Florida Department of
Environmental Protection

Lawton Chiles
Governor

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

Virginia B. Wetherell
Secretary

December 9, 1993

Mr. Allan Weatherford
Compliance Environmentalist
Florida Gas Transmission Company
P.O. Box 94500
Maitland, Florida 32794-5100

Dear Mr. Weatherford:

RE: Request for Amendments and Extensions to Air Construction Permits AC 57-188869, AC 67-189220, AC 20-189438, AC 62-189439, AC 04-189454, AC 42-189455, AC 48-189456, AC 05-189655, and AC 56-189457
Phase II - Florida Gas Transmission Company

The Department is in receipt of Mr. Barry Andrew's letter dated December 3, 1993, on behalf of your company, requesting to amend the above permits to use EPA Method 3A instead of EPA Method 3 for Gas Analysis. The Department has reviewed this request and has determined to amend the above mentioned permits as requested.

Specific Condition No. 8 of the above mentioned permits will be amended as follows:

SPECIFIC CONDITION NO. 8

FROM:

8. Compliance with the NO_X, SO_2, CO, VE, and VOC standards shall be determined by the following reference methods as described in 40 CFR 60, Appendix A (July 1, 1988) and adopted by reference in F.A.C. Rule 17-2.700.

- Method 1. Sample and Velocity Traverses
- Method 2. Volumetric Flow Rate
- Method 3. Gas Analysis
- Method 7E. Determination of Nitrogen Oxides Emissions from Stationary Sources
- Method 9. Determination of the Opacity of the Emissions from Stationary Sources
- Method 10. Determination of the Carbon Monoxide Emission from Stationary Sources
- Method 25. Determination of Total Gaseous Nonmethane Organic Emissions as Carbon

TO:

8. Compliance with the NO_X, SO_2, CO, VE, and VOC standards shall be determined by the following reference methods as described in 40 CFR 60, Appendix A (July 1, 1992) and adopted by reference in F.A.C. Rule 17-2.700.

- Method 1. Sample and Velocity Traverses
- Method 2. Volumetric Flow Rate
- **Method 3A. Gas Analysis**
- Method 7E. Determination of Nitrogen Oxides Emissions from Stationary Sources
- Method 9. Determination of the Opacity of the Emissions from Stationary Sources
- Method 10. Determination of the Carbon Monoxide Emission from Stationary Sources
- **Method 25A. Determination of Total Gaseous Organic Concentrations Using a Flame Ionization Analyses**

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, Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400. Petitions filed by the applicant of the amendment request/application and the parties listed below must be filed within 14 days of receipt of this amendment. Petitions filed by other persons must be filed within 14 days of the amendment issuance or within 14 days of their receipt of this amendment, whichever occurs first. Petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. 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, Florida Statutes.

The Petition shall contain the following information:

(a) The name, address and telephone number of each petitioner, the applicant's name and address, the Department Permit File Number and the county in which the project is proposed;
(b) A statement of how and when each petitioner received notice of the Department's action or proposed action;
(c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action;
(d) A statement of the material facts disputed by Petitioner, if any;

(e) A statement of facts which petitioner contends warrant reversal or modification of the Department's action or proposed action;
(f) A statement of which rules or statutes petitioner contends require reversal or modification of the Department's action or proposed action;
(g) A statement of the relief sought by petitioner, stating precisely the action the petitioner wants the Department to take with respect to the Department's action or proposed action.

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 position taken by it in this amendment. Persons whose substantial interests will be affected by any decision of the Department with regard to the request/application have the right to petition to become a party to the proceeding. The petition must conform to the requirements specified above and be filed (received) within 14 days of receipt of this amendment in the Office of General Counsel at the above address of the Department. Failure to petition within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, F.S., and to participate as a party to this proceeding. Any subsequent intervention will only be at the approval of the presiding officer upon motion filed pursuant to Rule 28-5.207, F.A.C.

This letter must be attached to the above mentioned permits and shall become a part of each permit.

Sincerely,

Howard L Rhodes

Howard Rhodes
Director
Division of Air Resources
Management

Attachment to be Incorporated

Mr. Barry Andrew's letter of December 3, 1993.

cc: E. Middleswart, NWD
Robert Leetch, NED
Charles Collins, CD
Isidore Goldman, SED
Duane Pierce, FGTC
Barry Andrews, ENSR

CERTIFICATE OF SERVICE

The undersigned duly designated deputy clerk hereby certifies that this AMENDMENT and all copies were mailed by certified mail before the close of business on 12/21/93 to the listed persons.

Clerk Stamp

FILING AND ACKNOWLEDGMENT FILED, on this date, pursuant to §120.52(11), Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Barbara J. Boutwell 12/21/93
Clerk Date

ENSR

ENSR Consulting
and Engineering

2809 West Mall Drive
Florence, AL 35630
(205) 767-1210
FAX (205) 767-1211

December 3, 1993

RECEIVED
DEC - 6 1993
Division of Air
Resources Management

Mr. Clair Fancy, P.E.
Chief, Bureau of Air Regulation
Florida Department of Environmental Protection
2600 Blairstone Road
Tallahassee, FL 32399-2400

Dear Clair:

RE: Request for Amendments to Permits
Florida Gas Transmission Company

Station 12 - Permit No. AC57-188869
Munson, Santa Rosa County, Florida

Station 13 - Permit No. AC67-189220
Caryville, Washington county, Florida

Station 14 - Permit No. AC20-189438
Quincy, Gadsden County, Florida

Station 15 - Permit No. AC62-189439
Perry, Taylor County, Florida

Station 16 - Permit No. AC04-189454
Brooker, Bradford County, Florida

Station 17 - Permit No. AC42-189455
Salt Springs, Marion County, Florida

Station 18 - Permit No. AC48-189456
Orlando, Orange County, Florida

Station 19 - Permit No. AC05-189665
Melbourne, Brevard County, Florida

Station 20 - Permit No. AC56-189457
Ft. Pierce, St. Lucie County, Florida

ENSR

This letter is in response to our recent conversation regarding a previous request by Florida Gas Transmission Company (FGTC) to amend the above permits to include Method 3A instead of Method 3.

On June 29, 1993, FGTC requested that the permits for the compressor engines referenced in this letter be amended to adjust the horsepower ratings and heat input rates. On September 9, 1993 (letter attached), FGTC further requested that specific condition 8 in each of the permits be amended to replace Method 3 with 3A, and that the SO_2 emission limits be clarified to base SO_2 emissions on the fuels sulfur content.

On September 17, 1993 the Division of Air Resources Management (DARM) responded to FGTC's request with a letter amending the permits. Included were the amendments for horsepower ratings, heat input, restrictions, and clarification of sulfur as the basis for SO_2 emissions.

It has recently come to FGTC's attention through the process of obtaining operating permits from the district offices that the request to replace Method 3 with Method 3A was not included in DARM's response. Until now it was assumed that the request had been included in the September 17, 1993 letter of amendment.

Accordingly, FGTC requests that DARM evaluate the request for the amendment to the testing method. This should not require an alternate sampling procedure since there is no regulatory requirement for determining the oxygen and carbon dioxide concentrations from compressor station engines.

Your expedited response to this request is appreciated since it relates to the issuance of our operating permits. Should you need additional information or have any questions please contact Mr. Alan Weatherford with FGTC at (407) 875-5816.

Sincerely,

Barry Andrews

Barry D. Andrews, P.E.
Manager, Air Quality Services

cc : Alan Weatherford

Enclosure

Florida Department of
Environmental Protection

Lawton Chiles
Governor

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

Virginia B. Wetherell
Secretary

September 17, 1993

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Allan Weatherford
Compliance Environmentalist
Florida Gas Transmission Company
P. O. Box 94500
Maitland, Florida 32794-5100

Dear Mr. Weatherford:

Re: Request for Amendments and Extensions to Air Construction Permits **AC**57-188869, **AC**67-189220, **AC**20-189438, **AC**62-189439, **AC**04-189454, **AC**42-189455, **AC**48-189456, **AC**05-189655, and **AC**56-189457

The Department is in receipt of your letter dated June 29, 1993, requesting to extend the expiration date and to change the engine horsepower (HP) capacity, fuel consumption and heat input at various compressor stations. The Department has reviewed this request and has determined to amend the above mentioned permits as requested since there is no increase in permitted emission levels (lbs/hr and tons/yr).

The following changes are allowed by the Department:

COMPRESSOR STATION NO. 12 - SANTA ROSA COUNTY:

Description

FROM: For the construction of one 4,000 bhp natural gas fired engine to be located at the Florida Gas Transmission facility in Munson, Santa Rosa County, Florida. The UTM coordinates are Zone 16, 510.83 km East and 3419.03 km North.

TO: For the construction of one **4,100** bhp natural gas fired engine to be located at the Florida Gas Transmission facility in Munson, Santa Rosa County, Florida. The UTM coordinates are Zone 16, 510.83 km East and 3419.03 km North.

Specific Condition No. 1

FROM: The maximum allowable emissions from this source shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	17.6	77.2	2.0 g/bhp-hr
Carbon Monoxide	22.1	96.6	2.5 g/bhp-hr
Volatile Organic Compounds (non-methane)	8.8	38.6	1.0 g/bhp-hr
Particulate Matter (TSP)	0.14	0.61	5 lbs/MMscf
Particulate Matter (PM_{10})	0.14	0.61	5 lbs/MMscf
Sulfur Dioxide	0.8	3.5	10 gr/100scf

TO: The maximum allowable emissions from this source shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	17.6	77.2	**1.95** g/bhp-hr
Carbon Monoxide	22.1	96.6	**2.44** g/bhp-hr
Volatile Organic Compounds (non-methane)	8.8	38.6	**0.97** g/bhp-hr
Particulate Matter (TSP)	0.14	0.61	**4.03** lbs/MMscf
Particulate Matter (PM_{10})	0.14	0.61	**4.03** lbs/MMscf
Sulfur Dioxide	0.8	3.5	**8.06** gr S/100scf

Specific Condition No. 5

FROM: The permitted operating parameters and utilization rates for this natural gas compressor engine shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed 27,810 scf/hr.
- Maximum heat input shall not exceed 29.20 MMBtu/hr.

TO: The permitted operating parameters and utilization rates for this natural gas compressor engine shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed **34,525** scf/hr.
- Maximum heat input shall not exceed **36.25** MMBtu/hr.

COMPRESSOR STATION NO. 13 - WASHINGTON COUNTY:

Description

FROM: For the construction of one 2,400 bhp natural gas fired engine to be located 9 miles south of Caryville on CR 284. The UTM coordinates are Zone 16, 610.69 km East and 3394.28 km North.

TO: For the construction of one **2,700** bhp natural gas fired engine to be located at the Florida Gas Transmission facility in Caryville, Washington County, Florida. The UTM coordinates are Zone 16, 610.69 km East and 3394.28 km North.

Specific Condition No. 1

FROM: The maximum allowable emissions from this source shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	10.6	46.3	2.0 g/bhp-hr
Carbon Monoxide	11.1	48.7	2.1 g/bhp-hr
Volatile Organic Compounds (non-methane)	2.6	11.6	0.5 g/bhp-hr
Particulate Matter (TSP)	0.08	0.4	5 lbs/MMscf
Particulate Matter (PM_{10})	0.08	0.4	5 lbs/MMscf
Sulfur Dioxide	0.46	2.0	10 gr/100scf

TO: The maximum allowable emissions from this source shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	10.6	46.3	**1.78** g/bhp-hr
Carbon Monoxide	11.1	48.7	**1.87** g/bhp-hr
Volatile Organic Compounds (non-methane)	2.6	11.6	**0.44** g/bhp-hr
Particulate Matter (TSP)	0.08	0.4	**3.87** lbs/MMscf
Particulate Matter (PM_{10})	0.08	0.4	**3.87** lbs/MMscf
Sulfur Dioxide	0.46	2.0	**7.74** gr **S**/100scf

Specific Condition No. 5

FROM: The permitted operating parameters and utilization rates for this natural gas compressor engine shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed 16,154 scf/hr.
- Maximum heat input shall not exceed 16.80 MMBtu/hr.

TO: The permitted operating parameters and utilization rates for this natural gas compressor engine shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed **20,856** scf/hr.
- Maximum heat input shall not exceed **21.69** MMBtu/hr.

COMPRESSOR STATION NO. 14 - GADSDEN COUNTY:

Description

FROM: For the construction of one 2,400 bhp natural gas fired engine to be located 8 miles southwest of Quincy on SR 65. The UTM coordinates are Zone 16, 719.97 km East and 3377.39 km North.

TO: For the construction of one **2,700** bhp natural gas fired engine to be located at the Florida Gas Transmission facility in Quincy, Gadsden County, Florida. The UTM coordinates are Zone 16, 719.97 km East and 3377.39 km North.

Specific Condition No. 1

FROM: The maximum allowable emissions from this source shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	10.6	46.3	2.0 g/bhp-hr
Carbon Monoxide	11.1	48.7	2.1 g/bhp-hr
Volatile Organic Compounds (non-methane)	2.6	11.6	0.5 g/bhp-hr
Particulate Matter (TSP)	0.08	0.4	5 lbs/MMscf
Particulate Matter (PM_{10})	0.08	0.4	5 lbs/MMscf
Sulfur Dioxide	0.46	2.0	10 gr/100scf

TO: The maximum allowable emissions from this source shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	10.6	46.3	**1.78** g/bhp-hr
Carbon Monoxide	11.1	48.7	**1.87** g/bhp-hr

Volatile Organic Compounds (non-methane)	2.6	11.6	**0.44** g/bhp-hr
Particulate Matter (TSP)	0.08	0.4	**3.87** lbs/MMscf
Particulate Matter (PM_{10})	0.08	0.4	**3.87** lbs/MMscf
Sulfur Dioxide	0.46	2.0	**7.74** gr S/100scf

Specific Condition No. 5

FROM: The permitted operating parameters and utilization rates for this natural gas compressor engine shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed 16,154 scf/hr.
- Maximum heat input shall not exceed 16.80 MMBtu/hr.

TO: The permitted operating parameters and utilization rates for this natural gas compressor engine shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed **20,856** scf/hr.
- Maximum heat input shall not exceed **21.69** MMBtu/hr.

COMPRESSOR STATION NO. 18 - ORANGE COUNTY:

FROM: For the construction of one 2,400 bhp natural gas fired engine to be located at 7990 Steer Lake Road. The UTM coordinates are Zone 17, 451.86 km East and 3154.79 km North.

TO: For the construction of one **2,700** bhp natural gas fired engine to be located at the Florida Gas Transmission facility in Orlando, Orange County, Florida. The UTM coordinates are Zone 16, 451.86 km East and 3154.79 km North.

Specific Condition No. 1

FROM: The maximum allowable emissions from this source shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	10.6	46.3	2.0 g/bhp-hr
Carbon Monoxide	11.1	48.7	2.1 g/bhp-hr

Volatile Organic Compounds (non-methane)	2.6	11.6	0.5 g/bhp-hr
Particulate Matter (TSP)	0.08	0.4	5 lbs/MMscf
Particulate Matter (PM_{10})	0.08	0.4	5 lbs/MMscf
Sulfur Dioxide	0.476	2.2	10 gr/100scf

TO: The maximum allowable emissions from this source shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	10.6	46.3	**1.78** g/bhp-hr
Carbon Monoxide	11.1	48.7	**1.87** g/bhp-hr
Volatile Organic Compounds (non-methane)	2.6	11.6	**0.44** g/bhp-hr
Particulate Matter (TSP)	0.08	0.4	**3.95** lbs/MMscf
Particulate Matter (PM_{10})	0.08	0.4	**3.95** lbs/MMscf
Sulfur Dioxide	0.476	2.2	**7.90** gr S/100scf

Specific Condition No. 5

FROM: The permitted operating parameters and utilization rates for this natural gas compressor engine shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed 16,311 scf/hr.
- Maximum heat input shall not exceed 16.80 MMBtu/hr.

TO: The permitted operating parameters and utilization rates for this natural gas compressor engine shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed **20,640** scf/hr.
- Maximum heat input shall not exceed **21.26** MMBtu/hr.

COMPRESSOR STATION NO. 19 - BREVARD COUNTY:

Description

FROM: For the construction of two 2,500 bhp natural gas fired engines to be located 6 miles west-southwest of Melbourne Regional Airport. The UTM coordinates are Zone 17, 528.67 km East and 3101.64 km North.

TO: For the construction of two **2,600** bhp natural gas fired engine to be located at the Florida Gas Transmission facility in Melbourne, Brevard County, Florida. The UTM coordinates are Zone 17, 528.67 km East and 3101.64 km North.

Specific Condition No. 1

FROM: The maximum allowable emissions from each engine shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	11.0	48.3	2.0 g/bhp-hr
Carbon Monoxide	15.4	67.6	2.8 g/bhp-hr
Volatile Organic Compounds (non-methane)	9.4	41.0	1.7 g/bhp-hr
Particulate Matter (TSP)	0.09	0.4	5 lbs/MMscf
Particulate Matter (PM_{10})	0.09	0.4	5 lbs/MMscf
Sulfur Dioxide	0.51	2.2	10 gr/100scf

TO: The maximum allowable emissions from each engine shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	11.0	48.3	**1.92** g/bhp-hr
Carbon Monoxide	15.4	67.6	**2.69** g/bhp-hr
Volatile Organic Compounds (non-methane)	9.4	41.0	**1.64** g/bhp-hr
Particulate Matter (TSP)	0.09	0.4	**3.90** lbs/MMscf
Particulate Matter (PM_{10})	0.09	0.4	**3.90** lbs/MMscf
Sulfur Dioxide	0.51	2.2	**7.80** gr S/100scf

Specific Condition No. 5

FROM: The permitted operating parameters and utilization rates for these natural gas compressor engines shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed 17,718 scf/hr per engine.
- Maximum heat input shall not exceed 36.50 MMBtu/hr for both engines.

TO: The permitted operating parameters and utilization rates for these natural gas compressor engines shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed **22,703** scf/hr per engine.
- Maximum heat input shall not exceed **46.77** MMBtu/hr for both engines.

COMPRESSOR STATION NO. 15 - TAYLOR COUNTY:

Specific Condition No. 1

FROM: The maximum allowable emissions from this source shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	17.6	77.2	2.0 g/bhp-hr
Carbon Monoxide	22.0	96.6	2.5 g/bhp-hr
Volatile Organic Compounds (non-methane)	8.8	38.6	1.0 g/bhp-hr
Particulate Matter (TSP)	0.13	0.6	5 lbs/MMscf
Particulate Matter (PM_{10})	0.13	0.6	5 lbs/MMscf
Sulfur Dioxide	0.75	3.3	10 gr/100scf

TO: The maximum allowable emissions from this source shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	17.6	77.2	2.0 g/bhp-hr
Carbon Monoxide	22.0	96.6	2.5 g/bhp-hr
Volatile Organic Compounds (non-methane)	8.8	38.6	1.0 g/bhp-hr
Particulate Matter (TSP)	0.13	0.6	**4.23** lbs/MMscf
Particulate Matter (PM_{10})	0.13	0.6	**4.23** lbs/MMscf
Sulfur Dioxide	0.75	3.3	**8.53** gr **S**/100scf

Specific Condition No. 5

FROM: The permitted operating parameters and utilization rates for this natural gas compressor engine shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed 26,154 scf/hr.
- Maximum heat input shall not exceed 27.20 MMBtu/hr.

TO: The permitted operating parameters and utilization rates for this natural gas compressor engine shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed **30,943** scf/hr.
- Maximum heat input shall not exceed **32.18** MMBtu/hr.

COMPRESSOR STATION NO. 16 - BRADFORD COUNTY:

Specific Condition No. 1

FROM: The maximum allowable emissions from this source shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	17.6	77.2	2.0 g/bhp-hr
Carbon Monoxide	22.0	96.6	2.5 g/bhp-hr
Volatile Organic Compounds (non-methane)	8.8	38.6	1.0 g/bhp-hr
Particulate Matter (TSP)	0.13	0.6	5 lbs/MMscf
Particulate Matter (PM_{10})	0.13	0.6	5 lbs/MMscf
Sulfur Dioxide	0.75	3.3	10 gr/100scf

TO: The maximum allowable emissions from this source shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	17.6	77.2	2.0 g/bhp-hr
Carbon Monoxide	22.0	96.6	2.5 g/bhp-hr
Volatile Organic Compounds (non-methane)	8.8	38.6	1.0 g/bhp-hr
Particulate Matter (TSP)	0.13	0.6	**3.90** lbs/MMscf
Particulate Matter (PM_{10})	0.13	0.6	**3.90** lbs/MMscf
Sulfur Dioxide	0.75	3.3	**7.80** gr **S**/100scf

Specific Condition No. 5

FROM: The permitted operating parameters and utilization rates for this natural gas compressor engine shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed 26,408 scf/hr.
- Maximum heat input shall not exceed 27.20 MMBtu/hr.

TO: The permitted operating parameters and utilization rates for this natural gas compressor engine shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed **33,833** scf/hr.
- Maximum heat input shall not exceed **34.85** MMBtu/hr.

COMPRESSOR STATION NO. 17 - MARION COUNTY

Specific Condition No. 1

FROM: The maximum allowable emissions from this source shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	10.6	46.3	2.0 g/bhp-hr
Carbon Monoxide	14.8	64.9	2.8 g/bhp-hr
Volatile Organic Compounds (non-methane)	9.0	39.4	1.7 g/bhp-hr
Particulate Matter (TSP)	0.09	0.4	5 lbs/MMscf
Particulate Matter (PM_{10})	0.09	0.4	5 lbs/MMscf
Sulfur Dioxide	0.49	2.2	10 gr/100scf

TO: The maximum allowable emissions from this source shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	10.6	46.3	2.0 g/bhp-hr
Carbon Monoxide	14.8	64.9	2.8 g/bhp-hr
Volatile Organic Compounds (non-methane)	9.0	39.4	1.7 g/bhp-hr
Particulate Matter (TSP)	0.09	0.4	**4.13** lbs/MMscf
Particulate Matter (PM_{10})	0.09	0.4	**4.13** lbs/MMscf
Sulfur Dioxide	0.49	2.2	**8.27** gr **S**/100scf

Specific Condition No. 5

FROM: The permitted operating parameters and utilization rates for this natural gas compressor engine shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed 17,010 scf/hr.
- Maximum heat input shall not exceed 17.52 MMBtu/hr.

TO: The permitted operating parameters and utilization rates for this natural gas compressor engine shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed **20,569** scf/hr.
- Maximum heat input shall not exceed **21.19** MMBtu/hr.

COMPRESSOR STATION NO. 20 - ST. LUCIE COUNTY

FROM: The maximum allowable emissions from this unit shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	10.6	46.3	2.0 g/bhp-hr
Carbon Monoxide	14.8	64.9	2.8 g/bhp-hr
Volatile Organic Compounds (non-methane)	9.0	39.4	1.7 g/bhp-hr
Particulate Matter (TSP)	0.09	0.4	5 lbs/MMscf
Particulate Matter (PM_{10})	0.09	0.4	5 lbs/MMscf
Sulfur Dioxide	0.49	2.0	10 gr/100scf

TO: The maximum allowable emissions from this unit shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	10.6	46.3	2.0 g/bhp-hr
Carbon Monoxide	14.8	64.9	2.8 g/bhp-hr
Volatile Organic Compounds (non-methane)	9.0	39.4	1.7 g/bhp-hr
Particulate Matter (TSP)	0.09	0.4	**4.13** lbs/MMscf
Particulate Matter (PM_{10})	0.09	0.4	**4.13** lbs/MMscf
Sulfur Dioxide	0.49	2.0	**8.27** gr **S**/100scf

Specific Condition No. 5

FROM: The permitted operating parameters and utilization rates for this natural gas compressor engine shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed 17,010 scf/hr.
- Maximum heat input shall not exceed 17.52 MMBtu/hr.

TO: The permitted operating parameters and utilization rates for this natural gas compressor engine shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed **20,569** scf/hr.
- Maximum heat input shall not exceed **21.19** MMBtu/hr.

Expiration Date

The expiration date of the above mentioned permit will be changed from June 30, 1993, to **December 31, 1993.**

This letter must be attached to the above mentioned permits and shall become a part of each permit. If you have any questions, please call Teresa Heron at (904) 488-1344.

Sincerely,

Howard L Rhodes

Howard L. Rhodes
Director
Division of Air Resources
Management

HLR/TH/plm

Attachment to be Incorporated:
Mr. Allan Weatherford's letter of June 29, 1993

cc: E. Middleswart, NWD
Robert Leetch, NED
Charles Collins, CD
Isidore Goldman, SED
Duane Pierce, FGTC
Barry Andrews, ENSR

STATION 17

SILVER SPRINGS, FLORIDA

ENSR PROJECT 6792-071-200 05/27/93 15:28

Station	Model Run Factor	MAXIMUM 1-HR CONCENTRATION (ug/m**3) NOx	CO	VOCs	Particulates	SO2	Maximum Emission (lb/hr) NOx	CO	VOCs	Particulates	SO2
17 Permitted	2.724	28.874	40.315	24.516	0.245	1.335	10.60	14.80	9.00	0.09	0.49
17 Revised	2.234	23.636	33.086	20.084	0.223	1.072	10.58	14.81	8.99	0.10	0.48

Model Run Factor is maximum 1-hr concentration based on emission of 1 lb/hr.
Maximum 1-hr concentrations calculated as (Model Run Factor) X (Maximum Emission).

04-06-93
18:04:43

*** SCREEN-1.1 MODEL RUN ***
*** VERSION DATED 88300 ***

Station 17--Permit--Simple Terrain, no Downwash

SIMPLE TERRAIN INPUTS:

SOURCE TYPE	=	POINT
EMISSION RATE (G/S)	=	.1260
STACK HEIGHT (M)	=	12.19
STK INSIDE DIAM (M)	=	.39
STK EXIT VELOCITY (M/S)	=	57.39
STK GAS EXIT TEMP (K)	=	641.48
AMBIENT AIR TEMP (K)	=	293.00
RECEPTOR HEIGHT (M)	=	.00
IOPT (1=URB,2=RUR)	=	2
BUILDING HEIGHT (M)	=	.00
MIN HORIZ BLDG DIM (M)	=	.00
MAX HORIZ BLDG DIM (M)	=	.00

*** FULL METEOROLOGY ***

****
*** SCREEN AUTOMATED DISTANCES ***
****

*** TERRAIN HEIGHT OF .00 M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	.0000	0	.0	.0	.0	.0	.0	.0	
100.	.1968	3	10.0	10.2	3200.0	25.3	12.7	7.8	NO
200.	2.465	3	10.0	10.2	3200.0	25.3	23.9	14.4	NO
300.	2.667	3	8.0	8.2	2560.0	28.6	34.6	20.9	NO
400.	2.384	3	5.0	5.1	1600.0	38.4	45.3	27.5	NO
500.	2.315	4	10.0	10.3	3200.0	25.2	36.3	18.7	NO
600.	2.218	4	8.0	8.2	2560.0	28.4	43.0	21.7	NO
700.	2.053	4	8.0	8.2	2560.0	28.4	49.4	24.5	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:

252.	2.724	3	10.0	10.2	3200.0	25.3	29.6	17.8	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SUMMARY OF SCREEN MODEL RESULTS ***
****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	2.724	252.	0.

****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
****

04-06-93
18:05:56

*** SCREEN-1.1 MODEL RUN ***
*** VERSION DATED 88300 ***

Station 17--Actual--Simple Terrain, no Downwash

SIMPLE TERRAIN INPUTS:

SOURCE TYPE	=	POINT
EMISSION RATE (G/S)	=	.1260
STACK HEIGHT (M)	=	14.85
STK INSIDE DIAM (M)	=	.44
STK EXIT VELOCITY (M/S)	=	43.62
STK GAS EXIT TEMP (K)	=	641.48
AMBIENT AIR TEMP (K)	=	293.00
RECEPTOR HEIGHT (M)	=	.00
IOPT (1=URB,2=RUR)	=	2
BUILDING HEIGHT (M)	=	.00
MIN HORIZ BLDG DIM (M)	=	.00
MAX HORIZ BLDG DIM (M)	=	.00

*** FULL METEOROLOGY ***

****
*** SCREEN AUTOMATED DISTANCES ***
****

*** TERRAIN HEIGHT OF .00 M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	.0000	0	.0	.0	.0	.0	.0	.0	
100.	.6589E-01	3	10.0	10.4	3200.0	27.7	12.6	7.7	NO
200.	1.778	3	10.0	10.4	3200.0	27.7	23.9	14.4	NO
300.	2.227	3	8.0	8.3	2560.0	30.9	34.6	20.8	NO
400.	2.088	3	5.0	5.2	1600.0	40.5	45.2	27.4	NO
500.	1.997	3	5.0	5.2	1600.0	40.5	55.3	33.3	NO
600.	1.877	4	8.0	8.5	2560.0	30.6	43.0	21.7	NO
700.	1.790	4	8.0	8.5	2560.0	30.6	49.4	24.5	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:

314.	2.234	3	8.0	8.3	2560.0	30.9	36.2	21.7	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SUMMARY OF SCREEN MODEL RESULTS ***
****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	2.234	314.	0.

****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
****

Air Emissions Estimates for Permitting
Station 17 Silver Springs, FL

	NOX (TPY)	CO (TPY)	NMHC (TPY)	SO2 (TPY)	PM (TPY)
Engines					
Compressor Engine 1	212.47	27.04	8.50	1.79	0.31
Compressor Engine 2	212.47	27.04	8.50	1.79	0.31
Compressor Engine 3	212.47	27.04	8.50	1.79	0.31
Compressor Engine 4	212.47	27.04	8.50	1.79	0.31
Compressor Engine 5	46.36	64.90	39.40	2.09	0.41
Emergency Generator Engine No. 1	3.83	0.35	0.17	0.02	0.00
Emergency Generator Engine No. 2	3.83	0.35	0.17	0.02	0.00
Air Compressor Engine No. 1	0.13	0.74	0.01	0.00	0.00
Air Compressor Engine No. 2 (Electric)	0.00	0.00	0.00	0.00	0.00
Air Compressor Engine No. 3 (Electric)	0.00	0.00	0.00	0.00	0.00
Tanks					
Oil & Water Separator No. 1	0.00	0.00	0.15	0.00	0.00
Oil & Water Separator No. 2	0.00	0.00	0.14	0.00	0.00
Pipeline Condensate Tank No. 1	0.00	0.00	0.14	0.00	0.00
Lube Oil Storage Tank No. 1	0.00	0.00	0.01	0.00	0.00
Lube Oil Storage Tank No. 2	0.00	0.00	0.00	0.00	0.00
Lube Oil Rundown Tank No. 1	0.00	0.00	0.00	0.00	0.00
Waste Oil Tank No. 1	0.00	0.00	0.00	0.00	0.00
Cleaning Machines					
Parts Cleaner No. 1	0.00	0.00	0.15	0.00	0.00
Parts Cleaner No. 2	0.00	0.00	0.07	0.00	0.00
Paint Cleaner No. 1	0.00	0.00	0.03	0.00	0.00
Blowdown					
ESD and Maintenance Blowdowns	0.00	0.00	1.60	0.00	0.00
Fugitive Emissions					
Fugitive Emissions	0.00	0.00	?	0.00	0.00
Total Emissions (except for "?" indicated items)	904.03	174.50	76.04	9.29	1.65

Engine Emission Calculation Worksheet
Station 17; Silver Springs, FL

Emergency Generator Engine 1

Engine data	
Annual use (maximum); hr./yr.	400 hr./yr.
Power; Hp	395 Hp
Power; Btu/hr. (@ 8026 (Btu/hr.)/Hp)	3170270 Btu/hr.
Fuel consumption; scf/hr. (@ 1040 Btu/scf)	3048 scf/hr.
Emission factors	
NOx	22.0 g/Hp-hr.
CO	2.0 g/Hp-hr.
NMHC	1.0 g/Hp-hr.
SO2	0.1 grains/scf
PM	5.0 lb/MMscf
Calculated emissions	
NOx	3.83 TPY
CO	0.35 TPY
NMHC	0.17 TPY
SO2	0.02 TPY
PM	0.00 TPY

Engine Emission Calculation Worksheet
Station 17; Silver Springs, FL

Emergency Generator Engine 2

Engine data

Annual use (maximum); hr./yr.	400 hr./yr.
Power; Hp	395 Hp
Power; Btu/hr. (@ 8026 (Btu/hr.)/Hp)	3170270 Btu/hr.
Fuel consumption; scf/hr. (@ 1040 Btu/scf)	3048 scf/hr.

Emission factors

NOx	22.0 g/Hp-hr.
CO	2.0 g/Hp-hr.
NMHC	1.0 g/Hp-hr.
SO2	0.1 grains/scf
PM	5.0 lb/MMscf

Calculated emissions

NOx	3.83 TPY
CO	0.35 TPY
NMHC	0.17 TPY
SO2	0.02 TPY
PM	0.00 TPY

Engine Emission Calculation Worksheet
Station 17; Silver Springs, FL

Air Compressor Engine 1

Engine data	
Annual use (maximum); hr./yr.	325 hr./yr.
Power; Hp	46 Hp
Power; Btu/hr. (@ 8026 (Btu/hr.)/Hp)	369196 Btu/hr.
Fuel consumption; scf/hr. (@ 1040 Btu/scf)	355 scf/hr.
Emission factors	
NOx	8.0 g/Hp-hr.
CO	45.0 g/Hp-hr.
NMHC	0.5 g/Hp-hr.
SO2	0.1 grains/scf
PM	5.0 lb/MMscf
Calculated emissions	
NOx	0.13 TPY
CO	0.74 TPY
NMHC	0.01 TPY
SO2	0.00 TPY
PM	0.00 TPY

FIXED ROOF TANK VOLATILE ORGANIC COMPOUND EMISSIONS (Rev. 6/90)

CLIENT: Florida Gas Transmission DATE: 05/06/93

LOCATION: Station 17 JOB NO:

CALCULATED USING AP-42, FOURTH EDITION SEP. 85, EQUATIONS 4.3-(1)&(2)

TANK PHYSICAL DATA		
TANK IDENTIFICATION NUMBER	Oil & Water Separator 1	
EMISSION CONTROLS	None	
PERCENT EFFICIENCY		0 %
TANK PAINT COLOR	Black	
TANK DIAMETER (FT), D		10.0
TANK HEIGHT (FT), H		15.0
PAINT FACTOR, FsubP		1.58
TANK CAPACITY (BBLS), VB		210
TANK CAPACITY (GALLONS), V		8820
ADJUSTMENT FACTOR FOR DIA., C		0.53
WEATHER DATA	Gainsville	
AVG. DAILY TEMP. CHANGE (DEG F), DeltaT		20.0
STORAGE TEMP. (DEG. F)		73.8
AVG. ATM. PRESS. (PSIA), PsubA		14.7
PRODUCT PHYSICAL DATA		
MATERIAL STORED	Oily Wastewater	
MOLECULAR WEIGHT (#/#MOLE) MsubV		53.00
VAPOR PRESS. AT STG. TEMP. (DEG. F), P		2.80
PRODUCT FACTOR, KsubC (CRUDE 0.65, OTHER 1.0)		1.00
THROUGHPUT DATA		
DAYS IN SERVICE, DsubS		365
VAPOR SPACE HEIGHT (FT), VH		7.50
TANK THROUGHPUT (BBLS FOR DAYS IN SERVICE), TT		369.05
FILLING RATE (BBLS/HR), FR		128.57
NUMBER OF TURNOVERS FOR DAYS IN SERVICE, N		1.8
TURNOVER FACTOR, KsubN		1.00

FIXED ROOF TANK BREATHING LOSS, # LsubB =
2.26x10-2*(MsubV)*(P/(PsubA-P)) EXP 0.68*(D)EXP 1.73*(VH)EXP 0.51*
(DeltaT)EXP 0.5*(FsubP)*(C)*(KsubC)*DsubS/365*(100-%eff)/100

FIXED ROOF TANK WORKING LOSS, # LsubW =
2.4 EXP-05*MsubV*P*V*N*KsubN*KsubC*(100-%eff)/100

VOLATILE ORGANIC COMPOUND LOSSES		BREATHING	WORKING	TOTAL
POUNDS FOR DAYS SERVICE	=	252	55	307
TONS FOR DAYS SERVICE	=	0.13	0.03	0.15
ANNUALIZED POUNDS	=	252	55	307
ANNUALIZED TONS	=	0.13	0.03	0.15
POUND/HR (AVG)	=	0.03	0.01	0.04
MAXIMUM EMISSION RATE (#/HR)	=	0.06	19.26	19.32

FIXED ROOF TANK VOLATILE ORGANIC COMPOUND EMISSIONS (Rev. 6/90)

CLIENT: Florida Gas Transmission DATE: 04/27/93

LOCATION: Station 17 JOB NO:

CALCULATED USING AP-42, FOURTH EDITION SEP. 85, EQUATIONS 4.3-(1)&(2)

TANK PHYSICAL DATA		
TANK IDENTIFICATION NUMBER	Oil & Water Separator 2	
EMISSION CONTROLS	None	
PERCENT EFFICIENCY		0 %
TANK PAINT COLOR	Black	
TANK DIAMETER (FT), D		10.0
TANK HEIGHT (FT), H		15.0
PAINT FACTOR, FsubP		1.58
TANK CAPACITY (BBLS), VB		210
TANK CAPACITY (GALLONS), V		8820
ADJUSTMENT FACTOR FOR DIA., C		0.53
WEATHER DATA	Gainsville	
AVG. DAILY TEMP. CHANGE (DEG F), DeltaT		20.0
STORAGE TEMP. (DEG. F)		73.8
AVG. ATM. PRESS. (PSIA), PsubA		14.7 *
PRODUCT PHYSICAL DATA		
MATERIAL STORED	Oily Wastewater	
MOLECULAR WEIGHT (#/#MOLE) MsubV		53.00
VAPOR PRESS. AT STG. TEMP. (DEG. F), P		2.80
PRODUCT FACTOR, KsubC (CRUDE 0.65, OTHER 1.0)		1.00
THROUGHPUT DATA		
DAYS IN SERVICE, DsubS		365
VAPOR SPACE HEIGHT (FT), VH		7.50
TANK THROUGHPUT (BBLS FOR DAYS IN SERVICE), TT		202.40
FILLING RATE (BBLS/HR), FR		128.60
NUMBER OF TURNOVERS FOR DAYS IN SERVICE, N		1.0
TURNOVER FACTOR, KsubN		1.00

FIXED ROOF TANK BREATHING LOSS, # LsubB =
2.26x10-2*(MsubV)*(P/(PsubA-P)) EXP 0.68*(D)EXP 1.73*(VH)EXP 0.51*
(DeltaT)EXP 0.5*(FsubP)*(C)*(KsubC)*DsubS/365*(100-%eff)/100

FIXED ROOF TANK WORKING LOSS, # LsubW =
2.4 EXP-05*MsubV*P*V*N*KsubN*KsubC*(100-%eff)/100

VOLATILE ORGANIC COMPOUND LOSSES		BREATHING	WORKING	TOTAL
POUNDS FOR DAYS SERVICE	=	252	30	282
TONS FOR DAYS SERVICE	=	0.13	0.02	0.14
ANNUALIZED POUNDS	=	252	30	282
ANNUALIZED TONS	=	0.13	0.02	0.14
POUND/HR (AVG)	=	0.03	0.00	0.03
MAXIMUM EMISSION RATE (#/HR)	=	0.06	19.16	19.22

FIXED ROOF TANK VOLATILE ORGANIC COMPOUND EMISSIONS (Rev. 6/90)

CLIENT: Florida Gas Transmission DATE: 04/27/93

LOCATION: Station 17 JOB NO:

CALCULATED USING AP-42, FOURTH EDITION SEP. 85, EQUATIONS 4.3-(1)&(2)

TANK PHYSICAL DATA		
TANK IDENTIFICATION NUMBER	Condensate 1	
EMISSION CONTROLS	None	
PERCENT EFFICIENCY		0 %
TANK PAINT COLOR	Black	
TANK DIAMETER (FT), D		10.0
TANK HEIGHT (FT), H		15.0
PAINT FACTOR, FsubP		1.58
TANK CAPACITY (BBLS), VB		210
TANK CAPACITY (GALLONS), V		8820
ADJUSTMENT FACTOR FOR DIA., C		0.53
WEATHER DATA	Gainsville	
AVG. DAILY TEMP. CHANGE (DEG F), DeltaT		20.0
STORAGE TEMP. (DEG. F)		73.8
AVG. ATM. PRESS. (PSIA), PsubA		14.7
PRODUCT PHYSICAL DATA		
MATERIAL STORED	Condensate	
MOLECULAR WEIGHT (#/#MOLE) MsubV		53.00
VAPOR PRESS. AT STG. TEMP. (DEG. F), P		2.80
PRODUCT FACTOR, KsubC (CRUDE 0.65, OTHER 1.0)		1.00
THROUGHPUT DATA		
DAYS IN SERVICE, DsubS		365
VAPOR SPACE HEIGHT (FT), VH		7.50
TANK THROUGHPUT (BBLS FOR DAYS IN SERVICE), TT		130.95
FILLING RATE (BBLS/HR), FR		128.60
NUMBER OF TURNOVERS FOR DAYS IN SERVICE, N		0.6
TURNOVER FACTOR, KsubN		1.00

FIXED ROOF TANK BREATHING LOSS, # LsubB =
2.26x10-2*(MsubV)*(P/(PsubA-P)) EXP 0.68*(D)EXP 1.73*(VH)EXP 0.51*
(DeltaT)EXP 0.5*(FsubP)*(C)*(KsubC)*DsubS/365*(100-%eff)/100

FIXED ROOF TANK WORKING LOSS, # LsubW =
2.4 EXP-05*MsubV*P*V*N*KsubN*KsubC*(100-%eff)/100

VOLATILE ORGANIC COMPOUND LOSSES		BREATHING	WORKING	TOTAL
POUNDS FOR DAYS SERVICE	=	252	19	271
TONS FOR DAYS SERVICE	=	0.13	0.01	0.14
ANNUALIZED POUNDS	=	252	19	271
ANNUALIZED TONS	=	0.13	0.01	0.14
POUND/HR (AVG)	=	0.03	0.00	0.03
MAXIMUM EMISSION RATE (#/HR)	=	0.06	19.13	19.18

FIXED ROOF TANK VOLATILE ORGANIC COMPOUND EMISSIONS (Rev. 6/90)

CLIENT: Florida Gas Transmission DATE: 05/14/93

LOCATION: Station 17 JOB NO:

CALCULATED USING AP-42, FOURTH EDITION SEP. 85, EQUATIONS 4.3-(1)&(2)

TANK PHYSICAL DATA		
TANK IDENTIFICATION NUMBER	Lube Oil Storage Tank #1	
EMISSION CONTROLS	None	
PERCENT EFFICIENCY		0 %
TANK PAINT COLOR	White	
TANK DIAMETER (FT), D		17.9
TANK HEIGHT (FT), H		7.0
PAINT FACTOR, FsubP		1.15
TANK CAPACITY (BBLS), VB		238
TANK CAPACITY (GALLONS), V		10000
ADJUSTMENT FACTOR FOR DIA., C		0.83
WEATHER DATA	Gainsville	
AVG. DAILY TEMP. CHANGE (DEG F), DeltaT		20.0
STORAGE TEMP. (DEG. F)		68.8
AVG. ATM. PRESS. (PSIA), PsubA		14.7
PRODUCT PHYSICAL DATA		
MATERIAL STORED	Lube Oil	
MOLECULAR WEIGHT (#/#MOLE) MsubV		190.00
VAPOR PRESS. AT STG. TEMP. (DEG. F), P		0.0019
PRODUCT FACTOR, KsubC (CRUDE 0.65, OTHER 1.0)		1.00
THROUGHPUT DATA		
DAYS IN SERVICE, DsubS		365
VAPOR SPACE HEIGHT (FT), VH		3.50
TANK THROUGHPUT (BBLS FOR DAYS IN SERVICE), TT		285.7
FILLING RATE (BBLS/HR), FR		
NUMBER OF TURNOVERS FOR DAYS IN SERVICE, N		1.2
TURNOVER FACTOR, KsubN		1.00

FIXED ROOF TANK BREATHING LOSS, # LsubB =
2.26x10-2*(MsubV)*(P/(PsubA-P)) EXP 0.68*(D)EXP 1.73*(VH)EXP 0.51*
(DeltaT)EXP 0.5*(FsubP)*(C)*(KsubC)*DsubS/365*(100-%eff)/100

FIXED ROOF TANK WORKING LOSS, # LsubW =
2.4 EXP-05*MsubV*P*V*N*KsubN*KsubC*(100-%eff)/100

VOLATILE ORGANIC COMPOUND LOSSES		BREATHING	WORKING	TOTAL
POUNDS FOR DAYS SERVICE	=	12	0	12
TONS FOR DAYS SERVICE	=	0.01	0.00	0.01
ANNUALIZED POUNDS	=	12	0	12
ANNUALIZED TONS	=	0.01	0.00	0.01
POUND/HR (AVG)	=	0.00	0.00	0.00
MAXIMUM EMISSION RATE (#/HR)	=			

Effective Diameter for a Horizontal Fixed Roof Tank
(From Supplement E of AP-42)

FGT Station 17
Lube Oil Storage Tank No. 1

Tank Measurements	
Length of Tank (ft) - L	36
Actual Diameter of Tank (ft) - D	7
Calculated Values	
Effective Tank Diameter (ft) - Deff	17.9
Vapor Space Outage (ft) - Hvo	3.5

Equations:

Deff = SQRT(L*D/0.785) Equation 1-5 of Chapter 12

Hvo = D/2 Equation 1-6 of Chapter 12

FIXED ROOF TANK VOLATILE ORGANIC COMPOUND EMISSIONS (Rev. 6/90)

CLIENT: Florida Gas Transmission DATE: 05/14/93

LOCATION: Station 17 JOB NO:

CALCULATED USING AP-42, FOURTH EDITION SEP. 85, EQUATIONS 4.3-(1)&(2)

TANK PHYSICAL DATA		
TANK IDENTIFICATION NUMBER	Lube Oil Storage Tank #2	
EMISSION CONTROLS	None	
PERCENT EFFICIENCY		0 %
TANK PAINT COLOR	Primer	
TANK DIAMETER (FT), D		12.4
TANK HEIGHT (FT), H		5.0
PAINT FACTOR, FsubP		1.44
TANK CAPACITY (BBLS), VB		84
TANK CAPACITY (GALLONS), V		3528
ADJUSTMENT FACTOR FOR DIA., C		0.65
WEATHER DATA	Gainsville	
AVG. DAILY TEMP. CHANGE (DEG F), DeltaT		20.0
STORAGE TEMP. (DEG. F)		73.8
AVG. ATM. PRESS. (PSIA), PsubA		14.7
PRODUCT PHYSICAL DATA		
MATERIAL STORED	Lube Oil	
MOLECULAR WEIGHT (#/#MOLE) MsubV		190.00
VAPOR PRESS. AT STG. TEMP. (DEG. F), P		0.0019
PRODUCT FACTOR, KsubC (CRUDE 0.65, OTHER 1.0)		1.00
THROUGHPUT DATA		
DAYS IN SERVICE, DsubS		365
VAPOR SPACE HEIGHT (FT), VH		2.50
TANK THROUGHPUT (BBLS FOR DAYS IN SERVICE), TT		95.2
FILLING RATE (BBLS/HR), FR		
NUMBER OF TURNOVERS FOR DAYS IN SERVICE, N		1.14
TURNOVER FACTOR, KsubN		1.00

FIXED ROOF TANK BREATHING LOSS, # LsubB =
2.26x10-2*(MsubV)*(P/(PsubA-P)) EXP 0.68*(D)EXP 1.73*(VH)EXP 0.51*
(DeltaT)EXP 0.5*(FsubP)*(C)*(KsubC)*DsubS/365*(100-%eff)/100

FIXED ROOF TANK WORKING LOSS, # LsubW =
2.4 EXP-05*MsubV*P*V*N*KsubN*KsubC*(100-%eff)/100

VOLATILE ORGANIC COMPOUND LOSSES		BREATHING	WORKING	TOTAL
POUNDS FOR DAYS SERVICE	=	5	0	5
TONS FOR DAYS SERVICE	=	0.00	0.00	0.00
ANNUALIZED POUNDS	=	5	0	5
ANNUALIZED TONS	=	0.00	0.00	0.00
POUND/HR (AVG)	=	0.00	0.00	0.00
MAXIMUM EMISSION RATE (#/HR)	=			

Effective Diameter for a Horizontal Fixed Roof Tank
(From Supplement E of AP-42)

FGT Station 17
Lube Oil Storage Tank No. 2

Tank Measurements	
Length of Tank (ft) - L	24
Actual Diameter of Tank (ft) - D	5
Calculated Values	
Effective Tank Diameter (ft) - Deff	12.4
Vapor Space Outage (ft) - Hvo	2.5

Equations:

Deff = SQRT(L*D/0.785) Equation 1-5 of Chapter 12

Hvo = D/2 Equation 1-6 of Chapter 12

FIXED ROOF TANK VOLATILE ORGANIC COMPOUND EMISSIONS (Rev. 6/90)

CLIENT: Florida Gas Transmission DATE: 05/14/93

LOCATION: Station 17 JOB NO:

CALCULATED USING AP-42, FOURTH EDITION SEP. 85, EQUATIONS 4.3-(1)&(2)

TANK PHYSICAL DATA		
TANK IDENTIFICATION NUMBER	Lube Oil Rundown Tank #1	
EMISSION CONTROLS	None	
PERCENT EFFICIENCY		0 %
TANK PAINT COLOR	White	
TANK DIAMETER (FT), D		7.5
TANK HEIGHT (FT), H		4.0
PAINT FACTOR, FsubP		1.00
TANK CAPACITY (BBLS), VB		25
TANK CAPACITY (GALLONS), V		1050
ADJUSTMENT FACTOR FOR DIA., C		0.37
WEATHER DATA	Gainsville	
AVG. DAILY TEMP. CHANGE (DEG F), DeltaT		20.0
STORAGE TEMP. (DEG. F)		68.8
AVG. ATM. PRESS. (PSIA), PsubA		14.7
PRODUCT PHYSICAL DATA		
MATERIAL STORED	Lube Oil	
MOLECULAR WEIGHT (#/#MOLE) MsubV		190.00
VAPOR PRESS. AT STG. TEMP. (DEG. F), P		0.0019
PRODUCT FACTOR, KsubC (CRUDE 0.65, OTHER 1.0)		1.00
THROUGHPUT DATA		
DAYS IN SERVICE, DsubS		365
VAPOR SPACE HEIGHT (FT), VH		2.00
TANK THROUGHPUT (BBLS FOR DAYS IN SERVICE), TT		11.9
FILLING RATE (BBLS/HR), FR		
NUMBER OF TURNOVERS FOR DAYS IN SERVICE, N		0.48
TURNOVER FACTOR, KsubN		1.00

FIXED ROOF TANK BREATHING LOSS, # LsubB =
2.26x10-2*(MsubV)*(P/(PsubA-P)) EXP 0.68*(D)EXP 1.73*(VH)EXP 0.51*
(DeltaT)EXP 0.5*(FsubP)*(C)*(KsubC)*DsubS/365*(100-%eff)/100

FIXED ROOF TANK WORKING LOSS, # LsubW =
2.4 EXP-05*MsubV*P*V*N*KsubN*KsubC*(100-%eff)/100

VOLATILE ORGANIC COMPOUND LOSSES		BREATHING	WORKING	TOTAL
POUNDS FOR DAYS SERVICE	=	1	0	1
TONS FOR DAYS SERVICE	=	0.00	0.00	0.00
ANNUALIZED POUNDS	=	1	0	1
ANNUALIZED TONS	=	0.00	0.00	0.00
POUND/HR (AVG)	=	0.00	0.00	0.00
MAXIMUM EMISSION RATE (#/HR)	=			

Effective Diameter for a Horizontal Fixed Roof Tank
(From Supplement E of AP-42)

FGT Station 17
Lube Oil Rundown No. 1

Tank Measurements	
Length of Tank (ft) - L	11
Actual Diameter of Tank (ft) - D	4
Calculated Values	
Effective Tank Diameter (ft) - Deff	7.5
Vapor Space Outage (ft) - Hvo	2

Equations:	Deff = SQRT(L*D/0.785)	Equation 1-5 of Chapter 12
	Hvo = D/2	Equation 1-6 of Chapter 12

FIXED ROOF TANK VOLATILE ORGANIC COMPOUND EMISSIONS (Rev. 6/90)

CLIENT: Florida Gas Transmission DATE: 04/27/93

LOCATION: Station 17 JOB NO:

CALCULATED USING AP-42, FOURTH EDITION SEP. 85, EQUATIONS 4.3-(1)&(2)

TANK PHYSICAL DATA		
TANK IDENTIFICATION NUMBER	Waste Oil Tank 1	
EMISSION CONTROLS	None	
PERCENT EFFICIENCY		0 %
TANK PAINT COLOR	Black	
TANK DIAMETER (FT), D		7.9
TANK HEIGHT (FT), H		10.0
PAINT FACTOR, FsubP		1.58
TANK CAPACITY (BBLS), VB		90
TANK CAPACITY (GALLONS), V		3780
ADJUSTMENT FACTOR FOR DIA., C		0.41
WEATHER DATA	Gainsville	
AVG. DAILY TEMP. CHANGE (DEG F), DeltaT		20.0
STORAGE TEMP. (DEG. F)		73.8
AVG. ATM. PRESS. (PSIA), PsubA		14.7
PRODUCT PHYSICAL DATA		
MATERIAL STORED	Waste oil	
MOLECULAR WEIGHT (#/#MOLE) MsubV		190.00
VAPOR PRESS. AT STG. TEMP. (DEG. F), P		0.0019
PRODUCT FACTOR, KsubC (CRUDE 0.65, OTHER 1.0)		1.00
THROUGHPUT DATA		
DAYS IN SERVICE, DsubS		365
VAPOR SPACE HEIGHT (FT), VH		5.00
TANK THROUGHPUT (BBLS FOR DAYS IN SERVICE), TT		85.70
FILLING RATE (BBLS/HR), FR		128.60
NUMBER OF TURNOVERS FOR DAYS IN SERVICE, N		1.0
TURNOVER FACTOR, KsubN		1.00

FIXED ROOF TANK BREATHING LOSS, # LsubB =
2.26x10-2*(MsubV)*(P/(PsubA-P)) EXP 0.68*(D)EXP 1.73*(VH)EXP 0.51*
(DeltaT)EXP 0.5*(FsubP)*(C)*(KsubC)*DsubS/365*(100-%eff)/100

FIXED ROOF TANK WORKING LOSS, # LsubW =
2.4 EXP-05*MsubV*P*V*N*KsubN*KsubC*(100-%eff)/100

VOLATILE ORGANIC COMPOUND LOSSES		BREATHING	WORKING	TOTAL
POUNDS FOR DAYS SERVICE	=	2	0	2
TONS FOR DAYS SERVICE	=	0.00	0.00	0.00
ANNUALIZED POUNDS	=	2	0	2
ANNUALIZED TONS	=	0.00	0.00	0.00
POUND/HR (AVG)	=	0.00	0.00	0.00
MAXIMUM EMISSION RATE (#/HR)	=	0.00	0.05	0.05

Cleaning Machines Calculation Worksheet
Station 17 Silver Springs, FL

	Gal Solvent Used in 1991	Weighting Factor for Allocating Emissions	VOC Emissions (lb/yr)	VOC Emissions (Tons/yr)
Parts No. 1	210	0.618	309	0.15
Parts No. 2	90	0.265	132	0.07
Paint No. 1	40	0.118	59	0.03
Total	340	1.000	500	0.25

Notes:

Pounds of estimated makeup during year for the 3 cleaning machines: 500

Assumption for air emissions calculations is that all of the material requiring makeup evaporated.

The total assumed emission is allocated among the units based on the total material used during the year (including changed-out material).

Calculation of annual HC emissions from blowdowns
(for a typical station)

unmetered gas released (due to blowdowns)	300	Mscf/mo.
unmetered gas released (due to blowdowns)	3.6	MMscf/yr.
unmetered gas released (due to blowdowns) (@21.98 scf/lb)	0.16	MMlb/yr.
unmetered gas released (due to blowdowns) (@21.98 scf/lb)	81.89	TPY
VOCs released (due to blowdowns) (@2% VOCs)	1.64	TPY

Phase I Station Characteristics

05-Jun-92
CS17.WK1

Compressor Station: Number 17
Name: Silver Springs
County: Marion
Nearest City: Silver Springs
Compressor Supervisor: Leroy Coker
Mailing Address: Box 337
Silver Springs, Florida 32688-0337
Telephone: 904-685-2421
Latitude: 29-17-47
Longitude: 81-50-08
UTM Zone: 17
UTM Easting: 418.84 km
UTM Northing: 3,240.90 km
Elevation (ft): 92

Phase I Engine Characteristics

Engine Identification	1	2	3	4
Permit Number				
Serial Number	7023	7022	7021	7020
Operating Time				
Hours/Day	24	24	24	24
Days/Week	7	7	7	7
Weeks/Year	52	52	52	52
Engine Type	Recip	Recip	Recip	Recip
Date of Installation	1966	1966	1966	1966
Engine Make	Cooper	Cooper	Cooper	Cooper
Engine Model	LS-8-SG	LS-8-SG	LS-8-SG	LS-8-SG
Horsepower Rating	2000	2000	2000	2000
Air Charging	Turbo.	Turbo.	Turbo.	Turbo.
Exhaust Temperature (F)	875	875	875	875
Mass Flow Rate (lbs/hr) (a)	21000	21000	21000	21000
Volumetric Flow Rate (acfm)	11760	11760	11760	11760
Volumetric Flow Rate (dscfm)	4279	4279	4279	4279
Exit Velocity (af/s)	154.5	154.5	154.5	154.5
Water Vapor Content (%)	8	8	8	8
Ave. Fuel Consumption (MMCF/Hr) (b)	0.0146	0.0146	0.0146	0.0146
Max. Fuel Consumption (MMCF/Hr) (b)	0.0146	0.0146	0.0146	0.0146
Specific Fuel Consump. (BTU/bhp-hr)	6200	6200	6200	6200
Maximum Heat Input (MMBTU/Hr)	12	12	12	12
Stack Height (ft)	28.17	28.17	28.17	28.17
Stack Diameter (in)	15.25	15.25	15.25	15.25
Stack to Building Offset (ft)	17.00	17.00	17.00	17.00
Building Height (ft) (c)	31.75			
Building Length (ft) (c)	~~155.00~~ 191	← same	← same	← same
Building Width (ft) (c)	55.00			

Phase I Fuel Characteristics

Fuel Type	N.G.	N.G.	N.G.	N.G.
Heating Value (BTU/CF)	1030	1030	1030	1030
Heat Capacity (BTU/lb)	22637	22637	22637	22637
Density (lb/cubic ft)	0.0455	0.0455	0.0455	0.0455
Percent Sulfur (%) (d)	0.031	0.031	0.031	0.031
Percent Ash (%)	N/A	N/A	N/A	N/A

Phase I Emissions Rates by Engine for Station 17

Engine Identification	1	2	3	4
Grams/BHP–Hour				
NOX	11.000	11.000	11.000	11.000
CO	1.400	1.400	1.400	1.400
NMHC	0.440	0.440	0.440	0.440
SO2 (e)	0.093	0.093	0.093	0.093
PM (f)	0.016	0.016	0.016	0.016
Pounds/Hour				
NOX	48.51	48.51	48.51	48.51
CO	6.17	6.17	6.17	6.17
NMHC	1.94	1.94	1.94	1.94
SO2	0.41	0.41	0.41	0.41
PM	0.07	0.07	0.07	0.07
Tons/Year				
NOX	212.47	212.47	212.47	212.47
CO	27.04	27.04	27.04	27.04
NMHC	8.50	8.50	8.50	8.50
SO2	1.79	1.79	1.79	1.79
PM	0.31	0.31	0.31	0.31

Phase I Emissions Rates for Total Station

Grams/BHP–Hour	
NOX	11.000
CO	1.400
NMHC	0.440
SO2	0.093
PM	0.016
Pounds/Hour	
NOX	194.04
CO	24.70
NMHC	7.76
SO2	1.63
PM	0.29
Tons/Year	
NOX	849.90
CO	108.17
NMHC	34.00
SO2	7.16
PM	1.25

SOURCE CLASSIFICATION WITH RESPECT TO PSD

MAJOR SOURCE

Notes:
(a) Wet mass flow (@ 60 F, 14.7 psi).
(b) Based on heating value of fuel gas.
(c) All engines enclosed in one building.
(d) Percent by weight.
(e) Based on 10 grains/SCF.
(f) Based AP–42 factor of 5 lbs/MMSCF.

Phase II Station Characteristics

Compressor Station:	Number 17
Name:	Silver Springs
County:	Marion
Nearest City:	Silver Springs
Compressor Supervisor:	Leroy Coker
Mailing Address:	Box 337
	Silver Springs, Florida 32688–0337
Telephone:	904–685–2421
Latitude:	29–17–47
Longitude:	81–50–08
UTM Zone:	17
UTM Easting:	418.84 km
UTM Northing:	3,240.90 km
Elevation (ft):	92

Phase II Engine Characteristics

Engine Identification	5
Permit Number	
Serial Number	412KVSRA226AP
Operating Time	
Hours/Day	24
Days/Week	7
Weeks/Year	52
Engine Type	Recip
Date of Installation	1991
Engine Make	Dresser–Rand
Engine Model	412–KVSR
Horsepower Rating	2400
Air Charging	Turbo.
Exhaust Temperature (F)	695
Mass Flow Rate (lbs/hr) (a)	29622
Volumetric Flow Rate (acfm)	14355
Volumetric Flow Rate (dscfm)	6036
Exit Velocity (af/s)	143.23
Water Vapor Content (%)	8
Ave. Fuel Consumption (MMCF/Hr) (b)	0.0169
Max. Fuel Consumption (MMCF/Hr) (b)	0.0169
Specific Fuel Consump. (BTU/bhp–hr)	7300
Maximum Heat Input (MMBTU/Hr)	17.52
Stack Height (ft)	48.71
Stack Diameter (in)	17.5
Stack to Building Offset (ft)	17.00
Building Height (ft) (c)	31.75
Building Length (ft) (c)	~~105.00~~ 191
Building Width (ft) (c)	55.00

Phase II Fuel Characteristics

Fuel Type	N.G.
Heating Value (BTU/CF)	1030
Heat Capacity (BTU/lb)	22637
Density (lb/cubic ft)	0.0455
Percent Sulfur (%) (d)	0.031
Percent Ash (%)	N/A

Phase II Emissions Rates by Engine for Station 17

Engine Identification		5
Grams/BHP-Hour		
	NOX	2.000
	CO	2.800
	NMHC	1.700
	SO2 (e)	0.090
	PM (f)	0.018
Pounds/Hour		
	NOX	10.58
	CO	14.82
	NMHC	9.00
	SO2	0.48
	PM	0.09
Tons/Year		
	NOX	46.36
	CO	64.90
	NMHC	39.40
	SO2	2.09
	PM	0.41

Phase II Emissions Rates for Total Station

Grams/BHP-Hour		
	NOX	8.923
	CO	1.723
	NMHC	0.731
	SO2	0.092
	PM	0.017
Pounds/Hour		
	NOX	204.62
	CO	39.51
	NMHC	16.76
	SO2	2.11
	PM	0.38
Tons/Year		
	NOX	896.25
	CO	173.07
	NMHC	73.40
	SO2	9.24
	PM	1.66

SOURCE CLASSIFICATION WITH RESPECT TO PSD

MAJOR SOURCE

Florida Gas Transmission Company
P. O. Box 945100 Maitland, Florida 32794-5100 (407) 875-5800

June 29, 1993

VIA FEDERAL EXPRESS
(overnight delivery)

Mr. Clair Fancy, P.E.
Chief, Bureau of Air Regulation
Florida Department of Environmental Regulation
2600 Blair Stone Road
Tallahassee, FL 32399-2400

RECEIVED 1993 JUN 30 AM 10:16 DER - MAIL ROOM

Dear Mr. Fancy:

RE: Request for Amendments and Extensions to Air Construction Permits

Permit No. AC57-188869
Florida Gas Transmission Company, Station 12 ← This file contains all the attachments related to this correspondence.
Munson, Santa Rosa County, Florida

Permit No. AC67-189220
Florida Gas Transmission Company, Station 13
Caryville, Washington County, Florida

Permit No. AC20-189438
Florida Gas Transmission Company, Station 14
Quincy, Gadsden County, Florida

Permit No. AC62-189439
Florida Gas Transmission Company, Station 15
Perry, Taylor County, Florida

Permit No. AC04-189454
Florida Gas Transmission Company, Station 16
Brooker, Bradford County, Florida

Permit No. AC42-189455
Florida Gas Transmission Company, Station 17
Salt Springs, Marion County, Florida

Permit No. AC48-189456
Florida Gas Transmission Company, Station 18
Orlando, Orange County, Florida

Permit No. AC05-189665
Florida Gas Transmission Company, Station 19
Melbourne, Brevard County, Florida

Permit No. AC56-189457
Florida Gas Transmission Company, Station 20
Ft. Pierce, St. Lucie County, Florida

On May 27, 1993, Florida Gas Transmission Company (FGT) submitted Certificates of Completion of Construction to the appropriate district offices to obtain operating permits for

Department of Environmental Regulation

Routing and Transmittal Slip

To: (Name, Office, Location) ① ~~[illegible]~~ ② Patty - file

1. ~~Preston Lewis, P.E. III~~
2. ARM BAR Permit
3. TL II
4.

Remarks:

RECEIVED

JUN 11 1993

Division of Air
Resources Management

From: Alan Zahm	Date 6/10/93
	Phone

Florida Department of Environmental Regulation

Central District • 3319 Maguire Boulevard, Suite 232 • Orlando, Florida 32803-3767

Lawton Chiles, Governor

~~Carol M. Browner, Secretary~~

COMPLETENESS SUMMARY AIR POLLUTION SOURCES

SOURCE NAME: Station 18 (AC48-189456)
Station 17 (AC42-189455)
Station 19 (AC05-189665)

DATE RECEIVED: 6/1/93

NAME: Alan Weatherford, Compliance Environmentalist

DATE REVIEWED: 6/9/92

ADDRESS: Florida Gas Transmission Co.
P.O. Box 945100
Maitland, Fl 32794-5100

REVIEWED BY: John Turner
(AO48-232110)
(AO42-232109)
(AO05-232111)

Your application for a permit to operate this referenced project has been received and reviewed for completeness. The following items are needed from your professional engineer to complete your application.

1. Submit the heat input rates (MMBTU/hr) during the compliance testing. If any permit limit is exceeded, submit evidence the construction permit has been modified such that compliance is shown. Copy Mr. Preston Lewis, DER Tallahassee, on the application package and advise him of any change in engine size, heat input rate, potential emissions or other factor.

2. Submit page two of the revised construction application signed by the professional engineer.

Pursuant to Section 120.60(2) F.S., the Department may deny an application if the applicant, after receiving timely notice fails to correct errors, omissions or supply additional information within a reasonable period of time.

If you have any questions, please call John Turner at 407/894-7555 or write to the above address.

Sincerely,

Alan D. Zahm

Alan D. Zahm, P.E.
Supervisor, Permitting
Air Resources Management

10 June '93

Date

AZ/jt

cc: Barry Andrews, P.E.
Preston Lewis, P.E.

DER Form 17-1.202(2)

Florida Department of Environmental Regulation

Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400

Lawton Chiles, Governor

Carol M. Browner, Secretary

February 12, 1993

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Alan Weatherford
Compliance Environmentalist
Florida Gas Transmission Company
P.O. Box 945100
Maitland, Florida 32794-5100

Dear Mr. Weatherford:

Re: Permits AC57-188869, AC67-189220, AC20-189438, AC62-189439, AC04-189454, AC42-189455, AC48-189456, AC05-189665 and AC56-189457; Permit Amendment Request

The Department is in receipt of your letter dated January 18, 1993, requesting an amendment of the specific condition regarding test method for measuring VOC emissions for each one of the above referenced permits. The Department has reviewed your request and has determined to change Specific Condition No. 10 for each one of the permits as follows:

Specific Condition No. 10:

FROM: Initial compliance with the volatile organic compound emission (VOC) limits will be demonstrated by EPA Method 25, thereafter, compliance with the VOC emission limits will be assumed, provided the CO allowable emission rate is achieved.

TO: Initial compliance with the volatile organic compound emission (VOC) limits will be demonstrated by EPA Method 25A, thereafter, compliance with the VOC emission limits will be assumed, provided the CO allowable emission rate is achieved.

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, Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400. Petitions filed by the permit applicant and the parties listed below must be filed within

14 days of receipt of this intent. Petitions filed by other persons must be filed within 14 days of publication of the public notice or within 14 days of their receipt of this intent, whichever first occurs. Petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. 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, Florida Statutes.

The Petition shall contain the following information:

(a) The name, address, and telephone number of each petitioner, the applicant's name and address, the Department Permit File Number and the county in which the project is proposed;
(b) A statement of how and when each petitioner received notice of the Department's action or proposed action;
(c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action;
(d) A statement of the material facts disputed by Petitioner, if any;
(e) A statement of facts which petitioner contends warrant reversal or modification of the Department's action or proposed action;
(f) A statement of which rules or statutes petitioner contends require reversal or modification of the Department's action or proposed action; and
(g) A statement of the relief sought by petitioner, stating precisely the action petitioner wants the Department to take with respect to the Department's action or proposed action.

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 position taken by it in this intent. Persons whose substantial interests will be affected by any decision of the Department with regard to the application have the right to petition to become a party to the proceeding. The petition must conform to the requirements specified above and be filed (received) within 14 days of receipt of this intent in the Office of General Counsel at the above address of the Department. Failure to petition within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, F.S., and to participate as a party to this proceeding. Any subsequent intervention will only be at the approval of the presiding officer upon motion filed pursuant to Rule 28-5.207, F.A.C.

A copy of this letter shall be attached to the above mentioned permit and shall become a part of that permit.

Sincerely,

Howard L. Rhodes
Director
Division of Air Resources
Management

HLR/TH/plm

Attachment to be Incorporated:
Mr. Alan Weatherford's letter of December 7, 1992

cc: Ed Middleswart, NWD
Charles Collins, CD
Isidore Goldman, SED
Andy Kutyna, NED

Florida Gas Transmission Company

P. O. Box 945100 Maitland, Florida 32794-5100 (407) 875-5800

Certified Mail

December 7 , 1992

Mr. Clair Fancy
Florida Department of
Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Dear Mr. Fancy:

RE: Request for Modification to Permits

Permit No. AC57-188869
Florida Gas Transmission Company, Station 12
Munson, Santa Rosa County, Florida

Permit No. AC67-189220
Florida Gas Transmission Company, Station 13
Caryville, Washington County, Florida

Permit No. AC20-189438
Florida Gas Transmission Company, Station 14
Quincy, Gadsden County, Florida

Permit No. AC62-189439
Florida Gas Transmission Company, Station 15
Perry, Taylor County, Florida

Permit No. AC04-189454
Florida Gas Transmission Company, Station 16
Brooker, Bradford County, Florida

Permit No. AC42-189455
Florida Gas Transmission Company, Station 17
Salt Springs, Marion County, Florida

Permit No. AC48-189456
Florida Gas Transmission Company, Station 18
Orlando, Orange County, Florida

Permit No. Ac05-189665
Florida Gas Transmission Company, Station 19
Melbourne, Brevard County, Florida

Permit No. AC56-189457
Florida Gas Transmission Company, Station 20
Ft. Pierce, St. Lucie County, Florida

RECEIVED

DEC 17 1992

Division of Air
Resources Management

Florida Gas Transmission Company (FGT) requests that the permits referenced above be modified as follows:

<u>Modify Specific Condition 10 which currently reads</u>

> "Initial compliance with the volatile organic compound (VOC) emissions limits will be demonstrated by EPA Method 25, thereafter, compliance with the VOC emission limits will be assumed, provided the CO allowable emission rate is achieved.",

<u>so that it reads</u>

> "Initial compliance with the volatile organic compound (VOC) emissions limits will be demonstrated by EPA Method <u>25A,</u> thereafter, compliance with the VOC emission limits will be assumed, provided the CO allowable emission rate is achieved."

FGT has supplied your office with evidence supporting our contention that the use of Method 25 to measure VOC emissions in compressor engines is questionable. We believe the evidence supports the use of Method 25A. Mr. Barry Andrews, ENSR Consulting & Engineering, has spoken to you about this on FGT's behalf.

Since no specific test method is listed for our source (i.e. NSPS or 17-2.700), we ask that this change be made through a simple permit modification.

Please call me at 407-875-5816 if you have any questions.

