

STATE OF FLORIDA  
DEPARTMENT OF ENVIRONMENTAL PROTECTION  
NOTICE OF FINAL PERMIT

In the Matter of an  
Application for Permit by:

Mr. John S. Ellis  
IPS Avon Park Corporation  
1560 Gulf Boulevard  
Clearwater, Florida 32767

DEP File No. 1010373-001  
Permit No.: PSD-FL-280  
Shady hills Generating Station  
Pasco County

Enclosed is the Final Permit Number PSD-FL-280 to construct: three nominal 170 megawatt (MW) natural gas and distillate fuel oil-fired combustion turbine-electrical generators with 60-foot stacks and one 2.8 million gallon fuel oil storage tanks for the proposed Shady Hills Generating Station to be located in unincorporated Pasco County. This permit is issued pursuant to Chapter 403, Florida Statutes.

Any party to this order (permit) has the right to seek judicial review of the permit pursuant to Section 120.68, F.S., 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 Legal Office; 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 (thirty) days from the date this Notice is filed with the Clerk of the Department.

Executed in Tallahassee, Florida.



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


**CERTIFICATE OF SERVICE**

The undersigned duly designated deputy agency clerk hereby certifies that this NOTICE OF FINAL PERMIT (including the FINAL permit) was sent by certified mail\* and copies were mailed by U.S. Mail before the close of business on 1-13-00 to the person(s) listed:

John S. Ellis, IPSAPC\*  
Gregg Worley, EPA  
John Bunyak, NPS  
Bill Thomas, DEP SWD  
Ken Kosky, P.E., Golder Associates  
Chair, Pasco County BCC

Clerk Stamp

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

  
(Clerk) 1-13-00 (Date)

FINAL DETERMINATION  
SHADY HILLS GENERATING STATION  
PASCO COUNTY  
THREE SIMPLE CYCLE COMBUSTION TURBINES

The Department distributed a Public Notice package on November 30, 1999 for the project to construct a nominal 510 megawatt (MW) natural gas and distillate fuel oil-fired simple cycle power plant near Hudson, Pasco County. The project includes: three nominal 170 MW combustion turbine-electrical generators with 60-foot stacks and one 2.8 million gallon distillate fuel oil storage tank. The Public Notice of Intent to Issue was published on December 14 in The Tampa Tribune.

No written comments were received by the Department from the public, the applicant, or the U.S. EPA Region IV. Comments were received from the Fish and Wildlife Service (FWS) in a letter dated December 16.

The Department previously received written comments from EPA Region IV on the (almost identical) Vandolah Power Project and Draft Permit. Those comments were addressed in the Final Determination for the Vandolah project dated December 16, 1999. The Department's resolution of those comments was also incorporated into the present Shady Hills Generating Station Permit.

EPA verbally advised that SCONOX™ technology for nitrogen oxides control is now available from ABB Alstom Power for large combustion turbines and requested that this be mentioned in future technology discussions.

The FWS concurred that Dry Low NO<sub>x</sub> technology to achieve 9 ppmvd of NO<sub>x</sub> is best available control technology (BACT) for this simple cycle project. FWS also concurred with use of 0.05 percent sulfur fuel oil and a NO<sub>x</sub> limit of 42 ppmvd as BACT during the limited oil firing.

FWS advised that the visibility analysis was performed correctly and that there would be low potential for impacts to visibility due to plumes in the Class I Area. FWS expressed concern about modeled exceedances of Class I sulfur dioxide increments. Because this specific project does not contribute significantly to increment consumption, it is considered to comply with the increments.

FWS requests that the Department identify the sources of the exceedances and take remedial action to rectify the exceedances.

The final action is to issue the permit as proposed with minor changes in the BACT write-up to reflect the present status of both the SCONOX and XONON™ nitrogen oxides control technologies.

Z 031 391 918

US Postal Service  
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No Insurance Coverage Provided.  
Do not use for International Mail (See reverse)

PS Form 3800, April 1995

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Post Office, State, & ZIP Code <i>Clearwater FL</i>	
Postage	\$
Certified Fee	
Special Delivery Fee	
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Return Receipt Showing to Whom & Date Delivered	
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TOTAL Postage & Fees	\$
Postmark or Date <i>1010373-001 AC 1-13-99</i> <i>PSD-FI-280</i>	

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- Complete items 1 and/or 2 for additional services.
- Complete items 3, 4a, and 4b.
- 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.
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I also wish to receive the following services (for an extra fee):

- 1.  Addressee's Address
- 2.  Restricted Delivery

Consult postmaster for fee.

3. Article Addressed to:

*John S. Ellis*  
*IPS Avon Park Corp.*  
*1560 Gulf Blvd*  
*Clearwater, FL*

*32767*

4a. Article Number

*Z 031 391 918*

4b. Service Type

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*1-15-00*

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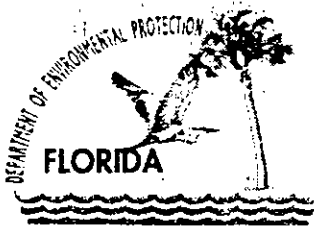
*Linda Ellis*

6. Signature: (Addressee or Agent)

*X Linda Ellis*

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Thank you for using Return Receipt Service.



Jeb Bush  
Governor

# Department of Environmental Protection

Marjory Stoneman Douglas Building  
3900 Commonwealth Boulevard  
Tallahassee, Florida 32399-3000

David B. Struhs  
Secretary

## PERMITTEE:

IPS Avon Park Corporation  
1560 Gulf Boulevard, # 701  
Clearwater, Florida 32767

Permit No.	PSD-FL-280
File No.	1010373-001-AC
SIC No.	4911
Expires:	July 1, 2002

## Authorized Representative:

John S. Ellis

## PROJECT AND LOCATION:

Air Construction Permit pursuant to the requirements for the Prevention of Significant Deterioration of Air Quality Permit for: three dual-fuel nominal 170 megawatt (MW) General Electric PG7241FA combustion turbine-electrical generators; one 2.8-million gallon fuel oil storage tank; and three 60-foot stacks. The units will operate in simple cycle mode and intermittent duty. The units will be equipped with Dry Low NO<sub>x</sub> (DLN-2.6) combustors and wet injection capability.

The project will be located East of Hudson and North of SR 52 in unincorporated, Pasco County. UTM coordinates are: Zone 17; 347.0 km E; 3139.0 km N.

## STATEMENT OF BASIS:

This Air Construction permit is issued under the provisions of Chapter 403 of the Florida Statutes (F.S.), and Chapters 62-4, 62-204, 62-210, 62-212, 62-296, and 62-297 of the Florida Administrative Code (F.A.C.). The above named permittee is authorized to modify the facility in accordance with the conditions of this permit and as described in the application, approved drawings, plans, and other documents on file with the Department of Environmental Protection (Department).

Attached Appendices and Tables made a part of this permit:

Appendix BD	BACT Determination
Appendix GC	Construction Permit General Conditions

Howard L. Rhodes, Director  
Division of Air Resources  
Management

# AIR CONSTRUCTION PERMIT PSD-FL-280 (1010373-001-AC)

## SECTION I. FACILITY INFORMATION

### FACILITY DESCRIPTION

This facility is a new site. This permitting action is to install three dual-fuel nominal 170 megawatt (MW) General Electric PG7241FA combustion turbine-electrical generators with three 60-foot stacks and one 2.8-million gallon fuel oil storage tanks. Emissions from the new units will be controlled by Dry Low NO<sub>x</sub> (DLN-2.6) combustors when operating on natural gas and wet injection when firing fuel oil. Inherently clean fuels and good combustion practices will be employed to control all pollutants.

### EMISSION UNITS

This permit addresses the following emission units:

ARMS EMISSIONS UNIT	SYSTEM	EMISSION UNIT DESCRIPTION
001	Power Generation	One nominal 170 Megawatt Gas Simple Cycle Combustion Turbine-Electrical Generator
002	Power Generation	One nominal 170 Megawatt Simple Cycle Gas Combustion Turbine-Electrical Generator
003	Power Generation	One nominal 170 Megawatt Simple Cycle Gas Combustion Turbine-Electrical Generator
004	Fuel Storage	One 2.8 Million Gallon Fuel Oil Storage Tank

### REGULATORY CLASSIFICATION

The facility is classified as a Major or Title V Source of air pollution because emissions of at least one regulated air pollutant, such as particulate matter (PM/PM<sub>10</sub>), sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), carbon monoxide (CO), or volatile organic compounds (VOC) exceeds 100 tons per year (TPY).

This facility is not within an industry included in the list of the 28 Major Facility Categories per Table 212.400-1, F.A.C. Because emissions are greater than 250 TPY for at least one criteria pollutant, the facility is also a Major Facility with respect to Rule 62-212.400, Prevention of Significant Deterioration (PSD). Pursuant to Table 62-212.400-2, modifications at this facility resulting in emissions increases greater than any of the following values require review per the PSD rules as well as a determination of Best Available Control Technology (BACT): 40 TPY of NO<sub>x</sub>, SO<sub>2</sub>, or VOC; 25/15 TPY of PM/PM<sub>10</sub>; 100 TPY of CO; or 7 TPY of sulfuric acid mist (SAM). This facility and the project are also subject to applicable provisions of Title IV, Acid Rain, of the Clean Air Act.

# AIR CONSTRUCTION PERMIT PSD-FL-280 (1010373-001-AC)

## SECTION I. FACILITY INFORMATION

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### PERMIT SCHEDULE

- 12/14/99 Notice of Intent published in The Tampa tribune
- 11/30/99 Distributed Intent to Issue Permit
- 10/26/99 Application deemed complete
- 10/26/99 Received Application

### RELEVANT DOCUMENTS:

The documents listed below are the basis of the permit. They are specifically related to this permitting action, but not all are incorporated into this permit. These documents are on file with the Department.

- Application received on October 26, 1999
- Letter from the U.S. Fish and Wildlife Service dated December 16, 1999
- Department's Intent to Issue and Public Notice Package dated November 30, 1999
- Department's Final Determination and Best Available Control Technology Determination issued concurrently with this permit.

# AIR CONSTRUCTION PERMIT PSD-FL-280 (1010373-001-AC)

## SECTION II. ADMINISTRATIVE REQUIREMENTS

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1. Regulating Agencies: All documents related to applications for permits to construct, operate or modify an emissions unit should be submitted to the Bureau of Air Regulation (BAR), Florida Department of Environmental Protection (FDEP), at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400 and phone number (850) 488-0114. All documents related to reports, tests, and notifications should be submitted to the DEP Southwest District office, 3804 Coconut Palm Drive, Tampa, Florida 33619-8218 and phone number 813/744-6100.
2. General Conditions: The owner and operator is subject to and shall operate under the attached General Permit Conditions G.1 through G.15 listed in Appendix GC of this permit. General Permit Conditions are binding and enforceable pursuant to Chapter 403 of the Florida Statutes. [Rule 62-4.160, F.A.C.]
3. Terminology: The terms used in this permit have specific meanings as defined in the corresponding chapters of the Florida Administrative Code.
4. Forms and Application Procedures: The permittee shall use the applicable forms listed in Rule 62-210.900, F.A.C. and follow the application procedures in Chapter 62-4, F.A.C. [Rule 62-210.900, F.A.C.]
5. 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. [Chapters 62-210 and 62-212]
6. Expiration: Approval to construct shall become invalid if construction is not commenced within 18 months after receipt of such approval, or if construction is discontinued for a period of 18 months or more, or if construction is not completed within a reasonable time. The Department may extend the 18-month period upon a satisfactory showing that an extension is justified. [40 CFR 52.21(r)(2)].
7. BACT Determination: In accordance with Rule 62-212.400(6)(b), F.A.C. (and 40 CFR 51.156(j)(4)), the Best Available Control Technology (BACT) determination shall be reviewed and modified as appropriate in the event of a plant conversion. This paragraph states: "For phased construction project, the determination of best available control technology shall be reviewed and modified as appropriate at the latest reasonable time which occurs no later than 18 months prior to commencement of construction of each independent phase of the project. At such time, the owner or operator of the applicable stationary source may be required to demonstrate the adequacy of any previous determination of best available control technology for the source." This reassessment will also be conducted for this project if there are any increases in heat input limits, hours of operation, oil firing, low or baseload operation (e.g. conversion to combined-cycle operation) short-term or annual emission limits, annual fuel heat input limits or similar changes. [40 CFR 51.166(j)(4) and Rule 62-212.400(6)(b), F.A.C.]

# AIR CONSTRUCTION PERMIT PSD-FL-280 (1010373-001-AC)

## SECTION II. ADMINISTRATIVE REQUIREMENTS

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8. Application for Title V Permit: An application for a Title V operating permit, pursuant to Chapter 62-213, F.A.C., must be submitted to the DEP's Bureau of Air Regulation, and a copy to the Department's Southwest District office. [Chapter 62-213, F.A.C.]
9. New or Additional Conditions: Pursuant to Rule 62-4.080, F.A.C., for good cause shown and after notice and an administrative hearing, if requested, the Department may require the permittee to conform to new or additional conditions. The Department shall allow the permittee a reasonable time to conform to the new or additional conditions, and on application of the permittee, the Department may grant additional time. [Rule 62-4.080, F.A.C.]
10. Annual Reports: Pursuant to Rule 62-210.370(2), F.A.C., Annual Operation Reports, the permittee is required to submit annual reports on the actual operating rates and emissions from this facility. Annual operating reports shall be sent to the DEP's Southwest District office by March 1st of each year. [Rule 62-210.370(2), F.A.C.]
11. Stack Testing Facilities: Stack sampling facilities shall be installed in accordance with Rule 62-297.310(6), F.A.C.
12. Permit Extension: 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 [Rule 62-4.080, F.A.C.]
13. Quarterly Reports: Quarterly excess emission reports, in accordance with 40 CFR 60.7 (a)(7) (c) (1998 version), shall be submitted to the DEP's Southwest District office. Each excess emission report shall include the information required in 40 CFR 60.7(c) and 60.334.



