

State of Florida
Department of Environmental Protection

Memo

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| TO: | |
| THRU: | |
| THRU: | Bruce Mitchell |
| FROM: | William Leffler, P.E. |
| DATE: | October 12, 2001 |
| SUBJECT: | Preliminary review of Title V Operating Permit Revision Applications 0310045-008-AV Northside Generating Station and 0310047-011-AV Kennedy Generating Station Jacksonville Electric Authority |

Application for revision of the title V permits was received at BAR on October 5, 2001. The applications were apparently complete.

The scope of the both applications was to amend Title V permits to authorize the operation of fogging devices ahead of the compressors on four identical General Electric Model MS 7000 combustion turbine generators, located at Northside, and three identical Westinghouse Model W 501G combustion turbines at Kennedy.

The purpose of inlet fogging is to provide adiabatic cooling to of inlet air to increase the mechanical output of a direct combustion turbine while decreasing the heat rate. Heat is removed by the vaporization of the added water (1075 btu/lb). The additional water vapor increases efficiency by adding mass to the power end of the turbine. There is a practical limits to the water rate at a fuel/water mass ratio between 0.8 and 1.0 where droplet impingment causes erosion of turbine blades and where cooling causes the combustion flame to be extinguished.

The Combustion turbines are authorized to operate continuously, but as a practical matter they are used for peaking, load leveling, emergencies and control testing.

The most recent Title V permits for these facilities were issued:

| | | |
|----------------|------------------------------|--------|
| 0310045-002-AV | Northside Generating Station | issued |
| 0310047-008-AV | Kennedy Generating Station | issued |

Construction permits for the foggers were issued April 20, 2000 The conditions were identical for all four Combustion turbines at Northside, and all three of the combustion

turbines at Kennedy, limiting the heat input, providing a NO_x emission limit and requiring the combustion of new No. 2 fuel oil.

On July 10, JEA requested modification of both construction permits to accommodate EPA Method 7E for nitrogen oxides. Both construction permits were modified by letter on July 13, 2000, allowing the use of either EPA method 7 or 7E as the approved test method for nitrogen oxides.

On March 1, 2001, JEA requested an additional modification for both facilities eliminating the maximum heat input and NO_x emission limits with the foggers and eliminating the requirement to provide "manufacturers curves corrected for site conditions or equations for correction to other ambient conditions" within 45 days after testing. The revised conditions reduced the authorized operation to 399 hours per year with no increase in NO_x emissions because of the fogger operation. This modification was issued March 30, 2001.

By limiting the operation of these units with foggers to less than 400 hours per year the operator escapes the general compliance testing requirements for annual testing with foggers under specific condition C.15. (a)3.b., of the title V Permits, except for visible emissions. Annual compliance testing is still required if the turbine operates more than 399 hours per year, but could probably be performed under more favorable cold weather conditions.

Reports of testing for one turbine at each facility are contained in the applications. The testing was conducted by Technical Services, Inc of Jacksonville Florida and their report contains a certification of process variables by of Joseph W Werner P.E., an employee of JEA .

The compliance test measured only NO_x production against fuel flow and laboratory results for fuel heating value. Increases for other criteria pollutants, due to the increased fuel needed to vaporize the added water, were calculated on the basis of AP42 emission factors. No turbine performance curves were provided to evaluate the optimum water to fuel ratio to optimize peak performance.

Specific condition C.13. Operation Rate During Testing of the Title V Permits for both facilities require testing at 90 percent % of maximum operating rate (or limitation of maximum operating rate to 110 % of tested load. Both of the tests provided were at loads less than 90 percent of measured mechanical (electrical) output rate but greater than 90 percent of the previously permitted heat input rate (limitation removed by March 30, 2001 revision). It is reasonably anticipated that the same heat input with cold intake air would produce substantially more electrical power.

While a NO_x reduction was demonstrated the reduction should not be credited against the facility's overall NO_x production because the proposed operation was not undertaken to achieve a NO_x offset nor is the test data sufficient to demonstrate that the NO_x reduction would be constant across varying ambient air conditions. Tabulated test results follow.

achieve a NOx offset nor is the test data sufficient to demonstrate that the NOx reduction would be constant across varying ambient air conditions. Tabulated test results follow.

