P 230 524 300

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Street and No. 2500 City West Blvd. Ste 150 FL Power	
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PS Form 3800, June 1991

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1. ☐ Addressee's Address
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Consult postmaster for fee.

3. Article Addressed to:
Mr. Robert I. Taylor
Project Manager
Central Florida Power, L.P.
2500 City West Blvd., Suite 150
Houston, TX 77042

4a. Article Number: P 230 524 300

4b. Service Type
☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

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5. Signature (Addressee)

8. Addressee's Address (Only if requested and fee is paid)

6. Signature (Agent)

PS Form 3811, December 1991 ☆U.S. GPO: 1992—323-402 DOMESTIC RETURN RECEIPT

Thank you for using Return Receipt Service.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
NOTICE OF PERMIT

In the matter of an
Application for Permits by:

Mr. Robert I. Taylor, Project Manager
Central Florida Power, L.P.
2500 City West Blvd., Suite 150
Houston, Texas 77042

DER File No. AC53-214903
PSD-FL-190
Polk County

/

Enclosed is Permit Number AC 53-214903 for Central Florida Power, L.P. to consruct a 258 MW cogeneration facility in Ft. Meade, Polk County, Florida. This permit is issued pursuant to Section(s) 403, Florida Statutes.

Any party to this Order (permit) has the right to seek judicial review of the permit pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date this Notice is filed with the Clerk of the Department.

Executed in Tallahassee, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL REGULATION

C. H. Fancy, P.E., Chief
Bureau of Air Regulation
2600 Blair Stone Road
Tallahassee, FL 32399-2400
904-488-1344

CERTIFICATE OF SERVICE

The undersigned duly designated deputy agency clerk hereby certifies that this NOTICE OF PERMIT and all copies were mailed before the close of business on 5-17-93 to the listed persons.

Clerk Stamp

FILING AND ACKNOWLEDGMENT FILED,
on this date, pursuant to
§120.52(11), Florida Statutes,
with the designated Department
Clerk, receipt of which is hereby
acknowledged.

(Clerk) 5-17-93 (Date)

Copies furnished to:

B. Thomas, SW District
K. Kosky, P.E., KBN
J. Harper, EPA
J. Bunyak, NPS
L. Novak, Polk County

Final Determination

Central Florida Power, Limited Partnership
Ft. Meade, Polk County, Florida

258 MW Cogeneration Facility

Permit Number: **AC**53-214903
PSD-FL-190

Department of Environmental Regulation
Division of Air Resources Management
Bureau of Air Regulation

May 6, 1993

Final Determination

The Technical Evaluation and Preliminary Determination for the permit to construct a 258 cogeneration facility at Central Florida Power, Limited Partnership (CFPLP), in Ft. Meade, Polk County, Florida, was distributed on January 15, 1993. The Notice of Intent to Issue was published in The Polk County Democrat on February 4, 1993. Copies of the evaluation were available for public inspection at the Department's offices in Tampa and Tallahassee.

CFPLP's application for a permit to construct a 258 MW cogeneration facility has been reviewed by the Bureau of Air Regulation in Tallahassee. No adverse comments were submitted by the U.S. Environmental Protection Agency (EPA) in their letter dated February 16, 1993, or by the U.S. Department of the Interior (Fish and Wildlife Services) in their letter of February 5, 1993.

Comments regarding the Technical Evaluation and Preliminary Determination (Sypnosis of Application) and Permit Specific Conditions were submitted by Kennard F. Kosky, P.E., President of KBN Engineering and Applied Sciences, Inc. The Bureau has considered Mr. Kosky's comments and agreed to the changes proposed in the wording and adjustment of numerical limits to reflect manufacturer's specifications since these changes will not affect the potential emissions considered during the evaluation of this project. The amendments to the Specific Conditions of the permit are as follows:

RESPONSE TO COMMENTS NOS. 1, 2, 3, 4, AND 5

These changes will be incorporated in Table 1.

RESPONSE TO COMMENTS NOS. 5 AND 6

The table on page 9 of the BACT determination and Table 1 of the permit (Specific Condition No. 1) will be amended to reflect these comments.

BACT DETERMINATION BY DER (PAGE 8)

This paragraph will be added to the NO_x control section: For this turbine, an even lower NO_x emission level than 15 (gas)/42 (oil) ppmvd, corrected to 15% O_2, may become a condition of this permit pursuant to F.A.C. Rule 17-4.080, Modification of Permit Conditions.

RESPONSE TO ITEM NO. 2 ON KBN'S LETTER OF JANUARY 30, 1993

Information given to DER and to the U.S. Department of Interior (Fish and Wildlife Services) indicates that General Electric's goal is to attempt a NO_x level of 9 ppmvd when firing natural gas.

IN RESPONSE TO THE U.S. DEPARTMENT OF INTERIOR, SPECIFIC CONDITION NO. 15 WILL BE CHANGED AS FOLLOWS:

FROM: The permittee shall leave sufficient space in the heat recovery steam generator suitable for future installation of SCR equipment should the facility be unable to meet the NO_x standards, if required.

TO: The permittee shall comply with the following by 12/31/97:

a) For this turbine, if the 15 (gas)/42 (oil) ppmv emission rates cannot be met by 12/31/97, SCR or other control technology will be installed. Hence, the permittee shall install a duct module suitable for future installation of SCR equipment.

IN RESPONSE TO THE MARCH 11, 1993, LETTER FROM KENNARD F. KOSKY, KBN

The Department has determined the following:

Mandating SCR: The Department is giving the permittee the flexibility to incorporate any design feature to meet the 15 (gas) ppmvd at 15% O_2 NO_x emission limit. SCR or other control technology shall be installed if the 15 (gas) ppmvd cannot be met by 12/31/97.

Lowering the permit/BACT limit for NO_x: The Department may revise the permitted emission level for NO_x. For this turbine, an even lower NO_x emission level than 15 (gas)/42 (oil) ppmvd, corrected to 15% O_2, may become a condition of this permit, pursuant to F.A.C. Rule 17-4.080, Modification of Permit Conditions.

SPECIFIC CONDITION NO. 14 WILL BE MODIFIED AS FOLLOWS. THE PARAGRAPH IN BOLD WAS INADVERTENTLY OMITTED IN THE DRAFT PERMIT

Specific Condition No. 14: Test results will be the average of 3 valid runs. The Southwest District office will be notified at least 30 days in writing in advance of the compliance test(s). The sources, combustion turbine and duct burner, shall operate between 95% to 100% of the maximum capacity for the ambient conditions experienced during compliance test(s). **The turbine manufacturer's capacity vs temperature (ambient) curve shall be included with the compliance test results.** Compliance test results shall be submitted to the Southwest District office no later than 45 days after completion.

The final action of the Department will be to issue construction permit **AC**53-214903 (PSD-FL-190) with the changes noted above.

Florida Department of Environmental Regulation

Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400

Lawton Chiles, Governor

Virginia B. Wetherell, Secretary

PERMITTEE:
Central Florida Power, L.P.
2500 City West Blvd., Ste. 150
Houston, Texas 77042

Permit Number: AC53-214903
PSD-FL-190
Expiration Date: January 1, 1996
County: Polk
Latitude/Longitude: 27°44'46.7"N
81°51'0.3"W
Project: A 258 MW Cogeneration Facility

This permit is issued under the provisions of Chapter 403, Florida Statutes, and Florida Administrative Code Chapters 17-210, 212, 275, 296, 297 and 17-4. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawings, plans, and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

Central Florida Power, Limited Partnership, proposes to operate a 258 MW cogeneration facility consisting of one combustion turbine generator, one steam turbine generator, one duct burner-fired heat recovery steam generator and ancillary equipment. This facility is located near Ft. Meade, Polk County, Florida. The UTM coordinates are Zone 17, 416.22 km East and 3069.22 km North.

