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April 13, 2007

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DOCKET
06-AFC-4
DATE APR 1 3 2007
RECD. APR 1 3 2007

Dr. James Reede
Siting Project Manager
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814-5512

RE: CBE Data Response, Set 1B
Vernon Power Project (06-AFC-4)

On behalf of the City of Vernon, please find attached 12 copies and one original of the CBE Data Responses, Set 1B, in response to CBE's Data Requests dated February 16, 2007. We are also filing copies of this Data Response electronically.

Please call me if you have any questions.

Sincerely,

CH2M HILL

John L. Carrier, J.D.
Program Manager

c: Project File
Proof of Service List

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION OF THE STATE OF CALIFORNIA

APPLICATION FOR CERTIFICATION FOR THE VERNON POWER PLANT PROJECT BY THE CITY OF VERNON	**DOCKET NO. 06-AFC-4** **PROOF OF SERVICE LIST** **(REVISED 3/16/07)**

INSTRUCTIONS: All parties shall (1) file a printed, original signed document plus 12 copies OR file one original signed document and e-mail the document to the Docket address below, AND (2) all parties shall also send a printed OR electronic copy of the document, plus a proof of service declaration, to each of the entities and individuals on the proof of service list:

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DECLARATION OF SERVICE

I, Jeannette Harris, declare that on April 13, 2007, I deposited the required copies of the attached CBE Data Response, Set 1B for Vernon Power Plant (06-AFC-4) in the United States mail at Sacramento, California with first-class postage thereon fully prepaid and addressed to those identified on the Proof of Service list above. I declare under penalty of perjury that the foregoing is true and correct.

OR

Transmission via electronic mail was consistent with the requirements of California Code of Regulations, title 20, sections 1209, 1209.5, and 1210. All electronic copies were sent to all those identified on the Proof of Service list above.

I declare under penalty of perjury that the foregoing is true and correct.

Jeannette Harris
[signature]

VERNON POWER PLANT
(06-AFC-4)

CBE DATA RESPONSE, SET 1B

**(Responses to Data Requests: Air Quality 15 to 18;
Traffic and Transportation 63)**

Submitted by

City of Vernon

April 13, 2007

CH2MHILL

2485 Natomas Park Drive, Suite 600
Sacramento, California 95833-2937

VERNON POWER PLANT
(06-AFC-4)
CBE DATA RESPONSES, SET 1B

Technical Area: Air Quality

Background

The project is expected to generate up to 197 tons per year of ammonia emissions, derived from the use of aqueous ammonia in selective catalytic reduction of NOx. There exists a strong correlation between ion sum, including ammonium ion, and concentration of fine particulate matter.

Data Request

15. Please provide information on the contributive effect of ammonia emissions on PM10 and PM2.5, as well as the effect on their long-range transport.

    Response: The South Coast Air Quality Management District (District) has required the use of selective catalytic reduction (SCR) since the 1980s and has recognized the potential for secondary pollutant formation. The District first discussed secondary particulate matter formation in the Environmental Impact Report (EIR) for Rule 1135. In subsequent rule making EIRs, the District determined that secondary particulate matter formation would be less than significant if ammonia emissions associated with SCRs were limited to between 5 to 10 parts per million.[1]

    Therefore, contributive effects of ammonia emissions on secondary particulate matter formation is not expected to significantly impact local or regional air quality. Furthermore, the ammonia emissions presented in the Application for Certification represent the maximum expected ammonia emissions due to unreacted ammonia being emitted to the atmosphere. In reality, ammonia emissions will only approach the 5 parts per million levels toward the end of the catalyst's useful life, and the catalyst is expected to be replaced before ammonia emissions actually reach 5 parts per million. The expected ammonia emissions, prior to the point the catalyst requires replacement, are expected to be significantly less than 5 parts per million. This will further reduce the potential secondary particulate matter emissions associated with ammonia use.

16. Please describe available methods and plans for controlling ammonia emissions to reduce its effects on PM concentration and transport.

    Response: The most effective method for controlling ammonia emissions will be to operate and maintain the SCR system according to manufacturer's requirements. This will require the periodic inspection of the catalyst bed and testing of the catalyst activity. Proper operation of the SCR system will reduce the ammonia emissions, further reducing the already insignificant potential for secondary particulate matter formation.

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[1] 2007 Draft AQMP Program Environmental Impact Report, page 4.1-26.

Background

The applicant's response to Staff's Data Request #18 acknowledged that the cooling tower fans will not have a variable speed/flow controller.

