

CALIFORNIA ENERGY COMMISSION

1516 NINTH STREET
SACRAMENTO, CA 95814-5512



DATE: August 10, 2007
TO: Interested Parties
FROM: Connie Bruins, Compliance Project Manager
SUBJECT: Midway Sunset Cogeneration Project (85-AFC-3C)
Staff Analysis of Request to Increase Ammonia Slip

On June 29, 2007, the California Energy Commission received a petition from the Midway Sunset Cogeneration Company (MSCC) to amend the Energy Commission Decision for the Midway Sunset Cogeneration Project.

The Midway Sunset Cogeneration Project is a 225 MW cogeneration power plant located near the community of Fellows in Kern County. The project was certified by the Energy Commission on May 14, 1987 and began commercial operation on May 1, 1989. The power plant produces steam that is used in the enhanced oil recovery process.

The modification proposed in the petition would allow the project to increase the amount of unreacted ammonia (ammonia slip) in the stack emissions from 5 to 10 parts million (ppm) at 15 percent O₂ averaged over 24 hours. The increase is required because of the use of Selective Catalytic Reduction (SCR) systems as described in the enclosed staff analysis.

Energy Commission staff reviewed the petition and assessed the impacts of this proposal on environmental quality, public health and safety, and proposes revisions to existing Condition of Certification Air Quality-48. It is staff's opinion that, with the implementation of the revised condition, the project will remain in compliance with all applicable laws, ordinances, regulations, and standards and that the proposed modifications will not result in a significant adverse direct or cumulative impact to the environment (Title 20, California Code of Regulations, Section 1769).

The amendment petition has been posted on the Energy Commission's webpage at http://www.energy.ca.gov/siting_pre-1999_compliance/index.html. Staff's analyses are enclosed for your information and review. Staff's analysis and the order (if the amendment is approved) will also be posted on the webpage. Energy Commission staff intends to recommend approval of the petition at the September 26, 2007 Business Meeting of the Energy Commission. If you have comments on this proposed modification, please submit them to me at the address below prior to September 26, 2007.

Connie Bruins, Compliance Project Manager
California Energy Commission
1516 9th Street, MS-2000
Sacramento, CA 95814

Comments may also be submitted by fax to (916) 654-3882, or by e-mail to cbruins@energy.state.ca.us. If you have any questions, please contact me at (916) 654-4545.

Enclosures:

Air Quality Analysis
Mail List #764

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**Midway-Sunset Cogeneration Power Plant (85-AFC-3)
Request to Amend the Air Quality Conditions of Certification
Prepared by: Joseph M. Loyer
August 8, 2007**

Amendment Request

The Midway-Sunset Cogeneration Company (MSCC) has submitted a petition to amend Condition of Certification AQ-48 for the Midway-Sunset Cogeneration Power Plant (MSPP) to reflect a needed increase of the ammonia slip emission limit as a result of a newly imposed lower NOx emission limit.

Background

The MSPP is a 225 megawatt (MW) cogeneration power plant located near the community of Fellows on the western side of Kern County in the San Joaquin Valley, within the North Midway Sunset oil field. MSPP includes three turbine trains each consisting of a GE Frame 7E gas turbine, dry-low NOx combustors (DLN), and an unfired heat recovery steam generator. MSPP has been base loaded (operating at the maximum available level for the maximum available time) providing steam and power to the Midway Sunset oil field thermally enhanced oil recovery (TEOR) activities since May of 1989.

The original license established hourly emission limits assuming that MSPP would use water-injected Quiet Combustors, but was amended to allow for the installation of first, DLN-15 Combustors, and subsequently DLN-9 Combustors, and most recently ammonia injected Selective Catalytic Reduction (SCR) systems over a period of years during the normal major overhaul schedule for the project. MSCC would typically take one unit off-line, install the new equipment, as well as perform other necessary maintenance, and restart the unit. This would allow MSCC to investigate any anomalies that may occur and thus better prepare for the installation of equipment on the other turbines. This method of installing one unit at a time has enabled MSCC to test the new equipment while continuing to supply the oil field with steam without the need to increase the operation of steam field generators, which typically have higher emissions.