The sources shall be constructed in accordance with the permit application, plans, documents, amendments and drawings, except as otherwise noted in the General and Specific Conditions.

Attachments are listed below:

1. Central Florida Power, Limited Partnership's (CFPLP) application received on June 15, 1992.
2. Department's letters dated July 14 and October 9, 1992.
3. CFPLP's letters received on August 26, October 9, and October 23, 1992.

GENERAL CONDITIONS:

1. The terms, conditions, requirements, limitations, and restrictions set forth in this permit are "Permit Conditions" and are binding and enforceable pursuant to Sections 403.161, 403.727, or 403.859 through 403.861, Florida Statutes. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in Subsections 403.087(6) and 403.722(5), Florida Statutes, the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

4. This permit conveys no title to land or water, does not constitute State recognition or acknowledgement of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title.

5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

GENERAL CONDITIONS:

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law and at a reasonable time, access to the premises, where the permitted activity is located or conducted to:

a. Have access to and copy any records that must be kept under the conditions of the permit;

b. Inspect the facility, equipment, practices, or operations regulated or required under this permit; and

c. Sample or monitor any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

Reasonable time may depend on the nature of the concern being investigated.

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with the following information:

a. a description of and cause of non-compliance; and

b. the period of noncompliance, including dates and times; or, if not corrected, the anticipated time the non-compliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the non-compliance.

The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or for revocation of this permit.

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.73 and 403.111, Florida Statutes. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

GENERAL CONDITIONS:

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

11. This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 17-4.120 and 17-30.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. This permit also constitutes:

(x) Determination of Best Available Control Technology (BACT)
(x) Determination of Prevention of Significant Deterioration (PSD)
(x) Compliance with New Source Performance Standards (NSPS)

14. The permittee shall comply with the following:

a. Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.

b. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

c. Records of monitoring information shall include:

- the date, exact place, and time of sampling or measurements;

GENERAL CONDITIONS:

- the person responsible for performing the sampling or measurements;
- the dates analyses were performed;
- the person responsible for performing the analyses;
- the analytical techniques or methods used; and
- the results of such analyses.

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be corrected promptly.

SPECIFIC CONDITIONS:

Emission Limits

1. The maximum allowable emissions from this source shall not exceed the emission rates listed in Table 1.

2. Visible emissions for full load operation shall not exceed 10% opacity when firing natural gas and 20% opacity when firing distillate fuel oil.

Operating Rates

3. This source is allowed to operate continuously (8,760 hours per year).

4. This source is allowed to use natural gas as the primary fuel for 8,760 hours per year and low sulfur distillate fuel oil (0.05% S) as the secondary fuel up to 3,742,327 gallons per calendar year.

5. The permitted materials and utilization rates for the combined cycle gas turbine system shall be as stated in the application. The operating parameters include, but are not limited to:

184 MW Combustion Turbine

a) The maximum heat input of 1,849.9 MMBtu/hr (LHV) at 27°F and at base load for distillate fuel oil.

b) The maximum heat input of 1,614.8 MMBtu/hr (LHV) at 27°F and at base load for natural gas.

SPECIFIC CONDITIONS:

Duct Burner

c) The maximum heat input of 100 MMBtu/hr (HHV) of natural gas.

6. Any change in the method of operation, equipment or operating hours pursuant to Rule 17-212.200, F.A.C., Definitions-Modifications, shall be submitted to DER's Bureau of Air Regulation and Southwest District offices.

7. Any other operating parameters established during compliance testing and/or inspection that will ensure the proper operation of this facility shall be included in the operating permit.

Compliance Determination

8. Compliance with the NO_x, SO_2, CO, PM, PM_{10}, and VOC standards shall be determined (while operating at 95-100% of the permitted maximum heat rate input corresponding to the particular ambient conditions) within 180 days of initial operation of the maximum capability of the unit and annually thereafter, by the following reference methods as described in 40 CFR 60, Appendix A (July, 1992 version) and adopted by reference in F.A.C. Rule 17-297.

- Method 1 Sample and Velocity Traverses for Stationary Sources
- Method 2 Determination of Stack Gas Velocity and Volumetric Flow Rate
- Method 3 Gas Analysis
- Method 5 or Method 17 Determination of Particulate Emissions from Stationary Sources / Determination of Particulate Emissions from Stationary Sources
- Method 18 Measurement of Gaseous Organic Compound Emissions by Gas Chromatography
- Method 9 Visual Determination of the Opacity of Emissions from Stationary Sources
- Method 8 Determination of Sulfuric Acid Mist and Sulfur Dioxide Emissions from Stationary Sources
- Method 10 Determination of Carbon Monoxide Emission from Stationary Sources
- Method 20 Determination of Nitrogen Oxides, Sulfur Dioxide, and Diluent Emissions from Stationary Gas Turbines
- Method 25A Determination of Total Gaseous Organic Concentrations Using a Flame Ionization Analyzer

SPECIFIC CONDITIONS:

- Method 201A and Method 202 — Determination of PM_{10} Emissions from Stationary Sources; Determination of Condensible Particulate Emissions from Stationary Sources

Other DER approved methods may be used for compliance testing after prior Departmental approval.

9. Method 5 or Method 17 or Method 201A and Method 202 must be performed to determine the initial compliance status of particulate matter emissions of the unit. Thereafter, the opacity emissions test, Method 9, may be used unless the applicable opacity is exceeded. Also, the ambient particulate matter entering the gas turbine can be subtracted from the total particulate matter emissions if that quantity can be measured at the inlet of the gas turbine.

10. Compliance with the SO_2 and sulfuric acid mist emission limit can also be determined by calculations based on fuel analysis using ASTM D4294 for the sulfur content of liquid fuels and ASTM D3246-81 for sulfur content of gaseous fuel.

11. Trace elements of Beryllium (Be) shall be tested during initial compliance test using EMTIC Interim Test Method. As an alternative, Method 104 may be used; or Be may be determined from fuel sample analysis using either Method 7090 or 7091, and sample extraction using Method 3040 as described in the EPA solid waste regulations SW 846.

12. Mercury (Hg) shall be tested during initial compliance test using EPA Method 101 (40 CFR 61, Appendix B) or fuel sampling analysis using methods acceptable to the Department.

13. During performance tests, to determine compliance with the NO_X standard, measured NO_X emissions at 15 percent oxygen will be adjusted to ISO ambient atmospheric conditions by the following correction factor:

$$NO_X = (NO_{X\ obs}) \left(\frac{P_{ref}}{P_{obs}}\right)^{0.5} e^{19\ (H_{obs} - 0.00633)} \left(\frac{288°K}{T_{AMB}}\right) 1.53$$

where:

SPECIFIC CONDITIONS:

NO_X = Emissions of NO_X at 15 percent oxygen and ISO standard ambient conditions.

$NO_{X\ obs}$ = Measured NO_X emission at 15 percent oxygen, ppmv.

