the Russell City Energy Center, and in particular whether it will be the cleanest and most efficient equipment consistent with the Best Available Control Technology requirements of the Federal PSD permitting program. Some of these comments stated that the Air District incorrectly based its BACT analysis for the combustion turbines/heat recovery boilers on the equipment that the applicant has already purchased and intends to use at the facility. Some comments questioned whether other equipment besides what the applicant intends to use for the project would be able to achieve lower emission rates. Although many of these comments were specific to emissions of individual PSD-regulated pollutants (or potentially PSD-regulated pollutants such as greenhouse gases), a number of them were directed at whether alternative equipment might be cleaner and more efficient in general. In response to these comments, the Air District explored whether there was more efficient generating equipment that the facility could use.

The Air District has identified "FD3" turbine technology as the current state-of-the-art electrical generating equipment for a facility of this type, as outlined in detail in Section III below. FD3 turbine technology would allow the facility to achieve an overall thermal efficiency of 56.4% (lower heating value), which is the highest efficiency of any similar plant that the Air District reviewed. This FD3 technology is slightly more efficient than the "FD2" technology that the applicant originally proposed. After further discussions with the project applicant, the applicant has agreed to upgrade its equipment to incorporate the more modern FD3 technology. These FD3 upgrades will result in an improvement in the thermal performance of the gas turbines, resulting in a slightly higher efficiency for the plant as a whole. That is, they will result in a reduction in the plant's "heat rate", which is the amount of fuel required to produce a megawatt (MW) of electricity, making the gas turbine's efficiency comparable to the best F-Class turbines available on the market today. The Air District is basing its BACT determinations on this state-of-the-art technology, not on the FD2 technology used in the turbines that the applicant originally proposed.

The FD3 upgrades will consist of decreasing the clearances in the compressor section of the turbine, adjusting the inlet guide vanes and optimizing the control system components. More specifically, the upgrades will include the following:

- The inlet guide vanes will be opened more to increase airflow.
- The existing compressor row 7-15 diaphragm inter-stage labyrinth seal holders will be replaced with honeycomb seals.

- The compressor row 16 blades will be replaced with a new design.
- The gas turbine row 1 blades will be replaced with a new design.
- The gas turbine row 1 ring segments and isolation rings will be replaced with a new improved design.
- The gas turbine row 2 seal housing will be replaced with a new rope seal.
- The gas turbine rows 2 and 3 vane sealing will be enhanced.
- The gas turbine row 4 blade ring assembly, consisting of blade rings, vanes, ring segments and inter-stage seal housing will be replaced with a new design.
- The gas turbine row 4 blades will be replaced with a new design.
- The existing exhaust cylinder will be replaced.

The Applicant will also implement operational and maintenance changes recommended by the original equipment manufacturer to improve performance, reliability and maintainability of the equipment. In addition, the Applicant will replace the control system with Siemens' latest control technology, known as the "T-3000" system.[2]

With these upgrades, the turbines the applicant has already purchased will, for all emissions performance purposes, be the equivalent of FD3 turbines commercially available today. These upgrades will increase the plant's overall efficiency, such that the rate of emissions per unit of energy produced will be reduced, which will allow the facility to meet a BACT standard set by the emissions rate achievable by FD3 turbines. Based on this FD3 technology, the facility will be able to achieve a thermal efficiency of 56.4%, which is the highest efficiency of any similar plant the Air District reviewed. This highly efficient technology will generate fewer emissions for a given amount of power generation than any other similar facility. The Air District is basing its proposed BACT permit conditions on this current technology.[3]

Furthermore, to clarify the record on this issue, Air District notes that it is basing its proposed BACT permit conditions on the emissions performance of this FD3-level technology, but is not proposing permit requirements specifying exactly what equipment must be used to satisfy the applicable BACT permit limits. BACT requires emission limits to be imposed based on the best emissions performance achievable by current state-of-the-art technology, but once the BACT limits are established based on this technology as the Air District is proposing, the specific

[2] *See* Email Memorandum re "RCEC: GHGs BACT Analysis Technical Documentation", from K. Poloncarz, Calpine Counsel, to A. Crockett, BAAQMD, April 2, 2009.

[3] The BACT analyses for certain specific pollutants and/or specific operating scenarios depend on other factors such as the availability of add-on controls, *etc*. But to the extent that emissions performance is linked to turbine efficiency, the emissions performance from these FD3-equivalent turbines will be the lowest achievable because FD3 turbines are the most efficient for this type of application. The gist of the comments the Air District received regarding turbine efficiency were primarily directed at greenhouse gases (to the extent that these are regulated NSR pollutants subject to BACT), but this same analysis holds true for the other pollutants, which are also dependent to some extent on turbine efficiency (*i.e.*, how much power can be generated for a given amount of fuel).

equipment the facility uses to achieve that limitation is irrelevant. As long as the facility keeps emissions within the BACT emission standards, it does not matter what particular choice of equipment the facility uses to do so. Certainly, from an environmental standpoint the choice is irrelevant because it is the emissions that impact air quality not the make or model of the equipment that generates them. If the applicant can meet current emission standards by upgrading existing equipment, there may be significant benefits to be gained, such as avoiding the costs of purchasing new equipment that would ultimately be borne by ratepayers and avoiding the waste inherent in junking serviceable equipment. But how the applicant meets current emission standards is up to the applicant. What matters from an air quality perspective – and what matters for purposes of the Federal PSD Permit requirements – is whether the limits established in the permit reflect the maximum emission reductions achievable for the source using current technology. As demonstrated in the Air District's BACT analyses (as set forth in more detail in the rest of this document), the limits the District is imposing on this facility are all based on current technology. Since the limits that the facility will be subject to are based on current technology, issues such as the date of manufacture or purchase of the specific equipment the applicant may choose to install are not relevant for purposes of the Federal PSD Permit.

B. Use of Duct Burners to Generate Additional Power

The District also received comments asserting that the proposed design of using duct burners to generate additional steam to power the steam turbine is not the most efficient method to generate additional power to meet peak demand. These comments asserted that duct burners are inefficient and reduce the fuel efficiency (and thus increase the air emissions) of the facility. They stated that the Air District should have considered alternatives to duct burners, such as simple-cycle turbines or solar alternatives, to meet peak load demand. In light of these comments, the Air District has considered further whether the use of duct burners satisfies the BACT requirement.

Upon further consideration, the District has concluded that there are no more efficient alternatives that would meet the power generation needs for which this facility was designed. The facility is designed to meet a maximum power demand of nominally 600 megawatts, but a 2x1 combined-cycle facility without duct burning can meet a nominal demand of only 550 megawatts.[4] Duct burning is an efficient way of generating additional power to meet peak demand from the combustion turbine exhaust. Duct burning involves burning additional natural gas in the ducts to the heat recovery boiler, which increases the temperature of the exhaust coming from the combustion turbines and thereby creates additional steam for the steam turbine.

[4] Combustion turbines come only in discrete size classes, and so it is not always possible to design a facility to meet the demand called for using turbines alone. Where it is not possible, some way of making up the additional capacity must be used. (Note that these are nominal capacities; actual power output from a specific facility at any given time depends on a large number of design and operational variables.) The facility's design capacity cannot be achieved here by use of a 2x1 turbine configuration alone without some additional peak power.

In response to these comments, the Air District evaluated whether the additional peak capacity could be more efficiently provided by other technologies besides duct burning.[5]

The Air District first evaluated the alternative of replacing the duct burners with simple-cycle generating technology (*i.e.*, "peaker" turbines) that could generate approximately the same amount of energy during peak demand periods. Simple-cycle turbines would not be more efficient than duct burning here, however. To the contrary, simple-cycle turbines of similar capacity would have a higher heat rate (i.e., take more fuel to produce a unit of power) than duct burning. The incremental additional heat rate using duct burning to generate peak capacity (rated at 46.3 MW) is 7,595 Btu/kWhr (LHV).[6] In comparison, a basic GE LM6000 gas turbine generator set, rated at 42.3 megawatts, would have a heat rate of 8,308 Btu/kWh (LHV); with additional features, a GE LM6000 Sprint ("Spray-Intercooled Turbine"), rated at 46.9 megawatts, would have a heat rate of 8,235 Btu/kWh (LHV).[7] Duct firing will therefore be a more efficient method of generating peak capacity than installation of the most efficient form of simple-cycle generation capacity the Air District is aware of. The Air District therefore concludes that the use of a simple-cycle turbine would not provide any advantage over duct burning.

Moreover, even if it were not for the superior performance of Russell City Energy Center's duct burners in comparison to an LM6000, replacement of duct burners with a separate simple-cycle unit would likely be eliminated from consideration as BACT based upon the significantly greater cost and ancillary environmental impacts. According to a report prepared by the California Energy Commission, the cost to replace the proposed Russell City Energy Center's peaking capacity with a simple cycle plant would be approximately $507.98 per MWhr for an investor-owned utility (IOU) plant or $647.28 per MWhr for a "merchant" plant.[8] In contrast, the total

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[5] It is not clear whether the BACT analysis requires a consideration of alternatives to duct firing to meet peak capacity demand. The BACT analysis is not intended to require the applicant to change its design from construction of a combined cycle to simple cycle facility or to eliminate and replace key elements of its design with different sources. (*See*, *e.g.*, *In re Kendall New Century Development*, PSD Appeal No. 03-01, 11 E.A.D. 40, 51-52 (EAB 2003) (finding that, in identifying BACT for a proposed peaking generating facility, the permitting authority "does not have authority to require [the Applicant] to construct a facility with larger combustion units or one that would run in combined-cycle mode since this would change the intended nature of the Facility"); *see also In re Prairie State Generating Co.*, *supra* note 5, slip op. at 32 (referencing the EAB's recognition in *In re Kendall New Century Development* that "it [is] appropriate for the permitting authority to distinguish between electric generating stations designed to function as 'base load' facilities and those designed to function as 'peaking' facilities, and that this distinction affects how the facility is designed and the pollutant emissions control equipment that can be effectively used by the facility").) This issue is moot here, however, as the Air District has concluded that there are no superior alternatives even if such an analysis were required.

[6] *See* Russell City Energy Center Heat Balance Diagrams.

[7] GE Aero Energy Products, brochure, LM6000 SPRINT™ Gas Turbine Generator Set, available at: www.gepower.com/prod_serv/products/aero_turbines/en/downloads/lm6000_sprint.pdf.

[8] California Energy Commission, *Comparative Costs of California Central Station Electricity Generation Technologies*, Final Staff Report, December 2007, CEC-200-2007-011-SF, at pp. 10, 12; available at: www.energy.ca.gov/2007publications/CEC-200-2007-011/CEC-200-2007-011-

estimated cost for a 550-MW combined cycle plant with duct firing is approximately $95.59 or $103.52 per MWhr for an IOU or merchant plant, respectively;[9] whereas the cost for a combined cycle facility without duct firing is estimated for an IOU and merchant plant at $94.47 or $102.19 per MWhr, respectively.[10] In light of these estimates, the marginal cost associated with duct firing at a facility like the proposed Russell City Energy Center would appear substantially more favorable than the cost to replace its peak capacity with a separate simple-cycle unit. The Air District therefore concludes the cost of requiring simple-cycle peak power generation would be obviously excessive, and thus would not be required as BACT for this additional reason as well.

The Air District also examined the potential for using solar thermal technology as an alternative to using duct burners in response to this comment. The Air District reviewed the approach taken with the proposed Victorville 2 Hybrid Power Project, which utilizes solar technology to eliminate some of the need for duct burning to address peak demand. The Victorville Project will be a 570-MW facility located in the Mojave Desert and will consist of natural gas-fired, combined-cycle generating equipment integrated with solar thermal generating equipment. The solar thermal component of the Victorville "hybrid" Project will consist of a series of diurnal, single-axis-tracking parabolic trough solar collectors laid out in parallel rows aligned on a north-south horizontal axis. Each solar collector will track the sun from east to west to assure that it continuously reflects the greatest amount of sunlight possible onto a "linear receiver", which contains a heat transfer fluid that circulates through the receiver and returns to a series of heat exchangers, where it is used to generate high-pressure steam for two heat recovery steam generators (HRSGs). The solar thermal input is intended to provide approximately 10% of the power generated by the facility during peak periods. Use of solar thermal equipment is projected to increase the overall thermal efficiency of the combined-cycle plant from 52.7% to 59% (LHV) because it would allow the facility to reduce firing of the duct burners during peak periods and replace that peak capacity with the input from the solar thermal generating equipment.[11] In comparison to Victorville's 59% efficiency rating (LHV) during such periods, the Russell City Energy Center's efficiency rating would be 56.44% (LHV) during periods of duct burning.[12]

A solar alternative to duct burning would not be feasible for the Russell City facility, however, because there is far less available area at the project than in the Mojave Desert, and the compact site would not provide adequate space for installation of a solar collectors. To construct a solar thermal plant to replace some of the peak capacity from duct burning would need 275 acres of

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SF.PDF. An LM6000 is the equivalent of "Small Simple Cycle" (50 MW) in the Energy Commission's report. Dollar figures are given in nominal 2007 dollars.

[9] *Id.* at p. 12.

[10] *Id.* at p. 10.

[11] City of Victorville, *Application for Certification, Victorville 2 Hybrid Power Project*, February 28, 2007, at 2.1-2.14; available at www.energy.ca.gov/sitingcases/victorville2/documents/applicant/afc/ (hereinafter, "Victorville 2 Application"). Again, it is not clear that the BACT requirement is intended to involve replacement of duct firing to meet peak capacity demand with a completely different type of facility design, but that issue is moot because the Air District has found that solar peaking capacity would not be feasible here.

[12] *See* Table, Comparison of FD3 Turbines with and without duct burner firing, prepared by Alex Prusi, P.E., Director of Engineering, Calpine, April 2, 2009.

land,[13] which would not be feasible given the space-constrained project site on the edge of the San Francisco Bay.[14] Redesigning the project to incorporate a solar system like Victorville's would therefore require the facility to be moved to another location, making it impossible to achieve the project objectives served by the current location, which include "[t]o locate near centers of demand and key infrastructure, such as transmission line interconnections, supplies of process water (preferably wastewater), and natural gas at competitive prices",[15] and "[t]o serve the electrical power needs of the East Bay, San Francisco Peninsula, and City of San Francisco."[16] Requiring additional space to build a solar system would also eliminate the environmental benefits of locating adjacent to the City of Hayward's waste water treatment plant so the facility can recycle approximately 4 million gallons per day of effluent from the plant and eliminate discharges of that waste water to the San Francisco Bay, and of locating at a previously-developed brownfield site. For these reasons, the Air District has found that thermal solar peaking capacity is not an available alternative to reduce the facility's use of duct burning to generate peak capacity.

The Air District therefore concludes that none of these alternative methods to generate the additional peak capacity needed to meet the facility's design load would be required under a BACT analysis for this facility, even if one were required.

C. Design of Facility for Intermediate-to-Baseload Service

The District also received comments noting that the facility would be operated to meet contractual load and spot sale demand, and may not operate on a full-time, base-loaded basis. These comments questioned the anticipated operating mode of the proposed Russell City Energy Center, suggesting that if it were intended for load-following or other duty that would involve frequent startup and shutdown events, the Applicant should be required to construct a fast-start-capable, peaking-to-intermediate duty plant instead.

The Air District has considered this issue further in light of these comments. The Air District notes that the Federal PSD Permit process is designed to ensure that a proposed facility will be as low-emitting as possible (among other requirements). It is not designed to require an applicant to propose a different type of project of a different fundamental scope and design, for example to substitute a simple-cycle peaking plant instead of a combined-cycle intermediate-to-baseload

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[13] *See* Victorville 2 Application, *supra* note 11, at pp. 2-3.

[14] The project site for the Russell City Energy Center is a 14.7-acre area located in the West Industrial District of Hayward, California, adjacent to the City of Hayward Water Pollution Control Facility and near existing transmission facilities. *See* Calpine, *Application for Certification*, *Russell City Energy Center* (May 2001) (hereinafter, "RCEC Application for Certification"), at 9-3 – 9-4; available at: www.energy.ca.gov/sitingcases/russellcity/documents/applicant_files/afc/vol-1/.

[15] California Energy Commission, *Commission Decision, Russell City Energy Center* (July 2002, P800-02-007) (hereinafter, "2002 Energy Commission Decision"), pp. 17 (available at: www.energy.ca.gov/sitingcases/russellcity/index.html).

[16] RCEC Application for Certification, *supra* note 14, at pp. 9-1 – 9-2.

project as the commenters suggest here.[17] Moreover, it would not make any sense from an emissions standpoint to require a simple-cycle facility for the purpose that this facility is intended to be used for, which is to serve intermediate-to-baseload capacity. Simple-cycle facilities are less efficient than combined-cycle facilities, which recover the heat from the turbine exhaust (which would simply be emitted and wasted in a simple-cycle facility) and use it to generate additional electricity. Simple-cycle facilities are therefore generally inferior to combined-cycle facilities, except for applications where the generating capacity must come on-line in a very short time frame, which is not the case with the uses for which this facility has been proposed and designed. The Air District therefore disagrees that it should require the applicant to redesign the facility as a simple-cycle peaking facility.

D. Source of Emissions Estimates

Some commenters also criticized the Air District for relying on emissions estimates from the project applicant and from the CEC in its explanation of the emissions from the project. The Air District believes that the project applicant and the CEC are among the best sources of information about potential emissions from the facility based on their detailed knowledge and understanding of the proposed project and the type of operation involved. Moreover, the Air District has not seen any suggestion that any of the emissions estimates the Air District relied on may be unreliable in any way, or that there may be alternative sources of emissions estimates that it should consider instead. And in any event, the Air District is proposing to turn the emissions estimates into enforceable emissions limits in the PSD permit, along with monitoring and recordkeeping requirements to ensure that actual emissions stay below these limits. Thus, if the underlying estimates turn out to be inaccurate and actual emissions exceed the estimates as they have been incorporated into the permit limits, the facility will be in violation of its permit and will have to shut down or curtail operations unless it can fix whatever problems are causing the increased emissions. For all of these reasons, the Air District disagrees that it is inappropriate to consider emissions estimates from the project applicant or from the CEC in its permitting analysis. In light of this reasoning, if any members of the public believe that there are alternative sources of emissions information that would be relevant to the PSD permitting process for this facility, the Air District seeks input on what those sources of information may be and how they may be relevant.

E. Specific Turbine Information

Finally, the District also received some comments asking for detailed information about the combustion turbines the applicant intends to use at the facility, such as turbine serial numbers, dates of manufacture, cost, *etc*. But specific details such as these are not relevant to determining the Best Available Control Technology and applicable permit limits for this equipment or for analyzing the potential air quality impacts of the facility, and so the Air District has not sought such information from Calpine. For example, if the Air District determines that a certain type of turbine technology is BACT and imposes a BACT permit limit based on the achievable

[17] This principle has been well established by the Environmental Appeals Board in reviewing PSD permits. *See, e.g.*, *In re Prairie State Generating Co.*, *supra* note 5, slip op. at 32; *In re Kendall New Century Development, supra* note 5, at 51-52.

emissions performance for that turbine technology, it makes no difference which particular turbine is used (*e.g.*, which particular serial number) as long as the facility complies with the applicable permit conditions. The Air District therefore disagrees that such specific information about individual pieces of equipment is relevant to the Federal PSD Permitting analysis. To the extent that information about particular types of turbine technologies is relevant (*e.g.*, costs, ancillary environmental or energy impacts, relative efficiency, achievable emissions performance standards, *etc*.) the Air District has sought that information and provided it in the relevant sections of its permitting analysis. To the extent that members of the public believe that additional information would be relevant to the PSD Permitting analysis, the District solicits further comment on how it could be relevant and how it could impact the PSD permit process.

III. GREENHOUSE GAS EMISSIONS

Since the Air District initially prepared its voluntary Greenhouse Gas BACT analysis in December of 2008, it has substantially revised the analysis based on the many insightful comments it received and on additional analysis by District staff and submissions by the Applicant. The Air District's revisions to its voluntary Greenhouse Gas BACT analysis are described in detail below. The corresponding proposed permit conditions are included in the Draft Federal PSD permit conditions at the end of this document, based on the applicant's agreement to be subject to greenhouse gas BACT limits despite the lack of guidance from EPA that BACT limits are required under its PSD regulations.

A. Applicability Of PSD Permit Requirements To Greenhouse Gas Emissions

In the Statement of Basis, the Air District noted that the status of greenhouse gas regulation is not as well developed at the federal level, particularly under the federal PSD permitting program. This continues to be the case, although there have been several additional developments since the Air District published its initial proposal. A number of commenters claimed that these recent developments make greenhouse gases "subject to regulation" under the Clean Air Act, and that as a result they must be subject to PSD Permitting. The Air District is therefore recounting these developments in this Additional Statement of Basis to clarify the record on whether the Federal PSD regulations require consideration of Greenhouse Gases. Ultimately, however, whether PSD review of greenhouse gases is required under the Federal PSD permit program is a moot issue in this case, as the applicant has agreed voluntarily to subject itself to PSD review regardless of whether it is legally required or not.

As the Air District noted in the Statement of Basis, EPA's Environmental Appeals Board found in November of 2008 in the *Deseret Power* case that EPA as an agency has the discretion to determine whether greenhouse gases should be subject to PSD regulation or not, but had not at that time adopted any definitive policy position on the issue.[18] The EAB also suggested that it may be more appropriate for EPA to address this issue through a nationwide rulemaking, rather than through individual case-by-case PSD permitting decisions. The issue was thus in a highly unresolved state when the Air District issued its initial proposal on December 8, 2008. Then, on December 18, 2008, EPA issued a policy memorandum in response to the EAB's *Deseret Power* opinion. The impact of EPA's December 18 memorandum is that EPA is not requiring greenhouse gases to be regulated under the Federal PSD permitting program (at least not at this time).[19] The Sierra Club then petitioned for reconsideration of the December 18, 2008, memorandum claiming that it was an unlawful interpretation of the Federal PSD permit

[18] *See In re Deseret Power Electric Cooperative*, PSD Appeal No. 07-03, slip op. at 63-65 (EAB Nov. 13, 2008).

[19] *See* Memorandum, Stephen L. Johnson, Administrator, *EPA's Interpretation of Regulations that Determine Pollutants Covered by Federal Prevention of Significant Deterioration (PSD) Permit Program*, December 18, 2008; notice provided at 73 Fed. Reg. 80300 (Dec. 31, 2008).

requirements, and on February 17, 2009, EPA granted the petition for reconsideration.[20] As a consequence, EPA is now reconsidering whether greenhouse gases are subject to Federal PSD permit requirements, and will be soliciting public comment on the issue. As EPA explained in its February 17, 2009, letter, "PSD permitting authorities should not assume that the [December 18, 2008] memorandum is the final word on the appropriate interpretation of Clean Air Act requirements." EPA declined to stay the effectiveness of the December 18, 2008, memorandum, however, and so that memorandum remains in effect as EPA policy for the time being.

Greenhouse gases are therefore currently not subject to Federal PSD Permit review pursuant to the December 18, 2008, memorandum because the memorandum has not been stayed. EPA has indicated that this interpretation is not necessarily "the final word" on the issue, however, and so greenhouse gases may become subject to Federal PSD permit requirements at some point in the future. The project applicant has therefore voluntarily agreed to go forward with the Air District's proposal to impose BACT permit limits on greenhouse gas emissions, so that the permit will satisfy PSD requirements for greenhouse gases in the event that they become subject to regulation in the future.

Several comments also stated that the Air District should impose greenhouse gas limits in the Federal PSD Permit under various authorities in California law. The District disagrees that it could impose greenhouse gas conditions under California law (or any other state-law conditions) in a federal PSD permit. It is certainly true that greenhouse gas issues are the subject of various California statutes and are being addressed by various California regulatory agencies, including the Air District, but that does not mean that the District can impose permit conditions under California law in a federal permit issued on behalf of the federal EPA.

Furthermore, the District also disagrees with assertions by certain commenters that the U.S. Supreme Court's decision in *Massachusetts v. EPA* means that greenhouse gases are "subject to regulation" under the Federal Clean Air Act. That case determined that greenhouse gases are within the definition of "air pollutant" as used in the Clean Air Act; it did not address the question of whether greenhouse gases are pollutants that are "subject to regulation" under the Clean Air Act.[21] Similarly, the Air District also disagrees that EPA's recent proposal to make a finding that greenhouse gases endanger public health and welfare[22] means that greenhouse gases are "subject to regulation". That proposal is not yet final, and even if EPA does finalize it as proposed the finding will not establish that greenhouse gases are subject to regulation under the PSD program. As EPA made clear in the proposal, that question will be answered in the reconsideration of the December 18, 2008, memorandum.[23]

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[20] *See* Letter, Lisa P. Jackson to David Bookbinder, February 17, 2009, available at: www.epa.gov/air/nsr/documents/ 20090217LPJlettertosierraclub.pdf.

[21] *See generally In re: Christian County Generation, LLC*, PSD Appeal No. 07-01, 13 E.A.D. __, slip op. at 7 n. 12 (EAB Jan. 28, 2008).

[22] *See* Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act, US EPA (April 17, 2009), available at epa.gov/ climatechange/endangerment/downloads/GHGEndangermentProposal.pdf.

[23] *See id.* at n. 29.

In addition, after the close of the initial comment period, another issue was raised concerning greenhouse gases involving the potential for CO_2 emissions to contribute to increased ozone and particulate matter pollution in the vicinity where the CO_2 emissions occur. This issue was raised by recently-published research findings by Mark Z. Jacobson, a researcher at Stanford University, who has posited that locally-emitted CO_2 will form "domes" over urban areas where it is emitted, which will cause localized temperature increases under the "CO_2 domes", and the localized temperature increases will in turn increase the rate of formation of ozone and particulate matter in such areas.[24] The Air District notes that the concern expressed in this paper is similar to the general concern that has been expressed about greenhouse gases and the secondary pollution impacts that would arise from warmer temperatures on a global scale. This study is interesting in that it is the first time (that the Air District is aware of) that scientific research has focused on these issues on a local scale. With respect to whether the paper's findings mean that the Air District should treat greenhouse gases as pollutants "subject to regulation" for PSD permitting purposes, the Air District first notes that concerns about temperature increases from the greenhouse effect having secondary impacts on criteria pollutant formation have been known for some time, and yet have not led EPA to treat greenhouse gases as "subject to regulation" at this point as outlined above. The Air District is bound to follow EPA guidance with respect to the Federal PSD program, and so the Air District does not have the discretion to depart from EPA's position in response to a study such as this one. Moreover, since concerns about secondary pollutant effects from warming temperatures globally have not led EPA to consider greenhouse gases "subject to regulation" at this stage, it seems unlikely that consideration of such concerns on a local scale would do so either (at least, at this point in the evolution of EPA's approach to greenhouse gas regulation). This point is especially applicable here, where the first research supporting this hypothesis has only just emerged and there has not yet been time for a scientific consensus to develop around it. But in any event, as with all of these arguments about whether greenhouse gases should be considered "subject to regulation", the issue is moot in this case because the applicant has voluntarily agreed to have the Air District treat greenhouse gases as if they are regulated and to impose greenhouse gas BACT limits in the facility's PSD permit, as the Air District is proposing.

For all of these reasons, the Air District continues to regard the available guidance from EPA on this matter to direct that greenhouse gases are *not* "subject to regulation" under the Federal Clean Air Act and not legally required to be included in the Federal PSD Permit review. Nevertheless, since the District is treating greenhouse gases as subject to PSD permitting as discussed above, these issues are moot.

B. Greenhouse Gas BACT Technology Analysis For Combined-Cycle Power Generation Trains

The Air District has also conducted further analysis regarding the appropriate BACT standard for greenhouse gas emissions from combined-cycle intermediate-to-baseload combustion turbines, as explained in detail below. The District first looked at issues that have been raised about whether BACT requires an analysis of alternatives to fossil-fuel-fired combustion technology.

[24] *See The Enhancement of Local Air Pollution by Urban CO_2 Domes*, Mark Z. Jacobson, April 3, 2009, available at: www.stanford.edu/group/efmh/jacobson/PDF%20files/CO2loc0409.pdf.

The District next considered what emissions performance can be achieved by the most efficient combustion equipment available for the proposed facility here. Third, the Air District conducted additional analysis of what the most appropriate BACT permit conditions should be for such equipment, and as a result is substantially revising its proposed permit conditions.

1. Evaluation of Non-Fossil-Fuel-Fired Electrical Generation Alternatives

Of the comments the Air District has received so far, none has disagreed with the Air District's assessment that the only feasible control technology for reducing greenhouse gas emissions from fossil-fuel burning power generating facilities is to use the most efficient electrical generating technology,[25] and that at present there are no feasible post-combustion add-on controls for such facilities. The Air District did receive comments stating that the Air District should have evaluated alternative energy production methods that do not rely on fossil fuel combustion, however. These comments suggested that the District should not focus simply on turbine efficiency, as opposed to looking at more efficient ways of making electricity without using combustion turbines.

The Air District has considered these comments and is in agreement that the development of non-fossil-fuel electrical generating sources is of critical importance in meeting California's energy needs while at the same time furthering its air quality goals, especially in light of recent advances in the understanding of the problems posed by global climate change. The Air District recognizes, however, that alternative generating technologies are not currently capable of meeting the state's electrical power demand at all times and under all circumstances, and that some fossil-fuel generating capacity is still needed.[26] Determining the most appropriate mix of electrical generation sources under these circumstances is a highly complex engineering and policy exercise that is most appropriately undertaken by the California Energy Commission, the state's expert agency on energy policy matters. The Air District obviously has a supporting role to play in helping the Energy Commission to understand the air quality impacts of its siting decisions and to include appropriate air quality conditions in its licenses. But as an agency, the Air District does not have the expertise nor the authority to determine what type of generation sources are needed, of what capacity, and where. The Air District must therefore necessarily defer to the Energy Commission's decision that the proposed natural-gas fired, combined-cycle facility is the most appropriate alternative for this project. If it would be more appropriate to use wind or solar power to serve the function intended for the proposed Russell City project, the Energy Commission is the agency best suited – and specifically tasked by the California legislature – to make that determination.

