

STATE OF FLORIDA  
DEPARTMENT OF ENVIRONMENTAL REGULATION  
NOTICE OF PERMIT

In the matter of an  
Application for Permit by:

DER File No. AC 31-184928  
PSD-FL-152  
Indian River County

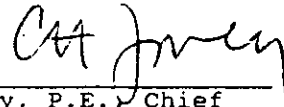
Vero Beach Municipal Power Plant  
P. O. Box 1389  
Vero Beach, Florida 32961-1389

Enclosed is Permit Number AC 31-184928, PSD-FL-152 to construct a 60 MW combined gas turbine system to be located in Vero Beach, Indian River, 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 REGULATION



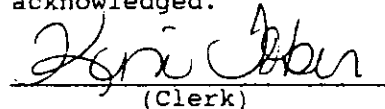
C. H. Fancy, P.E., Chief  
Bureau of Air Regulation  
2600 Blair Stone Road  
Tallahassee, FL 32399-2400  
904-488-1344

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 7-1-91 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)

7-1-91  
(Date)

Copies furnished to:  
Charles Collins, CD  
Lloyd Wade Sherrill, P.E.  
Jewell Harper, EPA

a copy was picked-up by HBCAS for Mr. Perko 7-1-91 RAN

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 2.  Restricted Delivery (Extra charge)

3. Article Addressed to:  
 Vero Beach Municipal  
 Power Plant  
 P.O. Box 1389  
 Vero Beach, FL 32961-1389

4. Article Number  
 P 832 539 797

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PS Form 3811, Apr. 1989 \* U.S.G.P.O. 1989-238-815 DOMESTIC RETURN RECEIPT

P 832 539 797



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 AC 31-18492B  
 PSD-FL-15.2

PS Form 3800, June 1990

Final Determination

Vero Beach Municipal Power Plant  
Indian River, Florida

60 MW Combined Cycle Gas Turbine System

Permit Number: AC 31-184928  
PSD-FL-152

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

June 19, 1991

## FINAL DETERMINATION

The City of Vero Beach ("City") submitted an application for an air pollution source construction permit authorizing construction of a 60 megawatt combined cycle combustion turbine unit at the Vero Beach Municipal Power Plant. The Florida Department of Environmental Regulation ("Department") reviewed the application and issued a Preliminary Determination and Technical Evaluation, along with its Notice of Intent to Issue a permit for the combustion turbine unit on December 21, 1990. The U.S. Environmental Protection Agency ("EPA") submitted a letter commenting on the Preliminary Determination on January 28, 1991. On February 14, 1991, the City filed a Petition for Administrative Proceedings challenging certain nitrogen oxide ("NOx") emission limitations proposed as best available control technology ("BACT") in the Department's proposed permit. On March 27, 1991, the City submitted additional information, including revised incremental cost figures for controlling NOx emissions with selective catalytic reduction ("SCR"). On May 9, 1991, the City submitted additional information and proposed alternative NOx emission limitations as BACT for NOx.

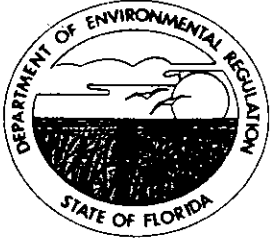
### Revised BACT Analysis

Department staff preliminarily determined that NOx emission limitations requiring use of SCR would be BACT for the City's combustion turbine project. In its Petition for Administrative Proceedings, the City challenged the appropriateness of SCR at the Vero Beach plant. Among other things, the City claims the significant capital and operating costs, loss of energy output, and need to handle and store ammonia near an adjacent residential area make SCR particularly inappropriate and unreasonable for the combustion turbine project.

Since filing the petition, the City has learned that low NOx combustors capable of achieving a NOx emissions rate of 25 ppmvd (at 15% O<sub>2</sub> on a dry basis) during natural gas firing are being developed for the combustion turbine selected for the City's project. If installed on the proposed combustion turbine, low NOx combustors would alleviate the need to handle and store the ammonia required for operation of an SCR system. In addition, unlike SCR, the low NOx combustors currently under development would reduce NOx emissions from the new combustion turbine during both combined and simple cycle modes of operation. Although these combustors are not available prior to shipment of the combustion turbine selected for the City's project, a retrofit low NOx combustion system should be available in the near future. Consequently, the City has proposed to install low NOx combustors or SCR within one year of the date the new combustion

turbine commences commercial operation. In addition, the City has proposed to accept a capacity factor limit on oil-firing of the new unit, unless SCR is installed. The City has also agreed to accept a 25 percent capacity factor limit on simple cycle operation, if SCR is installed.

