REEDY CREEK ENERGY SERVICES, INC.
P.O. BOX 10,000 • LAKE BUENA VISTA, FLORIDA 32830-1000
(305) 824-4024

December 21, 1987

Bureau of Air Quality Management
Florida Department of
Environmental Regulation
2600 Blair Stone Road
Twin Towers Building
Tallahassee, FL 32399-2400

DER
DEC 22 1987
BAQM

Attention Mr. C. H. Fancy, PE
Deputy Chief

Gas Fired Turbine
Generator Permit Application
AC48-137740
PSD-FL-123

Dear Mr. Fancy:

Per our technical meeting of December 8, 1987 at your offices, please accept these amendments to the above Permit Application.

In order to resolve the outstanding BACT issues, it was discussed at that meeting that we might amend our permit application in one of two ways: 1) select an approach involving PSD Review with application of BACT determination based on an economic criterion of $1000/ton of NOx reduction; 2) select an approach involving a voluntary limitation of annual NOx emissions to below the significance level. We have selected the latter methodology. We believe the attached satisfies the items discussed per the stipulated guidelines.

It was suggested that if we were able to submit these revisions before the Holidays, your staff would be able to act on this application promptly. As our 1988 schedule is now being impacted severely, we would greatly appreciate your timely response.

As requested previously, if you have any questions on this application, please contact us immediately, thus allowing our timely follow-up.

Very truly yours,

Edward Godwin, P.E.
Project Engineer
Reedy Creek Energy Services, Inc.

bgfh:D509:k

Attachments

pc Mr. Thomas M. Moses

Copied: Pradeep Raval
C.H.F./B.T.
Tom Sawicki
12-23-87

FEDERAL EXPRESS

QUESTIONS? CALL 800-238-5355 TOLL FREE.

AIRBILL NUMBER **5151306790**

72034 5151306790

[redacted]

Date 12/21/87

1 From (Your Name) Please Print: RON SADOW

Your Phone Number (Very Important): (318) 323-9000

Company: FORD BACON & DAVIS INC

Department/Floor No

Street Address: 4001 JACKSON STREET

City: MONROE State: LA ZIP Required For Correct Invoicing: 71202

2 To (Recipient's Name) Please Print: MR. C.H. FANCY

Recipient's Phone Number (Very Important): ( )

Department/Floor No.: BUREAU OF AIR QUALITY MANAGEMENT FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATIONS

Exact Street Address (Use of P.O. Boxes or P.O. ® Zip Codes Will Delay Delivery And Result in Extra Charge.): 2600 BLAIR STONE ROAD TWIN TOWERS BLD

City: TALLAHASSEE State: FL ZIP Street Address Zip Required: 32399-2400

3 **YOUR BILLING REFERENCE INFORMATION (FIRST 24 CHARACTERS WILL APPEAR ON INVOICE.)** [redacted]0260R

H **HOLD FOR PICK-UP AT THIS FEDERAL EXPRESS LOCATION:** Street Address (See Service Guide or Call 800-238-5355)

City State

ZIP ® Zip Code of Street Address Required

PAYMENT ☑ Bill Sender ☐ Cash ☐ Bill Recipient's FedEx Acct. No. ☐ Bill 3rd Party FedEx Acct. No. ☐ Bill Credit Card [redacted]

4 **SERVICES CHECK ONLY ONE BOX**

1 ☐ **PRIORITY 1** Overnight Delivery Using Your Packaging

6 ☐ **OVERNIGHT LETTER*** (Our Packaging 9¾"x12½")

OVERNIGHT DELIVERY USING OUR PACKAGING

2 ☒ Courier-Pak Overnight Envelope* 12"x 15½"

3 ☐ Overnight Box 12¼"x 17½"x 3" A ☐

4 ☐ Overnight Tube 38"x 6"x 6"x 6" B ☐

*Declared Value Limit $100

STANDARD AIR

5 ☐ Delivery not later than second business day

SERVICE COMMITMENT

PRIORITY 1 - Delivery is scheduled early next business morning in most locations. It may take two or more business days if the destination is outside our primary service areas.

STANDARD AIR - Delivery is generally next business day or not later than second business day. It may take three or more business days if the destination is outside our primary service areas.

DELIVERY AND SPECIAL HANDLING CHECK SERVICES REQUIRED

1 ☐ **HOLD FOR PICK-UP** (Fill in Section H at right)

2 ☑ **DELIVER WEEKDAY**

3 **DELIVER SATURDAY** (Extra charge) ☐

4 ☐ **DANGEROUS GOODS** (P-1 and Standard Air Packages only Extra charge)

5 ☐ **CONSTANT SURVEILLANCE SERVICE (CSS)** (Extra charge) (Do Not Complete Section 5)

6 ☐ **DRY ICE** ___ Lbs

7 ☐ **OTHER SPECIAL SERVICE** ___

8 ☐

9 ☐ **SATURDAY PICK-UP** (Extra charge)

10 ☐

PACKAGES	WEIGHT	YOUR DECLARED VALUE	OVER SIZE
1	2		
	LBS		
	LBS		
	LBS		
Total 1	Total 2	Total	

Received At: 1 ☒ Regular Stop 2 ☐ On-Call Stop 3 ☐ Drop Box 4 ☐ B.S.C. 5 ☐ Station

Federal Express Corp. Employee No. 50509

Date/Time For Federal Express Use 12/21 1645

Emp. No. Date

☐ Cash Received

☐ Return Shipment ☐ Third Party ☐ Chg To Del ☐ Chg To Hold

Street Address

City State Zip

Received By: X

Date/Time Received FedEx Employee Number

Federal Express Use

Base Charges

Declared Value Charge

Origin Agent Charge

Other

Total Charges

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RECIPIENT'S COPY

5 Sender authorizes Federal Express to deliver this shipment without obtaining a delivery signature and shall indemnify and hold harmless Federal Express from any claims resulting therefrom.

Release Signature:

Ford, Bacon & Davis Incorporated

Engineers Constructors

Ronald D. Sadow, P.E.
Manager of Environmental Engineering

P. O. Box 1894
4001 Jackson Street
Monroe, LA 71210
318/323-9000

Air Bill #5151306790   Federal Express 12-21 Monroe LA   File Copy

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STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32301-8241

BOB GRAHAM
GOVERNOR

VICTORIA J. TSCHINKEL
SECRETARY

APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: ______________________ [ ] New[1] [ ] Existing[1]

APPLICATION TYPE: [ ] Construction [ ] Operation [ ] Modification

COMPANY NAME: ______________________ COUNTY: ______________

Identify the specific emission point source(s) addressed in this application (i.e. Lime Kiln No. 4 with Venturi Scrubber; Peaking Unit No. 2, Gas Fired) ______________

SOURCE LOCATION: Street ______________________ City ______________

UTM: East ______________ North ______________

Latitude ___ ° ___ ' ___ "N Longitude ___ ° ___ ' ___ "W

APPLICANT NAME AND TITLE: ______________________

APPLICANT ADDRESS: ______________________

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative* of ______________

I certify that the statements made in this application for a ______________ permit are true, correct and complete to the best of my knowledge and belief. Further, I agree to maintain and operate the pollution control source and pollution control facilities in such a manner as to comply with the provision of Chapter 403, Florida Statutes, and all the rules and regulations of the department and revisions thereof. I also understand that a permit, if granted by the department, will be non-transferable and I will promptly notify the department upon sale or legal transfer of the permitted establishment.

