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APPLICATION FOR AIR PERMIT  
INSTALLATION OF DIRECT WATER  
SPRAY FOGGING SYSTEMS  
MARTIN PLANT

Prepared For:

Florida Power & Light, Inc.  
700 Universe Blvd.  
Juno Beach, Florida 33408

Prepared By:

Golder Associates Inc.  
6241 NW 23rd Street, Suite 500  
Gainesville, Florida 32653

March 1999  
9737572Y/F3

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2 Copies - Golder Associates Inc.

PART I  
APPLICATION FOR AIR PERMIT  
LONG FORM

# Department of Environmental Protection

## DIVISION OF AIR RESOURCES MANAGEMENT

### APPLICATION FOR AIR PERMIT - LONG FORM

See Instructions for Form No. 62-210.900(1)

#### I. APPLICATION INFORMATION

This section of the Application for Air Permit form identifies the facility and provides general information on the scope and purpose of this application. This section also includes information on the owner or authorized representative of the facility (or the responsible official in the case of a Title V source) and the necessary statements for the applicant and professional engineer, where required, to sign and date for formal submittal of the Application for Air Permit to the Department. If the application form is submitted to the Department using ELSA, this section of the Application for Air Permit must also be submitted in hard-copy.

#### Identification of Facility Addressed in This Application

Enter the name of the corporation, business, governmental entity, or individual that has ownership or control of the facility; the facility site name, if any; and the facility's physical location. If known, also enter the facility identification number.

1. Facility Owner/Company Name: <b>Florida Power &amp; Light Company</b>	
2. Site Name: <b>Martin Plant</b>	
3. Facility Identification Number: <b>0850001</b> <span style="float: right;">[ ] Unknown</span>	
4. Facility Location Information: Street Address or Other Locator: <b>7m N of Indiantown on SR 710</b> City: <b>Indiantown</b> County: <b>Martin</b> Zip Code: <b>34956</b>	
5. Relocatable Facility? [ ] Yes [X] No	6. Existing Permitted Facility? [X] Yes [ ] No

#### Application Processing Information (DEP Use)

1. Date of Receipt of Application:	<b>March 29, 1999</b>
2. Permit Number:	<b>0850001-005-AC</b>
3. PSD Number (if applicable):	
4. Siting Number (if applicable):	

**Owner/Authorized Representative or Responsible Official**

1. Name and Title of Owner/Authorized Representative or Responsible Official: <b>John Lindsay, Plant General Manager</b>
2. Owner/Authorized Representative or Responsible Official Mailing Address: Organization/Firm: <b>FPL - Martin Plant</b> Street Address: <b>P.O. Box 176</b> City: <b>Indiantown</b> State: <b>FL</b> Zip Code: <b>34956-0176</b>
3. Owner/Authorized Representative or Responsible Official Telephone Numbers:  Telephone: <b>(561) 597-7106</b> Fax: <b>(561) 597-7416</b>
4. Owner/Authorized Representative or Responsible Official Statement:  <i>I, the undersigned, am the owner or authorized representative* of the non-Title V source addressed in this Application for Air Permit or the responsible official, as defined in Rule 62-210.200, F.A.C., of the Title V source addressed in this application, whichever is applicable. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof. I understand that a permit, if granted by the Department, cannot be transferred without authorization from the Department, and I will promptly notify the Department upon sale or legal transfer of any permitted emissions unit.</i>  Signature <u><i>John Lindsay</i></u> Date <u><i>3/10/99</i></u>

\* Attach letter of authorization if not currently on file.

**Scope of Application**

This Application for Air Permit addresses the following emissions unit(s) at the facility. An Emissions Unit Information Section (a Section III of the form) must be included for each emissions unit listed.

Emissions Unit ID		Description of Emissions Unit	Permit Type
Unit #	Unit ID		
1	003	CT3A - Combustion Turbine with HRSG	AC1B
2	004	CT3B - Combustion Turbine with HRSG	AC1B
3	005	CT4A - Combustion Turbine with HRSG	AC1B
4	006	CT4B - Combustion Turbine with HRSG	AC1B

See individual Emissions Unit (EU) sections for more detailed descriptions.  
Multiple EU IDs indicated with an asterisk (\*). Regulated EU indicated with an "R".

**Purpose of Application and Category**

Check one (except as otherwise indicated):

**Category I: All Air Operation Permit Applications Subject to Processing Under Chapter 62-213, F.A.C.**

This Application for Air Permit is submitted to obtain:

- Initial air operation permit under Chapter 62-213, F.A.C., for an existing facility which is classified as a Title V source.
- Initial air operation permit under Chapter 62-213, F.A.C., for a facility which, upon start up of one or more newly constructed or modified emissions units addressed in this application, would become classified as a Title V source.

