



Jeb Bush
Governor

Department of Environmental Protection

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

David B. Struhs
Secretary

March 15, 2002

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Florida Gas Transmission Company
1400 Smith Street
Houston, TX 77002

Authorized Representative:

Mr. Danny Pribble, V.P. of Operations

Re: Florida Gas Transmission Company - Bradford Compressor Station No. 16
Extension of Air Construction Permit Expiration Date
Air Permit No. 0070012-004-AC

Dear Mr. Pribble:

On March 5, 2002, Florida Gas Transmission Company requested an extension of the expiration date of air construction Permit No. 0070012-004-AC for the Bradford Compressor Station No. 16 located approximately 3 miles north of the city of Brooker on Highway 231 in Bradford County, Florida. Additional time is requested complete the modifications, perform the required tests and submit a timely Title V operation permit. The Department approves this request.

The expiration date is hereby extended from **June 1, 2002** to **December 31, 2002** to provide the necessary time to complete construction and submit a complete application for a Title V air operation permit. This permitting action does not authorize any new construction. A copy of this letter shall be filed with the referenced permit and shall become part of the permit. This permitting decision is issued pursuant to Chapter 403, Florida Statutes.

A person whose substantial interests are affected by the proposed permitting decision may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57 of the Florida Statutes (F.S.). The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station #35, Tallahassee, Florida, 32399-3000. Petitions filed by the permit applicant or any of the parties listed below must be filed within fourteen (14) days of receipt of this notice of intent. Petitions filed by any persons other than those entitled to written notice under section 120.60(3), F.S., must be filed within fourteen (14) days of publication of the public notice or within fourteen (14) days of receipt of this notice of intent, whichever occurs first. Under Section 120.60(3), F.S., however, any person who asked the Department for notice of agency action may file a petition within fourteen (14) days of receipt of that notice, regardless of the date of publication. A petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57, F.S., or to intervene in this proceeding and participate as a party to it. Any subsequent intervention will be only at the approval of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205 of the Florida Administrative Code (F.A.C.)

"More Protection, Less Process"

Printed on recycled paper.

A petition that disputes the material facts on which the Department's action is based must contain the following information: (a) The name and address of each agency affected and each agency's file or identification number, if known; (b) The name, address, and telephone number of the petitioner, the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests will be affected by the agency determination; (c) A statement of how and when petitioner received notice of the agency action or proposed action; (d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate; (e) A concise statement of the ultimate facts alleged, including the specific facts the petitioner contends warrant reversal or modification of the agency's proposed action; (f) A statement of the specific rules or statutes the petitioner contends require reversal or modification of the agency's proposed action; and (g) A statement of the relief sought by the petitioner, stating precisely the action petitioner wishes the agency to take with respect to the agency's proposed action.

A petition that does not dispute the material facts upon which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by Rule 28-106.301, F.A.C.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that 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 such final decision of the Department on the application have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation is not available in this proceeding.

In addition to the above, a person subject to regulation has a right to apply for a variance from or waiver of the requirements of particular rules, on certain conditions, under Section 120.542, F.S. The relief provided by this state statute applies only to state rules, not statutes, and not to any federal regulatory requirements. Applying for a variance or waiver does not substitute or extend the time for filing a petition for an administrative hearing or exercising any other right that a person may have in relation to the action proposed in this notice of intent.

The application for a variance or waiver is made by filing a petition with the Office of General Counsel of the Department, 3900 Commonwealth Boulevard, Mail Station #35, Tallahassee, Florida 32399-3000. The petition must specify the following information: (a) The name, address, and telephone number of the petitioner; (b) The name, address, and telephone number of the attorney or qualified representative of the petitioner, if any; (c) Each rule or portion of a rule from which a variance or waiver is requested; (d) The citation to the statute underlying (implemented by) the rule identified in (c) above; (e) The type of action requested; (f) The specific facts that would justify a variance or waiver for the petitioner; (g) The reason why the variance or waiver would serve the purposes of the underlying statute (implemented by the rule); and (h) A statement whether the variance or waiver is permanent or temporary and, if temporary, a statement of the dates showing the duration of the variance or waiver requested.

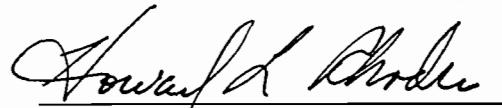
The Department will grant a variance or waiver when the petition demonstrates both that the application of the rule would create a substantial hardship or violate principles of fairness, as each of those terms is defined in Section 120.542(2), F.S., and that the purpose of the underlying statute will be or has been achieved by other means by the petitioner.

Persons subject to regulation pursuant to any federally delegated or approved air program should be aware that Florida is specifically not authorized to issue variances or waivers from any requirements of any such federally delegated or approved program. The requirements of the program remain fully enforceable by the Administrator of the EPA and by any person under the Clean Air Act unless and until the Administrator separately approves any variance or waiver in accordance with the procedures of the federal program.

This permitting decision is final and effective on the date filed with the clerk of the Department unless a petition is filed in accordance with the above paragraphs or unless a request for extension of time in which to file a petition is filed within the time specified for filing a petition pursuant to Rule 62-110.106, F.A.C., and the petition conforms to the content requirements of Rules 28-106.201 and 28-106.301, F.A.C. Upon timely filing of a petition or a request for extension of time, this action will not be effective until further order of the Department.

Any party to this permitting decision (order) has the right to seek judicial review of it under Section 120.68, F.S., by filing a notice of appeal under Rule 9.110 of the Florida Rules of Appellate Procedure with the clerk of the Department of Environmental Protection in the Office of General Counsel, Mail Station #35, 3900 Commonwealth Boulevard, Tallahassee, Florida, 32399-3000, 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 must be filed within thirty (30) days after this order is filed with the clerk of the Department.

Executed in Tallahassee, Florida.



Howard L. Rhodes, Director
Division of Air Resources Management

CERTIFICATE OF SERVICE


The undersigned duly designated deputy agency clerk hereby certifies that this order was sent by certified mail (*) and copies were mailed by U.S. Mail before the close of business on 3/18/02 to the person(s) listed:

Mr. Danny Pribble, FGTC*
Mr. Jim Thompson, FGTC
Mr. Kevin McGlynn, McGlynn Consulting Co.

Mr. V. Duane Pierce, AQMcS
Mr. Chris Kirts, NED



Clerk Stamp

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

 March 18, 2002
(Clerk) (Date)

Florida Department of
Environmental Protection

Memorandum

TO: Howard Rhodes
THRU: Clair Fancy 
Al Linero
FROM: Jeff Koerner 
DATE: March 15, 2002
SUBJECT: Florida Gas Transmission Company - Bradford Compressor Station No. 16
Extension of Air Construction Permit Expiration Date
Air Permit No. 0070012-004-AC

Attached for your approval and signature is a permit modification that extends the permit expiration date for the above referenced project.

Day 74 is May 17, 2002. I recommend your approval and signature.

Attachments

CHF/AAL/jfk



Florida Gas Transmission Company

Capital Projects Field Office, 111 Kelsey Lane, Ste. A., Tampa, FL 33619
813.655.7441 / 800.381.1477

March 4, 2002

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Jeff Koerner, P.E.
New Source Review Section
Bureau of Air Regulation
Florida Department of Environmental Protection
Twin Towers Office Bldg.
2600 Blirstone Road
Tallahassee, FL 32399-2400

RECEIVED

MAR 05 2002

BUREAU OF AIR REGULATION

Reference: Permit No. 0070012-004-AC
Compressor Station No. 16, Bradford County

Permit No. 0830070-003-AC
Compressor Station No. 17, Marion County

Dear Mr. Koerner:

Subject: Extension of Construction Permit Expiration

The above referenced construction permits have expiration dates of June 1, 2002. It will not be possible for Florida Gas Transmission Company (FGT) to complete the modifications to these facilities, perform the required initial emissions compliance tests and apply for a Title V operating permit at least 120 days before their expiration dates.

FGT requests a 120-day extension to both of the referenced construction permits in order to complete construction, perform the required initial emissions performance tests and to submit applications for the Title V operating permits.

If you have any questions or need additional information, please call me at (800) 381-1477 or Dr. Duane Pierce at (281) 373-5365.

Sincerely,

Jim Thompson
Project Manager, Environmental

CC: Jake Krautsch
Duane Pierce

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Mr. Danny Pribble
 Vice President of Operations
 Florida Gas Transmission Company
 1400 Smith Street
 Houston, TX 77002

COMPLETE THIS SECTION ON DELIVERY

A. Received by (Please Print Clearly) **H. WYATT** B. Date of Delivery **3-21-02**

C. Signature **H. Wyatt** Agent Addressee

D. Is delivery address different from item 1? Yes No
 If YES, enter delivery address below:

3. Service Type
 Certified Mail Express Mail
 Registered Return Receipt for Merchandise
 Insured Mail C.O.D.

4. Restricted Delivery? (Extra Fee) Yes

7001 0320 0001 3692 9205

PS Form 3811, July 1999

Domestic Return Receipt

102595-00-M-0952

U.S. Postal Service
CERTIFIED MAIL RECEIPT
 (Domestic Mail Only; No Insurance Coverage Provided)

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OFFICIAL USE

Postage	\$
Certified Fee	
Return Receipt Fee (Endorsement Required)	
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	\$

Postmark
Here

Sent To **Danny Pribble**
 Street, Apt. No.,
 or PO Box **1400 Smith Street**
 City, State, ZIP+4
Houston, TX 77002

PS Form 3800, January 2001

See Reverse for Instructions

U.S. Postal Service
CERTIFIED MAIL RECEIPT
(Domestic Mail Only; No Insurance Coverage Provided)

5026 2692 1000 0320 0001 3692 7001 0320 0001 3692 7001

OFFICIAL USE

Postage	\$	Postmark Here
Certified Fee		
Return Receipt Fee (Endorsement Required)		
Restricted Delivery Fee (Endorsement Required)		
Total Postage & Fees	\$	

Sent To **Danny Pribble**
 Street, Apt. No.,
 or PO Box **1400 Smith Street**
 City, State, ZIP+4
Houston, TX 77002

PS Form 3800, January 2001 See Reverse for Instructions

SENDER: COMPLETE THIS SECTION	COMPLETE THIS SECTION ON DELIVERY										
<ul style="list-style-type: none"> Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired. Print your name and address on the reverse so that we can return the card to you. Attach this card to the back of the mailpiece, or on the front if space permits. 	<table border="1"> <tr> <td>A. Received by (Please Print Clearly)</td> <td>B. Date of Delivery</td> </tr> <tr> <td><i>H. Wyatt</i></td> <td><i>3-21-02</i></td> </tr> <tr> <td>C. Signature</td> <td><input type="checkbox"/> Agent</td> </tr> <tr> <td><i>H. Wyatt</i></td> <td><input type="checkbox"/> Addressee</td> </tr> <tr> <td>D. Is delivery address different from item 1? If YES, enter delivery address below:</td> <td><input type="checkbox"/> Yes <input type="checkbox"/> No</td> </tr> </table>	A. Received by (Please Print Clearly)	B. Date of Delivery	<i>H. Wyatt</i>	<i>3-21-02</i>	C. Signature	<input type="checkbox"/> Agent	<i>H. Wyatt</i>	<input type="checkbox"/> Addressee	D. Is delivery address different from item 1? If YES, enter delivery address below:	<input type="checkbox"/> Yes <input type="checkbox"/> No
A. Received by (Please Print Clearly)	B. Date of Delivery										
<i>H. Wyatt</i>	<i>3-21-02</i>										
C. Signature	<input type="checkbox"/> Agent										
<i>H. Wyatt</i>	<input type="checkbox"/> Addressee										
D. Is delivery address different from item 1? If YES, enter delivery address below:	<input type="checkbox"/> Yes <input type="checkbox"/> No										
<p>1 Article Addressed to:</p> <p>Mr. Danny Pribble Vice President of Operations Florida Gas Transmission Company 1400 Smith Street Houston, TX 77002</p>	<p>3. Service Type</p> <p><input checked="" type="checkbox"/> Certified Mail <input type="checkbox"/> Express Mail <input type="checkbox"/> Registered <input type="checkbox"/> Return Receipt for Merchandise <input type="checkbox"/> Insured Mail <input type="checkbox"/> C.O.D.</p>										
	<p>4. Restricted Delivery? (Extra Fee) <input type="checkbox"/> Yes</p>										

7001 0320 0001 3692 9205

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Dept. of Environmental Protection
Division of Air Resources Mgt.
Bureau of Air Regulation, NSR
2600 Blair Stone Rd., MS 5505
Tallahassee, FL 32399-2400

BUREAU OF AIR REGULATION

MAR 25 2002

RECEIVED





Lawton Chiles
Governor

Florida Department of Environmental Protection

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

Virginia B. Wetheroll
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, SO₂, 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

Mr. Allan Weatherford
December 9, 1993
Page Two

TO:

8. Compliance with the NO_x, SO₂, 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;

Mr. Allan Weatherford
December 9, 1993
Page Three

(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 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

Mr. Allan Weatherford
December 9, 1993
Page Four

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
Clerk

12/21/93
Date



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

December 3, 1993

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

RECEIVED
DEC - 6 1993
Division of Air
Resources Management

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



December 3, 1993
Mr. Clair Fancy
Page 2

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 SO₂ emission limits be clarified to base SO₂ 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 SO₂ 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,

A handwritten signature in black ink that reads "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 AC57-188869, AC67-189220, AC20-189438, AC62-189439,
AC04-189454, AC42-189455, AC48-189456, AC05-189655, and
AC56-189457

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:

<u>Pollutant</u>	<u>lbs/hr</u>	<u>tons/yr</u>	<u>Emission Factor</u>
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:

<u>Pollutant</u>	<u>lbs/hr</u>	<u>tons/yr</u>	<u>Emission Factor</u>
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:

<u>Pollutant</u>	<u>lbs/hr</u>	<u>tons/yr</u>	<u>Emission Factor</u>
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:

<u>Pollutant</u>	<u>lbs/hr</u>	<u>tons/yr</u>	<u>Emission Factor</u>
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:

<u>Pollutant</u>	<u>lbs/hr</u>	<u>tons/yr</u>	<u>Emission Factor</u>
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:

<u>Pollutant</u>	<u>lbs/hr</u>	<u>tons/yr</u>	<u>Emission Factor</u>
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:

<u>Pollutant</u>	<u>lbs/hr</u>	<u>tons/yr</u>	<u>Emission Factor</u>
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:

<u>Pollutant</u>	<u>lbs/hr</u>	<u>tons/yr</u>	<u>Emission Factor</u>
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:

<u>Pollutant</u>	<u>lbs/hr</u>	<u>tons/yr</u>	<u>Emission Factor</u>
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:

<u>Pollutant</u>	<u>lbs/hr</u>	<u>tons/yr</u>	<u>Emission Factor</u>
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:

<u>Pollutant</u>	<u>lbs/hr</u>	<u>tons/yr</u>	<u>Emission Factor</u>
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:

<u>Pollutant</u>	<u>lbs/hr</u>	<u>tons/yr</u>	<u>Emission Factor</u>
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:

<u>Pollutant</u>	<u>lbs/hr</u>	<u>tons/yr</u>	<u>Emission Factor</u>
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:

<u>Pollutant</u>	<u>lbs/hr</u>	<u>tons/yr</u>	<u>Emission Factor</u>
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:

<u>Pollutant</u>	<u>lbs/hr</u>	<u>tons/yr</u>	<u>Emission Factor</u>
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:

<u>Pollutant</u>	<u>lbs/hr</u>	<u>tons/yr</u>	<u>Emission Factor</u>
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.

Mr. Allan Weatherford
Request for Amendments and Extensions
Page 12

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
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 16

BROOKER, FLORIDA

Station	Model Run Factor	MAXIMUM 1-HR CONCENTRATION (ug/m**3)					Maximum Emission (lb/hr)				
		NOx	CO	VOCs	Particulates	SO2	NOx	CO	VOCs	Particulates	SO2
16 Permitted	3.396	59.770	74.712	29.885	0.441	2.547	17.60	22.00	8.80	0.13	0.75
16 Revised	1.808	31.893	39.866	15.947	0.289	1.428	17.64	22.05	8.82	0.16	0.79

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).

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

Station 16--Permit--Simple Terrain, no Downwash

SIMPLE TERRAIN INPUTS:

SOURCE TYPE = POINT
EMISSION RATE (G/S) = .1260
STACK HEIGHT (M) = 10.67
STK INSIDE DIAM (M) = .59
STK EXIT VELOCITY (M/S) = 24.95
STK GAS EXIT TEMP (K) = 560.93
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.	.5284	3	10.0	10.1	3200.0	22.8	12.6	7.7	NO
200.	3.317	3	10.0	10.1	3200.0	22.8	23.9	14.4	NO
300.	3.200	3	8.0	8.1	2560.0	25.8	34.6	20.8	NO
400.	2.970	4	10.0	10.1	3200.0	22.8	29.7	15.7	NO
500.	2.830	4	8.0	8.1	2560.0	25.8	36.4	18.8	NO

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

225.	3.396	3	10.0	10.1	3200.0	22.8	26.7	16.1	NO
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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	3.396	225.	0.

 ** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **

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

Station 16--Actual--Simple Terrain, no Downwash

SIMPLE TERRAIN INPUTS:

SOURCE TYPE = POINT
EMISSION RATE (G/S) = .1260
STACK HEIGHT (M) = 19.99
STK INSIDE DIAM (M) = .76
STK EXIT VELOCITY (M/S) = 14.99
STK GAS EXIT TEMP (K) = 560.93
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.	.2402E-01	2	5.0	5.2	1600.0	43.3	19.7	11.4	NO
200.	1.354	1	3.0	3.1	960.0	58.8	51.1	31.2	NO
300.	1.760	2	5.0	5.2	1600.0	43.3	52.6	30.9	NO
400.	1.772	3	5.0	5.4	1600.0	42.8	45.1	27.2	NO
500.	1.776	3	5.0	5.4	1600.0	42.8	55.2	33.1	NO
600.	1.701	3	4.0	4.3	1280.0	48.5	65.2	39.2	NO
700.	1.614	3	3.0	3.2	960.0	58.0	75.3	45.4	NO

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

448.	1.808	3	5.0	5.4	1600.0	42.8	50.1	30.1	NO
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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	1.808	448.	0.

 ** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **

Engine Emission Calculation Worksheet

Station 16; Brooker, FL
Emergency Generator Engine 1

Engine data

Annual use (maximum); hr./yr.	400 hr./yr.
Power; Hp	200 Hp
Power; Btu/hr. (@ 8026 (Btu/hr.)/Hp)	1605200 Btu/hr.
Fuel consumption; scf/hr. (@ 1040 Btu/scf)	1543 scf/hr.

Emission Factors

NOx	21.0 g/Hp-hr.
CO	2.0 g/Hp-hr.
NMHC	0.5 g/Hp-hr.
SO2	0.1 grains/scf
PM	5.0 lb/MMscf

Calculated Emissions

NOx	1.85 TPY
CO	0.18 TPY
NMHC	0.04 TPY
SO2	0.01 TPY
PM	0.00 TPY

Engine Emission Calculation Worksheet

Station 16; Brooker, FL
Emergency Generator Engine 2

Engine data

Annual use (maximum); hr./yr.	400 hr./yr.
Power; Hp	220 Hp
Power; Btu/hr. (@ 8026 (Btu/hr.)/Hp)	1765720 Btu/hr.
Fuel consumption; scf/hr. (@ 1040 Btu/scf)	1698 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	2.13 TPY
CO	0.19 TPY
NMHC	0.10 TPY
SO2	0.01 TPY
PM	0.00 TPY

Engine Emission Calculation Worksheet

Station 16; Brooker, FL
Air Compressor Engine 1

Engine data

Annual use (maximum); hr./yr.	600 hr./yr.
Power; Hp	80 Hp
Power; Btu/hr. (@ 8026 (Btu/hr.)/Hp)	642080 Btu/hr.
Fuel consumption; scf/hr. (@ 1040 Btu/scf)	617 scf/hr.

Emission factors

NOx	11.0 g/Hp-hr.
CO	3.1 g/Hp-hr.
NMHC	0.044 g/Hp-hr.
SO2	0.1 grains/scf
PM	5.0 lb/MMscf

Calculated Emissions

NOx	0.58 TPY
CO	0.16 TPY
NMHC	0.00 TPY
SO2	0.01 TPY
PM	0.00 TPY

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

(C) COPYRIGHT 1990, PHOENIX ENGINEERING, INC.

CLIENT: Florida Gas Transmission

DATE: 05/14/93

LOCATION: Station 16

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	1190.50
FILLING RATE (BBLs/HR), FR	
NUMBER OF TURNOVERS FOR DAYS IN SERVICE, N	5.7
TURNOVER FACTOR, KsubN	1.00

FIXED ROOF TANK BREATHING LOSS, # LsubB =

$$2.26 \times 10^{-2} * (M_{subV}) * (P / (P_{subA} - P)) \text{ EXP } 0.68 * (D) \text{ EXP } 1.73 * (VH) \text{ EXP } 0.51 * (\Delta T) \text{ EXP } 0.5 * (F_{subP}) * (C) * (K_{subC}) * D_{subS} / 365 * (100 - \% \text{eff}) / 100$$

FIXED ROOF TANK WORKING LOSS, # LsubW =

$$2.4 \text{ EXP } -05 * M_{subV} * P * V * N * K_{subN} * K_{subC} * (100 - \% \text{eff}) / 100$$

VOLATILE ORGANIC COMPOUND LOSSES	BREATHING	WORKING	TOTAL
POUNDS FOR DAYS SERVICE =	252	179	431
TONS FOR DAYS SERVICE =	0.13	0.09	0.22
ANNUALIZED POUNDS =	252	179	431
ANNUALIZED TONS =	0.13	0.09	0.22
POUND/HR (AVG) =	0.03	0.02	0.05
MAXIMUM EMISSION RATE (#/HR) =			

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

(C) COPYRIGHT 1990, PHOENIX ENGINEERING, INC.

CLIENT: Florida Gas Transmission

DATE: 05/14/93

LOCATION: Station 16

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	1190.50
FILLING RATE (BBLs/HR), FR	
NUMBER OF TURNOVERS FOR DAYS IN SERVICE, N	5.7
TURNOVER FACTOR, KsubN	1.00

FIXED ROOF TANK BREATHING LOSS, # LsubB =
 $2.26 \times 10^{-2} * (M_{subV}) * (P / (P_{subA} - P)) \text{ EXP } 0.68 * (D) \text{ EXP } 1.73 * (VH) \text{ EXP } 0.51 * (\Delta T) \text{ EXP } 0.5 * (F_{subP}) * (C) * (K_{subC}) * D_{subS} / 365 * (100 - \% \text{eff}) / 100$

FIXED ROOF TANK WORKING LOSS, # LsubW =
 $2.4 \text{ EXP } -05 * M_{subV} * P * V * N * K_{subN} * K_{subC} * (100 - \% \text{eff}) / 100$

VOLATILE ORGANIC COMPOUND LOSSES	BREATHING	WORKING	TOTAL
POUNDS FOR DAYS SERVICE =	252	179	431
TONS FOR DAYS SERVICE =	0.13	0.09	0.22
ANNUALIZED POUNDS =	252	179	431
ANNUALIZED TONS =	0.13	0.09	0.22
POUND/HR (AVG) =	0.03	0.02	0.05
MAXIMUM EMISSION RATE (#/HR) =			

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

(C) COPYRIGHT 1990, PHOENIX ENGINEERING, INC.

CLIENT: Florida Gas Transmission

DATE: 05/14/93

LOCATION: Station 16

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		23.80
FILLING RATE (BBLs/HR), FR		
NUMBER OF TURNOVERS FOR DAYS IN SERVICE, N		0.11
TURNOVER FACTOR, KsubN		1.00

FIXED ROOF TANK BREATHING LOSS, # LsubB =

$$2.26 \times 10^{-2} * (M_{subV}) * (P / (P_{subA} - P)) \text{ EXP } 0.68 * (D) \text{ EXP } 1.73 * (VH) \text{ EXP } 0.51 * (\Delta T) \text{ EXP } 0.5 * (F_{subP}) * (C) * (K_{subC}) * D_{subS} / 365 * (100 - \% \text{eff}) / 100$$

FIXED ROOF TANK WORKING LOSS, # LsubW =

$$2.4 \text{ EXP } -05 * M_{subV} * P * V * N * K_{subN} * K_{subC} * (100 - \% \text{eff}) / 100$$

VOLATILE ORGANIC COMPOUND LOSSES	BREATHING	WORKING	TOTAL
POUNDS FOR DAYS SERVICE =	252	3	255
TONS FOR DAYS SERVICE =	0.13	0.00	0.13
ANNUALIZED POUNDS =	252	3	255
ANNUALIZED TONS =	0.13	0.00	0.13
POUND/HR (AVG) =	0.03	0.00	0.03
MAXIMUM EMISSION RATE (#/HR) =			

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

(C) COPYRIGHT 1990, PHOENIX ENGINEERING, INC.

CLIENT: Florida Gas Transmission

DATE: 05/13/93

LOCATION: Station 16

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	17.7
TANK HEIGHT (FT), H	7.0
PAINT FACTOR, FsubP	1.00
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	238.00
FILLING RATE (BBLs/HR), FR	
NUMBER OF TURNS FOR DAYS IN SERVICE, N	1.0
TURNOVER FACTOR, KsubN	1.00

FIXED ROOF TANK BREATHING LOSS, # LsubB =
 $2.26 \times 10^{-2} * (M_{subV}) * (P / (P_{subA} - P)) \text{ EXP } 0.68 * (D) \text{ EXP } 1.73 * (VH) \text{ EXP } 0.51 * (\Delta T) \text{ EXP } 0.5 * (F_{subP}) * (C) * (K_{subC}) * D_{subS} / 365 * (100 - \% \text{eff}) / 100$

FIXED ROOF TANK WORKING LOSS, # LsubW =
 $2.4 \text{ EXP } -05 * M_{subV} * P * V * N * K_{subN} * K_{subC} * (100 - \% \text{eff}) / 100$

VOLATILE ORGANIC COMPOUND LOSSES	BREATHING	WORKING	TOTAL
POUNDS FOR DAYS SERVICE =	10	0	10
TONS FOR DAYS SERVICE =	0.00	0.00	0.00
ANNUALIZED POUNDS =	10	0	10
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 16
Lube Oil Storage Tank No. 1

Tank Measurements

Length of Tank (ft) - L	35
Actual Diameter of Tank (ft) - D	7

Calculated Values

Effective Tank Diameter (ft) - D _{eff}	17.7
Vapor Space Outage (ft) - H _{vo}	3.5

Equations:

$$D_{eff} = \text{SQRT}(L \cdot D / 0.785)$$

Equation 1-5 of Chapter 12

$$H_{vo} = D/2$$

Equation 1-6 of Chapter 12

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

(C) COPYRIGHT 1990, PHOENIX ENGINEERING, INC.

CLIENT: Florida Gas Transmission

DATE: 05/13/93

LOCATION: Station 16

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	White	
TANK DIAMETER (FT), D		7.0
TANK HEIGHT (FT), H		4.0
PAINT FACTOR, FsubP		1.00
TANK CAPACITY (BBLs), VB		238
TANK CAPACITY (GALLONS), V		500
ADJUSTMENT FACTOR FOR DIA., C		0.38

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	12
VAPOR SPACE HEIGHT (FT), VH	2.00
TANK THROUGHPUT (BBLs FOR DAYS IN SERVICE), TT	143.00
FILLING RATE (BBLs/HR), FR	
NUMBER OF TURNOVERS FOR DAYS IN SERVICE, N	12.0
TURNOVER FACTOR, KsubN	1.00

FIXED ROOF TANK BREATHING LOSS, # LsubB =

$$2.26 \times 10^{-2} * (M_{subV}) * (P / (P_{subA} - P)) \text{ EXP } 0.68 * (D) \text{ EXP } 1.73 * (VH) \text{ EXP } 0.51 * (\Delta T) \text{ EXP } 0.5 * (F_{subP}) * (C) * (K_{subC}) * D_{subS} / 365 * (100 - \% \text{eff}) / 100$$

FIXED ROOF TANK WORKING LOSS, # LsubW =

$$2.4 \text{ EXP}^{-05} * M_{subV} * P * V * N * K_{subN} * K_{subC} * (100 - \% \text{eff}) / 100$$

VOLATILE ORGANIC COMPOUND LOSSES	BREATHING	WORKING	TOTAL
POUNDS FOR DAYS SERVICE =	0	0	0
TONS FOR DAYS SERVICE =	0.00	0.00	0.00
ANNUALIZED POUNDS =	1	2	2
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 16
Lube Oil Storage Tank No. 2

Tank Measurements

Length of Tank (ft) - L	9.5
Actual Diameter of Tank (ft) - D	4

Calculated Values

Effective Tank Diameter (ft) - D _{eff}	7.0
Vapor Space Outage (ft) - H _{vo}	2

Equations:

$D_{eff} = \text{SQRT}(L \cdot D / 0.785)$	Equation 1-5 of Chapter 12
$H_{vo} = D / 2$	Equation 1-6 of Chapter 12

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

(C) COPYRIGHT 1990, PHOENIX ENGINEERING, INC.

CLIENT: Florida Gas Transmission

DATE: 05/14/93

LOCATION: Station 16

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		9.50
FILLING RATE (BBLs/HR), FR		
NUMBER OF TURNS OVER FOR DAYS IN SERVICE, N		0.1
TURNOVER FACTOR, KsubN		1.00

FIXED ROOF TANK BREATHING LOSS, # LsubB =

$$2.26 \times 10^{-2} * (M_{subV}) * (P / (P_{subA} - P)) \text{ EXP } 0.68 * (D) \text{ EXP } 1.73 * (VH) \text{ EXP } 0.51 * (\Delta T) \text{ EXP } 0.5 * (F_{subP}) * (C) * (K_{subC}) * D_{subS} / 365 * (100 - \% \text{eff}) / 100$$

FIXED ROOF TANK WORKING LOSS, # LsubW =

$$2.4 \text{ EXP } -05 * M_{subV} * P * V * N * K_{subN} * K_{subC} * (100 - \% \text{eff}) / 100$$

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) =			

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

15-Jun-92
CS16.WK1

Compressor Station: Number 16
 Name: Brooker
 County: Bradford
 Nearest City: Brooker
 Compressor Supervisor: William "Les" Shadd
 Mailing Address: P.O. Box 8
 Brooker, Florida 32622-0008
 Telephone: 904-485-1211 Fax: 904-485-2723
 Latitude: 29-55-16
 Longitude: 82-19-34
 UTM Zone: 17
 UTM Easting: 371.98 km
 UTM Northing: 3,310.57 km
 Elevation (ft): 100

Phase I Engine Characteristics

Engine Identification	1	2	3	4	5
Permit Number					
Serial Number	G-2372	G-2373	G-2374	G-2663	G-2777
Operating Time					
Hours/Day	24	24	24	24	24
Days/Week	7	7	7	7	7
Weeks/Year	52	52	52	52	52
Engine Type	Recip	Recip	Recip	Recip	Recip
Date of Installation	1958	1958	1958	1966	1968
Engine Make	Worthington	Worthington	Worthington	Worthington	Worthington
Engine Model	SEHG-8	SEHG-8	SEHG-8	SEHG-8	SEHG-8
Horsepower Rating	2000	2000	2000	2000	2000
Air Charging	Turbo.	Turbo.	Turbo.	Turbo.	Turbo.
Exhaust Temperature (F)	600	600	600	600	600
Mass Flow Rate (lbs/hr) (a)	26172	26172	26172	26172	26172
Volumetric Flow Rate (acfm)	11637	11637	11637	11637	11637
Volumetric Flow Rate (dscfm)	5333	5333	5333	5333	5333
Exit Velocity (ft/s)	119.5	119.5	119.5	119.5	119.5
Water Vapor Content (%)	8	8	8	8	8
Ave. Fuel Consumption (MMCF/Hr) (b)	0.0146	0.0146	0.0146	0.0146	0.0146
Max. Fuel Consumption (MMCF/Hr) (b)	0.0146	0.0146	0.0146	0.0146	0.0146
Specific Fuel Consump. (BTU/bhp-hr)	6350	6350	6350	6350	6350
Maximum Heat Input (MMBTU/Hr)	15	15	15	15	15
Stack Height (ft)	28.08	28.08	28.08	28.08	28.08
Stack Diameter (in)	17.25	17.25	17.25	17.25	17.25
Stack to Building Offset (ft)	17.00	17.00	17.00	17.00	17.00
Building Height (ft) (c)	31.75				
Building Length (ft) (c)	195.00				
Building Width (ft) (c)	55.00				

Phase I Fuel Characteristics

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

* Engines 1 through 6 are in the same building.

Building length 235 ft.
 Building width 55 ft.

Building Height. 31.75 ft. in the 195 ft of length housing units 1-5.
 33.75 ft. in the 40 ft of length housing unit 6.

Phase I Emissions Rates by Engine for Station 16

Engine Identification	1	2	3	4	5
Grams/BHP-Hour					
NOX	11.000	11.000	11.000	11.000	11.000
CO	1.400	1.400	1.400	1.400	1.400
NMHC	0.440	0.440	0.440	0.440	0.440
SO2 (e)	0.093	0.093	0.093	0.093	0.093
PM (f)	0.016	0.016	0.016	0.016	0.016
Pounds/Hour					
NOX	48.51	48.51	48.51	48.51	48.51
CO	6.17	6.17	6.17	6.17	6.17
NMHC	1.94	1.94	1.94	1.94	1.94
SO2	0.41	0.41	0.41	0.41	0.41
PM	0.07	0.07	0.07	0.07	0.07
Tons/Year					
NOX	212.47	212.47	212.47	212.47	212.47
CO	27.04	27.04	27.04	27.04	27.04
NMHC	8.50	8.50	8.50	8.50	8.50
SO2	1.79	1.79	1.79	1.79	1.79
PM	0.31	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	242.55	
CO	30.87	
NMHC	9.70	
SO2	2.04	
PM	0.36	
Tons/Year		
NOX	1062.37	
CO	135.21	
NMHC	42.49	
SO2	8.94	
PM	1.57	

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

15-Jun-92
CS18.WK1

Compressor Station: Number 16
 Name: Brooker
 County: Bradford
 Nearest City: Brooker
 Compressor Supervisor: William "Les" Shadd
 Mailing Address: P.O. Box 8
 Brooker, Florida 32622-0008
 Telephone: 904-485-1211
 Latitude: 29-55-16
 Longitude: 82-19-34
 UTM Zone: 17
 UTM Easting: 371.98 km
 UTM Northing: 3,310.57 km
 Elevation (ft): 100

Fax: 904-485-2723

Phase II Engine Characteristics

Engine Identification	6
Permit Number	
Serial Number	G-49117
Operating Time	
Hours/Day	24
Days/Week	7
Weeks/Year	52
Engine Type	Recip
Date of Installation	1991
Engine Make	Cooper-Bessemer
Engine Model	GW-330C2
Horsepower Rating	4000
Air Charging	Turbo.
Exhaust Temperature (F)	550
Mass Flow Rate (lbs/hr) (a)	71100
Volumetric Flow Rate (acfm)	30138
Volumetric Flow Rate (dscfm)	14487
Exit Velocity (ft/s)	102.33
Water Vapor Content (%)	8
Ave. Fuel Consumption (MMCF/Hr) (b)	0.0264
Max. Fuel Consumption (MMCF/Hr) (b)	0.0264
Specific Fuel Consump. (BTU/bhp-hr)	6800
Maximum Heat Input (MMBTU/Hr)	27.2
Stack Height (ft)	65.625
Stack Diameter (in)	30
Stack to Building Offset (ft)	17.00
Building Height (ft) (c)	31.75
Building Length (ft) (c)	235.00
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

* see page with information on units 1-5.

Phase II Emissions Rates by Engine for Station 16
Engine Identification

6

Grams/BHP-Hour		
	NOX	2.000
	CO	2.500
	NMHC	1.000
	SO2 (a)	0.090
	PM (f)	0.018
Pounds/Hour		
	NOX	17.64
	CO	22.05
	NMHC	8.82
	SO2	0.79
	PM	0.15
Tons/Year		
	NOX	77.26
	CO	96.58
	NMHC	38.63
	SO2	3.48
	PM	0.68

Phase II Emissions Rates for Total Station

Grams/BHP-Hour		
	NOX	8.428
	CO	1.714
	NMHC	0.600
	SO2	0.092
	PM	0.017
Pounds/Hour		
	NOX	260.19
	CO	52.92
	NMHC	18.52
	SO2	2.84
	PM	0.51
Tons/Year		
	NOX	1139.63
	CO	231.79
	NMHC	81.13
	SO2	12.42
	PM	2.24

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.



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

Dear Mr. Fancy:

**RE: Request for Amendments and Extensions to Air
Construction 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

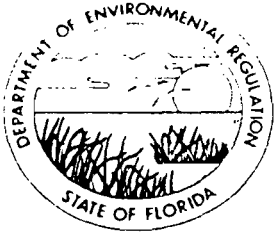
Permit No. AC56-189457 PSD-FL-164
Florida Gas Transmission Company, Station 20
Ft. Pierce, St. Lucie County, Florida

*This file contains
all the attachments
related to this
correspondence.*

RECEIVED
MAIL ROOM
1993 JUN 30 11:10:19

(PSD-FL-203
AC 56-230129)
AIRS 1110060

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



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:

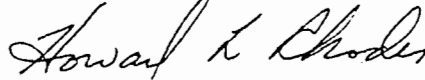
- (a) The name, address, and telephone number of each petitioner, the applicant's name and address, the Department Permit File Number and the county in which the project is proposed;
- (b) A statement of how and when each petitioner received notice of the Department's action or proposed action;
- (c) 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.

Mr. Alan Weatherford
Florida Gas Transmission Company
Page 3

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

An **ENRON/SONAT** Affiliate

Division of Air
Resources Management

Mr. Clair Fancy
Page 2 of 2
December 7, 1992

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

Modify Specific Condition 10 which currently reads

"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."

so that it reads

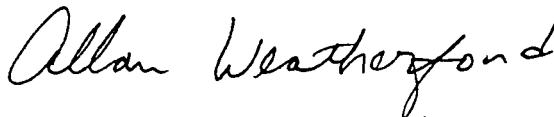
"Initial compliance with the volatile organic compound (VOC) emissions limits will be demonstrated by EPA Method 25A, thereafter, compliance with the VOC emission limits will be assumed, provided the CO allowable emission rate is achieved."

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
Compliance Environmentalist

bc
aw1207cf

cc: Chuck Truby
Raymond Young
Fred Griffin
Barry Andrews, ENSR

J. Person
C. Middleton



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

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.

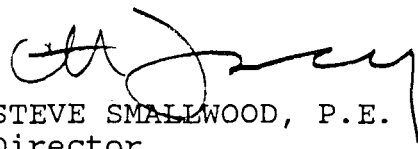
A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) in accordance with Section 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the 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

Attachment to be Incorporated:

Mr. Weatherford's letter of April 29, 1992

cc: Ed Middleswart Andy Kutyna
Charles Collins Isidore Goldman

Best Available Copy



Florida Gas Transmission Company

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

Federal Express

April 29, 1992

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

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

Mr. Clair Fancy
Page 2 of 2
April 29, 1992

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

S. Alton

TEST REPORT
on
EXHAUST EMISSIONS
from a
COOPER BESSEMER 8W330C2 COMPRESSOR ENGINE
at
**FLORIDA GAS TRANSMISSION'S
COMPRESSOR STATION NO. 16
BROOKER, BRADFORD 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

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CO ₂ , THC	
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INTRODUCTION


One Cooper Bessemer 8W330C2 compressor engine was tested to determine the quantity of emissions released into the atmosphere. The tests were conducted on March 23, 1992 at Compressor Station No. 16 located near Brooker, in Bradford 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 04-189454.

Quantities of nitrogen oxides (NO_x), 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

<u>Source Owner/Operator:</u>	Florida Gas Transmission Co. 601 South Lake Destiny Drive Maitland, Florida 32751 (407) 875-5816 TEL (407) 875-5896 FAX Attn: Allan Weatherford
<u>Testing Organization</u>	Cubix Corporation 9225 Lockhart Hwy Austin, Texas 78747 (512) 243-0202 TEL (512) 243-0222 FAX Attn: Lowell Faulkner
<u>Test Participants:</u>	Florida Gas Transmission Co. Allan Weatherford Fred Griffin Cooper Bessemer Carl McCluney FDER Stan Mazur Shannon Baruch Cubix Corporation Lowell Faulkner Rick Krenzke Joe Rudyk
<u>Test Date:</u>	March 23, 1992
<u>Location:</u>	near Brooker in Bradford County, Florida
<u>Process Description:</u>	Cooper Bessemer compressor engine
<u>Sampling Points:</u>	Exhaust stack of compressor engine (See Appendix A)

Regulatory Application:

Florida Department of
Environmental Regulation Permit
No. AC 04-189454

Required Test Methods:

EPA Method 1 for traverse point layout
EPA Method 2 for stack gas velocity
EPA Method 3 for O₂ and CO₂
concentrations
EPA Method 4 for moisture content
EPA Method 7e for NO_x 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 SO₂ emissions

Alternate Test Methods:
(conducted for
comparison purposes)

EPA Method 3a for CO₂ and O₂
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 Cooper Bessemer 8W330C2 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 23, 1992 at Compressor Station No. 16 located near Brooker, in Bradford 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 NO_x, O₂, CO₂, CO, nonmethane hydrocarbons (i.e. VOC), SO₂, 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 NO_x, CO, O₂, CO₂, 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 NO_x, 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 SO₂ emissions. The SO₂ 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 NO_x were found to be 5.40 lbs/hr, 23.6 tons/yr, and 0.61 g/hp-hr. By comparison, permit limits are 17.6 lbs/hr, 77.2 tons/yr, and 2.0 g/hp-hr. CO emissions averaged 10.6 lbs/hr, 46.3 tons/yr, and 1.19 g/hp-hr and are limited by the permit to 22.0 lbs/hr, 96.6 tons/yr, and 2.5 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 0.071 grains/100 DSCF. The permit limits the sulfur content of the fuel to 10

grains/100 DSCF. The mass emission rate of SO₂ presented in Table 2 was calculated from the estimated fuel flow to the engine assuming that all sulfur in the fuel was oxidized to SO₂. The SO₂ emission rate based on this calculation averaged 0.0031 lbs/hr or 0.014 tons/yr. The permit limits for SO₂ mass emissions are 0.75 lbs/hr and 3.3 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 6.40 lbs/hr, 28.0 tons/yr, and 0.72 g/hp-hr. The permit limits nonmethane hydrocarbon emissions to 8.8 lbs/hr, 38.6 tons/yr, and 1.0 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 CO₂ and moisture interferences, 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 CO₂ 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 3.03 lbs/hr (13.3 tons/yr and 0.34 g/hp-hr). When compared with the data obtained from Method 25, one can see that the CO₂ and moisture interferences 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 O₂ and CO₂ 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 O₂ and CO₂ 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 5%.

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 Brooker Compressor Station
Location	Bradford County, Florida
Source	Cooper Bessamer Compressor
Technicians	RK,LF,JR

Test Run No.	C-1	C-2	C-3
Date	3/23/92	3/23/92	3/23/92
Start Time	15:49	16:55	18:04
Stop Time	16:49	17:55	19:04
Engine/Compressor Operation			
Engine Speed (rpm)	328	328	328
Ignition Timing (°BTDC)	3	3	3
Air Manifold Pressure (psig)	14.3	14.1	14.1
Air Manifold Temperature (°F)	106/108	106/107	110/108
Estimated Fuel Flow AT 7800 BTU/hp-hr (SCFH)	30757	30742	30528
Fuel Manifold Pressure (psig)	55.5	55.2	54.9
Pre-Combustion Chamber (psig)	48.5	48	47.8
Exhaust Temperature (°F)	663	666	670
Turbo Inlet Vacuum (in. H2O)	4.3	4.3	4.2
Turbo rpm	10260	10230	10190
Pockets Open Out of 16	5	5	4
Suction Pressure (psig)	695	700	702
Suction Temperature (°F)	44	44	42
Discharge Pressure (psig)	940	945	948
Discharge Temperature (°F)	87	85	89
Engine Load (BHP)	4030	4028	4000
Torque (%)	100.5	100.5	100
Ambient Conditions			
Atmospheric Pressure (in. Hg)	29.68	29.69	29.72
Temperature (°F) : Dry bulb	71	72	68
(°F) Wet bulb	62	62	58
Humidity (lb/lb air)	0.0097	0.0095	0.0079
Measured Emissions			
NOx (ppmv)	42.6	44.2	45.6
CO (ppmv)	145.0	144.0	137.0
O2 via EPA Method 3 (vol %)	16.2	16.0	16.0
CO2 via EPA Method 3 (vol %)	2.8	3.0	3.0
VOC via EPA Method 25 (ppmv)	172.6	96.4	183.0
SO2 in fuel (grains/100 DSCF)	0.071	0.071	0.071
Stack Volumetric Flow Rates			
via Pitot Tube (SCFH, dry)	1.04E+06	1.02E+06	1.01E+06
Calculated Emission Rates (via pitot tube)			
NOx (lbs/hr)	5.29	5.40	5.50
CO (lbs/hr)	11.0	10.7	10.1
VOC (lbs/hr)	7.45	4.09	7.67
SO2 (lbs/hr)	0.0031	0.0031	0.0031
NOx (tons/yr)	23.2	23.6	24.1
CO (tons/yr)	48.0	46.9	44.0
VOC (tons/yr)	32.6	17.9	33.6
SO2 (tons/yr)	0.014	0.014	0.014
NOx (g/hp-hr)	0.60	0.61	0.62
CO (g/hp-hr)	1.23	1.21	1.14
VOC (g/hp-hr)	0.84	0.46	0.87

PROCESS DESCRIPTION

Florida Gas Transmission Co. owns and operates Compressor Station No. 16 located near Brooker, 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 Cooper Bessemer 8W330C2 compressor engine bearing the serial number 49117. The engine is rated at 4000 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 23.0" 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 NO_x, CO, O₂, and CO₂ 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. NO_x 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 4 diameters downstream and 12 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 CO₂ and O₂ 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 O₂ and CO₂ concentrations due to the greater accuracy and precision provided by the instruments. The CO₂ analyzer was based on the principle of infrared absorption; and, the O₂ analyzer operated on a paramagnetic cell. The data presented in *Summary of Results* contains the O₂ and CO₂ 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 provided results that were approximately 10% higher than those obtained by the pitot tube measurement. AGA's carbon balance technique yielded results only 2% higher than those of EPA Methods 1-4. 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 NO_x. A chemiluminescence cell analyzer was used. The NO_x mass emission rates were calculated as if all the NO_x were in the form of NO₂. This approach corresponds to EPA's convention. However, it tends to overestimate the actual stack NO_x mass emission rates, since the majority of the NO_x is in the form of NO which is less dense (i.e. lbs of emissions per ppmv concentration) than the NO₂ form of NO_x. This gives a worst case scenario of NO_x 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 CO₂, 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 SO₂, the SO₂ 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

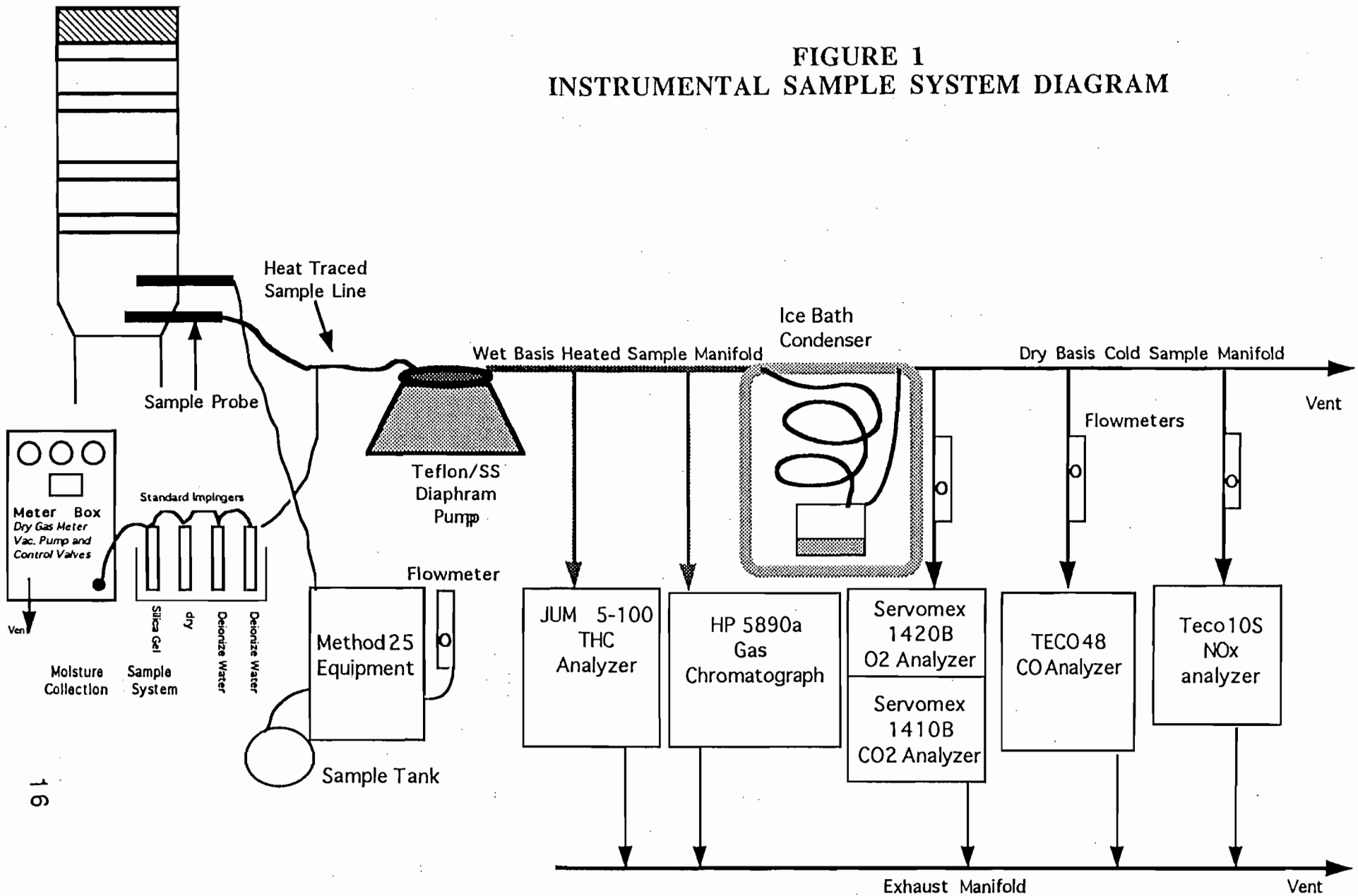
collected by Florida Gas personnel and is presented in Appendix A. Key operational data collected include compressor discharge pressures, compressor suction pressures, engine manifold pressure, engine speed, timing, and horsepower. Florida Gas also provided a recent fuel composition analysis to allow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

TABLE 3
ANALYTICAL INSTRUMENTATION

<u>Parameter</u>	<u>Model and Manufacturer</u>	<u>Common Use Ranges</u>	<u>Sensitivity</u>	<u>Response Time (sec.)</u>	<u>Detection Principle</u>
NO _x	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 its 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 CO₂ 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 NO_x, CO, CO₂, and O₂ analyzers. The sum of the interference responses for H₂O, CO, SO₂, CO₂ and O₂ (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 NO_x and O₂ sampling and analysis system was checked for response time per the procedures outlined in EPA's Method 20. The average NO_x analyzer's response times were 0.61 minutes upscale and 0.65 minutes downscale. The O₂ 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 NO_x 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. NO_x 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 NO₂ to NO converter in the NO_x analyzer was checked by having the analyzer sample a mixture of NO in N₂ standard gas and zero air from a Tedlar® bag. When this bag is mixed and exposed to sunlight, the NO is oxidized to NO₂ over approximately a 30-minute period. If the NO_x instrument's converter is 100% efficient, then the NO_x response does not decrease as the NO in the bag is converted to NO₂. The criterion for acceptability is a demonstrated NO_x 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 $\pm 1\%$ accuracy for NO_x and O₂, and to $\pm 2\%$ accuracy for the remaining gases. EPA Protocol No. 1 was used, where applicable (i.e. NO_x 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 as per EPA Method 9. 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

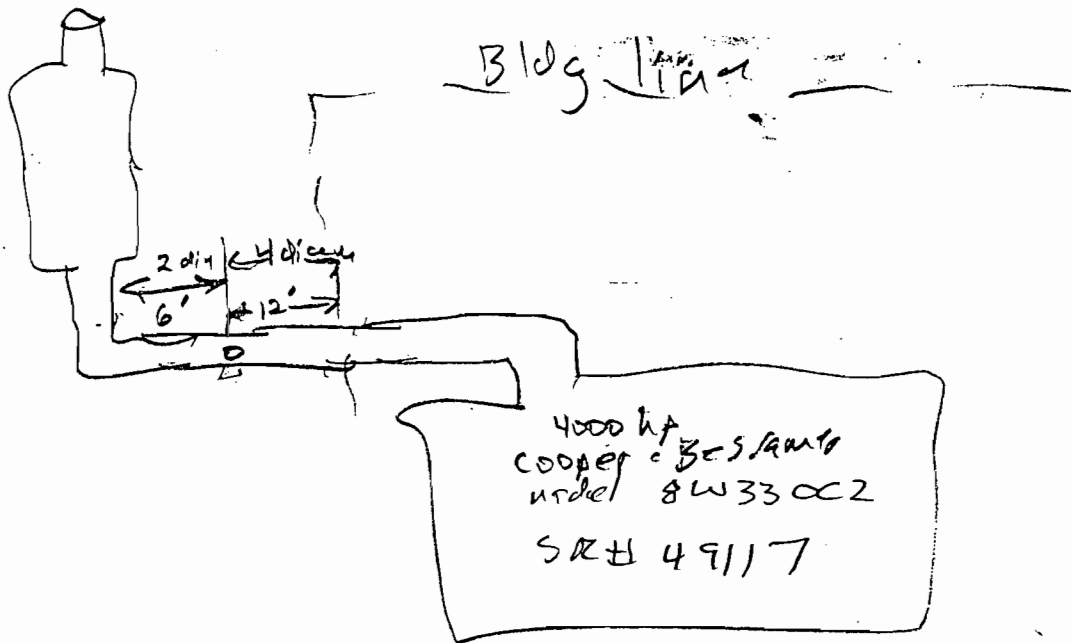
JOB NAME: Florida Gas Station # 16 DATE: 3 / 23 / 92
 LOCATION: Near Brooker, Florida PERMIT # AC-04-18945
 SOURCE(S): Cooper Engine PSD-FL-161
 PARTICIPANTS: Cubix Corporation
FGT

NAME:	AFFILIATION:	PHONE NUMBER:
RICK J. KRENZKE	CUBIX CORP.	512-243-0202
ALLAN WEATHERFORD	FLA. GAS	407 875-5800
FRED GRIFFIN	" "	" " "
STAN MAZUR	FLA. DER. - JACKSONVILLE	(904) 448-4310
SHANNON BARUCH	FLA. DER. - GAINESVILLE	(904) 336-2095
Lowell Fowler	CUBIX	512 243 0202
JOE Rudy / 7	"	512 243 0202

Circular Stack Sampling Traverse Point Layout (EPA Method 1)

Date: 3/23/92 Port + Stack ID: 47 in.
 Plant: Brooklyr F&G Port Extension 12 in.
 Source: Cooper-Bassner Engine Stack ID: 35 in.
 Technician(s): LF RK JZ Stack Area 6.69 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)				Distance from Reference Point (inches)
	4	6	8	12	
1	6.7	4.4	3.2	2.1	<u>1.1</u>
2	25.0	14.6	10.5	8.2	<u>3.7</u>
3	75.0	29.6	19.4	11.8	<u>6.8</u>
4	93.3	70.4	32.3	17.7	<u>11.3</u>
5		85.4	67.7	25.0	<u>23.7</u>
6		95.6	80.6	35.6	<u>28.2</u>
7			89.5	64.4	<u>31.3</u>
8			96.8	75.0	<u>33.9</u>
9				82.3	_____
10				88.2	_____
11				93.3	_____
12				97.9	_____

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3/23/92
 Plant/Operator: F&T/Biodiesel
 Source: Cooper Engine
 Technicians: L F J R R K
 Atm. Pres. 29.69 in.Hg(Pb)
 Test Run # C-1

Dry Gas Meter ID: Anderson
 Dry Gas Meter Factor: 2904 (Kd)
 Pitot Tube #/Type: 107 / 574
 Pitot Tube Factor: .24 (Kp)
 Static Pres. 1.43 in.H₂O(Pg)
 Average Stack Temp. 503 °F(Ts)

Pre-test Leak check	0 ft.3/min at 22 in. Hg Vacuum	Impinger #	Contents	Initial Weight	Final Weight
0/9		1	H ₂ O	563.8	580.4
Post-test Leak check	0 ft.3/min at 23 in. Hg Vacuum	2	H ₂ O	590.8	593.7
0/9		3	MT	473.0	473.8
		4	SILICA	706.4	714.2
		5			
		6			
		Totals	 	2334	2362.1

Moisture Train

	Initial	Final
Time:	1550	1647
Meter Reading (ft ³ or L)	722.403	746.585
Meter Temp. (°F)	75	110
Sample Box #	TR 7 Box	
O ₂ %	16.2 %	
CO ₂ %	2.8 %	

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	South			North		
	ΔP (" H ₂ O)	°F	B	ΔP (" H ₂ O)	°F	B
1	1.1			1.0		
2	1.3			1.2		
3	1.3			1.3		
4	1.3			1.2		
5	1.3			1.3		
6	1.3			1.2		
7	1.2			1.1		
8	1.1			1.1		
9						
10						
11						
12						

Orsat ↑
Results

Pitot Leak Check
 (+) 3.2" for 60 sec. - no leaks (OK)
 (-) 3.3" for 60 sec. - 0.01" in 60 sec. (OK)

AJK

MOISTURE AND VELOCITY FIELD DATA SHEETS

**BEST
AVAILABLE
COPY**

Date: 3-23-92
 Plant/Operator: FGT/BROOKER
 Source: CB Unit #6
 Technicians: RK, JR, LF
 Atm. Pres. 29.69 in.Hg(Pb)
 Test Run # C-2

Dry Gas Meter ID: Anderson
 Dry Gas Meter Factor: .9904 (Kd)
 Pitot Tube #/Type: #107 Stype
 Pitot Tube Factor: .84 (Kp)
 Static Pres. +.43 in.H₂O(Pg)
 Average Stack Temp. 503 °F(Ts)

Pre-test Leak check	ft.3/min at in. Hg Vacuum	Impinger #	Contents	Initial Weight	Final Weight
<u>OK</u>	<u>22</u>	1	H ₂ O	580.4	595.1
		2	H ₂ O	593.7	596.0
		3	Dry	473.8	476.5
		4	SG	714.2	719.7
		5			
		6			
		Totals	X	2367.1	2387.3

Moisture Train

	Initial	Final
Time:	<u>1702</u>	<u>1756</u>
Meter Reading (ft ³ or L)	<u>746.68</u>	<u>769.23</u>
Meter Temp. (°F)	<u>100°</u>	<u>125°</u>
Sample Box #	<u>T 7 B 0 1</u>	

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	N			S		
	ΔP (" H ₂ O)	°F	B	ΔP (" H ₂ O)	°F	B
1	.95			.91		
2	1.1			1.2		
3	1.2			1.3		
4	1.3			1.3		
5	1.2			1.3		
6	1.1			1.2		
7	1.2			1.2		
8	1.1			1.1		
9						
10						
11						
12						

great results

O ₂ %	<u>16.00</u>
CO ₂ %	<u>3.00</u>

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3-23-92
 Plant/Operator: FGT-BROOKER
 Source: CB Unit #6
 Technicians: RK, JR, LF
 Atm. Pres. 29.72 in.Hg(Pb)
 Test Run # C-3

Dry Gas Meter ID: Anderson
 Dry Gas Meter Factor: 1.9904 (Kd)
 Pitot Tube #/Type: #107 S-Type
 Pitot Tube Factor: .84 (Kp)
 Static Pres. 1.49 in.H₂O(Pg)
 Average Stack Temp. 504 °F(Ts)

Leak Check = 0.01 @ 24"

Pre-test Leak check	ft. ³ /min at in. Hg Vacuum	Impinger #	Contents	Initial Weight	Final Weight
<u>OK</u>	<u>0.01 @ 24"</u>	1	H ₂ O	597.9	612.5
Post-test Leak check <u>OK</u>	<u>0</u> ft. ³ /min at in. Hg Vacuum <u>23</u>	2	H ₂ O	595.9	598.2
		3	Empty	459.4	460.1
		4	SB	715.0	721.2
		5			
		6			
		Totals	 	2368.2	2392

Moisture Train

	Initial	Final
Time:	1831	1921
Meter Reading (ft ³ or L)	771.270	793.175
Meter Temp. (°F)	98	112
Sample Box #	<u>757805</u> <u>DF52</u>	
O ₂ %	16.0	
CO ₂ %	3.0	

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	S		N	
	ΔP (" H ₂ O)	°F	ΔP (" H ₂ O)	°F
1	1.0		.82	
2	1.1		1.1	
3	1.2		1.1	
4	1.3		1.2	
5	1.2		1.1	
6	1.2		1.2	
7	1.1		1.2	
8	1.2		1.1	
9				
10				
11				
12				

Brooker Compressor Station--Moisture, Molecular Weight, Stack Flow Rate

Operator/Plant Florida Gas Brooker Compressor Station
 Location Bradford County, Florida
 Source Cooper Bessamer Compressor
 Technicians RK,LF,JR

Test Run No.	C-1	C-2	C-3
Stack Moisture & Molecular Wt. via EPA Method 4			
CO2 (%)	2.80	3.00	3.00
O2 (%)	16.20	16.00	16.00
Beginning Meter Reading (ft3)	722.803	746.680	771.270
Ending Meter Reading (ft3)	746.585	769.230	793.175
Beginning Impinger Wt. (g)	2334	2362.1	2368.2
Ending Impinger Wt. (g)	2362.1	2387.3	2392
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	75	100	98
Dry Gas Meter Temperature (°F end)	110	125	112
Atmospheric Pressure (in Hg, abs.)	29.68	29.69	29.72
Stack Gas Moisture (% volume)	5.60	5.50	5.28
Dry Gas Fraction	0.944	0.945	0.947
Stack Gas Molecular Wt. (lbs/lb-mole)	28.47	28.51	28.53
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	1.10	0.95	1.00
ΔP #2	1.30	1.10	1.10
ΔP #3	1.30	1.20	1.20
ΔP #4	1.30	1.30	1.30
ΔP #5	1.30	1.20	1.20
ΔP #6	1.30	1.10	1.20
ΔP #7	1.20	1.20	1.10
ΔP #8	1.10	1.10	1.20
ΔP #9	1.00	0.91	0.82
ΔP #10	1.20	1.20	1.10
ΔP #11	1.30	1.30	1.10
ΔP #12	1.20	1.30	1.20
ΔP #13	1.30	1.30	1.10
ΔP #14	1.20	1.20	1.20
ΔP #15	1.10	1.20	1.20
ΔP #16	1.10	1.10	1.10
Sum of Square Root of ΔP's	17.6	17.3	17.0
Number of Traverse Points	16	16	16
Average Square Root of ΔP's	1.10	1.08	1.06
Average Temperature (°F)	503	503	504
Static Pressure (in. H2O)	0.43	0.43	0.49
Stack Diameter (in.)	35	35	35
Stack Area (ft2)	6.68	6.68	6.68
Stack Velocity (ft/min)	5044	4954	4879
Stack Flow,wet (ACFM)	33701	33098	32602
Stack Flow,dry (SCFH)	1.04E+06	1.02E+06	1.01E+06

Volatile Organic Carbon by Method 25

Best Available Copy

Client: <u>Florida GAS TRANS</u>	Project #: <u>0</u>
Plant: <u>Brooker #16</u>	Sample Location: <u>Center of stack</u>
Operator: <u>JR, RKL, LF</u>	Date: <u>3-23-92</u>
Run Number: <u>01</u>	Sample ID: _____
Tank Number: <u>AT 121 ✓</u>	Trap Number: <u>V? X-27</u>
Sampling Train ID#: _____	% CO2: <u>2.98</u>
Side: Left / Right: <u>SAMPLE 1</u>	% H2O: <u>5.04</u>
Start Time: <u>1525</u>	Stop Time: <u>1626</u>

Pressure Readings	Tank Vacuum		Barometric Pressure mm Hg / in Hg	Ambient Temperature C / F
	Manometer mm Hg / in Hg	Gauge mm Hg / in Hg		
Pre Test	<u>27.90</u>	<u>28.80</u>	<u>29.68</u>	<u>71</u>
Post Test	<u>7.50</u>	<u>8.50</u>	<u>29.69</u>	<u>72</u>

Leak Rate	Tank * (in Hg)		Trap black ball reading
	Allowable	Actual	
Pre Test	<u>.52</u>	<u>1.3</u>	<u>0</u>
Post Test	<u>.52</u>	<u>0.2</u>	<u>0</u>

$$\Delta P = .01 \frac{F P_b \theta}{V_t}$$

$$= \frac{.01 \times 29.9 \times 35}{100}$$

ΔP = Pressure Change (in Hg)
 F = Sampling Flow Rate cc/min
 P_b = Barometric Pressure (in Hg)
 θ = Leak Check Time Period (min)
 V_t = 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
<u>1526</u>	<u>28.80</u>	<u>35 cc</u>	<u>265</u>	<u>265</u>	<u>START</u>
<u>1531</u>	<u>27.50</u>	<u>20</u>	<u>265</u>	<u>265</u>	
<u>1536</u>	<u>26.80</u>	<u>18</u>	<u>265</u>	<u>265</u>	<u>Frozen line</u>
<u>1541</u>	<u>26.80</u>	<u>35</u>	<u>265</u>	<u>265</u>	
<u>1546</u>	<u>25.20</u>	<u>25</u>	<u>265</u>	<u>265</u>	<u>line open</u>
<u>1551</u>	<u>23.80</u>	<u>35</u>	<u>265</u>	<u>265</u>	<u>Flow steady</u>
<u>1556</u>	<u>20.30</u>	<u>32</u>	<u>265</u>	<u>265</u>	
<u>1601</u>	<u>18.00</u>	<u>35</u>	<u>265</u>	<u>265</u>	
<u>1606</u>	<u>16.20</u>	<u>35</u>	<u>265</u>	<u>265</u>	
<u>1611</u>	<u>14.60</u>	<u>33</u>	<u>266</u>	<u>265</u>	
<u>1616</u>	<u>12.80</u>	<u>30</u>	<u>265</u>	<u>265</u>	<u>Adjust flow</u>
<u>1621</u>	<u>10.20</u>	<u>30</u>	<u>265</u>	<u>265</u>	<u>lube oil</u>
<u>1626</u>	<u>8.50</u>	<u>33</u>	<u>265</u>	<u>265</u>	<u>through out stack</u>



Volatile Organic Carbon by Method 25

Best Available Copy

Client: <u>Florida GAS Trans</u>	Project #: _____
Plant: <u>Brooker #16</u>	Sample Location: _____
Operator: <u>LR, LF, RK</u>	Date: <u>3/23/92</u>
Run Number: <u>C-2</u>	Sample ID: _____
Tank Number: <u>4T108</u>	Trap Number: <u>X-17</u> <i>used before</i>
Sampling Train ID#: _____	% CO2: <u>2.91</u>
Side: Left / Right: <u>Sample -1</u>	% H2O: <u>5.07</u>
Start Time: _____	Stop Time: _____

Pressure Readings	Tank Vacuum		Barometric Pressure mm Hg / in Hg	Ambient Temperature C/F
	Manometer mm Hg / in Hg	Gauge mm Hg / in Hg		
Pre Test	<u>27.90</u>	<u>28.90</u>	<u>29.69</u>	<u>72</u>
Post Test	<u>5.5</u>	<u>6.5</u>	<u>29.72</u>	<u>68</u>

Leak Rate	Tank (in Hg)		Trap black ball reading
	Allowable	Actual	
Pre Test	<u>1.04</u>	<u>0</u>	<u>0</u>
Post Test	<u>1.04</u>	<u>.2</u>	<u>0</u>

$$\Delta P = .01 \frac{F P_b \theta}{V_t}$$

$$.0135 \frac{29.69}{100}$$

ΔP = Pressure Change (in Hg)
 F = Sampling Flow Rate cc / min
 P_b = Barometric Pressure (in Hg)
 θ = Leak Check Time Period (min)
 V_t = 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
1713	28.50	35	265	265	Start
1718	27.20	35	265	265	
1723	26.10	33	265	265	
1728	24.00	30	265	265	
1733	21.90	30	265	265	
1738	19.90	30	265	265	Adjust Flow
1743	17.20	35	265	265	
1748	14.60	33	265	263	
1753	12.30	30	265	265	
1758	10.20	30	265	265	Adjust Flow
1703	8.90	33	265	265	
1708	7.50	28	265	265	
1712	6.5	20	265	265	



Volatile Organic Carbon by Method 25

Client: <u>Florida GAS</u>	Project #: _____
Plant: <u>Brooker</u>	Sample Location: <u>STACK</u>
Operator: <u>JR, LF, RK</u>	Date: <u>3/23/92</u>
Run Number: <u>C-3</u>	Sample ID: _____
Tank Number: <u>4T-182</u>	Trap Number: <u>C-15</u>
Sampling Train ID#: _____	% CO ₂ : <u>2.87</u>
Side: Left / Right: <u>SAMPLE 2</u>	% H ₂ O: <u>4.93</u>
Start Time: <u>1833</u>	Stop Time: <u>1933</u>

Pressure Readings	Tank Vacuum		Barometric Pressure mm Hg / in Hg	Ambient Temperature C / F
	Manometer mm Hg / in Hg	Gauge mm Hg / in Hg		
Pre Test	27.90	29.20	29.72	68°
Post Test	5.90	6.00	29.78	66°

Leak Rate	Tank * (in Hg)		Trap black ball reading
	Allowable	Actual	
Pre Test	1.0402	0	0
Post Test	1.0423	0	0

$\Delta P = .01 \frac{F P_b \phi}{V_t}$
 ΔP = Pressure Change (in Hg)
 F = Sampling Flow Rate cc / min
 P_b = Barometric Pressure (in Hg)
 ϕ = Leak Check Time Period (min)
 V_t = 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
1833	29.20	35	267	264	START
1838	27.30	33	267	265	
1843	25.40	35	266	264	
1848	23.60	33	266	264	
1853	21.50	35	267	264	
1858	19.40	33	266	265	
1903	16.00	35	265	263	
1908	14.20	33	266	264	
1913	12.70	30	267	265	
1918	10.90	28	267	266	Adjust Flow
1923	8.90	35	267	266	
1928	7.60	33	267	266	
1933	6.00	30	268	266	



4334

CHAIN OF CUSTODY RECORD

PROJ. NO.		PROJECT NAME				NO. OF CONTAINERS	REMARKS										
DEPT. NO. 8151		Cubix Corp.															
SAMPLERS: (Signature) <i>[Signature]</i> Joseph Rudyk						CO2 BLANK VALUE (ppmv)	<div style="border: 1px solid black; width: 100%; height: 100%; background: repeating-linear-gradient(45deg, transparent, transparent 2px, black 2px, black 4px);"></div>										
LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION													
	C-1	3/20/92	830	Trap #	B35							3.0	Melbourne - Fla. GAS ✓				
	C-2	3/17/92	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	900		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	3/22			C15							3.6	BROOKER				
	C-2	3/26/92	955		C37							0.8	Melbourne - Fla. GAS ✓				
	C-2	3/17/92	1300		Room							4.3	Corking with C - PGW				
					Room	1.2											
					Room	2.5											
	<u>C-2</u>	<u>3/22</u>			<u>X1</u>	<u>2.6</u>	<u>BROOKER</u>										
→	C-1	3/20/92	830		X10	2.5	Perry - Fla. GAS ✓										
Relinquished by: (Signature)		Date / Time		Received by: (Signature)		Relinquished by: (Signature)		Date / Time		Received by: (Signature)							
<i>[Signature]</i>		4/1/92 1142		<i>[Signature]</i>													
Relinquished by: (Signature)		Date / Time		Received by: (Signature)		Relinquished by: (Signature)		Date / Time		Received by: (Signature)							
Relinquished by: (Signature)		Date / Time		Received for Laboratory by:		Date / Time											
REMARKS:																	



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

4335

CHAIN OF CUSTODY RECORD

PROJ. NO.		PROJECT NAME			NO. OF CONTAINERS	REMARKS		
DEPT. NO. 8151		Cubix Corp						
SAMPLERS: (Signature) <i>Joseph Rudyk</i> Joseph Rudyk					CO ₂ BLANK VALVE (ppmv)			
LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION				
→	C-2	3/20/92	1000	Trap # X13 ? Brooker			1.8	Perry - Fla. GAS ✓
				X14			0.9	
				X16			2.3	
				X23			2.6	Melbourne
	C-1	3/23/92		X27			1.8	Brook LCO
				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	3/8/92	1100	N19	3.0	Caryville Fla GAS ✓		
Relinquished by: (Signature) <i>Joseph Rudyk</i>		Date / Time 4/1/92 1:42		Received by: (Signature) <i>Tom G...</i>		Relinquished by: (Signature) <i>[Signature]</i>		
Relinquished by: (Signature)		Date / Time		Received by: (Signature)		Relinquished by: (Signature)		
Relinquished by: (Signature)		Date / Time		Received for Laboratory		Date / Time		
REMARKS:								



Clean Air Engineering

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

4337

CHAIN OF CUSTODY RECORD

Best Available Copy

PROJ. NO.		PROJECT NAME				NO. OF CONTAINERS	REMARKS				
DEPT. NO.		SAMPLERS: (Signature)									
LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION							
8151		Cubix, Corp				0.1	N/AHC BLACK VALUE (PHUC)				
Joseph Rudyk											
Audit 2	3/26/92			TANK # 4T107	0.1					Melbourne	
C-2	3/23/92	17:33		4T108	0.1					Brooker - Fla. GAS ✓	
C-1	3/20/92	3:30		4T114	0.2					Permy - Fla. GAS ✓	
C-6	3/27/92			4T119	0.7					Melbourne	
C-11	3/23/92	5:26		4T121	0.1					Brooker - Fla. GAS ✓	
				4T127	0.4						
Audit 1	3/26/92			4T128	0.2					Melbourne	
C-1	3/19/92	9:00		4T149	0.9					Quincy - Fla. GAS ✓	
				4T159	1.1						
C-3	3/19/92	11:35		4T177	1.1					Quincy - Fla. GAS ✓	
C-3	3/23/92	18:33		4T182	0.1					Brooker - Fla. GAS ✓	
C-3	3/24/92	3:10		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	
Relinquished by: (Signature)		Date / Time		Received by: (Signature)		Date / Time		Received by: (Signature)			
[Signature]		4/1/92 1:42		[Signature]							
Relinquished by: (Signature)		Date / Time		Received by: (Signature)		Date / Time		Received by: (Signature)			
[Signature]		[Signature]		[Signature]		[Signature]		[Signature]			
Relinquished by: (Signature)		Date / Time		Received for Laboratory Use:		Date / Time					
[Signature]		[Signature]		[Signature]		[Signature]					

REMARKS:



Table of Carbon Concentration for Method 25.
 Samples collected by Cubix Corp. at Florida
 Gas & Trans on 3/23/92 and reported on 4/30/92.