P_{ref} = Reference combustor inlet absolute pressure at 101.3 kilopascals (1 atmosphere) ambient pressure.

P_{obs} = Measured combustor inlet absolute pressure at test ambient pressure.

H_{obs} = Specific humidity of ambient air at test.

e = Transcendental constant (2.718).

T_{AMB} = Temperature of ambient air at test.

14. Test results will be the average of 3 valid runs. The Southwest District office will be notified at least 30 days in writing in advance of the compliance test(s). The sources, combustion turbine and duct burner, shall operate between 95% and 100% of maximum capacity for the ambient conditions experienced during compliance test(s). The turbine manufacturer's capacity vs temperature (ambient) curve shall be included with the compliance test results. Compliance test results shall be submitted to the Southwest District office no later than 45 days after completion.

15. The permittee shall comply with the following by 12/31/97:

a) For this turbine, if the 15 (gas)/42 (oil) ppmvd, corrected to 15% O_2 emission rates cannot be met by 12/31/97, SCR or other control technology will be installed. Hence, the permittee shall install a duct module suitable for future installation of SCR equipment.

16. The permittee shall install, calibrate, maintain, and operate a continuous emission monitor in the stack to measure and record the nitrogen oxides emissions from this source. The continuous emission monitor must comply with 40 CFR 60, Appendix B, Performance Specification 2 (July 1, 1992).

17. A continuous monitoring system shall be installed to monitor and record the fuel consumption on the CT and duct burner. While water/steam injection is being utilized for NO_X control, the water/steam to fuel ratio at which compliance is achieved shall be incorporated into the permit and shall be continuously monitored. The system shall meet the requirements of 40 CFR Part 60, Subpart GG.

SPECIFIC CONDITIONS:

18. Sulfur and nitrogen content and lower heating value of the fuel being fired in the combustion turbines shall be determined as specified in 40 CFR 60.334(b). Any request for a future custom monitoring schedule shall be made in writing and directed to the Southwest District office. Any custom schedule approved by DER pursuant to 40 CFR 60.334(b) will be recognized as enforceable provisions of the permit, provided that the holder of this permit demonstrates that the provisions of the schedule will be adequate to assure continuous compliance. The records of distillate fuel oil usage shall be kept by the company for a two-year period for regulatory agency inspection purposes. For sulfur dioxide, periods of excess emissions shall be reported if the fuel being fired in the gas turbine exceeds 0.05 percent sulfur by weight.

Rule Requirements

19. This source shall comply with all applicable provisions of Chapter 403, Florida Statutes, Chapters 17-210, 212, 275, 296, 297 and 17-4, Florida Administrative Code and 40 CFR 60 (July, 1992 version).

20. The sources shall comply with all requirements of 40 CFR 60, Subpart GG and Subpart Dc, and F.A.C. Rule 17-296.800,(2)(a), Standards of Performance for Stationary Gas Turbines and Standards of Performance for Industrial, Commercial, and Institutional Steam Generating Units.

21. Issuance of this permit does not relieve the facility owner or operator from compliance with any applicable federal, state, or local permitting requirements and regulations (F.A.C. Rule 17-210.300(1)).

22. This source shall be in compliance with all applicable provisions of F.A.C. Rules 17-210.650: Circumvention; 17-210.700: Excess Emissions; 17-296.800: Standards of Performance for New Stationary Sources (NSPS); 17-297: Stationary Sources-Emissions Monitoring; and, 17-4.130: Plant Operation-Problems.

23. If construction does not commence within 18 months of issuance of this permit, then the permittee shall obtain from the Department a review and, if necessary, a modification of the control technology and allowable emissions for the unit(s) on which contruction has not commenced (40 CFR 52.21(r)(2)).

24. Quarterly excess emission reports, in accordance with the July 1, 1992 version of 40 CFR 60.7 and 60.334 shall be submitted to the Department's Southwest District office.

SPECIFIC CONDITIONS:

25. Fugitive dust emissions, during the construction period, shall be minimized by covering or watering dust generation areas.

26. Pursuant to F.A.C. Rule 17-210.300(2), Air Operating Permits, the permittee is required to submit annual reports on the actual operating rates and emissions from this facility. These reports shall include, but are not limited to the following: sulfur content and the lower heating value of the fuel being fired, fuel usage, hours of operation, air emissions limits, etc. Annual reports shall be sent to the Department's Southwest District office by March 1 of each calendar year.

27. The permittee, for good cause, may request that this construction permit be extended. Such a request shall be submitted to the Bureau of Air Regulation prior to 60 days before the expiration of the permit (F.A.C. Rule 17-4.090).

28. An application for an operation permit must be submitted to the Southwest District office at least 90 days prior to the expiration date of this construction permit. To properly apply for an operation permit, the applicant shall submit the appropriate application form, fee, certification that construction was completed noting any deviations from the conditions in the construction permit, and compliance test reports as required by this permit (F.A.C. Rules 17-4.055 and 17-4.220).

Issued this 17th day
of May, 1993

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL REGULATION

Virginia B. Wetherell
Virginia B. Wetherell
Secretary

CENTRAL FLORIDA POWER, L.P. - AC53-214903 (PSD-FL-190)
258 MW COMBINED CYCLE GAS TURBINE

Table 1 - Allowable Emission Rates

Pollutant	Fuel[A]	Allowable Emission[C] Standard/Limitation	Basis
NO_x (CT)	Gas	15 ppmvd @ 15% O_2 (97.2 lbs/hr; 425.7 TPY)[B]	BACT
	Gas	25 ppmvd @ 15% O_2 (161.9 lbs/hr; 709.1 TPY)	BACT
	Oil	42 ppmvd @ 15% O_2 (326 lbs/hr; 48.9 TPY)	BACT
NO_x (DB)	Gas	0.1 lbs/MMBtu (10 lbs/hr, 43.8 TPY)	BACT
CO (CT)	Gas	15 ppmvd (48.8 lbs/hr; 213.7 TPY)[D]	BACT
	Oil	30 ppmvd (98.4 lbs/hr; 14.8 TPY)	BACT
CO (DB)	Gas	10 lbs/hr; 43.8 TPY	BACT
VOC (CT)	Gas	2.8 lbs/hr; 12.3 TPY	BACT
	Oil	7.5 lbs/hr; 1.1 TPY	BACT
VOC (DB)	Gas	2.9 lbs/hr; 12.7 TPY	BACT
PM_{10} (CT)	Gas	9 lbs/hr; 39.4 TPY	BACT
	Oil	17 lbs/hr; 2.6 TPY	BACT
PM_{10} (DB)	Gas	0.0100 lbs/MMBtu	BACT
SO_2 (CT)	Gas	4.86 lbs/hr; 21.3 TPY	Appl.
	Oil	99.7 lbs/hr; 15.0 TPY	Appl.
SO_2 (DB)	Gas	0.3 lbs/hr; 1.32 TPY	Appl.
H_2SO_4 (CT)	Gas	5.95×10^{-1} lbs/hr; 2.6 TPY	Appl.
	Oil	1.22 lbs/hr; 0.183 TPY	Appl.
H_2SO_4 (DB)	Gas	3.7×10^{-2} lbs/hr; 1.61×10^{-1} TPY	Appl.
Opacity	Gas	10% opacity[D]	BACT
	Oil	20% opacity[D]	BACT
Hg	Oil	3.0×10^{-6} lbs/MMBtu (5.55×10^{-3} lbs/hr; 8.32×10^{-4} TPY)	Appl.
As	Oil	4.2×10^{-6} lbs/MMBtu (7.77×10^{-3} lbs/hr; 1.17×10^{-3} TPY)	BACT
Be	Oil	2.5×10^{-6} lbs/MMBtu (4.62×10^{-3} lbs/hr; 6.94×10^{-4} TPY)	BACT
Pb	Oil	8.9×10^{-6} lbs/MMBtu (1.65×10^{-2} lbs/hr; 2.47×10^{-3} TPY)	Appl.