**SECTION III. EMISSION UNITS SPECIFIC CONDITIONS**

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**APPLICABLE STANDARDS AND REGULATIONS:**

1. Unless otherwise indicated in this permit, the construction and operation of the subject emission unit(s) shall be in accordance with the capacities and specifications stated in the application. The facility is subject to all applicable provisions of Chapter 403, F.S. and Florida Administrative Code Chapters 62-4, 62-103, 62-204, 62-210, 62-212, 62-213, 62-214, 62-296, 62-297; and the applicable requirements of the Code of Federal Regulations Section 40, Parts 60, 72, 73, and 75.
2. Issuance of this permit does not relieve the facility owner or operator from compliance with any applicable federal, state, or local permitting requirements or regulations. [Rule 62-210.300, F.A.C.]
3. These emission units shall comply with all applicable requirements of 40CFR60, Subpart A, General Provisions including:
  - 40CFR60.7, Notification and Recordkeeping
  - 40CFR60.8, Performance Tests
  - 40CFR60.11, Compliance with Standards and Maintenance Requirements
  - 40CFR60.12, Circumvention
  - 40CFR60.13, Monitoring Requirements
  - 40CFR60.19, General Notification and Reporting requirements
4. ARMS Emission Units 001-003, Power Generation, consisting of three 170 megawatt combustion turbines shall comply with all applicable provisions of 40CFR60, Subpart GG, Standards of performance for Stationary Gas Turbines, adopted by reference in Rule 62-204.800(7)(b), F.A.C. The Subpart GG requirement to correct test data to ISO conditions applies. However, such correction is not used for compliance determinations with the BACT standard(s). [Rule 62-204.800(7)(b), F.A.C.]
5. ARMS Emission Unit 004, Fuel Storage, consisting of one 2.8 million gallon distillate fuel oil storage tanks shall comply with all applicable provisions of 40CFR60, Subpart Kb, Standards of Performance for Volatile Organic Liquid Storage Vessels, adopted by reference in Rule 62-204.800, F.A.C. [Rule 62-204.800(7)(b), F.A.C.]
6. All notifications and reports required by the above specific conditions shall be submitted to the DEP's Southwest District.

**GENERAL OPERATION REQUIREMENTS**

7. Fuels: Only pipeline natural gas or maximum 0.05 percent sulfur fuel oil No. 2 or superior grade of distillate fuel oil shall be fired in these units. [Applicant Request, Rule 62-210.200, F.A.C. (Definitions - Potential Emissions)] {Note: The limitation of this specific condition is more stringent than the NSPS sulfur dioxide limitation and thus assures compliance with 40 CFR 60.333 and 60.334}

## AIR CONSTRUCTION PERMIT PSD-FL-280 (1010373-001-AC)

### SECTION III. EMISSION UNITS SPECIFIC CONDITIONS

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8. Capacity: The maximum heat input rates, based on the lower heating value (LHV) of each fuel to each Unit (1-3) at ambient conditions of 59°F temperature, 60% relative humidity, 100% load, and 14.7 psi pressure shall not exceed 1,612 million Btu per hour (MMBtu/hr) when firing natural gas, nor 1,806 MMBtu/hr when firing No. 2 or superior grade of distillate fuel oil. These maximum heat input rates will vary depending upon ambient conditions and the combustion turbine characteristics. Manufacturer's curves corrected for site conditions or equations for correction to other ambient conditions shall be provided to the Department of Environmental Protection (DEP) within 45 days of completing the initial compliance testing. [Design, Rule 62-210.200, F.A.C. (Definitions - Potential Emissions)]
9. Unconfined Particulate Emissions: During the construction period, unconfined particulate matter emissions shall be minimized by dust suppressing techniques such as covering and/or application of water or chemicals to the affected areas, as necessary. [Rule 62-296.320(4)(c), F.A.C.]
10. Plant Operation - Problems: If temporarily unable to comply with any of the conditions of the permit due to breakdown of equipment or destruction by fire, wind or other cause, the owner or operator shall notify the DEP Southwest District as soon as possible, but at least within (1) working day, excluding weekends and holidays. The notification shall include: pertinent information as to the cause of the problem; the steps being taken to correct the problem and prevent future recurrence; and where applicable, the owner's intent toward reconstruction of destroyed facilities. Such notification does not release the permittee from any liability for failure to comply with the conditions of this permit and the regulations. [Rule 62-4.130, F.A.C.]
11. Operating Procedures: Operating procedures shall include good operating practices and proper training of all operators and supervisors. The good operating practices shall meet the guidelines and procedures as established by the equipment manufacturers. All operators (including supervisors) of air pollution control devices shall be properly trained in plant specific equipment. [Rule 62-4.070(3), F.A.C.]
12. Circumvention: The owner or operator shall not circumvent the air pollution control equipment or allow the emission of air pollutants without this equipment operating properly. [Rules 62-210.650, F.A.C.]
13. Maximum allowable hours: The stationary gas turbines shall only operate up to 3,390 hours per unit including up to 1000 hours on fuel oil during any calendar year. No single combustion turbine shall operate more than 5,000 hours in a single year. [Applicant Request, Rule 62-210.200, F.A.C. (Definitions - Potential Emissions), Rule 62-212.400, F.A.C. (BACT)]
14. Fuel oil usage: The amount of back-up fuel (fuel oil) burned at the site (in BTU's) shall not exceed the amount of natural gas (primary fuel) burned at the site (in BTU's) during any consecutive 12-month period [Rule 62-210.200, F.A.C. (BACT)]

AIR CONSTRUCTION PERMIT PSD-FL-280 (1010373-001-AC)

**SECTION III. EMISSION UNITS SPECIFIC CONDITIONS**

**Control Technology**

15. Dry Low NO<sub>x</sub> (DLN-2.6) combustors shall be installed on the stationary combustion turbine to control nitrogen oxides (NO<sub>x</sub>) emissions while firing natural gas. [Design, Rules 62-4.070 and 62-212.400, F.A.C. (BACT)]
16. A water injection (WI) system shall be installed for use when firing No. 2 or superior grade distillate fuel oil for control of NO<sub>x</sub> emissions. [Design, Rules 62-4.070 and 62-212.400, F.A.C. (BACT)]
17. The permittee shall provide manufacturer's emissions performance versus load diagrams for the DLN and wet injection systems prior to their installation. DLN systems shall each be tuned upon initial operation to optimize emissions reductions consistent with normal operation and maintenance practices and shall be maintained to minimize NO<sub>x</sub> emissions and CO emissions, consistent with normal operation and maintenance practices. Operation of the DLN systems in the diffusion-firing mode shall be minimized when firing natural gas. [Rule 62-4.070 and 62-210.650 F.A.C.]

**EMISSION LIMITS AND STANDARDS**

18. Following is a summary of the emission limits and required technology. Values for NO<sub>x</sub> are corrected to 15 % O<sub>2</sub> on a dry basis. These limits or their equivalent in terms of lb/hr or NSPS units, as well as the applicable averaging times, are followed by the applicable specific conditions [Rules 62-212.400, 62-204.800(7)(b) (Subpart GG), 62-210.200 (Definitions-Potential Emissions) F.A.C.]

POLLUTANT	CONTROL TECHNOLOGY	EMISSION LIMIT
PM/PM <sub>10</sub> , VE	Pipeline Natural Gas Good Combustion	10/17 lb/hr (Gas/Fuel Oil) 10 Percent Opacity (Gas or Fuel Oil)
VOC (not PSD)	As Above	1.4 ppmvd (Gas) 7 ppmvw (Fuel Oil)
CO	As Above	12 ppmvd (Gas) 20 ppmvd (Fuel Oil)
SO <sub>2</sub> and Sulfuric Acid Mist	Pipeline Natural Gas Low Sulfur Fuel Oil	1 gr S/100 ft <sup>3</sup> (in Gas) 0.05% S (in Fuel Oil)
NO <sub>x</sub>	Dry Low NO <sub>x</sub> for Natural Gas Wet Injection and limited Fuel Oil usage	9 ppmvd (Gas) 42 ppmvd (Fuel Oil)

19. Nitrogen Oxides (NO<sub>x</sub>) Emissions:

- While firing Natural Gas: The emission rate of NO<sub>x</sub> in the exhaust gas shall not exceed 9 ppmvd @15% O<sub>2</sub> on a 24 hr block average (of valid hours during which the unit is operated only) as measured by the continuous emission monitoring system (CEMS). Refer to Condition 30 for valid hours contributing to the block average.

# AIR CONSTRUCTION PERMIT PSD-FL-280 (1010373-001-AC)

## SECTION III. EMISSION UNITS SPECIFIC CONDITIONS

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In addition, NO<sub>x</sub> emissions calculated as NO<sub>2</sub> shall not exceed 64.1 pounds per hour (at ISO conditions) and 9 ppmvd @15% O<sub>2</sub> to be demonstrated by the initial "new and clean" GE performance stack test. [Rule 62-212.400, F.A.C.]

- While firing Fuel Oil: The concentration of NO<sub>x</sub> in the exhaust gas shall not exceed 42 ppmvd at 15% O<sub>2</sub> on the basis of a 3-hr average (of valid hour hours during which the unit is actually operated only) as measured by the continuous emission monitoring system (CEMS). In addition, NO<sub>x</sub> emissions calculated as NO<sub>2</sub> shall not exceed 351 lb/hr (at ISO conditions) and 42 ppmvd @15% O<sub>2</sub> to be demonstrated by stack test. [Rule 62-212.400, F.A.C.]

The permittee shall develop a NO<sub>x</sub> reduction plan when the hours of oil firing reach the allowable limit of 1000 hours per year. This plan shall include a testing protocol designed to establish the maximum water injection rate and the lowest NO<sub>x</sub> emissions possible without affecting the actual performance of the gas turbine. The testing protocol shall set a range of water injection rates and attempt to quantify the corresponding NO<sub>x</sub> emissions for each rate and noting any problems with performance. Based on the test results, the plan shall recommend a new NO<sub>x</sub> emissions limiting standard and shall be submitted to the Department's Bureau of Air Regulation and Compliance Authority for review. If the Department determines that a lower NO<sub>x</sub> emissions standard is warranted for oil firing, this permit shall be revised. (BACT Determination).

20. Carbon Monoxide (CO) Emissions: The concentration of CO in the stack exhaust gas shall exceed neither 12 ppmvd and 42.5 lb/hr (at ISO conditions) while firing gas and neither 20 ppmvd and 71.4 lb/hr (at ISO conditions). The permittee shall demonstrate compliance with these limits by stack test using EPA Method 10. [Rule 62-212.400, F.A.C.]
21. Volatile Organic Compounds (VOC) Emissions: The concentration of VOC in the stack exhaust gas with the combustion turbine operating on natural gas shall exceed neither 1.4 ppmvd nor 2.8 lb/hr (ISO conditions) and neither 7 ppmvw nor 16.2 lb/hr (ISO conditions) while operating on oil to be demonstrated by initial stack test using EPA Method 18, 25 or 25A. [Applicant Request to Avoid PSD, Rule 62-212.400, F.A.C.]
22. Sulfur Dioxide (SO<sub>2</sub>) Emissions: SO<sub>2</sub> emissions shall be limited by firing pipeline natural gas (sulfur content less than 1 grain per 100 standard cubic foot) or by firing No. 2 or superior grade distillate fuel oil with a maximum 0.05 percent sulfur for 1000 hours per year per unit. Emissions of SO<sub>2</sub> (at ISO conditions) shall not exceed 5 lb/hr (natural gas) and 98.7 lb/hr (fuel oil) as measured by applicable compliance methods described below. [40CFR60 Subpart GG and Rules 62-4.070, 62-212.400, and 62-204.800(7), F.A.C.]
23. Particulate Matter (PM/PM<sub>10</sub>): PM/PM<sub>10</sub> emissions shall not exceed 10 lb/hr when operating on natural gas and shall not exceed 17 lb/hr when operating on fuel oil. Visible emissions testing shall serve as a surrogate for PM/PM<sub>10</sub> compliance testing. [Rule 62-212.400, F.A.C.]
24. Visible Emissions (VE): VE emissions shall serve as a surrogate for PM/PM<sub>10</sub> emissions and shall not exceed 10 opacity. Rules 62-4.070, 62-212.400, and 62-204.800(7), F.A.C.]

## AIR CONSTRUCTION PERMIT PSD-FL-280 (1010373-001-AC)

### SECTION III. EMISSION UNITS SPECIFIC CONDITIONS

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#### EXCESS EMISSIONS

25. Excess emissions resulting from startup, shutdown, or malfunction shall be permitted provided that best operational practices are adhered to and the duration of excess emissions shall be minimized. Excess emissions occurrences shall in no case exceed two hours in any 24-hour period for other reasons unless specifically authorized by DEP for longer duration. Operation below 50% output shall be limited to 2 hours per unit cycle (breaker closed to breaker open).
26. Excess emissions entirely or in part by poor maintenance, poor operation, or any other equipment or process failure that may reasonably be prevented during startup, shutdown or malfunction, shall be prohibited pursuant to Rule 62-210.700, F.A.C. These emissions shall be included in the 24-hr average for NO<sub>x</sub>.
27. Excess Emissions Report: If excess emissions occur due to malfunction, the owner or operator shall notify DEP's Southwest District within (1) working day of: the nature, extent, and duration of the excess emissions; the cause of the excess emissions; and the actions taken to correct the problem. In addition, the Department may request a written summary report of the incident. Following the NSPS format, 40 CFR 60.7 Subpart A, periods of startup, shutdown, malfunction, shall be monitored, recorded, and reported as excess emissions when emission levels exceed the permitted standards listed in Specific Condition No. 18 and 19. [Rules 62-4.130, 62-204.800, 62-210.700(6), F.A.C., and 40 CFR 60.7 (1998 version)].

#### COMPLIANCE DETERMINATION

28. Compliance with the allowable emission limiting standards shall be determined within 60 days after achieving the maximum production rate, but not later than 180 days of initial operation of the unit, and annually thereafter as indicated in this permit, by using the following reference methods as described in 40 CFR 60, Appendix A (1998 version), and adopted by reference in Chapter 62-204.800, F.A.C.
29. Initial (I) performance tests (for both fuels) shall be performed on each unit while firing natural gas as well as while firing oil. Initial tests shall also be conducted after any modifications (and shake down period not to exceed 100 days after re-starting the CT) of air pollution control equipment such as change or tuning of combustors. Annual (A) compliance tests shall be performed during every federal fiscal year (October 1 - September 30) pursuant to Rule 62-297.310(7), F.A.C., on each unit as indicated. The following reference methods shall be used. No other test methods may be used for compliance testing unless prior DEP approval is received in writing.
  - EPA Reference Method 9, "Visual Determination of the Opacity of Emissions from Stationary Sources" (I, A).
  - EPA Reference Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources" (I, A).

