

ENGINEERING EVALUATION REPORT
PE-BERKELEY, INC.
PLANT NUMBER 11326
APPLICATION NUMBER 579

BACKGROUND

PE-Berkeley has been operating a combined cycle cogeneration plant consisting of a gas turbine and a duct burner at the title V facility on the campus of the University of California in Berkeley. NOx emissions from the gas turbine are controlled by injecting steam. In order to comply with the requirements of Regulation 9 Rule 9 by January 1, 2000, the steam injection rate has been increased, and in doing so emissions of carbon monoxide (CO), a secondary pollutant, has increased. Currently CO emission rate are limited to 919 pounds per day (lb/day), when the turbine is firing natural gas, and 2,195 lb/day, when the turbine is firing fuel oil. This application requests that the CO emission rate limit be raised to 2,195 lb/day, when the turbine is firing natural gas.

The proposed changes to the NOx concentration and emission limits are considered minor permit revisions per Regulation 2-6-226, and were made administratively on December 29, 1999. However, increase in the daily CO emission rate triggers PSD modeling requirements of Regulation 2-2-305, and 30-day public notification per Regulation 2-2-405. It is also subject to a 45-day EPA review because it is a significant modification to the existing Title V permit.

In a letter dated 2/14/2000, PE-Berkeley submitted a request to repair the duct burner by replacing the duct burner elements. These elements are 14 years old and have physically deteriorated. The new elements will have the same heat input rating as the existing units, and will have the same or lower emissions, and therefore is considered an equivalent unit. Per the District Regulation 2-1-301, replacement of burners with non-identical components is an alteration, requiring an authority to construct. Since emissions will not increase, however, it is not considered a modification (per Regulation 2-2-223) and therefore BACT is not required.. The description of the duct burner is updated in Table II-A of the proposed modified Major Facility Review Permit.

The application covers the following sources:

S-40 Gas Turbine, General Electric, LM2500, 243 MMBTU/hr
S-41 Duct Burner, COEN, PowerPlus, 84 MMBTU/hr.

EMISSION CALCULATIONS

Basis:

- a. Natural gas combustion for 280 days/yr
- b. Rating: gas turbine = 243 MMBTU/hr; duct burner = 83.4 MMBTU/hr
- c. Exhaust NOx emission concentration = 20.2 ppm
- d. Exhaust CO emission concentration = 200 ppm (RACT)

$$\begin{aligned} 1. \text{ NOx emissions} &= (243+83.4 \text{ MMBTU/hr})(29,105 \text{ dscf/MMBTU})(20.2\text{E-}6)(\text{lb-mole}/387 \\ &\text{sdcf})(46 \text{ lb/} \\ &\qquad \qquad \qquad \text{lb-mole})(24 \text{ hr/day}) \\ &= 547 \text{ lb/day} \end{aligned}$$

2. CO emissions:

at lower ambient temperature of 43 degree Fahrenheit the exhaust rate was estimated to be 113,986 dscf/min at 14.48% O₂

$$\begin{aligned} &= (200 \text{ ppm})(113,986 \text{ dscf/min})\{(20.95-14.48)/(20.95-15)\}(60 \text{ min/hr})(28 \text{ lb/lb-} \\ &\text{mole})/(387 \text{ dscf/lb-mole}) \\ &= 108.93 \text{ lb/hr} \end{aligned}$$

at higher ambient temperature of 80 degree Fahrenheit the exhaust rate was estimated to be 101,760 dscf/min at 14.49% O₂

$$\begin{aligned} &= (200 \text{ ppm})(101,760 \text{ dscf/min})\{(20.95-14.49)/(20.95-15)\}(60 \text{ min/hr})(28 \text{ lb/lb-} \\ &\text{mole})/(387 \text{ dscf/lb-mole}) \\ &= 95.92 \text{ lb/day} \end{aligned}$$

The proposed CO emission rate of 2,195 lb/day corresponds to an hourly average rate of 91.5 pounds, which would be less than the values calculated above on the basis of RACT emission level.

$$\begin{aligned} \text{CO emissions increase} &= (2,195 \text{ lb/day} - 919 \text{ lb/day})(280 \text{ days/yr}) \\ &= 357,280 \text{ lb/yr} \\ &= 178.64 \text{ ton/yr} \end{aligned}$$

PLANT CUMULATIVE INCREASE

$$\begin{aligned} \text{CO: } &0.0 \text{ ton/yr (current)} + 178.64 \text{ ton/yr (new)} \\ &= 178.64 \text{ ton/yr (new total)} \end{aligned}$$

BACT/RACT DETERMINATION

The proposed modification (higher steam injection) will reduce NO_x emissions so as to comply with the requirements of Regulation 9-9-303.2, but at the same time it will result in the increase of secondary pollutant, CO. Per Regulation 2-2-112, Exemption, Secondary Pollutants from Abatement, emissions of secondary pollutant are exempt from BACT but are subject to the RACT requirements. Various district rules and the California Air Resources Board (CARB) RACT guidance for gas turbines were reviewed to find out if a RACT limit for CO has been adopted or recommended. The District Regulation 9-9 does not, also, specify any CO limitation. Only the San Joaquin Valley District Rule 4703 contain a limit for CO, which is 200 ppm at 15% O₂. This limit is considered as RACT. The exhaust concentration from the gas turbine with the proposed modification is not expected to exceed the RACT limit.

PSD MODELING REQUIREMENTS

PE-Berkeley is a major facility and the proposed modification is a major modification with respect to CO, and therefore requires PSD modeling per the District Regulation 2-2-305, Carbon Monoxide Modeling Requirement, PSD. PE-Berkeley submitted a modeling analysis which was performed in accordance with the District Regulation 2-2-414, PSD Air Quality Analysis. The result of the air quality impact analysis indicate that the proposed modification would not interfere with the attainment or maintenance of applicable NAAQS for CO. The analysis was reviewed and approved by the Planning Division of the District.

STATEMENT OF COMPLIANCE

The facility is expected to continue to comply with the applicable requirements listed in the modified Major Facility Review Permit.

The project is categorically exempt from the California Environmental Quality Act (CEQA) per the District Regulation 2-1-312.3, Permit applications for projects undertaken for the sole purpose of bringing an existing facility into compliance with newly adopted regulatory requirements of the District or of any local, state or federal agency.

BACT/RACT, and PSD modeling requirements are discussed in separate sections of this report.

NESHAPS do not apply.

PERMIT CONDITIONS

The Permit condition ID# 366 part 10 has been modified to include the new CO limit. New conditions part 4a, 5a, and 12a are added to limit CO emissions at RACT level, and require CO monitoring . Major Facility Review Permit has been amended to incorporate these changes.

RECOMMENDATIONS

I recommend that PE -Berkeley be issued modified Major Facility Review Permit. I recommend that PE-Berkeley be issued a permit to operate the replacement burner.

BY: _____
Dharam Singh, PE