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[25] Notably, one comment expressly stated agreement with the District's assessment that the only currently feasible control option for CO_2 is more efficient energy production.

[26] *See, e.g.*, *Framework for Evaluating Greenhouse Gas Implications of Natural Gas-Fired Power Plants in California*, consultant report prepared by MRW & Associates for the California Energy Commission (available at: www.energy.ca.gov/2009publications/CEC-700-2009-009/CEC-700-2009-009.PDF .

Here, the Energy Commission specifically evaluated potential non-fossil-fuel-fired alternatives, such as solar, wind, and biomass, in its licensing proceeding for the Russell City Energy Center. The Energy Commission ultimately rejected those alternatives as not feasible because "they do not fulfill a basic objective of the plant: to provide power from a baseload facility to meet the growing demands for reliable power in the San Francisco Bay Area."[27] The Energy Commission rejected wind and solar generating sources because of their inherently intermittent nature, which makes them inappropriate for a baseload generating resource intended to ensure an adequate supply of power in periods when solar and wind sources do not provide power to the grid.[28] The Energy Commission also noted that alternatives like wind and solar involve other environmental trade-offs that can offset the benefits of reduced air emissions. For example, the Energy Commission found that a "wind farm" capable of generating 600 megawatts of power would require 10,200 acres, approximately 690 times the amount of land needed for the Russell City project and associated facilities."[29] The Energy Commission similarly found that a solar thermal project would require approximately 3,000 acres, or over 200 times the amount of land needed for the Russell City project.[30] For all of these reasons, the Energy Commission determined that the better policy choice, taking into account all relevant factors, would be the facility as proposed and not a facility using alternative, non-fossil-fuel generating technology.[31] The Energy

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[27] 2002 Energy Commission Decision, *supra* note 15, at p. 19. The Energy Commission made a further finding in its 2007 Amendment decision that no renewable alternatives would be able to meet the project's objectives. *See* California Energy Commission, *Final Commission Decision, Russell City Energy Center* (October 2007) (hereinafter, "2007 Energy Commission Decision"), p. 21, finding 3 (available at www.energy.ca.gov/2007publications/CEC-800-2007-003/CEC-800-2007-003-CMF.PDF). In making this finding, the Commission relied in part upon the detailed analyses that were undertaken in connection with the original licensing proceeding in 2002. *See id*. at pp. 20-21.

[28] 2002 Energy Commission Decision, *supra* note 15, at p. 18.

[29] *Id*.

[30] *Id*.

[31] One alternative that the Energy Commission did not consider was coal-fired generating technologies. Some have argued that coal and natural gas should be considered alternatives of one another, and if this approach were taken then coal should be considered as an alternative along with wind, solar and biomass. To the extent that the Energy Commission even considered this issue, it is likely that it did not undertake a considered evaluation of a coal-fired alternative because in most respects natural gas is a far cleaner fuel. For example, the average emissions rate from existing coal-fired generation in the United States has been estimated by U.S. EPA at 2,249 lbs/MWh of CO_2. (*See* Environmental Protection Agency, *Air Emissions* (hereinafter EPA Air Emissions Summary), available at www.epa.gov/cleanrgy/energy-and-you/affect/air-emissions.html.) Other sources have estimated an average emissions rate over 2,300 lbs/MW-hr. (*See* California Air Resources Board, *Documentation for Emission Default Factors in Joint Staff Proposal for an Electricity Retail Provider GHG Reporting Protocol R.06-04-009 and Docket 07-OIIP-01* (June 20, 2007), available at: www.arb.ca.gov/cc/ccei/presentations/OOS_EmissionFactors.pdf. Meanwhile, according to U.S. EPA, "[c]ompared to the average air emissions from coal-fired generation, [combustion of] natural gas produces half as much carbon dioxide," or about 1,135 lbs/MWh. (*See* EPA Air Emissions Summary, *supra*.) Other estimates put this number as low as 800 lbs/MWh. (*See* Pace, *Life Cycle Assessment of GHG Emissions*

Commission also considered biomass such as wood chips or agricultural waste as a fuel source, but found that such an alternative would not be feasible because no biomass fuel source is available in large enough quantities in the vicinity of the project.[32]

The Federal PSD BACT requirement is not designed to intrude upon this analysis by the expert state agency on power generation and supply policy. To the contrary, Federal PSD permitting explicitly contemplates that PSD permitting authorities will defer to other state agencies on siting decisions.[33] The Air District therefore disagrees that it should require a further review of alternative types of projects – even if they would involve fewer emissions – because that type of alternatives analysis is properly within the province of the Energy Commission's siting authority under the Warren-Alquist Act.

The Air District is of course cognizant of its obligation to provide a determination of what the Federal PSD BACT provision requires for a power plant like this one, in its role in advising the Energy Commission on Air Quality requirements. But the federal BACT framework is clear that it does not require consideration of the use of non-fossil-fuel-fired alternatives, and the Air District therefore could not suggest to the Energy Commission that such alternatives are required by the Federal PSD regulations, regardless of whether there are sound policy reasons to consider them. In determining the Best Available Control Technology for a proposed facility, EPA requires that the Air District examine the best technology for that particular type of facility. EPA requires that the Air District consider the purpose and basic design of the facility, and consider only control technologies consistent with that purpose and basic design. EPA has made clear that the BACT analysis should not include alternative technologies that would require the facility to undergo significant modifications that would alter its fundamental scope, or would change design elements inherent to the facility's purpose, or would call into question the existence of the facility, or would disrupt the applicant's basic business purpose for the proposed facility.[34] Here,

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from LNG and Coal Fired Generation Scenarios: Assumptions and Results, prepared for Center for Liquefied Natural Gas (Feb. 3, 2009) at p. 13; available at: www.energy.ca.gov/lng/documents/2009-02-03_LCA_ASSUMPTIONS_LNG_AND_COAL.PDF.) Even the most recent advanced coal generation technologies such as an integrated gasification combined-cycle (IGCC) coal-fired plant, which emits over 1,700 lb/MW-hr, would not come close to the emissions performance of natural gas. (*See id* at 11-12.) Any comparison of natural gas and coal as fuels would therefore find that natural gas is by far the preferable alternative.

[32] 2002 Energy Commission Decision, *supra* note 15, at p. 18.

[33] *See In re Prairie State Generating Co.*, PSD Appeal 05-05, *supra* note 5, slip op. at 44; *In re SEI Birchwood, Inc*., 5 E.A.D. 25, 33 (EAB 1994); *In re EcoEléctrica, LP*, 7 E.A.D. 56, 74 (EAB 1997); *In re Kentucky Utils. Co*., PSD Appeal No. 82-5, at 2 (Adm'r 1982).

[34] *See generally* Draft New Source Review Workshop Manual, Prevention of Significant Deterioration and Nonattainment Area Permitting US Environmental Protection Agency (October 1990) (hereinafter "NSR Workshop Manual"), at p. B.13; *In re Prairie State Generating Co.*, *supra* note 5, slip op. at 32; *In re Kendall New Century Dev.*, *supra* note 5, at pp. 50-52 & n. 14; *In re Hillman Power Co.*, 10 E.A.D. 673, 691-92 (EAB 2002); *In re Knauf Fiber Glass, Gmbh*, 8 E.A.D. 121, 136 (EAB 1999); after remand, 9 E.A.D. 1, 8-11 (EAB 2000); *In re SEI Birchwood, Inc.*, 5 E.A.D. 25, 29-30 n.8 (EAB 1994); *In re Hawaii Commercial & Sugar Co.*, 4 E.A.D. 95, 99-100 (EAB 1992); *In re Old Dominion Elec. Coop.*, 3 E.A.D. 779, 793 n. 38 (Adm'r 1992).

non-fossil fuel technologies, such as wind and solar, would not be consistent with the facility's purpose and basic design. To the contrary, they would require a fundamental change in the facility's purpose – generating electric power from natural gas combustion – and would require a complete redesign of the basic elements of the facility. Moreover, changing to such technologies would likely call the existence of the facility into question, because it is far from clear whether wind or solar technologies could be used in lieu of combustion technology to meet the power generation demand the proposed facility will serve, according to the Energy Commission's findings discussed above. For all of these reasons, the BACT analysis is not required to consider such alternatives.

2. Evaluation of Most Efficient Combined-Cycle Combustion Turbine Technology

The Air District also received some comments that criticized the District's initial assessment that the Siemens-Westinghouse 501F turbines the applicant proposed for the project, which the District found to be 55.8% efficient, are the most efficient equipment available. Commenters stated that Siemens' new G-class turbines could be used to achieve a net plant efficiency of 58% and are already in operation at a number of plants. Commenters also stated that GE "H Class" turbines can achieve 60% efficiency, and have been in operation in Wales and Japan for some time. Commenters also claimed that the proposed Siemens F-Class turbines are at the bottom end of the 55.8-56.5% range found in similar turbines as evaluated in the Energy Commission's documents, and the Air District has not explained why more efficient turbines should not have been required.

Based on these comments, the Air District has further reviewed the types of gas turbine equipment available for this project to ensure that the facility will use the most efficient equipment. As noted above in Section II.A., the Air District found that recent advances in the Siemens F-class turbines have resulted in increased efficiency over the FD2 turbines that the applicant initially proposed. These FD3 upgrades can achieve a gross efficiency of 56.45% (LHV) for the combined-cycle facility (without duct burning), a small but significant increase over the 55.8% for the FD2 turbines as initially proposed. The Air District has therefore determined that an efficiency of 56.45% is achievable using FD3-equivalent technology, and is basing its revised greenhouse gas BACT analysis on this efficiency level.

Beyond the FD3-equivent technology, the Air District also examined the feasibility and potential emissions performance advantages of using next-generation turbine equipment such as G-Class or H-Class turbines at this facility. For G-Class turbines, this equipment would actually reduce the overall efficiency of the facility and increase greenhouse gas emissions per megawatt of power produced. This is because G-class turbines have a substantially greater power output than F-Class turbines. Thus, in order to build a 612-megawatt combined-cycle power plant as proposed here using G-Class turbines, the Applicant would need to use a substantially smaller steam turbine (143 MW) to provide the equivalent plant output, which is limited at 612.8 MW (net).[35] This would result in an inefficient bottoming cycle and would lower the overall plant

[35] *See* Table, Comparison of Plant Efficiency, 612.8 MW: FD2, FD3, G-Class and Flex 10 Configurations, Prepared by A. Prusi, Calpine, April 2, 2008. Siemens G-class turbines, when

gross efficiency rating to 49.8% (LHV), according to an analysis provided by the Applicant, compared to the 56.4% efficiency rating of the facility using the latest F-Class technology.[36] As a consequence, although the G-Class turbines may be marginally more efficient by themselves, when incorporated into a combined-cycle facility of this size they would result in lower efficiency for the facility as a whole. The Air District has therefore concluded that the use of G-class turbines would not be the top-ranked eliminated control technology here (i.e., would not lead to the most efficient plant), and would not constitute BACT.

As for H-Class turbines, that turbine class is not yet demonstrated and commercially available for the 60 Hz electrical power system used in the United States, and is therefore not a feasible control technology for purposes of the BACT analysis. GE does have an H-Class turbine that has been fairly well demonstrated for 50 Hz power systems used in other countries. It installed an initial 50 Hz technology validation project at Baglan Bay in Wales that has been in operation since 2003;[37] and it has a second 50 Hz project in Futtsu, Japan, that began operation in July 2008 (with a second turbine expected to come on-line in late 2009), which GE characterizes as "a key step in the commercial development of [the] H System gas turbine".[38] But GE's H-Class 60-Hz turbine is not as far along in the development process, and the company has only just installed its first 60-Hz H-class test turbine at the Inland Empire Energy Center in Riverside County, CA, which just began operation on January 28, 2009 (with a second turbine that is currently being installed but is not yet online).[39] This project will require extensive testing to ensure that it meets all design specifications and is sufficiently reliable for long-term

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initially introduced in 1999, had an output of 235 MW. (*See* E. Bancalari & P. Chan, Siemens AG, *Adaptation of the SGT6-6000G to a Dynamic Power Generation Market*, December 2005, at 12 (available at: www.powergeneration.siemens.com/news-events/technical-papers/gas-turbines-power-plants/index.htm#AdaptationoftheSGT6-6000GtoaDynamicPowerGenerationMarket).) Using two such turbines in a 2x1 configuration would require a 142.8 MW steam turbine to meet a 612.8 MW design capacity (235+235+142.8=612.8). This is a conservative estimate because current G-class turbines are even larger (*see id.*), which would necessitate an even smaller steam turbine and even less overall efficiency.

[36] *See* Table, Comparison of Plant Efficiency, 612.8 MW: FD2, FD3, G-Class and Flex 10 Configurations, *supra* note 35.

[37] GE Energy Press Release, *GE's H System Gas Turbine Hits Project Milestone in Japan* (Dec. 11, 2007), *available at* www.gepower.com/about/press/en/2007_press/121107b.htm; Frank J. Bartos P.E., *New, efficient industrial gas turbines coming: Siemens, GE, Full Report* Control Engineering, (August 8, 2008) (available at mobile.controleng.com/article/268171-New_efficient_industrial_gas_turbines_coming_Siemens_GE_full_report.php).

[38] Steve Bolze, Vice President-Power Generation, GE Energy, *quoted in* GE Energy Press Release, *GE's H System Gas Turbine Hits Project Milestone in Japan* (Dec. 11, 2007), *available at* www.gepower.com/about/press/en/2007_press/121107b.htm.

[39] *See* GE Energy Press Release, *GE's H System Gas Turbine Hits Project Milestone in Japan*, supra note 37; Frank J. Bartos P.E., *The Hunt for 60%+ Thermal Efficiency*, Control Engineering (August 1, 2008) (available at www.controleng.com/article/CA6584899.html). The specific startup date for the Inland Empire project was provided by the applicant in communications in April of 2009.

operations,[40] and cannot be considered an available technology until this validation process is completed. As the Energy Commission noted in approving the installation of these H-Class turbines, the "install[ation], operat[ion] and test[ing of] this initial Frame 7H machine [is an] essential step in the development and marketing of this new product[.]"[41] The Air District has therefore concluded that H-Class turbines are not an available technology at the present time for this type of project.[42]

Based on this review, the Air District concludes that there is no other commercially available generating technology that would meet the needs of this project that would have a greater energy efficiency than the upgraded "FD3" turbines the applicant has proposed for use at the facility. The Air District also compared the 56.4% efficiency of this facility with other similar facilities in California that have been recently permitted or are currently undergoing review, and found it to be higher than any other comparable facility (with the exception of the Inland Empire Frame 7H demonstration turbines addressed above). The results of this comparison are summarized in Table 1 below.[43]

[40] *See generally* Frank J. Bartos P.E., *supra* note 37 ("Extensive, predefined testing is necessary to ensure that turbine performance meets design specs, along with reliable, long-term operation associated with power systems. With several different technology levels being validated, the long development cycle needed for these turbines—from first firing through commercialization—becomes evident.").

[41] Memorandum, *Inland Empire Energy Center Power Project (01-AFC-17C) Staff Analysis Of Proposed Modifications To Change To GE 107H Combined-Cycle Systems, Increase Generation and Add Additional Laydown Areas*, From Connie Bruins, CEC Compliance Division Manager, to Interested Parties (Jun. 8, 2005) (hereinafter "Inland Empire Energy Center Staff Analysis Memorandum"), at p. iii. (available at: www.energy.ca.gov/sitingcases/inlandempire/compliance/2005-06-10_FINAL_ANALYSIS.PDF.) The Commission staff also observed that "as with any emerging technology, the proposed project involves a heightened risk of underperformance." *Id.* at p. 2.

[42] The Air District also examined Siemens technology in addition to GE. Siemens is also developing an H-Class product, but it is farther behind than GE. Siemens has installed a 50 Hz test project in Irsching, Germany, but it is currently validating the turbine in simple-cycle mode, with build-out of a combined-cycle configuration not planned until 2009-2011. (*See* Frank J. Bartos P.E., *Largest Gas Turbine: 2,838 Sensors, 90 GB Data Per Hour of Testing* Control Engineering, (February 13, 2009) (available at www.controleng.com/article/ca6637328.html?nid=2488&rid=1768760).) Siemens does not yet have a 60-Hz application installed anywhere in the world.

[43] The information in this table was taken from documents on the Energy Commission's website at www.energy.ca.gov.

Table 1: Comparison of Thermal Efficiency of Similar Combined-Cycle Power Plants

Facility	CEC Application Date	Facility Size (MW)	Thermal Efficiency (LHV)
Colusa Generation Station	11/6/2006	660	56%
Blythe Energy Project Phase II	2/19/2002	520	55-58% (est.)
Lodi Energy Center	9/10/2008	255	55.6%
CPV Vaca Station Power Plant	11/18/2008	660	55%
Victorville 2 Hybrid Power Project	2/28/2007	563	52.7% (w/ duct burn)
Avenal Energy Power Plant[44]	2/21/2008	600	50.5%
Palomar Energy Project	8/2003	550	55.3% (w/o duct firing) 54.2% (w/ duct firing)
SMUD Consumnes Phase I	9/13/2001	500	55.1%

For all of these reasons, the Air District has determined that the 56.4% thermal efficiency proposed for the Russell City Energy Center is the best efficiency performance achievable from commercially available systems for a 600 MW combined-cycle power plant. The District invites members of the public to review and comment on this additional analysis regarding the most efficient generating equipment for the proposed facility with respect to greenhouse gases.

C. Expression Of BACT Emissions Limit In Permit Conditions

In addition to comments regarding the turbine technology that the applicant initially proposed for the facility, the Air District also received several comments critical of the District's proposal of a BACT limit for greenhouse gas emissions of 1100 lb/MW-hr. The commenters raised a number of related points in this regard.

- *Linkage Between lb/MW-hr CO_2 Emission Rates and Thermal Efficiency:* Some comments questioned the District's analysis of the range of lb/MW-hr CO_2 emissions performance levels among various turbines in the context of thermal efficiency. These comments referred to the fact that the BACT technology analysis was explained in terms of turbine thermal efficiency; yet when selecting the BACT performance level BACT was stated in terms of mass emissions per unit of power output. The commenters stated that the District had not explained how the range of turbine thermal efficiency percentages evaluated relates to the range of lb/MW-hr CO_2 emissions levels (although they stated that they presumed that the higher lb/MW-hr CO_2 emissions levels correspond to the less efficient turbines).
- *Use of Emissions Standard from SB 1368:* Commenters stated that the proposed 1100 lb/MW-hr permit limit was taken from SB 1368, and that it was developed in that context to accommodate existing facilities with older, higher-emitting equipment as well as new plants. The commenters claimed that this number can therefore at most be a floor for setting a BACT limit, and that it is not a measure of the best achievable performance.

[44] With respect to Avenal, one commenter stated that this proposed facility would be able to achieve a CO_2 emissions rate of 499.7 lb/MW-hr, but its calculation was based on estimated emissions at 50% load ("Case 12" in the table referenced by the commenter). At full load, emissions would be over 900 lb/MW-hr (using "Case 1") and a nominal power output of 600 MW based on the documentation cited by this commenter.

The commenters also claimed that the number was intended to apply to facilities state-wide, and it is not a case-specific determination of what a particular facility can achieve as required by BACT.

- *Data Showing Achievable Emissions ~800 lb/MW-hr:* The commenters stated that emissions data from new turbines show that current equipment should be able to achieve emissions as low as 800 lb/MW-hr. Commenters also stated that the District should look at the best achievable performance level of all turbines, including new turbines, and not limit its review to turbines that were built several years ago. Commenters also claimed that the District considered emissions data from only one year of operation from only two facilities, and should conduct a broader review.
- *Justification For Compliance Margin:* The commenters also criticized the District's claim that the BACT limit should be set at 1100 lb/MW-hr limit in order to provide a compliance margin. These commenters noted that 1100 lb/MW-hr is significantly higher than the emissions measured from the comparable facilities that the District examined (Metcalf and Delta). They asserted that the District should explain in more detail the need for a compliance margin and also the necessary magnitude of the margin. They claimed that the District should explain what foreseeable operating conditions might affect emissions performance, and provide data showing how much of a compliance margin these conditions would warrant.
- *Justification for Heat Input Limit:* One commenter framed its objection in terms of the heat input limit that the District derived from the 1100 lb/MW-hr emissions rate. The commenter noted that the corresponding heat input rate the District used as a BACT limit – 2944.3 mmBtu/hr – is 35% higher than what the rated maximum for the proposed turbines. The commenter objected that this approach would allow turbines with a much lower efficiency than the 55.8% level achievable by these turbines. The commenter claimed that this limit has no connection to actual emission rates achievable by such sources.
- *"Output-Based" Limit to Address Efficiency Changes Over Time:* Several commenters objected to the District's proposal to express the BACT limit for greenhouse gases as a limit on turbine heat input. These commenters claimed that instead of limiting heat input, the District should impose a limit on the mass of CO_2 emitted per MW-hr directly. The commenters claimed that if the limit is imposed on heat input only, emissions on a lb/MW-hr basis could rise if turbine efficiency declines because of maintenance issues, equipment modifications, or other reasons. Once commenter cited the *Steel Dynamics* EAB decision for the proposition that a BACT limit needs to ensure compliance on a continual basis over all levels of operation.

The Air District has reevaluated its proposed BACT emissions level in light these comments, and upon further consideration agrees that 1100 lb/MW-hr would not be an appropriate BACT limit for greenhouse gas emissions. Instead, the Air District is proposing a lower BACT emissions limit, as well as an "output-based" requirement for periodic compliance testing to ensure that the plant maintains the BACT efficiency standard over time. In particular, the Air District has adjusted its proposed BACT determination as follows.

- First, the Air District has focused its analysis of what emissions performance is achievable by generating equipment with a thermal efficiency at a BACT level of 56.4%. The Air District agrees with the comment that simply looking at lb/MW-hr numbers reported in the ARB database does not necessarily tie the analysis into thermal efficiency, which is the basis for the District's BACT analysis. Tying the analysis of the achievable numerical BACT emissions limitation to specific data about expected turbine performance is intended to address this issue. As explained below, for purposes of establishing an enforceable numerical efficiency limit the Air District has used heat input per unit of power output, in MMBtu/kWhr, as the appropriate metric for establishing the BACT limit because the objective, industry-standard method for measuring efficiency uses that metric.
- Second, the Air District agrees that using the 1100 lb/MW-hr number established for purposes of SB1368 as a performance standard for all turbines does not necessarily capture the best performance achievable by the most efficient turbines available for use in new projects, on which a BACT analysis should be based. Instead, the District has analyzed the greenhouse gas emissions that can be achieved by state-of-the-art FD3 class turbines, as noted above. The Air District has determined that the BACT emissions rate should be based upon a best achievable design base heat rate of 6852 Btu/kWhr (which is approximately equivalent to an emissions rate of 792-815 lb/MW-hr, depending on which emissions factor is used), with a reasonable compliance margin of a little over 12% to account for various factors that may make the best design performance unachievable during all operating scenarios over the life of the equipment. This compliance margin is based on a thorough analysis the various elements of turbine operation that may reduce turbine efficiency over time and thereby increase greenhouse gas emissions per unit of power output, as discussed in detail below.
- Third, the Air District agrees that the BACT limit as expressed in the permit needs to be "output based", instead of just an absolute limit on greenhouse gas emissions, in order to take into account the potential that maintenance issues may lead to declining efficiency. The Air District is therefore proposing to require both absolute mass emissions limits based on the amount of greenhouse gas emissions expected for combined-cycle turbines of this size and level of thermal efficiency, plus periodic compliance tests to ensure that the efficiency remains within the established BACT levels. The Air District is proposing to base the efficiency compliance test on an ASTM standard that measures heat rate per power output, which is a well-accepted engineering standard with objectively-defined measurement standards.

By adjusting its approach to the greenhouse gas BACT issue in this way, the Air District believes that its revised proposal will ensure a BACT standard that is based on the best achievable thermal efficiency of available equipment, with a reasonable and documented compliance margin to make sure it is as stringent as possible and still achievable across all operating scenarios. This revised approach also includes continuous short-term and long-term emissions monitoring as well as periodic efficiency monitoring to ensure that BACT performance does not unreasonably degrade over time because of maintenance lapses or similar concerns.

The Air District's revised analysis is set forth in full in the following sections. The Air District encourages all interested members of the public to review and comment on this revised analysis.

1. Conceptual Overview of Proposed Numerical Greenhouse Gas BACT Limits

The Air District is revising the draft Federal PSD Permit to incorporate two interrelated numerical BACT emissions limits for greenhouse gases. First, based on the Air District's technological analysis in the Statement of Basis and as further refined in this subsequent analysis, the Air District is proposing to adopt numerical greenhouse gas mass emissions limits based on the emissions expected from the facility's state-of-the-art electrical generating equipment. These proposed mass emissions limits are based on the maximum rated heat input capacity of the combustion turbines and HRSG duct burners needed to produce the power generation demand that the facility has been designed to serve. Every unit of heat input generates a known amount of greenhouse gas emissions, and so the Air District is proposing greenhouse gas mass emissions limits based on this heat input capacity, on an hourly, daily, and annual basis. The proposed heat input and greenhouse gas emissions limits the Air District is imposing are set forth in Table 2 below.

Table 2 - Proposed Heat Input and Greenhouse Gas Emissions Limit Summary

Averaging Period	Heat Input Limit (MMBtu)	Greenhouse Gas Emissions Limits (metric tons CO_2E)			
		CO_2	CH_4	N_2O	CO_2E
1-Hour	4,477.2	242	0.08	0.14	242
24-Hour	107,452.0	5,797	2.03	3.33	5,802
Annual	35,708,858.0	1,926,399	675	1,107.48	1,928,182

These proposed heat input and mass emissions limits are intended to ensure that the facility's turbines and HRSG duct burners will not use any more natural gas, and not have any more greenhouse gas emissions, than the Air District has determined is necessary to meet the design power generation capacity. As described in detail below, under this revised proposal the heat input and greenhouse gas emissions will be monitored in real time using natural gas usage information, which provides a very accurate indication of these parameters.

Second, the District is also proposing an "output-based" efficiency limit that takes into account the amount of power generated by the facility, in order to address the concern raised in comments that simply specifying maximum heat input and corresponding greenhouse gas output fails to address the potential that turbine efficiency may decline to the point where it no longer reflects BACT. The District is therefore proposing to impose a minimum turbine efficiency permit condition, expressed as MMBtu of heat input per megawatt of power output, that the facility will be required to achieve. The Air District is proposing to require the facility to conduct annual compliance tests in which heat input and power output are measured to a high degree of accuracy, and to ensure that gas turbine heat input remains below 7,730 Btu/kWHr (HHV), a rate equivalent to generating a minimum of one megawatt-hour of electric power per 7.73 MMBtu of natural gas burned.

The District is proposing this 7,730 Btu/kWHr (HHV) efficiency limit as the lowest heat input rate that can be reasonably assured under all operating scenarios. As outlined below, the limit was based upon the design efficiency of the 56.4% thermally-efficient FD3-equivalent

combustion turbines[45] that the Air District has concluded are the BACT technology for a nominal 600-megawatt natural-gas fired combined-cycle electrical generating facility. This value, known as the "Design Base Heat Rate" for the facility, is 6,852 Btu/KW-hr (HHV), and reflects the thermal efficiency that the facility is designed for. To ensure that the numerical BACT efficiency limit reflects a reasonable margin of compliance, the District has evaluated the factors that could reasonably be expected to degrade the theoretical design efficiency of the turbines and increase the heat rate (*i.e.*, cause more fuel to be required to produce a megawatt of power). The Air District has considered a number of factors in this regard as explained in detail below, including (i) a reasonable design margin of 3.3% to reflect that the equipment as actually constructed and installed may not fully achieve the assumptions that went into the design calculations; (ii) a reasonable performance degradation margin of 6% to reflect reduced efficiency from normal wear and tear on the equipment between major maintenance overhauls; and (iii) an additional 3% degradation margin based on additional wear and tear caused by variability in the operation of the auxiliary plant equipment that will be powered by the turbines, including the natural gas compressors and water recycling system. These potential degradation factors are an unavoidable aspect of building and operating the facility, consistent with best engineering practices, and the ultimate BACT limit needs to account for them to ensure that it is achievable over all operating scenarios. Applying these potential degradation factors to the Design Base Heat Rate, the Air District has concluded that the appropriate numerical Greenhouse Gas BACT heat input efficiency limit for this equipment is 7,730 Btu/kWHr (HHV). The Air District is proposing this limit as an enforceable not-to-exceed permit limit, along with appropriate monitoring requirements.

In conducting this analysis, the Air District has also been mindful that under normal circumstances the establishment of a numerical BACT permit limit would often involve a review of permit limits imposed by other facilities and of monitoring data required under such permits. In this case, however, no facility the Air District is aware of has ever been subject to an enforceable BACT limit on its emissions of greenhouse gases; nor has any facility, to the Air District's knowledge, been subject to an enforceable limitation on its efficiency (heat rate per kW-hr of power output). Because this represents a "first of its kind" limitation in an air permit, there is little relevant performance data which might provide a basis for concluding that a lower Heat Rate Limit can consistently be met over time. An enforceable BACT limitation must be set at a level that the facility can achieve for the life of the facility, including as its equipment ages and incurs anticipated degradation. At the same time, the Air District believes the proposed Heat Rate Limit is stringent enough to assure that the facility operator will not allow the equipment to incur undue or extraordinary efficiency losses through deferral of necessary maintenance, such that the assumptions which supported this BACT determination are no longer valid.

