



Jeb Bush
Governor

Department of Environmental Protection

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

David B. Struhs
Secretary

January 31, 2000

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Walter P. Bussells, CEO and Managing
Director
Jacksonville Electric Authority
21 West Church Street
Jacksonville, Florida 32202

Re: DEP File No. 0310045-004-AC
Kennedy Plant, Spray Fogging Systems

Dear Mr. Bussells:

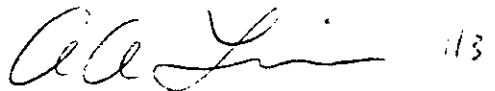
The Department has received the application on January 3, 2000 for the installation of direct water spray fogging systems in the inlet ducts of the existing 3 simple cycle combustion turbines at the above referenced facility in Duval County. Based on our initial review of the proposed project, we have determined that additional information is needed in order to continue processing this application package. Please submit the information requested below to the Department's Bureau of Air Regulation:

1. Please provide the necessary calculations to support the maximum annual emissions numbers for PM, SO₂ and VOC as outlined on Page 5, Part II of the application.
2. Please indicate if the PSD analysis for increase in annual potential emissions were done assuming that the past actual emissions were zero. There are no calculations available in the application for the determination of past actual emissions. Normally, the PSD applicability review requires a comparison of past actual emissions with future potential emissions.
3. Please indicate if the 1000 hrs/yr fogging operation for each of the 3 combustion turbines is in excess of the past 2-year average base operation for the same units. Will there be an increase in the base operation of these units compared to their past 2-year average. If so, was that taken into account when determining the increase in annual potential emissions on Page 5, Part II of the application.

The Department will resume processing this application after receipt of the requested information. Rule 62-4.050(3), F.A.C. requires that all applications for a Department permit must

be certified by a professional engineer registered in the State of Florida. This requirement also applies to responses to Department requests for additional information of an engineering nature. A new certification statement by the authorized representative or responsible official must accompany any material changes to the application. Rule 62-4.055(1), F.A.C. now requires applicants to respond to requests for information within 90 days. If there are any questions, please call Syed Arif, P.E. at (850) 921-9528.

Sincerely,

A handwritten signature in cursive script, appearing to read "A.A. Linero", followed by the number "1131".

A.A. Linero, P.E. Administrator
New Source Review Section

AAAL/sa

cc: Ken Kosky, Golder Associates, Inc.
Bert Gianazza, JEA
C. Kirts, DEP-NED
J. Manning, RESD

Fold at line over top of envelope to
the return address

Is your RETURN ADDRESS completed on the reverse side?

SENDER:

- 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.
- Write "Return Receipt Requested" on the mailpiece below the article number.
- The Return Receipt will show to whom the article was delivered and the date delivered.

I also wish to receive the following services (for an extra fee):

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

Consult postmaster for fee.

<p>3. Article Addressed to: <i>Walter Bussells, CEO</i> <i>Jacksonville E. A.</i> <i>21 W. Church St.</i> <i>Jacksonville, FL</i> <i>32202</i></p>	<p>4a. Article Number <i>2031 391 929</i></p> <p>4b. Service Type <input type="checkbox"/> Registered <input checked="" type="checkbox"/> Certified <input type="checkbox"/> Express Mail <input type="checkbox"/> Insured <input type="checkbox"/> Return Receipt for Merchandise <input type="checkbox"/> COD</p> <p>7. Date of Delivery <i>2.3.00</i></p>
<p>5. Received By: (Print Name)</p>	<p>8. Addressee's Address (Only if requested and fee is paid)</p>
<p>6. Signature: (Addressee or Agent) <i>X Margaret Bussells</i></p>	

Thank you for using Return Receipt Service.

Z 031 391 929

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

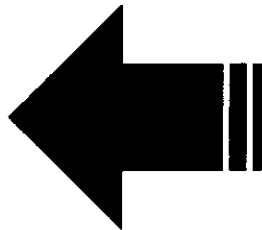
Sent to	<i>Walter Bussells</i>
Street & Number	<i>21 W. Church St.</i>
Post Office, State, & ZIP Code	<i>JAX FL 32202</i>
Postage	\$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	<i>(Kennedy)</i>
Return Receipt Showing to Whom, Date, & Addressee's Address	
TOTAL Postage & Fees	\$
Postmark or Date	<i>2-1-00</i>
<i>0310045-004-AC</i>	

PS Form 3800, April 1995

This is a Patch T type separator sheet.