Current construction permit number: \_\_\_\_\_

- Air operation permit renewal under Chapter 62-213, F.A.C., for a Title V source.

Operation permit to be renewed: \_\_\_\_\_

- Air operation permit revision for a Title V source to address one or more newly constructed or modified emissions units addressed in this application.

Current construction permit number: \_\_\_\_\_

Operation permit to be renewed: \_\_\_\_\_

- Air operation permit revision or administrative correction for a Title V source to address one or more proposed new or modified emissions units and to be processed concurrently with the air construction permit application. Also check Category III.

Operation permit to be revised/corrected: \_\_\_\_\_

\_\_\_\_\_

- Air operation permit revision for a Title V source for reasons other than construction or modification of an emissions unit. Give reason for the revision e.g., to comply with a new applicable requirement or to request approval of an "Early Reductions" proposal.

Operation permit to be revised: \_\_\_\_\_

Reason for revision: \_\_\_\_\_

\_\_\_\_\_

**Category II: All Air Construction Permit Applications Subject to Processing Under Rule 62-210.300(2)(b),F.A.C.**

This Application for Air Permit is submitted to obtain:

- Initial air operation permit under Rule 62-210.300(2)(b), F.A.C., for an existing facility seeking classification as a synthetic non-Title V source.

Current operation/construction permit number(s): \_\_\_\_\_  
\_\_\_\_\_

- Renewal air operation permit under Rule 62-210.300(2)(b), F.A.C., for a synthetic non-Title V source.

Operation permit to be renewed: \_\_\_\_\_

- Air operation permit revision for a synthetic non-Title V source. Give reason for revision; e.g.; to address one or more newly constructed or modified emissions units.

Operation permit to be revised: \_\_\_\_\_

Reason for revision: \_\_\_\_\_  
\_\_\_\_\_

**Category III: All Air Construction Permit Applications for All Facilities and Emissions Units.**

This Application for Air Permit is submitted to obtain:

- Air construction permit to construct or modify one or more emissions units within a facility (including any facility classified as a Title V source).

Current operation permit number(s), if any: \_\_\_\_\_  
0850001-004-AV

- Air construction permit to make federally enforceable an assumed restriction on the potential emissions of one or more existing, permitted emissions units.

Current operation permit number(s): \_\_\_\_\_  
\_\_\_\_\_

- Air construction permit for one or more existing, but unpermitted, emissions units.



**Application Processing Fee**

Check one:

Attached - Amount: \_\_\_\_\_

Not Applicable.

**Construction/Modification Information**

1. Description of Proposed Project or Alterations:

Installation of direct water spray inlet fogging systems. Since the facility holds a Title V permit pursuant to Chapter 62-213 F.A.C., a permit fee is not required. Refer to Part II for discussion.

2. Projected or Actual Date of Commencement of Construction :

3. Projected Date of Completion of Construction :

**Professional Engineer Certification**

1. Professional Engineer Name: **Kennard F. Kosky**  
Registration Number: **14996**

2. Professional Engineer Mailing Address:  
Organization/Firm: **Golder Associates Inc.**  
Street Address: **6241 NW 23rd Street, Suite 500**  
City: **Gainesville** State: **FL** Zip Code: **32653-1500**

3. Professional Engineer Telephone Numbers:  
Telephone: **(352) 336-5600** Fax: **(352) 336-6603**

4. Professional Engineer's Statement:

*I, the undersigned, hereby certify, except as particularly noted herein\*, that:*

*(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this Application for Air Permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and*

*(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.*

*If the purpose of this application is to obtain a Title V source air operation permit (check here [ ] if so), I further certify that each emissions unit described in this Application for Air Permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance schedule is submitted with this application.*

*If the purpose of this application is to obtain an air construction permit for one or more proposed new or modified emissions units (check here [X] if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.*

*If the purpose of this application is to obtain an initial air operation permit or operation permit revision for one or more newly constructed or modified emissions units (check here [ ] if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.*

*Yennad F. Kaly*

Signature

(seal)

*3/3/99*

Date

\*Attach any exception to certification statement.