Source	Sample - Run ID #	Carbon Concentration			
		Total (Mc) (mg/dscm)	Total (C) (ppmv)	Conden- sible (Ccm) (ppmv)	Noncon- densible (Ctm) (ppmv)
BROOKER STATION	C-1	86.2	172.6	131.0	41.7
	C-2	48.1	96.4	52.8	43.6
	C-3	91.4	183.0	137.4	45.6

Compiled By: *Stanford My* On: 5-1-92

Approved By: *S.L.* On: 5/1/92



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

Plant: Florida Gas & Trans.
 Sample Loc. Brooker Station
 (In/Out) Centroid
 Date 3/23/92

Preliminary Data-----

Run No.	C-1	C-2	C-3
Tank No.	4T121	4T108	4T182
Trap No.	X27	X13	C15
Tank Volume V(cc)	4040	4021	4011

Field Data-----

PTI (mm Hg)	-709	-709	-708
TTI (F)	71	68	68
PbI (mm Hg)	753	755	755
PT (mm Hg)	-191	-150	-150
TT (F)	72	66	66
Pb (mm Hg)	753	756	756

Noncondensibles Organics-----

PT(Lab) (mm Hg)	-204	-150	-142
TT(Lab) (F)	78	78	78
Pb(Lab) (mm Hg)	746	745	745
PTF (mm Hg)	920	930	1032
TTF (F)	78	78	78
PbF (mm Hg)	746	745	745
Ba (ppmv C)	0.1	0.1	0.1
Ctm 1 (ppmv C)	12.8	15.1	14.3
Ctm 2 (ppmv C)	12.5	14.9	16.1
Ctm 3 (ppmv C)	14.3	15.0	13.9
Avg. Ctm (ppmv C)	13.2	15.0	14.8
RSD Ctm (%)	7.3	0.7	7.9

Condensibles Organics-----

ICV Tank No.	4T240	4T66	4T232
ICV Tank, Vv (cc)	4265	4036	4280
PFI (mm Hg)	-736	-734	-738
TFI (F)	78	78	78
PbFI (mm Hg)	746	745	745
PF (mm Hg)	920	920	920
TF (F)	78	78	78
PbFf (mm Hg)	746	745	745
Bt (ppmv C)	1.8	2.3	3.6
Ccm 1 (ppmv C)	42.1	20.6	47.9
Ccm 2 (ppmv C)	40.4	20.4	47.7
Ccm 3 (ppmv C)	39.9	20.2	47.9
Avg. Ccm (ppmv C)	40.8	20.4	47.8
RSD Ccm (%)	2.8	1.0	0.2

Total Gaseous Nonmethane Organics (TGNMO)=====

Vs (cc)	2734	2976	2964
Dil. Factor (Non)	3.181	2.923	3.107
Dil. Factor (Con)	3.358	2.917	3.106
Ct (ppmv C)	41.7	43.6	45.6
Cc (ppmv C)	131.0	52.8	137.4
Ct+Cc= C (ppmv C)	172.6	96.4	183.0
Mc (mg C/dscm)	86.2	48.1	91.4



DATE 3-23-92
UNIT NO. 1606

ENGINE/COMPRESSOR PERFORMANCE
EMISSION & PERFORMANCE TEST FORM

STATION 16-BROOKER
STA. EL. 100

	1	2	3	4	5	TEST NO		
	4000	4000	4000	4200	4200	4200	4200	4200
<u>POWER END ANALYSIS</u>	110° 330RPM	110 330	110 330	95° 330	95 330			
ENGINE SPEED - RPM	328	328	328	328	328			
IGN. TIMING - BTDC	3°	3	3	3	3			
AMP - PSIG / IN PSI	14.3	14.1	14.1	15.1	15.9			
AMT - F	100 108	100 107	110 108	95 95	95 95			
FUEL STATIC PR. - PSIA	55							
FUEL DIFF. - "H2O								
FUEL TEMP. - F								
FMP - PSIG	55.5	55.2	54.9	58.0	57.6			
FUEL FLOW - SCFH								
AMBIENT TEMP. - F	68°	68°	66°	63°	60°			
O2 PCC	48.4	48.4	47.8	51.0	50.3			
NO ppm Exhaust Temp	663°	666°	670	658	659			
CO2								
NO ppm TIME	4:17 PM	5:15 PM	6:20 PM	7:13 PM	7:54 PM			
NO2 ppm Turbo Inlet Valve H ₂ O	4.3"	4.3"	4.2"	4.5"	4.5			
THC - (ppmv as C1)								

Turbo RPM 10,260 10,230 10,190

<u>COMPRESSOR END ANALYSIS</u>								
LOADING STEP	5	5	4	5	4			
SUCTION PRESSURE - PSIG	695	700	702	700	700			
SUCTION TEMP. - F	44°	44°	42°	42°	42°			
DISCHARGE PRESSURE-PSIG	940	945	948	950	948			
DISCHARGE TEMP. - F	87°	85°	89°	84°	85°			
COMPRESSOR FLOW - MMCFD								
TESTED BHP	4030	4028	4000	4204	4200			
TESTED TORQUE - %	100.5	100.5	100.0	105.0	105.1			
SFC - BTU/BHP-HR								

4010
100.5

**APPENDIX B:
EXAMPLE CALCULATIONS**

MOISTURE CONTENT

refers to test run C-1

$$\begin{aligned}V_1 &= \text{initial dry gas meter reading} = 722.803 \text{ ft}^3 \\V_2 &= \text{final dry gas meter reading} = 746.585 \text{ ft}^3 \\V_{\text{net}} &= \text{total gas sample volume collected (ft}^3\text{)} \\&= V_2 - V_1 \\&= 746.585 - 722.803 = 23.782 \text{ ft}^3\end{aligned}$$

$$\begin{aligned}M_1 &= \text{initial weight of impinger train} = 2334 \text{ g} \\M_2 &= \text{final weight of impinger train} = 2362.1 \text{ g}\end{aligned}$$

$$\begin{aligned}\text{MWC} &= \text{total weight gain of all impingers (g)} \\&= M_2 - M_1 = 2362.1 - 2334 \\&= 28.1 \text{ g}\end{aligned}$$

$$K_d = \text{dry gas meter factor (unitless)} = 0.9904$$

$$\begin{aligned}V_{\text{corrected}} &= V_{\text{net}} \times K_d = x \\&= 23.782 \times 0.9904 = 23.554 \text{ ft}^3\end{aligned}$$

1.335 liters weighs 1 gram at standard conditions

499.4 = Gas constant

$$P_{\text{bar}} = \text{barometric pressure (in Hg)} = 29.68$$

$$T = \text{temperature of gas DGM (F}^\circ\text{)} = 92.5$$

F_w = moisture fraction by volume

$$\begin{aligned}&= \frac{\text{volume H}_2\text{O collected in impingers}}{\text{vol. H}_2\text{O collected} + \text{volume gas dry gas collected}}\end{aligned}$$

$$\begin{aligned}&= \frac{\text{MWC} \times 1.335}{(\text{MWC} \times 1.335) + (((V_{\text{cor}} \times P_{\text{bar}}) / (T + 460)) \times 499.4)} \\&= \frac{(28.1 \times 1.335)}{(28.1 \times 1.335) + (((23.554 \times 29.68) / (92.5 + 460)) \times 499.4)} \\&= 0.056 \text{ moisture}\end{aligned}$$

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 = 2.8 (from Orsat)

C_{O_2} = concentration of O_2 = 16.2 (from Orsat)

C_{N_2} = concentration of N_2 = $1 - (C_{CO_2} + C_{O_2}) = 0.81$

F_w = moisture fraction = 0.056

F_d = dry gas fraction = $1 - F_w = 0.944$

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

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

$$= (18 \times 0.056) + (0.944 \times ((44 \times 0.028) + (32 \times 0.162) + (28 \times 0.81)))$$

$$= 28.47 \text{ lb/lb-mole}$$

STACK GAS VELOCITY AND FLOW RATE

refers to test run C-1

$$\begin{aligned}K_p &= \text{pitot tube factor} = .84 \\ \Delta P &= \text{pressure difference in stack as measured (in. H}_2\text{O)} \\ (\sqrt{\Delta P})_{\text{avg}} &= \text{average of square root of } \Delta P\text{'s} = 1.0974 \\ T_s &= \text{stack temperature} = 503 \text{ F}^\circ = 963 \text{ R}^\circ \\ P_b &= \text{atmospheric pressure (in Hg)} = 29.68 \\ P_g &= \text{stack static pressure (in. H}_2\text{O)} = 0.43 \\ P_s &= \text{absolute stack pressure} \\ &= P_b + (P_g \times .0735 \text{ in.Hg / in.H}_2\text{O}) = 29.71 \text{ in. Hg}\end{aligned}$$

V = stack velocity (ft/min)

$$\begin{aligned}&= 5128 \times K_p \times (\sqrt{\Delta P})_{\text{avg}} \times \sqrt{(T_s / (P_s \times MW))} \\ &= 5128.8 \times .84 \times 1.0974 \times \sqrt{(963 / (29.71 \times 28.47))} \\ &= 5044 \text{ ft/min}\end{aligned}$$

Q_a = stack flow rate (ft³/min)

$$\begin{aligned}&= V \times A, \text{ where } A = \text{area of stack} = 6.68 \text{ ft}^2 \\ &= 5044 \times 6.68 = 33700 \text{ ft}^3/\text{min}\end{aligned}$$

Q_d = stack flow rate on dry basis at standard conditions (SCFH)

$$\begin{aligned}&= Q_a \times 1059 \times (P_s / T_s) \times F_d \\ &= 33700 \times 1059 \times (29.71 / 963) \times 0.944 \\ &= 1.04 \times 10^6 \text{ SCFH}\end{aligned}$$

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

$$\begin{aligned}Q_f &= \text{estimated fuel flow} = 30757 \text{ SCF/hr} \\F_{\text{BTU}} &= \text{heating value of gas} = 1022 \text{ BTU/SCF} \\F &= \text{O}_2 \text{ F factor} = 8636 \text{ SCF/MMBTU} \\C_{\text{O}_2} &= \text{concentration of O}_2 = 16.0 \%(\text{from analyzer})\end{aligned}$$

$$\begin{aligned}Q_d &= \text{stack flow rate on dry basis at standard conditions (SCFH)} \\&= Q_f \times F_{\text{BTU}} \times 10^{-6} \times F \times 20.9 / (20.9 - C_{\text{O}_2}) \\&= 30757 \times 1022 \times 10^{-6} \times 8636 \times 20.9 / (20.9 - 16.0) \\&= 1.16 \times 10^6 \text{ SCFH}\end{aligned}$$

With CO₂ F-factor (i.e. F=1022), same calculation is used except for final term.....

$$\begin{aligned}Q_d &= Q_f \times F_{\text{BTU}} \times 10^{-6} \times F \times 100/C_{\text{CO}_2} \\&= 30757 \times 1022 \times 10^{-6} \times 1022 \times 100/2.92 \\&= 1.10 \times 10^6 \text{ SCFH}\end{aligned}$$

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

MASS EMISSION RATES

refers to test run C-1

NO_x = concentration of NO_x = 42.6 ppmv

CO = observed concentration of CO = 145 ppmv

VOC = observed concentration via EPA Method 25 and 18
= 74.2 ppmv

1 SCF NO_x = 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 = 1.04×10^6 SCFH

E_{NO_x} = mass emission rate of NO_x (lb/hr)

$$= \text{NO}_x \times \text{Qd} \times 11.94 \times 10^{-8}$$

$$E_{\text{NO}_x} = 42.6 \times 1.04 \times 10^6 \times 11.94 \times 10^{-8}$$

$$E_{\text{NO}_x} = 5.29 \text{ lb/hr}$$

$$E_{\text{CO}} = 11.0 \text{ lb/hr}$$

$$E_{\text{VOC}} = 3.2 \text{ lb/hr}$$

HP = engine horsepower = 4030 hp

454 g = 1.0 lb

$$E_{\text{NO}_x} \text{ (g/hp-hr)} = E_{\text{NO}_x} \times 454 / \text{HP}$$
$$= 5.29 \times 454 / 4030$$

$$E_{\text{NO}_x} \text{ (g/hp-hr)} = 0.6 \text{ g/hp-hr}$$

$$E_{\text{CO}} \text{ (g/hp-hr)} = 1.23 \text{ g/hp-hr}$$

$$E_{\text{VOC}} \text{ (g/hp-hr)} = 0.36 \text{ g/hp-hr}$$

Stack Gas Flow Rate via AGA Carbon Balance Method

Refers to Test Run #C-1

$$\begin{aligned} Q_f &= \text{fuel flow} = 30757 \text{ SCF/hr} \\ C_f &= \text{carbon content of fuel (from fuel analysis)} = 1.022 \\ C_e &= \text{exhaust gas carbon content} \\ &= \text{CO} + \text{THC (as C1)} + \text{CO}_2 \\ &= (145 + 890) / 10000 + 2.92 = 3.0235 \% \end{aligned}$$

$$\begin{aligned} Q &= \text{stack flow rate} \\ &= Q_f \times C_f \times 100 / C_e \\ &= 30757 \times 1.022 \times 100 / 3.0235 \\ &= 1.04 \times 10^6 \text{ SCFH} \end{aligned}$$

SO2 Emission Rate from Fuel Analysis

Refers to Test Run #C-1

S = sulfur content of fuel = 0.071 grains/100 DSCF

7000 grains = 1.0 lb

$Q_f = 30757$ SCF/hr

SO2 = mass emission rate of SO2

= $S / 100 / 7000 \times Q_f$

= $.071 / 100 / 7000 \times 30757$

= <0.0031 lbs/hr

Moisture Content via Stoichiometry

Refers to test run #1

H = Ambient humidity (via psychrometer) = 0.0097 lb/lb air

O₂ = O₂ concentration in stack = 16.0%

F = wet basis O₂ F-factor (from fuel calcs)

= 10641 DSCF/MMBTU

FW = moisture F-factor = 2006 SCF of H₂O/MMBTU

CM = combustion moisture % at 0% O₂

= $F_w / F \times 100 = 2006 / 10641 \times 100$

= 18.86 %

F_w = moisture content

= $(CM \times (20.9 - O_2) / 20.9) + (H \times 64.3)$

= $(18.86 \times (20.9 - 16.0) / 20.9) + (.0097 \times 64.3)$

= 5.04 %

**APPENDIX C:
QUALITY ASSURANCE ACTIVITIES**

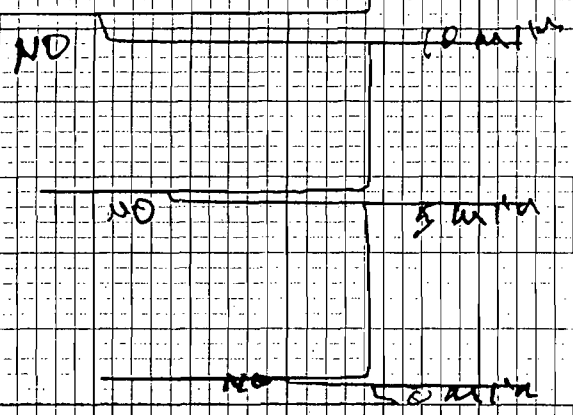
MULTI-POINT LINEARITY CHECK

Initial Range
 N₂ 0-1000 PPM
 CO₂ 0-1000 PPM
 O₂ 0-25%

QUALITY ASSURANCE ACTIVITIES

603123/92

FLORIDA GAS TRANSMISSION
 BROOKER COMPRESSOR STATION



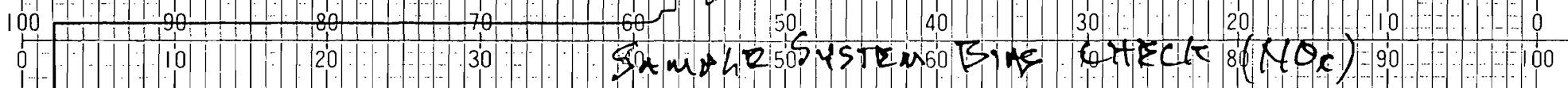
888.1 NOx
in air

780cm

NOx CONVERTED EFFICIENCY TEST

406.4 NOx thru probe

406.4 NOx direct



1157.7 NOx

150.00

3.9907

406.4 NOx

401.00

1.9802

888.1 NOx

12.99

07

(6334)

O. RN2-01-25-20M

760cm (6334)

CHART NO. RN2-01-25-20M

Charts-Inc

1549 Shift C-

401 CO
179902

REZERO & SPAN ON NEW RANGE

30 mV RANGE - 250

50 0-500

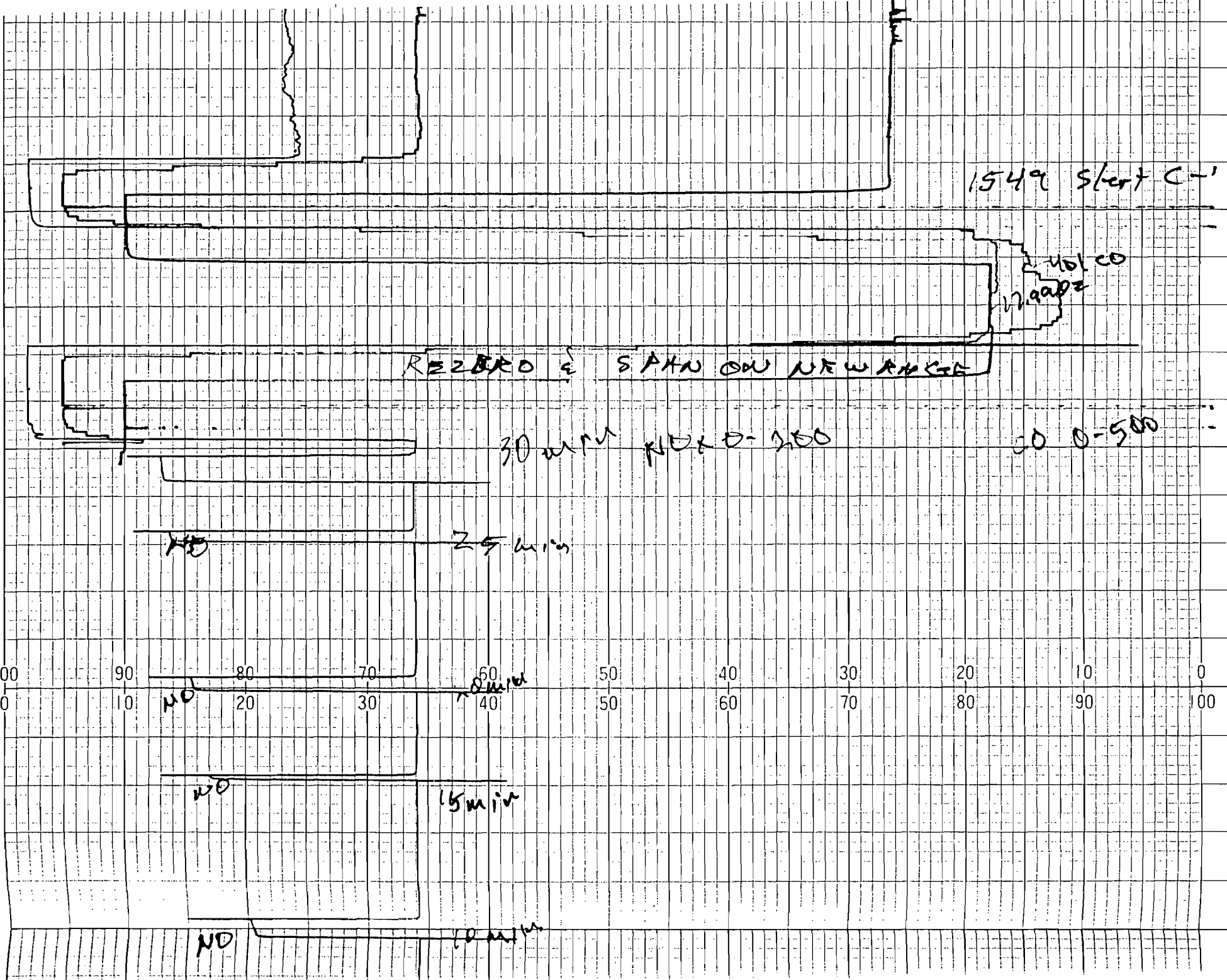
NO 25 min

NO 15 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



NO. SAMPLE SYSTEM BIAS CHECK
(AFTER TEST)

157000 540100

1904 END C-3

660cm

100	90	80	70	60	50	40	30	20
0	10	20	30	40	50	60	70	80

NO₂ = 45.0
CO = 13.9
O₂ = 16.0

(6334)

CHART NO. RN2-01-25-20M

(6334)

CHART NO. RN2-01-25-20M

Charts-inc

1160cm

KEZENO 250M

CO₂ 0.4%

5.73 CO₂

4000 C₁ thru probe

4000 C₁ direct

SAMPLE SYSTEM BIAS CHECK (TIC)

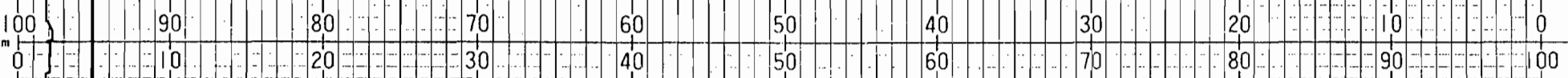
3925 C₁
3.925 CO₂

3925 C₁

7.99 CO₂

4000 C₁

2.89 CO₂



INITIAL RANGES

CO₂ 0-20%

TIC 0-5000 MM
(cal C₁)

MULTI POINT LINEARITY CHECK

QUALITY ASSURANCE ACTIVITIES

3/23/92

FLORIDA GAS TRANSMISSION

IRAWA RIVER TRANSMISSION STATION



CHART NO. RN2-01-25-20M

1066075 (6334)

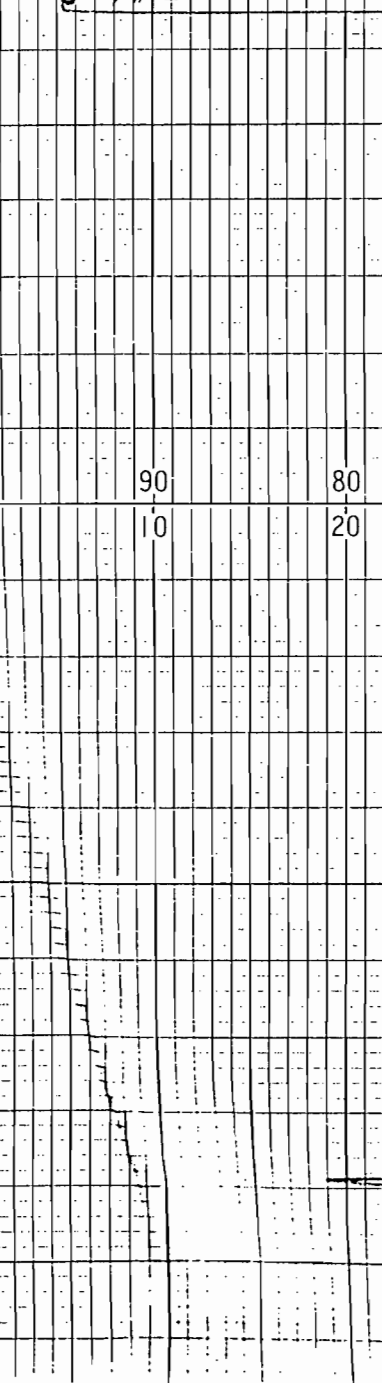
CO₂
TAC

TFC Sample System Bias Check
End of Test

1904 END C-3

CO₂ = 2.87
TAC = 935

100	90	80	70	60	50	40	30	20	10	0
0	10	20	30	40	50	60	70	80	90	100



Quality Assurance Worksheet: Brooker Compressor Station

	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	2.0	0.0	42.6	2.0	0.0	44.2	2.1	0.1	45.6	2.2	0.2
low	157.7	17.8	17.3	-0.5	% Chart	81.1	0.3	% Chart	80.5	-0.3	% Chart	82.1	1.3
mid	406.4	42.6	42.0	-0.6	23.3	n.a.	n.a.	24.1	n.a.	n.a.	24.8	n.a.	n.a.
high	888.1	90.8	91.2	0.4		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	1000.0				200.0			200.0			200.0		
CO					Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	5.0	5.0	0.0	145.0	5.0	0.0	144.0	5.2	0.2	137.0	5.0	0.0
low	150.0	20.3	20.5	0.2	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	401.0	45.3	46.2	0.9	34.0	85.6	0.4	33.8	83.4	-1.8	32.4	85.2	0.0
high	918.0	96.5	97.2	0.7		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	16.00	10.3	0.3	15.95	10.0	0.0	16.00	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	42.5	0.6	74.0	n.a.	n.a.	73.8	n.a.	n.a.	74.0	n.a.	n.a.
high	17.90	81.6	82.1	0.5		81.9	0.3		81.8	0.2		81.9	0.3
full scale	25.0				25.0			25.0			25.0		
CO2					Avg.%			Avg.%			Avg.%		
zero	0.0	2.0	2.2	0.2	2.92	2.2	0.2	2.91	2.2	0.2	2.87	2.2	0.2
low	3.18	17.8	17.9	0.1	% Chart	81.3	-0.2	% Chart	81.4	-0.1	% Chart	81.3	-0.2
mid	7.99	42.0	17.9	-24.1	75.0	n.a.	n.a.	74.8	n.a.	n.a.	73.8	n.a.	n.a.
high	17.99	92.0	92.0	0.1		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	20				4.0			4.0			4.0		
THC					Avg. ppmv			Avg. ppmv			Avg. ppmv		
zero	0.0	5.0	5.0	0.0	890	5.1	0.1	885	5.0	0.0	935	5.2	0.2
low	395	12.9	12.9	0.0	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	823	21.5	21.7	0.2	22.8	n.a.	n.a.	22.7	n.a.	n.a.	23.7	n.a.	n.a.
high	4000	85.0	85.0	0.0		85.9	0.9		84.0	-1.0		84.8	-0.2
full scale	5000.00				5000.0			5000			5000		

TR 7

INTERFERENCE RESPONSE TEST

Environmental Instruments Division

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

DATE OF TEST JAN 20, 1992

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

<u>TEST GAS TYPE</u>	<u>CONCENTRATION PPM</u>	<u>ANALYZER OUTPUT RESPONSE</u>	<u>% OF SPAN</u>
<u>CO</u>	<u>500</u>	<u>2.1 PPM</u>	<u>8.4%</u>
<u>CO₂</u>	<u>201</u>	<u>2.1 PPM</u>	<u>8.4%</u>
<u>CO₂</u>	<u>10%</u>	<u>2.1 PPM</u>	<u>8.4%</u>
<u>O₂</u>	<u>20.9%</u>	<u>2.1 PPM</u>	<u>8.4%</u>

Continuous 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 ppm v

Test Gas		Analyzer Response		Response Ratio
Type Gas	Concentration	Concentration <u>PPM_v</u>	% of Range	
<u>Air</u>	<u>CO Free</u>	<u>0.0</u>	<u>N/A</u>	
<u>CO₂/O₂</u>	<u>4% / 18%</u>	<u>0.0</u>		<u>0.000</u>
<u>CO₂/O₂</u>	<u>12% / 18%</u>	<u>-0.2</u>		<u>-0.017 / -0.025</u>
<u>CO₂/O₂</u>	<u>21% / 13%</u>	<u>-0.3</u>		<u>-0.014 / -0.100</u>
<u>Air</u>	<u>Dry</u>	<u>0.4</u>		<u>CO Impurity?</u>
<u>NO_x</u>	<u>176 ppm v</u>	<u>0.4</u>	↓	<u>0.002</u>
<u>NO_x</u>	<u>3030 ppm v</u>	<u>0.4</u>		<u>0.0001</u>
<u>SO₂</u>	<u>401 ppm v</u>	<u>-0.2</u>		<u>0.0005</u>
<u>Propene</u>	<u>240 ppm v</u>	<u>0.4</u>		<u>0.002</u>

↑
 all interferences are
 negligible

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: NO_x Analyzer

Oxygen Analyzer

Model: TECO 10AR

Telodyne 320 AX

Range: 0-1000 ppm

0-25%

Span Gas: 900 ppm NO_x

Air = 20.9% O₂

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

Instrumental Analysis Quality Assurance Data

Date: 3/23/12
 Plant: FGT Brooker Compressor Station
 Technician: LA R. J. Jr

NOx Analyzer: NO2 to NO Converter Efficiency Test

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

	NOx Concentration (ppm)	% Decrease from Initial Concentration	NO Concentration (ppm)
Initial Concentration	<u>522</u>	<u>u.a.</u>	<u>280</u>
10 minute Concentration	<u>322</u>	<u>0</u>	<u>182</u>
20 minute Concentration	<u>320</u>	<u>0.6</u>	<u>135</u>
30 minute Concentration	<u>320</u>	<u>1.2</u>	<u>110</u>

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	406.4	1000			
NOx before test	<u>406.4</u>	<u>1000</u>	<u>408</u>	<u>402</u>	<u>-0.6%</u>
SO2					
THC before test	<u>4000</u>	<u>5000</u>	<u>3990</u>	<u>3980</u>	<u>-0.2%</u>
NOx after test	<u>157.7</u>	<u>200</u>	<u>159.8</u>	<u>158</u>	<u>-0.9%</u>
THC after test	<u>4000</u>	<u>5000</u>	<u>4000</u>	<u>4000</u>	<u>0%</u>

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

* NOTE: Equation per EPA Method 6C (40 CFR 60, Appendix A)

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.

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

Compiled By: *Michael Guy* On: 5-1-92

Approved By: *S.C.* On: 5/1/92 Page 1



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

Noncondensable 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

Condensable 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**

Customer :

CUBIX CORPORATION
1713 FORT VIEW ROAD
AUSTIN, TX. 78704

Best Available Copy

*** CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ***
PERFORMED ACCORDING TO SECTION 3.0.4
Certified Per Traceability Procedure # G1
Protocol # 1
File # PDB133
Certified Accuracy 1 % NBS Traceable

Expiration Date : 7-28-92

Cylinder Number : ALK-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 GM15*	FF-16175 11A-6B40	2854 PPM 971.6 PPM	BECKMAN 951A	1-8-91	CHEMILUMINESCENCE
BALANCE GAS : NITROGEN							
NITROGEN DIOXIDE	5.82 PPM (FROM SECOND ANALYSIS)						

EPA PROTOCOL

FIRST ANALYSIS						SECOND ANALYSIS						CALIBRATION CURVE 1 st DEGREE					
ZERO		TEST		REFERENCE		ZERO		TEST		REFERENCE		SRM #	CONC.	SPLIT	DVM	FITTED	PERCENT
(aV)	(aV)	PPM	PPM	CONC.	(aV)	PPM	(aV)	(aV)	PPM	CONC.	(aV)	PPM	PPM	PT (%)	(aV)	VALUE	ERROR
0.00	30.50	889.5	889.5	2854 PPM	98.00	2854	0.00	30.40	886.6	886.6	2854 PPM	98.00	2854	100	98.00	2854	0.00
0.00	30.50	889.5	889.5	98.00	2854	2854	0.00	30.40	886.6	886.6	98.00	2854	11	50	49.00	1428	-0.00
0.00	30.50	889.5	889.5	98.00	2854	2854	0.00	30.40	886.6	886.6	98.00	2854	11	34	33.10	971.6	-0.66
							0.00	30.60 NOX	892.5	892.5	98.00	2854	11	17	16.80	489.0	0.38
													11	0	0.00	0.0000	0.00
													11	0	0.00	0.0000	0.00
CALCULATED		889.5				CALCULATED		886.6									
RESULTS		889.5				RESULTS		886.6									
		889.5						886.6		892.5 PPM NOX						16866	
AVERAGE :		889.5 PPM				AVERAGE :		886.6 PPM								N/A	
																971.6 GM15*	
																33.10	
																965.2	
																-0.66	

* GM15 - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst: *Lou P. Doran* Approved By: *J. 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.

Best Available Copy

||||| CERTIFICATE OF ANALYSIS - EPA PROTOCOL BASES |||||
PERFORMED ACCORDING TO SECTION 3.0.4

Certified Per Traceability Protocol # 1 Procedure # B1

File # P08274

Certified Accuracy 1 % NBS Traceable

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

REFERENCE STD

GAS ANALYZER

COMPONENT	CERTIFIED CONC.	SRM # (CRM #)	CYLINDER NUMBER	CONC.	MAKE/MODEL	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
NITRIC OXIDE	157.7 PPM	1685	AAL-9851	236.0 PPM	BECKMAN	12-4-90	CHEMILUMINESCENCE
		6M191	AAL-14484	145.3 PPM	951A		
BALANCE GAS : NITROGEN		1684	ALM-003623	97.28 PPM			
NITROGEN DIOXIDE	1.77 PPM						

CERTIFIED PROTOCOL

FIRST ANALYSIS			DATE : 2-11-91			SECOND ANALYSIS			DATE : 2-18-91			CALIBRATION CURVE 2nd DEGREE					
ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	RESULTS PPM	DATE	ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	RESULTS PPM	DATE	SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
0.00	53.30	157.4	236.0 PPM	80.00	236.0	0.00	53.50	158.0	236.0 PPM	80.00	236.0	1685	236.0	100	80.00	236.0	-0.00
0.00	53.30	157.4	80.00	80.00	236.0	0.00	53.50	158.0	80.00	236.0			207.6	88	70.50	208.1	0.23
0.00	53.30	157.4	80.00	80.00	236.0	0.00	53.50	158.0	80.00	236.0			145.3	62	49.10	145.1	-0.17
						0.00	53.50	158.0	80.00	236.0		1684	97.28	41	33.00	97.54	0.27
						0.00	54.10 NOX	159.8					0.0000	0	0.00	0.0000	0.00
													0			0.00	0.00
													0			0.00	0.00
CALCULATED RESULTS	157.4	157.4				CALCULATED RESULTS	158.0	158.0									
	157.4						158.0	159.8 PPM NOX				1684	97.28	LOW	33.00	97.54	0.27
AVERAGE :	157.4 PPM					AVERAGE :	158.0 PPM					1685	236.0	HIGH	80.00	236.0	-0.00

THIS - GAS MANUFACTURER'S INTERNAL STANDARD of this Company for use which falls to comply with this analysis shall be replacement the Approved Company without extra cost.

Handwritten Signature

Shipped from : Scott Michigan
 Our Project # : 532228
 Your P.O. # : 92 0000
 Expiration Date : 7-21-93
 Cylinder Number : AAL5112
 Cylinder Pressure : 1900 psig
 1 of 1 Component(s)

Best Available Copy

*** CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ***
 PERFORMED ACCORDING TO SECTION 3.0.4
 Certified For Traceability Procedure # 61
 Protocol # 1
 File # PD-2143
 Certified Accuracy 1% HES traceable

Customer :
 CUBIX CORPORATION
 9225 LOCKHART HWY
 AUSTIN TX 78747

ANALYZED COMPONENT	CYLINDER CERTIFIED CONC.	REFERENCE STD		INSTRUMENTATION		ANALYTICAL PRINCIPLE
		SRM # (CRM #)	CYLINDER NUMBER	CONC.	INSTR/MODEL/SERIAL #	
COXIDE	406.4 PPM	1687	ALM-014665	965.5 PPM	BECKMAN	CHEMILUMINESCENCE
		1685	ALM-008700	250.3 PPM	951A 270-092899B	
NITROGEN						
NOXEN DIOXIDE	0.00 PPM (FROM SECOND ANALYSIS)					

FIRST ANALYSIS		DATE : 1-15-92		SECOND ANALYSIS		DATE : 1-21-92		CALIBRATION CURVE		1 ST DEGREE			
TEST GAS	RESULTS (mV) PPM	REFERENCE GAS CONC. (mV)	RESULTS PPM	ZERO GAS (mV)	TEST GAS (mV) PPM	REFERENCE GAS CONC. (mV)	RESULTS PPM	SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
CO	406.9	965.5 PPM	965.5	0.00	406.0	965.5 PPM	965.5	1684B	965.5	100	96.50	965.5	0.00
	406.9	96.50	965.5	0.00	40.60	96.50	965.5		748.0	77	75.00	750.3	0.30
	406.9	96.50	965.5	0.00	40.60	96.50	965.5		395.0	41	39.60	395.9	0.22
	406.9	96.50	965.5	0.00	40.60	96.50	965.5	1685	250.3	26	25.10	250.7	0.16
				0.00	40.60 NOX				0.0000			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

3 - GAS MANUFACTURER'S INTERNAL STANDARD
 Analyst : *F.P. Davis*
 Approved By : *J. 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.

Best Available Copy



Scott Specialty Gases, Inc.

FAX: 713-644-0244
PHONE: 713-644-4820

3714 LAPAS DRIVE, HOUSTON, TEXAS 77023

6/03/91

UBIX CORPORATION
225 LOCKHART

PROJECT #: 04-11057
PO #: 91105

JUSTIN
EVUN JANCK

TX 78747-0000

CYLINDER #: ALM006621

ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION	ANALYSIS 1 (MOLES) U/M
MONOXIDE	150.0 PPM	150. PPM
E	80.0 PPM	79.7 PPM
EN	BALANCE	BALANCE

ANALYTICAL METHOD: GRAV.MASTER GAS

DATE OF ANALYSIS: 6/03/91

ANALYST: John D. McCallister
ANALYST

APPROVED BY: [Signature]
SUPERVISOR

CELEBRATED

Best Available Copy



Scott Specialty Gases, Inc.

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

10/17/91

CUBIX CORPORATION
9225 LOCKHART HWY

PROJECT #: 04-13936
PO #: 910523

AUSTIN

TX 78747-0000

CYLINDER #: AAL9308

ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION	ANALYSIS 1 (MOLES) U/M
3ON MONOXIDE	400.0 PPM	401. PPM
HANE	400.0 PPM	395. PPM
ROGEN	BALANCE	BALANCE

ANALYTICAL METHOD: ACUBLEND MASTER

DATE OF ANALYSIS: 10/17/91

ANALYST:

ANALYST

APPROVED BY:

SUPERVISOR



Scott Specialty Gases, Inc.

3714 LAPAS DRIVE, HOUSTON, TX 77029-0000
PHONE: 713-644-4820 FAX: 713-644-0244

10/22/91

CUBIX CORPORATION
9225 LUCKHART HWY

PROJECT #: 04-13836
PO #: 910505

AUSTIN

TX 78747-0000

CYLINDER #: AAL13971

ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION	ANALYSIS 1 (MOLES) U/M
MONOXIDE	910.0 PPM	915. PPM
ANE	820.0 PPM	823. PPM
GEN	BALANCE	BALANCE

NOTES: EXP: 11/92

ANALYTICAL METHOD: ACUBLEND MASTER

DATE OF ANALYSIS: 10/22/91

ANALYST:

ANALYST

APPROVED BY:

SUPERVISOR

10/23

FILED

OFFICE BOX 908
CORTE, TEXAS 77571
PHONE: (713) 471-2544

RECEIVED JAN 17 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. _____

Comments:

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

LABORATORY REPORT ON GAS ANALYSIS

1R

1R

	CYL. # MIXTURE REQ.	ANALYSIS
ON	<u>SX-23633</u>	
IDE	<u>3.20%</u>	<u>3.18% ± .02</u>
EN	<u>18.00%</u>	<u>17.9% ± .02</u>
OGEN	<u>BALANCE</u>	<u>BALANCE</u>

	CYL. # MIXTURE REQ.	ANALYSIS
	<u>SX-23625</u>	
	<u>8.00%</u>	<u>7.98% ± .02</u>
	<u>8.00%</u>	<u>7.98% ± .02</u>
	<u>BALANCE</u>	<u>BALANCE</u>

1R

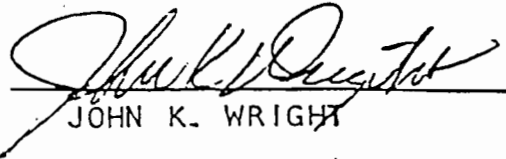
	CYL. # MIXTURE REQ.	ANALYSIS
ON	<u>SX-23652</u>	
IDE	<u>18.00%</u>	<u>17.99% ± .02</u>
EN	<u>4.00%</u>	<u>3.99% ± .02</u>
OGEN	<u>BALANCE</u>	<u>BALANCE</u>

	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.	Analytical Accuracy	Concentration
<u>AAL17750</u>	<u>±1%</u>	
Component	WT%	Concentration
CARBON MONOXIDE		4000 PPM
METHANE		4000 PPM
NITROGEN		BALANCE
NBS TRACEABLE BY WEIGHT		

Cyl No.	Analytical Accuracy	Concentration
Component	WT%	Concentration

Cyl No.	Analytical Accuracy	Concentration
Component	WT%	Concentration

Cyl No.	Analytical Accuracy	Concentration
Component	WT%	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.

CERTIFIED REFERENCE MATERIALS EPA PROTOCOL GASES
ACUBLEND® CALIBRATION & SPECIALTY GAS MIXTURES PURE GASES
ACCESSORY PRODUCTS CUSTOM ANALYTICAL SERVICES

TROY, MICHIGAN / SAN BERNARDINO, CALIFORNIA / HOUSTON, TEXAS / BATON ROUGE, LOUISIANA / AUSTIN, TEXAS
SOUTH PLAINFIELD, NEW JERSEY / FREMONT, CALIFORNIA / WAKEFIELD, MASSACHUSETTS / LONGMONT, COLORADO

Best Available Copy

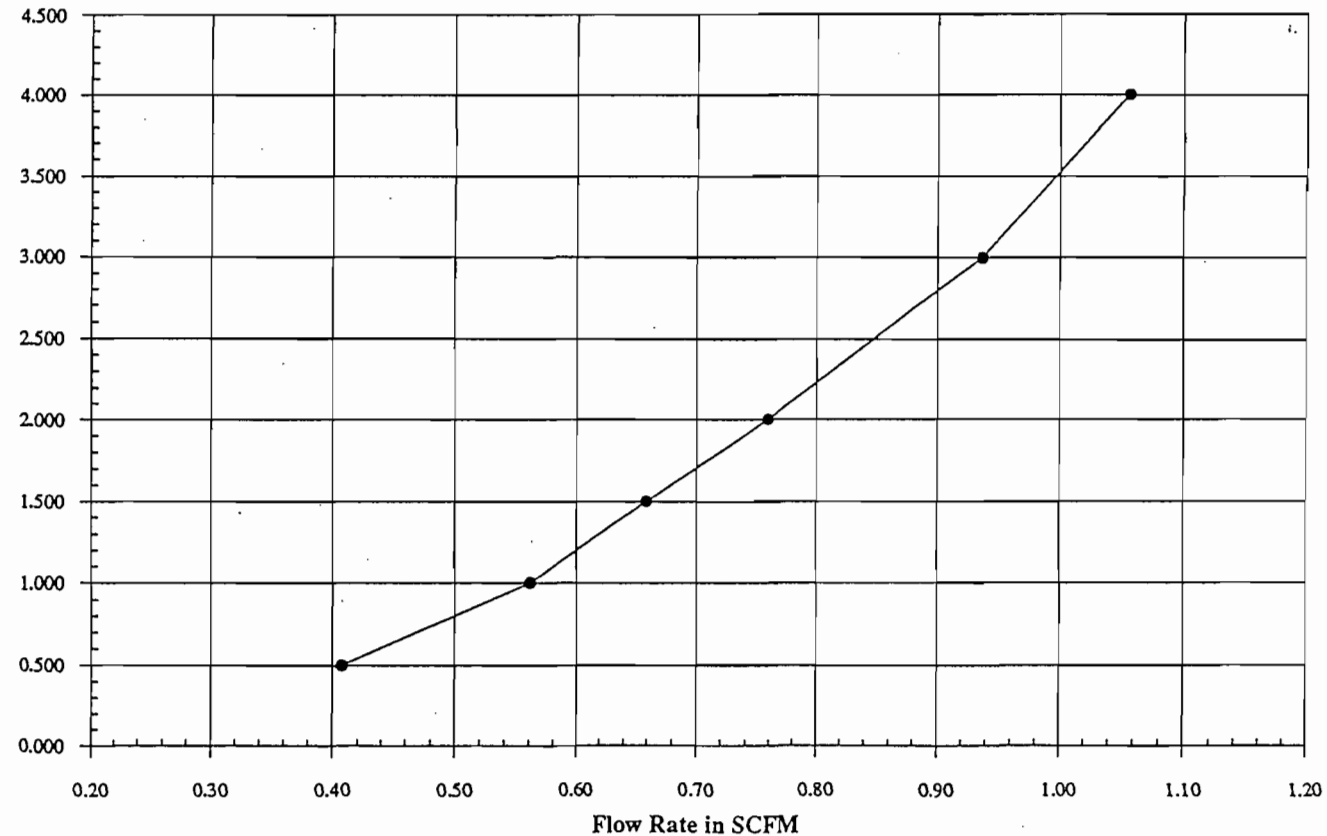
METER BOX DRY GAS METER and ORIFICE CALIBRATION

8/2/91
 Calib. Date: 12/27/90
 Location: 1713 Fortview, Austin, Tx
 Technician: DH,LLJB
 No: 1286-3061
 Pressure: 29.32

Test Meter ID: P164240
 Make & Model: American Singer
 Calibration Factor: 0.998

Meter Reading ("H2O)	Elapsed Time (min.)	Meter Box				Standard Test Meter				Calculated Meter Factor (Kd)	Calculated ΔH@ 0.75 SCFM ("H2O)
		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)		
50	10.00	43.095	47.310	77	86	0.000	4.080	72	72	0.9821	1.704
00	10.00	47.310	53.164	86	97	4.080	9.695	72	72	0.9899	1.767
50	10.00	53.164	60.138	97	109	9.695	16.300	72	73	0.9956	1.880
00	10.00	60.138	68.398	109	114	16.300	23.900	73	73	0.9797	1.868
50	10.00	68.398	78.344	114	120	23.900	33.287	73	73	1.0121	1.820
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. <u>5934P-1A.83</u>			SERIAL NO. <u>3H909</u>		
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.

Jay Luu
 AUTHORIZED SIGNATURE

FEB 11 1992
 DATE

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 \leq 0.01
Cp(s) from Side A - Cp(s) from Side B =	0.003	must be less \leq 0.01

Best Available Copy

TEL-TRU MANUFACTURING. CO.

408 ST. PAUL STREET ROCHESTER, NY 14605 USA

CERTIFICATE OF CALIBRATION

TEL-TRU ORDER NO. 23832	LINE NUMBER 111	TICKET NO.	ORDER REC WK NO. 43	SHIP BY WK NO. 47
CUSTOMER NUMBER 2-52845000		CUSTOMER P.O. NO. 910537		MANUFACTURING NO. Stock
QUANTITY 4	ITEM NUMBER 34100260	DESCRIPTION ST300R 2.5" Stem 2.5/12.5F		

TOLERANCE OF $\pm 1\%$ OF RANGE:
EX. 0-200°F = $\pm 2^\circ$ 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:

**APPENDIX E:
STRIP CHART RECORDS**

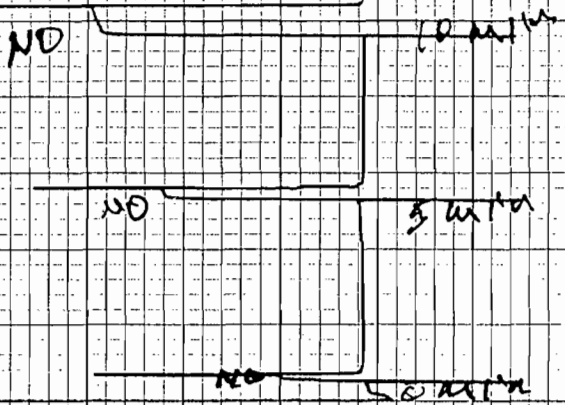
NO_x, O₂, CO

MULTI-POINT LINEARITY CHECK

Initial Range
 NO₂ 0-1000 PPM
 CO 0-100 PPM
 O₂ 0-25%

QUALITY ASSURANCE ACTIVITIES

603123/92
 FLORIDA GAS TRANSMISSION
 BROOKER COMPRESSION STATION



780cm

NOx CONVERTER EFFICIENCY TEST

406.4 NOx thru probe

406.4 NOx direct

100 90 80 70 60 50 40 30 20 10 0
 0 10 20 30 40 50 60 70 80 90 100
 SAMPLE SYSTEM SIDE CHECK (NOx)

157.7 NOx

130 CO

3,990

406.4 NOx

401 CO

7,980

899.7 NOx

2,918 CO

12,199

07

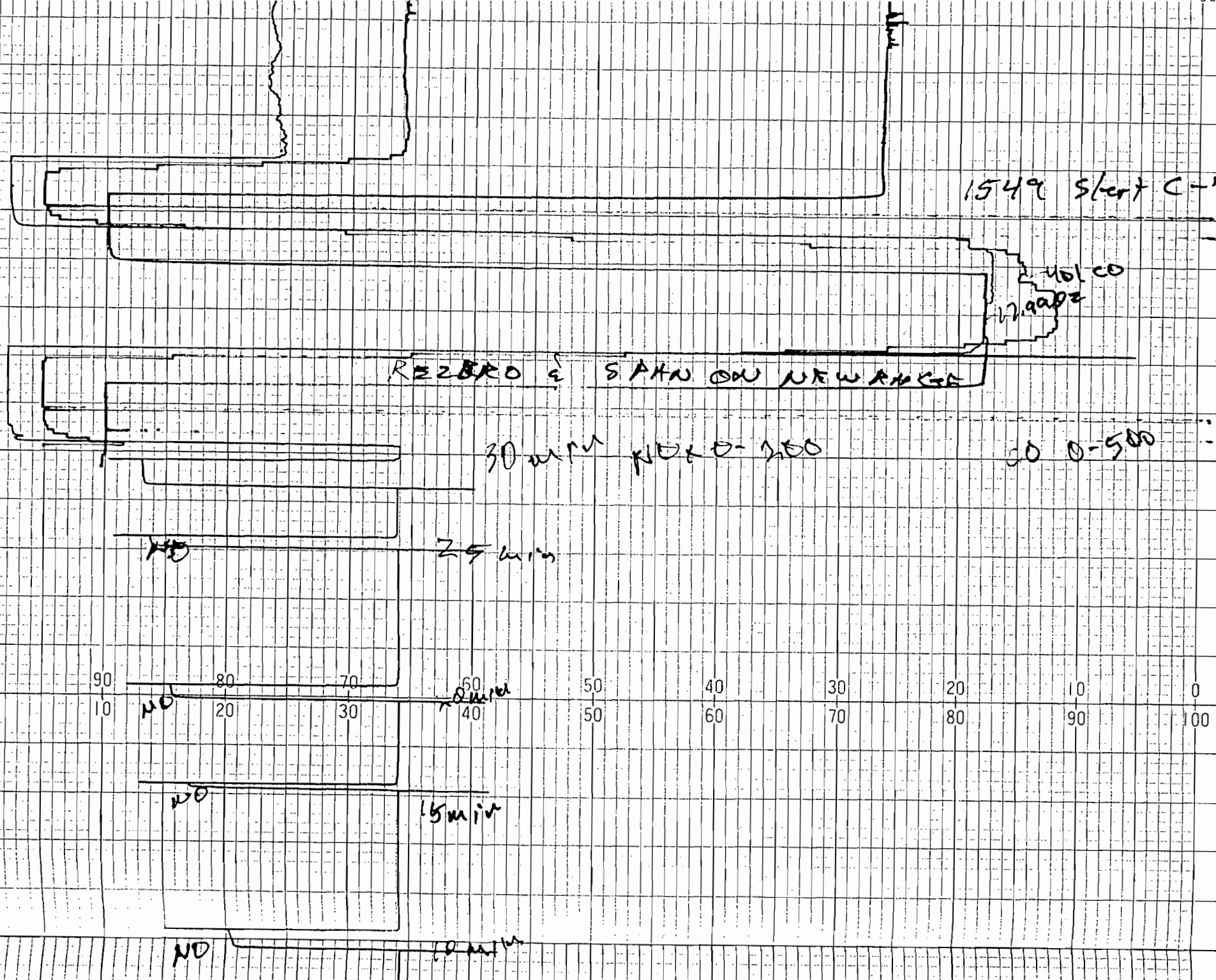
(6334)

JO. RN2-01-25-20M

760cm (6334)

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

$NO_x = 24.5$
 $CO = 14.5$
 $O_2 = 16.0$

Charts-Inc

740cm

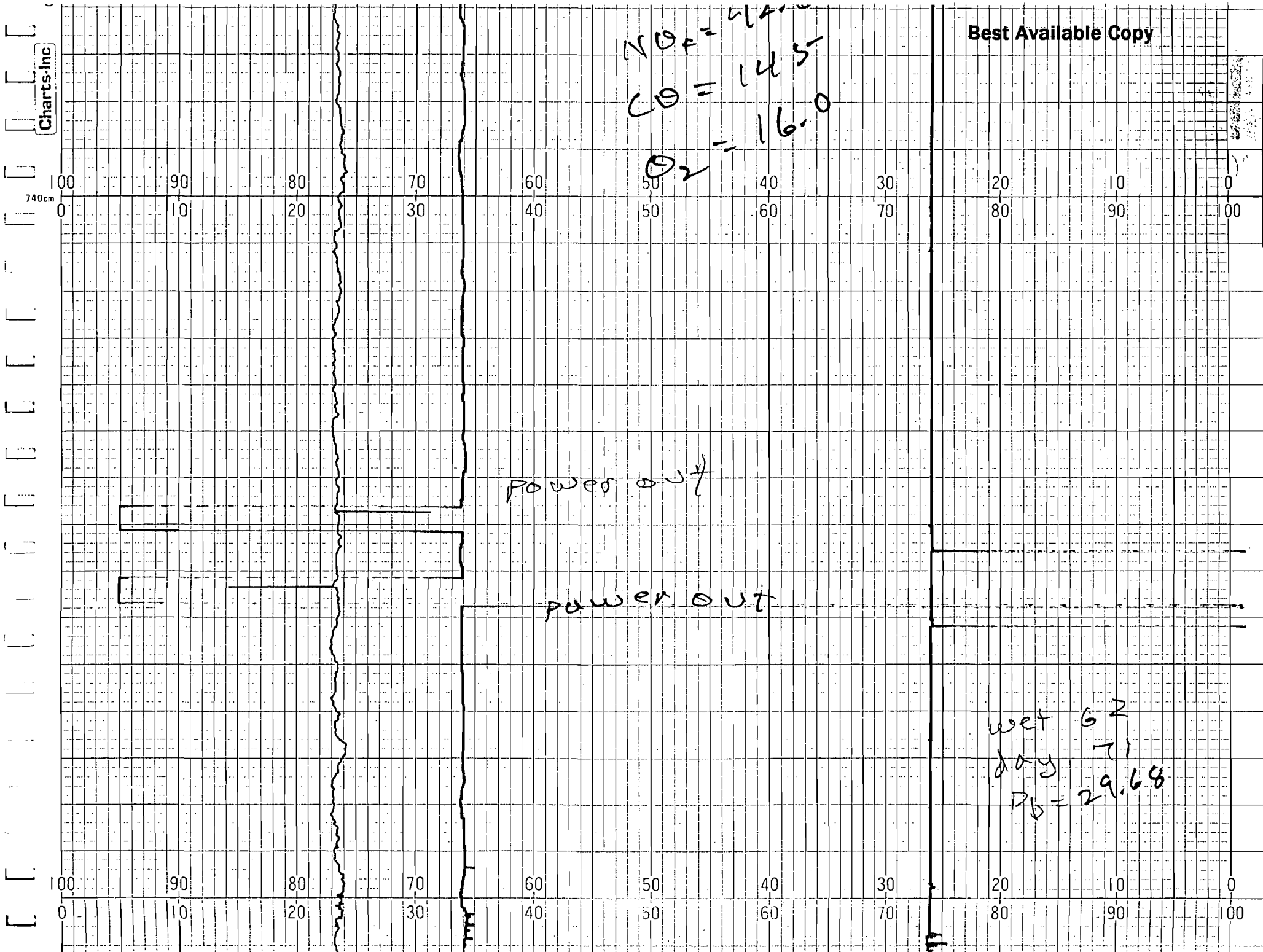
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100

100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100

power out

power out

wet GR
day 71
PB = 29.68



720cm

100 90 80 70 60 50 40 30 20 10 0
 0 10 20 30 40 50 60 70 80 90 100

62 wet
 72 dry
 29.6% = 105

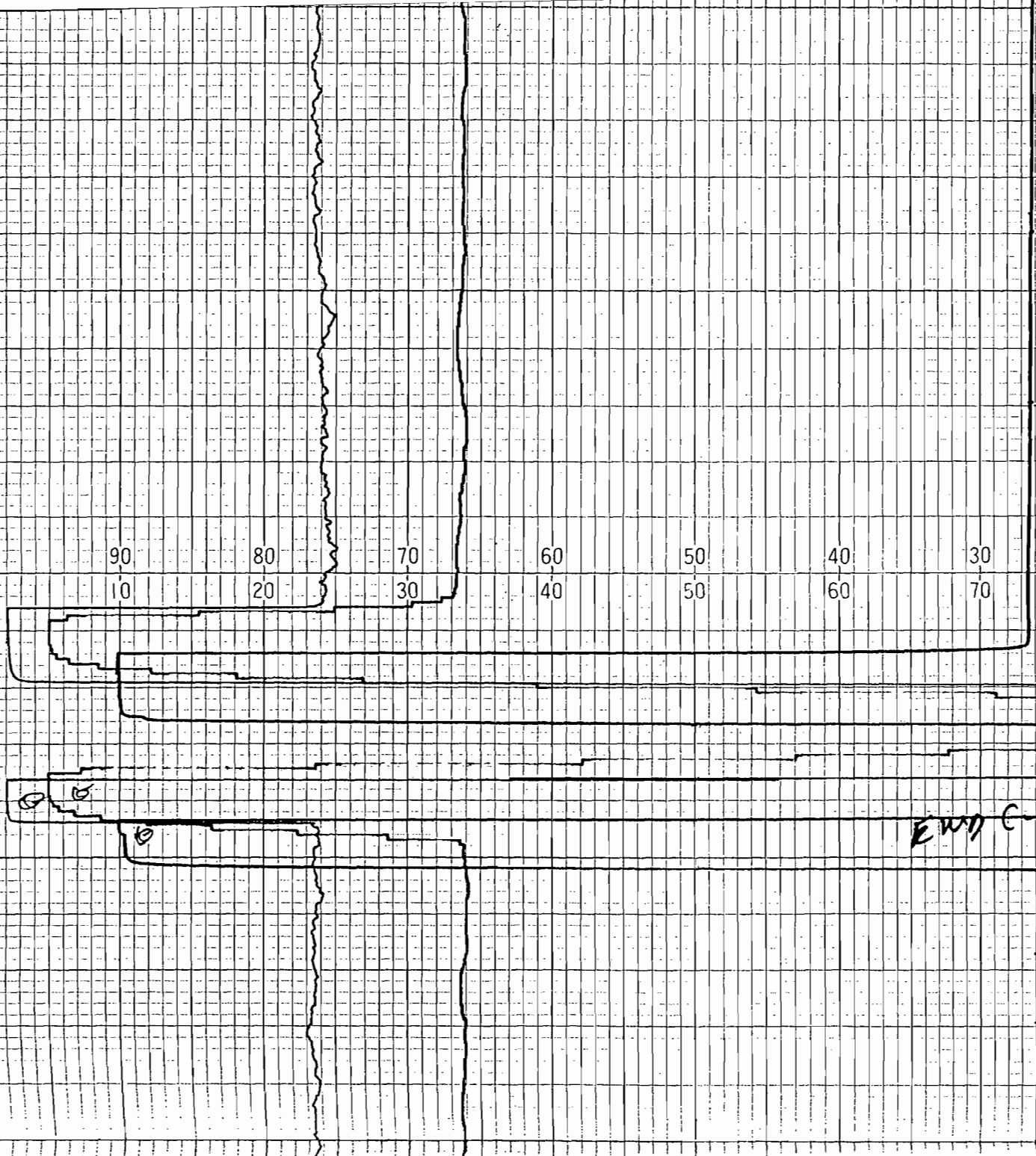
1655 start of C-2

157.7109
 17.9902

END C-1 1640

(6334)

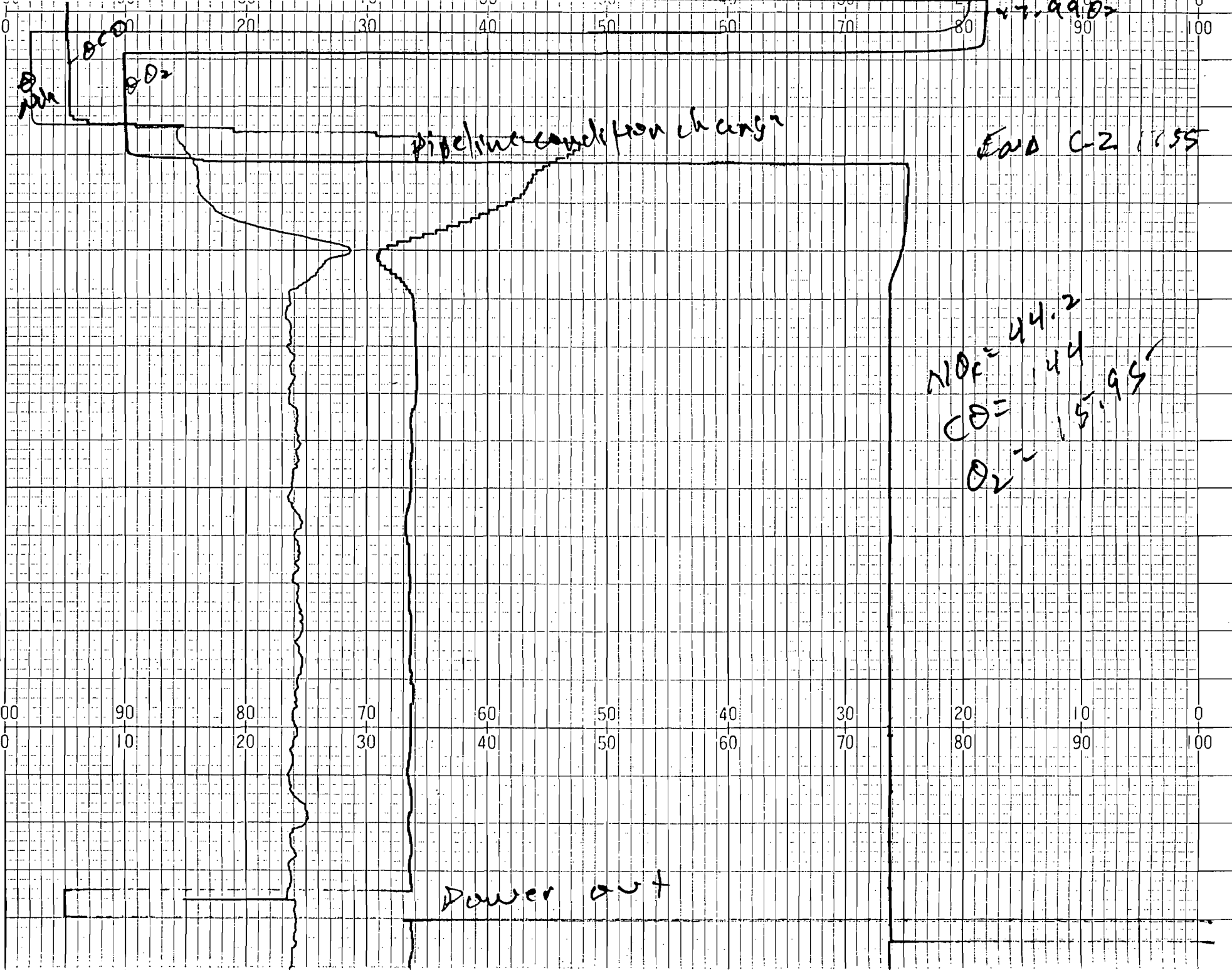
RT NO. RN2-01-25-20M



(6334)
/UUCM

CHART NO. RN2-01-25-20M

Charts-Inc



NOF

CO

D2

pipeline completion change

End C-2 1155

NOF = 44.2
CO = 44
D2 = 15.95

Power out

Charts-Inc

650cm

100 90 80 70 60 50 40 30 20 10 0
 0 10 20 30 40 50 60 70 80 90 100

58 wet
 68 day
 P_{ave} = 29.72

start C-3 7804

4010

157.2 WOF

47.9902

100 90 80 70 60 50 40 30 20 10 0
 0 10 20 30 40 50 60 70 80 90 100

8000

802

8.