Form Type = "PSD"
CODE128 type barcode



Landscape Feed

New Form Follows...

Printed on 5/3/2004 12:09:07 PM

Copyright ©Kofax Image Products 1994-1999

This is a Patch T type separator sheet.



Form Type = "PSD"
CODE128 type barcode



Portrait Feed

New Form Follows...

Printed on 5/3/2004 12:09:07 PM

Copyright ©Kofax Image Products 1994-1999

21 West Church Street
Jacksonville, Florida 32202-3139



December 30, 1999

RECEIVED

JAN 03 2000

BUREAU OF AIR REGULATION

Mr. Al Linero, P.E.
New Source Review Administrator
Department of Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32399-2400

RE: Northside Generating Station ✓
Kennedy Generating Station ✓
Combustion Turbine Fogging Systems

① 0310045-004-AC
② 0310047-004-AC

Dear Mr. Linero:

Enclosed please find an original and four (4) copies each of the permit applications for installing spray fogging systems on the existing combustion turbines at the Northside and Kennedy Generating Stations.

If you have any questions with regard to this matter, please contact me at (904) 665-6247.

Sincerely,

N. Bert Gianazza, P.E.
Environmental Permitting
& Compliance Group

cc: Steve Pace, P.E., RESD

cc: NED
EPA

APPLICATION FOR AIR PERMIT
INSTALLATION OF DIRECT WATER
SPRAY FOGGING SYSTEMS
JACKSONVILLE ELECTRIC AUTHORITY
NORTHSIDE PLANT

Prepared For:

Jacksonville Electric Authority
21 West Church Street
Jacksonville, Florida 32202-3139

Prepared By:

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

December 1999
9937578Y/F1

DISTRIBUTION:

3 Copies - Jacksonville Electric Authority
1 Copies - Golder Associates Inc.

PART I
APPLICATION FOR AIR PERMIT
LONG FORM

Purpose of Application

Air Operation Permit Application

This Application for Air Permit is submitted to obtain: (Check one)

[] Initial Title V air operation permit for an existing facility which is classified as a Title V source.

[] Initial Title V air operation permit 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: _____

[] Title V air operation permit revision to address one or more newly constructed or modified emissions units addressed in this application.

Current construction permit number: _____

Operation permit number to be revised: _____

[] Title V air operation permit revision or administrative correction to address one or more proposed new or modified emissions units and to be processed concurrently with the air construction permit application. (Also check Air Construction Permit Application below.)

Operation permit number to be revised/corrected: _____

[] Title V air operation permit revision 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 number to be revised: _____

Reason for revision: _____

Air Construction Permit Application

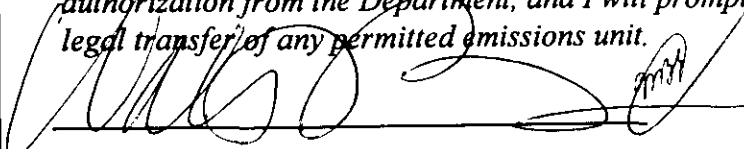
This Application for Air Permit is submitted to obtain: (Check one)

[X] Air construction permit to construct or modify one or more emissions units.

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

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

Owner/Authorized Representative or Responsible Official

1. Name and Title of Owner/Authorized Representative or Responsible Official: Walter P. Bussells, CEO and Managing Director
2. Owner/Authorized Representative or Responsible Official Mailing Address: Organization/Firm: Jacksonville Electric Authority Street Address: 21 West Church Street City: Jacksonville State: FL Zip Code: 32202
3. Owner/Authorized Representative or Responsible Official Telephone Numbers: Telephone: (904) 665 - 7220 Fax: (904) 665 - 7376
4. Owner/Authorized Representative or Responsible Official Statement: <i>I, the undersigned, am the owner or authorized representative*(check here [], if so) or the responsible official (check here [], if so) 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 _____ Date <u>12/23/99</u>

* Attach letter of authorization if not currently on file.

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 Statement:

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

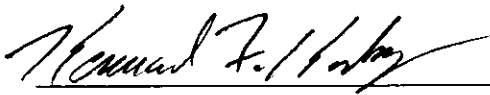
(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this Application for Air Permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions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


Signature

12/20/99
Date

(seal) 

* Attach any exception to certification statement.

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:

Application Comment

Existing gas turbines Nos. 3 through 6 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. Therefore, PSD review does not apply to proposed project. Refer to Part II for discussion.