2. Derivation of Numerical Greenhouse Gas BACT Limits

Greenhouse Gas Mass Emissions Limits: The Air District calculated the appropriate heat-rate limit and mass emissions rate limits using the maximum heat input capacity of gas turbines and duct burners combined (*i.e.*, at maximum plant capacity). The facility's maximum heat input

[45] The combustion turbine equipment on which the BACT heat rate analysis was based included the FD3 upgrades discussed above.

capacity is 4,477.2 MMBtu per hour; 107,452.0 MMBtu/day; and 35,708,858.0 per year. (*See* Proposed Permit Conditions 13, 14 & 15.) The Air District then calculated corresponding mass emissions rates for CO_2, CH_4, N_2O, and CO_2E using established emissions factors. For CO_2, emissions were calculated using the CO_2 emissions factor of 118.9 lbs/MMBtu, as required under EPA's Acid Rain Trading Program, 40 C.F.R. Part 75. For CH_4 and N_2O, emissions were calculated using the Air Resources Board's emissions factors of 0.0020 and 0.00022 lb/MMBtu, respectively. CO_2E was calculated by applying a global warming potential multiplier of 21 and 310 for CH_4 and N_2O, respectively, based upon the Air Resources Board's mandatory reporting rule.[46] The associated mass emissions limits are outlined in Table 2 above on an hourly, daily and annual basis.

Heat Rate Efficiency Limit: To determine the appropriate heat-input efficiency limit, the Air District started with the turbines' Design Base Heat Rate[47] and then calculated a reasonable compliance margin based upon reasonable degradation factors that may foreseeably reduce efficiency under real-world conditions as noted above.

- ***Net Design Base Heat Rate – 6,852 Btu/kWhr:***

The turbines' Design Base Heat Rate is 6,852 Btu/kWhr (HHV), based on operation of both combustion turbines with no duct firing, corrected to ISO conditions.[48] (For comparison with a pounds-per-megawatt-hour efficiency rating, this is between 792.9 and 815.5 lbs/MWhr, depending upon which CO_2 emissions factor is applied.[49]) This represents what the plant (at the design stage) is expected to achieve when it is new and clean; it does not represent what it will achieve over time as the equipment incurs degradation between major maintenance overhauls. It also does not represent the equipment manufacturer's guaranteed levels of performance.

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[46] The Air District would also note that it is following the convention of stating emissions of greenhouse gases in terms of "CO_2-equivalents" (CO_2E), which, for this source, include emissions of methane (CH_4) and nitrous oxide (N_2O) as well. These two pollutants have a higher "global warming potential" than CO_2, reflecting their relative propensity to trap solar radiation within the Earth's atmosphere that would otherwise be reflected back into outer space and thereby contribute to global warming. The emissions factors and global warming potentials for N_2O and CH_4 are specified by the Air Resources Board's mandatory reporting rule: For N_2O, the emissions are 0.00022 lbs/MMBtu and the global warming potential is 310; for CH_4, the emissions are 0.0020 lbs/MMBtu and the global warming potential is 21.

[47] Electric generating facilities typically measure their efficiency in terms of the "heat rate", which is the energy content of the fuel, in British thermal units (Btu), that it takes to generate a kilowatt-hour (kW-hr) of electric power to the grid.

[48] *See* Russell City Energy Center Heat Balance Diagrams, *supra* note 6.

[49] The lower and higher figure reflect application of the emissions factors for CO_2 applicable under U.S. EPA's Climate Leaders program – 115.6 lb/MMBtu – and the Part 75 Acid Rain Monitoring Program, 118.9 lb/MMBtu. Other relevant emissions factors include the California Climate Action Registry's factor of 116.9 lb/MMBtu and the Air Resources Board's mandatory reporting rule, which applies emissions factors for CO_2 between 116.5 and 120.5 lb/MMBtu of natural gas, depending upon the Btu content of the gas stream.

Note that this Design Base Heat Rate of 6,852 Btu/kWhr (HHV) without duct firing and 6,970 Btu/kWhr (HHV) with duct firing reflects the facility's "net" power production, meaning the denominator is the amount of power provided to the grid; it does not reflect the total amount of energy produced by the plant, which also includes auxiliary load consumed by operation of the plant.[50] The total auxiliary load for this facility is 21.1 MW without duct firing or 24 MW with duct firing.[51] Accounting for this auxiliary load would result in a "gross" Design Base Heat Rate of 6,743 Btu/kWhr (HHV) when duct firing is not occurring, which would result in emissions between 780.3 and 802.5 lbs/MW-hr of CO_2E, depending upon which emissions factor is applied for CO_2. When duct firing is occurring, the "gross" Design Base Heat Rate would be 6,868 Btu/kWhr (HHV), or between 794.7 and 817.4 lbs/MWhr of CO_2E.

- ***Installed Design Base Heat Rate – 7,080 Btu/kWhr:***

While the Design Base Heat Rate reflects what the engineers aim to achieve in designing the facility, design and construction of a combined-cycle power plant involves many assumptions about anticipated performance of the many elements of the plant, which are often imprecise or not reflective of conditions once installed at the site. As a consequence, the facility also calculates an "Installed Base Heat Rate", which represents a design margin of 3.3% to address such items as equipment underperformance and short-term degradation. According to information provided by the Applicant, a design margin of up to 5% is typical in the commercial terms for the engineering, procurement and construction contracts for a combined-cycle power plant. Normally the performance guarantees from the combustion and steam turbine original equipment manufacturers and the contractual terms require demonstration that the project, as constructed, achieves the design output and heat rate, subject to a plus or minus 5% margin. For example, if the tested output is less than 95% of the guaranteed output, or the tested heat rate is more than 105% of the guaranteed heat rate, the original equipment manufacturer and engineering, procurement and construction contractor can declare substantial completion and pay liquidated damages to compensate for the performance shortfalls. The design margin also reflects some tolerance for uncertainties associated with the plant's auxiliary load, such as the potential variance between assumptions about the amount of load that will be required to conduct treatment and evaporation of the City's waste water within the facility, and actual experience. Adding this 3.3% design margin to the Design Base Heat Rate would result in an Installed Base Heat Rate of 7,080 Btu/kWhr (HHV), assuming dual unit operation without duct burner firing, corrected to ISO conditions.

[50] This auxiliary load includes power for the facility's recycling of wastewater from the adjacent City of Hayward's wastewater treatment plant. This system will recycle roughly 4 million gallons of water a day in the facility's operations instead of having to obtain it from other sources; and will use a "Zero Liquid Discharge" system so that none of that wastewater will be discharged to the Bay. The facility also will include a "Low Noise/Plume-Abated" cooling tower, which will consume additional load due to use of recycled waste water. These are important environmentally beneficial aspects of the project.

[51] *See* Russell City Energy Center Heat Balance Diagrams, *supra* note 6.

- ***Degraded Base Heat Rate – 7,730 Btu/kWhr:***

To establish an enforceable BACT condition that can be achieved over the life of the facility, the Air District also must account for anticipated degradation of the equipment over time between regular maintenance cycles.

For the gas turbines, the Air District is basing its analysis on a 48,000-operating-hour degradation curve provided by Siemens, which reflects anticipated recoverable and non-recoverable degradation in heat rate between major maintenance overhauls of approximately 5.2%.[52] According to combustion turbine manufacturers, anticipated degradation in heat rate of the gas turbines alone can be expected to increase non-linearly over time. The degradation curves relied upon by the Applicant describe the amount of "recoverable" and "non-recoverable" degradation. The former includes degradation that can be recovered through compressor water washing, filter changes, instrumentation calibration and auxiliary equipment maintenance. The latter includes degradation that cannot be restored upon a maintenance overhaul.

The 48,000-hour maintenance interval is based upon Siemens' recommendations, which provide detailed formulae for determining when the equipment should undergo certain inspection and maintenance activities, based upon the accumulated total for both "Equivalent Baseload Hours" and "Equivalent Starts".[53] By calculating Equivalent Baseload Hours and Equivalent Starts, the facility operator accounts for the specific operating conditions and events experienced by the facility that may impact the equipment's performance. These include the difference between baseload and peak firing hours and the impacts caused by instantaneous load changes (*i.e.*, outside of the expected ramp rate).

The original equipment manufacturer's degradation curves only account for anticipated degradation within the first 48,000 hours of the gas turbine's useful life; they do not reflect any potential increase in this rate which might be expected after the first major overhaul and/or as the equipment approaches the end of its useful life. Further, because the projected 5.2% degradation rate represents the *average*, and not the maximum or guaranteed, rate of degradation for the gas turbines, the Air District has determined that, for purposes of deriving an enforceable BACT limitation on the proposed facility's heat rate, gas turbine degradation may reasonably be estimated at 6% of the facility's heat rate. A slightly higher than average expected degradation is justified for purposes of developing an enforceable emissions limit here, given the limited operational experience of the new FD3-level turbine technology. Adding this 6% degradation factor to the facility's "Installed Base Heat Rate" of 7,080 Btu/kWhr (HHV) (*i.e.*, the projected heat rate of the equipment in its original condition, after accounting for a predicted 3.3% design margin) would result in a potential heat rate of 7,505 Btu/kWhr (HHV) (without duct firing).

Finally, in addition to the heat rate degradation from normal wear and tear on the turbines, the Air District is also providing a reasonable compliance margin based on potential degradation in

[52] Siemens Power Generation, Inc, *Guiding Principles for Conducting Site Performance Tests on Siemens Industrial Gas Turbine-Generator Units*, EC-93208-R10 (July 15, 2008), Figure 3 "Degradation Effect on Gas Turbine Heat Rate" TT-DEG-76.

[53] Siemens Power Generation, Inc., Service Bulletin 36803, *Combustion Turbine Maintenance and Inspection Intervals*, Revision No. 10 (Oct. 7, 2004).

other elements of the combined cycle plant that would cause the overall plant heat rate to rise (*i.e.*, cause efficiency to fall). These other elements include the following:

- *Variability in Natural Gas Pressure:* The facility needs to bring the natural gas burned in the turbines up to a pressure of 500 psi, and uses gas compressors to do so because the natural gas supplied to the facility is delivered at a lower pressure. According to data from PG&E, the natural gas supplier, the delivery pressure may fluctuate between 170 and 355 psi (or between 250 and 410 psi with upgrades to the natural gas line).[54] Because of the variability in delivery pressure, the gas compressor engines may have to cycle up and down, which can result in increased wear and tear on the engine and decreased fuel efficiency. This would increase auxiliary load on the facility and reduce overall plant efficiency.
- *Variability in Natural Gas Quality:* In addition to changes in natural gas pressure, the gas supply for the facility may also experience substantial variation in the quality of the natural gas (in terms of its chemical constituents). This can further exacerbate degradation of the gas turbines, in the same way that using low-quality gasoline can affect an automobile's performance.
- *Variability in Cooling Water Quality:* The facility's water recycling system will treat approximately 4 million gallons per day of waste water from the City of Hayward's adjacent treatment plant for use in the plant's operations. Data from the water treatment plant shows a substantial degree of variability in the water quality, which in some cases may require additional recycling of the water supply prior to its use by the facility.[55] The additional recycling would require greater load to conduct such treatment and could result in accelerated degradation of various components of the water treatment system, including pumps and rotating equipment. The same is true of the evaporator and Zero Liquid Discharge system, as well as of the plume-abated cooling towers.
- *Degradation in Turbine Exhaust Flow:* The gas turbine manufacturer's degradation curves predict potential recoverable and non-recoverable degradation in gas turbine exhaust flow of 3.75% over the 48,000 maintenance cycle.[56] This degradation in exhaust flow will result in a direct reduction in the ability of the steam turbine to generate power, which will further degrade the plant's overall efficiency. While degradation in the exhaust flow is expected to be partially offset by degradation in exhaust temperature (which rises over the maintenance cycle)[57], this offset will not make up for anticipated degradation in the reduction in steam turbine power as a result of reduced exhaust flow.

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[54] Letter, Rodney Boschee, Pacific Gas & Electric, Wholesale Marketing & Business Development, to Chris Delaney, CPN Pipeline Company, subject: Calpine Russell City Energy Center, December 2, 2008.

[55] *See* City of Hayward Wastewater Treatment Plant water monitoring data, November 1, 2008 – March 20, 2009; Summary data, *Reclaimed Water Project-2008, Final Clarifier* for sample dated April 16, 2008.

[56] Siemens Power Generation, Inc, *Guiding Principles for Conducting Site Performance Tests on Siemens Industrial Gas Turbine-Generator Units*, *supra* note 52, Figure 4 "Degradation Effect on Gas Turbine Exhaust Flow," TT-DEG-77.

[57] *Id*., Figure 5, "Degradation Effect on Gas Turbine Exhaust Temperature" TT-DEG-78.

- *Degradation in Steam Turbine Performance:* Degradation in the performance of the heat recovery boilers and steam turbine is also expected to occur over the course of a major maintenance cycle.
- *Degradation in Gas Turbine Performance:* The influence of the bay-side environment on the air inlet filter may cause inlet air pressure to be reduced, which would further degrade the performance of the gas turbines.

The Air District found little documentation on which to base a specific numerical estimate of exactly what the efficiency impacts would be from these affects, in part because regulatory agencies have not had to undertake analyses in this area before. Without usable precedents or documentation regarding the precise potential for degradation from these issues, the Air District has had to use its best engineering judgment to assess how much additional degradation should be anticipated. The Air District believes in its engineering judgment that an additional 3% degradation is a reasonable and appropriate estimate under the circumstances, taking into account the fact that the limits being imposed based on this estimate will be enforceable, not-to-exceed permit conditions. The Air District solicits further comment on this issue.

3. Implementation of Numerical Greenhouse Gas BACT Limits In Permit Conditions

Finally, the Air District is proposing to implement these greenhouse gas BACT limits as enforceable permit conditions, with appropriate monitoring and recordkeeping requirements. For the heat-input and GHG mass emissions limits, the Air District is proposing to require the facility to demonstrate compliance by monitoring its fuel usage on a real-time basis, and then calculating heat-input and mass emissions based on the fuel usage. For CO_2, mass emissions would be calculated using the CO_2 emissions factor of 118.9 lbs/MMBtu, as required under EPA's Acid Rain Trading Program, 40 C.F.R. Part 75. For CH_4 and N_2O, mass emissions would be calculated using the Air Resources Board's emissions factors of 0.0020 and 0.00022 lb/MMBtu, respectively. CO_2E would be calculated by multiplying CH_4 and N_2O emissions by their respective global warming potentials of 21 and 310, based upon the Air Resources Board's mandatory reporting rule, and then adding them to CO_2 emissions.[58] The facility would be required to maintain records of its heat input and mass emissions monitoring data in order to ensure compliance.

For the turbine efficiency limit (the 7,730 Btu/kWhr heat-rate limit), the Air District is proposing to require compliance testing to demonstrate compliance within 90 days after the end of the commissioning period (as defined in the permit) and annually thereafter to ensure that efficiency is maintained at a BACT level. Under this periodic compliance test requirement, the facility would be required to perform a "Heat Rate Performance Test" using the industry-accepted method for heat rate and capacity testing, the American Society of Mechanical Engineers (ASME) Performance Test Code on Overall Plant Performance (ASME PTC 46-1996)). This

[58] For purposes of assuring consistency with existing reporting regimes for greenhouse gas emissions, it makes best sense to align monitoring and reporting requirements in the Federal PSD Permit with these prevailing methods for calculation and inventorying of greenhouse gas emissions.

test includes objective parameters that will ensure consistent and reliable reporting of actual turbine efficiency, and it is the accepted industry standard test for this purpose. The facility would be required to conduct the test at baseload (*i.e.*, full capacity), without duct firing. The facility will be required to submit a test plan to the Air District for its review and approval at least thirty (30) days in advance of the proposed test. The test will consist of three one-hour test runs, and the results of each test run will be averaged and then corrected back to ISO conditions of:

- Ambient Dry Bulb Temperature: 59^{o}F
- Ambient Relative Humidity: 60%
- Barometric Pressure: 14.69 psia
- Fuel Lower Heating Value: 20,866 Btu/lb
- Fuel HHV/LHV Ratio: 1.1099

To determine compliance with this condition, the result of this test will be compared to the Heat Rate Limit of 7,730 Btu/kWhr (HHV).

These compliance monitoring requirements will be effective to ensure compliance with the greenhouse gas limits in the permit. The Air District has also considered whether to require the facility to use a Continuous Emissions Monitor (CEM) to measure greenhouse gas emissions directly (as CO_2), but has concluded that calculating emissions from heat input is preferable. Unlike some other pollutants such as NOx or carbon monoxide whose formation is heavily dependent on conditions of combustion and/or performance of add-on emissions controls, greenhouse gases are a direct and unavoidable byproduct of the combustion process. The amount of carbon within the fuel will all ultimately be emitted as greenhouse gases in a manner that is easily determined using well-established emissions factors. One can therefore determine with great accuracy what greenhouse gases are being emitted by measuring the amount of hydrocarbon fuel being burned (measured as heat input). For this reason, the test methods for measuring heat rate and capacity can achieve an accuracy of ±1.5%,[59] which is better than the relative accuracy of CEMs which typically ranges as high as ±10%.[60] The Air District is therefore proposing to require surrogate monitoring for greenhouse gas emissions using heat rate instead of a CEM.

The Air District also considered whether it would be possible to monitor thermal efficiency on a continuous basis in terms of emissions (or heat input) per unit of power output, but found that it would not be feasible to measure efficiency in this manner on a continual basis in any meaningful way. Measuring efficiency with a high degree of accuracy requires expertly-administered test procedures as set forth in the ASME PTC 46 standard, and it is not feasible to require this testing methodology to be implemented at all times of facility operation. Moreover,

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[59] American Society of Mechanical Engineers (ASME), *Performance Test Code on Overall Plant Performance*, (PTC 46-1996), October 15, 1997, Table 1.1, "Largest Expected Test Uncertainties", at p. 4 (providing 1.5% variance in the corrected heat rate for "combined gas turbine and steam turbine cycles with or without supplemental firing to a steam generator").

[60] *See, e.g.*, 40 C.F.R. Part 75, Appendix A, § 3.3.3 ("The relative accuracy for CO_2 and O_2 monitors shall not exceed 10.0 percent.")

measuring efficiency by comparing heat input to power output would not be feasible during periods such as startup, shutdown, or tuning when no power is being produced for the grid. There will be heat input during this period, but with no power output the denominator in the pounds-per-megawatt-hour efficiency measurement will be zero. And finally, thermal efficiency is unlikely to experience major ups and downs over time. Unlike NOx or CO, which could fall out of compliance rapidly if good combustion conditions are not maintained or if an add-on control device fails, thermal efficiency is likely to degrade relatively slowly over time.[61] A one-day snapshot of turbine efficiency from a periodic compliance test is therefore likely to be relatively representative of efficiency over a longer time frame. For all of these reasons, the Air District is proposing to require the facility to demonstrate compliance with the heat rate BACT limit through periodic compliance testing, not continuous monitoring. The Air District is proposing an annual test requirement, which is the typical test frequency the District requires in periodic monitoring situations such as this. Based on the performance degradation documentation the Air District has reviewed, annual compliance testing is an appropriate testing frequency for this type of permit limit.

D. Other Greenhouse Gas Emissions

The District has also undertaken a BACT analysis for greenhouse gas emissions from the diesel firepump engine and circuit breakers, which were not included in the greenhouse gas analysis in the initial Statement of Basis. This equipment has the potential to emit greenhouse gases, and in order for a greenhouse gas BACT analysis to be comprehensive it should include these sources as well. The Air District is therefore including the emergency diesel firepump engine and the circuit breakers in the voluntary greenhouse BACT analysis, and is proposing mandatory permit conditions to ensure that they are subject to enforceable BACT emission limits.[62] The Air District invites interested members of the public to comment on these elements of the BACT analysis.

1. Diesel Fire Pump

The emergency diesel firepump engine will have the potential to emit greenhouse gases (CO_2, CH_4, and N_2O) because it will combust a hydrocarbon fuel, just as with the gas turbines and heat recovery boilers. There are no effective combustion controls to reduce the greenhouse gas emissions from hydrocarbon fuel combustion, and there are no currently available post-combustion controls, as the District explained in its greenhouse gas analysis for the gas turbines. The Air District therefore concludes that the only achievable technological approach to reducing greenhouse gases from the firepump engine is to use the most efficient engine that meets the stringent National Fire Protection Association ("NFPA") standards for reserve horsepower capacity, engine cranking systems, engine cooling systems, fuel types instrumentation and control and exhaust systems. (*See generally* Statement of Basis at pp. 55-56, describing the NFPA requirements.) As there is only one control technology to choose from, application of the 5 steps in the Top-Down BACT analysis results in the selection of that control technology.

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[61] *See generally* documentation regarding heat rate degradation cited in heat rate discussion above, pp. 31-33.

[62] The District received one comment stating that the greenhouse gas BACT analysis should also include the facility's pre-heater. This project does not involve a pre-heater.

The 2100 R.P.M. 300-hp Clarke JW6H-UF40 diesel firepump engine that the applicant has proposed for use here has a fuel consumption rate of 14.0 gallons per hour.[63] The Air District has reviewed fuel-efficiency data for similarly-sized NFPA-20 certified firepump diesel engines rated at 2100 R.P.M., and has not found any such engines with a higher fuel efficiency.[64] The Air District has therefore concluded that the 14-gal/hr Clarke engine is the most efficient equipment available, and so it qualifies as the BACT control technology.[65]

The firepump engine may have to be used for up to 50 hours per year for reliability testing and maintenance purposes. Use of the engine at 14 gallons of diesel fuel per hour for up to 50 hours per year would result in total greenhouse gas emissions from the fire pump of 7.6 tons CO_2E per year.[66] The Air District is therefore imposing a greenhouse gas limit in the permit of 7.6 tons per year of CO_2E as a BACT limit. The facility will be required to demonstrate compliance with this limit by recording fuel usage and using an emissions factor of 21.7 lb/ CO_2E-gal to determine resulting CO_2E emissions.

As with turbine emissions, the Air District considered using a CEM to monitor greenhouse gas emissions directly. But it concluded that determining emissions based on fuel usage as a surrogate is a preferable approach, for similar reasons as with the turbines. Fuel usage can be accurately measured, and the amount of greenhouse gas equivalents can be calculated precisely based on well-established emissions factors.

Finally, the Air District also received a comment suggesting that the District should impose conditions to ensure that the firepump engine is used only in emergency circumstances. The Air District notes that the engine also needs to be operated for short periods for testing, maintenance, and reliability purposes. The permit conditions as proposed explicitly limit operation to emergencies and for these specific, necessary non-emergency purposes.

2. Circuit Breakers

The facility's circuit breakers will also have the potential to emit a greenhouse gas, sulfur hexafluoride (SF_6). Circuit breakers do not emit SF_6 directly, but they do have the potential for fugitive emissions (leaks).[67] The Applicant's facility will include a switchyard with five circuit

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[63] *See* Clarke JW6H-UF40 Fire Pump Driver, Emission Data for California ATCM Tier 2, Clarke Fire Protection Products (Rev. E, July 12, 2007), at p.1.

[64] *Cf.* Cummins CFP11E-F10 Fire Pump Driver, California ATCM Tier 2 Emission Data (Aug. 26, 2008) (fuel consumption rate of 16.0 gal/hr); Deutz DFP6 1013 C25 fire protection engine, EPA Tier 2/CARB Technical Data Sheet (Apr. 2008) (fuel consumption rate 15 gal/hr).

[65] In the terminology of the "Top-Down" BACT analysis, the Clarke engine at 14.0 gal./hr would be ranked the No. 1 technically feasible control alternative at Step 3 of the analysis. Since the Air District is selecting the top technology, the additional steps in the analysis become moot.

[66] Unlike emissions of criteria pollutants, it is feasible here to impose a numerical emissions limitation for CO_2E because CO_2E has a direct correlation to fuel usage, which is readily measureable. The emissions factor for diesel fuel is 21.7 pounds of CO_2E per gallon.

[67] U.S. EPA, J. Blackman (U.S. EPA, Program Manager, SF_6 Emission Reduction Partnership for Electric Power Systems), M. Averyt (ICF Consulting), and Z. Taylor (ICF Consulting), *SF_6 Leak Rates from High Voltage Circuit Breakers – U.S. EPA Investigates Potential Greenhouse*

breakers, and the applicant has proposed breakers containing approximately 145 pounds of SF_6 each in an enclosed-pressure system.[68] SF_6, a gaseous dielectric used in the breakers, is a highly potent greenhouse gas, with a "global warming potential" over a 100-year period 23,900 times greater than carbon dioxide (CO_2).[69] Leakage is expected to be minimal, and is expected to occur only as a result of circuit interruption and at extremely low temperatures not anticipated in the Bay Area. Nevertheless, given SF_6's high global warming potential, even small amounts of leakage can be significant and should be considered for purposes of a greenhouse gas BACT analysis.

STEP 1: Identify Control Technologies for SF_6

Step 1 of the Top-Down BACT analysis is to identify all feasible control technologies. One alternative the Air District has considered is to substitute another, non-greenhouse-gas substance for SF_6 as the dielectric material in the breakers. One alternative to SF_6 would be use of a dielectric oil or compressed air ("air blast") circuit breaker, which historically were used in high-voltage installations prior to the development of SF_6 breakers. This type of technology is feasible for use here, although SF_6 has become the predominant insulator and arc quenching substance in circuit breakers today because of its superior capabilities.[70]

Another alternative the Air District has considered is to use state-of-the-art SF_6 technology with leak detection to limit fugitive emissions. In comparison to older SF_6 circuit breakers, modern breakers are designed as a totally enclosed-pressure system with far lower potential for SF_6 emissions. The best modern equipment can be guaranteed to leak at a rate of no more than 0.5% per year (by weight). In addition, the effectiveness of leak-tight closed systems can be enhanced by equipping them with a density alarm that provides a warning when 10% of the SF_6 (by weight) has escaped. The use of an alarm identifies potential leak problems before the bulk of the SF_6 has escaped, so that it can be addressed proactively in order to prevent further release of the gas.

Gas Emissions Source, June 2006, first published in Proceedings of the 2006 IEEE Power Engineering Society General Meeting, Montreal, Quebec, Canada (June 2006), available at: www.epa.gov/electricpower-sf6/documents/leakrates_circuitbreakers.pdf.

[68] Alstom USA Inc., *Instruction Manual-Type HGF 1012/1014*, HG12IM, Revision 0, Part 1, Page 10, 19.

[69] Letter, David, Mehl (California Air Resources Board, Manager, Energy Section), *Re: Sulfur Hexafluoride (SF6) Emissions Survey for the Electricity Sector and Particle Accelerator Operators*, January 13, 2009, available at: www.arb.ca.gov/cc/sf6elec/survey/surveycoverletter.pdf.

[70] *See* Christophorou, L.G., J.K. Olthoff and D.S. Green, National Institute of Standards and Technology (NIST), Electricity Division (Electronics and Electrical Engineering Laboratory) and Process Measurements Division (Chemical Science and Technology Laboratory), *NIST Technical Note 1425: Gases for Electrical Insulation and Arc Interruption: Possible Present and Future Alternatives to Pure SF_6*, November 1997 (hereinafter, "*NIST Technical Note 142"*), available at: www.epa.gov/electricpower-sf6/documents/new_report_final.pdf.

The Air District also considered the possibility of other emerging technologies that would replace SF_6 with a material that has similar dielectric and arc-quenching properties, but without the drawbacks of oil and air-blast breakers.

STEP 2: Eliminate Technically Infeasible Options

The Air District next examined the technical feasibility of each of the control alternatives identified. Looking at oil or air-blast circuit breakers, the Air District concluded that this alternative is not technically feasible for this project because it would require significantly larger equipment to replicate the same insulating and arc-quenching capabilities of the SF_6 breakers.[71] The proposed project site does not have adequate space within the switchyard to accommodate oil or air-blast breakers. As previously noted, the project has been proposed for location in a densely populated area because, according to the Energy Commission, the project's objectives were "[t]o locate near centers of demand and key infrastructure, such as transmission line interconnections, supplies of process water (preferably wastewater), and natural gas at competitive prices", and "[t]o serve the electrical power needs of the East Bay, San Francisco Peninsula, and City of San Francisco."[72] As a consequence, replacement of the proposed circuit breakers with breakers that do not use SF_6 is not a feasible option for this Project, given the space constraints imposed by construction of the Project on a former industrial site near a source of recycled waste water.

As for the feasibility of enclosed-pressure SF_6 circuit breakers with leak detection, which are far smaller than oil/air-blast breakers for the same application, they are feasible for this location. The project proponent has proposed to use this equipment because of its performance benefits.

Finally, the Air District also evaluated the technical feasibility of emerging alternatives to SF_6. According to the most recent report released by the EPA SF_6 Partnership, "[n]o clear alternative exists for this gas that is used extensively in circuit breakers, gas-insulated substations, and switch gear, due to its inertness and dielectric properties."[73] Research and development efforts have focused on finding substitutes for SF_6 that have comparable insulating and arc quenching properties in high-voltage applications.[74] While some progress has reportedly been made using mixtures of SF_6 and other inert gases (*e.g.*, nitrogen or helium) in lower-voltage applications, most studies have concluded, "that there is no replacement gas immediately available to use as

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[71] Although the Air District's assessment is that oil and air-blast breakers are not feasible for this project, the District also conducted a BACT comparison between oil/air-blast breakers and SF6 breakers in Step 4 discussed below. The Air District has concluded that oil/air-blast breakers would be eliminated from the BACT analysis for two separate and independent reasons, because they are technically infeasible under Step 2 and because their ancillary impacts outweigh their net emission benefits under Step 4.

[72] 2002 Energy Commission Decision, *supra* note 15, at p. 17.

[73] SF_6 Emission Reduction Partnership for Electric Power Systems 2007 Annual Report, December 2008, at p. 1 (available at www.epa.gov/electricpower-sf6).

[74] *See, e.g.*, NIST Technical Note 142, *supra* note 70; *see also* U.S. Climate Change Technology Program, Technology Options for the Near and Long Term, November 2003, § 4.3.5, "Electric Power System and Magnesium: Substitutes for SF_6", at 185; available at: www.climatetechnology.gov/library/2003/tech-options/tech-options-4-3-5.pdf

an SF_6 substitute"[75] for high-voltage applications. The Air District therefore eliminated this alternative as technically infeasible.

