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STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

BOB MARTINEZ
GOVERNOR

DALE TWACHTMANN
SECRETARY

November 23, 1987

Mr. Miguel Flores
Chief, Permit Review and Technical
Support Branch
National Park Service-Air
Post Office Box 25287
Denver, Colorado 80225

Dear Mr. Flores:

RE: Technical Evaluation & Preliminary Determination
Reedy Creek Improvement District
Air Construction Permit: AC 48-137740
Federal Permit Number: PSD-FL-123

Enclosed for your review and comment is the Technical Evaluation & Preliminary Determination and draft permit for the above referenced facility. If you have any comments or questions, please contact Pradeep Raval or Max Linn by December 11, 1987, at the above address or at (904)488-1344.

Sincerely,

M. V. Janes

Margaret V. Janes
Bureau of Air Quality
Management

/mj

enclosure

PS Form 3811, July 1983 447-845

SENDER: Complete items 1, 2, 3 and 4.

Put your address in the "RETURN TO" space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for service(s) requested.

1. ☑ Show to whom, date and address of delivery.
2. ☐ Restricted Delivery.

3. Article Addressed to: Thomas M. Moses, Dir.
Reedy Creek Improvement Dist
1675 Buena Vista Drive, Suite 265
Post Office Box 36
Lake Buena Vista, FL 32830

4. Type of Service:	Article Number
☐ Registered ☐ Insured ☒ Certified ☐ COD ☐ Express Mail	P 274 007 647

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature – Addressee
X

6. Signature – Agent
X

7. Date of Delivery 11-28-87

8. Addressee's Address (ONLY if requested and fee paid)

DOMESTIC RETURN RECEIPT

P 274 007 647

RECEIPT FOR CERTIFIED MAIL
NO INSURANCE COVERAGE PROVIDED
NOT FOR INTERNATIONAL MAIL
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Sent to Thomas M. Moses, Dir. Reedy Creek Improvement Dist. 1675 Buena Vista Drive, St 265 P.O. Box 36 Lake Buena Vista, FL 32830	
Postage	$
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PS Form 3800, June 1985 * U.S.G.P.O. 1985-480-794

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STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

BOB MARTINEZ
GOVERNOR

DALE TWACHTMANN
SECRETARY

November 23, 1987

CERTIFIED MAIL-RETURN RECEIPT REQUESTED

Mr. Thomas M. Moses
Director/General Manager
Reedy Creek Improvement District
1675 Buena Vista Drive
Suite 265
Post Office Box 36
Lake Buena Vista, FL 32830

Dear Mr. Moses:

Attached is one copy of the Technical Evaluation and Preliminary Determination and proposed permit to construct a 38 MW natural gas fired turbine generator with a heat reovery system, with a total heat input of 445.2 MMBtu/hr, at the Central Energy Plant, Bay Lake location, near Lake Buena Vista, Orange County, Florida. The proposed project will emit the pollutants nitrogen oxides (NOx), sulfur dioxide (SO_2), particulate matter (PM), carbon monoxide (CO), and volatile organic compounds (VOCs).

Please submit, in writing, any comments which you wish to have considered concerning the Department's proposed action to Mr. Bill Thomas of the Bureau of Air Quality Management.

Sincerely,

C. H. Fancy, P.E.
Deputy Chief
Bureau of Air Quality
Management

CHF/bm

Attachments

cc: T. Sawicki, CF Dist.
H. Culp, P.E.
W. Aronson, EPA
M. Flores, NPS

State of Florida
Department of Environmental Regulation
Notice of Intent

The Department of Environmental Regulation hereby gives notice of its intent to issue a permit to construct a 38 MW natural gas fired turbine generator with a heat recovery system, with a total heat input of 445.2 MMBtu/hr, at the Central Energy Plant, Bay Lake Location, near Lake Buena Vista, Orange County, Florida. The proposed project will emit the pollutants nitrogen oxides (NOx), sulfur dioxide (SO_2), particulate matter (PM), carbon monoxide (CO), and volatile organic compounds (VOCs). The Department is issuing this Intent to Issue for the reasons stated in the attached Technical Evaluation and Preliminary Determination.

Persons whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative determination (hearing) in accordance with Section 120.57, Florida Statutes. The petition must conform to the requirements of Chapters 17-103 and 28-5, Florida Administrative Code, and must be filed (received) in the Department's Office of General Counsel, 2600 Blair Stone Road, Twin Towers Office Building, Tallahassee, Florida 32399-2400, within fourteen (14) days of publication of this notice. Failure to file a petition within this time period constitutes a waiver of any right such person has to request an administrative determination (hearing) under Section 120.57, Florida Statutes.

If a petition is filed, the administrative hearing process is designed to formulate agency action. Accordingly, the Department's final action may be different from the proposed agency action. Therefore, persons who may not wish to file a petition may wish to intervene in the proceeding. A petition for intervention must be filed pursuant to Rule 28-5.207, Florida Administrative Code, at least five (5) days before the final hearing and be filed with the hearing officer if one has been assigned at the Division of Administrative Hearings, Department of Administration, 2009, Apalachee Parkway, Tallahassee, Florida 32301. If no hearing officer has been assigned, the petition is to be filed with the Department's Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400. Failure to petition to intervene within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, Florida Statutes.

The application is available for public inspection during normal business hours, 8:00 a.m. to 5:00 p.m., Monday through Friday, except legal holidays, at:

Dept. of Environmental Regulation
Bureau of Air Quality Management
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Dept. of Environmental Regulation
Central Florida District
3319 Maguire Blvd., Suite 232
Orlando, Florida 32803-3767

Any person may send written comments on the proposed action to Mr. Bill Thomas at the Department's Tallahassee address. All comments mailed within 30 days of the publication of this notice will be considered in the Department's final determination.

RULES OF THE ADMINISTRATIVE COMMISSION
MODEL RULES OF PROCEDURE
CHAPTER 28-5
DECISIONS DETERMINING SUBSTANTIAL INTERESTS

28-5.15 Requests for Formal and Informal Proceedings

(1) Requests for proceedings shall be made by petition to the agency involved. Each petition shall be printed, typewritten or otherwise duplicated in legible form on white paper of standard legal size. Unless printed, the impression shall be on one side of the paper only and lines shall be double spaced and indented.

(2) All petitions filed under these rules should contain:

(a) The name and address of each agency affected and each agency's file or identification number, if known;

(b) The name and address of the petitioner or petitioners;

(c) All disputed issues of material fact. If there are none, the petition must so indicate;

(d) A concise statement of the ultimate facts alleged, and the rules, regulations and constitutional provisions which entitle the petitioner to relief;

(e) A statement summarizing any informal action taken to resolve the issues, and the results of that action;

(f) A demand for the relief to which the petitioner deems himself entitled; and

(g) Such other information which the petitioner contends is material.

BEFORE THE STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

In the Matter of
Application for Permit by:

Reedy Creek Improvement District
Post Office Box 40
Lake Buena Vista, Florida 32830

DER File No. AC 48-137740
Fed. Permit: PSD-FL-123

INTENT TO ISSUE

The Department of Environmental Regulation hereby gives notice of its intent to issue a permit (copy attached) to construct a 38 MW natural gas fired turbine generator with a heat recovery system, with a total heat input of 445.2 MMBtu/hr, at the Central Energy Plant, Bay Lake location, near Lake Buena Vista, Orange County, Florida. The proposed project will emit the pollutants nitrogen oxides (NOx), sulfur dioxide (SO_2), particulate matter (PM), carbon monoxide (CO), and volatile organic compounds (VOCs). The Department is issuing this Intent to Issue for the reasons stated in the attached Technical Evaluation and Preliminary Determination.

The applicant, Reedy Creek Inprovement District, applied on August 6, 1987, to the Department of Environmental Regulation for a construction permit.

The Department has permitting jurisdiction under Chapter 403, Florida Statutes (F.S.), and Florida Administrative Code (FAC) Rules 17-2 and 17-4. The project is not exempt from permitting procedures. The Department has determined that an air construction permit was needed for the proposed work.

Pursuant to Section 403.815, F.S., and FAC Rule 17-103.150, you (the applicant) are required to publish at your own expense the enclosed Notice of Proposed Agency Action on permit application. The notice must be published one time only in a section of a major local newspaper of general circulation in the county in which the project is located and within thirty (30) days from receipt of this intent. Proof of publication must be provided to the Department within seven days of publication of

the notice. Failure to publish the notice and provide proof of publication within the allotted time may result in the denial of the permit.

The Department will issue the permit with the attached conditions unless petition for an administrative proceeding (hearing) is filed pursuant to the provisions of Section 120.57, F.S. A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) in accordance with Section 120.57, F.S. Petitions must comply with the requirement of FAC Rules 17-103.155 and 28-5.201 (copies enclosed) and be filed with (received by) the Office of General Counsel of the Department at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400. Petitions filed by the permit applicant must be filed within fourteen (14) days of receipt of this intent. Petitions filed by other persons must be filed within fourteen (14) days of publication of the public notice or within fourteen (14) days of receipt of this intent, whichever first occurs. Failure to file a petition within this time period shall constitute a waiver of any right such person may have to request an administrative determination (hearing) under Section 120.57, F.S., concerning the subject permit application. Petitions which are not filed in accordance with the above provisions will be dismissed.

Executed in Tallahassee, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL REGULATION

C. H. Fancy, P.E.
Deputy Chief
Bureau of Air Quality
Management

Copies furnished to:

T. Sawicki, CF Dist.
H. Culp, P.E.
W. Aronson, EPA
M. Flores, NPS

CERTIFICATE OF SERVICE

The undersigned duly designated deputy clerk hereby certifies that this NOTICE OF INTENT TO ISSUE and all copies were mailed before the close of business on 11-23-87.

FILING AND ACKNOWLEDGEMENT
FILED, on this date, pursuant to §120.52(9), Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Martha J. Wise 11/23/87
Clerk Date

Technical Evaluation
and
Preliminary Determination

Reedy Creek Improvement District
Lake Buena Vista, Orange County, Florida

Gas Fired Turbine Generator
Permit No. AC 48-137740
PSD-FL-123

Florida Department of Environmental Regulation
Bureau of Air Quality Management
Central Air Permitting

November 20, 1987

I. Application

A. Applicant

Reedy Creek Improvement District
Post Office Box 40
Lake Buena Vista, Florida 32830

B. Project and Location

The applicant proposes to construct a 38 MW natural gas fired turbine generator with a heat recovery system, with a total heat input of 445.2 MMBtu/hr, at the Central Energy Plant, Bay Lake location, near Lake Buena Vista, Orange County, Florida. The proposed project will emit the pollutants nitrogen oxides (NOx), sulfur dioxide (SO_2), particulate matter (PM), carbon monoxide (CO), and volatile organic compounds (VOCs).

The UTM coordinates of this facility are Zone 17, 442 km East and 3139 km North.

C. Sources Reviewed

This technical evaluation will review the following sources:

1) The proposed GE turbine and its associated duct burner and heat recovery system

2) "Black" start Cummins emergency diesel generator

3) The two small Orenda turbines and their associated heat recovery systems which are being replaced.

Reedy Creek applied for a construction permit for the proposed project on August 5, 1987, and the application was deemed complete on September 23, 1987.

D. Facility Category

Reedy Creek's facility in Lake Buena Vista is classified in accordance with the Standard Industrial Classification (SIC) Code as Major Group 49, Electric, Gas and Sanitary Services; Group No. 493, Electric Gas and Other Services; Industry No. 4931, Electric Services.

The existing facility is classified as major in accordance with Chapter 17-2 of the Florida Administrative Code (FAC).

II. Project Description

The applicant proposes to replace two smaller Orenda turbines and their associated heat recovery system with a GE LM5000, 38 MW gas fired, oil stand-by, combustion turbine followed by an integrated heat recovery steam boiler and steam turbine, including an in-line 198 MMBtu/hr capacity gas fired duct burner. An emergency 1800HP diesel generator will also be installed and maintained in a state of readiness.

Both the turbine and downstream duct burner will fire No. 2 oil if natural gas supply is curtailed. The duct burner at low fire rate (normal mode) will have a 23 MMBtu/hr heat input rate and at high fire rate (when turbine is out of service) it will have a heat input rate of upto 198 MMBtu/hr.

During the equipment change over period, of shutting down the existing Orenda turbines and starting up the GE turbine, the existing No. 1 and 2 turbine installations will be maintained on a standby basis through a six-month project debugging period. The existing No. 1 waste heat boiler will also be kept on standby but the No. 2 boiler will be dismantled to make room for the new GE/Vogt unit. The project will have one main stack and one emergency by-pass stack.

It is anticipated that after a reasonable debugging period the remaining standby Orenda turbines and associated boiler will cease operation. Of the pollutants emitted, only NOx emissions will be significant and, therefore, will be controlled by water injection.

III. Rule Applicability

The proposed project will emit the pollutants NOx, SO_2, PM, CO, and VOCs. It is subject to preconstruction review requirements in accordance with Chapter 403 of the Florida Statutes and Chapters 17-2 and 17-4 of the Florida Administrative Code (FAC).

The proposed project will be located in Orange County, an area designated as nonattainment for ozone and attainment for NOx, SO_2, PM and CO in accordance with Rule 17-2.410 and 17-2.420, FAC, respectively.

The proposed project is more than a 100 km from the Chassahowitzka National Wilderness Area, a Class I area, in accordance with Rule 17-2.440, FAC.

The proposed project will be a major modification to a major facility since emission increases are significant (17-2, Table 500-2, FAC) and is therefore subject to a Prevention of Significant Deterioration (PSD) Review in accordance with Rule 17-2.500(2)(d)4, FAC.

The proposed project will not be subject to the New Source Review for Nonattainment Areas in accordance with Rule 17-2.510(2)(d)4, FAC, as emissions of VOC are less than signficant (17-2. Table 500-2, FAC).

The proposed project will be subject to 40 CFR 60 Subpart GG - Standards of Performance for Stationary Gas Turbines.

The proposed project will be also subject to 40 CFR 60 Subpart Db - Standards of Performance for Fossil Fuel Fired Steam Generating Units.

The applicable emission limiting standards will be determined by the Best Available Control Technology (BACT) for NOx, PM and SO_2, in accordance with Rule 17-2.630, FAC.

The proposed project will be required to show compliance with the emission limiting standards in accordance with:

a) Rule 17-2.700, FAC
b) 40 CFR 60, Subpart GG
c) 40 CFR 60, Subpart Db

Initial and annual compliance test will be conducted with the above listed rules for the following:

1. NOx and SO_2, EPA Method 20
2. CO, EPA Method 10
3. PM, EPA Method 5
4. Visible Emissions (VE), EPA Method 9

Other DER approved methods may be used with prior Departmental approval.

IV. Emission Limitations

As reflected by the BACT Determination attached and required by the New Source Performance Standards, the emissions from the combined cycle gas turbine including the duct burner will not exceed 25 ppm NOx and 150 ppm SO_2 at 15% O_2 and:

Pollutant	Gas Fired lb/hr	Gas Fired TPY*	Oil Fired lb/hr	Oil Fired TPY
Nitrogen Oxides (NOx)	75	310	75	27
Sulfur Dioxide (SO_2)	0.2	0.8	112	39
Particulates (PM)	0.5	2.1	9	4
Carbon Monoxide (CO)	15	64	20	7
Volatile Organics (VOCs)	7.5	32	8	3
Visible Emissions (VE)	5% opacity		10% opacity	

The duct burner NOx emissions shall not exceed (corresponding to 0.2 lb/MMBtu) 2.3 lb/hr for gas or oil at 23 MMBtu heat input or 38.5 lb/hr for oil and 39.6 lb/hr for gas at 198 MMBtu/hr.
*TPY (tons per year)

V. Air Quality Impact Analysis

1. Introduction

The proposed cogeneration turbine, to be located near Lake Buena Vista, Florida, on the Walt Disney complex, will emit the criteria pollutants sulfur dioxide (SO_2) and nitrogen oxides (NO_x). Only NO_x will be emitted in a PSD-significant amount.

The air quality impact analysis required by the PSD regulations for the pollutant NO_x includes:

- An analysis of existing air quality;
- An Ambient Air Quality Standards (AAQS) analysis;
- An analysis of impacts on soils, vegetation, and visibility and of growth-related air quality impacts; and
- A "Good Engineering Practice" (GEP) stack height determination.

The analysis of existing air quality generally relies on preconstruction monitoring data collected in accordance with EPA-approved methods. The AAQS analysis depends on the air quality dispersion modeling carried out in accordance with EPA guidelines.

Based on these required analyses, the Department has reasonable assurance that the proposed cogeneration turbine, as described in this report and subject to the conditions of approval proposed herein, will not cause or contribute to a violation of any ambient air quality standard. A discussion of the modeling methodology and required analysis follows.

2. Modeling Methodology

The EPA-approved Industrial Source Complex Short-Term (ISCST) dispersion model was used in the air quality impact analysis. This model determines ground-level concentrations of inert gases or small particles emitted into the atmosphere by point, area, and volume sources. The model incorporates elements for plume rise, transport by the mean wind, Gaussian dispersion, and pollutant removal mechanisms such as deposition and transformation. The ISCST model also allows for the separation of sources, building wake downwash, and various other input and output features. A series of specific model features, recommended by the EPA, are referred to as the regulatory options. These features were used to address the air quality

impacts of the proposed facility in both screening and refined analyses.

The modeling used a radial receptor grid with the center of the grid coinciding with the location of the proposed facility. Radials were spaced at 10° increments from 10° to 360°. A standard progression of receptor distances was estimated using PTPLU in accordance with the technique specified in the "Regional Workshop on Air Quality Modeling-A Summary Report," EPA-450/4-82-015, April 1981. PTPLU was used to identify the distance to the highest estimated concentration for the various combinations of atmospheric stability classes and wind speeds. The shortest of the distances predicted by PTPLU was selected as the first receptor. Eight more distances were selected by multiplying the first receptor distance by each of the following constants: 1.3, 1.7, 2.3, 3.0, 3.9, 5.2, 6.8, and 9.0.

The meteorological data used in the ISCST model consisted of five years (1981-1985) of hourly surface data taken at Orlando, Florida. Mixing heights used in the model were based on upper air data from Tampa, Florida, for the same period.

Two types of modeling analyses were performed by the applicant. The first was a facility maximum impact analysis. This analysis shows the maximum ground-level NO_x impact for the proposed new facility, taking into consideration the shutdown of the Orenda turbines. The second, the AAQS analysis, was performed using the emissions from the proposed new facility by itself, plus existing background.

The emission rates and stack parameters used in evaluating the ambient air impact are contained in Tables 1 and 2 respectively.

Table 1. Emission Rates

Source	Pollutant	Emission Rate (g/s)
New Facility	NO_x	17.43
Existing Facility	NO_x	8.26

Table 2. Stack Parameters

Source	Stack Height(m)	Exit Temperature(K)	Exit Velocity(m/s)	Stack Diameter(m)
New Facility	19.81	413.71	15.39*	3.40
Existing Facility	12.44	455.37	15.88	2.96

* This value was used in the modeling runs. However, the applicant subsequently changed this value to 15.91 m/s. This

change has a conservative effect on the modeling results because of the increased exit velocity and decreased concentrations of NO_x contained in the larger emission volume (NO_x tonnage per year remains the same).

3. Analysis of Existing Air Quality

Preconstruction ambient air quality monitoring is required for all pollutants subject to PSD review. In general, one year of quality assured data using an EPA reference, or the equivalent, monitor must be submitted. Sometimes less than one year of data, but no less than four months, may be accepted.

An exemption to the monitoring requirement can be obtained if the maximum air quality impact, as determined through air quality modeling, is less than a pollutant-specific "de minimus" concentration. In addition, if current monitoring data already exist, and these data are representative of the proposed source area, then at the discretion of the Department these data may be used.

The predicted ambient impact of the net emission increase of NO_x is less than the monitoring "de minimus" level for this pollutant. As such no additional monitoring was required.

There are currently two NO_2 monitors in the Orlando, Florida, area. In 1985, the maximum annual arithmetic mean for this pollutant was 16 ug/m^3. For purposes of this application, this value is considered the "background" concentration for NO_2 in this area.

4. Ambient Air Quality Standards Analysis

Given existing air quality in the area of the proposed cogeneration facility, emissions from the new facility are not expected to cause or contribute to a violation of the AAQS for NO_2. The results of the AAQS analysis are contained in Table 3.

Table 3. Ambient Air Quality Impact

Pollutant and Averaging Time	Maximum Impact Cogeneration Facility (ug/m^3)	Predicted Total Impact (ug/m^3)	Florida AAQS (ug/m^3)
NO_2 Annual	0.9	16.9	100

The total impact on ambient air was obtained by adding the "background" concentration to the maximum modeled concentration. The development of the background concentration was discussed in the previous section.

5. Additional Impacts Analysis

a. Impacts on Soils and Vegetation

The maximum ground-level concentration predicted to occur for NO_x as a result of the proposed project, including a background concentration, will be below the applicable AAQS including the national secondary standard developed to protect public welfare-related values. As such, this project is not expected to have a harmful impact on soils and vegetation.

b. Impact on Visibility

The proposed facility is located southwest of Orlando, Florida, about 135 km east-southeast of the Chassahowitzka Wilderness Area, the closest Federal Mandatory Class I area. Due to the distance between the proposed facility and the nearest Class I area (greater than 100 km) a visibility impact analysis is not required. However, the applicant submitted an EPA-approved Level I Visibility Analysis. The results of this exercise indicate that the proposed facility will have virtually no impact on visibility in the Class I area.

c. Growth-Related Air Quality Impacts

The proposed facility is not expected to significantly change employment, population, housing or commercial/industrial development in the area to the extent that an air quality impact will result.

d. GEP Stack Height Determination

Good Engineering Practice (GEP) stack height means the greater of: (1) 65 meters or (2) the maximum nearby building height plus 1.5 times the building height or width, whichever is less. For the proposed project a stack height of 19.81 meters is proposed. The proposed stack height is well below the GEP limit of 65 meters.

VI. Conclusion

Based on the information provided by Reedy Creek, the Department has reasonable assurance that the proposed project as described in this evaluation, and subject to the conditions proposed herein, will not cause or contribute to a violation of an ambient air quality standard or PSD increment, or any other provision of Chapter 17-2, FAC.

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

BOB MARTINEZ
GOVERNOR

DALE TWACHTMANN
SECRETARY

PERMITTEE:
Reedy Creek Improvement
District
Post Office Box 40
Lake Buena Vista, FL 32830

Permit Number:AC 48-137740
Expiration Date: December 1, 1988
County: Orange
Latitude/Longitude: 28° 25' 34"N
81° 34' 48"W
Project: GE Gas Fired Turbine Generator with Heat Recovery System

This permit is issued under the provisions of Chapter 403, Florida Statutes, and Florida Administrative Code Rule(s) 17-2 and 17-4. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawings, plans, and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

For the construction of a 38 MW GE LM5000 gas fired turbine generator system with a heat input capacity of 445.2 MMBtu/hr. The project will also include an in-line duct burner and heat recovery boiler, at the Central Energy Plant at Bay Lake, near Lake Buena Vista, Orange County, Florida.

Construction will be in accordance with the permit application and plans, documents, and reference material submitted unless otherwise stated in the General and Specific Conditions herein.

This project's federal permit number is PSD-FL-123.

Attachments:

1. Reedy Creek's application package dated August 5, 1987.
2. EPA's letter dated September 3, 1987.
3. Letter of incompleteness dated September 4, 1987.
4. Reedy Creek's response dated September 18, 1987.
5. U.S. Department of the Interior's letter dated September 28, 1987.
6. EPA's letter dated October 22, 1987.

PERMITTEE:
Reedy Creek Improvement District

Permit Number:AC 48-137740
Expiration Date: December 1, 1988

GENERAL CONDITIONS:

1. The terms, conditions, requirements, limitations, and restrictions set forth herein are "Permit Conditions" and as such are binding upon the permittee and enforceable pursuant to the authority of Sections 403.161, 403.727, or 403.859 through 403.861, Florida Statutes. The permittee is hereby placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of the "Permit Conditions" by the permittee, its agents, employees, servants or representatives.

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.

3. As provided in Subsections 403.087(6) and 403.722(5), Florida Statutes, the issuance of this permit does not convey any vested rights or any exclusive privileges. Nor does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit does not constitute a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

4. This permit conveys no title to land or water, does not constitute state recognition or acknowledgement of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the state. Only the Trustees of the Internal Improvement Trust Fund may express state opinion as to title.

5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, plant or aquatic life or property and penalties therefore caused by the construction or operation of this permitted source, nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

GENERAL CONDITIONS:

6. The permittee shall at all times properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law, access to the premises, at reasonable times, where the permitted activity is located or conducted for the purpose of:

a. Having access to and copying any records that must be kept under the conditions of the permit;

b. Inspecting the facility, equipment, practices, or operations regulated or required under this permit; and

c. Sampling or monitoring any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.

Reasonable time may depend on the nature of the concern being investigated.

8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately notify and provide the Department with the following information:

a. a description of and cause of non-compliance; and

b. the period of noncompliance, including exact dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance.

GENERAL CONDITIONS:

The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or revocation of this permit.

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source, which are submitted to the Department, may be used by the Department as evidence in any enforcement case arising under the Florida Statutes or Department rules, except where such use is proscribed by Sections 403.73 and 403.111, Florida Statutes.

10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.

11. This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 17-4.12 and 17-30.30, as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit is required to be kept at the work site of the permitted activity during the entire period of construction or operation.

13. This permit also constitutes:

(x) Determination of Best Available Control Technology (BACT)
(x) Determination of Prevention of Significant Deterioration (PSD)
(x) Compliance with New Source Performance Standards.

14. The permittee shall comply with the following monitoring and record keeping requirements:

a. Upon request, the permittee shall furnish all records and plans required under Department rules. The retention period for all records will be extended automatically, unless otherwise stipulated by the Department, during the course of any unresolved enforcement action.

GENERAL CONDITIONS:

b. The permittee shall retain at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation), copies of all reports required by this permit, and records of all data used to complete the application for this permit. The time period of retention shall be at least three years from the date of the sample, measurement, report or application unless otherwise specified by Department rule.

c. Records of monitoring information shall include:

- the date, exact place, and time of sampling or measurements;
- the person responsible for performing the sampling or measurements;
- the date(s) analyses were performed;
- the person responsible for performing the analyses;
- the analytical techniques or methods used; and
- the results of such analyses.