Information submitted by the City and Department calculations indicate that, when compared with low NOx combustors, the incremental cost of controlling NOx emissions with SCR for natural gas firing (\$5,907/ton) is high compared to other BACT determinations which require SCR. Although the incremental cost of SCR for 100% oil firing (\$4,630) could be considered reasonable, SCR is not cost effective when the agreed upon capacity factor limit on oil firing is considered. Based on the information presented by the City and the studies conducted, the Department believes that emission limitations requiring use of low NOx combustors would have been established as BACT if low NOx combustors had been available at the time of the City's original application. Consequently, the Department has determined that a permit requiring SCR for NOx control is not justifiable. Instead, the Department has revised the PSD permit to require the City to install low NOx combustors or SCR within one year of the date the combined cycle unit commences commercial operation. Until that time, NOx emissions shall be controlled by the use of wet injection to achieve 42 ppmvd and 65 ppmvd (at 15% O<sub>2</sub> on a dry basis) when firing natural gas and fuel oil, respectively.



# Florida Department of Environmental Regulation

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

Lawton Chiles, Governor

Carol M. Browner, Secretary

**PERMITTEE:**

Vero Beach Municipal Power Plant  
Post Office Box 1389  
Vero Beach, Florida 32961

Permit Number: AC 31-184928  
Expiration Date: December 31, 1993  
County: Indian River  
Latitude/Longitude: 27°37'59"N  
80°22'41"W

Project: 60 MW Combined Cycle  
Gas Turbine

This permit is issued under the provisions of Chapter 403, Florida Statutes, and Florida Administrative Code Chapter 17-2 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(s), plans, and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

For the construction of a 60 MW combined cycle gas turbine to be located at the Vero Beach Municipal Power Plant in Vero Beach, Florida. The UTM coordinates are 561.385 km East and 3056.538 km North.

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. Vero Beach Municipal Power Plant's application dated August 13, 1990.
2. Department's letter dated September 11, 1990.
3. Vero Beach Municipal Power Plant's letter received on October 1, 1990.
4. Letter from EPA dated November 30, 1990.
5. Letter from EPA dated January 28, 1991.
6. Letter from Hopping Boyd Green & Sams received on March 27, 1991.
7. Letter from Hopping Boyd Green & Sams received May 9, 1991.

PERMITTEE:

Permit Number: AC 31-184928

Vero Beach Municipal Power Plant

Expiration Date: December 31, 1993

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 acknowledgment 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 provisions 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.

PERMITTEE:

Vero Beach Municipal Power Plant

Permit Number: AC 31-184928

Expiration Date: December 31, 1993

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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Expiration Date: December 31, 1993

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 Rule 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 rules.
- c. Records of monitoring information shall include:
  - the date, exact place, and time of sampling or measurements;

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Expiration Date: December 31, 1993

**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. During the first year of commercial operation of Unit 5, the maximum allowable emissions from Unit 5 shall not exceed the emission limitations listed in Table 1. In addition, when constructing the combined cycle generating unit, the permittee shall install duct modules suitable for later installation of a selective catalytic reduction (SCR) system.

2. Within one year of the date Unit 5 commences commercial operation, the permittee shall install low NO<sub>x</sub> combustors or an SCR system to control NO<sub>x</sub> emissions from the unit. If low NO<sub>x</sub> combustors are installed, the maximum allowable emissions from Unit 5 shall not exceed the emission limitations listed in Table 2. However, should compliance testing performed in accordance with Specific Condition No. 10 establish, to the satisfaction of the Department, a NO<sub>x</sub> emissions rate of 42 ppmvd (at 15% O<sub>2</sub> on a dry basis) or lower, the emission limitations listed in Table 3 shall apply. In the event an SCR system is installed, the emission limitations listed in Table 4 shall apply. If an SCR system is installed, it may be bypassed during simple cycle operation.

3. Unless the Department has determined other concentrations are required to protect public health and safety, predicted acceptable ambient air concentrations (AAC) of the following pollutants shall not be exceeded:

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Vero Beach Municipal Power Plant

Expiration Date: December 31, 1993

SPECIFIC CONDITIONS:

Pollutant	Acceptable Ambient Concentrations		
	8 hrs	24 hrs	Annual
Beryllium	0.02	0.005	0.0004
Lead	1.5	0.36	0.09
Inorganic mercury compounds, all forms of vapor, as Hg	--	--	0.3

4. Visible emissions shall not exceed 10% opacity.

Operating Rates

5. This source is allowed to operate continuously (8760 hours per year).

6. This source is allowed to use either natural gas or No. 2 fuel oil.

7. The permitted materials and utilization rates for the combined cycle gas turbine shall not exceed the values as follows:

- Maximum No. 2 fuel oil consumption shall not exceed 3,390 gals/hr.
- Maximum No. 2 fuel oil consumption shall not exceed 7,500,000 gals/yr., unless SCR is installed. If low NO<sub>x</sub> burners are installed and compliance testing in accordance with Specific Condition No. 16 establishes a NO<sub>x</sub> emission rate of 42 ppmvd (at 15% O<sub>2</sub> on a dry basis) or lower, the limit on No. 2 fuel oil consumption shall be raised to 10,000,000 gals./yr.
- Maximum annual firing using No. 2 fuel oil shall not exceed 25% of the annual capacity factor, unless SCR is installed. If low NO<sub>x</sub> combustors are installed and compliance testing in accordance with Specific Condition No. 10 establishes a NO<sub>x</sub> emissions rate of 42 ppmvd (at 15% O<sub>2</sub> on a dry basis) or lower, the annual limit on firing of No. 2 fuel oil shall be raised to 33% of the annual capacity factor.
- Maximum annual simple cycle operation shall not exceed 25% of the annual capacity factor unless low NO<sub>x</sub> combustors are installed.
- Maximum sulfur (S) content in the oil shall not exceed 0.25 percent by weight.

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Expiration Date: December 31, 1993

SPECIFIC CONDITIONS:

- Maximum heat input shall not exceed 446 MMBtu/hr (gas) or 443 MMBtu/hr (oil), based on sea level pressure at 59° F ambient dry bulb temperatures & 60% relative humidity (ISO conditions).

8. Any change in the method of operation, equipment or operating hours shall be submitted to the DER's Bureau of Air Regulation and Central District offices.

9. 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

10. Initial (I) compliance tests shall be performed on each CT using both fuels. The stack test for each turbine shall be performed within 10 percent of the maximum heat rate input for the tested operating temperature. 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 the November 2, 1989, version of 40 CFR 60 Appendix A:

- a. 5 or 17 for PM (I, A, for oil only)
- b. 10 for CO (I)
- c. 9 for VE (I, A)
- d. 20 for NO<sub>x</sub>(I, A)
- e. Trace elements of Beryllium (Be) shall be tested (I, for oil only) 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.
- f. Mercury (Hg) shall be tested using EPA Method 101 (40 CFR 61, Appendix B) (I, for oil only) or fuel sampling analysis using methods acceptable to the Department.

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

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SPECIFIC CONDITIONS:

11. Method 5 must be used to determine the initial compliance status of this unit. Thereafter, the opacity emissions test may be used unless 10% opacity is exceeded.

12. Compliance with the SO<sub>2</sub> emission limit can also be determined by calculations based on fuel analysis using ASTM D2880-71 for the sulfur content of liquid fuels and ASTM D1072-80, D3031-81, D4084-82 or D3246-81 for sulfur content of gaseous fuels.

13. During performance tests, to determine compliance with the proposed NO<sub>x</sub> standard, measured NO<sub>x</sub> emission at 15 percent oxygen will be adjusted to ISO ambient atmospheric conditions by the following correction factor:

$$NO_x = (NO_x \text{ obs}) \left( \frac{P_{\text{ref}}}{P_{\text{obs}}} \right)^{0.5} e^{19 (H_{\text{obs}} - 0.00633)} \left( \frac{288^\circ\text{K}}{T_{\text{AMB}}} \right)^{1.53}$$

where:

NO<sub>x</sub> = Emissions of NO<sub>x</sub> at 15 percent oxygen and ISO standard ambient conditions.

NO<sub>x</sub> obs = Measured NO<sub>x</sub> emission at 15 percent oxygen, ppmv.

P<sub>ref</sub> = Reference combustor inlet absolute pressure at 101.3 kilopascals (1 atmosphere) ambient pressure.

P<sub>obs</sub> = Measured combustor inlet absolute pressure at test ambient pressure.

H<sub>obs</sub> = Specific humidity of ambient air at test.

e = Transcendental constant (2.718).

T<sub>AMB</sub> = Temperature of ambient air at test.

14. Test results will be the average of 3 valid runs. The Central District will be notified at least 30 days in advance of the compliance test. The source shall operate between 90% and 100% of permitted capacity during the compliance test. Compliance test results shall be submitted to the Central District office no later than 45 days after completion.

PERMITTEE:

Vero Beach Municipal Power Plant

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Expiration Date: December 31, 1993

SPECIFIC CONDITIONS:

15. After the installation of low NO<sub>x</sub> combustors or SCR, the permittee shall determine compliance with the NO<sub>x</sub> standards in accordance with Specific Conditions Nos. 10 and 13.

16. A continuous monitoring system shall be installed to monitor and record the fuel consumption. Continuous monitoring shall also be installed, operated, and maintained in accordance with 40 CFR 60, Appendix F, for the combined cycle unit to monitor nitrogen oxides emissions.