Data Request

17. Please provide a comparison for a cooling tower fan with variable speed drives versus the current configuration. For each alternative, indicate their relative efficiency and performance.

Response: The cooling tower for the VPP is configured with single-speed fans. This is typical for moderate climate areas such as City of Vernon where the winter and summer design temperature range (based on industry [ASHRAE] standards) is approximately 35°F to 85°F. In other areas of the country where significant freezing conditions are encountered, fans are sometimes specified with two-speed motors with additional reversing speed operation, as required.

A variable speed fan can vary the fan's output (cubic feet per minute of air moved) based on a control signal. The control signal will vary the fan speed through a combination motor starter/speed control package. Variable speed packages in the 250HP range are significantly more expensive than the single-speed motors.

Variable speed drives for cooling towers are more common for process plants/chiller plants where the return temperature of circulating (or condenser) water must be kept constant. There would be no need to reduce fan speed for power plant cooling towers at lower temperature since lower turbine back pressure will provide a greater steam turbine generator output up to the maximum capability of the generator. For cases where steam turbine load is reduced (due to one or two combustion turbines out of service), individual fan cells could be shutdown.

In summary, there is no increase in performance or relative efficiency with the use of variable speed drives for the cooling tower fans at VPP. In addition, due to the small difference between the average temperature in January and the average temperature in August, variable speed controllers are neither required nor economically justified for VPP.

18. Please provide a comparison of using a dry cooling system instead of a wet/dry cooling tower, including a comparison of potential emissions. Comparison of estimated costs should incorporate costs from the use of recycled wastewater system and costs to be incurred by other entities that are necessary to support the reclaimed water demand.

Response: The VPP has been designed to use a wet (mechanical draft) cooling tower. Recycled water from the Central Basin Municipal Water

District will be used for makeup to replace water that will be evaporated in the cooling process. The majority of the cooling will be accomplished by evaporation of water.

Non-evaporative cooling can be accomplished by use of a dry cooling tower, or air cooled condenser (ACC). The ACC consists of multiple finned heat exchange tubes mounted on a large steel framework. The cooling media is ambient air. Fans are used to draw air in the bottom of the frames and direct it upward through the bundles of tubes discharging the warm air to the atmosphere. The tubes are internally fed with steam from the steam turbine. The steam turbine exhaust is directed through large steam ducts and then distributed to the tubes, which are about 1-inch in diameter. The ACC must be located close to the steam turbine because of the expense of the large steam ducts both in terms of capital and operating costs.

The ACC system consists of multiple "cells," each cell being one element of heat exchange tubes and associated fan to force air over the tubes. For the VPP, anywhere from 35 to 50 cells might be required depending on the design optimization.

In comparing a wet vs. dry cooling tower there are significant differences with respect to plant performance, environmental impact, site requirements and plant economics. Each of these is discussed separately below.

Performance Impacts

The return temperature of the circulating water to the condenser will determine the backpressure on the steam turbine generator and the amount of electric power that can be generated. The lower the backpressure, the higher the electrical output.

In a dry cooling tower, the return water temperature is a function of the ambient air or dry bulb temperature. In an evaporative cooling tower the return water temperature is a function of the wet bulb temperature. The design of the cooling tower is optimized around a temperature difference between the return circulating water temperature and the temperature of the cooling medium (water for a wet tower and air for the dry tower). The return water temperature for the dry cooling tower will always be higher than for the wet cooling tower, resulting in lower output from the steam turbine generator.

Heat balances were prepared to compare the plant electrical output of the wet and dry cooling towers at different ambient temperatures. As indicated in Table AQ18-1, the output of the dry cooling tower approaches that of the wet cooling tower at low ambient temperatures but output is significantly lower than the wet cooling tower under high ambient temperature conditions.

TABLE AQ18-1
Comparison of Plant Electrical Output of Wet and Dry Towers

Ambient Temp. (°F)	Reduction in Net Plant Output For Dry Cooling Tower (kW)	Increase in Net Plant Heat Rate for Dry Cooling Tower (Btu/kWh, HHV)
35	9,322	72
65	14,223	111
84	32,585	266
93	46,337	389

The net plant heat rate is a measure of plant efficiency. The higher heat rates for the dry cooling tower results in higher fuel consumption to produce the same number of kilowatt hours. Based on an annual capacity factor of 80 percent and a plant net output of 914 MW, use of a dry cooling tower would result in the burning of an additional 711,000 million Btu of natural gas per year to produce the same quantity of electricity.