Sincerely,

Allan Weatherford

Allan Weatherford
Compliance Environmentalist

bc
aw1207cf

cc: Chuck Truby
Raymond Young
Fred Griffin
Barry Andrews, ENSR
J. Heron
[illegible]

Florida Gas Transmission Company
P. O. Box 945100 Maitland, Florida 32794-5100 (407) 875-5800

Certified Mail

October 16, 1992

Mr. Alan Zahm, P.E.
Supervisor, Permitting
Air Resource Management
3319 Maguire Blvd, Suite 232
Orlando, Florida 32803-3767

Dear Mr. Zahm:

RE: Air Permit - AC42-189455
Florida Gas Transmission Company - Station 17
Marion County, Silver Spring, Florida
Natural Gas Compressor Engine (Unit No.5)

In response to your October 8, 1992, letter to Mr. William Osbourne referencing the expiration of the above-referenced air permit, I've attached a copy of a letter from Steve Smallwood with the Florida DER. As you will note in his letter, the DER extended the expiration date of this permit to June 1993.

Please call me at 407-875-5816 if you have any questions.

Sincerely,

Allan Weatherford

Allan Weatherford
Compliance Environmentalist

bc
aw1016az
attachments

cc: Chuck Truby
Raymond Young
Bill Osbourne
Steve Smallwood, Florida DER ✓

Fold at line over top of envelope to the right of the return address

CERTIFIED
P 250 257 120
MAIL

RECEIVED
OCT 21 1992
Division of Air Resources Management

Florida Department of Environmental Regulation
Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400
Lawton Chiles, Governor Carol M. Browner, Secretary

May 15, 1992

RECEIVED
MAY 18 1992
TECH OPERATIONS

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Allan Weatherford
Compliance Environmentalist
Florida Gas Transmission Company
P.O. Box 945100
Maitland, Florida 32399-2400

Dear Mr. Weatherford:

Re: Construction Permits Nos. AC 57-188869, AC 67-189220, AC 20-189438, AC 62-189439, AC 04-189454, AC 42-189455, AC 48-189456, AC 05-189665, and AC 56-189457

The Department is in receipt of your letter dated April 29, 1992, requesting the extension of the expiration dates of the above referenced permits. This request is acceptable. The expiration dates of these construction permits will be changed as follows:

FROM: June 30, 1992
TO: June 30, 1993

This letter must be attached to the above mentioned permits and shall become a part of each permit.

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, Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400. Petitions filed by the permit applicant and the parties listed below must be filed within 14 days of receipt of this intent. Petitions filed by other persons must be filed within 14 days of publication of the public notice or within 14 days of their receipt of this intent, whichever first occurs. Petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. 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, Florida Statutes.

The Petition shall contain the following information:

(a) The name, address, and telephone number of each petitioner, the applicant's name and address, the Department Permit File Number and the county in which the project is proposed;
(b) A statement of how and when each petitioner received notice of the Department's action or proposed action;
(c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action;
(d) A statement of the material facts disputed by Petitioner, if any;
(e) A statement of facts which petitioner contends warrant reversal or modification of the Department's action or proposed action;
(f) A statement of which rules or statutes petitioner contends require reversal or modification of the Department's action or proposed action; and
(g) A statement of the relief sought by petitioner, stating precisely the action petitioner wants the Department to take with respect to the Department's action or proposed action.

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 position taken by it in this intent. Persons whose substantial interests will be affected by any decision of the Department with regard to the application have the right to petition to become a party to the proceeding. The petition must conform to the requirements specified above and be filed (received) within 14 days of receipt of this intent in the Office of General Counsel at the above address of the Department. Failure to petition within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, F.S., and to participate as a party to this proceeding. Any subsequent intervention will only be at the approval of the presiding officer upon motion filed pursuant to Rule 28-5.207, F.A.C.

Sincerely,

for STEVE SMALLWOOD, P.E.
Director
Division of Air Resources Mgmt.

SS/TH/plm

<u>Attachment to be Incorporated:</u>
Mr. Weatherford's letter of April 29, 1992

cc: Ed Middleswart
Charles Collins
Andy Kutyna
Isidore Goldman

Florida Gas Transmission Company

P. O. Box 945100 Maitland, Florida 32794-5100 (407) 875-5800

Federal Express

April 29, 1992

Mr. Clair Fancy
Florida Department of
Environmental Regulation
Bureau of Air Regulation
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Dear Mr. Fancy:

RE: Request for Extensions of Construction Permits Phase II Air Permits

Permit No. AC57-188869
Florida Gas Transmission Company, Station 12
Munson, Santa Rosa County, Florida

Permit No. AC67-189220
Florida Gas Transmission Company, Station 13
Caryville, Washington County, Florida

Permit No. AC20-189438
Florida Gas Transmission Company, Station 14
Quincy, Gadsden County, Florida

Permit No. AC62-189439
Florida Gas Transmission Company, Station 15
Perry, Taylor County, Florida

Permit No. AC04-189454
Florida Gas Transmission Company, Station 16
Brooker, Bradford County, Florida

Permit No. AC42-189455
Florida Gas Transmission Company, Station 17
Salt Springs, Marion County, Florida

Permit No. AC48-189456
Florida Gas Transmission Company, Station 18
Orlando, Orange County, Florida

Permit No. AC05-189665
Florida Gas Transmission Company, Station 19
Melbourne, Brevard County, Florida

Permit No. AC56-189457
Florida Gas Transmission Company, Station 20
Ft. Pierce, St. Lucie County, Florida

On behalf of Florida Gas Transmission Company, I respectfully request extensions of the construction permits referenced above. The permits are due to expire on June 30, 1992 and FGT needs more time to evaluate the operation and performance of the engines.

Emissions tests were done on the engines in March 1992. The test reports will be submitted to DER within the next two weeks. Preliminary results indicate that all emission limits were met.

FGT requests the expiration dates be extended to June 30, 1993. This 12-month extension will allow FGT the necessary time to thoroughly evaluate the operation of the new engines and to determine if additions or revisions to the permits are needed.

In anticipation of your approval, I've enclosed a check for $450 to cover the permit extension fee for each of the nine stations.

Sincerely,

Allan Weatherford
Compliance Environmentalist

bc
aw0429cf

cc: Chuck Truby
Raymond Young
Fred Griffin
Bill Osborne
Glenn Sellars
Levon Carroll
Bob Beckham
Don Sterba
Duwood Mulford
Buddy Morris
James Dollar
Jim Read
Les Shadd
Leroy Coker
Wayne Daniels
Riley Jackson
Donnie Owings
Joe Kolb
Tom Gardiner, ENSR

Florida Department of Environmental Regulation
Twin Towers Office Bldg. ● 2600 Blair Stone Road ● Tallahassee, Florida 32399-2400
Lawton Chiles, Governor
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May 15, 1992

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Director
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SS/TH/plm

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cc: Ed Middleswart, Andy Kutyna, Charles Collins, Isidore Goldman

Florida Gas Transmission Company

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RECEIVED
DER - MAIL ROOM
1992 APR 30 AM 10: 49

Federal Express

April 29, 1992

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Bureau of Air Regulation
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Buddy Morris
James Dollar
Jim Read
Les Shadd
Leroy Coker
Wayne Daniels
Riley Jackson
Donnie Owings
Joe Kolb
Tom Gardiner, ENSR
C. Fleming

TEST REPORT
on
EXHAUST EMISSIONS
from a
DRESSER RAND 412KVSR COMPRESSOR ENGINE
at
FLORIDA GAS TRANSMISSION'S
COMPRESSOR STATION NO. 17
SILVER SRPINGS, MARION COUNTY, FLORIDA

Prepared For

FLORIDA GAS TRANSMISSION COMPANY

April 1992

Prepared by

Cubix Corporation

9225 Lockhart Hwy., Austin, Texas 78747
(512) 243-0202 FAX (512) 243-0222

TABLE OF CONTENTS

INTRODUCTION

One Dresser Rand 412KVSR compressor engine was tested to determine the quantity of emissions released into the atmosphere. The tests were conducted on March 24, 1992 at Compressor Station No. 17 located near Silver Springs, in Marion County, Florida. This compressor station is owned and operated by Florida Gas Transmission Company (an affiliate of Enron).

The tests were conducted to determine the unit's compliance status with regard to the Florida Department of Environmental Regulation's Permit No. AC 42-189455.

Quantities of nitrogen oxides (NOx), carbon monoxide (CO), nonmethane hydrocarbon emissions (VOC), and other combustion products were determined in the exhaust stack of the engine. The tests followed the procedures set forth in the Code of Federal Regulations, Title 40, Part 60, Appendix A, Methods 1, 2, 3, 3a, 4, 7e, 9, 10, 18, 19, 25 and 25a, ASTM D-3246, and the American Gas Association's Carbon Balance Method*. All field testing was conducted by Cubix Corporation of Austin, Texas. The laboratory analyses for VOC concentrations and total sulfur in the fuel were conducted by Clean Air Engineering of Palatine, Illinois and Southern Petroleum Labs of Houston, Texas, respectively.

This test report has been reviewed and approved for submittal to the FDER by the following representatives:

*NOTE: Additional test methods (3a, 18, 25a, 19 and carbon balance) were done for comparison purposes. Florida Gas intends to formally request that Methods 3 and 25 be replaced by Methods 3a and 25a.

Florida Gas Transmission Co.

Cubix Corporation

Table 1
Background Data

Source Owner/Operator:	**Florida Gas Transmission Co.** 601 South Lake Destiny Drive Maitland, Florida 32751 (407) 875-5816 TEL (407) 875-5896 FAX Attn: Allan Weatherford
Testing Organization	**Cubix Corporation** 9225 Lockhart Hwy Austin, Texas 78747 (512) 243-0202 TEL (512) 243-0222 FAX Attn: Lowell Faulkner
Test Participants:	**Florida Gas Transmission Co.** Allan Weatherford Fred Griffin **Dresser Rand** David Anderson **Cubix Corporation** Lowell Faulkner Rick Krenzke Joe Rudyk
Test Date:	March 24, 1992
Location:	near Silver Springs in Marion County, Florida
Process Description:	Dresser Rand compressor engine
Sampling Points:	Exhaust stack of compressor engine (See Appendix A)
Regulatory Application:	Florida Department of Environmental Regulation Permit No. AC42-189455

Required Test Methods:

- EPA Method 1 for traverse point layout
- EPA Method 2 for stack gas velocity
- EPA Method 3 for O_2 and CO_2 concentrations
- EPA Method 4 for moisture content
- EPA Method 7e for NOx concentrations
- EPA Method 9 for opacity observations
- EPA Method 10 for CO concentrations
- EPA Method 25 for VOC concentration
- ASTM D-3246 for indirect measurement of SO_2 emissions

Alternate Test Methods:
(conducted for comparison purposes)

- EPA Method 3a for CO_2 and O_2 concentrations
- Stoichiometric calculation of moisture content
- EPA Method 18 for VOC portion of THC concentration
- EPA Method 19 for calculation of stack flow rate
- EPA Method 25a for THC concentration
- AGA Carbon Balance Method for stack flow rate calculation

SUMMARY OF RESULTS

One Dresser Rand 412KVSR compressor engine was tested to determine the quantity of emissions vented to the atmosphere. The emission measurements reported herein result from tests conducted on March 24, 1992 at Compressor Station No. 17 located near Silver Springs, in Marion County, Florida. The purpose of these tests was to determine the compliance status of this engine with regard to the FDER permit.

The permit required that tests be conducted for NOx, O_2, CO_2, CO, nonmethane hydrocarbons (i.e. VOC), SO_2, and opacity. These parameters were measured throughout three 1-hour test runs on this engine while operating at full load and full speed.

The results from these three test runs are presented in Table 2. This table includes the operating data and ambient conditions for each test run. The measured concentrations of NOx, CO, O_2, CO_2, VOC, and the stack flow rates are presented in the same units and using the same test methods listed in the permit. The calculated mass emission rates of NOx, CO, and VOC are presented in terms of lbs/hr, TPY, and g/hp-hr for comparison with the permit limits.

The sulfur content of the fuel provided an indirect measurement of SO_2 emissions. The SO_2 emission rate is calculated from the total sulfur in the fuel and the estimated fuel flow as based on the Florida Gas provided horsepower.

The average emissions over the three test runs for NOx were found to be 8.28 lbs/hr, 36.3 tons/yr, and 1.58 g/hp-hr. By comparison, permit limits are 10.6 lbs/hr, 46.3 tons/yr, and 2.0 g/hp-hr. CO emissions averaged 10.0 lbs/hr, 43.8 tons/yr, and 1.91 g/hp-hr and are limited by the permit to 14.8 lbs/hr, 64.9 tons/yr, and 2.8 g/hp-hr. The tons/yr emission rates are based on 8760 hrs/year operation of the engine.

The total sulfur content of the fuel was determined via laboratory analysis by Southern Petroleum Labs of Houston, Texas. The result of that analysis is contained in Appendix H and show that the fuel contained less than 0.059 grains/100 DSCF. The permit limits the sulfur content of the fuel to

10 grains/100 DSCF. The mass emission rate of SO_2 presented in Table 2 was calculated from the estimated fuel flow to the engine assuming that all sulfur in the fuel was oxidized to SO_2. The SO_2 emission rate based on this calculation averaged <0.0015 lbs/hr or <0.0066 tons/yr. The permit limits for SO_2 mass emissions are 0.49 lbs/hr and 2.2 tons/yr.

Nonmethane hydrocarbon (i.e. VOC) concentrations were measured as required by the permit using EPA Method 25. Table 2 contains the results of those measurements. The average VOC emissions using Method 25 were 3.2 lbs/hr, 14.0 tons/yr, and 0.61 g/hp-hr. The permit limits nonmethane hydrocarbon emissions to 9.0 lbs/hr, 39.4 tons/yr, and 1.7 g/hp-hr.

It is Cubix's belief that the applicability of using EPA Method 25 on this type of source is questionable. Method 25 results are affected by CO_2 and moisture interferents, both of which are present in percent levels in engine exhaust. These interferences would be expected to cause a high bias of the VOC concentration measurements. Even under ideal circumstances (i.e. measurements made from a matrix of air containing little or no CO_2 or moisture), the minimum detection limit of this method is 50 ppmv as compared to a minimum detection limit of <1.0 ppmv using other EPA test methods. For this reason, Cubix chose to also conduct VOC testing on this source using alternate, more appropriate methods.

Appendix I contains the results of these engine tests using alternate test methods. The alternate methods provided for a continuous measurement of total hydrocarbon concentrations (THC) using EPA Method 25a. The nonmethane portion of the THC was measured periodically during each test run using an on-site gas chromatograph as per EPA Method 18.

Examination of the data in Appendix I shows that the VOC emissions using the alternate methods averaged 1.01 lbs/hr (4.42 tons/yr and 0.19 g/hp-hr). When compared with the data obtained from Method 25, one can see that the CO_2 and moisture interferents may have biased the VOC concentrations high. In addition, the alternate methods are much less labor intensive, which eliminates a lot of the possibility of human error from the field or lab personnel.

Other alternate methods test results presented in Appendix I include the use of EPA Method 3a for O_2 and CO_2 concentrations rather than the Orsat procedure of EPA Method 3. Since turbulent, pulsating, engine exhaust can sometimes produce questionable flow rate results using a pitot tube, the exhaust flow rates were calculated stoichiometrically using two methods: (1) EPA Method 19 F-factors and (2) American Gas Association's Carbon Balance Method. Appendix I contains data that compares the flow rate results using these methods with those using the pitot tube traverse techniques of EPA Methods 1-4. The moisture content was also calculated stoichiometrically and compared with that obtained using EPA Method 4.

Appendix I shows that the instrumental techniques of EPA Method 3a provide more precision in measuring O_2 and CO_2 concentrations than the Orsat procedures of Method 3. When the proper analyzer range is used, EPA Method 3a provides a precision of tenfold that of EPA Method 3, even under the best of circumstances (i.e. no human error in performing Orsat). In addition, the *Quality Assurance* section of this report shows that EPA Method 3a results can be directly traced to various QA procedures including certified calibration gases and instrument linearity and interference tests. EPA Method 3 provides for no quality assurance procedures to ensure the accuracy of the results.

Data showing the use of stoichiometric calculations for determination of stack flow rate (i.e. F-factors and carbon balance) as well as for the stack moisture content included in Appendix I demonstrates that alternate methods are in agreement with the pitot tube traverse technique. During all three test runs on this engine, the moisture content obtained from stoichiometric calculations showed agreement within 10% of that obtained using EPA Method 4. The flow rate determination using F-factors agreed with the pitot tube measurements within 10%, averaged over the three test runs, and the carbon balance provided agreement within 15%.

Cubix's purpose in performing the additional testing on this unit in order to provide the data included in Appendix I is threefold:

(1) The unofficial VOC data provides alternate results to consider with regard to the compliance status of the unit. As stated earlier, Cubix believes that the data obtained from the alternate methods is more accurate than that obtained from the permit required test method.

(2) It is hoped that the data included in Appendix I can be used to allow for alternate test methods to be used on future emission tests on similar sources.

(3) The stoichiometric flow rate data included in Appendix I helps to verify the reasonableness of the results obtained from the pitot tube measurements of the exhaust flow.

Examples of any calculations necessary for presentation of the results of this section of the report or the alternate data contained in Appendix I are available in Appendix B of this report. Field data sheets and chain of custody records is presented in Appendix A as is the Method 25 laboratory analysis results. The strip chart records on which the instrumental analyses were recorded are provided in Appendix E and the chromatograms used for the Method 18 analyses can be found in Appendix F.

Opacity observation results and the certification for the technician performing the visible emission readings are contained in Appendix G. The permit stipulated that visible emissions shall not exceed 10%.No opacity was observed throughout the three 1-hour tests.

TABLE 2
SUMMARY OF RESULTS

Operator/Plant	Florida Gas Silver Springs Compressor Stati
Location	Marion County, Florida
Source	Dresser-Rand Compressor Engine
Technicians	RK,LF,JR

Test Run No.	**C-1**	**C-2**	**C-3**
Date	3/24/92	3/24/92	3/24/92
Start Time	10:06	13:00	14:10
Stop Time	11:06	14:00	15:10
Engine/Compressor Operation			
Engine Speed (rpm)	330	329	330
Ignition Timing (°BTDC)	14	14	14
Air Manifold Pressure (psig)	8.8	9	9
Air Manifold Temperature (°F)	128	128	128
Estimated Fuel Flow AT 7800 BTU/hp-hr (SCFH	17951	17951	18699
Fuel Temperature (°F)	68	68	68
Fuel Manifold Pressure (psig)	27.5	27.4	27.4
Pre-Combustion Chamber Pressure (psig)	19	19.1	19.2
Exhaust Temperature (°F)	704	701	700
Turbo (rpm x 100)	158/157	159/157	160/159
Pockets Open	12	12	12
Suction Pressure (psig)	790	742	733
Suction Temperature (°F)	69	68	69
Discharge Pressure (psig)	938	915	905
Discharge Temperature (°F)	98	108	104
Engine Load (BHP)	2352	2352	2450
Torque (%)	98	98	99
Ambient Conditions			
Atmospheric Pressure (in. Hg)	30.05	30.03	30.03
Temperature (°F) : Dry bulb	70	72	72
(°F) Wet bulb	62	62	68
Humidity (lb/lb air)	0.0098	0.0093	0.0134
Measured Emissions			
NOx (ppmv)	192	160	133
CO (ppmv)	329	324	312
O2 via EPA Method 3 (vol %)	12.2	12.0	12.0
CO2 via EPA Method 3 (vol %)	4.8	5.0	5.0
VOC via EPA Method 25 (ppmv)	195.7	167.0	176.6
SO2 in fuel (grains/100 DSCF)	<0.059	<0.059	<0.059
Stack Volumetric Flow Rates			
via Pitot Tube (SCFH, dry)	4.38E+05	4.26E+05	4.18E+05
Calculated Emission Rates (via pitot tube)			
NOx (lbs/hr)	10.05	8.14	6.65
CO (lbs/hr)	10.5	10.0	9.5
VOC (lbs/hr)	3.56	2.96	3.07
SO2 (lbs/hr)	<0.0015	<0.0015	<0.0016
NOx (tons/yr)	44.0	35.7	29.1
CO (tons/yr)	45.9	43.9	41.6
VOC (tons/yr)	15.6	12.9	13.4
SO2 (tons/yr)	<0.0066	<0.0066	<0.0069
NOx (g/hp-hr)	1.94	1.57	1.23
CO (g/hp/hr)	2.02	1.94	1.76
VOC (g/hp-hr)	0.69	0.57	0.57

PROCESS DESCRIPTION

Florida Gas Transmission Co. owns and operates Compressor Station No. 17 located near Silver Springs, Florida. This plant uses engines to compress natural gas to allow for transportation in the main pipeline system. This compressor station is a part of a system developed by Florida Gas Transmission Company to allow the transport of natural gas from reserves in Texas to the Florida market.

The engine tested is a Dresser Rand 412KVSR compressor engine bearing the serial number 412KVSRA226AP. The engine is rated at 2400 BHP. It is a lean burn, high air/fuel ratio engine including a precombustion chamber on each cylinder, main chamber mixture regulation, and a variable timing spark control responsive to speed, torque, and air temperature.

The engine emissions are vented to the atmosphere through a 23.5" ID exhaust pipe at approximately 45 feet above grade. Two sample ports were installed in a straight horizontal section of the exhaust pipe between the engine and the silencer. The ports met EPA Method 1 criteria with regard to location. A field diagram of the sampling location can be found in Appendix A.

ANALYTICAL TECHNIQUE

The sampling and analysis procedures used during these tests conform in principle with the methods outlined in the Code of Federal Regulations, Title 40, Part 60, Appendix A, Methods 1, 2, 3, 3a, 4, 7e, 9, 10, 18, 19, 25, and 25a, ASTM D-3246, and AGA's carbon balance method for flow rate measurement. Table 3 provides a description of the analyzers used for the instrumental portion of the tests.

Figure 1 depicts the sample system used for the tests. A stainless steel probe was inserted into the sample port of the stack. The gas sample was continuously pulled through the probe and transported via 3/8 inch heat-traced Teflon® tubing to the mobile laboratory located at ground level. To prevent the possibility of condensation of heavier hydrocarbons, the sample was then delivered to the THC analyzer and gas chromatograph portion of the sample manifold via a stainless steel/Teflon® diaphragm pump through more heat-traced sample line (i.e. wet sample). The remaining sample then passed through a stainless steel minimum-contact condenser designed to dry it. The dry sample returned to the sample manifold. From the manifold, the sample was partitioned to the NOx, CO, O_2, and CO_2 analyzers through glass and stainless steel rotameters that controlled the flow rate of the sample.

Figure 1 shows that the sample system was also equipped with a separate path through which a calibration gas could be delivered to the probe and back through the entire sampling system. This allowed for convenient performance of system bias checks as required by the testing methods.

All instruments were housed in an air conditioned trailer-mounted mobile laboratory. Gaseous calibration standards were provided in aluminum cylinders with the concentrations certified by the vendor. EPA Protocol No. 1 was used to determine the cylinder concentrations where applicable (i.e. NOx calibration gases).

All data from the continuous monitoring instruments were recorded on two synchronized 3-pen strip chart recorders (Soltec Model 1243). These recorders were operated at a chart speed of 30 centimeters/hour, recording over a 25-centimeter width. Strip chart records can be found in Appendix E of this report.

EPA Method 1 was used to determine the velocity traverse point locations. The stack diagram of Appendix A shows that the sample ports did meet the location criteria set forth by the method. The sample ports were located approximately 5 diameters downstream and 5 diameters upstream of the nearest flow disturbances.

EPA Method 2 was used to measure the stack gas velocity. A pitot tube and inclined manometer were used to measure the head pressure at each of sixteen traverse points. The stack temperature was determined with a K-type thermocouple and digital thermometer. Cubix checked for cyclonic flow during the first test run and found that none existed.

The stack gas analyses for CO_2 and O_2 concentrations were performed in accordance with procedures set forth in EPA Method 3. An Orsat device was used on a bag sample collected throughout each test run. Instrumental analyses (NDIR) as per EPA Method 3a were also used for O_2 and CO_2 concentrations due to the greater accuracy and precision provided by the instruments. The CO_2 analyzer was based on the principle of infrared absorption; and, the O_2 analyzer operated on a paramagnetic cell. The data presented in *Summary of Results* contains the O_2 and CO_2 concentrations obtained from EPA Method 3. Appendix I makes use of the data obtained from EPA Method 3a.

EPA Method 4 was used to measure the moisture content of the stack during each test run. An impinger train was used in conjunction with a calibrated dry gas meter. The sample used for the moisture determination was taken from the heat traced-line upstream of the condensor (see *Figure 1*). The moisture content was also estimated stoichiometrically using the combustion moisture, excess air dilution, and ambient humidity in the combustion air. The velocity template in Appendix I shows that the agreement was greater than 90% between stack moisture measurement methods. All calculations involved in the *Summary of Results* make use of the moisture measurements obtained from EPA Method 4.

Means, in addition to EPA Methods 1-4, were also employed to obtain the stack gas flow rate. The F-factor calculations of EPA Method 19 and the AGA carbon balance method both provided results that were approximately 10% less than those obtained by the pitot tube measurement. Both of these methods use stoichiometric relationships based on the estimated fuel flow, fuel composition, and excess air concentration for calculation of the stack flow rates. The *Summary of Results* uses the pitot tube values in all calculations to be consistent with the permit provisions. However, the alternate methods provided for a check of the pitot tube traverse results.

EPA Method 7e was used to determine concentrations of NOx. A chemiluminescence cell analyzer was used. The NOx mass emission rates were calculated as if all the NOx were in the form of NO_2. This approach corresponds to EPA's convention. However, it tends to overestimate the actual stack NOx mass emission rates, since the majority of the NOx is in the form of NO which is less dense (i.e. lbs of emissions per ppmv concentration) than the NO_2 form of NOx. This gives a worst case scenario of NOx emissions.

Opacity was determined via EPA Method 9. A one-hour opacity test run was performed concurrently with each gaseous compliance test run. The observer was certified with EPA in Florida. Appendix G provides the observer's field data sheets as well as Method 9 certification documentation.

CO emission concentrations were quantified in accordance with procedures set forth in EPA Method 10. A continuous nondispersive infrared (NDIR) analyzer was used for this purpose. This analyzer was equipped with a gas correlation filter which also removes any interference from CO_2, or other combustion products.

The non-methane portion of the hydrocarbon emissions (i.e. VOC) were determined using EPA Method 25 as required by the permit. Clean Air Engineering of Palatine, Illinois provided the sample system apparatus for Cubix's sample collection. A Clean Air Engineering Model 2610 instrument was used for the sample collection.

A gaseous sample was pulled under a vacuum through a heated probe and filter to a trap/tank assembly. The trap was immersed in dry ice to remove moisture and heavier hydrocarbons. The remaining sample was then collected in the tank. The tank started with a vacuum of approximately 30 in. Hg and the sample rate was set such that the vacuum was nearly depleted at the end of each one-hour test run. Each one-hour test run coincided with the other gaseous analyses. The field data sheets involved with the sample collection of this measurement are included in Appendix A. Following sample collection, the tanks and traps were packed in dry ice and shipped to Clean Air Engineering where the laboratory analyses for nonmethane hydrocarbon concentrations were performed. The data presented in *Summary of Results* reflects the VOC measurements taken using this technique.

VOC concentrations were also quantified during each test run using EPA Methods 25a and 18. Cubix feels that these test methods provide more accurate results on this type of source than does Method 25. The unofficial data contained in Appendix I summarizes the results obtained using these alternate methods.

Total hydrocarbon concentrations were determined continuously throughout each test run using an flame ionization detector (FID). This instrument was calibrated before and after each test run using methane standards of a known concentration. Therefore, the response of this instrument is based on methane equivalents.

During each test run, a minimum of two shots were taken on a gas chromatograph as per the procedures of EPA Method 18. The chromatograms contained in Appendix F show that the methane concentration of the THC was separated on the unit to allow for the determination of the VOC portion of the THC. A Hewlett Packard 5890 gas chromatograph equipped with a flame ionization detector and a 1cc sample loop was operated with a temperature program of 40°C for 1 min. and an increase of 15°C per minute until 150°C was reached. The Chrompack PoraPlot Q capillary column head pressure was maintained at 8 psi. The hydrogen and air flows to the detector were maintained at 10 psi and 20 psi respectively. This instrument was calibrated on methane standards before and after each test run.

One fuel sample was taken at this compressor station and analyzed via ASTM D-3246 to determine the total sulfur content of the fuel. By assuming that all of the sulfur in the fuel was oxidized to SO_2, the SO_2 mass emission rate can be calculated from the fuel flow to the engine. The fuel flow to the engine was estimated based on the horsepower value provided by Florida Gas, the heating value of the fuel, and an assumed heat efficiency (i.e. BTU/hp-hr) for an engine of this type. The fuel analysis was conducted by Southern Petroleum Labs of Houston, Texas and a copy of that report is contained in Appendix H.

Cubix personnel collected ambient absolute pressure, temperature and humidity data. A sling psychrometer was used to determine temperature and humidity conditions. An aircraft-type aneroid barometer (altimeter) was used to measure absolute atmospheric pressure.

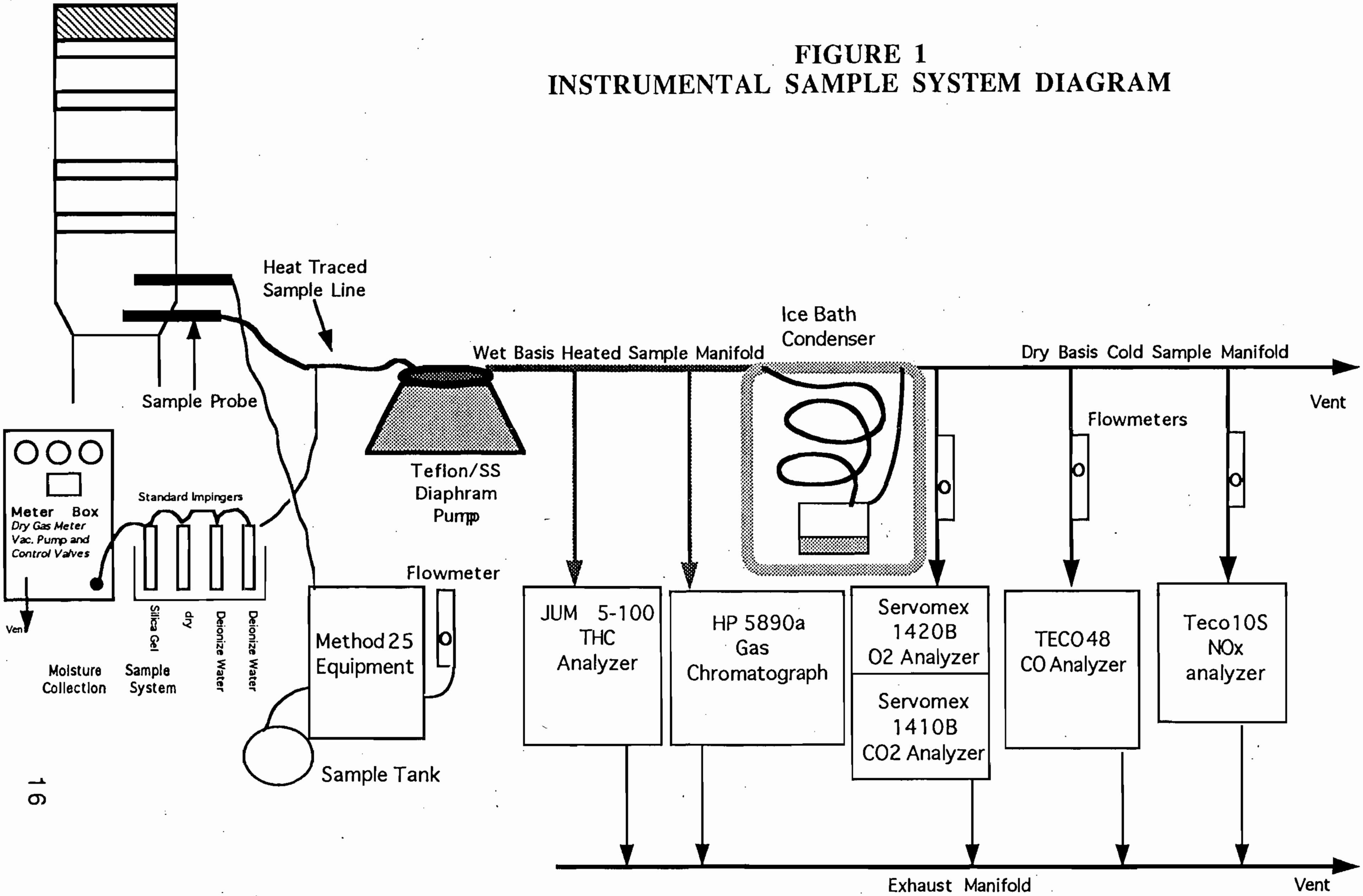
During the tests, the engine and compressor operational data was collected by Florida Gas personnel and is presented in Appendix A. Key operational data collected include compressor discharge pressures, compressor suction pressures, engine manifold pressure, engine speed, timing, and horsepower. Florida Gas also provided a recent fuel composition analysis to allow for the calculation of the heating values and F-factors.

TABLE 3
ANALYTICAL INSTRUMENTATION

Parameter	Model and Manufacturer	Common Use Ranges	Sensitivity	Response Time (sec.)	Detection Principle
NOx	TECO 10S	0-10 ppm 0-100 ppm 0-200 ppm 0-500 ppm 0-1,000 ppm 0-5,000 ppm	0.1ppm	1.7	Thermal reduction of NO_2 to NO. Chemiluminescence of reaction of NO with O_3. Detection by PMT. Inherently linear for listed ranges.
CO	TECO 48	0-10 ppm 0-20 ppm 0-50 ppm 0-100 ppm 0-200 ppm 0-500 ppm 0-1000 ppm	0.1ppm	10	Infrared absorption, gas filter correlation detector, micro-processor based linearization.
CO_2	Servomex 1410 B	0-4% 0-20%	0.02%	30	Infrared absorption, analog linearization.
O_2	Servomex 1420 B	0-10% 0-25 %	0.1%	15	Paramagnetic cell, inherently linear.
THC	JUM Model 5-100	0-10, 0-100, 0-1000, 0-10000 0-100000 ppm	0.2 ppm	5.0	Flame ionization of hydrocarbons inherently linear over 2 orders of magnitude.
VOC	HP 5890A	0-10, 0-100 ppm	0.5 ppm	na	Flame ionization of hydrocarbons inherently linear over 2 orders of magnitude.

NOTE: Higher ranges available by sample dilution.
Other ranges available via signal attenuation.

FIGURE 1
INSTRUMENTAL SAMPLE SYSTEM DIAGRAM



QUALITY ASSURANCE ACTIVITIES

A number of quality assurance activities were undertaken before, during, and after this testing project. This section of the report combined with the documentation in Appendices C and D describe each of those activities.

Each instrument's response was checked and adjusted in the field prior to the collection of data via multi-point calibration. The instrument's linearity was checked by first adjusting the it's zero and span responses to zero (nitrogen) and an upscale calibration gas in the range of the expected concentrations. The instrument response was then challenged with other calibration gases of known concentration and accepted as being linear if the response of the other calibration gases agreed within ± 2 percent of range of the predicted values. (The response of the infrared absorption type CO and CO_2 analyzers is electronically linearized.). The strip chart excerpts that present the results of the multi-point linearity test are provided in Appendix C.

Before and after each test run, the analyzers were checked for zero and span drift. This allowed each test run to be bracketed by calibrations and documents the precision of the data just collected. The criterion for acceptable data is that the instrument drift is no more than 2 percent of the full scale response. The quality assurance worksheets in Appendix E summarize all multipoint calibration checks and zero to span checks performed during the tests. These worksheets (as prepared from the strip chart records of Appendix E) show that no drifts in excess of 2 percent existed.

Interference response tests on the instruments were conducted by the instrument vendors and Cubix Corporation on the NOx, CO, CO_2, and O_2 analyzers. The sum of the interference responses for H_2O, CO, SO_2, CO_2 and O_2 (as appropriate for each analyzer) are less than 2 percent of the applicable full scale span value. The instruments used for the tests meet the performance specifications for EPA Methods 3a, 7e, and 10. The results of the interference tests are available in Appendix C of this report.

The residence time of the sampling and measurement system was estimated using the pump flow rate and the sampling system volume. The pump's rated flow is 0.8 SCFM at 5 psig. The sampling system volume is 0.13 scf. Therefore, the sample residence time is approximately 10 seconds.

The NOx and O_2 sampling and analysis system was checked for response time per the procedures outlined in EPA's Method 20. The average NOx analyzer's response times were 0.61 minutes upscale and 0.65 minutes downscale. The O_2 analyzer's response times were 0.76 minutes (46 seconds) upscale and 0.88 minutes (53 seconds) downscale. The results of these response time tests are contained in Appendix C.

The sampling systems were leak checked by demonstrating that a vacuum greater than 10" Hg (21 in. Hg actual) could be held for at least 1 minute with a decline of less than 1" Hg. A leak test was conducted after the sample system was set up and before the system was dismantled (i.e. after testing was completed). This test was conducted to ensure that ambient air had not diluted the sample. Any leakage detected prior to the tests was repaired and another leak check conducted before testing commenced. No leaks were found during the post test leak checks.

The moisture train and Method 25 sample systems were leak checked independently of the gaseous sample system before and after each individual test run. These leak checks were performed in accordance with EPA Methods 4 and 25 to ensure that the sample was not diluted by ambient air. No leaks were detected.

The absence of leaks in the sampling system was also verified by a system bias check. The sampling system's integrity was tested by comparing the responses of the NOx analyzer to a calibration gas introduced via two paths. The first path was into the analyzer via the zero/span calibration manifold. The second path was to introduce a calibration gas into the sample system at the sample probe. Any difference in the instrument responses by these two methods was attributed to sampling system bias or leakage. NOx was used for this bias check because it is the most reactive of the compounds measured. The bias check was also conducted using methane standards on the THC analyzer. The criteria for acceptance is agreement within 2% of the full scale range of the analyzer. Examination of the strip chart excerpts and Instrumental Analysis Quality Assurance Data worksheet in Appendix C show that the analyzer response via both sample paths agreed within 2% in all cases.

The efficiency of the NO_2 to NO converter in the NOx analyzer was checked by having the analyzer sample a mixture of NO in N_2 standard gas and zero air from a Tedlar® bag. When this bag is mixed and exposed to sunlight, the NO is oxidized to NO_2 over approximately a 30-minute period. If the NOx instrument's converter is 100% efficient, then the NOx response does not decrease as the NO in the bag is converted to NO_2. The criterion for acceptability is a demonstrated NOx converter efficiency greater than 90%. The strip chart excerpts that demonstrate the converter efficiency test are available in Appendix C. The above mentioned quality assurance worksheet of Appendix C also summarizes the results of the converter efficiency test.

The control gases used to calibrate the instruments were analyzed and certified by the compressed gas vendors to ± 1% accuracy for NOx and O_2, and to ± 2% accuracy for the remaining gases. EPA Protocol No. 1 was used, where applicable (i.e. NOx gases), to assign the concentration values traceable to the National Bureau of Standards, Standard Reference Materials (SRM's). The gas calibration sheets as prepared by the vendor are contained in Appendix D.

The pitot tube tips used during the testing were visually inspected to ensure that they met the criteria of EPA Method 2. The pitot tubes were also wind tunnel tested and the results of those tests are contained in Appendix D. The pitot tube lines were leak checked in the field each time connection to the manometer was made in accordance with EPA Method 2 guidelines.

The dry gas meter used for the moisture train was calibrated prior to testing in accordance with EPA Method 4. A standard dry gas meter traceable to NIST was used for this calibration. Calibration certification documentation of the dry gas meter can be found in Appendix D.

Appendix D also contains calibration data on the altimeter and digital thermometer used during this testing.

The observer for the opacity measurements was certified in Florida. The certification for the observer can be found in Appendix G.

Two Method 25 audit samples were provided by EPA at another compressor station during this series of compressor station tests. These audit samples were collected using the same equipment and techniques used during this test. The laboratory analysis of these audits were conducted concurrently with the sample analyses. The results of the audit samples are included in Appendix C.

Cubix collected and reported the enclosed test data in accordance with the procedures and quality assurance activities described in this test report. Cubix makes no warranty as to the suitability of the test methods. Cubix also assumes no liability relating to the interpretation and use of the test data.

APPENDIX A: FIELD DATA SHEETS AND OPERATIONAL DATA

SIGN IN SHEET

JOB NAME: Florida Gas

DATE: 3 / 24 / 92

LOCATION: Silver Springs

PERMIT # AC 42-189455
PSD FL 162

SOURCE(S): Dresser-Rand Engine

PARTICIPANTS: Cubix Corporation
Florida Gas
D-R

~~where is the name plate with serial number for this engine?~~

NAME:	AFFILIATION:	PHONE NUMBER:
Lowell Fairbanks	CUBIX	512 243 0202
RICK J. KRENZKE	CUBIX CORP.	512-243-0202
David N. Anderson	Dresser-Rand	607-937-2128
ALLAN WEATHERFORD	FLA. GAS	(407) 875-5800
FRED GRIFFIN	" "	" " "
Joe Rudyk	Cubix Corp.	512-243-0202

112 KVSRA
112 KVSRA226AP

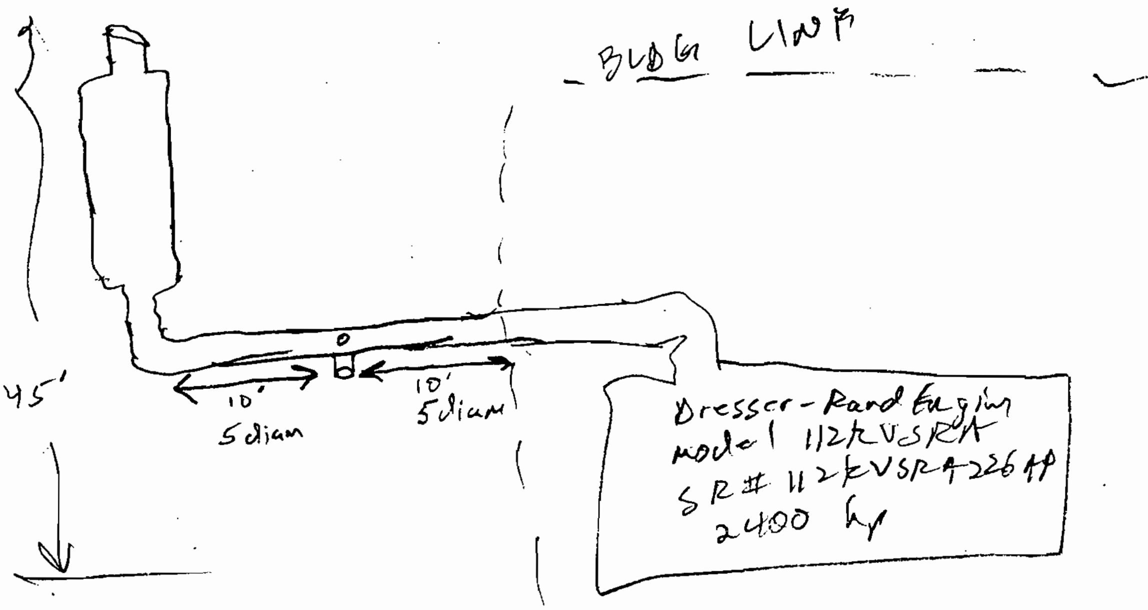
2400

Circular Stack Sampling Traverse Point Layout
(EPA Method 1)

Date: 3/24/92
Plant: FGT / Silver Springs
Source: Dresser Rand Engine
Technician(s) RK LF SR

Port + Stack ID: 27.5 in.
Port Extension 4 in.
Stack ID: 23.5 in.
Stack Area 3.01 ft²
Total Req'd Traverse Pts. 16
No. of Traverse Pts. 8 /diam.
No. of Traverse Pts. 8 /port

Stack Diagram (Side View showing major unit components, dimensions and nearest upstream & downstream flow disturbances)



Traverse Point Number	Length Factor (% of diameter) Number of traverse pts./diameter 4	6	8	12	Distance from Reference Point (inches)
1	6.7	4.4	3.2	2.1	.75=1
2	25.0	14.6	10.5	8.2	2.5
3	75.0	29.6	19.4	11.8	4.6
4	93.3	70.4	32.3	17.7	7.6
5		85.4	67.7	25.0	15.9
6		95.6	80.6	35.6	18.9
7			89.5	64.4	21
8			96.8	75.0	22.7=22.5
9				82.3	
10				88.2	
11				93.3	
12				97.9	

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3-24-92
Plant/Operator: FGT - Silver Springs #17
Source: Dresser Model 412 KVSR Recip
Technicians: RK, LF, JR
Atm. Pres. 30.05 in.Hg(Pb)
Test Run # C-1

Dry Gas Meter ID: Anderson # 1286306.1
Dry Gas Meter Factor: .9904 (Kd)
Pitot Tube #/Type: # 109 S-Type
Pitot Tube Factor: .84 (Kp)
Static Pres. + 1.3 in.H2O(Pg)
Average Stack Temp. ~~646~~ 646 °F(Ts)

Pre-test Leak check	ft.3/min at in. Hg Vacuum	Impinger #	Contents	Initial Weight	Final Weight
OK	0.0 @ 21"	1	H_2O	577.8	610.3
Post-test Leak check	0 ft.3/min at 23 in. Hg Vacuum	2	H_2O	598.0	596.2
OK		3	MT	460.0	462.3
		4	SG	845.1	858.2
		5			
		6			
		Totals	X	2480.9	2527

Moisture Train

	Initial	Final
Time:	10:11	1114
Meter Reading (ft3 or L)	838.300	862.65
Meter Temp. (°F)	90	116
Sample Box #	T-7	

O2 %	12.1
CO2 %	4.7

Orsat Results

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	Bottom ΔP (" H2O)	°F	ß	Side ΔP (" H2O)	°F	ß
1	1.3			1.4		
2	1.4			1.3		
3	1.4			1.4		
4	1.2			1.2		
5	1.3			1.2		
6	1.2			1.3		
7	1.1			1.2		
8	1.3			1.1		
9						
10						
11						
12						

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3/24/92
Plant/Operator: FGT / Silver Springs
Source: Dresser Engine
Technicians: RK LF JC
Atm. Pres. 30.03 in.Hg(Pb)
Test Run # C-2

Dry Gas Meter ID: Anderson
Dry Gas Meter Factor: .9904 (Kd)
Pitot Tube #/Type: 107 / S-type
Pitot Tube Factor: .84 (Kp)
Static Pres. + 1.4 in.H2O(Pg)
Average Stack Temp. 656 °F(Ts)

Pre-test Leak check OK	0 ft.3/min at 21 in. Hg Vacuum
Post-test Leak check OK	0 ft.3/min at 24 in. Hg Vacuum

Impinger #	Contents	Initial Weight	Final Weight
1	H_2O	610.3	644.0
2	H_2O	596.2	598.4
3	MT	462.3	463.8
4	SILICA	858.2	868.3
5			
6			
Totals		2527	2574.5

Moisture Train

	Initial	Final
Time:	1307	1405
Meter Reading (ft3 or L)	863.16	888.52
Meter Temp. (°F)	80	109
Sample Box #	TV 750	

O2 %	12.0
CO2 %	5.0

Orsat Results

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	B ΔP (" H2O)	°F	ß	S ΔP (" H2O)	°F	ß
1	1.2			1.3		
2	1.3			1.3		
3	1.2			1.2		
4	1.1			1.2		
5	1.2			1.3		
6	1.3			1.2		
7	1.2			1.1		
8	1.1			1.1		
9						
10						
11						
12						

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3/24/92
Plant/Operator: FGT / Silver Springs
Source: Dresser Recip Unit #5
Technicians: RK, LF, JR
Atm. Pres. 30.03 in.Hg(Pb)
Test Run # C-3

Dry Gas Meter ID: Anderson
Dry Gas Meter Factor: .9904 (Kd)
Pitot Tube #/Type: .84
Pitot Tube Factor: # 107 S-Type (Kp)
Static Pres. +1.4 in.H2O(Pg)
Average Stack Temp. 655 °F(Ts)

Pre-test Leak check	ft.3/min at in. Hg Vacuum
OK	0.0 @ 28"
Post-test Leak check	**ft.3/min at in. Hg Vacuum**
OK	0.0 @ 25"

Impinger #	Contents	Initial Weight	Final Weight
1	H_2O	598.4	646.5
2	H_2O	544.0	630.9
3	MT	463.8	465.0
4	SG	868.3	876.5
5			
6			
Totals	X	2574.5	2618.9

Moisture Train

	Initial	Final
Time:	1419	1510
Meter Reading (ft3 or L)	889.130	911.22
Meter Temp. (°F)	95	101
Sample Box #	Tr 7 Box	

O2 %	12.0
CO2 %	5.0

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	ΔP (" H2O) B	°F	ß	ΔP (" H2O) S	°F	ß
1	1.2			1.2		
2	1.2			1.2		
3	1.2			1.1		
4	1.1			1.1		
5	1.2			1.2		
6	1.2			1.3		
7	1.1			1.3		
8	1.0			1.2		
9						
10						
11						
12						

Operator/Plant	Florida Gas Silver Springs Compressor Stati
Location	Marion County, Florida
Source	Dresser-Rand Compressor Engine
Technicians	RK,LF,JR

Test Run No.	C-1	C-2	C-3
Stack Moisture & Molecular Wt. via EPA Method 4			
CO2 (%)	4.80	5.00	5.00
O2 (%)	12.20	12.00	12.00
Beginning Meter Reading (ft3)	838.300	863.160	889.130
Ending Meter Reading (ft3)	862.650	888.520	911.220
Beginning Impinger Wt (g)	2480.9	2527	2574.5
Ending Impinger Wt. (g)	2527	2574.5	2618.9
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	90	80	95
Dry Gas Meter Temperature (°F end)	116	109	101
Atmospheric Pressure (in Hg, abs.)	30.05	30.03	30.03
Stack Gas Moisture (% volume)	8.74	8.54	9.16
Dry Gas Fraction	0.913	0.915	0.908
Stack Gas Molecular Wt. (lbs/lb-mole)	28.27	28.32	28.25
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	1.30	1.20	1.20
ΔP #2	1.40	1.30	1.20
ΔP #3	1.40	1.20	1.20
ΔP #4	1.20	1.10	1.10
ΔP #5	1.30	1.20	1.20
ΔP #6	1.20	1.30	1.20
ΔP #7	1.10	1.20	1.10
ΔP #8	1.30	1.10	1.00
ΔP #9	1.40	1.30	1.20
ΔP #10	1.30	1.30	1.20
ΔP #11	1.40	1.20	1.10
ΔP #12	1.20	1.20	1.10
ΔP #13	1.20	1.30	1.20
ΔP #14	1.30	1.20	1.30
ΔP #15	1.20	1.10	1.30
ΔP #16	1.10	1.10	1.20
Sum of Square Root of ΔP's	18.0	17.6	17.3
Number of Traverse Points	16	16	16
Average Square Root of ΔP's	1.13	1.10	1.08
Average Temperature (°F)	646	656	655
Static Pressure (in. H2O)	1.3	1.4	1.4
Stack Diameter (in.)	23.5	23.5	23.5
Stack Area (ft2)	3.01	3.01	3.01
Stack Velocity (ft/min)	5524	5409	5342
Stack Flow,wet (ACFM)	16638	16291	16091
Stack Flow,dry (SCFH)	4.38E+05	4.26E+05	4.18E+05

Volatile Organic Carbon by Method 25

Client:	Florida GAS Trans.	Project #:	
Plant:	Silver Springs # 17	Sample Location:	Stack
Operator:	JR, LF, RK	Date:	3-24-92
Run Number:	C-1	Sample ID:	C-2
Tank Number:	4T-89	Trap Number:	X-48
Sampling Train ID#:		% CO2:	5.0
Side: Left / Right:	Sample-1	% H2O:	9.0
Start Time:	1000	Stop Time:	1100

Pressure Readings	Tank Vacuum Manometer mm Hg / in Hg	Tank Vacuum Gauge mm Hg / in Hg	Barometric Pressure mm Hg / in Hg	Ambient Temperature C/F
Pre Test	28.00	28.80	30.05	68
Post Test	5.70	6.00	30.05	69

Leak Rate	Tank* (in Hg) Allowable	Tank* (in Hg) Actual	Trap black ball reading
Pre Test	1.051	0	0
Post Test	1.051	0	0

$$\Delta P = .01 \frac{F\, Pb\, \emptyset}{Vt}$$

ΔP = Pressure Change (in Hg)
F = Sampling Flow Rate cc / min
Pb = Barometric Pressure (in Hg)
ø = Leak Check Time Period (min)
Vt = Sample Train Volume (cc); approx 100 cc

Clock Time	Gauge Vacuum (in Hg)	Flowmeter Setting (silver ball)	Probe Temp C/F	Filter Temp C/F	Notes
1000	28.80	35	265	260	Start
1005	26.40	35	265	260	
1010	24.70	35	265	260	
1015	23.00	30	265	261	
1020	21.00	33	265	261	Adjust Flow
1025	18.80	33	266	263	✓
1030	16.50	35	266	264	
1035	14.90	33	267	264	
1040	12.30	35	267	265	
1045	10.50	30	267	266	
1050	8.70	28	267	267	Adjust Flow
1055	7.90	24	267	267	" "
1100	6.00	30	267	267	

Volatile Organic Carbon by Method 25

Client:	Florida Gas Trans	Project #:	
Plant:	Silver Springs	Sample Location:	
Operator:	JR, LF, RK	Date:	3-24-92
Run Number:	C-2	Sample ID:	C-2
Tank Number:	4T-80	Trap Number:	C-1
Sampling Train ID#:		% CO2:	5.0
Side: Left / Right:	Sample -1	% H2O:	9.0
Start Time:	1130	Stop Time:	1230

Pressure Readings	Tank Vacuum Manometer mm Hg / in Hg	Tank Vacuum Gauge mm Hg / in Hg	Barometric Pressure mm Hg / in Hg	Ambient Temperature C / F
Pre Test	2800	28.80	30.05	69
Post Test	7.50	7.90	30.05	71

Leak Rate	Tank * (in Hg) Allowable	Tank * (in Hg) Actual	Trap black ball reading
Pre Test	1.051	0	0
Post Test	1.051	0	0

$$\Delta P = .01 \frac{F\, Pb\, \phi}{Vt}$$

ΔP = Pressure Change (in Hg)
F = Sampling Flow Rate cc / min
Pb = Barometric Pressure (in Hg)
ø = Leak Check Time Period (min)
Vt = Sample Train Volume (cc); approx 100 cc

Clock Time	Gauge Vacuum (in Hg)	Flowmeter Setting (silver ball)	Probe Temp C / F	Filter Temp C / F	Notes
1130	28.80	35	267	266	Start
1135	27.00	33	267	266	
1140	24.80	35	267	265	
1145	22.60	33	267	265	
1150	20.90	30	267	266	
1155	19.20	28	267	267	Adjust Flow
1200	17.00	35	267	267	
1205	15.20	33	267	267	
1210	13.80	30	267	267	
1215	12.10	28	267	267	
1220	11.20	25	267	267	Adjust Flow
1225	9.40	35	267	267	
1230	7.90	30	267	267	

Volatile Organic Carbon by Method 25

Client:	Florida GAS Trans	Project #:	
Plant:	Silver Springs	Sample Location:	Stack
Operator:	JR, LF, QK	Date:	3-24-92
Run Number:	C-3	Sample ID:	C-2
Tank Number:	4T-187	Trap Number:	N-04
Sampling Train ID#:		% CO2:	5.0
Side: Left / Right:	Sample	% H2O:	9.0
Start Time:	1310	Stop Time:	1410

Pressure Readings	Tank Vacuum Manometer mm Hg / in Hg	Tank Vacuum Gauge mm Hg / in Hg	Barometric Pressure mm Hg / in Hg	Ambient Temperature C / F
Pre Test	28.00	28.80	30.05	71
Post Test	6.60	6.50	30.04	72

Leak Rate	Tank * (in Hg) Allowable	Tank * (in Hg) Actual	Trap black ball reading
Pre Test	1.0517	0	0
Post Test	1.0514	0	0

$$\Delta P = .01 \frac{F\,Pb\,\emptyset}{Vt}$$

ΔP = Pressure Change (in Hg)
F = Sampling Flow Rate cc / min
Pb = Barometric Pressure (in Hg)
ø = Leak Check Time Period (min)
Vt = Sample Train Volume (cc); approx 100 cc

Clock Time	Gauge Vacuum (in Hg)	Flowmeter Setting (silver ball)	Probe Temp C / F	Filter Temp C / F	Notes
1310	28.80	35	267	267	Start
1315	26.40	35	267	267	
1320	24.30	35	267	267	
1325	22.20	33	267	267	
1330	20.40	35	267	267	
1335	18.90	33	267	267	
1340	17.20	30	267	269	Adjust Flow
1345	15.70	33	267	267	
1350	13.90	30	267	267	
1355	12.50	28	267	267	
1400	11.40	25	267	266	Adjust Flow
1405	8.70	35	267	265	
1410	6.50	30	267	263	

4336

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
DEPT. NO. 8151	Cubix Corp

SAMPLERS: *(Signature)* [signature] Joseph Rudyk

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	CO2 BLANK VALUE (ppmvc)	NMHC BLANK VALUE (ppmvc)					REMARKS
	C-2	3/18/92	1020	Trap # N20		1.9						Quincy - Fla GAS ✓
	C-3	3/18/92	1325	N21		1.8						Caryville - Fla GAS ✓
				YWR		0.9						
	C-2	3/18/92	1210	TANK # 4T19			0.0					Caryville - Fla GAS ✓
	C-3	3/18/92	1325	4T22			0.0					Caryville - Fla GAS ✓
				4T29			1.8					
	C-3	3/26/92	1100	4T41			2.1					Melbourne - Fla. GAS ✓
				4T66			0.1					
				4T71			0.0					
	C-2	3/24/92	1330	4T80			0.0					Silver Springs - Fla. GAS ✓
	C-1	3/20/92	1120	4T81			0.2					Perry - Fla. GAS ✓
	C-1	3/24/92	1000	4T89			0.7					Silver Springs - Fla. GAS ?
	C-2	3/20/92	1000	4T91			0.1					Perry - Fla. GAS ✓
	C-2	3/26/92	955	4T103 LAB 412			0.5					Melbourne - Fla. GAS.

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Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by:	Date / Time		

REMARKS:

Clean Air Engineering
500 W. Wood Street
Palatine, IL 60067
708/991-3300

4334

CHAIN OF CUSTODY RECORD

PROJ. NO. / DEPT. NO. 8151

PROJECT NAME: Cubix Corp.

SAMPLERS: (Signature) [signature] Joseph Rudyk

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	COS BLANK VALUE (ppmv)						REMARKS
	C-1	3/20/92	830	Trap # B35		3.0						Melbourne - Fla. GAS ✓
	C-2	3/7/92	1530	B53		4.5						MUNSON - Fla. GAS ✓
	~~C-5~~	~~3/27/92~~		~~B233~~		1.3						Melbourne
	~~C-2~~	~~3/24/92~~	~~1130~~	~~C1~~		~~2.4~~						~~Silver Springs - Fla. GAS~~ ✓
	~~C-1~~	~~3/19/92~~	~~100~~	C3		3.5						Quincy - Fla. GAS
	Adit-2	3/26/92		C7		0.8						Melbourne
→	C-3	3/29/92	1120	C10		6.6						Perry - Fla. GAS ✓
	C-3	3/17/92	1643	C13		3.6						MUNSON - Fla. GAS ✓
	C-3			C15		3.6						Brooker
	C-2	3/26/92	955	C37		0.8						Melbourne - Fla. GAS ✓
	C-2	3/18	1300	R002		4.3						Coating with C - PGW
				R004		1.2						
				R008		2.5						
				X1		2.6						
→	C-1	3/20/92	830	X10		2.5						Perry - Fla. GAS ✓

LAB 4/2

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Relinquished by: (Signature)	Date / Time	Received for Laboratory by:	Date / Time		

REMARKS:

Clean Air Engineering
500 W. Wood Street
Palatine, IL 60067
708/991-3300

4335

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME	NO. OF CON-TAINERS	REMARKS
DEPT. NO. 8151	Cubix Corp		

SAMPLERS: (Signature) [signature] Joseph Rudyk

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CON-TAINERS	CO_2 BLANK VALUE (ppm vc)						REMARKS
→	C-2	3/20/92	1000	Trap # X13 % Brooker		1.8						Perry - Fla. GAS ✓
				X14		0.9						
				X16		2.3						
	Audit-1	3/26/92		X23		2.6						Melbourne
				X27		1.8						
				X28		8.0						
	C-3	3/24/92	1100	X32		3.3						Melbourne - Fla. GAS ✓
	C-1	3/24/92	1000	X48		9.0						Silver Springs - Fla. GAS
	C-4	3/27/92		X4		2.3						Melbourne
	C-3	3/19/92	1135	N2		5.6						Quincy Fla. GAS ✓
	C-3	3/24/92	1310	N4		3.0						Silver Spring - Fla. GAS ✓
				N7		2.1						
	C-6	3/27/92		N8		2.6						Melbourne
	C-1	3/17/92	1425	N13		8.7						Munson - Fla GAS ✓
	C4	3/18/92	1100	N19 LAB 4/2		3.0						Caryville Fla. GAS ✓

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[signature]	4/1/92 1:42	Tom Grosskrueger			
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Relinquished by: (Signature)	Date / Time	Received for Laboratory by:	Date / Time		

REMARKS:

Clean Air Engineering
500 W. Wood Street
Palatine, IL 60067
708/991-3300

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CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
DEPT. NO. 8151	Cubix Corp

SAMPLERS: (Signature) [signature] Joseph Rudyk

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	NMHC	BLANK VALUE (ppmvc)					REMARKS
	Audit-2	3/26/92		TANK # 4T107		0.1						Melbourne
	C-2	3/23/92	1773	4T108		0.1						Brooker — Fla. GAS ✓
→	C-1	3/20/92	930	4T114		0.2						Perry — Fla. GAS ✓
	C-6	3/27/92		4T119		0.7						Melbourne
	C-1	3/23/92	1526	4T121		0.1						Brooker — Fla. GAS ✓
				4T127		0.4						
	Audit 1	3/26/92		4T128		0.2						Melbourne
	C-1	3/19/92	900	4T149		0.9						Quincy — Fla. GAS ✓
				4T159		1.1						
	C-3	3/19/92	1135	4T177		1.1						Quincy — Fla. GAS ✓
	C-3	3/23/92	1833	4T182		0.1						Brooker — Fla. GAS ✓
	C-3	3/24/92	1310	4T187		1.5						Silver Springs. Fla. GAS ✓
	C-4	3/27/92		4T193		0.2						Melbourne
	C-1	3/26/92	8:30	4T194		0.1						Melbourne — Fla. GAS ✓
	C-5	3/27/92		4T197		0.1						Melbourne

LAB 4/2

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Relinquished by: (Signature)	Date / Time	Received for Laboratory by:	Date / Time		

REMARKS:

500 W. Wood Street

Table of Carbon Concentration for Method 25.
Samples collected by Cubix Corp. at Florida
Gas & Trans on 3/24/92 and reported on 4/30/92.

		Carbon Concentration			
Source	Sample - Run ID #	Total (Mc) (mg/dscm)	Total (C) (ppmv)	Condensible (Ccm) (ppmv)	Noncondensible (Ctm) (ppmv)
SILVER SPRINGS	C-1	97.7	195.7	155.4	40.3
	C-2	83.4	167.0	117.6	49.4
	C-3	88.2	176.6	140.3	36.2

Compiled By: [signature] On: 5-1-92

Approved By: [signature] On: 5/1/92

Job No. 8160	Plant: Florida Gas & Trans.
Client Cubix	Sample Loc. Silver Springs
Disk/File 8160S	(In/Out) Stack
Page No. 2	Date 3/24/92

Preliminary Data				
Run No.		C-1	C-2	C-3
Tank No.		4T89	4T80	4T187
Trap No.		X48	C1	NO 4
Tank Volume V(cc)		4272	4255	4265
Field Data				
PTI	(mm Hg)	-711	-711	-711
TTI	(F)	68	69	71
PbI	(mm Hg)	763	763	763
PT	(mm Hg)	-145	-191	-168
TT	(F)	69	71	72
Pb	(mm Hg)	763	763	763
Noncondensible Organics				
PT(Lab)	(mm Hg)	-148	-200	-174
TT(Lab)	(F)	78	77	78
Pb(Lab)	(mm Hg)	734	743	743
PTF	(mm Hg)	920	920	920
TTF	(F)	78	77	78
PbF	(mm Hg)	734	743	743
Ba	(ppmv C)	0.7	0.6	1.5
Ctm 1	(ppmv C)	14.8	16.4	13.1
Ctm 2	(ppmv C)	14.8	16.4	13.5
Ctm 3	(ppmv C)	14.6	15.8	13.8
Avg. Ctm	(ppmv C)	14.7	16.2	13.5
RSD Ctm	(%)	0.8	2.1	2.6
Condensible Organics				
ICV Tank No.		4T175	4T183	4T213
ICV Tank, Vv (cc)		3928	3962	4265
PFI	(mm Hg)	-722	-730	-732
TFI	(F)	78	77	78
PbFI	(mm Hg)	734	743	743
PF	(mm Hg)	920	920	920
TF	(F)	78	77	78
PbFf	(mm Hg)	734	743	743
Bt	(ppmv C)	9.0	2.4	3.0
Ccm 1	(ppmv C)	67.5	41.9	50.0
Ccm 2	(ppmv C)	67.6	42.2	49.5
Ccm 3	(ppmv C)	68.3	42.9	48.5
Avg. Ccm	(ppmv C)	67.8	42.3	49.3
RSD Ccm	(%)	0.6	1.2	1.5
Total Gaseous Nonmethane Organics (TGNMO)				
Vs	(cc)	3176	2895	3025
Dil. Factor (Non)		2.874	3.163	3.029
Dil. Factor (Con)		2.642	2.946	3.029
Ct	(ppmv C)	40.3	49.4	36.2
Cc	(ppmv C)	155.4	117.6	140.3
Ct+Cc= C	(ppmv C)	195.7	167.0	176.6
Mc	(mg C/dscm)	97.7	83.4	88.2

Air NUKP 226AP Field Emissions Acceptance Test 5/24/92 DNA 1 of 2

100% Load - 330 RPM

c/s 17

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	1A	1B	2A	2B	3A	3B
TYPE- KVSRA						
ENGINE SERIAL NO. 226 AP	10:40		1:01	1:20	2:15	2:51
ENGINE SPEED-RPM Moore	330		330	330	329	330
TURBO SPEED PE/WE-RPM	15700 / 15900		15800 / 16000	15700 / 15900	15800 / 16000	15850 / 16000
SPARK Dynalco/Moore %	14° / 47.8%		14° / 48.0%	14° / 47.7%	14° / 48.1%	14° / 48.2%
AMBIENT TEMP.	74°			77°	75°	77°
AIR MANFLD TEMP	128°		128°	128°	128	128°
FUEL TEMP						
LUBE OIL IN/OUT TEMP	146° / 163		146° / 163°	146° / 162	145° / 161°	145° / 161°
JACKET WATER IN/OUT TEMP	167° / 170°		167° / 170°	167° / 170°	168° / 172°	169° / 172°
AFTER CLR TEMP IN/OUT	125° / 126°		124° / 126°	124° / 126°	125° / 127°	124° / 126°
TURBO WATER OUT TEMP PE/WE						
AIR MANFLD PRESS psig	8.9			9.0	9.1	9.1
FUEL MANFLD PRESS psig	27.6			27.4	27.3	27.4
PCC FUEL MANFLD PRESS psig	19.0			19.1	19.1	19.2
FUEL SUPPLY PRESS						
FUEL FLOW						
BLOWOFF SIGNAL ~~PRESS~~				47.3%	44%	44%
MAIN OIL PUMP PRESS	68			68	68.5	68.5
PRE LUBE PUMP PRESS						
MAIN BRG OIL PRESS	50.5			51	51	51
TURBO OIL PRESS PE/WE	38.3 / 35.5			38.5 / 35.7	38.5 / 35.7	38.5 / 35.7
JACKET WATER PRESS IN/OUT				28 / 14.2	29.0 / 15.5	29.2 / 15.7
GAS SUCTION TEMP	69°			68°	69°	69°
GAS DISCH TEMP	96-98°			101°-102°	102°-104°	103°-104°
GAS SUCTION PRESS	792			740	738	735
GAS DISCH PRESS	940			915	908	909
TORQUE Dynalco/Moore	98 / 99			98 / 99	98 / 99	99 / 100
LOAD STEP	13			15	15	15
Barometer in Hg	30.05		30.05	30.03	30.03	30.03
POWER CYL TEMP						
#1/2	776 / 786			768 / 781	766 / 777	768 / 780
#3/4	817 / 818			815 / 815	810 / 812	812 / 813
#5/6	792 / 761			789 / 761	785 / 759	787 / 760
#7/8	772 / 797			771 / 794	768 / 790	771 / 791
#9/10	821 / 821			809 / 819	805 / 815	806 / 817
#11/12	822 / 796			822 / 794	816 / 789	817 / 792
TURBO EXHAUST TEMP PE/WE	704 / 731			702 / 730	697 / 729	701 / 728
% / CO_2 %	12.2 / 4.8			12.0 / 4.8	12.4 / 4.8	12.4 / 4.9
ppm / lb/Hr / g/BHP·Hr	329 / 11.9 / 2.29	[illegible] / 1.97		324 / 10.0 / 1.90	312 / 9.5 / 1.81	
ppm / g/f	192 / 11.4 / [illegible]	[illegible] / 1.99		160 / 8.1 / 1.54	133 / 6.6 / 1.27	

Guarantee
2.3 g/BHP·Hr
2.0 g/BHP·Hr

110% Load - 330 RPM C/S 17

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	4A			
TYPE- KVSRA				
ENGINE SERIAL NO. 226AP	3:37			
ENGINE SPEED-RPM Moore	330			
TURBO SPEED PE/WE-RPM	16800 / 16900			
SPARK Dynalco / Moore %	12° / 58.0 %			
AMBIENT TEMP.	76°			
AIR MANFLD TEMP	101°			
FUEL TEMP				
LUBE OIL IN/OUT TEMP	146° / 162°			
JACKET WATER IN/OUT TEMP	169° / 173°			
AFTER CLR TEMP IN/OUT	96° / 100°			
TURBO WATER OUT TEMP PE/WE				
AIR MANFLD PRESS PSIG Gauge/Moore	10.0 / 10.3			
FUEL MANFLD PRESS PSIG	32.1			
PCC FUEL MANFLD PRESS PSIG	20.1			
FUEL SUPPLY PRESS				
FUEL FLOW				
BLOWOFF SIGNAL ~~PRESS~~	60.0 %			
MAIN OIL PUMP PRESS	68.5			
PRE LUBE PUMP PRESS	[illegible]			
MAIN BRG OIL PRESS	57.0			
TURBO OIL PRESS PE/WE	38.5 / 35.5			
JACKET WATER PRESS IN/OUT	29.5 / 16.0			
GAS SUCTION TEMP	68°			
GAS DISCH TEMP	104-105°			
GAS SUCTION PRESS	730			
GAS DISCH PRESS	910			
TORQUE Dynalco / Moore	109 / 110			
LOAD Step	9			
Barometer	30.03			
POWER CYL TEMP				
#1/2	800 / 819			
#3/4	848 / 844			
#5/6	825 / 794			
#7/8	804 / 830			
#9/10	841 / 856			
#11/12	859 / 828			
TURBO EXHAUST TEMP PE/WE	721 / 753			
/ CO_2 %	12.1 / 4.9			
	315/10.4/1.72			

APPENDIX B: EXAMPLE CALCULATIONS

MOISTURE CONTENT
refers to test run C-1

V_1 = initial dry gas meter reading = 838.3 ft^3
V_2 = final dry gas meter reading = 862.65 ft^3
V_{net} = total gas sample volume collected (ft^3)
= $V_2 - V_1$
= 862.65 - 838.3 = 24.35 ft^3

M_1 = initial weight of impinger train = 2480.9 g
M_2 = final weight of impinger train = 2527.0 g

MWC = total weight gain of all impingers (g)
= $M_2 - M_1$ = 2527.0 - 2480.9
= 46.1 g

K_d = dry gas meter factor (unitless) = 0.9904

$V_{corrected} = V_{net} \times K_d =$ x
= 24.35 x 0.9904 = 24.116 ft^3

1.335 liters weighs 1 gram at standard conditions
499.4 = Gas constant
P_{bar} = barometric pressure (in Hg) = 30.05
T = temperature of gas DGM (F^o) = 92.5

F_w = moisture fraction by volume

$$= \frac{\text{volume } H_2O \text{ collected in impingers}}{\text{vol. } H_2O \text{ collected} + \text{volume gas dry gas collected}}$$

$$= \frac{MWC \times 1.335}{(MWC \times 1.335) + (((V_{cor} \times P_{bar}) / (T + 460)) \times 499.4)}$$

$$= \frac{(46.1 \times 1.335)}{(46.1 \times 1.335) + (((24.116 \times 30.05) / (103 + 460)) \times 499.4)}$$

= 0.074 moisture

MOLECULAR WEIGHT
refers to test run C-1

MW_{H_2O} = molecular wt of H_2O = 18 lb/lb-mole
MW_{CO_2} = molecular wt of CO_2 = 44 lb/lb-mole
MW_{O_2} = molecular wt of O_2 = 32 lb/lb-mole
MW_{N_2} = molecular wt of N_2 = 28 lb/lb-mole
C_{CO_2} = concentration of CO_2 = 4.8 (from Orsat)
C_{O_2} = concentration of O_2 = 12.2(from Orsat)
C_{N_2} = concentration of N_2 = $1-(C_{CO_2}+C_{O_2})$ = 0.83
Fw = moisture fraction = 0.0874
F_d = dry gas fraction = 1 - Fw = 0.9126

MW = molecular weight of stack gas (lb/lb-mole)
= wt of H_2O + wt. of CO_2 + wt. of O_2 + wt. of N_2

$$= (MW_{H_2O} \times F_w) + (F_d \times ((MW_{CO_2} \times C_{CO_2}) + (MW_{O_2} \times C_{O_2}) + (MW_{N_2} \times C_{N_2})))$$

$$= (18 \times 0.0874) + (0.9126 \times ((44 \times 0.048)+(32 \times 0.122) + (28 \times 0.83)))$$

$$= 28.27 \text{ lb/lb-mole}$$

STACK GAS VELOCITY AND FLOW RATE

refers to test run C-1

K_p = pitot tube factor = .84
ΔP = pressure difference in stack as measured (in. H_2O)
$(\sqrt{\Delta P})avg$ = average of square root of ΔP's = 1.1255
T_s = stack temperature = 646 F° = 1106 R°
P_b = atmospheric pressure (in Hg) = 30.05
P_g = stack static pressure (in. H_2O) = 1.3
Ps = absolute stack pressure
= P_b + (Pg x .0735 in.Hg / in.H_2O) = 30.146 in. Hg

V = stack velocity (ft/min)

= 5128 x Kp x $(\sqrt{\Delta P})avg$ x $\sqrt{(Ts / (Ps \times MW))}$

= 5128.8 x .84 x 1.1255 x $\sqrt{(1106/ (30.146 \times 28.27)}$
= 5524 ft/min

Q_a = stack flow rate (ft^3/min)
= V x A , where A= area of stack = 3.01 ft^2
= 5524 x 3.01 = 16630 ft^3/min

Qd= stack flow rate on dry basis at standard conditions (SCFH)
= Q_a x 1059 x (Ps / Ts) x Fd
= 16630 x 1059 x (30.146/1106) x 0.9126
= 4.38×10^5 SCFH

FLOW RATE DETERMINATION BY F-FACTOR (EPA Method 19)
refers to test run C-1

Q_f = estimated fuel flow = 17951 SCF/hr
F_{BTU} = heating value of gas = 1022 BTU/SCF
F = O_2 F factor = 8636 SCF/MMBTU
C_{O2} = concentration of O_2 = 12.25 %(from analyzer)

Q_d = stack flow rate on dry basis at standard conditions (SCFH)
$= Q_f \times F_{BTU} \times 10^{-6} \times F \times 20.9 / (20.9 - C_{O2})$
$= 17951 \times 1022 \times 10^{-6} \times 8636 \times 20.9 / (20.9 - 12.25)$
$= 3.83 \times 10^5$ SCFH

With CO2 F-factor (i.e. F=1023), same calculation is used except for final term......
$Q_d = Q_f \times F_{BTU} \times 10^{-6} \times F \times 100/C_{CO2}$
$= 17951 \times 1022 \times 10^{-6} \times 1023 \times 100/4.82$
$= 3.89 \times 10^5$ SCFH

* For calculation of f-factor and heating value of fuels, see Appendix H.