Additional Supplemental Requirements for Title V Air Operation Permit Applications

8. List of Proposed Insignificant Activities: <input type="checkbox"/> Attached, Document ID: _____ <input type="checkbox"/> Not Applicable
9. 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
10. Alternative Methods of Operation: <input type="checkbox"/> Attached, Document ID: _____ <input type="checkbox"/> Not Applicable
11. Alternative Modes of Operation (Emissions Trading): <input type="checkbox"/> Attached, Document ID: _____ <input type="checkbox"/> Not Applicable
12. Identification of Additional Applicable Requirements: <input type="checkbox"/> Attached, Document ID: _____ <input type="checkbox"/> Not Applicable
13. Risk Management Plan Verification: <input type="checkbox"/> Plan previously submitted to Chemical Emergency Preparedness and Prevention Office (CEPPO). Verification of submittal attached (Document ID: _____) or previously submitted to DEP (Date and DEP Office: _____) <input type="checkbox"/> Plan to be submitted to CEPPO (Date required: _____) <input type="checkbox"/> Not Applicable
14. Compliance Report and Plan: <input type="checkbox"/> Attached, Document ID: _____ <input type="checkbox"/> Not Applicable
15. Compliance Certification (Hard-copy Required): <input type="checkbox"/> Attached, Document ID: _____ <input type="checkbox"/> Not Applicable

PART II
SUPPORTING INFORMATION

**Application for Air Permit
Installation of Direct Water Spray Fogging Systems
Northside Plant**

Introduction

Jacksonville Electric Authority (JEA) is proposing to install direct water spray fogging systems in the inlet ducts of the existing 4 simple cycle combustion turbines at the Northside 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 based on the inlet cooling tests, which had an average temperature of 90°F and 62-percent relative humidity. The resultant wet bulb temperature, based on psychrometric charts is 79°F, which was demonstrated during the tests. 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 a.m. to 8 p.m. 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 11°F as demonstrated during the tests. This average was reviewed against a 30 year record of meteorological data for Jacksonville 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 Jacksonville would be 14°F and would occur in August with a mid-afternoon temperature of 91°F and 58-percent relative humidity. During January, the mid-afternoon cooling would be about 7°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 41.7°F to 55.7°F with relative humidities ranging from 83 to 88 percent. The amount of adiabatic cooling would range from only 1 to 2°F. For the Northside CTs, an average temperature reduction of 11°F was used as the basis of emission estimates.

Fogging Tests and Statistical Evaluation

A preliminary statistical evaluation of the tests performed on Northside Generating Station Combustion Turbine CT5 was conducted. The evaluation is summarized in the attached Table 1. The techniques used to evaluate the data were identical to those specified in 40 CFR Part 60 Appendix C for determining differences in emission rates, but for non-paired data. Parameters initially evaluated included NO_x emission rate in lb/mmBtu, NO_x emission rate in lb/hr, capacity in megawatts (MW) and heat input in mmBtu/hr. Three test conditions were evaluated: base operation, fogging with all data and fogging at 20 gallons/minute (gpm) or greater.

The results indicated that the NO_x emission rate in lb/mmBtu for the fogging categories evaluated are statistically lower at the 95 percent confidence level than at base load operation without fogging. This conclusion is for all data and at the higher fogging rates (i.e., >20 gpm). The NO_x emission rate in lb/hr for the fogging is not statistically different at the 95 percent confidence level from the base load operation. This is primarily a result in the increase in mass flow and volume that is shown by the increases in capacity and heat input. With fogging, the capacity and heat input are statistically higher at the 95 percent confidence level than at base load operation without fogging. The average increase in capacity was about 5.5 percent or about 2.5 MW with the higher fogging rates. Similarly, the average heat input increase was about 5.8 percent and about 37 mmBtu/hr.

All the data for carbon monoxide demonstrated emissions near zero; therefore, fogging did not appear to have any influence on the combustion process and emissions of CO. Given this result, any change in emissions of volatile organic compounds (VOCs) are not expected.

From an emission perspective, the data suggests that the NO_x emission rate in lb/hr does not increase. However, fogging will result in an increase in the heat input and concomitant increase in particulate matter and sulfur dioxide as a result of more fuel input to the CT.

The data suggests that both the increases in capacity and heat input are consistent with the performance curves. The predicted increase as a differential is about 2.5 MW and 30 mmBtu/hr for the average ambient dry bulb temperature and relative humidity. The fogging system brought the turbine inlet temperature very close to the wet bulb inlet temperature.