**Application Contact**

1. Name and Title of Application Contact: <b>Mr. Richard G. Piper, Repowering Licensing Manager</b>
2. Application Contact Mailing Address:  Organization/Firm: <b>FPL Environmental Services Dep.</b> Street Address: <b>700 Universe Blvd.</b> City: <b>Juno Beach</b> State: <b>FL</b> Zip Code: <b>33408</b>
3. Application Contact Telephone Numbers:  Telephone: <b>(561) 691-7058</b> Fax: <b>(561) 691-7070</b>

**Application Comment**

<p>The existing combustion turbines (Units 3A,3B,4A &amp; 4B) will be installed with direct water spray fogging systems that will reduce the turbine inlet air temperature. The temperature reduction will improve the heat rate and increase power due to the cooler-denser inlet air. The net emissions change from this project will not result in an increase of any regulated pollutant greater than the PSD significant emission rates. PSD review does not apply to proposed project. Discussed in Part II.</p>
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## II. FACILITY INFORMATION

### A. GENERAL FACILITY INFORMATION

#### Facility Location and Type

1. Facility UTM Coordinates: Zone: 17                      East (km): 543.2                      North (km): 2993.0			
2. Facility Latitude/Longitude: Latitude (DD/MM/SS): 27 / 3 / 29                      Longitude: (DD/MM/SS): 80 / 33 / 54			
3. Governmental Facility Code: 0	4. Facility Status Code: A	5. Facility Major Group SIC Code: 49	6. Facility SIC(s): 4911
7. Facility Comment (limit to 500 characters):  The existing Martin plant consists of 2 Fossil Fuel Fired Steam Generators (Units 1 and 2) and 2 Combined Cycle Units (Units 3 and 4). Each combined cycle unit consists of 2 combustion turbines and associated heat recovery steam generators (HRSGs). The primary fuel for the combustion turbines is natural gas with distillate oil as back-up. Refer to Part II for discussion			

#### Facility Contact

1. Name and Title of Facility Contact: Willie Welch, Environmental Specialist			
2. Facility Contact Mailing Address: Organization/Firm: FPL - Martin Plant Street Address: P.O. Box 176 City: Indiantown                      State: FL                      Zip Code: 34956-0176			
3. Facility Contact Telephone Numbers: Telephone: (561) 597-7106                      Fax: (561) 597-7416			



**B. FACILITY REGULATIONS**

**Rule Applicability Analysis** (Required for Category II applications and Category III applications involving non Title-V sources. See Instructions.)

A large, empty rectangular box with a black border, intended for the user to provide a Rule Applicability Analysis. The box is currently blank.

**List of Applicable Regulations** (Required for Category I applications and Category III applications involving Title-V sources. See Instructions.)

**Facility emissions covered under existing Title V permit, no additional facility or emission unit applicable requirements as a result of the proposed change.**

**C. FACILITY POLLUTANTS**

**Facility Pollutant Information**

1. Pollutant Emitted	2. Pollutant Classification



**D. FACILITY POLLUTANT DETAIL INFORMATION**

**Facility Pollutant Detail Information:**

1. Pollutant Emitted:		
2. Requested Emissions Cap:	(lb/hr)	(tons/yr)
3. Basis for Emissions Cap Code:		
4. Facility Pollutant Comment (limit to 400 characters):		

**Facility Pollutant Detail Information:**

1. Pollutant Emitted:		
2. Requested Emissions Cap:	(lb/hr)	(tons/yr)
3. Basis for Emissions Cap Code:		
4. Facility Pollutant Comment (limit to 400 characters):		

**E. FACILITY SUPPLEMENTAL INFORMATION**

**Supplemental Requirements for All Applications**

1. Area Map Showing Facility Location: <input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Not Applicable _____ <input type="checkbox"/> Waiver Requested
2. Facility Plot Plan: <input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Not Applicable _____ <input type="checkbox"/> Waiver Requested
3. Process Flow Diagram(s): <input checked="" type="checkbox"/> Attached, Document ID(s): <b>Part II</b> _____ <input type="checkbox"/> Not Applicable _____ <input type="checkbox"/> Waiver Requested
4. Precautions to Prevent Emissions of Unconfined Particulate Matter: <input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Not Applicable _____ <input type="checkbox"/> Waiver Requested
5. Fugitive Emissions Identification: <input type="checkbox"/> Attached, Document ID: _____ <input checked="" type="checkbox"/> Not Applicable _____ <input type="checkbox"/> Waiver Requested
6. Supplemental Information for Construction Permit Application: <input checked="" type="checkbox"/> Attached, Document ID: <b>Part II</b> _____ <input type="checkbox"/> Not Applicable _____

**Additional Supplemental Requirements for Category I Applications Only**

7. List of Proposed Exempt Activities: <input type="checkbox"/> Attached, Document ID: _____ <input type="checkbox"/> Not Applicable _____
8. List of Equipment/Activities Regulated under Title VI: <input type="checkbox"/> Attached, Document ID: _____ <input type="checkbox"/> Equipment/Activities On site but Not Required to be Individually Listed <input type="checkbox"/> Not Applicable _____
9. Alternative Methods of Operation: <input type="checkbox"/> Attached, Document ID: _____ <input type="checkbox"/> Not Applicable _____
10. Alternative Modes of Operation (Emissions Trading): <input type="checkbox"/> Attached, Document ID: _____ <input type="checkbox"/> Not Applicable _____