A) Fuel: Natural Gas: Emissions are based on 8760 hours per year operating time.
Fuel: Distillate Fuel Oil (0.05% S): Emissions are based on fuel usage equivalent to 300 hours per year at maximum capacity (i.e., 3,742,327 gallons per year).

B) The NO_x maximum limit will be lowered to 97.2 (lbs/hr) equivalent to 15 ppmvd @ 15% O_2 not later than 12/31/97 using appropriate combustion technology improvements or SCR.

C) Emission rates are based on 27°F at base load.

D) At full load conditions.

Best Available Control Technology (BACT) Determination
Central Florida Power, L.P.
Polk County
PSD-FL-190

The applicant proposes to construct a cogeneration facility near Ft. Meade, Polk County. This generator system will consist of a 184 MW General Electric PG7221FA combustion turbine generator (CT), equipped with a duct burner-fired heat recovery steam generator (HRSG), which will be used to power a nominal 74 MW steam turbine generator (ST).

The applicant has requested to burn natural gas for 8760 hours per year and distillate fuel oil, with a 0.05 percent sulfur content for a maximum 3,742,327 gallons per year. The applicant has indicated the maximum annual tonnage of regulated air pollutants emitted from the facility at base load, 27°F and type of fuel fired to be as follows:

Pollutant	Emissions (TPY) Gas		Oil	Total	PSD Significant Emission Rate (TPY)
	PG7221FA (8460 hrs)	Duct Burner (8760 hrs)	PG7221FA (300 hrs)		
NO_x	684.7	43.8	48.9	777.4	40
SO_2	20.5	1.3	15	36.8	40
PM/PM_{10}	38.1	4.4	2.6	45.1	25/15
CO	206.5	43.8	14.8	265.1	100
VOC	11.80	12.7	1.1	25.6	40
H_2SO_4	2.5	0.16	1.9	4.5	7
Be	nil	nil	6.94×10^{-4}	6.94×10^{-4}	0.0004
Hg	nil	nil	8.32×10^{-4}	8.32×10^{-4}	0.1
Pb	nil	nil	2.47×10^{-4}	2.47×10^{-4}	0.6
As	nil	nil	1.17×10^{-3}	1.17×10^{-3}	0

Florida Administrative Code (F.A.C.) Rule 17-212.400(2) (f) (3) requires a BACT review for all regulated pollutants emitted in an amount equal to or greater than the significant emission rates listed in the previous table.

Date of Receipt of a BACT Application

June 15, 1992

BACT Determination Requested by the Applicant

Pollutant	Proposed Limits
NO_x	25 ppmvd @ 15% O_2 (natural gas burning) 42 ppmvd @ 15% O_2 (for oil firing) Control Technology: Dry Low-NO_x Burners when firing natural gas and steam/water injection when firing distillate oil
SO_2	0.05% sulfur by weight (fuel oil firing)
CO, VOC	Combustion Control
PM/PM_{10}	Combustion Control

BACT Determination Procedure

In accordance with Florida Administrative Code Chapter 17-212, this BACT determination is based on the maximum degree of reduction of each pollutant emitted which the Department, on a case by case basis, taking into account energy, environmental and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems, and techniques. In addition, the regulations state that in making the BACT determination the Department shall give consideration to:

(a) Any Environmental Protection Agency determination of Best Available Control Technology pursuant to Section 169, and any emission limitation contained in 40 CFR Part 60 (Standards of Performance for New Stationary Sources) or 40 CFR Part 61 (National Emission Standards for Hazardous Air Pollutants).

(b) All scientific, engineering, and technical material and other information available to the Department.

(c) The emission limiting standards or BACT determinations of any other state.

(d) The social and economic impact of the application of such technology.

The EPA currently stresses that BACT should be determined using the "top-down" approach. The first step in this approach is to determine for the emission source in question the most stringent control available for a similar or identical source or source category. If it is shown that this level of control is technically or economically infeasible for the source in question, than the

next most stringent level of control is determined and similarly evaluated. This process continues until the BACT level under consideration cannot be eliminated by any substantial or unique technical, environmental, or economic objections.

The air pollutant emissions from combined cycle power plants can be grouped into categories based upon what control equipment and techniques are available to control emissions from these facilities. Using this approach, the emissions can be classified as follows:

- Combustion Products (e.g., particulates). Controlled generally by good combustion of clean fuels.
- Products of Incomplete Combustion (e.g., CO). Control is largely achieved by proper combustion techniques.
- Acid Gases (e.g., NO_x). Controlled generally by gaseous control devices.

Grouping the pollutants in this manner facilitates the BACT analysis because it enables the equipment available to control the type or group of pollutants emitted and the corresponding energy, economic, and environmental impacts to be examined on a common basis. Although all of the pollutants addressed in the BACT analysis may be subject to a specific emission limiting standard as a result of PSD review, the control of "nonregulated" air pollutants is considered in imposing a more stringent BACT limit on a "regulated" pollutant (i.e., particulates, sulfur dioxide, fluorides, sulfuric acid mist, etc,), if a reduction in "nonregulated" air pollutants can be directly attributed to the control device selected as BACT for the abatement of the "regulated" pollutants.

BACT POLLUTANT ANALYSIS

COMBUSTION PRODUCTS

Particulate Matter (PM/PM_{10})

The design of this system ensures that particulate emissions will be minimized by combustion control and the use of clean fuels. The particulate emissions from the combustion turbine when burning natural gas and fuel oil will not exceed 9 lbs/hr and 17 lbs/hr, respectively. The Department accepts the applicant's proposed control for particulate matter and heavy metals.

Lead, Mercury, Beryllium, Arsenic (Pb, Hg, Be, As)

The Department agrees with the applicant's rationale that there are no feasible methods to control lead, mercury, arsenic, and beryllium; except by limiting the inherent quality of the fuel.

Although the emissions of these toxic pollutants could be controlled by particulate control devices, such as a baghouse or scrubber, the amount of emission reductions would not warrant the added expense. As this is the case, the Department does not believe that the BACT determination for PM would be affected by the emissions of these pollutants.

PRODUCTS OF INCOMPLETE COMBUSTION

Carbon Monoxide (CO)

The emissions of carbon monoxide exceed the PSD significant emission rate of 100 TPY. The applicant has indicated that the carbon monoxide emissions from the proposed combined cycle turbine is on exhaust concentrations of 15 ppmv for natural gas firing and 30 ppmv for fuel oil firing.

The majority of BACT emissions limitations have been based on combustion controls for carbon monoxide and volatile organic compounds minimization, additional control is achievable through the use of catalytic oxidation. Catalytic oxidation is a postcombustion control that has been employed in CO nonattainment areas where regulations have required CO emission levels to be less than those associated with wet injection. These installations have been required to use LAER technology and typically have CO limits in the 10-ppm range (corrected to dry conditions).