# AIR CONSTRUCTION PERMIT PSD-FL-280 (1010373-001-AC)

## SECTION III. EMISSION UNITS SPECIFIC CONDITIONS

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- EPA Reference Method 20, "Determination of Oxides of Nitrogen Oxide, Sulfur Dioxide and Diluent Emissions from Stationary Gas Turbines." Initial test only for compliance with 40CFR60 Subpart GG and (I, A) short-term NO<sub>x</sub> BACT limits (EPA reference Method-7E, "Determination of Nitrogen Oxides Emissions from Stationary Sources" or RATA test data may be used to demonstrate compliance for annual test requirements).
  - EPA Reference Method 18, 25 and/or 25A, "Determination of Volatile Organic Concentrations." Initial test only.
30. Continuous compliance with the NO<sub>x</sub> emission limits: Continuous compliance with the NO<sub>x</sub> emission limits shall be demonstrated with the CEM system based on the applicable averaging time of 24-hr block average (DLN). Based on CEMS data, a separate compliance determination is conducted at the end of each operating day and a new average emission rate is calculated from the arithmetic average of all valid hourly emission rates from the previous operating day. A valid hourly emission rate shall be calculated for each hour in which at least two NO<sub>x</sub> concentrations are obtained at least 15 minutes apart. Valid hourly emission rates shall not include periods of start up, shutdown, or malfunction unless prohibited by 62-210.700 F.A.C. These excess emissions periods shall be reported as required in Conditions 25 and 26. [Rules 62-4.070 F.A.C., 62-210.700, F.A.C., 40 CFR 75 and BACT]
- All continuous monitoring systems (CEMS) shall be in continuous operation except for breakdowns, repairs, calibration checks, and zero and span adjustments. These CEMS shall meet minimum frequency of operation requirements: one cycle of operation (sampling, analyzing, and data recording) for each successive 15-minute period. Data recorded during periods of continuous monitoring system breakdowns, repairs, calibration checks, and zero and span adjustments shall not be included in the data average. [40CFR60.13]
31. Compliance with the SO<sub>2</sub> and PM/PM<sub>10</sub> emission limits: Notwithstanding the requirements of Rule 62-297.340, F.A.C., the use of pipeline natural gas, is the method for determining compliance for SO<sub>2</sub> and PM<sub>10</sub>. For the purposes of demonstrating compliance with the 40 CFR 60.333 SO<sub>2</sub> standard, ASTM methods D4084-82 or D3246-81 (or equivalent) for sulfur content of gaseous fuel shall be utilized in accordance with the EPA-approved custom fuel monitoring schedule or natural gas supplier data may be submitted or the natural gas sulfur content referenced in 40 CFR 75 Appendix D may be utilized. However, the applicant is responsible for ensuring that the procedures in 40 CFR60.335 or 40 CFR75 are used when determination of fuel sulfur content is made. Analysis may be performed by the owner or operator, a service contractor retained by the owner or operator, the fuel vendor, or any other qualified agency pursuant to 40 CFR 60.335(e) (1998 version).

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32. Compliance with CO emission limit: An initial test for CO shall be conducted concurrently with the initial NO<sub>x</sub> test, as required. The initial NO<sub>x</sub> and CO test results shall be the average of three valid one-hour runs. Annual compliance testing for CO may be conducted at less than capacity when compliance testing is conducted concurrent with the annual RATA testing for the NO<sub>x</sub> CEMS required pursuant to 40 CFR 75
33. Compliance with the VOC emission limit: An initial test is required to demonstrate compliance with the VOC emission limit. Thereafter, the CO emission limit and periodic tuning data will be employed as surrogate and no annual testing is required.
34. Testing procedures: Testing of emissions shall be conducted with the combustion turbine operating at permitted capacity. Permitted capacity is defined as 90-100 percent of the maximum heat input rate allowed by the permit, corrected for the average ambient air temperature during the test (with 100 percent represented by a curve depicting heat input vs. ambient temperature). If it is impracticable to test at permitted capacity, the source may be tested at less than permitted capacity. In this case, subsequent operation is limited by adjusting the entire heat input vs. ambient temperature curve downward by an increment equal to the difference between the maximum permitted heat input (corrected for ambient temperature) and 110 percent of the value reached during the test until a new test is conducted. Once the unit is so limited, operation at higher capacities is allowed for no more than 15 consecutive days for the purposes of additional compliance testing to regain the permitted capacity. Procedures for these tests shall meet all applicable requirements (i.e., testing time frequency, minimum compliance duration, etc.) of Chapters 62-204 and 62-297, F.A.C.
35. Test Notification: The DEP's Southwest District shall be notified, in writing, at least 30 days prior to the initial performance tests and at least 15 days before annual compliance test(s).
36. Special Compliance Tests: The DEP may request a special compliance test pursuant to Rule 62-297.310(7), F.A.C., when, after investigation (such as complaints, increased visible emissions, or questionable maintenance of control equipment), there is reason to believe that any applicable emission standard is being violated.
37. Test Results: Compliance test results shall be submitted to the DEP's Southwest District no later than 45 days after completion of the last test run. [Rule 62-297.310(8), F.A.C.]

### NOTIFICATION, REPORTING, AND RECORDKEEPING

38. Records: All measurements, records, and other data required to be maintained by IPSAPC shall be recorded in a permanent form and retained for at least five (5) years following the date on which such measurements, records, or data are recorded. These records shall be made available to DEP representatives upon request.
39. Compliance Test Reports: A test report indicating the results of the required compliance tests shall be filed as per Condition No.36 above. The test report shall provide sufficient detail on the tested emission unit and the procedures used to allow the Department to determine if the test was properly conducted and if the test results were properly computed. At a minimum, the test report shall provide the applicable information listed in Rule 62-297.310(8), F.A.C.

**SECTION III. EMISSION UNITS SPECIFIC CONDITIONS**

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**MONITORING REQUIREMENTS**

40. Continuous Monitoring System: The permittee shall install, calibrate, maintain, and operate a continuous emission monitor in the stack to measure and record the nitrogen oxides emissions from these units. Upon request from EPA or DEP, the CEMS emission rates for NO<sub>x</sub> on these Units shall be corrected to ISO conditions to demonstrate compliance with the NO<sub>x</sub> standard established in 40 CFR 60.332. [Rules 62-204.800, 62-210.700, 62-4.130, 62-4.160(8), F.A.C., 40 CFR 75 and 40 CFR 60.7 (1998 version)].
41. CEMS for reporting excess emissions: Excess Emissions and Monitoring System Performance Reports shall be submitted as specified in 40 CFR 60.7(c). CEM monitor downtime shall be calculated and reported according to the requirements of 40 CFR 60.7(c)(3) and 40 CFR 60.7(d)(2). Periods when NO<sub>x</sub> emissions (ppmv @ 15% oxygen) are above the BACT standards, listed in Specific Conditions No 18 and 19, shall be reported to the DEP Southwest District within one working day (verbally) followed up by a written explanation not later than three (3) working days (alternatively by facsimile within one working day).
42. CEMS in lieu of Water to Fuel Ratio: The NO<sub>x</sub> CEMS shall be used in lieu of the water/fuel monitoring system for reporting excess emissions in accordance with 40 CFR 60.334(c)(1), Subpart GG (1998 version). The calibration of the water/fuel monitoring device required in 40 CFR 60.335 (c)(2) (1998 version) will be replaced by the 40 CFR 75 certification tests of the NO<sub>x</sub> CEMS
43. Continuous Monitoring Certification and Quality Assurance Requirements: The monitoring devices shall comply with the certification and quality assurance, and any other applicable requirements of Rule 62-297.520, F.A.C., 40 CFR 60.13, including certification of each device in accordance with 40 CFR 60, Appendix B, Performance Specifications and 40 CFR 60.7(a)(5) or 40 CFR Part 75. Quality assurance procedures must conform to all applicable sections of 40 CFR 60, Appendix F or 40 CFR 75. The monitoring plan, consisting of data on CEM equipment specifications, manufacturer, type, calibration and maintenance needs, and its proposed location shall be provided to the DEP Emissions Monitoring Section Administrator and EPA for review no later than 45 days prior to the first scheduled certification test pursuant to 40 CFR 75.62.
44. Natural Gas Monitoring Schedule: A custom fuel monitoring schedule pursuant to 40 CFR 75 Appendix D for natural gas may be used in lieu of the daily sampling requirements of 40 CFR 60.334 (b)(2) provided the following requirements are met:
- The permittee shall apply for an Acid Rain permit within the deadlines specified in 40 CFR 72.30.
  - The permittee shall submit a monitoring plan, certified by signature of the Designated Representative, that commits to using a primary fuel of pipeline supplied natural gas (sulfur content less than 20 gr/100 scf pursuant to 40 CFR 75.11(d)(2)).
  - Each unit shall be monitored for SO<sub>2</sub> emissions using methods consistent with the requirements of 40 CFR 75 and certified by the USEPA.



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**SECTION III. EMISSION UNITS SPECIFIC CONDITIONS**

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This custom fuel monitoring schedule will only be valid when pipeline natural gas is used as a primary fuel. If the primary fuel for these units is changed to a higher sulfur fuel, SO<sub>2</sub> emissions must be accounted for as required pursuant to 40 CFR 75.11(d).

45. Fuel Oil Monitoring Schedule: The following monitoring schedule for No. 2 or superior grade fuel oil shall be followed: For all bulk shipments of No. 2 fuel oil received at this facility an analysis which reports the sulfur content and nitrogen content of the fuel shall be provided by the fuel vendor. The analysis shall also specify the methods by which the analyses were conducted and shall comply with the requirements of 40 CFR 60.335(d).
46. Determination of Process Variables:
- The permittee shall operate and maintain equipment and/or instruments necessary to determine process variables, such as process weight input or heat input, when such data is needed in conjunction with emissions data to determine the compliance of the emissions unit with applicable emission limiting standards.
  - Equipment and/or instruments used to directly or indirectly determine such process variables, including devices such as belt scales, weigh hoppers, flow meters, and tank scales, shall be calibrated and adjusted to indicate the true value of the parameter being measured with sufficient accuracy to allow the applicable process variable to be determined within 10% of its true value [Rule 62-297.310(5), F.A.C]

**APPENDIX BD**  
**BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION (BACT)**

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**Shady Hills Generating Station**  
**PSD-FL-280 and 1010373-001-AC**  
**Pasco County, Florida**

**BACKGROUND**

The applicant, IPS Avon Park Corporation (IPSAPC) proposes to install three nominal 170-megawatt (MW) General Electric PG 7241 FA combustion turbine-electrical generators at the planned Shady Hills Generating Station, East of Hudson in unincorporated Pasco County. The proposed project will constitute a New Major Facility per Rule 62-212.400(d)2.a., Florida Administrative Code (F.A.C.), because it will have the potential to emit at least 250 tons per year of a regulated pollutant. It is therefore subject to review for the Prevention of Significant Deterioration (PSD) and a determination of Best Available Control Technology (BACT) per Rule 62-212.400, F.A.C. Emissions of particulate matter (PM and PM<sub>10</sub>), carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), volatile organic compounds (VOC), sulfur dioxide (SO<sub>2</sub>), and sulfuric acid mist (SAM) will exceed the "Significant Emission Rates" with respect to Table 212.400-2, (F.A.C.). PSD and BACT reviews are required for each of these pollutants.

The new units will operate in simple cycle mode and intermittent duty and exhaust through separate 60-foot stacks. IPSAPC proposes to operate these units up to 3,390 hours per year per unit of which 1000 hr/yr/unit may be on maximum 0.05 percent sulfur distillate fuel oil. Descriptions of the process, project, air quality effects, and rule applicability are given in the Technical Evaluation and Preliminary Determination dated November 30, 1999, accompanying the Department's Intent to Issue.

**DATE OF RECEIPT OF A BACT APPLICATION:**

The application was received on October 26, 1999 and included a proposed BACT proposal prepared by the applicant's consultant, Golder Associates.

**REVIEW GROUP MEMBERS:**

A. A. Linero, P.E.

**BACT DETERMINATION REQUESTED BY THE APPLICANT:**

POLLUTANT	CONTROL TECHNOLOGY	PROPOSED BACT LIMIT
Nitrogen Oxides	Dry Low NO <sub>x</sub> Combustors Water Injection (Oil)	9 ppmvd @ 15% O <sub>2</sub> (gas) 42 ppmvd @ 15% O <sub>2</sub> (oil)
Particulate Matter	Pipeline Natural Gas No. 2 Distillate Oil (1000 hr/yr) Combustion Controls	10 pounds per hour (gas) 17 pounds per hour (oil)
Carbon Monoxide	As Above	12 ppmvd (gas, baseload) 20 ppmvd (oil baseload)
Sulfur Dioxide/Sulfuric Acid Mist	As Above	1 grain S/100 std cubic feet (gas) 0.05 percent sulfur (oil)

According to the application, the maximum emissions from the facility will be approximately 756 tons per year (TPY) of NO<sub>x</sub>, 259 TPY of CO, 61 TPY of PM/PM<sub>10</sub>, 166 TPY of SO<sub>2</sub>, 25 TPY of SAM, and 34 TPY of VOC.

**APPENDIX BD**  
**BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION (BACT)**

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**BACT DETERMINATION PROCEDURE:**

In accordance with Rule 62-212.400, F.A.C., this BACT determination is based on the maximum degree of reduction of each pollutant emitted which the Department of Environmental Protection (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:

- Any Environmental Protection Agency determination of BACT 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.
- All scientific, engineering, and technical material and other information available to the Department.
- The emission limiting standards or BACT determination of any other state.
- 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 unit in question, the most stringent control available for a similar or identical emission unit or emission unit category. If it is shown that this level of control is technically or economically unfeasible for the emission unit 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.

**STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES:**

The minimum basis for a BACT determination is 40 CFR 60, Subpart GG, Standards of Performance for Stationary Gas Turbines (NSPS). The Department adopted subpart GG by reference in Rule 62-204.800, F.A.C. The key emission limits required by Subpart GG are 75 ppmvd NO<sub>x</sub> @ 15% O<sub>2</sub> (assuming 25 percent efficiency) and 150 ppmvd SO<sub>2</sub> @ 15% O<sub>2</sub> (or <0.8% sulfur in fuel). The BACT proposed by IPSAPC is within the NSPS limit, which allows NO<sub>x</sub> emissions in the range of 110 ppmvd for the high efficiency units to be purchased for the Shady Hills Station.

No National Emission Standard for Hazardous Air Pollutants exists for stationary gas turbines.

**DETERMINATIONS BY EPA AND STATES:**

The following table is based primarily on "F" Class intermittent-duty simple cycle turbines recently permitted or still under review. One project (PREPA) based on smaller units but permitted to operate continuously is included as an example of a simple cycle unit with add-on control equipment. Another continuous-duty project (Lakeland) based on the larger "G" Class is also included. The proposed IPSAPC Shady Hills Station is included to facilitate comparison.

**APPENDIX BD**  
**BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION (BACT)**

Project Location	Power Output (MW)	NO <sub>x</sub> Limit ppmvd @ 15% O <sub>2</sub> and Fuel	Technology	Comments
Shady Hills Pasco, FL	510	9 - NG 42 - No. 2 FO	DLN WI	3x170 MW GE PG7241FA CTs Application 10/99. 1000 hrs on oil
Vandolah Hardee, FL	680	9 - NG 42 - No. 2 FO	DLN WI	4x170 MW GE PG7241FA CTs Issued 11/99. 1000 hrs on oil
Oleander Brevard, FL	850	9 - NG 42 - No. 2 FO	DLN WI	5x170 MW GE PG7241FA CTs Issued 11/99. 1000 hrs on oil
JEA Baldwin, FL	510	10.5 - NG 42 - No. 2 FO	DLN WI	3x170 MW GE MS7241FA CTs Issued 10/99. 750 hrs on oil
Reliant Osceola, FL	510	10.5 - NG 42 - No. 2 FO	DLN WI	3x170 MW GE MS7241FA CTs Draft 11/99. 750 hrs on oil
TEC Polk Power, FL	330	10.5 - NG 42 - No. 2 F.O.	DLN WI	2x165 MW GE MS7241FA CTs Issued 10/99. 750 hrs on oil
Dynegy, FL	510	15 - NG	DLN	3x170 MW WH 501F CTs Application 10/99. Gas only
Dynegy Heard, GA	510	15 - NG	DLN	3x170 MW WH 501F CTs Application. Gas only
Tenaska Heard, GA	960	15 - NG 42 - No. 2 FO	DLN WI	6x170 MW GE PG7241FA CTs Issued 12/98. 720 hrs on oil
Thomaston, GA	680	15 - NG 42 - No. 2 FO	DLN WI	4x170 MW GE PG7241FA CTs Application. 1687 hrs on oil
Dynegy Reidsville, NC	900	15 - NG (by 2002) 42 - No. 2 FO	DLN WI	5x180 MW WH 501F CTs Initially 25 ppm NO <sub>x</sub> limit on gas Draft 5/98. 1000 hrs on oil.
Lyondell Harris, TX	160	25 - NG	DLN	1x160 MW WH 501F CTs Issued 11/99. Gas only
Southern Energy, WI	525	15/12 - NG 42 - No. 2 FO	DLN WI	3x175 MW GE PG7241FA CTs 15/12 ppm are on 1/24 hr basis Issued 1/99. 800 hrs on oil
RockGen Cristiana, WI	525	15/12 - NG 42 - No. 2 FO	DLN WI	3x175 MW GE PG7241FA CTs 15/12 ppm are on 1/24 hr basis Issued 1/99. 800 hrs on oil
Lakeland, FL	250 CON	9/9 - NG (by 2002) 42/15 - No. 2 FO	DLN/HSCR WI/HSCR	250 MW WH 501G CT Initially 25 ppm NO <sub>x</sub> limit on gas Issued 7/98. 250 hrs on oil.
PREPA, PR	248 CON	10 - No. 2 FO	WI & HSCR	3x83 MW ABB GT11N CTs Issued 12/95.

CON = Continuous  
 SC = Simple Cycle  
 INT = Intermittent

DLN = Dry Low NO<sub>x</sub> Combustion  
 SCR = Selective Catalytic Reduction  
 HSCR = Hot SCR

FO = Fuel Oil  
 NG = Natural Gas  
 WI = Water or Steam Injection

GE = General Electric  
 WH = Westinghouse  
 ABB = Asea Brown Bovari

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**BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION (BACT)**

Project Location	CO - ppm (or as indicated)	VOC - ppm (or as indicated)	PM - lb/hr (or as indicated)	Technology and Comments
Shady Hills Pasco, FL	12 - NG 20 - FO	1.4 - NG 7 - FO	10 lb/hr - NG 17 lb/hr - FO	Clean Fuels Good Combustion
Vandolah Hardee, FL	12 - NG 20 - FO	1.4 - NG 7 - FO	10 lb/hr - NG 17 lb/hr - FO	Clean Fuels Good Combustion
Oleander Brevard, FL	12 - NG 20 - FO	3 - NG 6 - FO	10% Opacity	Clean Fuels Good Combustion
JEA Baldwin, FL	12 - NG 20 - FO	1.4 - NG/FO Not PSD	9/17 lb/hr - NG/FO 10% Opacity	Clean Fuels Good Combustion
Reliant Osceola, FL	10.5 - NG 20 - FO	2.8 lb/hr - NG 7.5 lb/hr - FO	9 lb/hr - NG 17 lb/hr - FO	Clean Fuels Good Combustion
TEC Polk Power, FL	15 - NG 33 - FO	7 - NG 7 - FO	10% Opacity	Clean Fuels Good Combustion
Dynegy, FL	25 - NG	? - NG	? - NG	Clean Fuels Good Combustion
Dynegy Heard Co., GA	25 - NG	? - NG	? - NG	Clean Fuels Good Combustion
Tenaska Heard Co., GA	15 - NG 20 - FO	? - NG ? - FO	? - NG ? lb/hr - FO	Clean Fuels Good Combustion
Dynegy Reidsville, NC	25 - NG 50 - FO	6 lb/hr - NG 8 lb/hr - FO	6 lb/hr - NG 23 lb/hr - FO	Clean Fuels Good Combustion
Lyondell Harris, TX	25 - NG			Clean Fuels Good Combustion
RockGen Cristiana, WI	12@>50% load - NG 15@>75% 24@<75% - FO	2 - NG 5 - FO	18 lb/hr - NG 44 lb/hr - FO	Clean Fuels Good Combustion
RockGen Cristiana, WI	12@>50% load - NG 15@>75% 24@<75% - FO	2 - NG 5 - FO	18 lb/hr - NG 44 lb/hr - FO	Clean Fuels Good Combustion
Lakeland, FL	25 - NG or 10 by Ox Cat 75 - FO @ 15% O <sub>2</sub>	4 - NG 10 - FO	10% Opacity	Clean Fuels Good Combustion
PREPA, PR	9 - FO @ 15% O <sub>2</sub>	11 - FO @ 15% O <sub>2</sub>	0.0171 gr/dscf	Clean Fuels Good Combustion

**OTHER INFORMATION AVAILABLE TO THE DEPARTMENT:**

Besides the information submitted by the applicant and that mentioned above, other information available to the Department consists of:

- Comments from the Fish and Wildlife Service dated December 27 1999
- DOE website information on Advanced Turbine Systems Project
- Alternative Control Techniques Document - NO<sub>x</sub> Emissions from Stationary Gas Turbines
- General Electric 39th Turbine State-of-the-Art Technology Seminar Proceedings
- GE Guarantee for JEA Brandy Branch Station Project
- GE Combustion Turbine Startup Curves
- Goal Line Environmental Technologies Website - [www.glet.com](http://www.glet.com)
- Catalytica Website - [www.catalytica-inc.com](http://www.catalytica-inc.com)

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**REVIEW OF NITROGEN OXIDES CONTROL TECHNOLOGIES:**

Some of the discussion in this section is based on a 1993 EPA document on Alternative Control Techniques for NO<sub>x</sub> Emissions from Stationary Gas Turbines. Project-specific information is included where applicable.

**Nitrogen Oxides Formation**

Nitrogen oxides form in the gas turbine combustion process as a result of the dissociation of molecular nitrogen and oxygen to their atomic forms and subsequent recombination into seven different oxides of nitrogen. Thermal NO<sub>x</sub> forms in the high temperature area of the gas turbine combustor. Thermal NO<sub>x</sub> increases exponentially with increases in flame temperature and linearly with increases in residence time. Flame temperature is dependent upon the ratio of fuel burned in a flame to the amount of fuel that consumes all of the available oxygen.

By maintaining a low fuel ratio (lean combustion), the flame temperature will be lower, thus reducing the potential for NO<sub>x</sub> formation. Prompt NO<sub>x</sub> is formed in the proximity of the flame front as intermediate combustion products. The contribution of Prompt to overall NO<sub>x</sub> is relatively small in near-stoichiometric combustors and increases for leaner fuel mixtures. This provides a practical limit for NO<sub>x</sub> control by lean combustion.

Fuel NO<sub>x</sub> is formed when fuels containing bound nitrogen are burned. This phenomenon is not important when combusting natural gas. It is not a significant issue for the Shady Hills project because these units will not be continuously operated, but rather will be "peakers". Also, low sulfur fuel oil (which has more fuel-bound nitrogen than natural gas) is proposed to be used for no more than 1000 hours per year (per CT).

Uncontrolled emissions range from about 100 to over 600 parts per million by volume, dry, corrected to 15 percent oxygen (ppmvd @15% O<sub>2</sub>). The Department estimates uncontrolled emissions at approximately 200 ppmvd @15% O<sub>2</sub> for each turbine of the Shady Hills Project. The proposed NO<sub>x</sub> controls will reduce these emissions significantly.

**NO<sub>x</sub> Control Techniques**

**Wet Injection**

Injection of either water or steam directly into the combustor lowers the flame temperature and thereby reduces thermal NO<sub>x</sub> formation. Typical emissions achieved by wet injection are in the range of 15–25 ppmvd when firing gas and 42 ppmvd when firing fuel oil in large combustion turbines. These values often form the basis, particularly in combined cycle turbines, for further reduction to BACT limits by other techniques. Carbon monoxide (CO) and hydrocarbon (HC) emissions are relatively low for most gas turbines. However steam and (more so) water injection may increase emissions of both of these pollutants.

**Combustion Controls**

The excess air in lean combustion cools the flame and reduces the rate of thermal NO<sub>x</sub> formation. Lean premixing of fuel and air prior to combustion can further reduce NO<sub>x</sub> emissions. This is accomplished by minimizing localized fuel-rich pockets (and high temperatures) that can occur when trying to achieve lean mixing within the combustion zones.

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The above principle is depicted in Figure 1 for a General Electric DLN-1 can-annular combustor operating on gas. For ignition, warm-up, and acceleration to approximately 20 percent load, the first stage serves as the complete combustor. Flame is present only in the first stage, which is operated as lean stable combustion will permit. With increasing load, fuel is introduced into the secondary stage, and combustion takes place in both stages. When the load reaches approximately 40 percent, fuel is cut off to the first stage and the flame in this stage is extinguished. The venturi ensures the flame in the second stage cannot propagate upstream to the first stage. When the fuel in the first-stage flame is extinguished (as verified by internal flame detectors), fuel is again introduced into the first stage, which becomes a premixing zone to deliver a lean, unburned, uniform mixture to the second stage. The second stage acts as the complete combustor in this configuration.

To further reduce NO<sub>x</sub> emissions, GE developed the DLN-2.0 (cross section shown in Figure 1) wherein air usage (other than for premixing) was minimized. The venturi and the centerbody assembly were eliminated and each combustor has a single burning zone. So-called "quaternary fuel" is introduced through pegs located on the circumference of the outward combustion casing.

GE has made further improvements in the DLN design. The most recent version is the DLN-2.6 (proposed for the Shady Hills project). The combustor is similar to the DLN-2 with the addition of a sixth (center) fuel nozzle. The emission characteristics of the DLN-2.6 combustor while firing natural gas are given in Figure 2 for a unit tuned to meet a 15 ppmvd NO<sub>x</sub> limit (by volume, dry corrected to at 15 percent oxygen) at JEA's Kennedy Station.

NO<sub>x</sub> concentrations are higher in the exhaust at lower loads because the combustor does not operate in the lean pre-mix mode. Therefore such a combustor emits NO<sub>x</sub> at concentrations of 15 ppmvd at loads between 50 and 100 percent of capacity, but concentrations as high as 100 ppmvd at less than 50 percent of capacity. Note that VOC comprises a very small amount of the "unburned hydrocarbons" which in turn is mostly non-VOC methane.

The combustor can be tuned differently to achieve emissions as low as 9 ppm of NO<sub>x</sub> and 9 ppm of CO. Emissions characteristics by wet injection NO<sub>x</sub> control while firing oil are expected to be similar for the DLN-2.6 as they are for those of the DLN-2.0 shown in Figure 3. Simplified cross sectional views of the totally premixed (while firing natural gas) DLN-2.6 combustor to be installed at the Shady Hills project are shown in Figure 4.

In all but the most recent gas turbine combustor designs, the high temperature combustion gases are cooled to an acceptable temperature with dilution air prior to entering the turbine (expansion) section. The sooner this cooling occurs, the lower the thermal NO<sub>x</sub> formation. Cooling is also required to protect the first stage nozzle. When this is accomplished by air cooling, the air is injected into the component and is ejected into the combustion gas stream, causing a further drop in combustion gas temperature. This, in turn, lowers achievable thermal efficiency for the unit.

Larger units, such as the Westinghouse 501 G or the planned General Electric 7H, use steam in a closed loop system to provide much of the cooling. The fluid is circulated through the internal portion of the nozzle component or around the transition piece between the combustor and the nozzle and does not enter the exhaust stream. Instead it is normally sent back to a steam generator. The difference between flame temperature and firing temperature into the first stage is minimized and higher efficiency is attained.