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 combustion turbines at the Northside plant, an 11°F average decrease in temperature would result in a 4.9 percent increase in power and an

associated 0.6 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 Northside turbines would be 2.8 mmBtu/hr/°F. The data were determined using manufacture supplied data (see Attachment A).

The increase in emissions of PM, SO₂, and VOC associated with fogging were determined using emission limits contained in the Title V Permit for the facility and AP-42 emission factors where no limits are provided. Table 2 presents a summary of the operating conditions and emission increases resulting from fogging. The annual emissions were determined by multiplying the heat input increase times the emissions rate in lb/mmBtu for the number of hours of proposed for the turbines. For the Northside turbines, a maximum of 1,000 hours of fogger operation for each turbine was used as the basis for annual emission estimates.

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 Northside 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.

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 the maximum potential annual increase in emissions is estimated as follows:

Summary of Maximum Annual Emissions - All Units - 4 CTs at 1,000 hours/year

<u>Pollutant</u>	<u>Tons/Year</u>
PM	2.33
NO _x	0.0 ^a
SO ₂	30.92
CO	0.0 ^a
VOC	1.04

^aDetermined from tests.

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.

JEA 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 4,000 hours of operation. As described previously, the emission rates would not be affected.

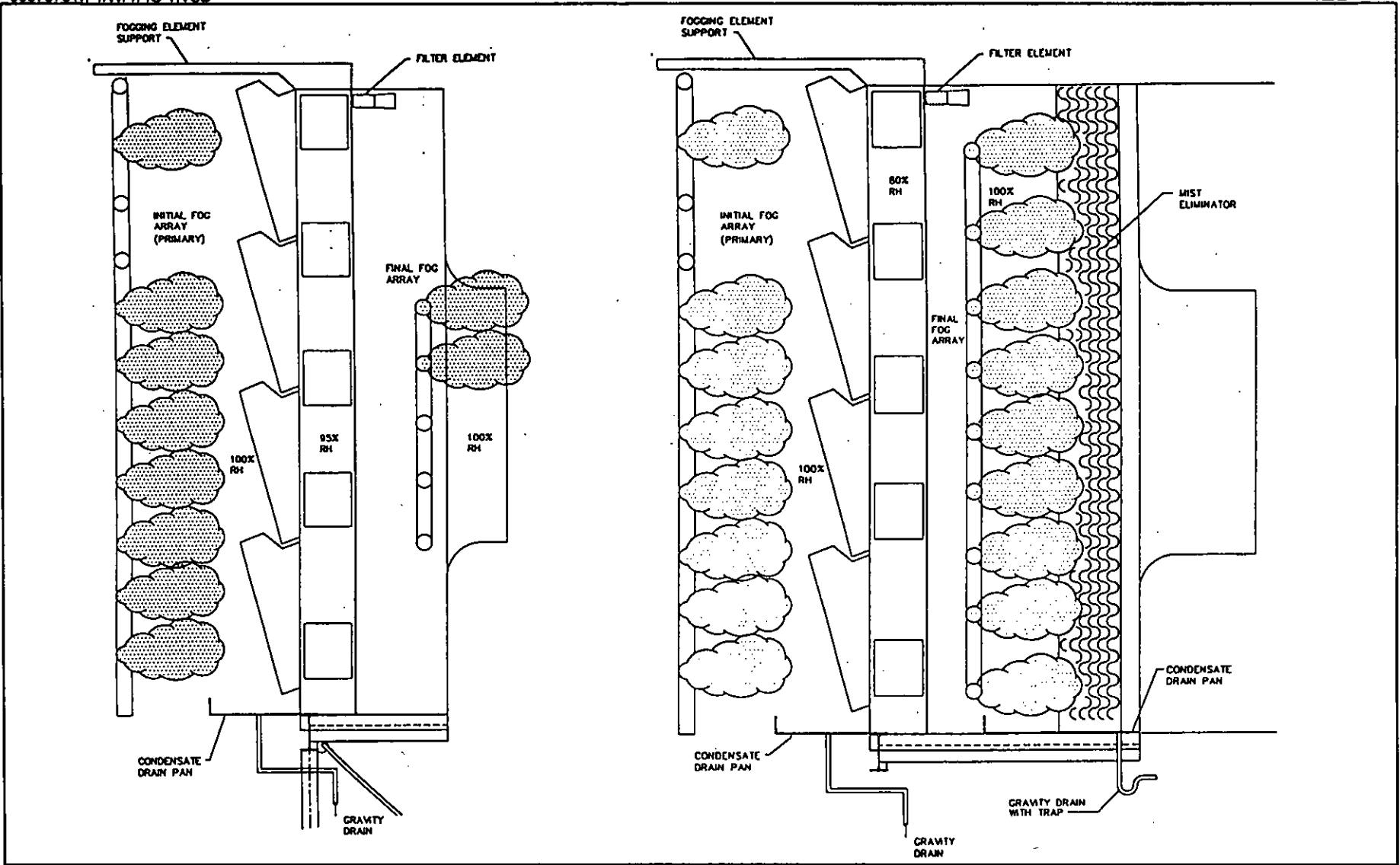


Figure 1. Illustrative (typical) Fogging System Schematic

Source: Caldwell Energy and Environmental, Inc.



Table 1. Average and Upper and Lower 95 Percent Confidence Intervals for Combustion Turbine Inlet Fogging Tests – Northside Generating Station CT5

Parameter	Test Condition	Upper C.I.	Average	Lower C.I.
NO _x (lb/mmBtu)	Base	0.48	0.47	0.45
NO _x (lb/mmBtu)	Fogging All Data	0.45	0.44	0.42
NO _x (lb/mmBtu)	Fogging > 20 gpm	0.44	0.43	0.41