The use of a dry cooling tower will eliminate the evaporation of cooling water and significantly reduce the consumption of recycled water. As shown on AFC Figure 2.2-6a, annual average recycled water supply is 3,885 gpm of which 3,375 gpm (87%) is makeup to the cooling tower for evaporation losses and blowdown. For a dry cooling tower, the water systems would be redesigned to reduce the quantity of water discharged from the evaporative cooler. As a result, a total reduction of recycled water consumption of about 95 percent could be achieved.

In addition, with use of a dry cooling tower, the quantity of water discharged to the municipal sewer system would be reduced. The average of 765 gpm shown on AFC Figure 2.2-6a would be reduced to about 100 gpm.

Environmental Impacts

The environmental impacts of the wet cooling tower (i.e., drift, fogging potential, noise) are addressed in the AFC. The use of a dry cooling tower eliminates cooling tower drift and fogging potential. However, the dry cooling tower has adverse environmental impacts in the following areas:

- Air emissions
- Noise
- Visual impacts

As a result of lower plant efficiency a power plant using a dry cooling tower will burn more fuel and thereby emit increased air emissions for the same quantity of electrical production. It is important to note that the VPP is expected to operate at higher capacity factors on the warmer days of the year, and will operate continuously on very hot days. At an ambient temperature of 93°F, approximately 5.5 percent more fuel will be used with a corresponding 5.5 percent increase in air emissions.

Noise levels from a dry cooling tower will be higher than from a wet cooling tower becasuse of the higher number of fans and fan size. Also, the noise source from the dry cooling tower will be at a higher elevation and will therefore attenuate less by natural and manmade topography. In the CEC Final Staff Assessment for the Palomar Power Project, an assessment of alternate cooling options estimated an increase of 3dBA at 400 feet (Ref. 1). This increase may be eliminated by use of fans with a "low noise" or "super low noise" design. These designs use lower speed fans with a resulting increase in tower size and cost.

The visual impact of a dry cooling tower will be significant. The proposed wet cooling tower for VPP will have a height of about 58 feet. The height of the dry cooling tower will be between 105 and 130 feet depending on the specific design and manufacturer. Also, the dry cooling tower footprint (land area) will be two to three times larger than the wet cooling tower.

Site Requirements

The proposed evaporative cooling tower for VPP will be a seven-cell system in two rows, with a total footprint of approximately 385 feet by 104 feet (40,000 sq. ft.). If a dry cooling tower were used a typical footprint would be 450 feet by 220 feet (99,000 sq. ft.). Thus, an additional 1.3 acres of land would be required to accommodate the dry cooling tower.

Economic Comparison

There are both capital cost and operating cost differences that result from the selection of cooling system technology.

The cost of the wet cooling tower, the supporting circulating water pumps, the main condenser, water storage and associated chemical treatment equipment are estimated to be about $16 million.

The installed cost of the dry cooling tower will depend on its final design but is estimated to be about $45 million. Also additional emission offset credits will have to be purchased to reflect higher fuel consumption during startup and operation.

The use of a dry cooling tower will reduce the size of the piping interconnections for recycled water and wastewater. The cost of the wastewater pipe is relatively small but the reduction in the recycled water supply pipe line could be on the order of $5 to $10 million.

Although a detailed capital cost comparison has not been made it is expected that the dry cooling tower will increase the plant capital cost between $15 to $25 million. This cost differential is consistent with the results of a comparison of cooling technologies prepared by the Electric Power Research Institute for the CEC in 2002 (Ref. 2) when adjusted for plant capacity.

The operating cost of the wet cooling system is considered as the "baseline" and any changes above or below the baseline cost have been used for this comparative analysis. The major operating cost differences will be from fuel consumption, water supply and waste water discharge.

The fuel consumption for the dry cooling tower case will be higher for production of the same quantity of electricity. Although the annual operating profile of the VPP will vary with the time of year and electric demands of the region, it is expected that the plant will operate at higher capacity levels during the warmer months. Based on an efficiency difference of 200 Btu/kWh and an 80 percent capacity factor, the cost of additional fuel (at a delivered gas cost of $8.00/million Btu) is estimated to be $10 million per year.

Water supply and wastewater discharge quantities will be significantly reduced with dry cooling. Recycled water consumption is expected to be reduced by 95 percent. Based on an annual capacity factor of 80 percent the purchased water will be reduced from 1,634 million gallons/year to 82 million gallons/year. The cost of recycled water is a combination of a commodity charge and a capital recovery charge. As the quantity of water is reduced, the capital recovery charge is increased on a unit basis ($/1,000 gallons). Although the actual cost cannot be determined at this time, a conservative value of $3.00/1,000 gallons is used. The reduction in purchase of 1,552 million gallons of reclaimed water will result in a cost decrease of about $4.65 million annually.