MASS EMISSION RATES
refers to test run C-1

NOx = concentration of NOx = 192 ppmv
CO = observed concentration of CO = 329 ppmv
VOC = observed concentration via EPA Method 25 and 18
= 42.9 ppmv
1 SCF NOx = 11.94×10^{-8} lbs
1 SCF CO = 7.26×10^{-8} lbs
1 SCF C1(methane) = 4.15×10^{-8} lbs
Qd = stack flow rate = 4.38×10^{5} SCFH
E_{NOx} = mass emission rate of NOx (lb/hr)
$= NOx \times Qd \times 11.94 \times 10^{-8}$
$E_{NOx} = 192 \times 4.38 \times 10^{5} \times 11.94 \times 10^{-8}$

E_{NOx}= 10.0 lb/hr
E_{CO} = 10.5 lb/hr
E_{VOC}= 0.78 lb/hr

HP = engine horsepower = 2352 hp
454 g = 1.0 lb

$E_{NOx\ (g/hp\text{-}hr)} = E_{NOx} \times 454 / HP$
$= 10.0 \times 454 / 2352$
$E_{NOx\ (g/hp\text{-}hr)}$= 1.94 g/hp-hr
$E_{CO\ (g/hp\text{-}hr)}$= 2.02 g/hp-hr
$E_{VOC\ (g/hp\text{-}hr)}$= 0.15 g/hp-hr

Stack Gas Flow Rate via AGA Carbon Balance Method

Refers to Test Run #C-1

Q_f = fuel flow = 17951 SCF/hr

Cf = carbon content of fuel (from fuel analysis) = 1.023

Ce = exhaust gas carbon content

= CO + THC (as C1) + CO2

= (329 + 820) / 10000 + 4.82 = 4.935 %

Q = stack flow rate

= Qf x Cf x 100 / Ce

= 17951 x 1.023 x 100 / 4.935

= 3.72×10^5 SCFH

SO_2 Emission Rate from Fuel Analysis

Refers to Test Run #C-1

S = sulfur content of fuel = <0.059 grains/100 DSCF

7000 grains = 1.0 lb

Q_f = 17951 SCF/hr

SO_2 = mass emission rate of SO_2

= $S / 100 / 7000 \times Q_f$

= <0.059 /100 / 7000 x 17951

= <0.0015 lbs/hr

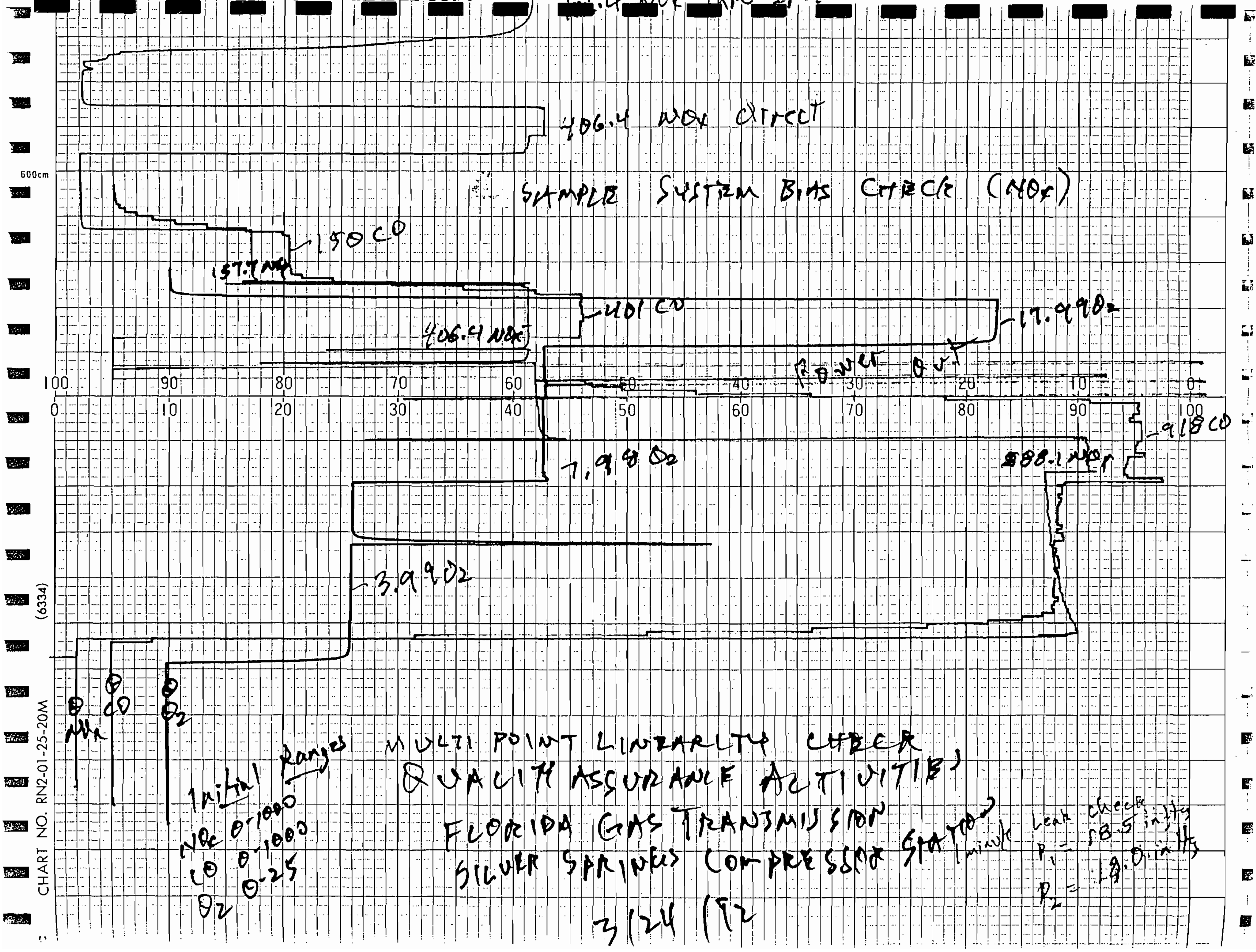
Moisture Content via Stoichiometry
Refers to test run #1

H = Ambient humidity (via psychrometer) = 0.0098 lb/lb air
O2 = O2 concentration in stack = 12.25%
F = wet basis O2 F-factor (from fuel calcs)
= 10643 DSCF/MMBTU
FW = moisture F-factor = 2007 SCF of H2O/MMBTU
CM = combustion moisture % at 0% O2
= Fw / F x 100 = 2007 / 10643 x 100
= 18.86 %

Fw = moisture content
= (CM x (20.9 - O2)/20.9) + (H x 64.3)
= (18.86 x (20.9 - 12.25)/20.9) + (.0098 x 64.3)
= 8.43 %

APPENDIX C:
QUALITY ASSURANCE ACTIVITIES

BEST AVAILABLE COPY



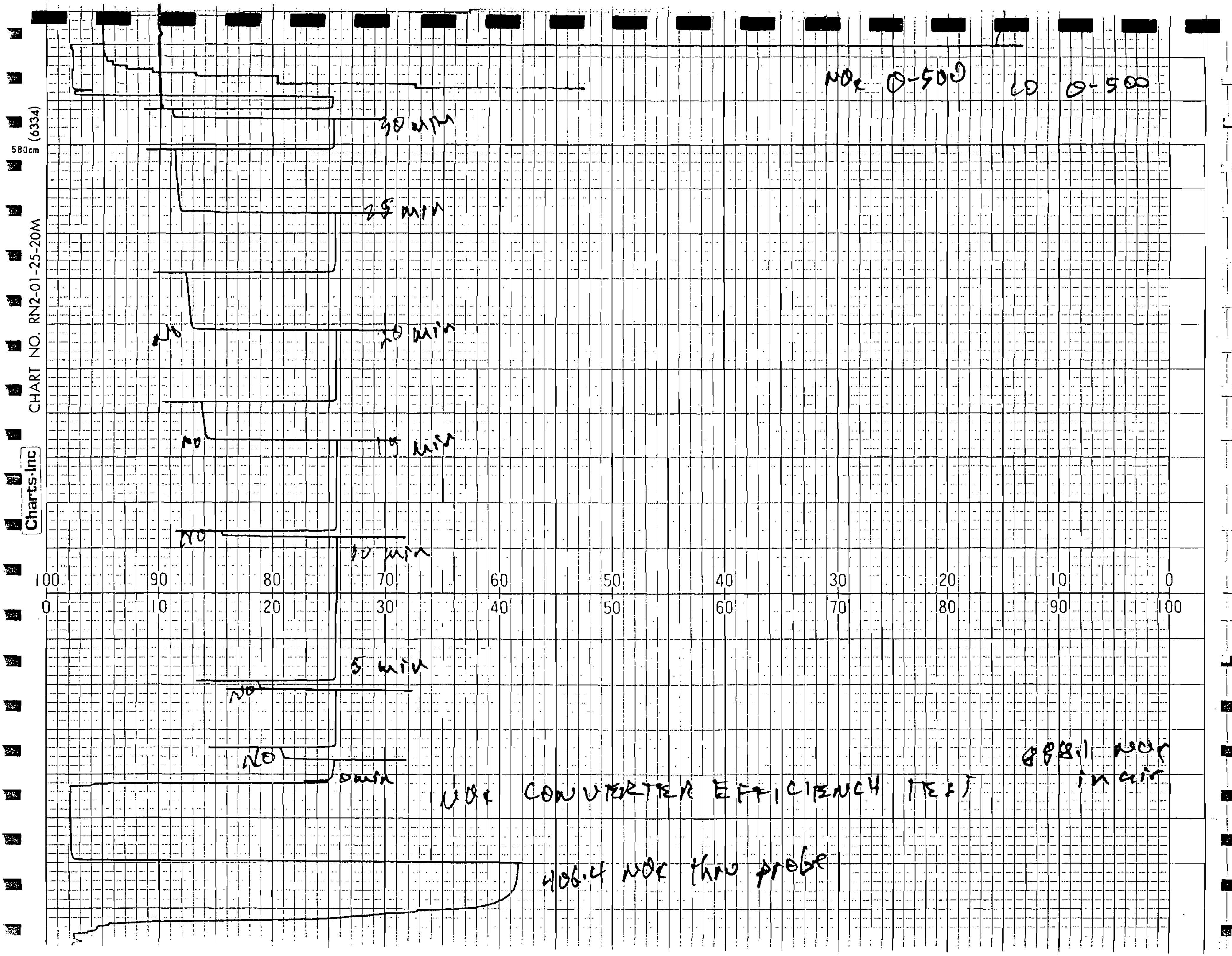
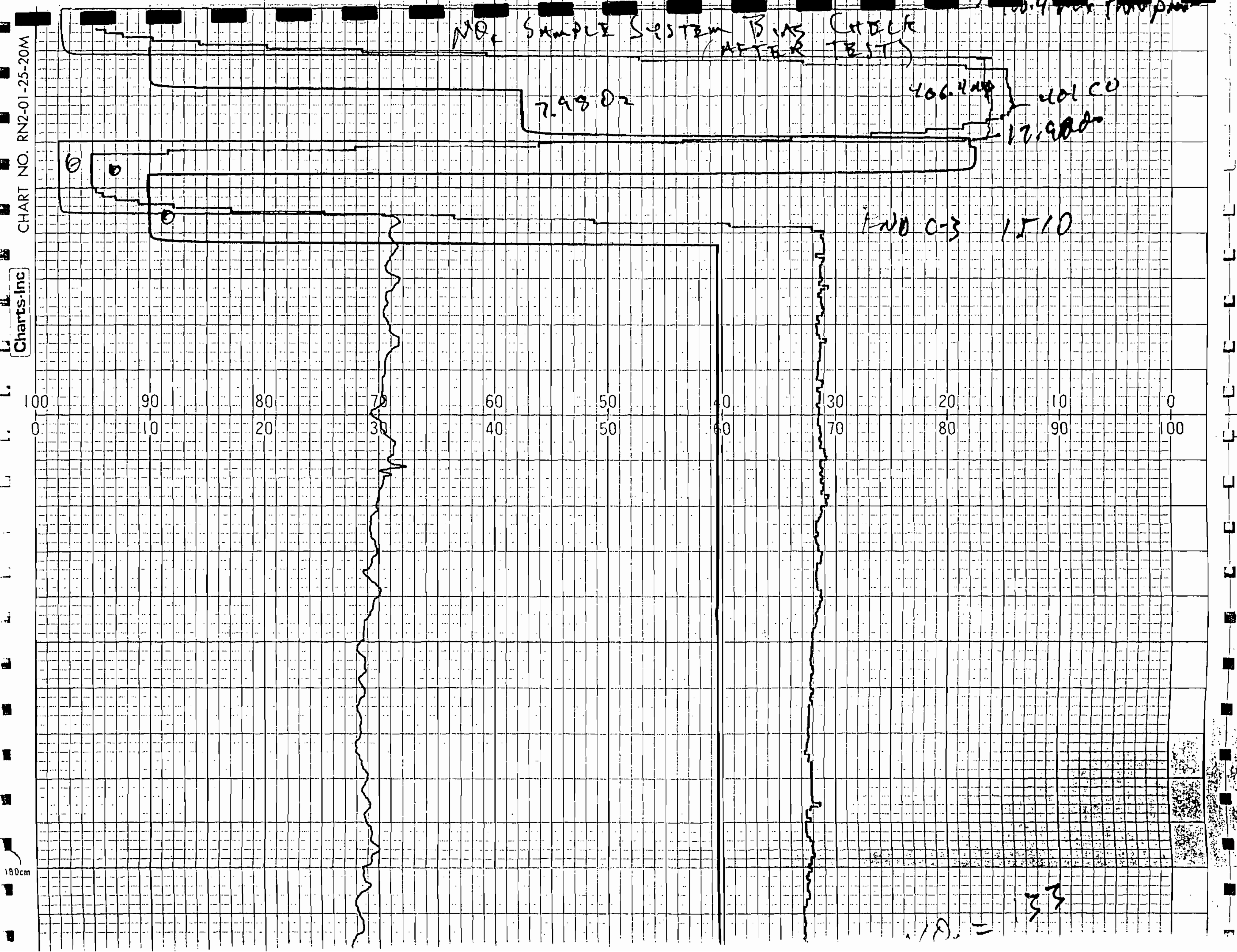
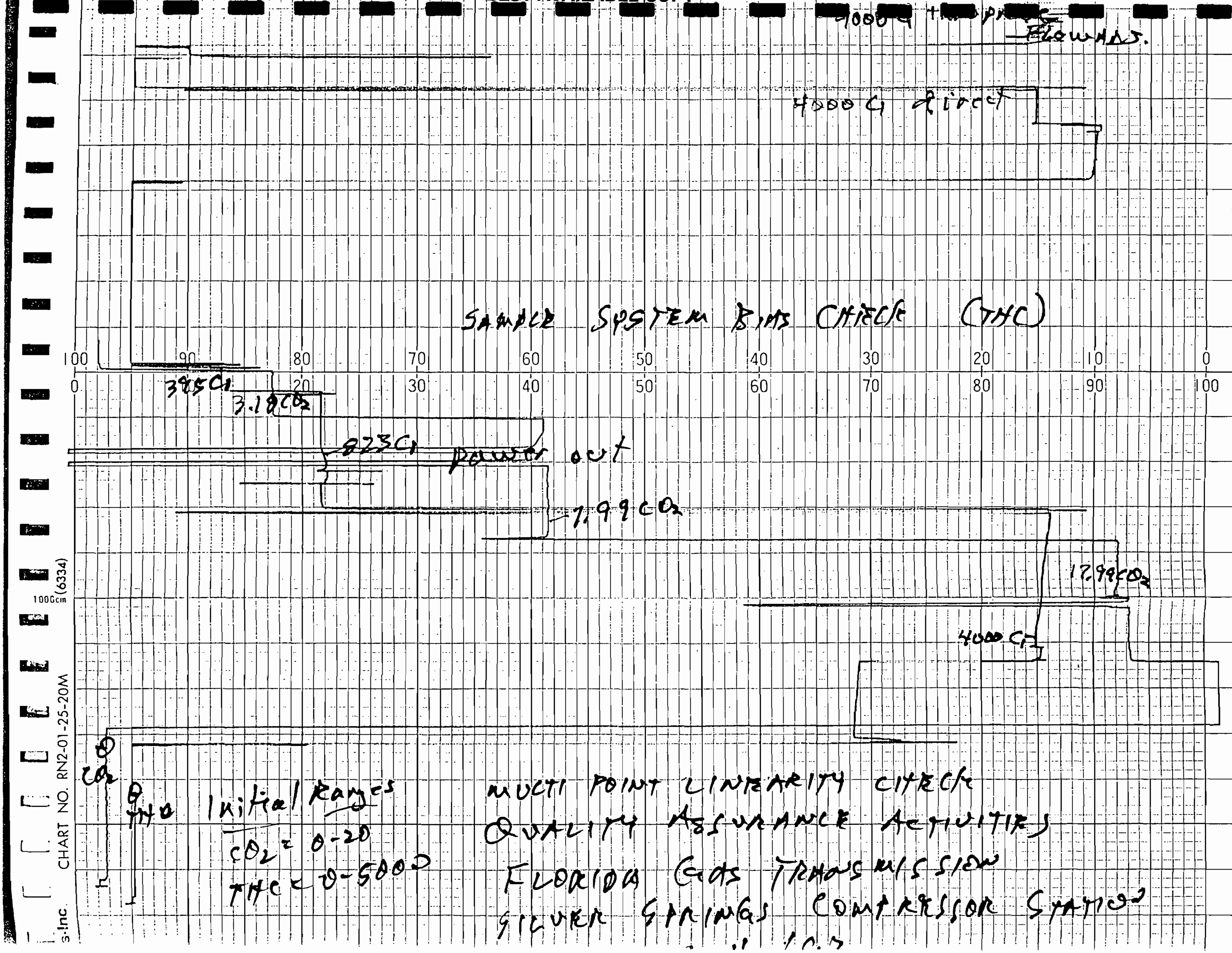


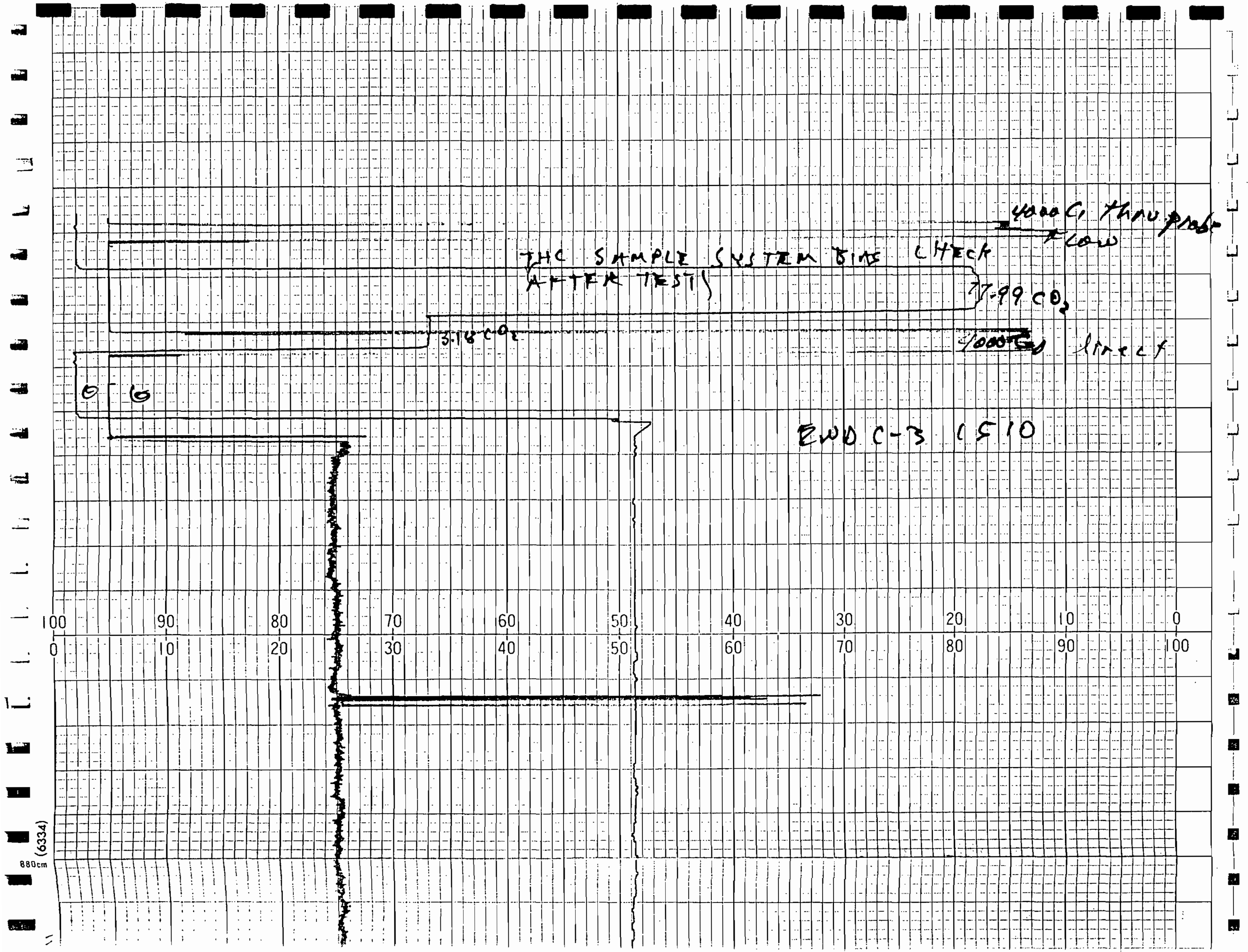
CHART NO. RN2-01-25-20M
Charts·Inc
(6334)
580cm
NOx 0-500
CO 0-500
30 min
25 min
20 min
NO
15 min
NO
10 min
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
5 min
NO
NO
0 min
NOx CONVERTER EFFICIENCY TEST
in air
406.4 NOx thru probe

BEST AVAILABLE COPY



BEST AVAILABLE COPY




THC SAMPLE SYSTEM BIAS CHECK
(AFTER TEST)
4000 C1 thru probe
flow
7.99 CO2
3.18 CO2
1000
direct
EWD C-3 1510
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
880cm
(6334)

	CERTIFIED GAS INPUT		INITIAL CALIBRATION & LINEARITY CHECK		TEST RUN #C1	ZERO and SPAN CALIBRATION CHECK		TEST RUN #C2	ZERO and SPAN CALIBRATION CHECK		TEST RUN #C3	ZERO and SPAN CALIBRATION CHECK	
	Concentration (% or ppm)	Target (% Chart)	Initial (% Chart)	Difference (% Chart)		Final (% Chart)	Drift (% Chart)		Final (% Chart)	Drift (% Chart)		Final (% Chart)	Drift (% Chart)
NOx					Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	2.0	1.9	-0.1	192.0	2.0	0.0	160.0	2.1	0.1	133.0	2.0	0.0
low	157.7	17.8	17.1	-0.7	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	406.4	42.6	41.2	-1.4	40.4	83.8	0.5	34.0	83.9	0.6	28.6	83.9	0.6
high	888.1	90.8	90.9	0.1		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	1000.0				500.0			500.0			500.0		
CO					Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	5.0	5.0	0.0	329.0	4.9	-0.1	324.0	4.9	-0.1	312.0	5.0	0.0
low	150.0	20.3	20.4	0.1	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	401.0	45.3	45.9	0.6	70.8	85.1	-0.1	69.8	85.8	0.6	67.4	85.3	0.1
high	918.0	96.5	95.5	-1.0		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	1000.0				500.0			500.0			500.0		
O2					Avg.%			Avg.%			Avg.%		
zero	0.0	10.0	9.9	-0.1	12.25	9.9	-0.1	12.05	10.0	0.0	12.40	10.0	0.0
low	3.99	26.0	25.9	-0.1	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	7.98	41.9	42.7	0.8	59.0	42.3	0.4	58.2	41.8	-0.1	59.6	42.4	0.5
high	17.90	81.6	82.7	1.1		81.9	0.3		80.9	-0.7		82.5	0.9
full scale	25.0				25.0			25.0			25.0		
CO2					Avg.%			Avg.%			Avg.%		
zero	0.0	2.0	2.8	0.8	4.82	2.0	0.0	4.89	2.0	0.0	4.91	2.0	0.0
low	3.18	17.8	17.4	-0.4	% Chart	32.7	-1.1	% Chart	33.1	-0.7	% Chart	33.2	-0.6
mid	7.99	42.0	41.3	-0.7	50.2	80.8	-1.1	50.9	81.9	0.0	51.1	82.2	0.3
high	17.99	92.0	92.2	0.3		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	20				10.0			10.0			10.0		
THC					Avg. ppmv			Avg. ppmv			Avg.ppmv		
zero	0.0	5.0	5.0	0.0	820	4.9	-0.1	975	5.0	0.0	1015	5.0	0.0
low	395	12.9	13.0	0.1	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	823	21.5	21.7	0.2	21.4	n.a.	n.a.	24.5	n.a.	n.a.	25.3	n.a.	n.a.
high	4000	85.0	86.1	1.1		84.7	-0.3		83.8	-1.2		86.8	1.8
full scale	5000				5000			5000			5000		

Thermo Electron CORPORATION

Richard A. Curran
Regional Sales Manager

Environmental Instruments Division

108 South Street
Hopkinton, Massachusetts 01748
(617) 435-5321

TR 7

INTERFERENCE RESPONSE TEST

DATE OF TEST JAN 20, 1992

ANALYZER TYPE 10 ~~AR~~ S RANGE 0-25PPM SERIAL NO. 105-19481-184

TEST GAS TYPE	CONCENTRATION PPM	ANALYZER OUTPUT RESPONSE	% OF SPAN
CO	500	< .1 PPM	< .1%
CO_2	201	< .1 PPM	< .1%
CO_2	10%	< .1 PPM	< .1%
O_2	20.9%	< .1 PPM	< .1%

Continous Emission Analyzer Interference Response Tests

Date: 7/8/88
Technician: KRB / MM

Analyzer Type: Thermo Environmental
Analyzer Model: Model 48 Gas Filter Correlation Analyzer
Serial Number: 48-23576-210
Analyzer Test Range: 0-20 ppmV

Test Gas		Analyzer Response		Response
Type Gas	Concentration	Concentration ppmv	% of Range	Ratio
Air	CO Free	0.0	N/A	
CO_2/O_2	4%/18%	0.0	↓	0.000
CO_2/O_2	12%/8%	-0.2	↓	-0.017 / -0.025
CO_2/O_2	21%/3%	-0.3	↓	-0.014 / -0.100
Air	Dry	0.4	↓	CO Impurity?
NOx	176 ppmv	0.4	↓	0.002
NOx	3030 ppmv	0.4	↓	0.0001
SO_2	401 ppmv	-0.2	↓	0.0005
Propane	240 ppmv	0.4	↓	0.002

(CO_2/O_2 ratios: ppmv/%; NOx, SO_2, Propane ratios: ppmv/ppmv)

all interferences are negligible

TR 7 O2 ANALYZER

Continous Emission Analyzer Interference Response Tests

Date: 1/16/92
Technician: LF

Analyzer Type: SERVOMEX O_2 ANALYZER
Analyzer Model: 1400
Serial Number: 01420 B701 627
Analyzer Test Range: 0-10

Test Gas		Analyzer Response		Response
Type Gas	Concentration	Concentration	% of Range	Ratio
CO	471 ppm	5.05%	5.5	
SO_2	348 ppm	5.05%	5.5	
CO_2	8%	5.05%	5.5	
NO_x	888 ppm	5.05%	5.5	

TA 7 CO_2 ANALYZER

Continous Emission Analyzer Interference Response Tests

Date: 1/16/92
Technician: LF

Analyzer Type: CO_2
Analyzer Model: SERVOMEX 1400
Serial Number: 01410 ~~[illegible]~~ B619
Analyzer Test Range: 0-20

Test Gas		Analyzer Response		Response
Type Gas	Concentration	Concentration	% of Range	Ratio
CO	491	<.02%	~~<.005~~ <.5	
SO_2	398	<.02%	~~<.005~~ <.5	
O_2	20.9	<.02%	~~<.005~~ <.5	
NO_x	888	<.02%	~~<.005~~ <.5	

Response Time Data Sheet

Date: 3/24/89

Plant: — Austin Office

Technician: MM/DC

Sample Manifold Press.: 6 psi

Sample Line Length: 140 ft.

Pump Model No.: 6-3 Dia-pump

Analyzer:	NOx Analyzer	Oxygen Analyzer
Model:	TECO 10AR	Teledyne 320AX
Range:	0 - 1000 ppm	0 - 25 %
Span Gas:	900 ppm NOx	Air = 20.9% O_2
Upscale Response	.65 min	.72 min
	.60	.75
	.60	.80
Average	.61 min	.76 min
Downscale Response	.65 min	.90 min
	.65	.90
	.65	.85
Average	.65 min	.88 min

Comments: 3/8" Sample line
Igloo Condenser

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Instrumental Analysis
Quality Assurance Data

Date: 3/24/92
Plant: FGT SILVER SPRINGS
Technician: LF RKJR

NOx Analyzer: NO2 to NO Converter Efficiency Test

NO Calibration Gas: 888.1 ppm
Dilutent Gas: Air (20.9% oxygen)

	NOx Concentration (ppm)	% Decrease from Initial Concentration	NO Concentration (ppm)
Initial Concentration	237	n.a.	189
10 minute Concentration	237	0	136
20 minute Concentration	237	0	106
30 minute Concentration	234	1.3	93

Sampling System Bias Check

Analysis	Calibration Gas Concentration (ppm)	Full Scale Span (ppm)	Direct Calibration Response (ppm)	Thru-Probe Sample System Response (ppm)	System Calibration Bias (% of Span)
Zero Gas					
NOx (before test)	406.4	1000	407	398	-0.9%
SO2					
THC (before test)	4000	5000	3975	3915	-1.2%
NOx (after test)	406.4	500	406	405.5	-0.1%
THC (after test)	4000	5000	4090	3990	-2.0%

$$\% \text{ Calibration Bias} = \frac{(\text{Thru-Probe Response}) - (\text{Direct Calibration Response})}{\text{Full Scale Span}} \times 100 *$$

Table of Carbon Concentration for Method 25.
Audit samples collected by Cubix Corp. at Fl.
Gas & Trans on 3/26/92 and reported on 4/30/92.

		Carbon Concentration			
Source	Sample - Run ID #	Total (Mc) (mg/dscm)	Total (C) (ppmv)	Condensible (Ccm) (ppmv)	Noncondensible (Ctm) (ppmv)
AUDITS	#470A	110.7	221.8	89.3	132.5
	#470B	806.8	1615.9	131.8	1484.1

Compiled By: [signature] On: 5-1-92

Approved By: [signature] On: 5/1/92

Job No. 8160
Client Cubix
Disk/File 8160
Page No. 2

Plant: Florida Gas & Trans
Sample Loc. Audits (In/Out)
Date 3/26/92

Preliminary Data			
Run No.		Audit #473B	Audit #473A
Tank No.		4T128	4T107
Trap No.		X23	C7
Tank Volume V(cc)		4033	4010
Field Data			
PTI	(mm Hg)	-711	-709
TTI	(F)	85	82
PbI	(mm Hg)	760	760
PT	(mm Hg)	0	0
TT	(F)	82	78
Pb	(mm Hg)	760	760
Noncondensible Organics			
PT(Lab)	(mm Hg)	24	4
TT(Lab)	(F)	78	78
Pb(Lab)	(mm Hg)	734	734
PTF	(mm Hg)	924	920
TTF	(F)	78	78
PbF	(mm Hg)	734	734
Ba	(ppmv C)	0.2	0.1
Ctm 1	(ppmv C)	56.3	642.8
Ctm 2	(ppmv C)	56.7	627.8
Ctm 3	(ppmv C)	56.9	639.3
Avg. Ctm	(ppmv C)	56.6	636.6
RSD Ctm	(%)	0.5	1.2
Condensible Organics			
ICV Tank No.		4T143	4T266
ICV Tank, Vv (cc)		4047	4270
PFI	(mm Hg)	-720	-722
TFI	(F)	78	78
PbFI	(mm Hg)	734	734
PF	(mm Hg)	1840	940
TF	(F)	78	78
PbFf	(mm Hg)	734	734
Bt	(ppmv C)	2.6	0.8
Ccm 1	(ppmv C)	26.6	52.1
Ccm 2	(ppmv C)	27.2	53.9
Ccm 3	(ppmv C)	27.2	53.7
Avg. Ccm	(ppmv C)	27.0	53.2
RSD Ccm	(%)	1.3	1.9
Total Gaseous Nonmethane Organics (TGNMO)			
Vs	(cc)	3678	3675
Dil. Factor	(Non)	2.348	2.332
Dil. Factor	(Con)	3.658	2.513
Ct	(ppmv C)	132.5	1484.1
Cc	(ppmv C)	89.3	131.8
Ct+Cc= C	(ppmv C)	221.8	1615.9
Mc	(mg C/dscm)	110.7	806.8

APPENDIX D:
CALIBRATION CERTIFICATIONS

[redacted]

1290 COMBERMERE STREET, TROY, MICHIGAN 48084 (313) 589-2950

Your P.O. # : 90547

Customer :
CUBIX CORPORATION
1713 FORT VIEW ROAD
AUSTIN, TX. 78704

****** CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ******
PERFORMED ACCORDING TO SECTION 3.0.4

Certified Per Traceability Protocol # 1 — Procedure # G1

File # P08133

Certified Accuracy 1 % NBS Traceable

Expiration Date : 7-28-92
Cylinder Number : ALM-016031
Cylinder Pressure 1900 psig

ANALYZED CYLINDER		REFERENCE STD			INSTRUMENTATION		
COMPONENT	CERTIFIED CONC.	SRM # (CRM #)	CYLINDER NUMBER	CONC.	INSTR/MODEL/SERIAL	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
NITRIC OXIDE	888.1 PPM	2631	FF-16175	2854 PPM	BECKMAN 951A	1-8-91	CHEMILUMINESCENCE
		GMIS*	HA-6840	971.6 PPM			

BALANCE GAS : NITROGEN

NITROGEN DIOXIDE 5.82 PPM (FROM SECOND ANALYSIS)

CERTIFIED EPA PROTOCOL

FIRST ANALYSIS — DATE : 1-21-91

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	30.50	889.5	2854 PPM	98.00	2854
0.00	30.50	889.5		98.00	2854
0.00	30.50	889.5		98.00	2854

CALCULATED RESULTS: 889.5, 889.5, 889.5

AVERAGE : 889.5 PPM

SECOND ANALYSIS — DATE : 1-28-91

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	30.40	886.6	2854 PPM	98.00	2854
0.00	30.40	886.6		98.00	2854
0.00	30.40	886.6		98.00	2854
0.00	30.60 NOX	892.5			

CALCULATED RESULTS: 886.6, 886.6, 886.6 — 892.5 PPM NOX

AVERAGE : 886.6 PPM

CALIBRATION CURVE — 1 st DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
2631	2854	100	98.00	2854	0.00
	1428	50	49.00	1428	-0.00
	971.6	34	33.10	965.2	-0.66
	489.0	17	16.80	490.8	0.38
	0.0000	0	0.00	0.0000	0.00
		0		0.0000	0.00
		0		0.00	0.00
16866	489.0	LOW	16.80	490.8	0.38
N/A	971.6	GMIS*	33.10	965.2	-0.66

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : Paul P. Doran

Approved By : L. Shapiro

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

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Scott Specialty Gases — a Scott Environmental Technology, Inc.

1290 COMBERMERE STREET, TROY, MICHIGAN 48084 (313) 589-2950

Your Project # : ...52000

Your P.O. # : 91004

er :
CUBIX CORPORATION
1713 FORT VIEW ROAD
AUSTIN, TX. 78704

**** CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ****
PERFORMED ACCORDING TO SECTION 3.0.4
Certified Per Traceability Procedure # G1
Protocol # 1
File # P08274
Certified Accuracy 1 % NBS Traceable

Expiration Date : 8-18-92
Cylinder Number AAL-9912
Cylinder Pressure 1900 psig

PONENT	CERTIFIED CONC.	REFERENCE STD: SRM # (CRM #)	CYLINDER NUMBER	CONC.	GAS ANALYZER: MAKE/MODEL	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
C OXIDE	157.7 PPM	1685	AAL-9851	236.0 PPM	BECKMAN	12-4-90	CHEMILUMINESCENCE
		GMIS*	AAL-14484	145.3 PPM	951A		
		1684	ALM-003623	97.28 PPM			

NCE GAS : NITROGEN

OGEN DIOXIDE 1.77 PPM

EPA PROTOCOL CERTIFIED

FIRST ANALYSIS DATE : 2-11-91

ZERO (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
	53.30	157.4	236.0 PPM	80.00	236.0
	53.30	157.4		80.00	236.0
	53.30	157.4		80.00	236.0

CALCULATED RESULTS 157.4 / 157.4 / 157.4

AVERAGE : 157.4 PPM

SECOND ANALYSIS DATE : 2-18-91

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	53.50	158.0	236.0 PPM	80.00	236.0
0.00	53.50	158.0		80.00	236.0
0.00	53.50	158.0		80.00	236.0
0.00	54.10 NOX	159.8			

CALCULATED RESULTS 158.0 / 158.0 / 158.0 159.8 PPM NOX

AVERAGE : 158.0 PPM

CALIBRATION CURVE 2 nd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
1685	236.0	100	80.00	236.0	-0.00
	207.6	88	70.50	208.1	0.23
	145.3	62	49.10	145.1	-0.17
1684	97.28	41	33.00	97.54	0.27
	0.0000	0	0.00	0.0000	0.00
		0		0.00	0.00
		0		0.00	0.00
1684	97.28	LOW	33.00	97.54	0.27
1685	236.0	HIGH	80.00	236.0	-0.00

MIS - GAS MANUFACTURER'S INTERNAL STANDARD

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

Analyzed By [signature] Approved By [signature] Shapiro [redacted] Sc[redacted]nvir[redacted]nta[redacted]hno[redacted], Inc[redacted]

1290 COMBERMERE STREET, TROY, MICHIGAN 48084 (313) 589-2950

BEST AVAILABLE COPY

Shipped From : Scott Michigan

Our Project # : 53222B

Your P.O. # : 92 0000

Expiration Date : 7-21-93

Cylinder Number : AAL5112

Cylinder Pressure 1900 psig

1 of 1 Component(s)

stomer :

CUBIX CORPORATION
9225 LOCKHART HWY
AUSTIN TX 78747

**** CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ****
PERFORMED ACCORDING TO SECTION 3.0.4

Certified For Traceability Procedure # G1
Protocol # 1

File # PO-2143

Certified Accuracy 1 % NBS traceable

NALYZED CYLINDER		REFERENCE STD			INSTRUMENTATION		
OMPONENT	CERTIFIED CONC.	SRM # (CRM #)	CYLINDER NUMBER	CONC.	INSTR/MODEL/SERIAL #	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
RIC OXIDE	406.4 PPM	1687	ALM-014665	965.5 PPM	BECKMAN	1-15-92	CHEMILUMINESCENCE
		1685	ALM-008700	250.3 PPM	951A		
					270-0828998		

ANCE GAS : NITROGEN

ROGEN DIOXIDE 0.00 PPM (FROM SECOND ANALYSIS)

FIRST ANALYSIS DATE : 1-15-92

O)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	(mV)	RESULTS PPM
	40.70	406.9	965.5 PPM	96.50	965.5
	40.70	406.9		96.50	965.5
	40.70	406.9		96.50	965.5

CALCULATED RESULTS 406.9
406.9
406.9

AVERAGE : 406.9 PPM

SECOND ANALYSIS DATE : 1-21-92

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	(mV)	RESULTS PPM
0.00	40.60	405.9	965.5 PPM	96.50	965.5
0.00	40.60	405.9		96.50	965.5
0.00	40.60	405.9		96.50	965.5
0.00	40.60 NOX	405.9			

CALCULATED RESULTS 405.9
405.9
405.9 405.9 PPM NOX

AVERAGE : 405.9 PPM

CALIBRATION CURVE 1 ST DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
1684B	965.5	100	96.50	965.5	0.00
	748.0	77	75.00	750.3	0.30
	395.0	41	39.60	395.9	0.22
1685	250.3	26	25.10	250.7	0.16
	0.0000			0.0000	0.00
				0.0000	0.00
		0		0.00	0.00
1685	250.3	LOW	25.10	250.7	0.16
1684B	965.5	HIGH	96.50	965.5	0.00

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

IS - GAS MANUFACTURER'S INTERNAL STANDARD Analyst : [signature] Approved By : [signature]

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Scott Specialty Gases, Inc. FAX: 713-644-0244 PHONE: 713-644-4820

3714 LAPAS DRIVE, HOUSTON, TEXAS 77023

6/03/91

CUBIX CORPORATION
9225 LOCKHART

AUSTIN TX 78747-0000
KEVUN JANCK

PROJECT #: 04-11057
PO #: 91105

CYLINDER #: ALM006621 ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION		ANALYSIS 1 (MOLES) U/M	
:N MONOXIDE	150.0	PPM	150.	PPM
:NE	80.0	PPM	79.7	PPM
:OGEN	BALANCE		BALANCE	

CERTIFIED

ANALYTICAL METHOD: GRAV.MASTER GAS

DATE OF ANALYSIS: 6/03/91

ANALYST: [signature]
ANALYST

APPROVED BY: [signature]
SUPERVISOR

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Scott Specialty Gases, Inc.

3714 LAPAS DRIVE, HOUSTON, TX 77023-0000 10/17/91
PHONE: 713-644-4820 FAX:713-644-0244

CUBIX CORPORATION PROJECT #: 04-13936
9225 LOCKHART HWY PO #: 910523

AUSTIN TX 78747-0000

CYLINDER #: AAL9308 ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION		ANALYSIS 1 (MOLES)	U/M
BON MONOXIDE	400.0	PPM	401.	PPM
THANE	400.0	PPM	395.	PPM
TROGEN	BALANCE		BALANCE	

ANALYTICAL METHOD: ACUBLEND MASTER

DATE OF ANALYSIS: 10/17/91

ANALYST: ______________ APPROVED BY: ______________
ANALYST SUPERVISOR

Scott Specialty Gases, Inc.

9714 LAPAS DRIVE, HOUSTON, TX 77023-0000 10/22/91
PHONE: 713-644-4820 FAX:713-644-0244

CUBIX CORPORATION PROJECT #: 04-13836
9225 LOCKHART HWY PO #: 910505

AUSTIN TX 78747-0000

CYLINDER #: AAL13971 ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION		ANALYSIS 1 (MOLES)	U/M
?ON MONOXIDE	910.0	PPM	916.	PPM
THANE	820.0	PPM	823.	PPM
TROGEN		BALANCE		BALANCE

NOTES: EXP: 11/92

ANALYTICAL METHOD: ACUBLEND MASTER

DATE OF ANALYSIS: 10/22/91

ANALYST: [signature] APPROVED BY: [signature] 10/23
ANALYST SUPERVISOR

CERTIFIED

Matheson Gas Products

World Leader in Specialty Gases & Equipment

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OST OFFICE BOX 908
LA PORTE, TEXAS 77571
TELEPHONE: (713) 471-2544

RECEIVED JAN 1 7 1992

WILSON OXYGEN AND SUPPLY CO.
2801 MONTOPOLIS
AUSTIN, TX 78760

Date 1-8-92

Our Invoice # 104-63230

Your P.O. # 04312

Lot No.

ntlemen:

Below are the results of the analysis you requested, as reported by our laboratory. Results are in volume rcent, unless otherwise indicated.

LABORATORY REPORT ON GAS ANALYSIS

1R

	CYL. # MIXTURE REQ. SX-23633	ANALYSIS
BON KIDE	3.20%	3.18% ± .02
YGEN	18.00%	17.9% ± .02
ROGEN	BALANCE	BALANCE

1R

	CYL. # MIXTURE REQ. SX-23625	ANALYSIS
	8.00%	7.99% ± .02
	8.00%	7.98% ± .02
	BALANCE	BALANCE

1R

	CYL. # MIXTURE REQ. SX-23652	ANALYSIS
ON IDE	18.00%	17.99% ± .02
YGEN	4.00%	3.99% ± .02
ROGEN	BALANCE	BALANCE

CYL. # MIXTURE REQ.	ANALYSIS

ACCEPTED BY

WILSON OXYGEN

Analyst
JOHN K. WRIGHT

Scott Specialty Gases

a division of
Scott Environmental Technology, Inc.

3714 LAPAS DRIVE, HOUSTON, TEXAS 77023, (713) 644-4820, FAX 644-0244

CUBIX CORPORATION
P.O. BOX 5083
AUSTIN, TX. 78763

Date: MARCH 1, 1990
Our Project No.: 0403425
Your P.O. No.: 90035

Gentlemen:
Thank you for choosing Scott for your Specialty Gas needs. The analyses for the gases ordered, as reported by our laboratory, are listed below. Results are in volume percent, unless otherwise indicated.

ANALYTICAL REPORT

Cyl No. AAL17750 Analytical Accuracy ±1%

Component WT%	Concentration
CARBON MONOXIDE	4000 PPM
METHANE	4000 PPM
NITROGEN	BALANCE
NBS TRACEABLE BY WEIGHT	

Cyl No. ______ Analytical Accuracy ______

Component	Concentration

Cyl No. ______ Analytical Accuracy ______

Component	Concentration

Cyl No. ______ Analytical Accuracy ______

Component	Concentration

Analyst John Lempe

Approved By [signature]

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the company without extra cost.

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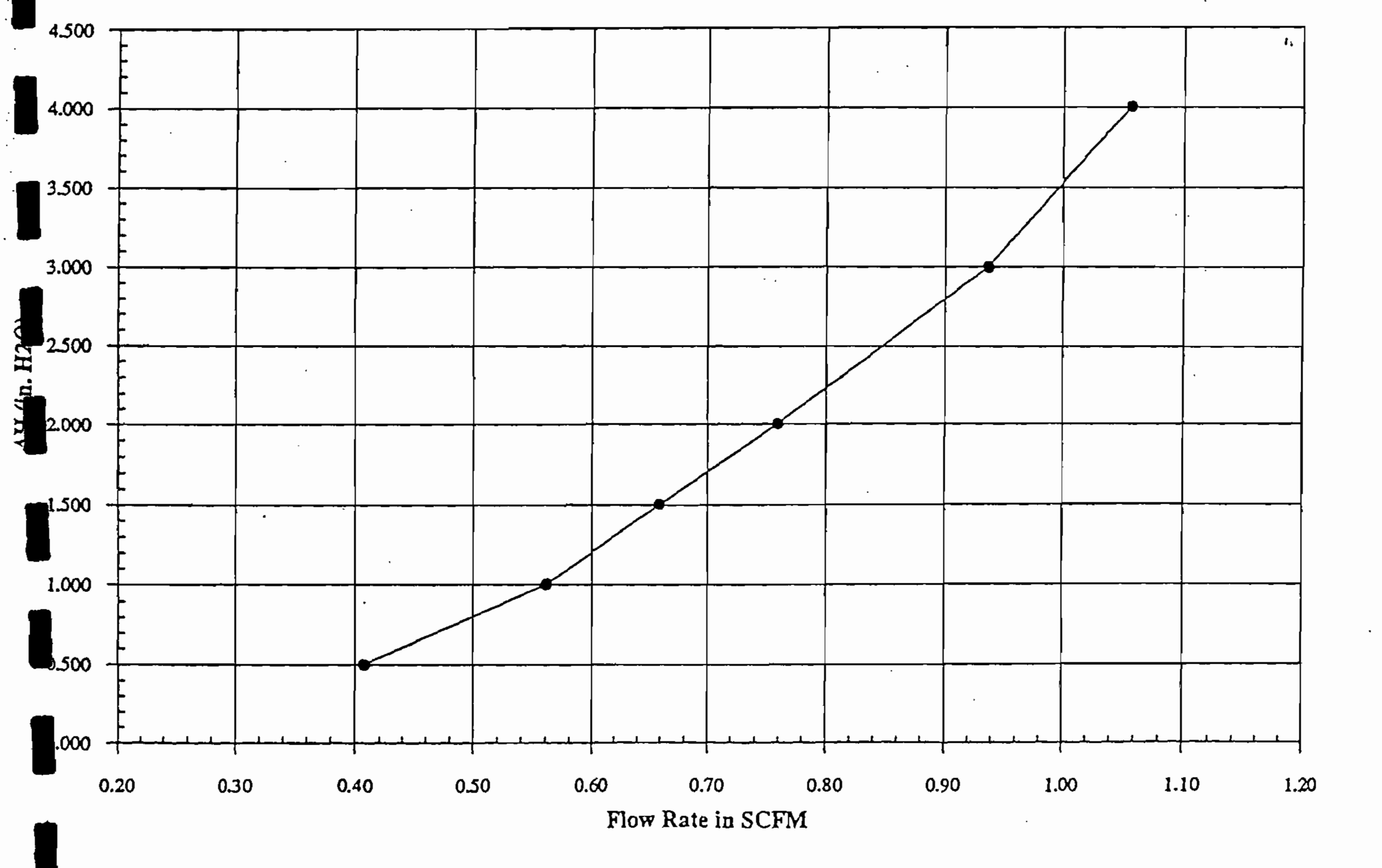
METER BOX DRY GAS METER and ORIFICE CALIBRATION

Date: 8/2/91		**Test Meter ID**	P164240
Prev. Calib. Date: 12/27/90		**Make & Model**	American Singer
Location: 1713 Fortview, Austin, Tx		**Calibration Factor**	0.998
Technician: DH,LI,JB			
Meter No: 1286-3061			
Atm. Pressure: 29.32			

		Meter Box				Standard Test Meter					
Orifice Meter Setting ΔH (in. H20)	Elapsed Time (min.)	Starting Reading ft3	Ending Reading ft3	Starting Avg. Temp. °F	Ending Avg. Temp (°F)	Starting Reading (ft3)	Ending Reading (ft3)	Starting Avg. Temp (°F)	Ending Avg. Temp. (°F)	Calculated Meter Factor (Kd)	Calculated ΔH@ 0.75 SCFM (" H2O)
[illegible].50	10.00	43.095	47.310	77	86	0.000	4.080	72	72	0.9821	1.704
1.00	10.00	47.310	53.164	86	97	4.080	9.695	72	72	0.9899	1.767
1.50	10.00	53.164	60.138	97	109	9.695	16.300	72	73	0.9956	1.880
[illegible].00	10.00	60.138	68.398	109	114	16.300	23.900	73	73	0.9797	1.868
[illegible].00	10.00	68.398	78.344	114	120	23.900	33.287	73	73	1.0121	1.820
4.00	10.00	78.344	89.968	120	124	33.287	43.872	73	72	0.9834	1.888
	Averages:			101	108			73	73	0.9904	1.845

Differential Pressure vs. Flow Rate Calibration Curve Andersen 8/91



Trailer #7 Altimeter

ALTIMETER SCALE ERROR					
PART NO. 5934P-1A.83			SERIAL NO. 3H909		
ALTIMETER PRESSURE					
TEST PT (FT)	INDICATOR READINGS AT + 25 °C	TEST PT (FT)	INDICATOR READINGS AT + 25 °C	TEST PT (FT)	INDICATOR READINGS AT + 25 °C
-1000	0	8,000	-45	30,000	
0 0	-20	10,000	-50	35,000	
500	-15	12,000	-70	40,000	
1000	-10	14,000	-70	45,000	
1500	-15	16,000	-65	50,000	
2000	-15	18,000	-50	55,000	
3000	-25	20,000	-45	60,000	
4000	-25	22,000		70,000	
6000	-30	25,000		80,000	

BFG/C9102

COMPONENT ALTIMETER

PART NO. 5934P-1A.83

SERIAL NO. 3H909

MFG. UNITED WORK ORDER # K0687

☐ Overhaul ☐ Repair ☒ Bench Check & Test

The Aircraft Appliance identified above was overhauled, repaired, or bench tested (as per block marked) and inspected, in accordance with current Federal Aviation Administration Regulations, and is approved for return to service. Details of this component are on file at this repair station.

[signature]
AUTHORIZED SIGNATURE

FEB 11 1992
DATE

TEL–TRU MANUFACTURING CO.

408 ST. PAUL STREET ROCHESTER, NY 14605 USA

CERTIFICATE OF CALIBRATION

TEL–TRU ORDER NO.	LINE NUMBER	TICKET NO.	ORDER REC WK NO.	SHIP BY WK NO.
23832	111		43	47

CUSTOMER NUMBER	CUSTOMER P.O. NO.	MANUFACTURING NO.
2-52845000	910537	Stock

QUANTITY	ITEM NUMBER	DESCRIPTION
4	34100260	BT300R 2.5" Stem 25/125F

TOLERANCE OF ±1% OF RANGE: EX. 0–200°F = ±2°F	THERMOMETERS CALIBRATED AGAINST MASTER PRECISION THERMOMETERS, DIRECTLY TRACEABLE TO NATIONAL BUREAU OF STANDARDS.

TAG NUMBER	CALIBRATING TEMPERATURE									
	-40°F / -40°C	0°F / -17.8°C	50°F / 10°C	100°F / 37.8°C	140°F / 60°C	160°F / 71°C	200°F / 93°C	220°F / 104°C	295°F / 146°C	400°F / 204°C	750°F / 399°C
1			50°F	100°F							
2			50°F	100°F							
3			50°F	100°F							
4			50°F	100°F							

DATE: 10-25-91 TESTED BY: BL CHECKED BY:

Pitot Tube Calibration Sheet

Date: 10/23/91
Technician: JB
Calibration pitot tube
Type: std
Size (OD): 1/4"
ID number: 450
Cp (std): 0.99
S-Type pitot tube
Size (OD): 3/8"
ID Number: 207

A-Side Calibration			
Δp std in H2O	Δp s in H2O	Cp(s)	DEV
0.675	0.930	0.843	0.003
0.675	0.925	0.846	0.006
0.670	0.925	0.843	0.003
0.545	0.750	0.844	0.004
0.545	0.755	0.841	0.001
0.550	0.750	0.848	0.008
0.250	0.350	0.837	0.003
0.250	0.355	0.831	0.009
0.245	0.350	0.828	0.012
	A-Side Averages	**0.840**	**0.005**

B-Side Calibration			
Δp std in H2O	Δp s in H2O	Cp(s)	DEV
0.670	0.930	0.840	0.003
0.670	0.925	0.843	0.001
0.675	0.925	0.846	0.002
0.560	0.775	0.842	0.002
0.560	0.770	0.844	0.001
0.555	0.770	0.840	0.003
0.225	0.310	0.843	0.000
0.225	0.305	0.850	0.007
0.220	0.305	0.841	0.002
	B-Side Averages	**0.843**	**0.002**

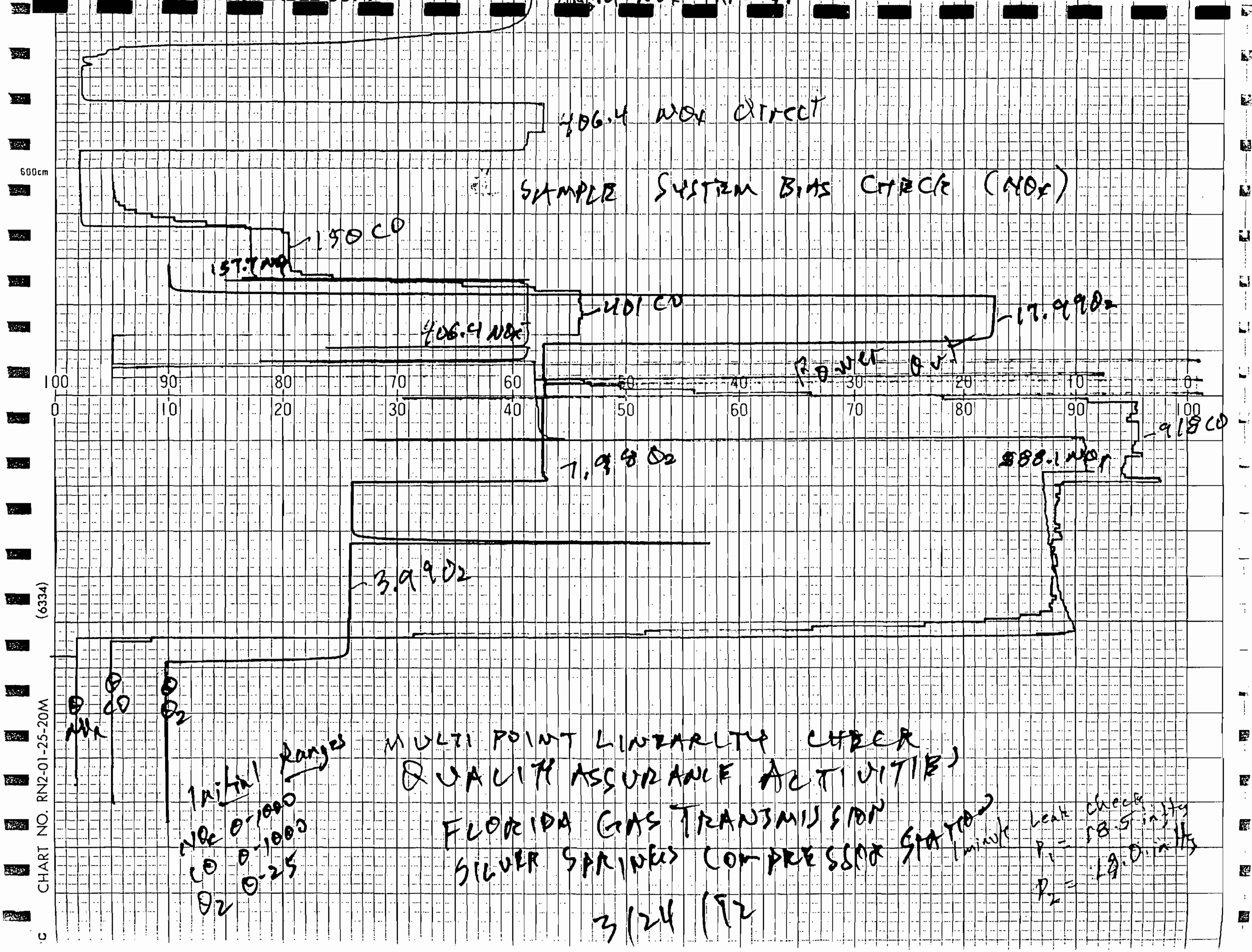
Average DEV =	0.004	must be less ≤ 0.01
Cp(s) from Side A - Cp(s) from Side B =	0.003	must be less ≤ 0.01

Calibrations Performed by Cubix Corporation, Austin, Texas

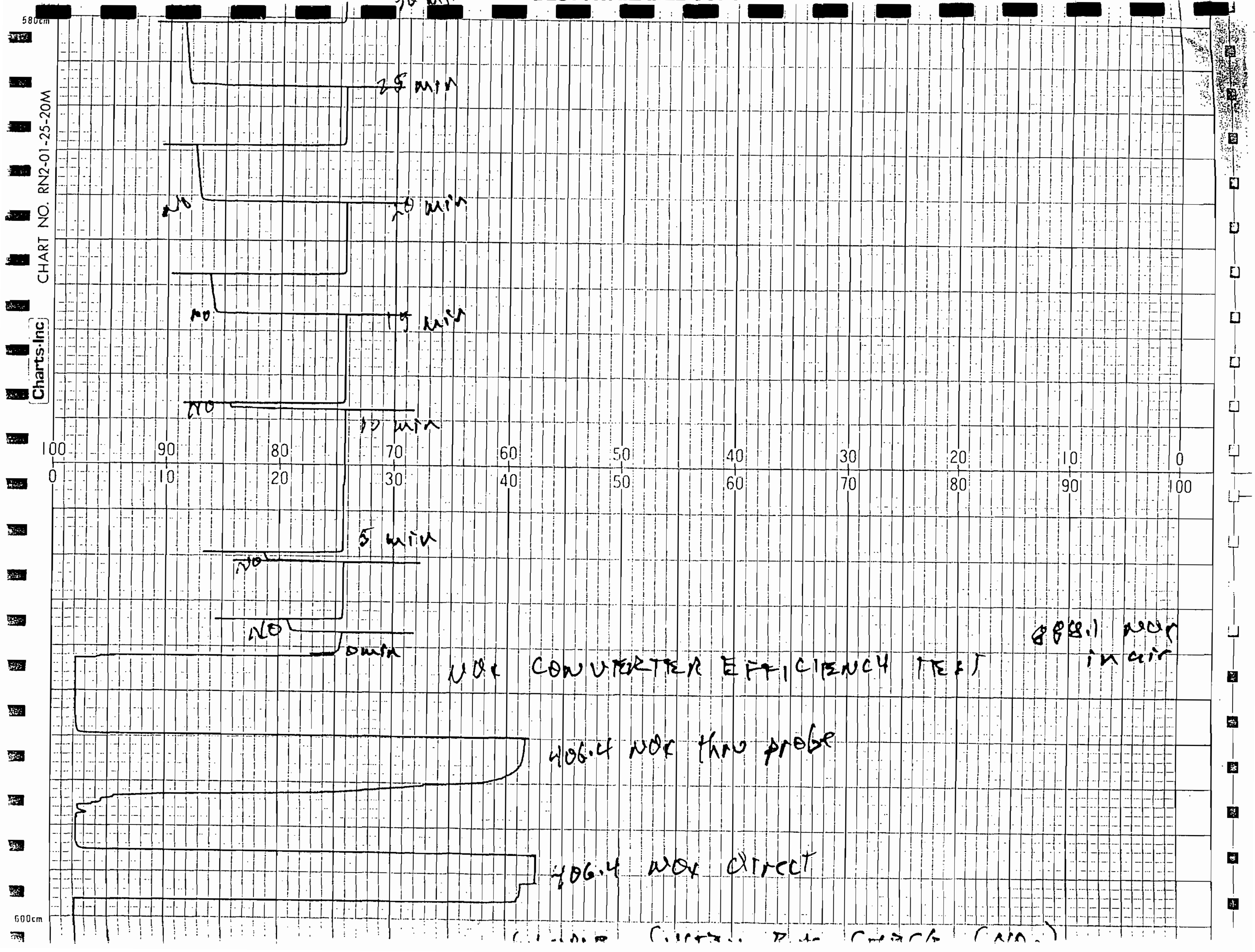
APPENDIX E: STRIP CHART RECORDS

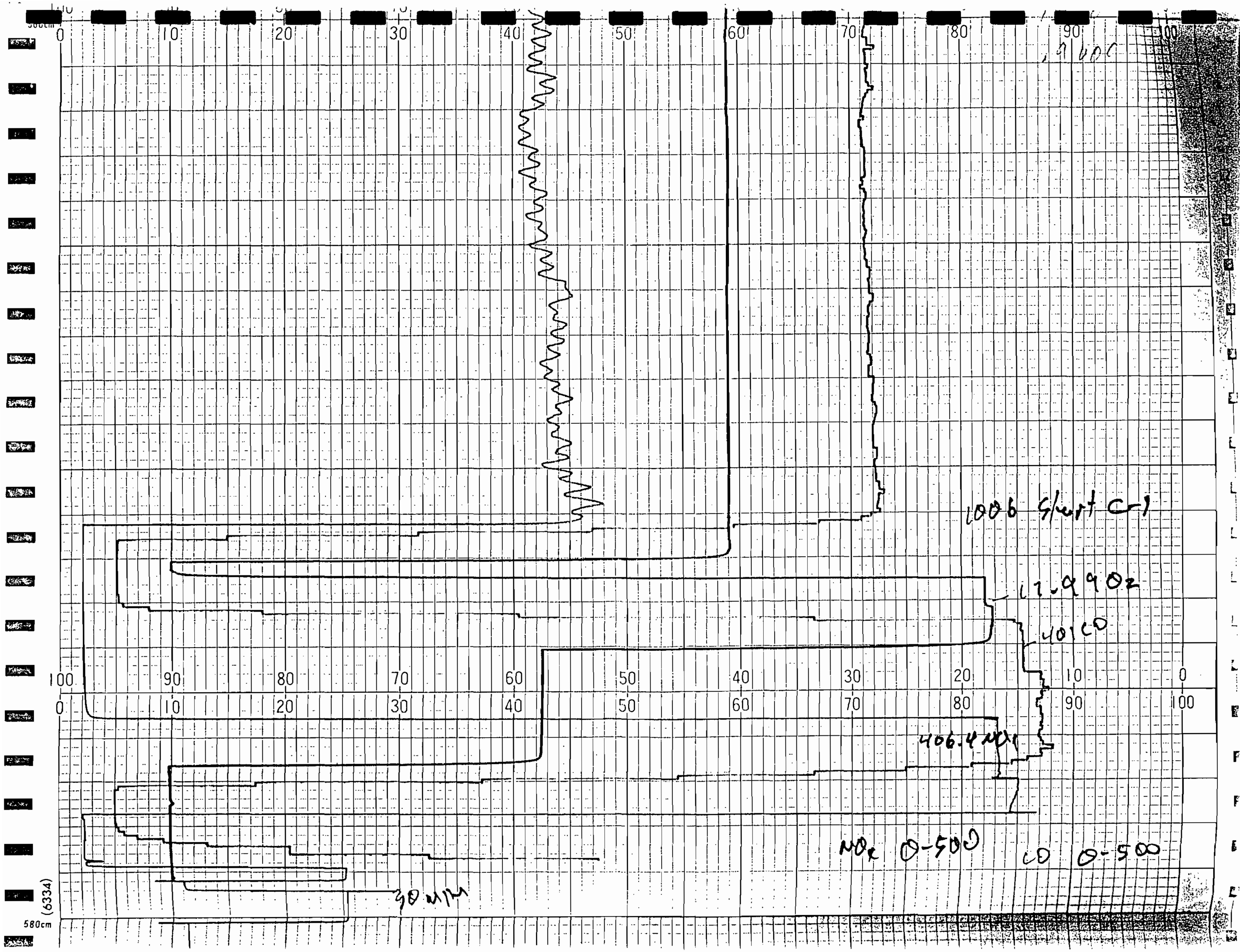
NOx, O_2, CO

BEST AVAILABLE COPY

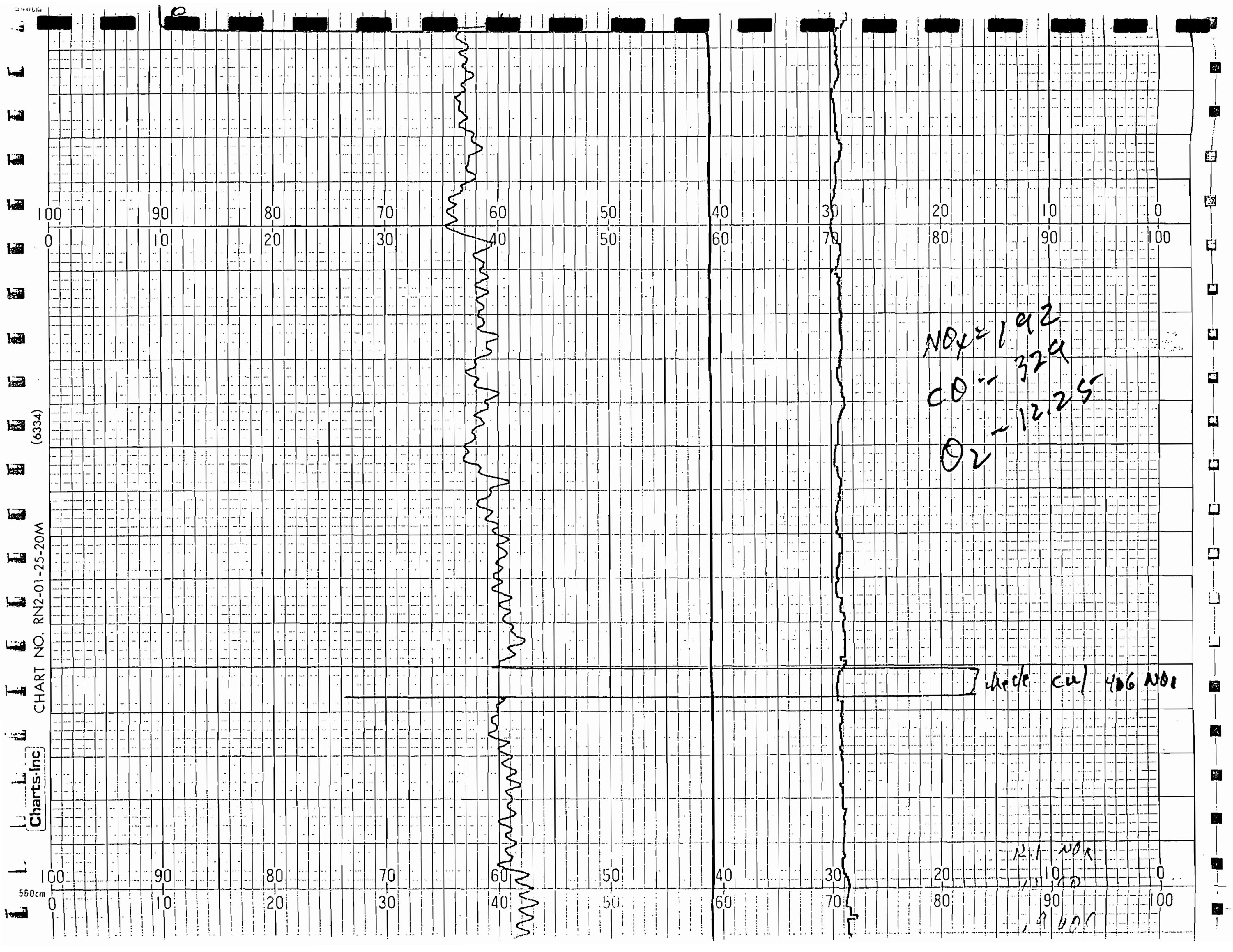


BEST AVAILABLE COPY





1006 Start C-1
12.99 O2
401 CO
406.4 NOx
30 MIN
NOx 0-500
CO 0-500
580cm
(6334)



100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
NOx = 192
CO = 329
O2 = 12.25
check cal 406 NOx
(6334)
CHART NO. RN2-01-25-20M
Charts Inc
560cm