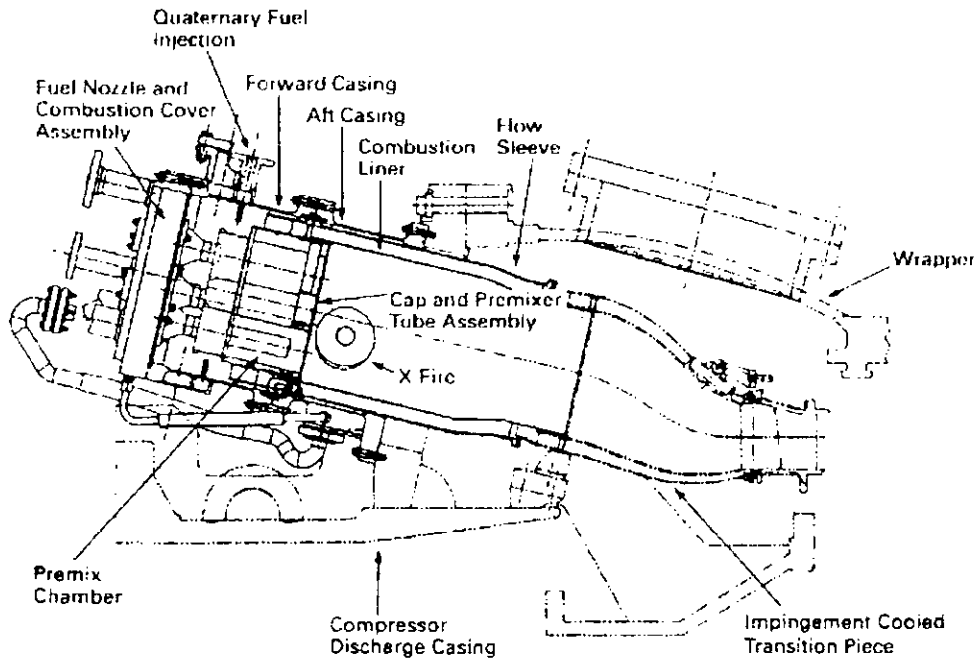
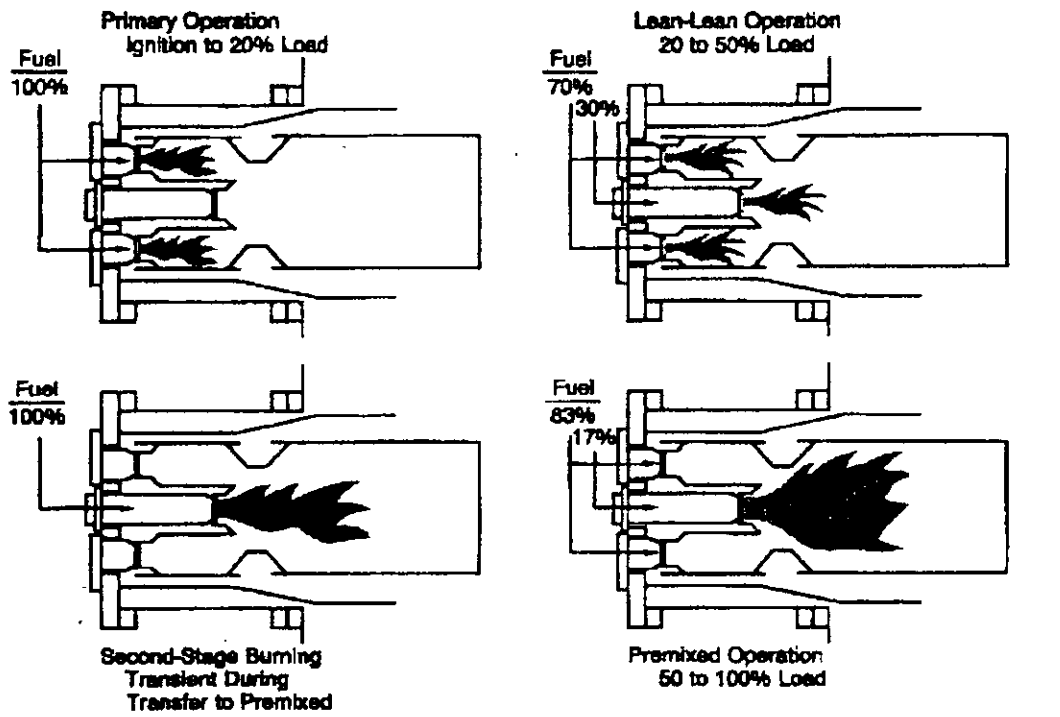


Figure 1 – Dry Low NO<sub>x</sub> Operating Modes – DLN-1  
 Cross Section of GE DLN-2



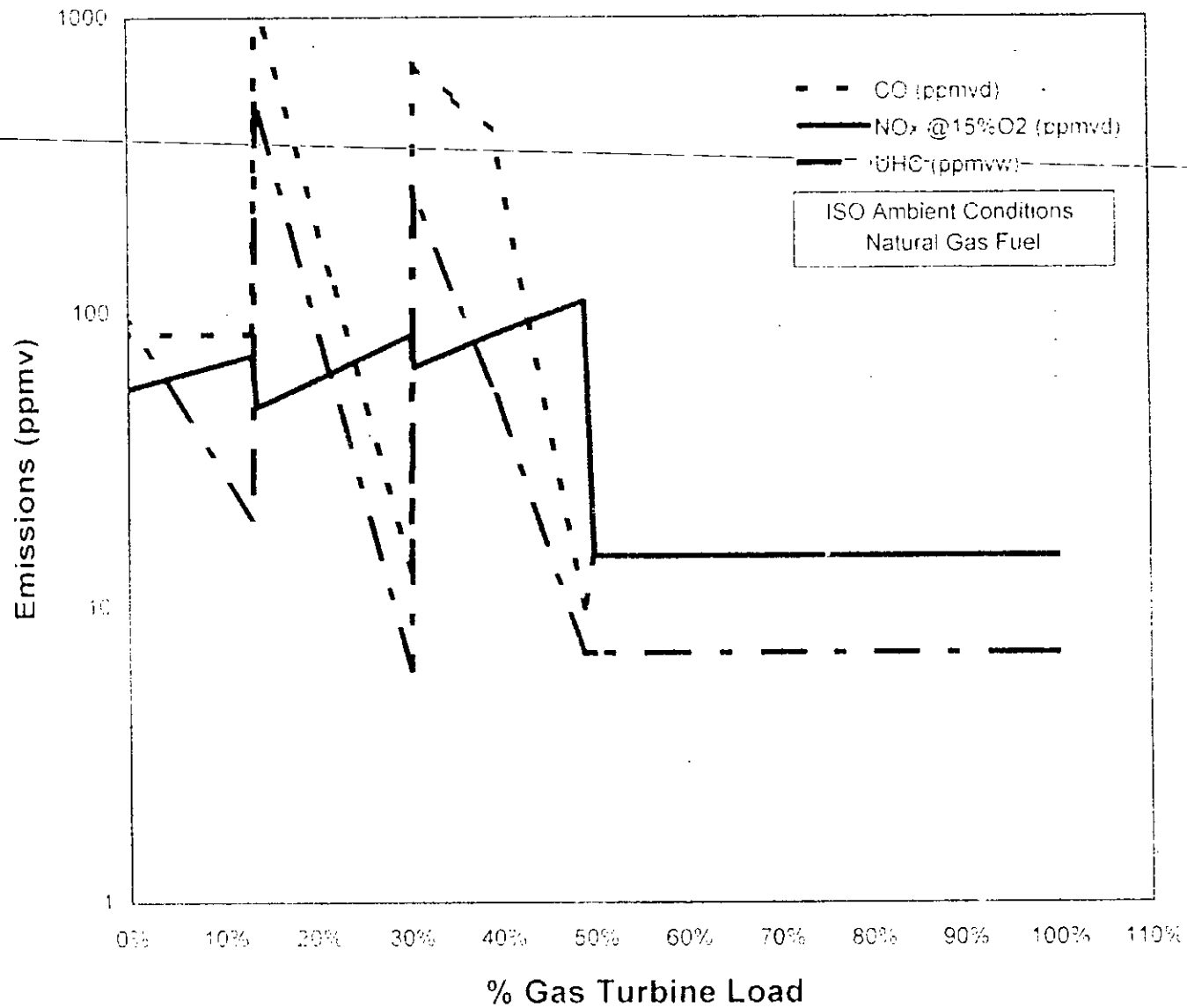


Figure 2 – Emissions Performance Curves for GE DLN-2.6 Combustor  
Firing Natural Gas in a Dual Fuel GE 7FA Combustion Turbine

(Simple Cycle Intermittent Duty – If Tuned to 15 ppmvd NO<sub>x</sub>)

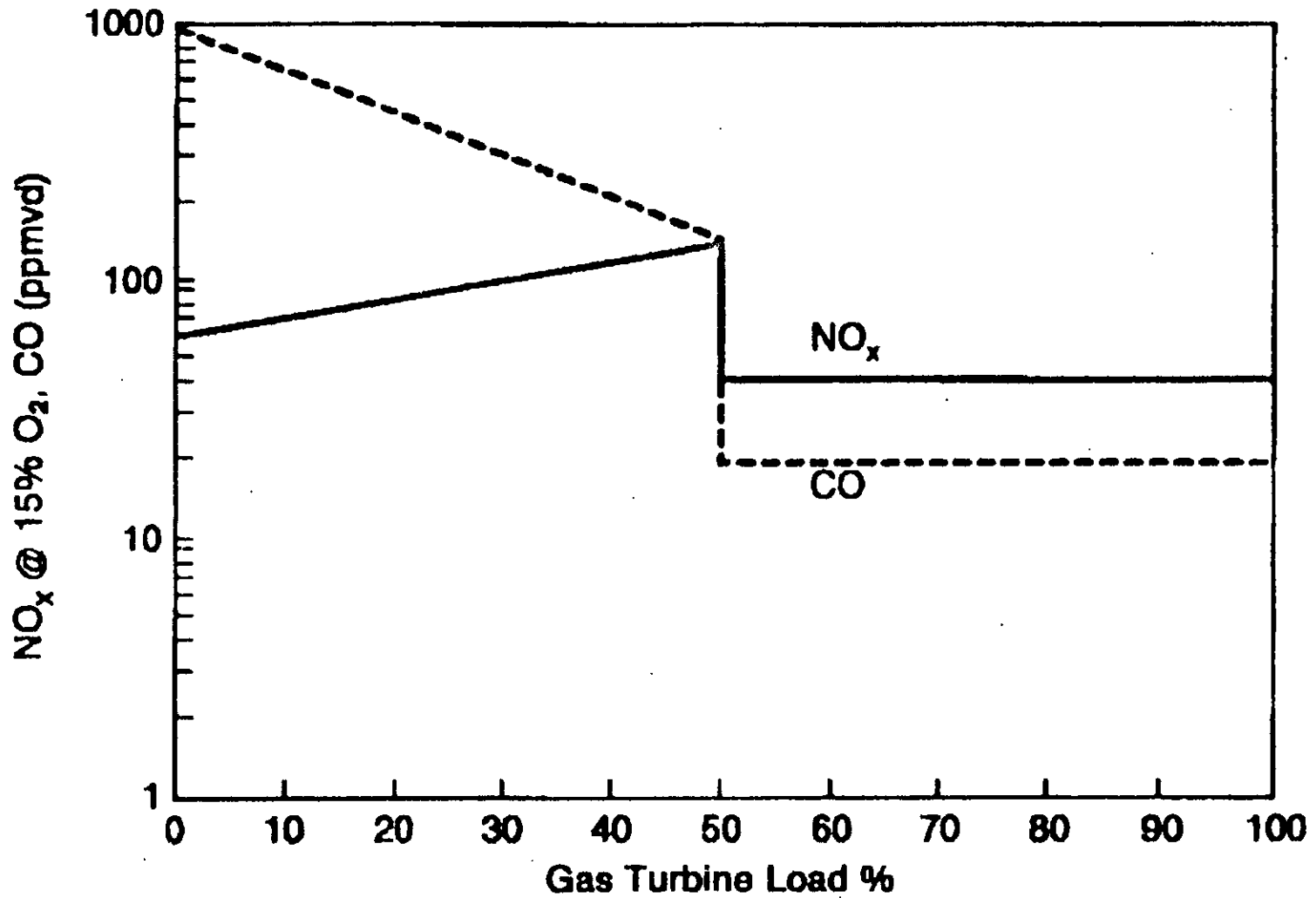
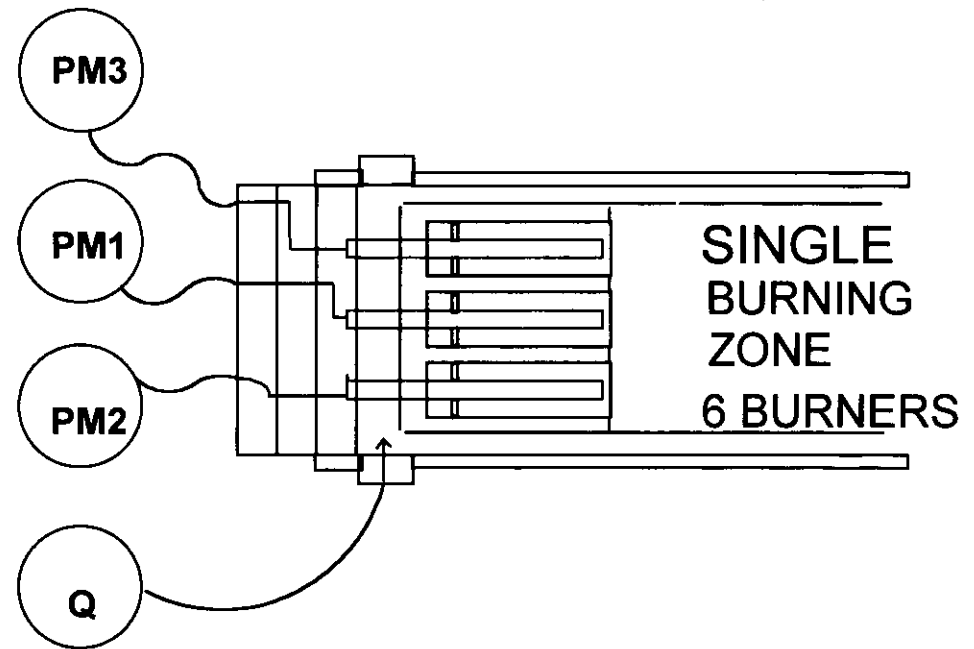
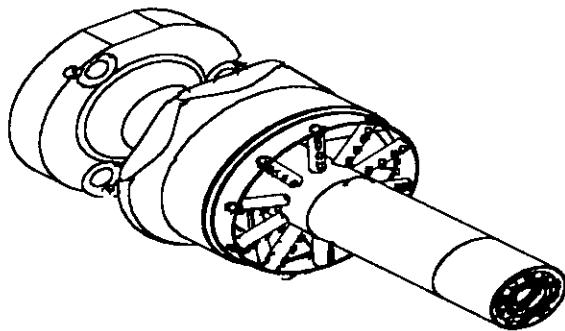
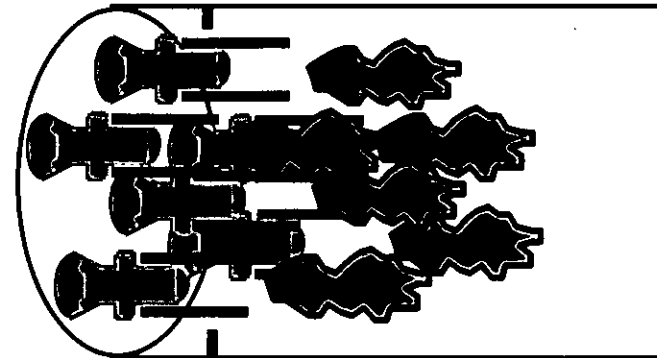
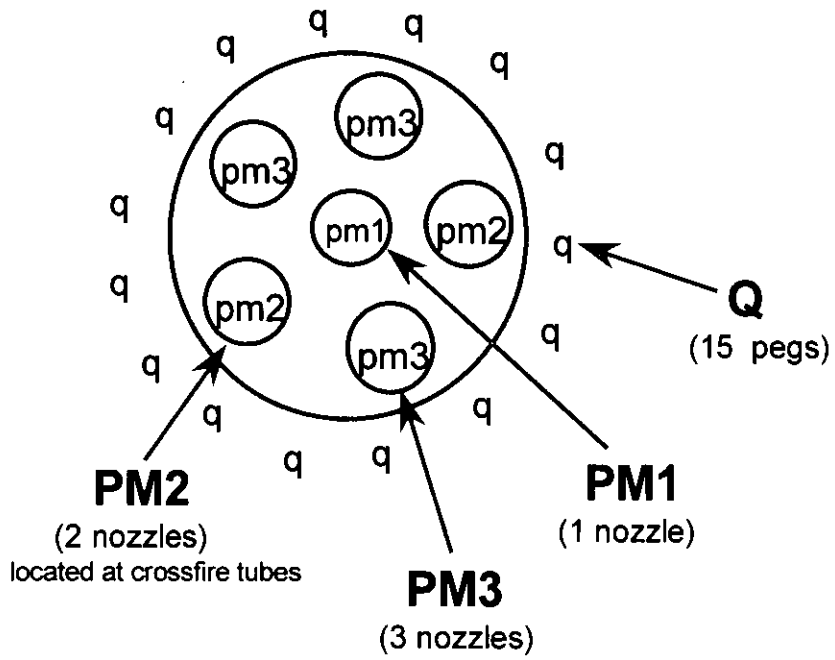


