

Final Determination

Florida Power Corporation  
Polk County, Florida

TWO COMBINED CYCLE COMBUSTION TURBINES  
(Phase IA - 2 X 235 MW)

File No: PSD-FL-195  
PA-92-33

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

February 14, 1994

STATE OF FLORIDA  
DEPARTMENT OF ENVIRONMENTAL PROTECTION  
NOTICE OF PERMIT

In the matter of an  
Application for Permit by:

DEP File No. PSD-FL-195  
Polk County

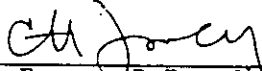
Mr. R. W. Neiser  
Florida Power Corporation  
3201 34th Street South  
St. Petersburg, FL 33733

Enclosed is Permit Number PSD-FL-195 to construct a power plant facility at County Road 555 approximately 7 miles south-southwest of Bartow, Polk County, Florida, 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 PROTECTION

  
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

3/1/94

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.

 3/1/94  
(Clerk) (Date)

Copies furnished to:

W. Thomas, SWD  
D. Martin, Polk Co.  
J. Harper, EPA  
J. Bunyak, NPS  
G. Sams, HBGS

FINAL

**SENDER:**  
 Complete items 1 and/or 2 for additional services.  
 Complete items 3 and 4a & b.  
 Print your name and address on the reverse of this form so that we can return this card to you.  
 Attach this form to the front of the mailpiece, or on the back if space does not permit.  
 Write "Return Receipt Requested" on the mailpiece below the article number. The Return Receipt will show to whom the article was delivered and the date delivered.

1.  Addressee's Address  
 2.  Restricted Delivery  
 Consult postmaster for fee.

3. Article Addressed to:  
 Mr. R. W. Neiser  
 Florida Power Corporation  
 3201 34th Street South  
 St. Petersburg, Florida 33733

4a. Article Number  
 P 872 562 674

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

7. Date of Delivery  
 MAR 3 1994

5. Signature (Addressee)  
 6. Signature (Agent)

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

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

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P 872 562 674



**Receipt for Certified Mail**

No Insurance Coverage Provided  
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Sent to  
 Mr. R. W. Neiser  
 Street and No.  
 3201 34th Street South  
 P.O., State and ZIP Code  
 St. Petersburg, FL 33733

Postage	\$
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Special Delivery Fee	
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TOTAL Postage & Fees	\$
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PS Form 3800, JUNE 1991

## Final Determination

The Technical Evaluation and Preliminary Determination for the permits to construct two 235 megawatt (MW) combined cycle combustion turbines, an auxiliary boiler, diesel generator and a fuel oil storage tank at an electrical power plant site in Bartow, Polk County, Florida, was distributed on December 16, 1993. The Notice of Intent to Issue was published in the Tampa Tribune on December 29, 1993. Copies of the evaluation were available for public inspection at the Department offices in Tampa and Tallahassee.

Comments on the evaluation and proposed permits were submitted by the National Park Service (NPS) and the applicant. The National Park Service comments and Department of Environmental Protection (DEP) responses are as follows:

### NPS Comment

NPS stated that the permit should require the permittee to install Selective Catalytic Reduction (SCR) if the dry low-NO<sub>x</sub> combustors cannot meet the NO<sub>x</sub> emission rate of 12 ppmvd @ 15% O<sub>2</sub> and 59°F.

### DEP Response

The Department concurs that the source must meet the 12 ppmvd @ 15% O<sub>2</sub> and 59°F as required by the permit. The Department does not concur that SCR be required as the means of attaining the 12 ppmvd if dry low NO<sub>x</sub> combustion fails to meet the 12 ppmvd. To limit the advantage of any other technology that may be available at that time and that may be more economical and effective.

The State of Florida (DEP) has been successful in permitting lower and lower NO<sub>x</sub> emission limits on combustion turbines, as the development in combustion technology allows these NO<sub>x</sub> improvements. DEP has been successful in reducing NO<sub>x</sub> limits on natural gas from 42 ppmvd @ 15% O<sub>2</sub> and 59°F (Orlando Utilities Commission) in 1988 to 25 ppmvd @ 15% O<sub>2</sub> and 59°F (Florida Power & Light) in 1991 to 15 ppmvd @ 15% O<sub>2</sub> and 59°F (Orlando CoGen) in 1992. The NO<sub>x</sub> limits in all these cases were attained through combustion technology. In other words, SCR was not required to achieve these limits. The recent initial compliance test at Orlando Cogen, which has a NO<sub>x</sub> limit of 15 ppmvd, tested at an average 13.8 ppmvd for NO<sub>x</sub> emissions.

The Florida Power Corporation (FPC) Polk County combustion turbines have been permitted at the lowest emission level of 12 ppmvd @ 15% O<sub>2</sub> and 59°F. In addition, the permit requires that the applicant operate for 1 year under a test mode, intended to determine the

lowest NO<sub>x</sub> emissions achievable. Based on the test data, the permit condition could even be adjusted downward.

These permit conditions are consistent with Florida's NO<sub>x</sub> emission plan of achieving the lowest possible NO<sub>x</sub> levels without the utilization of SCR.

#### NPS Comment

NPS requested some supporting documentation to demonstrate that the incremental cost effectiveness of \$6,400 per ton of carbon monoxide (CO) removed is reasonable when compared to other cogeneration facilities.

#### DEP Response

The following is a list of recent Florida combined cycle combustion turbine PSD carbon monoxide BACT determinations:

<u>Project</u>	<u>Date</u>	<u>CO BACT Determination</u>	<u>CO Removal Cost, \$/ton</u>
Intercession City	8/92	Combustion Controls	\$ 7,099
Polk Power Partners	11/92	Combustion Controls	\$ 6,000
Auburndale Partners	12/92	Combustion Controls	\$ 7,099
Kissimmee Utility	4/93	Combustion Controls	\$10,560
Central Florida Power	5/93	Combustion Controls	\$10,000

The CO removal costs listed above indicate that the FPC Polk County BACT analysis costs and determination are representative of other recent determinations in Florida.

#### NPS Comment

The Fish & Wildlife Services (FWS) criticized the use of a 1989 Forest Service (FS) document in the analysis of nitrogen and sulfur deposition on the Chassahowitzka wilderness area. The FWS states that screening values contained in the document are not appropriate for use in this wilderness area. However, FWS also commented that site-specific information is necessary in order to make informed evaluations of air quality related values (AQRV) effects, and the FWS is initiating special studies to gather information on the AQRVs of certain FWS Class I areas, including the Chassahowitzka wilderness area.

#### DEP Response

The Department will inform applicants not to use the 1989 FS document. The Department will continue to emphasize to applicants that they should follow the recommendations of the Interagency Workgroup on Air Quality Modeling (IWAQM) when preparing an AQRV analysis. These recommendations are contained in the "Interagency

Workgroup on Air Quality Modeling (IWAQM) Phase I Report: Interim Recommendation for Modeling Long Range Transport and Impacts on Regional Visibility (EPA-454/R-93-015).