NO. SAMPLE SYSTEM BIAS CHECK
(AFTER TEST)

STATION 4010

CO₂
CO

CO₂

1904 END C-3

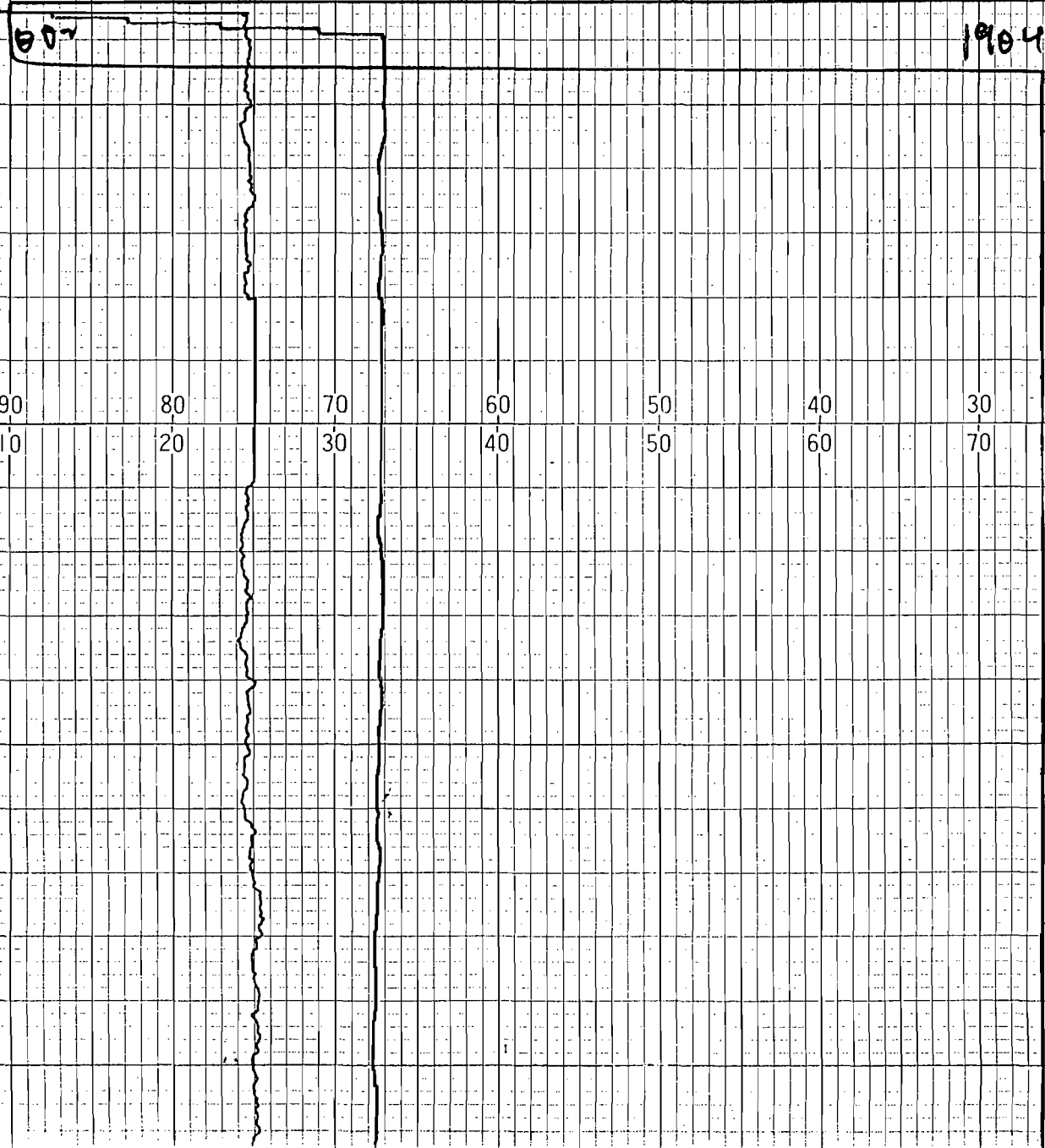
660cm

100 90 80 70 60 50 40 30 0
0 10 20 30 40 50 60 70 80 90 100

NO₂ = 45.0
CO = 13.7
O₂ = 16.0

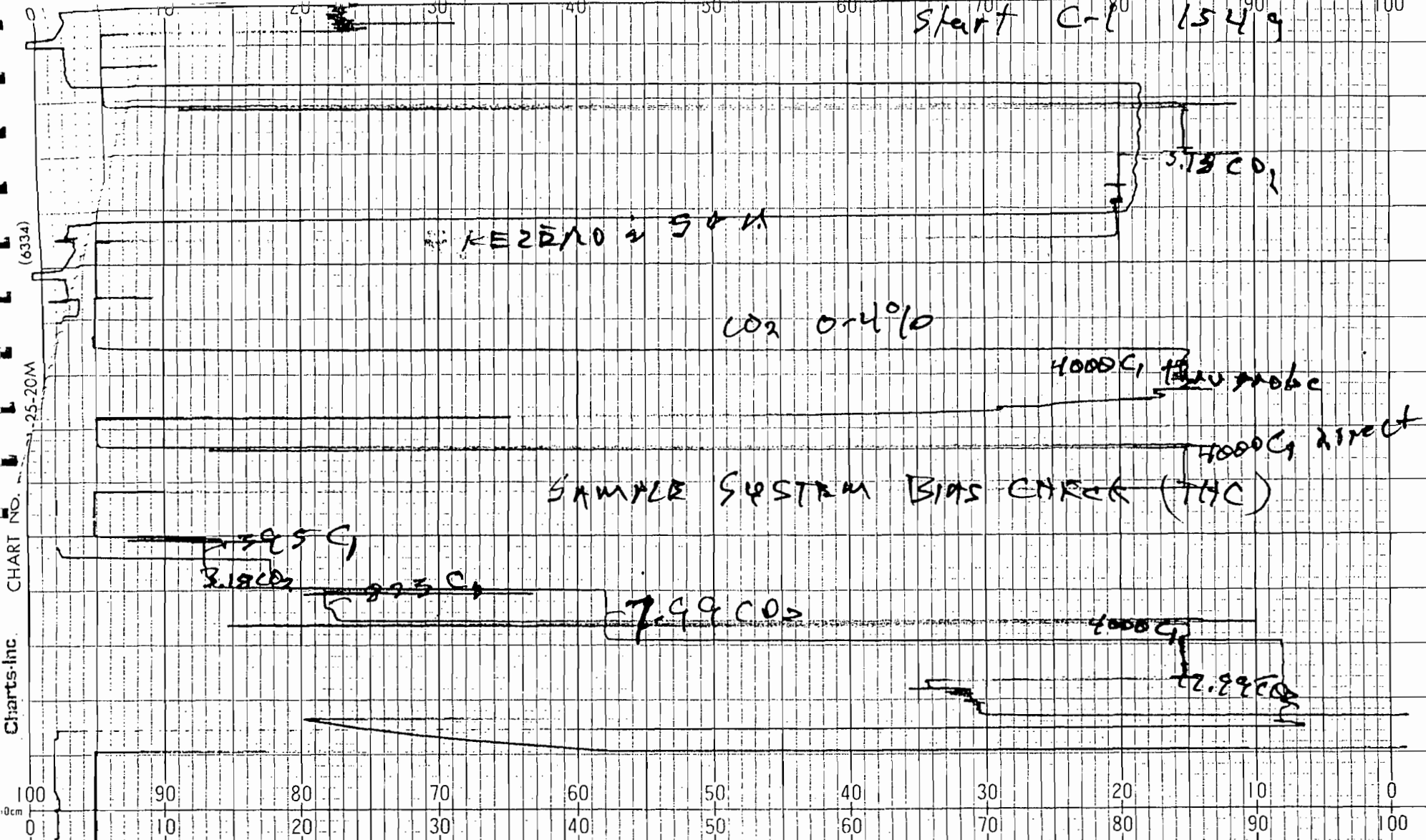
(6334)

CHART NO. RN2-01-25-20M



CO₂, THC

Start C-1 154g



SAMPLE SYSTEM BIAS CHECK (TIC)

INITIAL RUNS

CO₂ 0-20%

TIC 0-5000M
(cal C₁)

MULTI POINT LINEARITY CHECK

QUALITY ASSURANCE ACTIVITIES

2000-1-1

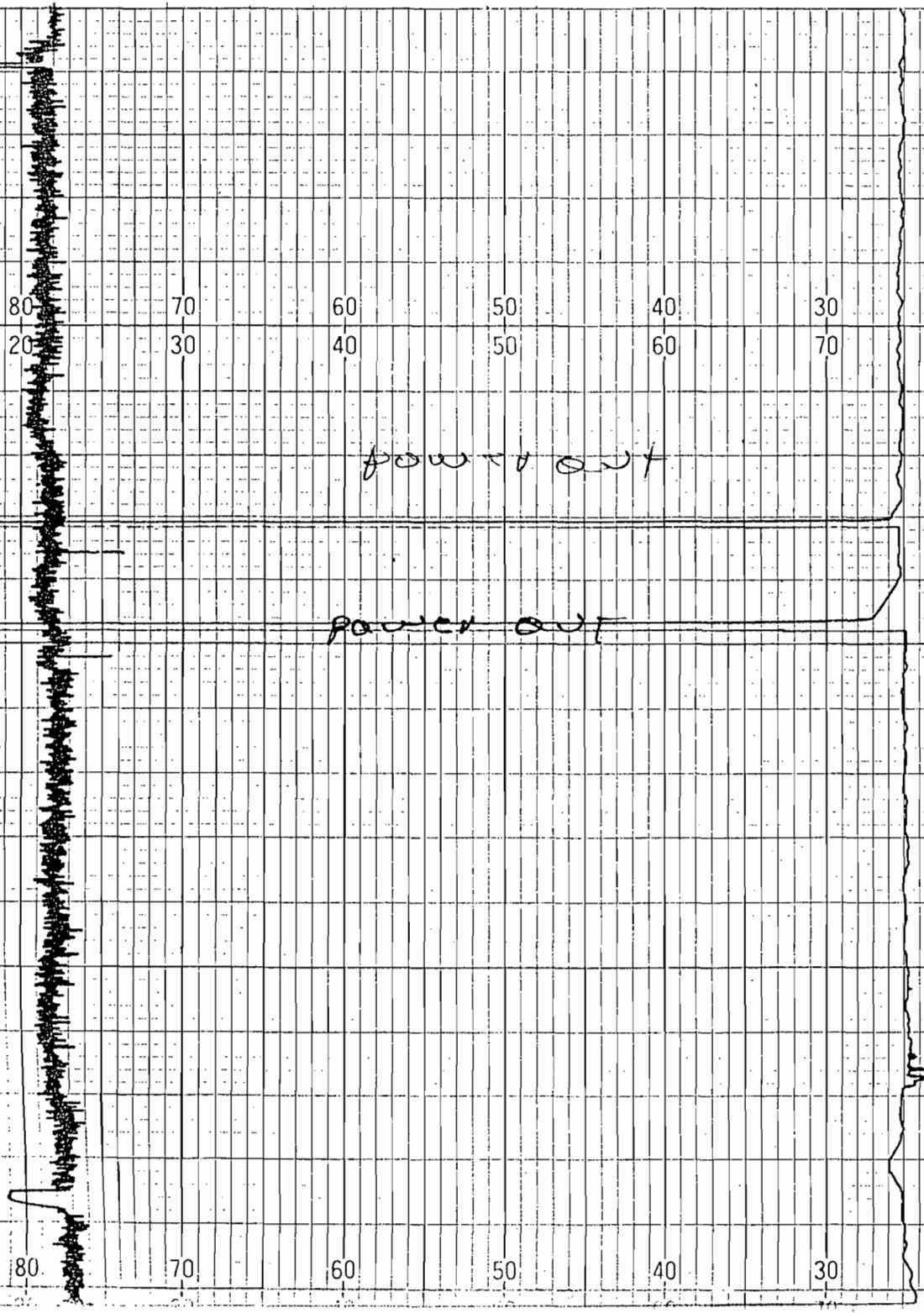
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100

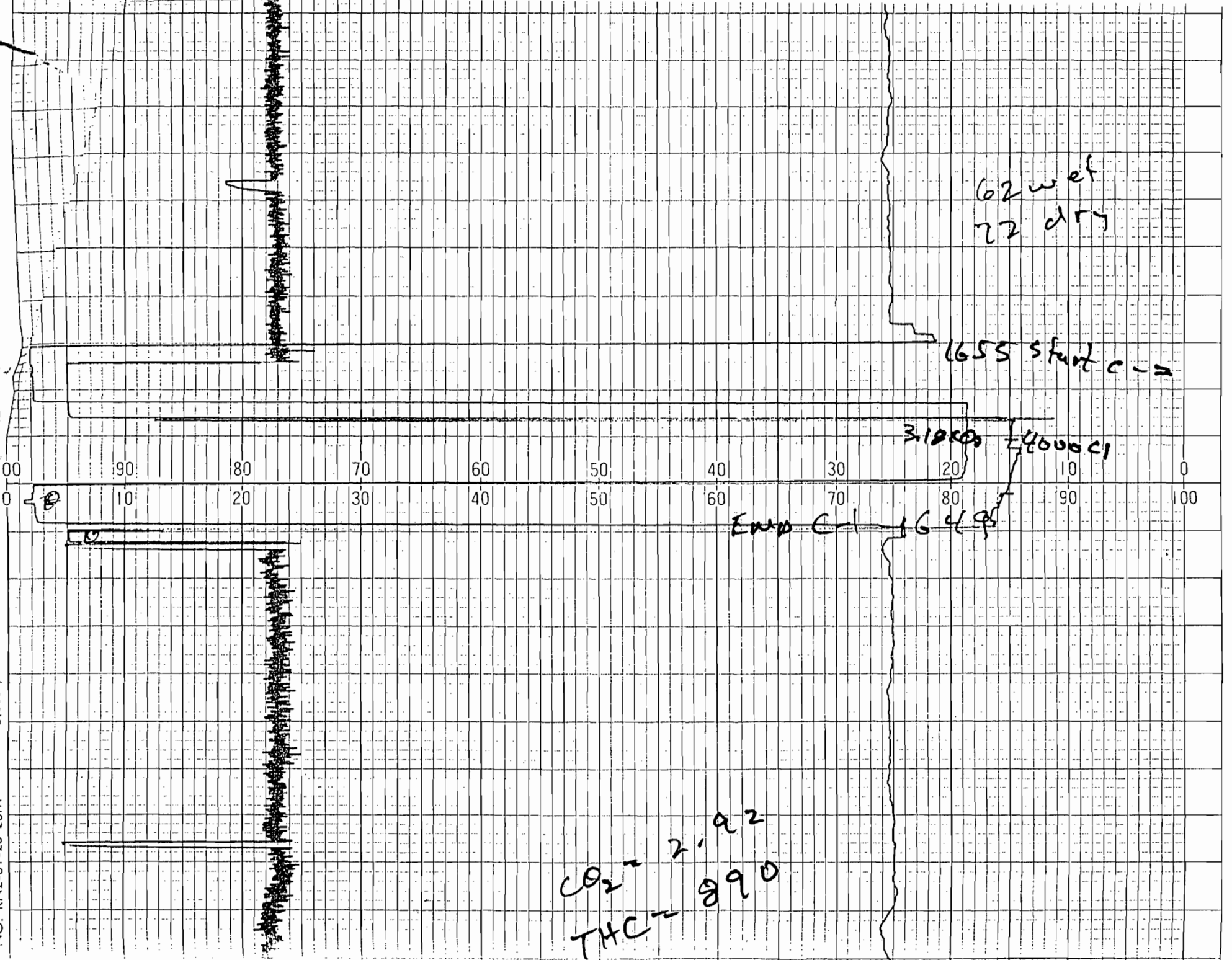
power out

power out

1140cm

100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100





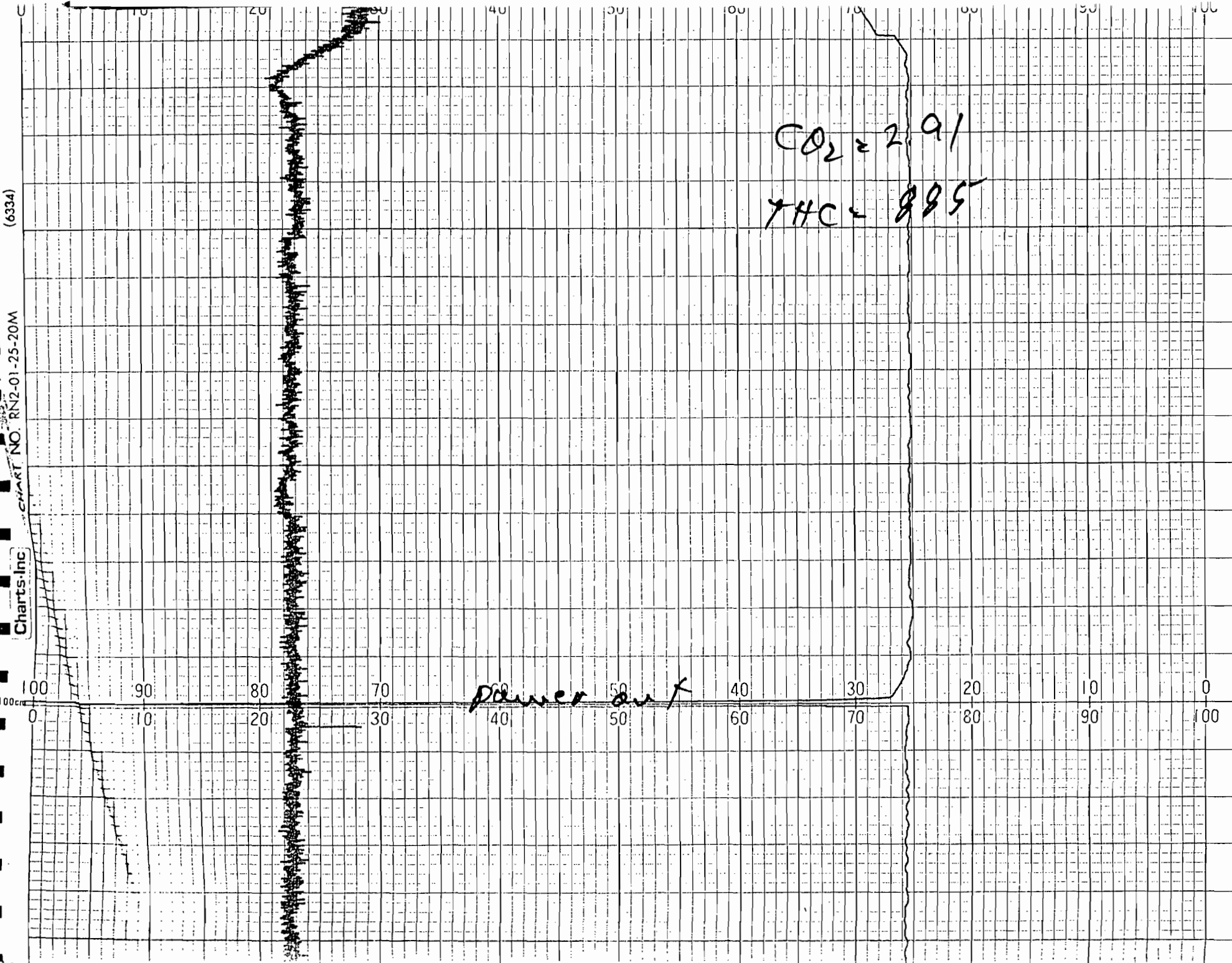
62 wet
22 dry

1655 start c ->

3.12 x 10³ 4.40 x 10³

Emp C 1649

CO₂ ~ 2.92
THC ~ 890



CO₂ = 2.91

THC = 885

power on

(6334)

CHART NO. RN2-01-25-20M

Charts-Inc

1100cm

Charts-Inc

100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100

Start C-5 1805

3.18 CO₂

4000 S

① MC

② CO₂

pipeline condition change

End C-2 1755

100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100

1080cm

010.

TFC Sample System Bias - C. Allen
End of Test

1904

TFC

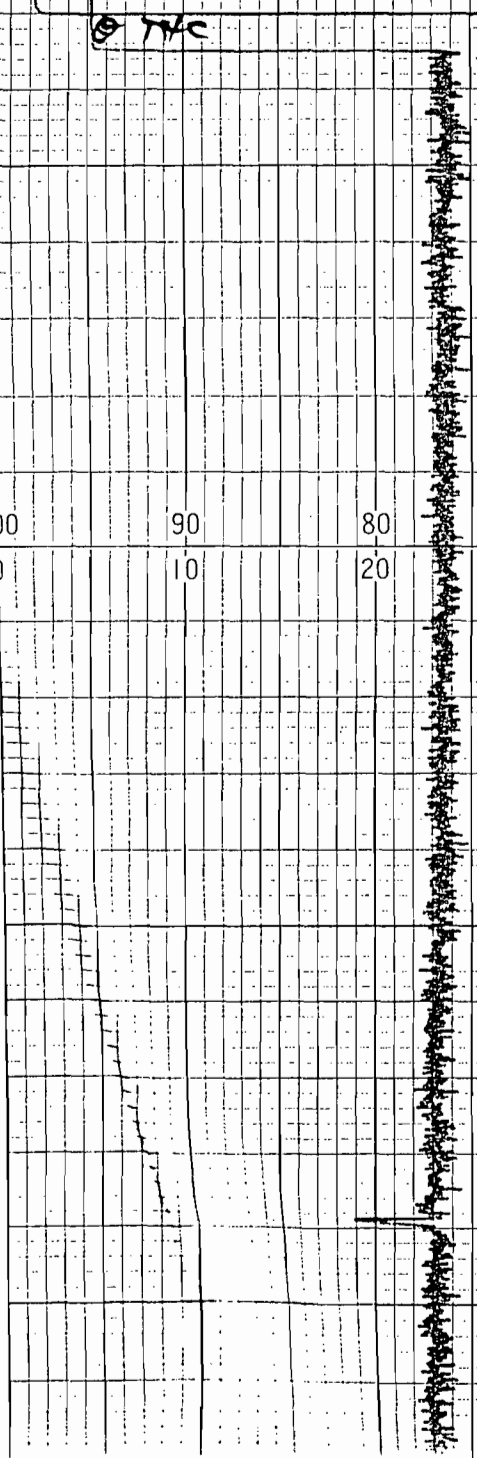
1904 RW C-3

CO₂ = 2.97
TFC = 935

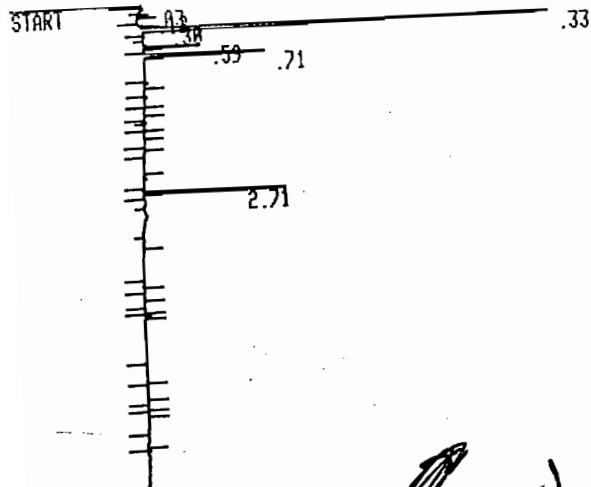
100	90	80	70	60	50	40	30	20	10	0
0	10	20	30	40	50	60	70	80	90	100

1060cm (6334)

CHART NO. RN2-01-25-20M



APPENDIX F
CHROMATOGRAMS



RUN # 3
WORKFILE ID: C
WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	0.83	686 PV	0.051	0.962
0.12	0.12	320 D VB	0.025	0.449
0.30	0.30	278 PV	0.015	0.390
0.33	0.33	64530 D VB	0.015	90.473 C1
0.59	0.59	1033 D PB	0.019	1.448
0.71	0.71	2429 D PB	0.021	3.406
2.71	2.71	2049 D PB	0.015	2.873

TOTAL AREA= 71325
MUL FACTOR= 1.0000E+00

7.87% V_{OC}

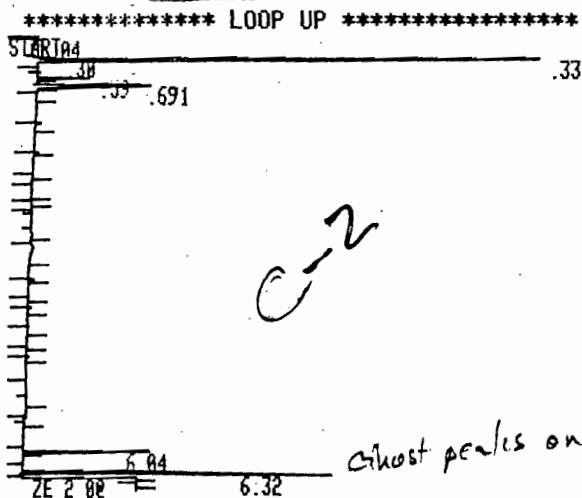


RUN # 1
WORKFILE ID: A
WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.04	0.04	1404 BB	0.081	4.022
0.30	0.30	253 D PV	0.015	0.725
0.33	0.33	32252 D VB	0.015	92.389
1.56	1.56	125 D PB	0.014	0.358
1.70	1.70	875 D BB	0.015	2.507

TOTAL AREA= 34909
MUL FACTOR= 1.0000E+00

***** LOOP DOWN *****

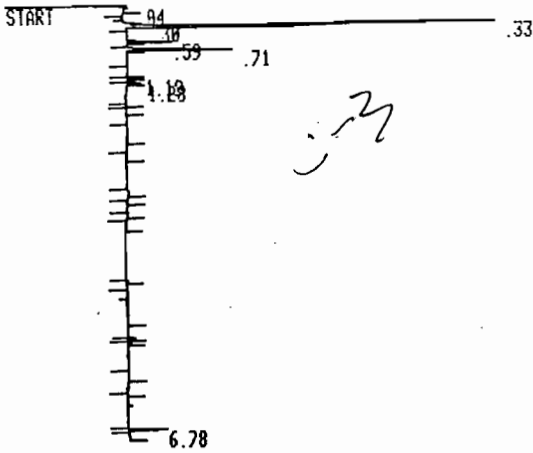


RUN # 2
WORKFILE ID: C
WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.04	0.04	1499 BP	0.093	2.006
0.30	0.30	253 D PV	0.014	0.339
0.33	0.33	62388 D VB	0.015	83.493 C1
0.59	0.59	968 D PB	0.019	1.296
0.69	0.69	1560 BV	0.015	2.088
0.71	0.71	2182 D VB	0.020	2.920
6.04	6.04	1046 D PB	0.015	2.471
6.32	6.32	4026 D BB	0.015	5.380

TOTAL AREA= 74722
MUL FACTOR= 1.0000E+00

7.02% V_{OC}

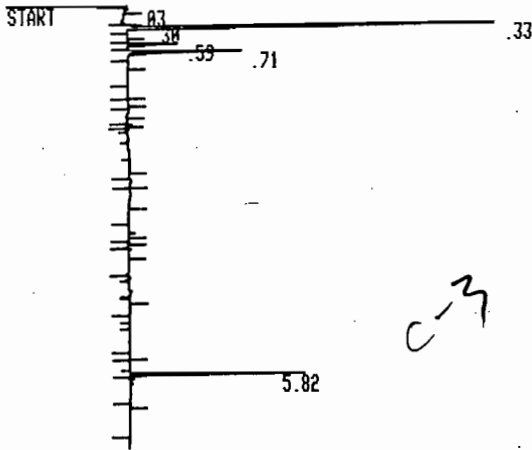


RUN # 7
 WORKFILE ID: C
 WORKFILE NAME:

5.58% VOC

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.04	687	PB	0.018	1.019
0.30	303	D PV	0.016	0.449
0.33	62196	D VB	0.015	92.239 C
0.59	940	D BB	0.019	1.394
0.71	2369	D BB	0.022	3.513
1.19	163	D PB	0.014	0.242
1.28	206	D PB	0.015	0.306
6.78	565	D BB	0.015	0.838

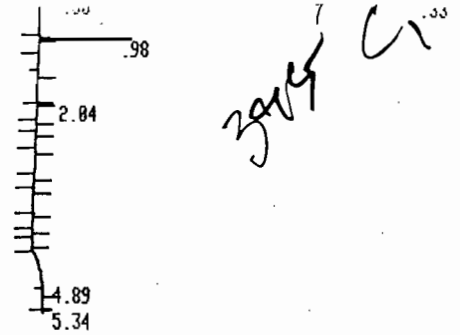
TOTAL AREA= 67429
 MUL FACTOR= 1.0000E+00



RUN # 8
 WORKFILE ID: C
 WORKFILE NAME:

8.48% VOC

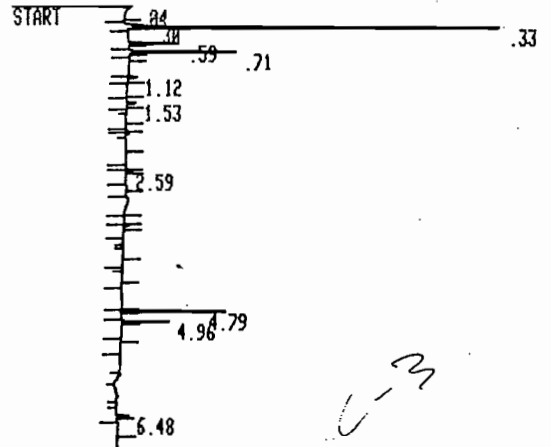
AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	494	PB	0.039	0.684
0.30	275	D BV	0.015	0.391
0.33	65411	D VB	0.015	90.541 C
0.59	969	D BB	0.018	1.341
0.71	2500	D BB	0.021	3.460
5.82	2596	D PB	0.016	3.593



RUN # 5
 WORKFILE ID: C
 WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.04	1460	BB	0.095	3.896
0.30	271	D PV	0.017	0.723
0.33	32344	D VB	0.015	86.381
0.98	1415	D BB	0.016	3.776
2.04	220	D BB	0.015	0.587
4.89	1633	BV	0.544	4.357
5.34	135	D BB	0.013	0.360

TOTAL AREA= 37478
 MUL FACTOR= 1.0000E+00



RUN # 6
 WORKFILE ID: C
 WORKFILE NAME:

8.70% VOC

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.04	1402	BB	0.087	1.922
0.30	285	D PV	0.016	0.391
0.33	64873	D VB	0.015	88.941 C
0.59	1063	D PB	0.020	1.457
0.71	2417	D PB	0.021	3.314
1.12	200	D BB	0.019	0.274
1.53	168	D PB	0.016	0.230
2.59	109	D PB	0.013	0.149
4.79	1516	D BB	0.015	2.078
4.96	710	D PB	0.016	0.973
6.48	196	D PB	0.018	0.269

TOTAL AREA= 72939

APPENDIX G
OPACITY OBSERVATIONS

VISIBLE EMISSIONS EVALUATOR

This is to certify that

Rick J. Krenyke

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.

Therese Hove
President

Will S. Lee
Vice President

David B. Savage, Jr.
Program Manager

232749
Certificate Number

Orlando
Location

February 26, 1992
Date of Issue

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME			OBSERVATION DATE				START TIME		STOP TIME			
Florida Gas BROOKER Comp. St. #6			3/23/92				1530		1630			
ADDRESS			sec				sec					
P.O. Box 8			M	0	15	30	45	M	0	15	30	45
3 miles North of Brooker on Hwy 235			1	0	0	0	0	31	0	0	0	0
CITY	STATE	ZIP	2	0	0	0	0	32	0	0	0	0
Brooker	Florida	32622-0008	3	0	0	0	0	33	0	0	0	0
PHONE	SOURCE ID NUMBER		4	0	0	0	0	34	0	0	0	0
904-485-1211	Unit #6 (Su. # 49117)		5	0	0	0	0	35	0	0	0	0
PROCESS EQUIPMENT	OPERATING MODE		6	0	0	0	0	36	0	0	0	0
CB Model 8W-330C2	Full load		7	0	0	0	0	37	0	0	0	0
CONTROL EQUIPMENT	OPERATING MODE		8	0	0	0	0	38	0	0	0	0
NA	NA		9	0	0	0	0	39	0	0	0	0
DESCRIBE EMISSION POINT			10	0	0	0	0	40	0	0	0	0
Exhaust Stack of Comp. Engine			11	0	0	0	0	41	0	0	0	0
HEIGHT ABOVE GROUND LEVEL	HEIGHT RELATIVE TO OBSERVER		12	0	0	0	0	42	0	0	0	0
65'	x 60'		13	0	0	0	0	43	0	0	0	0
DISTANCE FROM OBSERVER	DIRECTION FROM OBSERVER		14	0	0	0	0	44	0	0	0	0
150'	NE		15	0	0	0	0	45	0	0	0	0
DESCRIBE EMISSIONS			16	0	0	0	0	46	0	0	0	0
None Visible			17	0	0	0	0	47	0	0	0	0
EMISSION COLOR	PLUME TYPE: CONTINUOUS <input checked="" type="checkbox"/>		18	0	0	0	0	48	0	0	0	0
None Visible	FUGITIVE <input type="checkbox"/> INTERMITTENT <input type="checkbox"/>		19	0	0	0	0	49	0	0	0	0
WATER DROPLETS PRESENT	IS WATER DROPLET PLUME ATTACHED <input type="checkbox"/> DETACHED <input type="checkbox"/>		20	0	0	0	0	50	0	0	0	0
NO <input checked="" type="checkbox"/> YES <input type="checkbox"/>			21	0	0	0	0	51	0	0	0	0
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED			22	0	0	0	0	52	0	0	0	0
Exit of exhaust stack			23	0	0	0	0	53	0	0	0	0
DESCRIBE BACKGROUND			24	0	0	0	0	54	0	0	0	0
Sky			25	0	0	0	0	55	0	0	0	0
BACKGROUND COLOR	SKY CONDITIONS		26	0	0	0	0	56	0	0	0	0
gray/Blue	40% Dark Clouds		27	0	0	0	0	57	0	0	0	0
WIND SPEED	WIND DIRECTION		28	0	0	0	0	58	0	0	0	0
x 10-15 MPH	NNW		29	0	0	0	0	59	0	0	0	0
AMBIENT TEMP.	WET BULB TEMP.	RELATIVE HUMIDITY	30	0	0	0	0	60	0	0	0	0
71	62		SOURCE LAYOUT SKETCH			DRAW NORTH ARROW						
<p>The sketch shows a vertical line representing the emission point. A horizontal arrow labeled 'WIND' points to the right. A circle with an arrow indicates the north direction. A horizontal line below the emission point is labeled 'SUN SHADOW LINE' with two 70-degree angles marked. The observer's position is indicated at the bottom center of the shadow line.</p>			AVERAGE OPACITY FOR HIGHEST PERIOD			NUMBER OF READINGS ABOVE						
COMMENTS No emission visible from IC engine.			0			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			3-23-92						
ORGANIZATION CUBIN CORP.			CERTIFIED BY			Eastern Tech. Assoc.						
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS SIGNATURE TITLE			DATE			2-27-92						
VERIFIED BY			DATE									

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME Florida Gas Brooker Comp. St #16				OBSERVATION DATE 3/23/92				START TIME 1635				STOP TIME 1735			
ADDRESS P.O. Box 8				SEC M	0	15	30	45	SEC M	0	15	30	45		
3mils North of Brooker on Hwy 235				1	0	0	0	0	31	0	0	0	0		
CITY BROOKER,		STATE Florida		ZIP 32622-0008		2	0	0	0	32	0	0	0		
PHONE 904-485-1211		SOURCE ID NUMBER Unit #6 (Ser. # 49117)		3	0	0	0	0	33	0	0	0	0		
PROCESS EQUIPMENT CB Model 8W-330C2		OPERATING MODE Full Load		4	0	0	0	0	34	0	0	0	0		
CONTROL EQUIPMENT NA		OPERATING MODE NA		5	0	0	0	0	35	0	0	0	0		
DESCRIBE EMISSION POINT Exhaust Stack of Comp. Engine				6	0	0	0	0	36	0	0	0	0		
HEIGHT ABOVE GROUND LEVEL 65'		HEIGHT RELATIVE TO OBSERVER ≈ 60'		7	0	0	0	0	37	0	0	0	0		
DISTANCE FROM OBSERVER 150'		DIRECTION FROM OBSERVER NE		8	0	0	0	0	38	0	0	0	0		
DESCRIBE EMISSIONS None Visible				9	0	0	0	0	39	0	0	0	0		
EMISSION COLOR None Visible		PLUME TYPE: CONTINUOUS <input checked="" type="checkbox"/>		10	0	0	0	0	40	0	0	0	0		
WATER DROPLETS PRESENT NO <input checked="" type="checkbox"/> YES <input type="checkbox"/>		IS WATER DROPLET PLUME ATTACHED <input type="checkbox"/> DETACHED <input type="checkbox"/>		11	0	0	0	0	41	0	0	0	0		
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED Exit of exhaust stack				12	0	0	0	0	42	0	0	0	0		
DESCRIBE BACKGROUND Sky				13	0	0	0	0	43	0	0	0	0		
BACKGROUND COLOR White / Blue		SKY CONDITIONS 30% Clouds		14	0	0	0	0	44	0	0	0	0		
WIND SPEED ≈ 10-15 MPH		WIND DIRECTION NNW		15	0	0	0	0	45	0	0	0	0		
AMBIENT TEMP. 72	WET BULB TEMP. 61	RELATIVE HUMIDITY		16	0	0	0	0	46	0	0	0	0		
SOURCE LAYOUT SKETCH DRAW NORTH ARROW				17	0	0	0	0	47	0	0	0	0		
<p>The sketch shows an 'EMISSION POINT' at the top and 'OBSERVERS POSITION' at the bottom. A vertical line connects them. A north arrow is in the top right. A wind arrow points from the left. A sun shadow line is drawn from the observer's position, forming a triangle with the vertical line. The angle between the vertical line and the shadow line is marked as 70°.</p>				18	0	0	0	0	48	0	0	0	0		
				19	0	0	0	0	49	0	0	0	0	0	
				20	0	0	0	0	50	0	0	0	0	0	0
				21	0	0	0	0	51	0	0	0	0	0	0
				22	0	0	0	0	52	0	0	0	0	0	0
				23	0	0	0	0	53	0	0	0	0	0	0
				24	0	0	0	0	54	0	0	0	0	0	0
				25	0	0	0	0	55	0	0	0	0	0	0
				26	0	0	0	0	56	0	0	0	0	0	0
				27	0	0	0	0	57	0	0	0	0	0	0
28	0	0	0	0	58	0	0	0	0	0	0				
29	0	0	0	0	59	0	0	0	0	0	0	0			
30	0	0	0	0	60	0	0	0	0	0	0	0			
COMMENTS No visible emissions				AVERAGE OPACITY FOR HIGHEST PERIOD 0				NUMBER OF READINGS ABOVE 0 % WERE 0							
RANGE OF OPACITY READINGS 0 MINIMUM 0 MAXIMUM				OBSERVER'S NAME (PRINT) RICK J. KRENZKE				OBSERVER'S SIGNATURE <i>Rick J. Krenzke</i>							
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS				ORGANIZATION CUBIX CORP				DATE 3-23-92							
SIGNATURE				CERTIFIED BY State of Florida by ETA				DATE 2-27-92							
TITLE		DATE		VERIFIED BY		DATE									

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME			OBSERVATION DATE				START TIME		STOP TIME			
Florida Gas - Brooker Comp. St. # 16			3/23/92				1740		1840			
ADDRESS			sec		sec		sec		sec			
P.O. Box 8			M	0	15	30	45	M	0	15	30	45
3 miles North of Brooker, on Hwy 235			1	0	0	0	0	31	0	0	0	0
CITY	STATE	ZIP	2	0	0	0	0	32	0	0	0	0
Brooker	Florida	32622-0008	3	0	0	0	0	33	0	0	0	0
PHONE	SOURCE ID NUMBER		4	0	0	0	0	34	0	0	0	0
904-485-1211	Unit #6 (Sta. # 49117)		5	0	0	0	0	35	0	0	0	0
PROCESS EQUIPMENT		OPERATING MODE		6	0	0	0	0	36	0	0	0
CB Model 8W-330C2		Full Load		7	0	0	0	0	37	0	0	0
CONTROL EQUIPMENT		OPERATING MODE		8	0	0	0	0	38	0	0	0
NA		NA		9	0	0	0	0	39	0	0	0
DESCRIBE EMISSION POINT			10	0	0	0	0	40	0	0	0	0
Exhaust Stack of Comp. Engine			11	0	0	0	0	41	0	0	0	0
HEIGHT ABOVE GROUND LEVEL		HEIGHT RELATIVE TO OBSERVER		12	0	0	0	0	42	0	0	0
65'		60'		13	0	0	0	0	43	0	0	0
DISTANCE FROM OBSERVER		DIRECTION FROM OBSERVER		14	0	0	0	0	44	0	0	0
150'		NE		15	0	0	0	0	45	0	0	0
DESCRIBE EMISSIONS			16	0	0	0	0	46	0	0	0	0
None Visible			17	0	0	0	0	47	0	0	0	0
EMISSION COLOR		PLUME TYPE: CONTINUOUS <input checked="" type="checkbox"/>		18	0	0	0	0	48	0	0	0
None Visible		FUGITIVE <input type="checkbox"/> INTERMITTENT <input type="checkbox"/>		19	0	0	0	0	49	0	0	0
WATER DROPLETS PRESENT		IS WATER DROPLET PLUME		20	0	0	0	0	50	0	0	0
NO <input checked="" type="checkbox"/> YES <input type="checkbox"/>		ATTACHED <input type="checkbox"/> DETACHED <input type="checkbox"/>		21	0	0	0	0	51	0	0	0
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED			22	0	0	0	0	52	0	0	0	0
Exit of exhaust stack			23	0	0	0	0	53	0	0	0	0
DESCRIBE BACKGROUND			24	0	0	0	0	54	0	0	0	0
S by			25	0	0	0	0	55	0	0	0	0
BACKGROUND COLOR		SKY CONDITIONS		26	0	0	0	0	56	0	0	0
Blue		Clear		27	0	0	0	0	57	0	0	0
WIND SPEED		WIND DIRECTION		28	0	0	0	0	58	0	0	0
≈ 15-20		NNW		29	0	0	0	0	59	0	0	0
AMBIENT TEMP.	WET BULB TEMP.	RELATIVE HUMIDITY		30	0	0	0	0	60	0	0	0
72	62			AVERAGE OPACITY FOR HIGHEST PERIOD				NUMBER OF READINGS ABOVE				
SOURCE LAYOUT SKETCH			DRAW NORTH ARROW				0 % WERE 0					
COMMENTS			RANGE OF OPACITY READINGS									
No Visible Emission			0 MINIMUM				0 MAXIMUM					
			OBSERVER'S NAME (PRINT)									
			Rick J. Krenzke									
			OBSERVER'S SIGNATURE				DATE					
			Rick J. Krenzke				3/23/92					
			ORGANIZATION									
			Cubix CORP.									
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS			CERTIFIED BY				DATE					
SIGNATURE			State of Florida by ETA				2/27/92					
TITLE			VERIFIED BY				DATE					

**APPENDIX H:
FUEL ANALYSES
AND CALCULATIONS**

Best Available Copy

DATE: 03/23/92 ANALYSIS TIME: 345 STREAM SEQUENCE: 12
 TIME: 17:55 CYCLE TIME: 360 STREAM#: 2
 ANALYZER#: 2 MODE: RUN CYCLE START TIME: 17:49

COMP NAME	COMP CODE	MOLE %	GAL/MCF**	B.T.U.*	SP. GR.*
HEXANE +	151	0.011	0.0049	0.58	0.0004
PROPANE	152	0.252	0.0694	6.36	0.0038
I-BUTANE	153	0.019	0.0062	0.62	0.0004
N-BUTANE	154	0.010	0.0032	0.33	0.0002
IPENTANE	155	1618.69-6	0.0006	0.06	0.0000
NPENTANE	156	.000000	0.0000	0.00	0.0000
NITROGEN	157	0.443	0.0000	0.00	0.0043
METHANE	158	96.481	0.0000	976.67	0.5344
CO2	159	0.744	0.0000	0.00	0.0113
ETHANE	160	2.038	0.5452	36.15	0.0212
TOTALS		100.000	0.6295	1020.77	0.5760

@ 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) = 1022.9
 REAL SPECIFIC GRAVITY = 0.5769
 UNNORMALIZED TOTAL = 100.01
 ANALOG INPUT CHANNEL 1 = H2S 140 = .18264
 ANALOG INPUT CHANNEL 2 = WATER 144 = 2.9113

ACTIVE ALARMS

DNE

Sulphur .01

*1022
 9630
 @ 18.86
 2,2301
 1022*



CERTIFICATE OF ANALYSIS NUMBER 199906

SAMPLE IDENT.: BOOKER COMPOSITE STATION DATE: APRIL 08, 1992
FLORIDA GAS TRANS.
A-1 COOPER ENGINE FUEL P. O. NO.: 92143
03/23/92 @ 11:00

FOR: CUBIX CORPORATION
9225 LOCKHART HIGHWAY
AUSTIN, TEXAS 78747

ATTN: MR. JOE RUDYK

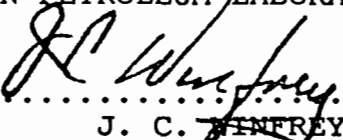
ASTM D-3246
TOTAL SULFUR ANALYSIS

1.2 ppm by wt.

0.071 Grains/100 cu. ft. by vol.

0.127 Grains/100 cu. ft. by wt.

SOUTHERN PETROLEUM LABORATORIES, INC.

.....

.....
J. C. WINFREY

Fuel Calculations

Client: Florida Gas
 Sample ID: Brooker Station Fuel Gas

CALCULATION OF DENSITY AND HEATING VALUE

Component	% Volume	Molecular Wt.	Density (lb/ft3)	% volume x		Component Gross Btu/lb	Weight Fract. Btu	Gross Heating Value (Btu/SCF)	Volume Fract. Btu
				Density	weight %				
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	0.4430	28.016	0.0744	0.00033	0.7470	0	0.00	0	0
CO2	0.7440	44.01	0.117	0.00087	1.9730	0	0.00	0	0
CO		28.01	0.074	0.00000	0.0000	4347	0.00	322	0
Methane	96.4810	16.041	0.0424	0.04091	92.7199	23879	22140.60	1013	977.35
Ethane	2.0380	30.067	0.0803	0.00164	3.7092	22320	827.90	1792	36.521
Ethylene		28.051	0.0746	0.00000	0.0000	21644	0.00	1614	0
Propane	0.2520	44.092	0.1196	0.00030	0.6831	21661	147.97	2590	6.5268
propylene		42.077	0.111	0.00000	0.0000	21041	0.00	2336	0
Isobutane	0.0190	58.118	0.1582	0.00003	0.0681	21308	14.52	3363	0.639
n-butane	0.0100	58.118	0.1582	0.00002	0.0359	21257	7.62	4016	0.4016
Isobutene		56.102	0.148	0.00000	0.0000	20840	0.00	3068	0
Isopentane	0.0016	72.144	0.1904	0.00000	0.0070	21091	1.47	4008	0.0649
n-pentane		72.144	0.1904	0.00000	0.0000	21052	0.00	3993	0
n-hexane	0.0110	86.169	0.2274	0.00003	0.0567	20940	11.87	4762	0.5238
H2S		34.076	0.0911	0.00000	0.0000	7100	0.00	647	0
total	100.00								

Average Density	0.04412	100.0000	Gross Heating Value	
Specific Gravity	0.57673		Btu/lb	23152
			Gross Heating Value	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	12.4111			0.744094988		
CO2	44.01	0.272273	0	0.74	32.7434	0.53449963	0		1.4272	
CO	28.01	0.42587	0	0.00	0.0000	0	0		0	
Methane	16.041	0.75	0.25	96.48	1547.6517	69.5909913	23.196997			
Ethane	30.067	0.8	0.2	2.04	61.2765	2.93902167	0.7347554			
Ethylene	28.051	0.85714	0.14286	0.00	0.0000	0	0			
Propane	44.092	0.81818	0.18182	0.25	11.1112	0.54503918	0.12112			
Propene	42.077	0.85714	0.14286	0.00	0.0000	0	0			
Isobutane	58.118	0.82759	0.17247	0.02	1.1042	0.05478959	0.0114182			
n-butane	58.118	0.82759	0.17247	0.01	0.5812	0.02883662	0.0060096			
Isobutene	56.102	0.85714	0.14286	0.00	0.0000	0	0			
Isopentane	72.144	0.83333	0.16667	0.00	0.1168	0.00583444	0.0011669			
n-pentane	72.144	0.83333	0.16667	0.00	0.0000	0	0			
n-hexane	86.169	0.83721	0.16279	0.01	0.9479	0.04757696	0.009251			
H2S	34.08	0	0	0.00	0.0000	0	0			0
Totals				99.99962	1667.9440	73.7465894	24.08	0.744094988	1.4272	0

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	2.33 %
CO2 F Factor	1022 DSCF of CO2/MM Btu of Fuel Burned @ 0% excess air

**APPENDIX I:
ALTERNATIVE COMPLIANCE
TEST DATA**

Brooker Compressor Station--Unofficial Data

Operator/Plant Florida Gas Brooker Compressor Station
Location Bradford County, Florida
Source Cooper Bessamer Compressor
Technicians RK,LF,JR

Test Run No.	C-1	C-2	C-3
Date	3/23/92	3/23/92	3/23/92
Start Time	15:49	16:55	18:04
Stop Time	16:49	17:55	19:04
Engine/Compressor Operation			
Engine Speed (rpm)	328	328	328
Ignition Timing (°BTDC)	3	3	3
Air Manifold Pressure (psig)	14.3	14.1	14.1
Air Manifold Temperature (°F)	106/108	106/107	110/108
Estimated Fuel Flow AT 7800 BTU/hp-hr (SCFH)	30757	30742	30528
Fuel Manifold Pressure (psig)	55.5	55.2	54.9
Pre-Combustion Chamber (psig)	48.5	48	47.8
Exhaust Temperature (°F)	663	666	670
Turbo Inlet Vacuum (in. H2O)	4.3	4.3	4.2
Turbo rpm	10260	10230	10190
Pockets Open Out of 16	5	5	4
Suction Pressure (psig)	695	700	702
Suction Temperature (°F)	44	44	42
Discharge Pressure (psig)	940	945	948
Discharge Temperature (°F)	87	85	89
Engine Load (BHP)	4030	4028	4000
Torque (%)	100.5	100.5	100
Ambient Conditions			
Atmospheric Pressure (in. Hg)	29.68	29.69	29.72
Temperature (°F) : Dry bulb	71	72	68
(°F) Wet bulb	62	62	58
Humidity (lb/lb air)	0.0097	0.0095	0.0079
Measured Emissions			
NOx (ppmv)	42.6	44.2	45.6
CO (ppmv)	145	144	137
O2 via Method 3a (%)	16.0	16.0	16.0
CO2 via Method 3a (%)	2.92	2.91	2.87
THC via EPA Method 25a (ppmv, wet)	890	885	935
VOC via EPA Method 18 (% of THC)	7.87%	7.02%	7.52%
VOC i.e. non methane via EPA 18 (ppmv, wet)	70.0	62.1	70.3
VOC via Methods 25a and 18 (ppmv, dry)	74.2	65.7	74.2
SO2 in fuel (grains/100 DSCF)	0.071	0.071	0.071
Stack Volumetric Flow Rates			
via Pitot Tube (SCFH, dry)	1.04E+06	1.02E+06	1.01E+06
Calculated Emission Rates (via pitot tube)			
NOx (lbs/hr)	5.29	5.40	5.50
CO (lbs/hr)	11.0	10.7	10.1
VOC (lbs/hr)	3.20	2.79	3.11
SO2 (lbs/hr)	0.0031	0.0031	0.0031
NOx (tons/yr)	23.2	23.6	24.1
CO (tons/yr)	48.0	46.9	44.0
VOC (tons/yr)	14.0	12.2	13.6
SO2 (tons/yr)	0.0137	0.0137	0.0136
NOx (g/hp-hr)	0.60	0.61	0.62
CO (g/hp-hr)	1.23	1.21	1.14
VOC (g/hp-hr)	0.36	0.31	0.35

Brooker Compressor Station--Unofficial Data

Operator/Plant	Florida Gas Brooker Compressor Station
Location	Bradford County, Florida
Source	Cooper Bessamer Compressor
Technicians	RK,LF,JR

Test Run No.	C-1	C-2	C-3
Stack Moisture & Molecular Wt. via EPA Method 4			
CO2 (%)	2.92	2.91	2.87
O2 (%)	16.00	15.95	16.00
Beginning Meter Reading (ft3)	722.803	746.680	771.270
Ending Meter Reading (ft3)	746.585	769.230	793.175
Beginning Impinger Wt (g)	2334	2362.1	2368.2
Ending Impinger Wt. (g)	2362.1	2387.3	2392
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	75	100	98
Dry Gas Meter Temperature (°F end)	110	125	112
Atmospheric Pressure (in Hg, abs.)	29.68	29.69	29.72
Stack Gas Moisture (% volume)	5.60	5.50	5.28
Dry Gas Fraction	0.944	0.945	0.947
Stack Gas Molecular Wt. (lbs/lb-mole)	28.48	28.49	28.51
Stack Moisture & Molecular Wt. via Stoichiometry			
Fuel Moisture Content (vol % @ 0% O2)	18.86	18.86	18.86
Moisture Content (vol %)	5.04	5.07	4.93
Difference between methods	10%	8%	7%
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	1.10	0.95	1.00
ΔP #2	1.30	1.10	1.10
ΔP #3	1.30	1.20	1.20
ΔP #4	1.30	1.30	1.30
ΔP #5	1.30	1.20	1.20
ΔP #6	1.30	1.10	1.20
ΔP #7	1.20	1.20	1.10
ΔP #8	1.10	1.10	1.20
ΔP #9	1.00	0.91	0.82
ΔP #10	1.20	1.20	1.10
ΔP #11	1.30	1.30	1.10
ΔP #12	1.20	1.30	1.20
ΔP #13	1.30	1.30	1.10
ΔP #14	1.20	1.20	1.20
ΔP #15	1.10	1.20	1.20
ΔP #16	1.10	1.10	1.10
Sum of Square Root of ΔP's	17.6	17.3	17.0
Number of Traverse Points	16	16	16
Average Square Root of ΔP's	1.10	1.08	1.06
Average Temperature (°F)	503	503	504
Static Pressure (in. H2O)	0.43	0.43	0.49
Stack Diameter (in.)	35	35	35
Stack Area (ft2)	6.68	6.68	6.68
Stack Velocity (ft/min)	5043	4955	4881
Stack Flow,wet (ACFM)	33695	33107	32613
Stack Flow,dry (SCFH)	1.04E+06	1.02E+06	1.01E+06
Stack Flow Rate via EPA Method 19			
Fuel Flow to Engine (SCFH)	30757	30742	30528
Fuel Heating Value (BTU/SCFH)	1022	1022	1022
Fuel O2 F-Factor (DSCFH/MMBTU)	8636	8636	8636
Fuel CO2 F-Factor (DSCFH/MMBTU)	1022	1022	1022
Stack Flow, dry via O2 F-factor (SCFH)	1.16E+06	1.15E+06	1.15E+06
Stack Flow, dry via CO2 F-factor (SCFH)	1.10E+06	1.10E+06	1.11E+06
Difference between O2 F-factor and pitot tube	11%	12%	14%
Difference between CO2 F-factor and pitot tube	6%	8%	10%
Stack Flow Rate via Carbon Balance			
Fuel Carbon Content	1.022	1.022	1.022
Exhaust Carbon Content	3.02	3.01	2.98
Stack Flow, dry via carbon balance (SCFH)	1.04E+06	1.04E+06	1.05E+06
Difference between carbon balance and pitot tube	0%	2%	4%

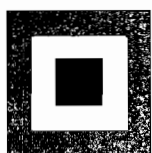
TEST REPORT
on
EXHAUST EMISSIONS
from two
DRESSER RAND 412KVSR COMPRESSOR ENGINES
at
**FLORIDA GAS TRANSMISSION'S
COMPRESSOR STATION NO. 19**
MELBOURNE, BREVARD COUNTY, FLORIDA

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

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INTRODUCTION

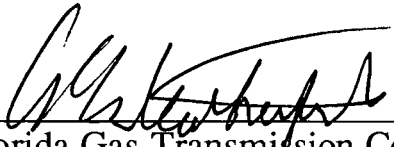
Two Dresser Rand 412KVSR compressor engines were tested to determine the quantity of emissions released into the atmosphere. The tests were conducted on March 26-27, 1992 at Compressor Station No. 19 located near Melbourne, in Brevard County, Florida. This compressor station is owned and operated by Florida Gas Transmission Company (an affiliate of Enron).

The tests were conducted to determine the units' compliance status with regard to the Florida Department of Environmental Regulation's Permit No. AC 05-189665.

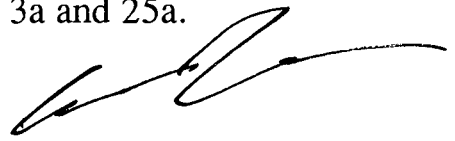
Quantities of nitrogen oxides (NO_x), carbon monoxide (CO), nonmethane hydrocarbon emissions (VOC), and other combustion products were determined in the exhaust stack of each engine. The tests followed the procedures set forth in the Code of Federal Regulations, Title 40, Part 60, Appendix A, Methods 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

I N T E R O F F I C E M E M O R A N D U M

Date: 04-Aug-1993 12:11 EST
From: William Leffler TAL
LEFFLER W
Dept: Air Resources Management
Tel No: 904/488-1344 222-3146
SUNCOM: 278-1344 291-9520

TO: See Below

Subject: Florida GAS Transmission Co Compliance Issues Phone Conf.

I have set up a "call in conference" for today August 4, 1993 at 3:00 eastern daylight saving time.

Possible agenda items:

1. Sufficiency of test notice?
2. Can we rely on the April 12 test reports by CUBIX as demonstrating compliance? Were they reviewed by the Districts?
3. What effect is the PSD requirement of reporting compliance within 180 days of completion?
4. When were the compressors substantially complete?
5. What is the effect of long term operation at fuel consumption rates that exceed those allowed by the construction permits?
6. What is the status of the application to extend the construction permits?
7. What is the status of the applications for operating permits?
8. What is the effect of our failure to take enforcement on the excess fuel consumption indicated in the April 92 test reports?
9. Technical problems with testing procedure... with contractor?
- 10 Participation in Alan Weatehrford's proposed technical resolution conference.

Conference call in Number for suncom is 292-6555
for non suncom (904)922-6555
confirmation number is 10g0804

Distribution:

TO: Clair Fancy TAL	(FANCY C)
TO: Jim Pennington TAL	(PENNINGTON J)
TO: Mike Harley TAL	(HARLEY M)
TO: Teresa Heron TAL	(HERON T)
TO: Bob Leetch JAX	(LEETCH B @ A1 @ JAX1)
TO: Shannon Baruch GNSV	(BARUCH S)
TO: Charles Collins ORL	(COLLINS C @ A1 @ ORL1)
TO: Caroline Shine ORL	(SHINE C @ A1 @ ORL1)
TO: Thomas Tittle WPB	(TITTLE T)
TO: Isidore Goldman WPB	(GOLDMAN I)
TO: Carolyn Salmon PEN	(SALMON C @ A1 @ PNS1)
TO: Robert Kriegel PEN	(KRIEGEL R @ A1 @ PNS1)
TO: Benjamin_m	(BENEFIELD_D @ A1 @ JAX1)

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TO: Robert Kriegel PEN	(KRIEGEL R @ A1 @ PNS1)
TO: Benjamin_m	(BENEFIELD_D @ A1 @ JAX1)

Table 1
Background Data

<u>Source Owner/Operator:</u>	Florida Gas Transmission Co. 601 South Lake Destiny Drive Maitland, Florida 32751 (407) 875-5816 TEL (407) 875-5896 FAX Attn: Allan Weatherford
<u>Testing Organization</u>	Cubix Corporation 9225 Lockhart Hwy Austin, Texas 78747 (512) 243-0202 TEL (512) 243-0222 FAX Attn: Lowell Faulkner
<u>Test Participants:</u>	Florida Gas Transmission Co. Allan Weatherford Fred Griffin FDER Garry Kuberski Dresser Rand David Anderson Cubix Corporation Lowell Faulkner Rick Krenzke Joe Rudyk
<u>Test Date:</u>	March 26-27, 1992
<u>Location:</u>	near Melbourne in Brevard County, Florida
<u>Process Description:</u>	2 Dresser Rand compressor engines
<u>Sampling Points:</u>	Exhaust stack of each compressor engine (See Appendix A)

Regulatory Application:

Florida Department of
Environmental Regulation Permit
No. AC 05-189665

Required Test Methods:

EPA Method 1 for traverse point layout
EPA Method 2 for stack gas velocity
EPA Method 3 for O₂ and CO₂
concentrations
EPA Method 4 for moisture content
EPA Method 7e for NO_x 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 SO₂ emissions

Alternate Test Methods:

(conducted for
comparison purposes)

EPA Method 3a for CO₂ and O₂
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

Two Dresser Rand 412KVS compressor engines were tested to determine the quantity of emissions vented to the atmosphere. The emission measurements reported herein result from tests conducted on March 26-27, 1992 at Compressor Station No. 19 located near Melbourne, in Brevard County, Florida. The purpose of these tests was to determine the compliance status of these engines with regard to the FDER permit.

The permit required that tests be conducted for NO_x, O₂, CO₂, CO, nonmethane hydrocarbons (i.e. VOC), SO₂, and opacity. These parameters were measured throughout three 1-hour test runs on each engine while operating at their rated horsepower of full load and full speed.

The results from these three test runs on Engines 1 and 2 are presented in Tables 2 and 3, respectively. These tables include the operating data and ambient conditions for each test run. The measured concentrations of NO_x, CO, O₂, CO₂, 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 NO_x, 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 SO₂ emissions. The SO₂ emission rate is calculated from the total sulfur in the fuel and the measured fuel flow as based on the Florida Gas provided horsepower.

On Engine 1, the average emissions over the three test runs for NO_x were found to be 7.97 lbs/hr, 34.9 tons/yr, and 1.34 g/hp-hr. Engine 2 NO_x emissions averaged 4.56 lbs/hr, 19.9 tons/yr, and 0.79 g/hp-hr. By comparison, permit limits are 11.0 lbs/hr, 48.3 tons/yr, and 2.0 g/hp-hr per engine. The tons/yr emission rates are based on 8760 hrs/year operation of the engines.

CO emissions averaged 11.9 lbs/hr, 52.3 tons/yr, and 2.0 g/hp-hr on Engine 1 and 11.8 lbs/hr, 51.7 tons/yr, and 2.06 g/hp-hr. CO emissions are limited by the permit to 15.4 lbs/hr, 67.6 tons/yr, and 2.8 g/hp-hr on each 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 0.107 grains/100 DSCF. The permit limits the sulfur content of the fuel to 10 grains/100 DSCF. The mass emission rates of SO₂ presented in Tables 2 and 3 were calculated from the measured fuel flow to the engines assuming that all sulfur in the fuel was oxidized to SO₂. The SO₂ emission rate based on this calculation averaged 0.0026 lbs/hr or 0.011 tons/yr on Engine 1 and 0.0031 lbs/hr and 0.014 tons/yr on Engine 2. The permit limits for SO₂ mass emissions are 0.51 lbs/hr and 2.2 tons/yr.

Nonmethane hydrocarbon (i.e. VOC) concentrations were measured as required by the permit using EPA Method 25. Tables 2 and 3 contain the results of those measurements. The average VOC emissions using Method 25 on Engine 1 were 13.5 lbs/hr, 59.2 tons/yr, and 2.27 g/hp-hr. The laboratory results for the Method 25 analyses contained in Appendix A note that a laboratory leak on the analysis of the sample from test run C-2 could have biased that number high. If that measurement is not included in the average emissions, Engine 1 emissions averaged 7.85 lbs/hr, 34.4 tons/yr, and 1.32 g/hp-hr. Engine 2 VOC emissions averaged 6.05 lbs/hr, 26.5 tons/yr, and 1.05 g/hp-hr over the three test runs. The permit limits nonmethane hydrocarbon emissions to 9.4 lbs/hr, 41.0 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 CO₂ and moisture interferences, 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 CO₂ 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 1.61 lbs/hr (7.03 tons/yr and 0.27 g/hp-hr) on Engine 1. Engine 2 average VOC emissions were 2.29 lbs/hr, 10.1 tons/yr, and 0.40 g/hp-hr. When compared with the data obtained from Method 25, one can see that the CO₂ and moisture interferences 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 O₂ and CO₂ 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 O₂ and CO₂ 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 both engines, 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 and carbon balance agreed with the pitot tube measurements within 10%, averaged over the three test runs on Engine 2. The agreement on Engine 1 was poor, indicating a faulty fuel flow meter as can be seen from a comparison of the fuel consumption for both engines at the same loads.

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 unofficial 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 on both engines.