Figure 3 – Emissions Performance for DLN-2 Combustors  
Firing Fuel Oil in Dual Fuel GE 7FA Turbine



**Figure 4 - DLN2.6 Fuel Nozzle Arrangement**

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Another important result of steam cooling is that a higher firing temperature can be attained with no increase in flame temperature. Flame temperatures and NO<sub>x</sub> emissions can therefore be maintained at comparatively low levels even at high firing temperatures. At the same time, thermal efficiency should be greater when employing steam cooling. A similar analysis applies to steam cooling around the transition piece between the combustor and first stage nozzle.

The relationship between flame temperature, firing temperature, unit efficiency, and NO<sub>x</sub> formation can be appreciated from Figure 5 which is from a General Electric discussion on these principles. In addition to employing pre-mixing and steam cooling, further reductions are accomplished through design optimization of the burners, testing, further evaluation, etc.

At the present time, emissions achieved by combustion controls are as low as 9 ppmvd from large gas turbines, such as the GE 7FA line. Specialized dual fuel DLN burners were installed in a project in Israel<sup>1</sup>, but their performance on fuel oil is not known to the Department.

Selective Catalytic Combustion

Selective catalytic reduction (SCR) is an add-on NO<sub>x</sub> control technology that is employed in the exhaust stream following the gas turbine. SCR reduces NO<sub>x</sub> emissions by injecting ammonia into the flue gas in the presence of a catalyst. Ammonia reacts with NO<sub>x</sub> in the presence of a catalyst and excess oxygen yielding molecular nitrogen and water. The catalysts used in combined cycle, low temperature applications (conventional SCR), are usually vanadium or titanium oxide and account for almost all installations. For high temperature applications (Hot SCR up to 1100 °F), such as simple cycle turbines, zeolite catalysts are available but used in few applications to-date. SCR units are typically used in combination with wet injection or DLN combustion controls.

In the past, sulfur was found to poison the catalyst material. Sulfur-resistant catalyst materials are now becoming more available. Catalyst formulation improvements have proven effective in resisting sulfur-induced performance degradation with fuel oil in Europe and Japan, where conventional SCR catalyst life in excess of 4 to 6 years has been achieved, while 8 to 10 years catalyst life has been reported with natural gas.

Excessive ammonia use tends to increase emissions of CO, ammonia (slip) and particulate matter (when sulfur-bearing fuels are used).

As of early 1992, over 100 gas turbine installations already used SCR in the United States. Only one combustion turbine project in Florida (FPC Hines Power Block 1) employs SCR. The equipment was installed on a temporary basis because Westinghouse had not yet demonstrated emissions as low as 12 ppmvd by DLN technology at the time the units were to start up in 1998. Seminole Electric will install SCR on a previously permitted 501F unit at the Hardee Unit 3 project. The reasons are similar to those for the FPC Hines Power Block I.

Permit limits as low as 2.0 to 3.5 ppmvd NO<sub>x</sub> have been specified using SCR on combined cycle F Class projects throughout the country. The recently permitted Kissimmee Cane Island Unit 3 project is one example.<sup>2</sup>

# Gas Turbine - Hot Gas Path Parts

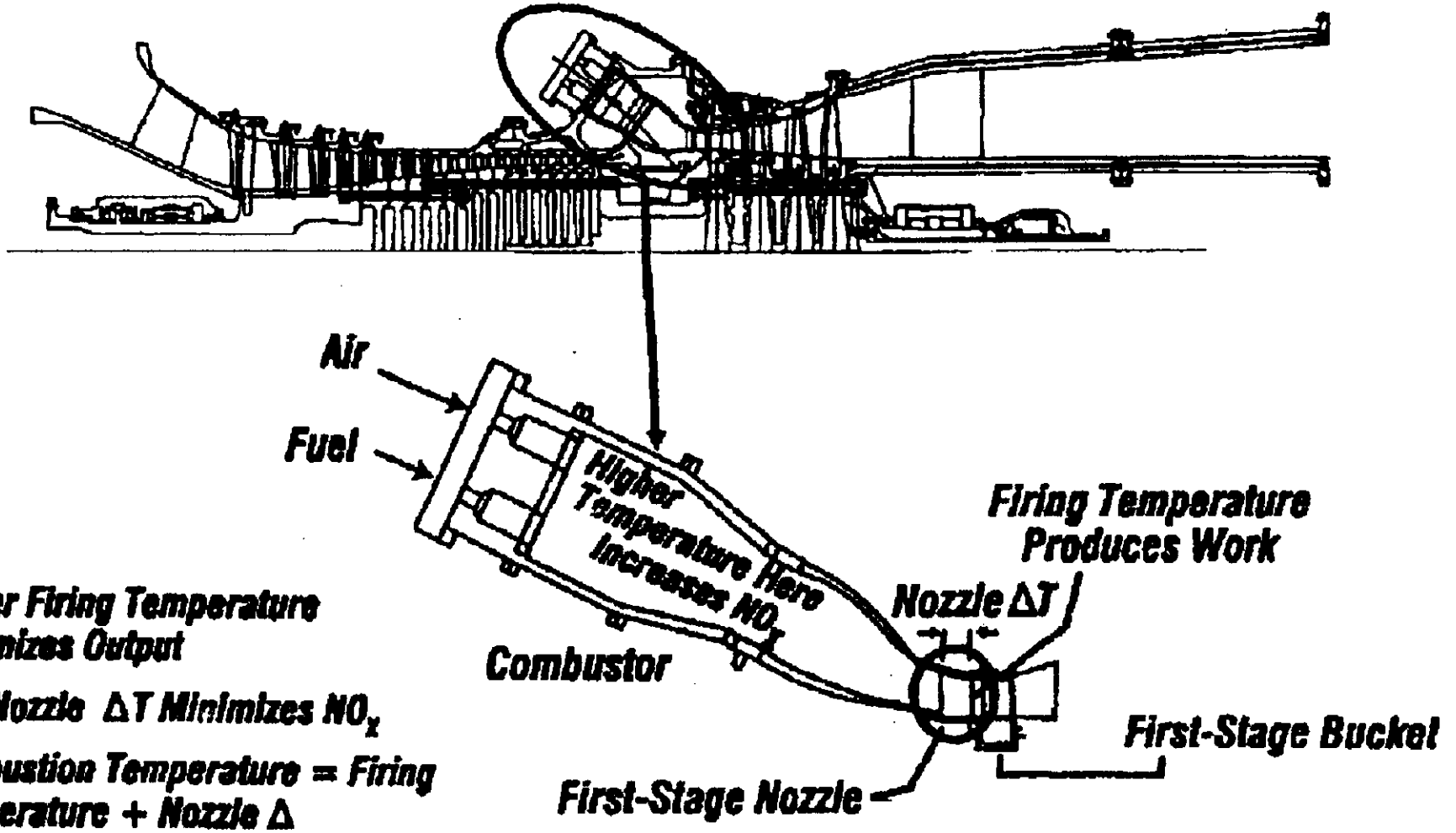


Figure 5 – Relation Between Flame Temperature and Firing Temperature

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Selective Non-Catalytic Combustion

Selective non-catalytic reduction (SNCR) reduction works on the same principle as SCR. The differences are that it is applicable to hotter streams than conventional or hot SCR, no catalyst is required, and urea can be used as a source of ammonia. No applications have been identified wherein SNCR was applied to a gas turbine because the exhaust temperature of 1100 °F is too low to support the NO<sub>x</sub> removal mechanism.

The Department did, however, specify SNCR as one of the available options for the combined cycle Santa Rosa Energy Center. The project will incorporate a large 600 MMBtu/hr duct burner in the heat recovery steam generator (HRSG) and can provide the acceptable temperatures (between 1400 and 2000 °F) and residence times to support the reactions.

Emerging Technologies: SCONO<sub>x</sub><sup>TM</sup> and XONON<sup>TM</sup>

SCONO<sub>x</sub><sup>TM</sup> is a catalytic technology that achieves NO<sub>x</sub> control by oxidizing and then absorbing the pollutant onto a honeycomb structure coated with potassium carbonate. The pollutant is then released as harmless molecular nitrogen during a regeneration cycle that requires dilute hydrogen gas. The technology has been demonstrated on small units in California and has been purchased for a small source in Massachusetts.<sup>3</sup> California regulators and industry sources have stated that the first 250 MW block to install SCONO<sub>x</sub><sup>TM</sup> will be at PG&E's La Paloma Plant near Bakersfield.<sup>4</sup> The overall project includes several more 250 MW blocks with SCR for control.<sup>5</sup> USEPA has identified an "achieved in practice" BACT value of 2.0 ppmvd over a three-hour rolling average based upon the recent performance of a Vernon, California natural gas-fired 32 MW combined cycle turbine equipped with SCONO<sub>x</sub><sup>TM</sup>.

SCONO<sub>x</sub><sup>TM</sup> technology (at 2.0 ppmvd) is considered to represent LAER in non-attainment areas where cost is not a factor in setting an emission limit. It competes with less-expensive SCR in those areas, but has the advantages that it does not cause ammonia emissions in exchange for NO<sub>x</sub> reduction. Advantages of the SCONO<sub>x</sub><sup>TM</sup> process include in addition to the reduction of NO<sub>x</sub>, the elimination of ammonia and the control of VOC and CO emissions. SCONO<sub>x</sub><sup>TM</sup> has not been applied on any major sources in ozone attainment areas.

In a letter dated March 23, 1998 to Goal Line Environmental Technologies, the SCONO<sub>x</sub><sup>TM</sup> process was deemed as technically feasible for maintaining NO<sub>x</sub> emissions at 2 ppmvd on a combined cycle unit. According to a recent press release, the Environmental Segment of ABB Alstom Power is now offering the technology (with performance guarantees) to "all owners and operators of natural gas-fired combined cycle combustion turbines, regardless of size."<sup>6</sup>

SCONO<sub>x</sub> requires a much lower temperature regime that is not available in simple cycle units and is therefore not feasible for this project. Therefore the SCONO<sub>x</sub> system cannot be considered as achievable or demonstrated in practice for this application.

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XONON™, which works by partially burning fuel in a low temperature pre-combustor and completing the combustion in a catalytic combustor. The overall result is low temperature partial combustion (and thus lower NO<sub>x</sub> combustion) followed by flameless catalytic combustion to further attenuate NO<sub>x</sub> formation. The technology has been demonstrated on combustors on the same order of size as SCONOX™ has. XONON™ avoids the emissions of ammonia and the need to generate hydrogen. It is also extremely attractive from a mechanical point of view.

Catalytica Combustion Systems, Inc. develops, manufactures and markets the XONON™ Combustion System. In a press release on October 8, 1998 Catalytica announced the first installation of a gas turbine equipped with the XONON™ Combustion System in a municipally owned utility for the production of electricity. The turbine was started up on that day at the Gianera Generating Station of Silicon Valley Power, a municipally owned utility serving the City of Santa Clara, Calif. The XONON™ Combustion System, deployed for the first time in a commercial setting, is designed to enable turbines to produce environmentally sound power without the need for expensive cleanup solutions. Previously, this XONON™ system had successfully completed over 1,200 hours of extensive full-scale tests which documented its ability to limit emissions of nitrogen oxides, a primary air pollutant, to less than 3 parts per million.