<p>11. Identification of Additional Applicable Requirements:</p> <p><input type="checkbox"/> Attached, Document ID: _____</p> <p><input type="checkbox"/> Not Applicable</p>
<p>12. Compliance Assurance Monitoring Plan:</p> <p><input type="checkbox"/> Attached, Document ID: _____</p> <p><input type="checkbox"/> Not Applicable</p>
<p>13. Risk Management Plan Verification:</p> <p><input type="checkbox"/> Plan Submitted to Implementing Agency - Verification Attached Document ID: _____</p> <p><input type="checkbox"/> Plan to be Submitted to Implementing Agency by Required Date</p> <p><input type="checkbox"/> Not Applicable</p>
<p>14. Compliance Report and Plan</p> <p><input type="checkbox"/> Attached, Document ID: _____</p> <p><input type="checkbox"/> Not Applicable</p>
<p>15. Compliance Statement (Hard-copy Required)</p> <p><input type="checkbox"/> Attached, Document ID: _____</p> <p><input type="checkbox"/> Not Applicable</p>

PART II  
SUPPORTING INFORMATION

## Part II

### Application for Air Permit Installation of Direct Water Spray Fogging Systems Martin Plant

#### Introduction

Florida Power & Light Company is proposing to install direct water spray fogging systems in the inlet ducts of the existing 4 combustion turbines in combined cycle configuration at the Martin Plant. The purpose of the inlet foggers to provide adiabatic inlet air cooling which increase turbine output and decreases heat rate. The project is part of increasing capacity in a cost effective manner.

#### Description

The direct inlet fogging systems achieve adiabatic cooling using water to form fine droplets (fog). The fog is produced by injection grids placed in the turbine inlet duct that use nozzles that produce a fine spray. The small fog particles (about 10 to 20 microns) extract the latent heat of vaporization from the gas stream when the water droplet is converted to gas. Heat is removed at a rate of 1,075 Btu/lb of water. The result of the fogging is a cooler more moisture laden air stream. Figure 1 presents a schematic of a typical fogging system.

The amount of heat removed is highly dependent upon the ambient air conditions. The two most important parameters are the dry bulb temperature and relative humidity. As moisture is added to the inlet air by the fogging, the vaporization of the fog droplets cools the air toward the wet-bulb temperature. For the proposed project, the design condition is 95°F and 50 percent relative humidity. The resultant wet bulb temperature, based on psychrometric charts is 79°F. At 100 percent saturation the inlet cooling system would result in a 16°F decrease of the turbine inlet air.

While adiabatic cooling is most efficient for dry climates, adiabatic cooling in Florida can be an effective means of inlet air cooling during the late morning to evening hours. This period is typically 8 to 10 hours per day from about 10 am to 8 pm. In the early morning hours and

evening hours, the typical relative humidity in Florida is 70 to 90 percent depending on the climatic conditions. Because of the highly variable nature of ambient air conditions, the annual average inlet cooling was assumed to be 8°F. This average was reviewed against a 30 year record of meteorological data for West Palm Beach and found to be representative of the range in conditions that occur over an annual period. This includes cooling associated with the typical mid-afternoon summer days and early morning/evening periods that occur year-round. The typical mid-afternoon cooling for West Palm Beach would be 11°F and would occur in August with a mid-afternoon temperature of 90°F and 64 percent relative humidity. During January, the mid-afternoon cooling would be about 9°F. The typical cooling that would occur in the early morning hours of evening hours with temperatures of about 80°F and a relative humidity of 80 percent would be 5°F. This cooling also assumes that the gas stream can be 100 percent saturated. The ambient air conditions that are modified by the fogging system occur naturally but are more frequent with the fogging system. For example, the average minimum temperatures for the months of November through April range from 55.5°F to 65.1°F with relative humidities ranging from 83 to 81 percent. The amount of adiabatic cooling would range from 3 to 4°F. The annual average temperature reduction used for gas firing was based on 24 hours operation would be about 5.5°F assuming 8°F for 12 hours during the day and 3°F for 12 hours during the night.

#### **Turbine Performance and Emission Estimates**

The effect of decreasing the turbine inlet air through the use of fogging will be to increase the mass flow of air that can go through the turbine which allows higher heat input and power output. The combustion turbine is also more efficient since the heat rate decreases with decreasing temperature. For the GE Model PG7221 (Frame 7FA) combustion turbines at the Martin plant, a 5.5°F average decrease in temperature for gas firing would result in a 2.1 percent increase in power and an associated 0.8 percent decrease in heat rate. Thus, while power increases, the production of power is more efficient with concomitant lower emissions per MW-hr generated. The increase in heat rate as a function of temperature decrease is a linear function and for the Fort Myers turbines would be 4.7 mmBtu/hr/°F. The data were determined using GE supplied data (see Attachment A).