#### FPC Comment

In addition to the above comments, FPC also submitted comments on the Technical Evaluation and Preliminary Determination for the Polk County project. The applicant noted that several of the emission figures listed in the evaluation were incorrect (not based on ambient conditions at 59°F). Further, the total annual tonnage figures for natural gas and fuel oil for some pollutants did not reflect the worst-case conditions.

#### DEP Response

In response to the applicant's comment, the table in the Best Available Control Technology (BACT) was changed to reflect the absolute maximum emissions based on the worst case conditions. Specific condition B.1 of the permit limits the maximum allowable to these quantities or less depending on the fuel bound nitrogen content of the fuel oil and hours of operation for each fuel.

The following pollutant emissions in the BACT Table were revised to reflect emissions at 59°F and ambient conditions. These were nitrogen oxides (NO<sub>x</sub>), sulfur dioxide (SO<sub>2</sub>), particulate matter (PM/PM<sub>10</sub>), carbon monoxide (CO), volatile organic compounds (VOC) and benzene.

No adverse comments were submitted by the U.S. Environmental Protection Agency (EPA) in their letter dated January 24, 1994.

The final action of the Department will be to issue the PSD permit (PSD-FL-195) with the changes noted above.



# Florida Department of Environmental Protection

Lawton Chiles  
Governor

Twin Towers Office Building  
2600 Blair Stone Road  
Tallahassee, Florida 32399-2400

Virginia B. Wetherell  
Secretary

**PERMITTEE:**  
Florida Power Corporation  
3201 34th Street South  
St. Petersburg, FL 33733

**Permit Number:** PA-92-33  
PSD-FL-195  
**Expiration Date:** November 1, 2000  
**County:** Polk  
**Latitude/Longitude:** 27°47'19"N  
81°52'10"W  
**Project:** 470 MW Combined Cycle  
Combustion Turbines

This permit is issued under the provisions of Chapter 403, Florida Statutes, and Florida Administrative Code Chapters 17-212 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 specifically described as follows:

For two 235 MW combined cycle combustion turbines (CTs) with maximum heat input at 59°F of 1,510 MMBtu/hr/unit (natural gas) and 1,730 MMBtu/hr/unit (oil) to be located at the Polk County site near Fort Meade, Florida. Phase IA would consist of two combined cycle combustion turbines for a total of 470 MW, a 99 MMBtu/hr auxiliary boiler, a 1,300 KW diesel generator and a 97,570 barrel fuel oil storage tank. The combustion turbines are to be GE PG7111FA or equivalent and equipped with dry low NO<sub>x</sub> combustors for natural gas firing and wet injection for fuel oil firing.

The source 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. Florida Power Corporation (FPC) application received August 4, 1992.
2. Department's letters dated August 31 and November 13, 1992.
3. FPC's letters dated October 13 and November 30, 1992.

PERMITTEE:  
Florida Power Corporation

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**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.



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**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.

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**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 17-730.300, 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.

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**GENERAL CONDITIONS:**

c. Records of monitoring information shall include:

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

The construction and operation of Polk County Site (Project) shall be in accordance with all applicable provisions of Chapters 17-210 to 297, F.A.C. The following emission limitations and conditions reflect BACT determinations for the Phase IA - 470 MW (two combined cycle combustion turbines and auxiliary equipment) of generating capacity for which the need has been determined. BACT determinations for the remaining phases will be made upon review of supplemental applications. In addition to the foregoing, the Project shall comply with the following conditions of certification as indicated.

**A. General Requirements**

1. The maximum heat input to each combustion turbine (CT) at an ambient temperature of 59° F shall neither exceed 1,510 MMBtu/hr while firing natural gas, nor 1,730 MMBtu/hr while firing fuel oil. Heat input may vary depending on ambient conditions and the CT characteristics. Manufacturer's curves or equations for correction to other temperatures shall be provided to DEP for review 90 days after selection of the CT. Subject to approval by the Department for technical validity applying sound engineering principles, the manufacturer's curves shall be used to establish heat input rates over a range of temperatures for the purpose of compliance determination.

2. Each of the two CTs in Phase IA may operate continuously, i.e., 8,760 hrs/year.

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**SPECIFIC CONDITIONS:**

3. Only natural gas (NG) or low sulfur fuel oil shall be fired in each combustion turbine and the auxiliary boiler. Only low sulfur fuel oil shall be fired in the diesel generator. The maximum sulfur content of the low sulfur fuel oil shall not exceed 0.05 percent, by weight.

4. The maximum heat input to the auxiliary boiler shall not exceed 99 MMBtu/hr when firing NG or No. 2 fuel oil with 0.05 percent maximum sulfur content (by weight). All fuel consumption must be continuously measured and recorded for the auxiliary boiler.

5. The maximum allowable fuel oil consumption for the two turbines is 13,762,806 gallons per year, which is equivalent to an aggregate of 1,000 hours per year of operation at full load.

6. The permittee shall have the option of installing duct module(s) suitable for possible future installation of an oxidation catalyst and/or SCR equipment on each combined cycle generating unit. In the event that the module(s) are not installed in the Heat Recovery Steam Generator (HRSG), the retrofit costs associated with not making provisions for such technology (initially) shall not be considered in any future economic evaluation to justify not installing SCR or an oxidation catalyst.

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

8. If site construction does not commence on Phase IA (470 MW) within 18 months of issuance of this permit, then FPC may request an extension of the 18-month period, provided that such request is received by the Department's Bureau of Air Regulation at least 90 days prior to the expiration date. Such a request shall identify the progress made toward commencement of the construction of the site and the expected time required to start and complete construction of the initial phase. The Department may grant the extension upon a satisfactory showing that the extension is justified.

Units to be constructed or modified in later phases of the project will be reviewed under the supplementary review process of the Power Plant Siting Act. If site construction has not commenced within 18 months of issuance of this certification, then FPC shall obtain from DEP a review and, if necessary, a modification of the BACT determination and allowable emissions for the unit(s) on which construction has not commenced [40 CFR 52.21(r)(2)].