*Attach letter of authorization

Signed: ______________________

____
Name and Title (Please Type)

Date: __________ Telephone No. ______________

B. PROFESSIONAL ENGINEER REGISTERED IN FLORIDA (where required by Chapter 471, F.S.)

This is to certify that the engineering features of this pollution control project have been designed/examined by me and found to be in conformity with modern engineering principles applicable to the treatment and disposal of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgment, that

[1] See Florida Administrative Code Rule 17-2.100(57) and (104)

the pollution control facilities, when properly maintained and operated, will discharge an effluent that complies with all applicable statutes of the State of Florida and the rules and regulations of the department. It is also agreed that the undersigned will furnish, if authorized by the owner, the applicant a set of instructions for the proper maintenance and operation of the pollution control facilities and, if applicable, pollution sources.

Signed *Harold L. Culp*

Harold L. Culp, PE
Name (Please Type)

Ford, Bacon & Davis, Inc.
Company Name (Please Type)

P. O. Box 1894, Monroe, Louisiana 71210
Mailing Address (Please Type)

Florida Registration No. 29275 Date: 12/21/1987 Telephone No. (318) 323-9000

SECTION II: GENERAL PROJECT INFORMATION

A. Describe the nature and extent of the project. Refer to pollution control equipment, and expected improvements in source performance as a result of installation. State whether the project will result in full compliance. Attach additional sheet if necessary.

Installation of a gas fired, aircraft derivative, turbine generator using water injection for NOx control, standby fuel oil, duct burner, steam generator and steam turbine to produce up to 38 MW of power for Reedy Creek Improvement District usage. See attached reports.

B. Schedule of project covered in this application (Construction Permit Application Only)

Start of Construction January 15, 1987 Completion of Construction November 30, 1988

C. Costs of pollution control system(s): (Note: Show breakdown of estimated costs only for individual components/units of the project serving pollution control purposes. Information on actual costs shall be furnished with the application for operation permit.)

Integral design of equipment and not individually available.

D. Indicate any previous DER permits, orders and notices associated with the emission point, including permit issuance and expiration dates.

Will replace existing smaller turbines and boilers A048-106735 and A048-106733.

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Signed Harold L Culp

Harold L. Culp, PE
Name (Please Type)

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Latitude ___° ___' ___"N Longitude ___° ___' ___"W

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APPLICANT ADDRESS: ______________________

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1 See Florida Administrative Code Rule 17-2.100(57) and (104)

Revised 12/21/87

E. Requested permitted equipment operating time: hrs/day 24 ; days/wk 7 ; wks/yr 52 ; if power plant, hrs/yr 8760 ; if seasonal, describe: Expect gas turbine itself to experience some maintenance downtime but request operating time allowance of 8760 hours/year on an average basis. Duct burners also operational 8760 hours/year.

F. If this is a new source or major modification, answer the following questions. (Yes or No)

1. Is this source in a non-attainment area for a particular pollutant? Yes

   a. If yes, has "offset" been applied? No

   b. If yes, has "Lowest Achievable Emission Rate" been applied? No

   c. If yes, list non-attainment pollutants. Ozone

2. Does best available control technology (BACT) apply to this source? If yes, see Section VI. No

3. Does the State "Prevention of Significant Deterioriation" (PSD) requirement apply to this source? If yes, see Sections VI and VII. No

4. Do "Standards of Performance for New Stationary Sources" (NSPS) apply to this source? Yes

5. Do "National Emission Standards for Hazardous Air Pollutants" (NESHAP) apply to this source? No

H. Do "Reasonably Available Control Technology" (RACT) requirements apply to this source? No

   a. If yes, for what pollutants? N/A

   b. If yes, in addition to the information required in this form, any information requested in Rule 17-2.650 must be submitted.

Attach all supportive information related to any answer of "Yes". Attach any justification for any answer of "No" that might be considered questionable.

See attachments

SECTION III: AIR POLLUTION SOURCES & CONTROL DEVICES (Other than Incinerators)

A. Raw Materials and Chemicals Used in your Process, if applicable: N/A

Description	Contaminants		Utilization Rate - lbs/hr	Relate to Flow Diagram
	Type	% Wt		

B. Process Rate, if applicable: (See Section V, Item 1)

1. Total Process Input Rate (lbs/hr): N/A

2. Product Weight (lbs/hr): N/A

C. Airborne Contaminants Emitted: (Information in this table must be submitted for each emission point, use additional sheets as necessary)

Name of Contaminant		Emission[1] Requested Max.		Allowed[2] Emission Rate per Rule 17-2 NSPS	Allowable[3] Emission lbs/hr	Potential[4] Emission		Relate to Flow Diagram
		Maximum lbs/hr	Actual T/yr			lbs/hr	T/yr	
	gas	11	46.4			11	46.4	
CO	*oil	24	4.0	N/A	N/A	24	4.0	Main
	gas	77	324.3	gas 152.1ppm	gas 206	248 (No H_2O)	1020	
NOx	*oil	100	16.8	oil 103.5ppm	oil 153	328	55	Stack
	gas	0.8	3.4			0.8	3.4	
PM	*oil	9	1.5	N/A	N/A	9	1.5	(See flow
	gas	0.19	0.8	oil 0.8%S		0.19	0.8	
SO_2	*oil	118	19.8	150ppmvd-15%O_2	14 days	118	19.8	diagram)
	gas	6	25.3			6	25.3	
•VOC	*oil	6	1.0	N/A	N/A	6	1.0	

*Standby No. 2 fuel oil to be used not more than 14 days/year •Methane plus non-methane

[1] See Section V, Item 2.
NOx - Reference Method 20 44 FR 52792

[2] Reference applicable emission standards and units (e.g. Rule 17-2.600(5)(b)2. Table II, E. (1) - 0.1 pounds per million BTU heat input)
NOx at ppmvd and 15% O_2 (NSPS)

[3] Calculated from operating rate and applicable standard.

[4] Emission, if source operated without control (See Section V, Item 3).

Projected using water injection based on mfg. data (no data without water except for NOx). CO and VOC also change with amount of water injection thus can vary from above emission rates.

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D. Control Devices: (See Section V, Item 4)

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)
Water Injection	NOx	65-75%	N/A	Mfg. data
(See vendor data)				

E. Fuels

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	
Natural Gas	0.373	0.448	450.0
No. 2 Fuel Oil (for only 14 days/yr)	2720	3184	447.5

*Units: Natural Gas--MMCF/hr; Fuel Oils--gallons/hr; Coal, wood, refuse, other--lbs/hr.

Fuel Analysis:

Percent Sulfur: 0.001± (gas) 0.32 (oil) Percent Ash: 0 (gas) 0.005 (oil)

Density: 7.1± (oil) lbs/gal Typical Percent Nitrogen: 0.756 (gas) 0 (oil)

Heat Capacity: 20797 LHV (gas) BTU/lb 131,350 LHV (oil) BTU/gal

Other Fuel Contaminants (which may cause air pollution): None of significance

F. If applicable, indicate the percent of fuel used for space heating.

Annual Average ______ Maximum ______

G. Indicate liquid or solid wastes generated and method of disposal.

Any miscellaneous oils will be collected and reclaimed by outside contract. Miscellaneous boiler/cooling tower blowdowns and water treatment regenerant/reject streams will be discharged to the sanitary sewer and treated.