TABLE 2 ENGINE 1 SUMMARY OF RESULTS

Operator/Plant	Florida Gas Melbourne Compressor Station
Location	Brevard County, Florida
Source	Dresser-Rand Compressor Engine
Technicians	RK,LF,JR

Test Run No.	C-1	C-2	C-3
Engine ID No.	1	1	1
Date	3/26/92	3/26/92	3/26/92
Start Time	08:36	09:45	10:51
Stop Time	09:36	10:45	11:51
Engine/Compressor Operation			
Engine Speed (rpm)	361	361	361
Ignition Timing (°BTDC)	13	13	13
Air Manifold Pressure (psig)	10.1	10.2	10.1
Air Manifold Temperature (°F)	130	131	130
Fuel Flow (SCFH)	16730	16730	16730
Fuel Manifold Pressure (psig)	32.8	32.8	32.8
Fuel Manifold Temperature (°F)	61	61	61
Pre-Combustion Chamber Pressure (psig)	20.4	20.3	20.3
Post Turbo Temperature (°F)	714	713	717
Turbo (rpm x 100)	116/167	166/168	168/167
After Cooler Water Temperature (°F)	129	129	n.a.
Pockets Open	17	17	17
Suction Pressure (psig)	700	694	698
Suction Temperature (°F)	59	67	66
Discharge Pressure (psig)	952	950	951
Discharge Temperature (°F)	114	113	111
Engine Load (BHP)	2708	2708	2708
Torque (%)	101	101	101
Ambient Conditions			
Atmospheric Pressure (in. Hg)	29.96	29.99	29.99
Temperature (°F) :			
Dry bulb	69	74	81
Wet bulb	63	65	70
Humidity (lb/lb air)	0.0107	0.0109	0.0128
Measured Emissions			
NOx (ppmv)	136	141	147
CO (ppmv)	342	345	355
O2 via EPA Method 3 (vol %)	12.0	12.0	12.0
CO2 via EPA Method 3 (vol %)	5.0	5.0	5.0
VOC via EPA Method 25 (ppmv)	433.4	1267.5	366.2
SO2 in fuel (grains/100 DSCF)	0.107	0.107	0.107
Stack Volumetric Flow Rates			
via Pitot Tube (SCFH, dry)	4.69E+05	4.72E+05	4.76E+05
Calculated Emission Rates (via pitot tube)			
NOx (lbs/hr)	7.62	7.95	8.35
CO (lbs/hr)	11.7	11.8	12.3
VOC (lbs/hr)	8.45	24.85	7.24
SO2 (lbs/hr)	0.0026	0.0026	0.0026
NOx (tons/yr)	33.4	34.8	36.6
CO (tons/yr)	51.1	51.8	53.8
VOC (tons/yr)	37.0	108.8	31.7
SO2 (tons/yr)	0.011	0.011	0.011
NOx (g/hp-hr)	1.28	1.33	1.40
CO (g/hp-hr)	1.96	1.98	2.06
VOC (g/hp-hr)	1.42	4.17	1.21

**TABLE 3
ENGINE 2
SUMMARY OF RESULTS**

Operator/Plant	Florida Gas Melbourne Compressor Station
Location	Brevard County, Florida
Source	Dresser-Rand Compressor Engine
Technicians	RK,LF,JR

Test Run No.	C-4	C-5	C-6
Engine ID No.	2	2	2
Date	3/27/92	3/27/92	3/27/92
Start Time	10:23	11:28	12:34
Stop Time	11:23	12:28	13:34
Engine/Compressor Operation			
Engine Speed (rpm)	360	360	361
Ignition Timing (°BTDC)	14	13	13
Air Manifold Pressure (psig)	10.6	10.4	10.4
Air Manifold Temperature (°F)	129	130	130
Fuel Flow (SCFH)	20639	20578	20490
Fuel Manifold Pressure (psig)	34.4	33	33
Fuel Manifold Temperature (°F)	63	63	64
Pre-Combustion Chamber Pressure (psig)	21.2	21.2	21.2
Post Turbo Temperature (°F)	708	709	708
Turbo (rpm x 100)	169/171	170/171	170/170
After Cooler Water Temperature (°F)	123	126	123
Pockets Open	17	17	17
Suction Pressure (psig)	700	698	695
Suction Temperature (°F)	66	66	66
Discharge Pressure (psig)	941	941	945
Discharge Temperature (°F)	109	106	115
Engine Load (BHP)	2617	2625	2594
Torque (%)	102	102	101
Ambient Conditions			
Atmospheric Pressure (in. Hg)	30.11	30.12	30.10
Temperature (°F) : Dry bulb	77	81	81
(°F) Wet bulb	61	64	63
Humidity (lb/lb air)	0.0075	0.0085	0.0078
Measured Emissions			
NOx (ppmv)	66	79	92
CO (ppmv)	334	340	339
O2 via EPA Method 3 (vol %)	12.5	12.5	12.5
CO2 via EPA Method 3 (vol %)	5.0	4.8	4.8
VOC via EPA Method 25 (ppmv)	261.1	317.5	329.5
SO2 in fuel (grains/100 DSCF)	0.107	0.107	0.107
Stack Volumetric Flow Rates			
via Pitot Tube (SCFH, dry)	4.82E+05	4.74E+05	4.88E+05
Calculated Emission Rates (via pitot tube)			
NOx (lbs/hr)	3.80	4.50	5.37
CO (lbs/hr)	11.7	11.7	12.0
VOC (lbs/hr)	5.22	6.25	6.68
SO2 (lbs/hr)	0.0032	0.0031	0.0031
NOx (tons/yr)	16.6	19.7	23.5
CO (tons/yr)	51.2	51.3	52.7
VOC (tons/yr)	22.9	27.4	29.3
SO2 (tons/yr)	0.014	0.014	0.014
NOx (g/hp-hr)	0.66	0.78	0.94
CO (g/hp-hr)	2.03	2.03	2.11
VOC (g/hp-hr)	0.91	1.08	1.17

PROCESS DESCRIPTION

Florida Gas Transmission Co. owns and operates Compressor Station No. 19 located near Melbourne, 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 engines tested are identical Dresser Rand 412KVSR compressor engines. The serial numbers for Engines 1 and 2 are 229AP and 228AP, respectively. The engines are rated at 2600 BHP. They are lean burn, high air/fuel ratio engines 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 23.5" ID exhaust pipes on each at approximately 45 feet above grade. Two sample ports were installed in a straight horizontal section of each 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 4 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 NO_x, CO, O₂, and CO₂ 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. NO_x 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 53 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 on each engine and found that none existed.

The stack gas analyses for CO₂ and O₂ 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 O₂ and CO₂ concentrations due to the greater accuracy and precision provided by the instruments. The CO₂ analyzer was based on the principle of infrared absorption; and, the O₂ analyzer operated on a paramagnetic cell. The data presented in *Summary of Results* contains the O₂ and CO₂ 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 provided results that were approximately 10% less than those obtained by the pitot tube measurement. On Engine 2, AGA's carbon balance technique yielded results approximately 15% lower than those of EPA Methods 1-4. 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 stoichiometric techniques used on Engine 1, yielded results over 30% lower than the pitot tube results. Comparison of the fuel consumption of the identical engines at equal loads show that the poor agreement between flow rate measurement techniques on Engine 1 can be attributed to a faulty fuel meter. 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 NO_x. A chemiluminescence cell analyzer was used. The NO_x mass emission rates were calculated as if all the NO_x were in the form of NO₂. This approach corresponds to EPA's convention. However, it tends to overestimate the actual stack NO_x mass emission rates, since the majority of the NO_x is in the form of NO which is less dense (i.e. lbs of emissions per ppmv concentration) than the NO₂ form of NO_x. This gives a worst case scenario of NO_x 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 CO₂, 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 SO₂, the SO₂ 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.

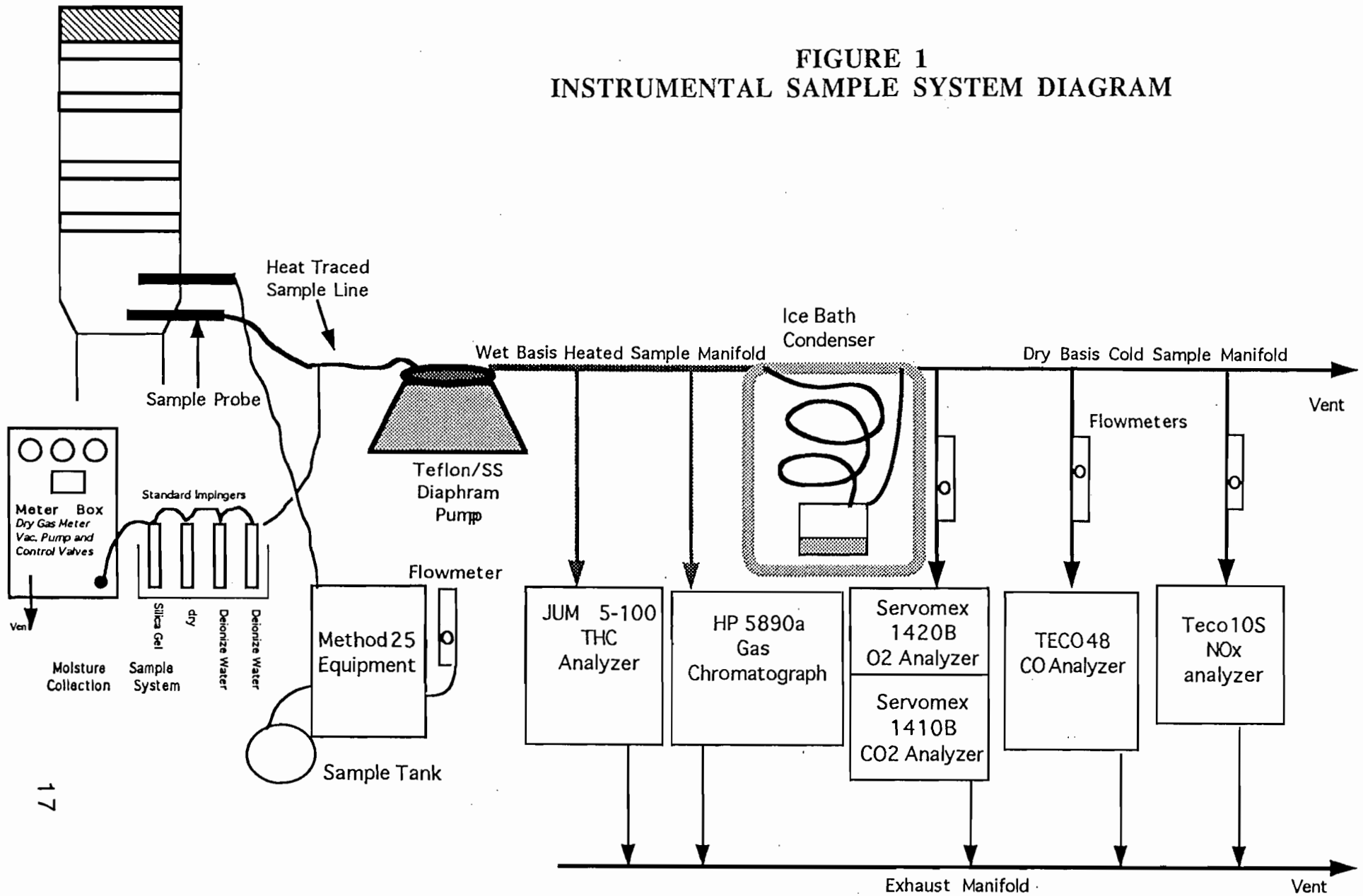
During the tests, the engine and compressor operational data was collected by Florida Gas personnel. Key operational data collected include compressor discharge pressures, compressor suction pressures, engine manifold pressure, engine speed, timing, and horsepower. Florida Gas also provided a recent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

TABLE 4
ANALYTICAL INSTRUMENTATION

<u>Parameter</u>	<u>Model and Manufacturer</u>	<u>Common Use Ranges</u>	<u>Sensitivity</u>	<u>Response Time (sec.)</u>	<u>Detection Principle</u>
NO _x	TECO 10S	0-10 ppm 0-100 ppm 0-200 ppm 0-500 ppm 0-1,000 ppm 0-5,000 ppm	0.1 ppm	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	0.1 ppm	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 its 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 CO₂ 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 NO_x, CO, CO₂, and O₂ analyzers. The sum of the interference responses for H₂O, CO, SO₂, CO₂ and O₂ (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 NO_x and O₂ sampling and analysis system was checked for response time per the procedures outlined in EPA's Method 20. The average NO_x analyzer's response times were 0.61 minutes upscale and 0.65 minutes downscale. The O₂ 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 NO_x 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. NO_x 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 NO₂ to NO converter in the NO_x analyzer was checked by having the analyzer sample a mixture of NO in N₂ standard gas and zero air from a Tedlar® bag. When this bag is mixed and exposed to sunlight, the NO is oxidized to NO₂ over approximately a 30-minute period. If the NO_x instrument's converter is 100% efficient, then the NO_x response does not decrease as the NO in the bag is converted to NO₂. The criterion for acceptability is a demonstrated NO_x 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 $\pm 1\%$ accuracy for NO_x and O₂, and to $\pm 2\%$ accuracy for the remaining gases. EPA Protocol No. 1 was used, where applicable (i.e. NO_x 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 this site. 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**

SIGN IN SHEET

JOB NAME: FLORIDA COVES

DATE: 3 / 26 / 02

LOCATION: MELBOURNE

PERMIT # AW05-189665

SOURCE(S): Dresser Rand Engines (2)

PARTICIPANTS: Cubix Corporation

FEET

Dressed

DER

PLEASE PRINT

NAME:

AFFILIATION:

PHONE NUMBER:

Lawer Falkner

CUBIX

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Allan Weatherford

FEET

Fred Griffin

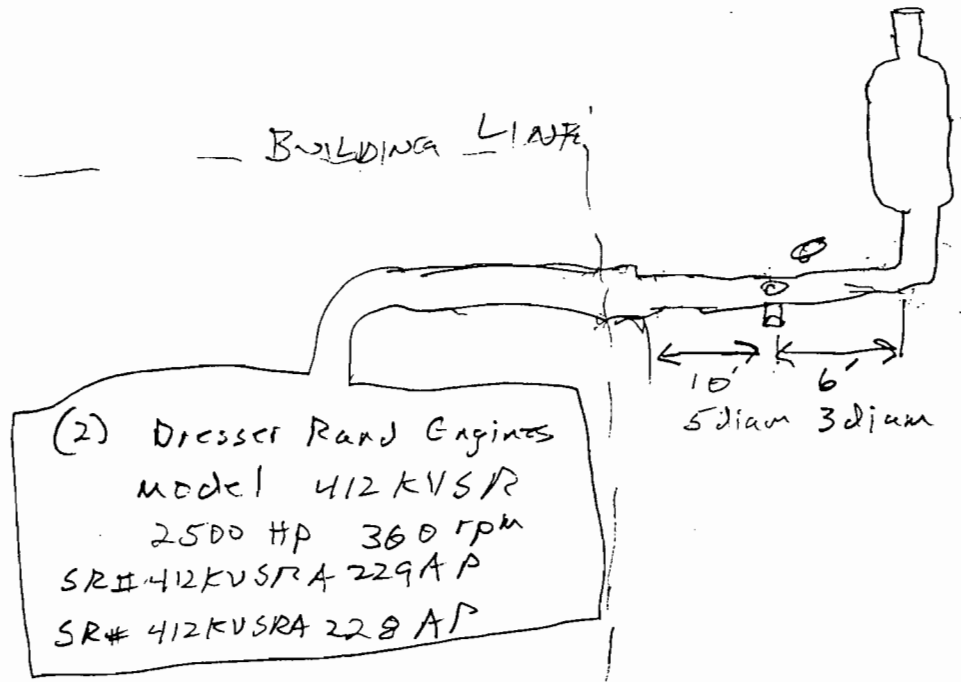
FEET

Circular Stack Sampling Traverse Point Layout (EPA Method 1)

Date: 3-26-92
 Plant: EGT / MCLB...
 Source: 2 Dresser Rand Engines
 Technician(s): LEAK SR

Port + Stack ID: 31 1/2 in.
 Port Extension 8 in.
 Stack ID: 23 1/2 in.
 Stack Area 3,012 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)				Distance from Reference Point (inches)
	Number of traverse pts./diameter				
	4	6	8	12	
1	6.7	4.4	3.2	2.1	<u>.75 = 1.0</u>
2	25.0	14.6	10.5	8.2	<u>2.55</u>
3	75.0	29.6	19.4	11.8	<u>4.6</u>
4	93.3	70.4	32.3	17.7	<u>7.6</u>
5		85.4	67.7	25.0	<u>15.9</u>
6		95.6	80.6	35.6	<u>18.9</u>
7			89.5	64.4	<u>21.0</u>
8			96.8	75.0	<u>22.7</u> ← 22.5
9				82.3	_____
10				88.2	_____
11				93.3	_____
12				97.9	_____

MOISTURE AND VELOCITY FIELD DATA SHEETS

st. #19

Date: 3-26-92 Dry Gas Meter ID: Anderson # 12863061
 Plant/Operator: FGT/Melbourne St. Dry Gas Meter Factor: .9904 (Kd)
 Source: Dresser 412 KUSR Recip Unit # Pitot Tube #/Type: #107 S-type
 Technicians: RK, LF, JR Pitot Tube Factor: .84 (Kp)
 Atm. Pres. 29.96 in.Hg(Pb) Static Pres. + 2.0 in.H2O(Pg)
 Test Run # C-1 Average Stack Temp. 652 °F(Ts)

Pre-test Leak check	ft.3/min at in. Hg Vacuum	Impinger #	Contents	Initial Weight	Final Weight
<u>OK</u>	<u>0</u> ft.3/min at <u>23</u> in. Hg Vacuum	1	<u>H2O</u>	<u>608.4</u>	<u>659.4</u>
		2	<u>H2O</u>	<u>608.6</u>	<u>594.4</u>
Post-test Leak check	<u>0</u> ft.3/min at <u>26</u> in. Hg Vacuum	3	<u>MT</u>	<u>459.7</u>	<u>462.1</u>
<u>OK</u>		4	<u>SG</u>	<u>778.4</u>	<u>786.4</u>
		5			
		6			
		Totals	 		

Moisture Train

	Initial	Final
Time:	<u>0837</u>	<u>936</u>
Meter Reading (ft ³ or L)	<u>913.010</u>	<u>938.500</u>
Meter Temp. (°F)	<u>72</u>	<u>134</u>
Sample Box #		
O2 %		<u>17.0</u>
CO2 %		<u>5.0</u>

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	Bottom			Side		
	ΔP (" H2O)	°F	B	ΔP (" H2O)	°F	B
1	<u>1.1</u>			<u>1.5</u>		
2	<u>1.3</u>			<u>1.5</u>		
3	<u>1.4</u>			<u>1.6</u>		
4	<u>1.3</u>			<u>1.6</u>		
5	<u>1.5</u>			<u>1.5</u>		
6	<u>1.5</u>			<u>1.5</u>		
7	<u>1.5</u>			<u>1.6</u>		
8	<u>1.4</u>			<u>1.6</u>		
9						
10						
11						
12						

↑ Onsite Results ↑

Best Available Copy
MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3-26-92
 Plant/Operator: FGT/Melbourne
 Source: Duron 412 KUSR #1
 Technicians: RK, LF, JR
 Atm. Pres. 29.99 in.Hg(Pb)
 Test Run # C-2

Dry Gas Meter ID: Anderson # 12863061
 Dry Gas Meter Factor: .9904 (Kd)
 Pitot Tube #/Type: #107 S-type
 Pitot Tube Factor: .84 (Kp)
 Static Pres. +1.8 in.H2O(Pg)
 Average Stack Temp. 662 °F(Ts)

Pre-test Leak check	ft.3/min at in. Hg Vacuum	Impinger #	Contents	Initial Weight	Final Weight
<u>OK</u>	<u>0</u> <u>25</u>	1	H ₂ O	659.4	692.7
Post-test Leak check	ft.3/min at in. Hg Vacuum	2	H ₂ O	594.4	597.8
<u>OK</u>	<u>0</u> <u>24</u>	3	MT	462.1	463.3
		4	SG	786.4	792.6
		5			
		6			
		Totals	X		

Moisture Train

Pitot Tube Traverse/Stack Temp./Angle

	Initial	Final
Time:	<u>955</u>	<u>1040</u>
Meter Reading (ft ³ or L)	<u>940335961880</u>	
Meter Temp. (°F)	<u>85</u>	<u>121</u>
Sample Box #	<u>TR 730R</u>	
O ₂ %	<u>12.0</u>	
CO ₂ %	<u>5.0</u>	

Traverse Pt.	ΔP (" H ₂ O)	°F	β	ΔP (" H ₂ O)	°F	β
1	<u>1.6</u>			<u>1.3</u>		
2	<u>1.6</u>			<u>1.5</u>		
3	<u>1.6</u>			<u>1.4</u>		
4	<u>1.4</u>			<u>1.4</u>		
5	<u>1.6</u>			<u>1.5</u>		
6	<u>1.7</u>			<u>1.5</u>		
7	<u>1.6</u>			<u>1.5</u>		
8	<u>1.5</u>			<u>1.5</u>		
9						
10						
11						
12						

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3-26-92
 Plant/Operator: FGT/Melbourne
 Source: Process 412 KUSR #1
 Technicians: RK, LF, JR
 Atm. Pres. 29.99 in.Hg(Pb)
 Test Run # C-13

Dry Gas Meter ID: Anderson # 12 863061
 Dry Gas Meter Factor: .9904 (Kd)
 Pitot Tube #/Type: #107 S-type
 Pitot Tube Factor: .84 (Kp)
 Static Pres. + 2.0 in.H₂O(Pg)
 Average Stack Temp. 669 °F(Ts)

Pre-test Leak check	ft.3/min at in. Hg Vacuum	Impinger #	Contents	Initial Weight	Final Weight
<u>OK</u>	<u>0</u> / <u>24</u>	1	H ₂ O	692.7	720.9
		2	H ₂ O	594.4	602.8
Post-test Leak check	ft.3/min at in. Hg Vacuum	3	MT	462.1	464.4
<u>OK</u>	<u>0</u> / <u>24</u>	4	SG	786.4	789.4
		5			
		6			
		Totals	X		

Moisture Train

Pitot Tube Traverse/Stack Temp./Angle

	Initial	Final
Time:	<u>11:00am</u>	<u>1150</u>
Meter Reading (ft ³ or L)	<u>962.200</u>	<u>985.750</u>
Meter Temp. (°F)	<u>118</u>	<u>141</u>
Sample Box #	<u>TR 7 Bon</u>	
O ₂ %	<u>12.0</u>	
CO ₂ %	<u>5.0</u>	

Traverse Pt.	B			S		
	ΔP (" H ₂ O)	°F	β	ΔP (" H ₂ O)	°F	β
1	<u>1.2</u>			<u>1.5</u>		
2	<u>1.5</u>			<u>1.6</u>		
3	<u>1.5</u>			<u>1.7</u>		
4	<u>1.5</u>			<u>1.5</u>		
5	<u>1.4</u>			<u>1.5</u>		
6	<u>1.6</u>			<u>1.6</u>		
7	<u>1.6</u>			<u>1.6</u>		
8	<u>1.5</u>			<u>1.6</u>		
9						
10						
11						
12						

on-site results

Melbourne Compressor Station--Moisture, Molecular Weight, Stack Flow Rate

Operator/Plant Florida Gas Melbourne Compressor Station
 Location Brevard 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 (%)	5.0	5.0	5.0
O2 (%)	12.0	12.0	12.0
Beginning Meter Reading (ft3)	913.010	940.350	962.200
Ending Meter Reading (ft3)	938.500	961.880	985.750
Beginning Impinger Wt (g)	2455.1	2502.3	2535.6
Ending Impinger Wt. (g)	2502.3	2546.4	2577.5
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	72	85	118
Dry Gas Meter Temperature (°F end)	134	121	141
Atmospheric Pressure (in Hg, abs.)	29.96	29.99	29.99
Stack Gas Moisture (% volume)	8.59	9.40	8.63
Dry Gas Fraction	0.914	0.906	0.914
Stack Gas Molecular Wt. (lbs/lb-mole)	28.31	28.22	28.31
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	1.10	1.60	1.20
ΔP #2	1.30	1.60	1.50
ΔP #3	1.40	1.60	1.50
ΔP #4	1.30	1.40	1.50
ΔP #5	1.50	1.60	1.40
ΔP #6	1.50	1.70	1.60
ΔP #7	1.50	1.60	1.60
ΔP #8	1.40	1.50	1.50
ΔP #9	1.50	1.30	1.50
ΔP #10	1.50	1.50	1.60
ΔP #11	1.60	1.40	1.70
ΔP #12	1.60	1.40	1.50
ΔP #13	1.50	1.50	1.50
ΔP #14	1.50	1.50	1.60
ΔP #15	1.60	1.50	1.60
ΔP #16	1.60	1.50	1.60
Sum of Square Root of ΔP's	19.3	19.7	19.7
Number of Traverse Points	16	16	16
Average Square Root of ΔP's	1.21	1.23	1.23
Average Temperature (°F)	652	662	669
Static Pressure (in. H2O)	2	1.8	2
Stack Diameter (in.)	23.5	23.5	23.5
Stack Area (ft2)	3.01	3.01	3.01
Stack Velocity (ft/min)	5944	6084	6116
Stack Flow,wet (ACFM)	17905	18325	18423
Stack Flow,dry (SCFH)	4.69E+05	4.72E+05	4.76E+05

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3-27-92 Dry Gas Meter ID: Anderson #12863061
 Plant/Operator: FGT/Melbourne #19 Dry Gas Meter Factor: .9904 (Kd)
 Source: Dresser 412 KUSE Pitot Tube #/Type: #107 S-Type
 Technicians: RK, LF, JR Pitot Tube Factor: .84 (Kp)
 Atm. Pres. 30.12 in.Hg(Pb) Static Pres. +2.1 in.H₂O(Pg)
 Test Run # C-4 Average Stack Temp. 670 °F(Ts)

Pre-test Leak check	0.0 ft.3/min at 25 in. Hg Vacuum	Impinger #	Contents	Initial Weight	Final Weight
<u>OK</u>		1	H ₂ O	582.0	607.1
		2	H ₂ O	602.8	622.2
Post-test Leak check	0.0 ft.3/min at 23" in. Hg Vacuum	3	MT	464.4	465.6
		4	SG	799.4	806.2
		5			
		6			
		Totals			

Moisture Train

	Initial	Final
Time:	1020	1124
Meter Reading (ft ³ or L)	985.405	1013.728
Meter Temp. (°F)	83	120
Sample Box #	TR7 BOX	
O ₂ %	12.5	
CO ₂ %	5.0	

Overat

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	B			S		
	ΔP (" H ₂ O)	°F	β	ΔP (" H ₂ O)	°F	β
1	1.6			1.3		
2	1.7			1.7		
3	1.4			1.6		
4	1.4			1.6		
5	1.5			1.5		
6	1.6			1.5		
7	1.6			1.7		
8	1.6			1.6		
9						
10						
11						
12						

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3-27-92 Dry Gas Meter ID: Anderson #12863061
 Plant/Operator: FGT/Melbourne #19 Dry Gas Meter Factor: .9904 (Kd)
 Source: Dresser 412 KUSR Pitot Tube #/Type: #107 S-Type
 Technicians: AK, LF, JR Pitot Tube Factor: .84 (Kp)
 Atm. Pres. 30.12 in.Hg(Pb) Static Pres. + 2.0 in.H2O(Pg)
 Test Run # C-5 Average Stack Temp. 667 °F(Ts)

Pre-test Leak check	0.0 ft.3/min at in. Hg Vacuum	Impinger #	Contents	Initial Weight	Final Weight
<u>OK</u>	<u>⊙ 24"</u>	1	<u>H2O</u>	<u>607.1</u>	<u>637.8</u>
		2	<u>H2O</u>	<u>622.2</u>	<u>627.0</u>
		3	<u>MT</u>	<u>465.6</u>	<u>466.5</u>
		4	<u>SG</u>	<u>955.2</u>	<u>961.4</u>
		5			
		6			
		Totals	X		

Moisture Train

	Initial	Final
Time:	<u>1140</u>	<u>1235</u>
Meter Reading (l3 or L)	<u>013.90</u>	<u>035.880</u>
Meter Temp. (°F)	<u>115</u>	<u>118</u>
Sample Box #	<u>7R</u>	<u>7</u>
O2 %	<u>12.5</u>	
CO2 %	<u>4.8</u>	

DRS AT

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	B			S		
	ΔP (" H2O)	°F	β	ΔP (" H2O)	°F	β
1	<u>1.2</u>			<u>1.2</u>		
2	<u>1.6</u>			<u>1.7</u>		
3	<u>1.5</u>			<u>1.5</u>		
4	<u>1.5</u>			<u>1.5</u>		
5	<u>1.6</u>			<u>1.4</u>		
6	<u>1.6</u>			<u>1.5</u>		
7	<u>1.7</u>			<u>1.5</u>		
8	<u>1.8</u>			<u>1.5</u>		
9						
10						
11						
12						

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3-27-92 Dry Gas Meter ID: Anderson #12863061
 Plant/Operator: F6T - Melbourne #17 Dry Gas Meter Factor: .9904 (Kd)
 Source: Dresser 412 KUSR Pitot Tube #/Type: #107 S-Type
 Technicians: RK, LF, JR Pitot Tube Factor: .84 (Kp)
 Atm. Pres. 30.12 in.Hg(Pb) Static Pres. + 2.1 in.H2O(Pg)
 Test Run # C-6 Average Stack Temp. 672 °F(Ts)

Pre-test Leak check	0.0 ft.3/min at in. Hg Vacuum	Impinger #	Contents	Initial Weight	Final Weight
OK	⊙ 25"	1	H ₂ O	637.8	669.5
Post-test Leak check	0 25 ft.3/min at in. Hg Vacuum	2	H ₂ O	627.0	631.1
OK		3	MT	466.5	467.2
		4	SG	961.4	964.1
		5			
		6			
		Totals			

Moisture Train

	Initial	Final
Time:	1240	1335
Meter Reading (ft ³ or L)	35900	5861
Meter Temp. (°F)	118	126
Sample Box #		
O ₂ %		12.5
CO ₂ %		4.8

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	B		S	
	ΔP (" H ₂ O)	°F	ΔP (" H ₂ O)	°F
1	1.6		1.3	
2	1.8		1.6	
3	1.7		1.6	
4	1.6		1.5	
5	1.5		1.6	
6	1.6		1.6	
7	1.7		1.5	
8	1.8		1.5	
9				
10				
11				
12				

onsat
Results

Melbourne Compressor Station--Moisture, Molecular Weight, Stack Flow Rate

Operator/Plant Florida Gas Melbourne Compressor Station
 Location Brevard County, Florida
 Source Dresser-Rand Compressor Engine
 Technicians RK,LF,JR

Test Run No.	C-4	C-5	C-6
Stack Moisture & Molecular Wt. via EPA Method 4			
CO2 (%)	5.00	4.80	4.80
O2 (%)	12.50	12.50	12.50
Beginning Meter Reading (ft3)	985.405	13.900	35.900
Ending Meter Reading (ft3)	1013.728	35.880	58.610
Beginning Impinger Wt (g)	2448.6	2650.1	2692.7
Ending Impinger Wt. (g)	2501.1	2692.7	2731.9
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	83	115	118
Dry Gas Meter Temperature (°F end)	120	118	126
Atmospheric Pressure (in Hg, abs.)	30.11	30.12	30.1
Stack Gas Moisture (% volume)	8.53	9.10	8.26
Dry Gas Fraction	0.915	0.909	0.917
Stack Gas Molecular Wt. (lbs/lb-mole)	28.34	28.24	28.34
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	1.60	1.20	1.60
ΔP #2	1.70	1.60	1.80
ΔP #3	1.40	1.50	1.70
ΔP #4	1.40	1.50	1.60
ΔP #5	1.50	1.60	1.50
ΔP #6	1.60	1.60	1.60
ΔP #7	1.60	1.70	1.70
ΔP #8	1.60	1.80	1.80
ΔP #9	1.30	1.20	1.30
ΔP #10	1.70	1.70	1.60
ΔP #11	1.60	1.50	1.60
ΔP #12	1.60	1.50	1.50
ΔP #13	1.50	1.40	1.60
ΔP #14	1.50	1.50	1.60
ΔP #15	1.70	1.50	1.50
ΔP #16	1.60	1.50	1.50
Sum of Square Root of ΔP's	19.9	19.7	20.2
Number of Traverse Points	16	16	16
Average Square Root of ΔP's	1.25	1.23	1.26
Average Temperature (°F)	670	667	672
Static Pressure (in. H2O)	2.1	2	2.1
Stack Diameter (in.)	23.5	23.5	23.5
Stack Area (ft2)	3.01	3.01	3.01
Stack Velocity (ft/min)	6165	6088	6245
Stack Flow,wet (ACFM)	18570	18338	18811
Stack Flow,dry (SCFH)	4.82E+05	4.74E+05	4.88E+05

Volatile Organic Carbon by Method 25

Client: FLORIDA GAS
 Plant: MALDEN STATION
 Operator: JR LR RK
 Run Number: C-1
 Tank Number: 4T-194
 Sampling Train ID#: ~~2610~~ 2610
 Side: Left / Right: #1
 Start Time: 8:30

Project #: _____
 Sample Location: Engine 1
 Date: 3-26-92
 Sample ID: C-1
 Trap Number: B35
 % CO₂: 5.0
 % H₂O: ~~8.6~~ 8.6
 Stop Time: 9:30

Pressure Readings	Tank Vacuum		Barometric Pressure mm Hg / in Hg	Ambient Temperature C/F
	Manometer mm Hg / in Hg	Gauge mm Hg / in Hg		
Pre Test	28.00	29.70	29.96	69
Post Test	6.60	7.50	29.99	72

Leak Rate	Tank * (in Hg)		Trap black ball reading
	Allowable	Actual	
Pre Test	1.0486	0	0
Post Test	1.0497	0	0

$$\Delta P = .01 \frac{F P_b \phi}{V_t} = \frac{.01 * 35 * 29.96 * 10}{100}$$

ΔP = Pressure Change (in Hg)
 F = Sampling Flow Rate cc / min
 P_b = Barometric Pressure (in Hg)
 ϕ = Leak Check Time Period (min)
 V_t = 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
8:30	28.70	35	263	265	
8:35	27.50	35	263	265	
8:40	25.40	35	263	265	
8:45	23.20	35	264	265	
8:50	21.10	35	264	265	
8:55	19.00	35	265	266	
9:00	17.00	30	265	266	
9:05	15.80	28	265	266	Adjust Flow
9:10	13.70	33	266	266	
9:15	12.30	30	267	267	
9:20	11.20	25	267	265	Adjust Flow
9:25	10.20	37	267	265	
9:30	7.50	29	267	265	



Volatile Organic Carbon by Method 25

Client: <u>Florida Gas Trans</u>	Project #: _____
Plant: <u>Melbourne #</u>	Sample Location: <u>ENGINE 2</u>
Operator: <u>JR LF RK</u>	Date: <u>3-26-92</u>
Run Number: <u>C-2</u>	Sample ID: <u>C-2</u>
Tank Number: <u>4 T-103</u>	Trap Number: <u>C-37</u>
Sampling Train ID#: <u>0.2610</u>	% CO2: <u>5</u>
Side: Left / Right: <u>SAMPLE 1</u>	% H2O: <u>9.4</u>
Start Time: <u>955</u>	Stop Time: <u>1055</u>

Pressure Readings	Tank Vacuum		Barometric Pressure mm Hg / in Hg	Ambient Temperature C / F
	Manometer mm Hg / in Hg	Gauge mm Hg / in Hg		
Pre Test	28.00	29.40	29.99	73
Post Test	6.40	7.20	29.99	78

Leak Rate	Tank* (in Hg)		Trap black ball reading
	Allowable	Actual	
Pre Test	1.0496	0	0
Post Test	1.0496	0	0

$$\Delta P = .01 \frac{F P_b \emptyset}{V_t}$$

ΔP = Pressure Change (in Hg)
 F = Sampling Flow Rate cc / min
 P_b = Barometric Pressure (in Hg)
 \emptyset = Leak Check Time Period (min)
 V_t = 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
955	28.60	35	265	265	start
1000	27.70	35	266	266	
1005	25.60	35	267	266	
1010	23.60	30	267	267	Adjust Flow
1015	21.50	35	267	267	
1020	19.20	35	267	267	
1025	17.10	35	267	267	
1030	15.80	33	267	267	
1035	14.20	30	267	267	
1040	13.70	28	267	267	
1045	12.80	25	267	267	Adjust Flow
1050	9.90	37	267	267	
1055	7.00	35	267	267	
1055					



Volatile Organic Carbon by Method 25

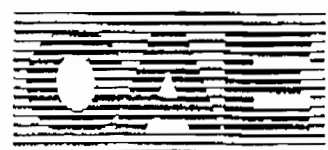
Client: <u>Fla GAS TRANS</u>	Project #:
Plant: <u>Melbourne # 19</u>	Sample Location: <u>Engine 1</u>
Operator: <u>SR, LF, RK</u>	Date: <u>3-26-92</u>
Run Number: <u>C-31</u>	Sample ID: <u>C-3</u>
Tank Number: <u>4T41</u>	Trap Number: <u>X-32</u>
Sampling Train ID#: <u>2610</u>	% CO2: <u>5.0</u>
Side: Left / Right: <u>SAMPLE - 1</u>	% H2O: <u>9.0</u>
Start Time: <u>1100</u>	Stop Time: <u>1200</u>

Pressure Readings	Tank Vacuum		Barometric Pressure mm Hg / in Hg	Ambient Temperature - C / F
	Manometer mm Hg / in Hg	Gauge mm Hg / in Hg		
Pre Test	28.20	29.00	29.99	78
Post Test	6.40	6.90	30.00	84

Leak Rate	Tank* (in Hg)		Trap black ball reading
	Allowable	Actual	
Pre Test	1.0496	0	0
Post Test	1.050	0	0

$\Delta P = .01 \frac{F P_b \emptyset}{V_t}$
 ΔP = Pressure Change (in Hg)
 F = Sampling Flow Rate cc / min
 P_b = Barometric Pressure (in Hg)
 \emptyset = Leak Check Time Period (min)
 V_t = 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
1100	28.20	35	267	267	
1105	27.10	33	267	267	
1110	26.20	30	267	267	
1115	24.80	30	267	267	
1120	22.90	35	267	267	
1125	20.80	33	267	267	
1130	18.00	30	267	267	
1135	16.40	28	267	267	Adjust Flow
1140	14.00	35	267	267	
1145	12.30	33	267	267	
1150	10.50	35	267	267	
1155	8.70	35	267	267	
1200	6.20	33	267	267	



Volatile Organic Carbon by Method 25

Client: <u>Florida GAS TRANS</u>	Project #:
Plant: <u>Melbourne</u>	Sample Location: <u>Engine - 2</u>
Operator: <u>SR, LF, RK</u>	Date: <u>3/27/92</u>
Run Number: <u>C-4</u>	Sample ID: <u>C-4</u>
Tank Number: <u>4 T 193</u>	Trap Number: <u>X-Y</u>
Sampling Train ID#: <u>2610</u>	% CO ₂ : <u>5.0</u>
Side: Left / Right: <u>Sample - 1</u>	% H ₂ O: <u>8.5</u>
Start Time: <u>1017</u>	Stop Time: <u>1117</u>

Pressure Readings	Tank Vacuum		Barometric Pressure mm Hg / in Hg	Ambient Temperature - C / F
	Manometer mm Hg / in Hg	Gauge mm Hg / in Hg		
Pre Test	27.90	28.50	30.11	69
Post Test	5.30	5.20	30.12	76

Leak Rate	Tank * (in Hg)		Trap black ball reading
	Allowable	Actual	
Pre Test	1.05	0	0
Post Test	1.05	0	0

$$\Delta P = .01 \frac{F P_b \phi}{V_t}$$

ΔP = Pressure Change (in Hg)

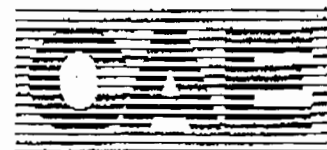
F = Sampling Flow Rate cc / min

P_b = Barometric Pressure (in Hg)

ϕ = Leak Check Time Period (min)

V_t = 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
1017	27.80	35	267	268	
1022	25.50	33	267	267	
1027	23.90	30	267	268	
1032	22.80	28	267	269	
1037	21.20	25	267	268	Adjust Flow
1042	19.80	35	267	268	✓
1047	17.40	35	267	268	
1052	15.20	33	267	268	
1057	13.10	35	267	268	
1102	11.40	35	267	268	
1107	9.20	33	267	268	
1112	7.30	30	267	268	
1117	5.40	35	267	268	



Volatile Organic Carbon by Method 25

Client: <u>Florida GAS</u>	Project #: <u>Engine 2</u>
Plant: <u>Melbourne</u>	Sample Location: <u>Stack</u>
Operator: <u>JR LF BK</u>	Date: <u>3-27-92</u>
Run Number: <u>C-5</u>	Sample ID: _____
Tank Number: <u>4 T 197</u>	Trap Number: <u>B 233</u>
Sampling Train ID#: <u>2610</u>	% CO ₂ : <u>4.5</u>
Side: Left / Right: <u>sample-1</u>	% H ₂ O: <u>0.1</u>
Start Time: <u>1120</u>	Stop Time: <u>1220</u>

Pressure Readings	Tank Vacuum		Barometric Pressure mm Hg / in Hg	Ambient Temperature C/F
	Manometer mm Hg / in Hg	Gauge mm Hg / in Hg		
Pre Test	28.00	29.00	30.12	82
Post Test	3.40	3.80	30.12	82

Leak Rate	Tank* (in Hg)		Trap black ball reading
	Allowable	Actual	
Pre Test	1.05	0	0
Post Test	1.05	0	0

$$\Delta P = .01 \frac{F P_b \alpha}{V_t}$$

ΔP = Pressure Change (in Hg)

F = Sampling Flow Rate cc / min

P_b = Barometric Pressure (in Hg)

α = Leak Check Time Period (min)

V_t = 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
1120	27.90	35	267	265	
1125	25.90	35	267	266	
1130	23.80	35	267	266	
1135	21.90	35	267	266	
1140	19.80	35	267	267	
1145	17.60	35	267	267	
1150	15.50	35	267	268	
1155	13.70	35	267	268	
1200	11.80	35	267	269	
1205	9.90	35	267	269	
1210	7.70	35	267	271	
1215	5.80	35	267	271	
1220	3.90	35	267	271	



Client: <u>Florida GAS TRANS</u>	Project #:
Plant: <u>Melbourne</u>	Sample Location: <u>Stack Eng 2</u>
Operator: <u>SR, LF, RK</u>	Date: <u>3/27/92</u>
Run Number: <u>056</u>	Sample ID:
Tank Number: <u>4T-119</u>	Trap Number: <u>NO 8</u>
Sampling Train ID#:	% CO2: <u>4.8</u>
Side: Left / Right: <u>Sample-1</u>	% H2O: <u>8.3</u>
Start Time: <u>1230</u>	Stop Time: <u>1330</u>

Pressure Readings	Tank Vacuum		Barometric Pressure mm Hg / in Hg	Ambient Temperature C/F
	Manometer mm Hg / in Hg	Gauge mm Hg / in Hg		
Pre Test	27.90	29.50	30.12	82
Post Test	4.90	5.20	30.12	84

Leak Rate	Tank (in Hg)		Trap black ball reading
	Allowable	Actual	
Pre Test	1.05	0	0
Post Test	1.05	0	0

$$\Delta P = .01 \frac{F P_b \theta}{V_t}$$
 ΔP = Pressure Change (in Hg)
 F = Sampling Flow Rate cc / min
 P_b = Barometric Pressure (in Hg)
 θ = Leak Check Time Period (min)
 V_t = 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
1230	29.00	35	267	267	
1235	27.20	35	267	267	
1240	25.00	35	267	267	
1245	23.30	35	267	267	
1250	21.40	35	267	267	
1255	19.60	35	267	267	
1300	17.90	35	267	267	
1305	15.60	35	267	267	
1310	13.40	35	267	267	
1315	11.50	35	267	267	
1320	9.40	35	267	267	
1325	7.30	35	267	267	
1330	5.00	35	267	267	



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CHAIN OF CUSTODY RECORD

PROJ. NO.		PROJECT NAME				NO. OF CONTAINERS	CO ₂ BLANK VALUE (PPHM)				REMARKS
DEPT. NO.											
8151		Cubix Corp									
SAMPLERS: (Signature)		Joseph Rudyk									
LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION							
→	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		X1		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	N15		8.7					Munson - Fla. GAS ✓
	C-1	3/28/92	1100	N19		3.0					Caryville Fla. GAS ✓
Relinquished by: (Signature)		Date / Time		Received by: (Signature)		Relinquished by: (Signature)		Date / Time		Received by: (Signature)	
[Signature]		4/1/92 142		[Signature]		[Signature]		[Signature]		[Signature]	
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Relinquished by: (Signature)		Date / Time		Received for Laboratory		Date / Time					
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REMARKS:											



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 Palatine, IL 60067
 708/991-3300

4337

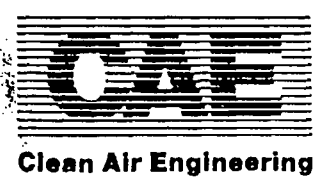
CHAIN OF CUSTODY RECORD

PROJ. NO.		PROJECT NAME				NO. OF CONTAINERS	REMARKS				
DEPT. NO.		Cubix Corp									
SAMPLERS: (Signature)		Joseph Rudyk				UHHC BLANK VALUE (ppmv)					
LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION							
	Audit-2	3/26/92		TANK # 4T107	0.1					Melbourne	
	C-2	3/23/92	1713	4T108	0.1					Brooker - Fla. GAS ✓	
	C-1	3/20/92	830	4T119	0.2					Perry Fla. GAS ✓	
	C-6	3/27/92	15	4T119	0.7					Melbourne	
	C-1	3/23/92	526	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 ✓	
	CA	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	
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Relinquished by: (Signature)		Date / Time		Received by: (Signature)		Date / Time		Received by: (Signature)			
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Relinquished by: (Signature)		Date / Time		Received for Laboratory Use		Date / Time					
[Signature]											



PROJ. NO.		PROJECT NAME				NO. OF CONTAINERS	REMARKS			
DEPT. NO.										
SAMPLERS: (Signature)										
LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION						
				TANK # 4T206	1.1					
	C-2	3/19/92	1020	4T210	0.7				Quincy - Fla GAS ?	
				4T217	0.4					
	C-2	3/17/92	1530	4T222	0.0				MUNSON - Fla GAS ✓	
	C-1	3/17/92	1425	4T238	1.6				MUNSON - Fla GAS ✓	
	C-1	3/18/92	1100	4T248	0.3				Caryville Fla. GAS ✓	
	C-3	3/17/92	1643	4T254	0.1				MUNSON - Fla. GAS ✓	
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[Signature]				[Signature]						
REMARKS:										

NHHC
BLANK VALUE (ppmv)



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PROJ. NO.		PROJECT NAME				NO. OF CONTAINERS	REMARKS				
DEPT. NO.		SAMPLERS: (Signature)									
LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	CO ₂	Blank value (ppmv)	WHITE	BLACK value (ppmv)			
81515		Cubic Corp				Joseph Rudyk					
	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 ✓		
				VWR	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	0.6				Silver Springs - Fla GAS ✓		
	C-3	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 by: (Signature)		Relinquished by: (Signature)		Date / Time		Received by: (Signature)	
[Signature]				[Signature]		[Signature]				[Signature]	
Relinquished by: (Signature)		Date / Time		Received for Laboratory by:		Date / Time					
[Signature]				[Signature]							
REMARKS:											



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 708/991-3300

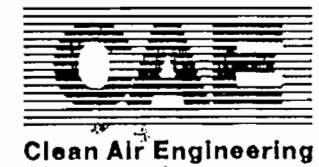
4334

CHAIN OF CUSTODY RECORD

PROJ. NO.		PROJECT NAME				NO. OF CONTAINERS	REMARKS				
DEPT. NO.		SAMPLERS: (Signature)									
8151		Cubix Corp.				COB	BLANK VALUE (ppmv)				
		Joseph Rudyk									
LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION							
	C-1	3/26/92	830	TAP # B35		3.0				Melbourne - Fla. GAS ✓	
	C-2	3/7/92	1530	B53		4.5				MUNSON - Fla. GAS ✓	
	C-5	3/24/92		B233		1.3				Melbourne	
	C-2	3/24/92	1130	C1		2.4				Silver Springs - Fla. GAS ✓	
	C-1	3/19/92	900	C3		3.5				Quincy - Fla. GAS ✓	
	Audit 2	3/24/92		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	3/6/92	955	C37		0.8				Melbourne - Fla. GAS ✓	
	C-2	3/28	1300	R002		7.5				Coarney with C - PGM	
				R004		1.2					
				R008		2.5					
				X1		2.6					
	C-1	3/20/92	830	X10		2.5				Perry - Fla. GAS ✓	

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REMARKS:



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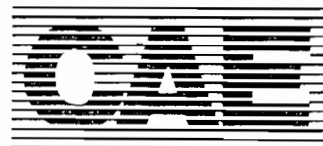
Table of Carbon Concentration for Method 25.
 Samples collected by Cubix Corp. at Florida
 Gas & Trans on 3/26/92 and reported on 4/30/92.

Source	Sample - Run ID #	Carbon Concentration			
		Total (Mc) (mg/dscm)	Total (C) (ppmv)	Conden- sible (Ccm) (ppmv)	Noncon- densible (Ctm) (ppmv)
MELBUORNE STATION	C-1	216.4	433.4	419.1	14.4
	C-2 *	632.8	1267.5	1255.6	11.9
	C-3	182.9	366.2	361.4	4.9

Compiled By: *Skripal Jay* On: 5-1-92

Approved By: *B.I.* On: 5/2/92

* Sample leaked during preparation, which could cause high results.



Job No. 8160
 Client Cubix
 Disk/File 8160M1
 Page No. 2

Plant: Florida Gas & Trans.
 Sample Loc. Melbourne Station
 (In/Out) Engine #1
 Date 3/26/92

Preliminary Data-----

Run No.	C-1	C-2	C-3
Tank No.	4T194	4T103	4T41
Trap No.	B35	C37	X32
Tank Volume V(cc)	4034	4016	4022

Field Data-----

PTI (mm Hg)	-711	-711	-716
TTI (F)	69	73	78
PbI (mm Hg)	761	762	762
PT (mm Hg)	-168	-163	-163
TT (F)	72	78	84
Pb (mm Hg)	762	762	762

Noncondensable Organics-----

PT(Lab) (mm Hg)	-202	-200	-192
TT(Lab) (F)	77	77	77
Pb(Lab) (mm Hg)	743	743	743
PTF (mm Hg)	936	922	948
TTF (F)	77	77	77
PbF (mm Hg)	743	743	743
Ba (ppmv C)	0.1	0.5	2.1
Ctm 1 (ppmv C)	4.4	4.4	3.7
Ctm 2 (ppmv C)	5.3	4.8	4.0
Ctm 3 (ppmv C)	4.7	4.0	3.3
Avg. Ctm (ppmv C)	4.8	4.4	3.7
RSD Ctm (%)	9.5	9.1	9.6

Condensable Organics-----

ICV Tank No.	4T5	4T224	4T120
ICV Tank, Vv (cc)	4008	4262	4043
PFI (mm Hg)	-736	-734	-728
TFI (F)	77	77	77
PbFI (mm Hg)	743	743	743
PF (mm Hg)	924	922	920
TF (F)	77	77	77
PbFf (mm Hg)	743	743	743
Bt (ppmv C)	3.0	0.8	3.3
Ccm 1 (ppmv C)	141.1	381.2	124.0
Ccm 2 (ppmv C)	143.5	387.8	121.4
Ccm 3 (ppmv C)	141.0	398.4	118.2
Avg. Ccm (ppmv C)	141.9	389.1	121.2
RSD Ccm (%)	1.0	2.2	2.4

Total Gaseous Nonmethane Organics (TGNMO)=====

Vs (cc)	2866	2841	2839
Dil. Factor (Non)	3.059	3.047	3.101
Dil. Factor (Con)	3.018	3.233	3.065
Ct (ppmv C)	14.4	11.9	4.9
Cc (ppmv C)	419.1	1255.6	361.4
Ct+Cc= C (ppmv C)	433.4	1267.5	366.2
Mc (mg C/dscm)	216.4	632.8	182.9

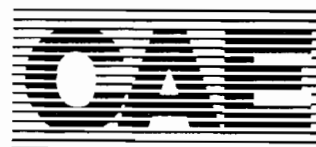


Table of Carbon Concentration for Method 25.
 Samples collected by Cubix Corp. at Florida
 Gas & Trans on 3/27/92 and reported on 4/30/92.

Source	Sample - Run ID #	Carbon Concentration			
		Total (Mc) (mg/dscm)	Total (C) (ppmv)	Conden- sible (Ccm) (ppmv)	Noncon- densible (Ctm) (ppmv)
MELBUORNE STATION	C-4	130.4	261.1	192.6	68.4
	C-5	158.5	317.5	254.5	63.1
	C-6	164.5	329.5	264.9	64.6

Compiled By: Stanford Gray On: 5-1-92

Approved By: B.L. On: 5/1/92 Page 1



Job No. 8160
 Client Cubix
 Disk/File 8160M2
 Page No. 2

Plant: Florida Gas & Trans.
 Sample Loc. Melbourne Station
 (In/Out) Engine #2
 Date 3/27/92

Preliminary Data-----

Run No.	C-4	C-5	C-6
Tank No.	4T193	4T197	4T119
Trap No.	XY	B233	NO 8
Tank Volume V(cc)	4006	3967	4043

Field Data-----

PTI (mm Hg)	-709	-711	-709
TTI (F)	69	82	82
PbI (mm Hg)	765	765	765
PT (mm Hg)	-135	-86	-124
TT (F)	76	82	84
Pb (mm Hg)	765	765	765

Noncondensable Organics-----

PT(Lab) (mm Hg)	-162	-134	-164
TT(Lab) (F)	78	77	77
Pb(Lab) (mm Hg)	750	750	750
PTF (mm Hg)	926	928	930
TTF (F)	77	77	77
PbF (mm Hg)	750	750	750
Ba (ppmv C)	0.2	0.1	0.7
Ctm 1 (ppmv C)	24.8	23.7	22.4
Ctm 2 (ppmv C)	22.9	23.2	22.2
Ctm 3 (ppmv C)	23.3	23.2	24.0
Avg. Ctm (ppmv C)	23.7	23.4	22.9
RSD Ctm (%)	4.2	1.2	4.3

Condensable Organics-----

ICV Tank No.	4T188	4T252	4T80
ICV Tank, Vv (cc)	3971	4260	4047
PFI (mm Hg)	-740	-740	-740
TFI (F)	78	77	77
PbFI (mm Hg)	750	750	750
PF (mm Hg)	920	922	930
TF (F)	77	77	77
PbFf (mm Hg)	750	750	750
Bt (ppmv C)	2.3	1.3	2.6
Ccm 1 (ppmv C)	68.8	88.8	92.9
Ccm 2 (ppmv C)	69.9	89.0	91.9
Ccm 3 (ppmv C)	68.8	89.3	95.4
Avg. Ccm (ppmv C)	69.2	89.0	93.4
RSD Ccm (%)	0.9	0.3	1.9

Total Gaseous Nonmethane Organics (TGNMO)=====

Vs (cc)	2979	3179	3017
Dil. Factor (Non)	2.917	2.710	2.914
Dil. Factor (Con)	2.881	2.900	2.917
Ct (ppmv C)	68.4	63.1	64.6
Cc (ppmv C)	192.6	254.5	264.9
Ct+Cc= C (ppmv C)	261.1	317.5	329.5
Mc (mg C/dscm)	130.4	158.5	164.5



**APPENDIX B:
EXAMPLE CALCULATIONS**

MOISTURE CONTENT

refers to test run C-1

$$V_1 = \text{initial dry gas meter reading} = 913.010 \text{ ft}^3$$

$$V_2 = \text{final dry gas meter reading} = 938.500 \text{ ft}^3$$

$$V_{\text{net}} = \text{total gas sample volume collected (ft}^3\text{)}$$

$$= V_2 - V_1$$

$$= 938.5 - 913.01 = 25.49 \text{ ft}^3$$

$$M_1 = \text{initial weight of impinger train} = 2455.1 \text{ g}$$

$$M_2 = \text{final weight of impinger train} = 2502.3 \text{ g}$$

$$\text{MWC} = \text{total weight gain of all impingers (g)}$$

$$= M_2 - M_1 = 2502.3 - 2455.1$$

$$= 47.2 \text{ g}$$

$$K_d = \text{dry gas meter factor (unitless)} = 0.9904$$

$$V_{\text{corrected}} = V_{\text{net}} \times K_d = x$$

$$= 25.49 \times 0.9904 = 25.245 \text{ ft}^3$$

1.335 liters weighs 1 gram at standard conditions

499.4 = Gas constant

$$P_{\text{bar}} = \text{barometric pressure (in Hg)} = 29.96$$

$$T = \text{temperature of gas DGM (F}^\circ\text{)} = 103$$

F_w = moisture fraction by volume

volume H₂O collected in impingers

= vol. H₂O collected + volume gas dry gas collected

MWC x 1.335

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

$$= \frac{(47.2 \times 1.335)}{$$

$$(47.2 \times 1.335) + (((25.245 \times 29.96) / (103 + 460)) \times 499.4)}$$

$$= 0.086 \text{ moisture}$$

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 = 5.0(from Orsat)

C_{O_2} = concentration of O_2 = 12.0(from Orsat)

C_{N_2} = concentration of N_2 = $1 - (C_{CO_2} + C_{O_2}) = 0.83$

F_w = moisture fraction = 0.0860

F_d = dry gas fraction = $1 - F_w = 0.914$

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

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

$$= (18 \times 0.0860) + (0.914 \times ((44 \times 0.050) + (32 \times 0.120) + (28 \times 0.83)))$$

$$= 28.31 \text{ lb/lb-mole}$$

STACK GAS VELOCITY AND FLOW RATE

refers to test run C-1

$$\begin{aligned}K_p &= \text{pitot tube factor} = .84 \\ \Delta P &= \text{pressure difference in stack as measured (in. H}_2\text{O)} \\ (\sqrt{\Delta P})_{\text{avg}} &= \text{average of square root of } \Delta P\text{'s} = 1.208 \\ T_s &= \text{stack temperature} = 652 \text{ F}^\circ = 1112 \text{ R}^\circ \\ P_b &= \text{atmospheric pressure (in Hg)} = 29.96 \\ P_g &= \text{stack static pressure (in. H}_2\text{O)} = 2.0 \\ P_s &= \text{absolute stack pressure} \\ &= P_b + (P_g \times .0735 \text{ in.Hg / in.H}_2\text{O}) = 30.107 \text{ in. Hg}\end{aligned}$$

$$V = \text{stack velocity (ft/min)}$$

$$\begin{aligned}&= 5128.8 \times K_p \times (\sqrt{\Delta P})_{\text{avg}} \times \sqrt{(T_s / (P_s \times MW))} \\ &= 5128.8 \times .84 \times 1.208 \times \sqrt{(1112 / (30.107 \times 28.31))} \\ &= 5944.43 \text{ ft/min}\end{aligned}$$

$$Q_a = \text{stack flow rate (ft}^3\text{/min)}$$

$$\begin{aligned}&= V \times A, \text{ where } A = \text{area of stack} = 3.01 \text{ ft}^2 \\ &= 5944.43 \times 3.012 = 17904.62 \text{ ft}^3\text{/min}\end{aligned}$$

$$Q_d = \text{stack flow rate on dry basis at standard conditions (SCFH)}$$

$$\begin{aligned}&= Q_a \times 1059 \times (P_s / T_s) \times F_d \\ &= 17904.62 \times 1059 \times (30.107 / 1112) \times 0.914 \\ &= 4.69 \times 10^5 \text{ SCFH}\end{aligned}$$

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

$$\begin{aligned}Q_f &= \text{estimated fuel flow} = 16730 \text{ SCF/hr} \\F_{\text{BTU}} &= \text{heating value of gas} = 1022 \text{ BTU/SCF} \\F &= \text{O}_2 \text{ F factor} = 8635 \text{ SCF/MMBTU} \\C_{\text{O}_2} &= \text{concentration of O}_2 = 12.20 \%(\text{from analyzer})\end{aligned}$$

$$\begin{aligned}Q_d &= \text{stack flow rate on dry basis at standard conditions (SCFH)} \\&= Q_f \times F_{\text{BTU}} \times 10^{-6} \times F \times 20.9 / (20.9 - C_{\text{O}_2}) \\&= 16730 \times 1022 \times 10^{-6} \times 8635 \times 20.9 / (20.9 - 12.20) \\&= 3.55 \times 10^5 \text{ SCFH}\end{aligned}$$

With CO₂ F-factor (i.e. F=1022), same calculation is used except for final term.....

$$\begin{aligned}Q_d &= Q_f \times F_{\text{BTU}} \times 10^{-6} \times F \times 100/C_{\text{CO}_2} \\&= 16730 \times 1022 \times 10^{-6} \times 1022 \times 100/5.04 \\&= 3.47 \times 10^5 \text{ SCFH}\end{aligned}$$

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

MASS EMISSION RATES

refers to test run C-1

$\text{NO}_x = \text{concentration of NO}_x = 136 \text{ ppmv}$

$\text{CO} = \text{observed concentration of CO} = 342 \text{ ppmv}$

$\text{VOC} = \text{observed concentration via EPA Method 25 and 18}$
 $= 43.0 \text{ ppmv}$

$1 \text{ SCF NO}_x = 11.94 \times 10^{-8} \text{ lbs}$

$1 \text{ SCF CO} = 7.26 \times 10^{-8} \text{ lbs}$

$1 \text{ SCF C1(methane)} = 4.15 \times 10^{-8} \text{ lbs}$

$Q_d = \text{stack flow rate} = 4.69 \times 10^5 \text{ SCFH}$

$E_{\text{NO}_x} = \text{mass emission rate of NO}_x \text{ (lb/hr)}$

$$= \text{NO}_x \times Q_d \times 11.94 \times 10^{-8}$$

$$E_{\text{NO}_x} = 136 \times 4.69 \times 10^5 \times 11.94 \times 10^{-8}$$

$$E_{\text{NO}_x} = 7.61 \text{ b/hr}$$

$$E_{\text{CO}} = 11.64 \text{ lb/hr}$$

$$E_{\text{VOC}} = 0.836 \text{ lb/hr}$$

$\text{HP} = \text{engine horsepower} = 2708 \text{ hp}$

$454 \text{ g} = 1.0 \text{ lb}$

$$E_{\text{NO}_x} \text{ (g/hp-hr)} = E_{\text{NO}_x} \times 454 / \text{HP}$$
$$= 7.61 \times 454 / 2708$$

$$E_{\text{NO}_x} \text{ (g/hp-hr)} = 1.275 \text{ g/hp-hr}$$

$$E_{\text{CO}} \text{ (g/hp-hr)} = 1.95 \text{ g/hp-hr}$$

$$E_{\text{VOC}} \text{ (g/hp-hr)} = 0.140 \text{ g/hp-hr}$$

Stack Gas Flow Rate via AGA Carbon Balance Method

Refers to Test Run #C-1

$$\begin{aligned} Q_f &= \text{fuel flow} = 16730 \text{ SCF/hr} \\ C_f &= \text{carbon content of fuel (from fuel analysis)} = 1.023 \\ C_e &= \text{exhaust gas carbon content} \\ &= \text{CO} + \text{THC (as C1)} + \text{CO}_2 \\ &= (342 + 1242) / 10000 + 5.04 = 5.198 \% \end{aligned}$$

$$\begin{aligned} Q &= \text{stack flow rate} \\ &= Q_f \times C_f \times 100 / C_e \\ &= 16730 \times 1.023 \times 100 / 5.198 \\ &= 3.29 \times 10^5 \text{ SCFH} \end{aligned}$$

SO2 Emission Rate from Fuel Analysis

Refers to Test Run #C-1

S = sulfur content of fuel = 0.107 grains/100 DSCF

7000 grains = 1.0 lb

$Q_f = 16730$ SCF/hr

SO2 = mass emission rate of SO2

= $S / 100 / 7000 \times Q_f$

= $0.107 / 100 / 7000 \times 16730$

= 0.0026 lbs/hr

Moisture Content via Stoichiometry

Refers to test run #1

H = Ambient humidity (via psychrometer) = 0.0107 lb/lb air

O₂ = O₂ concentration in stack = 12.20%

F = wet basis O₂ F-factor (from fuel calcs)

= 10643 SCF/MMBTU

FW = moisture F-factor = 2008 SCF of H₂O/MMBTU

CM = combustion moisture % at 0% O₂

= $F_w / F \times 100 = 2008 / 10643 \times 100$

= 18.86 %

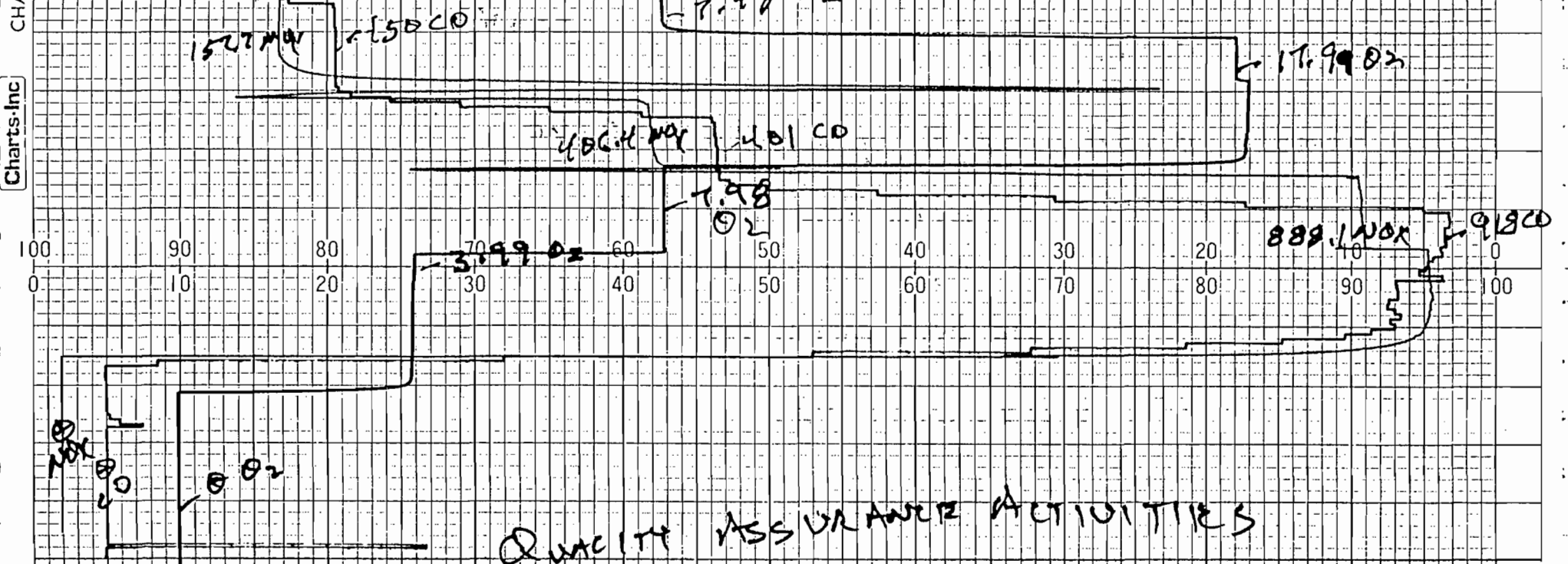
F_w = moisture content

= $(CM \times (20.9 - O_2) / 20.9) + (H \times 64.3)$

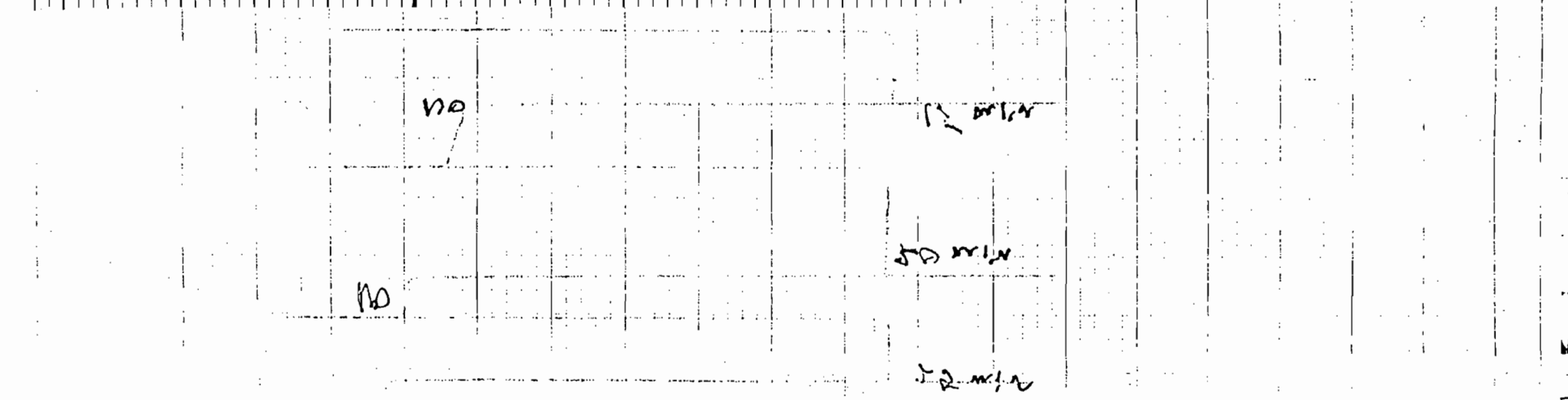
= $(18.86 \times (20.9 - 12.20) / 20.9) + (.0107 \times 64.3)$

= 8.54%

**APPENDIX C:
QUALITY ASSURANCE ACTIVITIES**



QUALITY ASSURANCE ACTIVITIES
 FLORIDA GENCO TRANSMISSION
 MELBOURNE COMPRESSOR STATION
 3/25/92



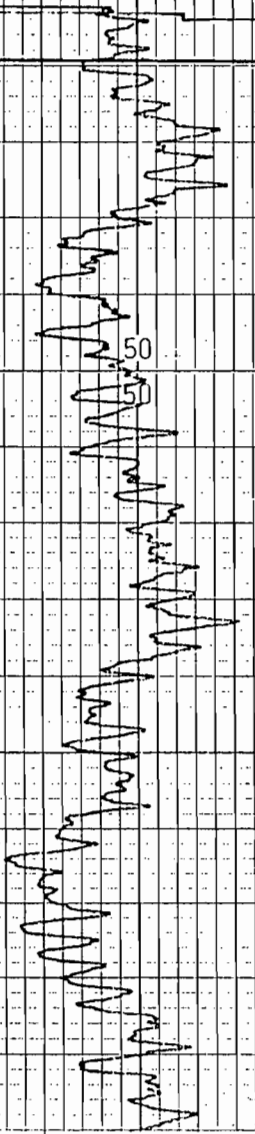
157.7 NO_x - 7 hrs
ppm hr

NO_x SAMPLER SYSTEM BITS CHECK
(AFTER TEST)