- a. Each continuous emission monitoring system (CEMS) shall meet performance specifications of 40 CFR 60, Appendix B.
- b. CEMS data shall be recorded and reported in accordance with Chapter 17-2, F.A.C., and 40 CFR 60. The record shall include periods of startup, shutdown and malfunction.
- c. 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 conditions or preventable equipment breakdown shall not be considered malfunctions.
- d. The procedures under 40 CFR 60.13 shall be followed for installation, evaluation and operation of all CEMS.
- e. For purposes of reports required under this permit, excess emissions are defined as any calculated average emission concentration, as determined pursuant to Condition No. 22 herein, which exceeds the applicable emission limits in Condition No. 1.

17. Sulfur, nitrogen content and lower heating value of the fuel being fired in the gas turbine shall be recorded daily. The records of fuel oil usage will be kept by the company for a two-year period; available for regulatory agency's inspection.

Rule Requirements

18. This source shall comply with all applicable provisions of Chapter 403, Florida Statutes and Chapter 17-2 and 17-4, Florida Administrative Code.

PERMITTEE: Vero Beach Municipal Power Plant Permit Number: AC 31-184928  
Expiration Date: December 31, 1993

SPECIFIC CONDITIONS:

19. This source shall comply with all requirements of 40-CFR 60, Subpart GG and F.A.C. Rule 17-2.660(2)(a), Standards of Performance for Stationary Gas Turbines.

20. 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 17-2.210(1)).

21. This source shall comply with F.A.C. Rule 17-2.700, Stationary Point Source Emission Test Procedure.

22. Pursuant to F.A.C. Rule 17-2.210(2), Air Operating Permits, the permittee is required to submit annual reports on the actual operating rate and emissions from the facility. These reports shall include, but are not limited to the following: sulfur, nitrogen content and 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 Central District office.

23. 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).

24. An application for an operation permit must be submitted to the Central District office at least 90 days prior to the expiration date of this construction permit or within 45 days after completion of compliance testing, whichever occurs first. 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. Rule 17-4.220).

Issued this 28<sup>th</sup> day of June, 1991.

STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION

  
CAROL M. BROWNER, Secretary

Revised Best Available Control Technology (BACT) Determination  
 City of Vero Beach  
 Indian River County

The applicant proposes to install a combustion turbine generator system at their facility in Vero Beach. The generator system will consist of a single 40 megawatt (MW) combustion turbine and a single heat recovery steam generator (HRSG) which will be used to repower an existing nominal 20 MW steam turbine.

The combustion turbine will be capable of both combined cycle and simple cycle operation. It is anticipated that the combustion turbine will use natural gas as the primary fuel and distillate oil as the backup fuel. The applicant has indicated the maximum annual tonnage of regulated air pollutants emitted from the facility based on 100 percent capacity for natural gas firing and 25% for oil-firing at ISO conditions to be as follows:

Pollutant	Potential Emissions (tons/yr)		PSD Significant Emission Rate (tons/yr)
	Natural Gas	Fuel Oil	
NO <sub>x</sub>	328.5	132.5	40
SO <sub>2</sub>	1.3	130.8	40
PM <sup>2</sup>	11.0	11.0	25
PM <sub>10</sub>	11.0	11.0	15
CO	43.8	11.0	100
VOC	21.9	5.5	40
H <sub>2</sub> SO <sub>4</sub>	0.019	3.9	7
Be	0.0	0.0012	0.0004
Hg	0.0	0.0015	0.1
Pb	0.0	0.0125	0.6

Florida Administrative Code Rule 17-2.500(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

May 9, 1991



BACT Determination Requested by the Applicant

<u>Pollutant</u>	<u>Determination</u>
NO <sub>x</sub>	25 ppmvd @ 15% O <sub>2</sub> (natural gas burning)* 65 ppmvd @ 15% O <sub>2</sub> (No. 2 fuel oil firing)
SO <sub>2</sub>	Firing of natural gas or No. 2 fuel oil with a maximum sulfur content of 0.25%
PM and PM <sub>10</sub>	Combustion control
H <sub>2</sub> SO <sub>4</sub>	Firing of No. 2 fuel oil with a maximum sulfur content of 0.25%
Be	Firing of No. 2 fuel oil

\* The applicant proposes to install low NO<sub>x</sub> combustors or SCR within one year after the date the combustion turbine commences commercial operation. The above NO<sub>x</sub> emission limitations would apply only if low NO<sub>x</sub> combustors are installed. If SCR is installed, the NO<sub>x</sub> emission limitations would be 9 ppmvd or 25 ppmvd (@ 15% O<sub>2</sub>) for natural gas or No. 2 fuel oil firing, respectively. Until installation of low NO<sub>x</sub> combustors or SCR, the applicant proposes to limit NO<sub>x</sub> emissions to 42 ppmvd and 65 ppmvd @ 15% oxygen when from natural gas and oil, respectively.