H. Emission Stack Geometry and Flow Characteristics (Provide data for each stack): on gas

Stack Height: 65 (M) 65 (B) ft. Stack Diameter: 11.16 (M) 12.41 (B) ft. (equivalents - rectangular)

Gas Flow Rate: 301,777 (M) 506,188 (B) ACFM 185,697 (M) 185,800 (B) DSCFM Gas Exit Temperature: 800 (B) 285 (M) °F.

Water Vapor Content: 9.4 (M) 9.1 (B) % Velocity: 51.42 (M) 69.75 (B) FPS

M = Main Stack
B = Bypass Stack

SECTION IV: INCINERATOR INFORMATION

N/A

Type of Waste	Type O (Plastics)	Type I (Rubbish)	Type II (Refuse)	Type III (Garbage)	Type IV (Pathological)	Type V (Liq.& Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Incinerated							
Uncontrolled (lbs/hr)							

Description of Waste ______

Total Weight Incinerated (lbs/hr) ______ Design Capacity (lbs/hr) ______

Approximate Number of Hours of Operation per day ______ day/wk ______ wks/yr. ______

Manufacturer ______

Date Constructed ______ Model No. ______

	Volume (ft)^3	Heat Release (BTU/hr)	Fuel		Temperature (°F)
			Type	BTU/hr	
Primary Chamber					
Secondary Chamber					

Stack Height: ______ ft. Stack Diamter: ______ Stack Temp. ______

Gas Flow Rate: ______ ACFM ______ DSCFM* Velocity: ______ FPS

*If 50 or more tons per day design capacity, submit the emissions rate in grains per standard cubic foot dry gas corrected to 50% excess air.

Type of pollution control device: [ ] Cyclone [ ] Wet Scrubber [ ] Afterburner

[ ] Other (specify) ______

Revised 12/21/87

Brief description of operating characteristics of control devices: ____________________

____

____

____

____

Ultimate disposal of any effluent other than that emitted from the stack (scrubber water, ash, etc.):

____

____

____

____

NOTE: Items 2, 3, 4, 6, 7, 8, and 10 in Section V must be included where applicable.

SECTION V: SUPPLEMENTAL REQUIREMENTS

Please provide the following supplements where required for this application.

1. Total process input rate and product weight -- show derivation [Rule 17-2.100(127)]

2. To a construction application, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach proposed methods (e.g., FR Part 60 Methods 1, 2, 3, 4, 5) to show proof of compliance with applicable standards. To an operation application, attach test results or methods used to show proof of compliance. Information provided when applying for an operation permit from a construction permit shall be indicative of the time at which the test was made.

3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).

4. With construction permit application, include design details for all air pollution control systems (e.g., for baghouse include cloth to air ratio; for scrubber include cross-section sketch, design pressure drop, etc.)

5. With construction permit application, attach derivation of control device(s) efficiency. Include test or design data. Items 2, 3 and 5 should be consistent: actual emissions = potential (1-efficiency).

6. An 8 1/2" x 11" flow diagram which will, without revealing trade secrets, identify the individual operations and/or processes. Indicate where raw materials enter, where solid and liquid waste exit, where gaseous emissions and/or airborne particles are evolved and where finished products are obtained.

7. An 8 1/2" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Example: Copy of relevant portion of USGS topographic map).

8. An 8 1/2" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram.

9. The appropriate application fee in accordance with Rule 17-4.05. The check should be made payable to the Department of Environmental Regulation.

10. With an application for operation permit, attach a Certificate of Completion of Construction indicating that the source was constructed as shown in the construction permit.

SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY

A. Are standards of performance for new stationary sources pursuant to 40 C.F.R. Part 60 applicable to the source?

[X] Yes [ ] No

Contaminant	Rate or Concentration
NOx	*152.1 ppmvd 15% O_2
SO_2	0.015% by vol., 15% O_2, dry, fuel under
	0.8% S by weight
	*Converts to 206 lbs./hr. NOx - on gas

B. Has EPA declared the best available control technology for this class of sources (If yes, attach copy)

[X] Yes [ ] No

Contaminant	Rate or Concentration
NOx, SO_2	
See 40 CFR subpart GG plus text of	60.330 et al
attached Addendum No. 1	

C. What emission levels do you propose as best available control technology?

Contaminant	Rate or Concentration
NOx	77 lbs/hr (gas) 100 lbs/hr (oil - 14 days/year)
SO_2	0.32% sulfur fuel oil (#2) - less than 0.8%

D. Describe the existing control and treatment technology (if any).

1. Control Device/System: Water injection into combustor
2. Operating Principles: Reduce flame temperatures
3. Efficiency:* 65-75% overall
4. Capital Costs: See text attached

*Explain method of determining

Revised 12/21/87

5. **Useful Life:** Combustor dome about 12,000 hours
6. **Operating Costs:** See text
7. **Energy:** 20 gpm gas, 35 gpm oil (water usage)
8. **Maintenance Cost:** See text
9. **Emissions:**

(See IIIc)

Contaminant	Rate or Concentration
NOx	77 lbs/hr (gas), 100 lbs/hr (oil)
SO_2	0.19 lbs/hr (gas), 118 lbs/hr (oil - for only 14 days/yr)

10. **Stack Parameters** M = Main Stack B = Bypass Stack

a. **Height:** 65 (M) 65 (B) ft.
b. **Diameter:** 11.16 (M) 12.41 (B) ft.
c. **Flow Rate:** 301,777(M) 506,188(B) ACFM
d. **Temperature:** 285 (M) 800 (B) °F.
e. **Velocity:** 51.42 (M) 69.75 (B) FPS

E. **Describe the control and treatment technology available (As many types as applicable, use additional pages if necessary).**

1. (See VI, D and text)

a. Control Device:
b. Operating Principles:
c. Efficiency:[1]
d. Capital Cost:
e. Useful Life:
f. Operating Cost:
g. Energy:[2]
h. Maintenance Cost:
i. Availability of construction materials and process chemicals:
j. Applicability to manufacturing processes:
k. Ability to construct with control device, install in available space, and operate within proposed levels:

2.

a. Control Device:
b. Operating Principles:
c. Efficiency:[1]
d. Capital Cost:
e. Useful Life:
f. Operating Cost:
g. Energy:[2]
h. Maintenance Cost:
i. Availability of construction materials and process chemicals:

[1]Explain method of determining efficiency.
[2]Energy to be reported in units of electrical power - KWH design rate.

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

3.

a. Control Device:

b. Operating Principles:

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d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

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b. Operating Principles:

c. Efficiency:[1]

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f. Operating Cost:

g. Energy:[2]

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i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

F. Describe the control technology selected:

1. Control Device:

2. Efficiency:[1]

3. Capital Cost:

4. Useful Life:

5. Operating Cost:

6. Energy:[2]

7. Maintenance Cost:

8. Manufacturer:

9. Other locations where employed on similar processes:

a. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

[1]Explain method of determining efficiency.
[2]Energy to be reported in units of electrical power - KWH design rate.