MSCC most recently proposed the installation of the Evolution Rotor which increased the power output of the turbine and thus triggered a best available control technology (BACT) review by the San Joaquin Valley Air Pollution Control District (District). The BACT finding from the District required a reduction from 5 to 2 ppm for the NOx emission limit and from 25 to 6 ppm for CO (at 15% O₂). However, in order to attain this level of NOx emission control MSPP must over inject ammonia and thus increase the ammonia slip from approximately an average 2 ppm to an average of 7 ppm. Therefore, MSCC must increase their

current ammonia slip limit of 5 ppm to 10 ppm @ 15% O₂ averaged over 24 hours.

Laws Ordinances Regulations and Statutes

No laws, ordinances, regulations or standards will be affected by this amendment request.

Analysis

MSCC installed an ammonia injected SCR system to control NO_x emissions. SCR systems emit a small amount of unreacted ammonia into the stack emissions, referred to as ammonia slip.

The California Air Resources Board staff guidelines recommend an ammonia slip limit of 5 ppm @ 15% O₂ averaged over 24 hours for this class of turbine. The Commission recently licensed several power plants at the 5 ppm ammonia limit. MSCC had a performance guarantee from the catalyst vendor of 2.5 ppm NO_x @ 15% O₂ in conjunction with an ammonia slip of 5 ppm @ 15% O₂. Thus the Commission agreed with Staff at the time of the SCR installation that MSPP could attain an ammonia slip limit of 5 ppm in conjunction with the then NO_x emission limit of 5 ppm.

However, with the installation of the Evolution Rotor, the recent District BACT finding imposed a NO_x emission limit of 2.0 ppm @ 15% O₂, which is below the performance guarantee for the Evolution Rotor. In order to comply with the lower NO_x limit, MSCC had to over inject ammonia into the SCR grid which increased the average ammonia slip from approximately 2 ppm to 7 ppm. MSCC has determined that they can not operate MSPP below an ammonia slip emission of 5 ppm @ 15% O₂ and meet the District BACT NO_x emission limit of 2.0 ppm @ 15% O₂.

Potential Impacts of Ammonia Slip Emissions

PM₁₀/PM_{2.5} can be formed downwind from an emission source as a secondary emission (similar to ozone) from a reaction between ammonia and airborne acids. The most dominant reactions are between SO_x emissions (as sulfuric acid, H₂SO₄) and NO_x emissions (as nitric acid, HNO₃). The complexity of these reactions arises from the formation of gaseous, liquid and solid forms of the products and reactants involved. The qualitative understanding of these reactions indicates that all the available ammonia will be reacted with all the available sulfuric acid prior to any ammonia being reacted with any available nitric acid (Seinfeld 1986). From this presumption, two cases of interest arise. The sulfate rich case (or ammonia limited), where the molar ratio of ammonia (NH₃) to sulfate (SO₄) is less than 2, so that there is insufficient ammonia to react with the sulfate. In the case of ammonia limited, additional ammonia will most likely cause further PM₁₀/PM_{2.5} formation downwind. The ammonia rich case, where the molar ratio of ammonia to sulfate is greater than 2, so that the sulfate is completely

reacted and there is excess ammonia (Seinfeld 1986). In the case of ammonia rich, additional ammonia emissions are not likely to cause further PM10/PM2.5 formation downwind.

Based on the 2000 ammonia inventory, the San Joaquin Valley is considered to be an ammonia rich area (368.7 tons/day). Thus, as discussed above, it is likely that the release of further ammonia will not lead to further PM10/PM2.5 formation downwind.

Conclusions and Recommendations

Staff has analyzed the proposed changes and concludes that there are no new or additional significant impacts associated with approval of the petition. Staff concludes that the proposed changes are based on information that was not available during the original licensing procedures. Staff concludes that the proposed language retains the intent of the original Commission Decision and conditions of certification. Staff recommends the following modifications to Condition of Certification AQ-48.

Proposed Modifications to the Air Quality Conditions of Certification

The following conditions of certification have been either added new or are modifications of the original. New language is in bold and deleted language is in strikethrough.

AQ-48 The emission of unreacted ammonia slip from any exhaust stack shall not exceed the following limits:

10 ppm	@ 15% O ₂	averaged over 24 hours
5 ppm	@ 15% O₂	averaged over 24 hours

Verification: The owner shall monitor and record the ammonia slip from each exhaust stack as required in Conditions of Certification AQ-49 through AQ-54. The owner shall report the ammonia slip as part of the quarterly emission report required by Condition of Certification AQ-21.