In an oxidation catalyst control system, CO emissions are reduced by allowing unburned CO to react with oxygen at the surface of a precious metal catalyst such as platinum. Combustion of CO starts at about 300°F, with efficiencies above 90 percent occurring at temperatures above 600°F. Catalytic oxidation occurs at temperatures 50 percent lower than that of thermal oxidation, which reduces the amount of thermal energy required. For CT/HRSG combinations, the oxidation catalyst can be located directly after the CT or in the HRSG. Catalyst size depends upon the exhaust flow, temperature, and desired efficiency.

Due to the oxidation of sulfur compounds and excessive formation of H_2SO_4 mist emissions, oxidation catalyst are not considered to be technically feasible for gas turbines fired with fuel oil.

Catalytic oxidation has not been demonstrated on a continuous basis when using fuel oil.

Use of oxidation catalyst technology would be technically feasible for this natural gas-fired unit; however, the cost of $10,000 per ton for the PG7221FA of CO removed will have an adverse economic impact on this project.

The Department is in agreement with the applicant's proposal of combustor design and good operating practices as BACT for CO for this cogeneration project.

ACID GASES

Nitrogen Oxides (NO_X)

The emissions of nitrogen oxides represent a significant proportion of the total emissions generated by this project, and need to be controlled if deemed appropriate. As such, the applicant presented an extensive analysis of the different available technologies for NO_X control.

The applicant has stated that BACT for nitrogen oxides will be met by using water/steam injection (when firing distillate fuel oil) and advanced combustor design to limit emissions to 25 ppmvd (corrected to 15% O_2) when burning natural gas and 42 ppmvd (corrected to 15% O_2) when burning fuel oil.

A review of the EPA's BACT/LAER Clearinghouse indicates that the lowest NO_X emission limit established to date for a combustion turbine is 4.5 ppmvd at 15% oxygen. This level of control was accomplished through the use of water injection and a selective catalytic reduction (SCR) system.

Selective catalytic reduction is a post-combustion method for control of NO_X emissions. The SCR process combines vaporized ammonia with NO_X in the presence of a catalyst to form nitrogen and water. The vaporized ammonia is injected into the exhaust gases prior to passage through the catalyst bed. The SCR process can achieve up to 90% reduction of NO_X with a new catalyst. As the catalyst ages, the maximum NO_X reduction will decrease to approximately 86 percent.

The effect of exhaust gas temperature on NO_X reduction depends on the specific catalyst formulation and reactor design. Generally, SCR units can be designed to achieve effective NO_X control over a 100-300°F operating window within the bounds of 450-800°F, although recently developed zeolite-based catalysts are claimed to be capable of operating at temperatures as high as 950°.

Most commercial SCR systems operate over a temperature range of about 600-750°F. At levels above and below this window, the specific catalyst formulation will not be effective and NO_x reduction will decrease. Operating at high temperatures can permanently damage the catalyst through sintering of surfaces.

Increased water vapor content in the exhaust gas (as would result from water or steam injection in the gas turbine combustor) can shift the operating temperature window of the SCR reactor to slightly higher levels.

Although technically feasible, the applicant has rejected using SCR on the combined cycle because of economic, energy, and environmental impacts. The applicant has identified the following limitations:

a) Reduced power output.
b) Emissions of unreacted ammonia (slip).
c) Disposal of hazardous waste generated (spent catalyst).
d) Ammonium bisulfate and ammonium sulfate particulate emissions (ammonium salts) due to the reaction of NH_3 with SO_3 present in the exhaust gases.
e) The energy impacts of SCR will reduce potential electrical power generation of more than 7 million kwh per year.
f) Incremental cost effectiveness for the application of SCR technology to the Central Florida Power project was considered to be $7,400 per ton of NO_x removed.

Since SCR has been determined to be BACT for several combined cycle facilities, the EPA has clearly stated that there must be unique circumstances to consider the rejection of such control on the basis of economics.

In a recent letter from EPA Region IV to the Department regarding the permitting of a combined cycle facility (Tropicana Products, Inc.), the following statement was made:

> "In order to reject a control option on the basis of economic considerations, the applicant must show why the costs associated with the control are significantly higher for this specific project than for other similar projects that have installed this control system or in general for controlling the pollutant."

For fuel oil firing, the cost associated with controlling NO_x emissions must take into account the potential operating problems that can occur with using SCR in the oil firing mode.

A concern associated with the use of SCR on combined cycle projects is the formation of ammonium bisulfate. For the SCR process, ammonium bisulfate can be formed due to the reaction of sulfur in the fuel and the ammonia injected. The ammonium bisulfate formed has a tendency to plug the tubes of the heat recovery steam generator leading to operational problems. As this is the case, SCR has been judged to be technically infeasible for oil firing in some previous BACT determinations.

The latest information available now indicates that SCR can be used for oil firing provided that adjustments are made in the ammonia to NO_X injection ratio. For natural gas firing operation, NO_X emissions can be controlled with up to a 90 percent efficiency using a 1 to 1 or greater ammonia injection ratio. By lowering the injection ratio for oil firing, testing has indicated that NO_X can be controlled with efficiencies ranging from 60 to 80 percent. When the injection ratio is lowered there is not a problem with ammonium bisulfate formation since essentially all of the ammonia is able to react with the nitrogen oxides present in the combustion gases. Based on this strategy SCR has been both proposed and established as BACT for oil fired combined cycle facilities with NO_X emission limits ranging from 11.7 to 25 ppmvd depending on the efficiency of control established.

The applicant has indicated that the total levelized annual operating cost to install SCR for this project at 100 percent capacity factor and burning natural gas is $3,364,400 for the PG7221FA. Taking into consideration the total annual cost, a cost/benefit analysis of using SCR can now be developed.

For this project, based on the information supplied by the applicant, it is estimated that the maximum annual NO_X emissions using dry low-NO_X (natural gas) and water injection (oil firing) will be 702.1 tons/year (at 72°F). Assuming that SCR would reduce the NO_X emissions by 65%, about 245.7 TPY would be emitted annually. When this reduction (456.4 TPY) is taken into consideration with the total levelized annual operating cost of $3,364,400; the cost per ton of controlling NO_X is $7,400. This calculated cost is higher than has previously been approved as BACT.

A review of the latest DER BACT determinations show limits of 15 ppmvd (natural gas) using low-NO_X burn technology for combined cycle turbines. General Electric is currently developing programs using both steam/water injection and dry low NO_X combustor to achieve NO_X emission control level of 9 ppm when firing natural gas. Therefore, since this technology will likely be available by

1997, the Department has accepted the water/steam injection (for distillate fuel oil firing), the dry low-NO_x burner design, and the 25 ppmvd (natural gas)/42 ppmvd (oil) at 15% O_2 as BACT for a limited time (up to 12/31/97).

BACT Determination by DER

NO_x Control

The information that the applicant presented and Department calculations indicates that the cost per ton of controlling NO_x for this turbine [$7,400 per ton (natural gas)] is high compared to other BACT determinations which require SCR. Based on the information presented by the applicant, the Department believes that the use of SCR for NO_x control is not justifiable as BACT at this time.