BACT Determination Procedure

In accordance with Florida Administrative Code Chapter 17-2, Air Pollution, 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 of 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 of 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:

- ° Combustion Products (Particulates and Heavy Metals). Controlled generally by good combustion of clean fuels.
- ° Products of Incomplete Combustion (CO, VOC, Toxic Organic Compounds). Control is largely achieved by proper combustion techniques.
- ° Acid Gases (SO<sub>x</sub>, NO<sub>x</sub>, HCl, F1). 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.

#### Combustion Products

The City of Vero Beach's projected emissions of particulate matter, PM<sub>10</sub>, and beryllium surpass the significant emission rates given in Florida Administrative Code Rule 17-2.500, Table 500-2 for No. 2 fuel oil firing only. A review of the BACT/LAER Clearinghouse indicates that the applicants proposed emission rate (equivalent to 0.025 lb/MMBtu) is representative of BACT for turbines of similar size.

As this is the case, a PM/PM<sub>10</sub> emissions limitation of 0.025 lb/MMBtu for No. 2 fuel oil firing is reasonable as BACT for the Vero Beach facility.

In general, the BACT/LAER Clearinghouse does not contain specific emission limits for beryllium from turbines. BACT for these heavy metals is typically represented by the level of particulate control. As this is the case, the emission factor of 0.025 lb/MMBtu for particulate matter PM<sub>10</sub> is judged to also represent BACT for beryllium.

#### Products of Incomplete Combustion

The emissions of carbon monoxide and volatile organic compounds are each below the significant level and therefore do not require a BACT analysis.

#### Acid Gases

The emissions of sulfur dioxide, nitrogen oxides, and sulfuric acid mist, represent a significant proportion of the total emissions and need to be controlled if deemed appropriate. Sulfur dioxide emissions from combustion turbines are directly related to the sulfur content of the fuel being combusted.

The applicant has proposed the use of natural gas and No. 2 fuel oil with a maximum sulfur content of 0.25% to control sulfur dioxide emissions. A review of the latest edition (1990) of the BACT/LAER Clearinghouse indicates that sulfur dioxide emissions from combustion turbines have been controlled by limiting fuel oil sulfur content to a range of 0.1 to 0.3%, with the average for the facilities listed being approximately 0.24 percent. As this is the case, the applicant's proposal to use No. 2 fuel oil with a maximum sulfur content of 0.25% is judged to represent BACT.

The applicant has stated that BACT for nitrogen oxides (NO<sub>x</sub>) will be complied with by installing low NO<sub>x</sub> combustors capable of limiting NO<sub>x</sub> emissions to 25 ppmvd or 65 ppmvd at 15% oxygen when burning natural gas or No. 2 fuel oil, respectively, or by installing selective catalytic reduction ("SCR") capable of limiting NO<sub>x</sub> emissions to 9 ppmvd or 25 ppmvd at 15% oxygen when burning natural gas and No. 2 fuel oil, respectively, within one year after the date the new unit commences commercial operation. Until the installation of low NO<sub>x</sub> combustors or SCR, wet injection will limit NO<sub>x</sub> emissions from Unit 5 to 42 ppmvd or 65 ppmvd at 15% oxygen when burning natural gas or No. 2 fuel oil, respectively.

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 percent oxygen. This level of control

was accomplished through the use of water injection and a SCR system.

SCR 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 maximum NO<sub>x</sub> reduction will decrease to approximately 86 percent.

Given the applicant's proposed BACT level for nitrogen oxides control stated above, an evaluation can be made of the cost and associated benefit of using SCR as follows:

The applicant has indicated that the total levelized annual cost (operating plus amortized capital cost) to install SCR for natural gas firing at 95 percent capacity factor is \$1,080,000. Taking into consideration the total levelized annual cost, a cost/benefit analysis of using SCR can now be developed.

Based on the information supplied by the applicant, it is estimated that the maximum annual NO<sub>x</sub> emissions with low NO<sub>x</sub> combustors from the Vero Beach facility will be 186 tons/year, at a total levelized annual cost of \$377,000. Assuming that SCR would reduce the NO<sub>x</sub> emissions by an additional 80%, the SCR would control 119 tons of NO<sub>x</sub> annually for natural gas firing. When this reduction is taken into consideration with the incremental annual cost of \$703,000 (cost of SCR less cost of low NO<sub>x</sub> combustors) the cost per ton of controlling NO<sub>x</sub> is \$5,907. This cost (\$5,907/ton) exceeds costs that have been previously justified as BACT.

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 is made:

"In order to reject a control program 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.

A review of the combined cycle facilities in which SCR has been established as a BACT requirement indicates that the majority of these facilities are also intended to operate at high capacity factors. As this is the case, the proposed project is similar to

other facilities in which SCR has been established as BACT, thereby supporting SCR as BACT for the proposed facility.