15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be submitted or corrected promptly.

SPECIFIC CONDITIONS:

1. The turbine may operate continuously (8760 hrs/yr).

2. Only natural gas shall be fired in the turbine and duct burner. No. 2 oil shall be used in periods of curtailed natural gas supply. The duration of oil firing shall not exceed 29 days annually.

3. The maximum heat input to the turbine and the duct burner shall not exceed 445.2 MMBtu/hr (normal duct burner heat input rate of 23 MMBtu/hr).

PERMITTEE:
Reedy Creek Improvement District

Permit Number:AC 48-137740
Expiration Date: December 1, 1988

SPECIFIC CONDITIONS:

4. When the gas turbine is not in operation, the duct burner heat input may be increased upto, but not to exceed, 198 MMBtu/hr.

5. The emissions, from the turbine and duct burner combined, shall not exceed 25 ppm for NOx and 150 ppm for SO_2 at 15% oxygen content dry basis and:

Pollutant	Gas Fired lb/hr	Gas Fired TPY*	Oil Fired lb/hr	Oil Fired TPY
Nitrogen Oxides (NOx)	75	310	75	27
Sulfur Dioxide (SO_2)	0.2	0.8	112	39
Particulates (PM)	0.5	2.1	9	4
Carbon Monoxide (CO)	15	64	20	7
Volatile Organics (VOCs)	7.5	32	8	3
Visible Emissions (VE)	5% opacity		10% opacity	

The duct burner NOx emissions shall not exceed (corresponding to 0.2 lb/MMBtu) 2.3 lb/hr for gas or oil at 23 MMBtu heat input or 38.5 lb/hr for oil and 39.6 lb/hr for gas at 198 MMBtu/hr.
*TPY (tons per year)

6. The No. 2 oil sulfur content shall not exceed 0.32 percent.

7. The "Black Start" Cummins No. 2 oil fired emergency generator, when fired on a normal basis to maintain a state of readiness shall not be operated beyond the 10 minutes/week check out period.

For inventory purposes only, the emergency generator's expected emissions are listed below:

Pollutant	lb/yr
NOx	232
CO	36
VOC	9
PM	8
SO_2	30

8. Water injection shall be utilized for NOx control at a minimum of 0.6/1.0 water to fuel ratio. If compliance testing warrants this ratio to be re-investigated, the ratio at which compliance is maintained shall be incorporated into the permit.

9. Initial and annual compliance testing shall be conducted with the fuels used in the preceeding 12 month period using:

1. EPA Method 20 for NOx and SO_2
2. EPA Method 10 for CO
3. EPA Method 5 for PM
4. EPA Method 9 for VE

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

10. DER's district office shall be notified in writing 15 days prior to source testing. Written reports of the tests shall be submitted to the district office within 45 days of test completion.

The construction shall reasonably conform to the plans and schedule submitted in the application. If the permittee is unable to complete construction on schedule, the Department must be notified in writing 60 days prior to the expiration of the construction permit and submit a new schedule and request for an extension of the construction permit, (Rule 17-2, FAC).

To obtain a permit to operate, the permittee must demonstrate compliance with the conditions of the construction permit and submit a complete application for an operating permit, including the application fee, along with compliance test results and Certificate of Completion, to the Department's District office 90 days prior to the expiration date of the construction permit. The permittee may continue to operate in compliance with all terms of the construction permit until its expiration date. Operation beyond the construction permit expiration date requires a valid permit to operate. (Rules 17-2 and 17-4, FAC).

If the construction permit expires prior to the permittee requesting an extension or obtaining a permit to operate, then all activities at the project must cease and the permittee must apply for a new permit to construct which can take up to 90 days to process a complete application. (Rule 17-4, FAC)

11. Any change in the method of operation, fuels, equipment or operating hours shall be submitted for approval to DER's District office.

PERMITTEE:
Reedy Creek Improvement District

Permit Number:AC 48-137740
Expiration Date: December 1, 1988

SPECIFIC CONDITIONS:

12. The proposed project shall comply with all the applicable requirements of:

a) Chapter 17-2, FAC
b) 40 CFR 60, Subpart GG, Gas Turbines
c) 40 CFR 60, Subpart Db, Industrial Steam Generating Units

13. During the new turbine debugging period, not to exceed nine months, the older Orenda power trains shall not be fired unless the new GE turbine is not in operation. After the debugging period is over, the Orenda turbines and their associated equipment shall be dismantled.

Issued this_____day of_____, 19___

STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION

_____
Dale Twachtmann, Secretary

Best Available Control Technology (BACT) Determination
Reedy Creek Improvement District
Orange County

The applicant proposes to install a cogeneration facility to better meet power needs at the Reedy Creek Improvement District (Walt Disney World). The cogeneration facility, which consists of a combined cycle power plant utilizing a General Electric (GE) aircraft derivative dual fuel combustion turbine attached to a waste heat recovery steam boiler and turbine, will replace two older smaller gas turbines and three associated heat recovery steam generators. The turbine will be fired normally with natural gas, but has the capability of standby operation with No. 2 fuel oil (diesel oil) for limited periods of time. In addition, the cogeneration facility will utilize a supplementary duct burner which will be normally fired with natural gas, but also is capable of firing No. 2 fuel oil (diesel oil) as a standby fuel. The guaranteed heat input rate for the system is estimated to be 311 million BTU/hr based on a fuel input of approximately 14,950 lb/hr of natural gas and a lower heating value of about 20,800 Btu/lb.

The applicant has indicated the net potential annual tonnage of regulated air pollutants emitted from the facility to be as follows:

Pollutant	Maximum Potential Emissions (tons/year) Natural Gas (8500 hrs/yr)	Diesel Fuel (29 days/yr)	PSD Significant Emission Rate (tons/year)
NOx	606	51.8	40
SO_2	0.75	39.0	40
PM	1.7	2.8	25
CO	50.1	6.1	100
VOC	25.9	2.3	40

Florida Administative Code Rule 17-2.500(2)(f)(3) requires a BACT review for all regulated pollutants emitted in an amount equal to or greater than the significant emission rates listed in the previous table. In addition, the duct burner requires a BACT determination for particulates and sulfur dioxide as set forth in the Florida Administrative Code Rule 17-2.600 (6) - Emissions Limiting and Performance Standards.

BACT Determination Requested by the Applicant

The BACT determinations requested by the applicant on a pollutant by pollutant basis are given below:

Pollutant	Determination
NOx	145 lbs/hr (natural gas firing) 150 lbs/hr (diesel oil firing)
SO_2	Low sulfur fuel (natural gas, diesel fuel with sulfur content not to exceed 0.32%)
PM	Firing of natural gas and diesel oil

Date of Receipt of a BACT application:

August 6, 1987

Review of Group Members:

This determination was based upon comments received from the applicant, EPA Region IV, and the Stationary Source Control Section.

BACT Determination Procedure:

In accordance with Florida Administrative Code Chapter 17-2, Air Pollution, this BACT determination will be based on the maximum degree of reduction of each pollutant emitted which the Department (DER), on a case-by-case basis taking into account energy, environmental and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems, and techniques. In addition, the regulations state that in making the BACT determination the Department shall give consideration to:

(a) Any Environmental Protection Agency determination of Best Available Control Technology pursuant to Section 169, and any emission limitation contained in 40 CFR Part 60 (Standards of Performance for New Stationary Sources) or 40 CFR Part 61 (National Emission Standards for Hazardous Air Pollutants).

(b) All scientific, engineering, and technical material and other information available to the Department.

(c) The emission limiting standards or BACT determinations of any other state.

(d) The social and economic impact of the application of such technology.

BACT Determined by DER:

Pollutant	Emission Limit
NOx	25 ppm (dry volume) at 15% O_2
SO_2	Emissions limited by natural gas and diesel oil firing (sulfur content not to exceed 0.32%)
Particulate	Emissions limited by natural gas and diesel oil firing (sulfur content not to exceed 0.32%)

BACT Determination Rationale

The DER's BACT determination is essentially equivalent to that proposed by the applicant except for the pollutant nitrogen oxides (NOx). The applicant has stated that BACT for nitrogen oxides will be met by using water injection at a 0.6/1.0 water to fuel ratio. This level of water injection will reduce the nitrogen oxides emissions to a level which is less than the New Source Performance Standard (NSPS) for Stationary Gas Turbines which computes to 152.1 ppm (215 lbs/hr) and 103.5 ppm (153 lbs/hr) for natural gas and diesel oil firing respectively. It is important to note that NSPS is only a starting point for a BACT determination. BACT can be and is often more stringent than NSPS. In accordance with this criteria, the Department has evaluated the following alternative control measures as representing BACT for this installation.

1) Increase of water to fuel injection ratio to further decrease the emissions of nitrogen oxides.

2) Selective Catalytic Reduction

The emissions of nitrogen oxides from gas turbines can be controlled to a large extent by the injection of either water or steam. The injection of water or steam into the combustion process provides a heat sink which absorbs some of the heat of reaction, thereby reducing peak combustion temperatures and the rate of nitrogen oxides formation. The degree of nitrogen oxides reduction achieved for a given turbine depends on the rate and method of introducing the water.

A review of the latest supplements (1986 and 1987) to the BACT/LAER Clearinghouse indicates that the nitrogen oxides emissions from several other gas turbines operating in the U.S. are much lower than the applicant's proposed emission rate. These differences in many cases are attributed to the use of selective catalytic reduction, however, some installations are reporting greatly reduced emissions brought about by higher water

to fuel injection ratios alone. One such installation is an indentical turbine (GE LM5000) operating in the State of California. For this unit, BACT for nitrogen oxides (25 ppm dry volume at 15% O_2) is being accomplished using steam injection at a steam/fuel ratio of 1.7 to 1.

In order to justify an increase in the water to fuel ratio as BACT, an economic analysis must be completed. With regard to determining the cost effectiveness of air pollution control, the EPA has developed costing guidelines to obtain the highest reduction of emissions per dollars invested. This method of maximizing emission reductions per capital invested is a major factor when New Source Performance Standards (NSPS) are developed by the EPA. For NOx emissions EPA has determined that a cost of up to $1,000 per ton of emissions controlled ($0.50/lb) is reasonable for NSPS.

The applicant has indicated that the proposed injection ratio of 0.6 to 1 is equivalent to a water consumption of 8 gallons per minute. Given this information, the cost/benefit analysis of increasing the water injection rate to reduce nitrogen oxides emissions to the level achieved by the identical equipment in California can be completed.

In accordance with the permit review completed for the identical unit in California, a nitrogen oxides emission rate of 25 ppm would be equivalent to an annual emission rate of approximately 205 tons per year. This represents a nitrogen oxides reduction of 401 tons per year for natural gas firing when compared to the proposed emission resulting from the 0.6 to 1 water injection rate. By increasing the water injection rate to a ratio of 1.7 to 1, the water requirement would increase by approximately 14.7 gallons per minute. This increase in water usage would increase the cost of nitrogen oxides control based on the cost of the water itself and the cost of treating the additional water that would be injected into the turbine.

Assuming that the cost of purchasing and treating the water are $1.50 and $2.50 per 1,000 gallons respectively, the cost increase to control nitrogen oxide to the 25 ppm level would be $29,988 per year for natural gas firing. This corresponds to a cost of approximately $75.00 per ton of nitrogen oxides controlled, which is insignificant compared to EPA's guideline of $1,000 for NSPS purposes.

It should be noted that the economic analysis computed above does not take into consideration that the applicant has proposed water injection and the alternative control measure evaluated uses steam injection. The cost associated with generating and injecting steam, when compared to injecting water, would not appreciably increase the cost of operating the facility. Since the facility uses a combined cycle operation, there would be steam available to use for injection purposes. Although this

would detract from the overall efficiency of the combined cycle, manufacturers have reported that steam injection results in about a 2 percent improvement over water injection in the heat rate of the turbine and a comparable increase in power output. As is the case, it is expected that the net cost of using steam injection as compared to water injection would not be significant.

Selective Catalytic Reduction (SCR) is a process that can be used in conjunction with water/steam injection to further reduce the emissions of nitrogen oxides from gas turbines. In order to justify the use of SCR as representing BACT, a cost/benefit analysis must again be completed.

The applicant has indicated that the addition of SCR would result in an nitrogen oxides emissions rate of 9 ppm. Although the economic analysis of using SCR for this particular installation has not been addressed, the applicant has submitted an analysis showing the cost/benefit of using steam injection at a ratio of 1.5 to 1 and has compared that to using SCR. In accordance with this analysis, the cost of using SCR would amount to an additional $13,400 per ton of nitrogen oxides controlled. This cost is well above the guideline discussed earlier and hence is judged to be prohibitively expensive.

The applicant has stated that natural gas and diesel will be used as fuels for the duct burner. Natural gas and diesel fuel generally contain low levels of sulfur and hence produce low emissions of sulfur dioxide when combusted. The emissions of particulates are also low since they are largely related to the fuel's sulfur content. As is the case, the Department has determined that the firing of natural gas or the firing of diesel fuel with a sulfur content not to exceed 0.32% is BACT for the duct burner.

Environmental Impact Analyses

Dispersion modeling has predicted that the impact from the facility will be 0.92% ug/m^3 when using the nitrogen oxides control proposed by the applicant. When the background concentration of 16 ug/m^3 is taken into consideration, the total concentration is well below the National Ambient Air Quality Standard of 100/ug/m^3 expressed as an annual average. Although the nitrogen oxides impact would be further reduced by increasing the water/steam injection rate, the impact is deemed to be reasonable when using the control proposed by the applicant.

The impacts of sulfur dioxide and particulates from the duct burner will be minimal. Natural gas combustion emits insignificant amounts of sulfur and particulates. Diesel fuel, on the other hand, emits higher levels of these pollutants but will be used on a standby basis only. As is the case, the

particulate and sulfur dioxide impacts associated with burning either natural gas or diesel fuel in the duct burner are not perceived to be a threat to air quality.

Energy Impact Analyses

Both of the control options should not result in energy impacts which are significant when compared to the applicant's proposal. The energy requirement to increase the injection of water/steam to the turbine is not excessive. If steam was injected at a ratio of 1.7 to 1, it is estimated that the additional heat input would be approximately 1.7 million BTU per hour when compared to injecting water at a 0.6 to 1 ratio. This is assuming that the steam would have to be produced from water by heat addition. However, since the facility is a combined cycle unit, steam is readily available and any reduction in the overall efficiency of the system would be compensated greatly by the improvement in heat rate when compared to water injection.

The applicant has indicated that the operating cost of SCR is less than using steam injection. The expense of using SCR is primarily attributed to the capital cost and not the cost of operation. As is the case, the energy impacts of using SCR are not judged to be significant. It is important to note that this facility is an energy producer and the energy that would be required to either increase the ratio of injection or operate a SCR would represent a very small fraction of the rated heat output.

Conclusion

The Department has determined that the level of control proposed by the applicant for the cogeneration facility does not represent BACT for nitrogen oxides. The applicant's proposal has been compared to other control strategies that have been deemed as BACT for similar facilities operating in the U.S. From an economic, energy and environmental standpoint, the applicant's proposal is only justified with respect to the ambient impact. However, when economics and energy impacts are taken into consideration, the overall impact of controlling the emissions of nitrogen oxides to the level established as BACT (25 ppm dry volume at 15% O_2) for another facility using an identical turbine does not appear to be prohibitive.

The Department has also concluded from the economic analysis that the cost of using selective catalytic reduction in conjunction with steam injection is not economically feasible for the incremental benefit achieved. As is the case, the Department has concluded that BACT for nitrogen oxides is to limit the emissions to a level of 25 ppm dry volume corrected to 15% O_2. Aside from nitrogen oxides, the Department agrees with the applicant that BACT is being applied.

Details of the Analysis May be Obtained by Contacting:

Barry Andrews, P.E., BACT Coordinator
Department of Environmental Regulation
Bureau of Air Quality Management
2600 Blairstone Road
Tallahassee, Florida 32399-2400

Recommended by:

_____
C. H. Fancy, P.E.
Deputy Bureau Chief, BAQM

_____
Date

Approved by:

_____
Dale Twachtmann, Secretary

_____
Date

PM
10/22/87
Atlanta, GA

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

OCT 22 1987

DER

OCT 26 1987

BAQM

4APT/APB-am

Ms. Margaret V. Janes, Planner
Bureau of Air Quality Management
Department of Environment Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Re: Reedy Creek Improvement District (PSD-FL-123)

Dear Ms. Janes:

Thank you for submitting the October 2, 1987, supplementary information package with regard to the above-referenced source for our review. After reviewing the document, a question arose regarding the proposed water flowrate in the water deNO_x system.

After examining Figure 1 & Figure 3 (NO_x vs. water injection curves), we have noticed that the curves show an upshift characteristic as the capacity of the turbine increases. In other words, the amount of water needed to achieve a certain amount of control is also proportional to the turbine's capacity. With this in mind, we have compared Reedy Creek's unit to a similar California unit (a copy of its BACT/LAER Clearinghouse information was enclosed in our September 3, 1987, letter). The California unit has a capacity of approximately 50 MW with a 25 ppm NO_x emission limit. The control of NO_x is through a steam system that will remove 75% of the total NO_x emissions. If this unit's NO_x vs. water injection curve were to be imposed on Figure 1, the corresponding water flowrate for a 25 ppm NO_x emission concentration would be greater than 25 GPM. This flowrate in turn is much greater than Reedy Creek's proposed water flowrate of 8 GPM. Thus, will Reedy Creek's flowrate satisfy a 75% control? Also, since both Reedy Creek and the California units have 75% NO_x control, why is Reedy Creek proposing an NO_x emission limit of 142 ppm? Does the California unit run that much cleaner?

We would also like to provide an additional comment with regard to the sufficiency of Reedy Creek's best available control technology (BACT) determination. Since Reedy Creek only addressed the feasibilities of two control alternatives, the determination may not be sufficient. Besides the water injection (75% control) and the water injection/catalytic reduction (80% control) systems, Reedy Creek ought to assess other alternatives in terms of their environmental, economic, and energy considerations. As part of the assessment, Reedy Creek should include a chart that compares each alternative's associated costs. In the future, EPA will soon require states to consider a "top-down" approach in evaluating BACT for all sources.

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ENVIRONMENTAL PROTECTION AGENCY
REGION IV
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Ms. Margaret V. Janes, Planner
Bureau of Air Quality Management
Department of Environment Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32399-2400

10/24/87

CHF → FYI

To explain briefly, this approach begins with establishing the most stringent available control as the first control alternative. If this control can be proven to be either technically or economically infeasible, the next most stringent level of control is determined and similarly evaluated and so on. We would recommend that Reedy Creek use this "top-down" approach.

Thank you for the opportunity to provide our comments. If you have any questions, please contact me or Gary Ng of my staff at (404) 347-2864.

Sincerely yours,

Bruce P. Miller

Bruce P. Miller, Chief
Air Programs Branch
Air, Pesticides, and Toxics
Management Division

Copied: CHF/BT
Barry Andrews
Pradeep Raval
Max Finn
Tom Sawicki
10/26/87

C48-137740
PSD-FL-123

NO PM Dt.
on envelop

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United States Department of the Interior
FISH AND WILDLIFE SERVICE

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Denver Federal Center
Denver, Colorado 80225

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Lakewood, Colorado 80228

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MAIL STOP 60130

SEP 28 1987

DER
OCT 12 1987
BAQM

Ms. Margaret V. Janes
Bureau of Air Quality Management
Florida Department of Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Dear Ms. Janes:

We have reviewed the information you sent to us regarding the Reedy Creek Improvement District's proposed cogeneration project near Lake Buena Vista, Florida. This location is approximately 100 km southeast of the Chassahowitzka National Wildlife Refuge, a class I air quality area administered by the Fish and Wildlife Service. We appreciate your continued early notification of permitting activities that have the potential to impact the air quality or air quality related values of class I areas in Florida.

The proposed project includes replacing two existing gas turbines with one larger gas turbine, resulting in a 318 ton per year net increase in nitrogen oxide emissions. We agree with the Reedy Creek Improvement District that water injection is the best control technology available to minimize nitrogen oxide emissions from the proposed turbine. Based on the information provided, the proposed project will increase ambient nitrogen dioxide concentrations by a maximum of 0.32 micrograms per cubic meter. This maximum concentration is expected to occur at a distance of 1.4 km from the proposed project. Because the expected nitrogen dioxide concentrations will decrease as the distance from the project site increases, impacts on the Chassahowitzka National Wildlife Refuge, located 100 km from the project site, should be insignificant. Therefore, we do not expect the proposed Reedy Creek turbine project to significantly impact the air quality or air quality related values of the refuge.

If you have any questions regarding this matter, please contact John Bunyak at (303) 969-2072.

Sincerely,

[signature]

Deputy Regional Director
Region 6

Copied: CHF/BT
Pradeep Raval
Max Linn
10/13/mm

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Bureau of Air Quality Mgmt
Florida Dept of Env Regulation
Twin Towers Office Bldg
2600 Blair Stone Road
Tallahassee, FL 32399-2400

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

BOB MARTINEZ
GOVERNOR

DALE TWACHTMANN
SECRETARY

September 25, 1987

Mr. Miguel Flores
Chief
Permit Review and Technical
Support Branch
National Park Service-Air
Post Office Box 25287
Denver, Colorado 80225

Dear Mr. Flores:

RE: Reedy Creek Improvement District
State Construction Permit: AC 48-137740
Federal Permit Number: PSD-FL-123

Enclosed for your review and comment is additional information on the above referenced permittee. If you have any comments or questions, please contact Pradeep Raval or Max Linn at the above address or at (904)488-1344.

Sincerely,

Margaret Janes

Margaret V. Janes
Planner
Bureau of Air Quality
Management

/mj

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

BOB MARTINEZ
GOVERNOR

DALE TWACHTMANN
SECRETARY

September 25, 1987

Mr. Wayne Aronson
Chief
Program Support Section
U.S. EPA, Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Dear Mr. Aronson:

RE: Reedy Creek Improvement District
State Construction Permit: AC 48-137740
Federal Permit Number: PSD-FL-123

Enclosed for your review and comment is additional information on the above referenced permittee. If you have any comments or questions, please contact Pradeep Raval or Max Linn at the above address or at (904)488-1344.

Sincerely,

Margaret James

Margaret V. James
Planner
Bureau of Air Quality
Management

/mj

Judicial Review
AL 42335 44595
9/22/87

File Copy

REEDY CREEK
IMPROVEMENT
DISTRICT

DIRECTOR/GENERAL MANAGER
Thomas M. Moses

DER
SEP 23 1987
BAQM

September 18, 1987

Mr. C.H. Fancy, P.E.
Deputy Chief
Bureau of Air Quality Management
Florida Department of Environmental Regulation
2600 Blair Stone Road
Twin Towers Offices
Tallahassee, Florida 32399-2400

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

Dear Mr. Fancy:

Pursuant to your letter of September 4, 1987 informing us that our submittal of August 6, 1987 was considered incomplete, please consider the following information and attachments our reply.

<u>Item 1</u>

Acknowledging that a NOx continuous emission monitor is not required, you have asked that we submit details of the methods and devices we intend to employ to provide a continuous means of verifying NOx emissions compliance.

Attachment I is a background document paper authorized by GE outlining the methods and results of abating LM5000 turbine emissions through the use of water injection. Our proposed 32 MW, 42 to 44.7 M HP unit falls adjacent to the contained curves for a 33.3 MW and 41.5 HP machine, and the graphed abscissas are marked indicating our projected water use rates. These values are consistent with those contained in those data forwarded with our original application.

Attachment II contains a description of our water injection ratio control facility along with a simplified flow interface schematic and relevant manufacturer's literature. After start-up calibration and verification

P.O. BOX 36 LAKE BUENA VISTA, FLORIDA 32830 TELEPHONE (305) 828-2034

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Declared Value Charge
Origin Agent Charge
Other
Total Charges

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

RECIPIENT'S COPY

PART #106001
FEC-S-751-1000
REVISION DATE 10/86
PRINTED U.S.A. GBFE

9/25/87

CHF:

FYI

Please return.
Thanks

(using Reference Method 20), we feel this system will ensure continuous control and indication of pre-set deviation points and satisfy continuous compliance observation needs to within at least 1-1 1/2±% accuracy. We request your review and concurrence of this design installation.

Item II

You have requested a current analysis of our natural gas supply with emphasis on supporting the fact that the gas does contain fuel-bound nitrogen along with documentation of the procedure and lab test method that formulates such a finding. We acknowledge that EPA Region IV has taken the position on a similar 1987 application that natural gas does not contain measurable amounts of fuel-bound nitrogen and that emissions credit cannot be given in the calculation of allowable NOx emissions under NSPS, Subpart GG, as we have documented in our August application.

Attachment III is the response communique received from Florida Gas Transmission Company on the subject. Our application used data from 1984 stipulating 0.453 mole percent (same as 0.756 weight percent) of fuel-bound nitrogen. The recent analysis indicates 0.445 mole percent or essentially little change. Florida Gas Transmission maintains their samples are not contaminated by outside air as indicated by the zero oxygen levels and that their results are valid. Our consulting engineer, who has worked with other domestic gas suppliers, indicates that various true fuel-bound nitrogen levels in natural gas are a normal occurrence.

Collectively, we feel Region IV's position is untenable and we respectfully request that the Reedy Creek Improvement District be fully credited for fuel-bound nitrogen in their natural gas supply. This would then enable proper utilization of the discharge standard formula contained in Paragraph 60.332 (a) (1) supplemented by the emission allowance defined by 60.332 (a) (3) of Subpart GG. We would also monitor the fuel's nitrogen content, as analyzed by our supplier frequently, so as to ensure proper adherence with regulatory requirements.

It is requested that emission allowances outlined in our original application be concurred with and approved by your agency.

Item III

We appreciate your advice in that it may be to the District's best interest to seek an SO_2 emission allowance, for oil burning, greater that that of 39 tons per year.

We have discussed this point, at some depth previously, but upon analysis of our loads, continuities, supplier dependability and relevant factors, we have decided that an equivalent allowance of oil consumption for 29 operating days per year (39 tons per year of SO_2) is sufficient for District needs. Therefore, it is requested that the oil consumption and allowance figures cited in our original application be retained.

If you have any questions on these issues, please inform us promptly, so there will be a minimum of delay in formally acting on our August application package.