NO _x (lb/hr)	Base	307.4	300.0	292.6
NO _x (lb/hr)	Fogging All Data	299.9	290.0	280.0
NO _x (lb/hr)	Fogging > 20 gpm	297.0	285.3	273.6
Capacity (MW)	Base	48.7	47.4	46.2
Capacity (MW)	Fogging All Data	50.3	49.5	48.7
Capacity (MW)	Fogging > 20 gpm	51.1	50.0	48.6
Heat Input (mmBtu/hr)	Base	641.6	634.0	626.4
Heat Input (mmBtu/hr)	Fogging All Data	671.7	666.2	660.8
Heat Input (mmBtu/hr)	Fogging > 20 gpm	674.7	671.0	667.3

Table B. Statistical Analysis of Northside Unit CT5 Fogging Tests.

Test Day	Date	Test Description	CF	RF	WF	NO _x (lb/mm ³ hr)	NO _x (lb/hr)	Load (mm ³ /hr)	
Tuesday	8/10	Base Load - no spray	79	86	76	48	0.48	304.61	641.02
Tuesday	8/10	Back to Base Load	78	86	70	52	0.47	303.18	649.35
Thursday	8/12	Base Load	79	94	50	44	0.49	300.89	616.05
Thursday	8/12	Back to Base Load	79	92	55	44	0.49	302.81	616.88
Friday	8/13	Base Load @ high humidity	ND	82	94	49	0.41	271.19	656.75
Wednesday	8/18	Base Load	79	95	49	46	0.51	319.84	631.31
Wednesday	8/18	Return to Base Load	80	92	59	49	0.48	298.52	626.75
Thursday	8/19	Base Load	78	93	51	46	0.49	307.73	627.78
Thursday	8/19	Back to Base Load	80	91	63	50	0.42		
Friday	8/20	Base Load	79	88	65	47	0.48	302.98	635.20
Friday	8/20	Back to Base Load	78	90	59	47	0.45	288.38	638.94
		Average:	79	90	63				
Tuesday	8/10	Base Load + 5 GPM	ND	ND	ND	48.68	0.47	304.71	649.35
Tuesday	8/10	Base Load + 10 GPM	82	89	74	49	0.48	315.35	658.71
Tuesday	8/10	Base Load + 15 GPM	ND	ND	ND		0.46		
Tuesday	8/10	Base Load + 20 GPM	78	84	76	50	0.44	297.22	668.08
Tuesday	8/10	Base Load + 25 GPM	78	86	73	51	0.47	320.20	674.32
Tuesday	8/10	Base Load + 30 GPM	78	86	70	52	0.42	288.90	682.65
Thursday	8/12	Base Load + 15 GPM	78	95	47	47	0.45	292.02	647.96
Thursday	8/12	Base Load + 30 GPM	80	95	50	49	0.44	289.67	661.32
Wednesday	8/18	Base Load + 30 GPM	80	92	59	49	0.42	278.18	666.00
Thursday	8/19	Base + Z1-Z4 @ 3000	78	93	51	46	0.45	300.44	672.66
Thursday	8/19	Base + Z1-Z4 @ 3200	80	92	61	50	0.40	264.13	666.52
Thursday	8/19	Base + Z1-Z4 @ 3400	80	91	63	50	0.39	264.13	671.55
Friday	8/20	Base + Z1-Z4 @ 3400	79	89	63	51	0.39	264.86	675.71
		Average (All Data):	79	90	62				
		Average (> 20 gpm):	79	90	63				