Because the turbine is operating on its original power curve, the emission characteristics do not change from what would normally occur at that temperature and relative humidity. An evaluation of emissions from the fogging tests conducted at the FPL Putnam plant did not result in any statistically significant differences in emission rates (see Attachment B). The increase in emissions of criteria pollutants associated with fogging were determined using emission limits contained in the Title V Permit for the facility. This provides the maximum potential allowed and would conservatively estimate emission rates. Table 1 and 2 presents a summary of the operating conditions and emission increases resulting from fogging firing natural gas and distillate fuel oil, respectively. The annual emissions were determined by multiplying the heat input increase per degree Fahrenheit times the emissions rate in lb/mmBtu for the number of degrees Fahrenheit-hours proposed for the turbines. The degree F-hours/year is the total amount of annual temperature reduction proposed for fogging and was calculated by using the average temperature reduction multiplied by the hours of year assumed. For example, the degrees Fahrenheit-hours for gas firing are calculated by multiplying 6,240 hours times 5.5°F or 34,320°F-hours. Each turbine inlet fogging system will be equipped with temperature probes to determine the amount of inlet cooling. This reduction will be recorded for each hour of fogger operation. For the Martin turbines, a maximum of 34,320°F-hours of operation when firing natural gas and 4,000°F-hours of operation when firing distillate fuel oil was used as the basis for annual emission estimates for each turbine.

#### **Regulatory Applicability**

A modification is defined in Rule 62-210.200 Florida Administrative Code (F.A.C.) as any physical change in, or a change in the method of operation of, or addition to a facility which would result in an increase in the actual emissions of any air pollutant subject to regulation under the Clean Air Act. A modification to a major source of air pollution, such as the Martin Plant, may be subject to review under the Department's Prevention of Significant Deterioration (PSD) rules codified in Rule 62-212.400 F.A.C.

The proposed installation of direct water spray fogging systems is a modification according to Rule 62-212.200 (188) F.A.C., since annual emissions will potentially increase as a result of the increased power and heat input. This has been confirmed by the Department in its December 31, 1998 correspondence to FPL.

Based on the available data, it is concluded that the emission rate does not change as a result of inlet fogging. Therefore, increase in annual potential emissions can be conservatively determined through the use of increases in heat input associated with the use of the fogging systems. For the 4 combustion turbines (CTs) the maximum potential annual increase in emissions is estimated as follows:

Summary of Maximum Annual Emissions - All 4 Units

<u>Pollutant</u>	<u>Gas-Firing Tons/Year</u>	<u>Oil-firing Tons/Year</u>	<u>Total (Oil &amp; Gas)</u>
PM	2.95	1.23	4.19
NO <sub>x</sub>	29.04	9.39	38.43
SO <sub>2</sub>	15.01	18.74	33.75
CO	15.47	2.15	17.63
VOC	0.49	0.22	0.72
Degrees Fahrenheit-Hours for Each Fuel	34,320	4,000	
Additional Degrees Fahrenheit-Hours on Gas	11,095	0	
Total Gas Only Degrees Fahrenheit-Hours	45,415	0	

These maximum potential emission rates are less than the significant emission rates in Table 62-212.400-2 in Rule 62-212.400 F.A.C. and therefore PSD would not apply. The pollutant closest to the PSD significant emission rates when firing natural gas is NO<sub>x</sub>. Emissions of SO<sub>2</sub> are primarily associated with distillate fuel oil which is only used a backup to natural gas. For natural gas only, the maximum potential NO<sub>x</sub> emissions would be 34.4 tons/year at 45,415°F-hours per year per CT. This is equivalent to 2.77°F-hours of gas firing for each degree Fahrenheit-hour of oil firing (i.e., 11,095°F hours/4,000°F hours = 2.77°F-hours). The emissions of the other pollutants would be 3.9 tons/year for PM, 19.9 tons/year for SO<sub>2</sub>, 20.5 tons/year for CO and 0.65 tons/year for VOC.



FPL proposes that the amount of fogging allowed by the Department be based on a cumulative amount of operating hours for the 4 combustion turbines. This would amount to 181,661 hours of operation when firing only natural gas. If only natural gas is fired, the proposed amount of hours would be decreased by 2.77°F hours for each °F-hour when fuel oil was fired during an annual period. As described previously, the emission rates would not be affected.

In addition, during periods when the fogging system is not used, the operation of the CTs will not be affected by this request and will be operated according to the Department's previous approvals (e.g., authorized to operated 8,760 hours/year/CT).

As described previously, the inlet fogging systems will have temperature monitoring equipment which will record the actual temperature reduction for each hour of operation. These data will be summarized monthly and reported to the Department with the Annual Operating Reports demonstrating that the annual period does not exceed 181,661 degree F-hours for Units 3 and 4.