157.7 NO_x - 7 hrs
ppm hr

7.98 O₂

NO C-6 1334



NO_x = 92.0
CO = 33.9
O₂ = 12.5

100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100

160cm

NO. RN2-01-25-20M

(6334)

NO

20 min

NO

15 min

NO

10 min

NO

5 min

NO in air

100 90 80 70 60 50 40 30 0 10 20 30 40 50 60 70 80 90 100

NO

NOx CONVERTER EFFICIENCY CHECK

NOx thru probe

NOx direct

SAMPLE SYSTEM BIAS CHECK (NOx)

3.9902

1.1802

400cm (6334)

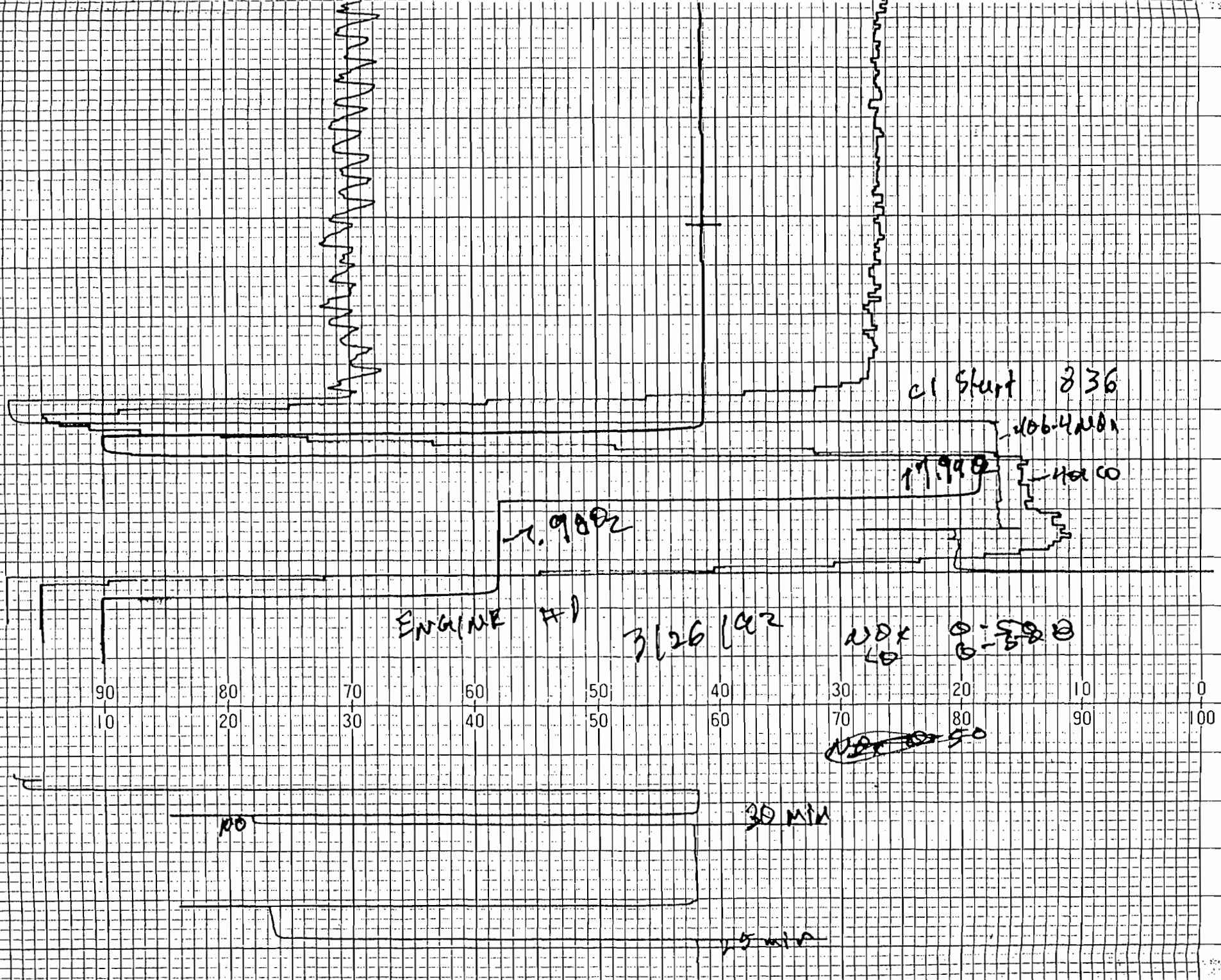
ART NO. RN2-01-25-20M

(6334)

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



ENGINE #1

3/26/62

1.9802

ci Start 836

406.4 WPM

11.990

406 CO

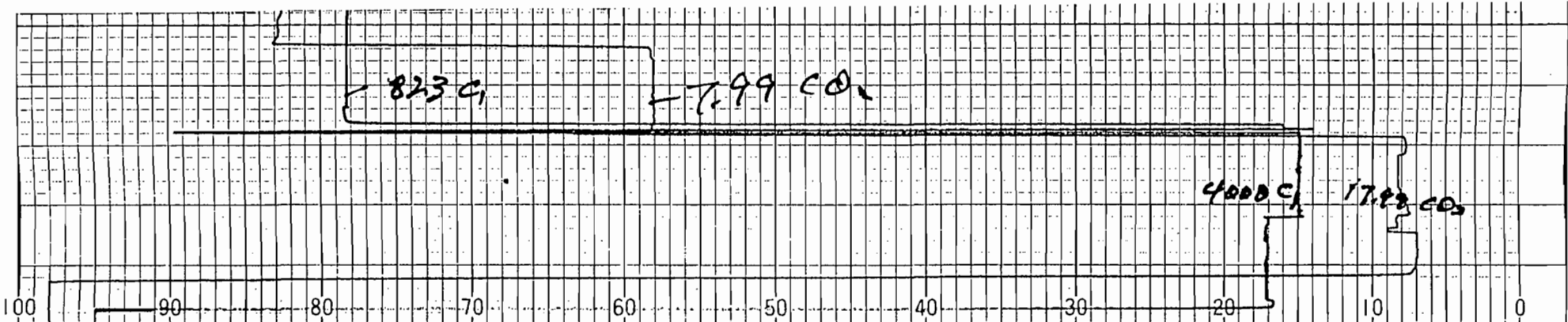
ADK 40

0-500
0-500

30 MIN

25 MIN

PO



MULTI POINT LINEARITY CHECK

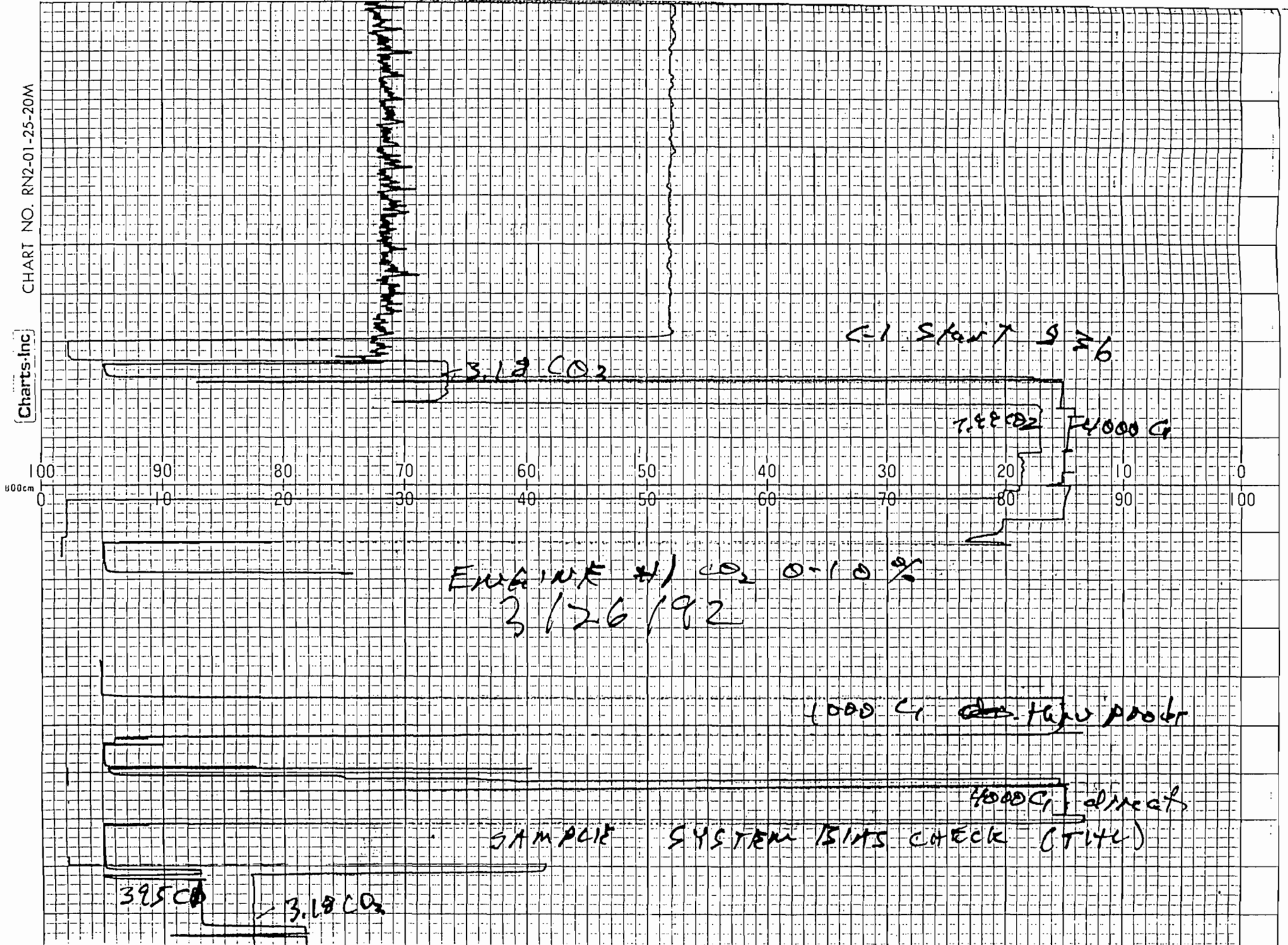
CO₂ @ TIC

Initial Ranges
 CO₂ = 0 - 20%
 TIC = 0 - 5000 ppm
 (as C₁)

QUALITY ASSURANCE ACTIVITIES

FLORIDA GAS TRANSMISSION
 MELBOURNE COMPRESSOR STATION

3/25/92



C-1 Start 9 26

3.18 CO₂

7.48 CO₂ 4000 C

ENGINE #1 CO₂ 0-10%
3/26/92

1000 C air thru probe

4000 C direct

SAMPLE SYSTEM BITS CHECK (TITLE)

395 C 3.18 CO₂

3.13 CO₂

4000 Ci through

299 CO₂

4000 Ci direct

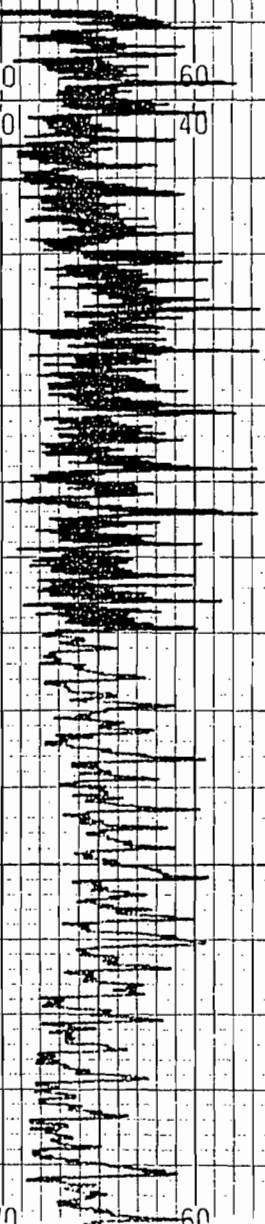
THC SAMPLE SYSTEM BIAS CHECK
AFTER TEST

END C-6

13340

0

100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100



CO₂ = 4.82
THC = 1.525

6334

CHART NO. RN2-01-25-20M

Charts-inc

100 90 80 70 60 50 40 30 20 10 0

Quality Assurance Worksheet: Melbourne Compressor Station

	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	2.0	0.0	136.0	2.3	0.3	141.0	2.0	0.0	147.0	2.2	0.2
low	157.7	17.8	17.8	0.0	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	406.4	42.6	41.9	-0.7	29.2	81.6	-1.7	30.2	83.4	0.1	31.4	84.0	0.7
high	888.1	90.8	90.7	-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	342.0	5.0	0.0	345.0	5.0	0.0	355.0	5.0	0.0
low	150.0	20.3	20.6	0.3	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	401.0	45.3	46.3	1.0	73.4	85.6	0.4	74.0	85.2	0.0	76.0	85.4	0.2
high	918.0	96.5	96.5	0.0		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	10.0	0.0	12.20	10.0	0.0		10.1	0.1	11.90	10.1	0.1
low	3.99	26.0	26.1	0.1	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	7.98	41.9	42.5	0.6	58.8	42.3	0.4	10.0	42.4	0.5	57.6	42.3	0.4
high	17.90	81.6	82.1	0.5		82.0	0.4		82.0	0.4		82.0	0.4
full scale	25.0				25.0			25.0			25.0		
CO2					Avg.%			Avg.%			Avg.%		
zero	0.0	2.0	2.0	0.0	5.04	2.2	0.2	5.10	2.0	0.0	5.08	2.0	0.0
low	3.18	17.8	17.4	-0.4	% Chart	33.0	-0.8	% Chart	33.2	-0.6	% Chart	33.0	-0.8
mid	7.99	42.0	41.9	-0.1	52.4	82.9	1.0	53.0	81.4	-0.5	52.8	81.2	-0.7
high	17.99	92.0	91.8	-0.1		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	1135	5.0	0.0	1195	5.0	0.0	1140	6.8	1.8
low	395	12.9	13.1	0.2	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	823	21.5	21.8	0.3	27.7	n.a.	n.a.	28.9	n.a.	n.a.	27.8	n.a.	n.a.
high	4000	85.0	85.0	0.0		84.4	-0.6		85.7	0.7		86.7	1.7
full scale	5000				5000			5000			5000		

Quality Assurance Worksheet: Melbourne Compressor Station

	CERTIFIED GAS INPUT		TEST RUN #C4	ZERO and SPAN CALIBRATION CHECK		TEST RUN #C5	ZERO and SPAN CALIBRATION CHECK		TEST RUN #C6	ZERO and SPAN CALIBRATION CHECK	
	Concentration (% or ppm)	Target (% 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	66.0	2.0	0.0	79.4	1.8	-0.2	92.0	2.1	0.1
low	157.7	17.8	% Chart	n.a.	n.a.	% Chart	81.6	0.8	% Chart	81.0	0.2
mid	406.4	42.6	15.2	81.4	-1.9	41.7	n.a.	n.a.	48.0	n.a.	n.a.
high	888.1	90.8		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	1000.0		500.0			200.0			200.0		
CO			Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	5.0	334.0	5.0	0.0	340.0	5.0	0.0	339.0	5.0	0.0
low	150.0	20.3	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	401.0	45.3	71.8	85.4	0.2	73.0	85.4	0.2	72.8	85.5	0.3
high	918.0	96.5		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	12.53	10.0	0.0	12.48	10.0	0.0	12.50	10.0	0.0
low	3.99	26.0	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	7.98	41.9	60.1	42.3	0.4	59.9	42.3	0.4	60.0	42.2	0.3
high	17.90	81.6		82.2	0.6		82.2	0.6		82.1	0.5
full scale	25.0		25.0			25.0			25.0		
CO2			Avg.%			Avg.%			Avg.%		
zero	0.0	2.0	4.85	2.0	0.0	4.74	2.0	0.0	4.82	2.1	0.1
low	3.18	17.8	% Chart	32.9	-0.9	% Chart	32.8	-1.0	% Chart	33.1	-0.7
mid	7.99	42.0	50.5	83.2	1.3	49.4	81.6	-0.3	50.2	81.2	-0.7
high	17.99	92.0		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	1350	5.0	0.0	1550	5.0	0.0	1525	5.0	0.0
low	395	12.9	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	823	21.5	32.0	n.a.	n.a.	36.0	n.a.	n.a.	35.5	n.a.	n.a.
high	4000	85.0		84.7	-0.3		86.1	1.1		86.0	1.0
full scale	5000		5000			5000			5000		

TR 7

Environmental Instruments Division

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

INTERFERENCE RESPONSE TEST

DATE OF TEST JAN 20, 1992

ANALYZER TYPE 10AAS RANGE 0-25PPM SERIAL NO. 105-19481-184

<u>TEST GAS TYPE</u>	<u>CONCENTRATION PPM</u>	<u>ANALYZER OUTPUT RESPONSE</u>	<u>% OF SPAN</u>
<u>CO</u>	<u>500</u>	<u>< .1 PPM</u>	<u>< .1%</u>
<u>CO₂</u>	<u>201</u>	<u>< .1 PPM</u>	<u>< .1%</u>
<u>CO₂</u>	<u>10%</u>	<u>< .1 PPM</u>	<u>< .1%</u>
<u>O₂</u>	<u>20.9%</u>	<u>< .1 PPM</u>	<u>< .1%</u>

Continuous Emission Analyzer Interference Response Tests

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

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

Test Gas		Analyzer Response		Response Ratio
Type Gas	Concentration	Concentration ppm _v	% of Range	
Air	CO Free	0.0	N/A	0.000
CO ₂ /O ₂	4% / 18%	0.0	 ↓	-0.017 / -0.025
CO ₂ /O ₂	12% / 8%	-0.2		-0.014 / -0.100
CO ₂ /O ₂	21% / 3%	-0.3		CO Impurity?
Air	Dry	0.4		0.002
NO _x	176 ppm _v	0.4		0.0001
NO _x	3030 ppm _v	0.4		0.0005
SO ₂	401 ppm _v	-0.2		0.002
Propene	240 ppm _v	0.4		

↑
 all interferences are
 negligible

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.: G-3 Dia-pump

Analyzer: NOx Analyzer

Oxygen Analyzer

Model: TECO 10AR

Telodyne 320 AX

Range: 0-1000 ppm

0-25%

Span Gas: 900 ppm NO_x

Air = 20.9% O₂

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

Instrumental Analysis
Quality Assurance Data

Date: 3/25/92
 Plant: FGT MELBOURNE COMPRESSION STATION
 Technician: LFJR R/c

NOx Analyzer: NO2 to NO Converter Efficiency Test

NO Calibration Gas: 688.1 ppm
 Diluent Gas: Air (20.9% oxygen)

	NOx Concentration (ppm)	% Decrease from Initial Concentration	NO Concentration (ppm)
Initial Concentration	<u>568</u>	<u>n.a.</u>	<u>425</u>
10 minute Concentration	<u>563</u>	<u>0.9</u>	<u>370</u>
20 minute Concentration	<u>559</u>	<u>1.6</u>	<u>230</u>
30 minute Concentration	<u>558</u>	<u>1.8</u>	<u>199</u>

Sampling System Bias Check

	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	_____	_____	_____	_____	_____
before NOx	<u>406.4</u>	<u>1000</u>	<u>408.0</u>	<u>405.0</u>	<u>-0.3%</u>
S02	_____	_____	_____	_____	_____
after NOx	<u>157.7</u>	<u>200</u>	<u>158</u>	<u>158</u>	<u>0%</u>
before THC	<u>4000</u>	<u>5000</u>	<u>4600</u>	<u>4000</u>	<u>0%</u>
after THC	<u>4000</u>	<u>5000</u>	<u>4050</u>	<u>3925</u>	<u>-2.5%</u>

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

* NOTE: Equation per EPA Method 6C (40 CFR 60, Appendix A)

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.

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

Compiled By: *Kingfred King* On: 5-1-92

Approved By: *S.C.* 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

Noncondensable Organics-----

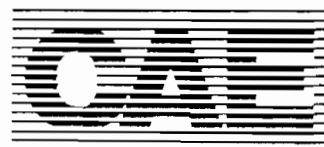
PT(Lab) (mm Hg)	24	4
TT(Lab) (F)	78	78
Pb(Lab) (mm Hg)	734	734
PTF (mm Hg)	924	920
TTF (F)	78	78
PbF (mm Hg)	734	734
Ba (ppmv C)	0.2	0.1
Ctm 1 (ppmv C)	56.3	642.8
Ctm 2 (ppmv C)	56.7	627.8
Ctm 3 (ppmv C)	56.9	639.3
Avg. Ctm (ppmv C)	56.6	636.6
RSD Ctm (%)	0.5	1.2

Condensable 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**



Scott Specialty Gases

BEST AVAILABLE COPY a division of
Scott Environmental Technology, Inc.

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

Shipped From : Scott Michigan

Our Project # : 520006

Your P.O. # : 91004

Customer :

CUBIX CORPORATION
1713 FORT VIEW ROAD
AUSTIN, TX. 78704

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

Certified Per Traceability Procedure # B1
Protocol # 1

File # POB274

Certified Accuracy 1 % NBS Traceable

Expiration Date : 8-18-92

Cylinder Number AAL-9912

Cylinder Pressure 1900 psig

COMPONENT	CERTIFIED CONC.	REFERENCE STD			GAS ANALYZER		ANALYTICAL PRINCIPLE
		SRM # (CRM #)	CYLINDER NUMBER	CONC.	MAKE/MODEL	LAST CALIBRATION DATE	
NITRIC OXIDE	157.7 PPM	1685	AAL-9851	236.0 PPM	BECKMAN	12-4-90	CHEMILUMINESCENCE
		6MIS	AAL-14484	145.3 PPM	951A		
		1684	ALM-003623	97.28 PPM			
BALANCE GAS : NITROGEN							
NITROGEN DIOXIDE	1.77 PPM						

EPA PROTOCOL

FIRST ANALYSIS				DATE : 2-11-91				SECOND ANALYSIS				DATE : 2-18-91				CALIBRATION CURVE 2 nd DEGREE					
ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC. (mV)	ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC. (mV)	ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC. (mV)	ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR	
0.00	53.30	157.4	236.0 PPM	80.00	236.0	158.0	236.0 PPM	80.00	53.50	158.0	236.0 PPM	80.00	53.50	236.0	1685	236.0	100	80.00	236.0	-0.00	
0.00	53.30	157.4	80.00	236.0	0.00	53.50	80.00	236.0	53.50	158.0	80.00	236.0	53.50	236.0		207.6	88	70.50	208.1	0.23	
0.00	53.30	157.4	80.00	236.0	0.00	53.50	80.00	236.0	53.50	158.0	80.00	236.0	53.50	236.0		145.3	62	49.10	145.1	-0.17	
					0.00	54.10 NOX			54.10 NOX	159.8			54.10 NOX	159.8	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	
CALCULATED RESULTS	157.4	157.4			CALCULATED RESULTS	158.0			CALCULATED RESULTS	158.0			CALCULATED RESULTS	158.0							
		157.4								158.0				159.8 PPM NOX		1684	97.28	LOW	33.00	97.54	0.27
AVERAGE : 157.4 PPM					AVERAGE : 158.0 PPM										1685	236.0	HIGH	80.00	236.0	-0.00	

* BMIS - GAS MANUFACTURER'S INTERNAL STANDARD. The responsibility of this Company for gas which fails to comply with this analysis shall be replacement the gas by the Company without extra cost.



Scott Specialty Gases

BEST AVAILABLE COPY a division of
Scott Environmental Technology, Inc.

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

Shipped From : Scott Michigan

Our Project # : 532228

Your P.O. # : 92 0000

Expiration Date : 7-21-93

Cylinder Number : AAL5112

Cylinder Pressure 1900 psig

1 of 1 Component(s)

Customer :

CUBIX CORPORATION
9225 LOCKHART HWY
AUSTIN TX 78747

*** CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ***

PERFORMED ACCORDING TO SECTION 3.0.4

Certified Per Traceability Procedure # G1

Protocol # 1

File # PD-2143

Certified Accuracy 1 % NPS Traceable

ANALYZED CYLINDER

REFERENCE STD

INSTRUMENTATION

COMPONENT	CERTIFIED CONC.	SRM # (CRM #)	CYLINDER NUMBER	CONC.	INSTR/MODEL/SERIAL #	LAST CALIBRATION DATE
NITRIC OXIDE	406.4 PPM	1687	ALM-014665	965.5 PPM	BECKMAN	1-15-92
		1685	ALM-006700	250.3 PPM	951A	
270-082899B						

ANALYTICAL PRINCIPLE
CHEMILUMINESCENCE

BALANCE GAS : NITROGEN

NITROGEN DIOXIDE 0.00 PPM (FROM SECOND ANALYSIS)

FIRST ANALYSIS

DATE : 1-15-92

SECOND ANALYSIS

DATE : 1-21-92

CALIBRATION CURVE

1 ST DEGREE

ZERO (mV)	TEST (mV)	RESULTS PPM	REFERENCE GAS CONC.	(mV)	RESULTS PPM	ZERO (mV)	TEST (mV)	RESULTS PPM	REFERENCE GAS CONC.	(mV)	RESULTS PPM	SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
0.00	40.70	406.9	965.5 PPM	96.50	965.5	0.00	40.60	405.9	965.5 PPM	96.50	965.5	1684B	965.5	100	96.50	965.5	0.00
0.00	40.70	406.9		96.50	965.5	0.00	40.60	405.9		96.50	965.5		748.0	77	75.00	750.3	0.30
0.00	40.70	406.9		96.50	965.5	0.00	40.60	405.9		96.50	965.5		395.0	41	39.60	395.9	0.22
0.00	40.70	406.9		96.50	965.5	0.00	40.60	405.9		96.50	965.5	1685	250.3	26	25.10	250.7	0.16
						0.0000							0.0000			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

CALCULATED RESULTS
406.9
406.9
406.9

CALCULATED RESULTS
405.9
405.9
405.9 PPM NOX

AVERAGE : 406.9 PPM

AVERAGE : 405.9 PPM

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.

[Signature]



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

Our Project #: 519062

Your P.O. #: 90347

Expiration Date: 7-28-92

Cylinder Number: ALM-016031

Cylinder Pressure 1900 psig

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

ANALYZED. CYLINDER		REFERENCE STD			INSTRUMENTATION		ANALYTICAL PRINCIPLE
COMPONENT	CERTIFIED CONC.	SRM # (CRM #)	CYLINDER NUMBER	CONC.	INSTR/MODEL/SERIAL #	LAST CALIBRATION DATE	
NITRIC OXIDE	889.1 PPM	2631 GMIS*	FF-16175 HA-6840	2854 PPM 971.6 PPM	BECKMAN 951A	1-8-91	CHEMILUMINESCENCE
BALANCE GAS: NITROGEN							
NITROGEN DIOXIDE	5.82 PPM (FROM SECOND ANALYSIS)						

FIRST ANALYSIS					DATE: 1-21-91	SECOND ANALYSIS					DATE: 1-28-91	CALIBRATION CURVE					1st DEGREE				
ZERO (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC. (mV)	RESULTS PPM	ZERO (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC. (mV)	RESULTS PPM	ZERO (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC. (mV)	RESULTS PPM	SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DM (mV)	FITTED VALUE	PERCENT ERROR	
0.00	30.50	889.5	2854 PPM	98.00	2854	0.00	30.40	886.6	2854 PPM	98.00	2854	0.00	30.40	886.6	2631	2854	100	98.00	2854	0.00	
0.00	30.50	889.5	98.00	2854	0.00	30.40	886.6	98.00	2854	0.00	30.40	886.6	98.00	2854		1428	50	49.00	1428	-0.00	
0.00	30.50	889.5	98.00	2854	0.00	30.40	886.6	98.00	2854	0.00	30.40	886.6	98.00	2854		971.6	34	33.10	965.2	-0.66	
					0.00	30.60 NOX	892.5									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: *J. 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.

Best Available Copy



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

PROJECT #: 04-11057
PO #: 91105

AUSTIN
KEVUN JANCK

TX 78747-0000

CYLINDER #: ALM006621

ANALYTICAL ACCURACY: +-1%

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

ANALYTICAL METHOD: GRAV.MASTER GAS

DATE OF ANALYSIS: 6/03/91

ANALYST: John D McCulloch
ANALYST

APPROVED BY: [Signature]
SUPERVISOR

CERTIFIED

Best Available Copy



Scott Specialty Gases, Inc.

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

10/17/91

CUBIX CORPORATION
9225 LOCKHART HWY

PROJECT #: 04-13936
PO #: 910523

AUSTIN

TX 78747-0000

CYLINDER #: AAL9308

ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION	ANALYSIS 1 (MOLES) U/M
RBON 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:

ANALYST

APPROVED BY:

SUPERVISOR

C E

E I E D



Scott Specialty Gases, Inc.

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

10/22/91

CUBIX CORPORATION
9225 LOCKHART HWY

PROJECT #: 04-13836
PO #: 910505

AUSTIN TX 78747-0000

CYLINDER #: AAL13971

ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION	ANALYSIS 1 (MOLES) U/M
ARBON MONOXIDE	910.0 PPM	915. PPM
ETHANE	820.0 PPM	823. PPM
ITROGEN	BALANCE	BALANCE

NOTES: EXP: 11/92

ANALYTICAL METHOD: ACUBLEND MASTER

DATE OF ANALYSIS: 10/22/91

ANALYST:

[Handwritten Signature]
ANALYST

APPROVED BY:

[Handwritten Signature] 10/23
SUPERVISOR

FILED



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. <u>AAL17750</u>	Analytical Accuracy <u>±1%</u>	Concentration
Component	WT%	
CARBON MONOXIDE		4000 PPM
METHANE		4000 PPM
NITROGEN		BALANCE
NBS TRACEABLE BY WEIGHT		

Cyl No. _____	Analytical Accuracy _____	Concentration
Component		

Cyl No. _____	Analytical Accuracy _____	Concentration
Component		

Cyl No. _____	Analytical Accuracy _____	Concentration
Component		

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.

CERTIFIED REFERENCE MATERIALS EPA PROTOCOL GASES
ACUBLEND® CALIBRATION & SPECIALTY GAS MIXTURES PURE GASES
ACCESSORY PRODUCTS CUSTOM ANALYTICAL SERVICES

TROY, MICHIGAN / SAN BERNARDINO, CALIFORNIA / HOUSTON, TEXAS / BATON ROUGE, LOUISIANA / AUSTIN, TEXAS
SOUTH PLAINFIELD, NEW JERSEY / FREMONT, CALIFORNIA / WAKEFIELD, MASSACHUSETTS / LONGMONT, COLORADO

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

RECEIVED JAN 17 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. _____

Gentlemen:

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

LABORATORY REPORT ON GAS ANALYSIS

IR

	CYL. # MIXTURE REQ.	ANALYSIS
CARBON DIOXIDE	<u>SX-23633</u>	
	3.20%	3.18% ± .02
OXYGEN	18.00%	17.9% ± .02
NITROGEN	BALANCE	BALANCE

IR

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

IR

	CYL. # MIXTURE REQ.	ANALYSIS
CARBON DIOXIDE	<u>SX-23652</u>	
	18.00%	17.99% ± .02
OXYGEN	4.00%	3.99% ± .02
NITROGEN	BALANCE	BALANCE

	CYL. # MIXTURE REQ.	ANALYSIS

ACCEPTED BY



WILSON OXYGEN

Analyst 
 JOHN K. WRIGHT

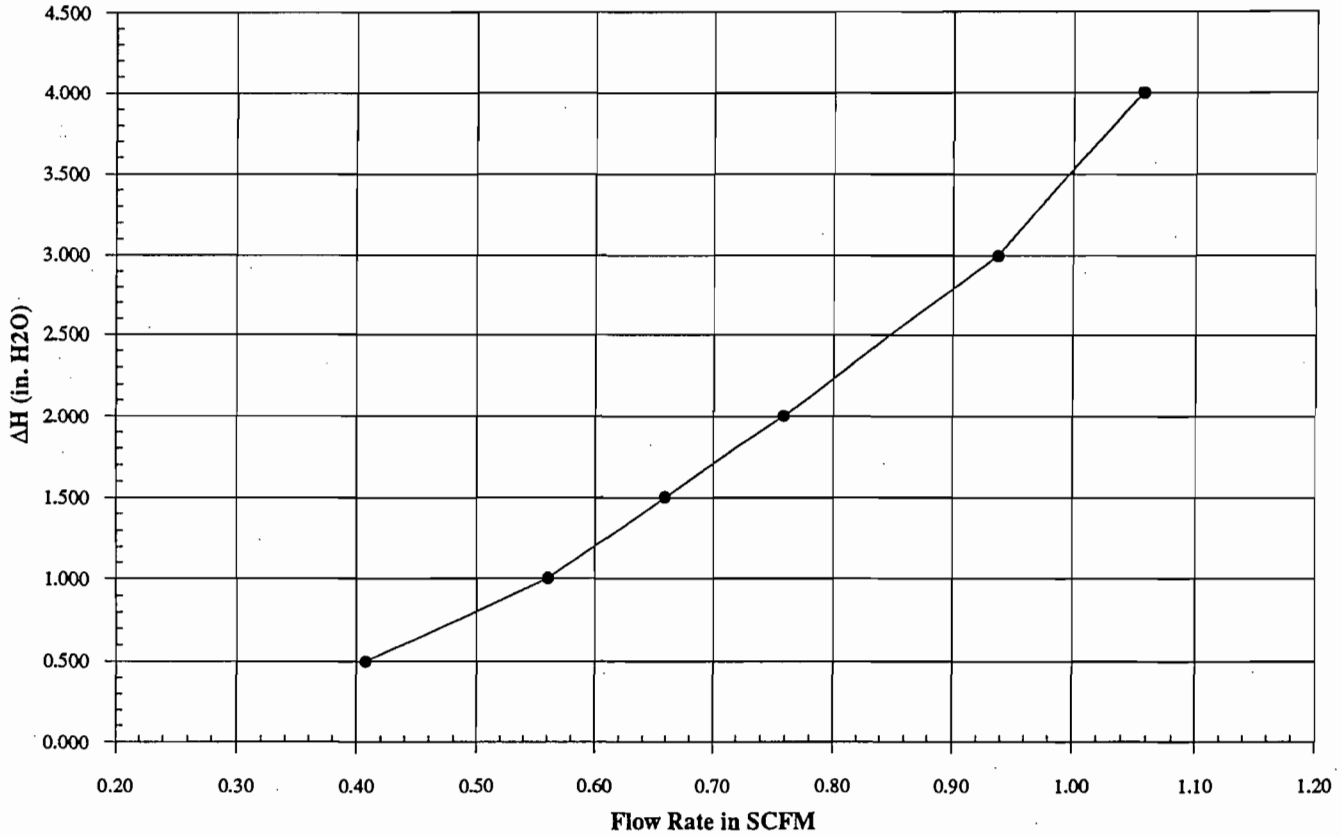
METER BOX DRY GAS METER and ORIFICE CALIBRATION

Date: 8/2/91
 Prev. Callb. Date: 12/27/90
 Location: 1713 Fortview, Austin, Tx
 Technician: DH,LI,JB
 Meter No: 1286-3061
 Atm. Pressure: 29.32

Test Meter ID P164240
 Make & Model American Singer
 Calibration Factor 0.998

Orifice Meter Setting ΔH (in. H ₂ O)	Elapsed Time (min.)	Meter Box				Standard Test Meter				Calculated Meter Factor (Kd)	Calculated $\Delta H@ 0.75$ SCFM (" H ₂ O)
		Starting Reading ft ³	Ending Reading ft ³	Starting Avg. Temp. °F	Ending Avg. Temp. (°F)	Starting Reading (ft ³)	Ending Reading (ft ³)	Starting Avg. Temp. (°F)	Ending Avg. Temp. (°F)		
0.50	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
2.00	10.00	60.138	68.398	109	114	16.300	23.900	73	73	0.9797	1.868
3.00	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



Pitot Tube Calibration Sheet

Date: 10/22/91

Technician: JB

Calibration pitot tube

Type: std

Size (OD): 1/4"

ID number: 450

Cp (std): 0.99

S-Type pitot tube

Size (OD): 1/4"

ID Number: 107

A-Side Calibration			
Δp std in H2O	Δp s in H2O	Cp(s)	DEV
0.640	0.895	0.837	0.002
0.640	0.900	0.835	0.004
0.635	0.890	0.836	0.003
0.415	0.575	0.841	0.002
0.420	0.580	0.842	0.003
0.415	0.570	0.845	0.006
0.210	0.290	0.842	0.003
0.205	0.285	0.840	0.001
0.205	0.290	0.832	0.007
A-Side Averages		0.839	0.003

B-Side Calibration			
Δp std in H2O	Δp s in H2O	Cp(s)	DEV
0.205	0.290	0.832	0.003
0.205	0.285	0.840	0.004
0.205	0.285	0.840	0.004
0.430	0.600	0.838	0.003
0.435	0.605	0.839	0.004
0.430	0.605	0.835	0.001
0.625	0.885	0.832	0.003
0.625	0.890	0.830	0.006
0.630	0.890	0.833	0.002
B-Side Averages		0.835	0.003

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

Trailer # 7 Altimeter

ALTIMETER SCALE ERROR					
PART NO. <u>5934P-1A.83</u>			SERIAL NO. <u>3H909</u>		
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.

Joy Luuomel
 AUTHORIZED SIGNATURE

FEB 11 1992
 DATE

Best Available Copy

TEL-TRU MANUFACTURING CO.

408 ST. PAUL STREET ROCHESTER, NY 14605 USA

CERTIFICATE OF CALIBRATION

TEL-TRU ORDER NO. 23832	LINE NUMBER 111	TICKET NO.	ORDER REC WK NO. 43	SHIP BY WK NO. 47
CUSTOMER NUMBER 2-52845000	CUSTOMER P.O. NO. 910537	MANUFACTURING NO. Stock		
QUANTITY 4	ITEM NUMBER 34102260	DESCRIPTION ST300R 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.

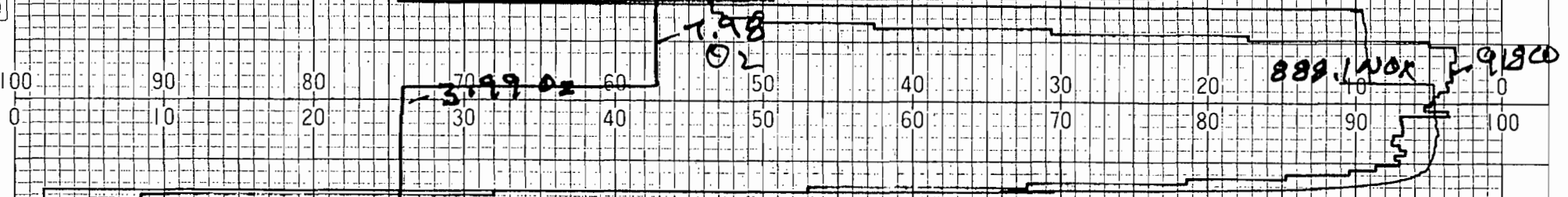
TAG NUMBER	CALIBRATING TEMPERATURE										
	-40°F -40°C	0°F -17.8°C	50°F 10°C	100°F 37.8°C	140°F 60°C	160°F 71°C	200°F 93°C	220°F 104°C	295°F 146°C	400°F 204°C	750°F 399°C
1			50°F 100°F								
2			50°F 100°F								
3			50°F 100°F								
4			50°F 100°F								

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

**APPENDIX E:
STRIP CHART RECORDS**

NO_x, O₂, CO

1527 MW 150 CO 7.1902
 4064 MW 401 CO 17.9902



QUALITY ASSURANCE ACTIVITIES

FLORIDA GENCO TRANSMISSION
 MELBOURNE COMPRESSOR STATION

3125192

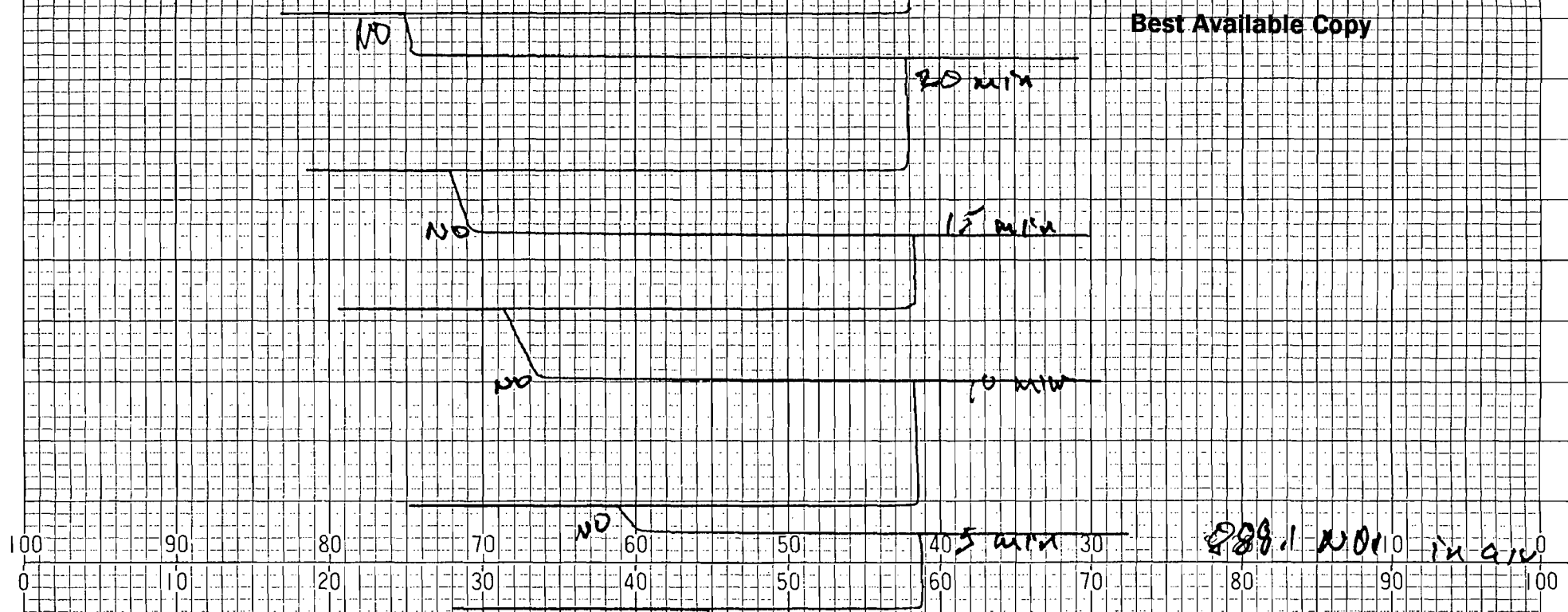
NO

15 min

NO

50 min

12 min

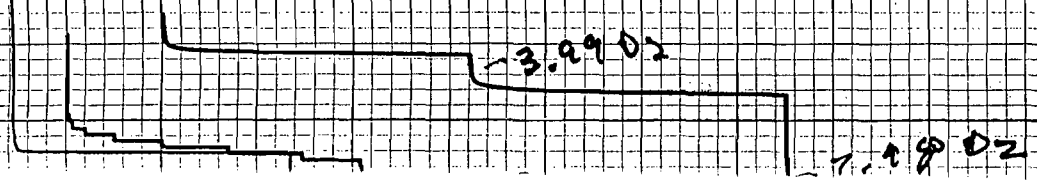


NO_x CONVERTER EFFICIENCY CHECK

NO_x thru probe

NO_x direct

SAMPLE SYSTEM BIAS CHECK (NO_x)



400 (6334)

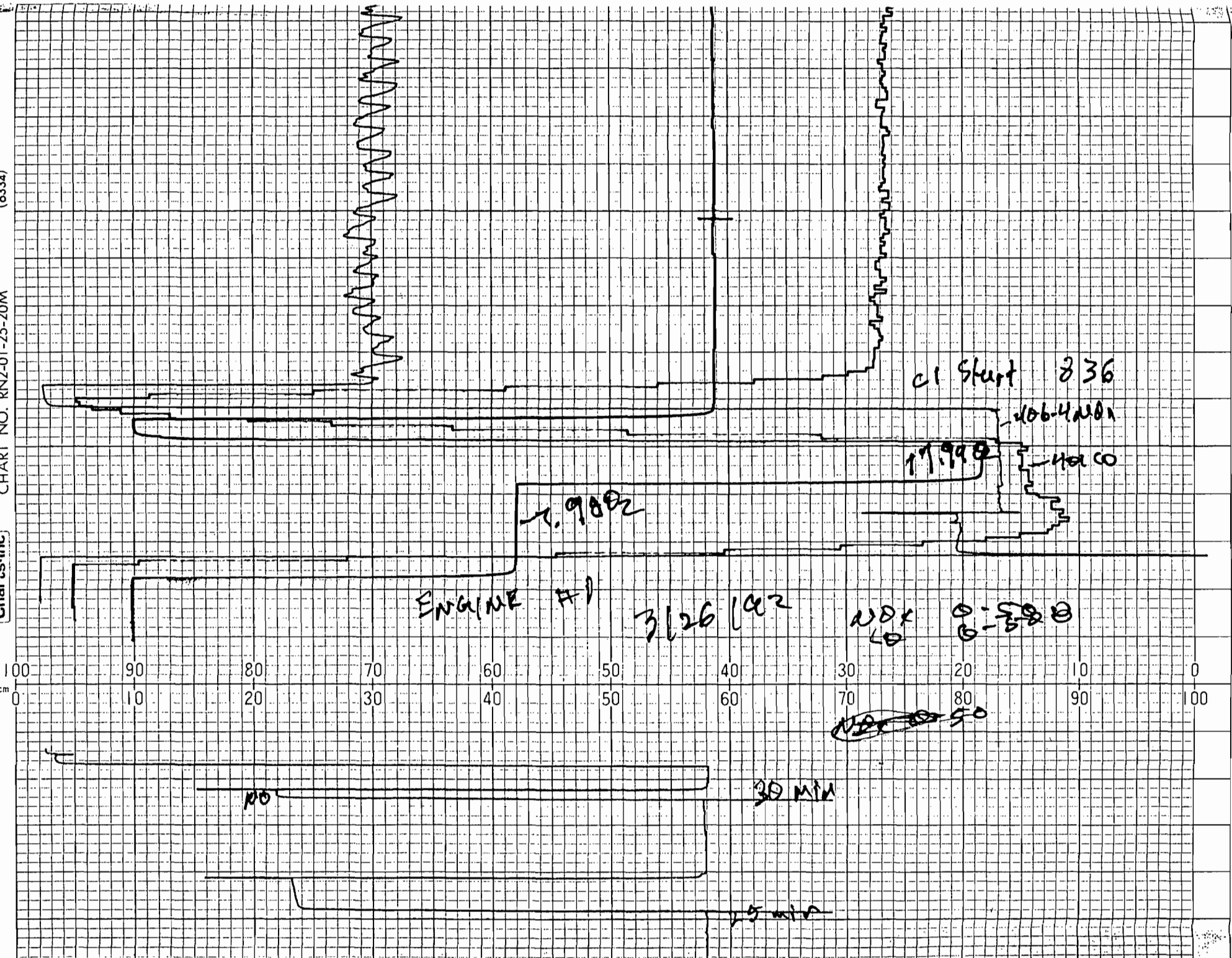
ART NO. RN2-01-25-20M

(6334)

CHART NO. RN2-01-25-20M

Charts Inc

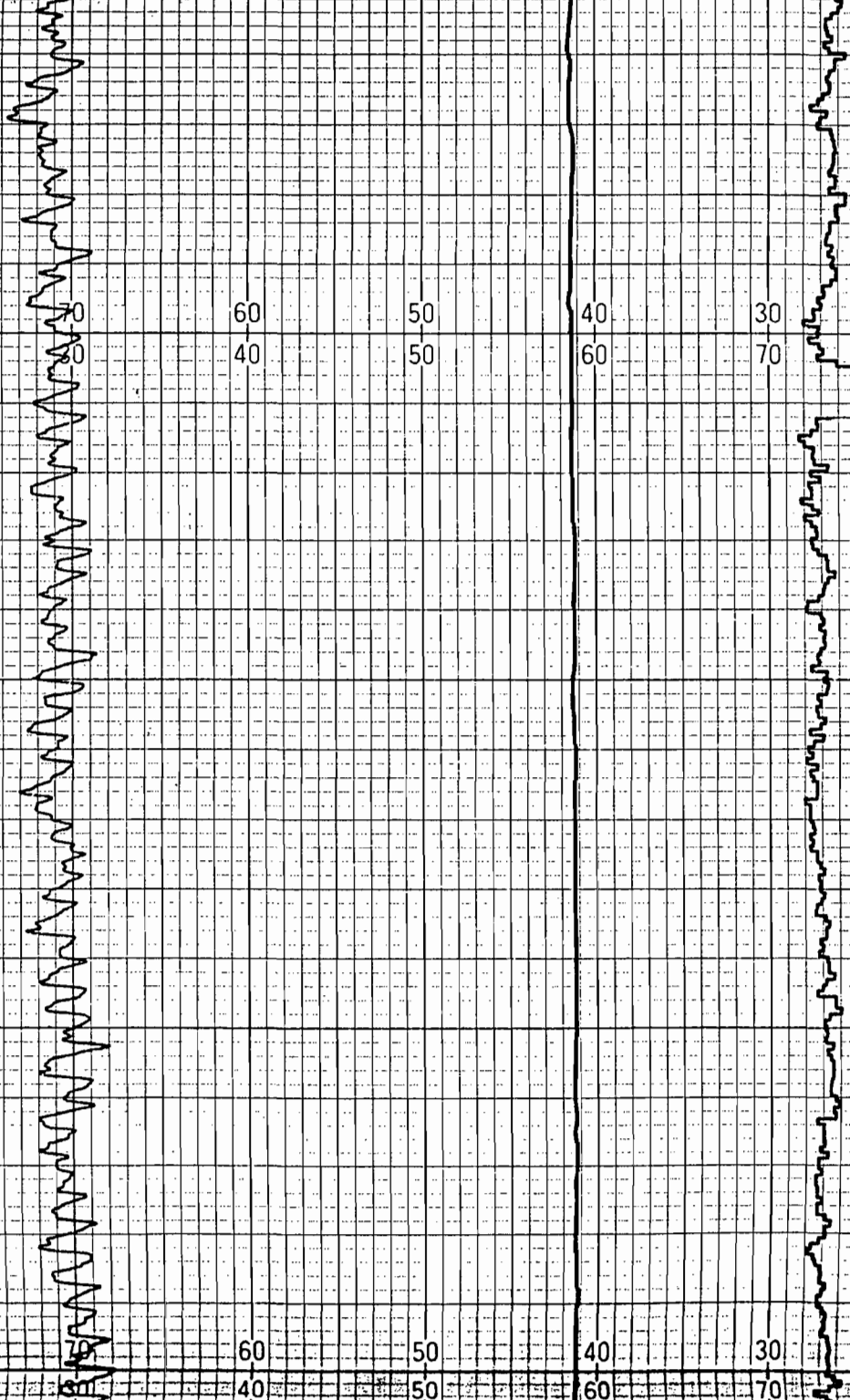
300cm



CHAR

Charts-Inc

100 90 80 60 50 40 30 20 10 0
 0 10 20 40 50 60 70 80 90 100

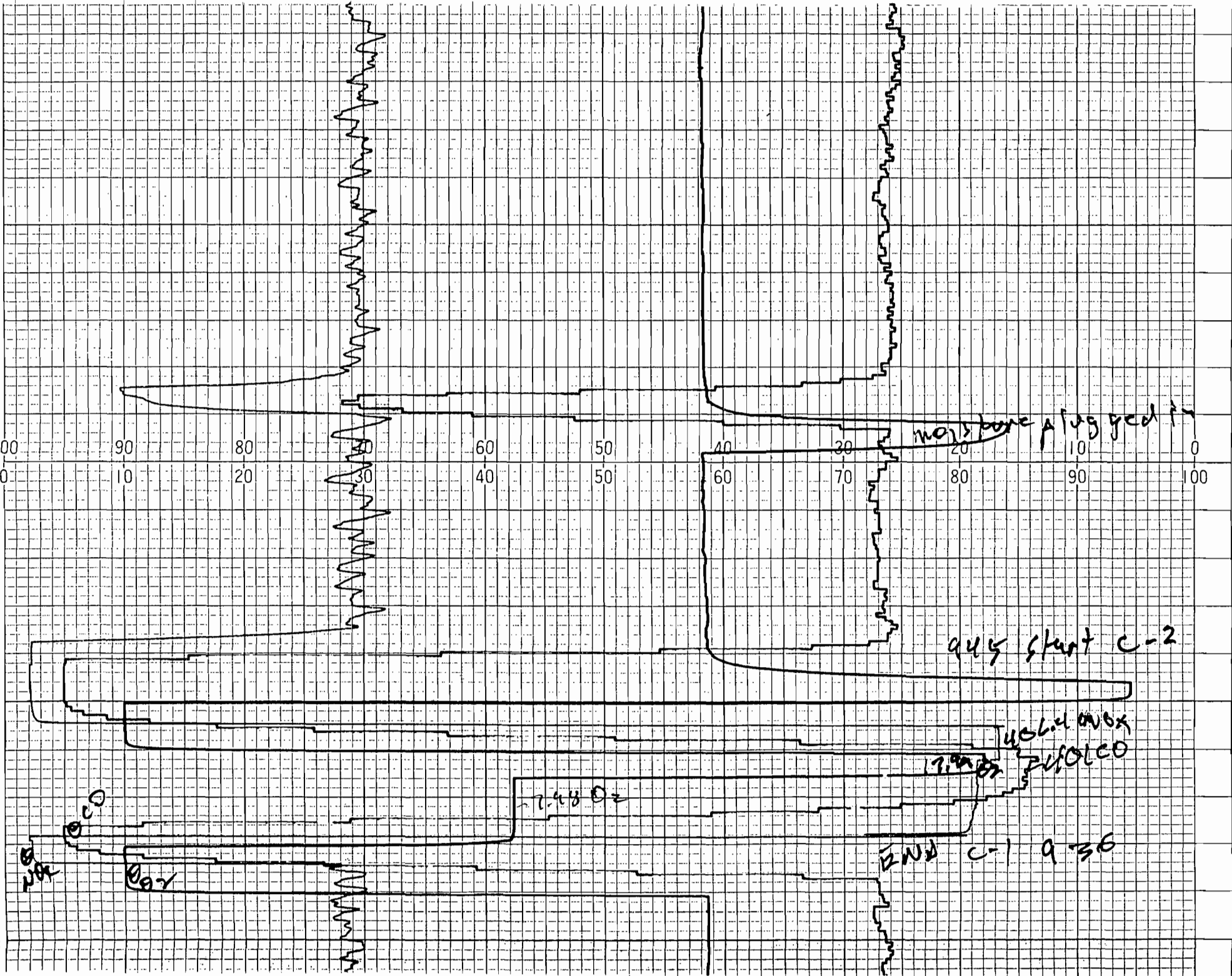


inadequate
cut 45 min

NO_x = 136
 CO = 342
 O₂ = 12.2

360cm

100 90 80 60 50 40 30 20 10 0
 0 10 20 40 50 60 70 80 90 100

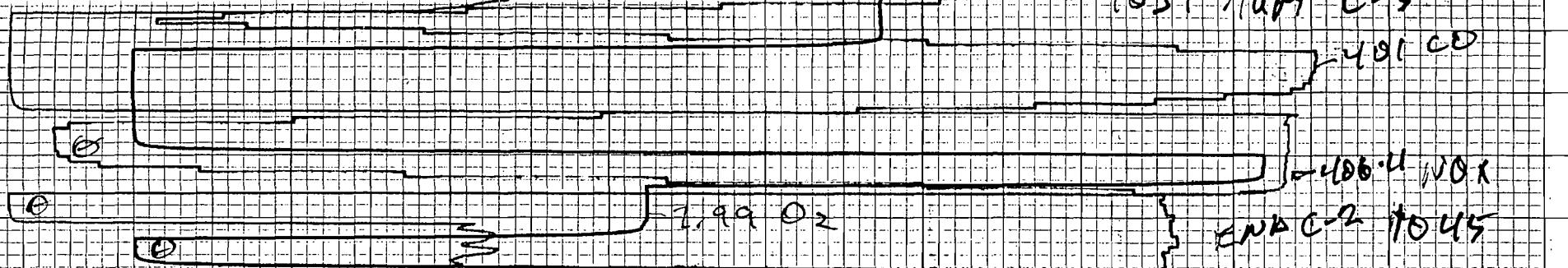


(6334)

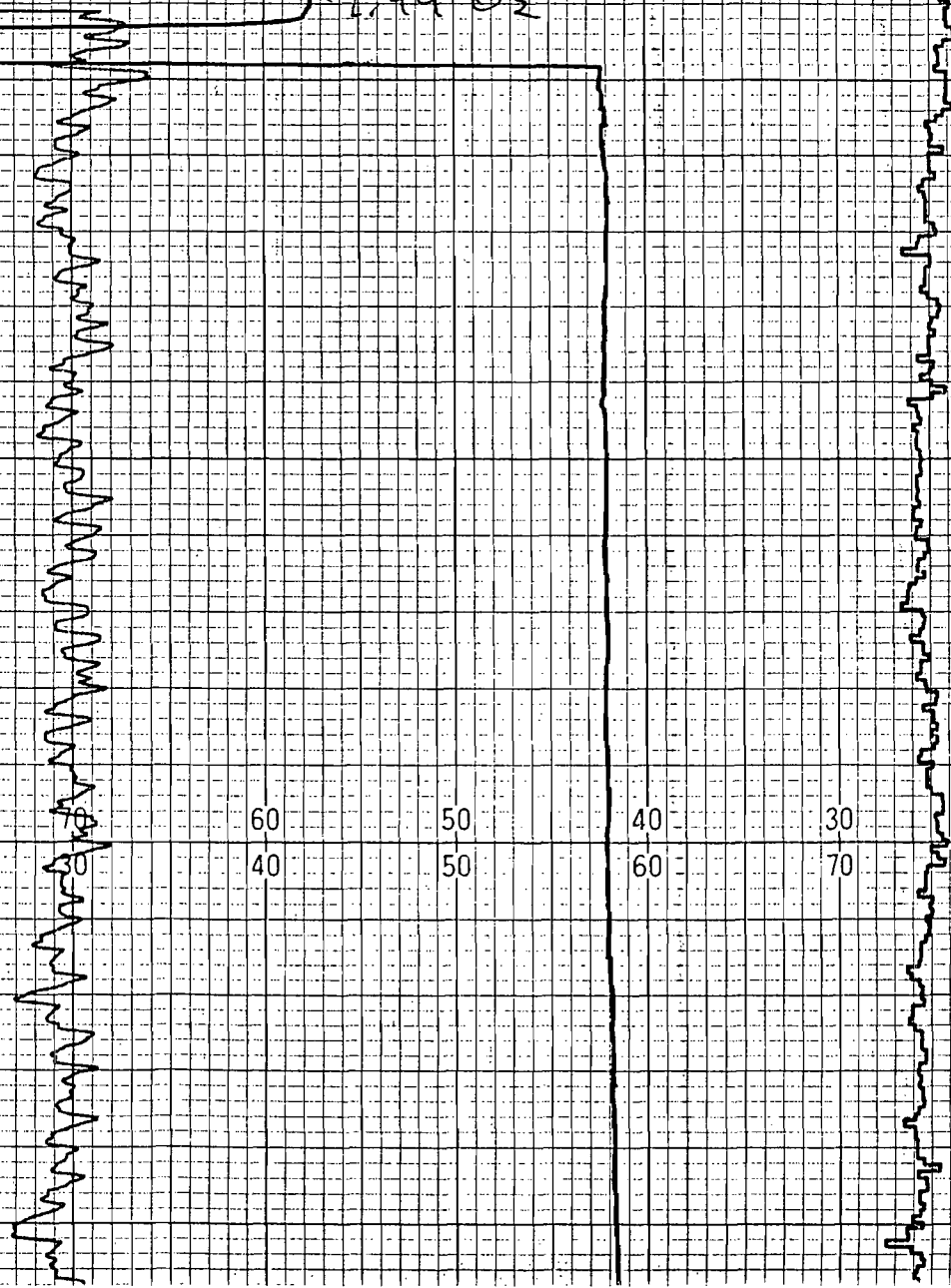
CHART NO. RN2-01-25-20M

Charts-Inc

320cm

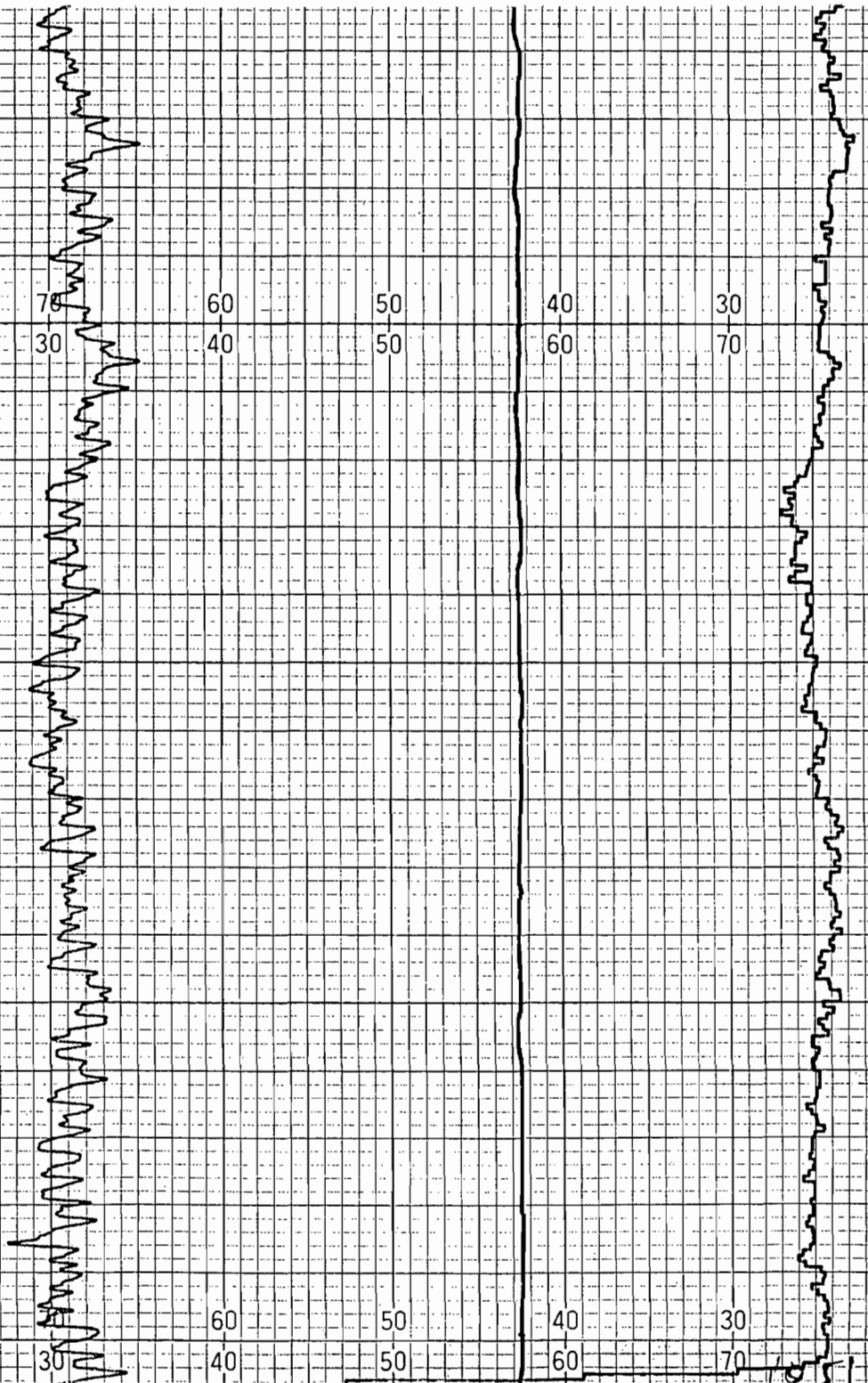


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$\text{NO}_x = 141$
 $\text{CO} = 345$
 $\text{O}_2 = 12.0$

100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100

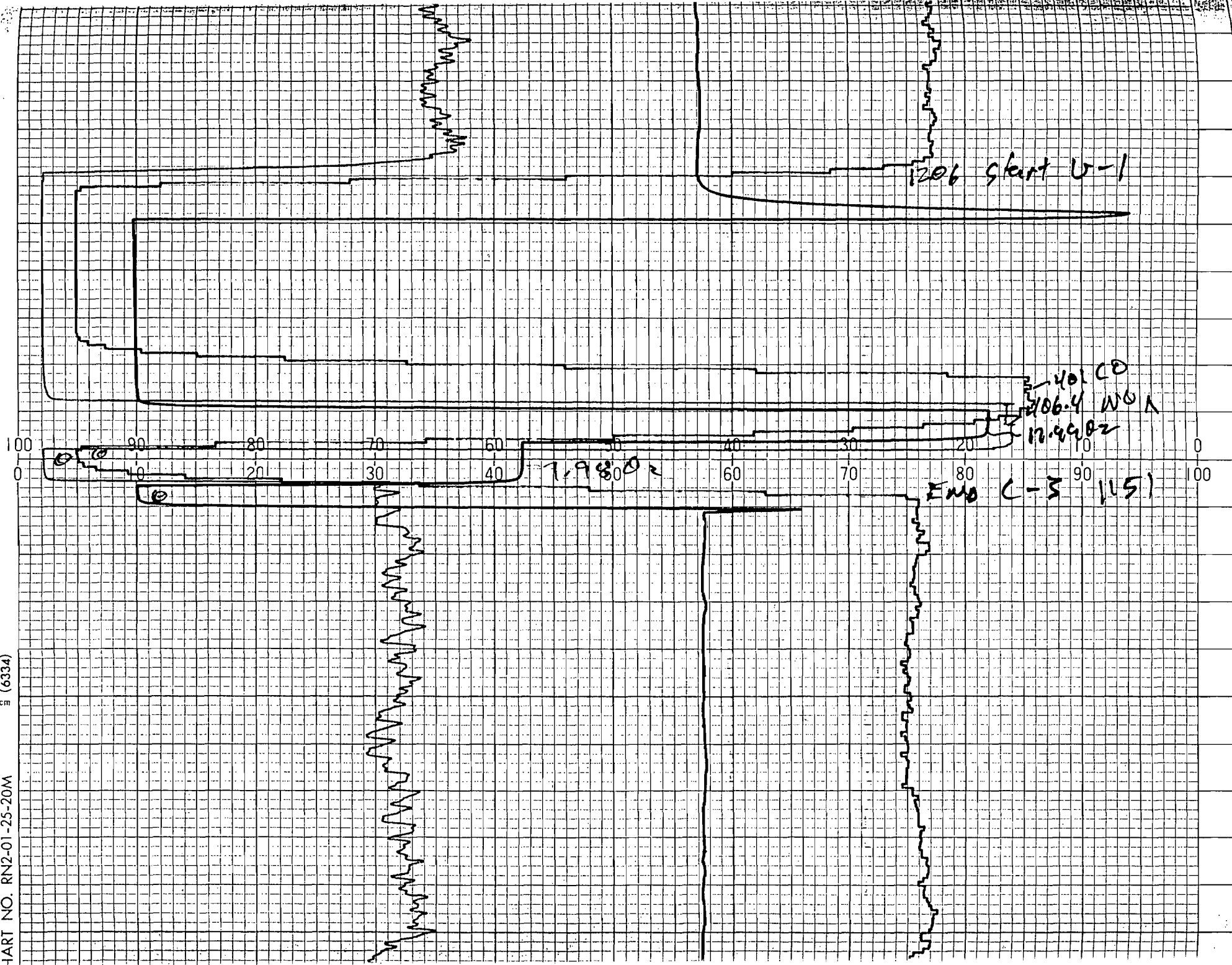


NDK = 147
CO = 355
O₂ = 11.9

100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100

100
0.902

300cm



1206 start U-1

Vol. CD
406.4 WOK
12.4902

1206

End C-3 (151)

100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100

100
0

3127191

EMERGENCY

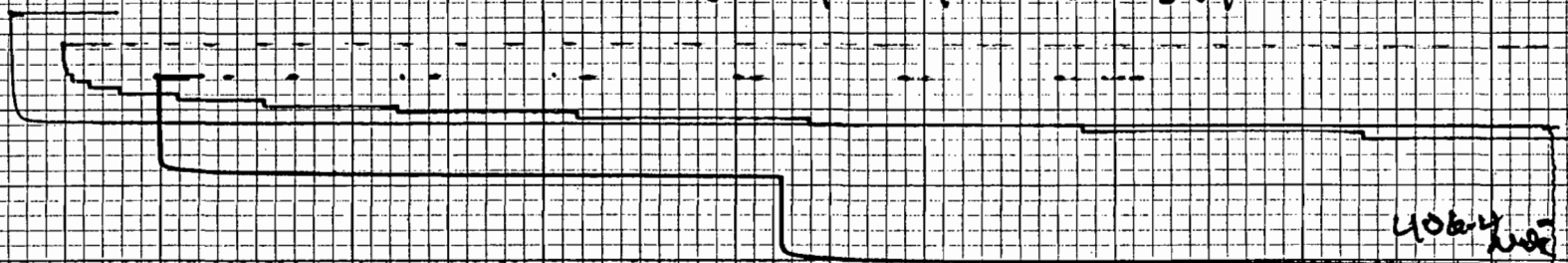
1023 START C-7 100

(6334)