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**SPECIFIC CONDITIONS:**

**B. Emission Limits**

1. The maximum allowable emissions from two CTs, when firing natural gas or low sulfur fuel oil, in accordance with the BACT determination, shall not exceed the following, at 59° F (except during periods of start up, shutdown, malfunction and load change):

EMISSIONS LIMITATIONS

<u>POLLUTANT</u>	<u>FUEL</u>	<u>BASIS (g)</u>	<u>LB/HR/CT (a)</u>	<u>TPY (b)</u>
NO <sub>x</sub>	Gas	12 ppmvd (h)	73	639
	Oil	42 ppmvd (c)	305	153
VOC (d)	Gas	7 ppmvw	10.4	91
	Oil	7 ppmvw	11.2	5.6
CO	Gas	25 ppmvd	77	675
	Oil	30 ppmvd	93	47
PM/PM <sub>10</sub>	Gas		9	79
	Oil (e)		17	8.5
SO <sub>2</sub>	Gas		0.99	8.7
	Oil (f)		94	47
Visible Emissions	Gas	10 percent opacity		
	Oil	20 percent opacity		

a. Emission limitations in LB/HR/CT are blocked 24-hour averages (midnight to midnight). Pollutant emission rates may vary depending on ambient conditions and the CT characteristics. Manufacturer's curves for the emission rate correction to other temperatures at different loads shall be provided to DEP for review 90 days after selection of the CT. Subject to approval by the Department for technical validity applying sound engineering principles, the manufacturer's curves shall be used to establish pollutant emission rates over a range of temperatures for the purpose of compliance determination.

b. Annual emission limits (TPY) for natural gas are based on a total of two CTs operating at full load 8,760 hours per year (i.e., NO<sub>x</sub> - 73 lbs/hr X 2 CTs X 8,760 hrs/yr X 1 ton/2,000 lbs = 639 TPY). Annual emission limits (TPY) for fuel oil are based on full load operation for a total of 1,000 hours per year for the two CTs (i.e., NO<sub>x</sub> - 305 lbs/hr X 1,000 hrs/yr X 1 ton/2,000 lbs = 153 TPY).

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**SPECIFIC CONDITIONS:**

c. Fuel oil NO<sub>x</sub> emissions are based on full load operation at ISO conditions and 15 percent oxygen. For fuel oil firing, NO<sub>x</sub> levels of 42 ppmvd @ 15 percent O<sub>2</sub> are based on a fuel bound nitrogen content of 0.015 percent or less. The emission limit for NO<sub>x</sub> is adjusted as follows for higher fuel nitrogen contents up to a maximum of 0.030 percent by weight:

<u>FUEL BOUND NITROGEN</u> <u>(% BY WEIGHT)</u>	<u>NO<sub>x</sub> LEVELS</u> <u>(PPMVD @ 15%O<sub>2</sub>)</u>	<u>NO<sub>x</sub> EMISSIONS</u> <u>LB/HR/CT</u>	<u>NO<sub>x</sub> EMISSIONS</u> <u>TPY</u>
0.015 or less	42	305	153
0.020	44	320	160
0.025	46	334	167
0.030	48	349	175

using the formula  $STD = 0.0042 + F$  where:

STD = allowable NO<sub>x</sub> emissions (percent by volume at 15 percent O<sub>2</sub> and on a dry basis).

F = NO<sub>x</sub> emission allowance for fuel-bound nitrogen defined by the following table:

<u>FUEL-BOUND NITROGEN (% BY WEIGHT)</u>	<u>F (NO<sub>x</sub> % BY VOLUME)</u>
0 < N < 0.015	0
0.015 < N < 0.03	0.04(N-0.015)

where: N = the nitrogen content of the fuel (% by weight).

NO<sub>x</sub> emissions limits are preliminary for the fuel oil specified in Specific Condition No. A.3. FPC shall submit fuel bound nitrogen content data for the low sulfur fuel oil prior to commercial operation.

d. Exclusive of background concentrations.

e. PM/PM<sub>10</sub> emission limitations are exclusive of sulfuric acid mist.

f. SO<sub>2</sub> emissions are based on a maximum of 0.05 percent sulfur in the fuel oil.

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**SPECIFIC CONDITIONS:**

g. The values are the computational basis for the lb/hr numbers, which are the actual emission limitations. Once a combustion turbine manufacturer has been selected, it may be necessary to modify this basis. If this basis is to be modified, a professional engineer-certified equivalency analysis by the manufacturer must be submitted to the Department. The equivalency analysis will recommend an emissions normalizing basis (i.e., lb/hr, lb/MMBtu, lb/MWh, or ppmvd) and associated emissions appropriate for the specific manufacturer's equipment. If the equivalency analysis demonstrates an impact equal to or less than the current lb/hr limit, the Department shall amend the conditions to reflect the alternate basis. The characteristics and parameters of the CT selected will be reflected in other permit conditions, where appropriate.

h. 12 ppmvd at 15 percent O<sub>2</sub>, not ISO corrected. The ISO corrected value is 15 ppmvd at 15 percent O<sub>2</sub>. Compliance will be determined through the initial and annual compliance tests required in Condition C.1.

2. The following CT emissions, determined by BACT, are tabulated for PSD purposes:

ESTIMATED EMISSIONS

<u>POLLUTANT</u>	<u>METHOD OF CONTROL</u>	<u>Basis(b)</u>
Benzene	Natural Gas	BACT
Inorganic Arsenic	No. 2 Fuel Oil(a)	BACT
Beryllium	No. 2 Fuel Oil(a)	BACT
Mercury	No. 2 Fuel Oil(a)	(c)
Pb	No. 2 Fuel Oil(a)	(c)

a. The No. 2 fuel oil shall have a maximum sulfur content of 0.05 percent.

b. Since these pollutants are inherent constituents in the fuel, the basis for control will be by specifying that only natural gas and No. 2 fuel oil can be fired at the facility.

c. Below PSD significant emission levels.

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**SPECIFIC CONDITIONS:**

3. The permittee will install a dry low NO<sub>x</sub> combustion turbine (CT). Permittee shall make every practicable effort to achieve with that CT the lowest possible NO<sub>x</sub> emission rate but must not exceed 73 lbs/hr (based on 12 ppmvd at 15 percent O<sub>2</sub> and 59° F) per CT (24-hour average, not including down time) on a continuous basis when firing natural gas.

4. After the initial compliance tests on the CTs (estimated to be in January, 1999), the permittee shall operate a certified continuous emissions monitor for NO<sub>x</sub> emissions, and collect 12 months of monitoring data. The monitor will at a minimum meet the requirements of 40 CFR 60 Appendix F quality assurance procedures. Within 17 months after the initial compliance test FPC shall prepare and submit for the Department's review an engineering report regarding the collection and the analysis of the data gathered from the monitor. In addition, this report shall include a conclusion regarding the lowest NO<sub>x</sub> emission rate which can be consistently achieved with a reasonable operating margin taking into account long-term performance expectations and assuming good operating and maintenance practices. The report shall also include results of the testing requirements of Appendix F procedures and the actual CEM data for the period of the study in an acceptable format.

5. One month after submittal of the engineering report (estimated to be by June 2000), the Department will make a determination based on the engineering report submitted by FPC on the revised NO<sub>x</sub> emission limits. If the data demonstrate that a NO<sub>x</sub> emission rate of less than 73 lb/hr (based on 12 ppmvd at 15 percent O<sub>2</sub> and 59°F) is consistently achievable, the NO<sub>x</sub> emission limits may be adjusted accordingly, but not lower than 55 lb/hr (based on 9 ppmvd at 15 percent O<sub>2</sub> and 59°F).

6. Excess emissions from a turbine resulting from start up, shutdown, malfunction, or load change shall be acceptable providing (1) best operational practices to minimize emissions are adhered to and (2) the duration of excess emissions shall be minimized but in no case exceed two hours in any 24 hour period unless specifically authorized by the Department for a longer duration. The permittee shall provide a general description of the procedures to be followed during periods of start up, shutdown, malfunction, or load change to ensure that the best operational practices to minimize emissions will be adhered to and the duration of any excess emissions will be minimized. The description should be submitted to the Department along with the initial compliance test data. The description may be updated as needed by submitting such update to the Department within thirty (30) days of implementation.