Recently, Catalytica and GE announced that the XONON™ combustion system has been specified as the preferred emissions control system with GE 7FA turbines that have been ordered for Enron's proposed 750 MW Pastoria Energy Facility.<sup>7</sup> The project will enter commercial operation by the Summer of 2001.

In principle, XONON™ will work on a simple cycle project. However, the Department does not have sufficient information regarding the status of the technology to for fuel oil firing and cycling operations.

**REVIEW OF SULFUR DIOXIDE (SO<sub>2</sub>) AND SULFURIC ACID MIST (SAM)**

SO<sub>2</sub> control processes can be classified into five categories: fuel/material sulfur content limitation, absorption by a solution, adsorption on a solid bed, direct conversion to sulfur, or direct conversion to sulfuric acid. A review of the BACT determinations for combustion turbines contained in the BACT Clearinghouse shows that the exclusive use of low sulfur fuels constitutes the top control option for SO<sub>2</sub>.

For this project, the applicant has proposed as BACT the use of 0.05% sulfur oil and pipeline natural gas. The applicant estimated total emissions for the project at 221 TPY of SO<sub>2</sub> and 34 TPY of SAM. The Department expects the emissions to be lower because of the limited oil consumption and the typical natural gas in Florida that contains less than 1 grain of sulfur per 100 standard cubic feet (gr S/100scf). This value is well below the "default" maximum value of 20 gr. S/100 scf, but high enough to require a BACT determination.

**REVIEW OF PARTICULATE MATTER (PM/PM<sub>10</sub>) CONTROL TECHNOLOGIES:**

Particulate matter is generated by various physical and chemical processes during combustion and will be affected by the design and operation of the NO<sub>x</sub> controls. The particulate matter emitted from this unit will mainly be less than 10 microns in diameter (PM<sub>10</sub>).

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Natural gas and 0.05 percent sulfur No. 2 (or superior grade) distillate fuel oil will be the only fuels fired and are efficiently combusted in gas turbines. Such fuels are necessary to avoid damaging turbine blades and other components already exposed to very high temperature and pressure. Natural gas is an inherently clean fuel and contains no ash. The fuel oil to be combusted contains a minimal amount of ash and its use is proposed for only 1000 hours per year making any conceivable add-on control technique for PM/PM<sub>10</sub> either unnecessary or impractical.

A technology review indicated that the top control option for PM/PM<sub>10</sub> is a combination of good combustion practices, fuel quality, and filtration of inlet air. Total annual emissions of PM<sub>10</sub> for the project are expected to be approximately 82 tons per year.

**REVIEW OF CARBON MONOXIDE (CO) CONTROL TECHNOLOGIES**

CO is emitted from combustion turbines due to incomplete fuel combustion. Combustion design and catalytic oxidation are the control alternatives that are viable for the project. The most stringent control technology for CO emissions is the use of an oxidation catalyst.

All combustion turbines using catalytic oxidation appear to be combined cycle units. Among the most recently permitted ones are the 500 MW Wyandotte Energy project in Michigan, the El Dorado project in Nevada, Ironwood in Pennsylvania, Millenium in Massachusetts, and Sutter Calpine in California. The permitted CO values of these units are between 3 and 5 ppm. Catalytic oxidation was recently installed at a cogeneration plant at Reedy Creek (Walt Disney World), Florida to avoid PSD review which would have been required due to increased operation at low load. Seminole Electric recently proposed catalytic oxidation in order to meet the permitted CO limit at its planned 244 MW Westinghouse 501FD combined cycle unit in Hardee County, Florida.<sup>8</sup>

Most combustion turbines incorporate good combustion to minimize emissions of CO. So far this appears to be the only technology proposed at simple cycle turbine projects. These installations are typically permitted between 10 and 25 ppmvd at full load while firing gas. The values of 12 and 20 ppm for gas and oil respectively at baseload proposed in IPSAPC's original application are within the range of recent determinations for simple cycle CO BACT determinations. Values given in GE-based applications are representative of operations between 50 and 100 percent of full load.

**REVIEW OF VOLATILE ORGANIC COMPOUND (VOC) CONTROL TECHNOLOGIES**

Volatile organic compound (VOC) emissions, like CO emissions, are formed due to incomplete combustion of fuel. There are no viable add-on control techniques, particularly for simple cycle combustion turbines. The high flame temperature is very efficient at destroying VOC. The applicant has proposed good combustion practices to control VOC. The limits proposed by IPSAPC for this project are 1.4 ppmvd for gas and 7 ppmvw for oil firing at baseload. These limits are sufficient to keep annual emissions of VOC below the 40 TPY threshold and a BACT determination is not required. According to GE, VOC emissions less than 1.4 ppm were achieved during recent tests of the DLN-2.6 technology when firing natural gas.<sup>9</sup>



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**BACKGROUND ON PROPOSED GAS TURBINE**

IPSAPC plans the purchase of three 170 MW (nominal) General Electric PG 7241FA simple cycle gas turbines. This is the most recent designation of GE's line of "F" Class units.

The first commercial GE 7F (or 7FA) unit was installed in a combined cycle project at the Virginia Power Chesterfield Station in 1990.<sup>10</sup> The initial units had a firing temperature of 2300 °F and a combined cycle efficiency exceeding 50 percent. By the mid-90s, the line was improved by higher combustor pressure, a firing temperature of 2400 °F, and a combined cycle efficiency of approximately 56 percent based on a 167 MW combustion turbine.

The first GE 7F/FA project in Florida was at the FPL Martin Plant in 1993 and entered commercial service in 1994.<sup>11</sup> The units were equipped with DLN-2 combustors with a permitted NO<sub>x</sub> limit of 25 ppmvd. These actually achieved emissions of 13-25 ppmvd of NO<sub>x</sub>, 0-3 ppm of CO, and 0-0.17 ppm of VOC.<sup>12</sup> The City of Tallahassee received a permit in 1998 to install a GE PG7231FA combustion turbine at its Purdom Plant.<sup>13</sup> Although permitted emissions are 12 ppmvd of NO<sub>x</sub>, the City obtained a performance guarantee from GE of 9 ppmvd.<sup>14</sup>

FPL also obtained a guarantee and permit limit of 9 ppmvd NO<sub>x</sub> for fourteen GE 7241FA turbines to be installed at the Fort Myers and Sanford Repowering Projects.<sup>15, 16</sup> The Santa Rosa Energy Center and the Lake Worth LLC projects in Florida also received a permit with a 9 ppmvd NO<sub>x</sub> limit for a GE 7241FA turbine with DLN-2.6 burners.<sup>17</sup>

Most recently, the Department issued BACT determinations for the simple cycle Oleander project in Brevard County, the Vandolah Power Project in Hardee County, the TEC project in Polk County and the JEA Brady Branch Project in Duval County. These five permits also include "new and clean" NO<sub>x</sub> limits of 9 ppmvd based on the DLN-2.6 technology installed on F Class units. The Oleander and Vandolah Projects will meet 9 ppmvd on a 24-hour basis and will be allowed to burn fuel oil for 1000 hr/yr/unit. The TEC and JEA projects will meet 10.5 ppmvd on a 24-hour basis, but will be limited in oil firing to 750 hr/yr/unit.

General Electric has primarily relied on further advancement and refinement of DLN technology to provide sufficient NO<sub>x</sub> control for their combustion turbines in Florida. When required by BACT determinations of most states, General Electric incorporates SCR in combined cycle projects.<sup>18</sup> In its recent permits, Florida has included separate and lower limits in the event that GE's DLN technology does not achieve 9 ppmvd or the applicant selects a manufacturer that does not provide combustors capable of meeting 9 ppmvd.

GE's approach of progressively refining such technology is a proven one, even on some relatively large units. Recently GE Frame 7FA units met performance guarantees of 9 ppmvd with "DLN-2.6" burners at Fort St. Vrain, Colorado and Clark County, Washington.<sup>19</sup> Although the permitted limit is 15 ppmvd, GE has already achieved emission levels of approximately 7-9 ppmvd on gas at a dual-fuel 7EA (120 MW combined cycle) KUA Cane Island Unit 2.<sup>20</sup> Unit 2 is equipped with DLN-1 combustors. Performance guarantees less than 9 ppmvd can be expected for DLN-2.6 combustors on units delivered in a couple of years.<sup>21</sup>

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The 9-ppmvd NO<sub>x</sub> limit on natural gas proposed by IPSAPC is very stringent for simple cycle 7FA combustion turbines. Typically, companies obtain a guarantee from GE to achieve 9 ppmvd during a test on a "new and clean unit." The test must be conducted at a steady-state load of 50 to 100 percent and completed within the first 100 fired hours of operation.

With the frequent start-ups and shutdowns of the unit, some applicants, such as TEC and JEA, are concerned about the ability to maintain the low NO<sub>x</sub> values for long periods of time. As a result, TEC and JEA agreed to a "new and clean" limit of 9 ppmvd but a continuing limit of 10.5 ppmvd. Their permits reflect fewer hours on oil for the higher NO<sub>x</sub> value on gas. Presumably, their concern would be lessened should these units be converted to baseload combined cycle operation. Although the Department is not fully aware of the details of the GE guarantee for Shady Hills (proposed 9 ppmvd on a simple cycle unit), the Department is aware from discussions with other applicants that a continuing guarantee may be available at a substantial cost.<sup>22</sup>

The GE Speedtronic™ Mark V Gas Control System will be used. This control system is designed to fulfill all gas turbine control requirements. These include control of liquid, gas, or both fuels in accordance with the requirements of the speed, load control under part-load conditions, temperature control under maximum capability conditions, or during start-up conditions. The Mark V also monitors the DLN process and controls fuel staging and combustion modes to maintain the programmed NO<sub>x</sub> values.<sup>23</sup>

**DEPARTMENT BACT DETERMINATION**

Following are the BACT limits determined for the Shady Hills project assuming full load. Values for NO<sub>x</sub> are corrected to 15% O<sub>2</sub> on a dry volume basis. The emission limits or their equivalents in terms of pounds per hour and NSPS units, as well as the applicable averaging times, are given in the permit Specific Conditions Nos. 18 through 23.

POLLUTANT	CONTROL TECHNOLOGY	PROPOSED BACT LIMIT
PM/PM <sub>10</sub> , VE	Pipeline Natural Gas Good Combustion	10 Percent Opacity 10/17 lb/hr - Gas/Fuel Oil
CO	As Above	12 ppmvd - Gas 20 ppmvd - Fuel Oil
SO <sub>2</sub> /SAM	As Above	1 grain of sulfur per 100 ft <sup>3</sup> gas 0.05 Percent Sulfur in Fuel Oil
NO <sub>x</sub>	Dry Low NO <sub>x</sub> , WI for F.O., limited oil use	9 ppmvd - Gas 42 ppmvd - F.O. for 1000 of 3,390 hours

**RATIONALE FOR DEPARTMENT'S DETERMINATION**

- The Top technology and Lowest Achievable Emission Rate (LAER) for simple cycle combustion turbines are Hot SCR and an emission limit of 5 ppmvd and possibly less. It is possible that XONON™ can be applied to this project.
- An example of the above is the Carson Plant in Sacramento, California where there is a Hot SCR system on a simple cycle LM6000PA combustion turbine. Emissions of ammonia are more than 10 ppmvd at the Carson Plant.

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- Hot SCR is not commonly used on simple cycle combustion turbines. Although it was required on the fuel oil-fired PREPA project (to achieve 10 ppmvd), the requirement has been removed from the permit. This does not mean that it is not feasible for intermittent duty simple cycle combustion turbines firing natural gas.
- Hot SCR is required at the simple cycle continuous duty Lakeland McIntosh Unit 5 Project if the Westinghouse 501 G unit fails to achieve 9 ppmvd while firing natural gas. Hot SCR was considered cost-effective because the unit will operate continuously and the expected NO<sub>x</sub> reduction is from 25<sup>+</sup> to 9 ppmvd). The ammonia slip guarantee is 10 ppmvd.
- The levelized costs of NO<sub>x</sub> removal by Hot SCR for the Shady Hills project were estimated by Golder at \$14,900 per ton assuming 3,390 hours of operation on natural gas and a reduction from 9 to 3.6 ppmvd on gas and 42 to 17 ppmvd on fuel oil. The estimate is based on an ammonia slip of 10 ppmvd.
- The Department believes that the cost of NO<sub>x</sub> control estimated for the Shady Hills project is on the “high side.” This is partly based on EPA Region IV comments on the Vandolah Power Project.<sup>24</sup> Also certain repetitive costs such as Engineering within Indirect Costs for three units are not likely to be three times as much as they are for a single units.
- In the face of a real requirement to install Hot SCR, a system could be engineered to cool the gases and use the heat in a recuperator of some kind. Additionally a once-through steam generator could accomplish the same end with the generated steam used for steam augmentation. This could increase revenues to pay for the additional equipment and possibly reduce the cost-effectiveness values.
- The Department believes, nevertheless, that the cost effectiveness of NO<sub>x</sub> control by Hot SCR is still more than \$10,000 per ton of NO<sub>x</sub> removed.
- Hot SCR is not commonly used in PSD attainment areas. Although the Department does not have a “bright line” cost-effectiveness figure and does not necessarily adopt the precise cost calculations for the Shady Hills Station, Hot SCR is not cost-effective for this project. Therefore it is rejected as BACT.
- The Department will limit operation of the three units to 3,390 hours per year per unit. No single unit may operate more than 5,000 hours per year to insure that the conclusion regarding cost-effectiveness remains applicable.
- The units will be operated in intermittent duty and simple cycle mode. Therefore control options, which are feasible only for combined cycle units, are not applicable. This rules out Low Temperature (conventional) SCR, which achieves 3.5 ppmvd NO<sub>x</sub> or lower. It also rules out the possibility of SCONO<sub>x</sub>. XONON is available for F Class gas-fired projects. However the status of its development for use in fuel oil or cycling operations is not known.
- General Electric has provided a “clean and new” guarantee of 9 ppmvd NO<sub>x</sub>. This value is equal to that required at the Lakeland continuous duty combustion turbine.