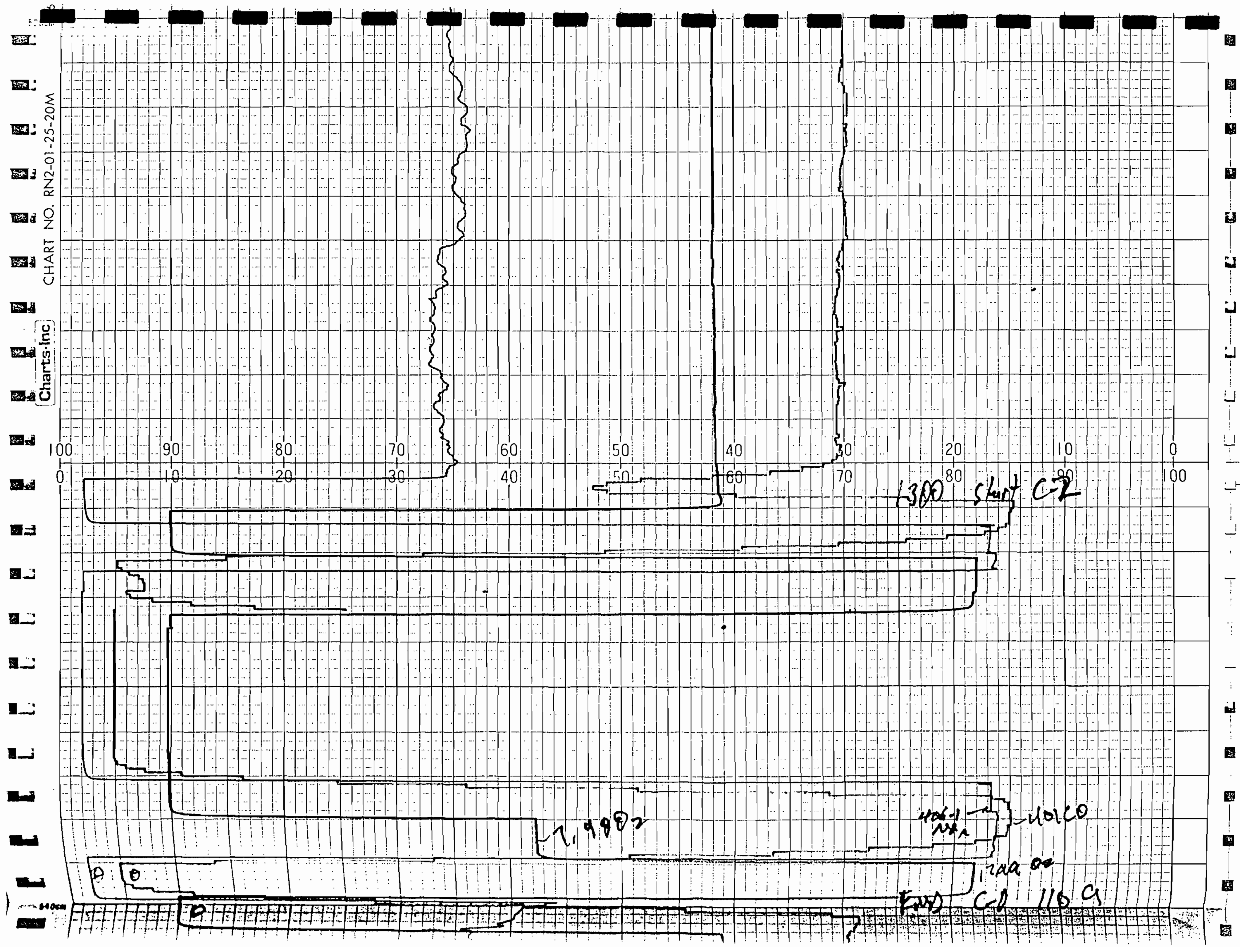
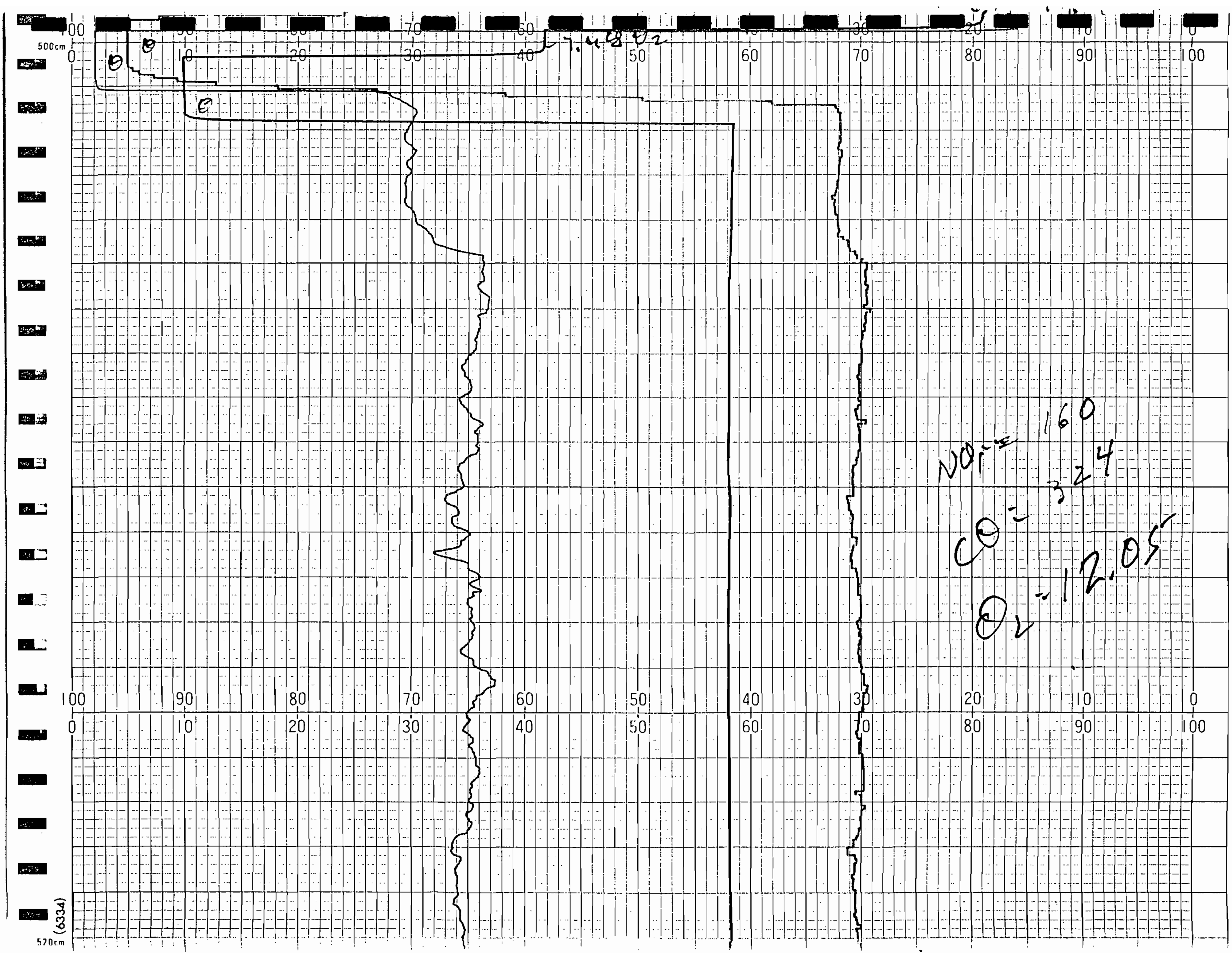
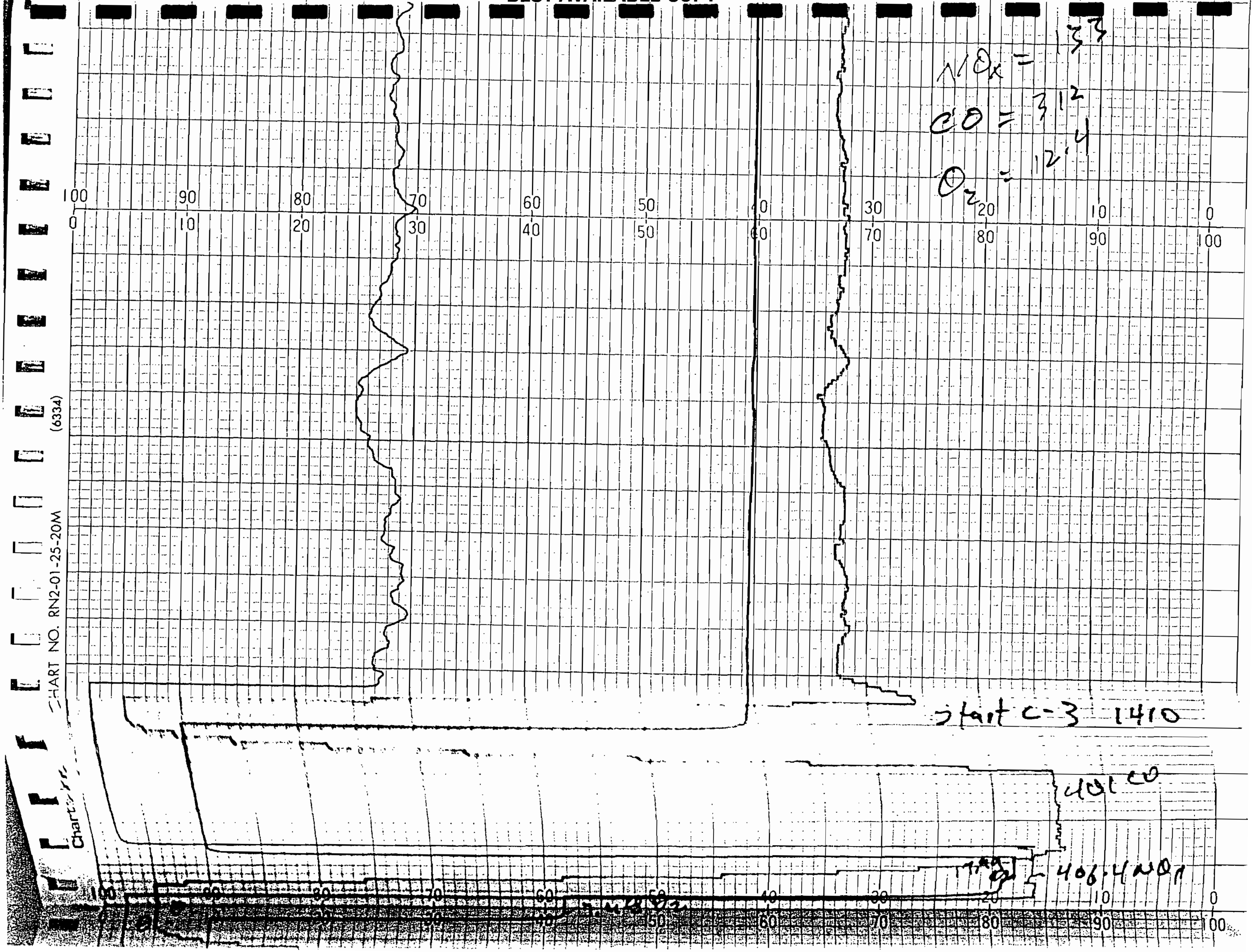


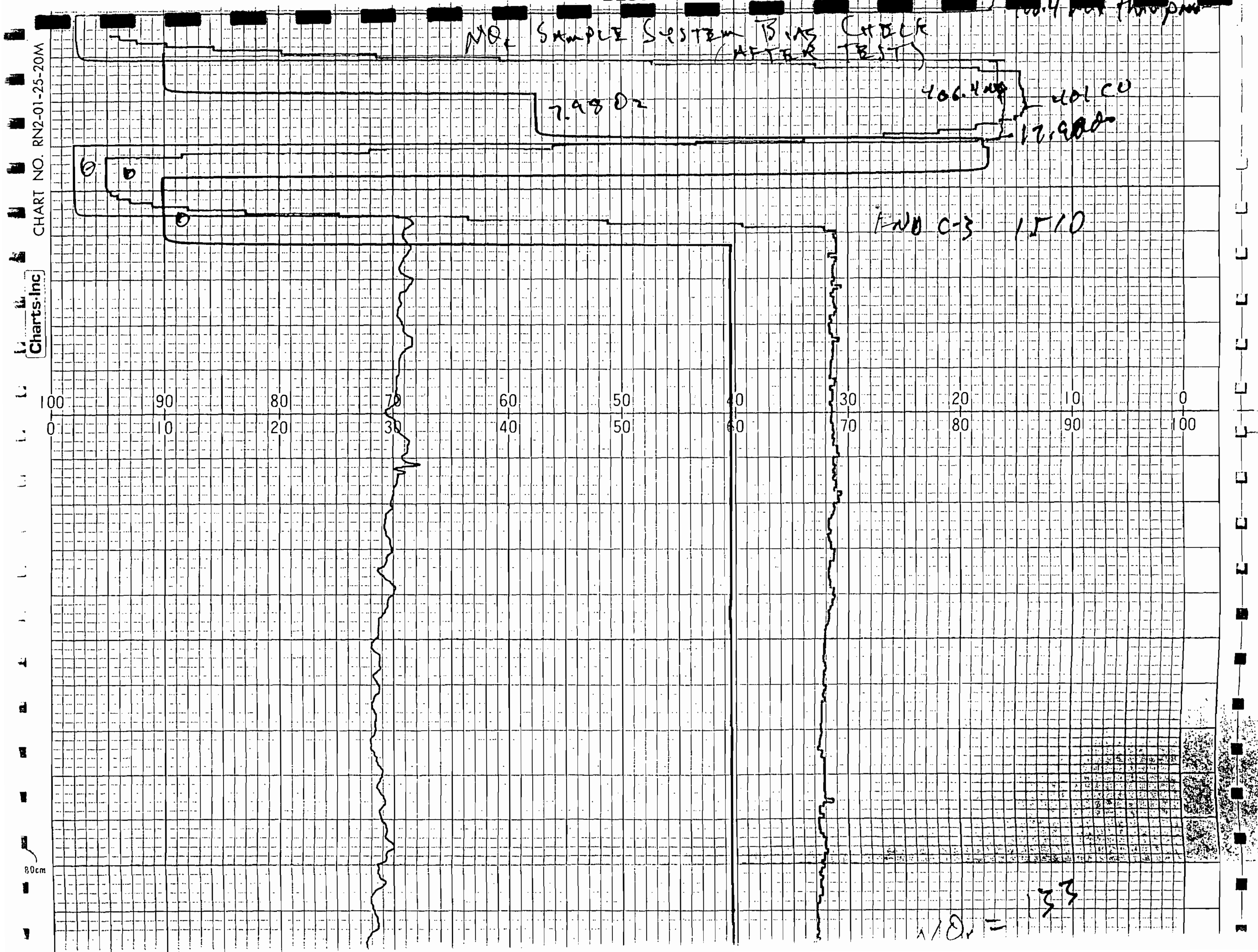
CHART NO. RN2-01-25-20M
Charts·Inc
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
1300 Start C-2
2,9982
4010
1200 00
End C-0 110 Ci


500cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
(6334)
520cm
160
324
12.05

BEST AVAILABLE COPY



BEST AVAILABLE COPY



CO_2, THC

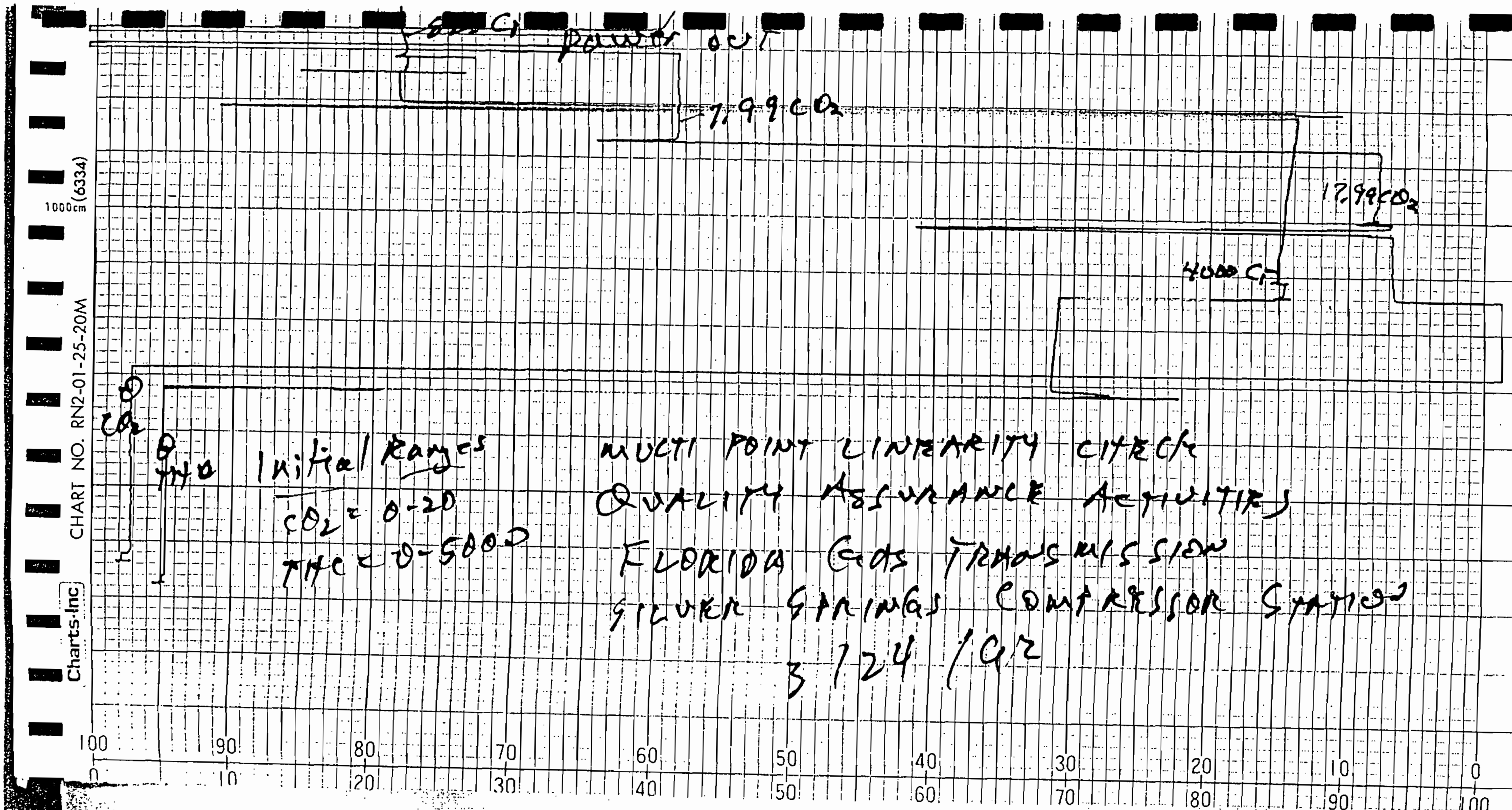
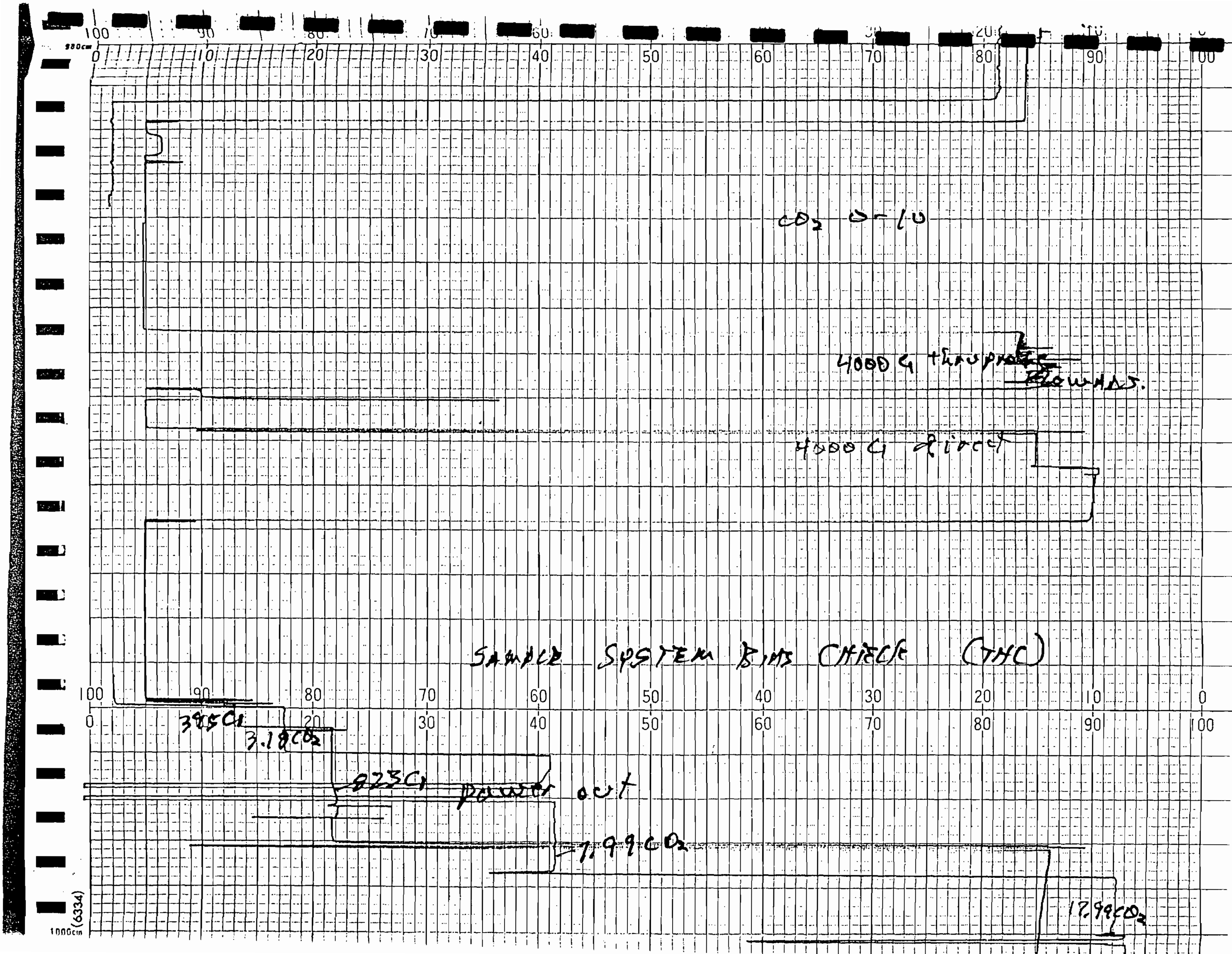
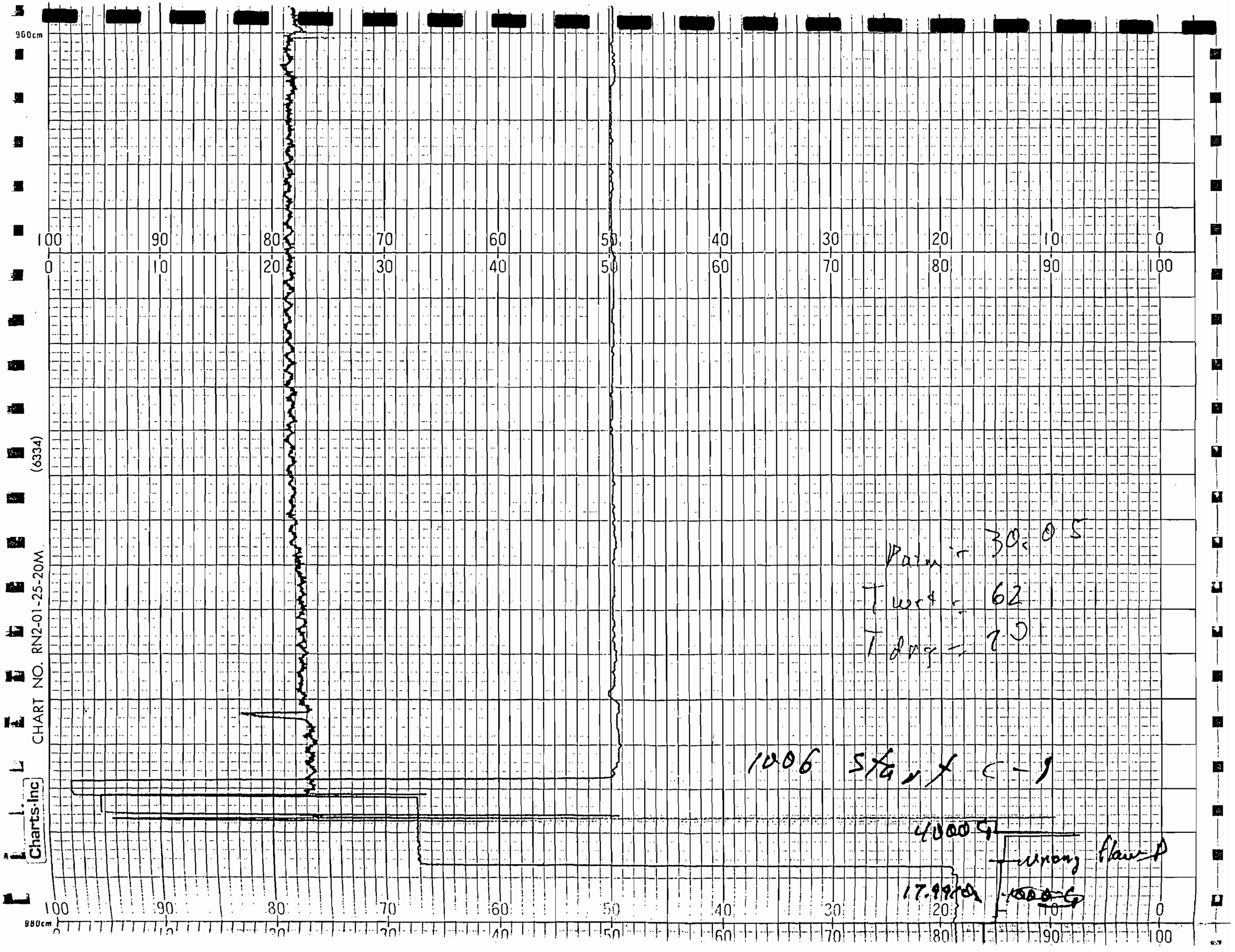


CHART NO. RN2-01-25-20M
Charts·Inc
1000cm (6334)
Power out
17.99 CO2
17.99 CO2
4000 C1
0 CO2
0 THC
Initial Ranges
CO2 = 0-20
THC = 0-5000
MULTI POINT LINEARITY CHECK
QUALITY ASSURANCE ACTIVITIES
FLORIDA GAS TRANSMISSION
SILVER SPRINGS COMPRESSOR STATION
3/24/02
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100


CO2 0-10
4000 C1 direct
SAMPLE SYSTEM BIAS CHECK (THC)
3.18 CO2
power out
7.99 CO2
17.99 CO2
(6334)


960cm
CHART NO. RN2-01-25-20M.
(6334)
Charts-Inc
880cm
Patm = 30.05
Twet = 62
Tdry = 70
1006 Start C-1
4000 G
Wrong flow
17.99 Ω
1000 G

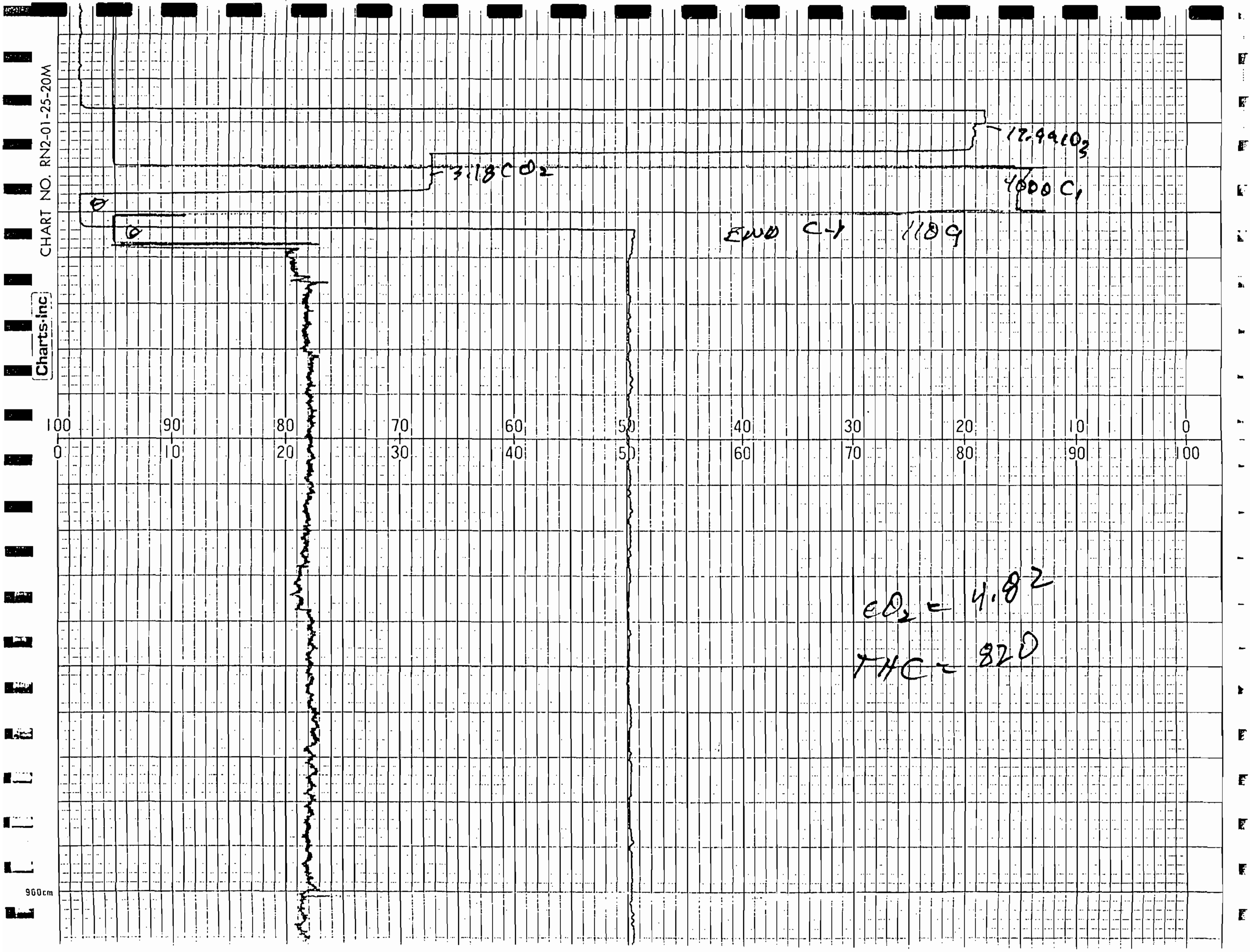
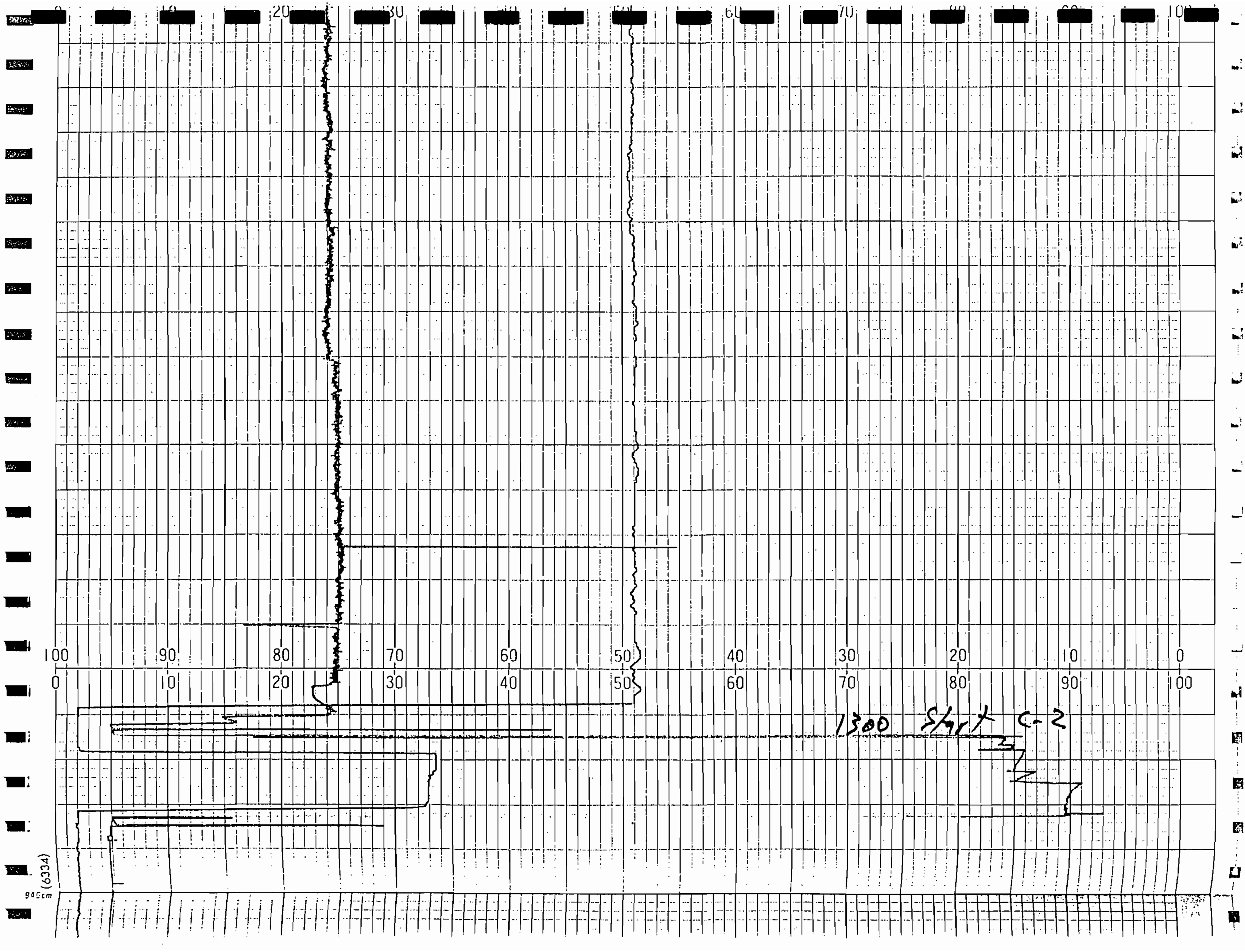
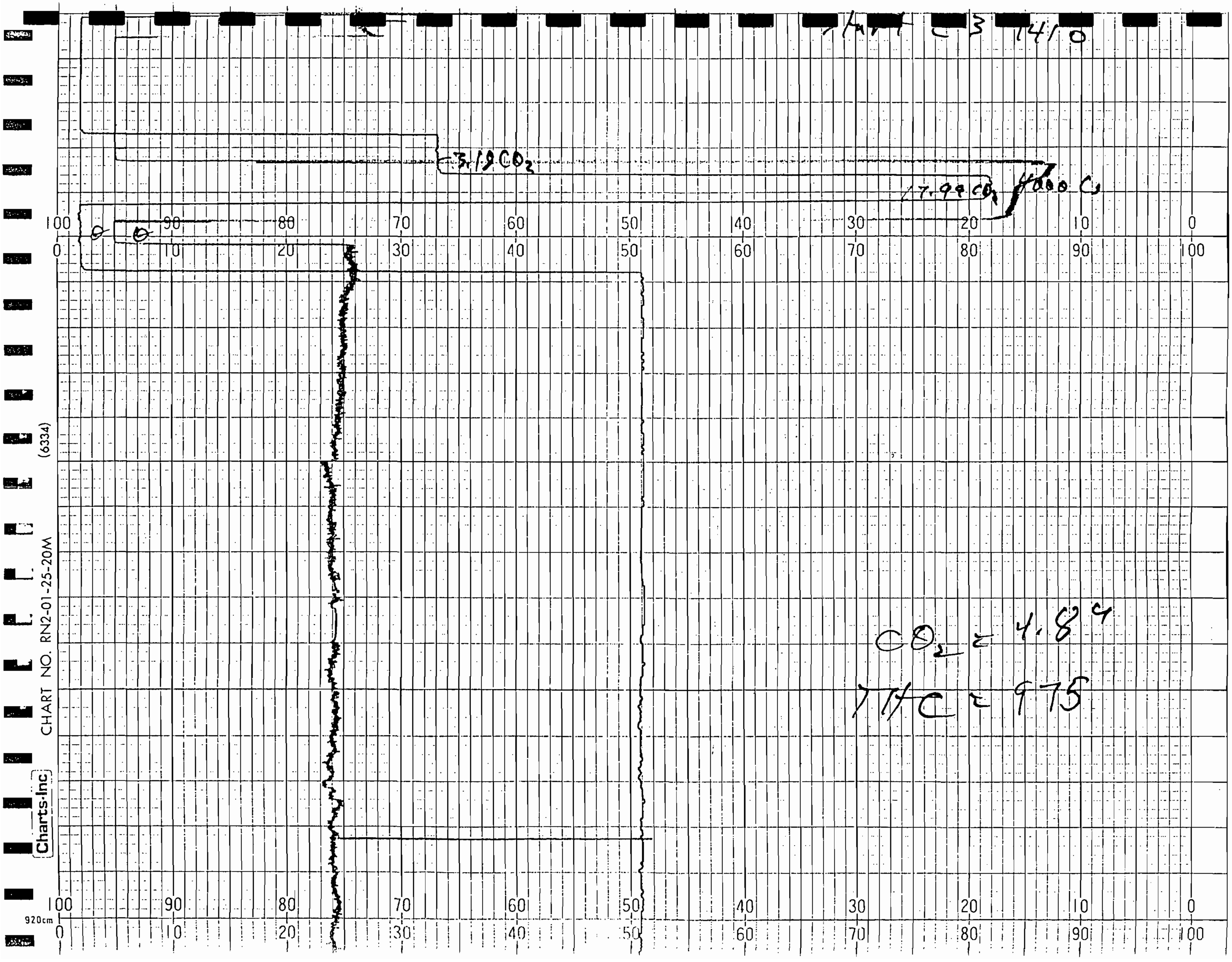
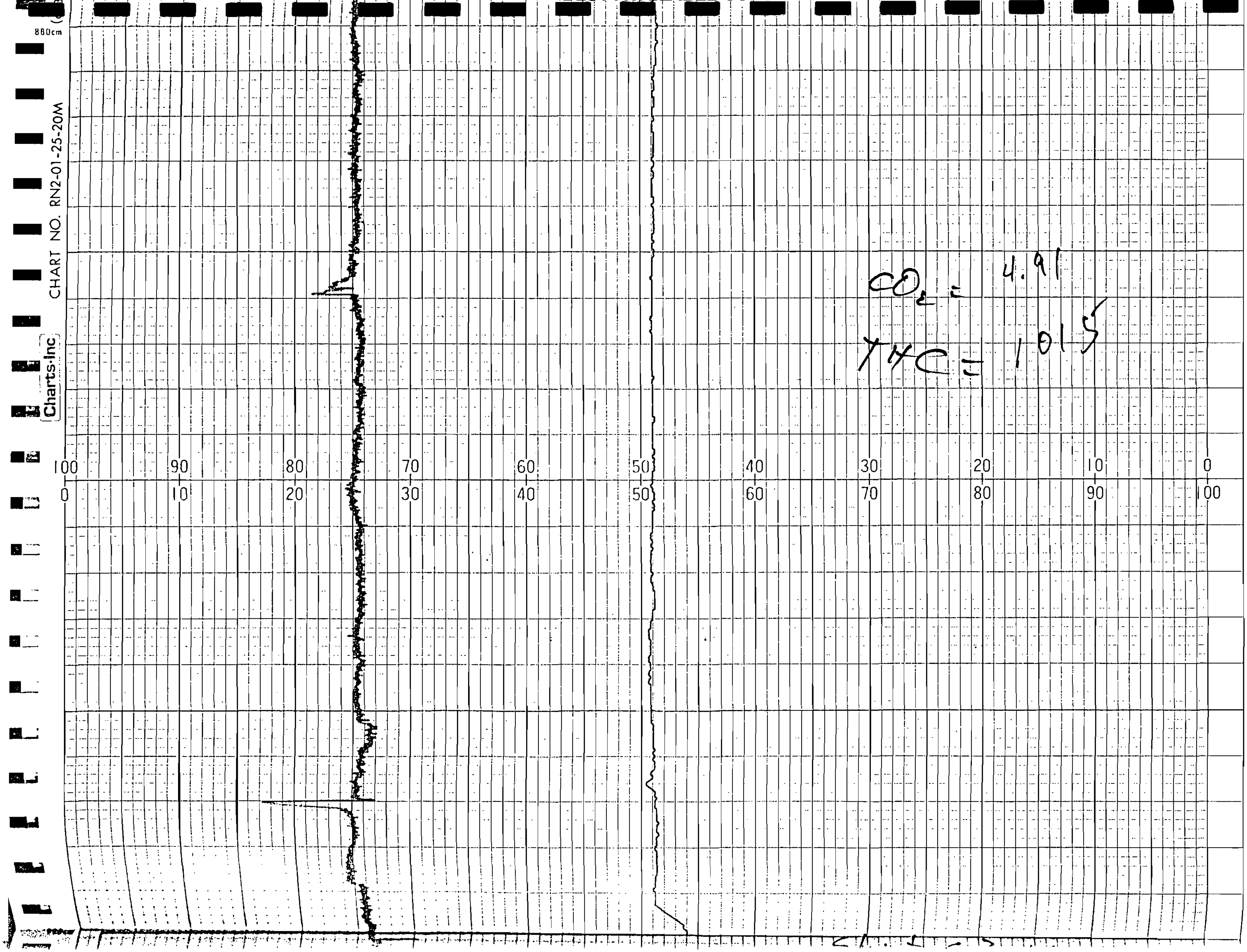


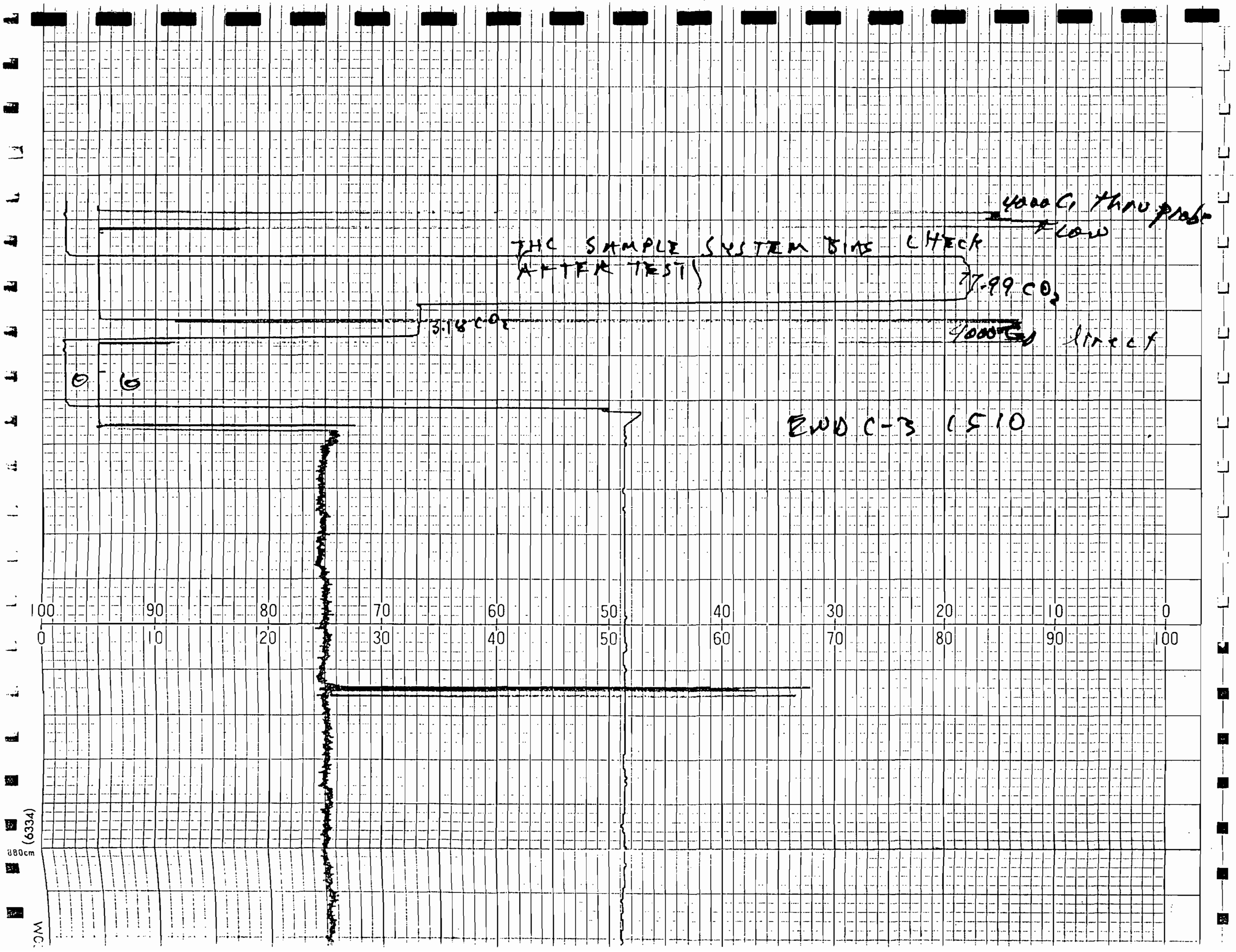
CHART NO. RN2-01-25-20M
Charts·inc
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
900cm
3.18 CO2
4000 C1
CO2 = 4.82
THC = 820


100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
1300 Start C-2
(6334)



Start C3 1410
3.19 CO2
7.94 CO2
4000 C3
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
CO2 = 4.84
THC = 975
(6334)
CHART NO. RN2-01-25-20M
Charts-Inc
920cm

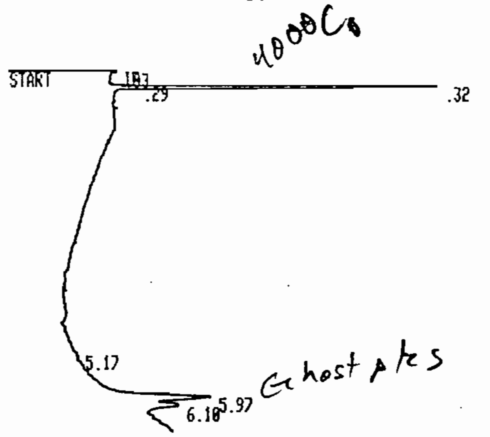

880cm
CHART NO. RN2-01-25-20M
Charts·Inc
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
CO2 = 4.91
THC = 1.015



THC SAMPLE SYSTEM BIAS CHECK
(AFTER TEST)
4000 C1 thru probe
Flow
77.99 CO2
3.18 CO2
4000
direct
0 6
END C-3 1510
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
(6334)
880cm

APPENDIX F
CHROMATOGRAMS

BEST AVAILABLE COPY

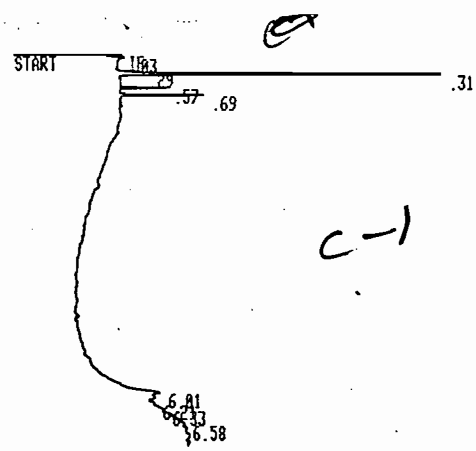


RUN # 12 MAR/24/92 10:34:15
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.03	1345	BB	0.060	0.308
0.29	290	D PV	0.013	0.067
0.32	366070	D VB	0.015	83.920
5.17	3140	BV	0.216	0.720
5.97	42450	VV	0.243	9.732
6.10	22917	VV	0.169	5.254

TOTAL AREA= 436210
MUL FACTOR= 1.0000E+00

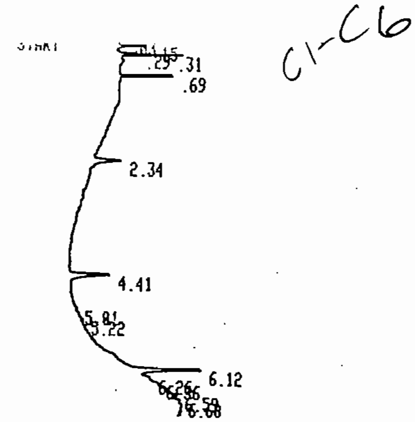


RUN # 14 MAR/24/92 10:56:17
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
~~0.03~~	~~1546~~	~~PV~~	~~0.075~~	~~1.989~~
~~0.29~~	~~296~~	~~PV~~	~~0.013~~	~~0.381~~
0.31	62765	D VB	0.015	80.765 c1
0.57	1014	D PB	0.018	1.305 } VOC
0.69	2130	D BB	0.021	2.741
~~6.01~~	~~1472~~	~~PV~~	~~0.039~~	~~1.894~~
~~6.21~~	~~1157~~	~~VV~~	~~0.067~~	~~1.489~~

4.77% VOC

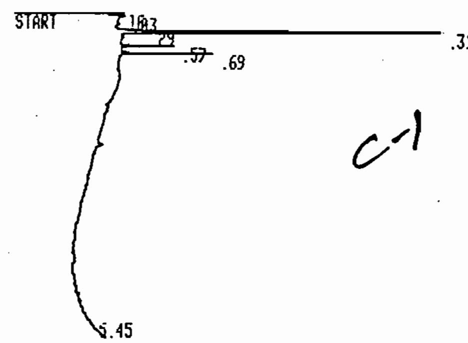


RUN # 13 MAR/24/92 10:44:55
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.03	613	PB	0.037	4.253
0.15	763	D BP	0.025	5.294
0.29	329	D VV	0.016	2.283
0.31	1130	D VB	0.015	7.840 c1
0.69	1298	D PB	0.021	9.005 c2
2.34	1976	BB	0.063	13.709 c3
4.41	2940	PV	0.062	20.397 c4
5.01	271	PP	0.146	1.880 c5
5.22	212	PB	0.071	1.471
~~6.12~~	~~0~~	~~PV~~	~~0.000~~	~~0.000~~
6.26	428	VV	0.052	2.969 c6
6.36	629	VV	0.063	4.364
6.59	2909	VV	0.182	20.182
6.68	916	VV	0.073	6.355

TOTAL AREA= 14414
MUL FACTOR= 1.0000E+00



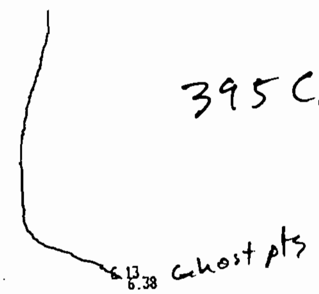
RUN # 15 MAR/24/92 11:08:18
WORKFILE ID: C
WORKFILE NAME:

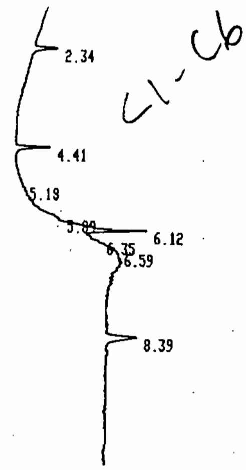
AREA%

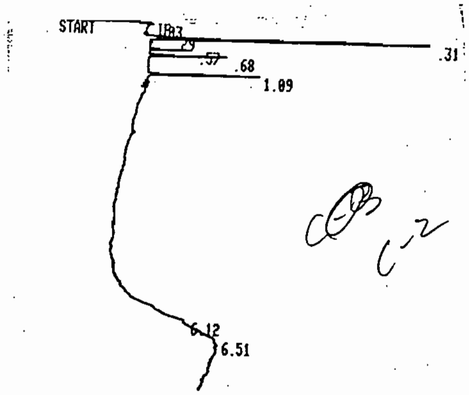
RT	AREA	TYPE	AR/HT	AREA%
~~0.03~~	~~1244~~	~~PV~~	~~0.064~~	~~1.565~~
~~0.29~~	~~361~~	~~D PV~~	~~0.015~~	~~0.454~~
0.31	69336	D VB	0.015	87.210 c1
0.57	1124	D BB	0.018	1.414 } VOC
0.69	2342	D BB	0.021	2.946
~~5.45~~	~~5098~~	~~VV~~	~~0.232~~	~~6.412~~

~~10.0% VOC~~
4.77% VOC

BEST AVAILABLE COPY







RUN # 16 MAR/24/92 11:25:05
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.03	815	PB	0.045	0.794
0.29	340	D PV	0.015	0.331
0.31	30058	D VB	0.015	29.283 C1
6.13	43522	VV	0.406	42.401
6.38	27910	VV	0.215	27.191

Ghost pks (6.13, 6.38)

TOTAL AREA= 102648
MUL FACTOR= 1.0000E+00

RUN # 18 MAR/24/92 12:09:53
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	489	BB	0.029	2.126
0.29	398	D BV	0.017	1.731
0.31	733	D VB	0.017	3.187 C1
0.69	1299	D BB	0.021	5.648 C2
2.34	2150	BB	0.067	9.348 C3
4.41	2572	PB	0.056	11.183 C4
5.18	309	PP	0.166	1.344 C5
5.89	0	PP	0.000	0.000
6.12	8221	PV	0.084	35.745
6.35	741	VV	0.110	3.222 C6
6.59	1831	VV	0.277	7.961
8.39	4256	PP	[illegible]	[illegible]

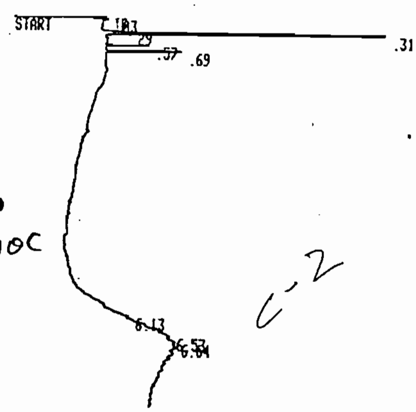
RUN # 22 MAR/24/92 13:45:43
WORKFILE ID: C
WORKFILE NAME:

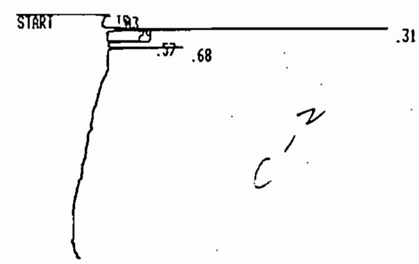
AREA%

RT	AREA	TYPE	AR/HT	AREA%
~~0.03~~	~~600~~	~~PV~~	~~0.034~~	~~0.768~~
~~0.29~~	~~331~~	~~PV~~	~~0.013~~	~~0.424~~
0.31	64790	D VB	0.015	82.946 C1
0.57	1037	D BV	0.018	1.328 VOC
0.68	2313	D PB	0.021	2.961 VOC
1.09	3029	D PB	0.019	3.878 VOC
~~6.12~~	~~0~~	~~PV~~	~~0.000~~	~~0.000~~
~~6.51~~	~~6011~~	~~VV~~	~~0.284~~	~~7.696~~

TOTAL AREA= 78111
MUL FACTOR= 1.0000E+00

8.96 % VOC





RUN # 20 MAR/24/92 13:21:05
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
~~0.03~~	~~216~~	~~PB~~	~~0.039~~	~~0.808~~
~~0.29~~	~~313~~	~~PV~~	~~0.013~~	~~0.353~~
0.31	64538	D VB	0.015	72.812 C1
0.57	1036	D PB	0.018	1.169 VOC
0.69	2224	D BB	0.021	2.509 VOC
~~6.13~~	~~0~~	~~PV~~	~~0.000~~	~~0.000~~
~~6.53~~	~~14119~~	~~VV~~	~~0.281~~	~~15.929~~
~~6.64~~	~~5691~~	~~VV~~	~~0.112~~	~~6.421~~

TOTAL AREA= 88637

4.81 % VOC

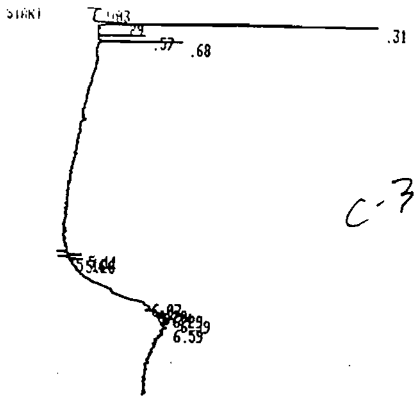
RUN # 21 MAR/24/92 13:35:18
WORKFILE ID: C
WORKFILE NAME:

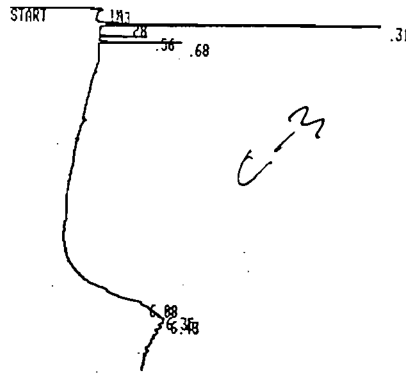
AREA%

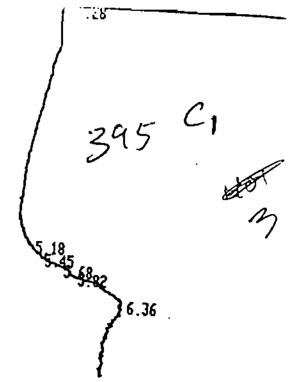
RT	AREA	TYPE	AR/HT	AREA%
~~0.03~~	~~1319~~	~~PP~~	~~0.074~~	~~1.932~~
~~0.29~~	~~228~~	~~PV~~	~~0.010~~	~~0.334~~
0.31	63480	D VB	0.015	93.001
0.57	1032	D PB	0.018	1.512 VOC
0.68	2198	D BB	0.021	3.220 VOC

4.84

BEST AVAILABLE COPY







RUN # 24 MAR/24/92 14:19:56
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.03	803	PB	0.042	0.722
0.29	284	PV	0.012	0.255
0.31	68427	D VB	0.015	61.525 C1
0.57	1186	D PB	0.018	1.066
0.68	2513	D PB	0.021	2.260 VOC
5.11	969	D BP	0.033	0.871
5.16	322	PV	0.025	0.290
5.20	680	D VV	0.024	0.611
6.07	12480	BV	0.227	11.221
6.20	7110	VV	0.128	6.393
6.24	1973	VV	0.032	1.774
6.29	3738	D VV	0.052	3.361
6.39	4670	VV	0.060	4.199
6.59	6063	VV	0.110	5.452

TOTAL AREA= 111220
MUL FACTOR= 1.0000E+00

6.39

RUN # 25 MAR/24/92 14:35:02
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
~~0.03~~	~~713~~	~~BV~~	~~0.045~~	~~0.963~~
~~0.28~~	~~288~~	~~D PV~~	~~0.013~~	~~0.389~~
0.31	67021	D VB	0.015	90.502 C1
0.56	1181	D BV	0.018	1.595 VOC
0.68	2522	D VP	0.022	3.406
~~6.03~~	~~0~~	~~PV~~	~~0.000~~	~~0.000~~
~~6.35~~	~~1920~~	~~VV~~	~~0.234~~	~~2.593~~
~~6.43~~	~~410~~	~~VB~~	~~0.063~~	~~0.554~~

TOTAL AREA= 74055
MUL FACTOR= 1.0000E+00

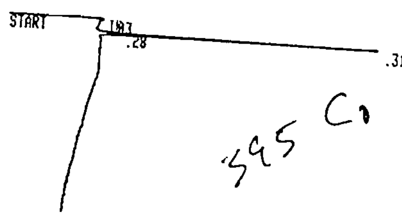
5.24

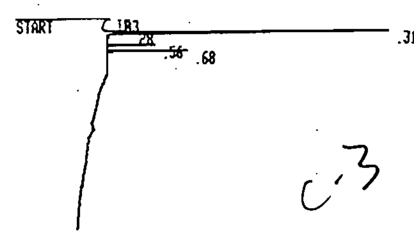
RUN # 23 MAR/24/92
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT
0.03	737	PB	0.047
0.28	320	D PV	0.015
0.31	26442	D VB	0.015
5.18	141	PP	0.062
5.45	200	BP	0.083
5.68	0	PV	0.000
5.82	996	VV	0.133
6.36	6586	VV	0.387

TOTAL AREA= 35422
MUL FACTOR= 1.0000E+00





RUN # 27 MAR/24/92 15:00:20
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.03	582	PB	0.034	1.984
0.28	405	D BV	0.016	1.381
0.31	28351	D VB	0.015	96.636

TOTAL AREA= 29338
MUL FACTOR= 1.0000E+00

RUN # 26 MAR/24/92 14:50:20
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.03	1401	PB	0.078	1.924
0.28	341	D BV	0.014	0.468
0.31	67526	D VB	0.015 C1	92.727
0.56	1158	D PB	0.018 VOC	1.590
0.68	2396	D PB	0.021	3.290

TOTAL AREA= 72822
MUL FACTOR= 1.0000E+00

5.00%

APPENDIX G
OPACITY OBSERVATIONS

VISIBLE EMISSIONS EVALUATOR

This is to certify that

Rick J. Krenzke

met the specifications of Federal Reference Method 9 and qualified as a visible emissions evaluator. Maximum deviation on white and black smoke did not exceed 7.5% opacity and no single error exceeding 15% opacity was incurred during the certification test conducted by Eastern Technical Associates of Raleigh, North Carolina. This certificate is valid for six months from date of issue.

Thomas Rose
President

232749
Certificate Number

Vice President

Orlando
Location

David B. Savage, Jr.
Program Manager

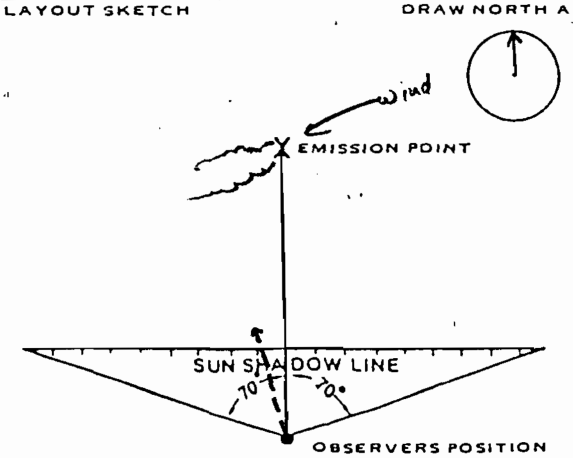
February 26, 1992
Date of Issue

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME	Florida Gas - Silver Springs Comp. St. #17
OBSERVATION DATE	3/24/92
START TIME	10:30 am
STOP TIME	11:30 am
ADDRESS	P.O. Box 337
CITY	Silver Springs
STATE	Fl
ZIP	32688-0337
PHONE	904-685-2421
SOURCE ID NUMBER	Unit # 5
PROCESS EQUIPMENT	Dresser Model 412 KVSR
OPERATING MODE	Full Load
CONTROL EQUIPMENT	NA
OPERATING MODE	NA
DESCRIBE EMISSION POINT	Exhaust Stack of Recip. Engine
HEIGHT ABOVE GROUND LEVEL	60'
HEIGHT RELATIVE TO OBSERVER	54'
DISTANCE FROM OBSERVER	120'
DIRECTION FROM OBSERVER	N
DESCRIBE EMISSIONS	No Visible Emissions
EMISSION COLOR	No Visible Emissions
PLUME TYPE:	CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT	NO ☑ YES ☐
IS WATER DROPLET PLUME	ATTACHED ☐ DETACHED ☐
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED	Exit of Exhaust Stack
DESCRIBE BACKGROUND	Sky
BACKGROUND COLOR	Blue
SKY CONDITIONS	10-20% white Cloud Cover
WIND SPEED	≈ 5-10 mph
WIND DIRECTION	NNE
AMBIENT TEMP.	
WET BULB TEMP.	
RELATIVE HUMIDITY	

SOURCE LAYOUT SKETCH

DRAW NORTH ARROW



M \ SEC	0	15	30	45	M \ SEC	0	15	30	45
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2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
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5	0	0	0	0	35	0	0	0	0
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8	0	0	0	0	38	0	0	0	0
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10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
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13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
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17	0	0	0	0	47	0	0	0	0
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26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

AVERAGE OPACITY FOR HIGHEST PERIOD	0
NUMBER OF READINGS ABOVE 0% WERE	0
RANGE OF OPACITY READINGS	MINIMUM 0 MAXIMUM 0
OBSERVER'S NAME (PRINT)	RICK J. KRENZKE
OBSERVER'S SIGNATURE	Rick J. Krenzke
DATE	3/24/92
ORGANIZATION	Cubix Corp.
CERTIFIED BY	State of Florida via ETA
DATE	2-27-92
VERIFIED BY	
DATE	
COMMENTS	

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SIGNATURE

TITLE

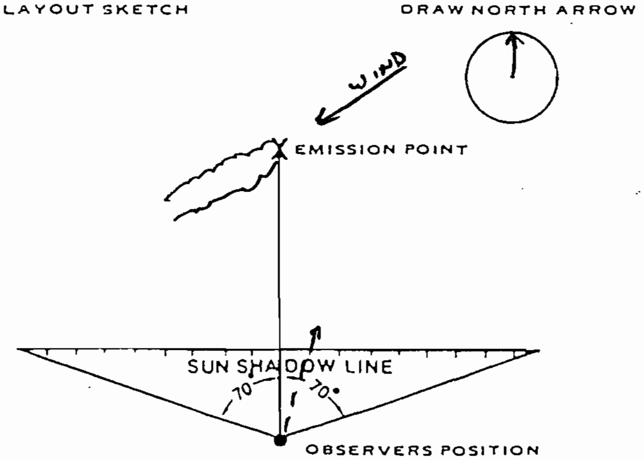
DATE

EPA 1R 0101

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME	Florida Gas - Silver Springs Comp St. #17
OBSERVATION DATE	3/24/92
START TIME	1310
STOP TIME	1410
ADDRESS	P.O. Box 337
CITY	Silver Springs
STATE	Florida
ZIP	32688-0337
PHONE	904-685-2421
SOURCE ID NUMBER	Unit #5
PROCESS EQUIPMENT	Dresser Model 412 KVSR
OPERATING MODE	Full Load
CONTROL EQUIPMENT	NA
OPERATING MODE	NA
DESCRIBE EMISSION POINT	Exhaust Stack of Recip. Engine
HEIGHT ABOVE GROUND LEVEL	60'
HEIGHT RELATIVE TO OBSERVER	54'
DISTANCE FROM OBSERVER	120'
DIRECTION FROM OBSERVER	
DESCRIBE EMISSIONS	No Visible Emissions
EMISSION COLOR	No Visible Emissions
PLUME TYPE: CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐	Continuous
WATER DROPLETS PRESENT	NO ☑ YES ☐
IS WATER DROPLET PLUME	ATTACHED ☐ DETACHED ☐
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED	Exit of Exhaust Stack
DESCRIBE BACKGROUND	Sky
BACKGROUND COLOR	Blue/white
SKY CONDITIONS	30-50 Cloud Cover
WIND SPEED	20 MPH
WIND DIRECTION	NNE
AMBIENT TEMP.	
WET BULB TEMP.	
RELATIVE HUMIDITY	

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



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2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
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25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

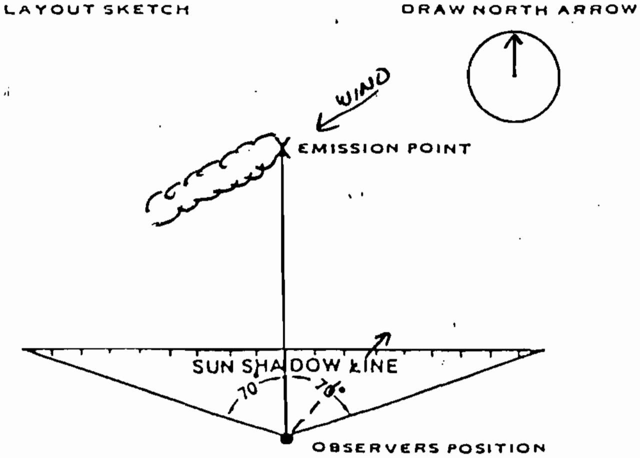
AVERAGE OPACITY FOR HIGHEST PERIOD	0
NUMBER OF READINGS ABOVE 0 % WERE	0
RANGE OF OPACITY READINGS	0 MINIMUM, 0 MAXIMUM
COMMENTS	
OBSERVER'S NAME (PRINT)	RICK J. KRENZKE
OBSERVER'S SIGNATURE	Rick J. Krenzke
DATE	3/24/92
ORGANIZATION	Cubix Corp.
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS — SIGNATURE	
TITLE	
DATE	
CERTIFIED BY	State of Florida by ETA
DATE	2-27-92
VERIFIED BY	
DATE	

EPA TR 0101

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME	Florida Gas - Silver Springs Comp. St. #17
ADDRESS	P.O. Box 337
CITY	Silver Springs
STATE	Fl
ZIP	32688-0337
PHONE	904-685-2421
SOURCE ID NUMBER	Unit #5
PROCESS EQUIPMENT	Dresser Model 412 KUSR
OPERATING MODE	Full Load
CONTROL EQUIPMENT	NA
OPERATING MODE	NA
DESCRIBE EMISSION POINT	Exhaust Stack of Recip Engine
HEIGHT ABOVE GROUND LEVEL	60'
HEIGHT RELATIVE TO OBSERVER	54'
DISTANCE FROM OBSERVER	120'
DIRECTION FROM OBSERVER	N
DESCRIBE EMISSIONS	No Visible Emissions
EMISSION COLOR	No VE
PLUME TYPE: CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐	Continuous
WATER DROPLETS PRESENT NO ☑ YES ☐	No
IS WATER DROPLET PLUME ATTACHED ☐ DETACHED ☐	
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED	Exit of Exhaust Stack
DESCRIBE BACKGROUND	Sky
BACKGROUND COLOR	Blue/white
SKY CONDITIONS	50-70% White Clouds
WIND SPEED	10 mph
WIND DIRECTION	NNE
AMBIENT TEMP.	
WET BULB TEMP.	
RELATIVE HUMIDITY	

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVATION DATE	START TIME	STOP TIME
3/24/92	1420	1520

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4	0	0	0	0	34	0	0	0	0
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6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
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19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
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27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

AVERAGE OPACITY FOR HIGHEST PERIOD: 0

NUMBER OF READINGS ABOVE 0 % WERE 0

RANGE OF OPACITY READINGS: 0 MINIMUM 0 MAXIMUM

COMMENTS

OBSERVER'S NAME (PRINT): RICK J. KRENZKE

OBSERVER'S SIGNATURE: Rick J. Krenzke — DATE: 3-24-92

ORGANIZATION: Cubix Corp.

CERTIFIED BY: State of Florida by ETA — DATE: 2-27-92

VERIFIED BY: — DATE:

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SIGNATURE

TITLE — DATE

EPA TH 0101

APPENDIX H: FUEL ANALYSES AND CALCULATIONS

CERTIFICATE OF ANALYSIS NUMBER 199905

SAMPLE IDENT.: SILVER SPRINGS M-5
FLORIDA GAS TRANS.
DRESSER ENGINE FUEL GAS
45 PSIG 17 TONY N
03/24/92 @ 12:45

DATE: APRIL 08, 1992

P. O. NO.: 92143

FOR: CUBIX CORPORATION
9225 LOCKHART HIGHWAY
AUSTIN, TEXAS 78747

ATTN: MR. JOE RUDYK

ASTM D-3246
TOTAL SULFUR ANALYSIS

< 1 ppm by wt.