A review of the permitting activities for combined cycle proposals across the nation indicates that SCR has been required and most recently proposed for installations with a variety of operating conditions (i.e., natural gas, fuel oil, and various capacity factors). Although, the cost and other concerns expressed by the applicant are valid, the Department, in this case, is willing to accept water/steam injection and low NO_x burner design as BACT for this project for a limited time (up to 12/31/97).

It is the Department's understanding that General Electric is developing programs for the PG7221FA using either steam/water injection or dry low NO_x combustor technology to achieve a NO_x emission control level of 9 ppm when firing natural gas.

Based on this, the Department has determined to revise and lower the allowable BACT limit for this project to 15 ppmvd at 15% O_2 no later than 12/31/97. For this turbine, an even lower NO_x emission level than 15 (gas)/42 (oil) ppmvd, corrected to 15% O_2, may become a condition of the permit pursuant to F.A.C. Rule 17-4.080.

CO Control

Combustion control will be considered as BACT for CO and VOC when firing natural gas.

Other Emissions Control

The emission limitations for PM and PM_{10}, Be, Pb, and Hg are based on previous BACT determinations for similar facilities.

The emission limits for the Central Florida Power, L.P. project are thereby established as follows:

258 MW COMBINED CYCLE COMBUSTION TURBINE
100 MMBtu/hr Duct Burner

Pollutant	Emission Standards/Limitations[a] Oil[b]	Gas[c]	Method of Control
NO_x (CT)	42 ppmvd at 15% O_2; 362.2 lbs/hr	25 ppmvd at 15% O_2; 161.9 lbs/hr 15 ppmvd at 15% O_2; 97.2 lbs/hr	Water Injection/ Dry Low-NO_x Combustor Dry Low-NO_x Combustor or any other NO_x Control Technology
NO_x (DB)		0.1 lbs/MMBtu	
CO (CT)	98.4 lbs/hr	49 lbs/hr	Combustion
CO (DB)		10 lbs/hr	
PM/PM_{10} (CT)	17 lbs/hr	9 lbs/hr	Combustion
PM/PM_{10} (DB)		0.01 lbs/MMBtu	
SO_2 (CT)	99.7 lbs/hr	4.9 lbs/hr	Distillate Fuel Oil (0.05% S)
SO_2 (DB)		0.3 lbs/hr	
H_2SO_4 (CT)	1.2 lbs/hr	5.95×10^{-1} lbs/hr	Distillate Fuel Oil (0.05% S)
H_2SO_4 (DB)		3.7×10^{-2} lbs/hr	
VOC (CT)	7.5 lbs/hr	2.8 lbs/hr	Combustion
VOC (DB)		2.9 lbs/hr	
Hg	3.0×10^{-6} lbs/MMBtu (5.5×10^{-3} lbs/hr)		Fuel Quality
Pb	8.9×10^{-6} lbs/MMBtu (1.65×10^{-2} lbs/hr)		Fuel Quality
Be	2.5×10^{-6} lbs/MMBtu (4.62×10^{-3} lbs/hr)		Fuel Quality
As	4.2×10^{-6} lbs/MMBtu (7.77×10^{-3} lbs/hr)		Fuel Quality

(a) Emissions calculated at base load and 27°F.
(b) Fuel oil with a maximum of 0.05% sulfur by weight.
(c) Natural gas (8760 hours per year), Fuel oil (3,742,327 gallons per calendar year).
(d) Initial NO_x emission rates for natural gas firing shall not exceed 25 ppmvd at 15% oxygen on a dry basis. The permittee shall achieve NO_x emissions of 15 ppmvd at 15% oxygen at the earliest achievable date based on dry low NO_x combustor injection technology or any other combustion technology, but no later than 12/31/97.

Details of the Analysis May be Obtained by Contacting:

Preston Lewis, BACT Coordinator
Department of Environmental Regulation
Bureau of Air Regulation
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Recommended by:

C. H. Fancy, P.E., Chief
Bureau of Air Regulation

May 4 1993
Date

Approved by:

Virginia B. Wetherell, Secretary
Dept. of Environmental Regulation

May 17 1993
Date

Best Available Control Technology (BACT) Determination
Central Florida Power, L.P.
Polk County
PSD-FL-190

The applicant proposes to construct a cogeneration facility near Ft. Meade, Polk County. This generator system will consist of a 184 MW General Electric PG7221FA combustion turbine generator (CT), equipped with a duct burner-fired heat recovery steam generator (HRSG), which will be used to power a nominal 74 MW steam turbine generator (ST).

The applicant has requested to burn natural gas for 8760 hours per year and distillate fuel oil, with a 0.05 percent sulfur content for a maximum 3,742,327 gallons per year. The applicant has indicated the maximum annual tonnage of regulated air pollutants emitted from the facility at base load, 27°F and type of fuel fired to be as follows:

Pollutant	Emissions (TPY) Gas		Oil	Total	PSD Significant Emission Rate (TPY)
	PG7221FA (8460 hrs)	Duct Burner (8760 hrs)	PG7221FA (300 hrs)		
NO_x	684.7	43.8	48.9	777.4	40
SO_2	20.5	1.3	15	36.8	40
PM/PM_{10}	38.1	4.4	2.6	45.1	25/15
CO	206.5	43.8	14.8	265.1	100
VOC	11.80	12.7	1.1	25.6	40
H_2SO_4	2.5	0.16	1.9	4.5	7
Be	nil	nil	6.94×10^{-4}	6.94×10^{-4}	0.0004
Hg	nil	nil	8.32×10^{-4}	8.32×10^{-4}	0.1
Pb	nil	nil	2.47×10^{-4}	2.47×10^{-4}	0.6
As	nil	nil	1.17×10^{-3}	1.17×10^{-3}	0

Florida Administrative Code (F.A.C.) Rule 17-212.400(2) (f) (3) requires a BACT review for all regulated pollutants emitted in an amount equal to or greater than the significant emission rates listed in the previous table.

Date of Receipt of a BACT Application

June 15, 1992

BACT Determination Requested by the Applicant

Pollutant	Proposed Limits
NO_x	25 ppmvd @ 15% O_2 (natural gas burning) 42 ppmvd @ 15% O_2 (for oil firing) Control Technology: Dry Low-NO_x Burners when firing natural gas and steam/water injection when firing distillate oil
SO_2	0.05% sulfur by weight (fuel oil firing)
CO, VOC	Combustion Control
PM/PM_{10}	Combustion Control

BACT Determination Procedure

In accordance with Florida Administrative Code Chapter 17-212, this BACT determination is based on the maximum degree of reduction of each pollutant emitted which the Department, on a case by case basis, taking into account energy, environmental and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems, and techniques. In addition, the regulations state that in making the BACT determination the Department shall give consideration to:

(a) Any Environmental Protection Agency determination of Best Available Control Technology pursuant to Section 169, and any emission limitation contained in 40 CFR Part 60 (Standards of Performance for New Stationary Sources) or 40 CFR Part 61 (National Emission Standards for Hazardous Air Pollutants).

(b) All scientific, engineering, and technical material and other information available to the Department.

(c) The emission limiting standards or BACT determinations of any other state.

(d) The social and economic impact of the application of such technology.

The EPA currently stresses that BACT should be determined using the "top-down" approach. The first step in this approach is to determine for the emission source in question the most stringent control available for a similar or identical source or source category. If it is shown that this level of control is technically or economically infeasible for the source in question, than the

next most stringent level of control is determined and similarly evaluated. This process continues until the BACT level under consideration cannot be eliminated by any substantial or unique technical, environmental, or economic objections.