ADDENDUM NO. 1

TO

ORIGINAL PERMIT APPLICATION REPORT FOR REEDY CREEK IMPROVEMENT DISTRICT AT LAKE BUENA VISTA, FLORIDA

DER FILE NO. AC-48-137740
FED. PERMIT PSD-FL-123

Prepared by:

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Original - July 29, 1987
Addendum 1 - December 21, 1987

10268R

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ADDENDUM NO. 1

I. Background

This document and accompanying pages of the Department of Environmental Regulation (DER Form 17-1.202(1)) constitute amendments to the original air permit application submitted by the Reedy Creek Improvement District on August 5, 1987.

As noted in the Bureau of Air Quality Management's (BAQM) Technical Evaluation and Preliminary Determination issued November 23, 1987, the Agency supported findings of the original application, except for the fact that the Best Available Control Technology (BACT) was not applied fully in the area of nitrogen oxides (N0x). Although the District proposed emitting about two-thirds of the N0x allowed under New Sources Performance Standards (NSPS), the BAQM felt that current technology would support about one-fourth to half of the requested allowance.

This was discussed in detail at a meeting held in the BAQM offices on December 8, 1987 attended by the Applicant, consultants for the Applicant, gas turbine representatives and Bureau staff personnel. The main issue involved the use of steam injection vs water and the appropriate quantities to achieve a discharge of down to 25 ppmvd of N0x (about 150 tons/year) on an acceptable cost-effective basis. Including related matters, participants discussed the fact that the proposed District turbine was not a STIG (steam injected gas) unit, thus wasn't designed to accept steam in the combuster dome, nor would the heat balance at the District support the large quantities of steam required.

The Manager of GE Gas Turbines pointed out there was no demonstrated, commercial unit in the world that could achieve a 25 ppmvd N0x emission using water injection, and even if possible, the combuster life would be so short (due to impact erosion) that commercialization could not be sustained. Even water rates equivalent to 42 ppmvd N0x emission shortens average combuster life to an expected 6,000 hours or half that experienced at 62 ppmvd.

An important BAQM/EPA consideration for gas turbine N0x control is their documented cost-effective hurdle determination whereby a cost of up to $1,000 per ton of N0x emission controlled is reasonable for BACT. From a regulatory view, NSPS is only a starting point for a BACT determination, and BACT is often more stringent than NSPS.

By definition the BAQM considers the $1,000/ton test as the incremental cost to be considered starting at the final level chosen for the initial application (103 ppmvd N0x emission on gas) rather than at NSPS or the point of zero water injection (no control). The District has structured their compliance response consistent with this definition.

The BAQM confirmed that, if at least two years of data out of the last five are used as documented N0x, CO and other relevant pollutant emission levels from the existing Orenda turbines and boilers (due to be shutdown), these totals may be used as contemporaneous decreases against the new GE turbine.

It was also stipulated that the N0x emissions variation applicable to the Reedy Creek sources over the past five years (or since the latest PSD based application which was PSD-FL-109 received June 7, 1985) must be accounted for when determining the overall net emissions increases.

It was noted the Applicant could not cost-effectively meet a 25 ppmvd N0x limitation with a water injected turbine while a total 103 ppmvd limit probably would not satisfy the $1,000 per ton test of N0x removed.

Thus it was agreed that Reedy Creek would submit an amended Permit Application based on higher water rates and a more cost effective N0x control and emission level.

If the emission totals were below the significance levels (with proper credit given for the existing units to be shutdown) then PSD review would not be required. What ever type application amendment was submitted, the Agency would act on it as promptly as possible due to ongoing project delays.

II. Amended Approach

This application amendment, based on the above guidelines, includes:

a) Determination of contemporaneous NOx and CO decreases available from existing equipment to be shutdown,

b) Compilation of costs accrued by operating at different levels of NOx control aimed at meeting $1,000 per ton incremental NOx removal target,

c) Development of representative combustion calculations to verify compliance conditions and equipment applications,

d) Formulation of temperature dependent curves depicting NOx emissions under varying seasonal conditions for compliance purposes.

e) Definition of concentrations and mass weights to be emitted with proper control levels, translate allowables to DER Form 17-1.202(1).

III. Technical Definition

A. Contemporaneous Decreases

Based on Annual Operating Reports developed by ESE of Gainesville, Florida for the Districts Utility Company, and subsequently forwarded to the DER for the years 1984-5-6, the following emissions occurred:

1984 Emissions (Tons)*

	Particulates	N0x	S02	CO	Hydrocarbons
CEP Turbine 1	5.52	162.7	0.24	45.3	16.55
CEP Turbine 2	5.61	165.5	0.24	46.1	16.83
Boiler 1	0.11	3.19	0.01	0.80	0.06
Boiler 2	0.16	4.39	0.02	1.10	0.09
	11.40	335.78	0.51	93.3	33.53

*Orenda turbines and their boilers

1985 Emissions (tons)

	Particulates	N0x	S02	CO	Hydrocarbons
CEP Turbine 1	4.40	129.8	0.19	36.1	13.20
CEP Turbine 2	5.54	163.4	0.24	45.5	16.61
Boiler 1	0.11	3.05	0.01	0.76	0.06
Boiler 2	0.18	5.09	0.02	1.27	0.10
	10.23	301.34	0.46	83.63	29.97

1986 Emissions (tons)

CEP Turbine 1	4.5	134.1	0.2	37.3	13.6
CEP Turbine 2	4.6	135.0	0.2	37.6	13.7
Boiler 1	0.09	2.6	0.01	0.7	0.05
Boiler 2	0.12	3.4	0.01	0.9	0.07
	9.31	275.1	0.42	76.5	27.42

Of the major pollutants, the following averaged totals are the contemporaneous decreases appropriate to this application (DER 17-2.510 (2) e):

N0x	304 tons/year
SO2	0.4 tons/year
CO	84.4 tons/year
Hydrocarbons	30.3 tons/year

There were no changes in Reedy Creek operations since the last submitted PSD application that affect the above listed credits.

B. N0x Control Costs and Emissions

Exhibit 1, as attached, depicts the economic study defining costs of abating N0x emissions for natural gas and oil firing. Conditions were based on the following 40 year average of Orlando weather data obtained from the National Weather Service:

Month	Temperature	Relative Humid. (%)
Jan.	60.5	73.5
Feb.	61.5	71.0

Mar.	66.8	70.3
Apr.	72.0	68.3
May	77.3	71.0
Jun.	80.9	76.5
Jul.	82.4	78.3
Aug.	82.5	79.8
Sept.	81.1	79.8
Oct.	74.9	75.8
Nov.	67.5	75.0
Dec.	62.0	75.5

Average 12 month temperature	= 72.4°F
Average 12 month humidity	= 74.6%
Average gas firing period temperature	= 73°F
Relative humidity to turbine due to evaporative cooler	= 95%

It has been decided that use of No. 2 oil by the District would occur only 14 days per year (using January as the gas curtailment period) thus the average temperature for the remainder of the year (73°F) was used to adjust N0x tonnages for a year.