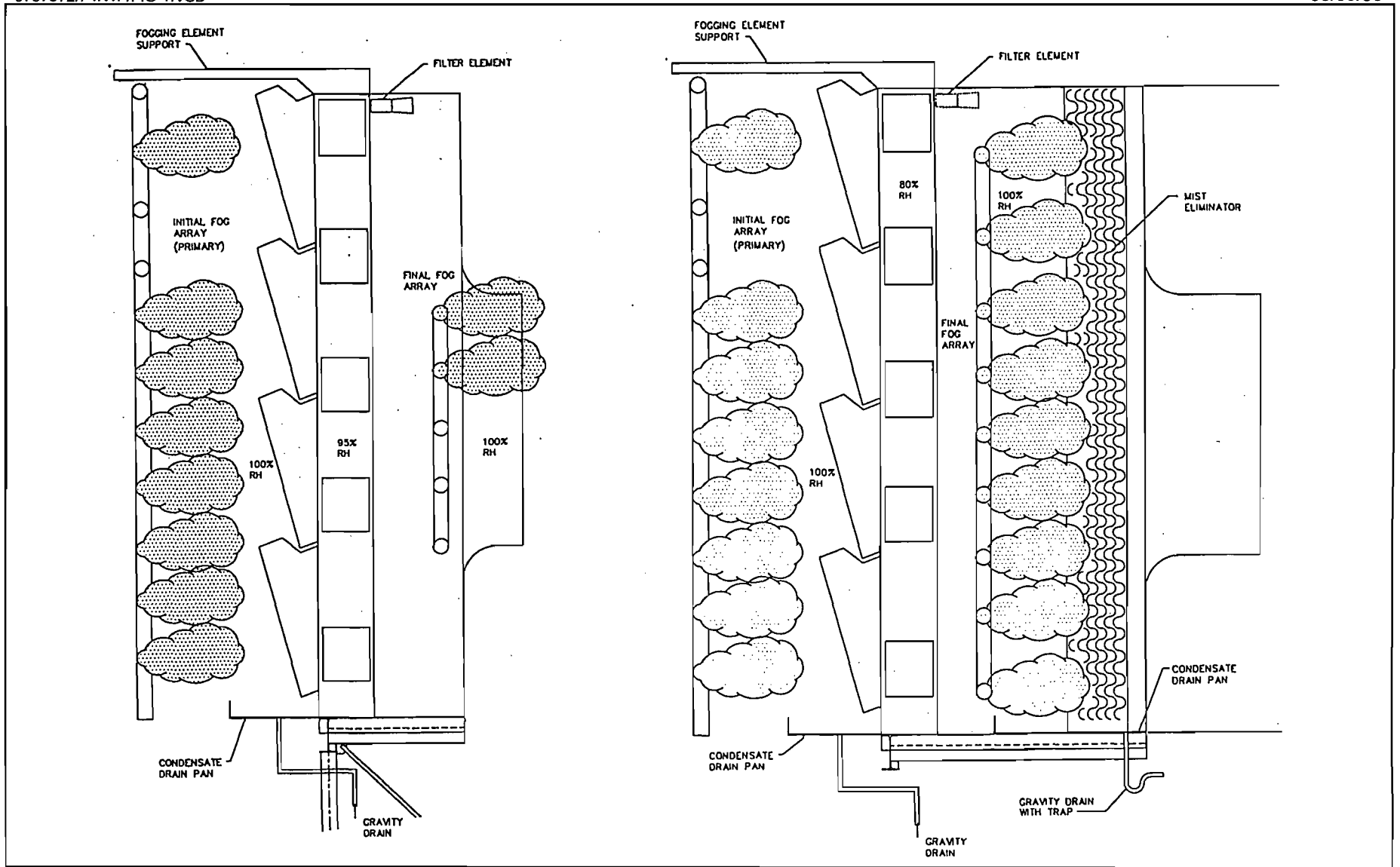


Figure 1. Illustrative Fogging System Schematic  
Florida Power & Light, Inc.

Source: Caldwell Energy and Environmental, Inc.



**Table 1** Emission Estimates of the Martin Combined Cycle Combustion Turbines with Inlet Air Cooling System with Direct Water Spray Inlet Fogging (Natural Gas Combustion).