< 0.059 Grains/100 cu. ft. by vol.

< 0.105 Grains/100 cu. ft. by wt.

SOUTHERN PETROLEUM LABORATORIES, INC.

J. C. WINFREY

ANALYSIS

DATE: 03/24/92		ANALYSIS TIME:	345	STREAM SEQUENCE:	12
TIME:	12:20	CYCLE TIME:	360	STREAM#:	2
ANALYZER#:	1	MODE:	RUN	CYCLE START TIME:	12:14

COMP NAME	COMP CODE	MOLE %	GAL/MCF**	B.T.U.*	SP. GR.*
HEXANE +	151	0.016	0.0071	0.84	0.0005
PROPANE	152	0.252	0.0694	6.35	0.0038
I-BUTANE	153	0.021	0.0069	0.68	0.0004
N-BUTANE	154	0.012	0.0038	0.39	0.0002
IPENTANE	155	3428.62-6	0.0013	0.14	0.0001
NPENTANE	156	2199.86-6	0.0008	0.09	0.0001
NITROGEN	157	0.436	0.0000	0.00	0.0042
METHANE	158	96.452	0.0000	976.39	0.5343
CO2	159	0.763	0.0000	0.00	0.0116
ETHANE	160	2.042	0.5463	36.22	0.0212
TOTALS		100.000	0.6355	1021.11	0.5764

* @ 14.730 PSIA DRY & UNCORRECTED FOR COMPRESSIBILITY

** @ 14.730 & 60 DEG. F

COMPRESSIBILITY FACTOR (1/Z)	= 1.0021
DRY B.T.U. @ 14.730 PSIA & 60 DEG. F CORRECTED FOR (1/Z)	= 1023.3
SAT B.T.U. @ 14.730 PSIA & 60 DEG. F CORRECTED FOR (1/Z)	= 1005.5
REAL SPECIFIC GRAVITY	= 0.5773
UNNORMALIZED TOTAL	= 99.99

ACTIVE ALARMS

NONE

FLORIDA GAS TRANSMISSION CO.

BROOKER LAB- comm

STANDARD GAS 1041.8 / 0.5939

CERTIFIED VALUE BTU 1041.9 GRAV. 0.5939

TOTAL SULFUR 0.45 GR/CCF H_2S 0.25 GR/CCF

H_2O 0.6 #/MMCF BY Bill Stevens

Allen Weatherford

From c/s 16 Brooker

Client: Florida Gas
Sample ID: Silver Springs Station Fuel Gas

CALCULATION OF DENSITY AND HEATING VALUE

Component	% Volume	Molecular Wt.	Density (lb/ft3)	% volume x Density	weight %	Component Gross Btu/lb	Weight Fract. Btu	Gross Heating Value (Btu/SCF)	Volume Fract. Btu
Hydrogen		2.016	0.0053	0.00000	0.0000	61100	0.00	325	0
Oxygen		32.000	0.0846	0.00000	0.0000	0	0.00	0	
Nitrogen	0.4360	28.016	0.0744	0.00032	0.7347	0	0.00	0	0
CO2	0.7630	44.01	0.117	0.00089	2.0218	0	0.00	0	0
CO		28.01	0.074	0.00000	0.0000	4347	0.00	322	0
Methane	96.4520	16.041	0.0424	0.04090	92.6222	23879	22117.26	1013	977.06
Ethane	2.0420	30.067	0.0803	0.00164	3.7137	22320	828.90	1792	36.593
Ethylene		28.051	0.0746	0.00000	0.0000	21644	0.00	1614	0
Propane	0.2520	44.092	0.1196	0.00030	0.6826	21661	147.86	2590	6.5268
propylene		42.077	0.111	0.00000	0.0000	21041	0.00	2336	0
Isobutane	0.0210	58.118	0.1582	0.00003	0.0752	21308	16.03	3363	0.7062
n-butane	0.0120	58.118	0.1582	0.00002	0.0430	21257	9.14	4016	0.4819
Isobutene		56.102	0.148	0.00000	0.0000	20840	0.00	3068	0
Isopentane	0.0034	72.144	0.1904	0.00001	0.0148	21091	3.12	4008	0.1374
n-pentane	0.0022	72.144	0.1904	0.00000	0.0095	21052	2.00	3993	0.0878
n-hexane	0.0160	86.169	0.2274	0.00004	0.0824	20940	17.26	4762	0.7619
H2S		34.076	0.0911	0.00000	0.0000	7100	0.00	647	0
total	100.00	Average Density		0.04415	100.0000	Gross Heating Value		Gross Heating Value	
		Specific Gravity		0.57717		Btu/lb	23142	Btu/SCF	1022

CALCULATION OF F FACTORS

Component	Mol. Wt.	C Factor	H Factor	% volume	Fract. Wt.	Weight Percents: Carbon	Hydrogen	Nitrogen	Oxygen	Sulfur
Hydrogen	2.016	0	1	0.00	0.0000	0	0			
Oxygen	32	0	0	0.00	0.0000				0	
Nitrogen	28.016	0	0	0.44	12.2150	0	0	0.731789842		
CO2	44.01	0.272273	0	0.76	33.5796	0.54773973	0		1.4625	
CO	28.01	0.42587	0	0.00	0.0000	0	0		0	
Methane	16.041	0.75	0.25	96.45	1547.1865	69.5180687	23.17269			
Ethane	30.067	0.8	0.2	2.04	61.3968	2.94258882	0.7356472			
Ethylene	28.051	0.85714	0.14286	0.00	0.0000	0	0			
Propane	44.092	0.81818	0.18182	0.25	11.1112	0.54463175	0.1210294			
Propene	42.077	0.85714	0.14286	0.00	0.0000	0	0			
Isobutane	58.118	0.82759	0.17247	0.02	1.2205	0.06051164	0.0126106			
n-butane	58.118	0.82759	0.17247	0.01	0.6974	0.03457808	0.0072061			
Isobutene	56.102	0.85714	0.14286	0.00	0.0000	0	0			
Isopentane	72.144	0.83333	0.16667	0.00	0.2474	0.01234896	0.0024699			
n-pentane	72.144	0.83333	0.16667	0.00	0.1587	0.0079233	0.0015847			
n-hexane	86.169	0.83721	0.16279	0.02	1.3787	0.06915112	0.013446			
H2S	34.08	0	0	0.00	0.0000	0	0			0
Totals				99.99963	1669.1918	73.7375421	24.07	0.731789842	1.4625	0
										99.999

CALCULATED VALUES		
O2 F Factor (dry)	8636	DSCF of Exhaust/MM Btu of Fuel Burned @ 0% excess air
O2 F Factor (wet)	10643	SCF of Exhaust/MM Btu of Fuel Burned @ 0% excess air
Moisture F Factor	2007	SCF of Water/MM Btu of Fuel Burned @ 0% excess air
Combust. Moisture	18.86	volume % water in flue gas @ 0% excess air
Fo	1.8	fuel factor (dimensionless)
VOC Portion of fuel	2.35	%
CO2 F Factor	1023	DSCF of CO2/MM Btu of Fuel Burned @ 0% excess air

APPENDIX I: ALTERNATIVE COMPLIANCE TEST DATA

Operator/Plant	Florida Gas Silver Springs Compressor Stati
Location	Marion County, Florida
Source	Dresser-Rand Compressor Engine
Technicians	RK,LF,JR

Test Run No.	C-1	C-2	C-3
Date	3/24/92	3/24/92	3/24/92
Start Time	10:06	13:00	14:10
Stop Time	11:06	14:00	15:10
Engine/Compressor Operation			
Engine Speed (rpm)	330	329	330
Ignition Timing (°BTDC)	14	14	14
Air Manifold Pressure (psig)	8.8	9	9
Air Manifold Temperature (°F)	128	128	128
Estimated Fuel Flow AT 7800 BTU/hp-hr (SCFH)	17951	17951	18699
Fuel Temperature (°F)	68	68	68
Fuel Manifold Pressure (psig)	27.5	27.4	27.4
Pre-Combustion Chamber Pressure (psig)	19	19.1	19.2
Exhaust Temperature (°F)	704	701	700
Turbo (rpm x 100)	158/157	159/157	160/159
Pockets Open	12	12	12
Suction Pressure (psig)	790	742	733
Suction Temperature (°F)	69	68	69
Discharge Pressure (psig)	938	915	905
Discharge Temperature (°F)	98	108	104
Engine Load (BHP)	2352	2352	2450
Torque (%)	98	98	99
Ambient Conditions			
Atmospheric Pressure (in. Hg)	30.05	30.03	30.03
Temperature (°F) : Dry bulb	70	72	72
(°F) Wet bulb	62	62	68
Humidity (lb/lb air)	0.0098	0.0093	0.0134
Measured Emissions			
NOx (ppmv)	192	160	133
CO (ppmv)	329	324	312
O2 via Method 3a (%)	12.3	12.1	12.4
CO2 via Method 3a (%)	4.82	4.89	4.91
THC via EPA Method 25a (ppmv, wet)	820	975	1015
VOC via EPA Method 18 (% of THC)	4.77%	6.20%	5.54%
VOC i.e. non methane via EPA 18 (ppmv, wet)	39.1	60.5	56.3
VOC via Methods 25a and 18 (ppmv, dry)	42.9	66.1	61.9
SO2 in fuel (grains/100 DSCF)	<0.059	<0.059	<0.059
Stack Volumetric Flow Rates			
via Pitot Tube (SCFH, dry)	4.38E+05	4.26E+05	4.18E+05
Calculated Emission Rates (via pitot tube)			
NOx (lbs/hr)	10.0	8.1	6.6
CO (lbs/hr)	10.5	10.0	9.5
VOC (lbs/hr)	0.78	1.17	1.08
SO2 (lbs/hr)	<0.0015	<0.0015	<0.0016
NOx (tons/yr)	44.0	35.7	29.1
CO (tons/yr)	45.9	44.0	41.6
VOC (tons/yr)	3.42	5.13	4.71
SO2 (tons/yr)	<0.0066	<0.0066	<0.0069
NOx (g/hp-hr)	1.94	1.57	1.23
CO (g/hp/hr)	2.02	1.94	1.76
VOC (g/hp-hr)	0.15	0.23	0.20

Operator/Plant	Florida Gas Silver Springs Compressor Stati
Location	Marion County, Florida
Source	Dresser-Rand Compressor Engine
Technicians	RK,LF,JR

Test Run No.	C-1	C-2	C-3
Stack Moisture & Molecular Wt. via EPA Method 4			
CO_2 (%)	4.82	4.89	4.91
O_2 (%)	12.25	12.05	12.40
Beginning Meter Reading (ft3)	838.300	863.160	889.130
Ending Meter Reading (ft3)	862.650	888.520	911.220
Beginning Impinger Wt (g)	2480.9	2527	2574.5
Ending Impinger Wt. (g)	2527	2574.5	2618.9
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	90	80	95
Dry Gas Meter Temperature (°F end)	116	109	101
Atmospheric Pressure (in Hg, abs.)	30.05	30.03	30.03
Stack Gas Moisture (% volume)	8.74	8.54	9.16
Dry Gas Fraction	0.913	0.915	0.908
Stack Gas Molecular Wt. (lbs/lb-mole)	28.28	28.30	28.25
Stack Moisture & Molecular Wt. via Stoichiometry			
Fuel Moisture Content (vol % @ 0% O_2)	18.86	18.86	18.86
Moisture Content (vol %)	8.43	8.59	8.53
Difference between methods	3%	1%	7%
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	1.30	1.20	1.20
ΔP #2	1.40	1.30	1.20
ΔP #3	1.40	1.20	1.20
ΔP #4	1.20	1.10	1.10
ΔP #5	1.30	1.20	1.20
ΔP #6	1.20	1.30	1.20
ΔP #7	1.10	1.20	1.10
ΔP #8	1.30	1.10	1.00
ΔP #9	1.40	1.30	1.20
ΔP #10	1.30	1.30	1.20
ΔP #11	1.40	1.20	1.10
ΔP #12	1.20	1.20	1.10
ΔP #13	1.20	1.30	1.20
ΔP #14	1.30	1.20	1.30
ΔP #15	1.20	1.10	1.30
ΔP #16	1.10	1.10	1.20
Sum of Square Root of ΔP's	18.0	17.6	17.3
Number of Traverse Points	16	16	16
Average Square Root of ΔP's	1.13	1.10	1.08
Average Temperature (°F)	646	656	655
Static Pressure (in. H_2O)	1.3	1.4	1.4
Stack Diameter (in.)	23.5	23.5	23.5
Stack Area (ft2)	3.01	3.01	3.01
Stack Velocity (ft/min)	5523	5410	5342
Stack Flow,wet (ACFM)	16637	16295	16091
Stack Flow,dry (SCFH)	4.38E+05	4.26E+05	4.18E+05
Stack Flow Rate via EPA Method 19			
Fuel Flow to Engine (SCFH)	17951	17951	18699
Fuel Heating Value (BTU/SCF)	1022	1022	1022
Fuel O_2 F-Factor (DSCFH/MMBTU)	8636	8636	8636
Fuel CO_2 F-Factor (DSCFH/MMBTU)	1023	1023	1023
Stack Flow, dry via O_2 F-factor (SCFH)	3.83E+05	3.74E+05	4.06E+05
Stack Flow, dry via CO_2 F-factor (SCFH)	3.89E+05	3.84E+05	3.98E+05
Difference between O_2 F-factor and pitot tube	13%	12%	3%
Difference between CO_2 F-factor and pitot tube	11%	10%	5%
Stack Flow Rate via Carbon Balance			
Fuel Carbon Content	1.023	1.023	1.023
Exhaust Carbon Content	4.93	5.02	5.04
Stack Flow, dry via carbon balance (SCFH)	3.72E+05	3.66E+05	3.79E+05
Difference between carbon balance and pitot tube	15%	14%	9%

Florida Department of Environmental Regulation

Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400

Lawton Chiles, Governor

Carol M. Browner, Secretary

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
NOTICE OF PERMIT

Mr. William R. Osborne, Project Environmentalist
Environmental Affairs Department
Florida Gas Transmission Company
Post Office Box 1188
Houston, Texas 77251-1188

May 9, 1991

Enclosed is construction permit AC 42-189455 (PSD-FL-162) to install one natural gas-fired engine at the Florida Gas Transmission facility in Marion County, Florida. This permit is issued pursuant to Section 403, Florida Statutes.

Any party to this permit has the right to seek judicial review of the permit pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date this permit is filed with the Clerk of the Department.

Executed in Tallahassee, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL REGULATION

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

Copy furnished to:

C. Collins, CD
D. Buff, P.E.
B. Beals, U.S. EPA
C. Shaver, NPS

CERTIFICATE OF SERVICE

The undersigned duly designated deputy clerk hereby certifies that this NOTICE OF PERMIT and all copies were mailed before the close of buisness on 5-10-91.

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.

Kim Tobin 5-10-91

Clerk Date

Final Determination

Florida Gas Transmission Company
Marion County, Florida

Gas-Fired Engine
AC 42-189455
PSD-FL-162

Department of Environmental Regulation
Division of Air Resources Management
Bureau of Air Regulation

May 9, 1991

Final Determination

The Technical Evaluation and Preliminary Determination for the permit to construct one gas-fired engine at the Florida Gas Transmission Company's facility 17 miles northeast of Silver Springs, Marion County, Florida, was distributed on March 15, 1991. The Notice of Intent to Issue was published in The Ocala Star-Banner on March 21, 1991. Copies of the evaluation were available for public inspection at the Department of Environmental Regulation, Bureau of Air Regulation, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400 and the Department of Environmental Regulation, Central District Office, 3319 Maguire Bldv., Suite 232, Orlando, Florida 32803-3767.

Comments were received from Mr. David Buff, P.E., from KBN Engineering and Applied Sciences, Inc. Mr. Buff requested some clarification regarding the requirement and time of the compliance tests. Also, Mr. Buff pointed out some minor typographical errors. As results of his comments, all typographical errors were corrected and an additional sentence was added to the Compliance Determination Section of each permit that reads:

Compliance Determination:

"This source shall demonstrate compliance with its limits for each affected pollutant within 60 days after completion of construction and annually thereafter, as follows:"

The final action of the Department will be to issue construction permit No. AC 42-189455, PSD-FL-162 with the changes as requested by Mr. Buff and noted above.

Florida Department of Environmental Regulation

Twin Towers Office Bldg. ● 2600 Blair Stone Road ● Tallahassee, Florida 32399-2400

Lawton Chiles, Governor

Carol M. Browner, Secretary

PERMITTEE:

Florida Gas Transmission Company
1400 Smith Street
Houston, Texas 77251-1188

Permit Number: AC 42-189455
PSD-FL-162
Expiration Date: June 30, 1992
County: Marion
Latitude/Longitude: 29°17'47"N
81°50'08"W
Project: Natural Gas Compressor Engine (Unit No. 5) Station No. 17

This permit is issued under the provisions of Chapter 403, Florida Statutes, and Florida Administrative Code Chapters 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 one natural gas fired engine to be located 17 miles northeast of Silver Springs on CR 314 in Silver Springs, Florida. The UTM coordinates are Zone 17, 418.84 km East and 3240.90 km North.

The source shall be constructed in accordance with the permit application, plans, documents, amendments and drawings, except as otherwise noted in the General and Specific Conditions.

Attachments are listed below:

1. Application to Construct/Operate Air Pollution Sources DER Form 17-1.202(1).
2. Department's letter dated November 20, 1990.
3. KBN Engineering and Applied Services, Inc.'s letter dated December 17, 1990.

GENERAL CONDITIONS:

1. The terms, conditions, requirements, limitations, and restrictions set forth in this permit are "Permit Conditions" and are binding and enforceable pursuant to Sections 403.141, 403.727, or 403.859 through 403.861, Florida Statutes. The permittee is placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of these conditions.

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. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit is not a waiver 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, or plant life, or property caused by the construction or operation of this permitted source, or from penalties therefore; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.

6. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules.

GENERAL CONDITIONS:

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 and at a reasonable time, access to the premises, where the permitted activity is located or conducted to:

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

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

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

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

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

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

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

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

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

GENERAL CONDITIONS:

which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except where such use is prescribed by Sections 403.73 and 403.111, Florida Statutes. Such evidence shall only be used to the extent it is consistent with the Florida Rules of Civil Procedure and appropriate evidentiary rules.

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 17-4.120 and 17-730.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

12. This permit or a copy thereof shall be kept at the work site of the permitted activity.

13. This permit also constitutes:

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

14. The permittee shall comply with the following:

a. Upon request, the permittee shall furnish all records and plans required under Department rules. During enforcement actions, the retention period for all records will be extended automatically unless otherwise stipulated by the Department.

b. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the

GENERAL CONDITIONS:

permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

c. Records of monitoring information shall include:

- the date, exact place, and time of sampling or measurements;
- the person responsible for performing the sampling or measurements;
- the dates 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 corrected promptly.

SPECIFIC CONDITIONS:

Emission Limits

1. The maximum allowable emissions from this source shall not exceed the emission rates as follows:

Pollutant	lbs/hr	tons/yr	Emission Factor
Nitrogen Oxides	10.6	46.3	2.0 g/bhp-hr
Carbon Monoxide	14.8	64.9	2.8 g/bhp-hr
Volatile Organic Compounds (non-methane)	9.0	39.4	1.7 g/bhp-hr
Particulate Matter (TSP)	0.09	0.4	5 lbs/MMscf
Particulate Matter (PM_{10})	0.09	0.4	5 lbs/MMscf
Sulfur Dioxide	0.49	2.2	10 gr/100scf

2. Visible emissions shall not exceed 10% opacity.

Operating Rates

3. This source is allowed to operate continuously (8760 hours per year).

SPECIFIC CONDITIONS:

4. This source is allowed to burn natural gas only.

5. The permitted operating parameters and utilization rates for this natural gas compressor engine shall not exceed the values stated in the application. The parameters include, but are not limited to:

- Maximum natural gas consumption shall not exceed 17,010 scf/hr.
- Maximum heat input shall not exceed 17.52 MMBtu/hr.

6. Any change in the method of operation, equipment or operating hours shall be submitted to the DER's Bureau of Air Regulation and Central District offices.

7. Any other operating parameters established during compliance testing and/or inspection that will ensure the proper operation of this facility shall be included in the operating permit.

Compliance Determination

This source shall demonstrate compliance with its emission limits for each affected pollutant within 60 days after completion of construction and annually thereafter as follows:

8. Compliance with the NO_X, SO_2, CO, and VOC standards shall be determined by the following reference methods as described in 40 CFR 60, Appendix A (July 1, 1988) and adopted by reference in F.A.C. Rule 17-2.700.

- Method 1. Sample and Velocity Traverses
- Method 2. Volumetric Flow Rate
- Method 3. Gas Analysis
- Method 7E. Determination of Nitrogen Oxides Emissions from Stationary Sources
- Method 9. Determination of the Opacity of the Emissions from Stationary Sources
- Method 10. Determination of the Carbon Monoxide Emission from Stationary Sources
- Method 25. Determination of Total Gaseous Nonmethane Organic Emissions as Carbon

9. Compliance with the SO_2 emission limit can be determined by calculations based on fuel analysis using ASTM D1072-80, D3031-81, D4084-82, or D3246-81 for sulfur content of gaseous fuels.

SPECIFIC CONDITIONS:

10. Initial compliance with the volatile organic compound (VOC) emissions limits will be demonstrated by EPA Method 25, thereafter, compliance with the VOC emission limits will be assumed, provided the CO allowable emission rate is achieved.

11. Test results will be the average of 3 valid runs. The Central District office will be notified at least 15 days in advance of the compliance test. The source shall operate between 90% and 100% of permitted capacity during the compliance test. Compliance test results shall be submitted to the Central District office no later than 45 days after completion.

<u>Rule Requirements</u>

12. This source shall comply with all applicable provisions of Chapter 403, Florida Statutes and Chapters 17-2 and 17-4, Florida Administrative Code.

13. Issuance of this permit does not relieve the facility owner or operator from compliance with any applicable federal, state, or local permitting requirements and regulations (F.A.C. Rule 17-2.210(1)).

14. This source shall comply with F.A.C. Rule 17-2.700, Stationary Point Source Emission Test Procedures.

15. Pursuant to F.A.C. Rule 17-2.210(2), Air Operating Permits, the permittee is required to submit annual reports on the actual operating rates and emissions from this facility. These reports shall include, but are not limited to the following: fuel usage, hours of operation, air to fuel ratio, air emissions limits, stack test results, etc. Annual reports shall be sent to the Department's Central District office.

16. The permittee, for good cause, may request that this construction permit be extended. Such a request shall be submitted to the Bureau of Air Regulation prior to 60 days before the expiration of the permit (F.A.C. Rule 17-4.090).

17. An application for an operation permit must be submitted to the Central District office at least 90 days prior to the expiration date of this construction permit or within 45 days after completion of compliance testing, whichever occurs first. To properly apply

SPECIFIC CONDITIONS:

for an operation permit, the applicant shall submit the appropriate application form, fee, certification that construction was completed noting any deviations from the conditions in the construction permit, and compliance test reports as required by this permit (F.A.C. Rule 17-4.220).

Issued this 8th day
of May, 1991

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL REGULATION

for Carol M. Browner, Secretary

Best Available Control Technology (BACT) Determination
Florida Gas Transmission Company
Marion County

The applicant proposes to expand its existing natural gas pipeline compressor station No. 17 near the town of Silver Springs in Marion County, Florida. The proposed expansion consists of adding one new 2,400 brake horsepower (BHP) natural-gas-fired, reciprocating internal combustion engine.

The applicant has indicated the maximum total annual tonnage of regulated air pollutants emitted from the compressor engine based on 8,760 hrs/year operation to be as follows:

Pollutant	Max. Net Increase in Emissions (TPY)	PSD Significant Emission Rate (TPY)
NOx	46.3	40
SO_2	2.13	40
PM/PM_{10}	0.37	25/15
CO	64.9	100
VOC	39.4	40

Rule 17-2.500(2)(f)(3) of the Florida Administrative Code (F.A.C.) 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.

BACT Determination Requested by the Applicant

The BACT Determination requested by the applicant is given below:

Pollutant	Determination
NOx	2.0 g/bhp-hr

Date of Receipt of a BACT Application

December 18, 1990

Review Group Members

This determination was based upon comments received from the applicant and the Permitting and Standards Section.

BACT Determination Procedure

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

(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.

The EPA currently stresses that BACT should be determined using the "top-down" approach. The first step in this approach is to determine the most stringent control available for a similar or identical source or source category. If it is shown that this level of control is technically or economically infeasible for the source in question, then the next most stringent level of control is determined and similarly evaluated. This process continues until the BACT level under consideration cannot be eliminated by any substantial or unique technical, environmental, or economic objections.

BACT Analysis

A review of previous BACT determinations and control measures utilized for natural gas compressor engines indicates that in general the nitrogen oxides emission rate proposed by the applicant is representative of BACT. BACT for nitrogen oxides has been established for reciprocating engines based on the following techniques:

- o engine modifications, and
- o add-on control technology

A review of the BACT/LAER Clearinghouse does not indicate the use of engine modifications on natural gas fired engines as representing BACT. A few engines have, however, been required to use selective catalytic reduction.

Selective catalytic reduction is a post-combustion method for control of NOx emissions. The SCR process combines vaporized ammonia with NOx in the presence of a catalyst to form nitrogen and water. The vaporized ammonia is injected into the exhaust gases prior to passage through the catalyst bed. The SCR process can achieve up to 90% reduction of NOx with a new catalyst. As the catalyst ages, the maximum NOx reduction will decrease to approximately 86 percent.

Given the applicant's proposed BACT level for nitrogen oxides control stated above, an evaluation can be made of the cost and associated benefit of using SCR as follows:

The applicant has indicated that the total levelized annual cost (operating plus amortized capital cost) to install SCR at 100 percent capacity factor is $377,131. Taking into consideration the total levelized annual cost, a cost/benefit analysis of using SCR can now be developed.

Based on the information supplied by the applicant, it is estimated that the maximum annual NOx emissions with the proposed compressor engines will be 46.3 tons/year. Assuming that SCR would reduce NOx emissions by an additional 80%, the SCR would control 37 tons of NOx annually. When this reduction is taken into consideration with the total levelized annual cost of $377,131, the cost per ton of controlling NOx is $10,193. This cost ($10,193/ton) is not representative of costs that have been previously justified as BACT and is judged to be cost prohibitive for this facility.

In addition to evaluating the use of SCR, the applicant has examined the energy and economic impacts of using nonselective catalytic reduction, air-to-fuel ratio changes, ignition timing retardation, derating, and exhaust gas recirculation. In each case these alternatives resulted in emissions that were essentially equivalent to that proposed or provided little benefit for the associated expense. As this is the case, none of these control strategies will be elaborated upon in this determination.

Environmental Impact Analysis

The predominant environmental impacts would be related to the use of SCR. The use of SCR could result in accidental spills, emissions of ammonia, and the handling of spent catalyst which is sometimes classified as hazardous waste. Other control techniques such as ignition timing retardation and power derating result in increases of carbon monoxide and hydrocarbons which reduce the gains provided by controlling nitrogen oxides.

In addition to nitrogen oxides, the impacts of toxic pollutants associated with the combustion of natural gas have been evaluated. These toxics (formaldehyde and polycyclic organic matter) common to the combustion of natural gas, are expected to be emitted in minimal amounts and will not have an impact on air quality or this BACT analysis.

BACT Determination by DER

Based on the information presented by the applicant and the studies conducted, the Department believes that the compressor engine proposed by the applicant satisfies the BACT requirement for nitrogen oxides. Although engine modifications and add-on control (SCR) could be used to provide additional control, the benefits that would be obtained do not warrant the cost. The emission limit for the compressor engine is thereby established as follows:

Pollutant	Emission Limit
NOx	2.0 grams/bhp-hr

Details of the Analysis May be Obtained by Contacting:

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

Recommended by:	Approved by:
C. H. Fancy, P.E., Chief for Bureau of Air Regulation	Carol M. Browner, Secretary Dept. of Environmental Regulation
May 8, 1991 Date	May 8 1991 Date

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

4APT-AEB

MAY 31 1991

Mr. Clair H. Fancy, P.E., Chief
Bureau of Air Regulation
Florida Department of Environmental
Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

RECEIVED
JUN 03 1991
Division of Air
Resources Management

RE: Florida Gas Transmission Company Compressor Stations
PSD-FL-156 Santa Rosa County
PSD-FL-158 Washington County
PSD-FL-159 Gadsden County
PSD-FL-160 Taylor County
PSD-FL-161 Bradford County
PSD-FL-162 Marion County
PSD-FL-163 Orange County
PSD-FL-164 St. Lucie County

Dear Mr. Fancy:

This is to acknowledge receipt of your final determinations and permits for modifications to Compressor Station Nos. 12 through 18 and 20 of the above referenced source, by letters dated May 9, 1991.

The proposed projects are similar in scope in that they each consist of the addition of one reciprocating internal combustion engine to an existing compressor station. The engines proposed for the stations in Santa Rosa, Taylor and Bradford Counties will be sized at 4000 brake horsepower. The engines for the remaining five counties will be sized at 2400 brake horsepower. We have reviewed the packages as requested and have no adverse comments.

Thank you for the opportunity to review and comment on this application. If you have any questions or comments on this package, please contact Mr. Gregg Worley of my staff at (404) 347-2904.

Sincerely yours,

Jewell A. Harper, Chief
Air Enforcement Branch
Air, Pesticides, and Toxics
Management Division

I. Heron
CHF/SA

Printed on Recycled Paper

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

4APT-AEB

RECEIVED
APR 15 1991
DER - BAQM

Mr. Clair H. Fancy, P.E., Chief
Bureau of Air Regulation
Florida Department of Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

RE: Florida Gas Transmission Company Compressor Stations
PSD-FL-158 Washington County
PSD-FL-159 Gadsden County
PSD-FL-160 Taylor County
PSD-FL-161 Bradford County
PSD-FL-162 Marion County
PSD-FL-163 Orange County
PSD-FL-164 St. Lucie County

Dear Mr. Fancy:

This is to acknowledge receipt of your preliminary determinations and draft permits for modifications to Compressor Station Nos. 13 through 18 and 20 of the above referenced source, by letters dated March 14, 1991.

The proposed projects are similar in scope in that they each consist of the addition of one reciprocating internal combustion engine to an existing compressor station. The engines proposed for the stations in Taylor and Bradford Counties will be sized at 4000 brake horsepower. The engines for the remaining five counties will be sized at 2400 brake horsepower. We have reviewed the package as requested and have no adverse comments at this time. There is however a typographical error in the draft permit for the Marion County Station. The federal permit number for this Station should be listed as PSD-FL-162.

Thank you for the opportunity to review and comment on this application. If you have any questions or comments on this package, please contact Mr. Gregg Worley of my staff at (404) 347-2904.

Sincerely yours,

Jewell A. Harper, Chief
Air Enforcement Branch
Air, Pesticides, and Toxics
Management Division

cc: J. Nelson

United States Department of the Interior
FISH AND WILDLIFE SERVICE

MAILING ADDRESS:
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION:
134 Union Blvd.
Lakewood, Colorado 80228

IN REPLY REFER TO:

RW Air Quality
Mail Stop 60130

APRIL 09 1991

RECEIVED

APR 15 1991

DER-BAQM

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

Dear Mr. Fancy:

We have completed reviews of PSD permit applications and the State's Preliminary Determinations for four projects proposed by Florida Gas Transmission Company (FGT). We understand that FGT has submitted a total of nine applications to the State relating to the proposed expansion of their existing natural gas pipeline. The four applications that we reviewed all consist of the addition of one natural-gas-fired, reciprocating internal combustion engine to an existing compressor station. It is proposed that stations 14 and 17 will add one 2400 brake horsepower engine each, while stations 15 and 16 will each add a 4000 brake horsepower engine. The applications are subject to PSD review because the expansions will result in significant increases in nitrogen oxide (NO_x) emissions.

The four stations are located near three class I air quality areas administered by the U.S. Fish and Wildlife Service. The table below lists the station number and the county in which it is located, the proposed NO_x emissions in tons per year (TPY), the distance and direction of each station from the class I area, and the maximum predicted annual nitrogen dioxide increment consumption from this project in micrograms per cubic meter (ug/m^3).

STATION NUMBER	NO_x (TPY)	CLASS I AREA	DISTANCE	MODEL IMPACT (ug/m^3)
14 (Gadsden County)	46.3	Saint Marks	58 NW	0.01
15 (Taylor County)	77.2	Saint Marks	36 E	0.01
16 (Bradford County)	77.2	Okefenokee	73 S	0.01
17 (Marion County)	46.3	Chassahowitzka	95 NE	0.004

We agree that the proposed lean-burn engines represent best available control technology. We also agree that the visibility analyses indicate that the proposed emissions would have low potential for visibility impairment due to plume impacts in the wilderness areas. The results of the State's air quality dispersion modeling analyses show a minimal increase in nitrogen dioxide concentrations in the wilderness areas from the proposed expansions. We prefer, in most cases, to see a cumulative analysis that includes all increment consuming sources having the potential of impacting class I areas. In addition, to assess potential impacts on sensitive air quality related values, it is important for us to know the total ambient concentrations (increment plus background) at the class I areas. However, given FGT's predicted impacts at the wilderness areas, it is unlikely that emissions from the proposed expansions would combine with other sources in the area to significantly impact the air quality or related values at the three class I areas of concern.

If you have any questions regarding this matter, please contact Tonnie Maniero of our Air Quality Branch in Denver at (303) 969-2071.

Sincerely,

Wilbur N. Ladd, Jr.

Wilbur N. Ladd, Jr.
Assistant Regional Director
Refuges and Wildlife, Region 6

cc: J. Heron
C. Holladay
B. Andrews

PM
4-2-91
Gainesville, FL

File Copy

KBN

April 2, 1991

Mr. C. H. Fancy, P.E.
Chief, Bureau of Air Regulation
Florida Department of Environmental Regulation
2600 Blair Stone Road
Tallahassee, FL 32399-2400

RECEIVED
APR 3 1991
DER - BAQM

Re: AC 42-189455; PSD-FL-161
Florida Gas Transmission Co.
Station 17, Unit No. 5
Marion County; Silver Springs, Florida

Dear Mr. Fancy:

On behalf of Florida Gas Transmission Co. (FGTC), KBN has reviewed the Technical Evaluation and Preliminary Determination (TE&PD) and the draft construction permit for the above referenced PSD permit application. Based on this review, I offer the following comments for your consideration.

In the draft construction permit, under Compliance Determination, it is not specifically stated what initial compliance tests will be required, or when such tests must be conducted.

Thank you for consideration of these comments.

Sincerely,

David A. Buff

David A. Buff, M.E., P.E.
Principal Engineer

cc: Bill Osborne
Jim Alves
Teresa Heron
BAI CHF
Chuck Collins, CD } 4-4-91 BAR

File Copy
AC 42-189155
PSD-FL-161

Florida Gas Transmission Company

Certified Mail P.O. Box 945100 Maitland, Florida 32794-5100 (407) 875-5800

March 26, 1991

Mr. Barry Andrews
Florida Department of Environmental Regulation
Division of Air Resources Management
Bureau of Air Regulation
Twin Towers Building
2600 Blair Stone Road
Tallahassee, Fl 32399-2400

Dear Mr. Andrews:

Re: Intent to Issue Permit
Proof of Publication - Air Permit
Florida Gas Transmission Company
Compressor Station 17, Silver Springs, Fl

I hereby submit one (1) affidavit as proof of publication of the intent issue notice for the site referenced above.

Sincerely,

Allan Weatherford
Compliance Environmentalist

AW:kb
letter.28

RECEIVED
MAR 28 1991
DER - BAQM

cc: Chuck Truby
Raymond Young
Levon Carroll
Leroy Coker
Joe Kolb
Bill Osborne
E. Andersen Olson

BEST AVAILABLE COPY

PROOF OF PUBLICATION

THE OCALA STAR-BANNER

Published—Daily

OCALA, MARION COUNTY, FLORIDA

STATE OF FLORIDA,
COUNTY OF MARION.

Before me the undersigned authority personally appeared Lynn Maxwell, who on oath says that he is Classified Manager of the Ocala Star-Banner, a daily newspaper published at Ocala, in Marion County, Florida; that the attached copy of advertisement, being a notice in the matter of #3J004-Notice of Intent to Issue

________ in the ________ Court,

was published in said newspaper in the issues of March 21, 1991

Affiant further says that the said THE OCALA STAR-BANNER is a daily newspaper published at Ocala, in said Marion County, Florida, and that the said newspaper has heretofore been continuously published in said Marion County, Florida, daily, and has been entered as second class mail matter at the post office in Ocala, in said Marion County, Florida, for a period of one year next preceding the first publication of the attached copy of advertisement; and affiant further says that he has neither paid nor promised any person, firm or cooperation any discount, rebate, commission or refund for the purpose of securing this advertisement for publication in the said newspaper.

[signature]

Sworn to and subscribed before me this 21 day

of March, A.D., 19 91

[signature]

(Seal) Notary Public

Notary Public, State of Florida at Large
My Commission Expires Sept. 1, 19[illegible]

RECEIVED

MAR 28 1991

DER - BAQM

State of Florida
Department of
Environmental Regulation

Notice of Intent to Issue

The Department of Environmental Regulation hereby gives notice of its intent to issue a permit to Florida Gas Transmission Company, P.O. Box 1188, Houston, Texas 77251-1188, to install one natural gas fired engine. The Company's facility is located 17 miles northeast of Silver Springs on CR 314 in Silver Springs, Marion County, Florida. The maximum annual No. 2 Class I increment consumed in the Chassahowitzka National Wilderness Area is much less than 1%. The maximum annual No. 2 Class II increment consumed is 3.6%. A determination of Best Available Control Technology (BACT) was required. The Department is issuing this Intent to Issue for the reasons stated in the Technical Evaluation and Preliminary Determination.

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, Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the department at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400, within fourteen (14) days of publication of this notice. Petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. 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, Florida Statutes.

The Petition shall contain the following information:

(a) The name, address and telephone number of each petitioner, the applicant's name and address, the Department Permit File Number and the county in which the project is proposed;

(b) A statement of how and when each petitioner received notice of the Department's action or proposed action;

(c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action;

(d) A statement of the material facts disputed by Petitioner, if any;

(e) A statement of facts which petitioner contends warrant reversal or modification of the Department's action or proposed action;

(f) A statement of which rules or statutes petitioner contends require reversal or modification of the Department's action or proposed action; and

(g) A statement of the relief sought by petitioner, stating precisely the action petitioner wants the Department to take with respect to the Department's action or proposed action.

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 position taken by it in this Notice. Persons whose substantial interests will be affected by any decision of the Department with regard to the application have the right to petition to become a party to the proceeding. The petition must conform to the requirements specified above and be filed (received) within 14 days of publication of this notice in the Office of General Counsel at the above address of the Department. Failure to petition within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, F.S., and to participate as a party to this proceeding. Any subsequent intervention will only be at the approval of the presiding officer upon motion filed pursuant to Rule 28-5.207, F.A.C.

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

Department of Environmental Regulation
Bureau of Air Regulation
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

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

Any person may send written comments on the proposed action to Mr. Barry Andrews at the Department's Tallahassee address. All comments mailed within 30 days of the publication of this no-[illegible]

KBN

RECEIVED

DEC 18 1990

DER - BAQM

December 17, 1990

Ms. Theresa Heron
Florida Dept. of Environmental Regulation
Twin Towers Office Bldg.
2600 Blair Stone Road
Tallahassee, FL 32399

RE: ENRON/FGTC Compressor Station No. 17 PSD Permit Application

Dear Ms. Heron:

As you requested, attached is the sheet of emission calculations for FGTC's Compressor Station No. 17. Please feel free to contact me at your convenience if you have further questions concerning this permit application.

Sincerely,

David A. Buff

David A. Buff, P.E.
Principal Engineer

TT/tla

cc: Alan Bowman, ENRON

Attachment

cc: T. Heron
B. Andrews
C. Holladay
J. Harper, EPA
C. Collins, C Dist
C. Shaver, NPS

90051A1/5

EMISSION CALCULATIONS

FGTC's COMPRESSOR STATION No. 17
MARION COUNTY, FLORIDA

Fuel usage and emission calculations are presented below for the proposed Dresser-Rand Model 412-KVSR reciprocating IC engine at Compressor Station No. 17.

Fuel Usage:

	(2,400 bhp) x (7,300 Btu/bhp-hr)	= 17.52 x 10^6 Btu/hr
	(17.52 x 10^6 Btu/hr)/(1,030 Btu/scf)	= 17,010 scf/hr

Emission Calculations:

NO_x:	(2.0 g/bhp-hr)(2,400 bhp)(1 lb/453.593 g)	= 10.582 lb/hr
	(10.582 lb/hr)(8,760 hr/yr)(1 ton/2,000 lb)	= 46.3 TPY
CO:	(2.8 g/bhp-hr)(2,400 bhp)(1 lb/453.593 g)	= 14.815 lb/hr
	(14.815 lb/hr)(8,760 hr/yr)(1 ton/2,000 lb)	= 64.9 TPY
VOCs(non-methane hydrocarbon):		
	(1.7 g/bhp-hr)(2,400 bhp)(1 lb/453.593 g)	= 8.995 lb/hr
	(8.995 lb/hr)(8,760 hr/yr)(1 ton/2,000 lb)	= 39.4 TPY
PM:	(5 lb/10^6 scf)(17,010 scf/hr)	= 0.085 lb/hr
	(0.085 lb/hr)(8,760 hr/yr)(1 ton/2,000 lb)	= 0.37 TPY
SO_2:	(10 gr/100 scf)(17,010 scf/hr)(1 lb/7,000 gr)	= 0.243 lb/hr of Sulfur
	(2 lb SO_2/lb Sulfur)(0.243 lb/hr Sulfur)	= 0.486 lb/hr of SO_2
	(0.486 lb/hr)(8,760 hr/yr)(1 ton/2,000 lb)	= 2.13 TPY

Florida Department of Environmental Regulation

Twin Towers Office Bldg. ● 2600 Blair Stone Road ● Tallahassee, Florida 32399-2400

Bob Martinez, Governor   Dale Twachtmann, Secretary   John Shearer, Assistant Secretary

November 28, 1990

Ms. Jewell A. Harper, Chief
Air Enforcement Branch
U.S. EPA - Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Dear Ms. Harper:

Re: Completeness Review

The enclosed information is being forwarded to you for completeness review.

1. Seminole Fertilizer Corp., Polk County, gas turbine cogeneration project, PSD-FL-157.

2. The following applications from Florida Gas Transmission Company:

   Compressor Sta. No. 12, Santa Rosa County, PSD-FL-156
   Compressor Sta. No. 13, Washington County, PSD-FL-158
   Compressor Sta. No. 14, Gadsden County, PSD-FL-159
   Compressor Sta. No. 15, Taylor County, PSD-FL-160
   Compressor Sta. No. 16, Bradford County, PSD-FL-161
   Compressor Sta. No. 17, Marion County, PSD-FL-162
   Compressor Sta. No. 18, Orange County, PSD-FL-163
   Compressor Sta. No. 20, St. Lucie County, PSD-FL-164

If there are any questions, please call Barry Andrews at (904)488-1344 or write to me at the above address. If it is convenient to FAX a response to us, the FAX number to use is (904)922-6979.

Sincerely,

Patricia G. Adams
for C. H. Fancy, P.E.
Chief
Bureau of Air Regulation

CHF/pa

Florida Department of Environmental Regulation
Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400
Bob Martinez, Governor | Dale Twachtmann, Secretary | John Shearer, Assistant Secretary

November 28, 1990

Mrs. Chris Shaver
Chief, Permit Review and Technical
Support Branch
National Park Service
Air Quality Division
P. O. Box 25287
Denver, Colorado 80255

Dear Mrs. Shaver:

Re: Completeness Review

The following PSD permit applications from Florida Gas Transmission Company are being submitted to you for your review and comment:

Compressor Sta. No. 14, Gadsden County, PSD-FL-159
Compressor Sta. No. 15, Taylor County, PSD-FL-160
Compressor Sta. No. 16, Bradford County, PSD-FL-161
Compressor Sta. No. 17, Marion County, PSD-FL-162

If there are any questions, please call Barry Andrews or Cleve Holladay at (904) 488-1344 or write to me at the above address. All comments, written or oral, should be received by December 15, 1990. If it is convenient to FAX a response to us, the FAX number to use is (904)922-6979.

Sincerely,

Patricia G. Adams

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

CHF/pa

ENRON
Gas Pipeline Operating Company

P. O. Box 1188 Houston, Texas 77251-1188 (713) 853-6161

RECEIVED
DER - MAIL ROOM
1990 NOV 20 AM 10: 43

November 17, 1990

Clair Fancy, P.E.
Chief, Bureau of Air Regulation
Florida Department of Environmental Regulation
2600 Blair Stone Road
Tallahassee, FL 32301

Dear Mr. Fancy:

RE: Construction Permit Application - Compressor Station No. 17
Marion County, Florida - Florida Gas Transmission Company

This permit application, sent to you on behalf of Florida Gas Transmission Company (FGT), describes the expansion of FGT's Compressor Station No. 17. With net NO_x emissions exceeding 40 tons per year, this addition, a 2,400 horsepower reciprocating compressor engine, constitutes a major modification. The maximum estimated NO_x concentration from the proposed lean burn engine, however, is less than EPA's significant impact level.

This is the sixth of nine permit applications we plan to submit to FDER as part of FGT's Phase II expansion. We have spent a lot of time and effort to ensure that it is of highest quality. For example, the Best Available Control Technology (BACT) analysis follows EPA's (draft) top-down guideline, and capitalizes on what Enron has learned about guideline interpretation from its Northern Natural Gas Company Waterloo, Iowa station - a recently approved permit application that followed the draft guideline.

Since FGT's Phase II project is designed to bring clean fuel to Floridians by the 1991-92 heating season, and to displace foreign oil imports, we would ask that you review this permit application and issue the construction permit as soon as possible.

If you have any questions concerning this letter, please contact me at (713) 853-7303, or David Buff, KBN Engineering and Applied Sciences, Inc., Gainesville, Florida, at (904) 331-9000.

Sincerely,

W. Alan Bowman

W. Alan Bowman (Room 2570)
Project Environmentalist
Environmental Affairs Department

Enclosures: 8 Copies of Permit Application
Construction Permit Fee

cc: Jerry Murphy, Enron
Kevin McGlynn, Enron
David Buff, KBN

FAN1102wab

CHECK NO.
0822020235

ENRON CORP

ENRON GAS PIPELINE OPERATING COMPANY
P.O. BOX 1188
HOUSTON, TEXAS 77251-1188

DATE OF CHECK
10-19-90

This check is VOID unless printed on BLUE background

AMOUNT OF CHECK

EXACTLY $*****1,000 DOLLARS 00 CENTS $*****1,000.00

PAY TO THE ORDER OF

BUREAU OF AIR REGULATION
FLORIDA DEPARTMENT OF
ENVIRONMENTAL REGULATION
2600 BLAIR STONE ROAD
TALLAHASSEE, FL
32399-2400

BY [signature]
AUTHORIZED REPRESENTATIVE

UNITED BANK OF GRAND JUNCTION

[redacted]

REMITTANCE STATEMENT
ENRON GAS PIPELINE OPERATING COMPANY

CHECK NO. 0822020235

PAGE 001 OF 001

VOUCHER NO.	INVOICE DATE	INVOICE NUMBER	PURCHASE ORDER	AMOUNT GROSS	AMOUNT DISCOUNT	AMOUNT NET
9010001571	101790	CKR10179004		1,000.00	0.00	1,000.00
C.S. #17 CONSTRUCTION PERMIT FGT						
					TOTAL	1,000.00

50 < Q < 100 tpy

Special Instructions
CALL SUZY AT EXT 7304

P. O. BOX 1188, HOUSTON, TEXAS 77251-1188
DETACH STATEMENT BEFORE DEPOSITING. ENDORSEMENT OF CHECK ATTACHED ACKNOWLEDGES PAYMENT IN FULL OF ALL ITEMS SHOWN ABOVE. IN CASE OF ERROR OR OMISSION RETURN BOTH CHECK AND STATEMENT

PSD PERMIT APPLICATION
FLORIDA GAS TRANSMISSION COMPANY
COMPRESSOR STATION NO. 17

Prepared For:

Florida Gas Transmission Company
1400 Smith Street
Houston, TX 77251-1188

Prepared By:

KBN Engineering and Applied Sciences, Inc.
1034 NW 57th Street
Gainesville, FL 32605

November 1990
90051G1/P

STATE OF FLORIDA

Station No. 17

DEPARTMENT OF ENVIRONMENTAL REGULATION

$1,000 pd.
11-20-90
Recpt.# 151212

AC 42-189455
PSD-FL-161

APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: Natural Gas Compressor Engine [X] New[1] [ ] Existing[1]

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

COMPANY NAME: Florida Gas Transmission Company COUNTY: Marion

Identify the specific emission point source(s) addressed in this application (i.e., Lime Kiln No. 4 with Venturi Scrubber; Peaking Unit No. 2, Gas Fired) Station 17, Unit No. 5

SOURCE LOCATION: Street 17 miles northeast of Silver Springs on CR 314 City Silver Springs

UTM: East 17:418.84 km North 3240.90 km

Latitude 29 ° 17 ' 47 "N Longitude 81 ° 50 ' 08 "W

APPLICANT NAME AND TITLE: W. Alan Bowman, Project Environmentalist

APPLICANT ADDRESS: P.O. Box 1188, Houston, Texas 77251 Phone: (713) 853-7303

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative* of Florida Gas Transmission Co.

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

*Attach letter of authorization

Signed: [signature]

C.L. Truby, Vice President
Name and Title (Please Type)

Date: 11-12-90 Telephone No. (713) 853-6161

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

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

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

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

Signed ______________________

David A. Buff, P.E.
Name (Please Type)

KBN Engineering and Applied Sciences, Inc.
Company Name (Please Type)

1034 NW 57th Street, Gainesville, FL 32605
Mailing Address (Please Type)

Florida Registration No. 19011 Date: Nov. 17, 1990 Telephone No. (904) 331-9000

SECTION II: GENERAL PROJECT INFORMATION

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

See PSD report, Section 1.0--Introduction, and
Section 2.0--Project Description

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

Start of Construction March 15, 1991 Completion of Construction 18 months after permit issuance

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

Not applicable

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

Not applicable

E. Requested permitted equipment operating time: hrs/day 24; days/wk 7; wks/yr 52;
If power plant, hrs/yr ____; if seasonal, describe: ____

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

1. Is this source in a non-attainment area for a particular pollutant? No
   a. If yes, has "offset" been applied? ____
   b. If yes, has "Lowest Achievable Emission Rate" been applied? ____
   c. If yes, list non-attainment pollutants. ____
2. Does best available control technology (BACT) apply to this source? If yes, see Section VI. Yes
3. Does the State "Prevention of Significant Deterioration" (PSD) requirement apply to this source? If yes, see Sections VI and VII. Yes
4. Do "Standards of Performance for New Stationary Sources" (NSPS) apply to this source? No
5. Do "National Emission Standards for Hazardous Air Pollutants" (NESHAP) apply to this source? No

H. Do "Reasonably Available Control Technology" (RACT) requirements apply to this source? No
   a. If yes, for what pollutants? ____
   b. If yes, in addition to the information required in this form, any information requested in Rule 17-2.650 must be submitted.

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

See PSD Report, Section 3.0--Air Quality Review Requirements and Applicability

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

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

Description	Contaminants		Utilization Rate - lbs/hr	Relate to Flow Diagram
	Type	% Wt		
Not applicable				

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

1. Total Process Input Rate (lbs/hr): Not applicable

2. Product Weight (lbs/hr): Not applicable

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

Name of Contaminant	Emission[1]		Allowed[2] Emission Rate per Rule 17-2	Allowable[3] Emission lbs/hr	Potential[4] Emission		Relate to Flow Diagram
	Maximum lbs/hr	Actual T/yr			lbs/hr	T/yr	
NO_x	10.6	46.3	BACT	BACT	10.6	46.3	
CO	14.8	64.9	N/A	N/A	14.8	64.9	
VOCs	9.0	39.4	N/A	N/A	9.0	39.4	
Particulates	0.09	0.37	N/A	N/A	0.09	0.37	
SO_2	0.49	2.13	N/A	N/A	0.49	2.13	

[1]See Section V, Item 2.

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

[3]Calculated from operating rate and applicable standard.

[4]Emission, if source operated with~~out~~ control (See Section V, Item 3).

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

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)
Lean Burn Engine Design	NO_x	80%	N/A	Design and
				AP-42

E. Fuels

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max/hr	
Natural Gas	0.0170	0.0170	17.52

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

Fuel Analysis:

Percent Sulfur: 0.031 (by weight)* Percent Ash: NA

Density: 0.0455 lb/ft³ lbs/gal Typical Percent Nitrogen: NA

Heat Capacity: 22,637 (based on 1,030 Btu/scf) BTU/lb NA BTU/gal

Other Fuel Contaminants (which may cause air pollution): NA

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

Annual Average Not applicable Maximum ______

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

Not applicable

*Based on contract limit of 10 gr/100 ft^3 and gas at 0.0455 lb/ft^3

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

Stack Height: 40 ft. Stack Diameter: 1.271 ft.

Gas Flow Rate: 14,355 ACFM 6,036 DSCFM Gas Exit Temperature: 695 °F.

Water Vapor Content: 8 %. Velocity: 188.57 FPS

SECTION IV: INCINERATOR INFORMATION

Not Applicable

Type of Waste	Type 0 (Plastics)	Type II (Rubbish)	Type III (Refuse)	Type IV (Garbage)	Type IV (Patholog-ical)	Type V (Liq.& Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Inciner-ated							
Uncon-trolled (lbs/hr)							

Description of Waste ____________________

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

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

Manufacturer ____________________

Date Constructed ____________________ Model No. ____________________

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

Stack Height: __________ ft. Stack Diamter: __________ Stack Temp. __________

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

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

Type of pollution control devices: [ ] Cyclone [ ] Wet Scrubber [ ] Afterburner [ ] Other

(specify) ____________________

Brief description of operating characteristics of control devices: ______________________

____

____

____

____

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

____

____

____

____

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

SECTION V: SUPPLEMENTAL REQUIREMENTS

Please provide the following supplements where required for this application.

1. Total process input rate and product weight -- show derivation [Rule 17-2.100(127)]
   Not Applicable
2. To a construction application, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach proposed methods (e.g., FR Part 60 Methods, 1, 2, 3, 4, 5) to show proof of compliance with applicable standards. To an operation application, attach test results or methods used to show proof of compliance. Information provided when applying for an operation permit from a construction permit shall be indicative of the time at which the test was made.
   See PSD Report, Section 2.0, Tables 2-1 and 2-2
3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).
   See PSD Report, Section 2.0
4. With construction permit application, include design details for all air pollution control systems (e.g., for baghouse include cloth to air ratio; for scrubber include cross-section sketch, design pressure drop, etc.)
   Not Applicable
5. With construction permit application, attach derivation of control device(s) efficiency. Include test or design data. Items 2, 3 and 5 should be consistent: actual emissions = potential (1-efficiency).
   Not Applicable
6. An 8 ½" x 11" flow diagram which will, without revealing trade secrets, identify the individual operations and/or processes. Indicate where raw materials enter, where solid and liquid waste exit, where gaseous emissions and/or airborne particles are evolved and where finished products are obtained.
   See PSD Report, Figure 2-2
7. An 8 ½" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Examples: Copy of relevant portion of USGS topographic map).
   See PSD Report, Figure 1-2
8. An 8 ½" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram.
   See PSD Report, Figure 2-1

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

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

SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY

See PSD report, Sections 3.0 and 6.0

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

[ ] Yes [ ] No

Contaminant	Rate or Concentration

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

[ ] Yes [ ] No

Contaminant	Rate or Concentration

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

Contaminant	Rate or Concentration

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

1. Control Device/System:
2. Operating Principles:
3. Efficiency:*
4. Capital Costs:

*Explain method of determining

5. Useful Life:

6. Operating Costs:

7. Energy:

8. Maintenance Cost:

9. Emissions:

Contaminant	Rate or Concentration

10. Stack Parameters

a. Height: ft.

b. Diameter ft.

c. Flow Rate: ACFM

d. Temperature: °F.

e. Velocity: FPS

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

1.

a. Control Devices:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

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

2.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

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

j. Applicability to manufacturing processes:

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

.

3.

a. Control Device: b. Operating Principles:

c. Efficiency:[1] d. Capital Cost:

e. Useful Life: f. Operating Cost:

g. Energy:[2] h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

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

4.

a. Control Device: b. Operating Principles:

c. Efficiency:[1] d. Capital Cost:

e. Useful Life: f. Operating Cost:

g. Energy:[2] h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

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

F. Describe the control technology selected:

1. Control Device: 2. Efficiency:[1]

3. Capital Cost: 4. Useful Life:

5. Operating Cost: 6. Energy:[2]

7. Maintenance Cost: 8. Manufacturer:

9. Other locations where employed on similar processes:

a. (1) Company:

(2) Mailing Address:

(3) City: (4) State:

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

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

Contaminant	Rate or Concentration

(8) Process Rate:[1]

b. (1) Company:

(2) Mailing Address:

(3) City: (4) State:

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

Contaminant	Rate or Concentration

(8) Process Rate:[1]

10. Reason for selection and description of systems:

[1]Applicant must provide this information when available. Should this information not be available, applicant must state the reason(s) why.

SECTION VII - PREVENTION OF SIGNIFICANT DETERIORATION

Refer to PSD report

A. Company Monitored Data

1. ____________ no. sites ___________ TSP _________( )___ SO^2* _____________ Wind spd/dir

Period of Monitoring ________/____/______ to __________/____/______
month day year month day year

Other data recorded ____

Attach all data or statistical summaries to this application.

*Specify bubbler (B) or continuous (C).

2. Instrumentation, Field and Laboratory

a. Was instrumentation EPA referenced or its equivalent? [ ] Yes [ ] No

b. Was instrumentation calibrated in accordance with Department procedures?

[ ] Yes [ ] No [ ] Unknown

B. Meteorological Data Used for Air Quality Modeling

1. ______ Year(s) of data from ______/______/______ to ______/______/______
month day year month day year

2. Surface data obtained from (location)______________________________

3. Upper air (mixing height) data obtained from (location) ______________________________

4. Stability wind rose (STAR) data obtained from (location) ______________________________

C. Computer Models Used

1. ______________________________ Modified? If yes, attach description.

2. ______________________________ Modified? If yes, attach description.

3. ______________________________ Modified? If yes, attach description.

4. ______________________________ Modified? If yes, attach description.

Attach copies of all final model runs showing input data, receptor locations, and principle output tables.

D. Applicants Maximum Allowable Emission Data

Pollutant Emission Rate

TSP ______________________________ grams/sec

SO^2 ______________________________ grams/sec

E. Emission Data Used in Modeling

Attach list of emission sources. Emission data required is source name, description of point source (on NEDS point number), UTM coordinates, stack data, allowable emissions, and normal operating time.

F. Attach all other information supportive to the PSD review.

G. Discuss the social and economic impact of the selected technology versus other applicable technologies (i.e, jobs, payroll, production, taxes, energy, etc.). Include assessment of the environmental impact of the sources.

H. Attach scientific, engineering, and technical material, reports, publications, journals, and other competent relevant information describing the theory and application of the requested best available control technology.

PREVENTION OF SIGNIFICANT DETERIORATION REPORT
FLORIDA GAS TRANSMISSION COMPANY
COMPRESSOR STATION NO. 17

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1.0 INTRODUCTION

Florida Gas Transmission Company (FGTC), a subsidiary of ENRON Corporation of Houston, Texas, is proposing to expand its existing natural gas pipeline Compressor Station No. 17. This proposed expansion is part of FGTC's Phase II expansion project aimed at increasing the natural gas transport capacity of the existing Florida gas pipeline system. The scope of work for Phase II includes expansions by addition of state-of-the-art compressor engines at eight existing compressor stations and at a newly proposed compressor station. The main gas pipeline and the approximate locations of the existing and proposed compressor stations along the main pipeline are shown in Figure 1-1.

Compressor Station No. 17 is located about 17 miles northeast of the town of Silver Springs on County Road 314 in Marion County, Florida. Figure 1-2 shows the site location of the existing compressor station.

The proposed expansion at this location consists of the addition of one new 2,400 brake horsepower (bhp) natural-gas-fired, reciprocating internal combustion (IC) engine. The proposed engine would be used solely for the purpose of transporting natural gas in the pipeline for distribution in Florida. The proposed engine is a turbocharged Dresser-Rand Model 412-KVSR. Under current federal and state air quality regulations, the proposed engine will constitute a major modification at an existing major stationary source.

This report addresses the requirements of the Prevention of Significant Deterioration (PSD) review procedures pursuant to rules and regulations implementing the Clean Air Act (CAA) Amendments of 1977. The Florida Department of Environmental Regulation (FDER) has PSD review and approval authority in Florida. Based on the proposed emissions from the addition of a 2,400-bhp engine, a PSD review is required for nitrogen oxides (NO_x).

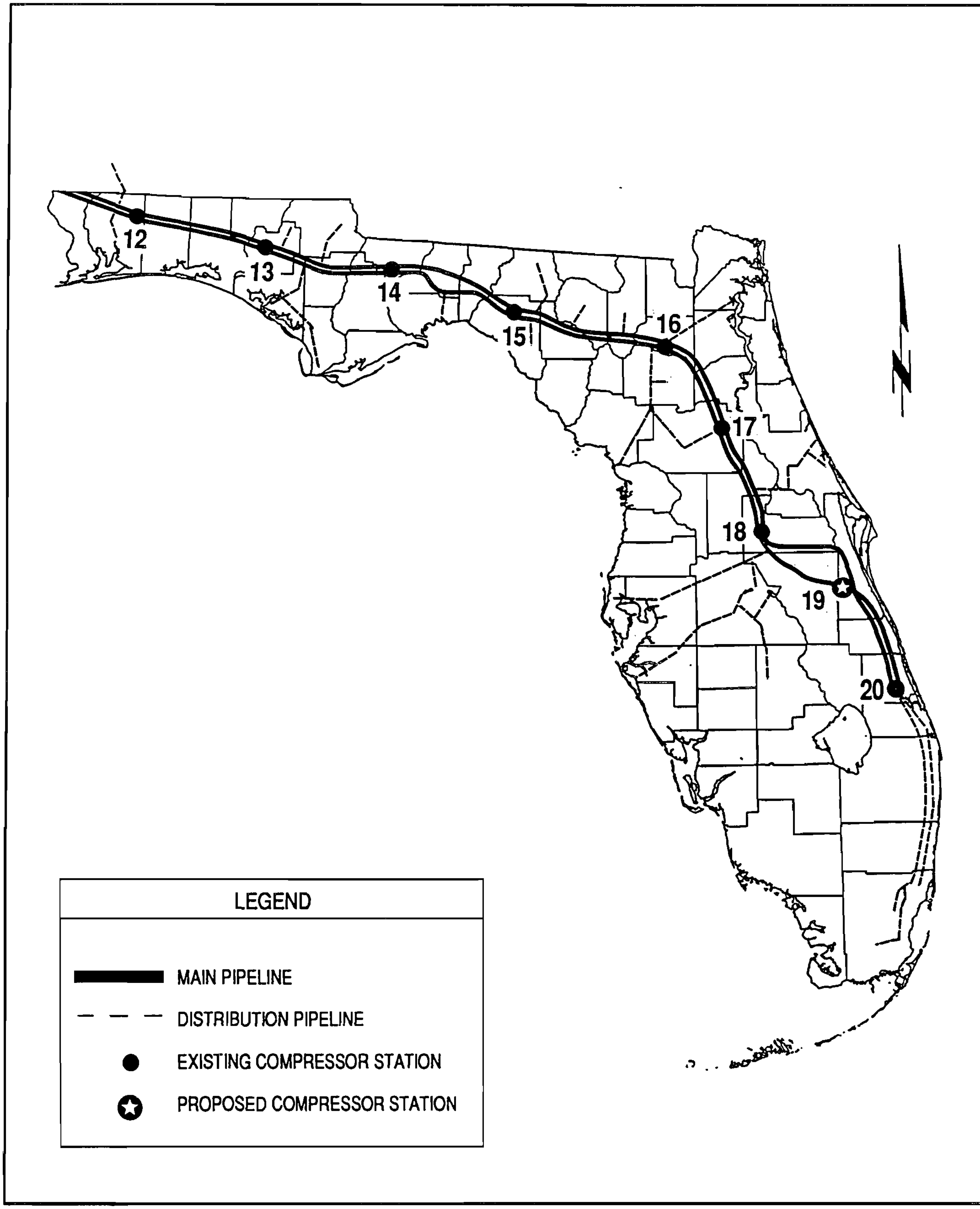

Figure 1-1 FGTC'S GAS TRANSMISSION SYSTEM

Florida Gas Transmission Company

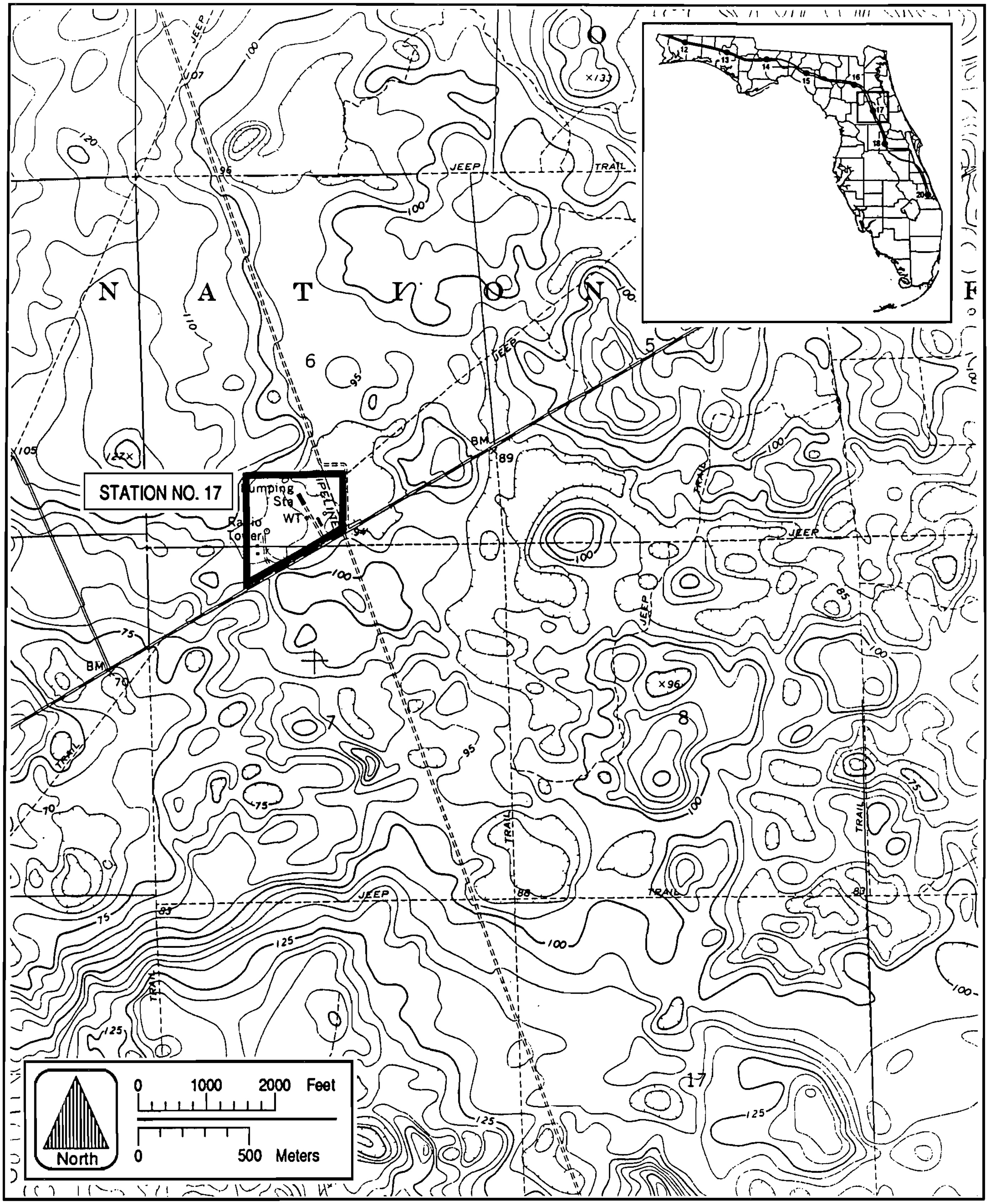

Figure 1-2 SITE LOCATION OF ENRON'S FLORIDA GAS TRANSMISSION LINE COMPRESSOR STATION NO. 17, SILVER SPRINGS, MARION COUNTY, FLORIDA

Florida Gas Transmission Company

Engineering designs for the proposed expansion project include selection of an engine incorporating lean-burn technology. The lean-burn technology for emission control represents best available control technology (BACT) for the proposed reciprocating IC engine.

This application contains five additional sections. Descriptions of the existing operation at FGTC's Compressor Station No. 17 and the proposed 2,400-bhp engine addition are presented in Section 2.0. The air quality review requirements and source applicability of the proposed engine to the regulations are discussed in Section 3.0. The methodology and results of the air dispersion modeling and air quality impact analysis are presented in Section 4.0, and impacts on soil, vegetation, and visibility are summarized in Section 5.0. The BACT analysis required as part of the PSD permitting process is presented in Section 6.0.

2.0 PROJECT DESCRIPTION

A plot plan of FGTC's Compressor Station No. 17, showing the location of the plant boundaries, the existing engines, and the proposed additional engine, is presented in Figure 2-1. The following sections describe the existing operations at this location, as well as a description of the proposed project.

2.1 EXISTING OPERATIONS

FGTC's existing Compressor Station No. 17 consists of four 2,000-bhp natural-gas-fired reciprocating IC engines. All of the engines are Cooper-Bessemer Model LS-8-SG. These engines were installed in 1966 before the CAA amendments of 1977. These existing engines are not being modified as part of this expansion project; therefore, they are not subject to PSD review.

2.2 PROPOSED COMPRESSOR STATION ADDITION

The proposed engine will be used to drive a gas compressor that is a part of the mechanical prime mover of the main gas transmission line that transports natural gas from source wells in Texas and Louisiana. The proposed engine will play a critical part in recompressing the natural gas for delivery throughout Florida. Without the proposed engine, it would not be possible to increase the volumetric delivery capacity in order to meet both short-term and long-term demands for natural gas in Florida.

FGTC proposes to install one natural-gas-fired engine at the Compressor Station No. 17. The expansion plan currently calls for installation of a Dresser-Rand Model 412-KVSR integral engine-compressor unit. The engine has 12 power cylinders and is rated at 2,400 bhp at 330 revolutions per minute (rpm). The engine is turbocharged, increasing the air inlet manifold pressure, which allows the engine to operate at a high air-to-fuel ratio. This turbocharging provides more power output from the engine than would otherwise be attained without having to use a larger size engine. A

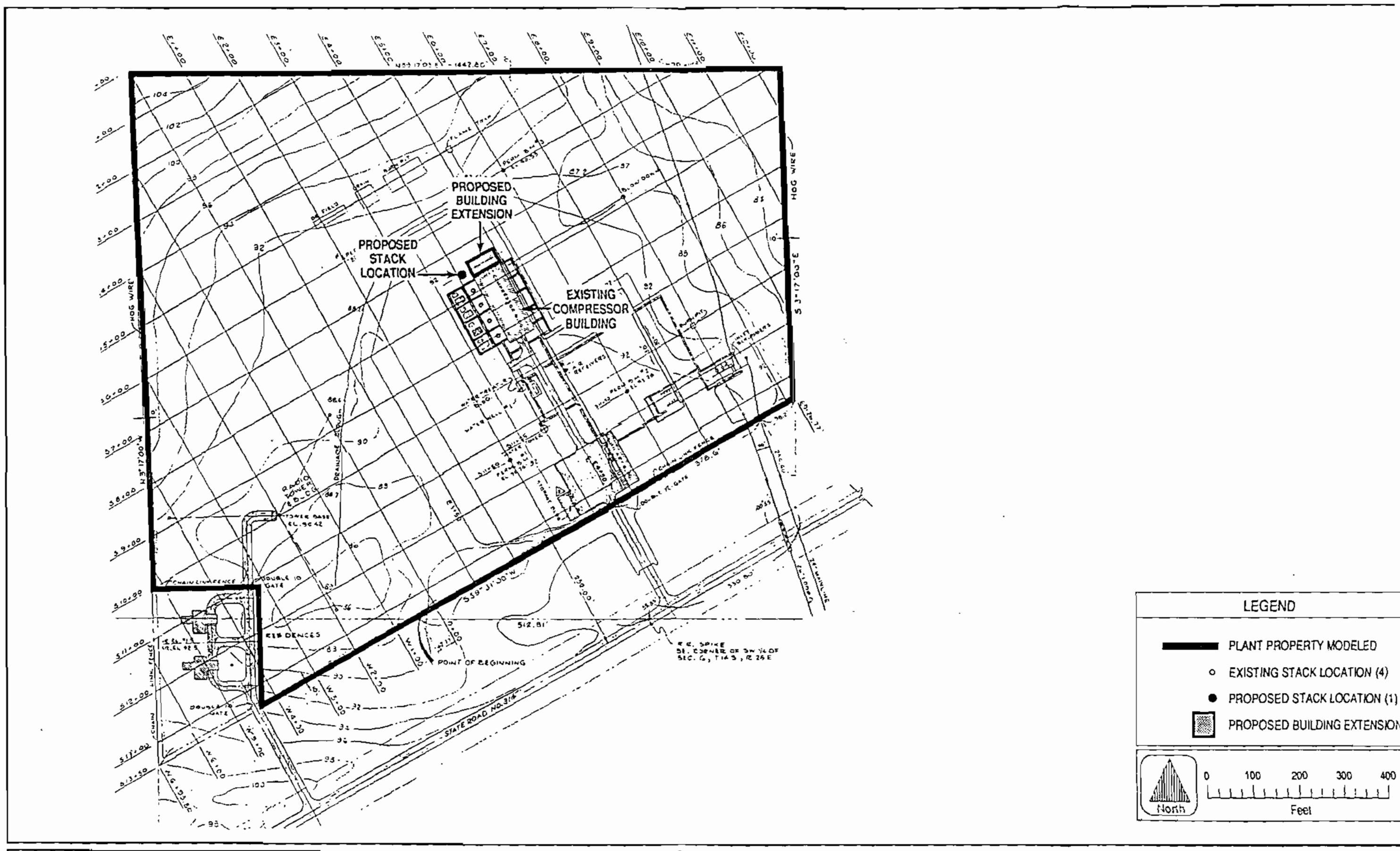

Figure 2-1 PLOT PLAN OF COMPRESSOR STATION NO. 17

Florida Gas Transmission Company

flow diagram of the integral engine compressor unit is presented in Figure 2-2. Fuel fired will be exclusively natural gas, supplied from the FGTC's gas pipeline. Based on the operating characteristics and design, this engine is classified as a high-power, large-bore, slow-speed reciprocating IC engine according to the U.S. Environmental Protection Agency's (EPA's) documented classification (EPA, 1979). Engine specifications and stack parameters for the proposed engine are presented in Table 2-1.