Fuel gas prices, being the largest incremental item, are based on Gas Research Institute projected fuel gas costs. October was chosen as a representative month due to its closeness to the 11½ month average temperature and the expected total N0x tonnages illustrated by the manufacturer's combustion calculations contained in Exhibit 2 and derived as follows:

Month and Conditions - Yearly Basis Emission

January - Turbine and Duct Burner on back-up fuel (oil) for 14 days (336 hours)

99.77 lbs/hr NOx = 16.76 tons

117.88 lbs/hr SO_2 = 19.8 tons

22.54 lbs/hr CO = 3.78 tons

- on gas for remaining 17 days of January along with remaining months of year as follows:

Total time of yearly turbine operation	8760 hrs
Less oil burning in January, if required	-336 hrs
	8424 hrs on gas

February thru December - Turbine and duct burner on gas except when turbine is down and then the duct burner is on gas at hi-fire (198 MM BTU/hr at 68°F).

Turbine on gas =	8424 hrs
Turbine and duct burner - 76.24 lbs/hr NOx x 8424 =	321.1 tons
- 0 lbs/hr SO_2	
- 10.71 lbs/hr CO x 8424 =	45.1 tons

Thus total average emissions for the installation over a years period becomes:

NOx	337.9 tons
SO_2	19.8 tons
CO	48.9 tons
Hydrocarbons	25.2 tons (from Exhibit 2).

Deducting contemporaneous decreases previously listed results in a net yearly emission change of:

NOx	33.9 tons
SO2	19.4 tons
CO	(35.5) tons
Hydrocarbons	(5.1) tons

These emission increases are all below the PSD significance levels.

Based on Exhibit 2, when burning oil, NOx emissions from the turbine, including the duct burner, will approximate 67 ppmvd on a 15% oxygen basis (14 days per year). Fuel gas usage on the same basis for the balance of the year yields NOx emissions of 57 ppmvd and 36 ppmvd with only the duct burner in service. Exhibit 1 illustrates, while burning gas, the level of approximately 61½ ppmvd that corresponds to a NOx removal cost totaling $1,051/ton. This indicates the cost-effective threshold to be in the low sixties ppmvd area, using the $1,000/ton incremental approach.

C. Compliance Verification

RCID proposes that compliance with the annual NOx emission limit be determined and verified by the establishment of a constant, enforceable water/fuel ratio. It is proposed that this water/fuel ratio be established during initial compliance testing. Because fuel consumption, and therefore NOx emissions, varies with inlet temperature, a curve of NOx vs inlet temp was derived (Exhibit 3). When average monthly inlet temperatures and operating hours are applied to this curve, the total annual NOx emissions will be equal to or less than the amended emission limit. It is proposed the initial compliance testing establish an enforceable water/fuel ratio that, at the actual turbine inlet temperature prevailing at the time, gives a NOx emission rate that falls on or below the curve.

It is noted that inlet temp (T2) is used rather than ambient temperature (TAMB). The use of an evaporative cooler in this project conditions the inlet air from ambient to a lower dry bulb temperature and a relatively constant 95% Relative Humidity. This modified inlet air condition results in a more predictable NOx emission curve and greatly simplifies the task of compliance testing by eliminating the need to adjust ambient humidity conditions to standard conditions. G.E. data indicate that, at constant 95% humidity, T2 is usually 4 to 6½°F below ambient temperatures.

T2 will always be recorded data, along with water, fuel usages and ambient temperatures, thus the constant correlation between temperatures and N0x emissions can be monitored, making a variable situation constant for overall reconcilation and compliance control.

Exhibit 3 illustrates temperature dependent N0x conditions for the project and the turbine N0x emission level (excluding duct burner) of 59 ppmvd which occurs during the typical October gas usage period. Lower winter temperatures will cause rises in N0x emissions and higher summer temperatures result in lower emission, the overall yearly result being compliance with the annual emission limit.

Month	Ambient °F Temperature	T2 Actual Inlet Temperature °F
Jan.	60.5	56.0
Feb.	61.5	56.6
Mar.	66.8	61.1
Apr.	72.0	65.3
May	77.3	70.9
Jun	80.9	75.2
Jul.	82.4	77.5
Aug.	82.5	77.9
Sept.	81.1	76.5
Oct.	74.9	69.9
Nov.	67.5	62.8
Dec.	62.0	57.5

IV. Conclusions

This submission is to amend, rather than replace, the previous application package submitted August 5, 1987 and is requested to be considered on that basis.

The District is committing to increase water injection rates for turbine NOx control with their attendant costs. The cost-effective NOx emission point for the turbine alone is 59 ppmvd (15% O_2) average (57 ppmvd with supplementary duct burner) based on the $1,000/ton incremental removal hurdle rate.

The proposed amendment will be achieved at a NOx control cost in excess of the $1000/ton that would be considered reasonable had PSD/BACT review been required.

All net emission increases for the described plant modification fall beneath PSD significance thresholds when considering net contemporaneous emission changes.

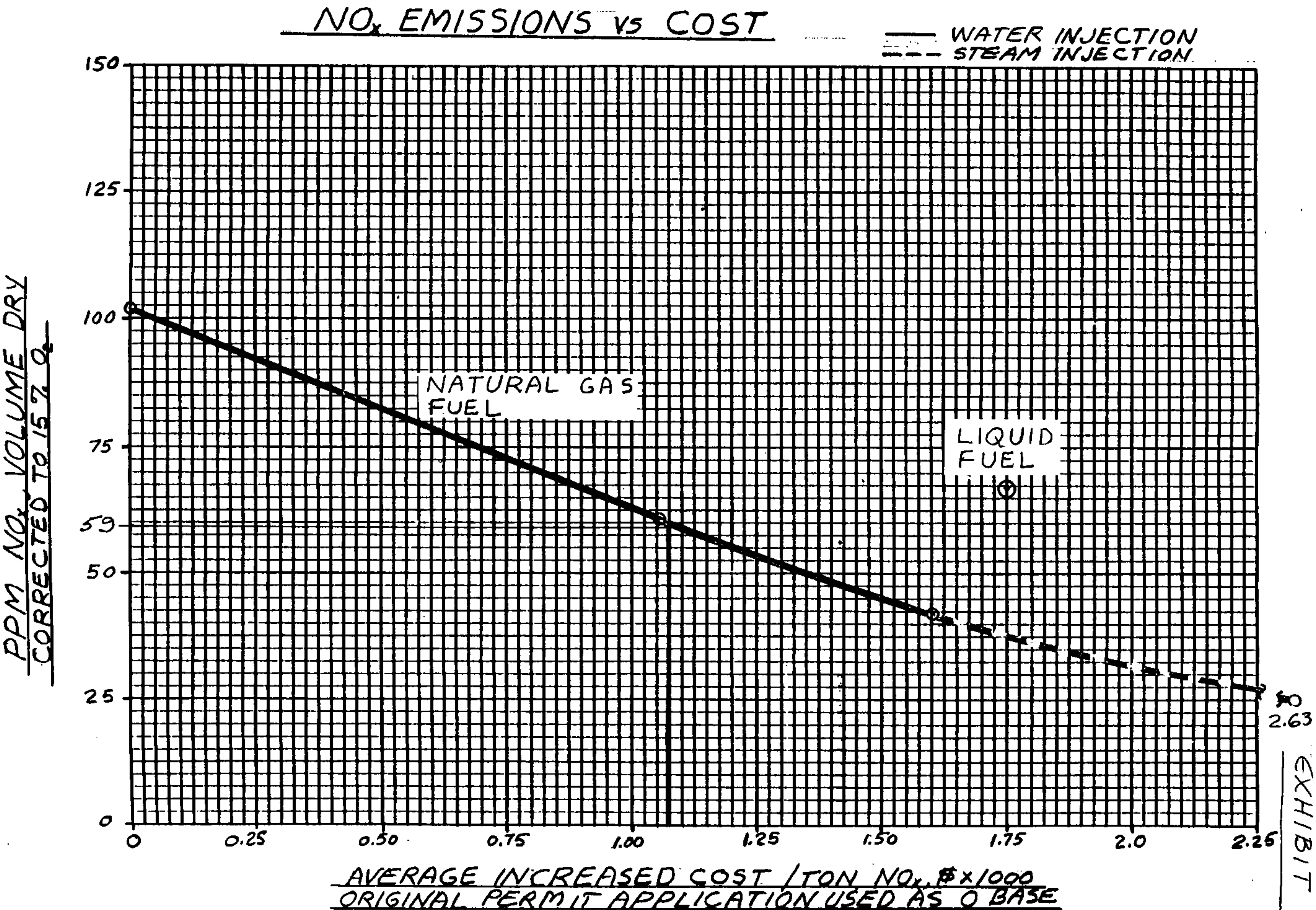
Ambient air quality net impacts for N0x are negligible with less than 1/3 ug/m^3 expected. Current background levels of N0x are about 16 ug/m^3.