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**SPECIFIC CONDITIONS:**

7. Operation of the auxiliary steam boiler shall be limited to a maximum of 100 hours per year and only during periods of cold CT startup, when no other source of steam is available or during periodic testing. The following emission limitations shall apply:

a. NO<sub>x</sub> emissions shall not exceed 0.1 lb/MMBtu for natural gas firing or 0.2 lb/MMBtu for oil firing.

b. Sulfur dioxide emissions shall be limited by firing natural gas or low sulfur fuel oil with a maximum sulfur content of 0.05 percent by weight.

c. Visible emissions shall not exceed 10 percent opacity while burning natural gas, or 20 percent opacity (except for one six-minute period per hour during which opacity shall not exceed 27 percent), while burning low sulfur fuel oil.

8. Operation of the emergency diesel generator shall be limited to a maximum of 100 hours per year and only during periods of on site emergency power needs (when no other power source is available) or during periodic testing. The following emission limitations shall apply:

a. NO<sub>x</sub> emissions shall not exceed 9.82 grams/hp-hr.

b. Sulfur dioxide emissions shall be limited by firing only low sulfur fuel oil with maximum sulfur content of 0.05 percent by weight.

c. Visible emissions shall not exceed 20 percent opacity.

**C. Performance Testing**

1. Initial (I) compliance tests shall be performed on each CT using both fuels. Testing of emissions shall be conducted with the source operating at capacity (maximum heat input rate for the tested operating temperature). Capacity is defined as 90 - 100 percent of permitted capacity. If it is impracticable to test at capacity, then sources may be tested at less than capacity; in this case subsequent source operation is limited to 110 percent of the test load until a new test is conducted. Once the unit is so limited, then operation at higher capacities is allowed for no more than fifteen consecutive days for purposes of additional compliance testing to regain the rated capacity in the permit, with prior notification to the Department. Annual (A) compliance tests shall be performed on each CT with the fuel(s) used for more than 400 hours in the preceding 12-month period. Tests shall be conducted using EPA reference methods in accordance with 40 CFR 60, Appendix A, as adopted by reference in Rule 17-297, F.A.C.:

PERMITTEE:  
Florida Power Corporation

Permit Number: PA-92-33; PSD-FL-195  
Expiration Date: November 1, 2000

**SPECIFIC CONDITIONS:**

- a. Reference Method 5B for PM (I, A, for oil only).
- b. Reference Method 9 for VE (I, A).
- c. Reference Method 10 for CO (I, A).
- d. Reference Method 20 for NOx (I, A).
- e. Reference Method 18 for VOC (I, A).
- f. Trace elements of Beryllium (Be) and Arsenic (As) shall be tested (I, for oil only) using EMTIC Interim Test Methods. As an alternative, Method 104 for Beryllium (Be) may be used; or Be and Arsenic may be determined from fuel analysis using either Method 7090 or 7091, and sample extraction using Method 3040 as described in the EPA solid waste regulations SW 846.
- g. ASTM D4294 (or equivalent) for sulfur content of distillate oil (I,A), which can be used for determining SO<sub>2</sub> emissions annually.
- h. ASTM D1072-80, D3031-81, D4084-82, or D3246-81 (or equivalent) for sulfur content of natural gas (I, and A if deemed necessary by DEP).

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

2. The maximum sulfur content of the low sulfur fuel oil shall not exceed 0.05 percent by weight. Compliance shall be demonstrated in accordance with the requirements of 40 CFR 60.334 testing for sulfur content of the fuel oil in the storage tanks on each occasion that fuel is transferred to the storage tanks from any other source. Testing for fuel bound nitrogen content and for fuel oil lower heating value, shall also be conducted on the same schedule.

**D. Monitoring Requirements**

For each combined cycle unit, the permittee shall install, operate, and maintain a continuous emission monitoring system (CEMS) (in accordance with 40 CFR 60, Appendix F) or use other approved alternate methods to monitor nitrogen oxides and, if necessary, a diluent gas (CO<sub>2</sub> or O<sub>2</sub>). The Federal Acid Rain Program requirements of 40 CFR 75 shall apply when those requirements become effective within the state.

1. Each CEMS shall meet performance specifications of 40 CFR 60, Appendix B.

**PERMITTEE:**  
Florida Power Corporation

**Permit Number:** PA-92-33; PSD-FL-195  
**Expiration Date:** November 1, 2000

**SPECIFIC CONDITIONS:**

2. CEMS data shall be recorded and reported in accordance with Chapter 17-297.500, F.A.C., 40 CFR 60 and 40 CFR 75. The record shall include periods of start up, shutdown, and malfunction. Compliance with condition B.1. for NO<sub>x</sub> shall be determined on a mass emission rate basis (LB/HR).

3. A malfunction means any sudden and unavoidable failure of air pollution control equipment or process equipment to operate in a normal or usual manner. Failures that are caused entirely or in part by poor maintenance, careless operation or any other preventable upset condition or preventable equipment breakdown shall not be considered malfunctions.

4. The procedures under 40 CFR 60.13 and 40 CFR 75 shall be followed for installation, evaluation, and operation of all CEMS.

5. For purposes of the reports required under this permit, excess emissions are defined as any calculated average emission rate, as determined pursuant to Condition B.6 herein, which exceeds the applicable emission limits in Condition B.1.

**E. Notification, Reporting and Recordkeeping**

1. To determine compliance with the natural gas and fuel oil firing heat input limitation, the permittee shall maintain daily records of natural gas and fuel oil consumption for each turbine and the heating value for each fuel. All records shall be maintained for a minimum of two years after the date of each record and shall be made available to representatives of the Department upon request.

2. The project shall comply with all the applicable requirements of Chapter 17, F.A.C., and 40 CFR 60 Subparts A and GG. The requirements shall include:

a. 40 CFR 60.7(a)(1) - By postmarking or delivering notification of the start of construction no more than 30 days after such date.

b. 40 CFR 60.7(a)(2) - By postmarking or delivering notification of the anticipated date of the initial start up of each CT and the auxiliary steam boiler not less than 30 days prior to such date.

c. 40 CFR 60.7(a)(3) - By postmarking or delivering notification of the actual start up of each turbine and the auxiliary steam boiler within 15 days after such date.