For fuel oil firing, the cost associated with controlling NO<sub>x</sub> 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<sub>x</sub> injection ratio. For natural gas firing operation NO<sub>x</sub> emissions can be controlled with up to a 90 percent efficiency using a 1 to 1 or greater injection ratio. By lowering the injection ratio for oil firing, testing has indicated that NO<sub>x</sub> can be controlled with efficiencies ranging from 60 to 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> emissions limits ranging from 11.7 to 25 ppmvd depending on the efficiency of control established.

Assuming that the lowered ammonia injection ratio strategy was used to control NO<sub>x</sub> emissions by 65%, the SCR would control 310 tons (62% of 503 tons/yr) of NO<sub>x</sub> annually for oil firing. When this reduction is taken into consideration with the total annual cost of SCR, the cost per ton of controlling NO<sub>x</sub> is \$4,630. This cost is lower than that determined for natural gas firing and is could be considered reasonable. However, when the proposed 25% capacity factor limit on oil-firing is taken into consideration, SCR technology is not cost effective.

#### Environmental Impact Analysis

The predominant environmental impacts associated with this proposal are related to the use of SCR for NO<sub>x</sub> control. The use of SCR results in emissions of ammonia, which may increase with increasing levels of NO<sub>x</sub> control. In addition, some catalysts may contain substances which are listed as hazardous waste, thereby creating an additional environmental burden. Although the use of SCR does have some environmental impacts, the disadvantages do not outweigh the benefit which would be provided

by reducing nitrogen oxide emissions by 80 percent. The overwhelming benefit of NO<sub>x</sub> control by using SCR is substantiated by the fact that nearly one half of all BACT determinations have established SCR as the control measure for nitrogen oxides over the last five years.

In addition to the criteria pollutants, the impacts of toxic pollutants associated with the combustion of natural gas and No. 2 fuel oil have been evaluated. Beryllium for oil fired operation exceeds PSD significant levels. Other toxics are expected to be emitted in minimal amounts, with the total emissions combined to be less than 0.1 tons per year.

Although the emissions of the 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 would be affected by the emissions of the toxic pollutants associated with the firing of natural gas or No. 2 fuel oil.

#### Potentially Sensitive Concerns

With regard to controlling NO<sub>x</sub> emissions with SCR, the applicant has identified the following technical limitations:

1. SCR would reduce output of combustion turbines by one percent.
2. SCR could result in the release of unreacted quantities of ammonia to the atmosphere.
3. SCR would require handling of ammonia by plant operators. Since it is a hazardous material, there is a concern about safety and productivity of operators.
4. SCR results in contaminated catalyst from flue gas trace elements which could be considered hazardous. Safety of operators and disposal of spent catalyst is a concern.

#### BACT Determination by DER

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

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, capacity factors ranging from low to high). However, the cost and other concerns expressed by the applicant are valid.

The information that the applicant presented and Department calculations indicates that the incremental cost of

controlling NO<sub>x</sub> with SCR (\$5,907/ton) for natural gas is high compared to other BACT determinations which require SCR. Although the cost of SCR for oil firing (\$4,630/ton) could be considered reasonable, when a 25% capacity factor limit on oil-firing is considered, SCR technology is not cost effective. Based on the information presented by the applicant and the studies conducted, the Department believes a permit requiring the use of SCR for NO<sub>x</sub> control is not justifiable.

Pursuant to Florida Administrative Code ("FAC") Rule 17-2.630(3)(a), the Department may approve the use of a system of innovative control technology as BACT if:

1. The proposed system would not cause or contribute to an unreasonable risk to public health, welfare, or safety in its operation or function.
2. The owner or operator shall be required to achieve a level of continuous emissions reduction equivalent to that which would have been required under a Section 17-2.630(1) BACT determination within a reasonable period of time specified by the Department, but not later than four years from the time of startup or seven years from the date of issuance of the construction permit.
3. Use of the proposed system would not:
  - a. Cause or contribute to a violation of any ambient air quality standard;
  - b. Have a significant impact on any Class I area; or
  - c. Have a significant impact on any area where an applicable maximum allowable increase is known to be violated.

"Innovative control technology" is defined as "[a]ny system of air pollution control that has not been adequately demonstrated in practice, but would have a substantial likelihood of achieving greater continuous emissions reduction than any control system in current practice or of achieving at least comparable reductions at lower cost in terms of energy, economics, or nonair quality environmental impacts." Rule 17-2.100(98), FAC.

Under the terms of the above rules, the low NO<sub>x</sub> combustion system proposed by the City qualifies as a system of innovative control technology. Therefore, the Department has revised the permit to require retrofit installation of low

NOx combustors or SCR within one year of the date the new combustion turbine begins commercial operation. In accordance with the above BACT analysis, unless SCR is installed, No. 2 fuel oil firing must be limited to 25% of the annual capacity factor. However, if low NOx combustors are installed, and compliance testing establishes a NOx emissions rate of 42 ppmvd (at 15% O<sub>2</sub> on a dry basis) or lower, the annual limit on No. 2 fuel oil firing shall be 33% of the annual capacity factor. The additional capacity for oil firing at the 42 ppmvd NOx emissions rate is consistent with recent BACT determinations in Florida. In addition, in response to comments from EPA, simple cycle operation of the new unit shall be limited to 25% of the annual capacity factor during the first year of commercial operation and thereafter if SCR is installed.