The current cogeneration upgrade project is essentially on hold due to abatement considerations noted in this revised application. Based on these data the District is requesting prompt and favorable consideration of this submittal.

RDS:bgfh:D509:k:12-20-87

Exhibit 1

NOx Emissions vs Cost



NOx EMISSIONS vs COST
WATER INJECTION
STEAM INJECTION
PPM NOx VOLUME DRY
CORRECTED TO 15% O2
150
125
100
75
59
50
25
0
NATURAL GAS FUEL
LIQUID FUEL
$0
2.63
0
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.0
2.25
AVERAGE INCREASED COST / TON NOx, $ x 1000
ORIGINAL PERMIT APPLICATION USED AS 0 BASE

EXHIBIT 1

NOx EMISSION VS COST
NATURAL GAS FIRING
103 PPM USED AS BASE

DER FILE AC 48-137740
FEDERAL PSD-FL-123

DATED DECEMBER 18, 1987

A	B	C	D	E	F	G	H
	Fuel & Elect.*(2)	Water*	Maint.*	Capital*	Annualized* Capital (4)	Total* Yearly	Average Increase $/Ton (3)
1. 103 PPM (1) 593 Tons/Yr	0	0	0	0	0	0	0
2. 61.6 PPM (1) 316.5 Tons/Yr	234	30.7	24.6	24	1.2	290.5	$1051/T
3. 42 PPM (1) 225 Tons/Yr	421.9	54.7	110	77	3.9	590.5	$1605/T
4. 25 PPM (1) 133 T/Yr Steam Injection Only	1058.8	145	-	80	4.0	1207.8	$2626/T

* - $1000

NOTES:

(1) PPM Vol. dry basis corrected to 15% O_2

(2) Fuel Cost: The required fuel cost to evaporate the water injected that exits the exhaust stack as vapor at 280°F. (Fuel cost's based on RCID actuals for 1986, 1987 and escalated according to GRI data to develop a 15 yr. average = $3.75/MM BTU) (Constant 1986 $)
Elect. Cost: The required electrical cost for operation of NOx water pumps and differential cost of purchased-to-generated power during gas turbine repairs.

(3) Calculation for average $/ton, for example 61.6 PPM case: H2 = G2/(A1-A2) tons.

(4) Annualized capital is based on straight line depreciation for 20 years.

GENERAL NOTES:

Comparison chart based on ambient operating temperature of 73°F.

bgfh:d509:kl

NOx EMISSION VS COST
LIQUID FUEL
103 PPM USED AS BASE

DER FILE AC 48-137740
FEDERAL PSD-FL-123

DATED DECEMBER 18, 1987

A	B Fuel & Elect.*(2)	C Water*	D Maint.*	E Capital*	F Annualized* Capital (4)	G Total*	H Average Increase $/Ton (3)
1. 103 PPM NOx (1) 22.8 Tons/2 wks	0	0	0	0	0	0	0
2. 67.19 PPM NOx (1) 16.7 Tons/2 wks	8.1	1.6	0.95	0.92	.05	10.7	$1750/T

* - $1000

NOTES:

(1) PPM Vol. dry basis, corrected to 15% O_2
(2) Fuel Cost: The required fuel cost to evaporate the water injected that exits the stack as vapor at 280°F. (Fuel cost's based on RCID actuals for 1986, 1987 and escalated according to GRI data to develop a 15 yr. average $3.75/MM BTU) (Constant 1986 $).
Elect. Cost: The required electrical cost for operation of NOx water pumps and differential cost of purchased-to-generated power during gas turbine repairs.
(3) Calculation for average $/ton, for example: H2 = G2/(A1 - A2) tons.
(4) Annualized capital cost is based on straight line depreciation for 20 years.

GENERAL NOTE:

January used as basis for fuel oil.

bgfh:d509:kl(2)

NATURAL GAS PRICE PROJECTIONS FOR USE IN AIR PERMITTING

File: COGENAIR
Date: 17 December, 1987
By: Ed Godwin, RCES
Basis of Projection: Gas Research Institute (GRI), 1987 Analysis
Plant Operation Period: 1989 - 2003
All Figures in 1986 $/MMBTU

Year	GRI Cost of Acquisition	GRI Cost To End-Users	RCES Acquisition
1985	$2.44	$4.17	$2.71*
1986	$1.82	$2.95	$2.74*
1987	$1.93	$3.08	$2.69*
1988	$2.04	$3.22	$2.81
1989	$2.17	$3.36	$2.94
1990	$2.30	$3.52	$3.07
1991	$2.41	$3.63	$3.17
1992	$2.54	$3.74	$3.27
1993	$2.67	$3.86	$3.37
1994	$2.80	$3.98	$3.48
1995	$2.95	$4.11	$3.59
1996	$3.10	$4.24	$3.70
1997	$3.25	$4.38	$3.82
1998	$3.42	$4.52	$3.94
1999	$3.60	$4.66	$4.07
2000	$3.78	$4.81	$4.20
2001	$3.95	$5.00	$4.36
2002	$4.13	$5.20	$4.53
2003	$4.32	$5.40	$4.71
2004	$4.52	$5.62	$4.90
2005	$4.73	$5.84	$5.09
2006	$4.94	$6.07	$5.30
2007	$5.17	$6.31	$5.51
2008	$5.41	$6.56	$5.72
2009	$5.65	$6.82	$5.95
2010	$5.91	$7.09	$6.19

Average RCES Cost of Gas Acquisition for the First
Fifteen Years of Operation: 1989 - 2003 = $3.75/MMBTU

* - Actual Purchase Costs.

Exhibit 2

Combustion Performance Data

EXHIBIT 2

PROJECT: Vogt/Reedy Creek Utilities Dec. 17, 1987 Page 1 JAN.
Operating Case 17A, Turbine Water/Fuel Ratio of 0.9409
TURBINE EXHAUST GAS FLOW (LBS/HR): 1026277

Turbine on Oil & water injection

TURBINE EXHAUST GAS TEMPERATURE: 794 Degrees F.