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**SPECIFIC CONDITIONS:**

d. 40 CFR 60.7(a)(5) - By postmarking or delivering notification of the date for demonstrating the CEMS performance, no less than 30 days prior to such date.

e. 40 CFR 60.7(a)(6) - By postmarking or delivering notification of the anticipated date for conducting the opacity observations no less than 30 days prior to such date.

f. 40 CFR 60.7(b) - By initiating a recordkeeping system to record the occurrence and duration of any start up, shutdown or malfunction of a turbine and the auxiliary steam boiler, of any malfunction of the air pollution control equipment, and the periods when the CEMS is inoperable.

g. 40 CFR 60.7(c) - By postmarking or delivering a quarterly excess emissions and monitoring system performance report within 30 days after the end of each calendar quarter. This report shall contain the information specified in 40 CFR 60.7(c) and (d).

h. 40 CFR 60.8(a) - By conducting all performance tests within 60 days after achieving the maximum turbine and boiler firing rates, but not more than 180 days after the initial start up of each CT and the auxiliary boiler.

i. 40 CFR 60.8(d) - By postmarking or delivering notification of the date of each performance test required by this permit at least 30 days prior to the test date; and,

j. 17-297.345 - By providing stack sampling facilities for each turbine and the auxiliary steam boiler.

All notifications and reports required by this specific condition shall be submitted to the Department's Air Program, within the Southwest District office. Performance test results shall be submitted within 45 days of completion of such test.

3. The following information shall be submitted to the Department's Bureau of Air Regulation within 90 days after selection of each, respectively:

a. Description of the final selection of the turbines, the auxiliary steam boiler and diesel generator for installation at the facility. Descriptions shall include the specific make and model numbers, any changes in the proposed method of operation, fuels, emissions or equipment.

b. Description of the CEMS selected. Description shall include the type of sensors, the manufacturer and model number of the equipment.

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**SPECIFIC CONDITIONS:**

4. The following protocols shall be submitted to the Department's Air Program, within the Southwest District office for approval;

a. CEMS Protocol - Within 60 days after selection of the CEMS, but prior to the initial startup, a CEMS protocol describing the system, its installation, operating and maintenance characteristics and requirements. The protocol shall meet the requirements of 40 CFR 60.13, Appendix B and Appendix F. The Federal Acid Rain Program requirements of 40 CFR 75 shall apply when those requirements become effective within the state.

b. Performance Test Protocol - At least 90 days prior to conducting the initial performance tests required by this permit, the permittee shall submit to the Department's Air Program, within the Southwest District office, a protocol outlining the procedures to be followed, the test methods and any differences between the reference methods and the test methods proposed to be used to verify compliance with the conditions of this permit. The Department shall approve the testing protocol provided that it meets the requirements of this permit.

**F. Modifications**

The permittee shall give written notification to the Department when there is any modification to this facility. This notice shall be submitted sufficiently in advance of any critical date involved to allow sufficient time for review, discussion, and revision of plans, if necessary. Such notice shall include, but not be limited to, information describing the precise nature of the change; modifications to any emission control system; production capacity of the facility before and after the change; and the anticipated completion date of the change.

Issued this 25<sup>th</sup> day  
of February, 1994

STATE OF FLORIDA DEPARTMENT  
OF ENVIRONMENTAL PROTECTION

Virginia B. Wetherell  
Virginia B. Wetherell, Secretary  
Department of Environmental  
Protection

Best Available Control Technology (BACT) Determination  
 Florida Power Corporation  
 Polk County  
 PSD-FL-195  
 PA-92-33

The applicant proposes to install two combined cycle combustion turbine generators at their facility in southwest Polk County about seven miles south-southwest of Bartow in an initial phase. These generator systems will consist of: 1) two nominal 235 megawatt (MW) General Electric PG7221(FA) (or equivalent) combined cycle combustion turbines (CCCTs), each with exhaust through a heat recovery steam generator (HRSG), which will be used to power a steam turbine. The initial phase (Phase IA) consists of two CTs, each equipped with one HRSG and exhausting to a separate stack, a 99 MMBtu/hr auxiliary boiler, a 1,300 kW diesel generator and a 97,570 barrel fuel oil storage tank. Phase IA is targeted for a maximum combined generating capacity of 470 MW. The CTs will be fired with natural gas and low sulfur fuel oil with a sulfur content not to exceed 0.05 percent, by weight, as a backup in Phase IA. Phase IB, which is not covered by this BACT determination, will add 470 MW of additional natural gas fired generating capacity and is to consist of two additional 235 MW CC units. At ultimate site capacity, the project will have a generating capacity of approximately 3,000 MW, consisting of 2,000 MW of coal gasification CC units and 1,000 MW of primarily natural gas fired CC units.

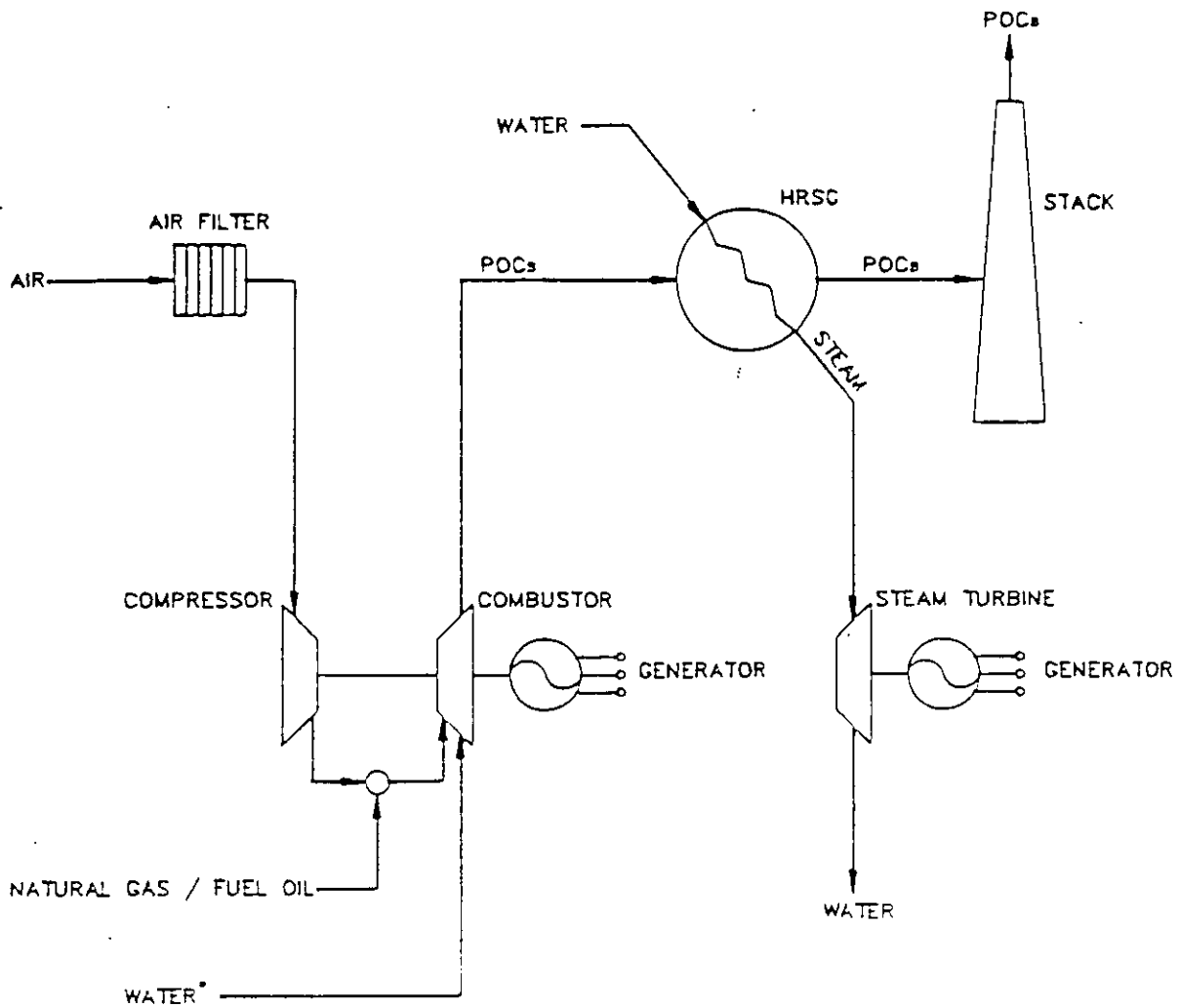
Construction and startup of the proposed 470 MW CC units of Phase IA at the Polk County Site will occur over a four-year period. The first CC unit will begin commercial startup in November 1998 and the second CC unit will begin commercial startup in November 1999. A simplified flow chart for the operation of a 235 MW CC unit is shown in Figure 1.