SO<sub>2</sub> Control

For sulfur dioxide BACT is represented by firing natural gas or No. 2 fuel oil with an average sulfur content not to exceed 0.25 percent.

Other Emissions Control

The emission limitations for PM and PM<sub>10</sub>, are based on previous BACT determinations for similar facilities, with the heavy metal beryllium being addressed through the particulate limitation and sulfuric acid mist being addressed through the sulfur dioxide limitation.

The emission limits for the City of Vero Beach project are thereby established as follows:

Pollutant	Emission Limit	
	Natural Gas Firing	No. 2 Fuel Oil Firing
NOx	25 ppmvd @ 15% O <sub>2</sub>	65 ppmvd @ 15% O <sub>2</sub> *
SO <sub>2</sub>	Natural gas as fuel	Sulfur content not to exceed 0.25%
PM & PM <sub>10</sub>	0.006 lb/MMBtu	0.025 lb/MMBtu
Sulfuric Acid Mist	Emissions limited by natural gas and No. 2 fuel oil firing	
Beryllium	Emissions limited by natural gas and No. 2 fuel oil firing	

\* The permittee must install low NOx combustors or SCR within one year after the date the combustion turbine commences commercial operation. The above NO<sub>x</sub> emission limitations

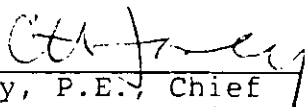


apply only if low NOx combustors are installed. If SCR is installed, the NOx emission limitations will be 9 ppmvd or 25 ppmvd (@ 15% O<sub>2</sub>) for natural gas or No. 2 fuel oil firing, respectively. Until low NOx combustors or SCR are installed, the permittee must limit NO<sub>x</sub> emissions to 42 ppmvd and 65 ppmvd @ 15% oxygen when from natural gas and oil, respectively.

Details of the Analysis May be Obtained by Contacting:

Barry Andrews, P.E., 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

June 17, 1991  
Date

Approved by:



Carol M. Browner, Secretary  
Dept. of Environmental Regulation

June 28, 1991  
Date

TABLE 2  
ALLOWABLE EMISSION LIMITS  
(If Low NOx Combustors Are Installed)

Pollutant	Standards		Gas Turbine and BRSG Tons Per Year <sup>(a)</sup>	Basis
	Gas Firing	No. 2 Fuel Oil Firing		
NO <sub>x</sub>	25 ppmvd at 15% oxygen on a dry basis	65 ppmvd at 15% oxygen on a dry basis	278.8	BACT
SO <sub>2</sub>	Natural gas as fuel	0.25 percent S by weight	131.9	BACT
PM	0.006 lb/MMBtu	0.025 lb/MMBtu	19.16	BACT
VOC	0.0112 lb/MMBtu	0.0113 lb/MMBtu	21.9	BACT
CO	0.0224 lb/MMBtu	0.0226 lb/MMBtu	43.8	BACT
Mercury (Hg)		$3.0 \times 10^{-6}$ lbs/MMBtu	0.0015	Est. by Appl.
Lead (Pb)		$2.8 \times 10^{-5}$ lbs/MMBtu	0.014	Est. by Appl.
Beryllium (be)		$2.5 \times 10^{-6}$ lbs/MMBtu	0.0012	BACT
Sulfuric Acid Mist	Natural gas as fuel	$8.1 \times 10^{-3}$ lbs/MMBtu	3.939	BACT

(a) Emission limitations based on 75 percent capacity factor for gas-firing; 25 percent capacity factor for oil-firing.

TABLE 1  
 ALLOWABLE EMISSION LIMITS  
 (Before Installation of Low NOx Combustors or SCR)

Pollutant	Standards		Gas Turbine and HRSG <sup>(a)</sup> Tons Per Year	Basis
	Gas Firing	No. 2 Fuel Oil Firing		
NO <sub>x</sub>	42 ppmvd at 15% oxygen on a dry basis	65 ppmvd at 15% oxygen on a dry basis	378.9	BACT
SO <sub>2</sub>	Natural gas as fuel	0.25 percent S by weight	131.9	BACT
PM	0.006 lb/MMBtu	0.025 lb/MMBtu	19.16	BACT
VOC	0.0112 lb/MMBtu	0.0113 lb/MMBtu	21.9	BACT
CO	0.0224 lb/MMBtu	0.0226 lb/MMBtu	43.8	BACT
Mercury (Hg)		$3.0 \times 10^{-6}$ lbs/MMBtu	0.0015	Est. by Appl.
Lead (Pb)		$2.8 \times 10^{-5}$ lbs/MMBtu	0.014	Est. by Appl.
Beryllium (be)		$2.5 \times 10^{-6}$ lbs/MMBtu	0.0012	BACT
Sulfuric Acid Mist	Natural gas as fuel	$8.1 \times 10^{-3}$ lbs/MMBtu	3.939	BACT

(a) Emission limitations based on 75 percent capacity factor for gas-firing; 25 percent capacity factor for oil-firing.