ATTACHMENT A
PERFORMANCE CURVE DATA

Table A. Combustion Turbine Performance Data

Temp. (°F)	Heat Input (mmBtu/hr)	Δ Increase (mmBtu/hr)	Δ Increase (%)	Δ Gas Dry (MW)	Δ Increase (MW)	Δ Increase (%)	Heat Rate (Btu/kWh)	Δ Decrease (Btu/kWh)	Δ Decrease (%)
100	639			49.57			12,891		
90	665	26	4.07%	51.87	2.3	4.64%	12,821	-70.35	-0.55%
80	691	26	3.91%	54.17	2.3	4.43%	12,756	-64.37	-0.50%
70	719	28	4.05%	56.47	2.3	4.25%	12,732	-23.71	-0.19%
60	747	28	3.89%	58.77	2.3	4.07%	12,711	-21.86	-0.17%
50	776	29	3.88%	61.07	2.3	3.91%	12,707	-3.84	-0.03%
40	806	30	3.87%	63.37	2.3	3.77%	12,719	12.22	0.10%
Average:		27.83	3.95%		2.3	4.18%		-28.65	-0.22%
Average per °F:		2.78	0.39%		0.23	0.42%		-2.87	-0.02%

**ATTACHMENT B
STATISTICAL ANALYSIS**

Table B. Statistical Analysis of Northside Unit CT5 Fogging Tests.

Test Day	Date	Test Name	Wet Bulb (°F)	Dry Bulb (°F)	RH (%)	Capacity MW	NO _x (lb/mmBtu)	NO _x (lb/hr)	Heat Input (mmBtu/hr)
Tuesday	8/10	Base Load - no spray	79	86	76	48	0.48	304.61	641.02
Tuesday	8/10	Back to Base Load	78	86	70	52	0.47	303.18	649.35
Thursday	8/12	Base Load	79	94	50	44	0.49	300.89	616.05
Thursday	8/12	Back to Base Load	79	92	55	44	0.49	302.81	616.88
Friday	8/13	Base Load @ high humidity	ND	82	94	49	0.41	271.19	656.75
Wednesday	8/18	Base Load	79	95	49	46	0.51	319.84	631.31
Wednesday	8/18	Return to Base Load	80	92	59	49	0.48	298.52	626.75
Thursday	8/19	Base Load	78	93	51	46	0.49	307.73	627.78
Thursday	8/19	Back to Base Load	80	91	63	50	0.42		
Friday	8/20	Base Load	79	88	65	47	0.48	302.98	635.20
Friday	8/20	Back to Base Load	78	90	59	47	0.45	288.38	638.94
		Average:	79	90	63				
Tuesday	8/10	Base Load + 5 GPM	ND	ND	ND	48.68	0.47	304.71	649.35
Tuesday	8/10	Base Load + 10 GPM	82	89	74	49	0.48	315.35	658.71
Tuesday	8/10	Base Load + 15 GPM	ND	ND	ND		0.46		
Tuesday	8/10	Base Load + 20 GPM	78	84	76	50	0.44	297.22	668.08
Tuesday	8/10	Base Load + 25 GPM	78	86	73	51	0.47	320.20	674.32
Tuesday	8/10	Base Load + 30 GPM	78	86	70	52	0.42	288.90	682.65
Thursday	8/12	Base Load + 15 GPM	78	95	47	47	0.45	292.02	647.96
Thursday	8/12	Base Load + 30 GPM	80	95	50	49	0.44	289.67	661.32
Wednesday	8/18	Base Load + 30 GPM	80	92	59	49	0.42	278.18	666.00
Thursday	8/19	Base + Z1-Z4 @ 3000	78	93	51	46	0.45	300.44	672.66
Thursday	8/19	Base + Z1-Z4 @ 3200	80	92	61	50	0.40	264.13	666.52
Thursday	8/19	Base + Z1-Z4 @ 3400	80	91	63	50	0.39	264.13	671.55
Friday	8/20	Base + Z1-Z4 @ 3400	79	89	63	51	0.39	264.86	675.71
		Average (All Data):	79	90	62				
		Average (> 20 gpm):	79	90	63				