The applicant has indicated the maximum annual air pollutant emission rates associated with the initial phase (470 MW), based on 100 percent capacity factor and type of fuel fired, to be as follows:

Pollutant	Emissions (TPY)					PSD Significant Emission Rate (TPY)
	CCCT <sup>1</sup>		Auxiliary Boiler <sup>2</sup>		PSD Diesel Generator <sup>2</sup>	
	Oil	Gas	Oil	Gas	Oil	
NO <sub>x</sub>	175	639	0.99	0.495	2.65	40
SO <sub>2</sub>	47	8.7	0.264	0.0032	0.044	40
PM/PM <sub>10</sub>	8.3	79	0.245	0.025	0.025	25/15
CO	47	675	0.245	0.245	0.60	100
VOC	5.6	91	0.05	0.025	0.14	40
H <sub>2</sub> SO <sub>4</sub>	5	0.9	0.0041	4.95E-5	6.5 E-4	7
Arsenic	0.0032	neg.	2.08E-5	neg.	3.7 E-6	---
Beryllium	0.0023	neg.	1.25E-5	neg.	2.2 E-6	0.0004
Mercury	0.0027	neg.	1.50E-5	neg.	2.6 E-6	0.3
Lead	0.008	neg.	4.41E-5	neg.	1.8 E-6	0.6
Benzene	neg.	0.93	neg.	3.3E-4	neg.	Any

1 - 500 hours on fuel oil and 8760 hours on gas at 59°F. The emissions for oil and gas show the maximum allowable for the worst case conditions. Total allowable emissions from any combination of fuel shall be determined utilizing the limitations in Specific Condition B.1 of the permit.

2 - Emission estimates are based on 100 hours operation per year on each fuel.

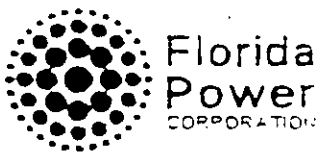


LEGEND

- POCs: PRODUCTS OF COMBUSTION
- HRSG: HEAT RECOVERY STEAM GENERATOR
- WATER INJECTION ONLY DURING FUEL OIL FIRING

SOURCE: EBASCO ENVIRONMENTAL 1992

NOT TO SCALE



Florida  
Power  
CORPORATION

Polk County Site

FIGURE 1  
SIMPLIFIED FLOW CHART  
235 MW COMBINED CYCLE UNIT

Florida Administrative Code (F.A.C.) Rule 17-212.400, Stationary Source Preconstruction Review, 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  
 August 4, 1992

BACT Determination Requested by the Applicant

Combined Cycle Combustion Turbines

<u>Pollutant</u>	<u>Fuel</u>	
	<u>Natural Gas</u>	<u>Fuel Oil</u>
NO <sub>x</sub>	12 ppmvd @ 15% O <sub>2</sub> Dry Low NO <sub>x</sub> Burners	42 ppmvd @ 15 % O <sub>2</sub> Water Injection Limited Fuel Oil Operation
SO <sub>2</sub>	Firing with Natural Gas	Low Sulfur Fuel Oil (0.05 %, by weight) Limited Fuel Oil Operation
CO	25 ppmvd Combustion Control	30 ppmvd Combustion Control Limited Fuel Oil Operation
VOC	7 ppmvw Combustion Control	7 ppmvw Combustion Control
PM/PM <sub>10</sub>	Combustion Control	Combustion Control Limited Fuel Oil Operation
Beryllium	Combustion Control	Combustion Control Limited Fuel Oil Operation
Inorganic Arsenic	Combustion Control	Combustion Control Limited Fuel Oil Operation
Benzene	Combustion Control	N/A

Auxiliary Boiler

<u>Pollutant</u>	<u>Control</u>
NO <sub>x</sub>	Low NO <sub>x</sub> Burners and Combustion Controls, Limited Operation on Fuel Oil
SO <sub>2</sub>	Natural Gas Firing, Use of Fuel Oil with a Sulfur Content not to Exceed 0.05 % by Weight, and Limited Operation on Fuel Oil



CO	Combustion Control, limited fuel oil operation
VOC	Combustion Control, limited fuel oil operation
PM/PM <sub>10</sub>	Combustion Control, limited fuel oil operation
Beryllium	Combustion Control, limited fuel oil operation
Inorganic Arsenic	Combustion Control, limited fuel oil operation
Benzene	Combustion Control

#### Diesel Generator

<u>Pollutant</u>	<u>Control</u>
NO <sub>x</sub>	Timing retardation & limited annual operation
SO <sub>2</sub>	Low sulfur fuel oil & limited annual operation
CO	Good combustion control & limited annual operation
VOC	Good combustion control & limited annual operation
PM/PM <sub>10</sub>	Good combustion control & limited annual operation
Beryllium	Good combustion control & limited annual operation
Inorganic Arsenic	Good combustion control & limited annual operation

#### Fuel Oil Storage

VOC Emissions	Submerged Filling
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#### BACT Determination Procedure

In accordance with F.A.C. Chapter 17-212.410, Best Available Control Technology Review, Stationary Source - Preconstruction Review, 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, then 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:

- o Combustion Products (e.g., particulates and trace metals). Controlled generally by good combustion of clean fuels.
- o Products of Incomplete Combustion (e.g., CO and VOCs). Control is largely achieved by proper combustion techniques.
- o Acid Gases (e.g., SO<sub>2</sub>, NO<sub>x</sub>). Controlled generally by gaseous control devices and fuel quality.

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<sub>10</sub>)**

The design of the CCCT system ensures that particulate emissions will be minimized by combustion control and the use of clean fuels. The particulate emissions from the combustion turbines when burning natural gas and fuel oil will not exceed 9 lbs/hr/CT (gas) and 17 lbs/hr/CT (oil) for the PG7221(FA) (or equivalent).