Thank you for your consideration of this response.

Very truly yours,

Thomas M. Moses

Thomas M. Moses
Director/General Manager

TMM:dh

Attachments:

pc Mr. Fred Harden w/attach.
(Reedy Creek Improvement District)
Mr. Frank Jones w/attach.
(Reedy Creek Utilities Company)

Tom Sawicki - CF Dist.
Miguel Flores - NPS
Wayne Aronson - EPA
Pradeep Raval
CHF1BT
Nat Finn
Barry Andrews

} 9/24/87 mr

ATTACHMENTS

ATTACHMENT I

GENERAL ELECTRIC

AIRCRAFT ENGINE BUSINESS GROUP
GENERAL ELECTRIC COMPANY • 1 NEUMANN WAY • CINCINNATI, OHIO 45215 • (513) 243-2000

September 16, 1987

Mr. Cary Holt
Stewart & Stevenson Services, Inc.
16415 Texas, 77015

Subject: 7LM5000PA Emissions Test Data

Dear Cary,

The attached is a description of emission testing and data from tests conducted on both natural gas and liquid fueled LM5000 engines with water injection for NOx suppression. Also included is a brief description of the emissions calculation methodology as integrated into the engine performance computer model.

The author of this paper is Dr. T.F. Lyon of GE's Combustor Technology Department. He also participated in the testing and the development of the computer model.

If any further information is desired, please let me know.

Regards,

W. W. Hockensmith

2500W/37

LM5000 EMISSIONS WITH DUAL FUEL CAPABILITY AND WATER INJECTION

Emissions Test Data - Gas Fuel

An emissions test of a natural gas fueled LM5000 with water injection was performed on December 7, 1983 at the Simpson Paper Co., Shasta Mill, Anderson, CA. Exhaust gas samples were obtained from a probe inserted into an existing sampling port near the top of the exhaust stack. The continuously flowing sample was analyzed for carbon monoxide (CO), oxides of nitrogen (NO_x), carbon dioxide (CO_2) and oxygen (O_2).

The four instruments used for the analysis were:

CO - Thermo-Electron Co. Model 48 NDIR.

CO_2 - CARLE Instruments Model AGC311 Gas Cromatograph/TCD

NO_x - Thermo-Electron Co. Model 10 Chemiluminescent

O_2 - Sybron-Taylor Model 54A Paramagnetic

A total of 38 test points were obtained over a range of total power output from 9 to 37 MW and water injection from 0 to 24 gal/min. The engine was equipped with dual fuel duplex-type fuel nozzles, part numbers L31422/P01, 02, 03. Although the engine had dual fuel capability, only gas fuel was used in this emissions test program.

Figure 1 shows NO_x plotted against combustor water flow rate at various

power levels. The NO_x is expressed as ppm by volume, dry, referenced to 15% O_2 and combustor water is in gal/min. The power levels are electric generator output in megawatts.

The NO_x reduction curve is shown in Figure 2. In this plot, the NO_x ratio (NO_x with water injection divided by NO_x without suppression) is plotted against water to fuel weight ratio. As is generally the case, this plot is independent of power at the highest power levels.

In contrast to the NO_x, CO levels tend to increase with increasing water injection rate as shown in Figure 3. As can be seen in this figure, CO is very low (a few ppm) at low water injection rates and high power levels. At the lower power levels, CO is quite sensitive to water injection rate.

Emissions Test Data - Liquid Fuel

An emissions test of a liquid fueled LM5000 gas generator with water injection was conducted at the GE Evendale, OH plant, test cell #37 during the period from April 25 to May 5, 1978. The engine "load" was provided by a fixed conical exhaust nozzle which was sized to produce the correct backpressure on the low pressure turbine. Power output was calculated as isentropic gas horsepower or that power which would be produced by isentropic expansion across the fixed exhaust nozzle. The actual mechanical power produced in a complete gas turbine system is about 87% of the isentropic gas horsepower.

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The fuel nozzles used were part numbers L25282 P01 and P02. These are liquid only fuel nozzles and are similar to the liquid side of the dual fuel duplex fuel nozzles. Water is introduced into the fuel system just upstream of the fuel manifold. Fuel was marine diesel (MIL-F-16884).

Exhaust samples were withdrawn through two probes located just downstream of the exhaust plane and mounted at different radial positions on a "windshield wiper" type of actuator. For each test point, twelve samples were obtained, six from each probe, at various locations across the exhaust plane.

Samples were analyzed for CO, CO_2, NO_x and total hydrocarbons (HC). Analytical instrumentation included:

CO - Beckman Model 865 (NDIR)

CO_2 - Beckman Model 864 (NDIR)

NO_x - Bechman Model 951 (Chemiluminescent)

HC - Beckman Model 402 (Flame Ionization)

Figure 4 shows NO_x in ppm Ref. 15% O_2 plotted against water injection rate at four power levels. The power levels are isentropic gas horsepower as described previously.

Figure 5 shows the NO_x reduction curve which is the NO_x ratio plotted against water to fuel weight ratio. The NO_x reduction obtained with liquid fuel and water injection is very similar to that obtained with gas fuel and water injection (see Figure 2).

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Emissions Calculation Methodology

An emissions calculation methodology has been developed and integrated into the engine performance decks for the LM1600, LM2500 and LM5000 engines. This capability permits the exhaust composition to be accurately projected for a wide range of parameters which reliably simulate engine performance under actual operating conditions. Utilizing this capability, such factors as ambient conditions, inlet and exit losses, fuel composition, water or steam injection rates and engine deterioration are all accounted for in the emissions calculations.

Basically the same model is used for each of the engines. The model is calibrated for a particular engine type using engine test data which is empirically matched to analytical expressions or data tables contained within the performance program. Data from the two tests described above was used to calibrate the LM5000 model for water injection.

The program can accommodate any fuel composition containing carbon, hydrogen, oxygen, sulfur and nitrogen. Exhaust products are argon (Ar), nitrogen (N_2), oxygen (O_2), carbon dioxide (CO_2), water (H_2O), sulfur dioxide (SO_2), carbon monoxide (CO), total hydrocarbons (HC) and oxides of nitrogen (NO_x) (nine species). Species concentrations are calculated in three subroutines contained within the performance program. The first of these is called the burner subroutine, in which CO and HC are calculated as a function of compressor discharge temperature (T_3) and injected water or steam to fuel ratio. In this

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subroutine, the effect of CO and HC on combustion efficiency is also evaluated and the appropriate adjustment to engine performance is made.

The NO_x subroutine calculates the NO_x concentration which is determined by compressor discharge temperature (T_3) and pressure (P_3), total inlet humidity (including evaporative cooler, if any), injected water or steam, fuel-air ratio and combustor reference velocity. In addition, NO_x from fuel-bound nitrogen is evaluated and the total NO_x is adjusted accordingly. The effect of non-standard gaseous fuel on NO_x is evaluated in the fuel program which is separate from the performance deck. In the fuel program, the maximum adiabatic flame temperature is calculated from the fuel composition, and a correction factor for NO_x is then computed. This correction factor is input to the performance program.

With emissions of CO, HC and NO_x thus calculated in the first two subroutines, SO_2 and the major species (Ar, O_2, N_2, CO_2, H_2O) are calculated in the exhaust composition subroutine by means of mass balance equations. The fuel sulfur is assumed to be converted to SO_2. The mass balance equations are derived by evaluating the products of the reaction of the actual fuel with standard dry air plus inlet moisture (from total inlet humidity) plus injected water or steam (if any).

The program output contains the complete exhaust composition as mole percent wet, mole percent dry (all water removed), weight percent wet and weight percent dry. Also included are NO_x in ppm Ref. 15% O_2, NO_x emission index and NO_x and CO in lb. per hour. Other related emission parameters can also be evaluated and included in the output.