STEP 3: Rank Control Technologies

The Air District then ranked the feasible control technologies. The most effective (and only) control technology that the Air District found to be technically feasible is to use state-of-the-art enclosed-pressure SF_6 circuit breakers. According to information from circuit breaker manufacturers, this equipment can be guaranteed to achieve a leak rate of 0.5% or less.[76] This leak rate meets the current maximum leak rate standard established by the International Electrotechnical Commission ("IEC").[77] This leak rate performance will be further enhanced by an alarm system to alert operators to potential leak problems as soon as they emerge.

Although the District found that oil/air-blast breakers would not be feasible for this particular project, the District nevertheless undertook a comparison between this alternative and the enclosed-pressure SF_6 alternative, which is outlined below. Oil/air-blast breakers would be the top-ranked alternative (with essentially no greenhouse gas emissions) if they had not been eliminated as infeasible. The District has undertaken this additional analysis to compare these two technologies, even though oil/air-blast breakers have already been eliminated, to see whether this alternative would be more attractive if it were feasible here.

STEP 4: Evaluate Most Effective Controls and Economic Impacts and Document Results

Step 4 of the top-down analysis involves consideration of the ancillary energy, environmental and economic impacts associated with using the top-ranked control technologies. Although the Air District eliminated oil/air-blast circuit breakers as not technically feasible at Stage 2 of the Top-Down analysis, the Air District has nevertheless compared that technology to SF_6 breakers to see how it would compare if it were feasible. This comparison shows that the use of the larger oil/air-blast breakers would have significant ancillary environmental impacts that would offset its greenhouse gas benefits, even if it were feasible. Oil/air-blast breakers would require additional land to be devoted to the project, would generate additional noise, and would increase the risks of accidental releases of dielectric fluid and/or associated fires. By contrast, according to the National Institute for Standards and Technology, SF_6 "offers significant savings in land use, is aesthetically acceptable, has relatively low radio and audible noise emissions, and enables substations to be installed in populated areas close to the loads."[78] Accordingly, even if oil/air-blast breakers were not eliminated at Step 2 of the top-down analysis, they would not surpass the choice of SF_6 breakers in Step 4 because of their adverse ancillary environmental impacts.

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[75] Siemens TechTopics No. 53, *Use of SF_6 Gas in Medium Voltage Switchgear*, Siemens Power Transmission & Distribution, Inc. (June 3, 2005), (available at www.energy.siemens.com /cms/us/US_Products/CustomerSupport/TechTopicsApplicationNotes/Documents/TechTopics53 Rev0.pdf), at p. 3.

[76] Email message from Tony Conte, Sr. Account Manager, ABB, 4/28/09; email message from Jason Cunningham, Regional Sales Manager, HVB AE Power Systems, Inc., 4/27/09.

[77] IEC Standard 62271-1, 2004.

[78] *NIST Technical Note 1425*, supra note 70, at p. 3.

STEP 5: Select BACT

Based on this top-down analysis, Air District concludes that using state-of-the-art enclosed-pressure SF_6 circuit breakers with leak detection would be the BACT control technology option. Breakers using oil or compressed air as a dielectric material are not technically feasible here because of their greatly increased size, and even if they were feasible the offsetting ancillary impacts would not preclude the choice of SF_6.

Select Appropriate BACT Emissions Limit

State-of-the-art enclosed-pressure SF_6 circuit breakers with leak detection is BACT should be able to maintain fugitive SF_6 emissions below 0.5% (by weight).[79] The Russell City Energy Center will require 5 breakers using 145 lbs. of SF_6 each, for a total inventory of 725 lbs SF_6. At a leak rate of 0.5%, annual SF_6 emissions would be a maximum of 3.6 lbs/year, which would equal approximately 39.3 metric tons CO_2E per year. The Air District is therefore incorporating an annual emissions limit of 39.3 metric tons CO_2E per year into the final permit.

Fugitive emissions are, by their nature, very difficult to monitor directly as they are not emitted from a discrete emissions point. Fugitive SF_6 emissions can be estimated very accurately, however, by measuring "top-ups", *i.e*., the replacement of lost SF_6 with new product.[80] One can conservatively (and very accurately) assume that the amount of SF_6 that has leaked and entered the atmosphere is the amount that has to be topped up to maintain a full SF_6 level. The Air District is therefore not requiring monitoring of SF_6 fugitive emissions directly, but is instead requiring surrogate monitoring through measuring the amount of SF_6 lost and using a conversion factor to assess annual SF_6 fugitive emissions in terms of CO_2E. The facility will be required to calculate annual fugitive emissions in this manner to ensure compliance with the 39.3 metric ton CO_2E limit. These monitoring and recordkeeping requirements are consistent with the requirements in other regulatory approaches to the SF_6 fugitive emissions issue.[81]

In addition, as mentioned above, the Air District will require the use of an alarm system to alert controllers when a circuit breaker loses 10% of its SF_6. This alarm will function as an early leak detector that will bring potential fugitive SF_6 emissions problems to light before a substantial

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[79] IEC Standard 62271-1, 2004; email message from Tony Conte, Sr. Account Manager, ABB, 4/28/09; email message from Jason Cunningham, Regional Sales Manager, HVB AE Power Systems, Inc., 4/27/09.

[80] *SF_6 Leak Rates from High Voltage Circuit Breakers – U.S. EPA Investigates Potential Greenhouse Gas Emissions Source*, *supra* note 67, at p. 1.

[81] *See generally* California Air Resources Board's Regulation for the Mandatory Reporting of Greenhouse Gas emissions, 17 Cal. Code Regs. §§ 95100 *et seq*. (hereinafter, "Mandatory Reporting Rule") (available at: www.arb.ca.gov/regact/2007/ghg2007/frofinoal.pdf). (Note that the Mandatory Reporting Rule contains a *de minimis* exemption that is not being included in the Federal PSD Permit reporting requirements.) The Mandatory Reporting Rule adopts the reporting protocol developed by EPA's SF_6 Partnership methodology, which requires tracking of the change in inventory, purchases/acquisitions and sales/disbursements of SF_6, and the change in total nameplate capacity. It also adopts the EPA SF_6 Partnership's reporting protocol form, which appears at Appendix A-21.

portion of the SF_6 escapes. The facility will also be required to investigate any alarms and take any necessary corrective action to address any problems.

E. Miscellaneous Greenhouse Gas Issues

The Air District has received comments stating that the District should include all greenhouse gas emissions in its BACT analysis, and not just CO_2. These comments specifically stated that the BACT analysis should include emissions of methane, N_2O, SF_6, and NH_3. In consideration of this comment, the Air District has ensured that its greenhouse gas BACT analyses do in fact take all greenhouse gases into account. The analyses and the associated emissions limits address greenhouse gases in terms of CO_2-equivalent emissions ("CO_2E"), which takes into account all greenhouse gases and provides a convenient measure for comparing the relative impacts of emissions from different sources. The Air District's analyses do not include NH_3 as a greenhouse gas, however, because it does not have a significant demonstrated potential for impacting climate change. If any members of the public continue to believe that NH_3 should be included as a greenhouse gas in these analyses, the Air District invites the public to submit additional comment as to why NH_3 should be considered a greenhouse gas.

The Air District also received comments stating that the "license should acknowledge the green house gas fees to be paid to the BAAQMD." These comments are correct that greenhouse gas emissions sources such as the proposed Russell City Energy Center will be subject to a permit fee that the Air District charges under its state-law authority to help defray the costs of its climate protection work, and the Air District acknowledges that here. But these fees are charged in connection with permit issuance and annual renewal, and are not established as permit conditions. There is no benefit from putting the fee requirement in the permit conditions, as the fees are enforceable and recoverable at the time when the permit is renewed each year. Moreover, these fees are not part of the federal PSD permit program, and so they would not belong in a Federal PSD permit in any event.

IV. NO_2 BACT ISSUES

The District also received several comments on its BACT analysis for NO_2. These comments are addressed in this section.

A. Control Technology Comparison/Selection

The Air District received several comments expressing a concern that some of the sources of information used to compare the energy and economic impacts of SCR and EMx control technologies are now several years old. For example, commenters questioned whether there may be some better method of estimating the costs of using an SCR control system than using the ONSITE SYCOM Energy Corp. cost analysis adjusted for inflation using the consumer price index; and whether it was appropriate for the District to rely on a study from 2000 in comparing the energy impacts of SCR and EMx control options.

The Air District continues to support its initial BACT analysis for NO_2, but would like to take this opportunity to clarify its analysis regarding these issues in the record. The Air District does not believe that any of the information it used to compare SCR and EMx as control technologies for NO_2 emissions is unreliable as a result of its age. With respect to the relative costs of the two technologies, some of the underlying information the Air District used in its analysis was several years old (although other sources were current), but the Air District adjusted those costs for inflation over that time period to obtain cost estimate information in current dollars. (*See* Statement of Basis at pp. 25-26 and fn. 19.) Adjusting costs for inflation in this way is a well-accepted method of estimating current costs, and the Air District has no reason to believe that these estimates are inaccurate. If any members of the pubic believe that these estimates are inaccurate, the Air District invites comment on how they are inaccurate. Moreover, if any members of the public believe that they have more accurate estimates, the Air District invites the public to submit their estimates during the comment period.

With respect to the analysis of ancillary energy and environmental impacts, these control technology alternatives have not changed in any significant way since the various sources of information cited in the Statement of Basis were published, and so there is no reason to doubt their current validity for purposes of the BACT comparison. Neither technology has changed in any significant way, and so attributes such as ammonia use, water consumption, and energy penalty implicit in these technologies have not changed in any significant way either. The Air District therefore does not find any reason to question the continued validity of the information it used in its energy and ancillary environmental impact comparison. If any members of the public believe that they have more accurate information in these areas, the Air District invites the public to submit this information during the further comment period.

Finally, the Air District notes that although the commenters have questioned the vintage of some of the sources of information that the Air District used in comparing these two technologies, the Air District did not receive any comments suggesting that its ultimate conclusion was incorrect: that neither of the two alternative technologies has any ancillary impacts significant enough to warrant elimination from consideration as a BACT technology. To the extent that any members of the public believe that the Air District should have used more accurate information in its

analysis, the District invites the public to comment on how different information would have led to a different conclusion in the BACT analysis of these two technologies.[82]

B. Potential Risks From Ammonia Spills/Releases

As the Air District found in the initial Statement of Basis, the risks of accidental releases of ammonia from the SCR system are relatively minor and will be adequately addressed under applicable industrial safety codes and standards, given the safety requirements outlined in the Energy Commission's licensing documentation. (*See* Statement of Basis at p. 26 and fn. 20.) These safety measures include the Risk Management Plan requirement pursuant to Section 112(r) of the Clean Air Act and the California Accidental Release Prevention Program, which must include an off-site consequences analysis and appropriate mitigation measures; a requirement to implement a Safety Management Plan (SMP) for delivery of ammonia and other liquid hazardous materials; a requirement to instruct vendors delivering hazardous chemicals, including aqueous ammonia, to travel certain routes; a requirement to install ammonia sensors to detect the occurrence of any potential migration of ammonia vapors offsite; a requirement to use an ammonia tank that meets specific standards to reduce the potential for a release event; and a requirement to conduct a "Vulnerability Assessment" to address the potential security risk associated with storage and use of aqueous ammonia onsite. Given the relatively low risk of accidental releases and the additional safeguards provided by these measures, the District concluded that the potential for impacts from the use of ammonia in the SCR system was not significant enough to reject SCR as a control alternative. The Air District continues to believe that this position is the correct one based on all of the available information, and solicits further public comment on this issue to the extent that any members of the public disagree.

The Air District did receive comments during the initial comment period claiming that the CEC found that the there will be a significant risk of health impacts from an accidental ammonia spill, and that the Air District incorrectly characterized the CEC's findings on this point. The Air District would like to take this opportunity to clarify the record on this point. The Energy Commission expressly found that "[t]he Hazardous Materials Management aspects of the project do not create significant direct or cumulative environmental effects."[83] This finding was based (at least in part) on the conclusions of the CEC staff's Final Staff Assessment, which found that with the appropriate mitigation measures and safeguards against accidental releases, "impacts

[82] One comment also questioned why, according to the Statement of Basis, it is "not known" whether Kawasaki Heavy Industries plans to make XONON technology available for other manufacturers' turbines, and whether the District should research this information further. The Air District has not researched whether XONON-brand catalytic combustors will be made available for other manufacturers' turbines because this type of combustion technology is available only for small turbine applications, and is not available for large-scale combustors used in large facilities such as this one. The Air District therefore concluded that this technology is not available as a BACT technology choice, making the issue of what manufacturers can provide the technology moot. If any members of the public believe that this is an issue that is relevant to the PSD Permit analysis, the Air District invites further comment as to why.

[83] 2007 Commission Decision, *supra* note 27, p. 115, Finding 3.

from the use and storage of hazardous materials [will be] less than significant."[84] Of course, if a major ammonia release was to occur, that situation would entail significant impacts. But the Energy Commission found that the safeguards in place to prevent and/or mitigate any accidental ammonia releases would adequately address this risk, and therefore that the overall impact from the use of ammonia at the facility would not be significant. This finding is consistent with the Air District's assessment in the Statement of Basis – that the potential for harm from accidental ammonia releases are not significant enough to rule out an SCR system using ammonia as a BACT technology. The commenters may have misunderstood the Air District's analysis on this point based on a sentence in the Statement of Basis that could be read to mean that the Air District believes that if an ammonia release occurred it would not have significant impacts. The Air District did not intend to take such a position, and agrees with the CEC and the commenters that an accidental ammonia release could potentially cause very significant impacts, and that this point is clear and indisputable regardless of any modeling that might be done. The Air District's conclusion in the Statement of Basis was that with the appropriate risk management requirements in place, the risk from the use of ammonia would not be significant enough to rule out SCR with ammonia use as a BACT alternative. The Air District invites any further comment that the public may have based on this analysis.

The Air District also received comments questioning whether the applicant has completed condition HAZ-2 of the CEC's conditions of certification (regarding preparation of a Risk Management Plan and Hazardous Materials Business Plan), and asking whether the District should review those plans in assessing the significance of the risks of a potential accidental ammonia releases. The Air District notes that this point that the detailed requirements for Risk Management Plans, Hazardous Materials Business Plans, and the other related hazardous materials safeguards are set forth in the applicable statutes and regulations that govern those plans. They are reviewed by the appropriate review bodies (*e.g.*, the hazardous materials division of the local fire department) before the facility begins operation. Those review bodies are the appropriate expert agencies to ensure that all of the applicable safeguards and precautions are in place. There Air District has no reason to believe that it should (or even could) conduct its own review to ensure that these safety requirements are being met. If any members of the public believe that the Air District cannot issue the Federal PSD Permit before the facility has completed these requirements (or before the District has reviewed them), the Air District solicits further comment as to why.

The Air District also received comments stating that if it does choose an SCR-type system, it should require the use of urea instead of ammonia in order to reduce the potential for impacts from accidental ammonia releases. The comments cited a technology called NOxOUT ULTRA that they claimed is feasible to allow the substitution of urea for ammonia. The NOxOUT ULTRA technology cited by the commenters generates ammonia from urea just before it is injected into the SCR system, which eliminates the need to store any significant amount of ammonia at the site. The elimination of ammonia storage would alleviate the risk of any significant amount of ammonia being released accidentally, and so it is worth evaluating as an

[84] California Energy Commission, *Russell City Energy Center, Staff Assessment – Part 1 and Part 2 Combined, Amendment No. 1 (01-AFC-7C)* (June 2007), CEC 700-2007-005-FSA, at pp. 4.4-5.

alternative technology. The Air District has considered this issue further in light of these comments and has concluded that requiring a urea SCR system over an ammonia system would not be the most appropriate BACT alternative. Although urea substitution could reduce the potential for accidental ammonia releases, the Air District has found that it would involve offsetting negative environmental impacts in the form of increased emissions of formaldehyde, a hazardous air pollutant and toxic air contaminant. The Air District reviewed data from a similar facility in Sumas, Washington, which demonstrated that urea injection (as opposed to the use of ammonia) resulted in a nearly five-fold increase in formaldehyde emissions.[85] These additional formaldehyde emissions, which would occur whenever the facility operates, substantially outweigh the benefits in further reducing the already low risk of a potential ammonia release event.

C. Secondary Particulate Impacts From Ammonia Slip

The Air District also received some comments suggesting that the potential for ammonia slip from the facility's NOx control equipment should be evaluated as a collateral environmental impact in terms of its potential for the ammonia slip to form secondary particulate matter. The Air District has considered that issue in detail as explained in the section on particulate matter emissions below. (*See* Section VI.C.) As explained there, the Air District has concluded that ammonia slip emissions are not a significant contributor to secondary particulate matter formation and thus are not a significant collateral environmental impact that would rule out the selection of SCR as a control technology for NO_2 compared with EMx technology.[86] The Air District examines collateral environmental impacts such as this on a case-by-case basis and does not have a bright-line rule for when a collateral impact would be considered "significant" or not. But certainly, in a case such as this one where the available evidence suggests that ammonia slip in fact will not cause significant secondary PM, the potential for such impacts would not be significant enough to eliminate a particular control technology.

D. NO_2 Permit Limits

The Air District also received a comment stating that the hourly BACT limit for NOx was updated in the 2007 permitting process, and was reduced from 2.5 ppm to 2.0 ppm, but the annual limit was not adjusted accordingly. In light of this comment, the District would like to clarify that the annual limit established in the 2002 permitting process was based on average annual emissions of 2.0. The Air District concluded during that permitting process that although short-term NOx emissions could be as much as 2.5 ppm, on average over the longer term they would not exceed 2.0 ppm. This new lower short-term limit represents a very stringent BACT

[85] *See* Valid Results, Inc., test report for June 13, 2002, EPA Method 316 Source Test (0.226 tpy formaldehyde emissions with urea); email message from Brian Fretwell to Barbara McBride, Calpine, March 4, 2009 (prior test without urea was 0.049 tpy formaldehyde emissions).

[86] The Air District notes that with respect to NOxOUT ULTRA, both SCR and NOxOUT ULTRA use ammonia in the NOx control reaction. The only difference with NOxOUT ULTRA is that it generates the ammonia from urea just prior to ammonia injection, so the facility does not have to store significant amounts of ammonia on-site. Ammonia emissions – as opposed to ammonia storage – is not a relevant issue in the comparison between these two technologies.

standard, and the Air District has no evidence to suggest that the facility will be able to maintain average emissions significantly below 2.0 over the long term. The Air District therefore used 2.0 ppm as the average emissions rate when calculating the annual facility NO_2 permit limit.

V. CARBON MONOXIDE BACT ISSUES

The Air District also received several comments on its BACT analysis for Carbon Monoxide suggesting that the CO BACT limit should be lower than the 4.0 ppm the Air District initially proposed. The Air District has reconsidered its BACT determination and is now proposing a lowered BACT limit for CO, at 2.0 ppm (1-hour average). The Air District reevaluated the operating data from the Metcalf Energy Center, which is a similar facility that the District looked to in its original analysis, and notes that the CEM data show that only 0.4% of the days of operation showed any exceedance of 2.0 ppm after the first year of operation. The Air District has concluded that a more critical analysis of this data suggests that it should be possible to design the system to ensure that Carbon Monoxide emissions are maintained below 2.0 ppm at all times.

The Air District also examined a number of other CO permit conditions for other facilities – many of which were pointed out in comments submitted during the initial comment period – and found that the consensus of permitting agencies around the country appears to be forming around a CO BACT limit of 2 ppm. The Air District notes that there were a total of 8 permits identified in the initial Statement of Basis with Carbon Monoxide limits of 2 ppm (either with 1-hour averages or 3-hour averages), suggesting an emerging consensus that this performance level is achievable. (*See* Statement of Basis, Table 11, pp. 32-33.) Based on this further assessment of the data, and on the large number of permitting agencies that have required other similar facilities to limit CO emissions to 2.0 ppm averaged over 1 hour, the Air District concludes that this 2.0 ppm limit (1-hour average) should be required here as BACT. If this limit is being applied and demonstrably achieved at other facilities, that fact supports a presumption that it is an achievable limitation at this facility for purposes of BACT.[87]

The Air District also considered whether it might be appropriate to impose a BACT CO limit below 2.0 ppm. The District notes that (as comments pointed out) permits have been issued containing Carbon Monoxide limits below 2.0 ppm for Kleen Energy Systems[88] and CPV Warren, suggesting that CO emission limits below 2.0 ppm may be achievable for certain facilities. The Air District notes that neither of these facilities has actually been built yet and so there is no operating data available on which to assess whether they will actually be able to meet these lower limits. This point, along with the fact that the consensus among other permitting

[87] The Air District disagrees with the comments that the mere issuance of a permit with a particular limit establishes that limit as BACT, without some further demonstration that the limit is achievable. A permitting agency may issue permits with very stringent limits with little or no technical justification at all if the applicant does not object to it. In such a situation, where there is no justification for the limit nor any operating data to show that the limit can be complied with, the mere existence of the permit limit would not, without more, establish that the limit is achievable as a technical matter. But this point is moot here, as the Air District has reviewed data and conducted a detailed analysis and has on this bases concluded that the 2.0 ppm limit is achievable as BACT.

[88] New Source Review Permit to Construct and Operate a Stationary Source, issued to Kleen Energy Systems, LLC, by Connecticut Department of Environmental Protection, Bureau of Air Management, February 25, 2008.

agencies appears to have coalesced around 2.0 for most facilities, underscores the requirement that lower limits must be considered on a case-by-case basis. The Air District has therefore evaluated whether a CO emissions limit of less than 2.0 ppm would be achievable by this particular facility, "taking into account energy, environmental and economic impacts and other costs" as is required in establishing a BACT limit.

To undertake this analysis, the Air District evaluated information from the applicant on the costs and emissions reduction benefits of installing a larger oxidation catalyst capable of consistently maintaining emissions below 1.5 ppm.[89] Based on these analyses, the cost of achieving a 1.5 ppm permit limit would be an additional $179,600 per year (above what it would cost to achieve a 2.0 ppm limit), and the additional reduction in CO emissions would be approximately 11 tons per year, making an incremental cost-effectiveness value of over $16,000 per ton of additional CO reduction.[90] Moreover, the total cost of achieving a 1.5 ppm CO limit (as opposed to the incremental costs of going from 2.0 ppm to 1.5 ppm) would be over $840,000 per year, and the total emission reductions of a 1.5 ppm limit would be 186 tons per year, making a total (or "average") cost effectiveness value of over $4,500.[91] Based on these high costs (on a per-ton basis) and the relatively little additional CO emissions benefit to be achieved (on a per-dollar basis), requiring a 1.5 ppm CO permit limit cannot reasonably be justified as a BACT limit. Requiring controls to meet a 1.5 ppm limit would be far more expensive, on a per-ton basis, than what other similar facilities are required to achieve. The Air District has not adopted its own cost-effectiveness guidelines for CO,[92] but a review of other districts in California found none that consider additional CO controls appropriate as BACT where the total (average) cost-effectiveness will be greater than $400 per ton, or where the incremental cost-effectiveness will be over $1,150 per ton.[93] Moreover, a review of recent CO BACT determinations in EPA's RACT/BACT/LAER Clearinghouse did not reveal any permits that had imposed CO controls at a cost-per-ton in the range that would be required here. The permits in the Clearinghouse going

[89] A potential lower limit of 1.5 ppm provides a reasonable basis for this analysis because that number is in the middle of the range of permit limits below 2.0 found in the other permits the Air District reviewed. Given that the results of the cost-effectiveness analysis for a 1.5 ppm limit are well above what has been required at other similar facilities to achieve CO reductions, the Air District has no reason to believe that any other limits below 2.0 ppm would be cost-effective for purposes of the BACT analysis, either.

[90] *See* Spreadsheet, Incremental Cost Effectiveness Analysis for CO Control From 2 to 1.5 ppmv, prepared by Barbara McBride, Calpine Corp., reviewed by Weyman Lee, P.E., BAAQMD.

[91] *See* Spreadsheet, Average/Total Cost Effectiveness Analysis for CO Control from 2 to 1.5 ppmv, prepared by Barbara Mcbride, Calpine Corp., reviewed by Weyman Lee, P.E., BAAQMD.

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

[93] South Coast Air Quality Management District, *Best Available Control Technology Guidelines*, August 17, 2000, revised July 14, 2006, at 29; available at: http://www.aqmd.gov/bact/BACTGuidelines2006-7-14.pdf; Memorandum, David Warner, Director of Permit Services, to Permit Services Staff, Subject: "Revised BACT Cost Effectiveness Thresholds", May 14, 2008; available at: www.valleyair.org/busind/pto/bact/May%202008%20updates%20to%20BACT%20cost%20effectiveness%20thresholds.pdf.

back through 2005 that included cost-effectiveness information showed a limit of 1.8 ppm being imposed based upon an average cost-effectiveness of $1,750 per ton of CO;[94] a limit of 3.5 ppm based upon an average cost-effectiveness of $2,736 per ton and an incremental cost-effectiveness of $5,472 per ton;[95] and a limit of 2.0 ppm an average cost-effectiveness of $1,161 per ton of CO.[96] Both the average and incremental cost-effectiveness values of imposing a 1.5 ppm limit for the Russell City facility would be substantially higher than what was required for any of these other similar facilities.

Because both the average and incremental costs per ton of CO that would be reduced by imposition of a CO limit below 2.0 ppmvd are significantly higher than the costs that have been or would be required at other similar facilities, the Air District is proposing not to require that level of control as BACT. Although it appears that an additional reduction below 2.0 ppm may well be feasible based on permits that have been issued to other facilities, the Air District would eliminate it as a BACT requirement in Step 4 of the Top-Down BACT analysis because it is not "achievable" for purposes of a BACT analysis taking into account cost/economic impacts.

Finally, the Air District received a comment claiming that different types of oxidation catalysts available for controlling CO will have different impacts on HAP and POC emissions, citing a 2002 EPA memorandum regarding HAP emissions from combustion turbines ("Roy Memorandum").[97] This comment claimed that the District should evaluate the differences between different types of oxidation catalysts in its CO BACT analysis. The Air District disagrees that there is evidence that different kinds of oxidation catalysts will have different impacts on HAP and POC emissions. The memorandum the comment relies on does not state that different oxidation catalysts will have different impacts on HAP and POC emissions. To the contrary, the memorandum (including its attachment) identify several specific types of catalysts, such as platinum, palladium, rhodium, and metal oxides, and discusses them all generally simply as "oxidation catalysts". (*See* Roy Memorandum at p. 6.) Moreover, the memorandum does not claim that SCONOx has any different impact on HAP or POC emissions than any other type of oxidation catalyst. To the contrary, it explicitly states that the two technologies are "comparable" in this regard, and in fact bases its evaluation of all oxidation catalysts generally on an evaluation of SCONOx. (*See id* at p. 1.) The only difference the memorandum points out between the two technologies is that SCONOx uses a chemically modified catalyst so that the catalyst also removes NOx. (*See id*.) For the Russell City Energy Center, the District is proposing to approve SCR for NOx control, and so the NOx-removal aspect of SCONOx does not provide any improvement over the combination of SCR for NOx control and an oxidation catalyst for CO control. The Air District is unaware of any studies on different types of

[94] U.S. EPA RACT/BACT/LAER Clearinghouse Identification No. GA-0127, for permit issued to Southern Company/Georgia Power Plant McDonough Combined Cycle, Permit No. 4911-067-0003-V-02-2, issued January 7, 2008.
[95] U.S. EPA RACT/BACT/LAER Clearinghouse Identification No. NV-0035, for permit issued to Sierra Pacific Power Company Tracey Substation Expansion Project, Permit No. AP4911-1504, issued August 16, 2005.
[96] U.S. EPA RACT/BACT/LAER Clearinghouse Identification No. OR-0041, Wanapa Energy Center, Permit No. R10PSD-OR-05-01, August 8, 2005.
[97] The memorandum cited is available at www.epa.gov/ttn/atw/combust/turbine/cttech8.pdf.

oxidation catalysts and associated abatement efficiencies for VOCs and HAPs, and has found nothing in this comment or elsewhere that warrants revising the BACT analysis for CO.

VI. PARTICULATE MATTER ISSUES

The Air District has made several revisions to its permit analysis with respect to particulate matter issues. The Air District's further analysis on these issues is discussed in this section.

A. Additional BACT Analysis Regarding Lowering Particulate Matter Emissions

Since the Air District initially issued the Draft Federal PSD permit, the District has explored whether particulate emissions limits for the turbines and heat recovery boilers could be further reduced in order to ensure that the facility will not cause exceedances of the National Ambient Air Quality Standards for particulate matter. Based on this further review, the Air District is proposing a revised limit on particulate matter emissions (for both PM_{10} and $PM_{2.5}$) from each gas turbine and heat recovery boiler train of 7.5 lb/hr or 0.0036 lb/MMBTU natural gas fired (with or without duct firing). This emissions limit would include all filterable and condensable particulate emissions (*i.e.*, "front" and "back" half, respectively).

The Air District has concluded that a lower limit of 7.5 lb/hr would be achievable by this equipment based on a review of additional source testing data from a number of similar combined-cycle facilities. These 73 source tests showed average particulate emissions of 4.58 lb/hr, with a high of 10.65 lb/hr.[98] The Air District believes that some of the higher test results may be attributed to anomalies in the testing and analytical methods, the influence of which may be mitigated by application of more rigorous quality assurance/quality control ("QA/QC") by the testing contractor or analytical laboratory. The Air District has therefore concluded that it would not be appropriate to establish a compliance margin that would accommodate these high test results. Instead, the Air District is discounting the highest 5% of the test results (4 of the 73), and proposing a permit limit based on the remaining 95%. This approach yields a proposed permit limit of 7.5 lb/hr. The Air District has also reviewed available permits for other similar facilities and has not found any lower permit limits. The Air District is therefore proposing a revised $PM_{10}/PM_{2.5}$ limit for each gas turbine/heat recovery boiler train of 7.5 lb/hr, or 0.00335 lb/MMBTU of natural gas fired, as the BACT limit for the sources. The Air District is also revising its proposed conditions for the daily and annual particulate matter limits accordingly.