Particulate/PM<sub>10</sub> emissions are controlled for the auxiliary boiler by firing with natural gas or with No. 2 fuel oil with a sulfur concentration not to exceed 0.05%, by weight. Use of the specified fuels is considered BACT for particulate emissions from the auxiliary boiler and will result in opacity within the allowable NSPS limit of 20 percent (40 CFR 60 Subpart Dc).

#### **Beryllium and Arsenic (Be, As)**

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

### PRODUCTS OF INCOMPLETE COMBUSTION

#### **Carbon Monoxide (CO) and Volatile Organic Compounds (VOC)**

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 turbines with dry low-NO<sub>x</sub> combustors are 25 ppmvd for natural gas firing and 30 ppmvd for fuel oil firing with water injection. Volatile organic compound emissions have been based on exhaust concentrations of 7 ppmvw for natural gas and 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

post-combustion 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. Oxidation 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.

The application of oxidation catalyst is not technically feasible for gas turbines fired with fuel oil due to the oxidation of sulfur compounds and excessive formation of H<sub>2</sub>SO<sub>4</sub> mist emissions. Catalytic oxidation has not been demonstrated on a continuous basis when using fuel oil.

Use of oxidation catalyst technology would be feasible for natural gas-fired unit; however, the cost effectiveness of \$6,384 per ton of CO/VOC removed for the PG7221(FA) (or equivalent) unit will have an economic impact on this project.

The applicant has proposed submerged filling for control of VOC emissions from the fuel oil storage tank. The proposed controls are consistent with other BACT determinations.

#### ACID GASES

##### **Nitrogen Oxides (NO<sub>x</sub>)**

The emissions of nitrogen oxides represent a significant portion 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<sub>x</sub> control.

The applicant has stated that BACT for nitrogen oxides will be met by using dry low-NO<sub>x</sub> combustors to limit emissions to 12 ppmvd (corrected to 15% O<sub>2</sub>) when burning natural gas and water injection to limit emissions to 42 ppmvd (corrected to 15% O<sub>2</sub>) when burning fuel oil.

A review of the EPA's BACT/LAER Clearinghouse indicates that the lowest NO<sub>x</sub> 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<sub>x</sub> emissions. The SCR process combines vaporized ammonia with NO<sub>x</sub> 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<sub>x</sub> with a new catalyst. As the catalyst ages, the NO<sub>x</sub> reduction efficiency while holding ammonia slip emissions constant will decrease.

The effect of exhaust gas temperature on NO<sub>x</sub> reduction depends on the specific catalyst formulation and reactor design. Generally, SCR units can be designed to achieve effective NO<sub>x</sub> control over a 100-300°F operating window within the bounds of 450-800°F. The preferable operating window is within the bounds of 600-750°F for effective NO<sub>x</sub> control.

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<sub>x</sub> 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.

As stated by the applicant, the exhaust temperatures of the proposed combined cycle CTs for this site are between 950°F to 1100°F. However, catalyst can be located in the appropriate temperature range in the HRSG but the applicant has stated that effective SCR operation will be difficult to maintain under significant load and ambient temperature variations. In this case, application of an SCR system appears to be technically feasible.

Although technically feasible, the applicant has also rejected using SCR on the combined cycle units 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) Increased sulfuric acid mist emissions.

- d) Disposal of hazardous waste generated (spent catalyst).
- e) Ammonium bisulfate and ammonium sulfate particulate emissions (ammonium salts) due to the reaction of  $\text{NH}_3$  with  $\text{SO}_3$  present in the exhaust gases.
- f) Cost effectiveness for the application of SCR technology to the Polk County project was considered to be \$10,587 per ton of  $\text{NO}_x$  removed when compared to use of dry low- $\text{NO}_x$  combustors.

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  $\text{NO}_x$  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  $\text{NO}_x$  injection ratio. For natural gas firing operation,  $\text{NO}_x$  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  $\text{NO}_x$  can be controlled with efficiencies ranging from 60 to approximately 75 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<sub>x</sub> 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 \$9,825,000. Taking into consideration the total annual cost, a cost/benefit analysis of using SCR can now be developed.

For the PG7221(FA) (or equivalent) combined cycle combustion turbine, based on the information supplied by the applicant, it is estimated that the maximum annual NO<sub>x</sub> emissions using dry low NO<sub>x</sub> combustors will be 1,446 tons/year (assuming 8,260 and 500 hours of operation per year while firing natural gas and fuel oil, respectively and with four CTs operating at 72°F and 80% relative humidity). Assuming that SCR would reduce the NO<sub>x</sub> emissions from 25 ppmvd to 6 ppmvd when firing natural gas and from 42 ppmvd to 15 ppmvd when firing fuel oil, 681 tons of NO<sub>x</sub> would be emitted annually. When this reduction of 765 TPY in comparison with the application of dry low-NO<sub>x</sub> combustors is taken into consideration with the total levelized annual operating cost differential of \$8,099,000; the cost per ton of controlling NO<sub>x</sub> is \$10,587. These calculated costs are higher than has previously been approved as BACT.

A review of the latest DEP BACT determinations show limits of 15 ppmvd (natural gas) using low-NO<sub>x</sub> combustor technology for combined cycle turbines. General Electric is currently developing programs using both steam/water injection and dry low NO<sub>x</sub> combustor to achieve NO<sub>x</sub> emission control level of 9 ppm when firing natural gas.

#### Sulfur Dioxide(SO<sub>2</sub>)

The applicant has stated that sulfur dioxide (SO<sub>2</sub>) emissions when firing fuel oil will be controlled by using fuel oil with a maximum sulfur content of 0.05% by weight. This will result in an annual emission rate of 49 tons SO<sub>2</sub> per year (operating at 500 hours per year) plus 8.5 tons SO<sub>2</sub> per year when firing natural gas.

In accordance with the "top down" BACT review approach, only two alternatives exist that would result in more stringent SO<sub>2</sub> emissions. These include the use of a lower sulfur content fuel oil or the use of wet lime or limestone-based scrubbers, otherwise known as flue gas desulfurization (FGD).

In developing the NSPS for stationary gas turbines, EPA recognized that FGD technology was inappropriate to apply to these combustion units. EPA acknowledged in the preamble of the proposed NSPS that "Due to the high volumes of exhaust gases, the cost of flue gas

desulfurization (FGD) to control SO<sub>2</sub> emissions from stationary gas turbines is considered unreasonable." EPA reinforced this point when, later on in the preamble, they stated that "FGD... would cost about two to three times as much as the gas turbine." The economic impact of applying FGD today would be no different.

Furthermore, the application of FGD would have negative environmental and energy impacts. Sludge would be generated that would have to be disposed of properly, and there would be increased utility (electricity and water) costs associated with the operation of a FGD system. Finally, there is no information in the literature to indicate that FGD has ever been applied to stationary gas turbines burning distillate oil.