The proposed engine will incorporate "lean-burn" technology, which is state-of-the-art design for minimizing air pollutant concentration in the exhaust gases from gas-fired reciprocating IC engines. In the lean-burn design, a small, fuel-rich mixture is combusted in a pre-ignition chamber. The hot combustion gases from the pre-ignition chamber then pass to the main combustion chamber, where they ignite a lean mixture of fuel. Since most of the fuel entering the engine is burned in a lean state (i.e., high ratio of air to fuel), exhaust NO_x emissions are minimized. However, volatile organic compound (VOC) emissions are approximately 40 to 50 percent higher than the standard "rich-burn" engines.

Maximum hourly and annual emissions of regulated pollutants from the proposed engine are presented in Table 2-2. Emissions of NO_x, carbon monoxide (CO), and VOC are based on the engine manufacturer's guarantee. Particulate matter (PM) emissions are based upon EPA publication AP-42 (EPA, 1988d) emission factors for natural gas combustion in boilers. Emissions of sulfur dioxide (SO_2) are based on ENRON's natural gas specification. According to EPA's publication entitled Toxic Air Pollutant Emission Factors--A Compilation for Selected Air Toxic Compounds and Sources, there are no emission factors for other regulated pollutants due to natural gas combustion in stationary IC engines (EPA, 1988a).

In order to accommodate the new engine at the existing compressor station site, the existing compressor building will be extended. The extent of the addition is shown in Figure 2-1. The new engine will be housed inside the

KBN 12/ENRON.A-4

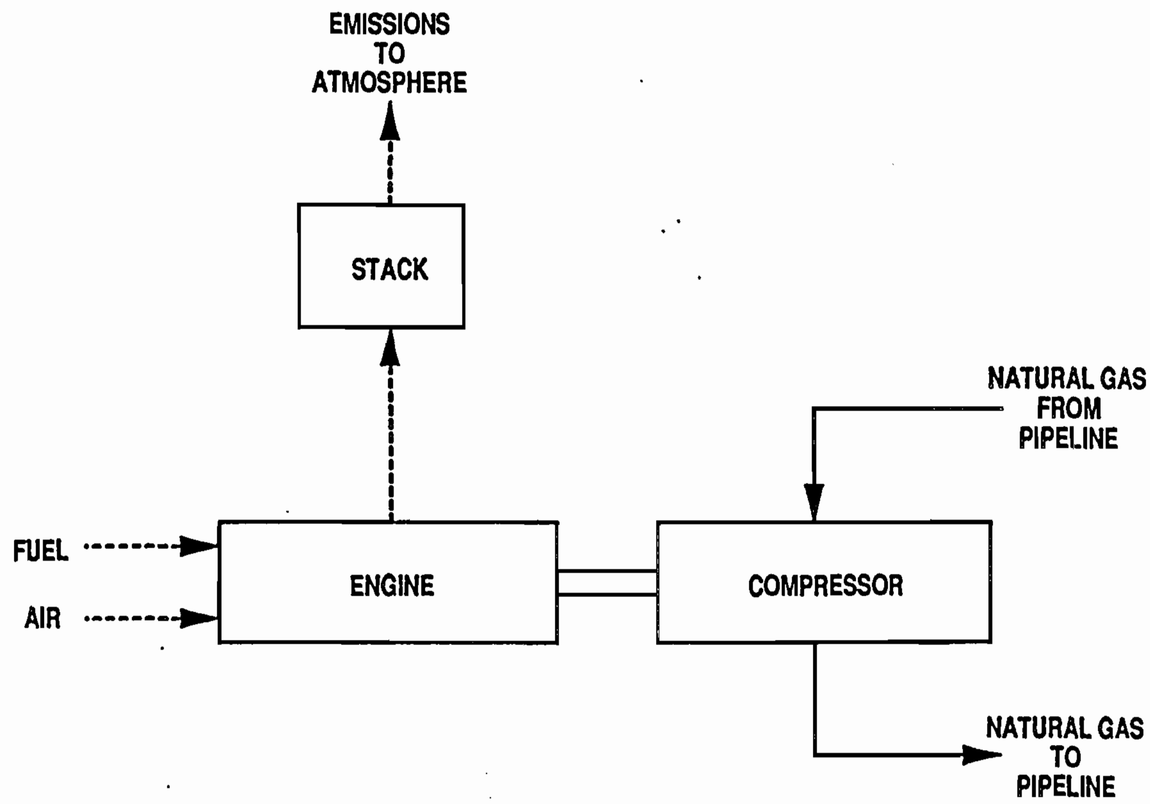

Figure 2-2 **PROCESS FLOW DIAGRAM OF AN INTEGRAL ENGINE-COMPRESSOR UNIT**

Florida Gas Transmission Company

Table 2-1. Engine Specifications and Stack Parameters for the Proposed Project

Parameter	Design Specification
<u>Engine-Compressor</u>	
Manufacturer	Dresser-Rand
Model	412-KVSR
Air Charging	Turbocharged
Unit Size	2,400 bhp
Number of Power Cylinders	12 cylinders
Number of Compressor Cylinders	4 cylinders
Power Cylinder Data	
Bore Size	16.25 inches
Stroke	18 inches
Cylinder Power	200 bhp/cylinder
Specific Heat Input	7,300 Btu/bhp-hr
Maximum Fuel Consumption	17,010 scf/hr[a]
Speed	330 rpm
<u>Stack Parameters</u>	
Stack Height	40 ft
Stack Diameter	15.25 inches
Exhaust Gas FLow	29,622 lb/hr 14,355 acfm
Exhaust Temperature	695°F
Exhaust Gas Velocity	188.57 ft/sec

Note:
acfm = actual cubic feet per minute.
bhp = brake horsepower.
Btu/bhp-hr = British thermal units per brake horsepower per hour.
°F = degrees fahrenheit.
ft = feet.
ft/sec = feet per second.
lb/hr = pounds per hour.
scf = standard cubic feet.
rpm = revolutions per minute.

[a]Based on heating value for natural gas of 1,030 British thermal units per standard cubic foot (Btu/scf).

Source: Dresser-Rand, 1990.
ENRON Corporation, 1990.

Table 2-2. Maximum Emissions From FGTC's Proposed Compressor Engine

Pollutant	Emission Factor	Reference	Maximum Emissions lb/hr	Maximum Emissions TPY
Nitrogen Oxides	2.0 g/bhp-hr	Manufacturer's guarantee	10.6	46.3
Carbon Monoxide	2.8 g/bhp-hr	Manufacturer's guarantee	14.8	64.9
Volatile Organic Compounds (non-methane)	1.7 g/bhp-hr	Manufacturer's guarantee	9.0	39.4
Particulate Matter	5 lb/MMscf	AP-42, Table 1.4-1	0.09	0.37
Sulfur Dioxide	10 gr/100 scf	ENRON Specification	0.49	2.13

Note: Maximum natural gas consumption is 17,010 standard cubic feet per hour (scf/hr).

g/bhp-hr = grams per brake horsepower per hour.
gr/100scf = grains per one hundred standard cubic feet.
lb/hr = pounds per hour.
lb/MMscf = pounds per million standard cubic feet.
TPY = tons per year.

enlarged building, on the north end of the existing compressor building. The location of the exhaust stack for the new engine is also shown in Figure 2-1.

3.0 AIR QUALITY REVIEW REQUIREMENTS AND APPLICABILITY

The following discussion pertains to the federal and state air regulatory requirements and their applicability to FGTC's proposed compressor station expansion. These regulations must be satisfied before construction can begin on the proposed source.

3.1 NATIONAL AND STATE AAQS

The existing applicable national and Florida ambient air quality standards (AAQS) are presented in Table 3-1. Primary national AAQS were promulgated to protect the public health, and secondary national AAQS were promulgated to protect the public welfare from any known or anticipated adverse effects associated with the presence of pollutants in the ambient air. Areas of the country in violation of AAQS are designated as "nonattainment" areas, and new sources to be located in or near these areas may be subject to more stringent air permitting requirements.

3.2 PSD REQUIREMENTS

3.2.1 GENERAL REQUIREMENTS

Federal PSD requirements are contained in the Code of Federal Regulations (CFR), 40, 52.21, Prevention of Significant Deterioration of air quality. The state of Florida has adopted PSD regulations [Chapter 17-2.510, Florida Administrative Code (F.A.C.)] that are essentially identical to the federal regulations. PSD regulations require that all new major stationary sources or major modifications to existing major sources of air pollutants regulated under CAA be reviewed and a construction permit issued. Florida's State Implementation Plan (SIP), which contains PSD regulations, has been approved by EPA, and, therefore, PSD approval authority in Florida has been granted to FDER.

A "major facility" is defined under PSD as any one of 28 named source categories which has the potential to emit 100 TPY or more, or any other

Table 3-1. National and State AAQS, Allowable PSD Increments, and Significance Levels ($\mu g/m^3$)

Pollutant	Averaging Time	AAQS National Primary Standard	AAQS National Secondary Standard	AAQS State of Florida	PSD Increments Class I	PSD Increments Class II	Significant Impact Levels
Particulate Matter (TSP)	Annual Geometric Mean	NA	NA	NA	5	19	1
	24-Hour Maximum[a]	NA	NA	NA	10	37	5
Particulate Matter (PM10)	Annual Arithmetic Mean	50	50	50	4[c]	17[c]	1
	24-Hour Maximum[b]	150	150	150	8[c]	30[c]	5
Sulfur Dioxide	Annual Arithmetic Mean	80	NA	60	2	20	1
	24-Hour Maximum[b]	365	NA	260	5	91	5
	3-Hour Maximum[b]	NA	1,300	1,300	25	512	25
Carbon Monoxide	8-Hour Maximum[b]	10,000	10,000	10,000	NA	NA	500
	1-Hour Maximum[b]	40,000	40,000	40,000	NA	NA	2,000
Nitrogen Dioxide	Annual Arithmetic Mean	100	100	100	2.5	25	1
Ozone	1-Hour Maximum[d]	235	235	235	NA	NA	NA
Lead	Calendar Quarter Arithmetic Mean	1.5	1.5	15	NA	NA	NA

[a]Maximum concentration not to be exceeded more than once per year.
[b]Achieved when the expected number of exceedances per year is less than 1.
[c]Proposed by EPA in the Federal Register on October 5, 1989.
[d]Achieved when the expected number of days per year with concentrations above the standard is less than 1.

Note: Particulate matter (TSP) = total suspended particulate matter.
Particulate matter (PM10) = particulate matter with aerodynamic diameter less than or equal to 10 micrometers.
$\mu g/m^3$ = micrograms per cubic meter.
NA = Not applicable, i.e., no standard exists.

Sources: Federal Register, Vol. 43, No. 118, June 19, 1978.
40 CFR 50.
40 CFR 52.21.
Chapter 17-2.400, F.A.C.

stationary facility that has the potential to emit 250 TPY or more of any pollutant regulated under CAA. A "source" is defined as an identifiable piece of process equipment or emissions unit. "Potential to emit" means the capability, at maximum design capacity, to emit a pollutant considering the application of control equipment and any other federally enforceable limitations on the source's capacity. A "major modification" is defined under PSD regulations as a change at an existing major stationary facility which increases emissions by greater than significant amounts. PSD significant emission rates are shown in Table 3-2.

PSD review is used to determine whether significant air quality deterioration will result from the new or modified facility. Major new facilities and major modifications are required to undergo the following analyses related to PSD for each pollutant emitted in significant amounts:

1. Control technology review,
2. Source impact analysis,
3. Air quality analysis (monitoring),
4. Source information, and
5. Additional impact analyses.

In addition to these analyses, a new facility must also be reviewed with respect to good engineering practices (GEP) stack height regulations. If the proposed new source or modification is located in a nonattainment area for any pollutant, the source may be subject to nonattainment new source review requirements. Discussions concerning each of these requirements are presented in the following sections.

3.2.2 INCREMENTS/CLASSIFICATIONS

The 1977 Clean Air Act (CAA) amendments address PSD of air quality. The law specifies that certain increases in air quality concentrations above the baseline concentration level of sulfur dioxide (SO_2) and particulate matter--total suspended particulates [PM(TSP)]--would constitute

Table 3-2. PSD Significant Emission Rates and De Minimis Monitoring Concentrations

Pollutant	Regulated Under	Significant Emission Rate (TPY)	De Minimis Monitoring Concentration ($\mu g/m^3$)
Sulfur Dioxide	NAAQS, NSPS	40	13, 24-hour
Particulate Matter (TSP)	NAAQS, NSPS	25	10, 24-hour
Particulate Matter (PM10)	NAAQS	15	10, 24-hour
Nitrogen Oxides	NAAQS, NSPS	40	14, annual
Carbon Monoxide	NAAQS, NSPS	100	575, 8-hour
Volatile Organic Compounds (Ozone)	NAAQS, NSPS	40	100 TPY[a]
Lead	NAAQS	0.6	0.1, 3-month
Sulfuric Acid Mist	NSPS	7	NM
Total Fluorides	NSPS	3	0.25, 24-hour
Total Reduced Sulfur	NSPS	10	10, 1-hour
Reduced Sulfur Compounds	NSPS	10	10, 1-hour
Hydrogen Sulfide	NSPS	10	0.2, 1-hour
Asbestos	NESHAP	0.007	NM
Beryllium	NESHAP	0.0004	0.001, 24-hour
Mercury	NESHAP	0.1	0.25, 24-hour
Vinyl Chloride	NESHAP	1	15, 24-hour
Benzene	NESHAP	b	NM
Radionuclides	NESHAP	b	NM
Inorganic Arsenic	NESHAP	b	NM

[a]No de minimis concentration; an increase in VOC emissions of 100 TPY or more will require monitoring analysis for ozone.
[b]Any emission rate of these pollutants.

Note: Ambient monitoring requirements for any pollutant may be exempted if the impact of the increase in emissions is below de minimis monitoring concentrations.

NAAQS = National Ambient Air Quality Standards.
NM = No ambient measurement method.
NSPS = New Source Performance Standards.
NESHAP = National Emission Standards for Hazardous Air Pollutants.
$\mu g/m^3$ = micrograms per cubic meter.

Sources: 40 CFR 52.21.
Chapter 17-2, F.A.C.

significant deterioration. The magnitude of the allowable increment depends on the classification of the area in which a new source (or modification) will be located or will have an impact. Congress also directed EPA to evaluate PSD increments for other criteria pollutants and, if appropriate, promulgate PSD increments for such pollutants.

Three classifications were designated, based on criteria established in the CAA Amendments. Certain types of areas (international parks, national wilderness areas, and memorial parks larger than 5,000 acres, and national parks larger than 6,000 acres) were designated as Class I areas. All other areas of the country were designated as Class II. PSD increments for Class III areas were defined, but no areas were designated as Class III. However, Congress made provisions in the law to allow the redesignation of Class II areas to Class III areas.

In 1977, EPA promulgated PSD regulations related to the requirements for classifications, increments, and area designations as set forth by Congress. PSD increments were initially set for only SO_2 and PM(TSP). However, in 1988, EPA promulgated final PSD regulations for nitrogen oxides (NO_x) and established PSD increments for nitrogen dioxide (NO_2).

The current federal PSD increments are shown in Table 3-1. As shown, Class I increments are the most stringent, allowing the smallest amount of air quality deterioration, while the Class III increments allow the greatest amount of deterioration. FDER has adopted the EPA class designations and allowable PSD increments for PM(TSP), SO_2, and NO_2.

On October 5, 1989, EPA proposed PSD increments for PM10. Those proposed increments are shown in Table 3-1. The PM10 increments as proposed are somewhat lower in magnitude than the current PM(TSP) increments.

The term "baseline concentration" evolves from federal and state PSD regulations and refers to a fictitious concentration level corresponding to a specified baseline date and certain additional baseline sources. By definition in the PSD regulations, baseline concentration means the ambient concentration level that exists in the baseline area at the time of the applicable baseline date. A baseline concentration is determined for each pollutant for which a baseline date is established and includes:

1. The actual emissions representative of sources in existence on the applicable baseline date; and
2. The allowable emissions of major stationary sources that began construction before January 6, 1975, for SO_2 and PM(TSP) sources, or February 8, 1988, for NO_x sources; but which were not in operation by the applicable baseline date.

The following emissions are not included in the baseline concentration and therefore affect PSD increment consumption:

1. Actual emissions from any major stationary source on which construction began after January 6, 1975, for SO_2 and PM(TSP) sources, and after February 8, 1988, for NO_x sources; and
2. Actual emission increases and decreases at any stationary source occurring after the baseline date.

In reference to the baseline concentration, the baseline date actually includes three different dates:

1. The major source baseline date, which is January 6, 1975, in the cases of SO_2 and PM(TSP), and February 8, 1988, in the case of NO_2;
2. The minor source baseline date, which is the earliest date after the trigger date on which a major stationary source or major modification subject to PSD regulations submits a complete PSD application; and
3. The trigger date, which is August 7, 1977, for SO_2 and PM(TSP), and February 8, 1988, for NO_2.

The minor source baseline date for SO_2 and PM(TSP) has been set as December 27, 1977, for the entire state of Florida (Chapter 17-2.450, F.A.C.). The minor source baseline date for NO_2 has been set as March 28, 1988, for all of Florida.

3.2.3 CONTROL TECHNOLOGY REVIEW

The control technology review requirements of the federal and state PSD regulations require that all applicable federal and state emission limiting standards be met and that BACT be applied to control emissions from the source [Chapter 17-2.500(5)(c), F.A.C]. The BACT requirements are applicable to all regulated pollutants for which the increase in emissions from the facility or modification exceeds the significant emission rate (see Table 3-2).

BACT is defined in Chapter 17-2.100(25), F.A.C. as:

> An emissions limitation, including a visible emission standard, based on the maximum degree of reduction of each pollutant emitted which the Department, on a case by case basis, taking into account energy, environmental, and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems, and techniques (including fuel cleaning or treatment or innovative fuel combustion techniques) for control of such pollutant. If the Department determines that technological or economic limitations on the application of measurement methodology to a particular part of a source or facility would make the imposition of an emission standard infeasible, a design, equipment, work practice, operational standard or combination thereof, may be prescribed instead to satisfy the requirement for the application of BACT. Such standard shall, to the degree possible, set forth the emissions reductions achievable by implementation of such design, equipment, work practice, or operation.

The requirements for BACT were promulgated within the framework of PSD in the 1977 amendments of the CAA [Public Law 95-95; Part C, Section 165(a)(4)]. The primary purpose of BACT is to optimize consumption of PSD air quality increments and, thereby, enlarge the potential for future economic growth without significantly degrading air quality (EPA, 1978; 1980). Guidelines for the evaluation of BACT can be found in EPA's Guidelines for Determining Best Available Control Technology (BACT) (EPA, 1978) and in the PSD Workshop Manual (EPA, 1980). These guidelines were promulgated by EPA to provide a consistent approach to BACT and to ensure that the impacts of alternative emission control systems are measured by the same set of parameters. In addition, through implementation of these guidelines, BACT in one area may not be identical to BACT in another area. According to EPA (1980),

> BACT analyses for the same types of emissions unit and the same pollutants in different locations or situations may determine that different control strategies should be applied to the different sites, depending on site-specific factors. Therefore, BACT analyses must be conducted on a case-by-case basis.

The BACT requirements are intended to ensure that the control systems incorporated in the design of a proposed facility reflect the latest in control technologies used in a particular industry and take into consideration existing and future air quality in the vicinity of the proposed facility. BACT must, as a minimum, demonstrate compliance with New Source Performance Standards (NSPS) for a source (if applicable). An evaluation of the air pollution control techniques and systems, including a cost-benefit analysis of alternative control technologies capable of achieving a higher degree of emission reduction than the proposed control technology, is required. The cost-benefit analysis requires the documentation of the materials, energy, and economic penalties associated with the proposed and alternative control systems, as well as the environmental benefits derived from these systems. A decision on BACT is to be based on sound judgment, balancing environmental benefits with energy, economic, and other impacts (EPA, 1978).

Historically, a "bottom-up" approach consistent with the BACT Guidelines and PSD Workshop Manual has been used. With this approach, an initial control level, which is usually NSPS, is evaluated against successively more stringent controls until a BACT level is selected. However, EPA developed a concern that the bottom-up approach was not providing the level of BACT decisions originally intended. As a result, in December 1987, the EPA Assistant Administrator for Air and Radiation mandated changes in the implementation of the PSD program including the adoption of a new "top-down" approach to BACT decision making.

The top-down BACT approach essentially starts with the most stringent (or top) technology and emissions limit that have been applied elsewhere to the same or a similar source category. The applicant must next provide a basis for rejecting this technology in favor of the next most stringent technology or propose to use it. Rejection of control alternatives may be based on technical or economic infeasibility. Such decisions are made on the basis of physical differences (e.g., fuel type), locational differences (e.g., availability of water), or significant differences that may exist in the environmental, economic or energy impacts. The differences between the proposed facility and the facility on which the control technique was applied previously must be justified. Recently, EPA issued a draft guidance document on the top-down approach entitled Top-Down Best Available Control Technology Guidance Document (EPA, 1990a).

3.2.4 AIR QUALITY MONITORING REQUIREMENTS

In accordance with requirements of 40 CFR 52.21(m) and Chapter 17-2.500(f), F.A.C, any application for a PSD permit must contain an analysis of ambient air quality data in the area affected by the proposed major stationary facility or major modification. For a new major facility, the affected pollutants are those that the facility would potentially emit in significant amounts. For a major modification, the pollutants are those for which the net emissions increase exceeds the significant emission rate (see Table 3-2).

Ambient air monitoring for a period of up to 1 year is generally appropriate to satisfy the PSD monitoring requirements. A minimum of

4 months of data is required. Existing data from the vicinity of the proposed source may be utilized if the data meet certain quality assurance requirements; otherwise, additional data may need to be gathered. Guidance in designing a PSD monitoring network is provided in EPA's Ambient Monitoring Guidelines for Prevention of Significant Deterioration (EPA, 1987a).

Under the exemption rule, FDER may exempt a proposed major stationary facility or major modification from the monitoring requirements with respect to a particular pollutant if the emissions increase of the pollutant from the facility or modification would cause, in any area, air quality impacts less than the de minimis levels presented in Table 3-2 [Chapter 17-2.500(3)(e), F.A.C.].

3.2.5 SOURCE IMPACT ANALYSIS

A source impact analysis must be performed for a proposed major source subject to PSD for each pollutant for which the increase in emissions exceeds the significant emission rate (Table 3-2). The PSD regulations specifically provide for the use of atmospheric dispersion models in performing impact analysis, estimating baseline and future air quality levels, and determining compliance with AAQS and allowable PSD increments. Designated EPA models must normally be used in performing the impact analysis. Specific applications for other than EPA-approved models require EPA's consultation and prior approval. Guidance for the use and application of dispersion models is presented in the EPA publication Guideline on Air Quality Models (EPA, 1987b). The source impact analysis for criteria pollutants may be limited to only the new or modified source if the net increase in impacts due to the new or modified source is below significance levels, as presented in Table 3-1.

Various lengths of record for meteorological data can be utilized for impact analysis. A 5-year period can be used with corresponding evaluation of highest, second-highest short-term concentrations for comparison to AAQS or PSD increments. The term "highest, second-highest" (HSH) refers to the highest of the second-highest concentrations at all receptors (i.e., the highest concentration at each receptor is discarded). The second-highest concentration is significant because short-term AAQS specify that the standard should not be exceeded at any location more than once a year. If less than 5 years of meteorological data are used in the modeling analysis, the highest concentration at each receptor must normally be used for comparison to air quality standards.

3.2.6 ADDITIONAL IMPACT ANALYSES

In addition to air quality impact analyses, federal and state of Florida PSD regulations require analysis of the impairment to visibility and the impacts on soils and vegetation that would occur as a result of the proposed source [40 CFR 52.21; Chapter 17-2.500(5)(e), F.A.C.]. These analyses are to be conducted primarily for PSD Class I areas. Impacts due to general commercial, residential, industrial, and other growth associated with the source must also be addressed. These analyses are required for each pollutant emitted in significant amounts (Table 3-2).

3.2.7 GOOD ENGINEERING PRACTICE STACK HEIGHT

The 1977 CAA amendments require that the degree of emission limitation required for control of any pollutant not be affected by a stack height that exceeds GEP, or any other dispersion technique. On July 8, 1985, EPA promulgated final stack height regulations (EPA, 1985). Identical regulations have been adopted by FDER [Chapter 17-2.270, F.A.C.]. GEP stack height is defined as the highest of:

1. 65 meters (m); or
2. A height established by applying the formula:

$$Hg = H + 1.5L$$

   where: Hg = GEP stack height,
   H = Height of the structure or nearby structure, and
   L = Lesser dimension (height or projected width) of nearby structure(s); or
3. A height demonstrated by a fluid model or field study.

"Nearby" is defined as a distance up to five times the lesser of the height or width dimensions of a structure or terrain feature, but not greater than 0.8 kilometers (km). Although GEP stack height regulations require that the stack height used in modeling for determining compliance with AAQS and PSD increments not exceed the GEP stack height, the actual stack height may be greater.

3.3 NONATTAINMENT RULES

Based on the current nonattainment provisions (Chapter 17-2.510, F.A.C.), all major new facilities and modifications to existing major facilities located in a nonattainment area must undergo nonattainment review if the proposed pieces of equipment have the potential to emit 100 TPY or more of the nonattainment pollutant, or if the modification results in a significant net emission increase of the nonattainment pollutant.

For major facilities or major modifications that locate in an attainment or unclassifiable area, the nonattainment review procedures apply if the source or modification is located within the area of influence of a nonattainment area. The area of influence is defined as an area which is outside the boundary of a nonattainment area but within the locus of all points that are 50 km outside the boundary of the nonattainment area. Based on Chapter 17-2.510(2)(a)2.a, F.A.C., all VOC sources which are located within an area of influence are exempt from the provisions of new source review for nonattainment areas. Sources which emit other nonattainment pollutants and are located within the area of influence are subject to nonattainment review unless the maximum allowable emissions from the proposed source do not have a significant impact within the nonattainment area.

3.4 SOURCE APPLICABILITY

3.4.1 PSD REVIEW

3.4.1.1 Pollutant Applicability

FGTC's Compressor Station No. 17 is located in Marion County, which has been designated by EPA and FDER as an attainment area for all criteria pollutants. Marion County and surrounding counties are designated as PSD Class II areas for SO_2, PM(TSP), and NO_2. The site is located within 100 km of a PSD Class I area. This Class I area is the Chassahowitzka National Wildlife Refuge, which is approximately 95 km southwest of the compressor station location.

FGTC's existing Compressor Station No. 17 is considered to be an existing major facility because total potential emissions of any regulated pollutant from the existing facility exceed 250 TPY. As a result, PSD review is required for the proposed expansion for each pollutant for which the net increase in emissions exceeds the PSD significant emission rates presented in Table 3-2 (i.e., major modification).

Table 3-3 presents the maximum hourly and annual emissions from the proposed new compressor engine. As shown, potential NO_x emissions from the engine will exceed the PSD significant emission rate for this regulated pollutant. Therefore, the proposed expansion project is subject to PSD review for NO_x.

3.4.1.2 Ambient Monitoring

Based upon the increase in emissions from FGTC's proposed expansion at Compressor Station No. 17, presented in Table 3-3, a PSD preconstruction ambient monitoring analysis is required for NO_x. However, if the increase in impacts of a pollutant is less than the de minimis monitoring concentration, then an exemption from the preconstruction ambient monitoring requirement may be granted for that pollutant. In addition, if an acceptable ambient monitoring method for the pollutant has not been established by EPA, monitoring is not required.

Table 3-3. Maximum Potential Emissions Due to Proposed Engine at Compressor Station No. 17

Pollutant	Maximum Potential Emissions From Proposed Compressor Engine (lb/hr)	(TPY)	Significant Emission Rate (TPY)	PSD Review Applies?
Nitrogen Oxides	10.6	46.3	40	Yes
Carbon Monoxide	14.8	64.9	100	No
Votatile Organic Compounds (non-methane)	9.0	39.4	40	No
Particulate Matter (TSP)	0.09	0.37	25	No
Particulate Matter (PM10)	0.09	0.37	15	No
Sulfur Dioxide	0.49	2.13	40	No

The maximum annual impact associated with the potential NO_x emissions from the proposed IC engine is 0.91 $\mu g/m^3$. The methodology used to predict this value is presented in Section 4.0, along with the impact analysis result. The de minimis concentration level for NO_x is 14 $\mu g/m^3$ annual average. Since the maximum impact of NO_x is less than its de minimis concentration level, the proposed expansion project is exempted from the PSD preconstruction ambient monitoring requirement for NO_x.

3.4.1.3 GEP Stack Height Analysis

The GEP stack height regulations allow any stack to be at least 65 m (213 ft) high. The proposed stack for the new compressor engine will be 40 ft high (12.19 m) and, therefore, does not exceed the GEP stack height. The potential for downwash of the engines' emissions due to nearby structures is discussed in Section 4.0, Source Impact Analysis.

3.4.2 NONATTAINMENT REVIEW

FGTC's Compressor Station No. 17 is not located in any nonattainment area or in any area of influence of a nonattainment area. As a result, nonattainment review does not apply to the proposed expansion project.

4.0 SOURCE IMPACT ANALYSIS

4.1 ANALYSIS APPROACH AND ASSUMPTIONS

4.1.1 GENERAL MODELING APPROACH

The general modeling approach follows EPA and FDER modeling guidelines for determining compliance with AAQS and PSD increments. In general, when model predictions are used to determine compliance with AAQS and PSD increments, current EPA and FDER policies stipulate that the highest annual average concentration and highest, second-highest short-term (i.e., 24 hours or less) concentration can be compared to the applicable standard.

Model predictions for annual average NO_x concentrations were performed using the Industrial Source Complex Long-Term (ISCLT) model (Version 90008). A brief description of the Industrial Source Complex (ISC) model is given in Section 4.1.2.

4.1.2 MODEL SELECTION

The ISC dispersion model (EPA, 1988b) was used to evaluate the NO_x emissions from the proposed compressor engine. This model is contained in the EPA User's Network for Applied Modeling of Air Pollution (UNAMAP), Version 6 (EPA, 1988c). The ISC model was selected primarily for the following reasons:

1. EPA and FDER have approved the general use of the model for air quality dispersion analysis because the model assumptions and methods are consistent with those in the Guideline on Air Quality Models (EPA, 1987b);
2. The ISC model is capable of predicting the impacts from stack, area, and volume sources that are spatially distributed over large areas and located in flat or gently rolling terrain; and
3. The results from the ISC model are appropriate for addressing compliance with AAQS and PSD increments.

The ISCLT model is an extension of the Air Quality Display Model (AQDM) and the Climatological Dispersion Model (CDM). The ISCLT model uses joint frequencies of wind direction, windspeed, and atmospheric stability to calculate seasonal and/or annual average ground-level concentrations. Because the input wind directions are for 16 sectors, with each sector defined as 22.5 degrees, the model calculates concentrations by assuming that the pollutant is uniformly distributed in the horizontal plane within a 22.5-degree sector.

Major features of the ISCLT model are presented in Table 4-1. Concentrations due to stack and volume sources are calculated by the model using the steady-state Gaussian plume equation for a continuous source. The area source equation in the ISC model is based on the equation for a continuous and finite crosswind line source.

The ISC model has rural and urban options which affect the windspeed profile exponent law, dispersion rates, and mixing-height formulations used in calculating ground-level concentrations. The criteria used to determine when the rural or urban mode is appropriate are based on land use near the proposed plant's surroundings (Auer, 1978). If the land use is classified as heavy industrial, light-moderate industrial, commercial, or compact residential for more than 50 percent of the area within a 3-km radius circle centered on the proposed source, the urban option is selected. Otherwise, the rural option is used.

For modeling analyses that will undergo regulatory review, such as PSD permit applications, the following model features are recommended by EPA (1987a) and are referred to as the regulatory options in the ISC model:

1. Final plume rise at all receptor locations,
2. Stack-tip downwash,
3. Buoyancy-induced dispersion,
4. Default windspeed profile coefficients for rural or urban option,
5. Default vertical potential temperature gradients, and

Table 4-1. Major Features of the ISCLT Model

ISCLT Model Features
• Polar or Cartesian coordinate systems for receptor locations
• Rural or one of three urban options that affect windspeed profile exponent, dispersion rates, and mixing height calculations
• Plume rise as a result of momentum and buoyancy as a function of downwind distance for stack emissions (Briggs)
• Procedures suggested by Huber and Snyder (1976), Huber (1977), Schulmann and Hanna (1986), and Schulmann and Scire (1980) for evaluating building downwash and wake effects
• Procedures suggested by Briggs for evaluating stack-tip downwash
• Separation of multiple point sources
• Consideration of the effects of gravitational settling and dry deposition on ambient particulate concentrations
• Capability of simulating point, line, volume, and area sources
• Capability to calculate dry deposition
• Variation of windspeed with height (windspeed-profile exponent law)
• Concentration estimates for annual average
• Terrain-adjustment procedures for elevated terrain including a terrain truncation algorithm
• Receptors located above local terrain (i.e., "flagpole" receptors)
• Consideration of time-dependent exponential decay of pollutants
• The method of Pasquill (1976) to account for buoyancy-induced dispersion
• A regulatory default option to set various model options and parameters to EPA recommended values (see text for regulatory options used)

Source: EPA, 1988a.

6. Reducing calculated SO_2 concentrations in urban areas by using a decay half-life of 4 hours (i.e., reduce the SO_2 concentration by 50 percent for every 4 hours of plume travel time).

In this analysis, the EPA regulatory options were used to address maximum impacts. Based on a review of the land use around the facility, the rural mode was selected based on the degree of residential, industrial, and commercial development within 3 km of the plant site.

4.1.3 METEOROLOGICAL DATA

EPA (1987b) recommends the use of 5 years of representative meteorological data for use in air quality modeling. The most recent, readily available 5-year period is preferred. The meteorological data may be collected either onsite or at the nearest National Weather Service (NWS) station.

Meteorological data used in the analysis were selected based on the recommendations of the FDER for the area in which the project is located. The data consisted of a 5-year record of surface weather observations (1982-1986) from the NWS station located at the Orlando International Airport. The database consists of hourly surface data (i.e., windspeed, wind direction, etc.) that are recorded and then sent to the National Climatic Data Center (NCDC) in Asheville, North Carolina. The NCDC digitizes the recorded data onto magnetic tape for sale to the public.

The NWS station in Orlando, located approximately 105 km southeast of the site, records the hourly surface meteorological data required by the air dispersion models. Because of the proximity of the Orlando NWS station to the plant site, the Orlando meteorological data are considered to be representative of weather conditions occurring at FGTC's Compressor Station No. 17 site.

The ISCLT model requires annual/seasonal mixing height data and ambient air temperatures. The appropriate values for Orlando for input to the model were obtained from FDER. The Orlando hourly surface data were input into the National Climatic Data Center (NCDC) stability array (STAR) preprocessor program. The STAR program converts the hourly data into the joint frequency of occurrence of wind direction, windspeed and atmospheric stability. The program can produce monthly, seasonal and annual stability arrays.

4.1.4 SOURCE DATA

The model parameters for the proposed compressor engine are given in Table 4-2. The location of the proposed engine stack within the FGTC's Compressor Station No. 17 site are presented in Figure 2-1.

4.1.5 RECEPTOR LOCATIONS

The locations of the receptors were based on identifying the areas in which maximum concentrations would be expected due to the proposed compressor engine. A description of the receptor locations for determining maximum predicted concentrations is as follows:

1. For the ISCLT model, 112 receptors were located on 16 radials centered on the proposed engine's stack location and at downwind distances of 200, 300, 400, 500, 750, 1,000, and 1,250 m.
2. To account for plant boundaries in all directions, 36 discrete receptors were located along 36 radials separated by 10-degree increments. These discrete receptors were located at the nearest plant boundary in each direction. The locations of the discrete receptors are given in Table 4-3.

Only those receptors located outside FGTC's Compressor Station No. 17 plant property were used in the determination of maximum impacts.

Table 4-2. Summary of Source Parameters Used in the Modeling Analysis

Modeled Source Number	Stack Dimensions (m)		Operating Parameters		Emissions (g/s)
	Height	Diameter	Temperature (K)	Velocity (m/s)	NO_2
1	12.19	0.39	641	57.47	1.33

Table 4-3. Discrete Plant Boundary Receptors, Compressor Station No. 17[a]

Direction	Distance (km)	Direction	Distance (km)
10	0.137	190	0.232
20	0.143	200	0.274
30	0.155	210	0.274
40	0.177	220	0.268
50	0.210	230	0.274
60	0.250	240	0.244
70	0.232	250	0.226
80	0.219	260	0.216
90	0.219	270	0.216
100	0.223	280	0.219
110	0.235	290	0.232
120	0.207	300	0.250
130	0.192	310	0.213
140	0.183	320	0.177
150	0.180	330	0.155
160	0.183	340	0.143
170	0.189	350	0.137
180	0.207	360	0.134

[a]Relative to the proposed stack located at (0,0) meters.

4.1.6 BUILDING DOWNWASH CONSIDERATIONS

Based on the dimensions of the compressor building that will house the proposed engine, the stack for the proposed engine will be less than GEP height. Also, based on the location of the proposed engine's exhaust stack in relation to the compressor building, the stack will be in the influence of the compressor building. Therefore, the potential for building downwash must be considered in the modeling analysis.

The procedures used for addressing the effects of building downwash are those recommended in the ISC Dispersion Model User's Guide. In the ISCLT model, the building height and width are input to the model, which are used to modify the dispersion parameters if the Huber-Snyder building downwash routine is used. The effective width used by the program is the diameter of a circle of equal area to the square of the width input to the model. If a specific width is to be modeled, then the value input to the model must be calculated according to the following formula:

$$M_w = \sqrt{\pi \left(\frac{H_w}{2}\right)^2} = 0.886\ H_w$$

where: M_w = building width input to the model to produce a building width of H_w used in the dispersion calculation.
H_w = the actual building width for which dispersion calculations are desired.

If the Schulman-Scire wake effects method is used, the user inputs the building height and projected width associated with each 22.5-degree wind sector. These building heights and projected widths are the same used for GEP stack height calculations.

A summary of actual and modeled building dimensions is presented in Table 4-4. Because of the proximity of the proposed stack to the compressor building (approximately 17 ft) and the low ratio of stack height to building height, potential downwash from this structure was assumed to occur. Because the stack-to-building height ratio is less than 1.5, the

Table 4-4. Building Dimensions used in the ISCLT Modeling, Compressor Station No. 17

Building	Actual Building Dimensions			Modeled Building Dimensions	
	Height (m)	Length (m)	Width (m)	Height (m)	Projected Width[a] (m)
Compressor Building[b]	9.69	59.4	16.8	9.69	61.9

[a]Maximum projected building width was assumed to be applicable in all directions.
[b]Dimensions are for expanded compressor building with proposed engine.

Schulman-Scire downwash method was used in the analysis. Therefore, directional specific building height and width for each 22.5-degree wind sector was determined for use as input values in this algorithm. In order to be conservative, the building diagonal was used as the input value for width in all 16 wind sectors.

4.2 MODEL RESULTS

A summary of the 5-year maximum annual NO_2 impact concentrations predicted for the proposed compressor engine is presented in Table 4-5. The maximum predicted annual average impact due to the proposed compressor engine is 0.91 $\mu g/m^3$, which is less than the NO_2 significance level of 1 $\mu g/m^3$, annual average concentration. This maximum concentration is predicted to occur in a direction of 270° and at a distance of 0.400 km from the proposed engine's stack. Further modeling refinement was not required to verify the reported maximum concentration value and the associated receptor location because of the accuracy of the sector averaging feature in the ISCLT model and the 100 m or less separation distances between the receptors. Since the predicted maximum NO_2 concentration is less than the significant impact level, further modeling of potential NO_2 impacts to the local surroundings of the compressor station is not required. The computer modeling printouts are provided in Appendix C.

The potential NO_x impacts with respect to the Chassahowitzka National Wildlife Refuge area must also be considered because Compressor Station No. 17 is within 100 km of this designated Class I area. Since the modeling results showed that maximum impacts are below the significant level (i.e., less than 1 $\mu g/m^3$) at the plant site, potential impacts on the Class I areas located 95 km or more away will be much less than 1 $\mu g/m^3$, annual average concentration.

Table 4-5. Maximum Predicted Annual Average NO_2 Concentrations Due to the Proposed Station 17 Compressor Engine for Comparison to Significant Impact Levels

Year Modeled	Maximum Concentration ($\mu g/m^3$)	Receptor Location Direction (°)	Receptor Location Distance (km)	NO_2 Significant Impact Level ($\mu g/m^3$)
1982	0.89	360	0.400	1
1983	0.84	360	0.400	
1984	0.89	270	0.400	
1985	0.91	270	0.400	
1986	0.77	270	0.500	

5.0 SOILS, VEGETATION, VISIBILITY AND ASSOCIATED POPULATION GROWTH IMPACTS

5.1 IMPACTS UPON SOILS AND VEGETATION

As demonstrated in Section 4.0, FGTC's proposed IC engine will have a very minimal impact upon ambient air quality in the vicinity of the Compressor Station No. 17 site. The maximum predicted impact of NO_x is below the EPA significance level, and emissions of VOC and CO are low. Since the predicted impacts are below significant concentration levels for the areas near the plant site, there is expected to be no significant impact to soils or vegetation in the Chassahowitzka National Wildlife Refuge Class I area caused by the proposed engine.

5.2 IMPACTS UPON VISIBILITY

The visibility analysis required by PSD regulations is directed primarily towards Class I areas. The Clean Air Act Amendments of 1977 provide for implementation of guidelines to prevent visibility impairment in mandatory PSD Class I areas. The guidelines are intended to protect the aesthetic quality of these pristine areas from reduction in visual range and atmospheric discoloration due to various pollutants. The nearest Class I area to the proposed facility is the Chassahowitzka National Wildlife Refuge, located about 95 km from the facility. A level-1 visibility screening analysis was performed to determine the potential adverse visibility effects using the approach suggested in the Workbook for Plume Visual Impact Screening and Analysis (EPA, 1988e). The Level-1 screening analysis is designed to provide a conservative estimate of plume visual impacts (i.e., impacts higher than expected). The EPA model, VISCREEN, was used for this analysis. Model input and output results are presented in Table 5-1. As indicated, the maximum visual impacts caused by the proposed compressor engine do not exceed the screening criteria inside or outside the Class I area.

Table 5-1. Visual Effects Screening Analysis for Compressor Station No. 17

Class I Area: CHASSAHOWITZKA NWR

*** Level-1 Screening ***

Input Emissions for

Particulates	0.09	LB /HR
NOx (as NO2)	10.60	LB /HR
Primary NO2	0.00	LB /HR
Soot	0.00	LB /HR
Primary SO4	0.00	LB /HR

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.04 ppm
Background Visual Range:	25.00 km
Source-Observer Distance:	96.00 km
Min. Source-Class I Distance:	96.00 km
Max. Source-Class I Distance:	110.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area

Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	96.0	84.	2.00	.002	.05	.000
SKY	140.	84.	96.0	84.	2.00	.001	.05	.000
TERRAIN	10.	84.	96.0	84.	2.00	.000	.05	.000
TERRAIN	140.	84.	96.0	84.	2.00	.000	.05	.000

Maximum Visual Impacts OUTSIDE Class I Area

Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	75.	92.9	94.	2.00	.002	.05	.000
SKY	140.	75.	92.9	94.	2.00	.001	.05	.000
TERRAIN	10.	60.	87.8	109.	2.00	.000	.05	.000
TERRAIN	140.	60.	87.8	109.	2.00	.000	.05	.000

With regard to local visibility impacts, the proposed source will meet Florida visible emission requirement of 20 percent opacity [Chapter 17-2.610(2), F.A.C.]. During normal operations, the expected actual opacity from the IC engine will be much less than 20 percent.

5.3 IMPACTS DUE TO ASSOCIATED POPULATION GROWTH

There will be a small increase in temporary construction workers during construction; however, there will be no increase in permanent employment at Compressor Station No. 17 as a result of adding the new engine. As a result, there will be no permanent impacts on air quality caused by associated population growth.

6.0 BEST AVAILABLE CONTROL TECHNOLOGY EVALUATION

The potential emissions of NO_x from the proposed engine exceed the PSD significant emission rate of 40-TPY; therefore, BACT analysis for NO_x is required. The complete "top-down" BACT evaluation of NO_x includes a description of natural gas prime movers (Section 6.1), the identification of NO_x control technologies for reciprocating internal combustion engines (Section 6.2), the environmental, energy and economic impact evaluations of all technically feasible methods (Section 6.3), and the BACT analysis summary (Section 6.4).

6.1 NATURAL GAS PRIME MOVERS

The prime movers in the natural gas industry are generally heavy duty natural-gas-fired stationary internal combustion (IC) engines. These engines are applied to power compressors used for pipeline transmission, field collection of gas from wells, underground storage, and gas processing plant activities. Stationary IC engines used include both gas turbines and reciprocating IC engines.

The use of gas turbines at new natural gas pipeline compression stations has increased in recent years for a wide variety of reasons. Their primary benefit is that gas turbines typically emit fewer pollutants than reciprocating IC engines (i.e., on g/bhp-hr basis); however, gas turbines are generally 10 to 15 percent less fuel efficient, requiring higher specific heat input rate (i.e., on Btu/bhp/hr basis). Also, gas turbines have been found to use more fuel to produce the same compression efficiency.

A primary limitation of gas turbines is related to their inability to respond quickly and efficiently to varying load changes in service demand. This often precludes the use of turbines when supplemental compression is required at a given compressor station. Furthermore, the use of gas turbines in conjunction with reciprocating IC engines at existing compressor stations is hindered by operating limitations. The mechanical operation of reciprocating IC engines generates a pulse vibration that can be transferred to adjacent equipment through physical connection to the pipeline. Gas turbines are sensitive to this type of vibration due to the destructive interference nature of this vibrational frequency; therefore, their operation and reliability can be adversely effected. Based on the above discussion, the use of gas turbines for FGTC's proposed expansion is not considered further.

The use of reciprocating IC engines has been more widespread in terms of the number of installations at natural gas pipeline compressor stations. A recent Gas Research Institute research study (GRI, 1990) reports that the number of such engines is five times that of gas turbines. Advantages of using reciprocating IC engines are primarily better fuel and compression efficiencies and their capability to operate at variable loads to meet the fluctuating consumptive demands.

Reciprocating IC engines used in gas pipeline transmission are generally integral engine-compressor units designed specifically for such application. The integral units provide greater gas-moving efficiency than separable compressors and offer greater operating flexibility than gas turbines. The engines are either two-cycle or four-cycle and are rated between 900 to 13,500 bhp. Old existing engines include four-cycle rich-burn or two- and four-cycle lean-burn. New engines installed in pipeline compressor stations are generally of lean-burn combustion design, which can achieve 80 percent or greater NO_x emission reduction compared to the older, rich-burn models.

6.2 IDENTIFICATION OF NO_x CONTROL TECHNOLOGIES FOR RECIPROCATING IC ENGINES

In this section, the control technologies capable of reducing NO_x emissions produced by reciprocating IC engines will be evaluated relative to their potential application as BACT for the proposed 2,400-bhp engine. This BACT analysis follows EPA's most recent draft guideline for the top-down approach (EPA, 1990a).

All potentially applicable control technologies for reciprocating IC engines are reviewed. The technologies can be separated into two major groups:

1. Reducing pollutant emissions by process modification (i.e., "low-NO_x" engine design), and
2. Converting NO_x in the exhaust gas by add-on catalytic exhaust gas treatment devices.

The discussion of each potential NO_x control technology includes a description of the technology and the potential NO_x emission reduction, if the technology is concluded to be technically feasible.

6.2.1 TECHNOLOGIES INVOLVING ENGINE MODIFICATION

The concept of low-NO_x reciprocating IC engines is described in the NSPS Background Information Document (BID) for stationary reciprocating IC engines issued by EPA in July 1979 (EPA, 1979). Five types of engine or process modifications have been recognized by EPA as technically viable for reducing NO_x emissions from such engines:

1. Steam injection,
2. Air-to-fuel ratio changes,
3. Retarded ignition timing,
4. Derating power output, and
5. Exhaust gas recirculation.

Each of these is discussed in the following sections.

6.2.1.1 Steam Injection

The concept of designing a low-NO_x reciprocating IC engine focuses on controlling the combustion temperature, since thermal NO_x generally increases as combustion temperature increases. Favorable conditions for thermal oxidation of molecular nitrogen can be reduced by quenching the flame temperature with low quality steam or water. In this method, water or steam is injected at a location downstream from the combustion zone inside each firing cylinder.

However, water or steam injection to reduce NO_x formation does not work well at the high water injection rate required for reciprocating IC engines. Reciprocating IC engines are typically designed with high gas flow rates and operate at high excess air. Also, experiments with large-bore engines have concluded that steam injection for controlling NO_x emissions can cause irreversible structural damage to the engine block (EPA, 1979). Thus, water or steam injection technology for reciprocating IC engines is considered technically infeasible. As a result, this method will not be discussed further.

Potential NO_x Emission Reduction

Not applicable for a technically infeasible process.

6.2.1.2 Air-to-Fuel Ratio Changes

The state-of-the-art concept in designing a low-NO_x reciprocating IC engine involves raising the air-to-fuel ratio to create a lean fuel mixture for the combustion process. The peak combustion temperature is lowered due to lower heat of combustion from burning less fuel, and by the high excess air, which tends to dilute the combustion gases. Such combustion results in less pollutants being emitted (i.e., a cleaner burning process). Cooper-Bessemer was the first original equipment manufacturer of reciprocating IC engines to incorporate this concept into engine design, which was appropriately named CleanBurn® technology.

In general, the high air-to-fuel ratio design is referred to as lean-burn technology (LBT) for gas-fired reciprocating IC engines. The name is derived from the lean mixture of air-to-fuel in the main combustion cylinder. The air-to-fuel ratio can reach as high as 200 for some IC engine designs and operating conditions, according to one of the major reciprocating IC engine suppliers (Dresser-Rand, 1990).

LBT is primarily accomplished by increasing the stoichiometric air-to-fuel ratio over the conventional rich-burn engine. In general, small increases in the air-to-fuel ratio (approximately 10 percent) cause a significant reduction in NO_x (approximately 30 percent) with less than 5 percent fuel penalty (EPA, 1979). On turbocharged engines, this can be accomplished by operating at high manifold pressures, which results in lower combustion temperatures and reduces NO_x formation. However, misfiring and erratic combustion can occur at very lean mixtures. The limits to which the air-to-fuel ratio can be increased are related to three major engine design factors:

1. The capability of the turbocharger to produce higher air manifold pressures for rated engine loading,
2. The ability of the ignition system to light-off the leaner mixtures, and
3. The combustion chamber characteristics to maintain efficient combustion with leaner combustible gaseous mixtures.

With current state-of-the-art engine and turbocharger designs coupled with advanced control technology, all of these three factors can be sufficiently achieved.

Potential NO_x Emission Reduction:

Pollutant	Uncontrolled Emission Level	Guaranteed Emission Level	Potential Percentage Reduction
NO_x	11.0 g/bhp-hr[a]	1.5-2.0 g/bhp-hr	82-86%

Note: [a]Represents emission level for the baseline rich-burn engine.

6.2.1.3 Retarded Ignition Timing

Retarding the spark ignition timing of the reciprocating IC engine reduces the peak combustion pressure and temperature, thereby lowering thermal NO_x formation. The timing delay is measured in degrees in reference to the engine's crankshaft rotation. There are limits to how much the ignition timing can be retarded. In general, retard values range from 2 to 6 degrees, depending on engine, and NO_x reduction per degree of retard decreases for increasing levels of retard.

A study by the American Gas Association showed that the NO_x emissions from 10 different gas-fired naturally aspirated engine models ranged from a 7 percent reduction to a 2 percent increase per degree of ignition retardation (Urban and Springer, 1975). EPA's research (1979) reported the percent of NO_x reduction per degree of retard ranged from 0.6 to 8.5 for turbocharged engines. Overall, EPA's report concluded that retarding ignition timing reduced NO_x emissions 15 percent for gas-fired engines.

Potential NO_x Emission Reduction:

Pollutant	Uncontrolled Emission Level	Achievable Emission Level	Potential Percentage Reduction
NO_x	11.0 g/bhp-hr[a]	9.4 g/bhp-hr	15%
	2.0 g/bhp-hr[b]	1.7 g/bhp-hr	15%

Note: [a] Represents emission level for the baseline rich-burn engine.
[b] Represents emission level for a typical lean-burn engine.

6.2.1.4 Derating Power Output

A reciprocating IC engine can be derated by operating at less than full or 100-percent rated power. The effect of derating on an engine is to reduce peak combustion cylinder temperatures and pressures, thus lowering NO_x formation rates.

Reported NO_x reduction levels achieved by derating vary greatly for different reciprocating IC engines primarily as a result of air charging. Data compiled by EPA (1979) show that non-turbocharged engines achieve the largest reduction because derating has a greater effect on air-to-fuel ratios. In contrast, turbocharged engines operate at an already high air-to-fuel ratio and, therefore, very little NO_x reduction is achieved by derating. Normalized NO_x reduction from derating (i.e., percent of NO_x reduction per percent derate) is reported from 0.25 to 6.2 for normally aspirated or blower-charged engines, and 0.01 to 2.6 for turbocharged engines. The EPA report showed that NO_x reduction ranged from 10 percent increase to 90 percent reduction, and averaged approximately 40 percent reduction at a derating of 75 percent of rated torque.

Potential NO_x Emission Reduction:

Pollutant	Uncontrolled Emission Level	Achievable Emission Level	Potential Percentage Reduction
NO_x	11.0 g/bhp-hr[a]	6.6 g/bhp-hr	40%
	2.0 g/bhp-hr[b]	1.2 g/bhp-hr	40%

Note: [a] Represents emission level for the baseline rich-burn engine.
[b] Represents emission level for a typical lean-burn engine.

6.2.1.5 Exhaust Gas Recirculation

Exhaust gas recirculation (EGR) reduces peak combustion temperatures in a reciprocating IC engine by replacing a fraction of the combustion air with exhaust gases. The recirculated exhaust gases serve to absorb heat without providing as much additional oxygen for the oxidation of nitrogen.

EGR can be accomplished by either introducing exhaust gases into the intake manifold or restricting the exit of gases from the cylinder by internal recirculation. Externally recirculated gases must be cooled prior to being reintroduced into the combustion cylinder in order to provide greater heat absorption per charge.

EGR is most effective in reducing NO_x emission from conventional rich-burn engines because its application can increase the air-to-fuel ratio. EPA's research (1979) reported a NO_x reduction of 34 percent for a gas-fired, blower-charged engine with 6 percent EGR rate. Excessive EGR rates can result in increased fuel consumption, high CO emissions, and misfiring (GRI, 1990).

EGR is not effective for a lean-burn engine with a high air intake flow rate since it cannot significantly further dilute the air/fuel mixture. In addition, no system has been developed to date for the complex control system needed to regulate the recirculation of the exhaust gases. As a result, EGR for lean-burn engines is not considered further.

Potential NO_x Emission Reduction:

Pollutant	Uncontrolled Emission Level	Achievable Emission Level	Potential Percentage Reduction
NO_x	11.0 g/bhp-hr[a]	7.3 g/bhp-hr	34%
	2.0 g/bhp-hr[b]	Not applicable	–

Note: [a] Represents emission level for the baseline rich-burn engine.
[b] Represents emission level for a typical lean-burn engine.

6.2.2 TECHNOLOGIES INVOLVING EXHAUST GAS TREATMENT

6.2.2.1 NO_xOUT Process

The NO_xOUT process originated from the initial research by the Electric Power Research Institute (EPRI) in 1976 on the use of urea to reduce NO_x. EPRI licensed the proprietary process to Fuel Tech, Inc., for commercialization. In the NO_xOUT process, aqueous urea is injected into the flue gas stream ideally within a temperature range of 1,600°F to 1,900°F. In the presence of oxygen, the following reaction occurs:

$$CO(NH_2)_2 + 2NO + \frac{1}{2}O_2 \rightarrow 2N_2 + CO_2 + 2H_2O$$

The amount of urea required is most cost effective when the treatment rate is 0.5 to 2 moles of urea per mole of NO_x. In addition to the original EPRI urea patents, Fuel Tech claims to have a number of proprietary catalysts capable of expanding the effective temperature range of the reaction to between 1,000°F and 1,950°F. Advantages of the system are:

1. Low capital and operating costs due to utilization of urea injection, and

2. The proprietary catalysts used are nontoxic and nonhazardous, thus eliminating potential disposal problems.

Disadvantages of the system are:

1. Formation of ammonia from excess urea treatment rates and/or improper use of reagent catalysts, and
2. SO_3, if present, will react with ammonia created from the urea to form ammonium bisulfate, potentially plugging the cold end equipment downstream.

Commercial application of the NO_xOUT system is limited to three reported cases:

1. Trial demonstration on a 62.5-ton-per-hour (TPH) stoker-fired wood waste boiler with 60 to 65 percent NO_x reduction,
2. A 600-million-British-thermal-unit (MMBtu) CO boiler with 60 to 70 percent NO_x reduction, and
3. A 75-megawatt (MW) pulverized coal-fired boiler with 65 percent NO_x reduction.

The NO_xOUT system has not been demonstrated on any stationary IC engine.

The NO_xOUT process is not technically feasible for the proposed lean-burn engine due to the high application temperature of 1,000°F to 1,950°F. The exhaust gas temperature of a lean-burn engine is typically between 495°F to 700°F. Raising the exhaust temperature to the required temperature level would essentially require the installation of an auxiliary heater. This would be economically prohibitive and would result in an increase in fuel consumption, an increase in the volume of gases that must be treated by the control system, and an increase in uncontrolled air emissions, including NO_x.

6.2.2.2 THERMAL $DeNO_x$

Thermal $DeNO_x$ is Exxon Research and Engineering Company's patented process for NO_x reduction. The process is a high temperature selective noncatalytic reduction (SNCR) of NO_x using ammonia as the reducing agent. Thermal $DeNO_x$ requires the exhaust gas temperature to be above 1,800°F. However, use of ammonia plus hydrogen lowers the temperature requirement to about 1,000°F. For some applications, this must be achieved by additional firing in the exhaust stream prior to ammonia injection.

The only known commercial applications of Thermal $DeNO_x$ are on industrial boilers, large furnaces, and incinerators which consistently produce exhaust gas temperatures above 1,800°F. There are no known applications or experience in the reciprocating IC engine industry. Temperatures of 1,800°F require alloy materials of construction with very large size piping and components since the exhaust gas volume would be increased by several times. As with the NO_xOUT process, high capital, operating, and maintenance costs are expected due to material of construction specification, additional duct burner system, and fuel consumption. Uncontrolled emissions would increase because of the additional fuel burning.

Thus, the Thermal $DeNO_x$ process will not be considered for the proposed project because it is technically infeasible due to its high application temperature.

6.2.2.3 Combination of Lean-Burn Engine and Nonselective Catalytic Reduction

Certain manufacturers, such as Engelhard and Johnson-Matthey, market a non-selective catalytic reduction system (NSCR) for NO_x control on reciprocating IC engines. The NSCR process requires a low oxygen content in the exhaust gas stream and high temperature (700°F to 1,400°F) in order to be effective. Rich-burn engines typically achieve low oxygen levels of less than 4 percent and the required temperature and, therefore, can use the NSCR process. Lean-burn engines, on the other hand, have a high air-to-fuel ratio, typical exhaust gas oxygen content of 12 to 15 percent, and the exhaust gas temperature is less than 700°F. As a result, NSCR is not a technically feasible add-on NO_x control device for FGTC's proposed lean-burn engine. Therefore, the combination of a lean-burn engine and NSCR was not considered further in the BACT analysis.

6.2.2.4 Selective Catalytic Reduction with Ammonia Injection

The NO_x abatement technology for oil- and gas-fired combustion sources that is currently receiving considerable attention is the selective catalytic reduction (SCR) process with ammonia injection. Engelhard Corporation's discovery in 1957 that ammonia reacts selectively with NO_x in the presence of a catalyst and excess oxygen has led to the commercialization of SCR technology for industrial boilers of various sizes. The technology has been well developed and applied in Japan, especially for control of emissions from gas-, oil-, and coal-fired utility boilers. It has been applied domestically on combustion sources which generate large quantities of NO_x, such as gas turbines.

SCR catalysts consist of two types: metal oxides and zeolite. In the metal oxides catalytic system, either vanadium or titanium is embedded into a ceramic matrix structure; the zeolite catalysts are ceramic molecular sieves extruded into modules of honeycomb shape. The all-ceramic zeolite catalysts are durable, and less susceptible to catalyst masking or poisoning than the noble metal/ceramic base catalysts. All catalysts exhibit advantages and disadvantages in terms of exhaust gas temperatures, ammonia/NO_x ratio, and optimum exhaust gas oxygen concentrations. A common disadvantage for all catalyst systems is the narrow window of temperature between 600°F and 900°F within which the NO_x reduction process takes place (Schorr, 1989; Steuler, 1990; Engelhard, 1990; Johnson-Matthey, 1990). Operating outside this temperature range results in catastrophic harm to the catalyst system. Chemical poisoning occurs at lower temperature conditions, while thermal degradation occurs at higher temperatures. Reactivity can only be restored through catalyst replacement.

Catalysts are subject to loss of activity over time. Since the catalyst is the most costly component of the SCR system, applications require servicing and cleaning of the catalyst surface every 2,000 to 3,000 hours of operation. The cleaning normally consists of blowing the catalyst surfaces with a compressed air gun or water jet. Most catalyst suppliers guarantee a catalyst life of 3 years, assuming certain operating conditions.

Technically, SCR is potentially applicable to further reduce the already low NO_x emissions (2 g/bhp-hr) from the proposed lean-burn reciprocating engine. SCR is capable of achieving NO_x reduction of 70 to 90 percent. For the proposed lean-burn engine, with already low NO_x concentration in the exhaust gases, vendors guarantee a removal rate of 80 percent. This would result in NO_x emissions of 0.4 g/bhp-hr. This represents an overall NO_x reduction of 96 percent compared to a rich-burn engine (at 11.0 g/bhp-hr).

6.2.2.5 Combination of Rich-Burn Engine and NSCR

Although the draft top-down BACT guideline document dated March 15, 1990, does not require an evaluation of processes that have inherently higher emission rates than the proposed process, the option of using a rich-burn engine equipped with NSCR also was considered in the BACT analysis.

Rich-burn reciprocating IC engines are defined as those which contain less than 4 percent oxygen concentration in the exhaust gas. Rich-burn engines typically are naturally aspirated engines with near stoichiometric air-to-fuel ratios and produce exhaust gas temperatures in the range of 1,200°F to 1,300°F.

NSCR technology uses a precious metal to catalyze the reactions of NO_x with CO and unburned hydrocarbon fuel in the exhaust gas streams to form nitrogen, carbon dioxide, and water vapor. A complete NSCR system includes exhaust gas oxygen sensor, exhaust gas monitor, hydrocarbon fuel injector, automatic air/fuel controller, and temperature sensor for automatic shut-down of the engine if overheating occurs. The engine exhaust entering the catalyst bed is maintained slightly fuel-rich to maximize NO_x reduction. The hydrocarbon fuel injector automatically controls an adjustable valve that supplies a small amount of hydrocarbon fuel to compensate for the changes in engine load or ambient conditions.

Technically, NSCR is potentially applicable to reduce 90 percent or more of the NO_x emissions in the exhaust gas of the rich-burn reciprocating IC engine. In general, vendors guarantee a removal rate of 90 percent for an equivalent NO_x emission level of 1.1 g/bhp-hr (i.e., 10 percent of the rich-burn engine NO_x emission rate of 11.0 g/bhp-hr).

6.2.3 SUMMARY OF TECHNICALLY FEASIBLE NO_x CONTROL METHODS

In summary, there are two basic alternatives for reduction of NO_x emissions from reciprocating IC engines: engine modification and add-on control technology. Presented in Table 6-1 is a summary of the technical evaluation of NO_x emission control methods applicable to reciprocating IC engines.

In the engine modification category, only the alternatives of air-to-fuel ratio change, retard ignition timing, derating power output, and EGR are applicable. EGR is applicable to rich-burn engines only. Steam/water injection and EGR (for lean-burn engines) are considered technically infeasible. In the add-on control technology category, only the lean-burn engine/SCR combination and rich-burn engine/NSCR combination are considered technically feasible. Other methods such as the NO_xOUT process, Thermal DeNO_x, and the lean-burn engine/NSCR combination are considered technically infeasible.

6.3 EVALUATION OF TECHNICALLY FEASIBLE NO_x CONTROL METHODS

This section examines all of the technically feasible NO_x control methods identified in the previous discussion. First, all five remaining control alternatives are ranked according to their total removal effectiveness. Each alternative is then examined further in regards to technical issues, environmental effects, energy requirements and impacts, and economic impacts.

Table 6-1 Summary of Technical Feasibility of NOx Emission Controls for Reciprocating Engine.

Control Technology	NOx Controlled Emission Rate	Technical Feasibility	Comments
<u>Engine Modification Alternatives</u>			
Steam Injection	Not Applicable	NO	Technically infeasible due to irreversible structural damage to engine block.
Air-to-fuel Ratio Change (or Lean-Burn Technology)	1.5-2.0 g/bhp-hr	YES	Lowest emission rate achievable by engine modification, at least 80% control efficiency.
Retarding Ignition Timing			
Rich-burn Engine	9.4 g/bhp-hr	YES	Engine timing retard between 2° and 6°;
Lean-burn Engine	1.7 g/bhp-hr	YES	average 15% NOx reduction.
Derating Power Output			
Rich-burn Engine	6.6 g/bhp-hr	YES	Average 40% NOx reduction at 25% of engine
Lean-burn Engine	1.2 g/bhp-hr	YES	power derated for gas-fired engines.
Exhaust Gas Recirculation			
Rich-burn Engine	7.3 g/bhp-hr	YES	Maximum 34% NOx reduction for standard engine.
Lean-burn Engine	Not Applicable	NO	Ineffective for lean-burn engine.
<u>Add-on Control Technology*</u>			
NOxOUT Process	Not Applicable	NO	Technically infeasible (1000-1600°F), cost prohibitive for high temperature auxiliary equipment.
THERMAL DeNOx	Not Applicable	NO	Technically infeasible (above 1000°F), cost prohibitive for high temperature auxiliary equipment.
Lean-Burn Engine/NSCR	Not Applicable	NO	Technically infeasible for lean-burn engine, required <4% O2 conc. in the exhaust stream.
Lean-Burn Engine/SCR	0.4 g/bhp-hr	YES	Applicable to lean-burn engine with control efficiency of 80 percent.
Rich-Burn Engine/NSCR	1.1 g/bhp-hr	YES	Applicable to rich-burn engine only, required greater than 4% O2 conc. in exhaust gas stream. control efficiency of 90%.

* Except for the rich-burn engine/NSCR option, all add-on control technologies are for lean-burn engines.

The discussion also reviews current permitting practices for applications similar to FGTC's proposed project. Presented in Table 6-2 is a summary of BACT determinations for NO_x emissions from gas-fired stationary reciprocating IC engines issued since 1985. The information was obtained from BACT/Lowest Achievable Emission Rate (LAER) Clearinghouse documents from 1985 to 1990, as well as from actual permit applications, issued permits, and personal conversations with personnel of air permitting agencies from various states.

6.3.1 RANKING OF FEASIBLE CONTROL TECHNOLOGIES

The top-down BACT approach requires the ranking of the NO_x emission control alternatives in terms of achievable emission level. The five options, in order of removal effectiveness, are as follows: first, the lean-burn engine equipped with SCR; second, the rich-burn engine equipped with NSCR; third, the lean-burn engine with derating; fourth, the lean-burn engine with retard ignition timing; and fifth, the lean-burn engine.

A baseline condition must be established for BACT ranking and economic analysis purposes. The baseline is defined as the uncontrolled rate of the process being reviewed. Therefore, the baseline condition for the control technologies involving stationary reciprocating IC engine would be a conventional rich-burn engine with a NO_x emission level of 11 g/bhp-hr (EPA, 1988d).

Presented in Table 6-3 is the BACT top-down hierarchy of technically feasible NO_x control technologies, their corresponding NO_x emission rates, and their control efficiencies calculated from the baseline emission level. Only control options that result in an NO_x emission rate lower than the proposed lean-burn engine (2.0 g/bhp-hr) are shown in the table. Only these options are evaluated further for BACT.

Table 6–2 Summary of BACT Determinations for NOx Emissions from Gas-fired Reciprocating Engines

Company Name	State	Permit Number	Date of Permit	Engine Specifications: Fuel* Type	Make	Model	Size (Bhp)	NOx Emission Limit**: (g/Bhp-hr)	(lb/hr)	(ppm)	Control Method	Comments
Source Type: Natural Gas Compressor Station												
Northern Natural Gas Company	IA		05-Sep-90	N.G.	Cooper		4,000	1.8	15.9		Lean burn engine	
same as above	IA		05-Sep-90	N.G.	Cooper		2,000	1.8	7.9		Lean burn engine	
National Fuel Gas Supply Corp.	PA	53-329-001	13-Jun-89	N.G.	Cooper	8015JHC2	3,000	2.0	13.2		Lean burn engine	
Natural Gas Pipeline Company	IL	85100014	01-Mar-89	N.G.	Worthington	MLV-10	4,000	9.0	79.4		Design & oper. practice	
Tennessee Gas Pipeline Company	PA	53-339-002	21-Jun-88	N.G.	Cooper	GMVH-10C	2,250	3.0	14.9		Lean burn engine	
Consolidated Gas Transmission Corp.	PA	59-399-008	10-May-88	N.G.	Dresser-Rand	TCV-10	4,200	3.0	27.8		Lean burn engine	Air to fuel ratio is 4.5:1
ANR Production Company	VA	11064	03-Mar-88	N.G.	Caterpiller	G398TAA	600	1.2	1.6		Catalytic converter	N.G. Compressor Sta.
Southern Natural Gas Company	AL	406-0003-X	19-Feb-88	N.G.	Dresser-Rand	TCVD-10	4,160	2.2	20.2		Lean burn engine	Per. cond.: stack test
National Fuel Gas Supply Corp.	PA	53-399-002	01-Feb-88	N.G.	Dresser-Rand	412 KEV-1	2,850	3.0	18.8		Lean burn engine	
Shell California Production Co.	CA	147853	14-Oct-86	N.G.			600	3.2	4.2		SCR	70% reduction
Northern Natural Gas Company	IA		04-Feb-86	N.G.			4,000			250	Engine design	
Consolidated Gas Transmission Corp.	PA	18-399-009	11-Dec-85	N.G.	Cooper	12W-330-C2	6,000	3.0	39.7		Lean burn engine	
Shell California Production	CA	0041-6	02-Dec-85	N.G.	Caterpiller		225	0.805	0.4	50	NSCR, rich burn engine	90% reduction
Source Type: Power Cogeneration and Other Uses												
University of Illinois, Ch. Cir. Camp.	IL	applying	1990	N.G.	Cooper	LSVB-GDC	8,000	1.9	33.5		Lean burn engine	
Northeast Landfill Power	RI	999-1014	12-Dec-89	L.G.	Waukesha	12V-AT25GL	2,400	1.3	6.6		Lean burn engine	High-speed (900 rpm)
Worcester Company	RI	988-990	27-Sep-89	N.G.	Superior	12-SGTB	2,000	1.5	6.6		Lean burn engine	High-speed (900 rpm)
City of Ventura	CA	1379-1	31-Dec-86	D.G.			773	2.0	3.4		Engine design	Digestive gas
State of Utah Natural Resources	UT		01-Sep-86	N.G.			4,630	3.5	36.0		Lean burn engine	Turbocharger ups fuel eff.
Tricounty Sun Energy Sheraton Hotel	CA	1369-1	07-Aug-86	N.G.	Caterpiller		200			50	NSCR, rich burn engine	90% reduction
Genstar Gas Recovery Systems	CA	30970	29-Aug-85	L.G.			2,650	1.5	8.8		Lean burn engine	Landfilled gas
same as above	CA	30893	29-Aug-85	L.G.			1,100	1.5	3.6		Lean burn engine	Landfilled gas
Pacific Lighting Energy	CA	30336	01-Mar-85	N.G.	Superior	16-SGTA	2,650	1.5	8.8		Lean burn engine	High-speed (900 rpm)

* N.G. = Natural Gas; L.G. = Landfilled Gas; and D.G. = Digestive Gas.
** for a single engine.