The Air District also conducted a similar review of the BACT limits for particulate matter emissions from the cooling tower. As noted in the initial Statement of Basis, the cooling tower can contribute to particulate matter emissions through solids dissolved in the water used in the cooling system, which can be emitted in the water vapor exhausted through the cooling tower. The Air District concluded that imposing a direct numerical limitation on emissions of PM from the cooling tower was infeasible, and instead proposed to limit the Total Dissolved Solids

[98] Each source test result represents the average of multiple test runs (3 in most cases) performed on the same unit. For a summary of the source test results, see spreadsheet, "Summary of Filterable PM_{10}", submitted by B. McBride (Director, Environment, Health and Safety, Calpine Corporation) to B. Bateman (Director, Engineering/Toxic Evaluation, Air District), W. Lee (Senior AQ Engineer, Engineering/Permit Evaluation, Air District) and B. Nishimura (Supervising AQ Engineer, Engineering/Permit Evaluation, Air District), by email dated June 10, 2009.

("TDS") in the cooling water to 8,000 parts per million by weight (along with a requirement to equip the cooling tower with high-efficiency drift eliminators guaranteed to achieve less than 0.0005 percent drift). (*See* Statement of Basis at p. 78 & proposed Condition No. 44.)

The Air District has conducted a further analysis of TDS data from the source of the proposed facility's cooling water, the City of Hayward's Waste Water Treatment Plant, which is adjacent to the proposed facility. Based on this analysis, the Air District has concluded that the facility should be able to keep the TDS of the cooling water at 6200 ppm or below. The Air District is therefore revising the proposed BACT limit for TDS from 8000 ppm to 6200 ppm.

B. Recent Regulatory Developments Regarding $PM_{2.5}$

There have also been several regulatory developments regarding particulate matter since the Air District issued the initial Draft PSD Permit and Statement of Basis. First, EPA has decided to reconsider (and apparently to repeal) its recently-adopted provision in 40 C.F.R. 52.21(i)(1)(xi) that directs PSD permitting agencies to use the so-called PM_{10} "surrogate" approach in addressing $PM_{2.5}$ compliance issues. EPA also stayed the effectiveness of Section 52.21(i)(1)(xi) while the reconsideration proceedings are underway. These developments make clear that EPA is changing its guidance on how to address $PM_{2.5}$ issues for PSD permitting purposes, and in response the Air District has concluded that $PM_{2.5}$ issues must be addressed directly and not through reliance on the surrogate policy.[99] This development means that the PSD permit analysis must (i) demonstrate that the facility will use Best Available Control Technology to control $PM_{2.5}$ emissions; and (ii) conduct an Air Quality Impact Analysis showing that the facility will not contribute to an exceedance of the $PM_{2.5}$ NAAQS (either the 24-hour standard or the annual standard).

Second, the outgoing EPA administrator signed a Federal Register notice on December 18, 2008, that would have the effect of designating the Bay Area as non-attainment of the National Ambient Air Quality Standard for $PM_{2.5}$ (24-hour average).[100] Although the document was signed by the outgoing EPA Administrator, the incoming administration has thus far declined to go ahead and actually publish it in the Federal Register. For that reason, the non-attainment designation has not become effective, and will not become effective for 90 days after Federal Register publication. This situation leaves the Bay Area in a sort of regulatory limbo on this issue, as the region is technically still unclassified for $PM_{2.5}$ (24-hour average) but is subject to an impending non-attainment designation that could become effective in the near future. This

[99] The granting of reconsideration and the issuance of the stay were made by letter from the EPA Administrator dated April 24, 2009, and in a subsequent Federal Register Notice dated June 1, 2009 (74 Fed. Reg. 26098). Before Section 52.21(i)(1)(xi) was adopted, the *status quo* was to follow published EPA policy guidance mandating the use of the surrogate approach, and there may be an argument that with Section 52.21(i)(1)(xi) stayed the situation should revert to that *status quo*. But the Administrator made clear in her letter that EPA considers that policy "no longer substantially justified . . . ," and will propose to repeal it. The Air District takes this as guidance rejecting the use of the surrogate policy, which would supersede any earlier guidance to the contrary.

[100] The re-designation as non-attainment was for the 24-hour standard only; the Bay Area would remain unclassifiable for the annual standard.

situation impacts the proposed Russell City permit because if the Bay Area remains unclassified, it will continue to be subject to PSD permitting requirements for $PM_{2.5}$ (24-hour average), but if the Bay Area becomes non-attainment the facility will be subject to Non-Attainment NSR permitting requirements for $PM_{2.5}$ (24-hour average).

The Air District is addressing this rapidly-evolving situation by proposing two separate alternative routes for public review and comment: First, the Air District is proposing that in the event that the Bay Area remains unclassified for $PM_{2.5}$ (24-hour average), it will issue a Federal PSD Permit addressing $PM_{2.5}$ for both the 24-hour and annual standards. Second, the Air District is proposing that in the event the Bay Area is designated non-attainment during the remainder of this proceeding, the Air District will issue a Federal PSD Permit addressing $PM_{2.5}$ for the annual standard only, and will leave NSR applicability issues regarding the 24-hour standard subject to 40 C.F.R. Part 51, Appendix S, which contains the regulatory requirements for non-attainment areas in the interim between the date of designation as non-attainment and the time that the state can adopt its own SIP-approved Non-Attainment NSR permit requirements. These two alternative approaches are set forth below. The Air District seeks input and comment from the public on both alternatives, and proposes to proceed with the appropriate alternative depending on how regulatory developments unfold during the remainder of this permit proceeding.

1. Continued "Unclassifiable" Status For $PM_{2.5}$ (24-hour)

If the District continues to be designated unclassifiable for $PM_{2.5}$ (24-hour average), the proposed Russell City Energy Center will be subject to two additional general areas of regulatory requirements: BACT and the Air Quality Impacts Analysis.

The first main area of additional analysis is that the facility will have to use BACT to control $PM_{2.5}$ emissions in accordance with 40 C.F.R. Section 52.21(j). With respect to the combustion turbines and heat recovery boilers, the BACT analysis for $PM_{2.5}$ is the same as for PM_{10}. Particulate emissions from natural gas combustion are less than one micron in diameter, so by definition it is both $PM_{2.5}$ and PM_{10}.[101] $PM_{2.5}$ and PM_{10} are therefore one and the same for natural gas combustion, and so the District is therefore proposing to use the same BACT analysis for $PM_{2.5}$ as it is using for PM_{10}. The Air District incorporates by reference the analysis set forth in the initial Statement of Basis PM_{10} as applicable for $PM_{2.5}$ as well. The Air District is also adding proposed conditions that will be applicable for $PM_{2.5}$ for these sources, as well as monitoring and recordkeeping requirements to ensure compliance. For the diesel firepump engine, the BACT analysis concluding that BACT requires the use of ultra-low-sulfur diesel fuel and an EPA-certified engine is the same for $PM_{2.5}$ as well. This BACT requirement, which was described in the initial Statement of Basis on pp. 51-56, was applicable to all PSD pollutants covered in the initial Statement of Basis and is applicable to $PM_{2.5}$ as well. Use of ultra-low-sulfur diesel fuel and an EPA-certified engine will provide the maximum level of $PM_{2.5}$ emissions control that is achievable at this time. For the cooling tower, the BACT control requirements the District has proposed for PM_{10} – keeping Total Dissolved Solids (TDS) in the

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

cooling water to the minimum feasible level and using high-efficiency drift eliminators[102] – are also the only effective mechanisms to control $PM_{2.5}$ emissions, and will ensure that $PM_{2.5}$ emissions are minimized to the maximum achievable extent consistent with the BACT requirements. The Air District solicits comment from interested members of the public on these $PM_{2.5}$ BACT issues.

Recent $PM_{2.5}$ regulations also require facilities to use BACT control technology to limit emissions of NOx and SO_2 as precursors to $PM_{2.5}$ formation, to the extent that the facility will emit those precursors in significant amounts.[103] NOx and SO_2 emissions are considered to be "significant" if they exceed 40 tons per year. (*See* 73 Fed. Reg. 28321, 28333 (May 16, 2008); 40 C.F.R. § 52.21(b)(23)(i).) The proposed Russell City facility will emit less than 40 tons per year of SO_2, but more than 40 tons per year of NOx. (*See* Statement of Basis at p. 14.) The facility must therefore use BACT to control NOx as a $PM_{2.5}$ precursor. The Air District has already evaluated NOx emissions and has proposed BACT limits for NOx in connection with the PSD requirements for NO_2, however. (*See* Statement of Basis at pp. 21-29.) No additional analysis or permit conditions are required to ensure compliance with this requirement.

The second main area of additional analysis is that the facility has to conduct an Air Quality Impact Analysis as required by 40 C.F.R. Sections 52.21(k)-(o). The facility has to undertake a Source Impact Analysis to show that it will not cause or contribute to an exceedance of the National Ambient Air Quality Standards or PSD increment for $PM_{2.5}$ as required by 40 C.F.R. Section 52.21(k); and has to conduct an additional impact analysis as required by 40 C.F.R. Section 52.21(o). These analyses have been conducted, and demonstrate that the proposed facility's $PM_{2.5}$ emissions (i) will not cause or contribute to an exceedance of any $PM_{2.5}$ NAAQS or increment; (ii) will not cause any significant impairment of visibility; and (iii) will not have any significant adverse impacts on soils and vegetation. These issues are discussed in detail in Section XI below, which addresses Air Quality Impacts Analysis issues. As explained in Section XI, the facility satisfies the Air Quality Impacts Analysis requirement in 40 C.F.R. Sections 52.21(k)-(o) with respect to $PM_{2.5}$ emissions.

2. Designation as "Non-Attainment" For $PM_{2.5}$ (24-hour)

In the event that the Bay Area is designated as non-attainment for the $PM_{2.5}$ 24-hour average standard, the Air District proposes to interpret this "split" designation (*i.e.*, non-attainment for the 24-hour standard and unclassifiable for the annual standard) as follows. Facilities that are major facilities for purposes of $PM_{2.5}$ under the PSD regulations will continue to be subject to PSD permitting, but only for the annual standard. That is, they will have to apply BACT for $PM_{2.5}$ and conduct an Air Quality Impact Analysis to show no violation of the annual standard. For facilities that are also major facilities for purposes of $PM_{2.5}$ under EPA's Non-Attainment NSR permitting requirements, these facilities will also be required to obtain Non-Attainment NSR permits for $PM_{2.5}$ in accordance EPA's Clean Air Implementation Rule, which applies to

[102] *See* Statement of Basis at pp. 50-51.

[103] The regulations also provide for states to require BACT for VOC and ammonia emissions if they determine to EPA's satisfaction that such emissions are a significant precursor to $PM_{2.5}$ formation, but no such determination has been made for the Bay Area.

sources in non-attainment areas while a state is developing its own Non-Attainment NSR requirements for $PM_{2.5}$. The Clean Air Implementation Rule is contained in Appendix S of 40 C.F.R. Part 51 ("Appendix S"). The Air District solicits comment on whether this is the correct approach, or whether Non-Attainment NSR permitting under Appendix S supersedes PSD permitting such that facilities would be subject to Appendix S permitting only for $PM_{2.5}$, as has been suggested from some quarters.

Based on this proposed approach for addressing "split" attainment designations, the Air District has analyzed the applicability of Appendix S in the event that the Bay Area's $PM_{2.5}$ (24-hour) re-designation becomes effective during this permitting proceeding. Here, the facility would be exempt from Appendix S because it will emit less than 100 tons per year of $PM_{2.5}$. (*See* 40 C.F.R. Appendix S, ¶ II.A.4(i)(a) (establishing 100 tpy threshold for regulation of Major Stationary Sources).[104]) There would be no additional Clean Air Act regulatory requirements applicable beyond the PSD regulations, and no additional federal permit required beyond the PSD Permit.[105]

With respect to PSD issues in the event the $PM_{2.5}$ (24-hour average) non-attainment designation becomes effective during the permit proceeding, the facility will remain subject to PSD permitting for the annual standard. The PSD analysis for this element of the permit will be the same as under the first scenario outlined above where the non-attainment designation does not become effective. The facility satisfies the $PM_{2.5}$ BACT and air quality impact analysis requirements for the annual standard as discussed above.

The District solicits public comment on all of these issues, including the applicability of $PM_{2.5}$ requirements, the $PM_{2.5}$ BACT analysis (as well as revised PM_{10} emissions limits), the determinations that the facility will not contribute to exceedances of the 24-hour or annual $PM_{2.5}$ NAAQS, the applicability of Appendix S in the event the Bay Area's redesignation becomes effective, and any other relevant issues.

C. Ammonia Slip/Secondary Particulate Matter Formation

The Air District also received comments questioning its analysis in the Statement of Basis that ammonia slip from the facility would not contribute to the formation of secondary particulate matter. The comments suggested that the memorandum the District cited in support of its conclusion that the Bay Area is nitric-acid limited was specific only to the San Jose/Livermore area and cannot be used to support a determination for the Hayward area. The comments further claimed that the District should undertake a BACT analysis for ammonia slip based upon the

[104] $PM_{2.5}$ is, by definition, a subset of PM_{10}. The fact that the facility will emit less than 100 tons per year of PM_{10} therefore establishes that it will emit less than 100 tons per year of $PM_{2.5}$. In addition, the facility will not emit more than 100 tons per year of $PM_{2.5}$ precursors, as defined in Appendix S ¶ II.A.31(iii). (*See* Statement of Basis, p. 14 Table 5.)

[105] In addition, it is worth noting that any Appendix S requirements would be applicable through a Non-Attainment NSR permit, not through the PSD Permit. There may be reasons to address both types of requirements in an integrated permit proceeding, but technically they are separate permitting programs applicable under different sections of the Clean Air Act.

potential for secondary PM formation. The comments also questioned the District's statement earlier in the permitting process that the potential impacts of ammonia slip emissions on the formation of secondary particulate matter within the boundaries of the San Joaquin Valley Air Pollution Control District are not known.

The Air District would like to take this opportunity to clarify its analysis in light of these comments. Although the comments are correct that the District's study finding nitric-acid limited conditions looked only at the San Jose and Livermore areas, which are south and east of the proposed project location, respectively, there is no indication that the same atmospheric conditions do not exist in the Hayward area as well. They are part of the same general airshed as Hayward, and the Air District is not aware of any data or other information to suggest that conditions may be materially different. The Air District therefore continues to believe that the evidence before it supports the conclusion that the air in the region of the proposed facility is nitric-acid limited, and that additional ammonia emissions in the form of ammonia slip are not likely to have any significant contribution to secondary particulate matter formation. If members of the public have data or information that the location of the proposed facility is in fact not nitric-acid limited, the Air District asks that the public submit it during the additional comment period so the District can consider it.

Moreover, secondary PM formation is a complex process that is not well understood at the present time. As EPA recently noted in its rulemaking on secondary particulate matter precursors, "Ammonia emission inventories are presently very uncertain in most areas, complicating the task of assessing potential impacts of ammonia emission reductions. In addition, data necessary to understand the atmospheric composition and balance of ammonia and nitric acid in an area are not widely available, making it difficult to predict the results of potential ammonia emission reductions."[106] Given this situation, the suggestion that ammonia slip from the facility may cause significant secondary Particulate Matter formation is speculative at most. EPA has made clear that it Federal PSD Permitting decisions should not be made based on potential impacts that are merely speculative in nature.[107] The Air District notes that the commenters' assertions about the areas in which the District's study could be made more comprehensive only highlight the uncertainties surrounding the issue of secondary Particulate Matter formation and the speculative nature of their claims that ammonia slip will cause additional Particulate Matter impacts.

Furthermore, EPA has found countervailing considerations that would counsel against unnecessarily restricting ammonia slip emissions, in the form of neutralizing harmful acids in the atmosphere. As EPA explained in its recent rulemaking, "Ammonia serves an important role in neutralizing acids in clouds, precipitation, and particles. In particular, ammonia neutralizes sulfuric acid and nitric acid, the two key contributors to acid deposition (acid rain)." EPA cited this trade-off between the potential benefits and drawbacks of ammonia restrictions, as well as

[106] Final Rule, Implementation of the New Source Review (NSR) Program for Particulate Matter Less Than 2.5 Micrometers ($PM_{2.5}$), 73 Fed. Reg. 28321, 28330 (May 16, 2008) (hereinafter, "$PM_{2.5}$ Implementation Rule").
[107] *See In re Three Mountain Power*, 10 E.A.D. 39, 57-58 (EAB 2001); *see also In re Sutter Power Plant*, 8 E.A.D. 680, 693-94 and n. 13 (EAB 1999).

the uncertainties surrounding the formation of secondary Particulate Matter from ammonia emissions, in adopting a presumption that ammonia should not be regulated as a precursor to Particulate Matter formation.[108] The Air District is mindful of these issues and declines to depart from EPA's considered approach, especially where the evidence that is available indicates that ammonia slip will not be a significant contributor to Particulate Matter formation in this case.

For these reasons, the Air District concludes that the Federal PSD BACT requirement does not require an analysis of ammonia slip emissions, as would be required if ammonia slip was demonstrated to be a precursor to Particulate Matter formation and that it would be emitted in significant amounts. If members of the public have additional information that may be relevant to these issues, the Air District invites the public to submit it during the additional comment period so the Air District can consider it further.

[108] *See* $PM_{2.5}$ Implementation Rule, *supra* note 106, at p. 28330.

VII. STARTUP AND SHUTDOWN ISSUES

The Air District received a number of comments on the proposed BACT startup and shutdown emission limits and District's technical analysis supporting them. In response to these comments, the Air District has further reviewed the proposed startup limits and is now proposing to strengthen them in several areas. The Air District addresses these and other startup-related issues in this section.

A. Applicability of BACT Requirement to Startups And Shutdowns

The District received one comment that claimed to disagree with the District's statement that the stringent BACT limits proposed for normal operations would not be achievable during startups and shutdowns. The comment claimed that the permit needs to include BACT limits for all operating modes, and cannot exclude startups and shutdowns from the BACT requirement. In this context, the comment cited the Environmental Appeals Board's decisions in the *Indeck-Niles Energy Center* case (in which the EAB observed that the petitioner had failed to raise the issue of whether the permit should have imposed short-term BACT emission limits for startup and shutdown emissions) and the *Tallmadge Generating Station* case (in which the EAB held that that PSD permits need to include BACT limits for startup and shutdown events). To clarify the record on this issue, the Air District agrees that BACT is applicable to and required for startup and shutdown operations. The District included BACT limits for startups and shutdowns in its initial proposal, and is now proposing even more stringent BACT limits for startups and shutdowns in this revised proposal. The District's analysis and permit limits are consistent with the cited EAB precedents and other authorities regarding BACT. The commenter appears to have misunderstood the District's point that the specific BACT limits imposed for normal operations are not achievable during startups and shutdowns. That point does not mean that BACT does not apply during startups and shutdowns, it simply means that different limits specific to those operating periods (and achievable during those periods) must be imposed.[109] The Air District invites further public comment on this issue in light of this clarification. If any member of the public continues to believe that the Air District is not proposing to impose permit conditions that would limit emissions during startups and shutdowns, the public is invited to submit comments explaining the basis for such a belief.

B. Proposed BACT Limits For Startups

The District also received a number of comments on the permit limits it proposed for startups and shutdowns. Upon further review, the Air District agrees with many of these comments, and in response has reconsidered its earlier proposal and is now proposing to reduce the startup limits in several areas as outlined below.

[109] *See In re Indeck-Niles Energy Center*, PSD Appeal No. 04-01, slip op. at 14-15 (EAB Sep. 30, 2004).

1. Stringency of Startup Emissions Limits

Several commenters claimed that the Air District should impose more stringent emissions limits for startups. In support, these commenters cited several facilities that they claimed establish that lower startup limits would be achievable for this facility. In particular, the commenters pointed to the Palomar Energy Center in Escondido, CA; the Lake Side Power Plant in Vineyard, UT; and the Caithness Long Island Energy Center in Brookhaven, NY, as facilities that demonstrate that startup lower limits would be achievable as BACT here. The Air District evaluated data from the first of these, Palomar, in the initial Statement of Basis (*see* Statement of Basis at pp. 41-42), but the comments claimed that additional data from the facility is available and that the Air District should obtain and analyze all available data. Some commenters stated that the Air District should require the specific technologies used at these facilities as BACT; while others stated that the Air District should establish a BACT emissions limit reflecting the same level of startup emissions reductions as achieved at these facilities, if it does not impose a requirement specifying the particular type of equipment to use.

The Air District agrees with these comments that based on all of the available information, including the examples from these three facilities, the facility should be able to achieve lower BACT startup emissions limits than the Air District initially proposed in several areas. For NO_2 emissions, the Air District has concluded that the BACT limit for hot startups should be lowered from 125 lbs. to 95 lbs. based on further review of the emissions performance achieved by other facilities, including the Palomar Energy Center. For warm and cold startups, the Air District continues to believe that the NO_2 emissions limits it initially proposed are appropriate because the additional information it has reviewed supports these limits as the lowest that can reasonably be achieved over time. For CO emissions, the Air District has concluded that the emissions limits should be reduced from 5028 lbs. to 2514 lbs. for cold startups and from 2514 pounds to 891 pounds for hot startups. For warm startups, the Air District continues to believe that the CO limit of 2514 points initially proposed is the appropriate BACT limit. Table 3 below provides a summary comparison of the startup emissions limits the District initially proposed and the revised limits the District is now proposing.

Table 3: Summary of Initial and Revised Proposed Startup Emissions Limits

	NO_2 Emissions Limits (lbs/startup)		**CO Emissions Limits (lbs/startup)**	
	Initial Proposal	Revised Proposal	Initial Proposal	Revised Proposal
Hot Startups	125	95	2514	891
Warm Startups	125	125	2514	2514
Cold Startups	480	480	5028	2514

The Air District's further evaluation of the appropriate BACT startup limits, including its assessment of the three comparable facilities cited in the comments received so far, is set forth in detail in the following paragraphs.

- ***Palomar Energy Center, Escondido, CA***

With respect to the Palomar facility, the Air District obtained additional emissions data that has been reported to the San Diego Air Pollution Control District (SDAPCD). This data included all NOx emissions data for the facility from October of 2006 through the end of 2007, and covers approximately 36 startup events involving the two turbines at the facility.[110] This is substantially more data than the Air District had from this facility when it initially considered the proposed startup limits in the initial Statement of Basis, although it is still somewhat of a preliminary picture of what the facility will be able to achieve over the long term given that it represents only a little over a year's worth of operation. Nevertheless, the Air District believes that it can use the data for what it is – an early indication of what startup NO_2 emissions this facility is likely to be able to achieve.[111]

The Air District has therefore analyzed all of this data, in conjunction with the startup data from other facilities it reviewed in its original analysis for the proposed permit, to refine its BACT analysis for startups. The Air District's analysis was based on taking the raw, minute-by-minute CEM data from the facility and estimating when startups began and ended based on changes in O_2 concentrations. The Air District notes that the emission rates it arrived at through these calculations are somewhat lower than the emissions rates calculated by the SDAPCD for the four startups where SDAPCD calculations are available.[112] The Air District therefore concludes that its method is a conservative assessment of the actual emissions performance achieved during these events. The Air District also notes that it considered data only from after October 13, 2006, for turbine 1 and after October 12, 2006, for turbine 2, the dates on which the facility began to implement the full complement of efforts it has made to reduce startup emissions under

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[110] The Air District sought additional data since the end of 2007, but the facility has not reported any to the SDAPCD. The Air District also contacted the Palomar facility directly and requested review of additional data, but the facility declined and the Air District had no way to compel release of the data. (Telephone conversation between Alexander G. Crockett, Esq., BAAQMD, and Taylor O. Miller, Esq., Sempra Energy, 4/15/09.) In addition, the applicable permit limits for Palomar are of little help in evaluating the appropriate BACT permit conditions here, as they are much higher than those proposed for Russell City and the Air District does not consider them to represent BACT limits.

[111] Note that the startup limits in the permit for the Palomar facility are far higher than anything the Air District has considered for Russell City: 400 lbs/hr NO_x and 2,000 lbs/hr CO (note that these limits are *hourly* limits, meaning that total emissions for an entire startup can be several times these hourly rates). (*See* Startup Authorization, SDG&E, 2300 Harveson Place, Escondido, CA 92029, San Diego County Air Pollution Control District, App. No. 984461, PO No. 976846, April 30, 2008, at Conditions No. 16-17.)

[112] The four startup events where SDAPCD calculations are available are the following:

Date	Turbine	SDAPCD Calculation	BAAQMD Calculation
12/10/06	1	26 pounds	22 pounds
10/22/07	1	285 pounds	225 pounds
12/23/06	2	115 pounds	111 pounds
10/22/07	2	437 pounds	375 pounds

In the following analysis, where data points are available from both the SDAPCD and BAAQMD calculations, both are given for the sake of completeness.

a variance from the SDAPCD Hearing Board. The Air District excluded data from these dates and before because the commenters who urged the Air District to consider the Palomar data asserted that it is the period after implementation of these efforts that evidences the best achievable startup emissions performance. Since the excluded data consist of, for the most part, data showing high emissions (for example, a cold startup event at turbine 1 on October 11, 2006, that produced 735 pounds of NO_2 emissions), the District's approach is, again, conservative.

Once the Air District collected and refined the data from Palomar, it broke the data out into cold, warm, and hot startups in order to compare it with the proposed Russell City limits.[113] (The Air District's summary of the Palomar data points is set forth in Appendix A.) Looking first at cold startups, the available data suggests that the Palomar facility is achieving cold startup emissions at levels very similar to the facilities on which the Air District based its initial proposed Russell City startup limits. The average NO_2 emissions for cold startups (defined as the turbine having been down for over 48 hours) were 182.8 pounds, which is very similar to the cold startup averages that the Air District reviewed for the Delta Energy Center and Metcalf Energy Center in the Statement of Basis, which were 193 pounds and 185 pounds, respectively (*see* Statement of Basis at page 46, tables 15 and 16). The highest NO_2 emissions during a cold startup at Palomar, on October 22, 2007, was 375 pounds according to the District's calculations or 437 pounds according to the SDAPCD's calculations, which again is similar to Delta and Metcalf, for which the highest cold startups were at 281 and 335 pounds, respectively (*see* Statement of Basis at page 46, tables 15 and 16). Based on this review, it appears that Palomar is performing at or near the level of the other similar facilities that the Air District considered in the Statement of Basis, but certainly not any better than that. The Air District concludes from this comparison that the Palomar data serve to confirm its earlier assessment of the appropriate cold startup limits for Russell City, and certainly do not suggest that the initial analysis was inaccurate.

The Air District did observe that the Palomar data showed a maximum startup emissions event of 375 or 437 pounds (depending on which calculation is used), which is somewhat below the proposed Russell City cold startup limit of 480 pounds, but the Air District does not consider this level of compliance margin – which is 9%-22% of the permit limit, depending on whose calculation is used – to be unreasonable for several reasons. First, the data from Palomar includes only five available data points for cold starts, which does not generate a great deal of statistical confidence that the maximum seen in this data set is representative of the maximum that can be expected over the entire life of the facility. Moreover, the wide variability in the data that is available highlights the variability in individual startups, underscoring the need to provide a sufficient compliance margin to allow the facility to be able to comply during all reasonably foreseeable startup scenarios. For both of these reasons, the Air District has concluded that a cold startup limit of 480 pounds of NO_2 is a reasonable BACT limit that is consistent with the startup emissions performance seen at the Palomar facility.

The Air District next reviewed the warm startup NO_2 emissions data from Palomar. The available Palomar data show NO_2 emissions from warm startups ranging as high as 111 pounds,

[113] Cold startups are startups when the turbine has been off-line for more than 48 hours; warm startups are when the turbine has been off-line for between 8 and 48 hours; and hot startups are when the turbine has been offline for less than 8 hours.

or 115 pounds according to SDAPCD's calculations (on December 23, 2006). This is just 14 pounds (or 10 pounds according to SDAPCD) below the proposed warm start limit of 125 pounds, or 11% (8%) of the proposed limit. The Air District concludes from this evidence that the proposed limit is at least as stringent as could consistently be expected at Palomar. It is statistically unlikely that the highest-emission startup event over the lifetime of the facility would occur during the first 14 months of available data, and it is therefore reasonable to anticipate that emissions could be even more than 111 pounds (or 114 pounds) during certain warm startups. A compliance margin of an additional 11% (or 8%) over the maximum observed over the first 14 months of data at Palomar is not unreasonable, and is appropriate to accommodate the variability in emissions among startup events over time. The Air District therefore finds no basis in the Palomar warm startup data to impose a more stringent NO_2 limit than the 125 pounds-per-startup limit it initially proposed.