The elimination of flue gas control as a BACT option then leaves the use of low sulfur fuel oil as the next option to be investigated. The use of No. 2 fuel oil with a 0.05% sulfur by weight, as proposed by the applicant, is acceptable as BACT for this project.

The auxiliary boiler is expected to operate 100 hours per year or less. The applicant is proposing to control SO<sub>2</sub> and acid gas emissions by firing with natural gas or No. 2 fuel oil with a sulfur content of 0.05% or less, by weight, and by using low NO<sub>x</sub> burners and combustion controls. This is accepted as BACT.

#### BACT Determination by DEP

##### Combined Cycle Combustion Turbines

##### NO<sub>x</sub> Control

The information that the applicant presented and Department calculations indicate that the cost per ton of controlling NO<sub>x</sub> for these turbines, \$10,587, is significantly higher 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<sub>x</sub> 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 injection and dry low-NO<sub>x</sub> burner design as BACT for this project.



The applicant has proposed a NO<sub>x</sub> emission limit of 73 lb/hr/CT (12 ppmvd) at 59°F. Combustion turbine manufacturers are currently offering NO<sub>x</sub> guarantees of approximately 9 ppmvd. However, these combustion turbine manufacturers have no commercial operating experience to validate this guarantee basis. Considering the uncertainty regarding the basis of CT manufacturer guarantees and the lack of commercial operating experience at this lower emission level, the Department has determined that a NO<sub>x</sub> emission limit of 73 lb/hr/CT (12 ppmvd) at 59°F for continuous compliance (on a blocked 24-hour average (midnight to midnight) basis, not corrected to ISO conditions), is required. The ISO corrected value will be based on 15 ppmvd, at 15% O<sub>2</sub> because ISO correction results in higher calculated emissions for the high temperature and humidity conditions typically found in Florida; compliance will be determined through the initial and annual stack tests required in Specific Condition C.1. Based on the first 12 months of actual operating experience, the Department may revise the continuous emission limit from 73 lb/hr/CT (12 ppmvd) to as low as 55 lb/hr/CT (based on 9 ppmvd at 59°F, but not ISO corrected), as described in Specific Condition B.5.

#### SO<sub>2</sub> Control

BACT for sulfur dioxide is the burning of fuel oil No. 2 with 0.05% sulfur content by weight. The Department accepts their proposal as BACT for this project.

#### VOC and CO Control

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

#### Other Emissions Control

The emission limitations for PM and PM<sub>10</sub>, Be, and As are based on previous BACT determinations for similar facilities. Although the emissions of these 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. Therefore, the Department does not believe that the BACT determination for Phase IA would be affected by the emissions of these pollutants. The Department accepts the applicant's proposed control of limiting the inherent quality of the fuel for these pollutants as BACT for the combined cycle units, auxiliary boiler and diesel generator.

The BACT emission limits for the Florida Power Corporation Polk County Phase IA project of two combined cycle units for 470 MW are thereby established as follows:

470 MW COMBINED CYCLE COMBUSTION TURBINES

Pollutant	Emission Standards/Limitations		Method of Control
	Oil(a)	Gas(b)	
NO <sub>x</sub>	42 ppmvd(d) @ 15% O <sub>2</sub>	12 ppmvd(c) @ 15% O <sub>2</sub>	Water Injection on oil Dry Low NO <sub>x</sub> Combustor on gas
CO	30 ppmvd	25 ppmvd	Combustion controls Limited Fuel Oil Operation
PM & PM <sub>10</sub>	34 lbs/hr	18 lbs/hr	Combustion controls Limited Fuel Oil Operation
SO <sub>2</sub>	188 lbs/hr	2.0 lbs/hr	No. 2 Fuel Oil (0.05% S)
VOC	7 ppmvw	7 ppmvw	Combustion controls
Be	--	--	Fuel Quality
As	--	--	Fuel Quality
Benzene	--	--	Fuel Quality

- (a) No. 2 fuel oil with a maximum of 0.05% sulfur by weight. Fuel oil firing not to exceed a total of 1,000 hours per year for the two turbines.
- (b) Natural gas firing of up to 8,760 hours per year.
- (c) Interim limit. May be retained or lowered (as low as 9 ppmvd at 15% O<sub>2</sub>) based on the results of a study of the first 12 months of commercial operation.
- (d) At a fuel bound nitrogen content of 0.015 percent. Adjusted to higher values (up to 48 ppmvd @ 15 percent O<sub>2</sub>) for higher fuel bound nitrogen content (up to 0.030 percent).

Auxiliary Steam Boiler

The auxiliary steam boiler will be operated in an infrequent or emergency mode. However BACT for these facilities typically limits NO<sub>x</sub> emissions from boilers to 0.1 lb/MMBtu and 0.2 Lb/MMBtu for natural gas and oil firing, respectively. The applicant has proposed to meet these levels.

Sulfur Dioxide emissions limitations for the auxiliary steam boiler are established by firing natural gas or limiting the No. 2 fuel oils sulfur content to 0.05%, by weight. The Department accepts the controls proposed as BACT for the auxiliary boiler.

Fuel Oil Storage Tank

Fuel Oil Storage

Control Technology

VOC

Submerged Filling

In accordance with F.A.C. 17-212.410(2), the determination of BACT shall be reviewed and modified as appropriate at the latest reasonable time at least 18 months prior to commencement of construction, as defined in F.A.C. 17-212.200 of each independent phase of the project. At such time, the owner or operator of the facility is required to demonstrate the adequacy of any previous determination of BACT.

Details of the Analysis May be Obtained by Contacting:

Douglas G. Outlaw, BACT Coordinator  
Department of Environmental Protection  
Bureau of Air Regulation  
2600 Blair Stone Road  
Tallahassee, Florida 32399-2400

Recommended by:

Approved by:

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

Virginia B. Wetherell  
Virginia B. Wetherell, Secretary  
Dept. of Environmental Protection

February 22, 1994  
Date

February 25 1994  
Date

Memorandum

Florida Department of  
Environmental Protection

TO: Virginia B. Wetherell  
FROM: Howard L. Rhodes *HLR*  
DATE: February 22, 1994  
SUBJECT: Approval of a PSD Permit (PSD-FL-195)  
Florida Power Corporation (FPC), Polk County Site

Attached for your approval and signature is the Final Determination for a PSD permit and a Best Available Control Technology for two 235 megawatt (MW) combined cycle combustion turbines at an electrical power plant site near Bartow, Polk County, Florida.

On January 25, 1994, the Governor and Cabinet, sitting as Siting Board, approved certification for the location, construction and operation of 470 MW of natural gas-fired combined cycle generating capacity at the FPC, Polk Power Station Site as proposed in the Site Certification Application.

This permit represents approval for the initial 470 MW of power generation at the Polk County site. The total project consists of the construction of multiple generating units and directly associated facilities at the Polk County site in multiple phases with an ultimate capacity of 3,000 MW.

The public did not express any objections to the issuance of this PSD permit.

I recommend your approval and signature.

HLR/SA/bjb

Attachment