CHART NO. RN2-01-25-20M

Charts-inc

260cm



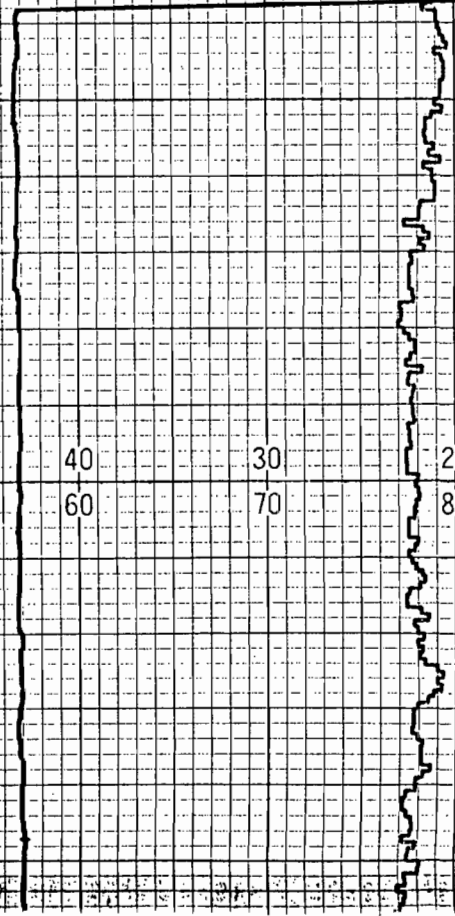
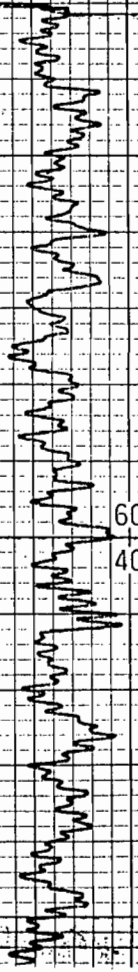
4064

4020

17-9902

000
000

END OF 1235



WIDE = 171
 CO = 367
 DZ = 11.7

100 90 80 70 60 50 40 30 20 10 0
 0 10 20 30 40 50 60 70 80 90 100

CH

Charts-Inc

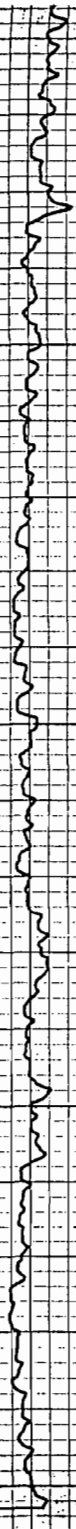
100 90 80 70 60 50 40 30 20 10 0
 0 10 20 30 40 50 60 70 80 90 100

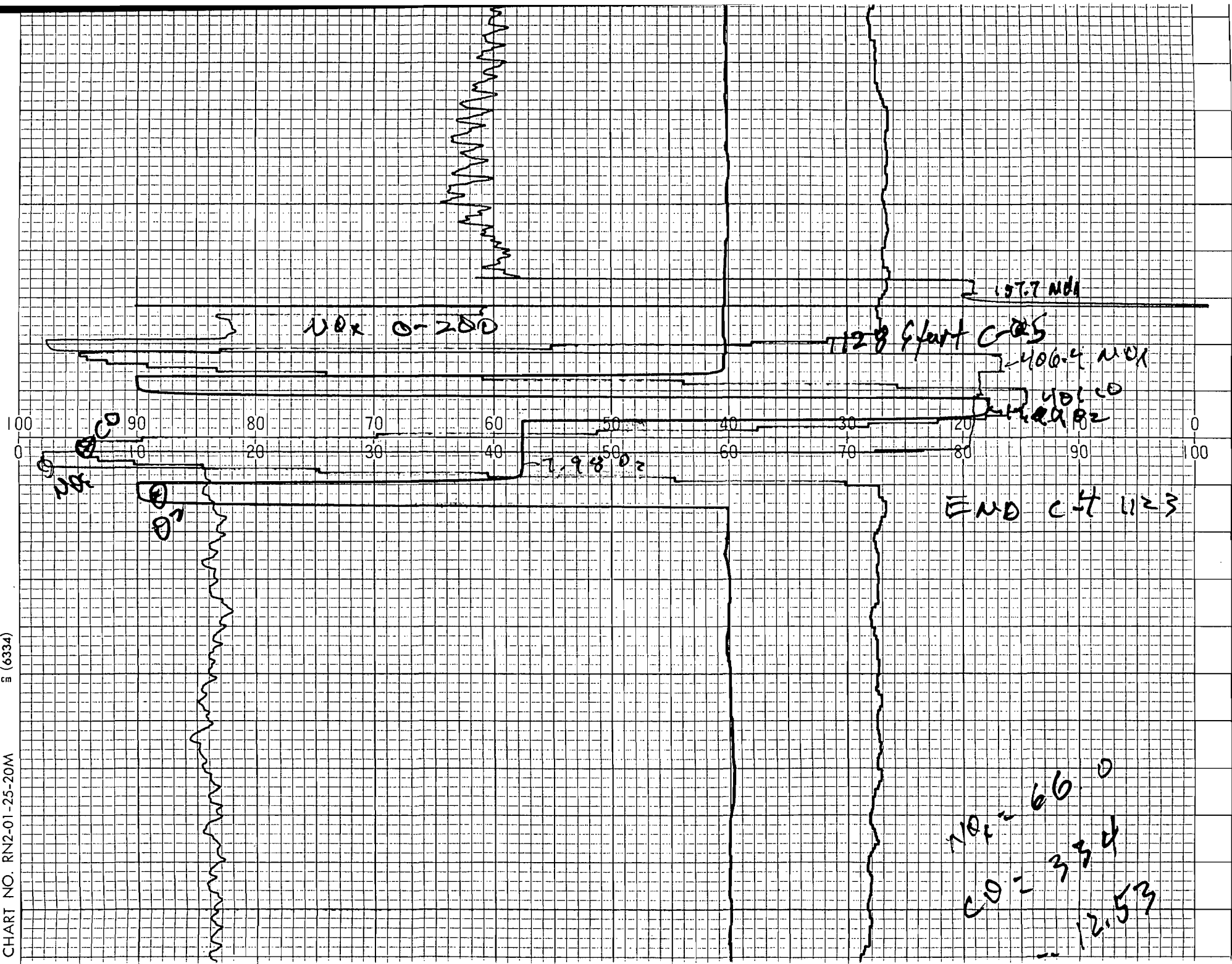
240cm

100 90 80 70 60 50 40 30 20 10 0
 0 10 20 30 40 50 60 70 80 90 100

0.2-1.5

1823 6.5.74 C-4





NOx 0-250

1128 Start CO₂

106.4 NOx

100 CO

100 O₂

1.98 O₂

END CH 1123

100 = 66 O

CO = 334

12.53

NOx

CO

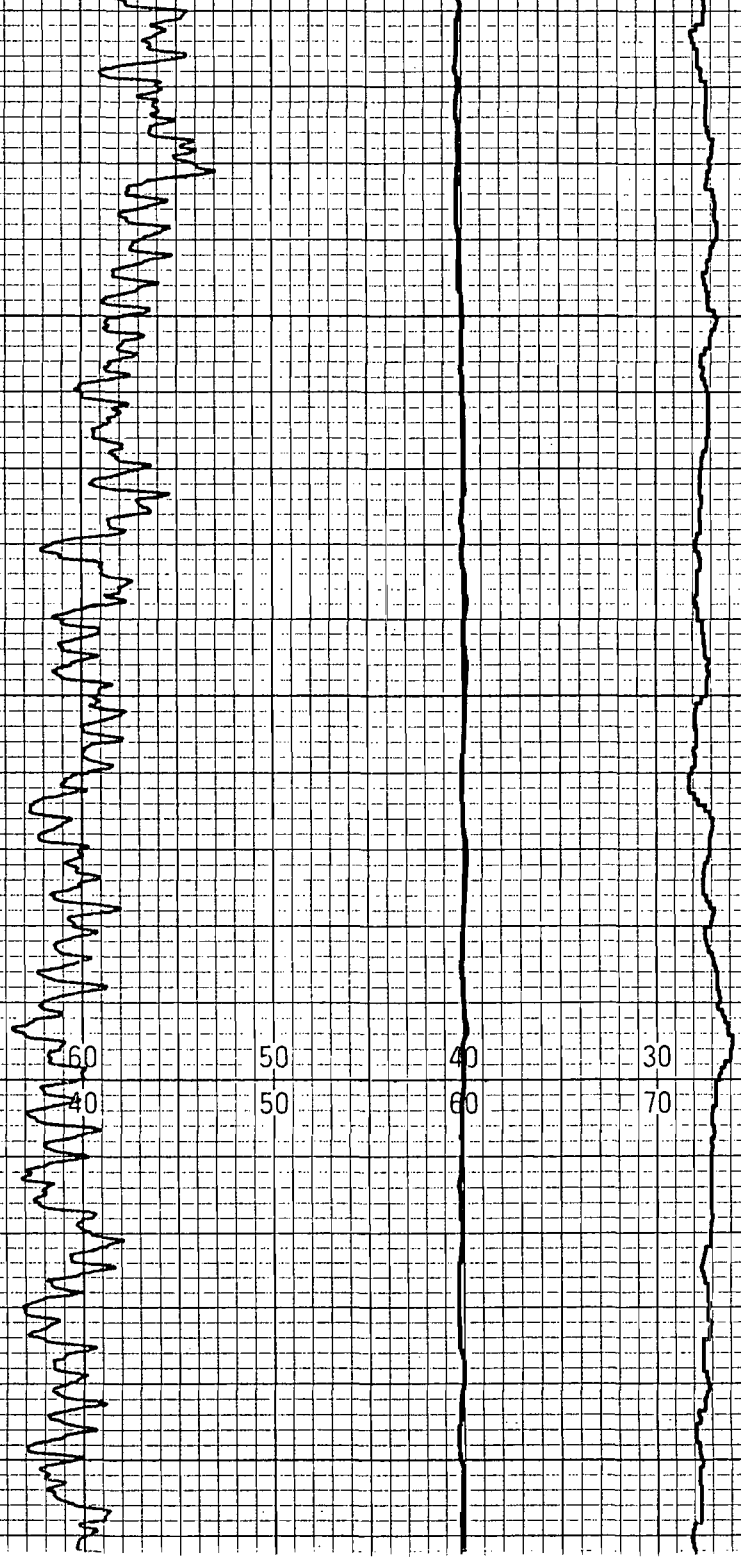
157.7 NOx

(6334)

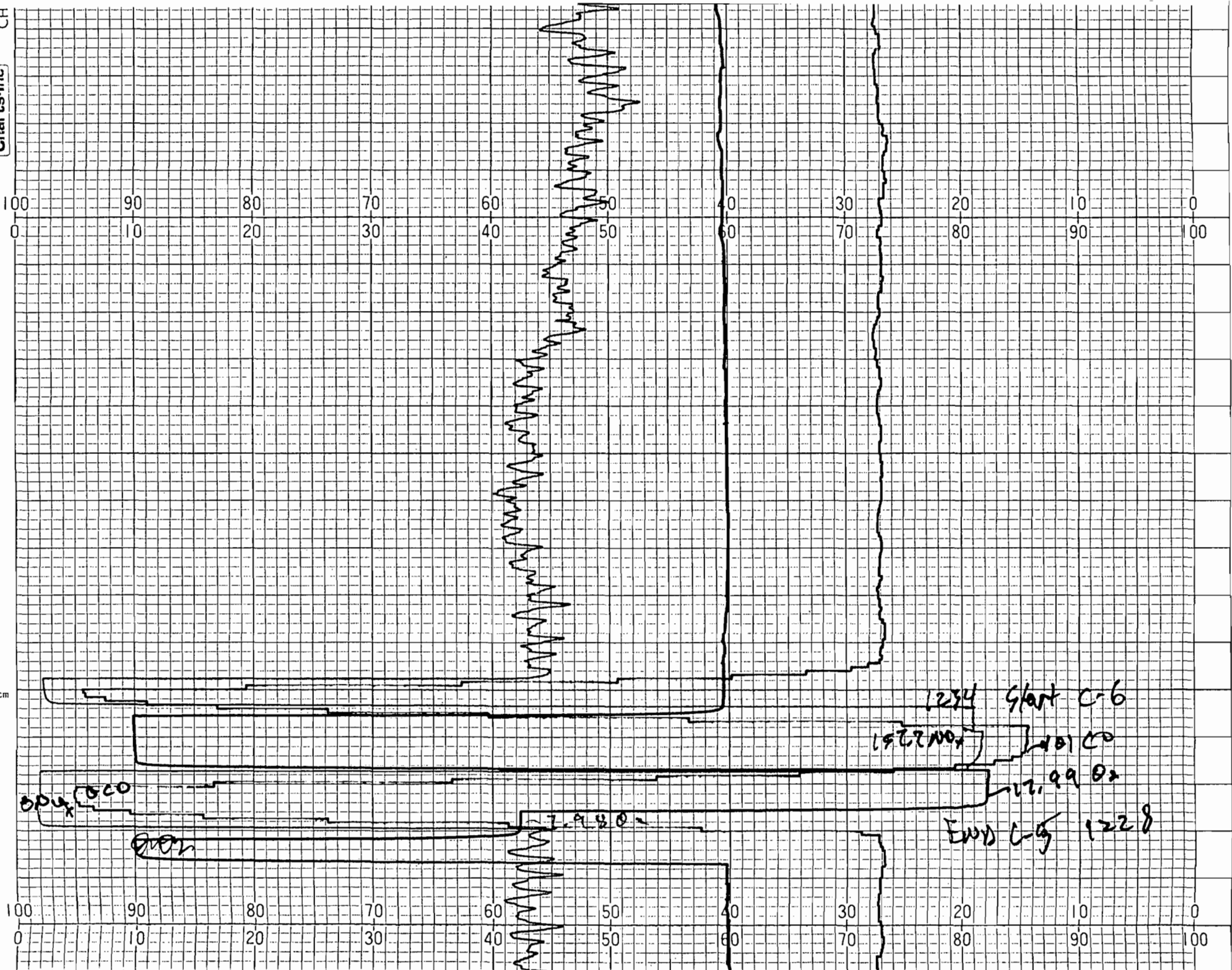
CHART NO. RN2-01-25-20M

Charts Inc

200cm



NO₂ = 79.4
CO = 340
O₂ = 12.48



180cm

004,050

122980

12234 Start C-6

122700

122990

End C-6 1228

157.7 NO_x thru
pro for

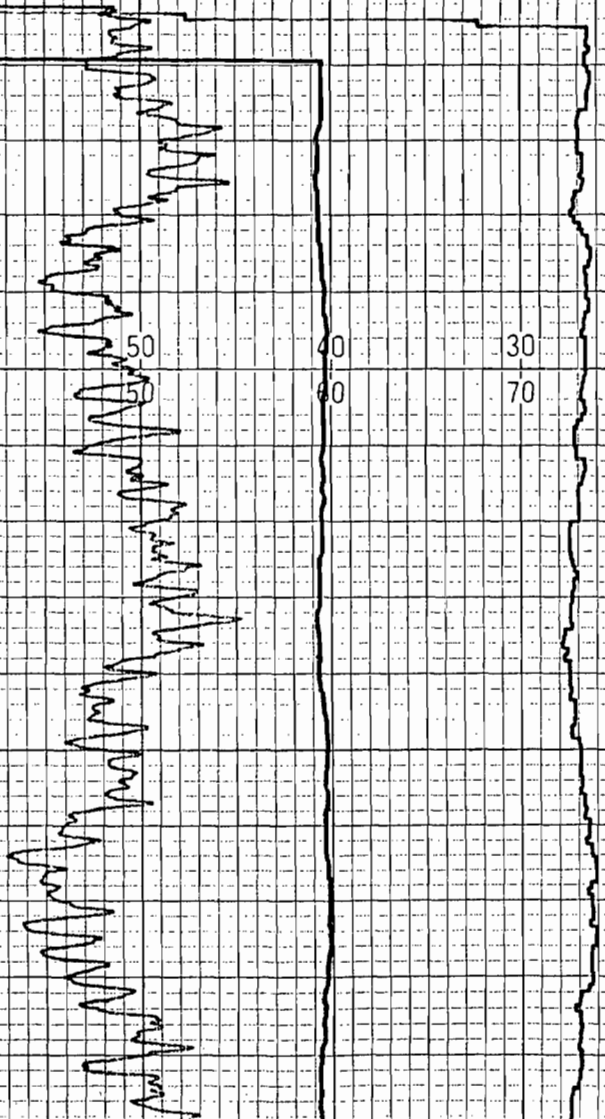
NO_x SAMPLE SYSTEM BIAS CHECK (AFTER TEST)

157.7 NO_x direct
157.7 NO_x direct
157.7 NO_x direct

7.98 O₂

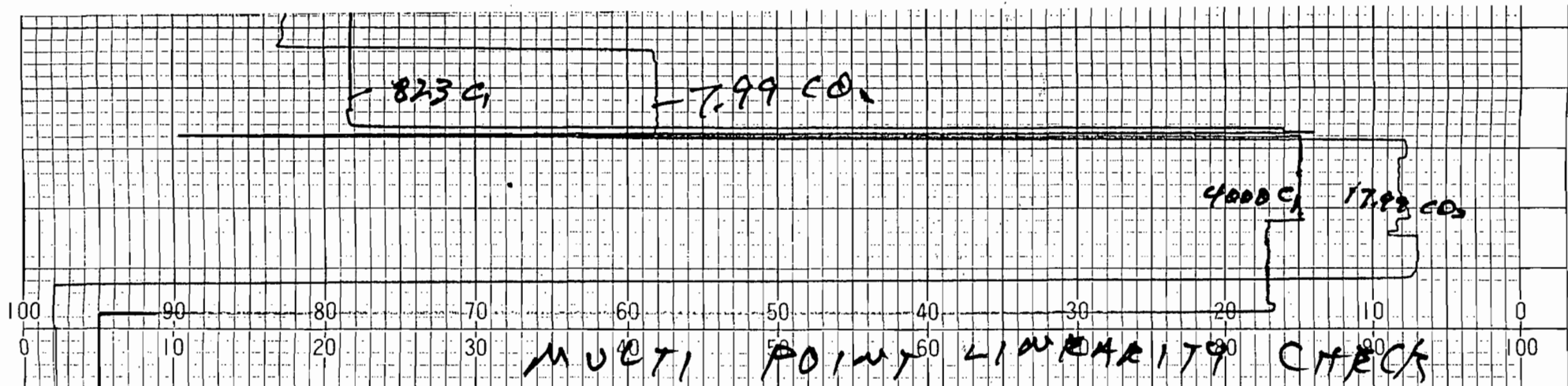
NO C-6 1334

100	90	80	70	60	50	40	30	20	10	0
0	10	20	30	40	50	60	70	80	90	100



NO_x = 92.0
 CO = 339
 O₂ = 12.5

CO₂, THC



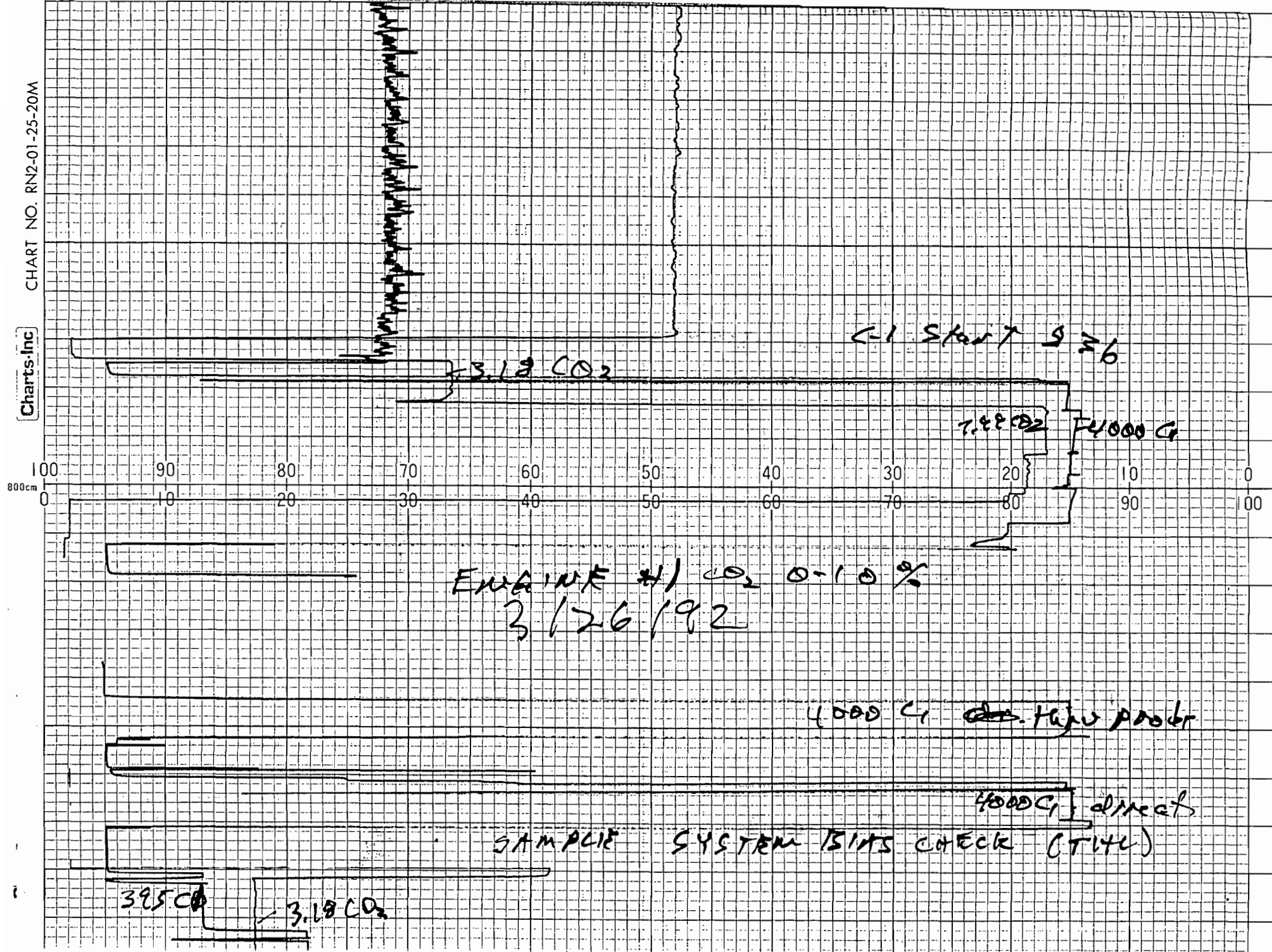
CO₂ @ TTC

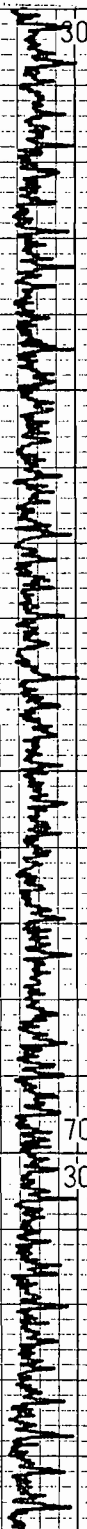
Initial Ranges
 CO₂ = 0-20%
 TTC = 0-5000 ppm
 (as C₁)

QUALITY ASSURANCE ACTIVITIES

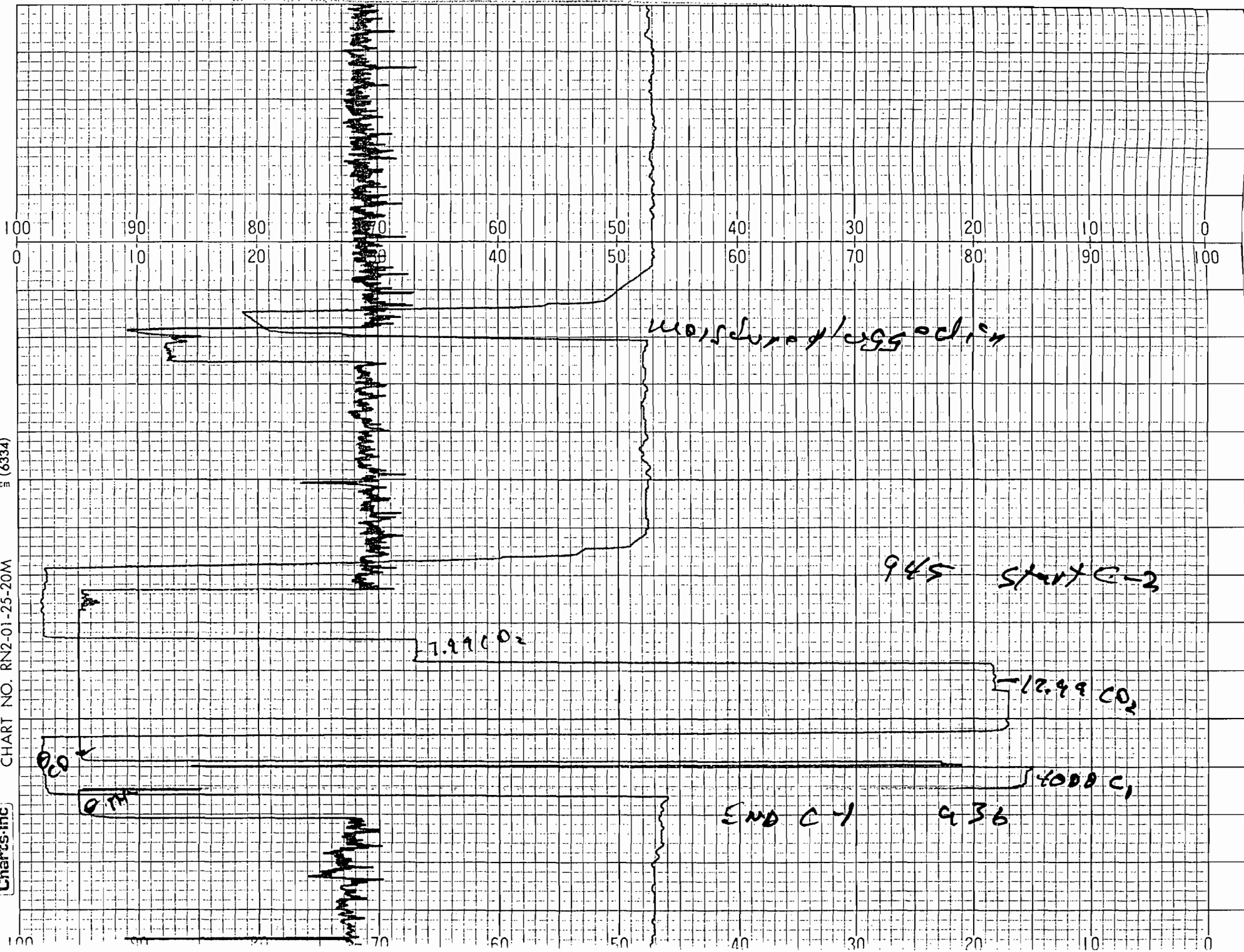
FLORIDA GAS TRANSMISSION
 MELBOURNE COMPRESSOR STATION

3/25/92





CO₂ = 5.04
TNC = 1175



nois during logging

945 Start C-2

1.91 CO₂

12.99 CO₂

4000 C₁

END C-1

936

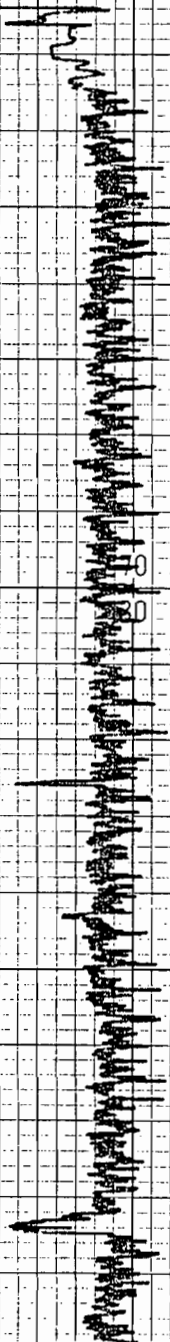
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100

100 90 80 70 60 50 40 30 20 10 0

5.18 CO₂

17.98 CO₂ ← 4000 ←
← FLOW ADS

END C-2 10 45

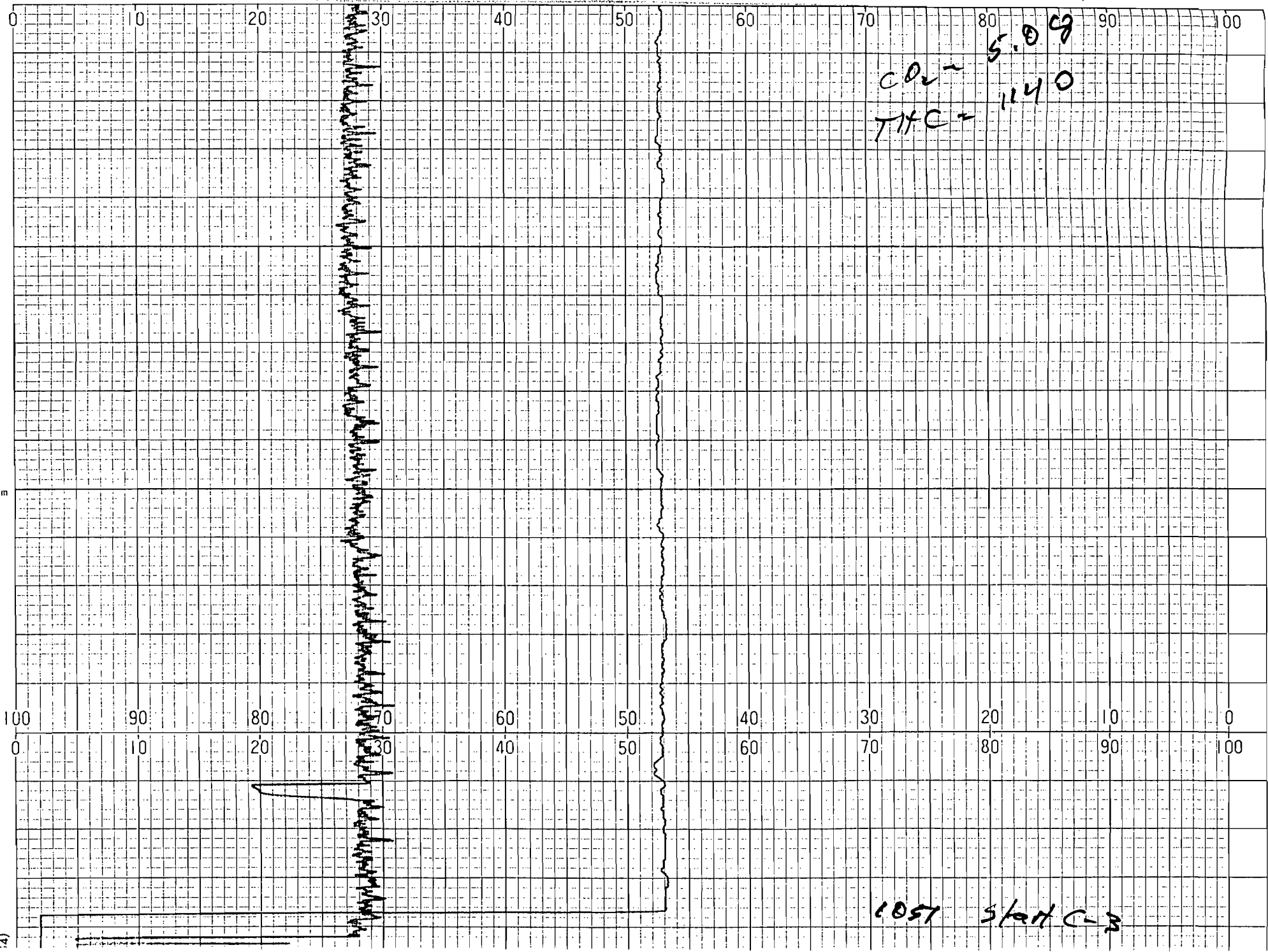


CO₂ = 5.10
 THC = 119.5

Handwritten notes on the left side of the grid, oriented vertically, including the number '720cm' and other illegible characters.

CO₂ ~ 5.0 g
TMC = 1140

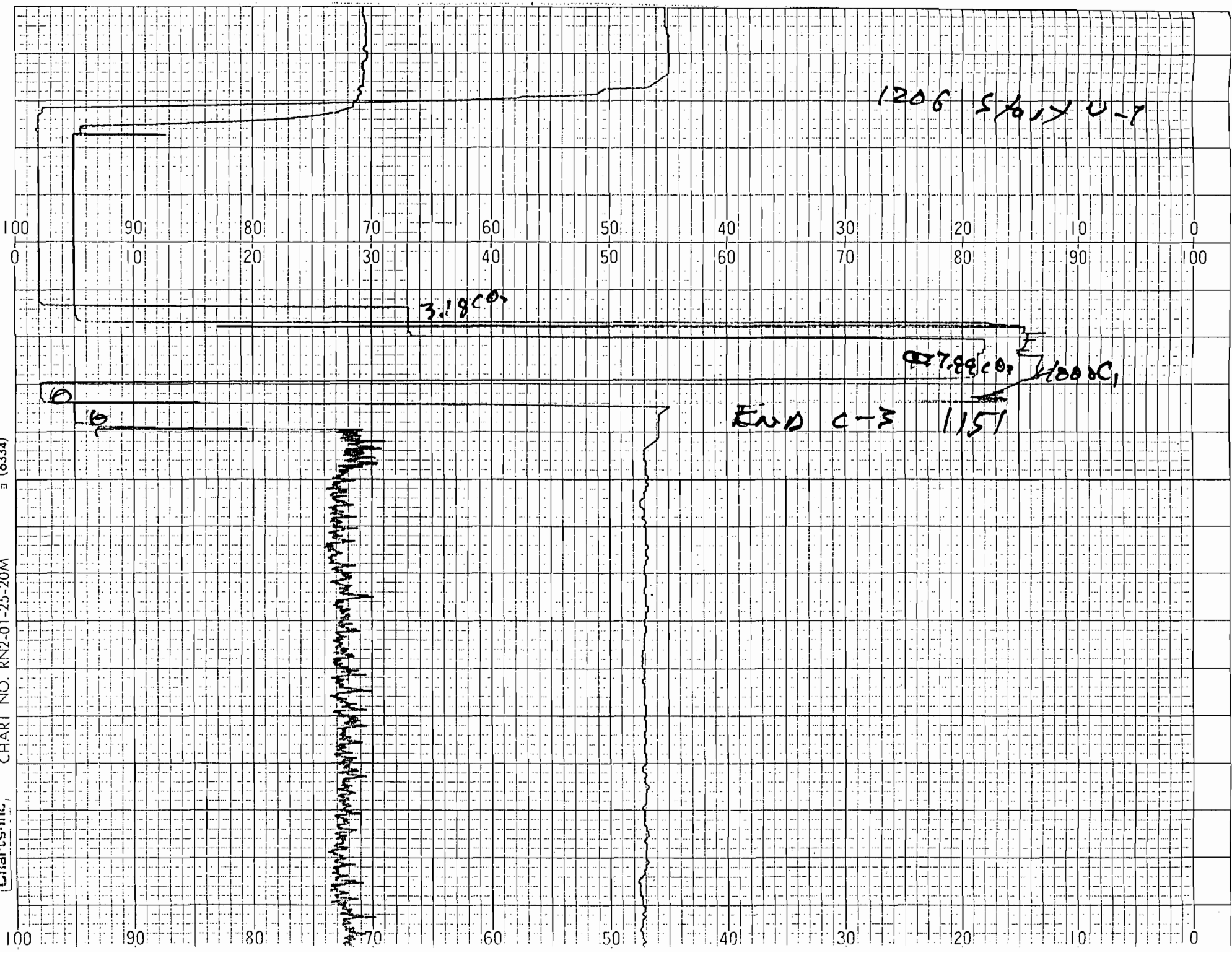
CO₂ Start C-3

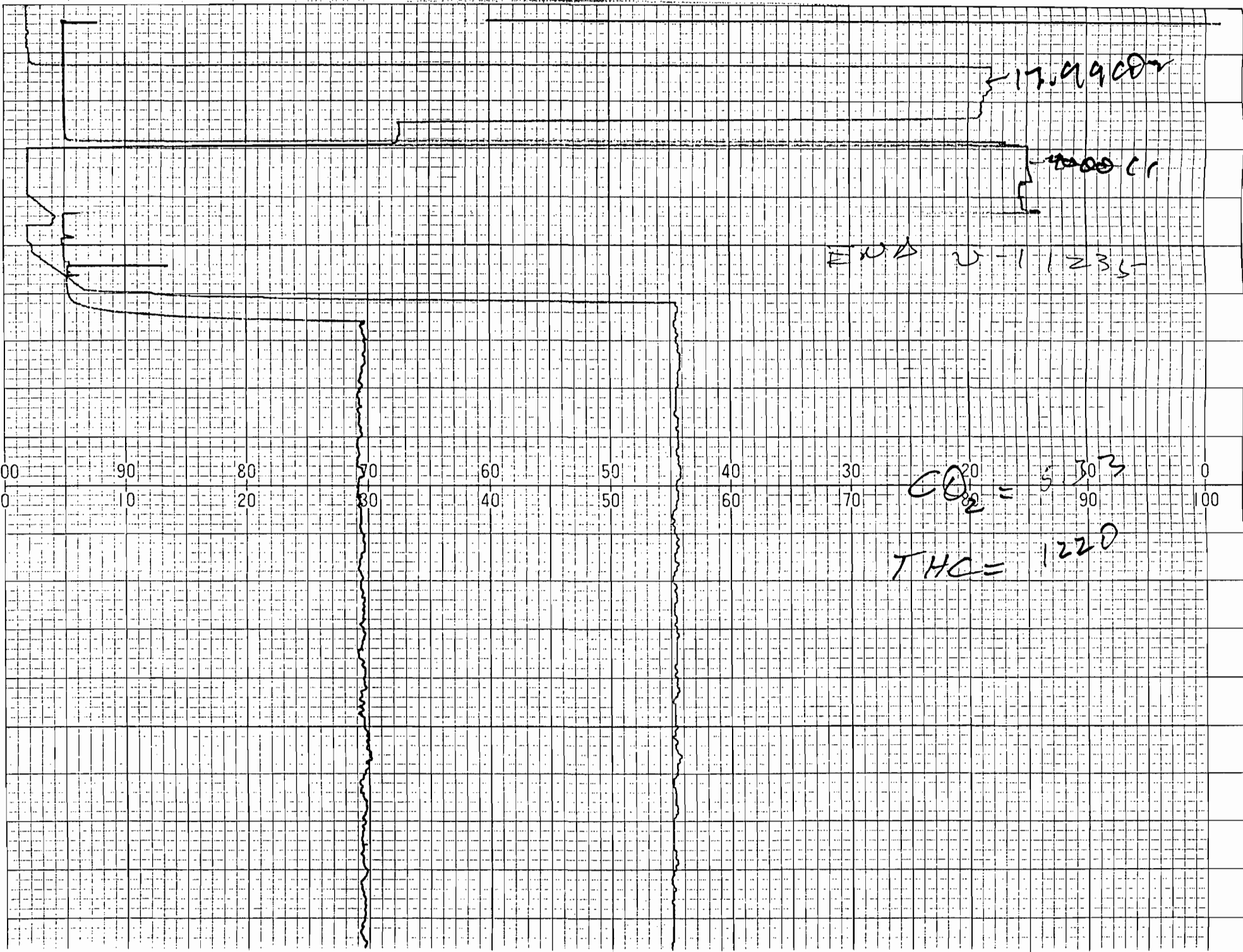


(6334)

CHART NO. RN2-01-25-20M

Charts-inc





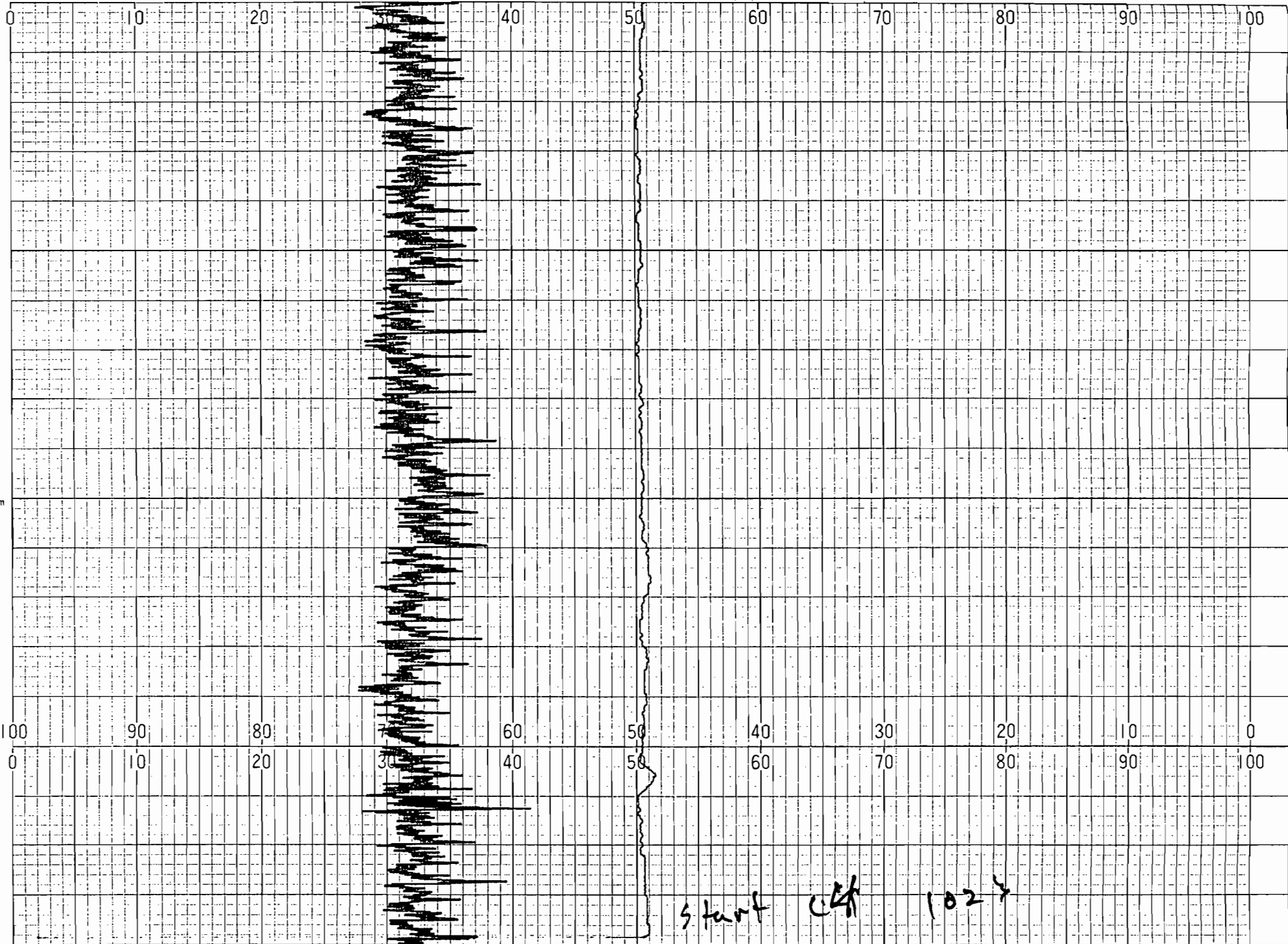
17.9900r

2000 C1

END 2-11-235

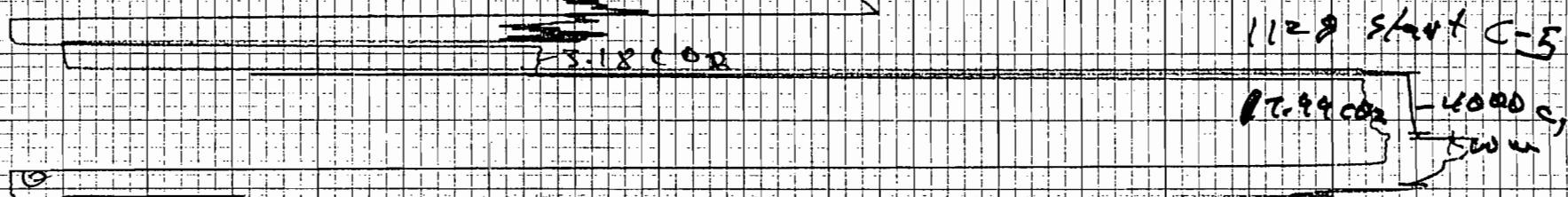
CO₂ = 5.303

TMC = 1220



start of 1027
 2127191 ~~2~~ NGC 1027 2

100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100



END C-5 1123

CO₂ = 4.95
TIC = 1350

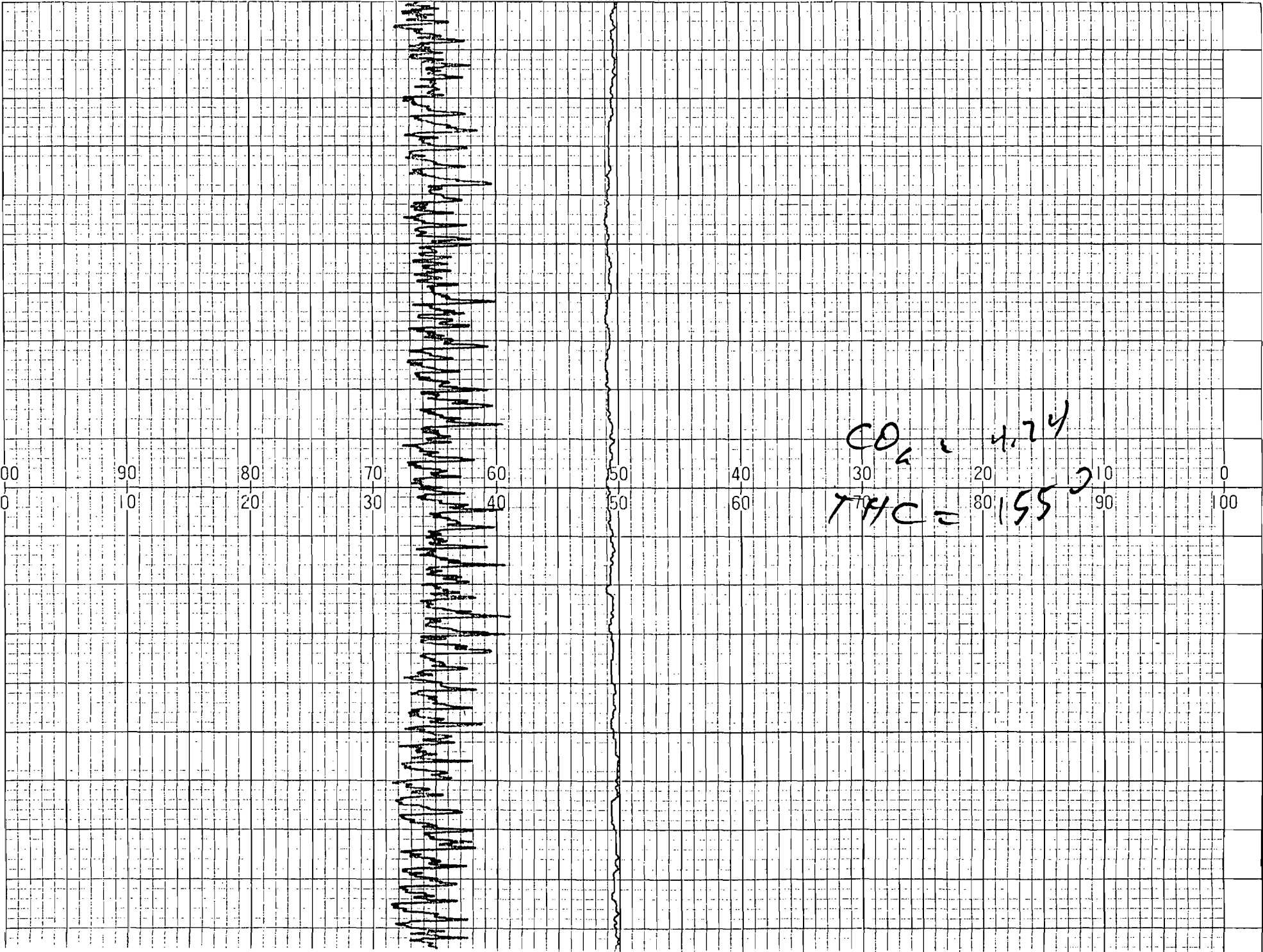
64um (6334)

CHART NO. RN2-01-25-20M

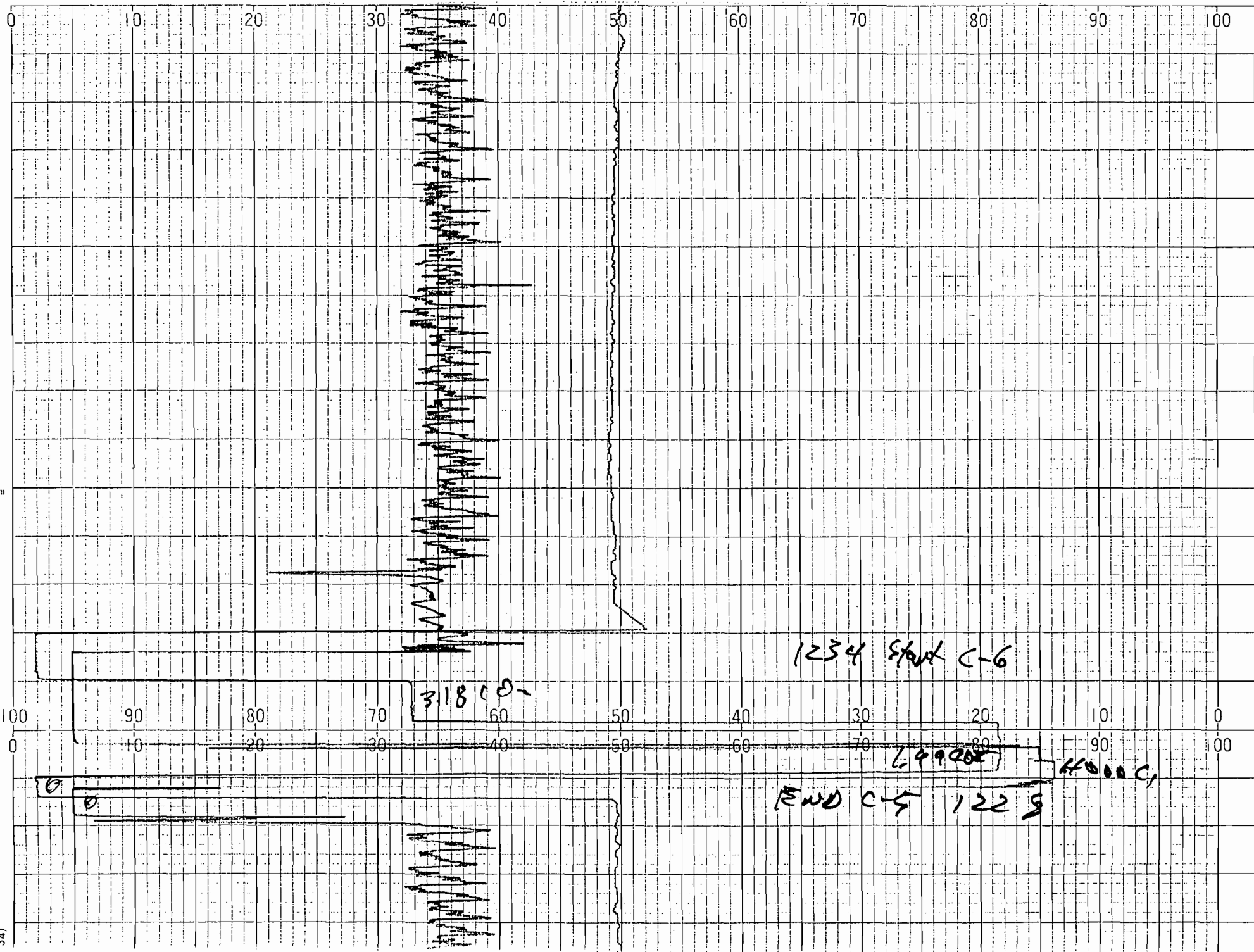
[Charts-inc]

100 90 80 70 60 50 40 30 20 10 0

620cm



CO₂ = 4.24
 TAC = 1.55



13.18 CO₂

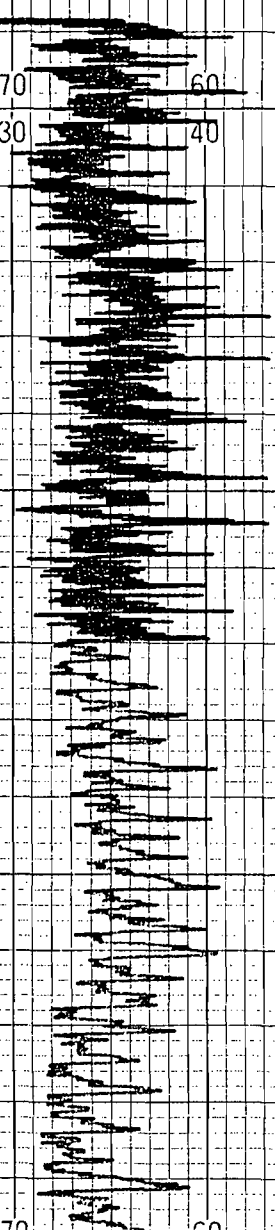
4000 Ci through probe
299 CO₂
4000 Ci direct

THC SAMPLE SYSTEM BIAS CHECK
CATERPILLAR

END C-6

13340

100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100



CO₂ = 4.82
THC = 1.525

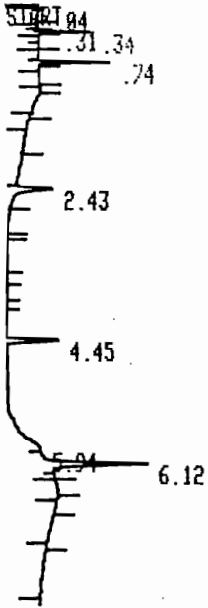
(6334)

CHART NO. RN2-01-25-20M

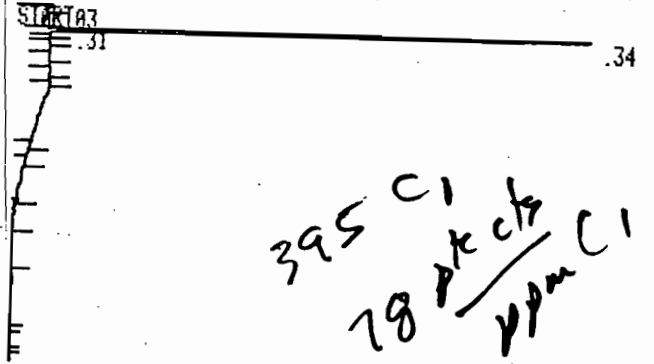
Charts Inc.

100 90 80 70 60 50 40 30 20 10 0

APPENDIX F
CHROMATOGRAMS



CI-C6
29 pte count
ppm CI



395 CI
18 pte cts
ppm CI

RUN # 88 MAR/26/92 08:37:57
 WORKFILE ID: C
 WORKFILE NAME:

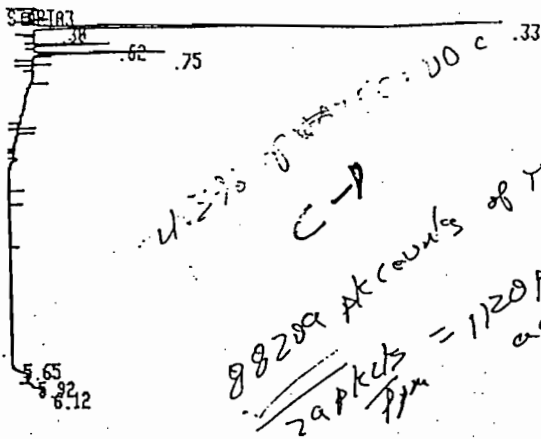
AREA#	RT	AREA	TYPE	AR/HT	AREA#
	0.04	1319	PB	0.069	9.666
	0.31	238	D PY	0.016	1.744
	0.34	762	D YB	0.016	5.584 <i>C1</i>
	0.74	1345	D PB	0.021	9.856 <i>C2</i>
	2.43	2027	BB	0.061	14.854 <i>C3</i>
	4.45	2613	PV	0.051	19.148 <i>C4</i>
	5.94	59	PV	0.012	0.432
	6.12	5283	VV	0.057	38.215 <i>C5</i>

TOTAL AREA= 13646
 MUL FACTOR= 1.0000E+00

RUN # 89 MAR/26/92 08:51:22
 WORKFILE ID: C
 WORKFILE NAME:

AREA#	RT	AREA	TYPE	AR/HT	AREA#
	0.03	659	PB	0.038	2.091
	0.31	212	PV	0.015	0.673
	0.34	30649	D YB	0.015	97.237

TOTAL AREA= 31520
 MUL FACTOR= 1.0000E+00



RUN # 91 MAR/26/92 09:14:09
 WORKFILE ID: C
 WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	682	PV	0.038	0.649
0.30	233	D PY	0.015	0.222
0.33	83683	D YB	0.015	79.626 C1
0.62	1499	D PP	0.019	1.426 C2
0.75	3027	D PB	0.022	2.880 C2
5.65	2184	VV	0.213	2.078
5.92	5296	VV	0.194	5.515 440st
6.12	7991	I YH	0.176	7.804 pkts

TOTAL AREA= 105090
 MUL FACTOR= 1.0000E+00

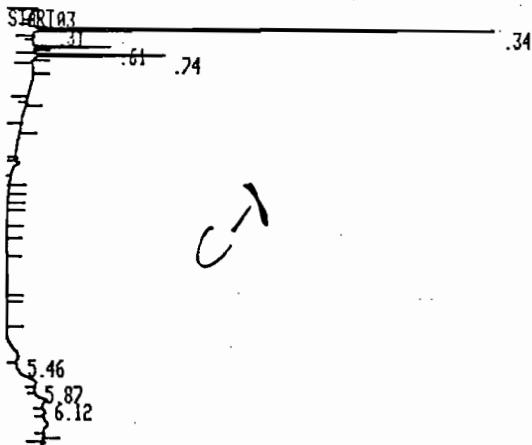
RUN # 90 MAR/26/92 09:01:12
 WORKFILE ID: C
 WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	791	PV	0.045	1.087
0.31	217	D PY	0.016	0.298
0.33	65083	D YB	0.015	89.405
5.90	2133	PY	0.143	2.930
6.12	4572	VV	0.190	6.291

TOTAL AREA= 72796
 MUL FACTOR= 1.0000E+00

823 C1
 79 pt counts
 ppm of C1

7.42% U.S.

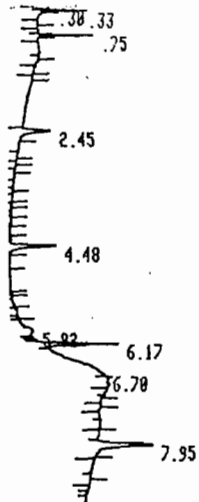


RUN # 93 MAR/26/92 09:32:33
 WORKFILE ID: C
 WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	1602	PV	0.003	1.664
0.31	131	PV	0.010	0.136
0.34	84513	D YB	0.015	87.800 C1
0.61	1585	D PB	0.019	1.647
0.74	3181	D BB	0.022	3.305
5.46	515	PP	0.121	0.535
5.87	1666	PV	0.118	1.731 C1
6.12	3063	VV	0.163	3.102

TOTAL AREA= 96256
 MUL FACTOR= 1.0000E+00

5.85% U.S.