Third, the Air District reviewed the hot startup NO_2 emissions data from Palomar. The data the Air District reviewed showed a startup designated as "regular" startup with NOx emissions of 145 pounds (May 1, 2007). "Regular" startups presumably indicate hot starts, as that is the most normal and frequent type of startup at the facility,[114] but the Air District finds it questionable as to whether this was actually a hot startup (*i.e.*, occurred when the turbine was down for less than 8 hours). Taking the data without this apparent outlier, the Palomar startup data show average NOx emissions of 30.3 pounds and a maximum startup event of 75 pounds (November 27, 2006). Looking at the average startup emissions, it appears that Palomar is actually experiencing *higher* average hot startup emissions than the Delta Energy Center on which the Air District based its initial startup limit evaluation. The average hot startup NO_2 emissions for the years 2005 through 2008 at Delta were 25, 26.6, 27.6, and 29.8 pounds respectively, which are all better than the 30.3 pound average at Palomar (and much better than the average of 38.5 pounds if the May 1, 2007 outlier startup is included). Looking at the highest reported startup events, the data from Palomar show a high similar to the highest high at Delta, although a little lower. The highest hot startup seen at Delta was 82.2 lbs, which is slightly higher than the 75 pound startup event at Palomar on November 27, 2006 (although still much better than the 145-pound outlier event of May 1, 2007). The Air District has therefore concluded that for hot startups that the Palomar facility is not achieving an overall startup emissions performance any better than the other comparable facilities the Air District evaluated in establishing the proposed BACT limits. In further considering all of this data, however, the Air District has concluded that a somewhat more stringent compliance margin would probably be achievable here for hot startups. At the 125 pounds hot-start limit initially proposed, the compliance margin would be 43 pounds more than the highest data point found at Delta and 50 pounds more than the highest data point from Palomar. The Air District is therefore proposing a lower NO_2 limit for hot starts in the revised draft permit of 95 pounds per startup. This lower limit would bring the permit limit more in line with the high-emissions startups that have been seen at other similar facilities, while still providing an appropriate margin of compliance to take into account the fact that startups are by their nature highly variable and the highest startup emissions seen in the data collected to date may not necessarily reflect the highest emissions that would reasonably be expected under all circumstances over the life of the facility.

[114] The Palomar facility most commonly operates during the day and shuts down overnight, so its most common startups are after less than 8 hours of down-time.

In summary, the Air District agrees with the commenters that the additional NO_2 startup data from Palomar shed more light on what level of startup emissions should be achievable at Russell City. The Air District reviewed the additional data and found that Palomar has so far been achieving emissions rates very similar to the facilities on which the Air District based its proposed limits. Based on its review of this data, the Air District has concluded that Palomar confirms the Air District's initial assessment in the Statement of Basis with respect to cold and warm startups, but provides evidence with respect to hot startups that the emissions limit can be reduced from the proposed 125 pounds to 95 pounds per startup. With this revised hot startup limit, the Russell City permit limits align very closely with the startup emissions seen at Palomar based on the available data, as summarized in Table 4 below:

Table 4: Comparison of Palomar Startup NOx Emissions Data to Proposed Russell City NOx Startup Limits

	Palomar 14-Month Maximum*	**Russell City Permit Limit**
Hot Startup	75 pounds	95 pounds
Warm Startup	111/115 pounds**	125 pounds
Cold Startup	375/437 pounds**	480 pounds

*excluding startups that occurred before implementation of startup emissions reduction measures.
**BAAQMD/SDAPCD calculations, respectively

- ***Lake Side Power Plant & Caithness Long Island Energy Center***

The Air District also reviewed the Lake Side Power Plant and Caithness Long Island Energy Center, the other two facilities that the commenters cited. The commenters discussed these two facilities primarily in the context of using an emerging startup technology – the "Fast-Start" once-through steam boiler design – in order to reduce startup emissions. As explained in greater detail in the startup technology section below, the Air District investigated these facilities further and found that they do not use Fast-Start technology, although they do utilize an auxiliary boiler that has a startup emissions benefit. Nevertheless, they are similar combined-cycle facilities and the Air District evaluated whether they are achieving better startup performance.

The only way to compare the Lake Side and Caithness facilities is based on their startup permit limits, as there is no published data from either facility because they are only just coming online. The Caithness facility has not yet been built, while the Lake Side facility has been operating only since December of 2008, as some commenters pointed out, and the Air District is not aware of any actual operating data that is available for it. Without actual operating data available for review, the Air District compared the permit limits for those facilities to see whether they suggest that lower permit limits might be appropriate for Russell City.

First, for Lake Side, the facility's permit has *no* limits whatsoever on emissions during startups.[115] The Air District does not believe that it would be appropriate to issue a permit for

[115] Utah DEQ Approval Order DAQE-AN3031001-05 (Lake Side Power Plant), Conditions 9 & 12 (available at www.airquality.utah.gov/Permits/DOCS/AN3031001-05.pdf.) The permit does

the Russell City Energy Center without limits on startup emissions, as discussed above. But to the extent that commenters contend that the Air District should look to Lake Side as a comparable facility, there are no startup limits to compare.

For Caithness, the permit does have emission limits for startups, and it is therefore possible to compare those limits with the proposed Russell City permit limits.[116] The Caithness permit establishes two tiers of startup limits, one for when the auxiliary boiler is being used and one for when the auxiliary boiler is not being used. The Air District evaluated the limits for startups without the auxiliary boiler first, which is the scenario corresponding to the applicant's proposed design for Russell City. For NO_2 emissions, the Caithness startup limits are all higher than the limits the Air District initially proposed for the Russell City permit here. The Air District therefore concludes that Caithness further supports the reasonableness of these NO_2 startup limits as the lowest achievable BACT limits. At the very least, the Caithness permit cannot be read to suggest that lower NO_2 startup limits are warranted. The story is slightly different for CO startup emissions, however, as the Caithness permits limits for hot and cold startups are below the CO startup limits the Air District initially proposed for Russell City. Specifically, the Caithness hot startup limit for CO (without auxiliary boiler) is 891 pounds, which is significantly lower than the 2514 pound CO hot startup limit initially proposed for Russell City. Further, the Caithness cold startup limit for CO (without auxiliary boiler) is 2813 pounds, which is significantly lower than the 5028 pound CO cold startup limit initially proposed for Russell City. Upon further consideration, the Air District believes that revisiting the proposed Russell City limits for hot and cold startups would be appropriate in light of this new information from Caithness. The Air District is therefore lowering its proposal for the hot startup limit to 891 pounds of CO, based on the limit imposed in the Caithness permit for similar equipment. The Air District is also lowering its proposal for the cold startup limit to 2514 pounds of CO, based on the Caithness permit and on another lower permit limit the Air District examined in further considering this issue, the Sutter Power Plant. The Sutter facility has a permit limit of 2514 pounds of CO per cold startup and has been achieving this limit, and the Air District concludes that a 2514 pound limit would be achievable at Russell City as well.

Based on this review, the Air District has concluded that under this revised proposal, the Russell City startup limits will be as stringent as (or more stringent than) either Lake Side or Caithness

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contain daily emissions limits, towards which startup emissions are counted, but has no limits specifically for emissions during startups. In addition, the permit application provided startup information based on vendor data, which were referenced in the Utah DEQ analysis for the permit, but these numbers were for one specific operating temperature and were not presented as vendor guarantees of what the equipment could reliably achieve under all foreseeable operating circumstances. Moreover, the numbers do not identify whether they were for startups using the auxiliary boiler or not. *See* Notice of Intent and Prevention of Significant Deterioration Air Quality Application, Lake Side Power Plant (May 2004), Table 3-6.

[116] *Prevention of Significant Deterioration of Air Quality (PSD), Caithness Long Island Energy Center*, April 7, 2006 (with transmittal letter from W. Mugdan, Director, U.S. EPA Region 2, Division of Environmental Planning and Protection, to R. Ain); available at: www.caithnesslongisland.com/Final%20PSD%20Permt_4.7.06.pdf.

for startups without an auxiliary boiler. For ease of comparison, the Lake Side, Caithness and proposed Russell City permit limits are summarized in Table 5 below.

Table 5
Comparison of Lake Side, Caithness and Proposed Russell City
Startup Emissions Limits (without Auxiliary Boiler)

Startup Scenario	Lake Side Permit Limit	Caithness Permit Limit	Proposed Russell City Permit Limit
Hot Startup	n/a	127 lbs. NOx	95 lbs. NO_2
	n/a	891 lbs. CO	891 lbs. CO
Warm Startup	n/a	488 lbs. NOx	125 lbs. NO_2
	n/a	2813 lbs. CO	2514 lbs. CO
Cold Startup	n/a	488 lbs. NOx	480 lbs. NO_2
	n/a	2813 lbs. CO	2514 lbs. CO

The Air District also considered the possibility of requiring an auxiliary boiler, which would presumably be able to achieve the lower emissions limits expressed in the Caithness permit applicable when the auxiliary boiler is used. Upon further consideration of this issue, the Air District has concluded that while auxiliary boilers are common technology in colder climates to keep equipment warm in cold weather, the costs associated with requiring such equipment at Russell City would not be justified by the relatively small startup emissions reductions that would be gained. (*See* discussion in Section VII C.2 below for the complete analysis.) The Caithness permit limits for this operating scenario are therefore not comparable to Russell City and the Air District does not consider them as indicative of what the Russell City facility will be able to achieve.

In summary, the Air District agrees with the comments that it should examine the Palomar, Lake Side, and Caithness facilities as potentially comparable facilities to determine if the startup limits in the Russell City permit are the lowest achievable. As outlined in this discussion, the conditions that the Air District is now proposing for this permit are the most stringent emissions performance levels that any of these facilities suggests is achievable for purposes of the BACT analysis. The Air District invites further comment on this additional analysis.

2. Startup Duration

The Air District also received some comments suggesting that the time it proposed to allow for startups is longer than it needs to be. The comments criticized the Air District's reliance on the startup limits for the Delta, Los Medanos, and Metcalf Energy Centers and the Sutter Power Plant in its analysis of the appropriate startup limits for Russell City, claiming that these facilities may not represent the best startup times achievable today using best work practices. The comments stated that the Air District should evaluate whether shorter startup timeframes would be achievable using best work practices, and cited one recent permit – for the Colusa Generating Station in Colusa, CA – that had been issued with shorter startup time limits of 4.5 hours for cold

startups (compared with 6 hours proposed for Russell City) and 1.5 hours for hot startups (compared with 3 hours proposed for Russell City).[117]

At the outset, the Air District notes that startup duration, as opposed to startup emissions, is not technically subject to the BACT requirement. BACT is "an *emission limitation* . . . based on the maximum degree of *reduction for each pollutant*" achievable by the facility (40 C.F.R. § 52.21(b)(12) (emphasis added)). It is thus a limitation on the amount of pollution emitted, not on the duration of any particular operating mode. As long as a facility can achieve the lowest *emissions* from startups among sources of its type, the facility will satisfy BACT even if it has to take a longer *time* to get to steady-state operating conditions. The reason for this rule is obvious: it is the emissions that matter from an air quality standpoint, not the time involved, and so if two facilities can achieve the same emissions performance there is no air quality reason to prefer one startup duration over the other (and indeed if one can achieve lower total emissions but needs a longer time frame to do so, the longer lower-emissions startup should be encouraged). The Air District has traditionally included startup duration among its permit conditions because as a general rule shorter startups equate to lower startup emissions, but as long as the emissions rates are at the lowest level achievable the facility will satisfy BACT regardless of duration. Here, the Air District's evaluation has concluded that the Russell City Energy Center will be subject to the most stringent achievable startup *emissions* limits as explained in the initial Statement of Basis and as further refined in this Additional Statement of Basis, and so the facility satisfies the BACT requirement on that basis. Imposing an additional requirement on startup durations is not technically required by BACT.

Beyond this threshold point regarding BACT applicability, the Air District has in light of these comments considered further whether current best practices can achieve shorter startup times than what was achievable by the facilities that were permitted pre-2001, and has concluded that there is no reliable evidence that they can. The commenters do not cite any evidence of advances in startup performance since those facilities were permitted, and their criticism of the Air District's reliance on those facilities is based solely on the passage of time. Moreover, some of the commenters themselves cited contrary evidence, in the form of recent testimony before the California Energy Commission that using current technology, startups at combined-cycle facilities "can take a minimum of three and possibly six hours . . . ."[118] Based on this record, the Air District finds little compelling evidence that there have been any significant advances in operational practices in recent years that can reduce startup times.

The one recent permit the comments did cite on this issue is the Colusa permit, which the Air District reviewed in detail in response to this comment. Although that facility has not been built yet and so there are no actual operating data on which to assess its startup performance, the commenters are correct that the permit for the facility does include tentative initial time limits for

[117] Note also that commenters on this subject cited emerging technologies that they claimed can reduce startup times, which are addressed in the technology choice section below. This section of the discussion focuses on the startup time limits that can be achieved using best work practices, without additional technologies that the Air District is not proposing to require as BACT.

[118] *See* Comments of Chabot-Las Positas Community College District, p. 11 (citing testimony before the California Energy Commission on December 18, 2008).

hot and cold startups that are shorter than the Air District is proposing for Russell City, as noted above.[119] But even if the facility will be able to achieve steady-state operation within these time limits, that does not mean that it will achieve better startup performance. To the contrary, the startup limits for the Russell City Energy Center will be *lower* than for Colusa, notwithstanding Colusa's shorter time limits. Specifically, the Colusa permit allows up to 779.1 pounds of NO_2 per cold startup and 259.9 pounds of NO_2 per hot startup.[120] By contrast, Russell City will be limited to 480 pounds of NO_2 per cold startup and 95 pounds of NO_2 per hot startup, approximately half the amount allowed at Colusa.[121] The Air District therefore concludes based upon its review of the Colusa permit that the Russell City proposed permit limits do satisfy the Federal PSD BACT requirement.

Finally, with respect to startup and shutdown durations, one commenter apparently understood that the Air District had conducted a BACT review for startups and shutdowns, but stated that the limits on startup and shutdown duration are not included in the permit conditions. To clarify this situation, the Air District refers to the proposed definitions of startup and shutdown. Startup and shutdown periods are defined with a maximum duration, and after the end of the startup and shutdown period the turbines have to comply with the more stringent emissions limits applicable during normal, steady-state operation. If the startup is not complete by the time the maximum

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[119] Because the facility has not yet been built, there is no evidence from this facility on which to rely other than the analysis and justification in the permitting agency's BACT analysis. But that analysis does not include any actual operating data showing that these limits are achievable. To the contrary, it appears that the permitting agency concluded that the startup limits satisfied BACT because the applicant had proposed them and because they were below the limits in other permits for similar facilities. (*See* Ambient Air Quality Impact Report, Colusa, at pp. 19-20.) Moreover, the permitting agency explicitly considered that the startup limits might not turn out to be achievable, explaining that if experience shows that they are unrealistic then they will have to be revaluated. (*See id.*) The Air District therefore finds it highly questionable whether the Colusa example provides any hard evidence on which to conclude that the short startup limits in the permit are achievable. The issue is moot, however, as regardless of startup times the Russell City permit limits require lower emissions than the Colusa permit limits.

[120] *See* Prevention of Significant Deterioration Permit, Colusa Generating Station (EPA Region 9, issued Sept. 29, 2008) at p. 8 (available at at www.regulations.gov/fdmspublic/component/main?main=DocketDetail&d=EPA-R09-OAR-2008-0436.

[121] The Air District notes that the Colusa startup limits for Carbon Monoxide are somewhat lower than the Russell City startup CO limits. (*See id*.) The fact that Colusa has higher NOx startup limits than Russell City in conjunction with lower CO startup limits highlights the NOx/CO tradeoff that the Air District noted in the Statement of Basis. The Air District does not agree with favoring reduced CO in exchange for increased NOx emissions because the Bay Area is in attainment of the applicable CO NAAQS but is non-attainment with the applicable ozone NAAQS (and NOx is an ozone precursor). The Air District therefore does not find that the Colusa permit provides evidence on which to justify a lower CO limit for startups. To the extent that the Colusa permit shows that lower CO startup limits are technically feasible, the Air District would reject them in favor of the limits it is imposing here based on the ancillary environmental impacts involved in going to those lower CO limits – that is, the increased NOx emissions that would be involved, as evidenced by the higher Colusa NOx limits.

startup duration has elapsed (*i.e.*, if the facility has not achieved normal, steady-state operation), the facility will have violated its permit conditions and will be subject to enforcement action.

C. BACT Technology Review

The Air District also received a number of comments regarding its analysis of the control technologies available to reduce startup emissions. A number of comments criticized the Air District's BACT technology review, claiming that certain technologies the Air District rejected should be required because they would result in lower BACT permit limits. Among the technologies cited in these comments were Fast-Start technology, which is an integrated system using a "once-through" steam boiler to reduce startup times; the use of an auxiliary boiler to keep equipment warm during shutdowns and therefore allow it to start back up more quickly; and Low-Load "turn down" technology, which aims to reduce emissions at lower loads and may potentially be effective to reduce emissions as the turbines ramp up to full load during startups. The Air District's has further analyzed these technologies in light of these comments, as follows.

1. "Fast Start" Once-Through Steam Boiler Technology

The Air District received comments asserting that "Fast Start" technology is available for combined-cycle facilities with higher-efficiency triple-pressure steam turbines of the type proposed for the Russell City facility. These comments claimed that the Siemens "Flex-Plant 30" design is available and could be used for this facility. The comments cited two projects – the Lake Side Power plant in Utah and the Caithness Long Island Energy Center in New York – that supposedly use FP-30 technology.

The Air District reviewed the situation regarding the availability of Fast Start technology in light of these comments. Siemens confirmed that no Flex Plant^{TM} 30 has been constructed or proposed at this time for a full-scale power plant project. The term "Flex Plant^{TM}" is used to describe a family of Siemens' combined cycle "platforms" based on integration of one or more Siemens' SGT6-5000F gas turbines, a Siemens integrated cycle design and HRSG specification, a Siemens steam turbine, and a Siemens SPPA-T3000 control system[122] Siemens representatives have confirmed to the Air District that the Lake Side and Caithness facilities both use the same 501F turbine technology and conventional triple-pressure boiler technology as proposed for Russell City, *i.e.*, they do not include a "once-through" Benson boiler.[123] According to Siemens,

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[122] Siemens Statement Regarding Available Siemens Technology Which Appear in Comments on RCEC's Draft PSD Permit (hereinafter, "Siemens Technology Statement"), received by email from Candido Viega, Region Vice President, Pacific Northwest, Siemens Energy, Inc., to Richard Thomas, Calpine, March 16, 2009.

[123] *Id.* The BACT analysis performed by the Utah Department of Environmental Quality's, Division of Air Quality also suggests that the Lake Side Power Plant does not reflect advanced technology, as alleged by one commenter. The engineering analysis says that "[t]he project will consist of generating equipment in a configuration that has been permitted and is in use throughout the United States and the world." *Engineering Review, Summit Vineyard, LLC, Lake Side Power Plant* (October 25, 2004) (hereinafter, "Lake Side Engineering Review"), at p. 5; available at: www.airquality.utah.gov/Permits/DOCS/ RN3031001-04.pdf.

"[n]either Lakeside [Power Plant] nor Caithness Long Island Energy Center (CLIEC) were represented as, nor [*sic*] sold as, a Flex Plant^{TM} 30."[124] The Air District also contacted the plant manager from the Lake Side plant, who confirmed that the facility uses the Siemens 501F turbine with the latest FD3 technology, along with a conventional triple-pressure boiler and steam drum; the facility does not use a once-through boiler design.[125]

The commenters' confusion over whether these the Lake Side and Caithness facilities use Flex-Plant 30 technology may have arisen because they both use an auxiliary boiler to keep the equipment warm during cold weather.[126] The use of such an auxiliary boiler is common in colder regions where low temperatures can greatly prolong startups during cold weather, but such equipment does not constitute Flex-Plant^{TM} 30 integrated plant design or similar "once-through" Benson boiler design. These two facilities do not, therefore, contradict the District's conclusion that Flex-Plant 30 technology is not yet available.

Regardless of this distinction in the types of technology used at Lake Side and Caithness, however, the Air District interprets the commenters' point to be that the Air District should consider whether to require the same type of technology used at those two plants to keep equipment warm and allow it to start up faster. The Air District considered the use of an auxiliary boiler as is used at Lake Side and Caithness, and its analysis is described in detail in subsection 2 below. As noted below, however, the Air District found that it would not be required as a BACT control because the economic impacts in having to install and operate the auxiliary boiler render it inconsistent with BACT, given the relatively small additional emissions reductions it would achieve. The Air District is therefore not requiring an auxiliary boiler as used at Lake Side and Caithness.

2. Use of Auxiliary Boiler

As noted above, in light of some of the comments that cited the Lake Side and Caithness facilities, which use an auxiliary boiler, the Air District considered whether it should require an auxiliary boiler to be used on this project. The District analyzed the startup emissions benefits of using an auxiliary boiler here in the context of the additional costs that would be involved. The District compared startup data from Calpine's facility in Mankato, Minnesota, a facility that is equipped with an auxiliary boiler. For some startups the plant uses the auxiliary boiler and for others it does not, and so the plant allows a direct comparison of the actual emissions reduction impact from using this technology. The data show that using the auxiliary boiler will reduce fuel usage (and consequently emissions) by approximately 18% for warm startups and approximately 31% for cold startups (with no impact on hot startups, as the HRSG and steam turbine are already at a high temperature).[127] Assuming an annual operating profile containing 6 cold startups and 100 warm startups (a conservative estimate because actual startups will likely be

[124] Siemens Technology Statement, *supra* note 122.
[125] Telephone conversation between Weyman Lee, BAAQMD Engineer, and John Bowater, Plant Manager, Lake Side Power Plant, April 8, 2008.
[126] *See* Lake Side Engineering Review, *supra* note 123, at pp. 6-7; Caithness Long Island Energy Center, *Environmental Impact Statement*, June 2005, at 9-35 – 9-36, available at: www.lipower.org/company/powering/caithness.html.
[127] *See* Excel spread-sheet entitled "Aux Boiler start profile DJ.xls".

lower), a similar reduction at Russell City from using an auxiliary boiler would result in 0.9 tons of NOx and 12.4 tons of CO per year.[128] The Air District compared these potential emissions reductions to the costs of using an auxiliary boiler, based on a cost estimate provided by Calpine and reviewed by the District.[129] That cost estimate showed that the annualized cost of $1,029,521 for the installation and operation of the auxiliary boiler. In terms of dollars-per-ton, these figures yields a cost-effectiveness number of $1,143,912 per ton for the NOx reductions and $83,025 per ton for the CO reductions. In light of these cost-effectiveness numbers, the costs of requiring an auxiliary boiler here would greatly exceed what any permitting agency would require in order to achieve this level of additional emissions reductions.

3. Use of Single-Pressure "Flex Plant 10" Technology

The Air District also received comments noting that two other proposed facilities for which applications have been recently submitted (Willow Pass and Marsh Landing) are proposing to use Flex-Plant 10 technology. (Flex-Plant 10 technology is similar to Flex-Plant 30 technology, except that is uses a single-pressure steam boiler instead of a triple-pressure steam boiler.) These comments suggested that these permitting applications show that Flex-Plant 10 should be reviewed for "its appropriateness at Hayward". Other comments took the opposite position, however, stating that Flex-Plant 10 technology is not appropriate for this type of facility. These comments stated that a Flex-Plant 10 system is appropriate for peaking-to-intermediate duty operations, whereas the Flex-Plant 30 system is the appropriate technology for intermediate-to-baseload operations. These comments were based on the observation that there is an energy efficiency penalty when using the single-pressure steam boilers system, compared with the more efficient triple-pressure system that is being proposed here. The Air District agrees with the latter comments. Flex-Plant 10 is an excellent technology to allow peaking-to-intermediate plants – which have to be able to start up and come on line very quickly – to gain the benefits from using combined-cycle technology (as opposed to less efficient simple-cycle turbines). But it is not appropriate for intermediate-to-baseload facilities where quick startup times are less important because of the energy efficiency penalty associated with using a single-pressure steam turbine. For intermediate-to-baseload facilities, it is preferable to obtain the better overall emissions performance achievable through the use of a triple-pressure system instead of using a less efficient single-pressure system like the Flex-Plant 10. (Note that when Flex-Plant 30 technology becomes available it will allow suitable triple-pressure systems to achieve faster startups as well, but this technology is not yet available for this project.)

A related comment objected to the District's comparison of Flex-Plant 10 technology as being less efficient than triple-pressure steam turbine systems. The comment asserted that Westinghouse 501F turbines can be between 36.5% and 56% efficient, and the comparison with the FP-10's stated efficiency of 48% might be different if it is made at an efficiency different from the 55.8% efficiency value the District used. The Air District believes that this commenter may be misunderstanding the efficiency ratings for these turbines, and would like to take this

[128] *See id*. Note that these reductions are net of the small additional emissions that would be generated by the auxiliary boiler itself. The Air District agrees with the commenters who stated that the emissions reductions from the auxiliary boiler would be more than offset by the startup reductions.

[129] *See* Excel spread-sheet entitled "Aux Boiler-NOx-2.xls".

opportunity to clarify the issue for the record. The 36.5% efficiency factor cited by the commenter for operation of an F-class turbine would be for operation in a simple cycle facility; that is, using the turbine only and not taking advantage of the waste heat in the turbine exhaust to generate steam for the combined-cycle heat recovery boiler. The proposed facility here is a combined-cycle facility that will have a heat recovery boiler to generate steam for additional electrical generation. The steam boiler that is being proposed here is a triple-pressure turbine that is more efficient than the single-pressure system used in the Flex-Plant 10 system. The Air District invites further comment on the Flex-Plant 10 issue to the extent that any commenters have misunderstood the technical basis of the Air District's analysis.

4. Low-Load "Turn-Down" Technology

The Air District received several comments asserting that it should require Op-Flex low-load "turn-down" technology as a BACT technology for reducing startup emissions. These comments noted that the Palomar facility in Escondido discussed above has installed Op-Flex technology, and argued that this fact demonstrates that the technology is technically feasible for reducing startup emissions. The comments also noted that the CEC staff suggested that Op-Flex should be required as BACT in a comment letter. Some of the comments stated that if the Air District does not require Op-Flex technology to be used, as an alternative it should require the same level of startup emissions reductions as achieved by other facilities with Op-Flex.

The Air District reviewed its assessment of Op-Flex in light of these comments. The Air District notes at the outset that the Federal PSD BACT requirement is ultimately an emissions limit, not a control technology *per se* (although, obviously, it must be based on the performance of the best available technology taking into account all relevant factors).[130] Based on the data that the Air District has reviewed from the Palomar facility that uses Op-Flex and early ammonia injection, the District has concluded that the Russell City facility will have startup emissions that are the same as or lower than startup emissions achieved at Palomar. (*See* discussion in Section VII B.1, above.) The Air District therefore agrees with the comments stating that the Air District should require the same level of startup emissions reductions achieved at facilities that have installed Op-Flex. The Air District disagrees, however, with the commenters who claimed that the Air District should specifically require the use of Op-Flex as a technology.

Moreover, the Air District does not find any reason to alter its BACT analysis of Op-Flex as not yet "available" for BACT purposes as an effective technology for reducing startup emissions. The Air District's conclusion was based upon the lack of a manufacturer's guarantee; the limited nature of the data from the only facility using Op-Flex, which is not sufficient to allow a determination that Op-Flex really is achieving any significant reductions in emissions beyond what is already achievable using other approaches; and the fact that no other permitting agencies have ever found Op-Flex to be an achievable technology for reducing startup emissions. None of the commenters has provided any reason to reconsider any of these rationales.

[130] *See, e.g.*, *In re Three Mountain Power*, 10 E.A.D. 39, 54-55 (EAB 2001) (BACT is an emission limitation not a control technology and if two alternatives can achieve the same emissions performance the choice is in essence immaterial).

The Air District therefore continues to conclude that Op-Flex as not yet an available technology, and is appropriately eliminated in Step 2 of the Top-Down BACT analysis. Moreover, based on the additional analysis referred to above, even if the Air District were to address Op-Flex as an available technology in Step 3 of the Top-Down analysis, there is no indication based on the available data that it should be ranked higher than the alternative the District ultimately selected, best work practices. For all of these reasons, the Air District disagrees that Op-Flex should be required as the BACT technology for this facility.[131]

5. EPA Region 9's Colusa PSD Permit

The Air District also received comments that disagreed with the District's assertion that EPA Region IX does not require OpFlex as BACT, based on the permit Region IX issued for the Colusa Project. The comments noted that a commenter in the Colusa proceeding brought the issue to the Region's attention in a comment, but that the comment was withdrawn and so Region IX did not consider it. The comments requested that the District consider the comments that were submitted and subsequently withdrawn in the Colusa proceeding here.

The District agrees that that EPA Region IX did not formally respond to the withdrawn comments on the record. But once EPA was aware of the issue, it would not (and legally could not) fail to require OpFlex technology if that technology were BACT. The agency has an independent responsibility to impose BACT based on all of the information available to it, even if the specific comment that brought the issue to light was withdrawn. For this reason, the District stated in the initial Statement of Basis that EPA Region IX did not require OpFlex as BACT.[132]

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[131] A comment also stated that the CEC found that Calpine rejected OpFlex because of the associated cost, and stated in this context that the District needs to ensure that its BACT analysis is "untainted" by considerations of things like costs. The District disagrees that cost was a part of the District's analysis of Op-Flex technology. The commenter has not identified any element of the Air District's BACT analysis regarding Op-Flex that is based on cost, and the District has not found any either.

[132] The same commenter also suggested that U.S. EPA Region 9's decision (or lack thereof) not to require OpFlex™ in the PSD permitting decision for Colusa Generating Station was irrelevant to the Air District's decision because the proposed Russell City Energy Center would be located in a populated metropolitan area designated as nonattainment for certain National Ambient Air Quality Standards. The Air District would note that the suggestion implicit in this comment – that the BACT standard should apply differently between a location in a "major metropolitan area" and one outside such an area – is without any basis in the federal PSD regulations. Further, to the extent that the commenter intended to suggest that PSD permits should not be issued or the BACT standard should be applied differently for sources located in non-attainment areas, the Air District notes that such sources are subject to non-attainment New Source Review for non-attainment pollutants. In those cases, the BACT determination would actually comprise a determination of the "Lowest Achievable Emissions Rate", which is not at issue in this permitting action.

Moreover, although the Air District pointed out that EPA had not required the use of OpFlex as BACT at Colusa, the Air District conducted its own case-by-case evaluation and reached its own independent conclusion that OpFlex should not be required as BACT here. That analysis, as further considered in this Additional Statement of Basis, provides a sufficient basis for the current permitting action regardless of EPA Region IX's analysis. The District continues to believe that EPA Region IX's conclusions lend further credence and support to its analysis, however.