LM5000 ESN 474-110
SIMPSON PAPER CO. - SHASTA MILL
DEC. 7, 1983
NAT. GAS FUEL - WATER INJECTION

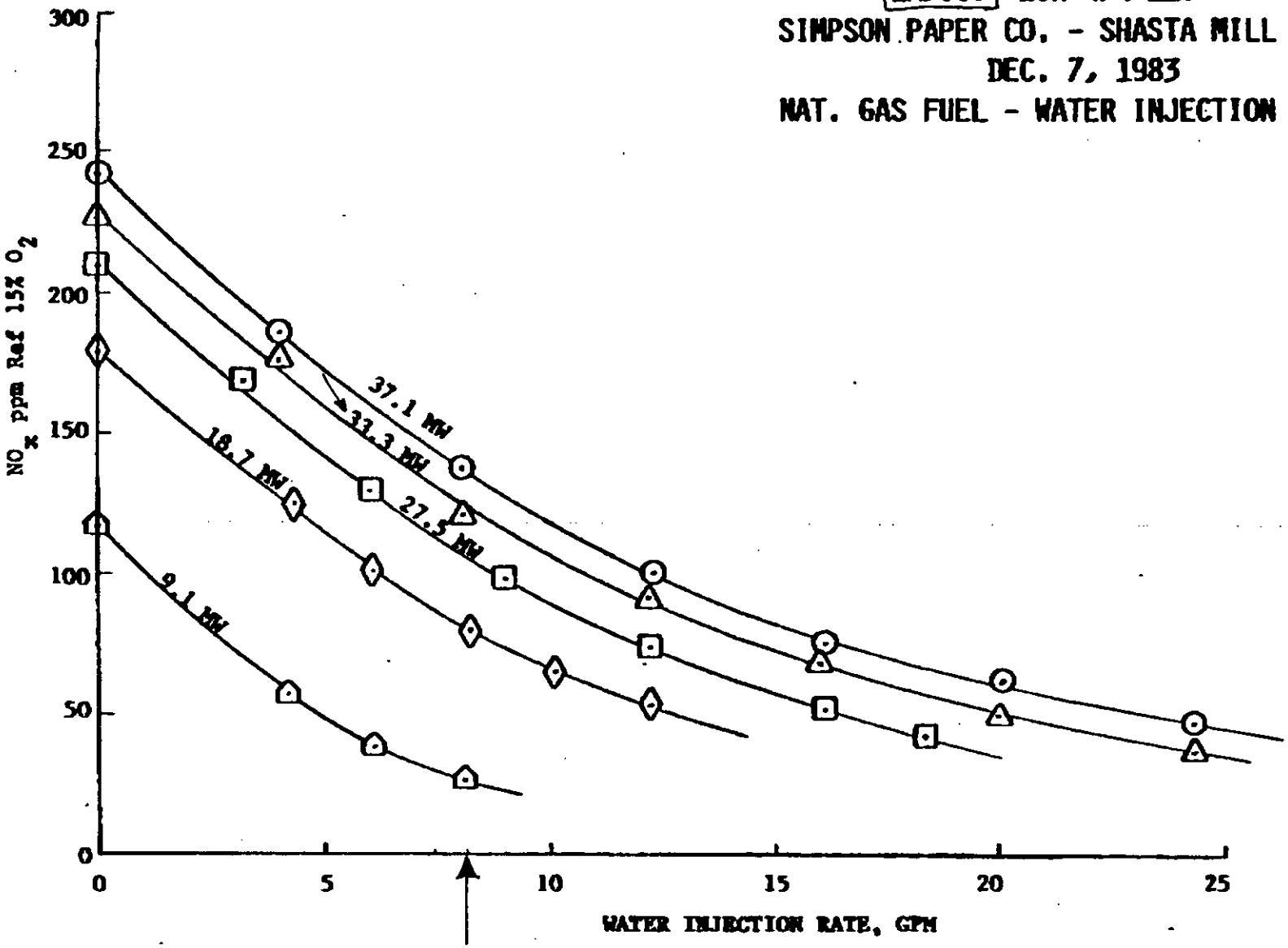


FIGURE 1. NO_x VS. WATER INJECTION RATE - GAS FUEL

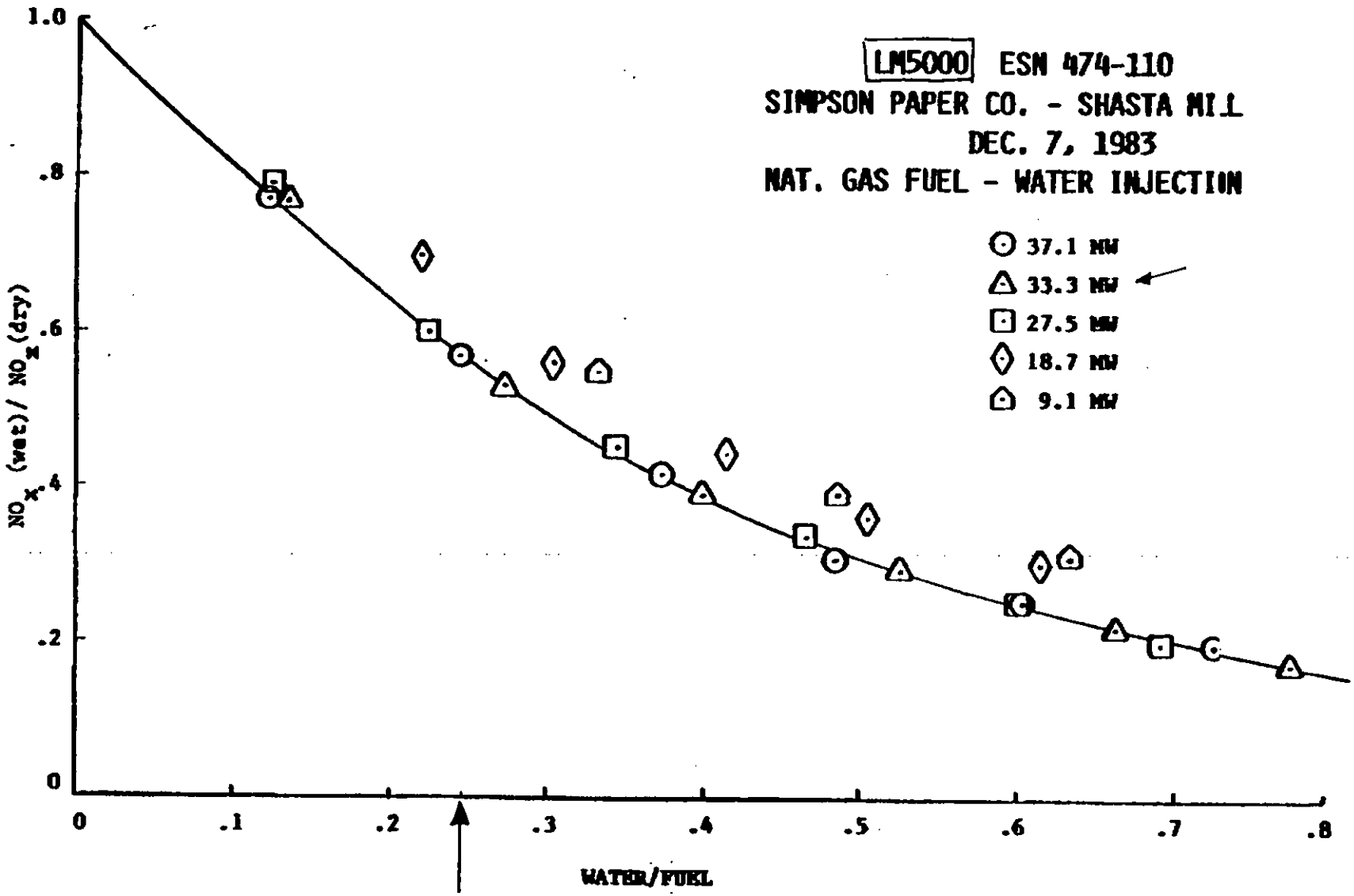


FIGURE 2. NO_x REDUCTION RATIO VS. WATER – FUEL RATIO – GAS FUEL

LM5000 ESN 474-110
SIMPSON PAPER CO. - SHASTA MILL
DEC. 7, 1983
NAT. GAS FUEL - WATER INJECTION

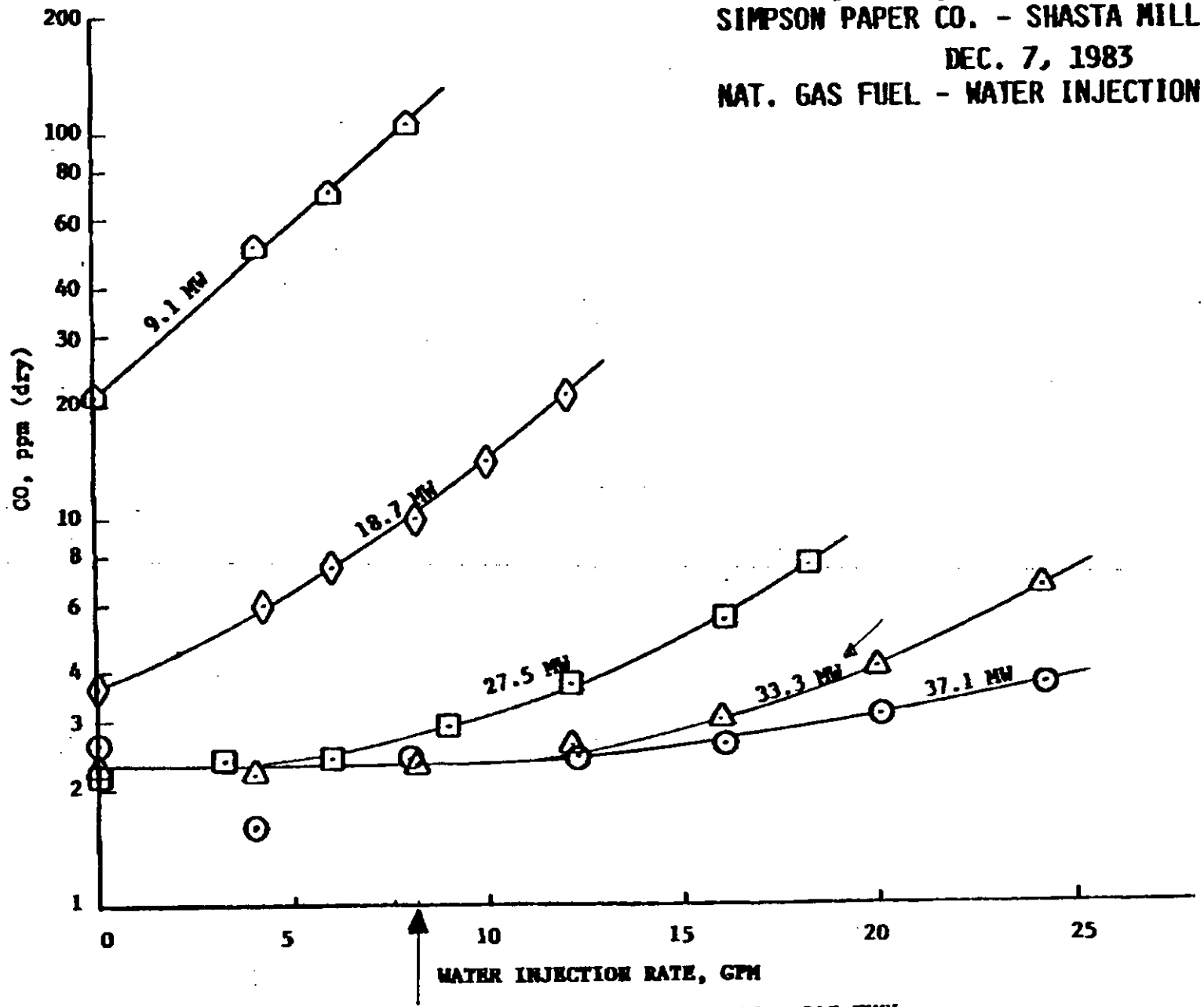


FIGURE 3. CO VS. WATER INJECTION RATE - GAS FUEL

H

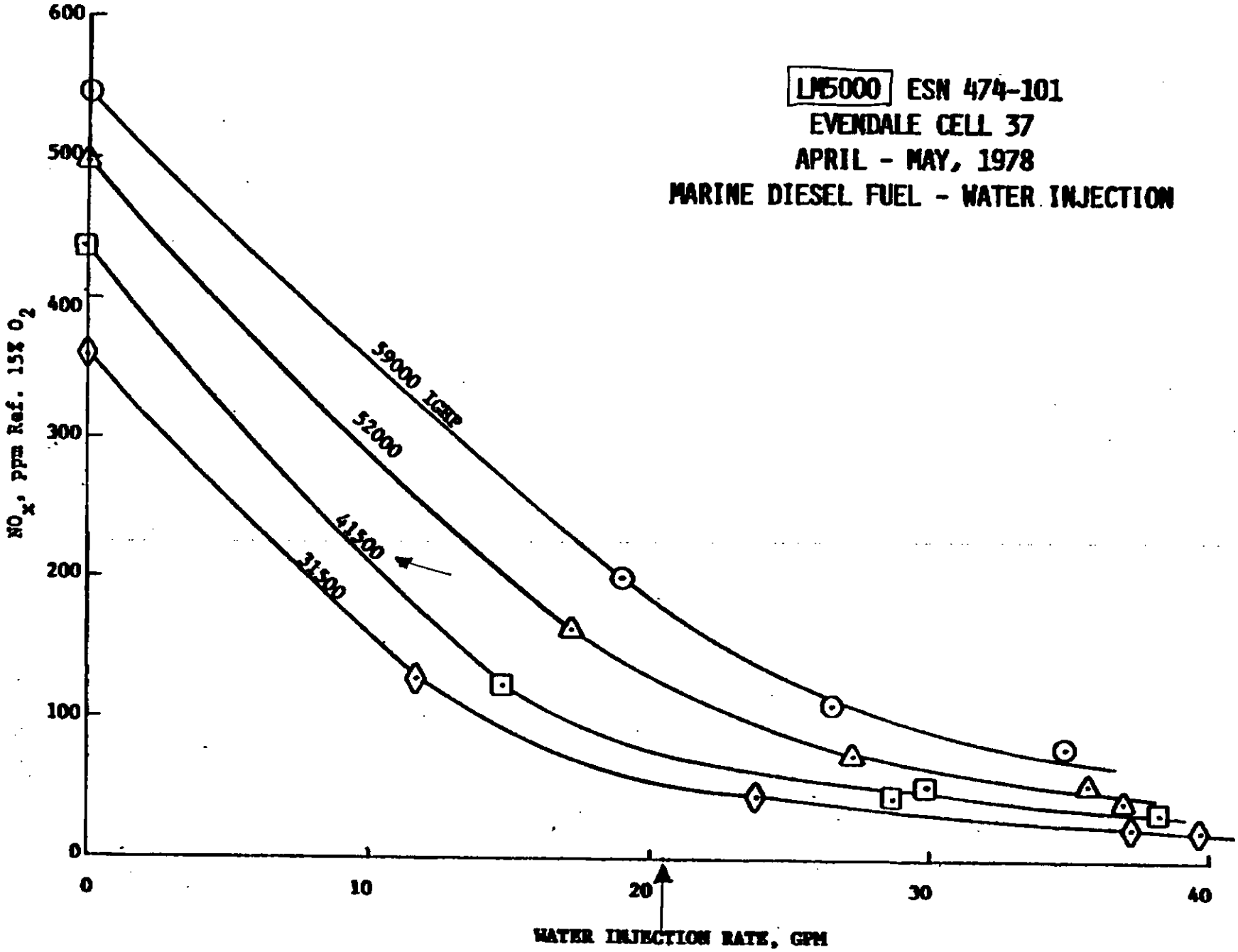


Figure 4. NO_x VS. WATER INJECTION RATE - LIQUID FUEL

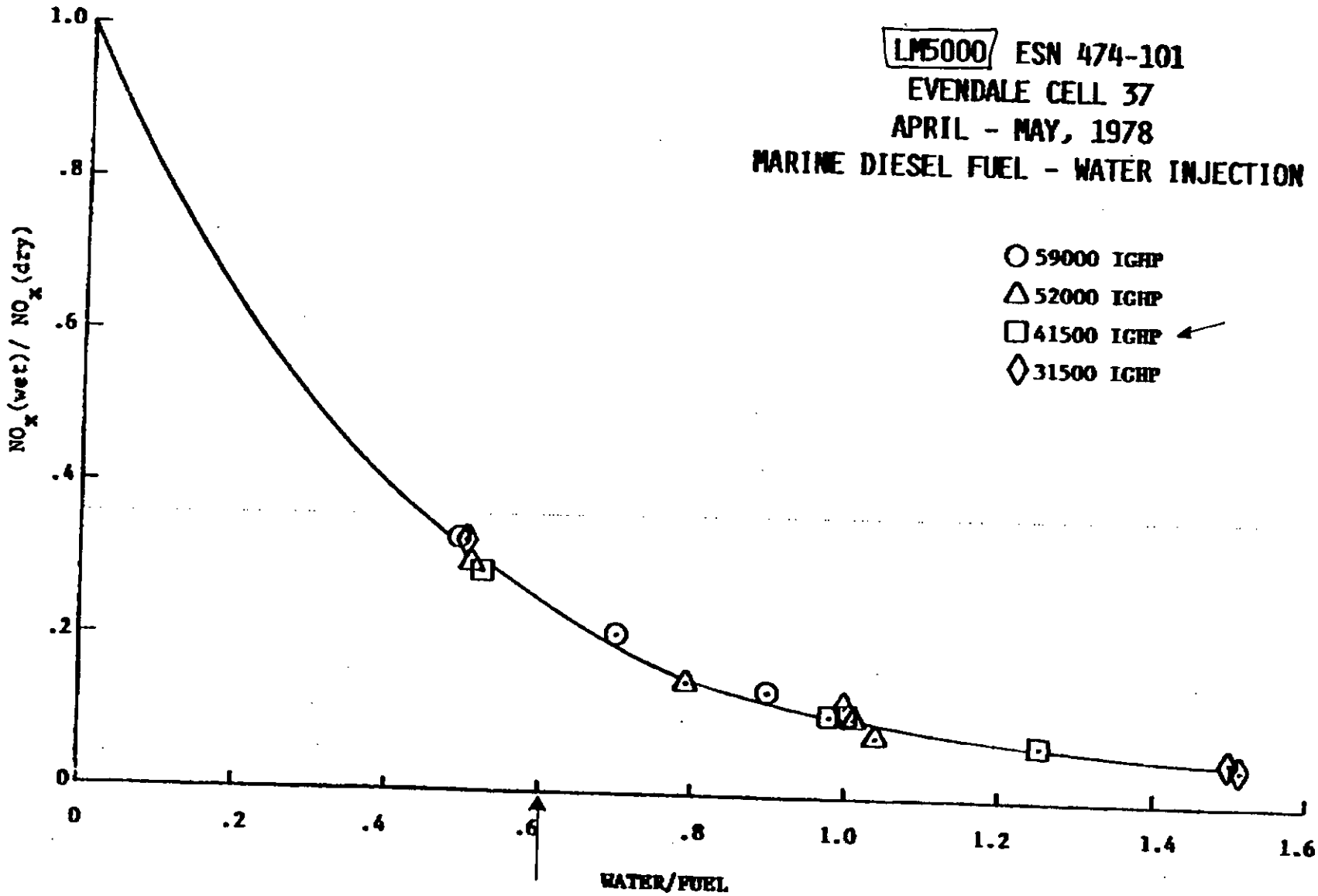


Figure 5. NO_x REDUCTION RATIO VS. WATER - FUEL RATIO - LIQUID FUEL

ATTACHMENT II

NOx WATER INJECTION AND FUEL RATIO CONTROL SYSTEM

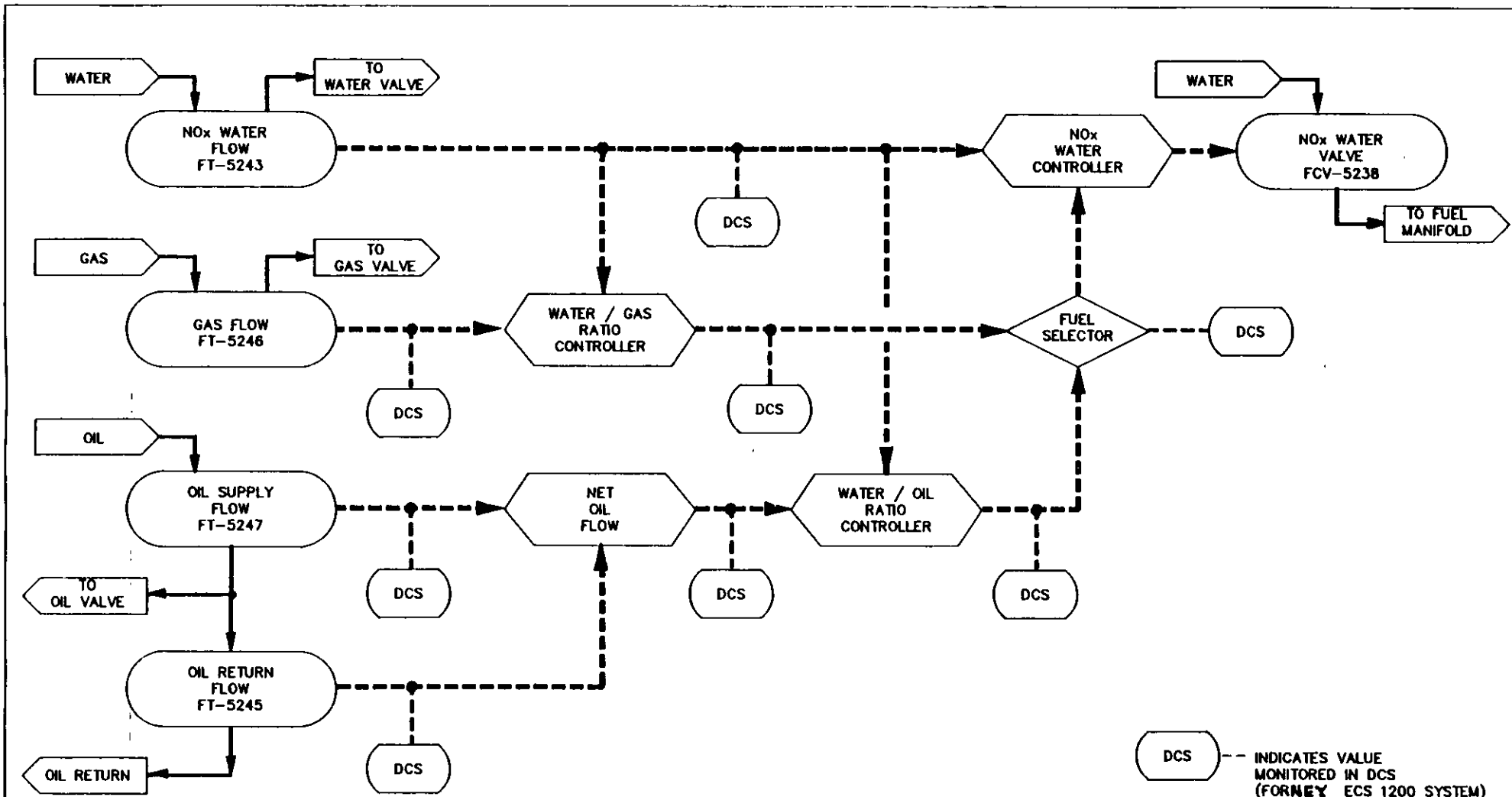
The NOx Water/Fuel ratio, along with ambient temperatures, will be used to determine NOx emissions compliance. The NOx water flow rate, gas flow rate, oil supply and return flow rates (used to obtain net oil consumption), plus the ambient temperature will be monitored and trended on the Digital Equipment Corporation MicroVAX computer system which is a part of the overall Distributed Control System (DCS).

The electrical load on the generator will also be monitored and trended, since NOx water is not required until the generator reaches 25% load (which is also dependent on ambient temperature).

The water/fuel ratio for whichever fuel is in use will be calculated from the above measurements. This ratio, along with the ambient temperature, will be compared to the emission values obtained during start-up testing, and the ratios inputted to the gas turbine computer will be corrected as necessary to obtain the required reduction in NOx levels. The gas turbine NOx water flow controller will automatically adjust the water flow rate to match the required ratio values obtained during start-up. If the controller cannot maintain the correct value as calculated by the MicroVAX system, then a deviation alarm based on a six-minute average (as is currently done with continuous emissions monitoring) will be generated on the DCS and logged to an alarm printer.

Additionally, a shift, daily, and monthly log report will be generated detailing the amount of water and fuel used, amount of time the generator was on load, minimum, average, and maximum ratios (expected and actual), number of deviation alarms, total amount of time of the deviations, average NOx ppm value and the total pounds of NOx emitted per hour.

The necessary hardware utilized is as attached.



35621001 JOB NO. 163561 9/18/87

RCU1117A 7-10-87

RCUD NO.306-86W

SHEET NO. 1 of 1 SH.

Reedy Creek Utilities Co., Engineering Department

P.O. BOX 40, Lake Buena Vista, Florida 32830 TELEPHONE (305)824-4824

PROJECT AREA: CENTRAL ENERGY PLANT NORTH SERVICE AREA

UNIT NAME: CO-GENERATION PLANT

SHEET TITLE: GAS TURBINE / NOx WATER CONTROL WOODWARD GOVERNOR MODEL 503 FAULT TOLERANT DIGITAL CONTROLLER

W.H. WILLIAMS, PROJECT MANAGER

E. GODWIN, PROJECT ENGINEER

DATE	9/18/87	5									
SCALE	NONE	4									
DRAWN	AEC	3									
CHECKED	EACoen	2									
APPROVED		1									
APPROVED		ISSUE NO.	APPR BY	DATE	ISSUED FOR	REV. NO.	APPR BY	DATE	DESCRIPTION		

NOMENCLATURE FOR NOx CONTROL INSTRUMENTATION

FT-5243	NOx Water Meter - Yokogawa Model YF102-ALSA-S3S3 1" Vortex Shedding Flow Meter, Range 3.3 to 82 GPM
FCV-5238	NOx Water Control Valve - Woodward 3151A/TM-40 1½" - 600# RF Flg. 316 SS Body; 316 SS Trim; Elect. Actuator, 4-20 mA; Range 0-65 GPM
FT-5246	Gas Meter - Yokogawa Model YF-108-AGSA-S3S3 3" Vortex Shedding Flow Meter, Range 29 to 730 M SCFH
FT-5245 FT-5247	Oil Flow Meters - Yokogawa Model YF-102-ALSA-S3S3 1" Vortex Shedding Flow Meter, Range 3.3 to 82 GPM
FCV-5201	Fuel Gas Control Valve - Woodward TM55-3103 Electro-Hydraulic Fuel Valve With Dual Coil Actuator, for Natural Gas Service; 2" - 600# RF FLG
FCV-5202	Fuel Oil Control Valve - Woodward TM55-1907 Electro-Hydraulic Fuel Valve With Dual Coil Actuator; 1" JIC (Oil-Tight) Connection

II

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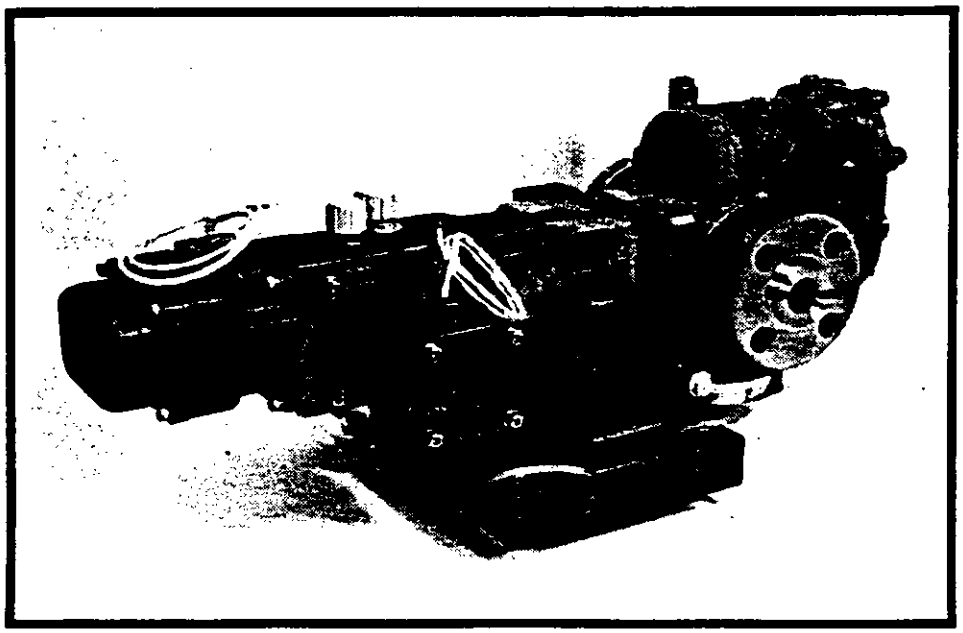
WOODWARD
®

3151A WATER VALVE/ TM-40LP ACTUATOR ASSEMBLY

FOR

GAS-TURBINE WATER INJECTION SYSTEM



WOODWARD GOVERNOR COMPANY

SECTION 1

GENERAL INFORMATION

Introduction

The 3151A Water Valve/TM-40LP Actuator assembly is manufactured by Woodward Governor Company, Engine and Turbine Controls Division, P.O. Box 1519, Fort Collins, Colorado, 80522. Phone (303) 482-5811.

The 3151A Water Valve/TM-40LP Actuator assembly meters water to gas-turbine combustors as part of a nitrous oxide (NOx) emission-reduction system.

Description

This section describes the 3151A Water Valve/TM-40LP Actuator. A schematic drawing, Figure 1-1, illustrates the working relationships of the various parts.

Water Valve

The 3151A Water Valve is intended for use with high-pressure centrifugal-type pumps and provides metered bypass flow for pump-stability and heat-balance considerations.

The water valve is primarily constructed of stainless steel. A replaceable, hardened, stainless-steel sleeve is located in the drain flange area of the valve housing, and protects the housing from cavitation damage. The sleeve can be rotated in one-quarter turn increments, or it can be replaced, to extend valve life when used in severe conditions.

Ceramic is used on metering valve and regulator valve parts to prevent galling and to resist erosion in an area subjected to high-velocity water streams.

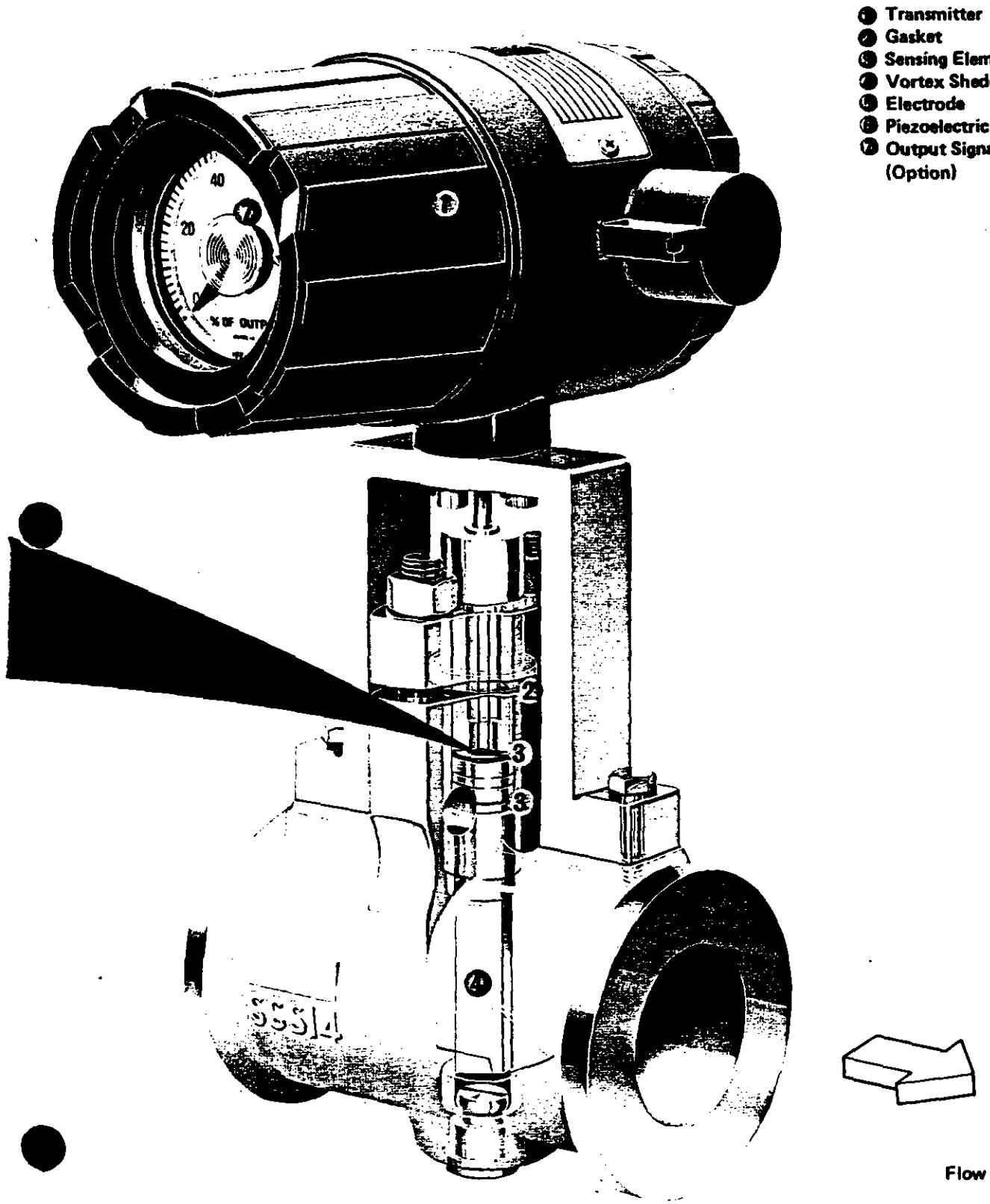
These design features make the 3151A Water Valve highly resistant to erosion, corrosion, and cavitation.

The Water Valve is designed to meter up to 45 gallons of water per minute with input water pressures from 350 psi to 1500 psi. The minimum flow is one gallon of water per minute.

The degree-of-flow accuracy is either 5.0% of point or 0.5% of maximum flow--whichever value is greater.

Standard seal material allows operation with water temperatures up to 150 degrees F. Special seal material is available for operation with higher water temperatures.

No moving parts, no sensor ports exposed to process fluid.

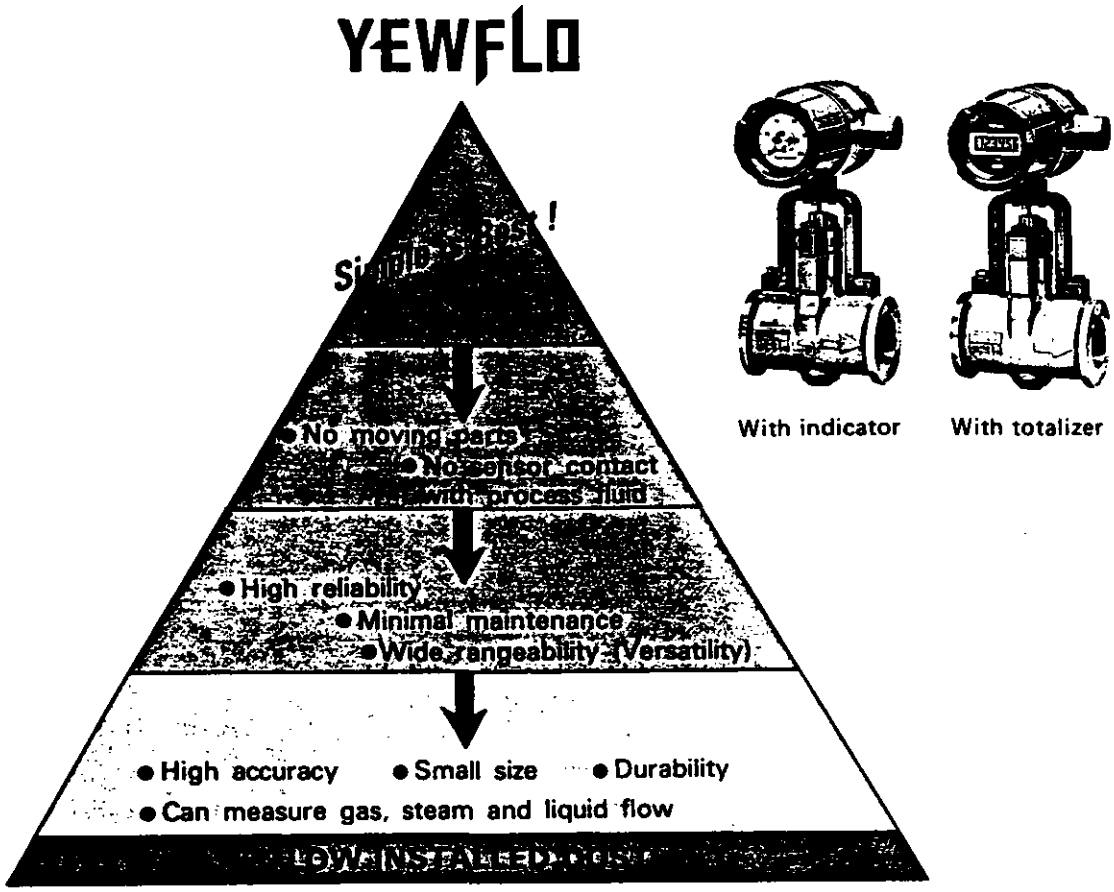


Brand-new from YOKOGAWA
YEWFLO—the flowmeter for the future.

Introduction:

In 1968 YOKOGAWA developed the first vortex shedding flowmeter in the world for measuring flarestack and flue gas flow rates.

Building on this, YOKOGAWA has developed a new generation of vortex type flowmeters – suitable for gas and steam as well as liquid flow measurement – and is marketing them under the name **YEWFLO**.



With indicator With totalizer

Features:

- **Simple construction, with no moving parts.**

Vortices stress the shedder body, which transmits stress to a piezoelectric sensor. The solid shedder body, which is in contact with the measurement fluid, is simple and strong, and has no moving parts. Further, there are no sensor ports exposed to process fluid.

As a result of these features, the flowmeter is exceptionally reliable and requires virtually no periodic maintenance.

- **Sensor and fluid are not in contact – vortex stress is transmitted via the shedder body – and the sensor is located outside the flow line.**
- **Low installed cost.**

The flowmeter offers wafer and flange type mounting in the process line. With the two-wire or pulse output type transmitter, no additional equipment, with the exception of a power supply, is required, and the all-inclusive installed cost is very competitive compared with other flowmeters.

- **Compact and lightweight, the flowmeter is easy to install.**
- **Wide rangeability – versatility: measures gas, steam and liquid flow.**

Because special materials are used, and the sensor is well isolated from the process fluid and located outside the flowline, the flowmeter can be used even under severe conditions – it will tolerate high or low temperatures and pressures, and can measure gas, steam and liquid flow. It has wide rangeability.

- **High accuracy.**

The flowmeter output is accurate and linear, and is unaffected by fluid temperature, pressure, density or viscosity. Its accuracy, repeatability, linearity and rangeability match the needs of control systems.

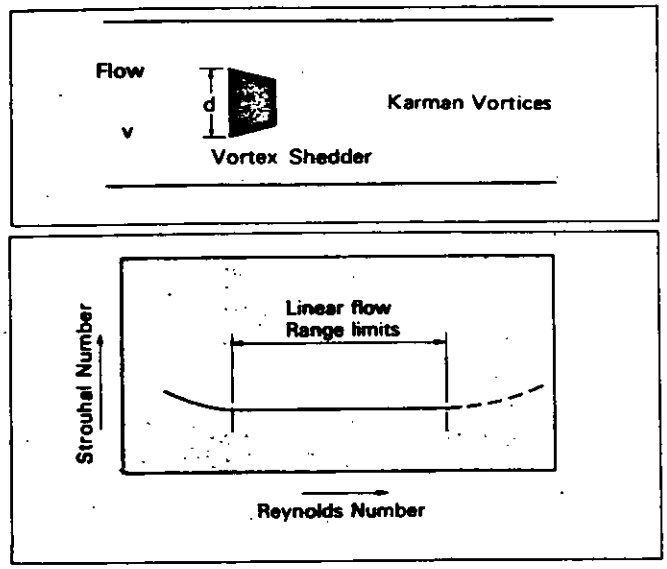
Presenting a new breakthrough in accuracy and dependability specially developed piezoelectric element senses vortex frequency.

Principle of vortex flowmeter operation:

When a fluid stream flows around a bluff body (vortex shedder), viscosity-related effect produce vortices downstream. The vortices are shed from one side of the shedder, and then the other side, in a regular train as shown in the figure.

The vortex shedding frequency (f), flow velocity (v), and shedder width (d) relate as follows:

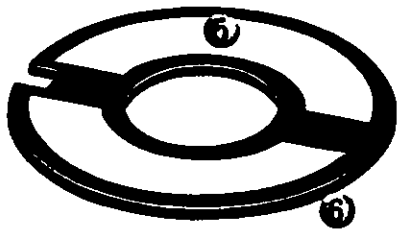
$$f = St \cdot v/d$$



The dimensionless constant St is called the "Strouhal number", and is a significant parameter in vortex flow measurement.

The figure shows a typical graph of Strouhal numbers vs. Reynolds numbers for a cylindrical vortex shedder. Within a wide range of Reynolds numbers, vortex shedding frequency is directly proportional to fluid velocity and is unaffected by changes in fluid density or viscosity. If the Strouhal number (St) for a given vortex shedder is known, flow rate can be measured by means of the vortex shedding frequency.

Simple is Best !

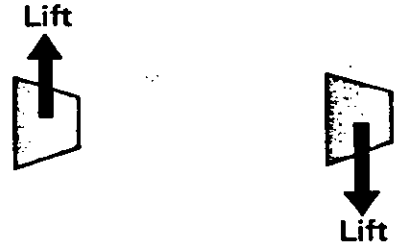


Vortex frequency sensing:

A piezoelectric sensor element is embedded inside the vortex shedder which is located outside the pipeline.

When vortices are shedding, the shedder is lift as shown in the figure below. The direction of the stress alternates at the vortex shedding frequency. The piezo element converts the stress into an electric pulse signal. Pipeline vibrations can be cancelled within a dual piezoelectric sensor.

The sensor is suitable for use over wide temperature range. It is also simple, robust, and maintainance-free — there are no moving parts, and no sensor ports exposed to process fluid.