The air pollutant emissions from combined cycle power plants can be grouped into categories based upon what control equipment and techniques are available to control emissions from these facilities. Using this approach, the emissions can be classified as follows:

- Combustion Products (e.g., particulates). Controlled generally by good combustion of clean fuels.
- Products of Incomplete Combustion (e.g., CO). Control is largely achieved by proper combustion techniques.
- Acid Gases (e.g., NO_X). Controlled generally by gaseous control devices.

Grouping the pollutants in this manner facilitates the BACT analysis because it enables the equipment available to control the type or group of pollutants emitted and the corresponding energy, economic, and environmental impacts to be examined on a common basis. Although all of the pollutants addressed in the BACT analysis may be subject to a specific emission limiting standard as a result of PSD review, the control of "nonregulated" air pollutants is considered in imposing a more stringent BACT limit on a "regulated" pollutant (i.e., particulates, sulfur dioxide, fluorides, sulfuric acid mist, etc,), if a reduction in "nonregulated" air pollutants can be directly attributed to the control device selected as BACT for the abatement of the "regulated" pollutants.

BACT POLLUTANT ANALYSIS

COMBUSTION PRODUCTS

Particulate Matter (PM/PM_{10})

The design of this system ensures that particulate emissions will be minimized by combustion control and the use of clean fuels. The particulate emissions from the combustion turbine when burning natural gas and fuel oil will not exceed 9 lbs/hr and 17 lbs/hr, respectively. The Department accepts the applicant's proposed control for particulate matter and heavy metals.

Lead, Mercury, Beryllium, Arsenic (Pb, Hg, Be, As)

The Department agrees with the applicant's rationale that there are no feasible methods to control lead, mercury, arsenic, and beryllium; except by limiting the inherent quality of the fuel.

Although the emissions of these toxic pollutants could be controlled by particulate control devices, such as a baghouse or scrubber, the amount of emission reductions would not warrant the added expense. As this is the case, the Department does not believe that the BACT determination for PM would be affected by the emissions of these pollutants.

PRODUCTS OF INCOMPLETE COMBUSTION

Carbon Monoxide (CO)

The emissions of carbon monoxide exceed the PSD significant emission rate of 100 TPY. The applicant has indicated that the carbon monoxide emissions from the proposed combined cycle turbine is on exhaust concentrations of 15 ppmv for natural gas firing and 30 ppmv for fuel oil firing.

The majority of BACT emissions limitations have been based on combustion controls for carbon monoxide and volatile organic compounds minimization, additional control is achievable through the use of catalytic oxidation. Catalytic oxidation is a postcombustion control that has been employed in CO nonattainment areas where regulations have required CO emission levels to be less than those associated with wet injection. These installations have been required to use LAER technology and typically have CO limits in the 10-ppm range (corrected to dry conditions).

In an oxidation catalyst control system, CO emissions are reduced by allowing unburned CO to react with oxygen at the surface of a precious metal catalyst such as platinum. Combustion of CO starts at about 300°F, with efficiencies above 90 percent occurring at temperatures above 600°F. Catalytic oxidation occurs at temperatures 50 percent lower than that of thermal oxidation, which reduces the amount of thermal energy required. For CT/HRSG combinations, the oxidation catalyst can be located directly after the CT or in the HRSG. Catalyst size depends upon the exhaust flow, temperature, and desired efficiency.

Due to the oxidation of sulfur compounds and excessive formation of H_2SO_4 mist emissions, oxidation catalyst are not considered to be technically feasible for gas turbines fired with fuel oil.

Catalytic oxidation has not been demonstrated on a continuous basis when using fuel oil.

Use of oxidation catalyst technology would be technically feasible for this natural gas-fired unit; however, the cost of $10,000 per ton for the PG7221FA of CO removed will have an adverse economic impact on this project.

The Department is in agreement with the applicant's proposal of combustor design and good operating practices as BACT for CO for this cogeneration project.

ACID GASES

Nitrogen Oxides (NO_X)

The emissions of nitrogen oxides represent a significant proportion of the total emissions generated by this project, and need to be controlled if deemed appropriate. As such, the applicant presented an extensive analysis of the different available technologies for NO_X control.

The applicant has stated that BACT for nitrogen oxides will be met by using water/steam injection (when firing distillate fuel oil) and advanced combustor design to limit emissions to 25 ppmvd (corrected to 15% O_2) when burning natural gas and 42 ppmvd (corrected to 15% O_2) when burning fuel oil.

A review of the EPA's BACT/LAER Clearinghouse indicates that the lowest NO_X emission limit established to date for a combustion turbine is 4.5 ppmvd at 15% oxygen. This level of control was accomplished through the use of water injection and a selective catalytic reduction (SCR) system.

Selective catalytic reduction is a post-combustion method for control of NO_X emissions. The SCR process combines vaporized ammonia with NO_X in the presence of a catalyst to form nitrogen and water. The vaporized ammonia is injected into the exhaust gases prior to passage through the catalyst bed. The SCR process can achieve up to 90% reduction of NO_X with a new catalyst. As the catalyst ages, the maximum NO_X reduction will decrease to approximately 86 percent.

The effect of exhaust gas temperature on NO_X reduction depends on the specific catalyst formulation and reactor design. Generally, SCR units can be designed to achieve effective NO_X control over a 100-300°F operating window within the bounds of 450-800°F, although recently developed zeolite-based catalysts are claimed to be capable of operating at temperatures as high as 950°.

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Increased water vapor content in the exhaust gas (as would result from water or steam injection in the gas turbine combustor) can shift the operating temperature window of the SCR reactor to slightly higher levels.

Although technically feasible, the applicant has rejected using SCR on the combined cycle because of economic, energy, and environmental impacts. The applicant has identified the following limitations:

a) Reduced power output.
b) Emissions of unreacted ammonia (slip).
c) Disposal of hazardous waste generated (spent catalyst).
d) Ammonium bisulfate and ammonium sulfate particulate emissions (ammonium salts) due to the reaction of NH_3 with SO_3 present in the exhaust gases.
e) The energy impacts of SCR will reduce potential electrical power generation of more than 7 million kwh per year.
f) Incremental cost effectiveness for the application of SCR technology to the Central Florida Power project was considered to be $7,400 per ton of NO_x removed.

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> "In order to reject a control option on the basis of economic considerations, the applicant must show why the costs associated with the control are significantly higher for this specific project than for other similar projects that have installed this control system or in general for controlling the pollutant."

For fuel oil firing, the cost associated with controlling NO_x emissions must take into account the potential operating problems that can occur with using SCR in the oil firing mode.

A concern associated with the use of SCR on combined cycle projects is the formation of ammonium bisulfate. For the SCR process, ammonium bisulfate can be formed due to the reaction of sulfur in the fuel and the ammonia injected. The ammonium bisulfate formed has a tendency to plug the tubes of the heat recovery steam generator leading to operational problems. As this is the case, SCR has been judged to be technically infeasible for oil firing in some previous BACT determinations.