Performance Basis			
Temperature Decrease	°F (1)	5.5	
Power Increase		2.09%	GE Curves
Heat Rate Decrease		1.22%	GE Curves
Heat Input Increase		1.44%	GE Curves
Heat Input Change	mmBtu/ °F	4.7	GE Curves
Hours/year		6,240 (2)	
Hours-°F/year		34,320	hours/year times temperature decrease
Pollutants	Units	Emissions (3)	Comments
PM	lb/MMBtu TPY	0.0092	Based on Title V Permit per machine
		0.74	
NO <sub>x</sub>	lb/MMBtu TPY	0.0900	Based on Title V Permit per machine
		7.26	
SO <sub>2</sub>	lb/MMBtu TPY	0.0465	Based on Title V Permit per machine
		3.75	
CO	lb/MMBtu TPY	0.0480	Based on Title V Permit per machine
		3.87	
VOC	lb/MMBtu TPY	0.0015	Based on Title V Permit per machine
		0.12	

Legend - TPY: tons per year

(1) Temperature decrease is the annual average temperature differential of ambient temperature to compressor inlet temperature utilizing inlet fogger. Assumes 12 hours at 8 °F for daytime and 12 hours at 3 °F for nighttime.

(2) Hours of fogger operation based on estimate of 24 hours per day, 5 days/week and 52 weeks per year.

(3) Emission factor references - PSD-FL-146, Site Certification PA-89-27 and Title V Permit No. 0850001-004-AV.

**Table 2** Emission Estimates of the Martin Combined Cycle Combustion Turbines with Inlet Air Cooling System with Direct Water Spray Inlet Fogging (No. 2 Fuel Oil Combustion).

Performance Basis			
Temperature Decrease	°F (1)	8	
Power Increase		3.04%	GE Curves
Heat Rate Decrease		1.22%	GE Curves
Heat Input Increase		2.10%	GE Curves
Heat Input Change	mmBtu/ °F	4.7	GE Curves
Hours/year		500 (2)	
Hours-°F/year		4,000	hours/year times temperature decrease
Pollutants	Units	Emissions (3)	Comments
PM	lb/MMBtu	0.0328	Based on Title V Permit per machine
	TPY	0.31	
NO <sub>x</sub>	lb/MMBtu	0.2497	Based on Title V Permit per machine
	TPY	2.35	
SO <sub>2</sub>	lb/MMBtu	0.4984	Based on Title V Permit per machine
	TPY	4.68	
CO	lb/MMBtu	0.0573	Based on Title V Permit per machine
	TPY	0.54	
VOC	lb/MMBtu	0.0060	Based on Title V Permit per machine
	TPY	0.06	

Legend - TPY: tons per year  
 (1) Temperature decrease is the annual average temperature differential of ambient temperature to compressor inlet temperature utilizing inlet fogger.  
 (2) Distillate oil firing limited to 2000 hours per year for all 4 combustion turbines combined.  
 (3) Emission factor references - PSD-FL-146, Site Certification PA-89-27 and Title V Permit No. 0850001-004-AV.

ATTACHMENT A

**Attachment A**

The following data were obtained from performance curves in the range that fogging would be most effective.

Plant Site: Martin Combined Cycle Units 3A, 3B, 4A and 4B  
Turbine Model: GE Model PG7221 (FA)

Turbine Inlet Temperature ( °F)	90	60
Difference ( °F)		30
Heat Input (mmBtu/hr)	1,550	1,690
Difference (mmBtu/hr)		140
Rate (mmBtu/hr/ °F) <sup>a</sup>		4.67

Note: <sup>a</sup> heat input difference divided by temperature difference.

ATTACHMENT B

**Golder Associates Inc.**

6241 NW 23rd Street, Suite 500  
Gainesville, FL 32653-1500  
Telephone (352) 336-5600  
Fax (352) 336-6603



December 15, 1998

9737572A/1

Florida Power & Light Company  
700 Universe Blvd.  
P.O. Box 14000  
Juno Beach, Florida 33408

Attention: Mr. John Hampp, Environmental Specialist

RE: Putnam Inlet Fogging Emission Tests  
Analysis of Data

Dear John:

Golder Associates Inc. has evaluated the emissions data taken during August 25 and 26, 1998 to determine the potential effect of inlet fogging on emission rates of nitrogen oxides (NO<sub>x</sub>) and carbon monoxide (CO). The data were obtained at the Putnam Plant using various inlet fogging conditions while operating the unit at nearly constant heat input. The heat input during testing on August 25, 1998 varied by less than 1.5 percent while heat input during testing on August 26, 1998 varied by about 2.5 percent. The data evaluated represented 178 individual 3 minute readings using continuous emission monitoring equipment. There were 72 data points when the inlet foggers were not operating (i.e., "off") while there were 106 data points where the various foggers were operating (i.e., "on").