Standard Specifications:

Fluid to be measured:	Liquid, Gas or Steam
Measurable flow rates:	Reynolds number from 5,000 to 7,000,000. The relationship between kinematic viscosity of specific weight and minimum flow rate is shown in Figures 2, and 3 respectively.
Accuracy:	Reynolds number ≧ 20,000 (40,000 for 6 inch and 8 inch meters). Liquid: ±0.8% of rate. Gas and Steam: ±1.5% of rate. For analog output, add ±0.1% of full scale to the above value.
Output signal:	
Analog output:	4 to 20 mA, 2 wire system
Pulse output:	Voltage pulses, 3 wire system
Power supply:	
Analog output:	12 to 45 VDC (CSA Explosionproof: 12 to 42V)
Pulse output:	12 to 30 VDC
Process temperature:	–40 to 300°C (–40 to 572°F) Refer to Figure 1 for intergral converter type. High process temperature version (–40 to 400°C or 752°F) available on request.
Maximum process pressure:	Flange rating.
Ambient temperature:	–40 to 80°C (–40 to 176°F)
With indicator:	–20 to 60°C (–4 to 140°F)
With totalizer:	–10 to 60°C (14 to 140°F)
Ambient humidity:	5 to 100% RH
Cable conduit connection:	½NPT Female.
Material:	
Case:	Aluminum alloy.
Body:	ASTM A296 Grade CF8M (AISI 316) stainless steel or ASTM A216 Grade WCC carbon steel.
Vortex shedder:	AISI 329 stainless steel (equivalent to or better than 316ss corrosion resistance)
Finish:	Darkgreen / baked polyurethane resin paint
Enclosure classification:	NEMA protection type 4 watertight and dust-tight.
Electrical classification:	Approved by FM. Explosionproof class I, Groups B,C & D, Division 1 & 2. Dustignitionproof class II, Groups E, F & G, Division 1 & 2. Class III, Division 1 & 2. Approved by CSA. Explosionproof class I, Groups C & D, Division 1 & 2. Dustignitionproof class II, Groups E, F & G, Division 1 & 2. Suitable for class III, Division 1 & 2.
Options:	Indicator; 0 to 100% uniform scale. Code: /TBL. Totalizer; Six-digit LCD display. Code: /TBT. Stainless steel tag number plate.; Code: /SCT

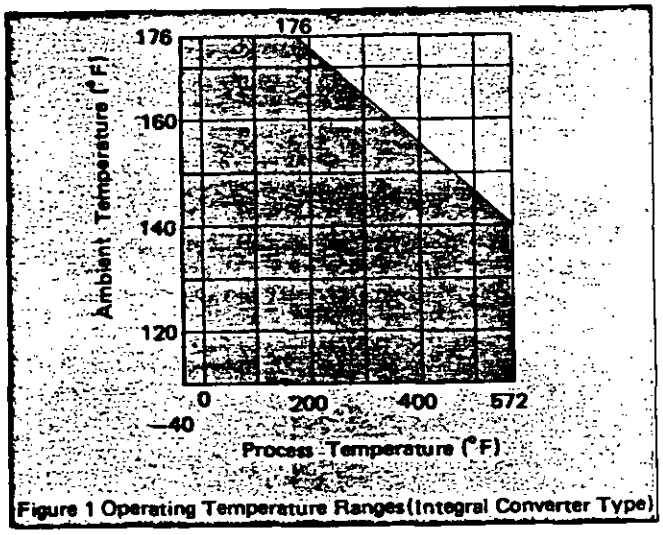


Figure 1 Operating Temperature Ranges (Integral Converter Type)

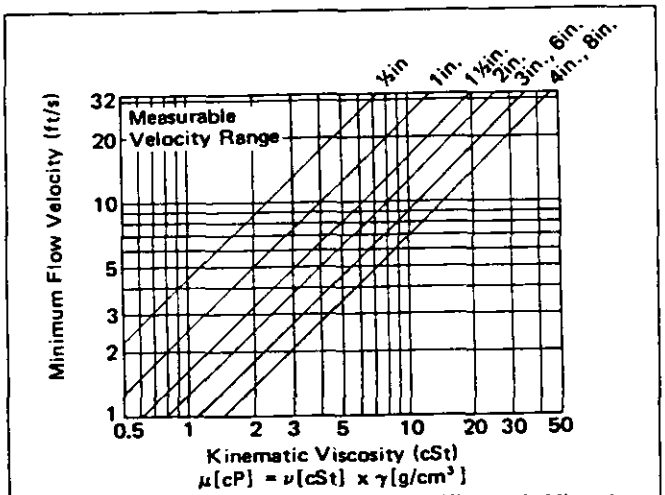


Figure 2 Minimum Flow Velocity versus Kinematic Viscosity

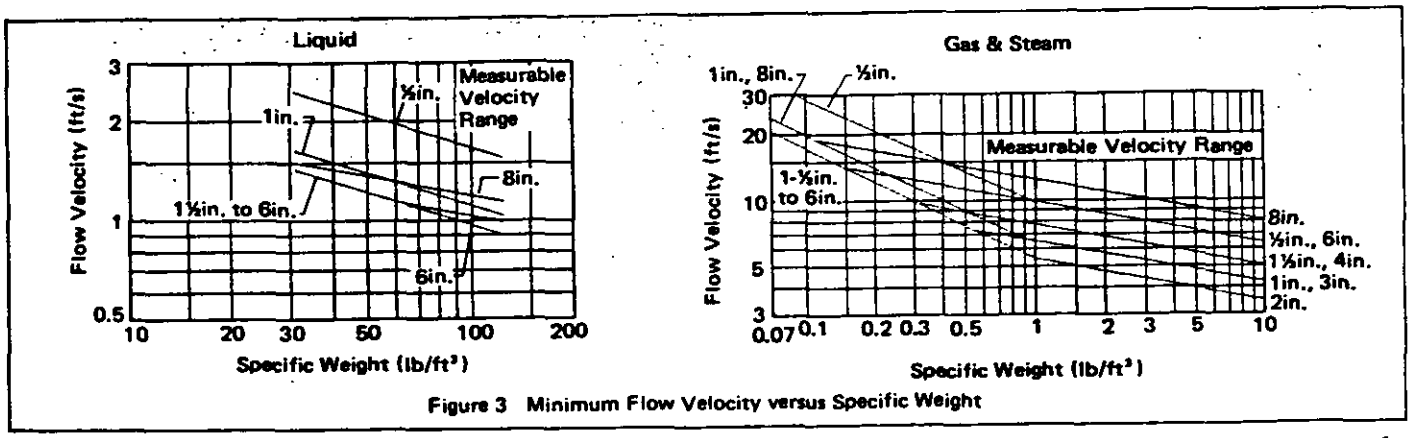


Figure 3 Minimum Flow Velocity versus Specific Weight

Minimum flow rate

The minimum flow rate measurable by the vortex flowmeter is determined by two factors:

(1) Kinematic viscosity.
The Strouhal number is constant with Reynolds numbers 20,000 or greater.
Kinematic viscosity, which affects Reynolds number, thus limits the minimum measurable flow rate, as in Figure 2.

(2) Specific weight
The specific weight of the fluid, which affects sensor sensitivity, also limits the minimum measurable flow rates, as shown in Figure 3.

The "minimum measurable flow rates" determined by (1) kinematic viscosity and (2) specific weight are read from the two graphs and the larger of the two limits taken as the minimum measurable flow rate.

Water Flow Rates (At standard conditions of 15°C (59°F).)

Nominal Size		Minimum and Maximum Measurable Flow Rates in GPM
15	½	1.6 (3.7) and 26
25	1	(1) 3.3(7.3)* and 82 (2)
40	1½	6.9(11.3)* and 196
50	2	12(14.5)* and 324
80	3	22 and 627
100	4	39 and 1090
150	6	84 and 2390
200	8	171 and 4280

(1) Minimum flow rates are based on Figure 3.
(2) Maximum flow rates are based on 10 m/s (32 ft/s).

Flowmeter Nominal K-Factor

Nominal Size		Nominal K-Factor		
		pulse/liter	pulse/ACF	pulse/U.S.gal
15	½	376	10645	1423
25	1	68.6	1940	259
40	1½	18.7	530	70.8
50	2	8.95	253	33.9
80	3	3.33	94.3	12.6
100	4	1.43	40.3	5.39
150	6	0.441	12.5	1.67
200	8	0.185	5.24	0.70

ACF: Actual cubic feet.

Air Flow Rates at Selected Process Pressures (At standard conditions of 15°C (59°F) and 1.0332 kg/cm² absolute (14.7 psia). SCFH: Standard cubic feet per hour.)

Nominal Size			10 psi	50 psi	100 psi	150 psi	200 psi	300 psi	400 psi	500 psi
15	½	min.(2)	210	440	585	738	913	1240	1550	1840
		max.(3)	1670	7480	13200	19000	24800	36300	47900	59500
25	1	min.	467(754)*	979	1310	1570	1900	2580	3220	3820
		max.	5290	23200	41200	59200	77200	113000	149000	185000
40	1½	min.	954(1170)*	2070	3260	4360	5380	7310	9110	10900
		max.	12500	55300	98000	140000	183000	269000	354000	407000
50	2	min.	1580	3320	4420	5290	6180	8380	10500	12500
		max.	20700	91000	162000	232000	303000	445000	524000	524000
80	3	min.	3050	6400	8760	11800	14500	19700	24600	29200
		max.	40600	178000	317000	455000	593000	731000	731000	731000
100	4	min.	5330	11600	18200	24300	30100	40800	50900	60500
		max.	69900	307000	545000	783000	963000	963000	963000	963000
150	6	min.	11700	31900	50500	67400	83300	114000	141000	168000
		max.	154000	677000	1200000	1420000	1420000	1420000	1420000	1420000
200	8	min.	24400	45800	72300	96600	120000	163000	203000	241000
		max.	274000	1210000	1900000	1900000	1900000	1900000	1900000	1900000

(1) Pressure listed is at process temperature of 15°C (59°F).
(2) Minimum values are based on Figure 3.
(3) Maximum flow rates are based on the lower of 80 m/s (262 ft/s) or Reynolds number limit (7,000,000), whichever is lower.

Saturated Steam Flow Rates at Selected Process Pressures

Nominal Size			10 psi	50 psi	100 psi	150 psi	200 psi	300 psi	400 psi	500 psi	600 psi	700 psi
15	½	min.(1)	16.0	18.3	24.2	26.9	31.9	33.1	36.2	38.4	40.7	45.1	49.0
		max.(2)	122	160	279	345	487	526	627	705	793	974	1150
25	1	min.	34.6(40.2)*	39.7(41.3)*	49.9	58.2	65.3	71.8	77.8	83.2	88.2	97.7	107
		max.	379	499	790	1070	1510	1630	1910	2190	2460	3020	3580
40	1½	min.	70.8	82.0	102	119	134	148	168	187	205	242	277
		max.	906	1190	1880	2560	3610	3900	4570	5230	5880	7220	8560
50	2	min.	118	135	169	198	222	244	264	282	299	331	360
		max.	1490	1970	3120	4240	5980	6450	7570	8650	9730	11900	14100
80	3	min.	227	260	327	381	427	470	509	544	577	649	743
		max.	2890	3810	6020	8190	11500	12400	14600	16700	18800	23000	27300
100	4	min.	396	453	570	664	745	824	935	1050	1150	1350	1550
		max.	5050	6650	10500	14200	20100	21700	25500	29100	32800	40200	47700
150	6	min.	866	991	1280	1640	1960	2290	2600	2890	3180	3740	4280
		max.	11000	14500	22900	31200	44000	47500	55700	63700	71700	88000	101000
200	8	min.	1810	2080	3130	3710	4880	5190	5970	6560	7210	8490	9720
		max.	19800	26000	41200	56000	79000	85300	100000	114000	128000	132000	135000

(1) Minimum values are based on Figure 3.
(2) Maximum flow rates are based on 80 m/s (262 ft/s) or Reynolds number limit (7,000,000), whichever is lower.

*The values in parentheses show the minimum linear flow rate (Re = 20,000) when they are higher than the minimum measurable flow rate.

YF100 Vortex Flowmeter

Model	Suffix code	Description
YF101	. . . . .	Size 15 mm (½ inch)
YF102	. . . . .	Size 25 mm (1 inch)
YF104	. . . . .	Size 40 mm (1½ inch)
YF105	. . . . .	Size 50 mm (2 inch)
YF108	. . . . .	Size 80 mm (3 inch)
YF110	. . . . .	Size 100 mm (4 inch)
YF115	. . . . .	Size 150 mm (6 inch)
YF120	. . . . .	Size 200 mm (8 inch)
Converter	–AL	Integral type (Liquid)
	–AG	Integral type (Gas or Steam)
	–NN	Remote converter type
Output Signal	S	4 to 20mA DC
	P	Pulse Output
	N	Remote converter type
Process connection	A1	ANSI Class 150 flange type
	A2	ANSI Class 300 flange type
	A3	ANSI Class 600 flange type (Not applicable for 200 mm (8 inch))
	B1	ANSI Class 150 wafer type
	B2	ANSI Class 300 wafer type
	B3	ANSI Class 600 wafer type
Electrical connection	A	ANSI ½NPT Female
Vortex shedder Material	–S3 . .	AISI 316 Stainless Steel
Body Material	S3 . . .	AISI 316 Stainless Steel
	C6 . .	Carbon Steel
Style Code	*C .	Style C
Electrical Classification		/FMF ... FM Explosionproof /CSF ... CSA Explosionproof
Options		/□/□

YFA11 Vortex Flow Converter (Remote Converter)

Model	Suffix code	Description
YFA11	. . . . .	Vortex Flow Converter
Fluid	–L	Liquid
	–G	Gas or Steam
Output Signal	S	4 to 20 mA DC
	P	Pulse Output
Mounting	P	2 inch Pipe Mounting
Electrical connection	A	ANSI ½ NPT Female
Flowmeter Nominal Size	–01 . . .	15 mm (½ inch)
	–02 . . .	25 mm (1 inch)
	–04 . . .	40 mm (1½ inch)
	–05 . . .	50 mm (2 inch)
	–08 . . .	80 mm (3 inch)
	–10 . . .	100 mm (4 inch)
	–15 . . .	150 mm (6 inch)
	–20 . . .	200 mm (8 inch)
Style Code	*C . . .	Style C
Electrical Classification		/FMF ... FM Explosionproof /CSF ... CSA Explosionproof
Options		/□/□

Flowmeter Selection Guide

Nominal Size	mm	15	25	40	50	80	100	150	200
	inch	½	1	1½	2	3	4	6	8
Process Connection	Wafer	YES	YES	YES	YES	YES	YES	NO	NO
	Flange	NO	NO	NO	YES	YES	YES	YES	YES
Body Material	Stainless Steel	YES	YES	YES	YES	YES	YES	YES	YES
	Carbon Steel	NO	NO	NO	NO	NO	NO	YES	YES

ORDERING INSTRUCTIONS

1. Model, suffix and optional codes.
2. Flow Conditions.
   a. Fluid name, or Gas composition.
   b. Maximum scale reading, normal flow and minimum flow rates.
   c. Maximum and normal operating temperatures.
   d. Maximum and normal operating pressures.
   e. Specific weight at flowing conditions.
   f. Viscosity at flowing conditions.
   g. Relative humidity at flowing conditions (wet gas only).

YOKOGAWA
Yokogawa Electric Corporation

YOKOGAWA CORPORATION OF AMERICA (YCA)
2 Dart Road, Shenandoah, Ga. 30265, U.S.A.
Tel.: 404-253-7000
Telex: 230810-766-4760 YCA SHEN

SALES HEADQUARTERS:
200 West Park Drive, Suite 251, Peachtree City, Ga. 30269 U.S.A.
Tel.: 404-487-1471

HOUSTON OFFICE:
1800 West Loop South, Suite 320, Houston, Texas, 77027, U.S.A.
Tel.: 713-621-9075

NEW JERSEY OFFICE:
Meadows Office Complex II 201 Route 17 North Rutherford,
New Jersey 07070, U.S.A.
Tel.: 201-933-9888

Represented by:

December 10, 1986/1-18(D) Printed in Japan

II

1.0 GENERAL DESCRIPTION

The ECS-1200 Distributed Control System has been applied in a wide range of applications such as electric generating plants steel, cement, chemical, petrochemical and refining facilities.

The ECS-1200 controller has the ability to perform both interlock-sequential and regulatory continuous control. The sequential and continuous control features are fully integrated so that interaction between them is transparent. Two processors are used within the ECS-1200 controller. Sequential control is assigned to one processor and continuous control is assigned to the other processor.

The processors used for the control are Intel 8086 with 8087 floating point coprocessors. This is true of both interlock-sequential and continuous control. Both processors share the resources of the controller bus and have access to the I/O and calculated variables. Configuration tables for continuous control and interlock programs are stored in CMOS memory with triple redundant battery backup. This backup provides a minimum of 400 hours retention of these configuration tables.

ECS-1200 controllers are provided with a set of systems level programs that define the operating environments for specific control applications. These include programs that define the data areas in the controller memory, the I/O scanning routines of the input/output interface (IOIF), and the communications instructions between multiple controllers in a network.

High-level language interpreters and bus protocol instructions are stored in EPROM for security and permanence. Regulatory algebraic blocks are also defined in this area of memory.

Tables for storage of the distributed control system database are defined and built during system configuration. The size and nature of these tables depends on the number and type of I/O at each controller.

II

REEDY CREEK UTILITIES CO., INC. PROJECT
Forney Engineering Company Proposal No. S7-0168
December 5, 1986

SECTION 2

PROPOSED SYSTEM AND SERVICES

I. PROCESS CONTROL SUBSYSTEM (HRSG, Duct Burner, Gas Turbine, Steam Turbine)

This subsystem provides sequential and regulatory control of the plant through the use of Forney provided I/O equipment. One (1) redundant process controller is proposed to handle all monitoring, control loops, and sequencing. The ECS-1200 controller is provided with 768 Kbytes of battery backed CMOS RAM and includes processing resources to accomodate the following I/O requirements:

1280 DI points
640 DO points
432 AI points
144 AO points

Although your requirements do not presently require the total capacity available, your future requirements may include expansion and the ECS-1200 will be capable of expansion to meet those needs.

At present we are providing I/O cards for the following requirements (including 20% spare cards):

280 AI Points
64 AO Points
136 DI Points
72 DO Points

The controller's contain separate sequential and regulatory CPUs (central processing units) which plug into a multibus cage and access a shared database.

Controller redundancy is accomplished by a complete duplicate of the CPUs, power supply, multibus card cage, application logics, etc. Automatic bumpless failover from the on-line primary controller to the stand-by secondary is initiated when the on-line controller fails sanity checking. This arrangment provides a complete one for one hardware and software backup for all control loops.

Redundant communication, at 1 megabaud, with the operator console, gateway controller and HIFR is provided by the use of two communication "C" links. Both "C" links are active at all times and failover from one link to the other is automatic and does not require operator activity.

I/O link connections to the redundant process controller will be through automatic failover switches that will ensure non-interrupted communication during control transfer from the primary to the secondary controller. The failover switches will be controlled by the RTXs (real time executor), located in each controller. The RTX provides watchdog time checks and sanity checking of the controllers. During automatic failover, the operators will be alerted through the normal alarm sequence.

All I/O cards are individually fused and can be removed or inserted while under power supply.

II. OPERATOR CONSOLE SUBSYSTEM

This subsystem includes two operator consoles; one in the main control room and one in the local control room, and a redundant ECS-1200 control remote connected to the other subsystems by the "C" link. This control remote stores all dynamic information related to graphic displays and accesses all required data from the other system devices.

The main control room console consists of a 96 inch wide console with housing for three CRTs, the local control room console consists of a 96 inch wide console with housing for one CRT, and desk top space for two more.

The operator CRTs use Forney's patented touch screen operation to provide effective and efficient operator-to-process interface. Each CRT with touch screen and auxiliary keyboard is driven by a separate video driver. All custom process graphics are stored in the memory of the drivers so that each screen can be designed to access all system graphics or only those related to a particular grouping. This capability allows each CRT to act independently as dedicated devices or to act independently as universal devices which can serve as backup units to each other. An alarm printer, to record all alarms in the system, and a color video copier are also provided for each control room.

III. ENGINEER'S CONSOLE SUBSYSTEM

On-line programming modifications can be accomplished using Forney's standard personal programming unit, which is a modified personal computer. The unit operates in MDOS and is supplied with proprietary Forney software to allow access to all system parameters. The programming console connects to the system processor in the operator console controller.

IV. HIFR SUBSYSTEM

This subsystem provides the interface between the ECS-1200 system and

the VECTOR-1200 computer. The HIFR is a nonredundant intelligent remote.

V. COMPUTER SUBSYSTEM

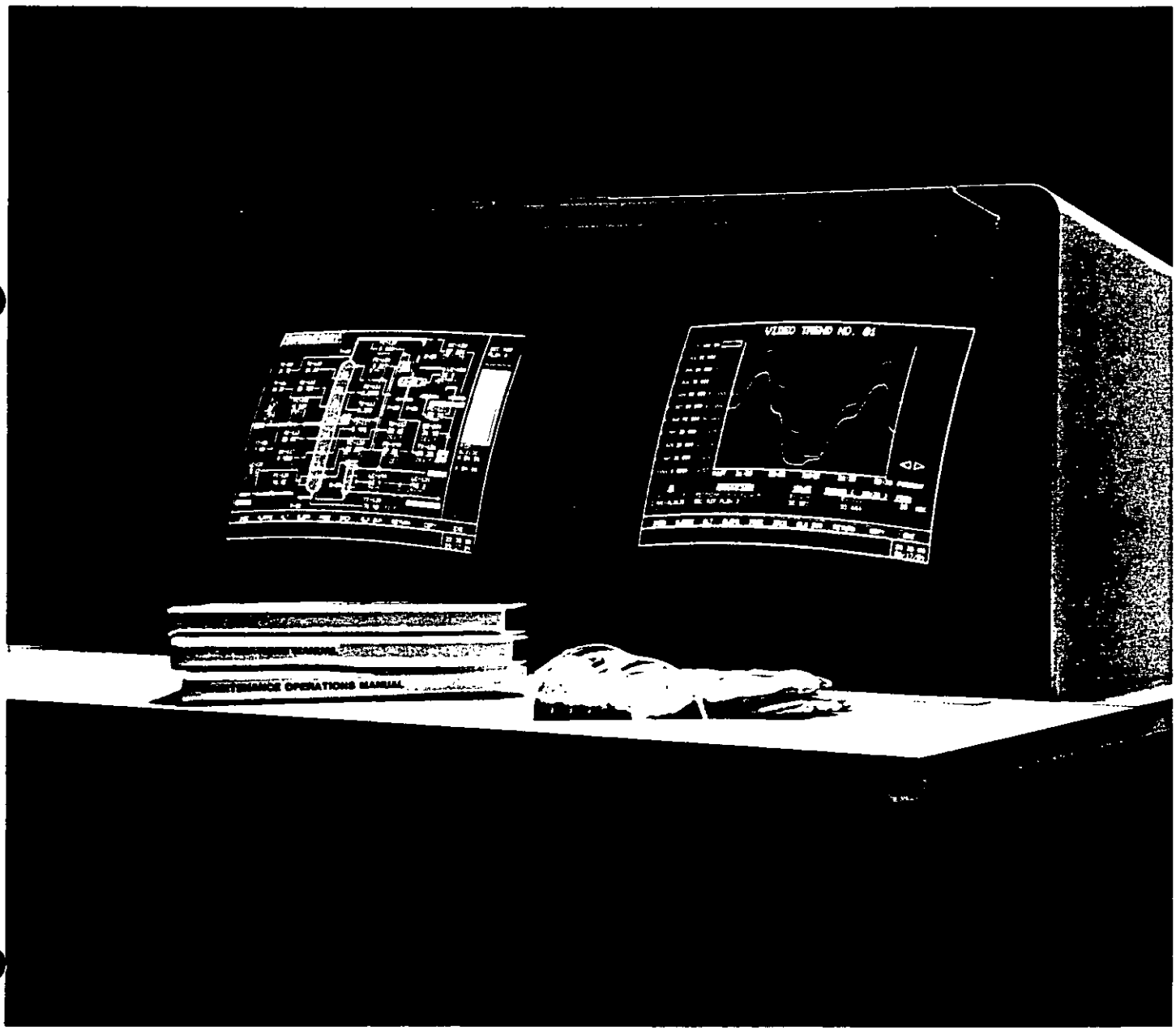
This subsystem includes a MicroVAX II computer, IBM PC-AT terminal, fixed hard disk, removable hard disk, two report printers, system console printer and a tape drive. It will perform the data acquisition/recording, performance calculations and mass data storage.

VI. GATEWAY SUBYSTEM

This subsystem contains the gateways to the analog transient recorder, MOD 30 link, SCADA system and CEMS.

FORNEY®
MODEL ECS-1200

A control system incorporating powerful fully interactive sequence and regulatory languages

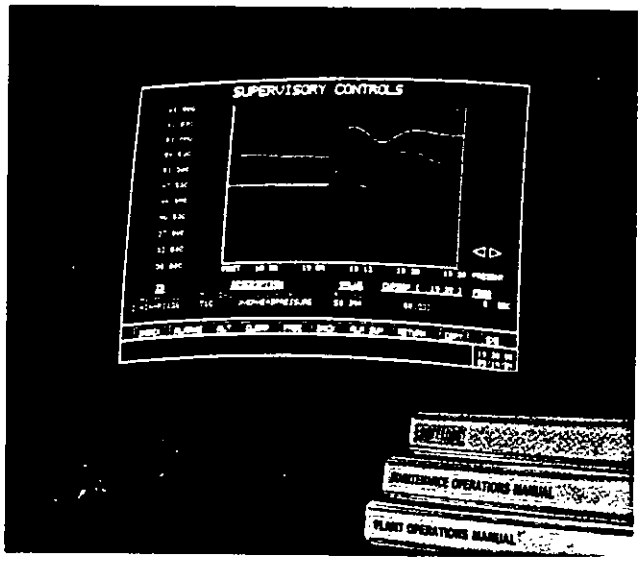


over 30 years of depth and experience in control systems

Introduction

The Model ECS-1200 is a microprocessor based programmable control system. It combines proven, state-of-the-art hardware and innovative software to provide a *powerful, flexible* and *reliable* industrial grade control system.

Knowledge of computer languages such as Fortran or Assembler is not necessary, since the ECS-1200 is designed to execute sequential and regulatory control by the use of the simple, user-oriented programming languages, CQ-III and CQ-IV, developed by Forney Engineering.



Model ECS-1200 Supervisory Control

System Architecture

The ECS-1200 control system utilizes a family of modular hardware and software packages designed with reliability as a primary objective. ECS-1200's architecture can accommodate a wide variety of functional I/Os, operator interfaces and system configurations.

An ECS-1200 control system may consist of one or a network of intelligent multiplexing units called remotes. A remote may simply be a wire replacer or may contain logic controllers. An installation may have a totally centralized system or a distributed system where each remote stands alone. The versatility of the ECS-1200 concept provides the client with unlimited choices in system design from the most basic requirements to the most complex. This can be accomplished by providing the system with configurations of a centralized controller, distributed controllers or a combination of both.

Each ECS-1200 remote contains a system bus through which all data transactions are made. The system bus is interfaced to the I/O bus by means of an interface module. Star and Multidrop configurations or a combination of the two is possible.

Full automatic bumpless redundancy is available permitting failover to a standby controller in the event of primary controller failure.

After the ECS-1200 has been properly configured using one or more remotes, the system is assembled using standard modular building blocks as shown in Figure 1.