TURBINE EXHAUST GAS COMPOSITION:	% WT.	LBS/HR	Vol. %	Vol.% Dry
Oxygen O2	16.0564	164783.1	14.326	15.477
Carbon Dioxide CO2	5.7939	59461.46	3.759	4.061
Water Vapor H2O	4.6909	48141.62	7.434	0
Nitrogen N2	72.2053	741025.8	73.588	79.498
Argon Ar	1.2315	12638.60	0.880	0.951
Carbon Monoxide CO	0.00147	15.11	0.0015	0.0016
Nitrogen Oxides NOx	0.00949	97.42	0.0059	0.0064
Hydrocarbons CH4	0.00019	1.95	0.0003	0.0004
Hydrocarbons C2H6	0	0	0	0
Sulfur Dioxide SO2	0.01090	111.86	0.0049	0.0052
Particulate	0	0	0	0
Water injection rate = 35 gpm TOTAL	100.00	1026277.	100.000	100.000

CO - PPMV Dry, Reference 15% Oxygen:	17.62 ✓
NOx - PPMV Dry, Reference 15% Oxygen:	69.14
CH4 - PPMV Dry, Reference 15% Oxygen:	3.97
C2H6 - PPMV Dry, Reference 15% Oxygen:	0.00
SO2 - PPMV Dry, Reference 15% Oxygen:	57.02

Exhaust Gas Molecular Weight: 28.552

Fuel: #2 Fuel Oil

Heating Value: 19504 BTU/LB (HHV)
18400 BTU/LB (LHV)

Duct Burner Heat Input: 19.550 Million BTU/HR (Gross HHV) supplementary
18.443 Million BTU/HR (Net LHV)

Fuel ~~Gas~~ Oil Elemental Composition:

	WEIGHT %	LBS/HR
CARBON	87.300%	875.059
HYDROGEN	12.400%	124.292
OXYGEN	0	0
SULFUR	0.300%	3.007
NITROGEN	0	0
ASH	0	0
TOTAL	100.000%	1002.358

Emissions Added by the Duct Burner (LB/Million BTU HHV):

NOx as NO2:	0.120
Carbon Monoxide:	0.380
UBHC as CH4:	0.190
UBHC as C2H6:	0
Particulate:	0.050

ADDITIONAL AIR SOURCES:

Flame Scanner Cooling Air:	1890 LBS/HR
Augmenting Combustion Air:	0 LBS/HR
Atomizing Air:	7560 LBS/HR
Total	9450 LBS/HR

JAN.

~~Page 2~~ Turbine + duct burner on oil with water injection

COMBUSTION PRODUCTS DOWNSTREAM OF THE DUCT BURNER

Downstream Firing Temperature: 851 Degrees F.

COMBUSTION PRODUCTS (LBS/HR)

	Upstream	Fuel	Air	Total
Oxygen O2	164783.1	-3317.54	2187.675	163653.2
Carbon Dioxide CO2	59461.46	3202.715	0	62664.17
Water Vapor H2O	48141.62	1111.175	0	49252.80
Nitrogen N2	741025.8	0.000	7262.325	748288.1
Argon Ar	12638.60	0	0	12638.60
Carbon Monoxide CO	15.11	7.43	0	22.54 ✓
Nitrogen Oxides NOx	97.42	2.35	0	99.77 ✓
Hydrocarbons CH4	1.95	3.71	0	5.66 ✓
Hydrocarbons C2H6	0	0	0	0
Sulfur Dioxide SO2	111.86	6.01	0	117.88 ✓
Particulate	0.00	0.98	0	0.98
TOTAL	1026277.	1016.825	9450.000	1036743.

Water injection rate = 35 gpm

COMBUSTION PRODUCTS - VOLUME BASIS

	Moles/HR	Vol. %	Vol. % Dry
Oxygen O2	5114.165	14.086	15.232
Carbon Dioxide CO2	1423.862	3.922	4.241
Water Vapor H2O	2733.230	7.528	0
Nitrogen N2	26715.03	73.579	79.569
Argon Ar	316.376	0.871	0.942
Carbon Monoxide CO	0.805	0.0022	0.0024
Nitrogen Oxides NOx	2.169	0.0060	0.0065
Hydrocarbons CH4	0.353	0.0010	0.0011
Hydrocarbons C2H6	0	0	0
Sulfur Dioxide SO2	1.840	0.0051	0.0055
Particulate	0.081	0.0002	0.0002
TOTAL	36307.91	100.000	100.000

CO - PPMV Dry, Reference 15% Oxygen: 24.93 ✓
NOx - PPMV Dry, Reference 15% Oxygen: 67.19 ✓
CH4 - PPMV Dry, Reference 15% Oxygen: 10.94
C2H6 - PPMV Dry, Reference 15% Oxygen: 0.00
SO2 - PPMV Dry, Reference 15% Oxygen: 57.01

Exhaust Gas Molecular Weight: 28.558

COEN Company, Incorporated
1510 Rollins Road; Burlingame, CA 94010
(415) 697-0440
Automatic Telefax Number (415) 579-3255

PROJECT: Vogt/Reedy Creek Utilities Dec. 17, 1987 Page 3 OCT.
Operating Case 19A, Turbine Water/Fuel Ratio of 0.67
TURBINE EXHAUST GAS FLOW (LBS/HR): 956696

Turbine on Gas & water injection

TURBINE EXHAUST GAS TEMPERATURE: 805 Degrees F.

TURBINE EXHAUST GAS COMPOSITION:

		% WT.	LBS/HR	Vol. %	Vol.% Dry
Oxygen	O_2	16.2191	155167.4	14.300	15.733
Carbon Dioxide	CO_2	4.2308	40475.89	2.712	2.984
Water Vapor	H_2O	5.8189	55669.18	9.112	0
Nitrogen	N_2	72.4870	693480.3	72.997	80.316
Argon	Ar	1.2361	11825.71	0.873	0.961
Carbon Monoxide	CO	0.00024	2.29	0.0002	0.0003
Nitrogen Oxides	NO_x	0.00769	73.59	0.0047	0.0052
Hydrocarbons	CH_4	0.00016	1.53	0.0003	0.0003
Hydrocarbons	C_2H_6	0	0	0	0
Sulfur Dioxide	SO_2	0	0	0	0
Particulate		0	0	0	0
TOTAL		100.00	956696.0	100.000	100.000

Water injection rate = 20 gpm

CO - PPMV Dry, Reference 15% Oxygen:	3.03
NOx - PPMV Dry, Reference 15% Oxygen:	59.12 ✓
CH4 - PPMV Dry, Reference 15% Oxygen:	3.53
C2H6 - PPMV Dry, Reference 15% Oxygen:	0
SO2 - PPMV Dry, Reference 15% Oxygen:	0

Bypass stack
d = 12.41'
v = 69.75 fps
506,188 acfm

Exhaust Gas Molecular Weight: 28.213

Fuel: Natural Gas

Heating Value: 21065 BTU/LB (HHV)
19000 BTU/LB (LHV)

Duct Burner Heat Input: 22.150 Million BTU/HR (Gross HHV) supplementary
19.979 Million BTU/HR (Net LHV)

Fuel Gas Elemental Composition:

	WEIGHT %	LBS/HR
CARBON	73.480%	772.648
HYDROGEN	24.080%	253.203
OXYGEN	1.684%	17.707
SULFUR	0	0
NITROGEN	0.756%	7.949
ASH	0	0
TOTAL	100.000%	1051.507

Emissions Added by the Duct Burner (LB/Million BTU HHV):

NOx as NO2:	0.120
Carbon Monoxide:	0.380
UBHC as CH4:	0.190
UBHC as C2H6:	0
Particulate:	0

ADDITIONAL AIR SOURCES:

Flame Scanner Cooling Air:	1890 LBS/HR
Augmenting Combustion Air:	0 LBS/HR
Atomizing Air:	0 LBS/HR
Total	1890 LBS/HR

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COMBUSTION PRODUCTS DOWNSTREAM OF THE DUCT BURNER

Turbine + duct burner on gas with water injection

Downstream Firing Temperature: 878 Degrees F.