As noted in the performance discussion above, the average wastewater discharge will be reduced from about 765 gpm to about 100 gpm. On an annual basis, assuming an 80 percent capacity factor and $1.00/1,000 gallons disposal cost, the savings will be $280,000.

It should be noted that there will be chemical treatment costs (acid and biocide) required for wet cooling but not for dry cooling. These chemical costs will be partially offset by the cost of maintaining additional fans and coil cleaning in the dry cooling tower. The net effect of these items will be small in comparison to water and fuel costs.

The net operating cost differential based on the above will be an increase of approximately $5 million per year when using a dry cooling tower.

Another important economic consequence from the use of a dry cooling will be the loss of revenue resulting from a reduction in plant output. During peak periods on hot days the value of electric power increases and there will be a loss of profit opportunity. As noted in the performance description above, at an ambient temperature of 93°F, the reduction in output exceeds 40,000 kW. This will occur at a time when power will be most valuable.

Summary

In summary, the wet evaporative cooling tower design has advantages over the dry cooling tower design in every evaluation criterion except water consumption. The wet cooling tower results in a better plant efficiency, higher plant output, lower air emissions, lower noise, less visual impact, lower capital costs and lower operating costs.

With respect to water consumption, Section 8.14.2.2.2 of the AFC notes that it is in the primary interest of the people of the California in the conservation of water resources to maximize the reuse of recycled water. By providing significant revenues to the Central Basin Municipal Water District, the VPP will assist the CBMWD in developing its infrastructure. This will assist in making recycled water available for less intensive uses such as landscape watering that will conserve potable water resources.

References:

1. Final Staff Assessment of Palomar Power Plant Project, January 23, 2003, California Energy Commission, Appendix A to Section 4.9
2. "Comparison of Alternate Cooling Technologies for California Power Plants", Report 500-02-079F, February 2002, Electric Power Research Institute

VERNON POWER PLANT
(06-AFC-4)
CBE DATA RESPONSES, SET 1B

Technical Area: Traffic and Transportation

Background

The AFC lays out the state vehicle code provisions and the existence of a local process, in lieu of local ordinances, regarding the [use] of oversized vehicles on local roads. However, it does not list the criteria for the local process, including that for obtaining a temporary Hauling Permit.

Data Request

63. Please provide information, in table form, of the size and weight limits in those municipalities.

Response: When Table TT63-1 was provided in CBE Data Response, Set 1A, the Applicant had not been able to obtain information from the City of Bell. Since then, the City of Bell has provided information. Thus, Table TT63-1 has been completed.

TABLE TT63-1
Size and Weight Limit Restrictions of Nearby Cities

Jurisdiction	Size/Weight Limit
Los Angeles County	The weight and vehicle restrictions provided for in Chapter 15.48 "Weight Limits" shall not apply to vehicles owned by or under contract to a public utility, public entity or a licensed contractor while necessary in use in the construction, installation or repair of a public utility or public improvement. *Source: Los Angeles County Code* *http://ordlink.com/codes/lacounty/index.htm*
Los Angeles	The provisions of the section 80.36.1 "Restricted use of certain streets" shall not apply to vehicles owned by or under contract to a public utility while necessary in use in the construction, installation or repair of such public utility. *Source: American Legal Publishing Online Library – City of Los Angeles Municipal Code*
Bell	The limit is 3 tons, and the truck routes are as follows: - Atlantic Avenue from Randolph Street to southern city limit - Atlantic Boulevard in the northern part of the City - Bandini Boulevard east/west - Eastern Avenue north/south - Florence Avenue - Gage Avenue - Maywood Avenue from Gage to northern city limits - Salt Lake Avenue south/north - Slauson Avenue east/west *Source: Luis Ramirez, City Engineer*

Huntington Park	No weight restriction on designated streets in section 4-7.904 "Commercial vehicles permitted: Streets designated" of the Municipal Code (see Attachment TT63-1A). Besides those streets, the limit for commercial vehicles is 3 tons or 6,000 pounds. *Source: City of Huntington Park Website http://www.huntingtonpark.org/*
Maywood	No weight restriction on designated truck routes (Alamo, Slauson, Atlantic, Randolph); 6,000-pound limit in residential areas. *Source: Officer Viega, City of Maywood Police Department.*
Vernon	H 20 Loading Per Caltrans Standards (see Attachment TT63-1B). *Source: City Of Vernon Building and Planning Division*