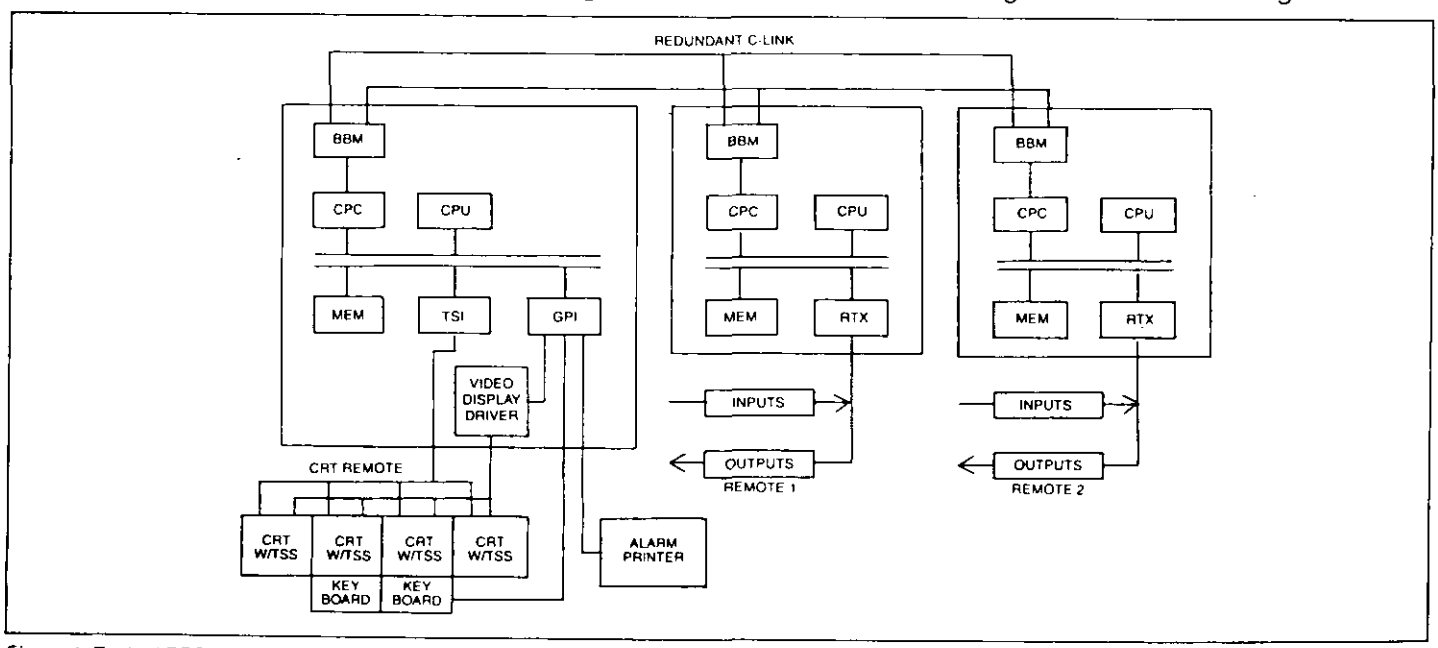
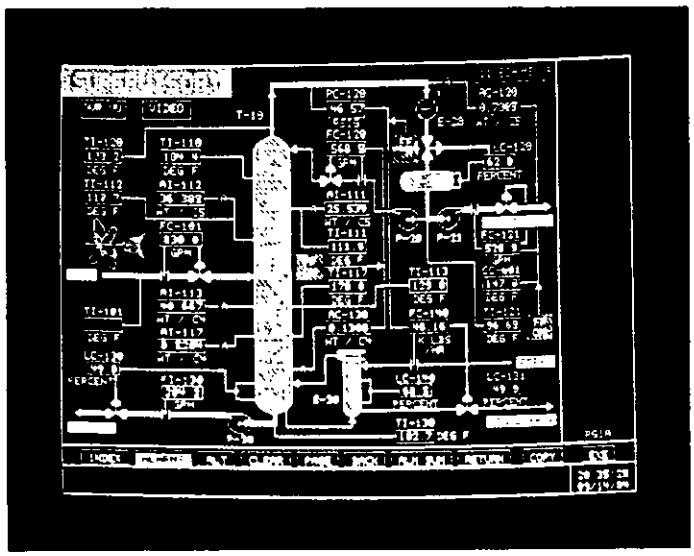


Figure 1. Typical ECS-1200 Distributed Control System

Major System Features

Operator Station

- CRT stations using 19" dynamic displays with touch-sensitive screens eliminate the "keyhole" effect.
- Interface to conventional control panels available by means of prefabricated plug-in cables.
- "Graphics-Build" package allows on-line modification of existing displays or creation of new ones.
- Overview, group, loop, trend, alarm and diagnostic displays, as well as custom graphics are standard.



Process Graphics

Communication Security

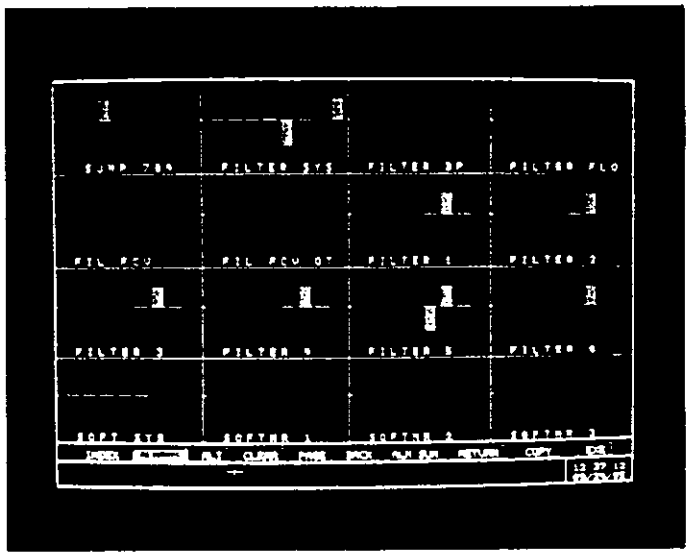
- Continuously checked redundant communication channels (C-Link) with automatic failover to alternate link without system degradation or loss of data.
- "Master for the Moment" concept eliminates possible central point of failures.
- C-Link operates at speeds up to 1 megabaud.
- Double block transmission plus CRC-16 error checking.
- Data transparency.
- Valid for Star or Multidrop loop systems.
- Positive acknowledgement of data and control.

System Redundancy

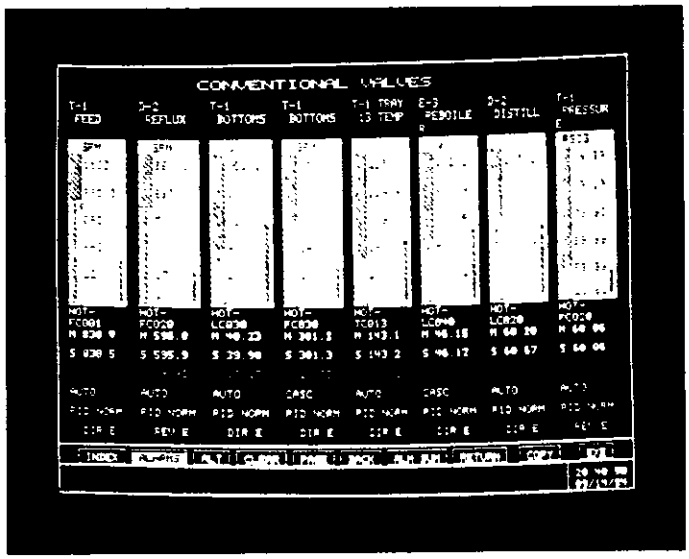
- Full automatic bumpless controller switchover on failure of primary controller.
- Redundant communications link hardware.
- Input/output power supply system optionally available.

System Control Security

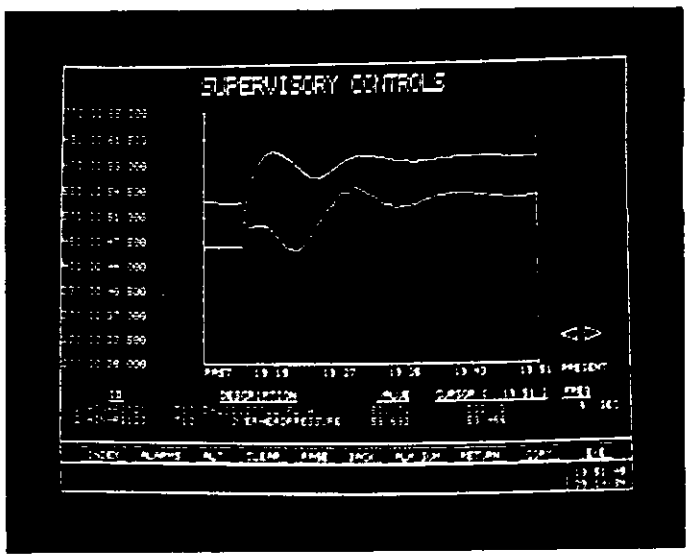
- Universal propagation of questionable process variable status.
- Universal propagation of antiwind-up code.
- Universal propogation of algorithm initialization.
- Individual output clamping capability.



Process Overview



Group Display



Trend Display

Input/Output Integrity

- Full complement of digital and analog cards is available.
- Digital cards are designed to provide 2500 volts of channel-to-channel and channel-to-ground isolation.
- Analog cards are designed to withstand up to 1500 volts of isolation.

Closed Loop Supervisory/DDC Controls

- Full automatic redundancy eliminates "graceful-degradation" problem.
- Interface with the process through existing distributed systems and/or ECS-1200's RTX.
- Touch screen process interface eliminates "keyhole" effect.
- Advanced control techniques such as:
  Closed loop analyzer controls
  Feedforward
  Decouplers
  Minimizers and maximizers
  Constraint controllers

Host Computer Independence

- The presence of a host computer is *not* required to achieve any of the functions described above.

Scan and Execution Speed

- Adjustable in increments of 1/10 of a second.

Applications Programming

The ECS-1200 provides two powerful control languages, one for sequential control, CQ-III, and one for regulatory control, CQ-IV, which run at the same level of hardware. These languages have a number of complementary features that allow for complex, coordinated batch structures and the implementation of sophisticated control concepts such as cascading, decoupling, feed forward, constraint control, etc.

The sequential language is also capable of performing addition, subtraction, multiplication and division operations on floating-point data, independently of the regulatory program. The block-type regulatory algorithms supplied can be linked in any order desired. These algorithms operate at the same level of hardware as the sequential program and include features that allow the sequential and regulatory programs to interact. These features include the ability of the sequential program to deactivate one regulatory strategy and activate another, to select an alternate predetermined set of tuning constants for a PID block and to pass counter and timer values to and from the regulatory strategies.

The PID function provides options for non-linear variation of gain with increasing error and external adjustment of gain. The sequential program has the ability to test and acknowledge the data output of each regulatory block for information about the quality or status of that data, such as whether the instrument is faulty, whether that control block is active, what control mode is selected and a number of other conditions. For the applications engineer, this opens up the arena of self-diagnosing control programs.

With the degree of flexibility shown above and a full complement of potent state-of-the-art algorithms, implementation of advanced control techniques is only limited by the experience and creativity of the control engineer.

Closed Loop Supervisory Control Techniques can be implemented either through your existing distributed control system (the ECS-1200 acts as host), directly interfacing with your process or a combination of both. The immediate results can be measured by increased profits resulting from better hands-off control even when process upsets occur.

Some of the typical applications where the above can be experienced are:

- Heaters:
  Capacity increase in the order of **10%**
  Energy conservation in the order of **3%**
- Compressors:
  Capacity increase in the order of **10%**
  Energy conservation in the order of **10%**
- Columns:
  Capacity increase in the order of **10%**
  Yield improvement in the order of **2%**
  Energy conservation in the order of **10%**

If we use as a specific example an application where Closed Loop Supervisory Control is used in conjunction with the ECS-1200 and compare it to the results obtained through conventional control using other distributed control systems, it is possible to understand how quickly profits may be increased if such an application is implemented.

VECTOR, from Control Applications, establishes a new level of software performance. The culmination of the experience and knowledge acquired in the development of over 100 software systems, VECTOR is the first to bring the state-of-the-art to a product that meets today's needs. VECTOR was designed to dramatically increase the amount of useful information and capabilities available, increasing the scope of operator control and adding to productivity. VECTOR's unmatched range of capabilities results from the system's unique combination of Supervisory Control and Data Acquisition (SCADA) and Information Management functions in a single fully integrated package. Unlike many other products available, VECTOR is the only system to combine these functions without compromising real-time performance. By linking two key functions in a single system, VECTOR effectively bridges the gap that has existed among operations, engineering, management, and data processing.

With VECTOR, all company departments can have a total range of Information Management capabilities at their disposal for such functions as report writing, graphic generation, and data retrieval, while data processing has access to real-time data for a "right now" orientation that was heretofore unavailable from a single system. VECTOR's capabilities are further enhanced by its compatibility with DEC VAX software products, plus it is designed to make the most of the powerful 32-bit VAX architecture. VECTOR's DEC VAX compatibility ensures its continued use years after many other systems become obsolete.

VECTOR is truly an easy-to-use system. Its "fill-in-the-blanks" mode with on-line help not only simplifies operation, it also makes addition/deletion functions a do-it-yourself operation. A fourth generation system, VECTOR allows the operator to tell the computer "what-to-do" without having to give instructions as to "how-to-do-it". VECTOR's overall simplicity of operation allows it to be up and running almost immediately upon delivery. Custom programming features can be added simultaneous to on-going operation in a safe and efficient manner.

Integrated Information Management

The VECTOR databases are compatible with DEC's information architecture allowing for full and direct use of any DEC Information Management package including: Datatrieve, Common Data Dictionary, and Terminal Data Management System. VECTOR automatically accesses the appropriate information architecture facility to determine how to meet user requests for information, making ease of operation a key feature. Additionally, all users can access any data in the VECTOR System so that real-time data can be used with historical information in report formulation. VECTOR's Information Management features include the capability to:

- Write reports using real-time input
- Present data in graphic as well as tabular formats
- Build operator entry and data presentation forms keyed to VECTOR data
- Fulfill user requests for information through automatic access of the appropriate part of the system
- Distribute data access via DECnet as well as other networking facilities
- Sort and manipulate information by simple English commands

Supervisory Control and Data Acquisition (SCADA)

With over 100 systems delivered, Control Applications has distinguished itself by producing some of the most highly sophisticated SCADA programs available. The experience and knowledge derived from the building of each of these systems is incorporated in the design of VECTOR making it the most complete and versatile SCADA system available. Key VECTOR SCADA functions include the capability to:

- Collect analog and digital data from field devices and process the acquired raw data into useful information
- Allow the addition or deletion of data points and color graphics while operating the system
- Deliver meaningful color graphics at both local and remote consoles
- Generate high resolution, full graphics with smooth continuous lines for realistic pictorials
- Store data and retrieve it in the form of trends, reports, or for use in application programs
- Set up a multi-level user access system to prevent unauthorized persons from altering the system or accessing privileged information
- Monitor data points on a continuous basis and annunciate any deviations from user established limits
- Initiate and monitor setpoint and discrete control messages with field devices
- Maintain security checks on communications to prevent faulty transmissions from affecting the information
- Employ multiple computers for high availability applications and distributed processing

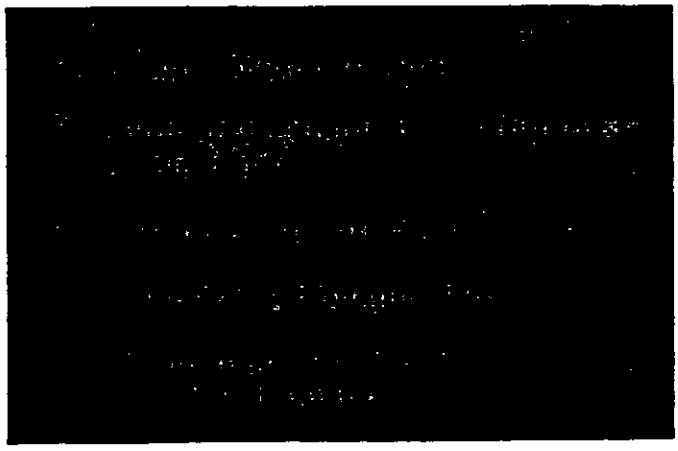
Combining SCADA and Information Management Capabilities

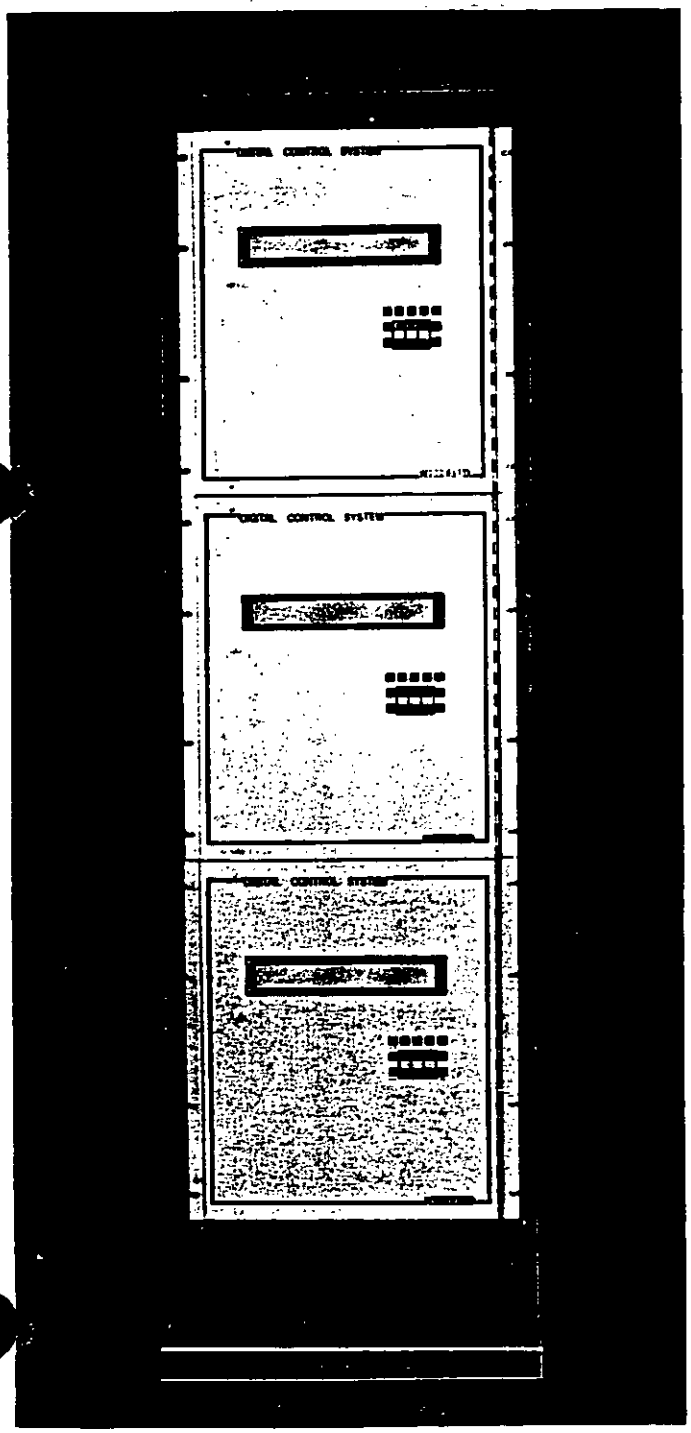
The increased accuracy and capabilities presented by the combination of SCADA and Information Management functions are key features of the system. By employing a VECTOR System, accounting or inventory control is now capable of accessing, in real-time, the exact status of any manufacturing or process operation. Decisions can now be based on the most current information. Manufacturing, at the same time, is able to professionally produce accurate reports using Information Management tools that were, to date, limited to a few people within the organization. In addition, VECTOR can serve to increase programmer productivity. The powerful tools available to the programmer using VECTOR enable him to concentrate on desired results and not waste time and effort with simple operating functions.

Vector is the first and only system to link the SCADA and Information Management functions of your company in a convenient stand alone product. The wide range of capabilities afforded by VECTOR and its ease of operation ensure that your organization will benefit through better communications, increased cooperation, and higher productivity.

WOODWARD®

FAULT TOLERANT 503 DIGITAL CONTROL SYSTEM





APPLICATIONS

The 503 DCS was designed for use in systems where shutdown costs are exceedingly high. These systems are typically found in (but not limited to) continuous processing operations.

The 503 DCS is a true fault-tolerant system; it must not be confused with dual redundant systems that often are erroneously referred to as fault-tolerant.

Like any true fault-tolerant system, Woodward's 503 DCS uses three computers to simultaneously read and compare all control functions.

Should one computer fail, the remaining two computers will provide continuous process control.

Since the 503 DCS mathematically approaches 100 percent availability, the user is assured of extremely low risks of system downtime due to control failure.

The 503 DCS is designed for use in new systems, and is easily adaptable to existing systems.

It has a full range of engine and turbine fuel-control functions; it is capable of performing sequencing functions.

RELIABILITY

The 503 DCS consists of three computer systems. The failure of any one of the three systems will not cause a control system shutdown.

NEW DIGITAL CONTROLLERS
THE TRIPLEX ADVANTAGE

Woodward Governor Company has designed and is manufacturing a true fault-tolerant control for prime mover applications

Fault-tolerant computers came of age when the United States began space exploration. The National Aeronautics and Space Administration (NASA) required computer-based control systems that were highly reliable and always available. These systems had to remain operational in event of signal or processor faults. Availability was necessary because once a mission was in progress, there was little or no opportunity to repair faults.

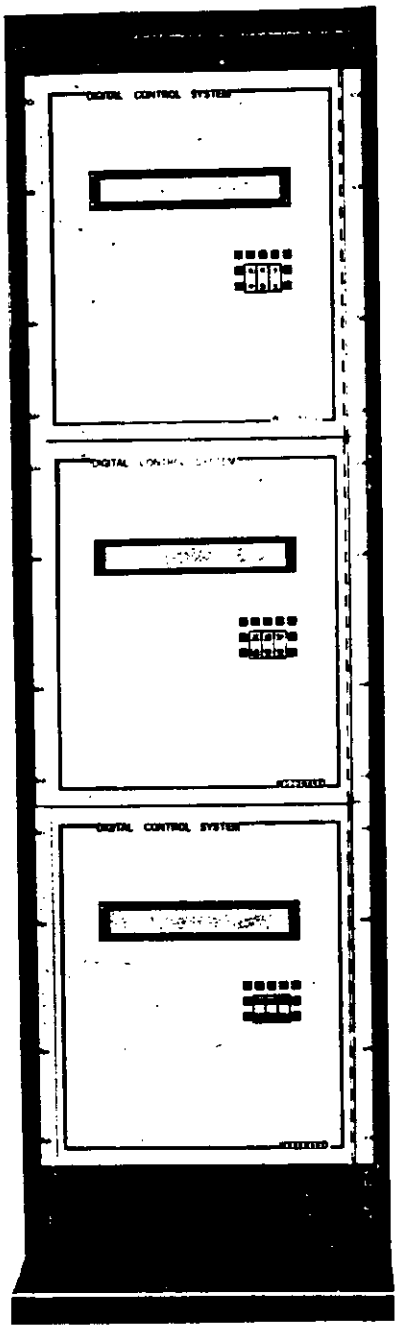
Woodward Governor Company, the world's oldest and largest designer and builder of prime mover controls exclusively, realized that an engine and turbine control able to provide features patterned after NASA's control concept would benefit many users of prime mover controls—among these were the metal, chemical, and pulp industries. Therefore, engineers at Woodward's Engine and Turbine Controls Division in Fort Collins, Colorado, undertook a study of space-age control systems. Their goal was to determine which control system would best fulfill the needs of the prime mover industry.

Fault Tolerance—What Is It?

First, Woodward engineers defined the concept of fault tolerance. They specified that a Woodward fault-tolerant system must be capable of tolerating any single-point fault and continue reliable operation in the presence of the fault. Also, the system must have the ability to detect and announce the device or component fault, to allow easy, rapid correction of the fault, and to return the control to fault-tolerant status without interrupting diesel or turbine operation.

High Availability

Woodward's team identified two major systems—a duplex (parallel or backup) system and a triplex (voting) system—for investigation. Each system presents varying degrees of availability.



85500-A-58

Woodward's 503 Digital Control System incorporates the triplex fault-tolerant design.

A system's degree of availability is dependent on several factors. Woodward's team determined that a truly reliable fault-tolerant control must have the ability to:

- Tolerate any single-point fault;
- Handle simplex, duplex, or triplex inputs and outputs;
- Quickly detect and isolate a fault;
- Inform the user about the presence of a fault;
- Provide the means to quickly correct the fault;
- Quickly retest the system after fault correction;
- Operate in "real time" with the process;
- Continue running while locking out the fault.

Dual Processor (Redundant) System

Woodward engineers investigated the redundant system first. This system uses two processors and provides a degree of backup control. One processor monitors the other, and if a fault occurs in the primary processor, a switch transfers control to the secondary processor.

Unwanted Switchovers

The engineers quickly identified a major flaw in the redundant system: the switchover takes time resulting in a loss of computing time and in a potential loss of data. Transfer bumps and channel windups that could occur during the switchover are not trivial problems and must be carefully considered. These conditions adversely affect system operation and could, under certain conditions, cause system shutdown.

Difficult to Troubleshoot

Another undesirable feature detected was the length of the redundant system's mean-time-to-repair (MTTR). Often the duplex system must be shut down in order to perform repairs, and troubleshooting may require skilled technicians who are familiar with the control and its circuitry. Troubleshooting offers another potential source of error—human error. All these factors can result in longer-than-desired repair times.

Duplex Design Can Never Provide True Fault Tolerance

Further investigation revealed that several methods have been tried in order to improve a redundant system's ability to handle faults.

One attempted solution is having dual processors operate in parallel. However, if a fault occurs, how does the system determine which processor is at fault? The logical decision is to halt the process. Also, this solution requires more equipment in order to operate, and more equipment normally results in a deterioration of the Mean-Time-Between-(Control System) Failure (MTBF).

Another concept is the "system O.K." message. This involves the processor sending a message that only can be sent by a "working" computer. The message is sent to circuitry called a watchdog timer. The timer must receive the "O.K." signal within predetermined time intervals. If a signal is not received within the intervals, sending-device control fault is assumed and the receiving control assumes process operation.

The watchdog method involves considerable processing requirements and only can identify processor status—it does not identify faulty inputs or outputs. Also, since the "O.K." message requires computing, it cannot be sent on a continuous basis. Errors that are not detectable could occur during the "O.K." transmission. This concept continues to remain vulnerable to data and signal losses during switchovers.

More advanced techniques can be built into the system. However, the engineers quickly concluded that these techniques result only in more hardware and that they frequently result in an increase in the system's cost and a decrease in the system's MTBF. After design work is completed, the system can protect only against the errors planned for by the designer. Unplanned errors still can occur—and perhaps escape detection.