Conclusion:

The inlet foggers demonstrated a negligible power increase on the Northside test involving the General Electric Turbines. There was a slight increase in power production at Kennedy with the Westinghouse Turbines. A probable explanation of the low increase in power of the Northside tests is that the ambient temperature was about 15° higher than the ambient temperature on the Kennedy tests. Both tests successfully demonstrated compliance with the permit condition that no increased NOx will be produced. Because the prospective operation of the foggers will be limited to 399 hours per unit, no annual testing with the foggers is anticipated.

Summary of Test Data

Compliance/performance testing was conducted on unit NCT5 of the Northside Generating Station, with foggers on May 22, 2001, and without foggers on May 11, 2001. The summarized test results are as follows:

| PARAMETER | W/ FOGGER | W/O FOGGER | COMMENTS |
|---|---------------------------------|---------------------------------|---|
| MWe (socc) GENERATOR OUTPUT 56.2 MW (NOMINAL) | 49.38 MW 88 % of nominal | 49.29 MW 88 % of nominal | $\Delta < .02\%$ |
| Comp °F | 80.30 | 87.23 | |
| Applied Water (fog) gpm | 17.25 | | |
| Fuel Feed Rate gal/hr | 80.26 | 79.19 | Water/fuel =20% |
| Higher Heating Value BTU/gal | 138646 | 138555 | |
| Heat Input MMBTU/hr | 6.676 E+08 | 6.583 E+06 | $\Delta 0.093 E+6 = 1.4\%$ |
| NOx Emissions | 0.5153 lb/MMBTU 344.05 lb/hr | 0.6188 lb/MMBTU 407.33 lb/hr | $\Delta 0.1035 \text{ lb/MMBTU}$ $\Delta -63.28 \text{ lb/hr}$ (-50.5 TPY for 4 CT's) |

Note 1. Minimal increased power for substantial heat increase fails to demonstrate effectiveness of misting for power augmentation.

Compliance/performance testing was conducted on KCT5 of the the Kennedy Generating Station, with on June 4, 2001, and without foggers on June 5, 2001

The summarized test results are as follows;

| PARAMETER | W/ FOGGER | W/O FOGGER | COMMENTS |
|--|---------------------------------|---------------------------------|--|
| MWe GENERATOR OUTPUT 56.2 MW (NOMINAL) | 48.56 MW 87% of nominal | 46.59 MW 83% of nominal | Δ 1.97 MW = 4.2% |
| Comp °F | 95.76 | 102.91 | |
| Applied Water (fog) gpm | 17.27 | | Water /fuel =21.3% |
| Fuel Feed Rate gal/hr | 86.15 | 84.91 | |
| Higher Heating Value BTU/gal | 13726 | 137175 | |
| Heat Input MMBTU/hr | 7.095 E+08 97% of permitted | 6.988 E+06 94% of permitted | Δ 0.107 E+6 = 1.5% |
| NOx Emissions | 0.6550 lb/MMBTU 464.72 lb/hr | 0.7436 lb/MMBTU 619.64 lb/hr | Δ 0.1035 lb/MMBTU Δ -54.92 lb/hr (-32.87 TPY for 3 CT's) |

Note 1. Increased power for heat increase demonstrates effectiveness of misting for power augmentation.

21 West Church Street
Jacksonville, Florida 32202-3139

RECEIVED

OCT 05 2001



October 3, 2001

BUREAU OF AIR REGULATION

Mr. Scott M. Sheplak, P.E.
Administrator
Department of Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32399-2400

ELECTRIC

WATER

SEWER

RE: Northside Generating Station (0310045-004-AC) — Project No. 0310045-008-AV
Kennedy Generating Station (0310047-004-AC) — Project No. 0310047-011-AV
Combustion Turbine (CT) Inlet Foggers Installation

Dear Mr. Sheplak:

Enclosed please find an original and three copies of the Title V Operating Permit Applications for the Northside and Kennedy CT inlet fogger projects.

If you have any questions with regard to this matter, please contact me at (904) 665-6247.

Sincerely,

A handwritten signature in black ink, appearing to read 'N. Bert Gianazza'.

N. Bert Gianazza, P.E.
Environmental Permitting
& Compliance Group