Table 6-3 BACT "Top-Down" Hierarchy of NOx Control Technologies

BACT Ranking	Technology	Brake Emission Rate (g/bhp-hr)	Annual Emissions (TPY)	Total Emission Reduction (TPY)*	Total Control Efficiency (%)*
First	Lean-burn Engine with SCR	0.4	9.3	245.7	96%
Second	Rich-burn Engine with NSCR	1.1	25.5	229.4	90%
Third	Lean-burn Engine/Derating Power+	1.2	27.8	227.1	89%
Fourth	Lean-burn Engine/Retard Timing	1.7	39.4	215.5	85%
Fifth	Lean-burn Engine	2.0	46.3	208.6	82%
Baseline	Rich-burn Engine	11.0	254.9	----	----

* Total emission reduction and total control effieciency are calculated from baseline emission level.

\+ The range of control effectiveness is dependent on the percent of engine's rated torque. The calculated values are based on 40% NOx reduction at 25% derated power (or at 75% rated torque).

6.3.2 ANALYSIS OF LEAN-BURN ENGINE WITH SCR

Technical Issues

As the most effective NO_x abatement process in terms of removal efficiency, SCR has been a more frequently attempted technology for state-of-the-art reciprocating IC engines. However, the reliability of SCR's performance on reciprocating IC engines has not been consistently demonstrated. Data on sustained NO_x reduction performance for reciprocating IC engines are very limited.

Technical issues involved in the use of SCR are the narrow operating temperature range and the possible damage to the catalyst and downstream equipment. Although the exhaust gas temperature of the proposed Dresser-Rand Model 412-KVSR engine was reported to be within the operating temperature range of the SCR, the temperature of the gas entering the SCR must be monitored. If stack gas reheat is required, this can further complicate an already complicated system consisting of SCR components and ammonia handling system. The use of ammonia as a reactant for the NO_x reduction reactions may allow excess ammonia to form ammonium bisulfate compounds under irregular operating conditions. These compounds can serve as catalyst poisoning agents and also cause damage to metal ductwork downstream. Thus, SCR application requires a strict maintenance service schedule. It is expected that the SCR system may require manual cleaning every 2,000 to 2,500 hours of operation (Steuler, 1990). Cleaning consists of blowing the catalyst surfaces with a compressed air gun and vacuuming any soot.

In California, the South Coast Air Quality Management District (SCAQMD, 1984) reported SCR demonstration tests on seven reciprocating engines. The report indicated that only one SCR system was able to complete the 4,000 hours of continuous testing operation; the other six engine/SCR units failed because of various reasons attributed to either poor catalyst performance and/or problematic ammonia injection operation. A recent survey report by the Gas Research Institute on SCR (GRI, 1990) states:

> A total of 13 SCR units are currently installed on reciprocating engines. Only one unit involves gas transmission. A number of operational problems impacting SCR performance and engine operation have been documented. At least three SCR units applied to reciprocating engines are scheduled to be replaced with alternative controls...

In addition, a review of the BACT determinations made to date on gas-fired reciprocating IC engines (Table 6-2) reveals that SCR has never been applied specifically to any large-bore (i.e., greater than 1,000 bhp) and low-speed (i.e., 300 rpm) lean-burn engine due to the already low NO_x emission rate. The economic consideration is also a significant factor for not using SCR in such applications.

Application of SCR on gas-fired engines has been limited to small-bore, high-speed engines typically less than 1,000 bhp, at 900 rpm or greater (i.e., ANR Production Company's 600-bhp engine, and Shell California Production's 600-bhp engine; see Table 6-2). The only SCR application to a large-bore reciprocating IC engine was reported for Pfizer, Inc.'s cogeneration facility in Massachusetts. This project was for a 6,710-bhp engine with estimated uncontrolled emission rates between 5 and 12 g/bhp-hr for dual-fuel (94 percent natural gas, 6 percent diesel) and diesel fuel, respectively (see Appendix A). However, Pfizer's engine is different than FGTC's proposed engine in both fuel-type and application. Furthermore, the reliability of Pfizer's operation is still in question pending its performance verification based on upcoming stack testing.

The most recent PSD permit for a reciprocating IC engine used in natural gas compression application was issued on September 5, 1990. This permit was issued to Northern Natural Gas Company for a gas-fired 4,000-bhp gas compressor engine in Iowa. It was determined by the permitting agency, the Iowa Department of Natural Resources (IDNR), that "application of SCR systems to the engine as applied for would represent a transfer of technology since none are known to be operational." They further found such "technology transfer to be unreliable at best with a high percentage of down time likely." Therefore, SCR was rejected as BACT by IDNR due to its uncertain reliability.

Environmental Effects

The add-on SCR technology for NO_x control will pose other potential adverse environmental impacts such as accidental spills and emissions of ammonia, and solid waste disposal for the non-inert spent catalyst. These issues are briefly described in the following discussion.

The SCR system requires the use of ammonia as reagent to convert NO_x to nitrogen gas and water. The main environmental impact centers around the issue of delivery, handling, and storage of ammonia, which poses inherent safety and health risks in the event of accidental releases. In proposing NO_x abatement regulations for stationary gas turbines, California's South Coast Air Quality Management District (SCAQMD) has performed a risk assessment study on spill handling and storage of ammonia. The study has concluded that this aspect of SCR operation could realistically present serious consequences, and recommended further consideration of potential impacts and mitigation measures (SCAQMD, 1979). The current practice is to use an aqueous ammonia system (normally between 25 to 29 percent ammonia concentration) at installations located in populated areas. However, such practice increases the complexity, size, and the cost of the ammonia system. Furthermore, ammonia slippage is a normal occurrence during operation of SCR control equipment. NO_x abatement system suppliers generally report an ammonia slippage level of 10 ppm.

Spent catalysts of the metal oxides pellet-type system must be disposed of properly. Ceramic-based honeycomb-shaped catalysts can be landfilled due to the inert intrinsic properties of ceramic materials.

Energy Requirements and Impacts

The add-on technology of SCR may impose further energy penalties. The additional energy requirements are caused by power loss due to additional back pressure from the SCR and electrical requirements for heating the ammonia solution and operating the injection system. Power loss caused by back pressure is small in this case. The operation of the ammonia vaporizer and injection system requires an addition of 5.1 megawatt-hours per year. However, using the lean-burn engine will result in better fuel economy than the baseline rich-burn engine. The heat input saving amounts to 1.68 MMBtu/hr or 14,717 MMBtu/yr.

Economic Analysis

This section presents the total capital investment (TCI) and the annualized cost (AC) of the SCR NO_x control system for the proposed lean-burn engine. The analysis uses the cost of the conventional rich-burn engine as the baseline cost. The detailed economic analysis procedure is given in Appendix B.

Capital and annualized cost estimates were prepared for two SCR systems:

1. Kleenaire system from Nitrogen Nergas Corporation, which uses the metal oxide-based catalyst and can achieve an 80 percent NO_x reduction on the proposed lean-burn engine; and
2. Engelhard NO_x abatement system which uses the all-ceramic honeycomb catalyst and can achieve an NO_x reduction efficiency of 80 percent on the proposed lean-burn engine.

Capital costs for both systems are tabulated in Table 6-4. In the purchased equipment costs for both SCR systems, the differential engine cost of $50,000 (i.e., Item 1a in Table 6-4) is added to account for the extra cost of the lean-burn engine. The vendor's equipment quote for the Kleenaire system is $137,000. The direct capital cost of the system is calculated to be $381,905, and the indirect capital cost is calculated to be $216,066. The total capital investment is $597,971. The basic equipment cost for the Engelhard System is $168,000. Direct capital cost is $443,635 and the indirect capital cost is $247,145 for a total capital investment of $690,780.

Table 6-4 Capital Cost Estimates for SCR Systems for NOx Emission Control

Cost Items	Cost Factors	Costs Kleenaire System+	 Engelhard System++
DIRECT CAPITAL COSTS (DCC):			
(1) Purchased Equipment			
(a) Differential Engine Cost	See Note 1	$50,000	$50,000
(b) SCR Basic Equipment	Vendor Quote	$137,000	$168,000
(c) Ammonia System	See Note 2	$13,000	$13,000
(d) Auxiliary Equipment (Reheat)	See Note 3	$0	$0
(e) Emission Monitoring	0.15 x (1b)	$20,550	$25,200
(f) Structure Support	0.10 x (1a-1e)	$22,055	$25,620
(g) Instrumentation & controls[1]	0.10 x (1a-1e)	$22,055	$25,620
(h) Freight[1]	0.05 x (1a-1g)	$13,233	$15,372
(i) Sales Tax (Florida)	0.06 x (1a-1g)	$15,880	$18,446
(j) Subtotal	(1a-1i)	$293,773	$341,258
(2) Direct Installation[1]	0.30 x (1j)	$88,132	$102,377
Total DCC:	(1) + (2)	$381,905	$443,635
INDIRECT CAPITAL COSTS (ICC):			
(3) Indirect Installation			
(a) Engineering & Supervision[1]	0.10 x (DCC)	$38,191	$44,364
(b) Construction & Field Expenses[1]	0.05 x (DCC)	$19,095	$22,182
(c) Contruction Contractor Fee[1]	0.10 x (DCC)	$38,191	$44,364
(d) Contigencies[2]	0.25 x (DCC)	$95,476	$110,909
(4) Other Indirect Costs			
(a) Startup & Testing[1]	0.03 x (DCC)	$11,457	$13,309
(b) Working Capital	30-day DOC*	$13,656	$12,017
Total ICC:	(3) + (4)	$216,066	$247,145
TOTAL CAPITAL INVESTMENT (TCI):	DCC + ICC	$597,971	$690,780

\+ Represents a typical first generation catalyst which is metal oxides embeded in ceramic matrix.

++ Represents second generation all ceramic catalyst extruded into honeycomb-shape.

* 30 days of direct operating costs, calculated from the annualized cost Table 6-5 (i.e., total DOC/12 months).

[1] Based on catalytic incinerators, from OAQPS Control Cost Manual, Fourth Edition.

[2] Guaranteed efficiency and operation for the installation of SCR on large-bore and low-speed lean-burn engine. Such application is not considered as well-proven technology.

Note 1: Differential engine cost is calculated from vendor's price quotation for a lean-burn engine minus vendor's price quotation for the rich-burn engine being used as baseline.

Note 2: Ammonia vendor's quotation from LaRoche Industries, Inc. for a 2,000-gallon anhydrous ammonia tank, an ammonia evaporator, and a dual-valve pressure regulator.

Note 3: Stack gas reheat is not required for the proposed Dresser-Rand 412-KVSR Model because of the 695°F temperature in the exhaust gas from the engine. The 695°F is within the operating temperature range of SCR device.

The annualized costs for these two NO_x abatement systems are given in Table 6-5. The calculation basis for cost items are also given in the table. The annualized costs are $377,131 and $378,129 for the Kleenaire system and the Engelhard system, respectively. Current application trend favors the use of the all-ceramic system due to its advantages of higher removal rates and more reliable catalyst component. In general, the all-ceramic catalyst system is considered the better system since it is less susceptible to catalyst damage and results in less operating costs. Therefore, subsequent economic cost effectiveness analysis uses the cost values computed for the Engelhard system.

6.3.3 ANALYSIS OF RICH-BURN ENGINE WITH NSCR

Technical Issues

Rich-burn engines operate at near stoichiometric air-to-fuel ratios and, therefore, generate high engine cylinder temperatures in the range of 1,200°F to 1,300°F. Engine manufacturers have found that such high temperatures do not allow loading the engine very high. For greater power output, engine manufacturers have found that engine modifications (i.e., turbocharged engines which can produce more power enhancements with lower emission levels) are the better choice than building larger engine blocks. In the current U.S. market, rich-burn engines over 2,000 bhp are not standard off-the-shelf items; however, a 2,400-bhp engine can be obtained by special order.

All known rich-burn engine/NSCR combination applications are found for small engines of approximately 1,000 bhp or less (i.e., a 600-bhp engine for ANR Production Company, Virginia; a 225-bhp engine for Shell California Production, California; and a 200-bhp engine for Tricounty Sheraton Hotel, California; see Table 6-2).

A significant technical consideration in the use of the rich-burn engine with NSCR is the NSCR's effect upon maintenance, operation, and reliability of the overall system. Any add-on technology requires substantially more maintenance, controls, monitors, and operating personnel compared to a

Table 6-5 Annualized Cost Estimates for SCR Systems for NOx Emission Control

Cost Items	Basis	Costs: Kleenair System+	Costs: Engelhard System++
DIRECT OPERATING COSTS (DOC):			
(1) Operating Labor			
Operator[2]	5,840 hr/yr @ $20/hr	$116,800	$116,800
Supervisor[1]	15% of operator cost	$17,520	$17,520
(2) Maintenance[2]	5% of direct capital cost	$19,095	$22,182
(3) Replacement Parts (include freight & tax)			
(a) Catalyst	(Part+Labor)xCRF; See Note 1	$31,507	$13,297
(b) Guard Bed	(Part+Labor)xCRF; See Note 2	$4,544	$0
(4) Utilities			
(a) Electricity	0.30 MW-hr/ton NH3; $85/MW-hr	$437	$437
(b) Fuel for stack reheat	See Note 3	$0	$0
(c) Fuel credit	$2.06/MMBtu; See Note 4	-$30,317	-$30,317
(5) Ammonia	0.37 lb NH3/lb NOx; $250/ton NH3	$4,287	$4,287
Total DOC		$163,873	$144,206
INDIRECT OPERATING COSTS (IOC):			
(7) Overhead[1]	60% of operating labor & maintenance	$92,049	$93,901
(8) Property Taxes[1]	1% of total capital investment	$5,980	$6,908
(9) Insurance[1]	1% of total capital investment	$5,980	$6,908
(10) Administration[1]	2% of total capital investment	$11,959	$13,816
Total IOC		$115,968	$121,533
CAPITAL RECOVERY COST (CRC)	CRF of 0.1627 times TCI	$97,290	$112,390
ANNUALIZED COST (AC):	DOC + IOC + CRC	$377,131	$378,129

\+ Represents a typical first generation catalyst which is metal oxides embeded in ceramic matrix.

++ Represents second generation all ceramic catalyst extruded in honeycomb shape.

[1] Based on catalytic incinerators, from OAQPS Control Cost Manual, Fourth Edition.

[2] Based on no existing installation of SCR on large-bore and low-speed lean-burn engine: 5.33 hours per shift are devoted to the emission control system operation and maintenance.

Note 1: Catalyst replacement part cost for the Kleenair System is $69,870 with a service life of 3 years. Catalyst replacement part cost for the Engelhard system is $29,070 with a service life of 3 years. Combined freight and tax factor is 11%; and CRF for a 3-year recovery period and 10% interest rate is 0.4021. Replacement labor cost is $50 per hour for two 8-hour days. Total cost includes both material and labor costs.

Note 2: The Kleenair system includes a guard bed which works as a pre-filter upstream from the metal oxides catalyst; the replacement part cost is $10,000 with an estimated service life of 3 years. Required labor is for 4 hours.

Note 3: Fuel for stack gas reheat is not required, see Note 3 of Table 6-4.

Note 4: Heat input for lean-burn engine is calculated from 7,300 Btu/bhp-hr times 2,400 bhp = 17.52 MMBtu/hr.
Heat input for rich-burn, naturally aspirated engine is calculated from 8,000 Btu/bhp-hr times 2,400 bhp = 19.20 MMBtu/hr.
Therefore, using a better fuel efficient engine results in saving an annual heat input of:
(19.20 - 17.52) MMBtu/hr x 8,760 hr/yr = 14,717 MMBtu/yr.

system without add-on technology (i.e., lean-burn engine). The system will have a much greater frequency of downtime and malfunctioning such that the system will have far less operating reliability. Reliability is an extremely important consideration for a compressor station engine, which must be operated nearly continuously throughout the year and usually is located in a remote area.

Environmental Effects

Catalyst disposal may be required when using NSCR, depending on the catalyst type. Most vendors guarantee a service life of 3 years for the catalyst system. Environmental impacts are expected to be minimal for the rich-burn engine/NSCR option since no toxic or hazardous reagents are required. Rich-burn/NSCR technology generally produces lower CO and VOC emissions as compared to a lean-burn engine.

Energy Requirements and Impacts

The NSCR converter does not require any additional fuel other than a small amount of hydrocarbon fuel used for injection into the exhaust gas mixture to ensure fuel rich conditions. However, the fuel economy of the rich-burn, naturally aspirated engine is approximately 8,000 Btu/bhp-hr (EPA, 1979) compared to the 7,300 Btu/bhp-hr for the proposed lean-burn engine. For a 2,400-bhp output, an additional 1.68 MMBtu/hr heat input is required, or approximately 14,717 MMBtu per year for an annual cost of $30,317.

Economic Analysis

Capital and annualized cost estimates were prepared for a NSCR converter. Cost of the NSCR converter was provided by Johnson-Matthey as $48,000. The NSCR can achieve 90 percent NO_x reduction. The resulting NO_x emission rate is 1.1 g/bhp-hr.

The total capital investment cost for a NSCR converter designed for a 2,400-bhp rich-burn engine is tabulated in Table 6-6. The direct capital cost is calculated to be $95,584, and the indirect capital cost is calculated to be $58,453. The total capital investment is $154,037. Also

Table 6–6 Capital Cost Estimates for Lean-burn Engine and Rich-burn Engine/NSCR System.

Cost Items	Cost Factors	Costs: Lean-Burn Engine	Costs: Johnson-Matthey NSCR System
DIRECT CAPITAL COSTS (DCC):			
(1) Purchased Equipment			
(a) Differential Engine Cost	See Note 1	$50,000	$0
(b) NSCR Converter	Vendor Quote	$0	$48,000
(c) Emission Monitoring	0.15 x (1b)	$0	$7,200
(d) Structural Support	0.10 x (1b-1c)	$0	$5,520
(e) Instrumentation[1]	0.10 x (1a-1c)	$5,000	$5,520
(f) Freight[1]	0.05 x (1a-1e)	$2,750	$3,312
(g) Sales Tax (Florida)	0.06 x (1a-1e)	$3,300	$3,974
(h) Subtotal	(1a-1g)	$61,050	$73,526
(2) Direct Installation[1]	0.30 x (1h)	$18,315	$22,058
Total DCC:	(1) + (2)	$79,365	$95,584
INDIRECT CAPITAL COSTS (ICC):			
(3) Indirect Installation			
(a) Engineering & Supervision[1]	0.10 x (DCC)	$7,937	$9,558
(b) Construction & Field Expenses[1]	0.05 x (DCC)	$3,968	$4,779
(c) Contruction Contractor Fee[1]	0.10 x (DCC)	$7,937	$9,558
(d) Contigencies	See Note 2	$11,905	$23,896
(4) Other Indirect Costs			
(a) Startup & Testing[1]	0.03 x (DCC)	$2,381	$2,868
(b) Working Capital	30-day DOC*	$0	$7,794
Total ICC:	(3) + (4)	$34,128	$58,453
TOTAL CAPITAL INVESTMENT (TCI):	DCC + ICC	$113,493	$154,037

* 30 days of direct operating costs, calculated from the annualized cost Table 6-7 (i.e., total DOC/12 months).

[1] Based on catalytic incinerators, from OAQPS Control Cost Manual, Fourth Edition.

Note 1: Differential engine cost is calculated from vendor's price quotation for a lean-burn engine minus vendor's price quotation for the rich-burn engine being designated as baseline.

Note 2: For lean-burn engine, 15 percent of DCC is used for a guaranteed efficiency and operation. For NSCR application, 25 percent of DCC is used for contigency based on no existing installtion of NSCR on large-bore rich-burn engine.

shown in the table is the differential cost of the lean-burn engine over that of the baseline rich-burn engine.

The annualized cost for the NSCR converter is given in Table 6-7. The calculation basis for cost items are also given in the table. The resulting annualized cost is $167,910. In comparison, the annualized differential cost of the lean-burn engine itself is -$963. As computed from Table 6-7, this negative value of the annualized cost for the lean-burn engine resulted from the fuel credit generated by using the proposed fuel-efficient engine.

6.3.4 ANALYSIS OF LEAN-BURN ENGINE WITH DERATING POWER OUTPUT

Technical Issues

Derating power output does not require additional equipment. Derating is accomplished by restricting the engine torque to a level below its normal operating design rate. This is done by making adjustment to the throttle valve setting in order to change the power output. Although a derated engine produces less NO_x emissions, such practice will also reduce the overall engine's efficiency and shorten its service life as much as 25 percent (Dresser-Rand, 1990). In addition, continuous derating operation would require a bigger, more expensive engine to meet the overall power requirement.

Derating power output is not considered BACT for the proposed lean-burn engine because of potential engine reliability problems, shortened engine life, and increased emissions of CO and hydrocarbons.

Environmental Effects

Application of this technology would result in lower NO_x emissions, but emissions of carbon monoxide (CO) and hydrocarbons would increase. For instance, Dresser-Rand Company has reported a 19.7 TPY emission reduction of NO_x with the corresponding emission increases of 16.2 TPY of CO and 243.3 TPY of total hydrocarbons based on a 30 percent derating of the proposed 2,400-bhp lean-burn engine.

Table 6-7 Annualized Cost Estimates for Lean-Burn Engine and Rich-Burn/NSCR System

Cost Items	Basis	Costs: Lean-Burn Engine	Costs: Johnson-Matthey NSCR System
DIRECT OPERATING COSTS (DOC):			
(1) Operating Labor			
Operator[2]	$20/hr (2,920 hr/yr for NSCR)	$0	$58,400
Supervisor[1]	15% of operator cost	$0	$8,760
(2) Maintenance[2]	5% of direct capital cost	$3,968	$4,779
(3) Replacement Parts (include freight & tax)			
Catalyst	(Part+Labor)xCRF; See Note 1	$0	$21,585
(4) Fuel			
Fuel credit (gas)	$2.06/MMBtu; See Note 2	-$30,317	$0
Total DOC		-$26,349	$93,524
INDIRECT OPERATING COSTS (IOC):			
(7) Overhead[1]	60% of operating labor & maintenance	$2,381	$43,163
(8) Property Taxes[1]	1% of total capital investment	$1,135	$1,540
(9) Insurance[1]	1% of total capital investment	$1,135	$1,540
(10) Administration[1]	2% of total capital investment	$2,270	$3,081
Total IOC		$6,921	$49,324
CAPITAL RECOVERY COST (CRC)	CRF of 0.1627 times TCI	$18,465	$25,062
ANNUALIZED COST (AC):	DOC + IOC + CRC	-$963	$167,910

[1] Based on catalytic incinerators, from OAQPS Control Cost Manual, Fourth Edition.

[2] Based on no existing installation of NSCR on high-load rich-burn engine: 2.667 hours per shift are devoted to the emission control system operation and maintenance.

Note 1: For NSCR, the catalyst accounts for 95% of the basic cost and has a service life of 3 year; therefore, catalyst replacement part cost is $48,000 times 0.95 plus 11% for the combined freight and tax cost. Replacement labor cost is $50 per hour for one 8-hour day. Total cost includes both material and labor costs. Thus, the annualized catalyst replacement cost is equal to the total replacement cost multiplied by the CRF for a 3-year recovery period and an interest rate of 10%. CRF = 0.4021.

Note 2: Heat input for lean-burn engine is calculated from 7,300 Btu/bhp-hr times 2,400 bhp = 17.25 MMBtu/hr. Heat input for rich-burn engine is calculated from 8,000 Btu/bhp-hr times 2,400 bhp = 19.20 MMBtu/hr. Therefore, using a better fuel efficient engine results in saving an annual heat input of: (19.20 - 17.25) MMBtu/hr x 8,760 hr/yr = 14,717 MMBtu/yr.

Energy Requirements and Impacts

In general, derating an engine will result in less fuel economy. EPA (1979) reported a fuel penalty of 8 percent based on derating power output on a dual-fuel engine by 25 percent. Manufacturers of gas-fired reciprocating engines state that approximately an 8 percent increase in fuel consumption will occur for a derating of 30 percent.

Economic Analysis

If derating is employed, a larger engine would be necessary to meet the FGTC power requirement of 2,400 bhp at Compressor Station No. 17. This will increase both the capital cost and annual operating cost for the engine. A detailed economic analysis was not performed for this technology.

6.3.5 ANALYSIS OF LEAN-BURN ENGINE WITH RETARD IGNITION TIMING

Technical Issues

EPA's research (1979) has reported that retard ignition timing is only effective for dual-fuel and diesel fuel burning engines. Retarding the spark for lean-burn engines will result in misfiring because spark-ignited engines are designed to be sensitive to any small deviation in timing changes. The summary of previous BACT determinations (Appendix A) shows that all ignition timing changes were exclusively applied to diesel burning reciprocating IC engines.

Ignition timing retardation increases exhaust temperatures above the engine's normal operating temperature. The increased engine operating temperature will result in additional maintenance, shorter engine life, and higher initial cost for high temperature exhaust components. Thus, retarding ignition timing for a lean-burn engine is not considered further.

Environmental Effects

Retarding ignition timing can increase the emission level of CO and VOC. This is due to less efficient combustion as the engine timing is changed from the optimal setting. In the event of misfiring, unburned hydrocarbons and CO emissions may increase significantly.

Energy Requirements and Impacts

Not performed--inapplicable technology.

Economic Analysis

Not performed--inapplicable technology. The expected capital cost is equal to the cost of the lean-burn engine since the low NO_x technology differs only in terms of operating practice.

6.3.6 ANALYSIS OF LEAN-BURN ENGINE

Technical Issues

The proposed turbocharged reciprocating IC engine will operate according to the manufacturer's specified operating parameters listed in Table 6-8. The engine's state-of-the-art design includes small pre-ignition chambers in which a rich fuel mixture is spark-ignited. The hot gases then enter the main combustion chambers and create spontaneous combustion of the lean fuel mixture. As a result, the overall combustion process is conducted under very lean fuel conditions. Operations on the lean side of the air-to-fuel ratio allow the proposed engine to obtain peak fuel economy.

In general, NO_x formation is directly proportional to the combustion temperature and residence time of the combustion gases (EPA, 1988d). The high mass flow rate at full-load, as indicated by the 29,622 pounds per hour of exhaust mass flow rate, reduces the residence time of the combustion gases compared to a rich-burn engine, which operates at an air-to-fuel ratio near unity. High mass flow rate also means the engine operates below the peak temperature region for thermal NO_x formation. The exhaust temperature for the proposed engine is 695°F, which is lower than the exhaust temperature of between 1,200°F and 1,300°F for an equivalent rich-burn engine. Thus, the rate of thermal NO_x formation is lower compared to the conventional rich-burn engine (i.e., 2 g/bhp-hr compared to 11 g/bhp-hr, respectively).

Table 6–8 Summary of the Operating Parameters for the Proposed Engine, Station No. 17

Parameter	Design Specification
Make and Model	Dresser-Rand 412-KVSR
Air/Fuel Ratio	35.04
Exhaust Mass Flow	29,622 lb/hr
Ignition Timing	14 °BTDC
Air Manifold Pressure	23.95 psia
Air Ambient Air Temperature	100 °F
Exhaust Temperature	695 °F
Maximum Allowed Back Pressure	5 inches of water
Specific Fuel Consumption	7,300 Btu/bhp-hr

Source: Dresser-Rand Company (1990).

The lean-burn engine-compressor has become the most effective method of transporting natural gas in a pipeline system judging by recent construction permits issued by several states (see Page 1 of Appendix A). The engine itself is very reliable and durable in continuous operation without requiring excessive maintenance attention as would be required in the case of additional add-on control technology.

Environmental Effects

There are no adverse environmental impacts expected for using the lean-burn engine, since there is no wastewater or solid waste created.

Energy Requirements and Impacts

The lean-burn engine is more fuel efficient than a comparable rich-burn engine. The fuel saved is 1.68 MMBtu/hr, for a total savings of 14,717 MMBtu/yr.

Economic Analysis

Capital and annualized cost estimates were prepared for the lean-burn engine. The differential engine cost of the lean-burn engine compared to the baseline rich-burn engine was provided by ENRON for the proposed 2,400-bhp Dresser-Rand 412-KVSR model. The engine has a guaranteed NO_x emission limit of 2 g/bhp-hr.

The differential capital cost of the integral engine-compressor unit is tabulated in Table 6-6. The differential engine cost for the Dresser-Rand engine is $50,000, from which the differential direct capital cost is calculated to be $79,365, and the indirect capital cost is calculated to be $34,128. The differential total capital investment is $113,493.

The annualized cost is given in Table 6-7. The calculation basis for cost items is also given. The direct operating cost consists of normal maintenance cost of the lean-burn technology parts for $3,968 and a fuel credit of $30,317 for better fuel efficiency operation. The differential annualized cost is -$963 for the lean-burn engine.

6.4 BACT SUMMARY AND CONCLUSION

The BACT analysis for NO_x control has identified three feasible control alternatives: the lean-burn engine with SCR, the rich-burn engine with NSCR, and the lean-burn engine. Elimination of a control technology as BACT will be based on comparison of the overall environmental, energy, and economic impacts. The most effective control alternative not eliminated will be selected as BACT.

6.4.1 COMPARISON OF TECHNICAL ISSUES

Of the three alternatives, the lean-burn engine is the most reliable option for pipeline transmission application. SCR and NSCR require significant routine maintenance and scheduled downtime for replacement service but also may cause unscheduled downtime because of malfunction or failure of SCR/NSCR components. Conversely, the lean-burn engine is highly reliable and requires low maintenance over unattended continuous operation. The lean-burn engine also has the capability of operating under variable load conditions. Since most compressor stations are located in rural areas, the lean-burn engine by itself without any add-on control device is most suitable for such operation.

6.4.2 COMPARISON OF ENVIRONMENTAL EFFECTS

Of the three alternatives, SCR poses the greatest potential for toxic impacts due to ammonia handling and storage, and ammonia slip. Comparing potential adverse environmental impacts: the lean-burn engine with SCR option is the worst due to potential ammonia release and disposal of catalysts; the rich-burn engine with NSCR is the next worse option due to disposal of catalyst. The lean-burn engine does not create any waste; therefore, it is the best alternative in terms of the environmental impact analysis.

6.4.3 COMPARISON OF ENERGY IMPACTS

The lean-burn engine equipped with SCR shows a fuel credit of 14,717 MMBtu/yr for using the fuel-efficient lean-burn engine. In addition, an annual 5.1 MW-hr of electrical power is required for the ammonia vaporizer and injection system. The highest energy requirement is for the rich-burn/NSCR combination. This alternative does not use any additional fuel or energy for operation of the control device. However, the rich-burn engine is less fuel efficient than the proposed lean-burn engine, making the rich-burn engine/NSCR option the worst ranking in terms of energy impacts. The lean-burn engine shows a savings of 14,717 MMBtu/yr in heat input over the rich-burn engine because of its inherent fuel efficient design, and no additional fuel is required. Thus, the lean-burn engine is the best alternative in view of the energy impact analysis.

6.4.4 COMPARISON OF ECONOMIC ANALYSIS

Economic analysis is based on the cost effectiveness of the control method. Economic impact is determined by the total and incremental cost effectiveness values. The detailed cost estimating procedure is presented in Appendix B. Results of the economic impact analysis are summarized in Table 6-9 for all three technically feasible NO_x control methods. Comparing the total cost effectiveness of these three NO_x control alternatives: the lean-burn engine/SCR technology has the highest cost effectiveness value of $1,539 per ton of NO_x removed; the rich-burn engine/NSCR technology is the next highest with $732 per ton of NO_x removed. The lean-burn engine has a total cost effectiveness value of -$5 per ton of NO_x removed.

The incremental cost effectiveness values for the lean-burn engine/SCR technology and the rich-burn engine/NSCR technology are $12,897 and $8,119 per ton of NO_x removed, respectively. The lean-burn engine has an incremental cost effectiveness of -$5 per ton of NO_x removed. Therefore, the lean-burn engine is the most cost effective control option.

Table 6-9 Summary of Top-Down BACT Impact Analysis Results for NOx.

Control Alternative	Total Emission Reduction (TPY)*	Incremental Emission Reduction (TPY)**	Environmental Impacts		Energy Impacts Incremental increase over baseline		Economic Impacts			
			Potential toxic air impact?	Potential adverse enviromental impacts?	Natural gas (MMBtu/yr)	Electricity (MW-hr/yr)	Total Annualized Cost ($/yr)	Incremental Annualized Cost ($/yr)	Total Cost Effectiveness ($/ton)	Incremental Cost Effectiveness ($/ton)
Lean-Burn Engine with SCR	245.7	16.3	Yes	Yes	-14,717	5.1	$378,129	$210,219	$1,539	$12,897
Rich-Burn Engine with NSCR	229.4	20.8	No	Yes	0	0	$167,910	$168,873	$732	$8,119
Lean-Burn Engine	208.6	208.6	No	No	-14,717	0	-$963	-$963	-$5	-$5
Baseline (rich-burn engine)	----	----	--	--	----	--	----	----	----	----

* Total emission reduction, total annualized cost, and total cost effectiveness are calculated based on similar baseline parameter values.

** Incremental values are based on the next lower control technology's parameter values.

KBN Engineering and Applied Sciences, Inc. (1990).

6.4.5 SUMMARY AND CONCLUSION

The top-down BACT analysis in terms of environmental, energy and economic impacts for the FGTC's proposed project is summarized in Table 6-9. Both the lean-burn engine/SCR and the rich-burn engine/NSCR control options are eliminated primarily based on the high total and incremental cost effectiveness for NO_x control. Recently, FDER has determined that incremental cost effectiveness values of \$4,000 to \$5,000 per ton of NO_x removed are unreasonable. These values were established for much larger sources of NO_x, such as utility gas turbine combined-cycle projects. In addition, add-on control technologies have significant energy penalties along with potential adverse environmental impacts, and these systems are not fully proven on IC engines of the size proposed by FGTC. On the other hand, lean-burn engines are the proven method for pipeline transmission application in which minimum maintenance and unattended operation are essential. Currently, lean-burn engines are the state-of-the-art application of reciprocating IC engines capable of achieving low emission without add-on control.

By eliminating lean-burn/SCR and rich-burn/NSCR options, the lean-burn engine is BACT. This is consistent with current BACT determinations shown in Table 6-2 for similar source applications. In the most recent top-down BACT analysis, IDNR has concluded that the inherently low NO_x emitting lean-burn engine is BACT for Northern Natural Gas Company. In its BACT summary, IDNR rejected SCR on the grounds of uncertain reliability and unreasonable cost effectiveness (i.e., total cost effectiveness of \$1,600 and incremental cost effectiveness of \$12,000 per ton NO_x removed).

No other stationary internal combustion sources, whether in natural-gas-related applications or other industrial processes, which use similar fuel and equivalent engines (i.e., natural-gas-fired and 2,400-bhp lean-burn engine) have been required to bear a high incremental cost effectiveness to reduce NO_x emissions. Furthermore, the FGTC's proposed lean-burn engine has low NO_x emissions of 46.3 TPY, and modeling results show an insignificant NO_x impact (less than 1.0 $\mu g/m^3$). In conclusion, the FGTC's proposed Dresser-Rand 412-KVSR lean-burn engine is BACT.

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APPENDIX A

Appendix A Summary of BACT Determinations for NOx Emissions from Stationary Reciprocating Engines (page 1 of 2).

Company Name	State	Permit Number	Date of Permit	Total Capacity	Engine Specifications: Fuel Type	Make	Model	Load (Bhp)	NOx Emission Limit*: (g/Bhp-hr)	(lb/hr)	(ppm)	Control Method	Comments
Source Type: Natural Gas Compressor Station													
Northern Natural Gas Company	IA		05-Sep-90	4,000 Bhp	N.G.	Cooper		4,000	1.8	15.9		Lean burn engine	
same as above	IA		05-Sep-90	4,000 Bhp	N.G.	Cooper		2,000	1.8	7.9		Lean burn engine	
National Fuel Gas Supply Corp.	PA	53-329-001	13-Jun-89	6,000 Bhp	N.G.	Cooper	8015JHC2	3,000	2.0	13.2		Lean burn engine	
Natural Gas Pipeline Company	IL	85100014	01-Mar-89	1,600 Bhp	N.G.	Worthington	MLV-10	4,000	9.0	79.4		Design & oper. practice	
Tennessee Gas Pipeline Company	PA	53-339-002	21-Jun-88	2,250 Bhp	N.G.	Cooper	GMVH-10C	2,250	3.0	14.9		Lean burn engine	
Consolidated Gas Transmission Corp.	PA	59-399-008	10-May-88	8,400 Bhp	N.G.	Dresser-Rand	TCV-10	4,200	3.0	27.8		Lean burn engine	Air to fuel ratio is 4.5:1
ANR Production Company	VA	11064	03-Mar-88	1,800 Bhp	N.G.	Caterpiller	G398TAA	600	1.2	1.6		Catalytic converter	N.G. Compressor Sta.
Southern Natural Gas Company	AL	406-0003-X0	19-Feb-88	4,160 Bhp	N.G.	Dresser-Rand	TCVD-10	4,160	2.2	20.2		Lean burn engine	Per. cond.: stack test
National Fuel Gas Supply Corp.	PA	53-399-002	01-Feb-88	2,850 Bhp	N.G.	Dresser-Rand	412 KEV-1	2,850	3.0	18.8		Lean burn engine	
Shell California Production Co.	CA	147853	14-Oct-86	600 Bhp				600	3.2	4.2		SCR	70% reduction
Northern Natural Gas Company	IA		04-Feb-86	8,000 Bhp	N.G.			4,000			250	Engine design	
Consolidated Gas Transmission Corp.	PA	18-399-009	11-Dec-85	6,000 Bhp	N.G.	Cooper	12W-330-C2	6,000	3.0	39.7		Lean burn engine	
Shell California Production	CA	0041-6	02-Dec-85	225 Bhp	N.G.	Caterpiller		225	0.805	0.4	50	NSCR, rich burn engine	90% reduction

* for a single engine.
N.G. = Natural Gas.

Appendix A Summary of BACT Determinations for NOx Emissions from Stationary Reciprocating Engines (page 2 of 2).

Company Name	State	Permit Number	Date of Permit	Total Capacity	Engine Specifications: Fuel Type	Make	Model	Load (Bhp)	NOx Emission Limit* (g/Bhp-hr)	(lb/hr)	(ppm)	Control Method	Comments
Source Type: Power Cogeneration and Other Uses													
University of Illinois, Ch. Cir. Camp.	IL	applying	1990	16,000 Bhp	N.G.	Cooper	LSVB-GDC	8,000	1.9	33.5		Lean burn engine	
Northeast Landfill Power	RI	999-1014	12-Dec-89	19,200 Bhp	L.G.	Waukesha	12V-AT25GL	2,400	1.3	6.6		Lean burn engine	High-speed (900 rpm)
Pfizer, Inc.	MA	B-87-C-006	16-Nov-89	6,710 Bhp	Dual/Diesel	Cooper	LSVB-16-GDT	6,710	0.7	10.1		SCR	90% reduction
Cogentrix (formerly Xiox)	PA	33-399-004	31-Oct-89	20,904 Bhp	Dual	Wartsila	18V32GD	6,968	5.0	76.8		Engine retardation	
Worcester Company	RI	988-990	27-Sep-89	6,000 Bhp	N.G.	Superior	12-SGTB	2,000	1.5	6.6		Lean burn engine	High-speed (900 rpm)
Citizens Utilities	HI	HI 88-04	19-Sep-89	42,000 Bhp	Diesel			10,500			605	Engine design	
Key West Electric System	FL	PSD-FL-135	05-Jun-89	26,532 Bhp	Diesel			13,266	6.0	175.5		Engine timing retard	
Maui Electric Company, Inc.	HI	HI 87-01	30-Dec-88	33,400 Bhp	Diesel			16,700	7.0	256.1	595	5° ignition retard	20% reduction
Power Ventures	FL	PSD-FL-120	05-Dec-88	8,800 Bhp	Dual	Undetermined			5.0			Engine design	
same as above	FL	PSD-FL-120	05-Dec-88	8,800 Bhp	Diesel	Undetermined			12.0			Engine design	
Maui Pineapple Co., Ltd.	HI	HI 87-02	17-May-88	4,020 Bhp	Diesel			2,010	5.2	23.0	536	2° ignition retard	
same as above	HI	HI 87-02	17-May-88	6,040 Bhp	Diesel			3,020	5.3	35.0	520	2° ignition retard	
Maui Electric Company, Inc.	HI	HI 86-02	17-Nov-87	6,700 Bhp	Diesel			3,350	9.3	68.4	600	4° ignition retard	20% reduction
Hawaii Electric Light Co., Inc.	HI	HI 85-03	17-Nov-87	10,050 Bhp	Diesel			3,350	9.3	68.4	600	4° engine retard	20% reduction
City of Ventura	CA	1379-1	31-Dec-86	773 Bhp	D.G.			773	2.0	3.4		Engine design	Digestive gas
State of Utah Natural Resources	UT		01-Sep-86	18,000 Bhp	N.G.			4,630	3.5	36.0		Lean burn engine	Turbocharger ups fuel eff.
Tricounty Sun Energy Sheraton Hotel	CA	1369-1	07-Aug-86	200 Bhp	N.G.	Caterpiller		200			50	NSCR, rich burn engine	90% reduction
LaJet Energy Company	CA	85096	17-Jul-86	1,385 Bhp	Diesel	Cummins	KTTA-50CC	1,385	5.4	16.5		Engine design	
3M	TX	PSD-TX-674	30-May-86	8,386 Bhp	Dual	Cooper	LSVG-20-GDT	8,386	5.0	92.4		Engine design	
Genstar Gas Recovery Systems	CA	30970	29-Aug-85	2,650 Bhp	L.G.			2,650	1.5	8.8		Lean burn engine	Landfilled gas
same as above	CA	30893	29-Aug-85	1,100 Bhp	L.G.			1,100	1.5	3.6		Lean burn engine	Landfilled gas
Pacific Lighting Energy	CA	30336	01-Mar-85	2,650 Bhp	N.G.	Superior	16-SGTA	2,650	1.5	8.8		Lean burn engine	High-speed (900 rpm)

* for a single engine. Note: N.G. = Natural Gas; L.G. = Landfilled Gas; D.G. = Digestive Gas.

APPENDIX B

APPENDIX B

ECONOMIC IMPACT ANALYSIS METHODOLOGY

In the "top-down" approach, the economic impact along with environmental and energy impacts is one of three main criteria for BACT evaluation in considering any emission control method. The economic analysis determines the cost effectiveness of each applicable emission control alternative.

The economic analysis is based on the cost estimating procedure outlined in EPA's control cost manual (EPA, 1990b). An overall description of this cost estimating methodology is given as follows:

1. The total capital investment consists of direct capital and indirect capital costs. The direct capital cost includes the purchased equipment cost and the direct installation cost. The indirect capital cost accounts for other indirect expenses pertaining to the installation of the emission control device, such as engineering, construction and field expenses, contractor fee, contingencies, and startup and testing.

2. The annualized cost consists of the direct operating cost, the indirect operating cost, and the capital recovery cost. The direct operating cost includes both annual operating and maintenance costs, cost of replacement parts, and fuel costs. The indirect annual operating cost accounts for items such as overhead, property taxes, insurance, and administration. The capital recovery cost is calculated from the total capital investment cost using a capital recovery factor.

3. The total annual operating cost is divided by the total emission reduction of the control system to result in dollars per ton of pollutant removed (i.e., dollars per ton of NO_x in this case). This value is defined as the cost effectiveness of the control method. Incremental cost effectiveness of one control method over

another is also calculated based on the incremental annual cost and incremental emission reduction.

Detailed descriptions of the cost estimates are presented in the following three sections for the SCR system being evaluated as an add-on control device for the lean-burn engine. The discussion includes economic analyses of the lean-burn engine and the NSCR system for the rich-burn engine. The baseline cost estimate is based on the rich-burn engine since it has been defined as the baseline engine on which all emission calculations are based.

SECTION I <u>TOTAL CAPITAL INVESTMENT (TCI)</u>

The TCI cost for the SCR converter covers a complete turn-key system. The basic purchased equipment costs consist of the differential reciprocating IC engine cost and the SCR system cost. The differential engine cost accounts for the difference in cost between the higher cost lean-burn and the lower cost rich-burn engines as quoted by Dresser-Rand. The cost of the SCR system is either a printed cost quotation or a "ball park" estimate of unit cost per brake horsepower obtained directly from the equipment vendors. Subsequently, other direct and indirect capital cost items are estimated from cost factors based on standard cost estimating guidelines (EPA, 1990b). The estimating method provides accuracies on the order of plus or minus 20 percent.

The direct capital costs (DCC) for the SCR converter are comprised of purchased equipment costs and direct installation costs. Purchased equipment costs represent the free on board (FOB) delivery costs of the differential lean-burn engine, the emission control basic equipment, ammonia auxiliary system, exhaust reheat duct burner system, emission monitoring equipment, structure support, instrumentation, freight, and sales tax. The differential engine cost accounts for the difference in costs of the lean-burn engine and an equivalent rich-burn engine (i.e., equivalent in terms of power output). Emission control basic equipment consists of all catalyst structure, and mechanical and electrical components required for efficient operation of the device. These include such items as internal piping and exhaust gas ductwork.

The storage tank and delivery equipment costs for the ammonia system were obtained from the ammonia supplier. The ammonia system was designed for a typical 3-month supply of anhydrous ammonia and its auxiliary equipment such as ammonia vaporizer/injection components.

Emission monitoring costs include the cost of NO_x and O_2 continuous monitors, which are not included in the basic equipment costs. These monitors are tied to the ammonia injection system to ensure proper NO_x reduction. These costs are estimated at 15 percent of the SCR basic equipment cost.

Structure support costs account for miscellaneous external piping, auxiliary support, independent flow controllers and indicators for the connection between the basic equipment and the ammonia system. Costs are estimated at 10 percent of the overall equipment cost. Overall equipment includes the engine, emission control device, exhaust reheating heater, monitoring equipment, and any other auxiliary system.

Plant instrumentation and controls are usually not included in the basic equipment cost; typical cost factors range from 10 to 15 percent of the overall equipment cost, depending on the specific application.

The purchased equipment costs are then the basis for determining the direct and indirect installation costs. The installation costs are based on standard cost factors (EPA, 1990b).

The direct installation costs consist of the direct expenditures for materials and labor for site preparation, foundations, structural steel, erection, piping, electrical, painting, and insulation. Direct installation costs are expressed as a percentage of the total basic equipment costs for standard industrial installations.

The indirect capital costs (ICC) typically cover several areas, such as: engineering and supervision, construction and field expenses, construction contractor fee, contingencies, start-up and testing, and working capital. Each of the above items is based on a percentage of the DCC; except for the working capital which is based on the direct operating cost (DOC).

For the proposed lean-burn engine, the TCI cost estimate is also calculated by summing the purchased equipment costs, direct installation costs, and indirect capital costs. In this case, the itemized basic purchased equipment costs only include the differential engine cost, instrumentation, freight, and sales tax. Other direct and indirect installation costs are estimated by multiplying the sum of the basic purchased equipment costs by the standard cost factors.

The TCI cost estimate for the NSCR converter was based on a similar cost estimating procedure. Basic purchased equipment costs for the NSCR system include the basic converter, emission monitoring, structural support, instrumentation, freight, and sales tax. The direct and indirect installation costs follow a similar procedure to the one described above.

SECTION II <u>**ANNUALIZED COST (AC)**</u>

The AC estimates for each SCR system are comprised of the direct operating costs (DOC), the indirect operating costs (IOC) and the capital recovery cost (CRC). The DOC includes the operating labor, maintenance, replacement catalyst and parts, utilities, and ammonia supply. The IOC includes plant overhead, property taxes, insurance, and administration. The CRC accounts for the annualized cost of the initial capital investment for the emission control system.

In the DOC category, the annual operating labor includes the operator and supervisor costs for continuous operation. The operator cost for the SCR system was calculated based on 5.33 hours per shift devoted to regular maintenance and safety assurance procedure for the emission control system, which includes the operation of the ammonia system. The maintenance requirement is 5 percent of the DCC.

Catalyst replacement cost was calculated using a capital recovery factor (CRF) computed for a three-year recovery period and a 10 percent interest rate. The CRF equation is given below. The total catalyst replacement cost includes the replacement part cost and the labor cost for technical supervision by the catalyst supplier.

The utility costs are the sum of the itemized costs for electricity and a fuel credit for using the more efficient lean-burn engine. Electricity cost is based on the estimated total annual consumption for the ammonia vaporizer/injection system. The unit cost for electrical power is current standard cost value. The price of natural gas is based on current natural gas pricing (DOE/EIA, 1989). The total tonnage of ammonia is calculated by the ammonia molar equivalent required to convert the total estimated NO_x emissions.

Indirect operating costs include the cost of plant overhead, property taxes, insurance, administration, and capital recovery cost. These costs are typically either one or two percent of the total capital investment; except the overhead which is sixty percent of the operating labor and maintenance costs. The capital recovery cost (CRC) is based on the service life of the control system, interest rate, capital depreciation rate, and total capital investment. The CRC is calculated by multiplying the TCI by the capital recovery factor (CRF), which is defined as:

$$CRF = \frac{i(1 + i)^n}{(1 + i)^n - 1}$$

where: i = annual interest rate (in percent), and
n = equipment service life (in years).

The standard estimated equipment service life for each alternative is 10 years, and the average interest rate is assumed to be 10 percent.

The annualized cost is the sum of the DOC, IOC, and CRC.

The annualized cost estimates for the lean-burn engine and the NSCR converter use similar cost estimating procedure as shown for the SCR system, with the exception of the ammonia supply in the DOC category. The DOC of the NSCR system includes the costs of the operating labor, maintenance, and catalyst replacement.

SECTION III COST EFFECTIVENESS

In general, the cost effectiveness of SCR, lean-burn engine, or rich-burn engine/NSCR option is based on the annualized cost of each system and the associated annual pollutant emission reduction. This is determined by dividing the annualized cost by the tonnage of pollutant removed per year.

This cost effectiveness value is presented in terms of total cost effectiveness and incremental cost effectiveness. The total cost effectiveness values are based on the differences in costs and tonnages of NO_x emitted between a given emission control option and the baseline. The incremental cost effectiveness values are based on the difference in costs and tonnages of NO_x emitted between a given emission control option and the next most effective control option.

APPENDIX C

ISCLT PRINTOUTS
FLORIDA GAS TRANSMISSION CO.
COMPRESSOR STATION NO. 17

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ISCLTK6L MODEL, A VERSION OF
  ISCLT (VERSION 90008)
  AN AIR QUALITY DISPERSION MODEL IN
  SECTION 1.  GUIDELINE MODELS.
  IN UNAMAP (VERSION 6) JAN 1990.
  SOURCE: FILE 7  ON UNAMAP MAGNETIC TAPE FROM NTIS.