RUN # 97 MAR/26/92 10:23:05
 WORKFILE ID: C
 WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	633	PV	0.037	2.838
0.30	204	D BV	0.016	0.915
0.33	821	D VB	0.016	3.681
0.75	1334	D PB	0.022	5.981
2.45	1998	PB	0.060	8.957
4.48	2964	BV	0.056	13.298
5.92	1425	PP	0.137	6.388
6.17	4059	PV	0.045	18.197
6.70	4140	VV	0.286	18.560
7.95	4728	PB	0.074	21.196

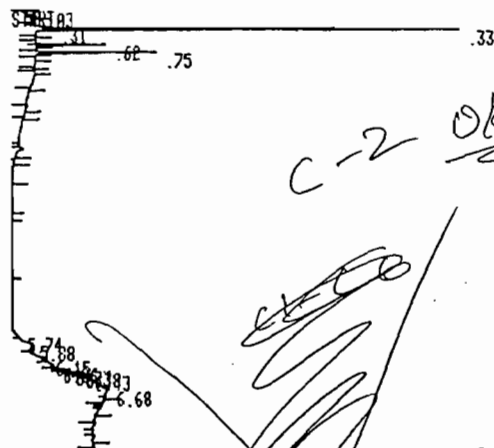
TOTAL AREA= 22306
 MUL FACTOR= 1.0000E+00



RUN # 94 MAR/26/92 09:44:32
 WORKFILE ID: C
 WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	954	PB	0.053	33.380
0.31	410	D PV	0.017	14.346
0.34	1446	D VB	0.015	50.595
5.50	48	PP	0.027	1.680
5.88	0	PP	0.000	0.000
6.65	0	PV	0.000	0.000

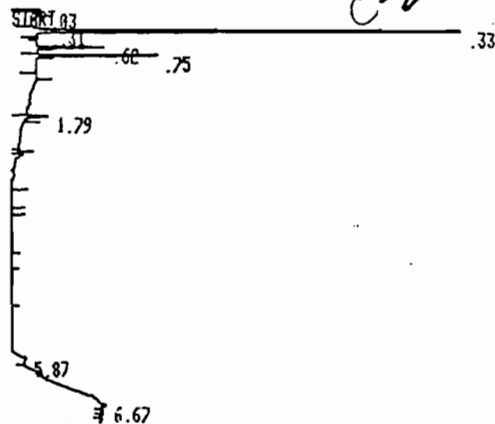
TOTAL AREA= 2858
 MUL FACTOR= 1.0000E+00



RUN # 96 MAR/26/92 10:10:15
 WORKFILE ID: C
 WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	599	PV	0.035	0.595
0.31	235	D PV	0.014	0.234
0.33	84018	D VB	0.015	83.511
0.62	1479	D PB	0.018	1.470
0.75	3043	D PB	0.022	3.025
5.74	0	PP	0.000	0.000
5.88	877	PP	0.099	0.872
6.15	470	PV	0.057	0.467
6.26	688	VP	0.088	0.684
6.33	588	PV	0.038	0.585
6.38	492	VV	0.021	0.489
6.43	1016	VV	0.037	1.010
6.60	7102	VV	0.274	7.059

TOTAL AREA= 100610
 MUL FACTOR= 1.0000E+00



RUN # 95 MAR/26/92 09:58:00
 WORKFILE ID: C
 WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	460	PB	0.030	0.303
0.31	165	D PV	0.011	0.109
0.33	84745	D VB	0.015	55.864
0.62	1431	D PB	0.019	0.943
0.75	2983	D PB	0.022	1.966
1.79	728	D BB	0.028	0.480
5.87	6810	VV	0.242	4.489
6.67	54378	VV	0.457	35.846

TOTAL AREA= 151700
 MUL FACTOR= 1.0000E+00

cl to -

C-2 OK

8.47% VOC

Ambient AIR

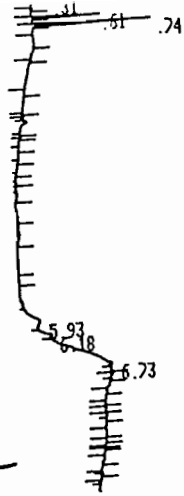
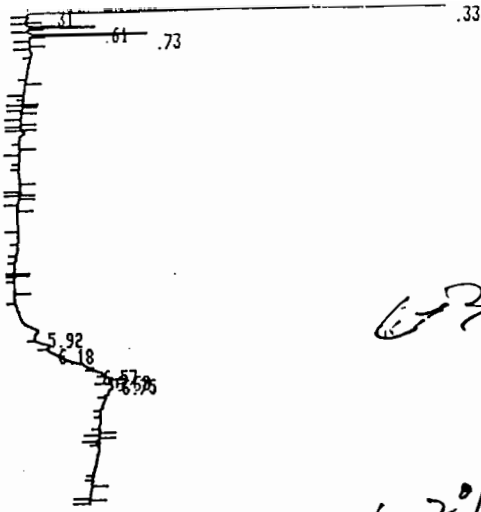
Ambient Air

Ghost PKs

C-2

5.72% VOC

Handwritten marks



RUN # 100
 WORKFILE ID: C
 WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	921	PV	0.056	1.028
0.31	60	PV	0.005	0.067
0.33	81941	D VB	0.015	91.471
0.61	1410	D PB	0.018	1.574
0.73	3006	D PB	0.022	3.356
5.92	456	PP	0.044	0.509
6.18	645	PP	0.077	0.728
6.57	431	PV	0.061	0.481
6.68	569	VV	0.087	0.635
6.75	142	VB	0.028	0.169

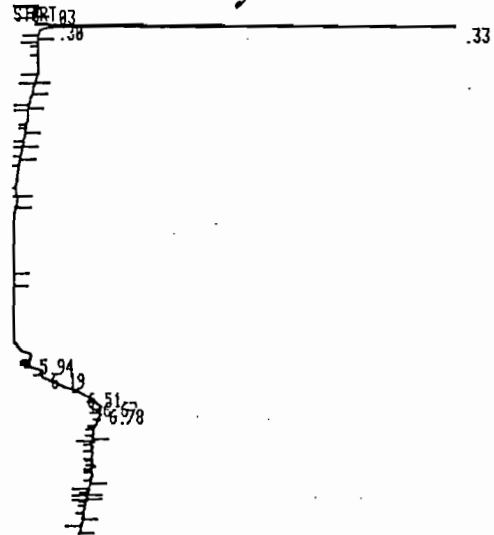
TOTAL AREA= 89581
 MUL FACTOR= 1.0000E+00



RUN # 101
 WORKFILE ID: C
 WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	776	BB	0.064	0.815
0.31	217	D PV	0.014	0.228
0.33	83845	D VB	0.015	88.079
0.61	1434	D BB	0.018	1.506
0.74	2994	D BB	0.022	3.145
5.93	1244	PP	0.142	1.307
6.18	284	PP	0.044	0.298
6.73	4399	PV	0.257	4.621

TOTAL AREA= 95193
 MUL FACTOR= 1.0000E+00



RUN # 98
 WORKFILE ID: C
 WORKFILE NAME:

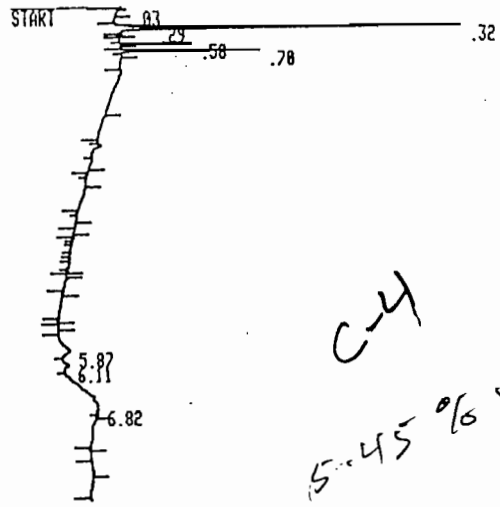
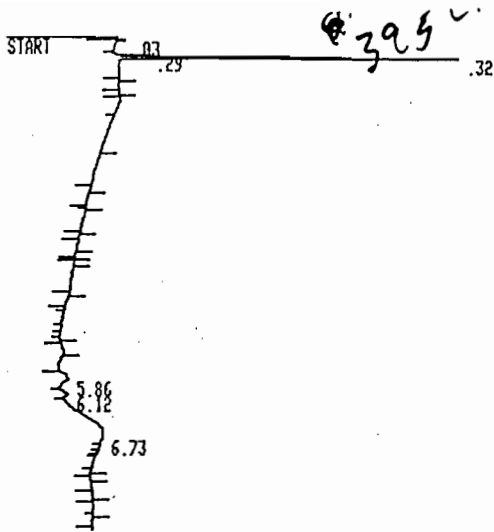
AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	594	PB	0.036	5.255
0.30	314	D BB	0.021	2.778
5.92	1139	PP	0.107	10.077
6.18	327	PV	0.050	2.893
6.71	8929	VV	0.280	78.997

TOTAL AREA= 11303
 MUL FACTOR= 1.0000E+00

RUN # 99
 WORKFILE ID: C
 WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	616	PV	0.040	1.284
0.30	0	PP	0.000	0.000
0.33	29539	D PB	0.015	61.565
5.94	1265	PV	0.131	2.637
6.19	732	PV	0.070	1.526
6.51	4249	VV	0.129	8.856
6.67	6036	VV	0.141	12.500
6.78	5543	VV	0.125	11.533

TOTAL AREA= 47980
 MUL FACTOR= 1.0000E+00



C-4
5.45% UOS

RUN # 124 MAR/27/92 10:33:35
 WORKFILE ID: C
 WORKFILE NAME:

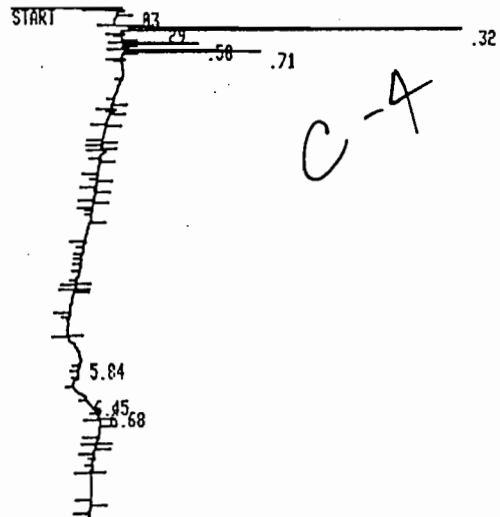
AREA#	RT	AREA TYPE	AR/HT	AREA#
	0.03	2024 BP	0.076	4.531
	0.29	530 D PV	0.015	1.186
	0.32	24021 D VB	0.015	53.770
	5.86	1660 BP	0.154	3.716
	6.12	685 PV	0.082	1.533
	6.73	15754 VV	0.467	35.264

TOTAL AREA= 44674
 MUL FACTOR= 1.0000E+00

RUN # 125 MAR/27/92 10:49:20
 WORKFILE ID: C
 WORKFILE NAME:

AREA#	RT	AREA TYPE	AR/HT	AREA#
	0.03	1200 PB	0.046	1.232
	0.29	420 D PV	0.013	0.431
	0.32	83291 D VB	0.015	85.506
	0.58	1484 D PB	0.018	1.524
	0.70	3315 D BV	0.021	3.403
	5.87	1551 PV	0.141	1.592
	6.11	612 VP	0.084	0.628
	6.82	5537 PV	0.439	5.684

TOTAL AREA= 97410
 MUL FACTOR= 1.0000E+00

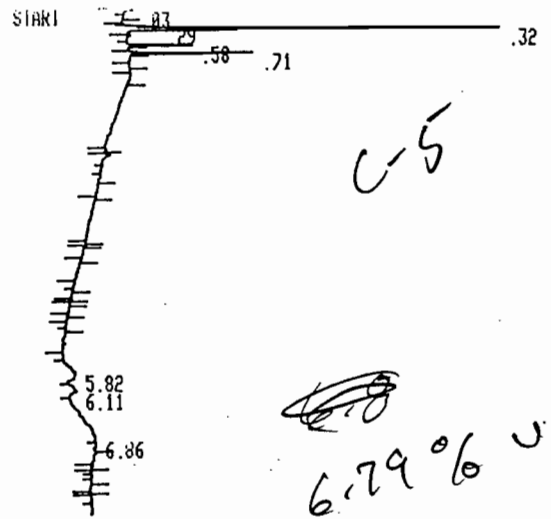
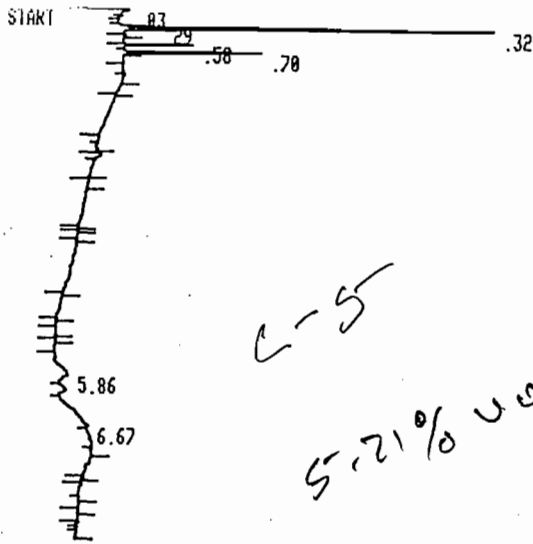


RUN # 127 MAR/27/92 11:22:03
 WORKFILE ID: C
 WORKFILE NAME:

AREA#	RT	AREA TYPE	AR/HT	AREA#
	0.03	1020 PB	0.038	1.054
	0.29	592 D PV	0.016	0.612
	0.32	85326 D VB	0.015	88.142
	0.58	1569 D BB	0.018	1.621
	0.71	3329 D BB	0.021	3.439
	5.84	3883 PV	0.270	4.011
	6.45	299 PV	0.059	0.309
	6.68	787 VV	0.085	0.813

TOTAL AREA= 96805
 MUL FACTOR= 1.0000E+00

6.55% UOS



RUN # 129 MAR/27/92 11:55:43
 WORKFILE ID: C
 WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	1477	PV	0.053	1.704
0.29	437	D PV	0.014	0.506
0.32	74771	D VB	0.015	86.519
0.58	1390	D BV	0.019	1.608
0.70	3137	D VB	0.022	3.630
5.86	2282	BV	0.194	2.641
6.67	2932	PV	0.216	3.393

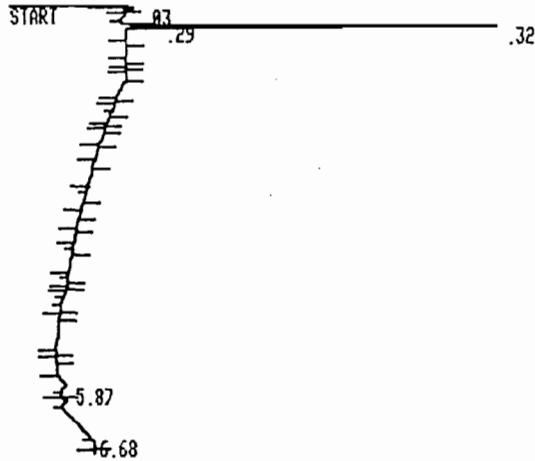
TOTAL AREA= 86422
 MUL FACTOR= 1.0000E+00

395 C1

RUN # 130 MAR/27/92 12:18:09
 WORKFILE ID: C
 WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	1261	PV	0.043	1.589
0.29	470	D PV	0.015	0.592
0.32	68018	D VB	0.015	85.690
0.58	1151	D PB	0.017	1.450
0.71	2730	D BB	0.021	3.439
5.82	2064	PV	0.172	2.600
6.11	1078	VP	0.119	1.358
6.86	2605	PV	0.388	3.202

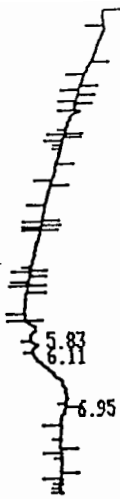
TOTAL AREA= 79377
 MUL FACTOR= 1.0000E+00



RUN # 128 MAR/27/92 11:36:24
 WORKFILE ID: C
 WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	773	PB	0.031	2.912
0.29	554	D PV	0.016	2.087
0.32	22966	D VB	0.015	86.507
5.87	885	BV	0.118	3.334
6.68	1370	PV	0.235	5.161

TOTAL AREA= 26548
 MUL FACTOR= 1.0000E+00

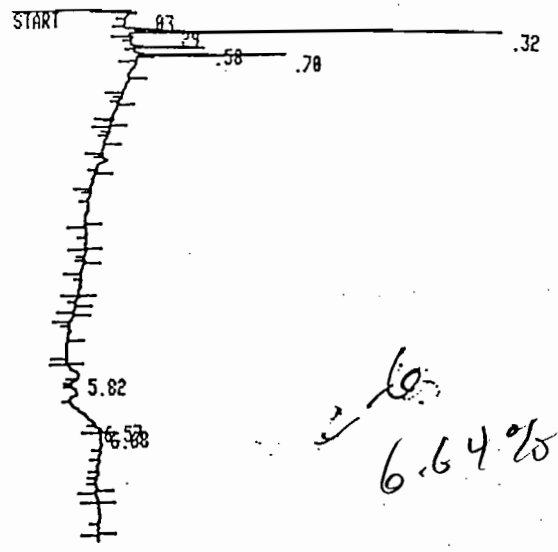


C-6
11.2% UOC

RUN # 132 MAR/27/92 12:50:23
WORKFILE ID: C
WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	958	PB	0.041	1.090
0.29	449 D	PV	0.014	0.511
0.32	75106 D	VB	0.015	85.462
0.58	1422 D	PB	0.019	1.618
0.70	3111 D	BB	0.021	3.540
5.83	1377	PP	0.139	1.567
6.11	508	PP	0.069	0.578
6.95	4951	PV	0.635	5.634

TOTAL AREA= 87882
MUL FACTOR= 1.0000E+00

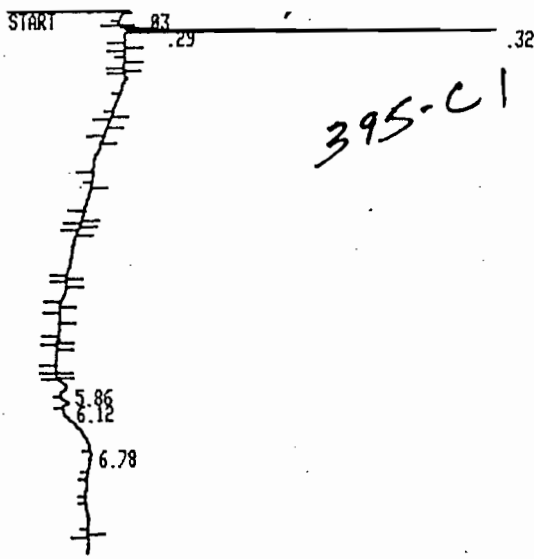


6.64% UOC

RUN # 133 MAR/27/92 13:11:44
WORKFILE ID: C
WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	1642	PV	0.057	1.816
0.29	455 D	PV	0.014	0.503
0.32	80680 D	VB	0.015	89.240
0.58	1362 D	VV	0.018	1.507
0.70	3343 D	VB	0.022	3.698
5.82	1897	PV	0.148	2.098
6.57	643	PV	0.129	0.711
6.68	386	VB	0.068	0.427

TOTAL AREA= 90408
MUL FACTOR= 1.0000E+00

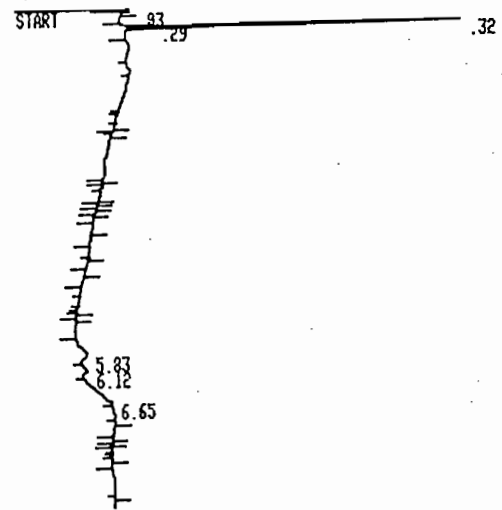


395-C1

RUN # 131 MAR/27/92 12:34:34
WORKFILE ID: C
WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	1998	PV	0.073	5.757
0.29	579 D	PV	0.016	1.668
0.32	22762 D	VB	0.015	65.581
5.86	1246	BP	0.130	3.590
6.12	597	PV	0.075	1.720
6.78	7526	VV	0.353	21.684

TOTAL AREA= 34708
MUL FACTOR= 1.0000E+00



RUN # 135 MAR/27/92 13:31:30
WORKFILE ID: C
WORKFILE NAME:

AREA%	RT	AREA TYPE	AR/HT	AREA%
0.03	1015	PB	0.039	3.400
0.29	608 D	BY	0.017	2.036
0.32	22564 D	VB	0.015	75.576
5.83	1848	BY	0.181	6.190
6.12	739	VP	0.099	2.475
6.65	3082	PV	0.204	10.323

TOTAL AREA= 29856
MUL FACTOR= 1.0000E+00

APPENDIX G
OPACITY OBSERVATIONS

VISIBLE EMISSIONS EVALUATOR

This is to certify that

Rick J. Kremyke

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 Hove
President

232749
Certificate Number

Will [Signature]
Vice President

Orlando
Location

David B. Savage, Jr.
Program Manager

February 26, 1992
Date of Issue

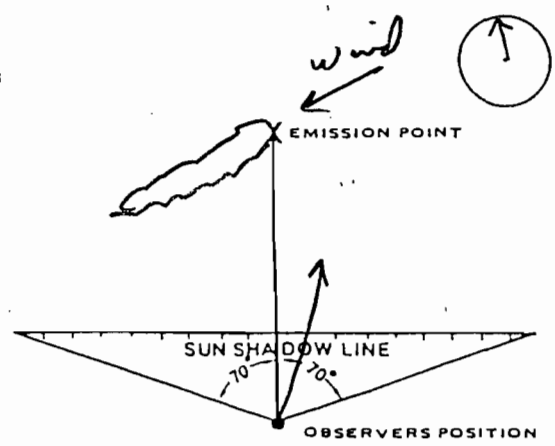
VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME Florida Gas - Melbourne St. #19			OBSERVATION DATE 3-27-92				START TIME 10:15		STOP TIME 11:15																					
ADDRESS 3400 Ranch Road			<table border="1"> <tr> <td>SEC</td> <td>0</td> <td>15</td> <td>30</td> <td>45</td> <td>SEC</td> <td>0</td> <td>15</td> <td>30</td> <td>45</td> </tr> <tr> <td>M</td> <td></td> <td></td> <td></td> <td></td> <td>M</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>				SEC	0	15	30	45	SEC	0	15	30	45	M					M								
SEC	0	15	30	45	SEC	0	15	30	45																					
M					M																									
CITY W. Melbourne			STATE FL		ZIP 32904-3514																									
PHONE 407-723-8998			SOURCE ID NUMBER Unit #2																											
PROCESS EQUIPMENT Dresser 412 KVSE			OPERATING MODE Full Load																											
CONTROL EQUIPMENT NA			OPERATING MODE NA																											
DESCRIBE EMISSION POINT Exhaust Stack of Recip Engine																														
HEIGHT ABOVE GROUND LEVEL 65'			HEIGHT RELATIVE TO OBSERVER 59'																											
DISTANCE FROM OBSERVER 150'			DIRECTION FROM OBSERVER North																											
DESCRIBE EMISSIONS NO VE'S																														
EMISSION COLOR NO VE'S			PLUME TYPE: CONTINUOUS <input checked="" type="checkbox"/> FUGITIVE <input type="checkbox"/> INTERMITTENT <input type="checkbox"/>																											
WATER DROPLETS PRESENT NO <input checked="" type="checkbox"/> YES <input type="checkbox"/>			IS WATER DROPLET PLUME ATTACHED <input type="checkbox"/> DETACHED <input type="checkbox"/>																											
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED Exit of exhaust stack																														
DESCRIBE BACKGROUND Sky																														
BACKGROUND COLOR Blue			SKY CONDITIONS Clear																											
WIND SPEED 5-10 mph			WIND DIRECTION East																											
AMBIENT TEMP.		WET BULB TEMP.		RELATIVE HUMIDITY																										
SOURCE LAYOUT SKETCH DRAW NORTH ARROW																														
AVERAGE OPACITY FOR HIGHEST PERIOD 0						NUMBER OF READINGS ABOVE 0 % WERE 0																								
COMMENTS																														
RANGE OF OPACITY READINGS 0 MINIMUM 0 MAXIMUM																														
OBSERVER'S NAME (PRINT) Rick J. Krenke																														
OBSERVER'S SIGNATURE Rick J. Krenke										DATE 3-27-92																				
ORGANIZATION Cubix Corp.																														
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS						CERTIFIED BY State of FL by ETA		DATE 2-27-92																						
SIGNATURE			DATE			VERIFIED BY			DATE																					

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME			OBSERVATION DATE				START TIME		STOP TIME			
Florida Gas - Melbourne St. #A			3-27-92				1130		1230			
ADDRESS			SEC		M		SEC		M			
3400 Ranch Road			M	0	15	30	45	M	0	15	30	45
CITY			STATE		ZIP		1		2		3	
W. Melbourne			FL		32904-3514		31		32		33	
PHONE			SOURCE ID NUMBER		4		5		6		7	
407-723-8998			Unit #2		34		35		36		37	
PROCESS EQUIPMENT			OPERATING MODE		8		9		10		11	
Dresser 412 KUSR			Full Load		38		39		40		41	
CONTROL EQUIPMENT			OPERATING MODE		12		13		14		15	
NA			NA		42		43		44		45	
DESCRIBE EMISSION POINT			HEIGHT ABOVE GROUND LEVEL		HEIGHT RELATIVE TO OBSERVER		16		17		18	
Exhaust Stack of Recip. Engine			65'		59'		46		47		48	
DISTANCE FROM OBSERVER			DIRECTION FROM OBSERVER		19		20		21		22	
150'			North		49		50		51		52	
DESCRIBE EMISSIONS			EMISSION COLOR		PLUME TYPE: CONTINUOUS <input checked="" type="checkbox"/> FUGITIVE <input type="checkbox"/> INTERMITTENT <input type="checkbox"/>		23		24		25	
No VE's			No VE's				53		54		55	
WATER DROPLETS PRESENT			IS WATER DROPLET PLUME ATTACHED <input type="checkbox"/> DETACHED <input type="checkbox"/>		26		27		28		29	
NO <input checked="" type="checkbox"/> YES <input type="checkbox"/>					56		57		58		59	
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED			BACKGROUND COLOR		SKY CONDITIONS		30		31		32	
Exit of Exhaust Stack			Blue		Clear		60		61		62	
DESCRIBE BACKGROUND			WIND SPEED		WIND DIRECTION		AVERAGE OPACITY FOR HIGHEST PERIOD		NUMBER OF READINGS ABOVE			
Sky			5-10 mph		East		0		0 % WERE 0			
SOURCE LAYOUT SKETCH			AMBIENT TEMP.		WET BULB TEMP.		RELATIVE HUMIDITY		COMMENTS			
									RANGE OF OPACITY READINGS MINIMUM 0 MAXIMUM 0 OBSERVER'S NAME (PRINT) Rick J. Krenzke OBSERVER'S SIGNATURE Rick J. Krenzke DATE 3-27-92 ORGANIZATION Cubix Corp.			
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS			SIGNATURE		DATE		CERTIFIED BY		DATE			
							State of FL. by ETA		2-27-92			
			TITLE		DATE		VERIFIED BY		DATE			

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME <i>Florida Gas - Melbourne St. #19</i>			OBSERVATION DATE <i>3-27-92</i>				START TIME <i>1245</i>				STOP TIME <i>1345</i>			
ADDRESS <i>3400 Ranch Road</i>			50C M	0	15	30	45	50C M	0	15	30	45		
CITY <i>W. Melbourne</i>			STATE <i>FL</i>	ZIP <i>32904-3514</i>	1	0	0	0	31	0	0	0	0	
PHONE <i>407-723-8998</i>			SOURCE ID NUMBER <i>Unit #2</i>	2	0	0	0	0	32	0	0	0	0	
PROCESS EQUIPMENT <i>Dresser 412 KUSR</i>			OPERATING MODE <i>Full Load</i>	3	0	0	0	0	33	0	0	0	0	
CONTROL EQUIPMENT <i>NA</i>			OPERATING MODE <i>NA</i>	4	0	0	0	0	34	0	0	0	0	
DESCRIBE EMISSION POINT <i>Exhaust Stack of Recip. Engine</i>			5	0	0	0	0	35	0	0	0	0	0	
HEIGHT ABOVE GROUND LEVEL <i>65'</i>		HEIGHT RELATIVE TO OBSERVER <i>59'</i>		6	0	0	0	0	36	0	0	0	0	
DISTANCE FROM OBSERVER <i>150'</i>		DIRECTION FROM OBSERVER <i>East</i>		7	0	0	0	0	37	0	0	0	0	
DESCRIBE EMISSIONS <i>No VE's</i>			8	0	0	0	0	38	0	0	0	0	0	
EMISSION COLOR <i>NO VE's</i>		PLUME TYPE: CONTINUOUS <input checked="" type="checkbox"/> FUGITIVE <input type="checkbox"/> INTERMITTENT <input type="checkbox"/>		9	0	0	0	0	39	0	0	0	0	
WATER DROPLETS PRESENT <i>NO</i> <input checked="" type="checkbox"/> YES <input type="checkbox"/>		IS WATER DROPLET PLUME ATTACHED <input type="checkbox"/> DETACHED <input type="checkbox"/>		10	0	0	0	0	40	0	0	0	0	
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED <i>Exit of Exhaust Stack</i>			11	0	0	0	0	41	0	0	0	0	0	
DESCRIBE BACKGROUND <i>Sky</i>			12	0	0	0	0	42	0	0	0	0	0	
BACKGROUND COLOR <i>Blue</i>		SKY CONDITIONS <i>Clear</i>		13	0	0	0	0	43	0	0	0	0	
WIND SPEED <i>5-10 MPH</i>		WIND DIRECTION <i>East</i>		14	0	0	0	0	44	0	0	0	0	
AMBIENT TEMP.	WET BULB TEMP.	RELATIVE HUMIDITY		15	0	0	0	0	45	0	0	0	0	
SOURCE LAYOUT SKETCH 			DRAW NORTH ARROW	16	0	0	0	0	46	0	0	0	0	
COMMENTS			17	0	0	0	0	47	0	0	0	0	0	
AVERAGE OPACITY FOR HIGHEST PERIOD <i>0</i>			18	0	0	0	0	48	0	0	0	0	0	
NUMBER OF READINGS ABOVE HIGHEST PERIOD <i>0</i> % WERE <i>0</i>			19	0	0	0	0	49	0	0	0	0	0	
RANGE OF OPACITY READINGS <i>0</i> MINIMUM <i>0</i> MAXIMUM			20	0	0	0	0	50	0	0	0	0	0	
OBSERVER'S NAME (PRINT) <i>RICK J. KRENZKE</i>			21	0	0	0	0	51	0	0	0	0	0	
OBSERVER'S SIGNATURE <i>Rick J. Krenzke</i>			22	0	0	0	0	52	0	0	0	0	0	
DATE <i>3-27-92</i>			23	0	0	0	0	53	0	0	0	0	0	
ORGANIZATION <i>Cubix Corp.</i>			24	0	0	0	0	54	0	0	0	0	0	
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS			25	0	0	0	0	55	0	0	0	0	0	
SIGNATURE			26	0	0	0	0	56	0	0	0	0	0	
TITLE			27	0	0	0	0	57	0	0	0	0	0	
DATE			28	0	0	0	0	58	0	0	0	0	0	
CERTIFIED BY <i>State of FL. by STA</i>			29	0	0	0	0	59	0	0	0	0	0	
DATE <i>2-27-92</i>			30	0	0	0	0	60	0	0	0	0	0	
VERIFIED BY			31	0	0	0	0	61	0	0	0	0	0	
DATE			32	0	0	0	0	62	0	0	0	0	0	

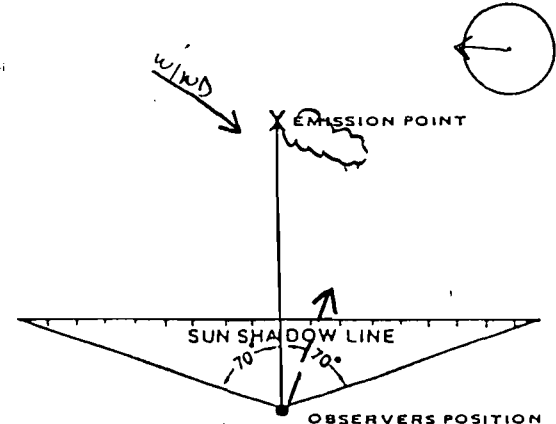
VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME Florida GAS - Melbourne Station #19			OBSERVATION DATE 3-26-92				START TIME 845		STOP TIME 945			
ADDRESS 3400 Ranch Road			SEC M	0	15	30	45	SEC M	0	15	30	45
CITY West Melbourne			STATE FL		ZIP 32904 - 3518		1	31	0	0	0	0
PHONE 407-723-9998			SOURCE ID NUMBER Unit #1				2	32	0	0	0	0
PROCESS EQUIPMENT Dresser Model 412KVR			OPERATING MODE Full Load				3	33	0	0	0	0
CONTROL EQUIPMENT NA			OPERATING MODE NA				4	34	0	0	0	0
DESCRIBE EMISSION POINT Exhaust of Recip. Engine			5	35	0	0	0	0	0	0	0	
HEIGHT ABOVE GROUND LEVEL 65'		HEIGHT RELATIVE TO OBSERVER 59'		6	36	0	0	0	0	0	0	
DISTANCE FROM OBSERVER 130'		DIRECTION FROM OBSERVER East		7	37	0	0	0	0	0	0	
DESCRIBE EMISSIONS No VES			8	38	0	0	0	0	0	0	0	
EMISSION COLOR No VES		PLUME TYPE: CONTINUOUS <input checked="" type="checkbox"/> FUGITIVE <input type="checkbox"/> INTERMITTENT <input type="checkbox"/>				9	39	0	0	0	0	
WATER DROPLETS PRESENT NO <input checked="" type="checkbox"/> YES <input type="checkbox"/>		IS WATER DROPLET PLUME ATTACHED <input type="checkbox"/> DETACHED <input type="checkbox"/>				10	40	0	0	0	0	
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED Exit of Exhaust Stack			11	41	0	0	0	0	0	0		
DESCRIBE BACKGROUND Sky			12	42	0	0	0	0	0	0		
BACKGROUND COLOR Blue		SKY CONDITIONS Clear		13	43	0	0	0	0	0		
WIND SPEED 5-10 mph		WIND DIRECTION N		14	44	0	0	0	0	0		
AMBIENT TEMP.	WET BULB TEMP.	RELATIVE HUMIDITY		15	45	0	0	0	0			
SOURCE LAYOUT SKETCH DRAW NORTH ARROW			16	46	0	0	0	0	0			
<p>The sketch shows an 'EMMISSION POINT' at the top, connected by a vertical line to the 'OBSERVERS POSITION' at the bottom. A horizontal arrow labeled 'wind' points from the left towards the emission point. A circular arrow indicates a north arrow pointing to the left. A 'SUN SHADOW LINE' is drawn as a horizontal line below the observer's position, with a dashed line indicating a 70-degree angle from the vertical line to the shadow line.</p>			17	47	0	0	0	0				
			18	48	0	0	0	0				
			19	49	0	0	0	0				
			20	50	0	0	0	0				
			21	51	0	0	0	0				
			22	52	0	0	0	0				
			23	53	0	0	0	0				
			24	54	0	0	0	0				
			25	55	0	0	0	0				
			26	56	0	0	0	0				
AVERAGE OPACITY FOR HIGHEST PERIOD 0			NUMBER OF READINGS ABOVE 0 % WERE 0									
COMMENTS			RANGE OF OPACITY READINGS 0 MINIMUM 0 MAXIMUM									
			OBSERVER'S NAME (PRINT) Rick J. KRENZKE									
			OBSERVER'S SIGNATURE Rick J. Krenzke		DATE 3-26-92							
			ORGANIZATION Cubic Corp.									
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS			CERTIFIED BY State of FL by ETA		DATE 2-27-92							
SIGNATURE		TITLE		DATE								

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME Florida Gas - Melbourne St. #19			OBSERVATION DATE 3-26-92				START TIME 955		STOP TIME 1055																																											
ADDRESS 3400 Ranch Road			<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td colspan="2">SEC</td> <td colspan="2">0</td> <td colspan="2">15</td> <td colspan="2">30</td> <td colspan="2">45</td> <td colspan="2">SEC</td> <td colspan="2">0</td> <td colspan="2">15</td> <td colspan="2">30</td> <td colspan="2">45</td> </tr> <tr> <td>M</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>M</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>										SEC		0		15		30		45		SEC		0		15		30		45		M										M									
SEC		0		15		30		45		SEC		0		15		30		45																																		
M										M																																										
CITY West Melbourne			STATE FL		ZIP 32904-3518					1		0		0		0		0																																		
PHONE 407-723-8978			SOURCE ID NUMBER Unit #1							2		0		0		0		0																																		
PROCESS EQUIPMENT Dresser Model 412 KUSR			OPERATING MODE Full Load							3		0		0		0		0																																		
CONTROL EQUIPMENT NA			OPERATING MODE NA							4		0		0		0		0																																		
DESCRIBE EMISSION POINT Exhaust of recip. Engine			HEIGHT ABOVE GROUND LEVEL 65'		HEIGHT RELATIVE TO OBSERVER 59'					5		0		0		0		0																																		
DISTANCE FROM OBSERVER 130'			DIRECTION FROM OBSERVER East							6		0		0		0		0																																		
DESCRIBE EMISSIONS No VE's			EMISSION COLOR No VE's							7		0		0		0		0																																		
PLUME TYPE: CONTINUOUS <input checked="" type="checkbox"/>			FUGITIVE <input type="checkbox"/> INTERMITTENT <input type="checkbox"/>							8		0		0		0		0																																		
WATER DROPLETS PRESENT NO <input checked="" type="checkbox"/> YES <input type="checkbox"/>			IS WATER DROPLET PLUME ATTACHED <input type="checkbox"/> DETACHED <input type="checkbox"/>							9		0		0		0		0																																		
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED Exit of Exhaust Stack			DESCRIBE BACKGROUND Sky							10		0		0		0		0																																		
BACKGROUND COLOR Blue			SKY CONDITIONS 0-10% Clear Clouds							11		0		0		0		0																																		
WIND SPEED 10 mph			WIND DIRECTION N							12		0		0		0		0																																		
AMBIENT TEMP.			WET BULB TEMP.			RELATIVE HUMIDITY					13		0		0		0		0																																	
SOURCE LAYOUT SKETCH			DRAW NORTH ARROW							14		0		0		0		0																																		
										15		0		0		0		0																																		
										16		0		0		0		0																																		
										17		0		0		0		0																																		
										18		0		0		0		0																																		
										19		0		0		0		0																																		
										20		0		0		0		0																																		
										21		0		0		0		0																																		
										22		0		0		0		0																																		
										23		0		0		0		0																																		
										24		0		0		0		0																																		
AVERAGE OPACITY FOR HIGHEST PERIOD 0			NUMBER OF READINGS ABOVE 0 % WERE 0							25		0		0		0		0																																		
COMMENTS			RANGE OF OPACITY READINGS 0 MINIMUM 0 MAXIMUM							26		0		0		0		0																																		
OBSERVER'S NAME (PRINT) Rick J. Krenzke			OBSERVER'S SIGNATURE <i>Rick J. Krenzke</i>							DATE 3-26-92		27		0		0		0																																		
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS			CERTIFIED BY State of FL by ETA							DATE 2-27-92		28		0		0		0																																		
SIGNATURE			VERIFIED BY C							DATE		29		0		0		0																																		
TITLE			DATE							30		0		0		0		0																																		

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME Florida Gas - Melbourne St. #17				OBSERVATION DATE 3-26-92				START TIME 1105				STOP TIME 1205			
ADDRESS 3400 Ranch Road				SEC M	0	15	30	45	SEC M	0	15	30	45		
CITY W. Melbourne				STATE FL	ZIP 32904-3518	1	0	0	0	31	0	0	0		
PHONE 407-723-8998		SOURCE ID NUMBER Unit #1		2	0	0	0	0	32	0	0	0	0		
PROCESS EQUIPMENT Dresser Model 412KUSK		OPERATING MODE Full		3	0	0	0	0	33	0	0	0	0		
CONTROL EQUIPMENT NA		OPERATING MODE NA		4	0	0	0	0	34	0	0	0	0		
DESCRIBE EMISSION POINT Exhaust stack of Recip engine				5	0	0	0	0	35	0	0	0	0		
HEIGHT ABOVE GROUND LEVEL 65'		HEIGHT RELATIVE TO OBSERVER 59'		6	0	0	0	0	36	0	0	0	0		
DISTANCE FROM OBSERVER 120 ft		DIRECTION FROM OBSERVER East		7	0	0	0	0	37	0	0	0	0		
DESCRIBE EMISSIONS No UE's				8	0	0	0	0	38	0	0	0	0		
EMISSION COLOR NO UE's		PLUME TYPE: CONTINUOUS <input checked="" type="checkbox"/> FUGITIVE <input type="checkbox"/> INTERMITTENT <input type="checkbox"/>		9	0	0	0	0	39	0	0	0	0		
WATER DROPLETS PRESENT NO <input checked="" type="checkbox"/> YES <input type="checkbox"/>		IS WATER DROPLET PLUME ATTACHED <input type="checkbox"/> DETACHED <input type="checkbox"/>		10	0	0	0	0	40	0	0	0	0		
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED Exit of exhaust stack				11	0	0	0	0	41	0	0	0	0		
DESCRIBE BACKGROUND Sky				12	0	0	0	0	42	0	0	0	0		
BACKGROUND COLOR Blue		SKY CONDITIONS Clear 10% cloud		13	0	0	0	0	43	0	0	0	0		
WIND SPEED 10 mph		WIND DIRECTION North		14	0	0	0	0	44	0	0	0	0		
AMBIENT TEMP.	WET BULB TEMP.	RELATIVE HUMIDITY		15	0	0	0	0	45	0	0	0	0		
SOURCE LAYOUT SKETCH 				16	0	0	0	0	46	0	0	0	0		
DRAW NORTH ARROW				17	0	0	0	0	47	0	0	0	0		
AVERAGE OPACITY FOR HIGHEST PERIOD 0				18	0	0	0	0	48	0	0	0	0		
NUMBER OF READINGS ABOVE 0% WERE 0				19	0	0	0	0	49	0	0	0	0		
RANGE OF OPACITY READINGS 0 MINIMUM 0 MAXIMUM				20	0	0	0	0	50	0	0	0	0		
OBSERVER'S NAME (PRINT) RICK J. KRENZKE				21	0	0	0	0	51	0	0	0	0		
OBSERVER'S SIGNATURE <i>Rick J. Krenzke</i>				22	0	0	0	0	52	0	0	0	0		
DATE 3-26-92				23	0	0	0	0	53	0	0	0	0		
ORGANIZATION Cubix Corp.				24	0	0	0	0	54	0	0	0	0		
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS				25	0	0	0	0	55	0	0	0	0		
SIGNATURE		DATE		26	0	0	0	0	56	0	0	0	0		
CERTIFIED BY State of Florida by EPA		DATE 2-27-92		27	0	0	0	0	57	0	0	0	0		
TITLE		DATE		28	0	0	0	0	58	0	0	0	0		
VERIFIED BY		DATE		29	0	0	0	0	59	0	0	0	0		
DATE		DATE		30	0	0	0	0	60	0	0	0	0		

**APPENDIX H:
FUEL ANALYSES**

Client: Florida Gas
 Sample ID: Melbourne Engine Fuel Gas

CALCULATION OF DENSITY AND HEATING VALUE

Component	% Volume	Molecular Wt.	Density (lb/ft3)	% volume		Component		Gross Heating Value (Btu/SCF)	Volume Fract. Btu
				x Density	weight %	Gross Btu/lb	Weight 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	0.4380	28.016	0.0744	0.00033	0.7402	0	0.00	0	0
CO2	0.6730	44.01	0.117	0.00079	1.7885	0	0.00	0	0
CO		28.01	0.074	0.00000	0.0000	4347	0.00	322	0
Methane	96.6170	16.041	0.0424	0.04097	93.0493	23879	22219.24	1013	978.73
Ethane	2.0120	30.067	0.0803	0.00162	3.6698	22320	819.09	1792	36.055
Ethylene		28.051	0.0746	0.00000	0.0000	21644	0.00	1614	0
Propane	0.2210	44.092	0.1196	0.00026	0.6004	21661	130.05	2590	5.7239
propylene		42.077	0.111	0.00000	0.0000	21041	0.00	2336	0
Isobutane	0.0150	58.118	0.1582	0.00002	0.0539	21308	11.49	3363	0.5045
n-butane	0.0084	58.118	0.1582	0.00001	0.0302	21257	6.42	4016	0.3378
Isobutene		56.102	0.148	0.00000	0.0000	20840	0.00	3068	0
Isopentane	0.0013	72.144	0.1904	0.00000	0.0058	21091	1.22	4008	0.0536
n-pentane		72.144	0.1904	0.00000	0.0000	21052	0.00	3993	0
n-hexane	0.0120	86.169	0.2274	0.00003	0.0620	20940	12.98	4762	0.5714
H2S		34.076	0.0911	0.00000	0.0000	7100	0.00	647	0
total	100.00								
		Average Density		0.04403	100.0000	Gross Heating Value		Gross Heating Value	
		Specific Gravity		0.57550		Btu/lb		Btu/SCF	
						23200		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	12.2710			0.737239547		
CO2	44.01	0.272273	0	0.67	29.6187	0.48450626	0		1.2937	
CO	28.01	0.42587	0	0.00	0.0000	0	0		0	
Methane	16.041	0.75	0.25	96.62	1549.8333	69.8352407	23.278414			
Ethane	30.067	0.8	0.2	2.01	60.4948	2.90761195	0.726903			
Ethylene	28.051	0.85714	0.14286	0.00	0.0000	0	0			
Propane	44.092	0.81818	0.18182	0.22	9.7443	0.47899316	0.1064431			
Propene	42.077	0.85714	0.14286	0.00	0.0000	0	0			
Isobutane	58.118	0.82759	0.17247	0.02	0.8718	0.04334565	0.0090332			
n-butane	58.118	0.82759	0.17247	0.01	0.4888	0.02430535	0.0050652			
Isobutene	56.102	0.85714	0.14286	0.00	0.0000	0	0			
Isopentane	72.144	0.83333	0.16667	0.00	0.0965	0.00483168	0.0009664			
n-pentane	72.144	0.83333	0.16667	0.00	0.0000	0	0			
n-hexane	86.169	0.83721	0.16279	0.01	1.0340	0.05201099	0.0101132			
H2S	34.08	0	0	0.00	0.0000	0	0			0
Totals				99.99775	1664.4533	73.8308458	24.14	0.737239547	1.2937	0

CALCULATED VALUES		
O2 F Factor (dry)	8635	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	2008	SCF of Water/MM Btu of Fuel Burned @ 0% excess air
Combust. Moisture Fo	1.8	fuel factor (dimensionless)
VOC Portion of fuel	2.27	%
CO2 F Factor	1022	DSCF of CO2/MM Btu of Fuel Burned @ 0% excess air

99.999

Best Available Copy

8635
1022
18.87
2.27
1022
P.2

ANALYSIS

DATE: 03/26/92	ANALYSIS TIME: 345	STREAM SEQUENCE: 12
TIME: 09:31	CYCLE TIME: 360	STREAM#: 2
ANALYZER#: 2	MODE: RUN	CYCLE START TIME: 09:25

COMP NAME	COMP CODE	MOLE %	GAL/MCF**	B.T.U.*	SP. GR.*
EXANE +	151	.00.012	0.0055	0.64	0.0004
PROPANE	152	.00.221	0.0610	5.58	0.0034
-BUTANE	153	.00.015	0.0049	0.49	0.0003
-BUTANE	154	8411.06-6	0.0027	0.28	0.0002
PENTANE	155	1337.68-6	0.0005	0.05	0.0000
PENTANE	156	.000000	0.0000	0.00	0.0000
NITROGEN	157	0.438	0.0000	0.00	0.0042
ETHANE	158	96.617	0.0000	978.06	0.5352
O2	159	.00.673	0.0000	0.00	0.0102
METHANE	160	.02.013	0.5385	35.71	0.0209
TOTALS		100.000	0.6129	1020.80	0.5748

@ 14.730 PSIA DRY & UNCORRECTED FOR COMPRESSIBILITY

@ 14.730 & 60 DEG. F

COMPRESSIBILITY FACTOR (1/Z)	= 1.0021
HEAT B.T.U. @ 14.730 PSIA & 60 DEG. F CORRECTED FOR (1/Z)	= 1022.9
HEAT SPECIFIC GRAVITY	= 0.5757
UNNORMALIZED TOTAL	= 100.01
ANALOG INPUT CHANNEL 1 = H 2 S	140 = .30898
ANALOG INPUT CHANNEL 2 = WATER	144 = 2.6366

ACTIVE ALARMS

NONE



CERTIFICATE OF ANALYSIS NUMBER 199907

SAMPLE IDENT.: MELBOURNE STATION 1380 DATE: APRIL 08, 1992
FLORIDA GAS TRANS.
ENGINE FUEL GAS P. O. NO.: 92143
FUEL LINE L.F.
03/26/92 @ 10:30

FOR: CUBIX CORPORATION
9225 LOCKHART HIGHWAY
AUSTIN, TEXAS 78747

ATTN: MR. JOE RUDYK

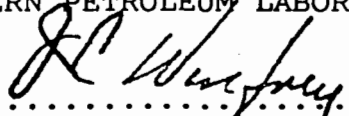
ASTM D-3246
TOTAL SULFUR ANALYSIS

1.8 ppm by wt.

0.107 Grains/100 cu. ft. by vol.

0.190 Grains/100 cu. ft. by wt.

SOUTHERN PETROLEUM LABORATORIES, INC.


.....
J. C. WINFREY

**APPENDIX I:
ALTERNATIVE COMPLIANCE
TEST DATA**

Melbourne Compressor Station--Engine 1--Unofficial Data

Operator/Plant Florida Gas Melbourne Compressor Station
Location Brevard County, Florida
Source Dresser-Rand Compressor Engine
Technicians RK,LF,JR

Test Run No.	C-1	C-2	C-3
Engine ID No.	1	1	1
Date	3/26/92	3/26/92	3/26/92
Start Time	08:36	09:45	10:51
Stop Time	09:36	10:45	11:51
Engine/Compressor Operation			
Engine Speed (rpm)	361	361	361
Ignition Timing (°BTDC)	13	13	13
Air Manifold Pressure (psig)	10.1	10.2	10.1
Air Manifold Temperature (°F)	130	131	130
Fuel Flow (SCFH)	16730	16730	16730
Fuel Manifold Pressure (psig)	32.8	32.8	32.8
Fuel Manifold Temperature (°F)	61	61	61
Pre-Combustion Chamber Pressure (psig)	20.4	20.3	20.3
Post Turbo Temperature (°F)	714	713	717
Turbo (rpm x 100)	116/167	166/168	168/167
After Cooler Water Temperature (°F)	129	129	n.a.
Pockets Open	17	17	17
Suction Pressure (psig)	700	694	698
Suction Temperature (°F)	59	67	66
Discharge Pressure (psig)	952	950	951
Discharge Temperature (°F)	114	113	111
Engine Load (BHP)	2708	2708	2708
Torque (%)	101	101	101
Ambient Conditions			
Atmospheric Pressure (in. Hg)	29.96	29.99	29.99
Temperature (°F) : Dry bulb	69	74	81
(°F) Wet bulb	63	65	70
Humidity (lb/lb air)	0.0107	0.0109	0.0128
Measured Emissions			
NOx (ppmv)	136	141	147
CO (ppmv)	342	345	355
O2 via Method 3a (%)	12.2	12.0	11.9
CO2 via Method 3a (%)	5.04	5.10	5.08
THC via EPA Method 25a (ppmv, wet)	1135	1195	1140
VOC via EPA Method 18 (% of THC)	6.65%	7.10%	5.61%
VOC i.e. non methane via EPA 18 (ppmv, wet)	75.5	84.8	64.0
VOC via Methods 25 and 18 (ppmv, dry)	82.6	93.6	70.0
SO2 in fuel (grains/100 DSCF)	0.107	0.107	0.107
Stack Volumetric Flow Rates			
via Pitot Tube (SCFH, dry)	4.69E+05	4.72E+05	4.76E+05
Calculated Emission Rates (via pitot tube)			
NOx (lbs/hr)	7.62	7.95	8.35
CO (lbs/hr)	11.7	11.8	12.3
VOC (lbs/hr)	1.61	1.83	1.38
SO2 (lbs/hr)	0.0026	0.0026	0.0026
NOx (tons/yr)	33.4	34.8	36.6
CO (tons/yr)	51.1	51.8	53.8
VOC (tons/yr)	7.0	8.0	6.1
SO2 (tons/yr)	0.011	0.011	0.011
NOx (g/hp-hr)	1.28	1.33	1.40
CO (g/hp-hr)	1.96	1.98	2.06
VOC (g/hp-hr)	0.27	0.31	0.23

Melbourne Compressor Station--Engine 1--Unofficial Data

Operator/Plant	Florida Gas Melbourne Compressor Station
Location	Brevard 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 (%)	5.04	5.10	5.08
O2 (%)	12.20	12.00	11.90
Beginning Meter Reading (ft3)	913.010	940.350	962.200
Ending Meter Reading (ft3)	938.500	961.880	985.750
Beginning Impinger Wt (g)	2455.1	2502.3	2535.6
Ending Impinger Wt. (g)	2502.3	2546.4	2577.5
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	72	85	118
Dry Gas Meter Temperature (°F end)	134	121	141
Atmospheric Pressure (in Hg, abs.)	29.96	29.99	29.99
Stack Gas Moisture (% volume)	8.59	9.40	8.63
Dry Gas Fraction	0.914	0.906	0.914
Stack Gas Molecular Wt. (lbs/lb-mole)	28.32	28.23	28.32
Stack Moisture & Molecular Wt. via Stoichiometry			
Fuel Moisture Content (vol % @ 0% O2)	18.87	18.87	18.87
Moisture Content (vol % at stack)	8.54	8.73	8.95
Difference between methods	0%	7%	4%
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	1.10	1.60	1.20
ΔP #2	1.30	1.60	1.50
ΔP #3	1.40	1.60	1.50
ΔP #4	1.30	1.40	1.50
ΔP #5	1.50	1.60	1.40
ΔP #6	1.50	1.70	1.60
ΔP #7	1.50	1.60	1.60
ΔP #8	1.40	1.50	1.50
ΔP #9	1.50	1.30	1.50
ΔP #10	1.50	1.50	1.60
ΔP #11	1.60	1.40	1.70
ΔP #12	1.60	1.40	1.50
ΔP #13	1.50	1.50	1.50
ΔP #14	1.50	1.50	1.60
ΔP #15	1.60	1.50	1.60
ΔP #16	1.60	1.50	1.60
Sum of Square Root of ΔP's	19.3	19.7	19.7
Number of Traverse Points	16	16	16
Average Square Root of ΔP's	1.21	1.23	1.23
Average Temperature (°F)	652	662	669
Static Pressure (in. H2O)	2	1.8	2
Stack Diameter (in.)	23.5	23.5	23.5
Stack Area (ft2)	3.01	3.01	3.01
Stack Velocity (ft/min)	5943	6082	6115
Stack Flow,wet (ACFM)	17901	18320	18420
Stack Flow,dry (SCFH)	4.69E+05	4.72E+05	4.76E+05
Stack Flow Rate via EPA Method 19			
Fuel Flow to Engine (SCFH)	16730	16730	16730
Fuel Heating Value (BTU/SCF)	1022	1022	1022
Fuel O2 F-Factor (DSCFH/MMBTU)	8635	8635	8635
Fuel CO2 F-Factor (DSCFH/MMBTU)	1022	1022	1022
Stack Flow, dry via O2 F-factor (SCFH)	3.55E+05	3.47E+05	3.43E+05
Stack Flow, dry via CO2 F-factor (SCFH)	3.47E+05	3.43E+05	3.44E+05
Difference between O2 F-factor and pitot tube	24%	27%	28%
Difference between CO2 F-factor and pitot tube	26%	27%	28%
Stack Flow Rate via Carbon Balance			
Fuel Carbon Content	1.021	1.021	1.021
Exhaust Carbon Content	5.19	5.25	5.23
Stack Flow, dry via carbon balance (SCFH)	3.29E+05	3.25E+05	3.27E+05
Difference between carbon balance and pitot tube (%)	30%	31%	31%

Melbourne Compressor Station--Engine 2--Unofficial Data

Operator/Plant Florida Gas Melbourne Compressor Station
 Location Brevard County, Florida
 Source Dresser-Rand Compressor Engine
 Technicians RK,LF,JR

Test Run No.	C-4	C-5	C-6
Engine ID No.	2	2	2
Date	3/27/92	3/27/92	3/27/92
Start Time	10:23	11:28	12:34
Stop Time	11:23	12:28	13:34
Engine/Compressor Operation			
Engine Speed (rpm)	360	360	361
Ignition Timing (°BTDC)	14	13	13
Air Manifold Pressure (psig)	10.6	10.4	10.4
Air Manifold Temperature (°F)	129	130	130
Fuel Flow (SCFH)	20639	20578	20490
Fuel Manifold Pressure (psig)	34.4	33	33
Fuel Manifold Temperature (°F)	63	63	64
Pre-Combustion Chamber Pressure (psig)	21.2	21.2	21.2
Post Turbo Temperature (°F)	708	709	708
Turbo (rpm x 100)	169/171	170/171	170/170
After Cooler Water Temperature (°F)	123	126	123
Pockets Open	17	17	17
Suction Pressure (psig)	700	698	695
Suction Temperature (°F)	66	66	66
Discharge Pressure (psig)	941	941	945
Discharge Temperature (°F)	109	106	115
Engine Load (BHP)	2617	2625	2594
Torque (%)	102	102	101
Ambient Conditions			
Atmospheric Pressure (in. Hg)	30.11	30.12	30.10
Temperature (°F) :			
Dry bulb	77	81	81
Wet bulb	61	64	63
Humidity (lb/lb air)	0.0075	0.0085	0.0078
Measured Emissions			
NOx (ppmv)	66	79	92
CO (ppmv)	334	340	339
O2 via Method 3a (%)	12.5	12.5	12.5
CO2 via Method 3a (%)	4.85	4.74	4.82
THC via EPA Method 25a (ppmv, wet)	1350	1550	1525
VOC via EPA Method 18 (% of THC)	6.00%	6.25%	8.92%
VOC i.e. non methane via EPA 18 (ppmv, wet)	81.0	96.9	136.0
VOC via Methods 25a and 18 (ppmv, dry)	88.6	106.6	148.3
SO2 in fuel (grains/100 DSCF)	0.107	0.107	0.107
Stack Volumetric Flow Rates			
via Pitot Tube (SCFH, dry)	4.82E+05	4.74E+05	4.88E+05
Calculated Emission Rates (via pitot tube)			
NOx (lbs/hr)	3.80	4.50	5.37
CO (lbs/hr)	11.7	11.7	12.0
VOC (lbs/hr)	1.77	2.10	3.01
SO2 (lbs/hr)	0.0032	0.0031	0.0031
NOx (tons/yr)	16.6	19.7	23.5
CO (tons/yr)	51.2	51.3	52.7
VOC (tons/yr)	7.8	9.2	13.2
SO2 (tons/yr)	0.014	0.014	0.014
NOx (g/hp-hr)	0.66	0.78	0.94
CO (g/hp-hr)	2.03	2.03	2.11
VOC (g/hp-hr)	0.31	0.36	0.53

Melbourne Compressor Station--Engine 2--Unofficial Data

Operator/Plant Florida Gas Melbourne Compressor Station
 Location Brevard County, Florida
 Source Dresser-Rand Compressor Engine
 Technicians RK,LF,JR

Test Run No.	C-4	C-5	C-6
Stack Moisture & Molecular Wt. via EPA Method 4			
CO2 (%)	4.85	4.74	4.82
O2 (%)	12.53	12.48	12.50
Beginning Meter Reading (ft3)	985.405	13.900	35.900
Ending Meter Reading (ft3)	1013.728	35.880	58.610
Beginning Impinger Wt (g)	2448.6	2650.1	2692.7
Ending Impinger Wt. (g)	2501.1	2692.7	2731.9
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	83	115	118
Dry Gas Meter Temperature (°F end)	120	118	126
Atmospheric Pressure (in Hg, abs.)	30.11	30.12	30.10
Stack Gas Moisture (% volume)	8.53	9.10	8.26
Dry Gas Fraction	0.915	0.909	0.917
Stack Gas Molecular Wt. (lbs/lb-mole)	28.31	28.23	28.34
Stack Moisture & Molecular Wt. via Stoichiometry			
Fuel Moisture Content (vol % @ 0% O2)	18.87	18.87	18.87
Moisture Content (vol % at stack)	8.04	8.15	8.09
Difference between methods	6%	10%	2%
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	1.60	1.20	1.60
ΔP #2	1.70	1.60	1.80
ΔP #3	1.40	1.50	1.70
ΔP #4	1.40	1.50	1.60
ΔP #5	1.50	1.60	1.50
ΔP #6	1.60	1.60	1.60
ΔP #7	1.60	1.70	1.70
ΔP #8	1.60	1.80	1.80
ΔP #9	1.30	1.20	1.30
ΔP #10	1.70	1.70	1.60
ΔP #11	1.60	1.50	1.60
ΔP #12	1.60	1.50	1.50
ΔP #13	1.50	1.40	1.60
ΔP #14	1.50	1.50	1.60
ΔP #15	1.70	1.50	1.50
ΔP #16	1.60	1.50	1.50
Sum of Square Root of ΔP's	19.9	19.7	20.2
Number of Traverse Points	16	16	16
Average Square Root of ΔP's	1.25	1.23	1.26
Average Temperature (°F)	670	667	672
Static Pressure (in. H2O)	2.1	2	2.1
Stack Diameter (in.)	23.5	23.5	23.5
Stack Area (ft2)	3.01	3.01	3.01
Stack Velocity (ft/min)	6168	6089	6245
Stack Flow,wet (ACFM)	18577	18341	18810
Stack Flow,dry (SCFH)	4.82E+05	4.74E+05	4.88E+05
Stack Flow Rate via EPA Method 19			
Fuel Flow to Engine (SCFH)	20639	20578	20490
Fuel Heating Value (BTU/SCF)	1022	1022	1022
Fuel O2 F-Factor (DSCFH/MMBTU)	8635	8635	8635
Fuel CO2 F-Factor (DSCFH/MMBTU)	1022	1022	1022
Stack Flow, dry via O2 F-factor (SCFH)	4.55E+05	4.51E+05	4.50E+05
Stack Flow, dry via CO2 F-factor (SCFH)	4.44E+05	4.53E+05	4.44E+05
Difference between O2 F-factor and pitot tube	6%	5%	8%
Difference between CO2 F-factor and pitot tube	8%	4%	9%
Stack Flow Rate via Carbon Balance			
Fuel Carbon Content	1.021	1.021	1.021
Exhaust Carbon Content	5.02	4.93	5.01
Stack Flow, dry via carbon balance (SCFH)	4.20E+05	4.26E+05	4.18E+05
Difference between carbon balance and pitot tube	13%	10%	14%



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

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

RECEIVED

JUN 03 1991

Division of Air
Resources Management

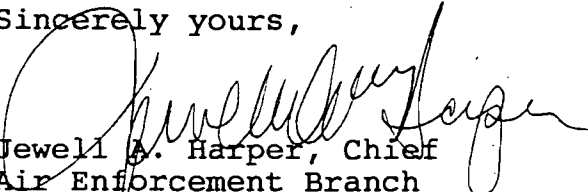
Dear Mr. Fancy:

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.

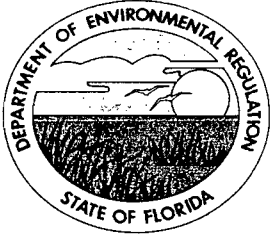
The proposed projects are similar in scope in that they each consist of the addition of one reciprocating internal combustion engine to an existing compressor station. The engines proposed for the stations in Santa Rosa, Taylor and Bradford Counties will be sized at 4000 brake horsepower. The engines 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

J. Harper
CHF/BA



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 04-189454 (PSD-FL-161) to install one natural gas-fired engine at the Florida Gas Transmission facility in Bradford 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:

- A. Kutyna, NED
- 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.

Keri Baker
Clerk

5-10-91
Date

Final Determination

Florida Gas Transmission Company
Bradford County, Florida

Gas-Fired Engine
AC 04-189454
PSD-FL-161

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 3 miles north of Brooker on Highway 235 in Bradford County, Florida, was distributed on March 15, 1991. The Notice of Intent to Issue was published in the The Gainesville Sun on March 15, 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, Northeast District Office, 7825 Baymeadows Way, Jacksonville, Florida 32256-7577.

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 04-189454, PSD-FL-161 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
P. O. Box 1188
Houston, Texas 77251-1188

Permit Number: AC 04-189454
PSD-FL-161

Expiration Date: June 30, 1992
County: Bradford
Latitude/Longitude: 29°55'16"N
82°19'34"W

Project: Natural Gas Compressor
Engine (Unit No. 6)

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 3 miles north of Brooker on Highway 235 in Bradford County, Florida. The UTM coordinates are Zone 17, 371.98 km East and 3310.57 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.

PERMITTEE:
Florida Gas Transmission Company

Permit Number: AC 04-189454
PSD-FL-161
Expiration Date: June 30, 1992

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.

PERMITTEE:
Florida Gas Transmission Company

Permit Number: AC 04-189454
PSD-FL-161
Expiration Date: June 30, 1992

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

PERMITTEE:
Florida Gas Transmission Company

Permit Number: AC 04-189454
PSD-FL-161
Expiration Date: June 30, 1992

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

PERMITTEE:
Florida Gas Transmission Company

Permit Number: AC 04-189454
PSD-FL-161
Expiration Date: June 30, 1992

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:

<u>Pollutant</u>	<u>lbs/hr</u>	<u>tons/yr</u>	<u>Emission Factor</u>
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

2. Visible emissions shall not exceed 10% opacity.

PERMITTEE:
Florida Gas Transmission Company

Permit Number: AC 04-189454
PSD-FL-161
Expiration Date: June 30, 1992

SPECIFIC CONDITIONS:

Operating Rates

3. This source is allowed to operate continuously (8760 hours per year).
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 26,408 scf/hr.
 - Maximum heat input shall not exceed 27.20 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 Northeast 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, SO₂, 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

PERMITTEE:
Florida Gas Transmission Company

Permit Number: AC 04-189454
PSD-FL-161
Expiration Date: June 30, 1992

SPECIFIC CONDITIONS:

9. Compliance with the SO₂ 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.

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 Northeast 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 Northeast District office no later than 45 days after completion.

Rule Requirements

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 Northeast 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).

PERMITTEE:
Florida Gas Transmission Company

Permit Number: AC 04-189454
PSD-FL-161
Expiration Date: June 30, 1992

SPECIFIC CONDITIONS:

17. An application for an operation permit must be submitted to the Northeast 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 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 Alan Smallwood
Carol M. Browner, Secretary

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

The applicant proposes to expand its existing natural gas pipeline compressor station No. 16 near the town of Brooker in Bradford County, Florida. The proposed expansion consists of adding one new 4,000 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:

<u>Pollutant</u>	<u>Max. Net Increase in Emissions (TPY)</u>	<u>PSD Significant Emission Rate (TPY)</u>
NOx	77.2	40
SO ₂	3.30	40
PM/PM ₁₀	0.58	25/15
CO	96.6	100
VOC	38.6	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:

<u>Pollutant</u>	<u>Determination</u>
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
Florida Gas Transmission Company
Bradford County-Page 2

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:

BACT
Florida Gas Transmission
Bradford County - Page 3

- 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 \$635,212. 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 77.2 tons/year. Assuming that SCR would reduce NOx emissions by an additional 80%, the SCR would control 62 tons of NOx annually. When this reduction is taken into consideration with the total levelized annual cost of \$635,212, the cost per ton of controlling NOx is \$10,245. This cost (\$10,245/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.

BACT
Florida Gas Transmission Company
Bradford County-Page 4

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:


<u>Pollutant</u>	<u>Emission Limit</u>
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
Bureau of Air Regulation



Carol M. Browner, Secretary
Dept. of Environmental Regulation

Date May 8, 1991

Date May 8, 1991



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

APR 9 1991

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

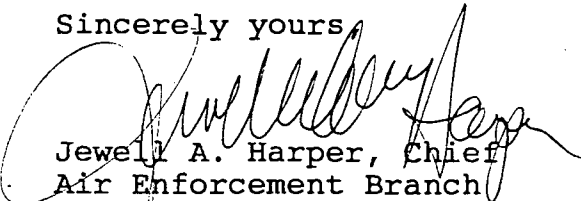
Dear Mr. Fancy:

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. Deaton



United States Department of the Interior
FISH AND WILDLIFE SERVICE



IN REPLY REFER TO:

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

STREET LOCATION:
134 Union Blvd.
Lakewood, Colorado 80228

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/m³).

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.
Assistant Regional Director
Refuges and Wildlife, Region 6

cc: J. Dixon
C. Holladay
B. Andrews



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: AC04-189454; PSD-FL-161
Florida Gas Transmission Co.
Station 16, Unit No. 6
Bradford County; Brooker, 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, Specific Condition 1, the emission factor shown for carbon monoxide is 2.1 g/bhp-hr, and for VOC is shown as 0.5 g/bhp-hr. The correct figures should be 2.5 g/bhp-hr for CO and 1.0 g/bhp-hr for VOC.

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, M.E., P.E.
Principal Engineer

cc: Bill Osborne
Jim Alves
Teresa Heron }
BA/CHF } 4-4-91 am
Andy Kutyna, NED }



Florida Gas Transmission Company

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

RECEIVED
APR 1 1991
DER-BAQM

Certified Mail

March 28, 1991

Mr. Barry Andrews
Florida Department of Environmental Regulation
Division of Air Resources Management
Bureau of Air Regulation
Twin Towers Office 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 16, Brooker, 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.34

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

Teresa Heron
A. Kutyna, MERRITT } 4-1-91 RM

STATE OF FLORIDA
COUNTY OF ALACHUA

No 4845

THE GAINESVILLE SUN
Published Daily and Sunday
GAINESVILLE, FLORIDA

Before the undersigned authority personally appeared Naomi Williams
who on oath says that he/she is Assistant Classified Mgr. of THE GAINESVILLE SUN, a daily
newspaper published at Gainesville in Alachua County, Florida, that the attached copy of advertisement, being a
Notice of intent to issue permit
in the matter of Station #16
in the Court, was published in said newspaper in the issue of,
3: 21 19 91

Affiant further says that the said THE GAINESVILLE SUN is a newspaper published at Gainesville, in said Alachua County, Florida, and that the said newspaper has heretofore been continuously published in said Alachua County, each day, and has been entered as second class mail matter at the post office in Gainesville, in said Alachua 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 corporation any discount for publication in the said newspaper.

Sworn to and subscribed before me this

25 day of March, A.D., 1991

Martha A. Patterson

(Seal) Notary Public



"OFFICIAL NOTARY SEAL"
MARTHA A. PATTERSON
MY COMM. EXP. 4/1/94

State of Florida
Department of Environmental
Regulation
Notice of Intent to Issue
The Department of Environ-

mental Regulation hereby gives notice of its intent to issue a permit to Florida Gas Transmission Company, P.O. Box 118, Houston, Texas 77251-118, to install one natural gas fired engine. The Company's facility is located 3 miles north of Brookier on Highway 225 in Bradford County, Florida. The maximum annual NO2 Class I increment consumed in the Okefenokee National Wilderness Area is less than one percent. The maximum annual NO2 Class II increment consumed is 3.7%. 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.

STATE OF FLORIDA
COUNTY OF ALACHUA

No 4845

THE GAINESVILLE SUN
Published Daily and Sunday
GAINESVILLE, FLORIDA

Before the undersigned authority personally appeared.....Naomi Williams.....

who on oath says that he/she is Assistant Classified Mgr. of THE GAINESVILLE SUN, a daily

newspaper published at Gainesville in Alachua County, Florida, that the attached copy of advertisement, being a

Notice of intent to issue permit

in the matter of Station #16

in the Court, was published in said newspaper in the issue of,

3:21 1991

Affiant further says that the said THE GAINESVILLE SUN is a newspaper published at Gainesville, in said Alachua County, Florida, and that the said newspaper has heretofore been continuously published in said Alachua County, each day, and has been entered as second class mail matter at the post office in Gainesville, in said Alachua 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 corporation any discount for publication in the said newspaper.

Sworn to and subscribed before me this

25 day of March, 1991

Maisha A. Peterson

(Seal) Notary Public



MAISHA A. PETERSON
NOTARY PUBLIC
MY COM. EX. 03/31/92

Naomi Williams

State of Florida
Department of Environmental
& Regulatory
Affairs
Office of Air Quality
The Department of Environmental
Regulation
Environmental Regulation hereby
gives notice of its intent to is-
sue a permit to Florida Gas
Transmission Company, P.O.
Box 1188, Houston, Texas 77201-
1188, to install one natural gas
fired engine. The Company's
facility is located 3 miles north
of Brookton on Highway 225 in
Bradford County, Florida. The
maximum annual NO2 Class I
increment consumed in the
Okefenokee National Wilder-
ness Area is less than one per-
cent. The maximum annual
NO2 Class II increment con-
sumed is 3.7%. A determina-
tion of Best Available Control
Technology (BACT) was re-
quired. The Department is is-
suing 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 per-
mitting decision may petition
for an administrative proceed-
ing (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 Gen-
eral Counsel of the Department
at 2600 Blair Stone Road, Tallah-
assee, Florida 32399-2400,
within fourteen (14) days of
publication of this notice. Peti-
tioner 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 de-
termination (hearing) under
Section 120.57, Florida
Statutes.
The Petition shall contain the
following information:
(a) The name, address, and
telephone number of each peti-
tioner, the applicant's name
and address, the Department's
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 ac-
tion or proposed action;
(c) A statement of how each
petitioner's substantial inter-
ests are affected by the Depart-
ment's action or proposed
action;
(d) A statement of the mate-
rial facts disputed by Petiti-
oner, if any;
(e) A statement of facts
which petitioner contends war-
rant reversal or modification
of the Department's action or
proposed action;
(f) A statement of which
rules or statutes petitioner con-
tends require reversal or modi-
fication 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 Depart-
ment's action or proposed
action.
If a petition is filed, the ad-
ministrative hearing process is
designed to formulate agency
action. Accordingly, the De-
partment's final action may be
different from the position tak-
en 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 require-
ments 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 De-
partment. Failure to petition
within the allowed time frame
constitutes a waiver of any
right such person has to re-
quest 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 mo-
tion filed pursuant to Rule 28,
F.A.C.
The application is available
for public inspection during
business hours, 8:30 a.m. to 5:00
p.m., Monday through Friday,
except legal holidays, at:
Department of Environmental
Regulation, Bureau of Air Reg-
ulation, 2600 Blair Stone Road,
Tallahassee, Florida 32399-2400;
Department of Environmental
Regulation, Northeast District,
785 Baymeadows Way, Jack-
sonville, Florida 32256-7177.
Any person may send written
comments on the proposed ac-
tion to Mr. Barry Andrews at
the Department's Tallahassee
address. All comments mailed
within 30 days of the publica-
tion of this notice will be con-
sidered in the Department's fi-
nal determination. Further, a
public hearing can be request-
ed by any person. Such re-
quests must be submitted with-
in 30 days of this notice.
(4845) 121



Florida Department of Environmental Regulation

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

Lawton Chiles, Governor

Carol M. Browner, Secretary

March 14, 1991

CERTIFIED MAIL-RETURN RECEIPT REQUESTED

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

Dear Mr. Osborne:

Attached is one copy of the Technical Evaluation and Preliminary Determination and proposed permit to install one natural gas fired engine.

Please submit any written comments you wish to have considered concerning the Department's proposed action to Mr. Barry Andrews of the Bureau of Air Regulation.

Sincerely,

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

CHF/TH/plm

Attachments

c: Andrew Kutyna, NED
Johnny Cole
David Buff, P.E.
Brian Beals, U.S. EPA
Chris Shaver, NPS

BEFORE THE STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

In the Matter of
Application for Permit by:

Florida Gas Transmission Company
P. O. Box 1188
Houston, Texas 77251-1188

DER File No. AC 04-189454
PSD-FL-161

INTENT TO ISSUE

The Department of Environmental Regulation hereby gives notice of its intent to issue an air construction permit (copy attached) for the proposed project as detailed in the application specified above. The Department is issuing this Intent to Issue for the reasons stated in the attached Technical Evaluation and Preliminary Determination.

The applicant, Florida Gas Transmission Company, applied on November 20, 1990, to the Department of Environmental Regulation for a permit to install one natural gas fired engine.

The Department has permitting jurisdiction under Chapter 403, Florida Statutes, and Florida Administrative Code Chapters 17-2 and 17-4. The project is not exempt from permitting procedures. The Department has determined that an air construction permit is required for the proposed work.