The latest information available now indicates that SCR can be used for oil firing provided that adjustments are made in the ammonia to NO_X injection ratio. For natural gas firing operation, NO_X emissions can be controlled with up to a 90 percent efficiency using a 1 to 1 or greater ammonia injection ratio. By lowering the injection ratio for oil firing, testing has indicated that NO_X can be controlled with efficiencies ranging from 60 to 80 percent. When the injection ratio is lowered there is not a problem with ammonium bisulfate formation since essentially all of the ammonia is able to react with the nitrogen oxides present in the combustion gases. Based on this strategy SCR has been both proposed and established as BACT for oil fired combined cycle facilities with NO_X emission limits ranging from 11.7 to 25 ppmvd depending on the efficiency of control established.

The applicant has indicated that the total levelized annual operating cost to install SCR for this project at 100 percent capacity factor and burning natural gas is $3,364,400 for the PG7221FA. Taking into consideration the total annual cost, a cost/benefit analysis of using SCR can now be developed.

For this project, based on the information supplied by the applicant, it is estimated that the maximum annual NO_X emissions using dry low-NO_X (natural gas) and water injection (oil firing) will be 702.1 tons/year (at 72°F). Assuming that SCR would reduce the NO_X emissions by 65%, about 245.7 TPY would be emitted annually. When this reduction (456.4 TPY) is taken into consideration with the total levelized annual operating cost of $3,364,400; the cost per ton of controlling NO_X is $7,400. This calculated cost is higher than has previously been approved as BACT.

A review of the latest DER BACT determinations show limits of 15 ppmvd (natural gas) using low-NO_X burn technology for combined cycle turbines. General Electric is currently developing programs using both steam/water injection and dry low NO_X combustor to achieve NO_X emission control level of 9 ppm when firing natural gas. Therefore, since this technology will likely be available by

1997, the Department has accepted the water/steam injection (for distillate fuel oil firing), the dry low-NO_x burner design, and the 25 ppmvd (natural gas)/42 ppmvd (oil) at 15% O_2 as BACT for a limited time (up to 12/31/97).

BACT Determination by DER

NO_x Control

The information that the applicant presented and Department calculations indicates that the cost per ton of controlling NO_x for this turbine [$7,400 per ton (natural gas)] is high compared to other BACT determinations which require SCR. Based on the information presented by the applicant, the Department believes that the use of SCR for NO_x control is not justifiable as BACT at this time.

A review of the permitting activities for combined cycle proposals across the nation indicates that SCR has been required and most recently proposed for installations with a variety of operating conditions (i.e., natural gas, fuel oil, and various capacity factors). Although, the cost and other concerns expressed by the applicant are valid, the Department, in this case, is willing to accept water/steam injection and low NO_x burner design as BACT for this project for a limited time (up to 12/31/97).

It is the Department's understanding that General Electric is developing programs for the PG7221FA using either steam/water injection or dry low NO_x combustor technology to achieve a NO_x emission control level of 9 ppm when firing natural gas.

Based on this, the Department has determined to revise and lower the allowable BACT limit for this project to 15 ppmvd at 15% O_2 no later than 12/31/97. For this turbine, an even lower NO_x emission level than 15 (gas)/42 (oil) ppmvd, corrected to 15% O_2, may become a condition of the permit pursuant to F.A.C. Rule 17-4.080.

CO Control

Combustion control will be considered as BACT for CO and VOC when firing natural gas.

Other Emissions Control

The emission limitations for PM and PM_{10}, Be, Pb, and Hg are based on previous BACT determinations for similar facilities.

The emission limits for the Central Florida Power, L.P. project are thereby established as follows:

258 MW COMBINED CYCLE COMBUSTION TURBINE
100 MMBtu/hr Duct Burner

Pollutant	Emission Standards/Limitations[a] Oil[b]	Gas[c]	Method of Control
NO_x (CT)	42 ppmvd at 15% O_2; 362.2 lbs/hr	25 ppmvd at 15% O_2; 161.9 lbs/hr	Water Injection/ Dry Low-NO_x Combustor
		15 ppmvd at 15% O_2; 97.2 lbs/hr	Dry Low-NO_x Combustor or any other NO_x Control Technology
NO_x (DB)		0.1 lbs/MMBtu	
CO (CT)	98.4 lbs/hr	49 lbs/hr	Combustion
CO (DB)		10 lbs/hr	
PM/PM_{10} (CT)	17 lbs/hr	9 lbs/hr	Combustion
PM/PM_{10} (DB)		0.01 lbs/MMBtu	
SO_2 (CT)	99.7 lbs/hr	4.9 lbs/hr	Distillate Fuel Oil (0.05% S)
SO_2 (DB)		0.3 lbs/hr	
H_2SO_4 (CT)	1.2 lbs/hr	5.95×10^{-1} lbs/hr	Distillate Fuel Oil (0.05% S)
H_2SO_4 (DB)		3.7×10^{-2} lbs/hr	
VOC (CT)	7.5 lbs/hr	2.8 lbs/hr	Combustion
VOC (DB)		2.9 lbs/hr	
Hg	3.0×10^{-6} lbs/MMBtu (5.5×10^{-3} lbs/hr)		Fuel Quality
Pb	8.9×10^{-6} lbs/MMBtu (1.65×10^{-2} lbs/hr)		Fuel Quality
Be	2.5×10^{-6} lbs/MMBtu (4.62×10^{-3} lbs/hr)		Fuel Quality
As	4.2×10^{-6} lbs/MMBtu (7.77×10^{-3} lbs/hr)		Fuel Quality

(a) Emissions calculated at base load and 27°F.
(b) Fuel oil with a maximum of 0.05% sulfur by weight.
(c) Natural gas (8760 hours per year), Fuel oil (3,742,327 gallons per calendar year).
(d) Initial NO_x emission rates for natural gas firing shall not exceed 25 ppmvd at 15% oxygen on a dry basis. The permittee shall achieve NO_x emissions of 15 ppmvd at 15% oxygen at the earliest achievable date based on dry low NO_x combustor injection technology or any other combustion technology, but no later than 12/31/97.

Details of the Analysis May be Obtained by Contacting:

Preston Lewis, BACT Coordinator
Department of Environmental Regulation
Bureau of Air Regulation
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Recommended by:

C. H. Fancy, P.E., Chief
Bureau of Air Regulation

May 4 1993
Date

Approved by:

Virginia B. Wetherell, Secretary
Dept. of Environmental Regulation

May 17 1993
Date

State of Florida
DEPARTMENT OF ENVIRONMENTAL REGULATION

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Interoffice Memorandum

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D.E.R. OFFICE
OF THE SECRETARY
MAY 14 1993

TO: Virginia B. Wetherell

FROM: Howard L. Rhodes HLR

DATE: May 6, 1993

Division of Air
Resources Management

SUBJ: Approval of Construction Permit AC53-214903 (PSD-FL-190)
Central Florida Power, Limited Partnership

Attached for your approval and signature is a permit prepared by the Bureau of Air Regulation for the above mentioned company to construct/operate a 258 megawatt (MW) cogeneration facility. Natural gas will be the primary fuel for the cogeneration facility over its lifetime and distillate fuel oil will be used as a backup fuel. Air emission sources associated with the proposed project consist of the combustion turbine (CT) and supplemental firing in the heat recovery steam generator (HRSG). Nitrogen oxide (NO_x) emissions will be minimized by using dry low-NO_x technology for the CT and low-NO_x burners when duct firing. The use of natural gas will minimize the emissions of sulfur dioxide (SO_2) and other pollutants.

I recommend your approval and signature.

HLR/TH/plm

Attachments

RECEIVED
MAY 11 1993
Division of Air
Resources Management