Sensor and wiring faults account for approximately 90% of all system failures. The study team determined that input/output sensor management must receive careful consideration. In order to maintain high system availability, important sensors must be duplicated and critical sensors (in order to achieve true fault tolerance) must be triplicated. The duplex computational or I/O sensor hardware may offer difficulties in sorting input faults, and cannot accommodate triplicate inputs.

A great concern to any prime mover expert is that these systems will not always offer real-time process control. They can lose inputs, contain recovery sequences slowing normal processing, or contain undetected errors. The system may be inoperable during repair, and it then becomes susceptible to human error during troubleshooting and repair cycles. Pre-testing may require further downtime before the system can be restarted.

The study concluded that the only way to achieve even minimal levels of availability is to provide for

significant amounts of self-test, cross-checking, parity-checking, and wrap-around of I/O. Even under these conditions, true fault tolerance has eluded the system designer.

After careful and extensive study, the engineering team decided that redundancy would not, could not, offer the high degree of control reliability required by modern industrial technology.

Three Processor (Triplex) System

Woodward studied the triplex concept next. This system uses three processors, three memories, and a fault-tolerant voting system. The processors use identical programs to provide common operations.

The team found that exacting synchronization allows each processor's input and output data to be compared to data gathered by the remaining two processors. The data is voted on, and the majority rules—two of the three processors must agree before action can take place.

The study identified many advantages of a triplex system.

Real-Time Operation

A great advantage of a triplex system is its ability to operate in real time, all the time.

A triplex system contains no switches or timers that can interfere with data acquisition, cause missed beats, or result in loss of real-time control. Triplex synchronization allows each processor to continually check its own operation and the operation of the system's other processors.

If one system fails, the remaining two systems provide continuous control operation. Since all data is subjected to the voting process before leaving the fault-containment areas, erroneous data is locked out and never can appear on an output signal. This voting process eliminates channel windup and transfer bumps.

Sensors Easily Triplicated

Triplication of critical I/O sensors is easily accomplished. Each sensor is connected to one of the three pieces of computing hardware. The synchronized voting structure broadcasts all three sensor readings to all three computers. Action determined by the application software and appropriate to the sensor values is taken.

Easy-To-Use System

Triplex fault detection immediately alerts the operator of the presence of the fault. The alert may be in the form of a visual indication, an audio indication, or a combination of the two alerts. The operator easily can trace the cause of the fault through the use of user-supplied indicators or by consulting the unit's LCD display. When the LCD display is consulted, the system's diagnostics inform the operator which of the three processors contains (or detected) the fault.

The modular concept found in triplex systems greatly simplifies troubleshooting. The faulty processor can be shut down to make repairs. (The remaining two processors continuously operate in real-time conditions.) Hardware repairs are made simply by replacing the faulty module or system sensor. Once repaired, the processor will perform self-diagnostics to ensure normal operation before returning to service. Resynchronization to the running units is fast and automatic.

Nonvolatile memory assists in the triplex approach to fault correction. If a processor is shut down for repair, no reprogramming time is required.

Very Reliable

It is not unusual for the MTBF of a triplex system to exceed 100 years, and MTTR is held to a minimum due to modular construction. System availability closely approaches 100%.

The engineers determined that the triplex control could well be the most reliable part of any process.

Reliability And Availability Make Economic Good Sense

Woodward engineers wanted not only to design the best system available but keep the system affordable. They discovered that a well-designed duplex system normally will contain about the same amount of hardware as a triplex system. Often there is very little or no difference in initial cost. The greater the sophistication of the duplex system, the less the cost differential—if any. Yet no matter what the cost differential, a duplex system presently will not provide the comprehensive fault detection, the means of rapid fault correction, or the true fault-tolerant operation that a triplex system provides.

An additional economic benefit is that fault-tolerant reliability often eliminates the need for and the expense of backup systems, separate operator

control panels, or other equipment that may be necessary to provide a highly available system.

The engineers decided that one common means of determining cost is by computing total cost of downtime. Total downtime cost is determined by multiplying the control failure rate by the MTTR. That answer is then factored by a downtime cost. Therefore any system with a longer MTBF and a shorter MTTR has an advantage of reduced cost. The more expensive the cost of downtime, the greater the advantage.

The extended (system) MTBF common to the triplex design, and the reduced MTTR (provided by rapid fault detection and correction inherent in the triplex design) easily demonstrates the triplex advantage.

True Fault Tolerance Now Available in a Woodward Control

The Woodward team concluded that only a thoroughly designed triplex system could offer the customer the reliability and availability so long associated with Woodward controls. Therefore, they set about designing a true fault-tolerant (triplex) control, not a pseudo fault-tolerant (redundant) control.

Today, Woodward Governor Company offers a control that was inspired by a system originally designed for NASA. This state-of-the-art control is Woodward's 503 Digital Control System; it is capable of providing fault-tolerant control for all types of prime movers or processes.

For additional information contact our Application Engineering Department.
Woodward Governor Company (303) 482-5811, ext. 1577
Engine & Turbine Controls Division
P.O. Box 1519, Ft. Collins, CO., 80522 U.S.A.

Ft. Collins, Colorado, U.S.A.	(303) 482-5811, ext. 1577
Levittown, Pennsylvania, U.S.A.	(215) 943-0666
Tomisato, Chiba, Japan	81-476-93-4661
Slough, England	44-753-26835
Hoofddorp, The Netherlands	31-2503-13241
Kingsgrove, N.S.W., Australia	61-2-758-2322
Campinas, S.P., Brazil	55-192-31-4977
Corporate Headquarters	
Rockford, Illinois, U.S.A.	(815) 877-7441

Thermocouple inputs are received by a 2-channel isolated module or a 10-channel non-isolated module. The number of modules used per chassis is dependent on the number of signals received.

COMPUTER OUTPUTS

Final-driver modules drive actuators with 20 to 160 mAdc or 4 to 20 mAdc signals.

Relay panels include 24 or 48 relays to provide relay contacts.

Output modules provide 0 to 1 mAdc or 4 to 20 mAdc signal for analog meters or other controllers.

INPUT POWER SOURCES

Each computer can operate on either an ac or a dc input voltage The ac power can be 120 or 240 Vac (±10 %) at 47 to 400 Hz. The dc input can be 24 or 125 Vdc (±10%).

If desired, one of these supplies may be a primary power source and the other a secondary source to protect against power failures.

MAINTENANCE

Each computer is easily maintainable. The modules are standard modules and are easily replaced in event of failure. Since they are standard, re-order lead times are minimal. Replacement of the modules may be accomplished without removing the chassis from the rack.

If one computing system should fail, it is individually removalble for routine maintenance or bench checks. Removal of one chassis does not shut down the user's process.

SYSTEM RATE GROUPS AND SYSTEM EXPANSION

Control loops are programmed to operate at 10, 20, 40, or 80 millisecond intervals. The system designer may assign a more frequent interval to the critical elements.

The computer's motherboard will accept a maximum of 12 I/O modules. An expansion rack allows the addition of another 12 modules.

ENVIRONMENTAL OPERATION

The 503 DCS was designed to operate in an environment with a temperature of -15 to +55 degrees centigrade; the humidity may be up to 95% noncondensing.

Vibration meets MIL-STD-167 requirements and shock protection meets standards set in MIL-S-810D.

EMI/RFI meets MIL-STD-461A and the unit will withstand surge as required in IEEE 472/ANSI C37.90a.

RACK MOUNTING

The DCS was designed for mounting in a standard 19-inch rack. This unit may stand alone, or it may be combined with other features in the control board.

Each computer system is assembled using high-quality parts and is subjected to pretesting before final assembly. The printed circuit boards (PCB) are designed and manufactured to the highest standards of quality in Woodward's PCB facility. Hand wiring is eliminated through the use of PCBs in both the modular boards and the motherboards. The modules feature ground and power planes to reduce noise susceptibility. Each system may contain redundant power supplies to further decrease failure risks.

Required repairs are easily diagnosed and corrected through internal self-diagnostic circuitry. These integated diagnostics allow fault detection and isolation. Memories, processors, and I/O modules are checked for proper operation. Standard modular construction makes on-line repair fast and accurate.

PROCESSING AND PROGRAMMING EQUIPMENT

Each computer's CPU contains a Z8001 microprocessor with memory supplied by UV-EPROM, E-EPROM, and RAM chips. Each system also contains a fault-tolerant control module. This module allows the fault-tolerant voting to occur.

A memory of 128K bytes allows for many options in the writing of programs for the DCS. A password-type security system is available to protect the application program.

RS-232 PORTS

Each computer contains two RS-232 ports. These ports allow communication with peripheral devices (CRTs, printers, data storage equipment) and other computers. The ports feature standard ASCII character handling with baud rates and message protocols programmable to meet specific user needs.

SYSTEM INPUTS/OUTPUTS

All inputs are received by each of the three microprocessors. Each microprocessor will individually analyze these signals to the same operational criteria. Critical sensors should be replicated to enhance system availability. Non-critical signals may be sent to all three processors from a single input device.

The 503 DCS is capable of sensing discrete and analog inputs. Typical sources are speed, temperature, fuel flow, vibration, or any other source capable of being sensed and generating a signal.

Outputs control fuel flow and other signals or warnings.

The system designer will determine the type(s) of input/output signals for all monitored operations.

COMPUTER INPUTS

Each computer is capable of receiving three isolated signals from magnetic pick-ups. This feature allows for redundant speed sensing. Additional speed sensing modules may be added if required.

Each discrete input module allows for 28 isolated inputs. The inputs are received from switch or relays and are 24 Vdc. The number of discrete modules per chassis is determined by the number of inputs required.

Analog inputs are received and conditioned in a 4-channel isolated module or a 10-channel non-isolated module. The analog signal is obtained from a transducer or a sensor producing a 4 to 20-milliamp direct current signal. The number of analog input modules per chassis is determined by the number and type of signals being monitored.

Florida Gas Transmission Company

P. O. Box 44 Winter Park, Florida 32790 (305) 646-1100

ATTACHMENT III

September 15, 1987

Mr. Ed Godwin
Chief Mechanical Engineer
Reedy Creek Utilities Co., Inc.
Post Office Box 40
Lake Buena Vista, Florida 32830

Dear Ed:

Please find for your information a copy of the July, 1987 gas analysis of Florida Gas Transmission Company's (FGT) natural gas from our mainline near Brooker, Florida. Since there is no other natural gas purchased downstream of the sample point, the gas analysis would not change.

The molecular percentage of nitrogen is 0.4450 for the July 28, 1987 sample. This is not an unusual amount of nitrogen to be found in the natural gas. It is possible that sample cylinders can be contaminated with air from time to time but, in that event, the oxygen level would be high and the sample analysis would be disregarded. For this sample, please note that the oxygen level is zero, indicating a good sample was taken.

Also enclosed for your use is a copy of a drawing of the technique used in obtaining samples. As noted on the drawing, all cylinders are evacuated at the lab to 30" HG before being shipped out for the next sample.

I hope this answers your questions but, if not, please give me a call.

Very truly yours,

JAMES C. DOWDEN
Director of Marketing

JCD:ben
Enclosures

111

08/14/87

FLORIDA GAS TRANSMISSION CO.
TECHNICAL OPERATIONS DEPT.
P. O. BOX 44
WINTER PARK FL 32790-0044

FGT - MARKET SERVICES
MR. JIM DOWDEN
P. O. BOX 44
WINTER PARK FL 32790

GAS ANALYSIS ID NUMBER 87 0575 MEAS. DIST. 07

METER STATION NAME FLA HYDROCARBON - OUTLET STATION NO. 47188

FIELD DATA TAKEN BY A. Kattawar DATE TAKEN 07-28-87
PRESSURE 650 TEMPERATURE 0 SPEC GRAV 0.5800
BTU 1015 WATER 0.0000 H2S
DATA ANALYZED BY Michael P. Campo DATE ANAL. 08-07-87

COMPONENT	MOLE %	B.T.U.	GPM	SPEC GRAV
OXYGEN	0.0000	0.0000	0.0000	0.0000
NITROGEN	0.4450	0.0000	0.0000	0.0043
CARBON DIOXIDE	0.8700	0.0000	0.0000	0.0132
METHANE	96.2490	957.2000	0.0000	0.5332
ETHANE	2.1440	37.3500	0.0000	0.0223
PROPANE	0.2610	6.4700	0.0719	0.0040
I BUTANE	0.0060	0.1900	0.0020	0.0001
N.BUTANE	0.0040	0.1300	0.0013	0.0001
I PENTANE	0.0030	0.1200	0.0011	0.0001
N PENTANE	0.0030	0.1200	0.0011	0.0001
HEXANE PLUS	0.0150	0.7700	0.0066	0.0005
TOTALS	100.0000	1002.3500	0.0840	0.5779

BTU/CU FT AT 14.73 PSIA 60 DEG F CORRECTED FOR Z
CALCULATED SATURATED 1004 DRY 1022 0.0000 LB/MMCF 1022
CALORIMETER SATURATED 1004 DRY 1022
SPECIFIC GRAVITY - AIR = 1.0000 CALC 0.5779 RANAREX 0.5790

COMPRESSIBILITY FACTOR - Z = 0.9979
SUPERCOMPRESSIBILITY FACTOR CALC AT 0.5790 SP GR 600 PSIG 90 DEG
BY TEST WITH BURNETT APPARATUS 1.0350
CALC AGA-NX-19 NO DILUENTS 1.0367
CALC AGA-NX-19 ADJUSTED FOR DILUENTS 1.0355

NOTES PHYSICAL CONSTANTS FROM AGA 3
GPM FROM NGPA PUB NO 2145-84
HEXANE PLUS DERIVED FROM ALPHAGAZ REF STANDARD

REMARKS 3000 cc line pressure spot sample.
Percent difference with respect to Burnett Apparatus
for calculated value using AGA-NX-19 formula and
adjusted for diluents equals (+ 0.048).

III

SELECT ? COMP ? CANC ? LIST FWD=PF8

MD3A PAGE 1 OF 1 FLORIDA GAS TRANSMISSION CO. CURR DATE 09-27-1984

GAS ANALYSIS ID NUMBER 84 0405 MEAS. DIST. 07

METER STATION NAME FLA HYDROCARBON - OUTLET STATION NO. 47188

FIELD DATA TAKEN BY A. KATTAWAR DATE TAKEN 05-21-84

PRESSURE 711 TEMPERATURE 0 SPEC GRAV 0.5820

BTU 1020 WATER 0.6000 H2S 0.1 GR

DATA ANALYZED BY MICHAEL P. CAMPO DATE ANAL. 05-30-84

COMPONENT	MOLE %	B.T.U.	GPM	SPEC GRAV
OXYGEN	0.0000	0.0000	0.0000	0.0000
NITROGEN	0.4530	0.0000	0.0000	0.0044
CARBON DIOXIDE	0.8830	0.0000	0.0000	0.0134
METHANE	95.8730	953.4600	0.0000	0.5311
ETHANE	2.5790	44.9300	0.0000	0.0268
PROPANE	0.1610	3.9900	0.0443	0.0025
I BUTANE	0.0090	0.2900	0.0029	0.0002
N. BUTANE	0.0080	0.2600	0.0025	0.0002
I PENTANE	0.0060	0.2400	0.0022	0.0001
N. PENTANE	0.0010	0.0400	0.0004	0.0000
HEXANE PLUS	0.0270	1.3900	0.0108	0.0009
TOTALS	100.0000	1004.6000	0.0631	0.5796

BTU/CU FT @ 14.73 PSIA 60 DEG F CORRECTED FOR Z

CALCULATED SATURATED 1007 DRY 1025 0.6000 LB/MMCF 1025

CALORIMETER SATURATED 1008 DRY 1026

SPECIFIC GRAVITY - AIR = 1.0000 CALC 0.5796 RANAREX 0.5790

COMPRESSIBILITY FACTOR - Z = 0.9979

SUPERCOMPRESSIBILITY FACTOR CALC AT 0.5790 SP GR 600 PSIG 90 DEG

BY TEST WITH BURNETT APPARATUS	1.0348
CALC AGA-NX-19 NO DILUENTS	1.0367
CALC AGA-NX-19 ADJUSTED FOR DILUENTS	1.0355

NOTES PHYSICAL CONSTANTS FROM AGA 3 GPM FROM NGPA PUB NO 2145-62
HEXANE PLUS DERIVED FROM PHILLIPS REF STANDARD

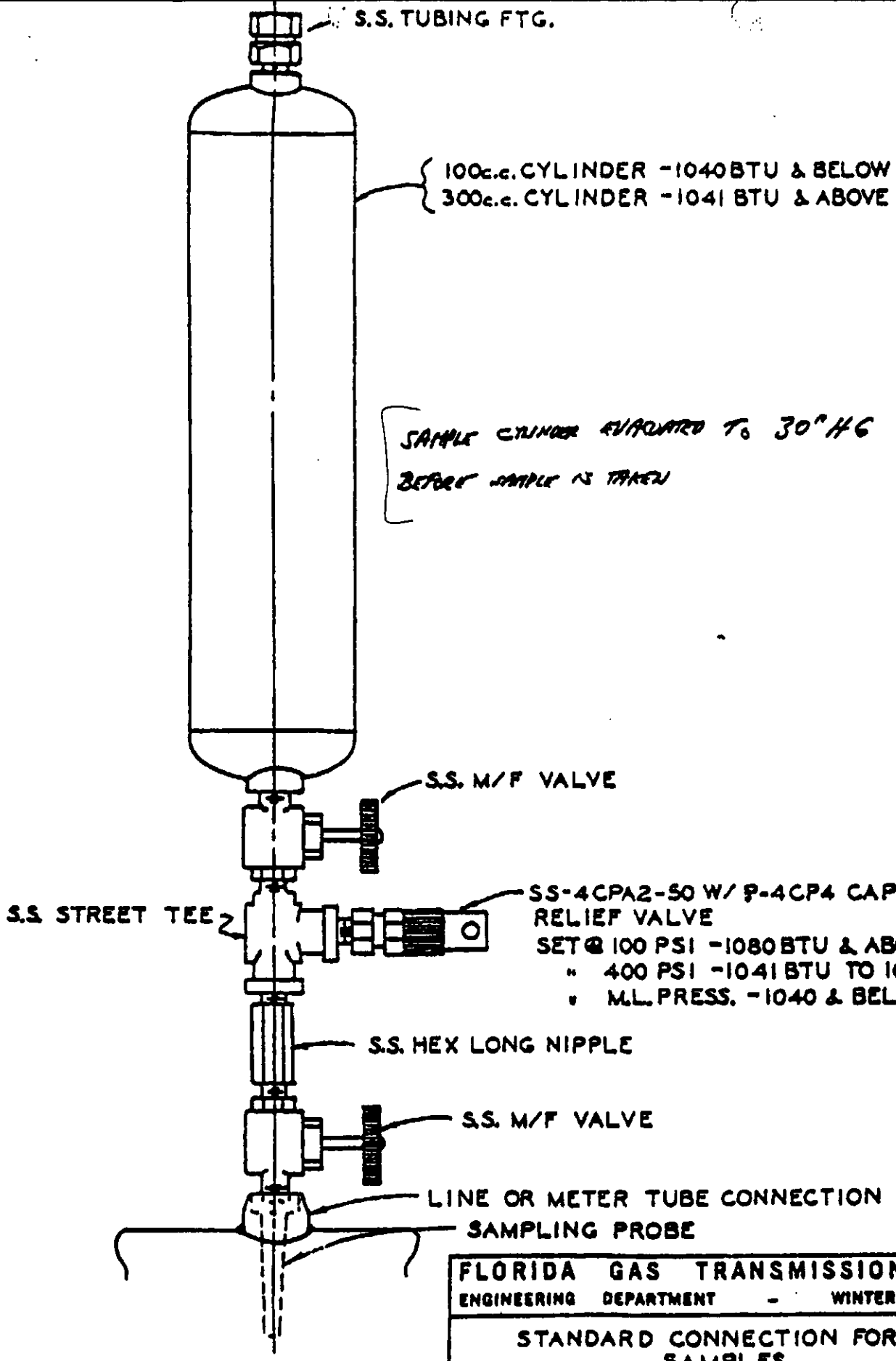
REMARKS PERCENT DIFFERENCE WITH RESPECT TO BURNETT APPARATUS
FOR CALCULATED VALUE USING AGA-NX-19 FORMULA AND
ADJUSTED FOR DILUENTS EQUALS (+ 0.068).

TYPE ? SPOT ? CONT ? PROD ANALYSIS COMMENT

ANALYSIS REVIEWED BY YOUNG R. REVIEWED ON 05-31-84

Algonquin Gas
Trans. Co;
Boston. = 0.34 mole % N_2
= 0 mole % O_2

III



FLORIDA GAS TRANSMISSION COMPANY
ENGINEERING DEPARTMENT - WINTER PARK, FLORIDA

STANDARD CONNECTION FOR TAKING SAMPLES

DRAWN BY: E.W.S.	DATE: 9-9-81	APPROVED BY:	APPROVED BY: CHIEF ENGR.
CHECKED BY:	DATE:	W. O.	DWG. NO. 200.90.7 A
APPROVED BY:	DATE:	SCALE: NONE	

NO.	DATE	REVISION	BY	CK'D.	APP'D.

III

FLORIDA GAS TRANSMISSION COMPANY
AN ENRON AFFILIATE
GAS ANALYTICAL LABORATORY

The procedure for determining the composition of the natural gas in the FLORIDA GAS pipeline is:

(1) A sample of gas is taken from the pipeline in a stainless steel cylinder through a probe which goes to the center of the pipeline.

(2) At the time the sample is taken the specific gravity of the gas being sampled is determine by a portable gravitometer.

(3) The sample is shipped to the Zachary Laboratory to be analyzed. (LA.)

(4) When the sample arrives in Zachary it is placed in an oven overnight.

(5) The sample is then connected to the chromatograph by a 1/8 inch stainless tubing.

(6) The plumbing associated with the chromatograph and the connections to the sample cylinder are evacuated.

(7) The valve on the cylinder is opened allowing gas to fill the evacuated space to a positive pressure of about 20 to 40 psig.

(8) The gas is then bled down to atmospheric pressure.

(9) Steps 6 and 7 are repeated several times.

(10) With the pressure now at atmospheric pressure the chromatograph is started.

The Carle chromatograph separates the gaseous mixture into individual pure components. The pure components are measured prior to being eluted from the chromatograph. An electrical signal proportional to the amount of each component is sent to a SP 4100 computing intergrator as it is measured. The SP 4100 logs the time which the signal is recieved and the amount of signal. The time is used to identify the component and the amount of signal is used to determine the quantity of that component. After all of the components in the gaseous mixture have been indentified and amount of each is known; the SP 4100 reports each component as a normalized percentage of the total mixture which will add up to 100 %. Using the physical constants reported in AGA #3 for pure components the specific gravity is calculated and compared to the field gravity. If the gravity differ

III

by more than 0.004 another sample will be requested.

Prior to analyzing a gaseous mixture of unknown composition the SP 4100 is calibrated by following steps 5 through 10 using a third party certified standard of known composition. The time of each component and the known quantity of each component are enter into a file on the SP 4100. With the SP 4100 in a calibration mode it will log and file the actual time and amount of signal associated with each component of the certified standard. After the calibration is completed the SP 4100 is placed in a run mode. When the SP 4100 is in the run mode it will compared the time and amount of signal for the unknown component to the filed time and amount of signal of the known components. This information will be used to identify the component and the quantity of the unknown component. As stated above the quantity of the component is reported as a normalized percentage of the total mixture.

Fla Gas Trans Co.
Michael P. Compo
9-19-87
Zachary, La.

III

FLORIDA GAS TRANSMISSION COMPANY
AN ENRON AFFILIATE
GAS ANALYTICAL LABORATORY
MICHAEL Paul CAMPO
POST OFFICE BOX 477
LOWER ZACHARY ROAD

ZACHARY, LOUISIANA 70791

Phone Number: (504) 654-0851

****

The Composition of the gas in the FLORIDA GAS PIPELINE is determined by chromatography. The chromatographs are calibrated by using a certified standard from a third party. In our Zachary Lab we are using a Carle GC model 111 192-A and a certified standard from Alphagaz.

Mike Cruse of Alphagaz informed me that the standard sent to Fla Gas in Zachary was prepared by mixing actual masses of pure gases. The mixture of gases is then analyzed as a secondary check. The weights used to determine the mass of each gas in the mixture are traceable to the National Bureau of Standards.

Michael P. Campo
9-17-87

2-23-87 -AC

III

ALPHAGAZ
SPECIALTY GASES DIVISION
LIQUID AIR CORPORATION
3070 West Cedar Street, Beaumont, Texas 77704

Telephone (409) 835-3958

ANALYSIS CERTIFICATION

CALIBRATION GAS ONLY

REPORT FOR: FLORIDA GAS TRANSMISSION CO

DATE: 10/22/86
CYLINDER VOLUME: 1300 LITERS
CYLINDER SERIAL: PGS5464

COMPOSITIONAL ANALYSIS:

COMPONENT	MOLE %	B.T.U.	SP.GRAVITY
OXYGEN	.496		5.479808E-03
NITROGEN	1.495		.01445964
CARBON DIOXIDE	3.2		.048624
ETHANE	2.97	52.6581	.03083454
PROPANE	1.9	47.9427	.0289275
ISO BUTANE	1	32.607	.020068
NORMAL BUTANE	1	32.698	.020068
NORMAL PENTANE	.39	15.6737	9.71529E-03
ISO PENTANE	.392	15.7180	9.765112E-03
HEXANES PLUS	.197	10.4098	6.526019E-03
METHANE	86.96	880.122	.48167144
TOTALS	100.0000	1087.82957	.676139349

THE ABOVE CALCULATIONS BASED ON 14.730 PSIA.