          CONVERTED BY :
KBN ENGINEERING AND APPLIED SCIENCES, INC.
       GAINESVILLE, FLORIDA
           (904)331-9000

          COPYRIGHT 1990 L


  CARD INPUT FILE IS         ER17LT82.I81
  SUMMARY OUTPUT FILE IS     ER17LT82.O81
  TITLE OF RUN IS            1982 ENRON STATION 17 / 40 FT STACK              10-29-90
```

- ISCLT INPUT DATA -

NUMBER OF SOURCES = 1
NUMBER OF X AXIS GRID SYSTEM POINTS = 7
NUMBER OF Y AXIS GRID SYSTEM POINTS = 16
NUMBER OF SPECIAL POINTS = 36
NUMBER OF SEASONS = 1
NUMBER OF WIND SPEED CLASSES = 6
NUMBER OF STABILITY CLASSES = 6
NUMBER OF WIND DIRECTION CLASSES = 16
FILE NUMBER OF DATA FILE USED FOR REPORTS = 1
THE PROGRAM IS RUN IN RURAL MODE
CONCENTRATION (DEPOSITION) UNITS CONVERSION FACTOR =0.10000000E+07
ACCELERATION OF GRAVITY (METERS/SEC**2) = 9.800
HEIGHT OF MEASUREMENT OF WIND SPEED (METERS) = 10.100
CORRECTION ANGLE FOR GRID SYSTEM VERSUS DIRECTION DATA NORTH (DEGREES) = 0.000
DECAY COEFFICIENT =0.00000000E+00
PROGRAM OPTION SWITCHES = 1, 2, 2, 0, 0, 3, 2, 1, 3, 2, 2, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 1, 0,
0,

RANGE X AXIS GRID SYSTEM POINTS (METERS)= 200.00, 300.00, 400.00, 500.00, 750.00, 1000.00,
1250.00,

RANGE X SPECIAL DISCRETE POINTS (METERS)= 137.00, 143.00, 155.00, 177.00, 210.00, 250.00,
232.00, 219.00, 219.00, 223.00, 235.00, 207.00, 192.00, 183.00, 180.00, 183.00,
189.00, 207.00, 232.00, 274.00, 274.00, 268.00, 274.00, 244.00, 226.00, 216.00,
216.00, 219.00, 232.00, 250.00, 213.00, 177.00, 155.00, 143.00, 137.00, 134.00,

AZIMUTH BEARING Y AXIS GRID SYSTEM POINTS (DEGREES)= 22.50, 45.00, 67.50, 90.00, 112.50, 135.00,
157.50, 180.00, 202.50, 225.00, 247.50, 270.00, 292.50, 315.00, 337.50, 360.00,

AZIMUTH BEARING Y SPECIAL DISCRETE POINTS (DEGREES)= 10.00, 20.00, 30.00, 40.00, 50.00, 60.00,
70.00, 80.00, 90.00, 100.00, 110.00, 120.00, 130.00, 140.00, 150.00, 160.00,
170.00, 180.00, 190.00, 200.00, 210.00, 220.00, 230.00, 240.00, 250.00, 260.00,
270.00, 280.00, 290.00, 300.00, 310.00, 320.00, 330.00, 340.00, 350.00, 360.00,

- AMBIENT AIR TEMPERATURE (DEGREES KELVIN) -

	STABILITY CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	300.0000	300.0000	300.0000	295.0000	290.0000	290.0000

- MIXING LAYER HEIGHT (METERS) -

SEASON 1

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.215100E+04	0.215100E+04	0.215100E+04	0.215100E+04	0.215100E+04	0.215100E+04
STABILITY CATEGORY 2	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04
STABILITY CATEGORY 3	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04
STABILITY CATEGORY 4	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04
STABILITY CATEGORY 5	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05
STABILITY CATEGORY 6	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00001500	0.00045701	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00000400	0.00011400	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00013300	0.00045701	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00001100	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00001500	0.00045701	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00002200	0.00068501	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00001100	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00001100	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00003400	0.00102701	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00001900	0.00057101	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00012900	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00012500	0.00022800	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00000700	0.00022800	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00001900	0.00057101	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00000400	0.00011400	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00024000	0.00011400	0.00000000	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 2

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00031500	0.00171202	0.00102701	0.00000000	0.00000000	0.00000000
22.500	0.00006100	0.00137002	0.00137002	0.00000000	0.00000000	0.00000000
45.000	0.00008200	0.00182602	0.00125602	0.00000000	0.00000000	0.00000000
67.500	0.00043901	0.00182602	0.00137002	0.00000000	0.00000000	0.00000000
90.000	0.00063501	0.00353904	0.00308204	0.00000000	0.00000000	0.00000000
112.500	0.00035100	0.00251103	0.00159802	0.00000000	0.00000000	0.00000000
135.000	0.00020600	0.00194102	0.00216903	0.00000000	0.00000000	0.00000000
157.500	0.00008200	0.00182602	0.00182602	0.00000000	0.00000000	0.00000000
180.000	0.00049601	0.00308204	0.00433805	0.00000000	0.00000000	0.00000000
202.500	0.00025200	0.00296804	0.00274003	0.00000000	0.00000000	0.00000000
225.000	0.00049601	0.00308204	0.00194102	0.00000000	0.00000000	0.00000000
247.500	0.00069801	0.00228303	0.00182602	0.00000000	0.00000000	0.00000000
270.000	0.00072401	0.00285403	0.00182602	0.00000000	0.00000000	0.00000000
292.500	0.00046001	0.00228303	0.00068501	0.00000000	0.00000000	0.00000000
315.000	0.00031500	0.00171202	0.00068501	0.00000000	0.00000000	0.00000000
337.500	0.00043901	0.00182602	0.00045701	0.00000000	0.00000000	0.00000000

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 3

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00012200	0.00399505	0.00547907	0.00057101	0.00000000	0.00000000
22.500	0.00053701	0.00216903	0.00411005	0.00068501	0.00000000	0.00000000
45.000	0.00021500	0.00319604	0.00867610	0.00057101	0.00011400	0.00000000
67.500	0.00009800	0.00319604	0.00662108	0.00159802	0.00011400	0.00000000
90.000	0.00021200	0.00308204	0.00742009	0.00159802	0.00000000	0.00000000
112.500	0.00010500	0.00342504	0.00787709	0.00079901	0.00000000	0.00000000
135.000	0.00010100	0.00331104	0.00353904	0.00034200	0.00000000	0.00000000
157.500	0.00004900	0.00159802	0.00456605	0.00057101	0.00000000	0.00000000
180.000	0.00058201	0.00365304	0.01016012	0.00182602	0.00000000	0.00000000
202.500	0.00031200	0.00251103	0.00365304	0.00045701	0.00011400	0.00000000
225.000	0.00005600	0.00182602	0.00456605	0.00045701	0.00000000	0.00000000
247.500	0.00018700	0.00228303	0.00319604	0.00022800	0.00000000	0.00000000
270.000	0.00015300	0.00114201	0.00331104	0.00057101	0.00000000	0.00000000
292.500	0.00018400	0.00216903	0.00353904	0.00045701	0.00000000	0.00000000
315.000	0.00002800	0.00091301	0.00296804	0.00057101	0.00000000	0.00000000
337.500	0.00002800	0.00091301	0.00296804	0.00011400	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 4

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00086901	0.00799110	0.01769421	0.01187214	0.00045701	0.00000000
22.500	0.00031300	0.00559407	0.01232915	0.01084513	0.00091301	0.00011400
45.000	0.00064701	0.00502306	0.01655320	0.01586819	0.00079901	0.00000000
67.500	0.00027700	0.00456605	0.01392717	0.01860722	0.00034200	0.00000000
90.000	0.00013900	0.00399505	0.01815122	0.01563919	0.00034200	0.00000000
112.500	0.00037900	0.00411005	0.01118714	0.01073113	0.00011400	0.00000000
135.000	0.00038700	0.00433805	0.01084513	0.00536506	0.00068501	0.00000000
157.500	0.00046201	0.00308204	0.00981712	0.00570807	0.00102701	0.00011400
180.000	0.00041500	0.00513706	0.01518318	0.01255715	0.00148402	0.00022800
202.500	0.00041400	0.00171202	0.00605007	0.00468006	0.00022800	0.00022800
225.000	0.00020600	0.00251103	0.00650708	0.00353904	0.00068501	0.00000000
247.500	0.00009900	0.00285403	0.00456605	0.00331104	0.00022800	0.00022800
270.000	0.00031200	0.00216903	0.00582207	0.00456605	0.00079901	0.00022800
292.500	0.00018200	0.00182602	0.00399505	0.00547907	0.00022800	0.00022800
315.000	0.00040200	0.00137002	0.00490906	0.00559407	0.00022800	0.00000000
337.500	0.00054801	0.00216903	0.00365304	0.00605007	0.00011400	0.00011400

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 5

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00000000	0.01369916	0.01210015	0.00000000	0.00000000	0.00000000
22.500	0.00000000	0.01004612	0.00399505	0.00000000	0.00000000	0.00000000
45.000	0.00000000	0.01210015	0.00547907	0.00000000	0.00000000	0.00000000
67.500	0.00000000	0.00913211	0.00605007	0.00000000	0.00000000	0.00000000
90.000	0.00000000	0.01141614	0.00936111	0.00000000	0.00000000	0.00000000
112.500	0.00000000	0.00799110	0.00445205	0.00000000	0.00000000	0.00000000
135.000	0.00000000	0.00764809	0.00251103	0.00000000	0.00000000	0.00000000
157.500	0.00000000	0.00901811	0.00182602	0.00000000	0.00000000	0.00000000
180.000	0.00000000	0.01621019	0.00125602	0.00000000	0.00000000	0.00000000
202.500	0.00000000	0.00388105	0.00102701	0.00000000	0.00000000	0.00000000
225.000	0.00000000	0.00365304	0.00182602	0.00000000	0.00000000	0.00000000
247.500	0.00000000	0.00388105	0.00137002	0.00000000	0.00000000	0.00000000
270.000	0.00000000	0.00376705	0.00319604	0.00000000	0.00000000	0.00000000
292.500	0.00000000	0.00388105	0.00353904	0.00000000	0.00000000	0.00000000
315.000	0.00000000	0.00182602	0.00228303	0.00000000	0.00000000	0.00000000
337.500	0.00000000	0.00342504	0.00342504	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 6

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.01031612	0.02488630	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00553207	0.01575319	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00540307	0.01369916	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00347904	0.01153014	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00515006	0.01449817	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00391605	0.01027412	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00415305	0.00799110	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00525206	0.00593607	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00652308	0.01244315	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00328104	0.00422405	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00198802	0.00319604	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00229803	0.00547907	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00435605	0.00833310	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00388505	0.00662108	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00262903	0.00228303	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00238703	0.00593607	0.00000000	0.00000000	0.00000000	0.00000000

- ISCLT INPUT DATA (CONT.) -

- VERTICAL POTENTIAL TEMPERATURE GRADIENT (DEGREES KELVIN/METER) -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 2	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 3	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 5	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01
STABILITY CATEGORY 6	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01

- WIND PROFILE POWER LAW EXPONENTS -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 2	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 3	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00
STABILITY CATEGORY 4	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00
STABILITY CATEGORY 5	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00
STABILITY CATEGORY 6	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		1	STACK	0.00	0.00	12.19	0.00	GAS EXIT TEMP (DEG K)= 641.00, GAS EXIT VEL. (M/SEC)= 57.47, STACK DIAMETER (M)= 0.390, HEIGHT OF ASSO. BLDG. (M)= -9.69, WIDTH OF ASSO. BLDG. (M)= 61.84, WAKE EFFECTS FLAG = 0

- DIRECTION SPECIFIC BUILDING DIMENSIONS -

SECTOR	DSBH	DSBW	IWAKE	SECTOR	DSBH	DSBW	IWAKE	SECTOR	DSBH	DSBW	IWAKE	SECTOR	DSBH	DSBW	IWAKE
1	9.7,	61.9,	0	2	9.7,	61.9,	0	3	9.7,	61.9,	0	4	9.7,	61.9,	0
5	9.7,	61.9,	0	6	9.7,	61.9,	0	7	9.7,	61.9,	0	8	9.7,	61.9,	0
9	9.7,	61.9,	0	10	9.7,	61.9,	0	11	9.7,	61.9,	0	12	9.7,	61.9,	0
13	9.7,	61.9,	0	14	9.7,	61.9,	0	15	9.7,	61.9,	0	16	9.7,	61.9,	0

- SOURCE STRENGTHS (GRAMS PER SEC) -

SEASON 1	SEASON 2	SEASON 3	SEASON 4
1.33000E+00			

WARNING - HW/HB > 5 FOR SOURCE 1 PROG. USES LATERAL VIRTUAL DIST. FOR UPPER BOUND OF CONCENTRATION (DEPOSITION) IN SECTOR(S):
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16.
IF LOWER BOUND IS DESIRED SET THE DIRECTION SPECIFIC BUILDING HEIGHT TO < 0 (WAKE EFFECTS FLAG) AND RERUN.

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 **

- GRID SYSTEM RECEPTORS -

- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	200.000	300.000	400.000	500.000	750.000	1000.000	1250.000
	- CONCENTRATION -						
360.000	0.670388	0.821965	0.890085	0.854014	0.670129	0.529820	0.433709
337.500	0.300454	0.377401	0.421927	0.416396	0.342128	0.278730	0.232620
315.000	0.274180	0.350920	0.408980	0.418590	0.363474	0.302550	0.253899
292.500	0.388944	0.537939	0.622004	0.616592	0.501371	0.400348	0.327963
270.000	0.557351	0.726090	0.828430	0.824083	0.681299	0.550633	0.455393
247.500	0.509987	0.666029	0.761944	0.755193	0.617807	0.494682	0.405616
225.000	0.467815	0.640198	0.751698	0.755678	0.630508	0.512655	0.425754
202.500	0.341556	0.436633	0.504897	0.510388	0.440459	0.371482	0.317570
180.000	0.347632	0.482868	0.593108	0.624913	0.574279	0.503842	0.442601
157.500	0.172439	0.247772	0.288453	0.283065	0.224559	0.179500	0.148760
135.000	0.190963	0.258330	0.294600	0.288802	0.229081	0.178026	0.142169
112.500	0.223275	0.300912	0.340037	0.330730	0.260442	0.205485	0.168218
90.000	0.270815	0.337695	0.368980	0.355587	0.279575	0.220483	0.180300
67.500	0.211822	0.275677	0.311059	0.306028	0.246257	0.195758	0.159590
45.000	0.261453	0.346107	0.387931	0.377192	0.296019	0.230009	0.183643
22.500	0.307744	0.380397	0.411794	0.393606	0.302082	0.231109	0.183166

- DISCRETE RECEPTORS -

X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION
137.0	10.0	0.575246	143.0	20.0	0.393266	155.0	30.0	0.321293
177.0	40.0	0.284402	210.0	50.0	0.243495	250.0	60.0	0.241066
232.0	70.0	0.213051	219.0	80.0	0.231336	219.0	90.0	0.257549
223.0	100.0	0.234233	235.0	110.0	0.229337	207.0	120.0	0.207557
192.0	130.0	0.199650	183.0	140.0	0.191385	180.0	150.0	0.182714
183.0	160.0	0.195869	189.0	170.0	0.272379	207.0	180.0	0.342776
232.0	190.0	0.325100	274.0	200.0	0.398946	274.0	210.0	0.441606
268.0	220.0	0.516356	274.0	230.0	0.574862	244.0	240.0	0.510970
226.0	250.0	0.485351	216.0	260.0	0.511816	216.0	270.0	0.536804
219.0	280.0	0.458396	232.0	290.0	0.403494	250.0	300.0	0.380937
213.0	310.0	0.287952	177.0	320.0	0.294872	155.0	330.0	0.321087
143.0	340.0	0.383329	137.0	350.0	0.570128	134.0	360.0	0.769162

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 (CONT.) **

- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF ALL SOURCES COMBINED -

X COORDINATE RANGE (METERS)	Y COORDINATE AZIMUTH BEARING (DEGREES)	CONCENTRATION
400.00	360.00	0.890085
500.00	360.00	0.854014
400.00	270.00	0.828430
500.00	270.00	0.824083
300.00	360.00	0.821965
134.00	360.00	0.769162
400.00	247.50	0.761944
500.00	225.00	0.755678
500.00	247.50	0.755193
400.00	225.00	0.751698

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******************************************* END OF ISCLT PROGRAM,     1 SOURCES PROCESSED *******************************************
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ISCLTK6L MODEL, A VERSION OF
ISCLT (VERSION 90008)
AN AIR QUALITY DISPERSION MODEL IN
SECTION 1. GUIDELINE MODELS.
IN UNAMAP (VERSION 6) JAN 1990.
SOURCE: FILE 7 ON UNAMAP MAGNETIC TAPE FROM NTIS.

CONVERTED BY :
KBN ENGINEERING AND APPLIED SCIENCES, INC.
GAINESVILLE, FLORIDA
(904)331-9000

CARD INPUT FILE IS	ER17LT83.I81	
SUMMARY OUTPUT FILE IS	ER17LT83.O81	
TITLE OF RUN IS	1983 ENRON STATION 17 / 40 FT STACK	10-29-90

- ISCLT INPUT DATA (CONT.) -

NUMBER OF SOURCES = 1
NUMBER OF X AXIS GRID SYSTEM POINTS = 7
NUMBER OF Y AXIS GRID SYSTEM POINTS = 16
NUMBER OF SPECIAL POINTS = 36
NUMBER OF SEASONS = 1
NUMBER OF WIND SPEED CLASSES = 6
NUMBER OF STABILITY CLASSES = 6
NUMBER OF WIND DIRECTION CLASSES = 16
FILE NUMBER OF DATA FILE USED FOR REPORTS = 1
THE PROGRAM IS RUN IN RURAL MODE
CONCENTRATION (DEPOSITION) UNITS CONVERSION FACTOR =0.10000000E+07
ACCELERATION OF GRAVITY (METERS/SEC**2) = 9.800
HEIGHT OF MEASUREMENT OF WIND SPEED (METERS) = 10.100
CORRECTION ANGLE FOR GRID SYSTEM VERSUS DIRECTION DATA NORTH (DEGREES) = 0.000
DECAY COEFFICIENT =0.00000000E+00
PROGRAM OPTION SWITCHES = 1, 2, 2, 0, 0, 3, 2, 1, 3, 2, 2, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 1, 0,
0,

RANGE X AXIS GRID SYSTEM POINTS (METERS)= 200.00, 300.00, 400.00, 500.00, 750.00, 1000.00,
1250.00,

RANGE X SPECIAL DISCRETE POINTS (METERS)= 137.00, 143.00, 155.00, 177.00, 210.00, 250.00,
232.00, 219.00, 219.00, 223.00, 235.00, 207.00, 192.00, 183.00, 180.00, 183.00,
189.00, 207.00, 232.00, 274.00, 274.00, 268.00, 274.00, 244.00, 226.00, 216.00,
216.00, 219.00, 232.00, 250.00, 213.00, 177.00, 155.00, 143.00, 137.00, 134.00,

AZIMUTH BEARING Y AXIS GRID SYSTEM POINTS (DEGREES)= 22.50, 45.00, 67.50, 90.00, 112.50, 135.00,
157.50, 180.00, 202.50, 225.00, 247.50, 270.00, 292.50, 315.00, 337.50, 360.00,

AZIMUTH BEARING Y SPECIAL DISCRETE POINTS (DEGREES)= 10.00, 20.00, 30.00, 40.00, 50.00, 60.00,
70.00, 80.00, 90.00, 100.00, 110.00, 120.00, 130.00, 140.00, 150.00, 160.00,
170.00, 180.00, 190.00, 200.00, 210.00, 220.00, 230.00, 240.00, 250.00, 260.00,
270.00, 280.00, 290.00, 300.00, 310.00, 320.00, 330.00, 340.00, 350.00, 360.00,

- AMBIENT AIR TEMPERATURE (DEGREES KELVIN) -

	STABILITY CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	300.0000	300.0000	300.0000	295.0000	290.0000	290.0000

- MIXING LAYER HEIGHT (METERS) -

SEASON 1

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.215100E+04	0.215100E+04	0.215100E+04	0.215100E+04	0.215100E+04	0.215100E+04
STABILITY CATEGORY 2	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04
STABILITY CATEGORY 3	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04
STABILITY CATEGORY 4	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04
STABILITY CATEGORY 5	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05
STABILITY CATEGORY 6	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00011400	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00011400	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00000000	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00000000	0.00137001	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00011400	0.00079901	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00000000	0.00022800	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00011400	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00011400	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00011400	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00000000	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00000000	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00011400	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00000000	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00000000	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00000000	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 2

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00076301	0.00251102	0.00148401	0.00000000	0.00000000	0.00000000
22.500	0.00027800	0.00182601	0.00068501	0.00000000	0.00000000	0.00000000
45.000	0.00028900	0.00228302	0.00182601	0.00000000	0.00000000	0.00000000
67.500	0.00030900	0.00308202	0.00194102	0.00000000	0.00000000	0.00000000
90.000	0.00018600	0.00285402	0.00296802	0.00000000	0.00000000	0.00000000
112.500	0.00039500	0.00182601	0.00205502	0.00000000	0.00000000	0.00000000
135.000	0.00015900	0.00171201	0.00274002	0.00000000	0.00000000	0.00000000
157.500	0.00004200	0.00171201	0.00216902	0.00000000	0.00000000	0.00000000
180.000	0.00003900	0.00159801	0.00308202	0.00000000	0.00000000	0.00000000
202.500	0.00028400	0.00205502	0.00137001	0.00000000	0.00000000	0.00000000
225.000	0.00025100	0.00068501	0.00068501	0.00000000	0.00000000	0.00000000
247.500	0.00038400	0.00137001	0.00057100	0.00000000	0.00000000	0.00000000
270.000	0.00027300	0.00159801	0.00114201	0.00000000	0.00000000	0.00000000
292.500	0.00049300	0.00102701	0.00194102	0.00000000	0.00000000	0.00000000
315.000	0.00016100	0.00182601	0.00125601	0.00000000	0.00000000	0.00000000
337.500	0.00014700	0.00125601	0.00079901	0.00000000	0.00000000	0.00000000

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 3

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00019800	0.00274002	0.00833307	0.00114201	0.00000000	0.00000000
22.500	0.00005100	0.00171201	0.00502304	0.00057100	0.00000000	0.00000000
45.000	0.00019200	0.00251102	0.00616405	0.00114201	0.00000000	0.00000000
67.500	0.00019800	0.00274002	0.00684905	0.00194102	0.00011400	0.00000000
90.000	0.00020900	0.00308202	0.00753406	0.00137001	0.00011400	0.00000000
112.500	0.00005100	0.00171201	0.00684905	0.00091301	0.00000000	0.00000000
135.000	0.00004400	0.00148401	0.00513704	0.00091301	0.00000000	0.00000000
157.500	0.00003700	0.00125601	0.00422403	0.00102701	0.00000000	0.00000000
180.000	0.00030900	0.00251102	0.00776306	0.00114201	0.00011400	0.00000000
202.500	0.00002000	0.00068501	0.00319603	0.00057100	0.00000000	0.00000000
225.000	0.00005400	0.00182601	0.00296802	0.00068501	0.00000000	0.00000000
247.500	0.00016100	0.00148401	0.00331103	0.00114201	0.00011400	0.00000000
270.000	0.00005700	0.00194102	0.00468004	0.00148401	0.00057100	0.00000000
292.500	0.00017800	0.00205502	0.00490904	0.00137001	0.00011400	0.00000000
315.000	0.00014400	0.00091301	0.00445204	0.00057100	0.00000000	0.00000000
337.500	0.00003700	0.00125601	0.00525104	0.00079901	0.00011400	0.00000000

SEASON 1

STABILITY CATEGORY 4

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00070701	0.00833307	0.02111917	0.01038808	0.00057100	0.00000000
22.500	0.00031100	0.00456604	0.01506812	0.00821907	0.00057100	0.00011400
45.000	0.00022000	0.00525104	0.01038808	0.00947508	0.00137001	0.00000000
67.500	0.00029600	0.00422403	0.01164409	0.01175809	0.00068501	0.00000000
90.000	0.00043400	0.00468004	0.01735214	0.01506812	0.00125601	0.00011400
112.500	0.00012900	0.00308202	0.01073109	0.01073109	0.00102701	0.00011400
135.000	0.00045700	0.00239702	0.01130109	0.00730606	0.00068501	0.00000000
157.500	0.00011500	0.00274002	0.00981708	0.00810506	0.00068501	0.00011400
180.000	0.00052900	0.00411003	0.01735214	0.01643813	0.00285402	0.00022800
202.500	0.00024800	0.00308202	0.00673505	0.00433803	0.00045700	0.00011400
225.000	0.00012900	0.00308202	0.00901807	0.00559404	0.00114201	0.00000000
247.500	0.00012500	0.00296802	0.00616405	0.00970308	0.00171201	0.00022800
270.000	0.00012000	0.00285402	0.00856207	0.01290010	0.00411003	0.00068501
292.500	0.00008100	0.00194102	0.00662105	0.01175809	0.00319603	0.00011400
315.000	0.00062901	0.00365303	0.00696306	0.00707806	0.00102701	0.00000000
337.500	0.00026300	0.00342503	0.00730606	0.00627905	0.00022800	0.00000000

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 5

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00000000	0.01187210	0.01004608	0.00000000	0.00000000	0.00000000
22.500	0.00000000	0.00970308	0.00593605	0.00000000	0.00000000	0.00000000
45.000	0.00000000	0.00684905	0.00445204	0.00000000	0.00000000	0.00000000
67.500	0.00000000	0.00616405	0.00662105	0.00000000	0.00000000	0.00000000
90.000	0.00000000	0.00844707	0.00799106	0.00000000	0.00000000	0.00000000
112.500	0.00000000	0.00742006	0.00593605	0.00000000	0.00000000	0.00000000
135.000	0.00000000	0.00639305	0.00445204	0.00000000	0.00000000	0.00000000
157.500	0.00000000	0.00753406	0.00239702	0.00000000	0.00000000	0.00000000
180.000	0.00000000	0.01278510	0.00239702	0.00000000	0.00000000	0.00000000
202.500	0.00000000	0.00559404	0.00079901	0.00000000	0.00000000	0.00000000
225.000	0.00000000	0.00433803	0.00159801	0.00000000	0.00000000	0.00000000
247.500	0.00000000	0.00525104	0.00433803	0.00000000	0.00000000	0.00000000
270.000	0.00000000	0.00593605	0.00742006	0.00000000	0.00000000	0.00000000
292.500	0.00000000	0.00399503	0.00593605	0.00000000	0.00000000	0.00000000
315.000	0.00000000	0.00216902	0.00319603	0.00000000	0.00000000	0.00000000
337.500	0.00000000	0.00468004	0.00559404	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 6

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00586605	0.02397319	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00418803	0.01255710	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00223402	0.00947508	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00149201	0.00593605	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00293702	0.01141609	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00238002	0.00844707	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00291902	0.00879007	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00199202	0.00468004	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00512404	0.01187210	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00215402	0.00502304	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00136301	0.00468004	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00294702	0.00662105	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00286302	0.00947508	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00349303	0.00947508	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00190702	0.00262602	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00214502	0.00616405	0.00000000	0.00000000	0.00000000	0.00000000

- ISCLT INPUT DATA (CONT.) -

- VERTICAL POTENTIAL TEMPERATURE GRADIENT (DEGREES KELVIN/METER) -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 2	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 3	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 5	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01
STABILITY CATEGORY 6	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01

- WIND PROFILE POWER LAW EXPONENTS -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 2	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 3	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00
STABILITY CATEGORY 4	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00
STABILITY CATEGORY 5	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00
STABILITY CATEGORY 6	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		1	STACK	0.00	0.00	12.19	0.00	GAS EXIT TEMP (DEG K)= 641.00, GAS EXIT VEL. (M/SEC)= 57.47, STACK DIAMETER (M)= 0.390, HEIGHT OF ASSO. BLDG. (M)= -9.69, WIDTH OF ASSO. BLDG. (M)= 61.84, WAKE EFFECTS FLAG = 0

- DIRECTION SPECIFIC BUILDING DIMENSIONS -

SECTOR	DSBH	DSBW	IWAKE	SECTOR	DSBH	DSBW	IWAKE	SECTOR	DSBH	DSBW	IWAKE	SECTOR	DSBH	DSBW	IWAKE
1	9.7,	61.9,	0	2	9.7,	61.9,	0	3	9.7,	61.9,	0	4	9.7,	61.9,	0
5	9.7,	61.9,	0	6	9.7,	61.9,	0	7	9.7,	61.9,	0	8	9.7,	61.9,	0
9	9.7,	61.9,	0	10	9.7,	61.9,	0	11	9.7,	61.9,	0	12	9.7,	61.9,	0
13	9.7,	61.9,	0	14	9.7,	61.9,	0	15	9.7,	61.9,	0	16	9.7,	61.9,	0

- SOURCE STRENGTHS (GRAMS PER SEC) -

SEASON 1	SEASON 2	SEASON 3	SEASON 4
1.33000E+00			

WARNING - HW/HB > 5 FOR SOURCE 1 PROG. USES LATERAL VIRTUAL DIST. FOR UPPER BOUND OF CONCENTRATION (DEPOSITION) IN SECTOR(S):
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16.
IF LOWER BOUND IS DESIRED SET THE DIRECTION SPECIFIC BUILDING HEIGHT TO < 0 (WAKE EFFECTS FLAG) AND RERUN.

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 **

- GRID SYSTEM RECEPTORS -

- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	200.000	300.000	400.000	500.000	750.000	1000.000	1250.000
	- CONCENTRATION -						
360.000	0.630105	0.757482	0.835400	0.816388	0.658727	0.524134	0.428562
337.500	0.350589	0.430523	0.471766	0.457884	0.366158	0.292178	0.239508
315.000	0.371657	0.457712	0.502333	0.489039	0.394775	0.316024	0.259980
292.500	0.416500	0.531442	0.592137	0.576948	0.463120	0.369641	0.303394
270.000	0.589317	0.739331	0.826060	0.811345	0.661308	0.530193	0.434281
247.500	0.510956	0.642574	0.702178	0.675228	0.533090	0.421381	0.341717
225.000	0.407006	0.515841	0.575694	0.563405	0.458512	0.370714	0.306040
202.500	0.284228	0.394206	0.477130	0.495656	0.439661	0.372528	0.317742
180.000	0.401363	0.562211	0.681785	0.710694	0.638080	0.545962	0.468736
157.500	0.252959	0.338260	0.382063	0.375137	0.308343	0.253185	0.211964
135.000	0.296201	0.376074	0.413120	0.397418	0.314800	0.249522	0.201813
112.500	0.514733	0.579251	0.601492	0.562302	0.426672	0.329828	0.265646
90.000	0.586387	0.644594	0.668903	0.627281	0.481535	0.378422	0.308623
67.500	0.350321	0.415091	0.448180	0.429637	0.339840	0.271765	0.224029
45.000	0.230903	0.285756	0.329046	0.335195	0.289479	0.237865	0.196383
22.500	0.214469	0.278928	0.315042	0.309859	0.251639	0.203374	0.168395

- DISCRETE RECEPTORS -

X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION
137.0	10.0	0.508321	143.0	20.0	0.290452	155.0	30.0	0.240431
177.0	40.0	0.239318	210.0	50.0	0.248716	250.0	60.0	0.316460
232.0	70.0	0.357319	219.0	80.0	0.450620	219.0	90.0	0.549772
223.0	100.0	0.511628	235.0	110.0	0.498720	207.0	120.0	0.430073
192.0	130.0	0.349585	183.0	140.0	0.295789	180.0	150.0	0.275783
183.0	160.0	0.276490	189.0	170.0	0.338592	207.0	180.0	0.396181
232.0	190.0	0.333376	274.0	200.0	0.365442	274.0	210.0	0.381065
268.0	220.0	0.431030	274.0	230.0	0.492678	244.0	240.0	0.483744
226.0	250.0	0.488812	216.0	260.0	0.528045	216.0	270.0	0.565633
219.0	280.0	0.484555	232.0	290.0	0.422742	250.0	300.0	0.420231
213.0	310.0	0.366531	177.0	320.0	0.387253	155.0	330.0	0.394865
143.0	340.0	0.432817	137.0	350.0	0.579001	134.0	360.0	0.737913

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 (CONT.) **

- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF ALL SOURCES COMBINED -

X COORDINATE RANGE (METERS)	Y COORDINATE AZIMUTH BEARING (DEGREES)	CONCENTRATION
400.00	360.00	0.835400
400.00	270.00	0.826060
500.00	360.00	0.816388
500.00	270.00	0.811345
300.00	360.00	0.757482
300.00	270.00	0.739331
134.00	360.00	0.737913
500.00	180.00	0.710694
400.00	247.50	0.702178
400.00	180.00	0.681785

** END OF ISCLT PROGRAM,   1 SOURCES PROCESSED **

ISCLTK6L MODEL, A VERSION OF
ISCLT (VERSION 90008)
AN AIR QUALITY DISPERSION MODEL IN
SECTION 1. GUIDELINE MODELS.
IN UNAMAP (VERSION 6) JAN 1990.
SOURCE: FILE 7 ON UNAMAP MAGNETIC TAPE FROM NTIS.

CONVERTED BY :
KBN ENGINEERING AND APPLIED SCIENCES, INC.
GAINESVILLE, FLORIDA
(904)331-9000

CARD INPUT FILE IS	ER17LT84.I81
SUMMARY OUTPUT FILE IS	ER17LT84.O81
TITLE OF RUN IS	1984 ENRON STATION 17 / 40 FT STACK 10-29-90

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                                   - ISCLT INPUT DATA (CONT.) -

         NUMBER OF SOURCES =    1
         NUMBER OF X AXIS GRID SYSTEM POINTS =    7
         NUMBER OF Y AXIS GRID SYSTEM POINTS =   16
         NUMBER OF SPECIAL POINTS =   36
         NUMBER OF SEASONS =    1
         NUMBER OF WIND SPEED CLASSES =   6
         NUMBER OF STABILITY CLASSES =   6
         NUMBER OF WIND DIRECTION CLASSES =  16
         FILE NUMBER OF DATA FILE USED FOR REPORTS =    1
         THE PROGRAM IS RUN IN RURAL MODE
         CONCENTRATION (DEPOSITION) UNITS CONVERSION FACTOR =0.10000000E+07
         ACCELERATION OF GRAVITY (METERS/SEC**2) =  9.800
         HEIGHT OF MEASUREMENT OF WIND SPEED (METERS) =  10.100
         CORRECTION ANGLE FOR GRID SYSTEM VERSUS DIRECTION DATA NORTH (DEGREES) =   0.000
         DECAY COEFFICIENT =0.00000000E+00
         PROGRAM OPTION SWITCHES = 1, 2, 2, 0, 0, 3, 2, 1, 3, 2, 2, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 1, 0,
 0,
           RANGE X AXIS GRID SYSTEM POINTS (METERS )=     200.00,     300.00,     400.00,     500.00,     750.00,    1000.00,
             1250.00,
           RANGE X SPECIAL DISCRETE POINTS (METERS )=     137.00,     143.00,     155.00,     177.00,     210.00,     250.00,
              232.00,     219.00,     219.00,     223.00,     235.00,     207.00,     192.00,     183.00,     180.00,     183.00,
              189.00,     207.00,     232.00,     274.00,     274.00,     268.00,     274.00,     244.00,     226.00,     216.00,
              216.00,     219.00,     232.00,     250.00,     213.00,     177.00,     155.00,     143.00,     137.00,     134.00,
  AZIMUTH BEARING Y AXIS GRID SYSTEM POINTS (DEGREES)=      22.50,      45.00,      67.50,      90.00,     112.50,     135.00,
              157.50,     180.00,     202.50,     225.00,     247.50,     270.00,     292.50,     315.00,     337.50,     360.00,
  AZIMUTH BEARING Y SPECIAL DISCRETE POINTS (DEGREES)=      10.00,      20.00,      30.00,      40.00,      50.00,      60.00,
               70.00,      80.00,      90.00,     100.00,     110.00,     120.00,     130.00,     140.00,     150.00,     160.00,
              170.00,     180.00,     190.00,     200.00,     210.00,     220.00,     230.00,     240.00,     250.00,     260.00,
              270.00,     280.00,     290.00,     300.00,     310.00,     320.00,     330.00,     340.00,     350.00,     360.00,

                              - AMBIENT AIR TEMPERATURE (DEGREES KELVIN) -

                  STABILITY  STABILITY  STABILITY  STABILITY  STABILITY  STABILITY
                  CATEGORY 1 CATEGORY 2 CATEGORY 3 CATEGORY 4 CATEGORY 5 CATEGORY 6
         SEASON  1   300.0000   300.0000   300.0000   295.0000   290.0000   290.0000

                                    - MIXING LAYER HEIGHT (METERS) -

                                             SEASON 1
                     WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                     CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
STABILITY CATEGORY 10.215100E+040.215100E+040.215100E+040.215100E+040.215100E+040.215100E+04
STABILITY CATEGORY 20.143400E+040.143400E+040.143400E+040.143400E+040.143400E+040.143400E+04
STABILITY CATEGORY 30.143400E+040.143400E+040.143400E+040.143400E+040.143400E+040.143400E+04
STABILITY CATEGORY 40.143400E+040.143400E+040.143400E+040.143400E+040.143400E+040.143400E+04
STABILITY CATEGORY 50.100000E+050.100000E+050.100000E+050.100000E+050.100000E+050.100000E+05
STABILITY CATEGORY 60.100000E+050.100000E+050.100000E+050.100000E+050.100000E+050.100000E+05
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- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00023500	0.00113800	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00001100	0.00011400	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00019100	0.00068300	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00022400	0.00102500	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00030500	0.00056900	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00015800	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00003300	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00027200	0.00022800	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00037000	0.00125200	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00005500	0.00056900	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00018000	0.00056900	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00011000	0.00113800	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00020200	0.00079700	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00023500	0.00113800	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00008800	0.00091100	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00018000	0.00056900	0.00000000	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 2

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00102600	0.00307401	0.00193501	0.00000000	0.00000000	0.00000000
22.500	0.00058300	0.00170801	0.00068300	0.00000000	0.00000000	0.00000000
45.000	0.00102600	0.00307401	0.00148000	0.00000000	0.00000000	0.00000000
67.500	0.00076400	0.00273201	0.00125200	0.00000000	0.00000000	0.00000000
90.000	0.00081100	0.00352901	0.00296001	0.00000000	0.00000000	0.00000000
112.500	0.00070400	0.00375701	0.00170801	0.00000000	0.00000000	0.00000000
135.000	0.00107900	0.00193501	0.00250501	0.00000000	0.00000000	0.00000000
157.500	0.00095800	0.00193501	0.00284601	0.00000000	0.00000000	0.00000000
180.000	0.00032900	0.00352901	0.00296001	0.00000000	0.00000000	0.00000000
202.500	0.00074400	0.00239101	0.00045500	0.00000000	0.00000000	0.00000000
225.000	0.00056300	0.00136600	0.00102500	0.00000000	0.00000000	0.00000000
247.500	0.00049000	0.00216301	0.00113800	0.00000000	0.00000000	0.00000000
270.000	0.00063000	0.00250501	0.00113800	0.00000000	0.00000000	0.00000000
292.500	0.00138700	0.00307401	0.00193501	0.00000000	0.00000000	0.00000000
315.000	0.00079100	0.00318801	0.00193501	0.00000000	0.00000000	0.00000000
337.500	0.00052300	0.00273201	0.00068300	0.00000000	0.00000000	0.00000000

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 3

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00036100	0.00330101	0.00569202	0.00068300	0.00000000	0.00000000
22.500	0.00022200	0.00273201	0.00546402	0.00079700	0.00000000	0.00000000
45.000	0.00050100	0.00387101	0.00535102	0.00079700	0.00000000	0.00000000
67.500	0.00016400	0.00432601	0.00831102	0.00204901	0.00000000	0.00000000
90.000	0.00029900	0.00478101	0.01013203	0.00204901	0.00000000	0.00000000
112.500	0.00008600	0.00227701	0.00785502	0.00125200	0.00000000	0.00000000
135.000	0.00020900	0.00239101	0.00523702	0.00079700	0.00000000	0.00000000
157.500	0.00005200	0.00136600	0.00478101	0.00056900	0.00000000	0.00000000
180.000	0.00034400	0.00284601	0.00603402	0.00102500	0.00000000	0.00000000
202.500	0.00018700	0.00182101	0.00204901	0.00056900	0.00000000	0.00000000
225.000	0.00008200	0.00216301	0.00216301	0.00045500	0.00011400	0.00000000
247.500	0.00020000	0.00216301	0.00227701	0.00045500	0.00011400	0.00000000
270.000	0.00031000	0.00193501	0.00398501	0.00216301	0.00000000	0.00000000
292.500	0.00009900	0.00261801	0.00421201	0.00068300	0.00000000	0.00011400
315.000	0.00022200	0.00273201	0.00626102	0.00068300	0.00000000	0.00000000
337.500	0.00007800	0.00204901	0.00421201	0.00045500	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 4

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00092700	0.00592002	0.01707705	0.01001803	0.00125200	0.00000000
22.500	0.00048400	0.00489501	0.00865203	0.00694402	0.00034200	0.00000000
45.000	0.00048400	0.00489501	0.00967703	0.00876603	0.00034200	0.00000000
67.500	0.00057700	0.00284601	0.01070103	0.01536905	0.00068300	0.00000000
90.000	0.00067400	0.00580602	0.01821505	0.01434404	0.00022800	0.00000000
112.500	0.00030800	0.00250501	0.01081503	0.00842403	0.00022800	0.00000000
135.000	0.00044700	0.00273201	0.00683102	0.00352901	0.00045500	0.00011400
157.500	0.00016000	0.00216301	0.00466801	0.00307401	0.00034200	0.00022800
180.000	0.00056500	0.00432601	0.01161203	0.00637502	0.00113800	0.00034200
202.500	0.00013500	0.00182101	0.00341501	0.00421201	0.00102500	0.00011400
225.000	0.00014300	0.00193501	0.00614802	0.00523702	0.00182101	0.00022800
247.500	0.00024000	0.00159400	0.00580602	0.00375701	0.00079700	0.00022800
270.000	0.00055200	0.00250501	0.00660302	0.01070103	0.00216301	0.00056900
292.500	0.00038800	0.00193501	0.00500902	0.00626102	0.00068300	0.00000000
315.000	0.00026500	0.00193501	0.00648902	0.00296001	0.00034200	0.00000000
337.500	0.00048000	0.00318801	0.00740002	0.00592002	0.00056900	0.00000000

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 5

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00000000	0.01149803	0.00466801	0.00000000	0.00000000	0.00000000
22.500	0.00000000	0.01070103	0.00227701	0.00000000	0.00000000	0.00000000
45.000	0.00000000	0.01195404	0.00330101	0.00000000	0.00000000	0.00000000
67.500	0.00000000	0.01275004	0.00512302	0.00000000	0.00000000	0.00000000
90.000	0.00000000	0.01320604	0.00819702	0.00000000	0.00000000	0.00000000
112.500	0.00000000	0.00774102	0.00512302	0.00000000	0.00000000	0.00000000
135.000	0.00000000	0.00694402	0.00341501	0.00000000	0.00000000	0.00000000
157.500	0.00000000	0.00671702	0.00056900	0.00000000	0.00000000	0.00000000
180.000	0.00000000	0.01206704	0.00159400	0.00000000	0.00000000	0.00000000
202.500	0.00000000	0.00500902	0.00056900	0.00000000	0.00000000	0.00000000
225.000	0.00000000	0.00603402	0.00045500	0.00000000	0.00000000	0.00000000
247.500	0.00000000	0.00557802	0.00136600	0.00000000	0.00000000	0.00000000
270.000	0.00000000	0.00421201	0.00466801	0.00000000	0.00000000	0.00000000
292.500	0.00000000	0.00284601	0.00193501	0.00000000	0.00000000	0.00000000
315.000	0.00000000	0.00239101	0.00284601	0.00000000	0.00000000	0.00000000
337.500	0.00000000	0.00352901	0.00671702	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 6

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.01320504	0.02060606	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.01089603	0.01992306	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00727002	0.01457204	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00806702	0.01377504	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00799902	0.01593805	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00427601	0.00694402	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00533302	0.00888003	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00355401	0.00512302	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00660702	0.00865203	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00326101	0.00466801	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00380101	0.00352901	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00434701	0.00717202	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00566102	0.00944903	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00439601	0.00637502	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00301101	0.00387101	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00485501	0.00831102	0.00000000	0.00000000	0.00000000	0.00000000

- ISCLT INPUT DATA (CONT.) -

- VERTICAL POTENTIAL TEMPERATURE GRADIENT (DEGREES KELVIN/METER) -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 2	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 3	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 5	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01
STABILITY CATEGORY 6	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01

- WIND PROFILE POWER LAW EXPONENTS -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 2	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 3	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00
STABILITY CATEGORY 4	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00
STABILITY CATEGORY 5	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00
STABILITY CATEGORY 6	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		1	STACK	0.00	0.00	12.19	0.00	GAS EXIT TEMP (DEG K)= 641.00, GAS EXIT VEL. (M/SEC)= 57.47, STACK DIAMETER (M)= 0.390, HEIGHT OF ASSO. BLDG. (M)= -9.69, WIDTH OF ASSO. BLDG. (M)= 61.84, WAKE EFFECTS FLAG = 0

- DIRECTION SPECIFIC BUILDING DIMENSIONS -

SECTOR	DSBH	DSBW	IWAKE	SECTOR	DSBH	DSBW	IWAKE	SECTOR	DSBH	DSBW	IWAKE	SECTOR	DSBH	DSBW	IWAKE
1	9.7,	61.9,	0	2	9.7,	61.9,	0	3	9.7,	61.9,	0	4	9.7,	61.9,	0
5	9.7,	61.9,	0	6	9.7,	61.9,	0	7	9.7,	61.9,	0	8	9.7,	61.9,	0
9	9.7,	61.9,	0	10	9.7,	61.9,	0	11	9.7,	61.9,	0	12	9.7,	61.9,	0
13	9.7,	61.9,	0	14	9.7,	61.9,	0	15	9.7,	61.9,	0	16	9.7,	61.9,	0

- SOURCE STRENGTHS (GRAMS PER SEC) -

SEASON 1	SEASON 2	SEASON 3	SEASON 4
1.33000E+00			

WARNING - HW/HB > 5 FOR SOURCE 1 PROG. USES LATERAL VIRTUAL DIST. FOR UPPER BOUND OF CONCENTRATION (DEPOSITION) IN SECTOR(S):
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16.
IF LOWER BOUND IS DESIRED SET THE DIRECTION SPECIFIC BUILDING HEIGHT TO < 0 (WAKE EFFECTS FLAG) AND RERUN.

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 **

- GRID SYSTEM RECEPTORS -

- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	200.000	300.000	400.000	500.000	750.000	1000.000	1250.000
	- CONCENTRATION -						
360.000	0.454424	0.561128	0.611901	0.589771	0.466145	0.373048	0.308452
337.500	0.280277	0.344535	0.367562	0.347742	0.263203	0.203794	0.165230
315.000	0.290713	0.364463	0.402000	0.393485	0.319284	0.257603	0.214186
292.500	0.377208	0.525991	0.605276	0.595820	0.474992	0.373377	0.302693
270.000	0.578601	0.773374	0.891571	0.889623	0.735558	0.595272	0.492879
247.500	0.533820	0.699923	0.786817	0.765070	0.601060	0.472289	0.386590
225.000	0.342882	0.467990	0.545996	0.548272	0.456946	0.375594	0.316825
202.500	0.249621	0.352435	0.420647	0.428727	0.367214	0.308778	0.266706
180.000	0.432243	0.564405	0.656643	0.667213	0.571788	0.474226	0.400454
157.500	0.243783	0.341143	0.397995	0.397584	0.329198	0.268578	0.223764
135.000	0.289109	0.390708	0.436846	0.423445	0.329253	0.251943	0.198369
112.500	0.343959	0.432622	0.470203	0.448693	0.339774	0.256306	0.201206
90.000	0.488303	0.563136	0.590381	0.553001	0.417746	0.322471	0.259795
67.500	0.252296	0.303809	0.329708	0.318969	0.252441	0.200184	0.164658
45.000	0.277939	0.319353	0.347003	0.338334	0.270791	0.214467	0.174651
22.500	0.210418	0.265342	0.293722	0.284494	0.221883	0.173699	0.141330

- DISCRETE RECEPTORS -

X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION
137.0	10.0	0.390784	143.0	20.0	0.266212	155.0	30.0	0.258816
177.0	40.0	0.280351	210.0	50.0	0.262693	250.0	60.0	0.262963
232.0	70.0	0.265536	219.0	80.0	0.360263	219.0	90.0	0.460580
223.0	100.0	0.394568	235.0	110.0	0.353635	207.0	120.0	0.317584
192.0	130.0	0.304167	183.0	140.0	0.286067	180.0	150.0	0.265453
183.0	160.0	0.271800	189.0	170.0	0.353527	207.0	180.0	0.425252
232.0	190.0	0.332726	274.0	200.0	0.333678	274.0	210.0	0.339455
268.0	220.0	0.382673	274.0	230.0	0.461692	244.0	240.0	0.487361
226.0	250.0	0.509657	216.0	260.0	0.534266	216.0	270.0	0.559058
219.0	280.0	0.465754	232.0	290.0	0.396380	250.0	300.0	0.378495
213.0	310.0	0.298091	177.0	320.0	0.303527	155.0	330.0	0.312523
143.0	340.0	0.339142	137.0	350.0	0.426992	134.0	360.0	0.523950

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 (CONT.) **

- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF ALL SOURCES COMBINED -

X COORDINATE RANGE (METERS)	Y COORDINATE AZIMUTH BEARING (DEGREES)	CONCENTRATION
400.00	270.00	0.891571
500.00	270.00	0.889623
400.00	247.50	0.786817
300.00	270.00	0.773374
500.00	247.50	0.765070
750.00	270.00	0.735558
300.00	247.50	0.699923
500.00	180.00	0.667213
400.00	180.00	0.656643
400.00	360.00	0.611901

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******************************************** END OF ISCLT PROGRAM,     1 SOURCES PROCESSED *******************************************
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ISCLTK6L MODEL, A VERSION OF
ISCLT (VERSION 90008)
AN AIR QUALITY DISPERSION MODEL IN
SECTION 1. GUIDELINE MODELS.
IN UNAMAP (VERSION 6) JAN 1990.
SOURCE: FILE 7 ON UNAMAP MAGNETIC TAPE FROM NTIS.

CONVERTED BY :
KBN ENGINEERING AND APPLIED SCIENCES, INC.
GAINESVILLE, FLORIDA
(904)331-9000

CARD INPUT FILE IS ER17LT85.I81
SUMMARY OUTPUT FILE IS ER17LT85.O81
TITLE OF RUN IS 1985 ENRON STATION 17 / 40 FT STACK 10-29-90

- ISCLT INPUT DATA (CONT.) -

```
        NUMBER OF SOURCES =    1
        NUMBER OF X AXIS GRID SYSTEM POINTS =    7
        NUMBER OF Y AXIS GRID SYSTEM POINTS =   16
        NUMBER OF SPECIAL POINTS =   36
        NUMBER OF SEASONS =    1
        NUMBER OF WIND SPEED CLASSES =    6
        NUMBER OF STABILITY CLASSES =    6
        NUMBER OF WIND DIRECTION CLASSES =  16
        FILE NUMBER OF DATA FILE USED FOR REPORTS =    1
        THE PROGRAM IS RUN IN RURAL MODE
        CONCENTRATION (DEPOSITION) UNITS CONVERSION FACTOR =0.10000000E+07
        ACCELERATION OF GRAVITY (METERS/SEC**2) =  9.800
        HEIGHT OF MEASUREMENT OF WIND SPEED (METERS) =  10.100
        CORRECTION ANGLE FOR GRID SYSTEM VERSUS DIRECTION DATA NORTH (DEGREES) =   0.000
        DECAY COEFFICIENT =0.00000000E+00
        PROGRAM OPTION SWITCHES = 1, 2, 2, 0, 0, 3, 2, 1, 3, 2, 2, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 1, 0,
0,
          RANGE X AXIS GRID SYSTEM POINTS (METERS )=     200.00,     300.00,     400.00,     500.00,     750.00,    1000.00,
            1250.00,
          RANGE X SPECIAL DISCRETE POINTS (METERS )=     137.00,     143.00,     155.00,     177.00,     210.00,     250.00,
             232.00,     219.00,     219.00,     223.00,     235.00,     207.00,     192.00,     183.00,     180.00,     183.00,
             189.00,     207.00,     232.00,     274.00,     274.00,     268.00,     274.00,     244.00,     226.00,     216.00,
             216.00,     219.00,     232.00,     250.00,     213.00,     177.00,     155.00,     143.00,     137.00,     134.00,
 AZIMUTH BEARING Y AXIS GRID SYSTEM POINTS (DEGREES)=      22.50,      45.00,      67.50,      90.00,     112.50,     135.00,
             157.50,     180.00,     202.50,     225.00,     247.50,     270.00,     292.50,     315.00,     337.50,     360.00,
 AZIMUTH BEARING Y SPECIAL DISCRETE POINTS (DEGREES)=      10.00,      20.00,      30.00,      40.00,      50.00,      60.00,
              70.00,      80.00,      90.00,     100.00,     110.00,     120.00,     130.00,     140.00,     150.00,     160.00,
             170.00,     180.00,     190.00,     200.00,     210.00,     220.00,     230.00,     240.00,     250.00,     260.00,
             270.00,     280.00,     290.00,     300.00,     310.00,     320.00,     330.00,     340.00,     350.00,     360.00,
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- AMBIENT AIR TEMPERATURE (DEGREES KELVIN) -

	STABILITY CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	300.0000	300.0000	300.0000	295.0000	290.0000	290.0000

- MIXING LAYER HEIGHT (METERS) -

SEASON 1

```
                  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                  CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
STABILITY CATEGORY 10.215100E+040.215100E+040.215100E+040.215100E+040.215100E+040.215100E+04
STABILITY CATEGORY 20.143400E+040.143400E+040.143400E+040.143400E+040.143400E+040.143400E+04
STABILITY CATEGORY 30.143400E+040.143400E+040.143400E+040.143400E+040.143400E+040.143400E+04
STABILITY CATEGORY 40.143400E+040.143400E+040.143400E+040.143400E+040.143400E+040.143400E+04
STABILITY CATEGORY 50.100000E+050.100000E+050.100000E+050.100000E+050.100000E+050.100000E+05
STABILITY CATEGORY 60.100000E+050.100000E+050.100000E+050.100000E+050.100000E+050.100000E+05
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- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00016500	0.00102701	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00015500	0.00079900	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00001000	0.00022800	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00013500	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00014500	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00003100	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00015000	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00002100	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00026900	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00002600	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00013000	0.00022800	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00014000	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00002100	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00015000	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00004100	0.00091300	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00012400	0.00011400	0.00000000	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 2

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00088100	0.00216901	0.00159801	0.00000000	0.00000000	0.00000000
22.500	0.00041500	0.00228301	0.00091300	0.00000000	0.00000000	0.00000000
45.000	0.00075400	0.00182601	0.00182601	0.00000000	0.00000000	0.00000000
67.500	0.00007200	0.00262601	0.00171201	0.00000000	0.00000000	0.00000000
90.000	0.00067800	0.00331102	0.00274001	0.00000000	0.00000000	0.00000000
112.500	0.00030100	0.00239701	0.00102701	0.00000000	0.00000000	0.00000000
135.000	0.00030100	0.00239701	0.00182601	0.00000000	0.00000000	0.00000000
157.500	0.00052600	0.00205501	0.00137001	0.00000000	0.00000000	0.00000000
180.000	0.00058500	0.00422402	0.00308202	0.00000000	0.00000000	0.00000000
202.500	0.00075400	0.00182601	0.00102701	0.00000000	0.00000000	0.00000000
225.000	0.00041200	0.00216901	0.00171201	0.00000000	0.00000000	0.00000000
247.500	0.00053200	0.00228301	0.00125601	0.00000000	0.00000000	0.00000000
270.000	0.00064300	0.00205501	0.00125601	0.00000000	0.00000000	0.00000000
292.500	0.00068400	0.00353902	0.00228301	0.00000000	0.00000000	0.00000000
315.000	0.00071500	0.00468002	0.00194101	0.00000000	0.00000000	0.00000000
337.500	0.00065200	0.00239701	0.00159801	0.00000000	0.00000000	0.00000000

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 3

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00032700	0.00296801	0.00593603	0.00022800	0.00000000	0.00000000
22.500	0.00008800	0.00285401	0.00456602	0.00011400	0.00000000	0.00000000
45.000	0.00022700	0.00353902	0.00502302	0.00102701	0.00000000	0.00000000
67.500	0.00024400	0.00411002	0.00867604	0.00148401	0.00000000	0.00000000
90.000	0.00024400	0.00411002	0.01095906	0.00159801	0.00000000	0.00000000
112.500	0.00076900	0.00205501	0.00502302	0.00091300	0.00000000	0.00000000
135.000	0.00030200	0.00216901	0.00194101	0.00068500	0.00000000	0.00000000
157.500	0.00017700	0.00194101	0.00422402	0.00045700	0.00000000	0.00000000
180.000	0.00032300	0.00285401	0.00799104	0.00148401	0.00000000	0.00000000
202.500	0.00005600	0.00182601	0.00411002	0.00068500	0.00000000	0.00000000
225.000	0.00032000	0.00274001	0.00388102	0.00045700	0.00022800	0.00000000
247.500	0.00004600	0.00148401	0.00285401	0.00091300	0.00022800	0.00000000
270.000	0.00004900	0.00159801	0.00559403	0.00137001	0.00011400	0.00000000
292.500	0.00033000	0.00308202	0.00684903	0.00068500	0.00000000	0.00000000
315.000	0.00020900	0.00296801	0.00627903	0.00045700	0.00000000	0.00000000
337.500	0.00028500	0.00159801	0.00342502	0.00011400	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 4

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00036500	0.00799104	0.00890404	0.00285401	0.00000000	0.00000000
22.500	0.00030500	0.00605003	0.00582203	0.00148401	0.00000000	0.00000000
45.000	0.00017000	0.00547903	0.00764804	0.00684903	0.00022800	0.00000000
67.500	0.00035500	0.00388102	0.01495407	0.01267106	0.00068500	0.00000000
90.000	0.00014800	0.00479502	0.01917810	0.01575308	0.00034200	0.00000000
112.500	0.00009900	0.00319602	0.01118706	0.00490902	0.00011400	0.00000000
135.000	0.00016700	0.00159801	0.00719204	0.00513703	0.00022800	0.00000000
157.500	0.00017100	0.00171201	0.00707804	0.00662103	0.00034200	0.00000000
180.000	0.00013100	0.00422402	0.01552508	0.01267106	0.00228301	0.00022800
202.500	0.00032700	0.00296801	0.00616403	0.00593603	0.00102701	0.00011400
225.000	0.00006000	0.00194101	0.00764804	0.00502302	0.00148401	0.00011400
247.500	0.00018100	0.00205501	0.00570803	0.00593603	0.00114201	0.00022800
270.000	0.00019200	0.00239701	0.00787704	0.01381307	0.00365302	0.00114201
292.500	0.00017400	0.00182601	0.00684903	0.01038805	0.00148401	0.00011400
315.000	0.00021300	0.00308202	0.00502302	0.00616403	0.00011400	0.00000000
337.500	0.00059400	0.00399502	0.00696304	0.00342502	0.00022800	0.00000000

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 5

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00000000	0.01461207	0.00411002	0.00000000	0.00000000	0.00000000
22.500	0.00000000	0.01290006	0.00182601	0.00000000	0.00000000	0.00000000
45.000	0.00000000	0.01381307	0.00228301	0.00000000	0.00000000	0.00000000
67.500	0.00000000	0.01347007	0.00399502	0.00000000	0.00000000	0.00000000
90.000	0.00000000	0.01563908	0.00468002	0.00000000	0.00000000	0.00000000
112.500	0.00000000	0.00867604	0.00331102	0.00000000	0.00000000	0.00000000
135.000	0.00000000	0.00901804	0.00251101	0.00000000	0.00000000	0.00000000
157.500	0.00000000	0.00582203	0.00365302	0.00000000	0.00000000	0.00000000
180.000	0.00000000	0.01461207	0.00605003	0.00000000	0.00000000	0.00000000
202.500	0.00000000	0.00502302	0.00148401	0.00000000	0.00000000	0.00000000
225.000	0.00000000	0.00513703	0.00159801	0.00000000	0.00000000	0.00000000
247.500	0.00000000	0.00490902	0.00411002	0.00000000	0.00000000	0.00000000
270.000	0.00000000	0.00365302	0.00844704	0.00000000	0.00000000	0.00000000
292.500	0.00000000	0.00274001	0.00616403	0.00000000	0.00000000	0.00000000
315.000	0.00000000	0.00388102	0.00353902	0.00000000	0.00000000	0.00000000
337.500	0.00000000	0.00422402	0.00388102	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 6

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.01042305	0.01769409	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00757004	0.01769409	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00831504	0.01803709	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00625303	0.01290006	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00478002	0.01301407	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00292601	0.00468002	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00312702	0.00502302	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00295401	0.00411002	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00507503	0.01027405	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00475702	0.00502302	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00285501	0.00502302	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00394602	0.00719204	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00409802	0.00799104	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00413702	0.00605003	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00345402	0.00388102	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00364102	0.00844704	0.00000000	0.00000000	0.00000000	0.00000000

- ISCLT INPUT DATA (CONT.) -

- VERTICAL POTENTIAL TEMPERATURE GRADIENT (DEGREES KELVIN/METER) -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 2	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 3	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 5	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01
STABILITY CATEGORY 6	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01

- WIND PROFILE POWER LAW EXPONENTS -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 2	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 3	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00
STABILITY CATEGORY 4	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00
STABILITY CATEGORY 5	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00
STABILITY CATEGORY 6	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		1	STACK	0.00	0.00	12.19	0.00	GAS EXIT TEMP (DEG K)= 641.00, GAS EXIT VEL. (M/SEC)= 57.47, STACK DIAMETER (M)= 0.390, HEIGHT OF ASSO. BLDG. (M)= -9.69, WIDTH OF ASSO. BLDG. (M)= 61.84, WAKE EFFECTS FLAG = 0

- DIRECTION SPECIFIC BUILDING DIMENSIONS -

SECTOR	DSBH	DSBW	IWAKE	SECTOR	DSBH	DSBW	IWAKE	SECTOR	DSBH	DSBW	IWAKE	SECTOR	DSBH	DSBW	IWAKE
1	9.7,	61.9,	0	2	9.7,	61.9,	0	3	9.7,	61.9,	0	4	9.7,	61.9,	0
5	9.7,	61.9,	0	6	9.7,	61.9,	0	7	9.7,	61.9,	0	8	9.7,	61.9,	0
9	9.7,	61.9,	0	10	9.7,	61.9,	0	11	9.7,	61.9,	0	12	9.7,	61.9,	0
13	9.7,	61.9,	0	14	9.7,	61.9,	0	15	9.7,	61.9,	0	16	9.7,	61.9,	0

- SOURCE STRENGTHS (GRAMS PER SEC) -

SEASON 1	SEASON 2	SEASON 3	SEASON 4
1.33000E+00			

WARNING - HW/HB > 5 FOR SOURCE 1 PROG. USES LATERAL VIRTUAL DIST. FOR UPPER BOUND OF CONCENTRATION (DEPOSITION) IN SECTOR(S):
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16.
IF LOWER BOUND IS DESIRED SET THE DIRECTION SPECIFIC BUILDING HEIGHT TO < 0 (WAKE EFFECTS FLAG) AND RERUN.

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 **

- GRID SYSTEM RECEPTORS -

- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	200.000	300.000	400.000	500.000	750.000	1000.000	1250.000
	- CONCENTRATION -						
360.000	0.612084	0.762230	0.841387	0.816398	0.649889	0.518916	0.427407
337.500	0.263457	0.351287	0.399448	0.394123	0.318169	0.253040	0.206829
315.000	0.254045	0.317465	0.353849	0.347919	0.283068	0.230360	0.193275
292.500	0.253513	0.352518	0.415420	0.422587	0.362887	0.301370	0.252562
270.000	0.583736	0.789948	0.913603	0.910853	0.746551	0.597418	0.490140
247.500	0.466271	0.630031	0.731636	0.730572	0.599978	0.482449	0.398609
225.000	0.300611	0.393437	0.450599	0.450501	0.379603	0.320322	0.278034
202.500	0.161705	0.244618	0.293602	0.298761	0.260629	0.231693	0.209997
180.000	0.236710	0.335915	0.395267	0.402268	0.356550	0.317197	0.284387
157.500	0.188916	0.263725	0.310662	0.315530	0.270773	0.226668	0.191883
135.000	0.332215	0.464312	0.520352	0.498134	0.377936	0.288638	0.228645
112.500	0.461786	0.590152	0.646531	0.615797	0.467297	0.355063	0.280101
90.000	0.592882	0.670965	0.700948	0.656293	0.498245	0.385614	0.310063
67.500	0.305129	0.362863	0.390058	0.372800	0.291268	0.230991	0.190193
45.000	0.301222	0.368243	0.410947	0.404815	0.326426	0.257008	0.207354
22.500	0.280253	0.353476	0.391710	0.381399	0.303958	0.240472	0.195645

- DISCRETE RECEPTORS -

X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION
137.0	10.0	0.522430	143.0	20.0	0.353224	155.0	30.0	0.315669
177.0	40.0	0.313452	210.0	50.0	0.292183	250.0	60.0	0.308221
232.0	70.0	0.320086	219.0	80.0	0.436160	219.0	90.0	0.557788
223.0	100.0	0.496922	235.0	110.0	0.470101	207.0	120.0	0.408502
192.0	130.0	0.363556	183.0	140.0	0.307770	180.0	150.0	0.242282
183.0	160.0	0.199706	189.0	170.0	0.217290	207.0	180.0	0.234086
232.0	190.0	0.197496	274.0	200.0	0.224476	274.0	210.0	0.255573
268.0	220.0	0.314883	274.0	230.0	0.397170	244.0	240.0	0.427718
226.0	250.0	0.454805	216.0	260.0	0.509027	216.0	270.0	0.564817
219.0	280.0	0.416450	232.0	290.0	0.285509	250.0	300.0	0.272676
213.0	310.0	0.244107	177.0	320.0	0.269392	155.0	330.0	0.282289
143.0	340.0	0.331158	137.0	350.0	0.510984	134.0	360.0	0.703521

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 (CONT.) **

- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF ALL SOURCES COMBINED -

X COORDINATE RANGE (METERS)	Y COORDINATE AZIMUTH BEARING (DEGREES)	CONCENTRATION
400.00	270.00	0.913603
500.00	270.00	0.910853
400.00	360.00	0.841387
500.00	360.00	0.816398
300.00	270.00	0.789948
300.00	360.00	0.762230
750.00	270.00	0.746551
400.00	247.50	0.731636
500.00	247.50	0.730572
134.00	360.00	0.703521

** END OF ISCLT PROGRAM,   1 SOURCES PROCESSED **

ISCLTK6L MODEL, A VERSION OF
ISCLT (VERSION 90008)
AN AIR QUALITY DISPERSION MODEL IN
SECTION 1. GUIDELINE MODELS.
IN UNAMAP (VERSION 6) JAN 1990.
SOURCE: FILE 7 ON UNAMAP MAGNETIC TAPE FROM NTIS.

CONVERTED BY :
KBN ENGINEERING AND APPLIED SCIENCES, INC.
GAINESVILLE, FLORIDA
(904)331-9000

CARD INPUT FILE IS ER17LT86.I81
SUMMARY OUTPUT FILE IS ER17LT86.O81
TITLE OF RUN IS 1986 ENRON STATION 17 / 40 FT STACK 10-29-90

- ISCLT INPUT DATA (CONT.) -

```
        NUMBER OF SOURCES =    1
        NUMBER OF X AXIS GRID SYSTEM POINTS =    7
        NUMBER OF Y AXIS GRID SYSTEM POINTS =   16
        NUMBER OF SPECIAL POINTS =   36
        NUMBER OF SEASONS =    1
        NUMBER OF WIND SPEED CLASSES =   6
        NUMBER OF STABILITY CLASSES =   6
        NUMBER OF WIND DIRECTION CLASSES =  16
        FILE NUMBER OF DATA FILE USED FOR REPORTS =    1
        THE PROGRAM IS RUN IN RURAL MODE
        CONCENTRATION (DEPOSITION) UNITS CONVERSION FACTOR =0.10000000E+07
        ACCELERATION OF GRAVITY (METERS/SEC**2) =  9.800
        HEIGHT OF MEASUREMENT OF WIND SPEED (METERS) =  10.100
        CORRECTION ANGLE FOR GRID SYSTEM VERSUS DIRECTION DATA NORTH (DEGREES) =   0.000
        DECAY COEFFICIENT =0.00000000E+00
        PROGRAM OPTION SWITCHES = 1, 2, 2, 0, 0, 3, 2, 1, 3, 2, 2, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 1, 0,
0,
          RANGE X AXIS GRID SYSTEM POINTS (METERS )=     200.00,     300.00,     400.00,     500.00,     750.00,    1000.00,
            1250.00,
          RANGE X SPECIAL DISCRETE POINTS (METERS )=     137.00,     143.00,     155.00,     177.00,     210.00,     250.00,
               232.00,     219.00,     219.00,     223.00,     235.00,     207.00,     192.00,     183.00,     180.00,     183.00,
               189.00,     207.00,     232.00,     274.00,     274.00,     268.00,     274.00,     244.00,     226.00,     216.00,
               216.00,     219.00,     232.00,     250.00,     213.00,     177.00,     155.00,     143.00,     137.00,     134.00,
 AZIMUTH BEARING Y AXIS GRID SYSTEM POINTS (DEGREES)=      22.50,      45.00,      67.50,      90.00,     112.50,     135.00,
               157.50,     180.00,     202.50,     225.00,     247.50,     270.00,     292.50,     315.00,     337.50,     360.00,
 AZIMUTH BEARING Y SPECIAL DISCRETE POINTS (DEGREES)=      10.00,      20.00,      30.00,      40.00,      50.00,      60.00,
                70.00,      80.00,      90.00,     100.00,     110.00,     120.00,     130.00,     140.00,     150.00,     160.00,
               170.00,     180.00,     190.00,     200.00,     210.00,     220.00,     230.00,     240.00,     250.00,     260.00,
               270.00,     280.00,     290.00,     300.00,     310.00,     320.00,     330.00,     340.00,     350.00,     360.00,
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- AMBIENT AIR TEMPERATURE (DEGREES KELVIN) -

	STABILITY CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	300.0000	300.0000	300.0000	295.0000	290.0000	290.0000

- MIXING LAYER HEIGHT (METERS) -

SEASON 1

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.215100E+04	0.215100E+04	0.215100E+04	0.215100E+04	0.215100E+04	0.215100E+04
STABILITY CATEGORY 2	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04
STABILITY CATEGORY 3	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04
STABILITY CATEGORY 4	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04	0.143400E+04
STABILITY CATEGORY 5	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05
STABILITY CATEGORY 6	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00038600	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00013600	0.00022800	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00040100	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00029400	0.00079900	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00038600	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00055900	0.00114200	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00029400	0.00079900	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00017300	0.00079900	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00019500	0.00114200	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00004400	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00018000	0.00091300	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00015100	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00027900	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00005800	0.00091300	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00018700	0.00102700	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00027200	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 2

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00084300	0.00353900	0.00182600	0.00000000	0.00000000	0.00000000
22.500	0.00077500	0.00171200	0.00137000	0.00000000	0.00000000	0.00000000
45.000	0.00105800	0.00296800	0.00125600	0.00000000	0.00000000	0.00000000
67.500	0.00086800	0.00422400	0.00148400	0.00000000	0.00000000	0.00000000
90.000	0.00148600	0.00490900	0.00205500	0.00000000	0.00000000	0.00000000
112.500	0.00071200	0.00319600	0.00182600	0.00000000	0.00000000	0.00000000
135.000	0.00073700	0.00388100	0.00137000	0.00000000	0.00000000	0.00000000
157.500	0.00070300	0.00296800	0.00228300	0.00000000	0.00000000	0.00000000
180.000	0.00097800	0.00399500	0.00285400	0.00000000	0.00000000	0.00000000
202.500	0.00080900	0.00262600	0.00114200	0.00000000	0.00000000	0.00000000
225.000	0.00021700	0.00262600	0.00205500	0.00000000	0.00000000	0.00000000
247.500	0.00083400	0.00331100	0.00194100	0.00000000	0.00000000	0.00000000
270.000	0.00069500	0.00274000	0.00251100	0.00000000	0.00000000	0.00000000
292.500	0.00059300	0.00319600	0.00262600	0.00000000	0.00000000	0.00000000
315.000	0.00059300	0.00319600	0.00239700	0.00000000	0.00000000	0.00000000
337.500	0.00054200	0.00182600	0.00102700	0.00000000	0.00000000	0.00000000

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 3

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00013600	0.00445200	0.00627899	0.00045700	0.00000000	0.00000000
22.500	0.00029800	0.00205500	0.00422400	0.00000000	0.00000000	0.00000000
45.000	0.00024000	0.00399500	0.00570799	0.00034200	0.00000000	0.00000000
67.500	0.00036100	0.00411000	0.00582199	0.00137000	0.00000000	0.00000000
90.000	0.00073100	0.00468000	0.01107299	0.00091300	0.00000000	0.00000000
112.500	0.00031500	0.00262600	0.00525100	0.00000000	0.00000000	0.00000000
135.000	0.00018000	0.00205500	0.00376700	0.00022800	0.00000000	0.00000000
157.500	0.00020500	0.00285400	0.00422400	0.00034200	0.00000000	0.00000000
180.000	0.00023600	0.00388100	0.00981699	0.00057100	0.00000000	0.00000000
202.500	0.00021900	0.00331100	0.00365300	0.00045700	0.00000000	0.00000000
225.000	0.00019800	0.00262600	0.00353900	0.00068500	0.00000000	0.00000000
247.500	0.00031900	0.00274000	0.00399500	0.00022800	0.00000000	0.00000000
270.000	0.00052300	0.00171200	0.00502300	0.00148400	0.00000000	0.00000000
292.500	0.00032600	0.00296800	0.00570799	0.00045700	0.00000000	0.00000000
315.000	0.00020800	0.00296800	0.00399500	0.00045700	0.00000000	0.00000000
337.500	0.00041600	0.00205500	0.00353900	0.00045700	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 4

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00128000	0.01084499	0.01164399	0.00342500	0.00011400	0.00000000
22.500	0.00085200	0.00468000	0.00684899	0.00182600	0.00000000	0.00000000
45.000	0.00079100	0.00650699	0.00730599	0.00353900	0.00000000	0.00000000
67.500	0.00056300	0.00673499	0.00981699	0.00570799	0.00000000	0.00000000
90.000	0.00046700	0.00741999	0.01940598	0.00650699	0.00022800	0.00000000
112.500	0.00087000	0.00525100	0.01050199	0.00445200	0.00000000	0.00000000
135.000	0.00008200	0.00262600	0.00593599	0.00159800	0.00011400	0.00000000
157.500	0.00068500	0.00308200	0.00730599	0.00274000	0.00000000	0.00000000
180.000	0.00070900	0.00764799	0.01974898	0.00696299	0.00022800	0.00000000
202.500	0.00022800	0.00353900	0.01004599	0.00445200	0.00011400	0.00000000
225.000	0.00034200	0.00342500	0.00924699	0.00479500	0.00011400	0.00011400
247.500	0.00036700	0.00422400	0.00844699	0.00627899	0.00068500	0.00000000
270.000	0.00043900	0.00274000	0.00616399	0.00525100	0.00102700	0.00011400
292.500	0.00031700	0.00262600	0.00547899	0.00296800	0.00045700	0.00000000
315.000	0.00059200	0.00388100	0.00502300	0.00091300	0.00011400	0.00000000
337.500	0.00054900	0.00627899	0.00616399	0.00205500	0.00000000	0.00000000

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 5

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00000000	0.01209999	0.00662099	0.00000000	0.00000000	0.00000000
22.500	0.00000000	0.00993199	0.00228300	0.00000000	0.00000000	0.00000000
45.000	0.00000000	0.01095899	0.00308200	0.00000000	0.00000000	0.00000000
67.500	0.00000000	0.01221499	0.00399500	0.00000000	0.00000000	0.00000000
90.000	0.00000000	0.01483999	0.00787699	0.00000000	0.00000000	0.00000000
112.500	0.00000000	0.00719199	0.00319600	0.00000000	0.00000000	0.00000000
135.000	0.00000000	0.00867599	0.00148400	0.00000000	0.00000000	0.00000000
157.500	0.00000000	0.00844699	0.00171200	0.00000000	0.00000000	0.00000000
180.000	0.00000000	0.01404099	0.00433800	0.00000000	0.00000000	0.00000000
202.500	0.00000000	0.00878999	0.00274000	0.00000000	0.00000000	0.00000000
225.000	0.00000000	0.00650699	0.00274000	0.00000000	0.00000000	0.00000000
247.500	0.00000000	0.00833299	0.00365300	0.00000000	0.00000000	0.00000000
270.000	0.00000000	0.00468000	0.00593599	0.00000000	0.00000000	0.00000000
292.500	0.00000000	0.00502300	0.00536499	0.00000000	0.00000000	0.00000000
315.000	0.00000000	0.00216900	0.00228300	0.00000000	0.00000000	0.00000000
337.500	0.00000000	0.00331100	0.00593599	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 6

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00829799	0.01757998	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00662399	0.01324199	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00722099	0.01826498	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00742599	0.01426899	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00609599	0.01952098	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00279300	0.00844699	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00241200	0.00582199	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00363800	0.00616399	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00600499	0.01438399	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00329700	0.00741999	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00360500	0.00593599	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00313200	0.00627899	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00403000	0.00616399	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00196900	0.00456600	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00276900	0.00468000	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00477100	0.00947499	0.00000000	0.00000000	0.00000000	0.00000000

- ISCLT INPUT DATA (CONT.) -

- VERTICAL POTENTIAL TEMPERATURE GRADIENT (DEGREES KELVIN/METER) -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 2	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 3	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 5	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01
STABILITY CATEGORY 6	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01

- WIND PROFILE POWER LAW EXPONENTS -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 2	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 3	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00
STABILITY CATEGORY 4	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00
STABILITY CATEGORY 5	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00
STABILITY CATEGORY 6	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		1	STACK	0.00	0.00	12.19	0.00	GAS EXIT TEMP (DEG K)= 641.00, GAS EXIT VEL. (M/SEC)= 57.47, STACK DIAMETER (M)= 0.390, HEIGHT OF ASSO. BLDG. (M)= -9.69, WIDTH OF ASSO. BLDG. (M)= 61.84, WAKE EFFECTS FLAG = 0

- DIRECTION SPECIFIC BUILDING DIMENSIONS -

SECTOR	DSBH	DSBW	IWAKE	SECTOR	DSBH	DSBW	IWAKE	SECTOR	DSBH	DSBW	IWAKE	SECTOR	DSBH	DSBW	IWAKE
1	9.7,	61.9,	0	2	9.7,	61.9,	0	3	9.7,	61.9,	0	4	9.7,	61.9,	0
5	9.7,	61.9,	0	6	9.7,	61.9,	0	7	9.7,	61.9,	0	8	9.7,	61.9,	0
9	9.7,	61.9,	0	10	9.7,	61.9,	0	11	9.7,	61.9,	0	12	9.7,	61.9,	0
13	9.7,	61.9,	0	14	9.7,	61.9,	0	15	9.7,	61.9,	0	16	9.7,	61.9,	0

- SOURCE STRENGTHS (GRAMS PER SEC) -

SEASON 1	SEASON 2	SEASON 3	SEASON 4
1.33000E+00			

WARNING - HW/HB > 5 FOR SOURCE 1 PROG. USES LATERAL VIRTUAL DIST. FOR UPPER BOUND OF CONCENTRATION (DEPOSITION) IN SECTOR(S):
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16.
IF LOWER BOUND IS DESIRED SET THE DIRECTION SPECIFIC BUILDING HEIGHT TO < 0 (WAKE EFFECTS FLAG) AND RERUN.

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 **

- GRID SYSTEM RECEPTORS -

- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	200.000	300.000	400.000	500.000	750.000	1000.000	1250.000
	- CONCENTRATION -						
360.000	0.430740	0.607777	0.721948	0.738066	0.635254	0.527169	0.442135
337.500	0.247318	0.332675	0.378764	0.375859	0.307036	0.248981	0.207391
315.000	0.196096	0.285944	0.333009	0.329516	0.264146	0.213227	0.178074
292.500	0.268095	0.384517	0.454560	0.458293	0.384655	0.316946	0.264909
270.000	0.393115	0.598264	0.739120	0.769073	0.672726	0.562997	0.476007
247.500	0.325819	0.457520	0.535849	0.538100	0.451227	0.376336	0.320548
225.000	0.223894	0.337863	0.410994	0.421048	0.361912	0.307848	0.267333
202.500	0.149967	0.223042	0.272579	0.283772	0.254298	0.223359	0.198444
180.000	0.255888	0.383246	0.474208	0.496606	0.451736	0.399657	0.352178
157.500	0.160314	0.228683	0.272055	0.279187	0.251759	0.222752	0.195210
135.000	0.242270	0.315353	0.346475	0.334460	0.264292	0.209281	0.169351
112.500	0.307566	0.399174	0.435780	0.416768	0.324661	0.256750	0.209611
90.000	0.378627	0.456528	0.483337	0.454897	0.349438	0.276003	0.225996
67.500	0.294584	0.393780	0.454016	0.453243	0.375843	0.307459	0.256364
45.000	0.286107	0.367394	0.414182	0.410038	0.337978	0.274578	0.227357
22.500	0.222121	0.313645	0.380874	0.396903	0.348153	0.290265	0.244174

- DISCRETE RECEPTORS -

X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION
137.0	10.0	0.357271	143.0	20.0	0.261830	155.0	30.0	0.260611
177.0	40.0	0.284729	210.0	50.0	0.279286	250.0	60.0	0.310326
232.0	70.0	0.297778	219.0	80.0	0.322569	219.0	90.0	0.359265
223.0	100.0	0.324688	235.0	110.0	0.314138	207.0	120.0	0.279034
192.0	130.0	0.259574	183.0	140.0	0.231296	180.0	150.0	0.192874
183.0	160.0	0.174580	189.0	170.0	0.214549	207.0	180.0	0.253410
232.0	190.0	0.203385	274.0	200.0	0.210356	274.0	210.0	0.223145
268.0	220.0	0.264206	274.0	230.0	0.317050	244.0	240.0	0.310897
226.0	250.0	0.319408	216.0	260.0	0.350319	216.0	270.0	0.385082
219.0	280.0	0.324467	232.0	290.0	0.282095	250.0	300.0	0.271720
213.0	310.0	0.205740	177.0	320.0	0.213766	155.0	330.0	0.245763
143.0	340.0	0.291049	137.0	350.0	0.372061	134.0	360.0	0.462016

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 (CONT.) **

- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF ALL SOURCES COMBINED -

X COORDINATE RANGE (METERS)	Y COORDINATE AZIMUTH BEARING (DEGREES)	CONCENTRATION
500.00	270.00	0.769073
400.00	270.00	0.739120
500.00	360.00	0.738066
400.00	360.00	0.721948
750.00	270.00	0.672726
750.00	360.00	0.635254
300.00	360.00	0.607777
300.00	270.00	0.598264
1000.00	270.00	0.562997
500.00	247.50	0.538100

*** END OF ISCLT PROGRAM,   1 SOURCES PROCESSED ***

Florida Gas Transmission Company
P. O. Box 945100 Maitland, Florida 32794-5100 (407) 875-5800

Certified Mail

October 16, 1992

Mr. Alan Zahm, P.E.
Supervisor, Permitting
Air Resource Management
3319 Maguire Blvd, Suite 232
Orlando, Florida 32803-3767

Dear Mr. Zahm:

RE: Air Permit - AC42-189455
Florida Gas Transmission Company - Station 17
Marion County, Silver Spring, Florida
Natural Gas Compressor Engine (Unit No.5)

In response to your October 8, 1992, letter to Mr. William Osbourne referencing the expiration of the above-referenced air permit, I've attached a copy of a letter from Steve Smallwood with the Florida DER. As you will note in his letter, the DER extended the expiration date of this permit to June 1993.

Please call me at 407-875-5816 if you have any questions.

Sincerely,

Allan Weatherford

Allan Weatherford
Compliance Environmentalist

bc
aw1016az
attachments

cc: Chuck Truby
Raymond Young
Bill Osbourne
Steve Smallwood, Florida DER ✓

Fold at line over top of envelope to the right of the return address

CERTIFIED
P 250 257 120
MAIL

RECEIVED
OCT 21 1992
Division of Air Resources Management

File Copy
AC42-189455
PSD-FL-161

Florida Gas Transmission Company

Certified Mail P.O. Box 945100 Maitland, Florida 32794-5100 (407) 875-5800

March 26, 1991

Mr. Barry Andrews
Florida Department of Environmental Regulation
Division of Air Resources Management
Bureau of Air Regulation
Twin Towers Building
2600 Blair Stone Road
Tallahassee, Fl 32399-2400

✓ NO2 vs. No. 2

Dear Mr. Andrews:

Re: Intent to Issue Permit
Proof of Publication - Air Permit
Florida Gas Transmission Company
Compressor Station 17, Silver Springs, Fl

I hereby submit one (1) affidavit as proof of publication of the intent issue notice for the site referenced above.

Sincerely,

Allan Weatherford
Compliance Environmentalist

RECEIVED
MAR 28 1991
DER - BAQM

AW:kb
letter.28

cc: Chuck Truby
Raymond Young
Levon Carroll
Leroy Coker
Joe Kolb
Bill Osborne
E. Andersen Olson
Teresa Heron
Chuck Collins } 3-28-91 KT

4-8-91

Called Allan Heatherford -
He will have newspaper
publish corrected notice.

PROOF OF PUBLICATION

THE OCALA STAR-BANNER

Published—Daily

OCALA, MARION COUNTY, FLORIDA

STATE OF FLORIDA,
COUNTY OF MARION.

Before me the undersigned authority personally appeared Lynn Maxwell, who on oath says that he is Classified Manager of the Ocala Star-Banner, a daily newspaper published at Ocala, in Marion County, Florida; that the attached copy of advertisement, being a notice in the matter of #3J004-Notice of Intent to Issue

__________ in the __________ Court,

was published in said newspaper in the issues of March 21, 1991

Affiant further says that the said THE OCALA STAR-BANNER is a daily newspaper published at Ocala, in said Marion County, Florida, and that the said newspaper has heretofore been continuously published in said Marion County, Florida, daily, and has been entered as second class mail matter at the post office in Ocala, in said Marion County, Florida, for a period of one year next preceding the first publication of the attached copy of advertisement; and affiant further says that he has neither paid nor promised any person, firm or cooperation any discount, rebate, commission or refund for the purpose of securing this advertisement for publication in the said newspaper.

Sworn to and subscribed before me this 21 day of March, A.D., 19 91

Notary Public

(Seal) NOTARY PUBLIC STATE OF FLORIDA

Notary Public, State of Florida at Large
My Commission Expires Sept. 1, 1994

RECEIVED
MAR 28 1991
DER - BAQM

State of Florida
Department of
Environmental Regulation
Notice of Intent to Issue

The Department of Environmental Regulation hereby gives notice of its intent to issue a permit to Florida Gas Transmission Company, P.O. Box 1188, Houston, Texas 77251-1188, to install one natural gas fired engine. The Company's facility is located 17 miles northeast of Silver Springs on CR 314 in Silver Springs, Marion County, Florida. The maximum annual No. 2 Class I increment consumed in the Chassahowitzka National Wilderness Area is much less than 1%. The maximum annual No. 2 Class II increment consumed is 3.6%. A determination of Best Available Control Technology (BACT) was required. The Department is issuing this Intent to Issue for the reasons stated in the Technical Evaluation and Preliminary Determination.

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, Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the department at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400, within fourteen (14) days of publication of this notice. Petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. 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, Florida Statutes.

The Petition shall contain the following information:

(a) The name, address and telephone number of each petitioner, the applicant's name and address, the Department Permit File Number and the county in which the project is proposed;

(b) A statement of how and when each petitioner received notice of the Department's action or proposed action;

(c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action;

(d) A statement of the material facts disputed by Petitioner, if any;

(e) A statement of facts which petitioner contends warrant reversal or modification of the Department's action or proposed action;

(f) A statement of which rules or statutes petitioner contends require reversal or modification of the Department's action or proposed action; and

(g) A statement of the relief sought by petitioner, stating precisely the action petitioner wants the Department to take with respect to the Department's action or proposed action.

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 position taken by it in this Notice. Persons whose substantial interests will be affected by any decision of the Department with regard to the application have the right to petition to become a party to the proceeding. The petition must conform to the requirements specified above and be filed (received) within 14 days of publication of this notice in the Office of General Counsel at the above address of the Department. Failure to petition within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, F.S., and to participate as a party to this proceeding. Any subsequent intervention will only be at the approval of the presiding officer upon motion filed pursuant to Rule 28-5.207, F.A.C.

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

Department of Environmental Regulation
Bureau of Air Regulation
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

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

Any person may send written comments on the proposed action to Mr. Barry Andrews 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. Further, a public hearing can be requested by any person. Such requests must be submitted within 30 days of this notice.

No. 3J004 — March 21, 1991

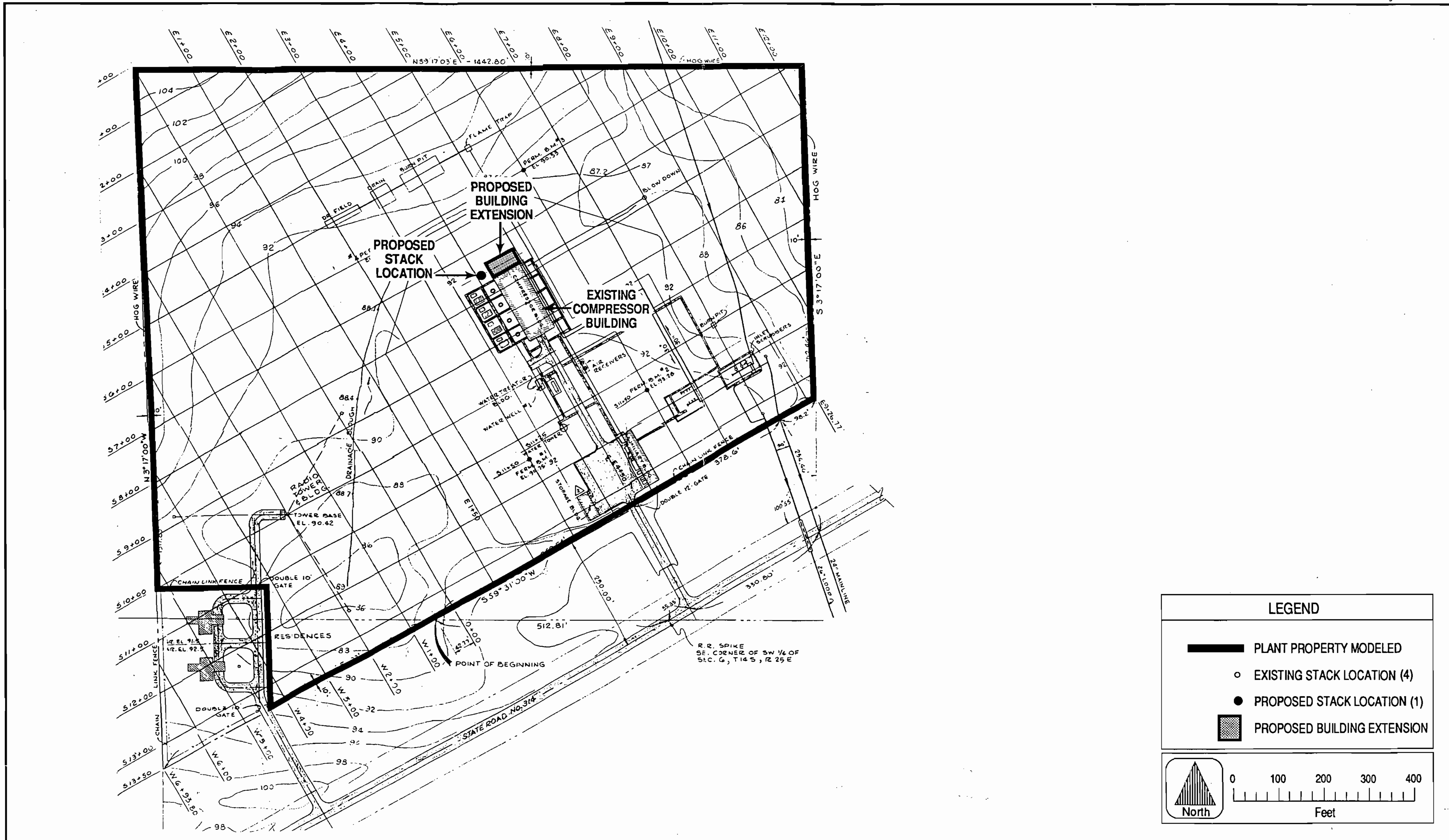

Figure 2-1 PLOT PLAN OF COMPRESSOR STATION NO. 17

Florida Gas Transmission Company