TABLE 3  
ALLOWABLE EMISSION LIMITS  
(If Low NOx Combustors Are Installed)

Pollutant	Standards		Gas Turbine and HRSG Tons Per Year <sup>(a)</sup>	Basis
	Gas Firing	No. 2 Fuel Oil Firing		
NO <sub>x</sub>	25 ppmvd at 15% oxygen on a dry basis	42 ppmvd at 15% oxygen on a dry basis	243.7	BACT
SO <sub>2</sub>	Natural gas as fuel	0.25 percent S by weight	173.6	BACT
PM	0.006 lb/MMBtu	0.025 lb/MMBtu	21.79	BACT
VOC	0.0112 lb/MMBtu	0.0113 lb/MMBtu	21.9	BACT
CO	0.0224 lb/MMBtu	0.0226 lb/MMBtu	43.8	BACT
Mercury (Hg)		$3.0 \times 10^{-6}$ lbs/MMBtu	0.0019	Est. by Appl.
Lead (Pb)		$2.8 \times 10^{-5}$ lbs/MMBtu	0.018	Est. by Appl.
Beryllium (be)		$2.5 \times 10^{-6}$ lbs/MMBtu	0.0016	BACT
Sulfuric Acid Mist	Natural gas as fuel	$8.1 \times 10^{-3}$ lbs/MMBtu	5.20	BACT

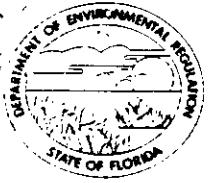
(a) Emission limitations based on 67 percent capacity factor for gas-firing; 33 percent capacity factor for oil-firing.

TABLE 4  
ALLOWABLE EMISSION LIMITS  
(If SCR is Installed)

Pollutant	Standards		Gas Turbine and HRSG Tons Per Year		Basis
	Gas Firing	No. 2 Fuel Oil Firing	Gas	Oil	
NO <sub>x</sub> - combined cycle <sup>(a)</sup>	9 ppmvd at 15% O <sub>2</sub> on a dry basis	25 ppmvd at 15% O <sub>2</sub> on a dry basis	65.7	186	BACT
NO <sub>x</sub> - simple cycle <sup>(b)</sup>	42 ppmvd at 15% O <sub>2</sub> on a dry basis	65 ppmvd at 15% O <sub>2</sub> on a dry basis	82.1	132.5	BACT
SO <sub>2</sub>	Natural gas as fuel	0.25 percent S by weight	1.3	523	BACT
PM	0.006 lb/MMBtu	0.025 lb/MMBtu	10.95	43.8	BACT
VOC	0.0112 lb/MMBtu	0.0113 lb/MMBtu	21.9	21.9	BACT
CO	0.0224 lb/MMBtu	0.0226 lb/MMBtu	43.8	43.8	BACT
Mercury (Hg)		$3.0 \times 10^{-6}$ lbs/MMBtu		0.006	Est. by Appl.
Lead (Pb)		$2.8 \times 10^{-5}$ lbs/MMBtu		0.05	Est. by Appl.
Beryllium (be)		$2.5 \times 10^{-6}$ lbs/MMBtu		0.005	BACT
Sulfuric Acid Mist	Natural gas as fuel	$8.1 \times 10^{-3}$ lbs/MMBtu	0.019	15.7	BACT

(a) Emission limitations based on 100 percent capacity factor for combined cycle operation.

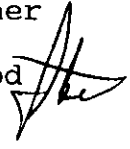
(b) Emission limitations based on 25 percent capacity factor for simple cycle operation.



State of Florida  
DEPARTMENT OF ENVIRONMENTAL REGULATION

For Routing To Other Than The Addressee	
To: _____	Location: _____
To: _____	Location: _____
To: _____	Location: _____
From: _____	Date: _____

# Interoffice Memorandum

TO: Carol M. Browner  
FROM: Steve Smallwood   
DATE: June 25, 1991  
SUBJ: Approval of Construction Permit AC 31-184928/PSD-FL-152  
Vero Beach Municipal Power Plant

Attached for your approval and signature is a permit and corresponding Best Available Control Technology (BACT) determination prepared by the Bureau of Air Regulation for the above mentioned company to construct a 60 MW combined cycle gas turbine system. The project is not controversial.

I recommend your approval and signature.

SS/PL/plm

Attachments