COMPRESSIBILITY FACTOR (1/Z) =1.00281036
DRY B.T.U. AT 14.696 PSIA AND CORRECTED FOR COMP. =1088.36876
WET B.T.U. AT 14.696 PSIA AND CORRECTED FOR COMP. =1069.43114
REAL SPECIFIC GRAVITY =.678039542

ANALYST

Table 9-14. Characteristics of Typical Non-petroleum Liquid Fuels

	Conventional coal-tar fuels*				Synthetic crude oils, by hydrogenation		
	CTF 50	CTF 100	CTF 250	CTF 400	Oil shale	Tar sands†	Coal
Density, lb./U.S. gal., 60°F.	8.5	8.5	9.8	10.3	6.8	7.2	7.7
Viscosity, Redwood No. 1, sec.	30–50 at 100°F.	35–50 at 100°F.	50–80 at 250°F.				
Ultimate analysis, %:							
Carbon	87.4	88.9	90.0	90.1	86.1	87.10	87.20
Hydrogen	7.9	7.4	5.9	5.4	13.84	12.69	11.48
Oxygen	3.6	2.6	2.4	2.4	0.12	0.04	0.72
Nitrogen	0.9	0.9	1.2	1.4	0.01	0.07	0.25
Sulfur	0.2	0.2	0.5	0.7	0.02	0.10	0.005
Ash‡	Trace	Trace	0.08	0.15			
C/H ratio	11.0	12.0	15.5	16.5	6.2	6.9	7.6
Gross calorific value, B.t.u./lb.	16,500 to 17,500	16,500 to 17,500	16,200 to 16,700	15,800 to 16,300			

*CTF 50, 100, etc., indicate approximate preheat temperature, °F., for atomization of fuel in burners (terminology used in British Standard B.S. 140

† Tar sands, although a form of petroleum, are included in this table for comparison.

‡ Inorganic mineral constituents of coal-tar fuel:
5 to 50 p.p.m.: Ca, Fe, Pb, Zn, (Na, in tar treated with soda ash)
0.05 to 5 p.p.m.: Al, Bi, Cu, Mg, Mn, K, Si, Na, Sn
Less than 0.05 p.p.m.: As, B, Cr, Ge, Ti, V, Mo
Not detected: Sb, Ba, Be, Cd, Co, Ni, Sr, W, Zr

and refined into relatively conventional fuels in demonstration plants but not commercially as yet. Data on the non-petroleum crudes are shown also in Table 9-14.

GASEOUS FUELS

Natural Gas. Natural gas, in normal usage, is construed to be a naturally occurring mixture of hydrocarbons and non-hydrocarbons associated with petroliferous geologic formations. It consists primarily of methane (CH_4) with minor amounts of ethane (C_2H_6) and other heavier hydrocarbons and certain non-combustibles such as carbon dioxide, nitrogen, and helium. Natural gas as supplied by the utility companies usually contains from 80 to 95 per cent methane, with ethane, propane, and nitrogen making up the remainder. The heating value of such gases ranges from 900 to 1200 B.t.u./cu. ft., with the specific gravity (air = 1.0) varying from 0.58 to 0.79.

Although there is no single composition that may be termed the "typical" natural gas, Table 9-15 shows analyses of natural gas as distributed in a number of cities in the United States.

Natural gas may be termed "dry," indicating less than 0.1 g of gasoline vapor per 1000 cu. ft., or "wet," indicating more th 0.1 gal./1000 cu. ft. Additional terms "sweet" and "sour" are u to denote absence or presence of hydrogen sulfide (H_2S).

As shown in the American Gas Association 1971 Gas Facts, pro recoverable reserves of natural gas totaled 290.7 trillion cu. ft. the end of 1970, whereas net production was 22.4 trillion cu. Production of natural gas (including liquids) accounted for 38.2 p cent of the total energy produced in the United States. Also, the end of 1970, 914,800 miles of mains and pipe lines were service, supplying on an average 40.9 million customers.

Research is currently under way to produce an interchangea high-B.t.u. gas from coal, lignite, or oil shale. Among the proces under investigation are gasification to synthesis gas followed catalytic methanation, and hydrogenation.

Liquefied Natural Gas. The technology of liquefaction of natu gas is an old art; however, it has recently enjoyed renewed inter for shipment and storage. A number of storage projects have be completed or are under construction both in the United States a elsewhere, utilizing either a cascade or expansion liquefaction cy and storage by means of metal double-wall or prestressed concr

Table 9-15. Analyses of Natural Gas*·†

City	Components of gas, % by volume									Heating value,‡ B.t.u./cu. ft.	Specif gravi
	Methane	Ethane	Propane	Butanes	Pentanes	Hexanes plus	CO_2	N_2	Misc.		
Baltimore, Md.	94.40	3.40	0.60	0.50	0.00	0.00	0.60	0.50	...	1051	0.59
Birmingham, Ala.	93.14	2.50	.67	.32	.12	.05	1.06	2.14	...	1024	.59
Boston, Mass.	93.51	3.82	.93	.28	.07	.06	0.94	0.39	...	1057	.60
Columbus, Ohio	93.54	3.58	0.66	.22	.06	.03	.85	1.11	...	1028	.59
Dallas, Texas	86.30	7.25	2.78	.48	.07	.02	.63	2.47	...	1093	.64
Houston, Texas	92.50	4.80	2.00	.30	...	...	.27	0.13	...	1031	.62
Kansas City, Mo.	72.79	6.42	2.91	.50	.06	Trace	.22	17.10	...	945	.69
Los Angeles, Calif.	86.50	8.00	1.90	.30	.10	.10	.50	2.60	...	1084	.63
Milwaukee, Wis.	89.01	5.19	1.89	.66	.44	.02	.00	2.73	.06 He	1051	.62
New York, N.Y.	94.52	3.29	0.73	.26	.10	.09	.70	0.31	...	1049	.59
Phoenix, Ariz.	87.37	8.11	2.26	.13	.00	.00	.61	1.37	...	1071	.63
Salt Lake City, Utah	91.17	5.29	1.69	.55	.16	.03	.29	0.82	...	1082	.61
San Francisco, Calif.	88.69	7.01	1.93	.28	.03	.00	.62	1.43	.01 He	1086	.62
Washington, D.C.	95.15	2.84	0.63	.24	.05	.05	.62	0.42	...	1042	.58

*Reproduced by permission from "Gas Engineers Handbook," American Gas Association, Industrial Press, New York, 1965.

† Average analyses (1954 data) obtained from the operating utility company(s) supplying the city. The gas supply may vary considerably from these da especially where more than one pipe line supplies the city. Also, as new supplies may be received from other sources, the analyses may change. Peak sha (if used) is not accounted for in these data.

‡ Gross or higher heating value at 30 in. Hg, 60°F., dry. To convert to a saturated basis deduct 1.73%: *i.e.*, 17.3 from 1000, 19 from 1100.

CHEMICAL ENGR. HANDBOOK - PERRY
5TH EDITION

Table 18a. Analyses of Typical Gaseous Fuels

Type of Gas	Analysis in percent by volume								
	CH_4	C_2H_6	C_3H_8	C_4H_{10}	CO	H_2	CO_2	O_2	N_2
Natural, Birmingham, Ala.	90.0	5.0	...	...	...	...	...	...	5.0
Natural, Cleveland, Ohio[a]	82.9	11.9	0.3		...	...	0.2	0.3	4.4
Natural, Kansas City, Mo.	84.1	6.7	...	...	...	...	0.8	...	8.4
Natural, Pittsburgh, Pa.	83.4	15.8	...	...	...	...	...	...	0.8
Blast furnace	...	...	...	...	27.5	1.0	11.5	...	60.0
Producer, bituminous	3.0	...	...	...	27.0	14.0	4.5	0.6	50.9
Coke oven, by-product	32.3	...	...	3.2	5.5	51.9	2.0	0.03	4.8
Blue (water), bituminous	4.6	...	...	0.7	28.2	32.5	5.5	0.9	27.6
Carbureted blue, low gravity	10.9	2.5	...	6.1	21.9	49.6	3.6	0.4	5.0
Carbureted blue, heavy oil	13.5	...	...	8.2	26.8	32.2	6.0	0.9	12.4
Sewage, Decatur	68.0	...	...	...	...	2.0	22.0	...	6.0
Commercial propane, natural gas	...	2.2	97.3	0.5					
Commercial propane, refinery gas	...	2.0	72.9	0.8	(24.3% C_3H_8)				
Commercial butane, natural gas	...	...	6.0	{70.7n- 23.3iso					
Commercial butane, refinery gas	...	...	5.0	{50.1n- 16.5iso-	(28.3% C_4H_8)				

[a]Courtesy of East Ohio Gas Co. Other data adapted from *Gaseous Fuels*, L. Shnidman (Editor), American Gas Association, N.Y., 1948.

NORTH AMERICAN COMBUSTION HANDBOOK

Table 18b. Properties of Typical Gaseous Fuels

Type of Gas	Specific gravity	Calorific value Btu per cu ft		Gross Btu per cu ft std air	Cu ft air req'd per cu ft gas	Combustion products in cu ft per cu ft gas				Ultimate $\%CO_2$ in dry flue gas
		Gross	Net			CO_2	H_2O	N_2	Total	
Natural, Birmingham, Ala.	0.60	1002	904	106.2	9.44	1.00	1.95	7.51	10.46	11.8
Natural, Cleveland, Ohio[a]	0.635	1059	959	105.9	10.00	1.08	2.03	7.95	11.06	12.0
Natural, Kansas City, Mo.	0.63	974	879	106.3	9.17	0.98	1.88	7.33	10.20	11.8
Natural, Pittsburgh, Pa.	0.61	1129	1021	106.2	10.62	1.15	2.14	8.41	11.70	12.0
Blast furnace	1.02	92	92	135.3	0.68	0.39	0.01	1.14	1.54	25.5
Producer, bituminous	0.86	163	153	131.6	1.24	0.34	0.20	1.49	2.03	18.6
Coke oven, by-product	0.40	569	509	104.4	5.45	0.53	1.32	4.36	6.21	10.8
Blue (water), bituminous	0.70	260	239	126.0	2.07	0.41	0.45	2.34	3.20	14.9
Carbureted blue, low gravity	0.54	536	461	106.1	5.05	0.66	1.09	4.04	5.79	14.0
Carbureted blue, heavy oil	0.66	530	451	101.7	5.21	0.79	1.00	4.23	6.02	15.7
Sewage, Decatur	0.79	690	621	105.2	6.55	0.90	1.38	5.24	6.52	14.7
Commercial propane, natural gas	1.55	2558	2358	107.5	23.8	2.98	3.98	18.80	25.76	13.7
Commercial propane, refinery gas	1.77	2504	2316	108.0	23.2	2.99	3.74	18.35	25.08	14.0
Commercial butane, natural gas	2.04	3210	2961	104.8	30.6	3.94	4.94	24.20	33.08	14.0
Commercial butane, refinery gas	2.00	3184	2935	106.1	30.0	3.95	4.67	23.75	32.37	14.3

[a]Courtesy of East Ohio Gas Co. Other data adapted from *Gaseous Fuels*, L. Shnidman (Editor), American Gas Association, N.Y., 1948.

SOURCE TYPE/SIZE: NATURAL GAS TURBINES — 49.90 MW

COMPANY NAME/SITE LOCATION: PG & E, STATION T, JESSIE ST BETWEEN 6TH & MINT *, SAN FRANCISCO, CA

DETERMINATION IS BACT FOR A MODIFIED SOURCE.
PERMIT NO. SFB 86-01
DETERMINATION MADE BY: EPA REGION IX (AGENCY); LINH TRAN (AGENCY CONTACT PERSON)

DATE OF PERMIT ISSUANCE-- 08/25/86
ESTIMATED DATE OF START-UP-- 1987
(415)-974-7631 (PHONE)

PROCESSES SUBJECT TO THIS PERMIT	THROUGHPUT CAPACITY	POLLUTANT EMITTED	EMISSION LIMITS	CONTROL EQUIPMENT OR PROCESS MODIFICATION	... & BASIS ... PCT EFF
TURBINE, GAS, GE LM5000	396.00 MMBTU/H	NOX	25.0000 PPM AT 15% O2 63.0000 LB/H	STEAM INJ. AT STEAM/FUEL RATIO = 1.7/1	BACT 75.00

NOTES --------
A CO OXIDIZING CATALYST SYSTEM FOR THE CONTROL OF CO EMISSIONS.

(*) INDICATES DATUM WAS TRUNCATED FOR THIS TABLE.

INITIAL REVIEW POST STARTUP
REVIEW STATUS:

PM
9-3-87
Atlanta, Ga.

File Copy

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

SEP 3 1987

DER
SEP 8 1987
BAQM

4APT/APB-aes

Margaret V. Janes
Bureau of Air Quality
Management
Florida Department of Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Re: Reedy Creek Improvement District

Dear Ms. Janes:

This is to acknowledge receipt of the application for a proposed modification at the above-referenced source. The proposed modification involves the replacement of two existing turbines by a General Electric LM 5000 dual-fuel combustion turbine coupled to a heat recovery steam boiler and a steam turbine. As a result of this modification, there will be a net emissions increase for NO_x.

After reviewing the application, we have one comment pertaining to the applicant's proposed modification. We would like to point out that the new source performance standard (NSPS) for NO_x (40 CFR 60 Subpart GG) is only a starting point for a best available control technology (BACT) determination. BACT can be and is often more stringent than NSPS. Therefore, the NO_x emission limit of 152.1 ppm (dry, 15% O_2) may not be representative of BACT. After searching through the second supplement to the 1985 edition of BACT/LAER Clearinghouse, the NO_x emission limits appear to be in the range of 8-42 ppm with an exception of 124 ppm. This 124 ppm belongs to a peat fueled turbine that is located at Carolina Cogeneration Co., Inc. in North Carolina. Since peat contains large amounts of nitrogen, the unit's BACT is not representative of the ordinary turbines. The rest of the units are located in California. Although some of the units' emission limits represent LAER, there are a few of the units that do represent BACT. One of these units is a GE LM 5000 unit (BACT/LAER information is enclosed) that is identical to the one proposed in the application. By employing a steam injection system with a 75% control as BACT, the resulting NO_x emission limit is 25 ppm at 15% O_2. Thus, in order to have a more realistic BACT emission limitation for the proposed unit, additional information on the approximate NO_x emissions from the turbine is needed.

Thank you for providing us with the opportunity to comment. If you have any questions, please contact me or Mr. Gary Ng of my staff at (404) 347-2864.

Sincerely yours,

Bruce P. Miller

Bruce P. Miller, Chief
Air Programs Branch
Air, Pesticides, and Toxics
Management Division

Enclosure

Copied: CHF/ET
Barry Andrews
Bradley Rauch
Max Hinn
Tom Sawicki - Central FL DCT
M. Jarvis - NPS

9/9/87

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET
ATLANTA, GEORGIA 30365

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

AIR-4

Ms. Margaret V. Janes
Bureau of Air Quality Management
Florida Department of Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, FL 32399-2400

PS Form 3811, July 1983 447-845

SENDER: Complete items 1, 2, 3 and 4.

Put your address in the "RETURN TO" space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for service(s) requested.

1. ☒ Show to whom, date and address of delivery.
2. ☐ Restricted Delivery.

3. Article Addressed to: Thomas M. Moses
Reedy Creek Improvement District
Post Office Box 40
Lake Buena Vista, FL 32830

4. Type of Service:	Article Number
☐ Registered ☐ Insured ☒ Certified ☐ COD ☐ Express Mail	P 274 007 700

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature – Addressee
X

6. Signature – Agent
X

7. Date of Delivery
9-4-87

8. Addressee's Address *(ONLY if requested and fee paid)*

DOMESTIC RETURN RECEIPT

P 274 007 700

RECEIPT FOR CERTIFIED MAIL

NO INSURANCE COVERAGE PROVIDED
NOT FOR INTERNATIONAL MAIL

Sent to Thomas M. Moses
Reedy Ck. Improvement Dist.
Street and No. P.O. Box 40
P.O. State and ZIP Code Lake Buena Vista, FL 32830

Postage	$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt showing to whom and Date Delivered	
Return Receipt showing to whom, Date, and Address of Delivery	
TOTAL Postage and Fees	$
Postmark or Date	Mailed: 09/04/87 Permit: AC 48-137740 Federal: PSD-FL-123

PS Form 3800, June 1985

* U.S.G.P.O. 1985-480-794

Jill

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

BOB MARTINEZ
GOVERNOR

DALE TWACHTMANN
SECRETARY

September 4, 1987

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Thomas M. Moses
Reedy Creek Improvement District
Post Office Box 40
Lake Buena Vista, Florida 32830

Dear Mr. Moses:

Re: Review of Application for Construction of a Gas Fired Turbine Generator, Permit No. AC 48-137740, PSD-FL-123

The Department has received your application package dated August 6, 1987, and has deemed it incomplete. To further process your application, please submit the following, including all calculations, assumptions and reference material:

1. Although a NOx CEM will not be required for your project as proposed, in accordance with NSPS Subparts GG and Db, continuous verification of compliance is required. Please submit details of the method(s) you intend to use to verify the unit's continuous compliance, for the Department's approval. If you intend to install monitoring devices, submit the manufacturer's specifications/literature.

2. Please submit an analysis of your natural gas, which states the fuel-bound nitrogen content specifically, with supporting documentation of the test methods and procedures used.

3. Please note that a specific condition in the proposed permit will put a federally enforceable operating hours limit on your oil fired operation since SO_2 emission (for 29 days of operation) will be at 39.9 tons per year, just below significant levels. If you wish to retain more flexibility, please revise your calculations reflecting the "maximum allowable" hours and rates for oil-fired operation.

If you have any questions please call Pradeep Raval at (904)488-1344 or write to me at the above address.

Sincerely,

Raval

for C. H. Fancy, P.E.
Deputy Chief
Bureau of Air Quality
Management

CHF/PR/s

Attachments

cc: R. Sadow
T. Sawicki
W. Aronson
M. Flores

air consulting and engineering

February 25, 1987
151 87 01

DER
APR 1 1987
BAQM

Mr. A.T. Sawicki
Florida Department of
Environmental Regulation
3319 Maguire Blvd., Suite 232
Orlando, Florida 32803

RE: Kissimmee Utilities Commission Gas Turbine Allowable NO_x Emissions As Specified In Permit Number AO-49-093754

Dear Mr. Sawicki:

On behalf of Kissimmee Utilities Commission (KUC), Air Consulting and Engineering (ACE) has investigated the current maximum allowable emissions specified in the referenced operating permit. It would appear from the information and calculations included in this submittal, that KUC should be allowed a maximum NO_x emission of 130 ppm corrected to standard conditions versus the current limit of 79 ppm. This adjustment is necessary in accordance with Subpart GG NSPS standards which allows credit for fuel bound nitrogen. It is my belief that the fuel bound nitrogen content of natural gas was either never investigated during the original permitting effort or that the fuel analysis has changed since that time period.

Please review the enclosed data. If you agree with my assessment, I wish to ask for a permit change to reflect the higher allowable emission. I would also like to point out that the high water injection rates that are now necessary to ensure a maximum emission of 79 ppm results in greater fuel usage (decreased efficiency) and considerable combuster and turbine damage (increased maintenance cost). The high water rates also result in higher than necessary carbon monoxide emissions at all loads.

Please contact Mr. Jeff Ling of KUC or me if you have any questions regarding this request.

Respectfully,

AIR CONSULTING AND ENGINEERING

Stephen L. Neck, P.E.

SLN:ctg

attachments

cc: Mr. Jeff Ling (KUC)

2106 N.W. 67th Place, Suite 4 • Gainesville, Florida 32606 • (904) 335-1889

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

BOB MARTINEZ
GOVERNOR

DALE TWACHTMANN
SECRETARY

April 10, 1987

Mr. Bruce Miller
Chief, Air Facilities Branch
Air & Waste Management Division
USEPA - Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Dear Mr. Miller:

Re: PSD-FL-087
Kissimmee Utilities (Osceola County)

Attached, for your information, is a copy of Kissimmee Utilities' request to increase NOx emission concentrations from their 49.9 MW-Combined Cycle Gas Turbine.

The construction permits for this unit, PSD-FL-087 and AC 49-46521, were originally issued on February 19, 1982, and November 25, 1981, respectively.

In 1983, the Company failed to apply for an operating permit within the time allowed by the construction permit. Therefore, we requested a submission of a new application. The application was reviewed and a new state permit was issued on March 30, 1984.

On April 1, 1984, we received the above mentioned request. Currently, we are in the process of modifying the BACT determination and specific conditions for state permits AC 49-74856 and AO 49-093754.

If you have any questions, please call Teresa Heron (Review Engineer) or Barry Andrews (BACT Coordinator) at (904)488-1344.

Sincerely,

Clair Fancy, P.E.
Deputy Chief
Bureau of Air Quality
Management

CHF/TH/s
Attachments sent 4/15/87 AA
cc: John Turner, DER Orlando

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

1987

4APT/APB-1jf

DER

1987

BAQM

Mr. Clair Fancy, P.E.
Deputy Chief
Bureau of Air Quality Management
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32301

Re: Kissimmee Utilities (Osceola County)

Dear Mr. Fancy:

This is in regard to your letter of April 10, 1987, forwarding the above company's request to increase the allowable nitrogen oxides emissions from their 49.9 MW combined cycle gas turbine. They have requested to increase their allowable emissions concentration limit from 79 ppm to 130 ppm using the fuel bound nitrogen credit as provided for in the New Source Performance Standards, Subpart GG.

We have reviewed the company's request to use the nitrogen content of their natural gas supply in calculating the emissions rate from equations contained in Subpart GG, New Source Performance Standards. During our review, we contacted the Office of Air Quality Planning and Standards regarding the definition of fuel bound nitrogen and data regarding measured concentrations of fuel bound nitrogen in natural gas. Their response was that natural gas does not contain measurable amounts of fuel bound nitrogen and that the nitrogen content reported by the supplier is probably atmospheric nitrogen which is not credible as fuel bound nitrogen. Therefore, the company's analysis supporting their request to increase their nitrogen oxides emissions rate is not valid.

In summary, the company's request to increase nitrogen oxides emissions when burning natural gas should be denied on the basis that the reported nitrogen content of the natural gas is not fuel bound nitrogen. Unless the supplier is able to provide an analysis of their natural gas which determines fuel bound nitrogen only, with supporting documentation of test methods and procedures, credit cannot be given in the calculation of allowable nitrogen oxide emissions as provided under the New Source Performance Standards, Subpart GG.

If you have any questions regarding this determination, you may contact Michael Brandon of my staff at (404) 347-2864.

Sincerely,

Bruce P. Miller

Bruce P. Miller, Chief
Air Programs Branch
Air, Pesticides and Toxics
Management Division

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

BOB MARTINEZ
GOVERNOR

DALE TWACHTMANN
SECRETARY

August 7, 1987

Mr. Wayne Aronson
Chief
Program Support Section
U.S. EPA, Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Dear Mr. Aronson:

RE: Reedy Creek Improvement District
State Construction Permit Number: AC 48-137740
PSD Number: PSD-FL-123

Enclosed for your review and comment is the application packet for the above referenced company. If you have any comments or questions, please contact Pradeep Raval or Max Linn by September 4, 1987, at the above address or at (904)488-1344.

Sincerely,

M. V. Janes

Margaret V. Janes
Bureau of Air Quality
Management

/mj

cc: Pradeep Raval
Max Linn
Tom Sawicki, Central Florida Dist.
Miguel Flores, NPS

enclosures

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

BOB MARTINEZ
GOVERNOR

DALE TWACHTMANN
SECRETARY

August 7, 1987

Mr. Miguel Flores
Chief, Permit Review and Technical
Support Branch
National Park Service-Air
Post Office Box 25287
Denver, Colorado 80225

Dear Mr. Flores:

RE: Reedy Creek Improvement District
State Construction Permit Number: AC 48-137740
PSD Number: PSD-FL-123

Enclosed for your review and comment is an application packet for the above referenced company. The facility is within 100 kilometers of the Chassahowitzka National Wildlife Refuge. If you have any comments or questions, please contact Pradeep Raval or Max Linn by September 4, 1987, at the above address or call him at (904)488-1344.

Sincerely,

M. V. Janes

Margaret V. Janes
Bureau of Air Quality
Management

/mj

cc: Pradeep Raval
Max Linn
Tom Sawicki, Central Florida Dist.
Wayne Aronson, EPA

enclosures

File Copy

Receipt # 76175 AC48-137740
PSD-FL-123

REEDY CREEK IMPROVEMENT DISTRICT

P.O. BOX 36 LAKE BUENA VISTA, FLORIDA 32830 TELEPHONE (305) 828-2034

DER

AUG 6 1987

BAQM

August 5, 1987

FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION
Bureau of Air Quality Management
Central Air Permitting Section
2600 Blair Stone Road
Tallahassee, FL 32301-8241

Gentlemen:

Enclosed are four copies of our completed Application for a Permit to construct, including all required exhibits, attachments and reports for a major new source CoGeneration facility planned for the Central Energy Plant at our Bay Lake location near Lake Buena Vista, Florida. At the suggestion of your Engineering Department we have executed both Department forms, DER 17-1.202(1) and DER 17-2.1000(1). We have also enclosed a check for the required processing fee of $1,000.00, and letter of authorization.

We had introduced this project to, and obtained initial guidance from, members of your staff at a meeting in your office on April 10, 1987.

If you have any administrative questions, please refer them to Robert H. Kohl, Director, Reedy Creek Utilities Company, Inc. (telephone (305) 824-4026). Technical questions should be referred to our Engineer/Construction; Ford, Bacon & Davis, Inc., attention of Harold L. Culp, P.E. or R. D. Sadow, as noted in the application.

As basic engineering work is getting underway, for this modernization, we would appreciate your timely response to this submittal.

Thank you for your attention to this matter. Please advise us if we may be of any assistance.

Very truly yours,

Richard H. Garvey

Richard Garvey
Planning and Environmental Permitting

RG:pb

Copies: Pradeep Raval
Max Lirin
Barry Andrews
Wayne Aronson, EPA
Miguel Flores, NPS
Tom Sawicki, Orlando

REEDY CREEK
IMPROVEMENT
DISTRICT

DIRECTOR/GENERAL MANAGER
Thomas M. Moses

August 5, 1987

State of Florida
Department of Environmental Regulation
Mr. Dale Twachtmann
Secretary
Twin Towers Office Building
Tallahassee, Florida 32399-2400

Dear Mr. Twachtmann:

This letter will serve to advise you that as the Director/General Manager of the Reedy Creek Improvement District I am authorized to sign all contracts, agreements and other official documents for the Reedy Creek Improvement District.

This authorization is a part of the job responsibilities assigned to my position.

If there are any questions regarding this matter please call me.

Sincerely,

Thomas M. Moses
Director/General Manager

TMM:dh