Finally, as for considering the Colusa comments that were withdrawn, they were submitted in the Colusa proceeding and were not submitted on the record as comments in this proceeding, so the District is not obligated to respond to them. If the commenters believe that the Air District should consider them on the record in this proceeding, they have an obligation to submit them into the record for the Air District to review, but they did not do so here. Nevertheless, the Air District obtained a copy of the comments from EPA Region IX to ensure that it had researched all information that could have bearing on this issue, and found nothing whatsoever in those comments to suggest that OpFlex should be required here. The comment letter cited several of the same points about the Palomar Energy Center that have been raised in this proceeding, to which the Air District is responding in detail in this section.

6. Siemens "Low-Load Carbon Monoxide" Technology

Another comment claimed that, based upon telephone conversations with Siemens representatives, a low-load "turn-down" technology product is currently available for Siemens turbines. The Air District investigated this issue further, and reviewed communications from Siemens confirming in writing that it does not have a low-load product that is commercially available for F-class turbines. Siemens' LLOF product, known as "Low Load Carbon Monoxide" (LLCO), has been validated for G-class turbines as noted in the documentation the Air District relied on in the initial Statement of Basis. (*See* Statement of Basis at p. 41 and n. 33.) The Air District confirmed this with Siemens in response to this comment. Siemens reports that "LLCO validation for F-class turbine began in December 2008 and [is] currently in process [but] the validation for the F-class turbine has not been concluded."[133]

Further, for the reasons discussed in the section of this Response on the Air District's BACT analysis for greenhouse gas emissions (Section III), the Air District has found that use of G-class turbines in place of the Applicant's proposed F-class turbines does not constitute BACT for Russell City Energy Center. Rather, as discussed in Section III B.2, use of G-class turbines for a proposed nominal 600 MW combined-cycle power plant would require installation of a substantially smaller steam turbine, which would result in a significant reduction in the plant's overall efficiency rating. In light of the ancillary environmental and energy impacts that would result from this efficiency loss, the Air District in not requiring the use of G-class turbines as BACT for this project.

[133] *See* Siemens Technology Statement, supra note 122.

7. Use of "Best Work Practices" as BACT for Startups

The Air District also received a comment objecting to the selection of Best Work Practices as the BACT control technique, characterizing this approach as "simply following 'operating instructions' ". In light of this comment, the Air District would like to clarify for the record that optimizing a facility's operating procedures to implement best work practices is an effective and well-accepted method of minimizing emissions from startups and shutdowns.[134] The Air District does not find that the commenter's characterization of this approach to minimizing emissions provides any reason to alter its BACT analysis.

[134] *See, e.g.*, Memorandum from John B. Rasnic, Director, Stationary Source Compliance Division, Office of Air Quality Planning and Standards, U.S. EPA, to Linda M. Murphy, Director, Air, Pesticides and Toxics Management Division, U.S. EPA Region I (Jan. 28, 1993); Memorandum from Kathleen M. Bennett, Assistant Administrator for Air, Noise, and Radiation, U.S. EPA, to Regional Administrators, Regions I-X (Feb. 15, 1983); Memorandum from Kathleen M. Bennett, Assistant Administrator for Air, Noise, and Radiation, U.S. EPA, to Regional Administrators, Regions I-X (Sept. 28, 1982).

VIII. COMMISSIONING PERIOD

The Air District received a comment suggesting that the Air District should require a shorter commissioning period. The comment stated that the data the District reviewed demonstrates that a shorter time is feasible (citing examples of 96 hours and 207 hours taken to commission certain other turbines). The Air District reviewed the commissioning period BACT analysis in light of this comment, and does not believe that the data shows that a shorter commissioning period is feasible. The data shows that the time required for commissioning varies greatly from turbine to turbine, and that a reasonable allowance must be made for this variability. The data the Air District evaluated shows that although on occasion facilities have been able to complete commissioning in as little as 96 hours, on other occasions they have required as long as 297 hours. Based on this data, as well as the Air District's review of the applicant's estimate of the time that will be required, the Air District concludes that 300 hours is a reasonable time limit. The Air District therefore disagrees with this comment that a shorter time period is feasible as a BACT requirement.

IX. SULFURIC ACID MIST ISSUES

The Air District received a few comments on sulfuric acid mist, and takes this opportunity to clarify the record with respect to the issues raised.

First, the Air District received comments questioning the District's assertion that emissions of sulfuric acid mist are difficult to estimate because the conversion of fuel sulfur to SO_3 and then to H_2SO_4 is not well established. These comments suggested that the District should be in a position to explain more precisely what actual sulfuric acid mist emissions will be. The comments also questioned whether the facility will in fact emit less than the 7 tons-per-year PSD significance threshold. In addition, some comments claimed that the permit should limit sulfuric acid mist emissions to less than 38 pounds per day. The Air District has reexamined its analysis of sulfuric acid mist emissions in light of these comments, and has concluded that its initial analysis is sound. As explained in the initial Statement of Basis, Air District has estimated sulfuric acid mist emissions as accurately as it can, and believes that emissions will be below 7 tons per year. The Air District is not aware of any data or analysis suggesting that emissions will be over 7 tons per year, and none of the comments on this issue cited any, and so the Air District continues to believe that this is an accurate assessment. Moreover, the Air District is not simply relying on this estimate to ensure that emissions will in fact be below 7 tons per year. The permit includes an enforceable sulfuric acid mist limit to ensure that emissions stay below this level, and the facility will be required to conduct compliance testing to ensure that they do. This testing requirement will ensure that actual emissions are below 7 tons per year, regardless of the accuracy of the Air District's estimate. With respect to the need for a daily 38-pound emissions limit, EPA's Federal PSD permitting requirements regulate sulfuric acid mist on an annual basis and require annual emissions to be below 7 tons per year if a BACT analysis is not conducted. The Federal PSD requirements in 40 C.F.R. section 52.21 do not break that 7 tpy threshold down into a daily emissions limit.

The Air District also received comments questioning whether annual compliance testing will be adequate to ensure compliance with the 7 tpy permit limit. Comments suggested that the facility might simply "retest in the absence of oversight until compliance is demonstrated." Comments suggested that the District establish specific test dates "to prevent test manipulation by retesting." The Air District considered this issue as well, and notes that the permit conditions require all non-compliance to be reported to the Air District. (*See* Proposed Permit Condition No. 37.) Thus, any non-compliance discovered during a compliance test will be reported, and the facility will not be allowed to keep a failed test secret and conduct a further test to show compliance. The Air District has therefore concluded that the compliance testing requirements as proposed will not allow the potential for "test manipulation by retesting".

Finally, some comments also cited a paper on new methodologies for estimating total sulfuric acid emissions from power plants. The Air District is unclear as to why the commenters consider this paper relevant, as the comments did not explain how this information pertains to this permitting action. The Air District has reexamined the issue of sulfuric acid testing methodologies, however, to the extent that these comments were intended to question the testing methodologies that will be used to determine compliance with the permit limits. The Air District

notes in this regard that any testing methodology must be approved by the Air District. This approval requirement ensures that the Air District can require the most accurate and up-to-date testing methodologies to be used. The Air District acknowledges the information provided by these comments, but does not find anything in it to suggest that the proposed permit conditions should be changed in some way. The Air District solicits further input on this additional discussion regarding sulfuric acid mist issues.

X. MONITORING ISSUES

The Air District also received some comments on the proposed monitoring requirements for the facility. The Air District has conducted further review and analysis of the proposed monitoring requirements, as explained below.

One comment claimed that the proposed monthly monitoring of the sulfur content of the facility's natural gas fuel is not frequent enough. The comment claimed that the sulfur content of the natural gas can vary significantly from one quarter to another (citing data tabulations from PG&E's website), and states that for this reason "the need for increased accuracy is essential". The commenter suggested weekly sulfur monitoring, in order to "assure the accuracy" of monitoring of sulfur content. The Air District considered this issue further in light of this comment, and has concluded that weekly monitoring is not necessary to ensure compliance with the natural gas sulfur limits. The comment claims that sulfur content can vary from quarter to quarter, but even if this is so, a monthly testing requirement will be able to track such variations. The comment did not point to any evidence that the additional data that could be gained from weekly monitoring would be worth the additional burden of doing so, and the Air District is not aware of any.

Another comment criticized the District's proposal to allow Russell City to use PG&E's monthly gas sulfur content measurements if the facility can show that they are 'representative'. The commenter objected that "there are no objective criteria specified in the permit conditions as to what qualifies as 'representative' ". The commenter also claimed that "PG&E adds chemicals to its natural gas" and "does not assure the accuracy of its published information". The Air District reviewed the proposed requirements for sulfur monitoring in the draft permit in light of this comment, and has concluded that they are adequate to ensure compliance. The sulfur monitoring condition allows the facility to use PG&E data only if the facility can demonstrate that the data is representative. PG&E data will not be acceptable if it is not accurate. Moreover, "representative" has a well-understood meaning and does not need "objective criteria" to define it further. In plain English, this proposed condition would require that the PG&E data provide a true and accurate picture of the actual sulfur content of the natural gas to be acceptable. The Air District has therefore concluded that the proposed condition allowing the use of representative data from PG&E does not need to be revised.

Another comment stated that ASTM fuel sulfur analysis methods were updated to correspond to NSPS Subpart GG as revised July 2004. With respect to the information about the ASTM fuel sulfur analysis methods, the Air District acknowledges the information but does not find anything in the comment suggesting that the proposed permit conditions need to be changed. The condition requires accurate testing of the sulfur content of the natural gas, and the fact that testing standards may have been revised is not inconsistent with this requirement.

Another comment stated that the District should require more stringent monitoring for PM emissions. The comment asserted that PM emissions can increase from poor air/fuel mixing or maintenance problems, and that the District should require more frequent monitoring to ensure that such problems do not go undetected. The Air District has reviewed this issue as well in light of this comment, and disagrees that annual compliance testing for particulate matter emissions is

inappropriate. A primary factor influencing PM emissions is sulfur content in the natural gas, which will be monitored on a monthly basis. To the extent that poor air/fuel mixing or similar combustion problems (whether related to maintenance problems or otherwise) might also increase PM emissions, those conditions would also be manifested in higher Carbon Monoxide emissions. Carbon Monoxide emissions are monitored on a continuous basis, and so the problems would be detected and addressed immediately. The Air District does not find that it would be necessary to add more frequent PM monitoring as well to address these concerns.

XI. AIR QUALITY IMPACT ANALYSIS ISSUES

This section addresses the source impact analysis and additional analyses required by the Federal PSD regulations.

A. Air Quality Impact Analysis Issues

The Air District first addresses comments related to the PSD Air Quality Impact Analysis is has prepared for this project.

1. Use of NSR Workshop Manual As Guidance For AQIA

The Air District received a comment questioning the District's use of EPA's 1990 Draft NSR Workshop Manual as guidance for conducting the Air Quality Impact Analysis. The commenter noted that the NSR Workshop Manual is not a binding regulation, and suggested that it may have been superseded by more recent EPA regulatory enactments. In response to this comment, the Air District wishes to clarify that although the NSR Workshop Manual is not binding as the commenter points out, it does provide a useful framework for conducting an Air Quality Impact Analysis. The Air District therefore uses the NSR Workshop Manual as guidance in situations where there is not any other more authoritative binding guidance that has been provided by EPA. The comment did not point out any specific area where the Air District's reliance on the NSR Workshop Manual was improper, and the District is not aware of any. If any member of the public considers the Air District's use of the NSR Workshop Manual to have been improper in any respect, the Air District invites the public to comment further on how such reliance may have been improper and what other guidance or procedure the District should follow instead.

2. Use of Highest Modeled PM_{10} Value for Comparison With SIL

The Air District also received comments stating that it should use the highest modeled PM_{10} value to compare with the ambient air quality impact significance threshold, not the sixth-highest value as used in the initial Statement of Basis. The Air District believes that use of the sixth-highest modeled value is consistent with EPA's modeling guidelines, which specify that the sixth-highest modeled value should be used to compare with the significance threshold.[135] As 40 C.F.R. Part 51 Appendix W states, "[f]or the 24-hour PM-10 NAAQS (which is a probabilistic standard)—when multiple years are modeled, they collectively represent a single period. Thus, if 5 years of [National Weather Service] data are modeled, then the highest sixth highest concentration for the whole period becomes the design value." Furthermore, the EPA guideline model AERMOD is hardcoded with an algorithm using the sixth-highest daily concentration; if another approach is to be used, the guideline approach has to be overridden.[136] For these reasons,

[135] *Guideline on Air Quality Models*, 40 C.F.R. Part 51, Appendix W (July 1, 2008) (hereinafter, "Appendix W Modeling Guideline"), § 7.2.1.1.b., applicable to PSD Air Quality Impact Analyses per 40 C.F.R. § 52.21(*l*)(1).

[136] *See* Section 3.2.5 Specifying the Pollutant Type of User's Guide for the AMS/EPA Regulatory Model-AERMOD - EPA-454/B-03-001, September 2004.

the Air District concludes that the best reading of the EPA guidance on this issue is that it requires the sixth-highest modeled value to be used for the PM_{10} analysis.

Nevertheless, in response to this comment the Air District evaluated the potential impacts from using the highest modeled value for the PM_{10} analysis. The Air District found that using the assumption that the cooling tower water could have up to 8,000 ppm (by weight) Total Dissolved Solids (TDS), the highest modeled value would exceed the PM_{10} Significant Impact Level of 5 $\mu g/m^3$. The Air District therefore explored with the applicant whether it could keep TDS levels within a lower limit. The applicant found that it could keep TDS within a limit of 6,200 ppmw, and so the Air District is lowering the TDS limit in the permit to that level. With the TDS limit reduced to 6,200 ppmw, the cooling tower's PM_{10} emissions would be reduced accordingly:

TDS:	8,000 ppmw	6,200 ppmw
Hourly PM_{10}	2.83 lbs	2.19 lbs
24-hour PM_{10}	67.9 lbs	52.6 lbs
Annual PM_{10}	12.1 tons	9.4 tons

The AERMOD modeling analysis was then re-run using a new pollutant ID to enable the program to predict the highest-high 24-hour concentration, and with the revised PM_{10} emissions rate. The analysis showed a highest modeled 24-hour PM_{10} concentration of 4.9 $\mu g/m^3$, which is below the Significant Impact Level. The Air District is revising proposed Condition No. 44 to in the final permit reflect this lowered TDS limit.

3. Representativeness of Meteorological and Background Air Quality Data

The Air District also received comments questioning the representativeness of the meteorological data and background air quality data that the District used in its analysis. The comments suggested that that meteorological data from Oakland Airport and the background ambient air quality data from the Fremont-Chapel Way Monitoring Station would not be representative of the project location. The comments also questioned why the District does not maintain a monitoring station in Hayward.

In response to these comments, the Air District would like to clarify that the meteorological and background air quality are representative of air quality in the vicinity of the project location. For the meteorological data, data from the Automated Surface Observing System (ASOS) at the Oakland International Airport was used. The site is located 20.8 kilometers to the northwest of the RCEC. AERSURFACE (version 08009) was used to determine surface characteristics in accordance with USEPA's January 2008 "AERMOD Implementation Guide" at both the Oakland Airport and the RCEC project site. The Oakland meteorological surface data (OAK) is representative of conditions at the Russell City Energy Center project site, based upon the requirements for representativeness set forth in the EPA's Guideline on Air Quality Models.[137]

[137] *See* Appendix W Modeling Guideline, *supra* note 135, Section 8.3 (Meteorological Input Data).

The Guideline on Air Quality Models states the following conditions should be considered when determining if weather data is representative: (1) The proximity of the meteorological monitoring site to the area under consideration; (2) the complexity of the terrain; (3) the exposure of the meteorological monitoring site; and (4) the period of time during which data are collected. The Oakland Airport data satisfies all four of these criteria for representativeness and is appropriate for modeling the proposed project. Both the Oakland Airport and the proposed project location are along the East Bay shoreline with similar predominant upwind fetches. The AERSURFACE analysis showed that both sites had similar land use characteristics. Both sites are located on simple terrain in similar proximity to the complex terrain to the east. The Oakland Airport site is a permanent National Weather Service/Federal Aviation Administration weather installation that operates 24 hours per day. The most recent five years of data at the time (2003-2007) were used for this modeling study. Based upon this comparison, the Oakland ASOS data were considered representative of the proposed project location and met all USEPA data completeness requirements.

With respect on ambient air quality data from the Fremont-Chapel Way monitoring station, the District notes at the outset that in the initial Source Impact Analysis it conducted in connection with its December, 2008, proposal, all of the modeled impacts for the regulated PSD pollutants examined in that analysis were below the SILs. Because all modeled impacts were below the SILs, no full impact analysis was required and background data did not have to be used. The Additional Impacts Analysis did take background levels into account in examining whether the facility's emissions, plus background concentrations, would cause ambient air concentrations at levels that might impact soils and vegetation. The District therefore wishes to clarify that the background data from the Fremont-Chapel Way station is representative for these purposes. That data is representative of the background air quality at the project location based upon the criteria EPA has established for assessing representativeness. EPA provides for monitoring data of this type to be used if it is sufficiently representative based on three factors: (i) monitor location, (ii) the quality of the data, and (iii) the currentness of the data.[138] The Fremont-Chapel Way data is representative under all three of these criteria. The Fremont-Chapel Way monitoring station is located approximately 18 km southeast of the project in an area within the same air basin and with the same general geography and level of development. In addition, the data from the Fremont-Chapel Way monitoring station is complete and of high quality, and it is current (2006-2008). The Air District therefore concluded that the Fremont-Chapel Way monitoring data is representative and appropriate for use in assessing the impacts from the proposed facility.[139]

In response to the comments suggesting that the Air District should establishing a monitoring station in Hayward, the Air District notes that maintaining a monitoring station is an expensive endeavor, and given the District's resource constraints it can only maintain a certain number throughout the entire Bay Area. The Air District maintains several monitoring sites in the East

[138] *See* NSR Workshop Manual, *supra* note 34, Section III.A., p. C.19.

[139] Note also that a full impact analysis was required for $PM_{2.5}$, based on regulatory developments since the initial Statement of Basis was published, and that analysis requires the use of $PM_{2.5}$ background monitoring data. Representativeness of the $PM_{2.5}$ data specifically is discussed further below in the discussion of the $PM_{2.5}$ source impact analysis.

Bay, which provide a good understanding of air quality conditions in the area given the District's resource constraints. The Air District will consider the needs for a monitoring station in Hayward, and in all other relevant areas in the East Bay and larger Bay Area, in its future planning for maintaining a representative monitoring network that will give an accurate picture of ambient air quality conditions.

4. Designation of Site as "Rural" for AERMOD Modeling:

The Air District received comments questioning whether the site location should have been designated as "rural" for the purposes of the AERMOD air quality impact modeling, given the development to the east of the project site. In this context, the commenters alluded to the fact that some areas near the project may be zoned for and used as urban, industrial land. In response to this comment, the Air District would like to clarify for the record that the "Rural" designation for purposes of AERMOD modeling is simply a variable that is used as an input in the model. It reflects the fact that the level of development in the project area is not of the intensity where increased surface heating would be expected due to the urban heat island effect. This designation is a 'term of art' based on an Auer land use analysis. The Air District's selection of the "Rural" designation for purposes of AERMOD modeling does not mean that the District considers the entire area to be rural in character. The Air District agrees with the commenter that areas in the project vicinity are light industrial in nature, but would like to clarify for the record that this does not mean that running the AERMOD model with a "rural" setting is inappropriate. To the contrary, the "rural" designation is appropriate for this facility based on the Auer land use analysis.

5. Completeness of Information Presented in Analysis

The Air District received comments suggesting that the Air Quality Impact Analysis's Table II (which presents emissions rates used for modeling for different pollutants and averaging times) and Table III (which presents the maximum predicted ambient air quality impacts that would result from the project) are incomplete. In light of these comments, the Air District would like to clarify for the record that certain boxes in these tables do not have data in them because they are not applicable. For example, in Table II, there are no emission rates provided for NO_2 and CO for the cooling tower because the cooling tower is not a source of emissions of these pollutants. To give another example, short-term emission rates are not provided for NO_2 because the NO_2 standard is an annual standard. The Air District did not put data in these boxes because it was not relevant to the PSD Air Quality Impact Analysis. If any members of the public believe that there is any data that is relevant and necessary to the Air District's that the Air District has overlooked, the District invites the public to comment further on what specific data is missing and how it would impact the outcome of the analysis.

6. Update to 2007 Air Quality Impacts Analysis:

The Air District received comments pointing out some changes that the District made to its Air Quality Impact Analysis it issued in connection with its December 2008 Statement of Basis and proposed permit compared with the analysis issued in connection with the District's 2007 permitting actions. For example, the comments pointed out that the analysis used for the

December 2008 Statement of Basis concludes that the maximum one-hour NO_2 impact will be 260 $\mu g/m^3$, whereas the analysis used for the 2007 permitting actions states that it will be 370 $\mu g/m^3$. In light of these comments, the Air District would like to take the opportunity to clarify the record on this issue. The modeling for the 2007 permitting actions was performed using the model ISCST. EPA has made that model a non-guideline model, and it has been replaced with AERMOD, the current EPA guideline model. The analysis used for the December 2008 Statement of Basis was performed using AERMOD, and represents the current best assessment of what project impacts will be. As the commenter noted, the maximum one-hour NO_2 impact will be 260 $\mu g/m^3$.

B. Air Quality Impact Analysis for $PM_{2.5}$

As noted above in Section VI in the discussion of Particulate Matter issues, EPA has stayed and proposed to repeal its exemption that provided for the analysis of PM_{10} impacts as a surrogate for analyzing $PM_{2.5}$. Because EPA has changed its position on the use of this surrogate policy, an analysis of $PM_{2.5}$ impacts is required for this permit. The project applicant therefore conducted an Air Quality Impact Analysis for $PM_{2.5}$ in conjunction with the Air District,[140] and the District has reviewed and documented the results of that analysis.[141] This section briefly sets forth the results of this analysis.[142]

1. Source Impact Analysis (40 C.F.R. § 52.21(k))

The principal element of the Air Quality Impacts Analysis is the source impact analysis required under 40 C.F.R. Section 52.21(k), which is designed to ensure that the project's emissions will not cause or contribute to any violation of the NAAQS or any established PSD increment. The source impact analysis is a two-step process that compares the projected air pollutant concentrations in the ambient air around the facility's location with the NAAQS and PSD increments. The first step in the process is to evaluate the air pollutant concentrations that would result from the project by itself, without any additional contributions from other sources. If the project's contribution would be less than "Significant Impact Levels" ("SILs") adopted by EPA, then the project is presumed not to cause or contribute to any exceedance of any NAAQS or PSD Increment and no further analysis needs to be conducted.[143] EPA has explained that it considers

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[140] *See* Atmospheric Dynamics, Inc., *$PM_{2.5}$ PSD Source Impact Analysis for the Russell City Energy Center Draft Prevention of Significant Deterioration (PSD) Permit* (July 30, 2009) (hereinafter, "Applicant's $PM_{2.5}$ Source Impact Analysis").

[141] *See* Summary of Air Quality Impact Analysis for $PM_{2.5}$ From the Russell City Energy Center, attached to Memorandum from Glen Long to Weyman Lee, July 27, 2009 (hereinafter, "Summary of $PM_{2.5}$ Air Quality Impact Analysis").

[142] Several comments criticized the use of the surrogate policy and stated that the District should conduct a $PM_{2.5}$-specific analysis. The District's analysis set forth in this section responds to those comments.

[143] *See* NSR Workshop Manual at pp. C.24-C.25.

sources whose impacts fall below the SIL will have at most a *de minimis* impact on air quality concentrations.[144]

If the concentrations from the project by itself would be above the Significant Impact Level, a full impact analysis is required based on multi-source modeling. The full impact analysis considers the project's contribution to ambient air pollution levels in conjunction with the contributions from other nearby sources and background levels to determine what the total ambient air concentrations would be if the project is built. If the total ambient air concentrations would not exceed the NAAQS at any location, or the project's contribution is below the Significance level at every location where the NAAQS would be exceeded, then the project does not "cause or contribute to air pollution in violation [a] national ambient air quality standard" within the meaning of 40 C.F.R. section 52.21(k)(1). If the total concentrations would exceed the NAAQS, and the project's contribution to that exceedance is above the Significance level at the location of the exceedance, then project is not eligible for a PSD permit.[145]

For $PM_{2.5}$, EPA has proposed three different alternative sets of SILs, but has not finalized its decision on which one to adopt.[146] To address this situation most conservatively, the Air District is proposing to use the lowest of the proposed SILs, which are 1.2 $\mu g/m^3$ for 24-hour average $PM_{2.5}$ concentrations and 0.3 $\mu g/m^3$ for annual average $PM_{2.5}$ concentrations. The Air District has found that emissions from the project by itself will cause ambient $PM_{2.5}$ concentrations above both of these SILs. For 24-hour average concentrations the project will have a maximum impact of 4.9 $\mu g/m^3$, and for annual average concentrations the project will have a maximum impact of 0.5 $\mu g/m^3$.[147] Because the project's contribution will be above these significance thresholds, a full impact analysis must be conducted utilizing multi-source modeling.

The first element of the full impact analysis is to define the "impact area" within which ambient concentrations must be evaluated through multi-source modeling. The "impact area" for this analysis is a circular area centered on the project location and extending outwards to the most distant point where the project's impacts are modeled to be above the SIL. Once the impact area is defined, the analysis then requires the project's contributions to be added to background ambient $PM_{2.5}$ concentrations obtained from air quality monitoring data, as well as emissions from any other point sources in the vicinity of the proposed project that should be addressed in addition to the contributions accounted for by the background monitoring data. All of these contributions must then be added together to determine whether the project's emissions will cause or contribute to any violation of the NAAQS within the impact area.

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[144] *See* Proposed Rule, "Prevention of Significant Deterioration (PSD) for Particulate Matter Less Than 2.5 Micrometers ($PM_{2.5}$)—Increments, Significant Impact Levels (SILs) and Significant Monitoring Concentration (SMC)", 72 Fed. Reg. 54112, 54138-39 (Sept. 21, 2007) (hereinafter, "Proposed $PM_{2.5}$ Increment, SIL & SMC Rule").

[145] In such cases, a project applicant can agree to shut down existing sources in the area to reduce ambient air pollutant concentrations such that there will be no exceedances of the NAAQS after the project is built.

[146] *See* Proposed $PM_{2.5}$ Increment, SIL & SMC Rule, *supra* note 144.

[147] *See* Summary of $PM_{2.5}$ Air Quality Impact Analysis, *supra* note 141, Table III.

The District used monitoring data from its Fremont-Chapel Way monitoring station as a measure of background ambient air quality. Ambient air quality data from this monitoring station is representative of the background conditions in the vicinity of the proposed project, and it satisfies all of EPA's requirements for representativeness as discussed above. EPA provides that regional monitoring data can be used as long as it is representative, based on (i) monitor location, (ii) the quality of the data, and (iii) the currentness of the data.[148] The Fremont-Chapel Way data is highly representative under all three of these criteria. The Fremont-Chapel Way monitoring station is located approximately 18 km southeast of the project in an area within the same air basin and with the same general geography and level of development. Moreover, $PM_{2.5}$ emissions in the wintertime (when particulate matter ambient concentrations are the worst) are similar at the Fremont-Chapel Way monitoring station and the proposed project site, further suggesting that background ambient concentrations are similar as well. (In fact, emissions at Fremont-Chapel Way monitoring station are slightly higher, suggesting that this is a conservative choice of representative monitoring data.) In addition, the data from the Fremont-Chapel Way monitoring station is of high quality and is current (2006-2008). The Fremont-Chapel Way station is also sited and operated in accordance with EPA's ambient monitoring data requirements set forth in EPA's "Ambient Monitoring Guidelines for Prevention of Significant Deterioration" (May 1987). For all of these reasons, the data satisfies EPA's requirements for representativeness of the background ambient air quality at the proposed project's location. The three-year average of the 98th percentile 24-hour average is 29.0 $\mu g/m^3$ and annual average is 9.5 $\mu g/m^3$.[149]

After background concentrations from air monitoring data are added, any other nearby point sources that are expected to cause a significant concentration gradient in the vicinity of the proposed project must be modeled. The contributions from all of these sources (the project itself, general background concentrations, and nearby point sources) are then summed and compared against the NAAQS at each modeled location within the impact area.[150] If, at any location within the impact area, the project's contribution is above the SIL, and the total of all contributions from all sources is above the NAAQS that that location, then the PSD requirements are violated. Conversely, if for each modeled location within the impact area, either (i) the total contribution from all sources is below the NAAQS or (ii) the project's contribution is below the SIL, then the project satisfies the PSD requirements.[151]

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[148] EPA regulations provide that a project can be excused from the requirement to use actual monitoring data in its PSD analysis where the project's contribution to ambient air concentrations will be less than EPA's Significant Monitoring Concentration leves ("SMCs"). As with the $PM_{2.5}$ SILs, EPA has proposed three separate alternative sets of SMCs, but has not finalized its selection of which one should be used. The District is therefore conservatively proposing to assume that the lowest SMCs will be chosen. The project exceeds these lowest most-conservative SMCs.

[149] *See* Summary of $PM_{2.5}$ Air Quality Impact Analysis, *supra* note 141, Table V.

[150] Per EPA regulations, the 98th percentile concentration predicted by the model is used to compare with the NAAQS. *See* Appendix W Modeling Guideline, *supra* note 135, § 10.1.c.

[151] *See* NSR Workshop Manual, *supra* note 34, at p. C.52 ("The source will not be considered to cause or contribute to the violation if its own impact is not significant at any violating receptor at the time of each predicted violation.").

The Source Impact Analysis undertook this exercise for both the 24-hour NAAQS and the annual NAAQS as discussed below, and also considered concerns regarding $PM_{2.5}$ increments and Class I impacts.