COMBUSTION PRODUCTS (LBS/HR)

Stack = 285°F

	Upstream	Fuel	Air	Total
Oxygen O_2	155167.4	-4047.96	437.535	151557.0
Carbon Dioxide CO_2	40475.89	2827.889	0	43303.78
Water Vapor H_2O	55669.18	2263.634	0	57932.81
Nitrogen N_2	693480.3	7.949	1452.465	694940.7
Argon Ar	11825.71	0	0	11825.71
Carbon Monoxide CO	2.29	8.42	0	10.71 ✓
Nitrogen Oxides NO_x	73.59	2.66	0	76.24 ✓
Hydrocarbons CH_4	1.53	4.21	0	5.74 ✓
Hydrocarbons C_2H_6	0	0	0	0
Sulfur Dioxide SO_2	0	0	0	0
Particulate	0	0	0	0
TOTAL	956696.0	1066.791	1890.000	959652.8

Water injection rate = 20 gpm

COMBUSTION PRODUCTS - VOLUME BASIS

	Moles/HR	Vol. %	Vol. % Dry
Oxygen O_2	4736.158	13.912	15.363
Carbon Dioxide CO_2	983.953	2.890	3.192
Water Vapor H_2O	3214.918	9.443	0
Nitrogen N_2	24810.45	72.878	80.478
Argon Ar	296.028	0.870	0.960
Carbon Monoxide CO	0.382	0.0011	0.0012
Nitrogen Oxides NO_x	1.657	0.0049	0.0054
Hydrocarbons CH_4	0.358	0.0011	0.0012
Hydrocarbons C_2H_6	0	0	0
Sulfur Dioxide SO_2	0	0	0
Particulate	0	0	0
TOTAL	34043.90	100.000	100.000

Main stack
d = 11.16'
v = 51.42 fps
301,777 acfm

CO - PPMV Dry, Reference 15% Oxygen: 13.20 ✓
NO_x - PPMV Dry, Reference 15% Oxygen: 57.81 ✓
CH_4 - PPMV Dry, Reference 15% Oxygen: 12.35
C_2H_6 - PPMV Dry, Reference 15% Oxygen: 0
SO_2 - PPMV Dry, Reference 15% Oxygen: 0

Exhaust Gas Molecular Weight: 28.193

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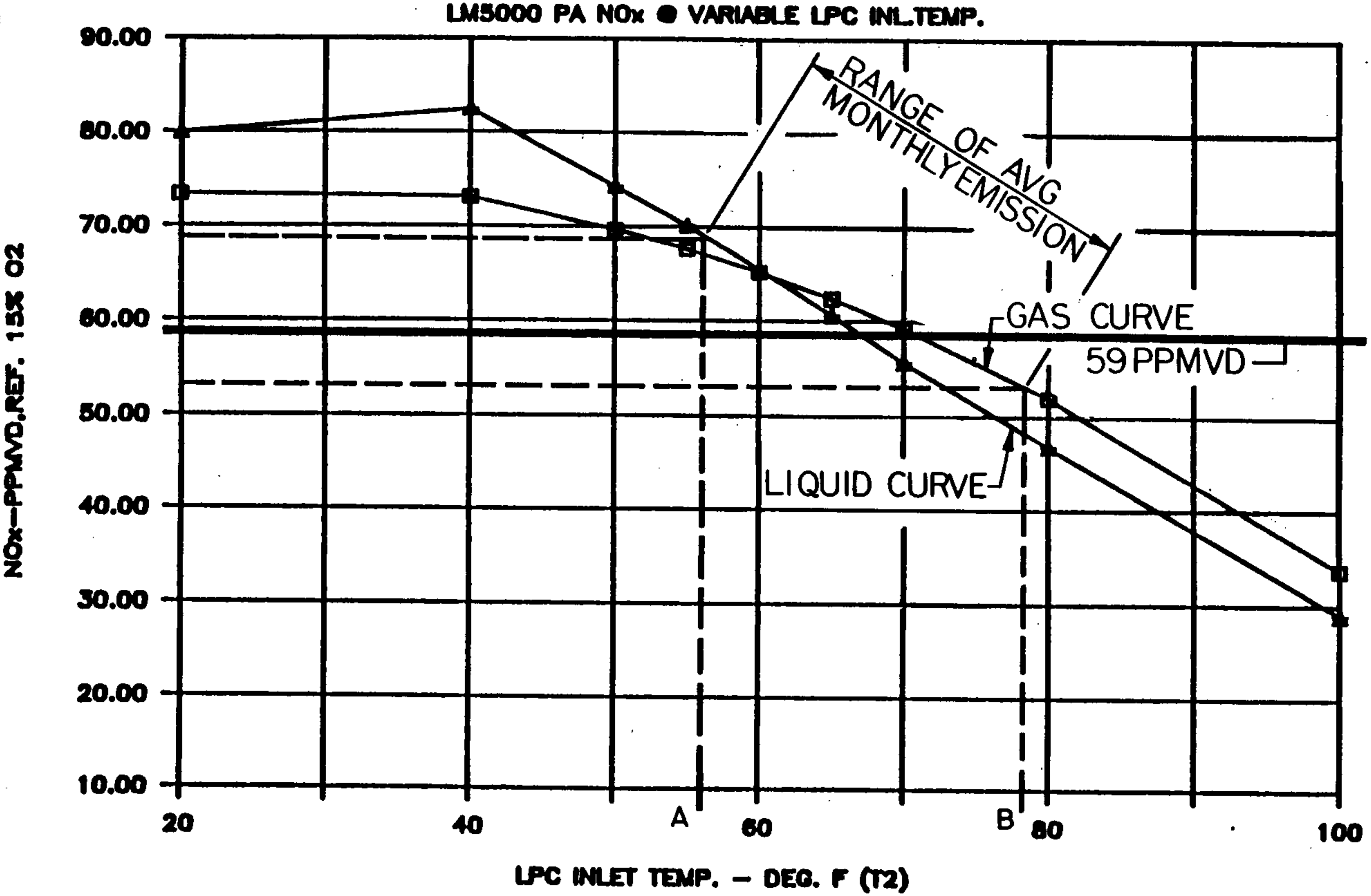
Exhibit 3

Inlet Temperatures vs Predicted NOx Emissions

REEDY CREEK ENERGY SERVICES



A-LOWEST AVG MONTHLY TEMP-(NWS DATA)
B-HIGHEST AVG MONTHLY TEMP-(NWS DATA)

EXHIBIT 3

pkg
12/11/87