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- Typical permit limits nation-wide for these GE 7FA units while operating on natural gas and in simple cycle mode and intermittent duty are 9-15 ppmvd even though GE provides the same “new and clean” guarantees for them. Limits as high as 25 ppmvd have been recently proposed by some for similar units produced by other manufacturers.
- A level of 9 ppmvd NO<sub>x</sub> by DLN has been demonstrated on GE 7FA combustion turbines at Fort St. Vrain, Colorado and Clark County, Washington. However the permitted limits are actually higher at these two facilities providing some level of operating margin.
- A long-term limit of 9 ppmvd is required for the for five GE7 FA units in the Oleander Project in Brevard County and for four identical units in the IPSAPC Vandolah Power Project in Hardee County. A BACT level of 9 ppmvd has been proposed by Virginia Power for a GE 7FA unit to avoid non-attainment New Source Review.
- The 9 ppmvd limit at Oleander, Vandolah, Shady Hills, and Virginia Power while firing natural gas is the lowest known BACT value for an “F” frame combustion turbine operating in simple cycle mode and intermittent duty. The 42 ppmvd limit while firing fuel oil is typical.
- The gas-based NO<sub>x</sub> emission limit of 9 ppmvd will be difficult to maintain over short term averaging times. That is the main reason why some operators cannot provide reasonable assurance they can meet such a low limit by DLN. The Department believes a 24-hour averaging time is appropriate. Only periods during which the unit is operated will contribute to the 24 hour average. For example if the unit operates only 6 hours in 24 hours and averages 9 ppmvd during the 6 hours, the reported concentration will still be 9 ppmvd.
- The Department prefers not to set a 24-hour average limit that includes start-up emissions for a peaking unit. There will be a short period during start-up when emissions will actually exceed 100 ppmvd (see Figure 2). Such periods can probably be absorbed into an emissions limit with a long-term averaging time for a continuous duty. It would be much more difficult for an intermittent duty unit that might run only a few continuous hours on occasion.
- The fuel oil-based NO<sub>x</sub> emissions limit of 42 ppmvd can be maintained over a short-term averaging period by varying the amount of water injected. The Department has determined that a 3-hour averaging time is appropriate.
- The Department issued permits for the TEC Polk Power, JEA Brandy Branch, and Reliant Osceola Projects with 10.5 ppmvd limit for the same simple cycle GE 7241FA units, but limited the hours of operation on fuel oil to only 750 hours compared with 1000 hours at Oleander, Vandolah and Shady Hills.
- The proposed BACT limit of 9 ppmvd is about less than one-tenth of the applicable NSPS limit per 40 CFR 60, Subpart GG for units as efficient as the 7FA.
- Comments from the National Park Service on the Oleander project suggested that a reduction from 42 to 25 ppmvd in NO<sub>x</sub> emissions while burning fuel oil is possible. GE has advised that 42 ppmvd NO<sub>x</sub> is the lowest guarantee on F Class units when firing oil. The Department has requested that GE work on developing wet or dry technologies to reduce NO<sub>x</sub> emissions for units permitted to fire substantial amounts of fuel oil.<sup>25</sup>

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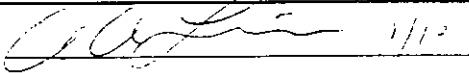
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- The Department is aware that ABB offers a DLN technology for fuel oil firing applicable to at least certain smaller combustion turbines (ABB-GTX). It is noted, however, that ABB does not offer a guarantee of 9 ppmvd on the same unit when firing natural gas.
- It is possible that the NO<sub>x</sub> emissions while firing oil from may be reduced from 42 ppmvd by increasing the water injection rate. In order to address this possibility, a specific condition will be added to conduct appropriate testing and prepare an engineering report. The report will be submitted for the Department's review to ensure that the lowest reliable NO<sub>x</sub> emission rates while firing oil have been achieved.
- The Department's overall BACT determination is equivalent to approximately 0.4 lb/MW-hr by Dry Low NO<sub>x</sub>. For reference, the new NSPS promulgated on September 3, 1998 requires that new conventional power plants (based on boilers, etc.) meet a limit of 1.6 lb/MW-hr.
- VOC emissions of 1.4 ppmvd while firing gas and 7 ppmvw proposed by the applicant are achievable and will insure that PSD is not triggered for this pollutant.
- The Department will set CO limits achievable by good combustion at full load as 12 ppm (gas) and 20 ppm (oil). These values are equal to the lowest values from permitted or proposed simple cycle units. These limits are equal to those proposed by the Department for the Oleander, Vandolah, Reliant, JEA Brandy Branch, and TEC Polk Power projects.
- Golder evaluated the use of an oxidation catalyst for the Shady Hills project with an 80 percent control efficiency. The oxidation catalyst control system was estimated to increase the capital cost of the project by \$1,700,000 per unit with an annualized cost of \$466,000 per year per unit. Golder estimated levelized costs for CO catalyst control at \$9,000 per ton. The Department does not necessarily adopt this estimate, but would agree that even much lower estimates would not be cost-effective for removal of CO.
- BACT for PM<sub>10</sub> was determined to be good combustion practices consisting of: inlet air filtering; use of pipeline natural gas; use of clean, low ash, low sulfur fuels, and operation of the unit in accordance with the manufacturer-provided manuals. The emission limits for PM<sub>10</sub> will be set at 10 pounds per hour during gas operation and 17 pounds per hour while operating on fuel oil.
- PM<sub>10</sub> emissions will be very low and difficult to measure. Additionally, the higher emission mode will involve fuel oil firing which will occur only approximately 1000 hours per year. It is not practical to require running the turbine on oil, simply to conduct tests. Therefore, the Department will set a Visible Emission standard of 10 percent opacity as BACT for both natural gas and fuel oil firing, consistent with the definition of BACT. Examples of installations with similar VE limits include the City of Lakeland, JEA Brandy Branch, TEC Polk Power, Oleander Power and quite a number of combined cycle projects.

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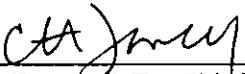
<b>POLLUTANT</b>	<b>COMPLIANCE PROCEDURE</b>
Visible Emissions	Method 9
Carbon Monoxide	Annual Method 10 (can use RATA if at capacity)
NO <sub>x</sub> (performance)	Annual Method 20 (can use RATA if at capacity)
NO <sub>x</sub> (gas - 24-hr block average) (oil - 3-hr block average)	NO <sub>x</sub> CEMS, O <sub>2</sub> or CO <sub>2</sub> diluent monitor, and flow device as needed. During gas operation, a separate compliance determination is conducted at the end of each operating day and a new average emission rate is calculated from the arithmetic average of all valid hourly emission rates from the previous operating day. A valid hourly emission rate shall be calculated for each hour in which at least two NO <sub>x</sub> concentrations are obtained at least 15 minutes apart. Valid hourly emission rates shall not include periods of start up, shutdown, or malfunction unless prohibited by 62-210.700 F.A.C.
SO <sub>2</sub> and SAM	Custom Fuel Monitoring Schedule


**DETAILS OF THE ANALYSIS MAY BE OBTAINED BY CONTACTING:**

A. A. Linero, P.E. Administrator  1/12  
 New Source Review Section  
 Department of Environmental Protection  
 Bureau of Air Regulation  
 2600 Blair Stone Road  
 Tallahassee, Florida 32399-2400

Recommended By:

Approved By:

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

  
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 Howard L. Rhodes, Director  
 Division of Air Resources Management

1/11/00  
 \_\_\_\_\_  
 Date:

1/11/00  
 \_\_\_\_\_  
 Date:

**APPENDIX BD**  
**BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION (BACT)**

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**REFERENCES**

- <sup>1</sup> Telecom. Linero, A.A., FDEP and Chalfin, J., GE. NO<sub>x</sub> control technology for fuel oil.
- <sup>2</sup> Permit. Florida DEP. Kissimmee Utility Authority Cane Island Unit 3. File PSD-FL-254. November, 1999.
- <sup>3</sup> News Release. Goaline Environmental. Genetics Institute Buys SCONOX Clean Air System. August 20, 1999.
- <sup>4</sup> "Control Maker Strives to Sway Utility Skeptics." Air Daily. Volume 5, No. 199. October 14, 1998.
- <sup>5</sup> Telecom. Linero, A.A., FDEP, and Beckham, D., U.S. Generating. Circa November 1998.
- <sup>6</sup> News Release. ABB Alstom Power, Environmental Segment. ABB Alstom Power to Supply Groundbreaking SCONOX™ Technology. December 1, 1999.
- <sup>7</sup> News Release. Catalytica. XONON™ Specified With GE 7FA Gas Turbines For Enron Power Project. December 15, 1999.
- <sup>8</sup> Letter. Opalinski, M.P., SECI to Linero, A.A., FDEP. Turbines and Related Equipment at Hardee Unit 3. December 9, 1998.
- <sup>9</sup> Telecon. Vandervort, C., GE, and Linero, A.A., DEP. "VOC Emissions from FA Gas Turbines with DLN-2.6 Combustors."
- <sup>10</sup> Brochure. General Electric. "GE Gas Turbines - MS7001FA." Circa 1993.
- <sup>11</sup> Davis, L.B., GE. "Dry Low NO<sub>x</sub> Combustion Systems for GE Heavy Duty Gas Turbines." 1994.
- <sup>12</sup> Report. Florida Power & Light. "Final Dry Low NO<sub>x</sub> Verification Testing at Martin Combine Cycle Plant." August 7, 1995.
- <sup>13</sup> Permit. Florida DEP. City of Tallahassee Purdom Unit 8. File PSD-FL-239. May, 1998.
- <sup>14</sup> Application. City of Tallahassee. PSD/Site Certification Application. April, 1997.
- <sup>15</sup> Permit. Florida DEP. FPL Fort Myers Repowering Project. File 0710002-004-AC. November, 1998.
- <sup>16</sup> Permit. Florida DEP. FPL Sanford Repowering Project. File 1270009-004-AC. September, 1998.
- <sup>17</sup> Permit. Florida DEP. Santa Rosa Energy Center. File 1130168-001-AC. December, 1998.
- <sup>18</sup> Permit. State of Alabama. Alabama Power Plant Barry. 1998.
- <sup>19</sup> Telecon. Schorr, M., GE, and Costello, M., Florida DEP. March 31, 1998. Status of DLN-2.6 Program
- <sup>20</sup> Monthly Report. Florida DEP Bureau of Air Regulation. June, 1998.
- <sup>21</sup> Telecon. Schorr, M., GE, and Linero, A.A., Florida DEP. August, 1998. Cost effectiveness of DLN versus SCR.
- <sup>22</sup> Telecon. Gianazza, N.B., JEA, and Linero, A.A., Florida DEP. Proposed NO<sub>x</sub> limits at Brandy Branch Project.
- <sup>23</sup> Rowen, W.I. "General Electric Speedtronic™ Mark V Gas Turbine Control System. 1994."
- <sup>24</sup> Letter. Neeley, R.D., EPA Region IV to Linero, A.A., FDEP. Draft Permit for IPS Avon Park Vandolah Power Project. November 19, 1999.
- <sup>25</sup> Letter. Linero, A. A., FDEP to Forry, J. and Chalfin, J. General Electric. NO<sub>x</sub> emissions control while firing fuel oil in Simple Cycle Units. October 12, 1999.

APPENDIX GC  
GENERAL PERMIT CONDITIONS [F.A.C. 62-4.160]

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- G.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.
- G.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 or exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.
- G.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 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.
- G.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.
- G.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.
- G.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.
- G.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 and 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.

- G.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.



**APPENDIX GC**  
GENERAL PERMIT CONDITIONS [F.A.C. 62-4.160]

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- G.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.
- G.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.
- G.11 This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 62-4.120 and 62-730.300, 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.
- G.12 This permit or a copy thereof shall be kept at the work site of the permitted activity.
- G.13 This permit also constitutes:
- a) Determination of Best Available Control Technology (X)
  - b) Determination of Prevention of Significant Deterioration (X); and
  - c) Compliance with New Source Performance Standards (X).
- G.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 or this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.
  - c) Records of monitoring information shall include:
    - 1. The date, exact place, and time of sampling or measurements;
    - 2. The person responsible for performing the sampling or measurements;
    - 3. The dates analyses were performed;
    - 4. The person responsible for performing the analyses;
    - 5. The analytical techniques or methods used; and
    - 6. The results of such analyses.
- G.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.

# Memorandum

# Florida Department of Environmental Protection

TO: Howard L. Rhodes

THRU: Clair Fancy

FROM: Al Linero  1/10

DATE: January 10, 2000

SUBJECT: IPSAPC Shady Hills Generating Station  
Three 170 MW Combustion Turbines  
DEP File No. 1010373-001-AC (PSD-FL-280)

BAR

Attached is the Final Determination, Notice, Permit, and BACT for construction of three dual-fuel, intermittent duty, simple cycle, 170 MW combustion turbines and one 2.8 million gallon fuel oil storage tanks at the planned Shady Hills Generating Station near Hudson in Pasco County.

Nitrogen Oxides (NO<sub>x</sub>) emissions from the gas turbine will be controlled by Dry Low NO<sub>x</sub> (DLN-2.6). The applicant proposed an NO<sub>x</sub> emission limit of 9 ppmvd @15% O<sub>2</sub>. The use of fuel oil will be allowed up to 1000 hours per year per unit. The NO<sub>x</sub> and fuel oil hours are equal to the values in the Final Oleander permit and the Final IPSAPC Vandolah Power permit. For reference, JEA and TEC were allowed 10.5 ppmvd NO<sub>x</sub> on gas, but only 750 hours per year per unit of operation on fuel oil.

NO<sub>x</sub> emissions will be controlled to 42 ppmvd during the limited fuel oil use. Emissions of carbon monoxide, volatile organic compounds, sulfur dioxide, sulfuric acid mist, and particulate matter (PM/PM<sub>10</sub>) will be very low because of the inherently clean pipeline quality natural gas, limited fuel oil use and, especially, the design of the GE unit.

The project will be located only 28 km South of the Chassahowitzka Class I Area. The modeling of all sources contributing to increment indicated modeled exceedances of the Class I sulfur dioxide increments. Because this project does not contribute significantly to the exceedances, the Fish and Wildlife Service did not object to its construction. However they requested by letter that the Department identify the sources responsible for the exceedances and take remedial action.

I recommend your approval and signature on the Permit and BACT determination.

AAL/al

Attachments