- *24-Hour NAAQS Analysis*

For the 24-hour standard, modeling of the facility's potential ambient air quality impacts showed emissions over the most-conservative 1.2 $\mu g/m^3$ SIL. The receptor locations where the facility's impacts were over the SIL were mostly within the immediate vicinity of the facility out to a distance of up to 1.26 km, but also at six specific more remote spots in the East Bay hills out to a furthest distance of 8.1 km. The Air District therefore considers the "impact area" for the full impacts analysis to consist of a circle around the facility with a radius of 8.1 km. For the full modeling analysis, the Air District considered the cumulative impact of the facility's emissions, background ambient air concentrations, and emissions from other nearby sources on receptors located within this impact area.

The facility's contribution was based on modeling using the facility's emissions, and the background contribution was based on the Fremont-Chapel Way monitoring data as discussed above. For the contribution from other nearby sources, the Air District undertook a search of its database of $PM_{2.5}$ sources within a radius of six miles (9.7 km) around the facility location that have been permitted since January 1, 2007, and located a total of 29 such sources (21 of which are diesel backup generators). The Air District also evaluated non-point sources within this area that could cause a significant concentration gradient at any of the areas where the facility's impact was above the SIL. The Air District identified a portion of Highway 92 that is located approximately 1 km south of the facility as such a non-point source, and included it in the analysis. The cumulative impact from all of these contributions (the facility, the 29 point sources, and Highway 92) was then modeled for each receptor location within the impact area where the facility's impact was above the SIL.

Based on this cumulative analysis, the District evaluated whether the highest 98^{th} percentile (highest 8^{th} high) $PM_{2.5}$ ambient air concentrations would be above the NAAQS at any receptor location where the project's contribution would be above the most-conservative 1.2 $\mu g/m^3$ SIL.[152] This evaluation examined whether the modeled concentration from the proposed facility plus other modeled sources would be above 6.0 $\mu g/m^3$ at any such receptor location, because the background level is 29.0 $\mu g/m^3$, meaning a further increase above 6.0 $\mu g/m^3$ would exceed the 24-hour NAAQS of 35 $\mu g/m^3$. The analysis concluded that there would not be any locations where both the project's contribution would be above 1.2 $\mu g/m^3$ and the total contribution from the project plus the other modeled sources would be above 6.0 $\mu g/m^3$. The Analysis found some locations where the total contribution from all modeled sources was over 6.0 $\mu g/m^3$. For example, the highest 98^{th} percentile modeled concentration from these sources was 11.27 $\mu g/m^3$. But in each of these situations, the project's contribution at that location was well below the SIL,

[152] EPA guidance requires the highest 98^{th} percentile value is used because compliance with the NAAQS is determined on this basis. *See* Appendix W Modeling Guideline, *supra* note 135, Section 10.1.c.

meaning that the project would not be causing or contributing to any NAAQS violation within the meaning of Section 52.21(k). Similarly, the analysis found some locations where the project's contribution was above the SIL, but in each of these situations the total contribution from all modeled sources was below 6.0 $\mu g/m^3$. This situation arises from the fact that when the wind is from the northwest, the project's impacts can sometimes exceed the SILs, but at those times the wind is blowing the contributions from other sources (such as Highway 92) in the other direction and not causing an exceedance of the NAAQS. Similarly, when the wind is blowing from the Southeast emissions from sources like Highway 92 can cause exceedances of the NAAQS within the impact area, but at those times the wind is blowing the project's contribution the other way such that the project's emissions are below the SIL. The proposed project therefore satisfies the Section 52.21(k) NAAQS compliance requirements for the 24-hour $PM_{2.5}$ standard.[153]

- *Annual NAAQS Analysis*

For the annual-average $PM_{2.5}$ NAAQS, the Source Impact Analysis conducted a similar multi-source modeling analysis. The impact area for the annual analysis is the same as the larger area for the 24-hour analysis, because the largest radius applicable to any averaging period should be used in establishing the impact area. The impact area for the annual analysis therefore extends out to the same 8.1 km distance from the facility as with the 24-hour impact area. The Air District conducted a cumulative analysis adding the contributions from the facility and the other modeled sources identified above plus background levels. This analysis found that the maximum total combined annual-average ambient air concentration would be 10.56 $\mu g/m^3$, which is well below the annual NAAQS standard of 15 $\mu g/m^3$. The proposed project therefore satisfies the Section 52.21(k) NAAQS compliance requirements for the annual $PM_{2.5}$ standard as well.[154]

- *PSD Increment Consumption Discussion*

With respect to exceedance of any PSD Increment for $PM_{2.5}$, the project cannot cause any such exceedance because EPA has not established any $PM_{2.5}$ increments yet. EPA has proposed increments, however, and so the District examined whether the facility would exceed any increment if they had been finalized. EPA's proposed Class II increments are 9 $\mu g/m^3$ and 4 $\mu g/m^3$ for the 24-hour and annual standards, respectively, and the facility's maximum impacts of 4.9 $\mu g/m^3$ and 0.5 $\mu g/m^3$, respectively, are well below these levels. Thus even if the proposed increments were in effect today, the facility would not cause any exceedance of them.[155]

- *Class I Areas Analysis*

Finally, EPA also requires an analysis of the potential for impacts to any Class I areas within 100 km of the proposed facility. Point Reyes National Seashore is located approximately 62 km from the project, so the Air District conducted a Class I area impact analysis for $PM_{2.5}$. The District

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[153] *See* further detailed analyses in Summary of $PM_{2.5}$ Air Quality Impact Analysis, *supra* note 141; and Applicant's $PM_{2.5}$ Source Impact Analysis, *supra* note 140.
[154] *See* Summary of $PM_{2.5}$ Air Quality Impact Analysis, *supra* note 141, at p. 11.
[155] *See id*.

used the previously-conducted AERMOD analysis for PM_{10} impacts, and conservatively assumed that all of the PM_{10} from the project is $PM_{2.5}$. The AERMOD analysis showed that the particulate matter impact would be only 0.06 $\mu g/m^3$ at Point Reyes National Seashore, which is well below EPA's significance level of 1.0 $\mu g/m^3$. The Air District therefore concludes that the project will not have any significant air quality impact on any Class I area.[156]

2. Additional Impact Analysis (40 C.F.R. § 52.21(o))

In addition to the Source Impact Analysis required under 40 C.F.R. section 52.21(k), the PSD regulations also require an additional impacts analysis under 40 C.F.R. section 52.21(o). This additional impacts analysis consists of an analysis of visibility impacts, of soils and vegetation impacts, and of impacts from general commercial, residential, industrial and other growth associated with the project.

The District conducted a visibility impairment analysis using EPA's VISCREEN model and also with the Calpuff model. Both analyses show that the proposed project's $PM_{2.5}$ emissions will not cause any impairment of visibility at Point Reyes National Seashore.[157]

The District also added a $PM_{2.5}$ analysis to its revised Soils & Vegetation analysis, which is discussed in more detail in the next section. As explained there, the Air District concludes that the project's $PM_{2.5}$ emissions will not have any significant adverse impacts on soils and vegetation.

Finally, the District's associated growth analysis is not impacted by EPA's stay of the PM_{10} surrogate policy and by the inclusion of $PM_{2.5}$ impacts in the Air Quality Impacts Analysis. The District's associated growth analysis is set forth in the initial Statement of Basis at p. 16. Specific Associated Growth issues are also addressed in further detail in Section XI.D. below.

C. Revised Soils & Vegetation Analysis

The Air District received a number of comments on its Soils and Vegetation analysis. The Air District has now revised its analysis, based on the comments received and on additional investigation and analysis undertaken since the December 2008 Statement of Basis was published (including an analysis of $PM_{2.5}$ emissions as discussed above).[158] This section addresses some of the specific comments received regarding the Soils & Vegetation analysis.

1. Survey of Existing Soils & Vegetation Resources:

The Air District received several comments criticizing the inventory of existing soils and vegetation resources in the vicinity of the project. These comments criticized the use of a soils and vegetation survey conducted for the original Energy Commission proceeding in 2001, and

[156] *See id*.
[157] *See id.* at p. 12.
[158] The Air District's Revised Soils & Vegetation analysis is included with the Memorandum from Glen Long to Weyman Lee, July 27, 2009.

claimed than an updated survey should be used. The comments stated that the soils and vegetation inventory omitted several plant species in the vicinity of the project location because of this situation. In response to these comments, the Air District has revised its inventory of soils and vegetation resources based on an updated survey of the project location. This updated inventory is outlined in the revised soils and vegetation analysis, and it now includes all plant species found in the vicinity of the proposed project. The Air District invites further public comment if any member of the public believes that there are any soils or vegetation resources that have not been included.

2. Consideration of Hayward Regional Shoreline and East Bay Hills

The Air District also received comments stating that it should evaluate the potential for soils and vegetation impacts in the Hayward Regional Shoreline and in several park areas in the East Bay hills. These comments coincided with further evaluation of the potential for endangered species impacts in these areas by EPA Region 9 and the Fish and Wildlife service. Further investigation of the potential for soils and vegetation impacts (as well as related wildlife impacts) in these areas as a result of the facility's emissions was conducted, and the Air District has included this further evaluation in its soils and vegetation analysis. The Air District invites the public to review and comment on this further analysis.

3. Endangered Species and Wildlife Issues

The Air District also received several comments criticizing the Air District's soils and vegetation analysis for failing to specifically address the potential for impacts to wildlife such as small mammals and birds. In response to these comments, the Air District wishes to clarify for the record that although potential impacts to wildlife are important resource considerations, they are addressed primarily through other regulatory mechanisms such as the Endangered Species Act and CEQA, not through the Federal PSD regulations. Looking specifically at the requirements of the Federal PSD regulations, they address only impacts to soils and vegetation. The Air District has evaluated the potential for such impacts as explained in its soils and vegetation analysis and has found that there will not be any significant soils and vegetation impacts as a result of air emissions from the facility. Soils and vegetation issues can often be related to wildlife issues because soils and vegetation provide habitat and food for wildlife, and so to the extent that there is such a connection here, the Air District's findings of no significant impact on soils and vegetation would support a finding of no significant impacts on wildlife, either. Moreover, EPA Region 9 and the US Fish and Wildlife Service are evaluating the potential for wildlife impacts in more detail, and the Air District has agreed not to take final action on this permit before those agencies can complete their consultation.

4. Nitrogen Deposition Issues

The Air District also received several comments criticizing its soils and vegetation analysis for not considering the potential for impacts from nitrogen deposition as a result of the project. These comments were based on a concern that non-native vegetation would be able to out-compete native vegetation, which is better adapted to nitrogen-poor soils, if significant additional nitrogen deposition caused those soils to become more nitrogen-rich. These comments also

coincided with further evaluation of the potential for nitrogen deposition-related impacts by EPA Region 9 and the Fish & Wildlife Service. In response to these comments, a nitrogen deposition analysis was undertaken for the project, as described in more detail in the Air District's revised soils and vegetation analysis.[159] Nitrogen deposition was modeled using both the AERMIC Model (AERMOD) and CALPUFF air dispersion model. According to the Applicant's assessment, the maximum annual deposition rates calculated by AERMOD in areas potentially occupied by selected species range from 0.02 to 0.37 kilograms per hectare per year (kg/ha/yr), which is more than ten times below the levels where limited invasion of non-native species have been observed (4-5 kg/ha/yr). The maximum annual deposition rates calculated by CALPUFF are more than 100 times below such levels. These results demonstrate that nitrogen deposition from the proposed facility will not result in adverse effects on soils or vegetation resources. The modeled deposition rates reflect a number of conservative assumptions and therefore represent an over-estimation of the actual deposition expected to occur as a result of the project. Even so, the modeled impacts fall far below the levels of concern identified by earlier studies. The Air District invites further public comment on this nitrogen deposition analysis.

D. "Associated Growth" And "Secondary Emissions" Analyses

The Air District also received comments questioning the associated growth analysis performed as part of the AQIA. Some comments noted that there may be emissions associated with temporary and permanent workers at the site, for example through commuting. Others suggested that the new electrical generating capability provided by the facility may cause associated growth, and that the Air District should take into account the air emissions from such growth.

With respect to emissions from the workforce that will be associated with the project, the Air District addressed this issue in its Air Quality Impact Analysis prepared in connection with the December 2008 proposed permit (*see* Statement of Basis at pp. 16, 93-94). The need for workers for the project will not cause any significant associated growth because they will come from the existing workforce, which is more than adequate to meet the facility's needs. As the project will not cause any significant increase in the size of the workforce in the Bay Area, there will not be any need for any significant expansion of associated infrastructure such as housing. With respect to the new electrical generating capacity that the project will provide, it is speculative whether this new capacity will be a cause or any significant growth in the region. Some of it may be used to take the place of older generating capacity that is being taken off-line, and even if it does provide some overall expansion of the region's total electric generating capacity there is no indication that this would cause any new development. It is unlikely that any new growth or development will occur simply because of the existence of excess electrical generating capacity, as opposed to some other independent reason. For these reasons, new electrical generating capacity is not an issue that falls within the "associated growth" analysis required by EPA's PSD permitting regulations.

The District also received a comment disagreeing with the District's assertion that the project will not involve secondary growth, claiming that it already has generated secondary growth in

[159] *See Russell City Energy Center: Nitrogen Deposition at East Bay Regional Parks*, Technical Memorandum from Craig Williams, Biologist, CH2M Hill, to Barbara McBride, Calpine, February 19, 2009.

the form of an expanded local water treatment plant the capacity of which was increased to handle cooling water for the project. This comment appears to be based on a misconception regarding the proposed facility's relationship with the City of Hayward's wastewater treatment plant. The proposed facility has been designed to handle wastewater from the treatment plant and use it as cooling water, not the other way around – the wastewater treatment plant was not built to handle wastewater from the proposed facility. This will be an environmentally beneficial aspect of the facility in that it will obviate the need for the City of Hayward to discharge its wastewater into the Bay. The project will require a new tertiary treatment plant to treat the wastewater from the wastewater treatment plant in order to make it clean enough to use in the facility's cooling system, but it will not involve any expansion to the capacity of the wastewater treatment plant. The District is unaware of any other relevant changes that have been made to the wastewater treatment plant, and in particular of any changes that may impact air quality. The Air District invites members of the public to comment further if they are aware of any increases in air emissions from any associated growth with respect to the wastewater treatment plant as a result of this project.

XII. HEALTH RISK ASSESSMENT ISSUES

The Air District also received some comments on issues related to the Health Risk Assessment it prepared for the proposed project. The Air District addresses Health Risk Assessment issues in this section.

1. Health Risk Assessment Methodology

The Air District received comments questioning the Health Risk Assessment methodology it used, and in particular whether it is appropriate for use in federal PSD Permitting. One comment also questioned why health impacts with a hazard index of less than 1 are not significant. Another comment criticized the District's methodology for assessing risk with respect to morbidity, and claimed that the District should consider mortality instead.

In response to these comments, the Air District wishes to clarify that the PSD permitting requirements do not directly require a Health Risk Assessment to be performed at all. PSD permitting does tangentially involve the District's Health Risk Assessment in areas such as the BACT comparison of alternative control technologies, which can involve an assessment of collateral environmental impacts such as toxics risk, but EPA does not specify any particular methodology for conducting such an assessment. Instead, EPA allows permitting agencies to use whatever methodology is most appropriate. The Air District uses the methodology developed by California's Office of Environmental Health Hazard Assessment ("OEHHA"), which is highly appropriate for this purpose. No commenters provided any specific information to suggest that this methodology is not appropriate for use here, or that some alternative methodology would be preferable, and the Air District is not aware of any.

With respect to why a hazard index of less than one is not significant, a hazard index below one means that the toxic exposure is less than the "Reference Exposure Level", which is a level developed by health professionals as an indicator of potential adverse health impacts. The hazard index is the sum of the individual hazard quotients for toxic air contaminants identified as affecting the same target organ or organ systems. A hazard quotient is the ratio of the estimated exposure level to the Reference Exposure Level, which is the concentration level at or below which no adverse health effects are anticipated. An exposure below the Reference Exposure Level means that no adverse health effects are anticipated for the exposure duration involved. The Hazard Index measures exposure relative to this Reference Exposure Level; a Hazard Index of less than 1 means that the exposure will be less than the Reference Exposure Level and thus protective of public health.

With respect to considering morbidity instead of mortality in assessing the level of risk, morbidity is an appropriate measure for health risk assessment purposes. Looking at morbidity is broader and more conservative in that it captures all potential health problems, not just those that are fatal. That is, morbidity encompasses all potential health effects that could arise from toxic exposures, whereas mortality encompasses only those health effects that might cause death, which is a smaller subset of exposures. The Air District therefore disagrees that the morbidity approach is inappropriate for a health risk analysis.

2. Exposure Assumptions for Non-Carcinogenic Chronic Risk

The Air District received comments stated that the chronic exposure modeling was based on the assumption that chronic exposure to toxic compounds will last one year, which they claimed is inappropriate for a power plant that will likely be in operation for a longer time period. In light of this comment, the Air District would like to clarify the record on how non-carcinogenic chronic health risks are assessed. For chronic risks, the Health Risk Assessment looks at the annual exposure rate for the maximally exposed individual, and then assumes that the individual will be exposed to this maximum annual exposure rate for the entire year over every year of an assumed 70-year life span. The Health Risk Assessment therefore appropriately captures lifetime risk; it does not assume that exposure occurs for one year and then stops.[160]

3. Health Risk Assessment for Ammonia Emissions

Commenters stated that ammonia emissions will be up to 15.2 lb/hr, which they claimed exceeds the acute trigger level of 7.1 lb/hr. The commenters claimed that the District should "thoroughly analyze potential health impacts from the ammonia emissions". The Air District would like to clarify for the record that the Health Risk Assessment did in fact take ammonia emissions into account.[161]

4. Health Risks From Legionnaire's Disease

Commenters suggested that the wet cooling system could involve a risk of causing Legionnaire's disease, and claimed that this potential health risk should be investigated further as part of the Health Risk Analysis. The Air District notes that its expertise as a public health agency is primarily in the area of chemical air pollutant and the health problems they can cause, not in medical pathogens. For this reason, the Air District does not address medical concerns such as issues related to Legionnaire's disease in its Health Risk Assessment. To the extent that the proposed project may raise concerns about Legionnaire's disease, those concerns should appropriately be addressed in the broader environmental review context through the Energy Commission's CEQA-equivalent process.

5. Health Risk Assessment for Aircraft Pilots and Passengers

Commenters claimed that the Health Risk Assessment should take into account potential health risks to pilots and passengers flying in the vicinity of the proposed facility. In response to these comments, the Air District has conducted an additional health risk assessment using an air dispersion model to determine emissions impact above ground level (*i.e.*, using a "flagpole receptor"). The maximum potential hazardous air pollutant emission rates were used. Flagpole receptor is defined where persons (pilots and passengers) may be exposed to concentrations above ground level (flight area) of a particular compound or substance. The locations are not necessarily a residence or a location where people actually exist; it may be any offsite above ground level where a person could potentially be present.

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[160] *See* Memorandum from Glen Long to Weyman Lee, February 28, 2007, at 1.
[161] *See id.*, p. 1 of attached supporting documentation showing ammonia analysis.

The proposed project will have two stacks each having a height of 150 feet above the ground level. The acute hazard index was calculated to be 0.52.[162] A value below 1.0 means that the exposure would not cause any acute adverse health effects. The location of the maximum acute hazard index is very close to the RCEC stacks and is based on one-hour exposure level. This is most likely a conservative assumption, as it is unlikely that that pilots and/or passengers would remain at this location in the airspace for a continuous hour and be exposed to the full extent assumed in the District's analysis.

6. Health Impacts of Fine Particulate Matter

The Air District received comments citing recent developments in the understanding of the health impacts of fine particulate matter. These comments suggested that the Air District should consider fine particulate matter in its Health Risk Assessment.

The District has considered adding fine particulate matter in our permitting procedures. In addition, OEHHA is planning to develop new procedures to address fine particulate matter and to incorporate them into its health risk assessment guidelines that are used by air districts. The District intends to participate in the public process to develop future updates to the risk assessment guidelines and procedures. These guidelines have not been developed at this stage, however, and so the Air District does not have the appropriate tools to include fine particulate matter in its formal Health Risk Assessment. The Air District has addressed fine particulate matter in its PSD Air Quality Impact analysis, however, as detailed above. That analysis found that emissions from the proposed facility would not have any significant contribution to any fine particulate matter pollution in violation of the stringent new National Ambient Air Quality Standards, which are health-protective standards established by EPA.

[162] *See* email memorandum from Glen Long to Bob Nishimura, March 12, 2009.

XIII. ENVIRONMENTAL JUSTICE ISSUES

The Air District received several comments regarding environmental justice issues. Commenters stated that there are areas near the proposed facility with low-income and minority residents, and claimed that the project disparately places environmental burdens on such residents. Some commenters also referenced an Environmental Justice analysis undertaken by the CEC that found that the area is "majority-minority". The Air District is aware of the CEC's analysis regarding the demographic makeup in areas near the project site. But the Air District's conclusion that there will be no disproportionate adverse impacts on any environmental justice community was not based on an assumption that there are no environmental justice communities near the project site, it was based on the District's assessment that there will be no significant adverse impacts to any community, regardless of demographic makeup. (*See* Statement of Basis, pp. 65-66.) The Air District continues to believe that there will not be any significant adverse impacts on any community regardless of demographic makeup.

The District also received comments claiming that the Air District cannot use the same Health Risk Assessment methodology it uses for other projects to assess potential impacts to Environmental Justice communities. These commenters claimed that environmental justice communities have specific attributes that make them susceptible to air pollution impacts in unique ways, such as increased susceptibility to diseases such as asthma, chronic lung disease, congestive heart failure and other chronic conditions, higher overall mortality rates, and less access to medical insurance coverage. In light of these comments, the Air District would like to clarify for the record that its Health Risk Assessment methodology is designed to take sensitive populations, such as those who may be particularly sensitive to air pollution concerns, into account.[163] This is an important consideration for all communities, as every community has some members who may have heightened sensitivity to potential airborne health hazards to some extent. The Air District supports its Health Risk Assessment methodology as an appropriate way to characterize the potential health risks associated with the proposed Russell City Energy Center with respect to communities that have members with heightened environmental sensitivies.

The Air District also received comments asserting that the District should also have examined the "synergistic effects" of existing pollution sources in the area. These comments asserted that the District should analyze the cumulative impacts of the emissions from the Russell City project in conjunction with existing sources in the area. The Air District's Health Risk Assessment methodology does not include an assessment of cumulative risk from project plus existing background sources for several reasons. First, where level of risk from a project is found to be

[163] OEHHA's methodology for deriving health effects values (CPFs and RELs) are protective of public health and account for potential exposure to sensitive populations. In accordance with OEHHA, the concentration, at or below which no adverse health effects are anticipated in the general human population, is termed the reference exposure level (REL). RELs are based on the most sensitive relevant adverse health effect reported in the medical and toxicological literature. RELs are designed to protect the most sensitive individuals in the population by the inclusion of margins of safety. CPFs (cancer potency factors), developed by OEHHA, are based on the use of the linearized 95% upper confidence interval of risk as a dose-response assessment, which is considered protective of public health.

so low that it is below the HRA significance thresholds, the project is not expected to make more than a *de minimis* contribution to any cumulative risk. Assessing the facility's addition to the overall cumulative risk burden would therefore add relatively little to the understanding of the cumulative concern. Moreover, undertaking a risk assessment encompassing all emission sources in the region of the facility would require resources that do not exist at this time. There are significant technical difficulties associated with completing a neighborhood-scale cumulative HRA, which are largely related to incompleteness of data (*e.g.*, spatial and temporal emission patterns) needed to estimate exposures and health risks, and to ascertain source contributions. Furthermore, unlike for criteria air pollutants, no standards have been established for health risks associated with cumulative exposure to TACs emitted from all sources, and so it would be difficult to assess at what level additional cumulative impacts would become significant. And finally, cumulative environmental impacts must be assessed for any project in California under CEQA, and so to the extent that cumulative toxic risks have the potential to be significant they can be addressed in that context. For all of these reasons, the Air District does not currently conduct an evaluation of a project's addition to cumulative health risk in its Health Risk Assessment process. But the District certainly does share the commenters' concerns about issues surrounding siting new projects in locations where there is already an elevated background level of toxic air contaminants. The Air District has recently issued a proposal to establish more stringent air permitting requirements for toxic air contaminants as a measure to address cumulative air pollution in more highly impacted communities. This proposal, if adopted, would represent the most stringent air permitting requirements for TACs in the country, as far as District staff are aware. The approach involves reducing the allowable project risk thresholds by a factor of two for projects located within more highly impacted communities. The maximum project risks for Russell City Energy Center are much less than these proposed more stringent project health risk standards.

Finally, the Air District received comments asserted that the District should have conducted a broader public outreach regarding environmental justice concerns. The Air District believes that it has conducted a very robust level of public outreach regarding all aspects of this project, including environmental justice issues. The Air District widely publicized its proposal to issue the Federal PSD permit in the community, and held a public hearing at Hayward City Hall to allow residents to express their views on the proposal. Notably, the Air District went well beyond what is required by the Federal PSD regulations in providing notice to Spanish-speaking populations and in providing a translation service at the public hearing to ensure the broadest possible opportunity for public participation.

PROPOSED PSD PERMIT CONDITIONS

The Air District is proposing the following permit conditions to ensure that the proposed project will comply with all applicable Federal PSD requirements. Compliance with emissions limits will be verified by continuous emission monitors and/or periodic source tests. The proposed facility will be required to maintain records of emissions and report them to the Air District for compliance purposes.

The Air District developed the following list of proposed permit conditions as part of its integrated permit review process covering both Federal PSD and state law requirements. As such, the entire list contains some conditions required by the Federal PSD Regulation and some conditions required under state law. In some instances a permit condition may be required under both the Federal PSD Regulation and state law, for example with certain Best Available Control Technology requirements where federal and state law overlap. The requirements of the Federal PSD Regulation are those discussed in the previous sections of this document, and the proposed conditions that are being implemented pursuant to the Federal PSD Regulation are the conditions necessary to ensure compliance with the requirements discussed above. To help the reader understand which requirements are part of the proposed amended Federal PSD Permit and which are based solely on state law requirements, the state-law requirements are presented in "strike-through" format below. For a full understanding of what permit conditions are required by the Federal PSD Regulation, the reader should consult the detailed analyses of Federal PSD requirements set forth in the previous sections of this document and in the initial Statement of Basis published in December of 2008; the Federal PSD Regulation itself; relevant decisions of the Environmental Appeals Board; and other related authorities. Permit conditions that are not being proposed pursuant the Federal PSD Regulation are not part of this proposed permitting action; persons interested in any such conditions will need to take up their concerns in the appropriate state law forum (to the extent one is available at this stage).[164]

The Air District is also providing citations to relevant authorities following certain conditions to help the reader understand the legal authority under which the Air District is proposing the condition. These citations are intended as reader aids only, and should not be considered the Air District's definitive analysis of the legal authorities underlying each condition. In particular, many conditions may be authorized by or otherwise implicate multiple legal authorities, some of which may not be listed for each condition. For a complete discussion of what permit requirements are being imposed pursuant to the Federal PSD Regulation, the reader should refer to the relevant discussions in previous sections of this document in the initial Statement of Basis published in December of 2008.

The readers should also note that the proposed conditions below constitute revisions from the conditions as initially proposed in December of 2008, in accordance with the Air District's additional and revised analysis set forth above. For the convenience of members of the public who have been following this permitting proceeding and are familiar with the December 2008

[164] As noted in the December 2008 Statement of Basis, the state-law permitting process has been completed and is now final. Avenues for reviewing state-law conditions have therefore been exhausted.

proposed conditions, a comparison of the December 2008 proposed conditions and the current proposed conditions is presented in "track changes" format in Appendix B.

Russell City Energy Center
Proposed Permit Conditions

(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.

(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-up, combustor tuning operation or shutdown. (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 does not exceed the limits established below. (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:

(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, and shutdowns 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(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 30. 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 54. 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)

PROPOSED FEDERAL PSD PERMIT DECISION

The Air District's Air Pollution Control Officer ("APCO") has concluded that the proposed Russell City Energy Center power plant, which is composed of the permitted sources listed below, will comply with all applicable Federal PSD Permit requirements. The APCO is therefore proposing to issue a Federal PSD Permit for the Russell City Energy Center as set forth in the December 8, 2008, Statement of Basis, and as revised and updated in this Additional Statement of Basis. The following sources will be subject to the proposed permit conditions discussed previously.

S-1 Combustion Turbine Generator (CTG) #1, Westinghouse 501F, 2,038.6 MMBtu/hr maximum rated capacity, natural gas fired only; abated by A-1 Selective Catalytic Reduction System (SCR) and A-2 Oxidation Catalyst

S-2 Heat Recovery Steam Generator (HRSG) #1, with Duct Burner Supplemental Firing System, 200 MMBtu/hr maximum rated capacity; Abated by A-1 Selective Catalytic Reduction (SCR) System and A-2 Oxidation Catalyst

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

S-4 Heat Recovery Steam Generator (HRSG) #2, with Duct Burner Supplemental Firing System, 200 MMBtu/hr maximum rated capacity; Abated by A-3 Selective Catalytic Reduction (SCR) System and A-4 Oxidation Catalyst

S-5 Cooling Tower, 9-Cell, 141,352 gallons per minute.

S-6 Fire Pump Diesel Engine, Clarke JW6H-UF40, 3400 hp, 2.02 MMBtu/hr rated heat input.

S-7 Circuit Breaker

S-8 Circuit Breaker

S-9 Circuit Breaker

S-10 Circuit Breaker

S-11 Circuit Breaker

Pursuant to the requirements of 40 C.F.R. Part 124, the Air District's revised proposal to issue a Federal PSD Permit for this project is subject to public notice and an opportunity for interested members of the public to review and comment on it. Information on how the public can participate in and comment on this revised proposed decision is provided in the opening pages of this document, and is also being provided to the public by formal legal notice.