The data were evaluated using the procedures in Appendix C to 40 CFR Part 60; Determination of Emission Rate Change. The data were also evaluated in terms of the potential effect of inlet fogging. Tables 1.1a and 1.1b present the results of Appendix C evaluation for NO<sub>x</sub> and CO, respectively for the data recorded on August 25, 1998. Tables 1.2a and 1.2b present the results of Appendix C evaluation for NO<sub>x</sub> and CO, respectively for the data recorded on August 26, 1998. Taken together, the analysis suggests that NO<sub>x</sub> concentrations may decrease slightly while CO may increase slightly with the operation of inlet foggers. However, the trend was not always consistent and the differences are small (i.e., up to a few ppm). Other factors also likely played a role in the variability of the data such as the response in continuous emission monitoring equipment, fuel input, ambient temperature and combustion turbine operation variability. Such changes, which cannot be completely accounted for in the data, would make it inappropriate to develop a specific relationships regarding emission rates at this time. Please call if you have any questions.

Sincerely,

GOLDER ASSOCIATES INC.

A handwritten signature in black ink that reads 'Kennard F. Kosky'.

Kennard F. Kosky, P.E.  
Principal

KFK/arz



Table 1.1a Florida Power And Light (FP&L) Test data for the Combustion Turbine  
 Inlet Air Cooling System with Direct Water Spray Inlet Fogging (8/25/98)  
 NO<sub>x</sub> Statistical Analysis (Unit 1GT2 - Putnam Plant, Palatka, FL.)

Hour Range	Fogger on/off	n	v (n-1)	Mean	Std Dev	t	95% C.I.	Upper C.I.	Lower C.I.
1345-1421	off (baseline)	13	12	87.8	0.98	1.782	0.485	88.3	87.4
1424-1521	on	20	19	86.5	1.33	1.729	0.514	87.0	85.9
1524	off	1	0	-	-	-	-		
1527-1533	on	3	2	89.0	0.35	2.92	0.592	89.6	88.4
1536-1539	off	2	1	88.5	0.78	1.86	1.023	89.5	87.4

Legend: n= sample size, v = sample size -1, t=t distribution

Table 1.1b Florida Power And Light (FP&L) Test data for the Combustion Turbine  
 Inlet Air Cooling System with Direct Water Spray Inlet Fogging (8/25/98)  
 CO Statistical Analysis (Unit 1GT2 - Putnam Plant, Palatka, FL.)

Hour Range	Fogger on/off	n	v (n-1)	Mean	Std Dev	t	95% C.I.	Upper C.I.	Lower C.I.
1345-1421	off (baseline)	13	12	75.9	2.90	1.782	1.433	77.4	74.5
1424-1521	on	20	19	81.0	1.43	1.729	0.554	81.5	80.4
1524	off	1	0	-	-	-	-		
1527-1533	on	3	2	78.0	2.00	2.92	3.372	81.4	74.6
1536-1539	off	2	1	79.5	2.12	1.86	2.790	82.3	76.7

Legend: n= sample size, v = sample size -1, t=t distribution

Table 1.2a Florida Power And Light (FP&L) Test data for the Combustion Turbine Inlet Air Cooling System with Direct Water Spray Inlet Fogging (8/26/98) NO<sub>x</sub> Statistical Analysis (Unit 1GT2 - Putnam Plant, Palatka, FL.)

Hour Range	Fogger on/off	n	v (n-1)	Mean	Std Dev	t	z	95% C.I.	Upper C.I.	Lower C.I.
1103-1227	off (baseline)	29	28	89.1	0.7	1.701	-	0.236	89.4	88.9
1230-1430	on	41	-	90.5	1.3	-	1.645	0.334	90.8	90.2
1433-1539	off	23		96.8	1.3	1.717		0.466	97.3	96.4
1542-1745	on	42		92.4	2.2		1.645	0.561	93.0	91.9
1748-1800	off	5	4	97.7	0.4	2.132	-	0.429	98.1	97.3

Legend: n= sample size, v = sample size -1, t=t distribution, z = z distribution (used when sample size is >30)

Table 1.2b Florida Power And Light (FP&L) Test data for the Combustion Turbine Inlet Air Cooling System with Direct Water Spray Inlet Fogging (8/26/98) CO Statistical Analysis (Unit 1GT2 - Putnam Plant, Palatka, FL.)

Hour Range	Fogger on/off	n	v (n-1)	Mean	Std Dev	t	z	95% C.I.	Upper C.I.	Lower C.I.
1103-1227	off (baseline)	29	28	72.6	2.3	1.701	-	0.728	73.3	71.9
1230-1430	on	41	-	70.9	1.9	-	1.645	0.494	71.4	70.4
1433-1539	off	23		67.2	1.9	1.717		0.688	67.9	66.5
1542-1745	on	42		69.5	3.3		1.645	0.828	70.4	68.7
1748-1800	off	5	4	63.4	0.9	2.132	-	0.853	64.3	62.5

Legend: n= sample size, v = sample size -1, t=t distribution, z = z distribution (used when sample size is >30)