Pursuant to Section 403.815, F.S. and DER Rule 17-103.150, F.A.C., you (the applicant) are required to publish at your own expense the enclosed Notice of Intent to Issue Permit. The notice shall be published one time only within 30 days, in the legal ad section of a newspaper of general circulation in the area affected. For the purpose of this rule, "publication in a newspaper of general circulation in the area affected" means publication in a newspaper meeting the requirements of Sections 50.011 and 50.031, F.S., in the county where the activity is to take place. The applicant shall provide proof of publication to the Department, at the address specified within seven days of publication. Failure to publish the notice and provide proof of publication within the allotted time may result in the denial of the permit.

The Department will issue the permit with the attached conditions unless a petition for an administrative proceeding (hearing) is filed pursuant to the provisions of Section 120.57, F.S.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) in accordance with Section 120.57, 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 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:

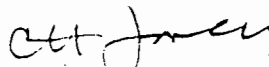
- (a) The name, address, and telephone number of each petitioner, the applicant's name and address, the Department Permit File Number and the county in which the project is proposed;
- (b) A statement of how and when each petitioner received notice of the Department's action or proposed action;
- (c) 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 notice. Persons whose substantial interests will be affected by any decision of the Department with regard to the application(s) 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 in 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.

Executed in Tallahassee, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL REGULATION



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

Copies furnished to:

Andrew Kutyna, NED
Johnny Cole
David Buff, P.E.
Brian Beals, U.S. EPA
Chris Shaver, NPS

CERTIFICATE OF SERVICE

The undersigned duly designated deputy clerk hereby certifies that this NOTICE OF INTENT TO ISSUE and all copies were mailed before the close of business on 3-15-91

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.

Keri Jober
Clerk

3-15-91
Date

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 3 miles north of Brooker on Highway 235 in Bradford County, Florida. The maximum annual NO₂ Class I increment consumed in the Okefenokee National Wilderness Area is less than one percent. The maximum annual NO₂ Class II increment consumed is 3.7%. 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
Northeast District
7825 Baymeadows Way
Jacksonville, Florida 32256-7577

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.

Technical Evaluation
and
Preliminary Determination

Florida Gas Transmission Company
Bradford County
Brooker, Florida
Station No. 16

Natural Gas Compressor Engine
Permit No. AC 04-189454
PSD-FL-161

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

March 14, 1991

SYNOPSIS OF APPLICATION

I.1 Applicant Name and Address

Florida Gas Transmission Company
P. O. Box 1188
Houston, Texas 77251-1188

I.2 Reviewing and Process Schedule

Date of Receipt of Application: November 20, 1990.

30 Days Completeness Review: December 18, 1990.

Additional Information Received: December 18, 1990.

Application Completeness Date: December 18, 1990.

II. FACILITY INFORMATION

II.1 Facility Location

Florida Gas Transmission Company's (FGTC) facility is located 3 miles north of Brooker on Highway 235 in Bradford County, Florida. The UTM coordinates are Zone 17, 371.98 km E and 3310.57 km N.

II.2 Standard Industrial Classification Code

This facility is classified as follows:

Major Group No. 49 - Electric, Gas and Sanitary Services

Group No. 492 - Gas Production and Distribution

Industry No. 4922 - Natural Gas Transmission

II.3 Facility Category

The FGTC site, in Brooker, is classified as a major emitting facility for nitrogen oxides (NO_x) and carbon monoxide (CO). The proposed project will increase NO_x emissions by 77 tons per year and CO emissions by 97 tons per year. The total permitted emissions for this facility shall not exceed 1139 tons NO_x per year and 232 tons CO per year.

III. PROJECT DESCRIPTION

The FGTC proposed to install one natural gas fired engine (Copper-Bessemer Model 8W-330C2 integral engine compressor unit). The engine has 8 power cylinders and is rated at 4,000 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 produces more power output from the engine than would otherwise be attained without having to use a larger size engine. A flow diagram of the integral engine compressor unit is presented in the attached figure 2.2.

III.1 Background Information

The FGTC existing compressor station consists of five 2,000 bhp natural gas fired reciprocating IC engines. All of the engines are Worthington Model SEHG-8 engine compressor units. These engines were installed before the CAA amendment of 1977: three engines were installed in 1962, the fourth engine was installed in 1966, and the fifth engine was installed in 1968. These existing engines are not being modified as part of this Phase II expansion project.

In general, the FGTC Phase II expansion project will be increasing the natural gas transport capacity of the existing Florida gas pipeline system. The scope of work for Phase II includes expansions by the addition of state-of-the-art compressor engines at light existing compressor stations and at a newly proposed compressor station. The proposed engines would be used solely for the purpose of transporting natural gas in the pipeline for distribution in Florida. 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.

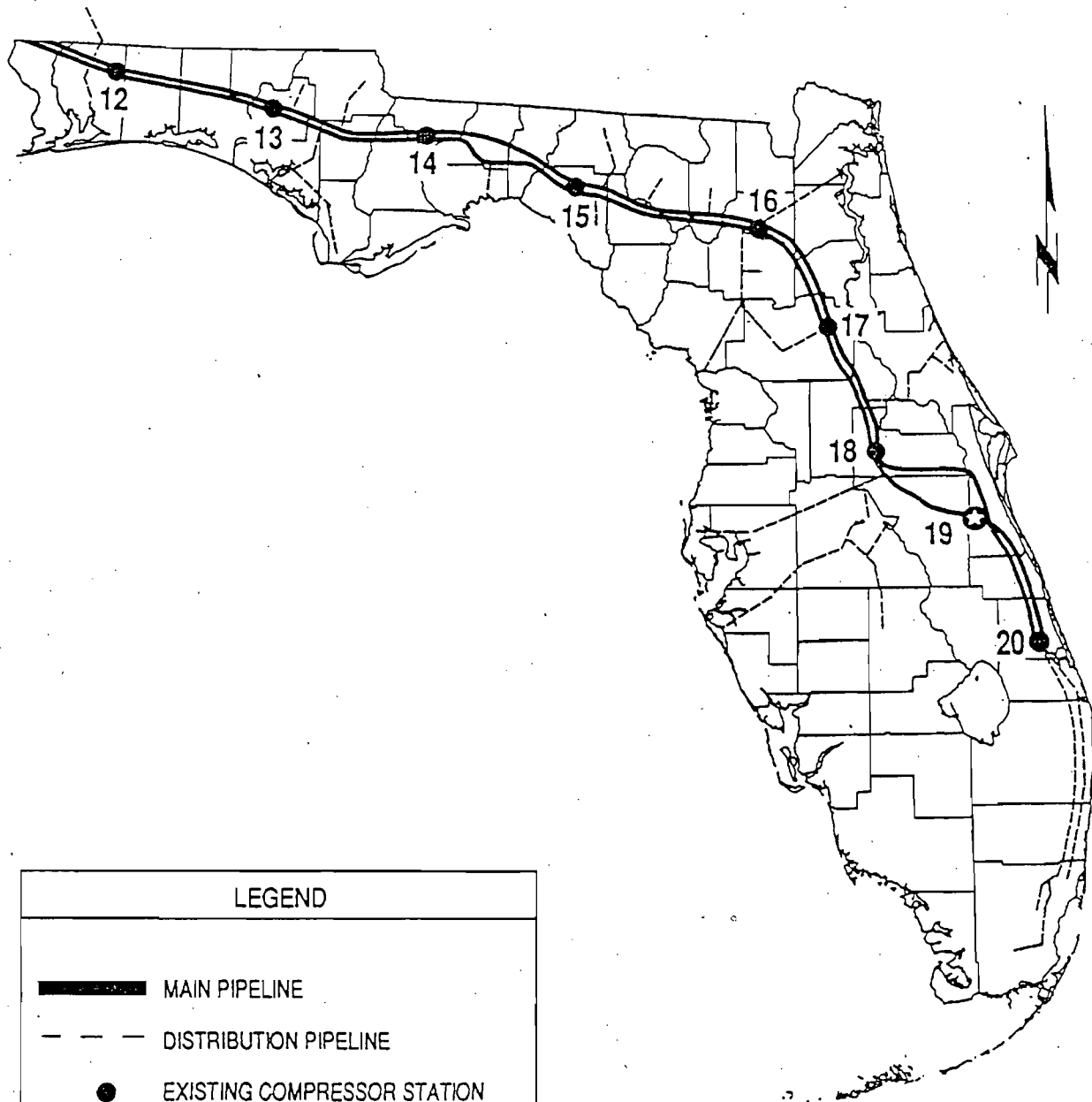
IV. RULE APPLICABILITY

The proposed project is subject to preconstruction review under the provisions of Chapter 403, Florida Statutes, and Florida Administrative Code (F.A.C.) Chapter 17-2.

This plant is located in an area (Bradford County) designated attainment for all criteria pollutants in accordance with F.A.C. Rule 17-2.420.

The proposed project will be reviewed in accordance with F.A.C. Rule 17-2.500, Prevention of Significant Deterioration, because it will be a major modification to a major facility. This review consists of a determination of Best Available Control Technology (BACT) and unless otherwise exempted, an air quality impact of the increased emissions. The review also includes a review of the project's impacts on soils, vegetation, visibility and air quality impact resulting from residential and industrial growth.

The proposed facility shall comply with applicable provisions of F.A.C. Rule 17-2.700, Emission Test Procedures; F.A.C. Rule 17-2.630, Best Available Control Technology; and F.A.C. Rule 17-2.500, Prevention of Significant Deterioration.







LEGEND	
	MAIN PIPELINE
	DISTRIBUTION PIPELINE
	EXISTING COMPRESSOR STATION
	PROPOSED COMPRESSOR STATION

Figure 1-1 FGTC'S GAS TRANSMISSION SYSTEM



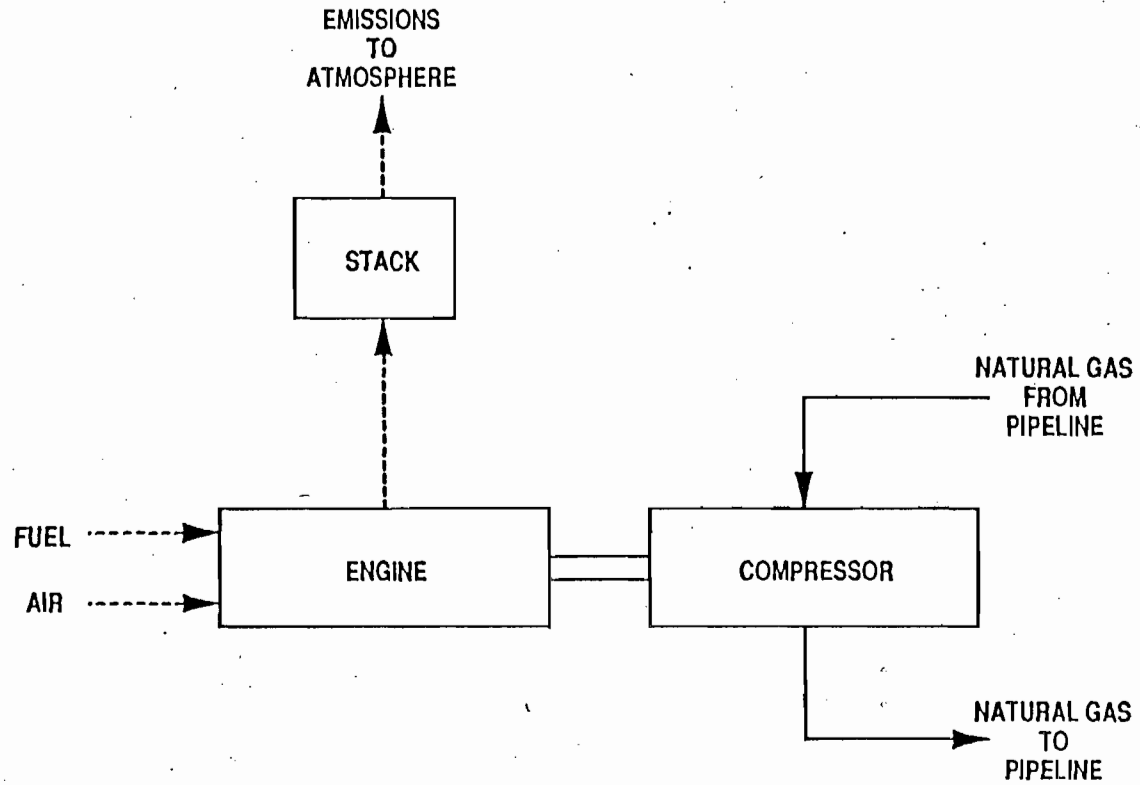


Figure 2-2 PROCESS FLOW DIAGRAM OF AN INTEGRAL ENGINE-COMPRESSOR UNIT

V. SOURCE IMPACT ANALYSIS

V.1 Control Technology Review

A complete BACT evaluation was submitted with the application. This evaluation included analyzing technologies involving engine modification and technologies involving exhaust gas treatment. Furthermore, the evaluation also included the feasibility of the different NO_x control methods and a comparison of the technical environmental, energy and economic impacts. Based on this approach, the lean-burn engine was determined to represent BACT.

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 preignition chamber. The hot combustion gases from the preignition 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.

V.2 Emission Limitations

The operation of this source will produce emissions of NO_x, CO, VOCs, particulates, and SO₂ from the burning of natural gas. Table I summarizes the proposed emissions and Table II summarizes the existing emissions from this facility.

TABLE I
SUMMARY OF EMISSIONS
(Unit No. 6)

Pollutant	Maximum Potential Emissions From Proposed Compressor Engine		Significant Emission Rate (TPY)
	(lbs/hr)	(TPY)	
Nitrogen Oxides	17.6	77.2	40
Carbon Monoxide	22.0	96.6	100
Volatile Organic Compounds (non-methane)	8.8	38.6	40
Particulate Matter (TSP)	0.13	0.58	25
Particulate Matter (PM ₁₀)	0.13	0.58	15
Sulfur Dioxide	0.75	3.3	40

TABLE II
SUMMARY OF EXISTING EMISSIONS

Pollutant	Per Each Engine		Total (TPY)
	(lbs/hr)	(TPY)	
NOx	48.5	212.4	1062.2
CO	6.17	27.0	135.2
VOC (non-methane)	1.9	8.5	42.5
PM	0.07	0.32	1.6
SO ₂	0.42	1.82	9.1

V.3 Air Quality Analysis

a. Introduction

The operation of the proposed engine will result in emissions increases which are projected to be greater than the PSD significant rate for NOx. Therefore, the project is subject to the PSD review requirements contained in F.A.C. Rule 17-2.500 for NOx. Part of the requirements is an air quality impact analysis for NOx which includes:

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

The analysis of existing air quality generally relies on preconstruction monitoring data collected in accordance with EPA-approved methods. The PSD increment and AAQS analyses are based on air quality dispersion modeling completed in accordance with the EPA guidelines. Based on these required analyses, the Department has reasonable assurance that the proposed project, as described in this report and subject to the conditions of approval proposed herein, will not cause or contribute to a violation of any PSD increment or AAQS. A brief description of the modeling method used and results of the required analyses follow. A more complete description is contained in the permit application on file.

b. Analysis of the Existing Air Quality

Preconstruction ambient air quality monitoring may be required for pollutants subject to PSD review. However, an exemption to the monitoring requirement can be obtained if the maximum air quality impact resulting from the projected emissions increase, as determined through air quality modeling, is less than a pollutant-specific de minimus concentration. The predicted maximum increase for NOx is 0.93 ug/m³, annual average which is less than the de minimus concentration for NOx of 14 ug/m³ annual coverage. Therefore, no preconstruction monitoring is required for NOx.

c. Modeling Method

The EPA-approved Industrial Source Complex Long-Term (ISCLT) dispersion model was used by the applicant to predict the impact of NO_x emissions from the proposed project on the surrounding ambient air. All recommended EPA default options were used. Downwash parameters were used because the proposed stack was less than the good engineering practice (GEP) stack height. Five years of surface weather observations (1982-1986) from the National Weather Service (NWS) station located at Tallahassee were used. These data were input into the National Climatic Data Center (NCDC) stability array (STAR) preprocessor program for use as input to the ISCLT model. The STAR program converts the hourly data into the joint frequency of occurrence of wind direction, windspeed and atmospheric stability. The STAR program can produce monthly, seasonal and annual stability arrays for input into ISCLT. The highest predicted yearly impact from the proposed NO_x emissions was compared with the standards.

d. Modeling Results

The applicant evaluated the potential increase in ambient ground-level concentration associated with the project to determine if these projected ambient concentration increases would be greater than the specified PSD significant impact level for NO_x. Dispersion modeling was performed with 112 receptors located on 16 radials centered on the proposed engine's stack location and at downwind differences of 200, 300, 400, 500, 750, 1000, and 1250m. In addition, 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 maximum predicted annual NO₂ impact from this modeling was 0.93 ug/m³, which is less than the NO₂ significant impact level of 1 ug/m³ annual average concentration. Because the maximum predicted NO₂ concentration is less than the significant impact level, further modeling for NO₂ for comparison with the AAQS and the Class II PSD increment was not required in this case. The maximum predicted NO₂ increment consumption by this project in the Class I Okefenokee Wilderness Area located 73 km away is 0.01 ug/m³.

e. Additional Impacts Analysis

A Level-1 screening analysis using the EPA model, VISCREEN was used to determine any potential adverse impacts on the Class I Okefenokee National Wilderness Area. Based on this analysis, the maximum predicted visual impacts due to the proposed project are less than the screening criteria both inside and outside these Class I areas. Because the impacts from NO_x emissions are less than the PSD significant impact level, no harmful effects on soils and vegetation is expected. In addition, the proposed modification will not significantly change employment, population, housing or commercial/industrial development.

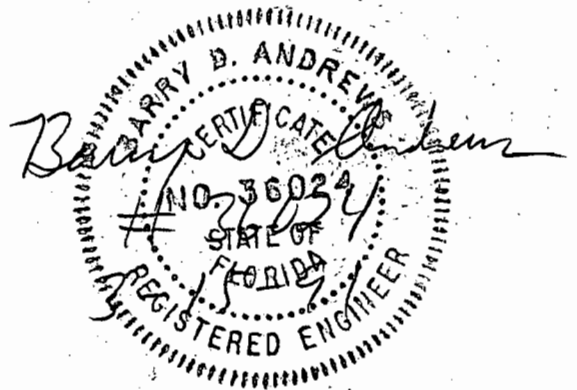
VI. CONCLUSION

Based on the information provided by Florida Gas Transmission Company, the Department has reasonable assurance that the proposed project, as described in this evaluation, and subject to the conditions proposed herein, will not cause or contribute to a violation of any air quality standard, PSD increment, or any other technical provision of Chapter 17-2 of the Florida Administrative Code.

Barry J. Andrews
36024
3-15-91

VI. CONCLUSION

Based on the information provided by Florida Gas Transmission Company, the Department has reasonable assurance that the proposed project, as described in this evaluation, and subject to the conditions proposed herein, will not cause or contribute to a violation of any air quality standard, PSD increment, or any other technical provision of Chapter 17-2 of the Florida Administrative Code.





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
P. O. Box 1188
Houston, Texas 77251-1188

Permit Number: AC 04-189454
PSD-FL-161

Expiration Date: June 30, 1992
County: Bradford
Latitude/Longitude: 29°55'16"N
82°19'34"W

Project: Natural Gas Compressor
Engine (Unit No. 6)

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 3 miles north of Brooker on Highway 235 in Bradford County, Florida. The UTM coordinates are Zone 17, 371.98 km East and 3310.57 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.

PERMITTEE:
Florida Gas Transmission Company

Permit Number: AC 04-189454

PSD-FL-161

Expiration Date: June 30, 1992

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.

PERMITTEE:
Florida Gas Transmission Company

Permit Number: AC 04-189454
PSD-FL-161
Expiration Date: June 30, 1992

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

PERMITTEE:
Florida Gas Transmission Company

Permit Number: AC 04-189454
PSD-FL-161
Expiration Date: June 30, 1992

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

PERMITTEE:
Florida Gas Transmission Company

Permit Number: AC 04-189454
PSD-FL-161
Expiration Date: June 30, 1992

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	17.6	77.2	2.0 g/bhp-hr
Carbon Monoxide	22.0	96.6	2.1 g/bhp-hr
Volatile Organic Compounds (non-methane)	8.8	38.6	0.5 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

2. Visible emissions shall not exceed 10% opacity.

PERMITTEE:
Florida Gas Transmission Company

Permit Number: AC 04-189454
PSD-FL-161
Expiration Date: June 30, 1992

SPECIFIC CONDITIONS:

Operating Rates

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

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 26,408 scf/hr.
- Maximum heat input shall not exceed 27.20 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 Northwest 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

8. Compliance with the NO_x, SO₂, 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 SO₂ 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.

PERMITTEE:
Florida Gas Transmission Company

Permit Number: AC 04-189454
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Expiration Date: June 30, 1992

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 Northeast 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 Northeast District office no later than 45 days after completion.

Rule Requirements

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 Northeast 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 Northeast 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

PERMITTEE:
Florida Gas Transmission Company

Permit Number: AC 04-189454
PSD-FL-161
Expiration Date: June 30, 1992

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 _____ day
of _____, 1991

**STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL REGULATION**

Carol M. Browner, Secretary

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

The applicant proposes to expand its existing natural gas pipeline compressor station No. 16 near the town of Brooker in Bradford County, Florida. The proposed expansion consists of adding one new 4,000 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:

<u>Pollutant</u>	<u>Max. Net Increase in Emissions (TPY)</u>	<u>PSD Significant Emission Rate (TPY)</u>
NOx	77.2	40
SO ₂	3.30	40
PM/PM ₁₀	0.58	25/15
CO	96.6	100
VOC	38.6	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:

<u>Pollutant</u>	<u>Determination</u>
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
Florida Gas Transmission Company
Bradford County-Page 2

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 \$635,212. 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 77.2 tons/year. Assuming that SCR would reduce NOx emissions by an additional 80%, the SCR would control 62 tons of NOx annually. When this reduction is taken into consideration with the total levelized annual cost of \$635,212, the cost per ton of controlling NOx is \$10,245. This cost (\$10,245/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:

<u>Pollutant</u>	<u>Emission Limit</u>
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:

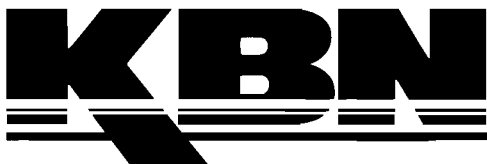
Approved by:

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

Carol M. Browner, Secretary
Dept. of Environmental Regulation

Date 1991

Date 1991



December 17, 1990

RECEIVED

DEC 18 1990

DER-BAQM

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. 16 PSD Permit Application

Dear Ms. Heron:

As you requested, attached is the sheet of emission calculations for FGTC's Compressor Station No. 16. Please feel free to contact me at your convenience if you have further questions concerning this permit application.

Sincerely,

David A. Buff, P.E.
Principal Engineer

TT/tla

cc: Alan Bowman, ENRON

Attachment

cc: J. Heron
B. Andrews
C. Holladay
J. Harper, EPA
A. Kutynna, NE Dist
C. Namer, NPS

EMISSION CALCULATIONS
FGTC's COMPRESSOR STATION No. 16
BROOKER COUNTY, FLORIDA

Fuel usage and emission calculations are presented below for the proposed Cooper-Bessemer Model 8W-330C2 reciprocating IC engine at Compressor Station No. 16.

Fuel Usage:

$$\begin{aligned} (4,000 \text{ bhp}) \times (6,800 \text{ Btu/bhp-hr}) &= 27.20 \times 10^6 \text{ Btu/hr} \\ (27.20 \times 10^6 \text{ Btu/hr}) / (1,030 \text{ Btu/scf}) &= 26,408 \text{ scf/hr} \end{aligned}$$

Emission Calculations:

$$\begin{aligned} \text{NO}_x: (2.0 \text{ g/bhp-hr})(4,000 \text{ bhp})(1 \text{ lb}/453.593 \text{ g}) &= 17.6 \text{ lb/hr} \\ (17.6 \text{ lb/hr})(8,760 \text{ hr/yr})(1 \text{ ton}/2,000 \text{ lb}) &= 77.2 \text{ TPY} \end{aligned}$$

$$\begin{aligned} \text{CO: } (2.5 \text{ g/bhp-hr})(4,000 \text{ bhp})(1 \text{ lb}/453.593 \text{ g}) &= 22.046 \text{ lb/hr} \\ (22.046 \text{ lb/hr})(8,760 \text{ hr/yr})(1 \text{ ton}/2,000 \text{ lb}) &= 96.6 \text{ TPY} \end{aligned}$$

VOCs(non-methane hydrocarbon):

$$\begin{aligned} (1.0 \text{ g/bhp-hr})(4,000 \text{ bhp})(1 \text{ lb}/453.593 \text{ g}) &= 8.819 \text{ lb/hr} \\ (8.819 \text{ lb/hr})(8,760 \text{ hr/yr})(1 \text{ ton}/2,000 \text{ lb}) &= 38.6 \text{ TPY} \end{aligned}$$

$$\begin{aligned} \text{PM: } (5 \text{ lb}/10^6 \text{ scf})(26,408 \text{ scf/hr}) &= 0.132 \text{ lb/hr} \\ (0.132 \text{ lb/hr})(8,760 \text{ hr/yr})(1 \text{ ton}/2,000 \text{ lb}) &= 0.58 \text{ TPY} \end{aligned}$$

$$\begin{aligned} \text{SO}_2: (10 \text{ gr}/100 \text{ scf})(26,408 \text{ scf/hr})(1 \text{ lb}/7,000 \text{ gr}) &= 0.377 \text{ lb/hr of} \\ &\text{Sulfur} \\ (2 \text{ lb SO}_2/\text{lb Sulfur})(0.377 \text{ lb/hr Sulfur}) &= 0.754 \text{ lb/hr of SO}_2 \\ (0.754 \text{ lb/hr})(8,760 \text{ hr/yr})(1 \text{ ton}/2,000 \text{ lb}) &= 3.30 \text{ TPY} \end{aligned}$$



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
JUN 07 1990
DER-BAQM

June 4, 1990

Mr. Clair Fancy
Chief, Bureau of Air Quality Management
Florida Department of Environmental Regulation
2600 Blair Stone Road
Tallahassee, FL 32301

Dear Mr. Fancy:

I wish to thank you for the time you spent with David Buff and me, May 22, 1990, discussing the Florida Gas Transmission Company's (FGT) permitting of existing Compressor Station Nos. 12-18, and 20, and FGT's proposed Phase II Expansion.

We are hopeful that we can enter into a single Consent Order, which will allow us to continue operating the existing compressor stations, and that the permitting of existing compressor stations and the Phase II Expansion can be consolidated.

As discussed, FGT intends to prepare and submit construction permit applications for the expansion, as soon as engineering details are finalized. KBN, a Gainesville consultant, will assist us in this matter.

If you have any questions or comments, please call me at (713) 853-7303. Again, we appreciate your time and assistance in this matter.

Sincerely,



W. Alan Bowman, PhD, CCM
Project Environmentalist
Environmental Affairs Department

cc: Earl Berdine, Enron
Kevin J. McGlynn, Enron
Jerry Murphy, Enron
David Buff, KBN

FAN0604wab

1990 NOV 20 AM 10:43

ENRON
Gas Pipeline Operating Company

P. O. Box 1188 Houston, Texas 77251-1188 (713) 853-6161

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. 16
Bradford 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. 16. With net NO_x emissions exceeding 40 tons per year, this addition, a 4,000 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 fifth 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 (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. 0822020234

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.

EXACTLY \$*****1,000 DOLLARS 00 CENTS

AMOUNT OF CHECK
\$*****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 
AUTHORIZED REPRESENTATIVE

UNITED BANK OF GRAND JUNCTION



CHECK NO. 0822020234

REMITTANCE STATEMENT
ENRON GAS PIPELINE OPERATING COMPANY

PAGE 001 OF 001

VOUCHER NO.	INVOICE DATE	INVOICE NUMBER	PURCHASE ORDER	AMOUNT		
				GROSS	DISCOUNT	NET
9010001570	101790	CKR10179003		1,000.00	0.00	1,000.00
	C.S. #16	CONSTRUCTION PERMIT	FGT		TOTAL	1,000.00
50 < Q < 100 tpy						
001031						

Special Instructions
CALL SUZY AT EXT 7304

Best Available Copy

FEDERAL EXPRESS

QUESTIONS? CALL 800-238-5355 TOLL FREE

AIRBILL PACKAGE TRACKING NUMBER

8202995474

05M 8202995474

RECIPIENT'S COPY

Date: 11-19-90

Your Name (Please Print): David A. Buff
 Your Phone Number (Very Important): 904-231-9000
 Department/Floor No.: 2

To (Recipient's Name) (Please Print): Clair, Nancy P.E.
 Recipient's Phone Number (Very Important): 904-488-4805
 Department/Floor No.:
 Company: Chief, Bureau of Air Regulation
 Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes): Fla. Dept. of Environmental Regulation
 2600 Blair Stone Road
 Gainesville, FL 32602

OUR INTERNAL BILLING REFERENCE INFORMATION (First 24 characters will appear on invoice): 90051

FOR PICK-UP: Print FEDEX Address Here

City: State: ZIP Required:

INTERNET Bill Sender / Bill Recipient / FedEx Acct. No. / Bill 3rd Party / FedEx Acct. No.

Cash / Check

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1 <input checked="" type="checkbox"/> PRIORITY OVERNIGHT SERVICE (Delivery by next business morning)	1 <input type="checkbox"/> HOLD FOR PICK-UP (See Box 10)						Base Charges
2 <input type="checkbox"/> FEDEX LETTER PAK	2 <input type="checkbox"/> DELIVER WEEKDAY						Declared Value Charge
3 <input type="checkbox"/> FEDEX PAK	3 <input type="checkbox"/> DELIVER SATURDAY (Extra charge)						Other 1
4 <input type="checkbox"/> FEDEX BOX	4 <input type="checkbox"/> DANGEROUS GOODS (Extra charge)						Other 2
5 <input type="checkbox"/> FEDEX TUBE	5 <input type="checkbox"/> DRY ICE						Total Charges
6 <input type="checkbox"/> ECONOMY DISTRIBUTION SERVICE (formerly Standard Air) (Delivery by second business day)	6 <input type="checkbox"/> OTHER SPECIAL SERVICE						
7 <input type="checkbox"/> DEFERRED HEAVYWEIGHT SERVICE (for Extra Large or any package over 150 lbs.)	7 <input type="checkbox"/> SATURDAY PICK-UP (Extra charge)						
8 <input type="checkbox"/> ECONOMY DIST. SVC.	8 <input type="checkbox"/> HOLIDAY DELIVERY (if observed)						
9 <input type="checkbox"/> DEFERRED HEAVYWEIGHT	9 <input type="checkbox"/> DIM DIMENSIONAL WEIGHT						
10 <input type="checkbox"/> DEFERRED HEAVYWEIGHT	10 <input type="checkbox"/> RECEIVED BY						
11 <input type="checkbox"/> DEFERRED HEAVYWEIGHT	11 <input type="checkbox"/> DATE/TIME RECEIVED						
12 <input type="checkbox"/> DEFERRED HEAVYWEIGHT	12 <input type="checkbox"/> FEDEX EMPLOYEE NUMBER						

REVISION DATE 4/90
 PART #119500 EXEM 7/90
 FORMAT #027

027

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**PSD PERMIT APPLICATION
FLORIDA GAS TRANSMISSION COMPANY
COMPRESSOR STATION NO. 16**

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
90051F1/P**

DEPARTMENT OF ENVIRONMENTAL REGULATION



ACD4-189454
PSD-FL-101

1,000 pd.
11-20-90
Receipt #151212

APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: Natural Gas Compressor Engine [X] New' [] Existing'

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

COMPANY NAME: Florida Gas Transmission Company COUNTY: Bradford

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 16, Unit No. 6

SOURCE LOCATION: Street 3 miles north of Brooker on Highway 235 City Brooker

UTM: East 17:371.98 km North 3310.57 km

Latitude 29 ° 55 ' 16 "N Longitude 82 ° 19 ' 34 "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: C. L. Truby

C.L. Truby, Vice President
Name and Title (Please Type)

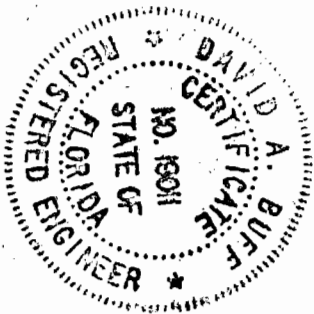
Date: 11-12-90 Telephone No. (713) 853-6161

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

*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

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. 16, 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	17.6	77.2	BACT	BACT	17.6	77.2	
CO	22.0	96.6	N/A	N/A	22.0	96.6	
VOCs	8.8	38.6	N/A	N/A	8.8	38.6	
Particulates	0.13	0.58	N/A	N/A	0.13	0.58	
SO ₂	0.75	3.30	N/A	N/A	0.75	3.30	

¹See Section V, Item 2.

²Reference 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)

³Calculated from operating rate and applicable standard.

⁴Emission, if source operated without 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	0.0264	0.0264	27.20

*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 ft³ and gas at 0.0455 lb/ft³

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

Stack Height: 35 ft. Stack Diameter: 1.938 ft.
 Gas Flow Rate: 30,138 ACFM 14,487 DSCFM Gas Exit Temperature: 550 °F.
 Water Vapor Content: 8 % Velocity: 170.28 FPS

SECTION IV: INCINERATOR INFORMATION
 Not Applicable

Type of Waste	Type 0 (Plastics)	Type II (Rubbish)	Type III (Refuse)	Type IV (Garbage)	Type IV (Pathological)	Type V (Liq. & Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Incinerated							
Uncontrolled (lbs/hr)							

Description of Waste _____
 Total Weight Incinerated (lbs/hr) _____ Design Capacity (lbs/hr) _____
 Approximate Number of Hours of Operation per day _____ day/wk _____ wks/yr. _____
 Manufacturer _____
 Date Constructed _____ Model No. _____

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

Stack Height: _____ ft. Stack Diameter: _____ 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

- 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:

¹Explain method of determining efficiency.

²Energy to be reported in units of electrical power - KWH design rate.

**PREVENTION OF SIGNIFICANT DETERIORATION
REPORT
FLORIDA GAS TRANSMISSION COMPANY
COMPRESSOR STATION NO. 16**

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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. 16. 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. 16 is located about 3 miles north of the town of Brooker on Highway 235 in Bradford 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 4,000 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 Cooper-Bessemer Model 8W-330C2. 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 4,000-bhp engine, a PSD review is required for nitrogen oxides (NO_x).

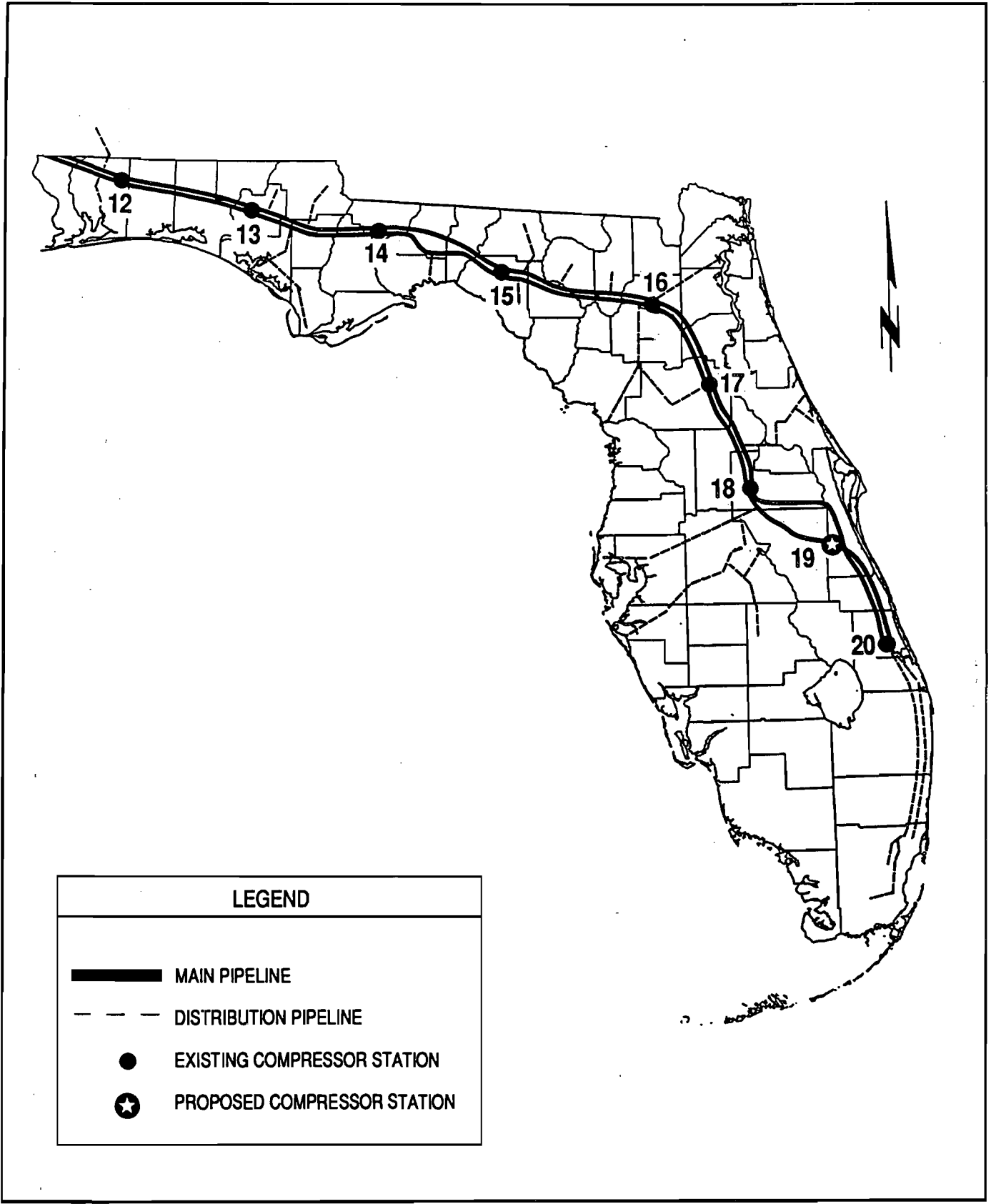


Figure 1-1 FGTC'S GAS TRANSMISSION SYSTEM



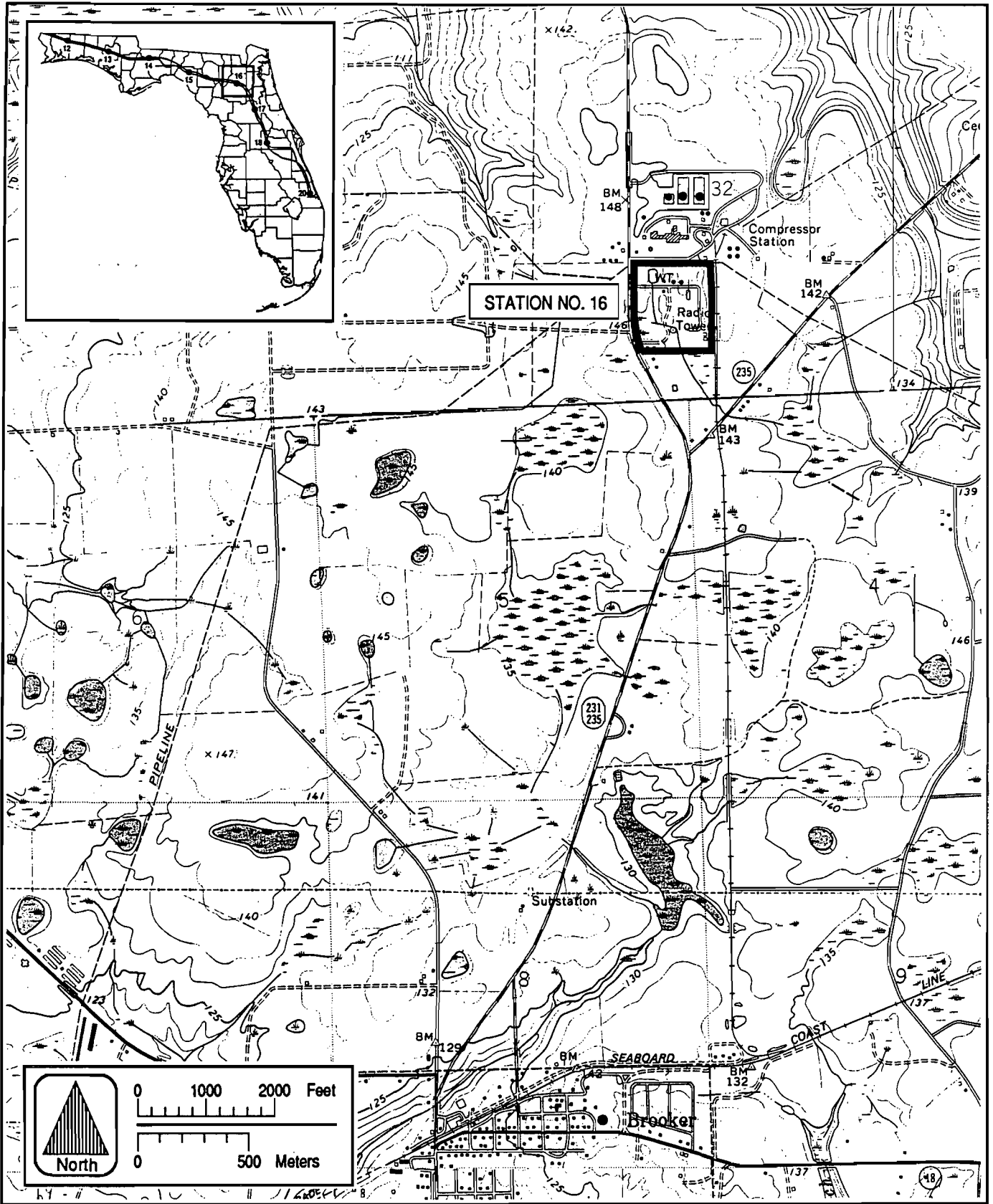


Figure 1-2 SITE LOCATION OF ENRON'S FLORIDA GAS TRANSMISSION LINE COMPRESSOR STATION NO. 16, BROOKER, BRADFORD COUNTY, FLORIDA



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. 16 and the proposed 4,000-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. 16, 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. 16 consists of five 2,000-bhp natural-gas-fired reciprocating IC engines. All of the engines are Worthington Model SEHG-8. These engines were installed prior to the CAA amendments of 1977: three engines were installed in 1962; the fourth engine was installed in 1966; and the fifth engine was installed in 1968. 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. 16. The expansion plan currently calls for installation of a Cooper-Bessemer Model 8W-330C2 integral engine-compressor unit. The engine has 8 power cylinders and is rated at 4,000 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

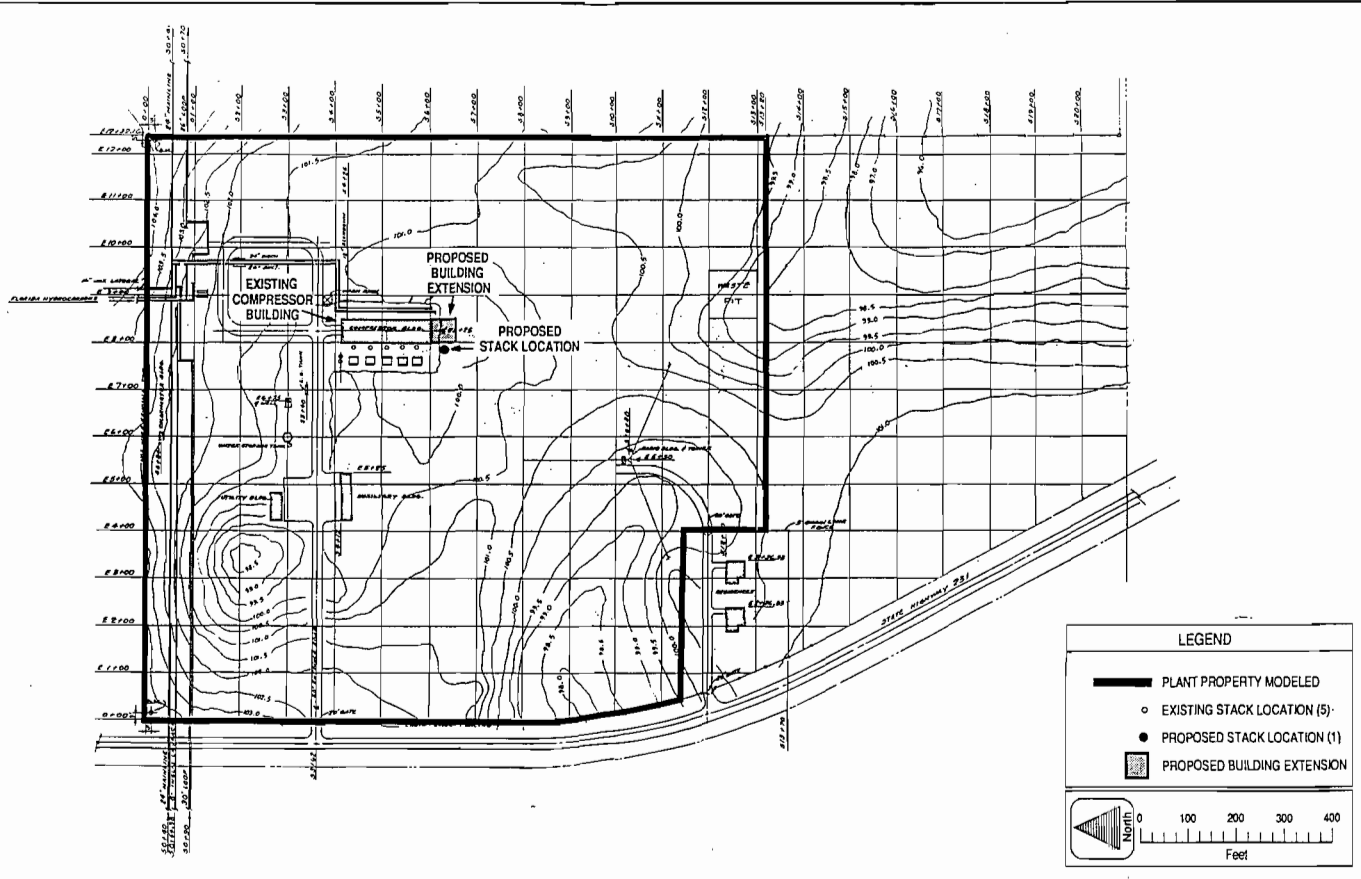


Figure 2-1 PLOT PLAN OF COMPRESSOR STATION NO. 16

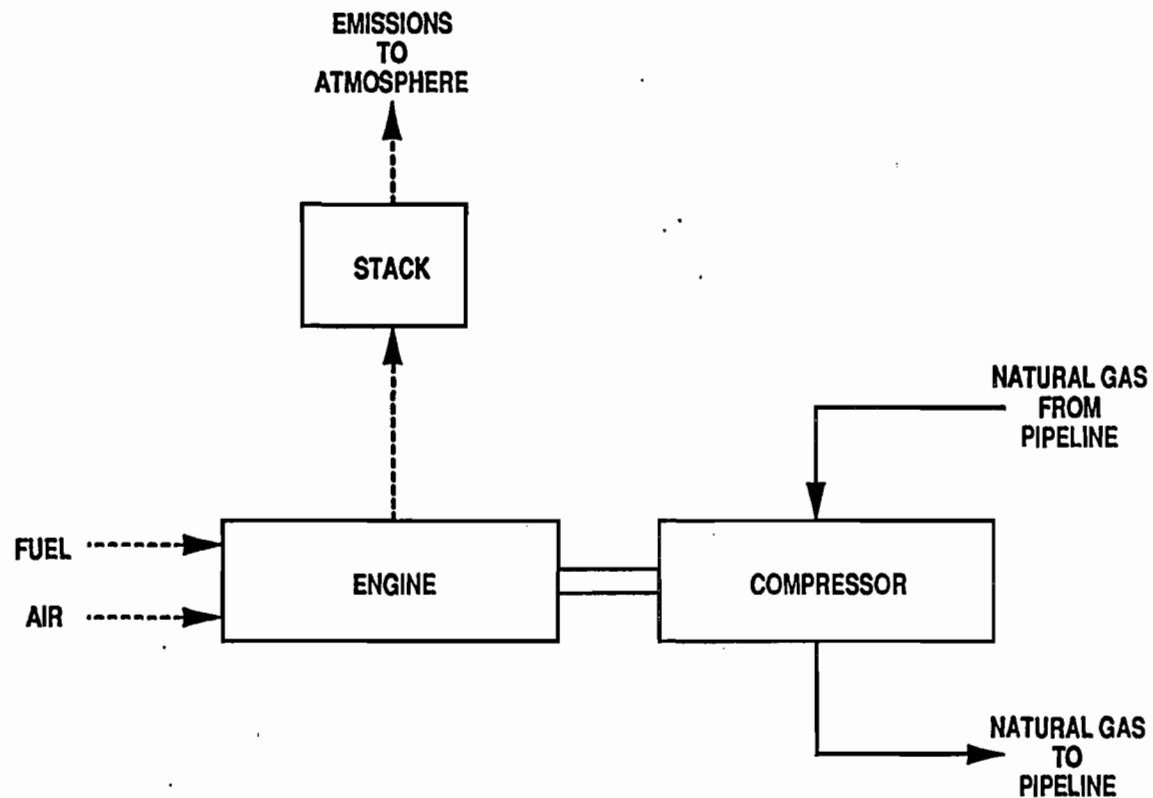


flow diagram of the integral engine compressor unit is presented in Figure 2-2. Fuel fired will be exclusively natural gas, supplied from the FGTC's gas pipeline. Based on the operating characteristics and design, this engine is classified as a high-power, large-bore, slow-speed reciprocating IC engine 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



2-4

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	Cooper-Bessemer
Model	8W-330C2
Air Charging	Turbocharged
Unit Size	4,000 bhp
Number of Power Cylinders	8 cylinders
Number of Compressor Cylinders	4 cylinders
Power Cylinder Data	
Bore Size	18 inches
Stroke	20 inches
Cylinder Power	500 bhp/cylinder
Specific Heat Input	6,800 Btu/bhp-hr
Maximum Fuel Consumption	26,408 scf/hr ^a
Speed	330 rpm
<u>Stack Parameters</u>	
Stack Height	35 ft
Stack Diameter	23.25 inches
Exhaust Gas FLOW	71,100 lb/hr 30,138 acfm
Exhaust Temperature	550°F
Exhaust Gas Velocity	170.28 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.

^aBased on heating value for natural gas of 1,030 British thermal units per standard cubic foot (Btu/scf).

Source: Cooper Industries, 1990.
ENRON Corporation, 1990.

Table 2-2. Maximum Emissions From FGTC's Proposed Compressor Engine

Pollutant	Emission Factor	Reference	Maximum Emissions	
			lb/hr	TPY
Nitrogen Oxides	2.0 g/bhp-hr	Manufacturer's guarantee	17.6	77.2
Carbon Monoxide	2.5 g/bhp-hr	Manufacturer's guarantee	22.0	96.6
Volatile Organic Compounds (non-methane)	1.0 g/bhp-hr	Manufacturer's guarantee	8.8	38.6
Particulate Matter	5 lb/MMscf	AP-42, Table 1.4-1	0.13	0.58
Sulfur Dioxide	10 gr/100 scf	ENRON Specification	0.75	3.30

Note: Maximum natural gas consumption is 26,408 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.

addition is shown in Figure 2-1. The new engine will be housed inside the enlarged building, on the south 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 ($\mu\text{g}/\text{m}^3$)

Pollutant	Averaging Time	AAQS			PSD Increments		Significant Impact Levels
		National		State of Florida	Class I	Class II	
		Primary Standard	Secondary Standard				
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

^aMaximum concentration not to be exceeded more than once per year.

^bAchieved when the expected number of exceedances per year is less than 1.

^cProposed by EPA in the Federal Register on October 5, 1989.

^dAchieved 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.

$\mu\text{g}/\text{m}^3$ = 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 (SO₂) 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)	<u>De Minimis</u> Monitoring Concentration ($\mu\text{g}/\text{m}^3$)
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

^aNo de minimis concentration; an increase in VOC emissions of 100 TPY or more will require monitoring analysis for ozone.

^bAny 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.

$\mu\text{g}/\text{m}^3$ = 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 SO₂ and PM(TSP). However, in 1988, EPA promulgated final PSD regulations for nitrogen oxides (NO_x) and established PSD increments for nitrogen dioxide (NO₂).

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), SO₂, and NO₂.

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 SO₂ 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 SO₂ 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 SO₂ and PM(TSP), and February 8, 1988, in the case of NO₂;
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 SO₂ and PM(TSP), and February 8, 1988, for NO₂.

The minor source baseline date for SO₂ 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 NO₂ 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:

$$H_g = H + 1.5L$$

where: H_g = 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. 16 is located in Bradford County, which has been designated by EPA and FDER as an attainment area for all criteria pollutants. Bradford County and surrounding counties are designated as PSD Class II areas for SO₂, PM(TSP), and NO₂. The site is located within 100 km of a PSD Class I area. This Class I area is the Okefenokee National Wildlife Refuge, which is approximately 73 km northeast of the compressor station location.

FGTC's existing Compressor Station No. 16 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. 16, 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. 16

Pollutant	Maximum Potential Emissions From Proposed Compressor Engine		Significant Emission Rate (TPY)	PSD Review Applies?
	(lb/hr)	(TPY)		
Nitrogen Oxides	17.6	77.2	40	Yes
Carbon Monoxide	22.0	96.6	100	No
Volatile Organic Compounds (non-methane)	8.8	38.6	40	No
Particulate Matter (TSP)	0.13	0.58	25	No
Particulate Matter (PM10)	0.13	0.58	15	No
Sulfur Dioxide	0.75	3.30	40	No

The maximum annual impact associated with the potential NO_x emissions from the proposed IC engine is 0.93 μg/m³. 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 μg/m³ 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 35 ft high (10.67 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. 16 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 SO₂ concentrations in urban areas by using a decay half-life of 4 hours (i.e., reduce the SO₂ 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 Tallahassee Municipal 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 Tallahassee is located approximately 200 km northwest of the site and records the hourly surface data required by the air dispersion models. Because of the proximity of the Tallahassee NWS station to the plant site, the Tallahassee meteorological data are considered to be representative of weather conditions occurring at FGTC's Compressor Station No. 16 site.

The ISCLT model requires annual/seasonal mixing height data and ambient air temperatures. The appropriate values for Tallahassee for input to the model were obtained from FDER. The Tallahassee 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. 16 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. 16 plant property were used in the determination of maximum impacts. After the screening modeling was completed, refined modeling was conducted using a receptor grid centered on the receptor that had the highest concentration, or was within 10 percent of the highest concentration, from the screening analysis. The refined receptors were located at 50-m intervals along nine radials separated by 2-degree increments.

Table 4-2. Summary of Source Parameters Used in the Modeling Analysis

Modeled Source Number	<u>Stack Dimensions (m)</u>		<u>Operating Parameters</u>		<u>Emissions (g/s)</u>
	Height	Diameter	Temperature (K)	Velocity (m/s)	NO ₂
1	10.67	0.59	561	51.90	2.22

Table 4-3. Discrete Plant Boundary Receptors, Compressor Station No. 16^a

Direction	Distance (km)	Direction	Distance (km)
10	0.195	190	0.216
20	0.204	200	0.226
30	0.219	210	0.232
40	0.213	220	0.207
50	0.180	230	0.250
60	0.158	240	0.265
70	0.146	250	0.253
80	0.140	260	0.244
90	0.137	270	0.241
100	0.140	280	0.244
110	0.146	290	0.256
120	0.158	300	0.277
130	0.180	310	0.296
140	0.213	320	0.250
150	0.247	330	0.219
160	0.226	340	0.204
170	0.216	350	0.195
180	0.213	360	0.192

^aRelative 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 Schulman-Scire downwash method was used in the analysis. Therefore,

Table 4-4. Building Dimensions used in the ISCLT Modeling, Compressor Station No. 16

Building	<u>Actual Building Dimensions</u>			<u>Modeled Building Dimensions</u>	
	Height (m)	Length (m)	Width (m)	Height (m)	Projected Width ^a (m)
Compressor Building ^b	9.69	71.6	16.8	9.69	73.5

^aMaximum projected building width was assumed to be applicable in all directions.

^bDimensions are for expanded compressor building with proposed engine.

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 maximum predicted annual NO₂ concentrations due to the proposed compressor engine only is presented in Table 4-5. The maximum predicted annual average impact due to the proposed compressor engine is 0.93 μg/m³, which is less than the NO₂ significance level of 1 μg/m³, annual average concentration. This maximum concentration is predicted to occur in a direction of 360° and at a distance of 0.192 km from the proposed engine's stack. (The location of this receptor, where the maximum concentration occurred, is along the property boundary of Compressor Station No. 16. Modeling refinement was performed for the year 1986 because the maximum predicted concentration occurred at a receptor where receptor spacing was more than 100 m. As reported in Table 4-5, the refinement concentration for 1986 is still less than the maximum concentration of 0.93 μg/m³ predicted for the year 1984. Because the predicted maximum NO₂ concentration for all 5 years is less than the significant impact level, further modeling for NO₂ is not required. Computer modeling printouts are provided in Appendix C.

The potential NO_x impacts with respect to the Okefenokee National Wildlife Refuge area must also be considered because Compressor Station No. 16 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 μg/m³) at the plant site, potential impacts on the Class I areas located more than 70 km away will be much less than 1 μg/m³, annual average concentration.

Table 4-5. Maximum Predicted Annual Average NO₂ Concentrations
Due to the Proposed Station 16 Compressor Engine for
Comparison to Significant Impact Levels

Year Modeled	Maximum Concentration (µg/m ³)	Receptor Location		NO ₂ Significant Impact Level (µg/m ³)
		Direction (°)	Distance (km)	
1982	0.82	360	0.750	1
1983	0.85	360	0.192	
1984	0.93	360	0.192	
1985	0.71	360	0.750	
1986	0.85 ^a	180	0.650	

^aRefined concentration

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. 16 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 Okefenokee 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 Okefenokee National Wildlife Refuge, located about 73 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. 16

Class I Area: OKEFENOKEE N.W.R.

*** Level-1 Screening ***

Input Emissions for

Particulates	0.13	LB /HR
NOx (as NO2)	17.60	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:	73.00 km
Min. Source-Class I Distance:	73.00 km
Max. Source-Class I Distance:	133.00 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

Backgrnd	Theta	Azi	Distance	Alpha	Delta E		Contrast	
					Crit	Plume	Crit	Plume
SKY	10.	84.	73.0	84.	2.00	.013	.05	.000
SKY	140.	84.	73.0	84.	2.00	.004	.05	.000
TERRAIN	10.	84.	73.0	84.	2.00	.001	.05	.000
TERRAIN	140.	84.	73.0	84.	2.00	.000	.05	.000

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

Backgrnd	Theta	Azi	Distance	Alpha	Delta E		Contrast	
					Crit	Plume	Crit	Plume
SKY	10.	70.	69.4	99.	2.00	.014	.05	.000
SKY	140.	70.	69.4	99.	2.00	.005	.05	.000
TERRAIN	10.	65.	68.1	104.	2.00	.001	.05	.000
TERRAIN	140.	65.	68.1	104.	2.00	.000	.05	.000

In regards 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. 16 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 4,000-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 three factors can be sufficiently achieved.

Potential NO_x Emission Reduction:

<u>Pollutant</u>	<u>Uncontrolled Emission Level</u>	<u>Guaranteed Emission Level</u>	<u>Potential Percentage Reduction</u>
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:

<u>Pollutant</u>	<u>Uncontrolled Emission Level</u>	<u>Achievable Emission Level</u>	<u>Potential Percentage Reduction</u>
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:

<u>Pollutant</u>	<u>Uncontrolled Emission Level</u>	<u>Achievable Emission Level</u>	<u>Potential Percentage Reduction</u>
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:

<u>Pollutant</u>	<u>Uncontrolled Emission Level</u>	<u>Achievable Emission Level</u>	<u>Potential Percentage Reduction</u>
NO _x	11.0 g/bhp-hr ^a	7.3 g/bhp-hr	34%
	2.0 g/bhp-hr ^b	Not applicable	--

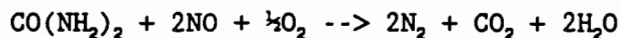
Note: ^a Represents emission level for the baseline rich-burn engine.

^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:



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_x OUT 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_x OUT system has not been demonstrated on any stationary IC engine.

The NO_x OUT 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,

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°; average 15% NOx reduction.
Lean-burn Engine	1.7 g/bhp-hr	YES	
Derating Power Output			
Rich-burn Engine	6.6 g/bhp-hr	YES	Average 40% NOx reduction at 25% of engine power derated for gas-fired engines.
Lean-burn Engine	1.2 g/bhp-hr	YES	
Exhaust Gas Recirculation			
Rich-burn Engine	7.3 g/bhp-hr	YES	Maximum 34% NOx reduction for standard engine. Ineffective for lean-burn engine.
Lean-burn Engine	Not Applicable	NO	
<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.

environmental effects, energy requirements and impacts, and economic impacts.

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			Size (Bhp)	NOx Emission Limit**			Control Method	Comments
				Fuel* Type	Make	Model		(g/Bhp-hr)	(lb/hr)	(ppm)		
<u>Source Type: Natural Gas Compressor Station</u>												
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.	Caterpillar	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.	Caterpillar		225	0.805	0.4	50	NSCR, rich burn engine	90% reduction
<u>Source Type: Power Cogeneration and Other Uses</u>												
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.	Caterpillar		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	15.4	409.5	96%
Second	Rich-burn Engine with NSCR	1.1	42.5	382.4	90%
Third	Lean-burn Engine/Derating Power+	1.2	46.3	378.6	89%
Fourth	Lean-burn Engine/Retard Timing	1.7	65.7	359.2	85%
Fifth	Lean-burn Engine	2.0	77.2	347.7	82%
Baseline	Rich-burn Engine	11.0	424.9	----	----

- * Total emission reduction and total control efficiency 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. A stack gas reheat system would be required to heat the exhaust gases up to the operating temperature of the SCR (see further discussion under Energy Requirements and Impacts). This further complicates 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 imposes further energy penalties. The additional energy requirements are caused by power loss due to additional back pressure from the SCR, electrical requirements for heating the ammonia

solution and operating the injection system, and additional energy necessary for reheating the proposed engine exhaust gases from 550°F up to the SCR operating range of 700°F. [SCR manufacturers specify a typical operating temperature window between 600°F to 900°F (Engelhard, 1990; and Steuler, 1990)]. A minimum of 3.47 MMBtu/hr is required for stack gas reheating or 30,397 MMBtu/yr. However, using the lean-burn engine will result in better fuel economy than the baseline rich-burn engine. The heat input saving amounts to 4.8 MMBtu/hr or 42,048 MMBtu/yr. Thus, the net fuel credit is 11,651 MMBtu/yr. Also, an addition of 8.6 megawatt-hour is required for the operation of the ammonia vaporizer and injection system.

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 \$100,000 (i.e., Item 1a in Table 6-4) is added to account for the differential cost of the lean-burn engine. The vendor's equipment quote for the Kleenaire system is \$350,000. The direct capital cost of the system is calculated to be \$965,367, and the indirect capital cost is calculated to be \$532,692. The total capital investment is \$1,498,059. The basic equipment cost for the Engelhard System is \$384,780. Direct capital

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	\$100,000	\$100,000
(b) SCR Basic Equipment	Vendor Quote	\$350,000	\$384,780
(c) Ammonia System	See Note 2	\$20,000	\$20,000
(d) Auxiliary Equipment (Reheat)*	0.10 x (1b)	\$35,000	\$38,478
(e) Emission Monitoring	0.15 x (1b)	\$52,500	\$57,717
(f) Structure Support	0.10 x (1a-1e)	\$55,750	\$60,098
(g) Instrumentation & controls ¹	0.10 x (1a-1e)	\$55,750	\$60,098
(h) Freight ¹	0.05 x (1a-1g)	\$33,450	\$36,059
(i) Sales Tax (Florida)	0.06 x (1a-1g)	\$40,140	\$43,270
(j) Subtotal	(1a-1i)	\$742,590	\$800,500
(2) Direct Installation ¹	0.30 x (1j)	\$222,777	\$240,150
Total DCC:	(1) + (2)	\$965,367	\$1,040,650
INDIRECT CAPITAL COSTS (ICC):			
(3) Indirect Installation			
(a) Engineering & Supervision ¹	0.10 x (DCC)	\$96,537	\$104,065
(b) Construction & Field Expenses ¹	0.05 x (DCC)	\$48,268	\$52,033
(c) Construction Contractor Fee ¹	0.10 x (DCC)	\$96,537	\$104,065
(d) Contingencies ²	0.25 x (DCC)	\$241,342	\$260,163
(4) Other Indirect Costs			
(a) Startup & Testing ¹	0.03 x (DCC)	\$28,961	\$31,220
(b) Working Capital	30-day DOC**	\$21,047	\$16,444
Total ICC:	(3) + (4)	\$532,692	\$567,990
TOTAL CAPITAL INVESTMENT (TCI):	DCC + ICC	\$1,498,059	\$1,608,640

+ Represents a typical first generation catalyst which is metal oxides embedded in ceramic matrix.

++ Represents second generation all ceramic catalyst extruded into honeycomb-shape.

* Duct burner system to reheat the exhaust gas from 550°F up to 700°F.

** 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 3,000-gallon anhydrous ammonia tank, an ammonia evaporator, and a dual-valve pressure regulator.

cost is \$1,040,650 and the indirect capital cost is \$567,990 for a total capital investment of \$1,608,640.

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 \$665,769 and \$635,212 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 4,000-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).

Table 6-5 Annualized Cost Estimates for SCR Systems for NOx Emission Control

Cost Items	Basis	Costs	
		Kleenair System+	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	\$48,268	\$52,033
(3) Replacement Parts (include freight & tax)			
(a) Catalyst	(Part+Labor)xCRF; See Note 1	\$80,661	\$27,102
(b) Guard Bed	(Part+Labor)xCRF; See Note 2	\$5,436	\$0
(4) Utilities			
(a) Electricity	0.30 MW-hr/ton NH ₃ ; \$85/MW-hr	\$729	\$729
(b) Fuel for stack reheat	\$2.06/MMBtu; See Note 3	\$62,618	\$62,618
(c) Fuel credit	\$2.06/MMBtu; See Note 4	-\$86,619	-\$86,619
(5) Ammonia	0.37 lb NH ₃ /lb NO _x ; \$250/ton NH ₃	\$7,146	\$7,146
Total DOC		\$252,559	\$197,329
INDIRECT OPERATING COSTS (IOC):			
(7) Overhead ¹	60% of operating labor & maintenance	\$109,553	\$111,812
(8) Property Taxes ¹	1% of total capital investment	\$14,981	\$16,086
(9) Insurance ¹	1% of total capital investment	\$14,981	\$16,086
(10) Administration ¹	2% of total capital investment	\$29,961	\$32,173
Total IOC		\$169,476	\$176,157
CAPITAL RECOVERY COST (CRC)	CRF of 0.1627 times TCI	\$243,734	\$261,726
ANNUALIZED COST (AC):	DOC + IOC + CRC	\$665,769	\$635,212

+ 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 \$180,000 with a service life of 3 years.

Catalyst replacement part cost for the Engelhard system is \$60,000 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 \$12,000 with an estimated service life of 3 years. Required labor is for 4 hours.

Note 3: Assumed heat transfer efficiency of 80%, heat input required to raise exhaust temperature to 700°F is:

$$Q = (71,100 \text{ lb/hr})(0.26 \text{ Btu/lb}^\circ\text{F for air})(700^\circ\text{F}-550^\circ\text{F})/(0.8) = 3.47 \text{ MMBtu/hr.}$$

$$\text{Annual heat input equals } 3.47 \text{ MMBtu/hr times } 8,760 \text{ hr/yr} = 30,397 \text{ MMBtu/yr.}$$

Note 4: Heat input for lean-burn engine is calculated from 6,800 Btu/bhp-hr times 4,000 bhp = 27.2 MMBtu/hr.

Heat input for rich-burn, naturally aspirated engine is calculated from 8,000 Btu/bhp-hr times 4,000 bhp = 32.0 MMBtu/hr.

Therefore, using a better fuel efficient engine results in saving an annual heat input of:

$$(32.0 - 27.2) \text{ MMBtu/hr} \times 8,760 \text{ hr/yr} = 42,048 \text{ MMBtu/yr.}$$

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 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. Potential toxic air 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 6,800 Btu/bhp-hr for the proposed lean-burn engine. For a 4,000-bhp output, an additional 4.8 MMBtu/hr heat input is required, or approximately 42,048 MMBtu per year for an annual cost of \$86,619.

Economic Analysis

Capital and annualized cost estimates were prepared for a NSCR converter. Cost of the NSCR converter was provided by Johnson-Matthey as \$80,000. 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 4,000-bhp rich-burn engine is tabulated in Table 6-6. The direct capital cost is calculated to be \$159,307, and the indirect capital cost is calculated to be \$93,682. The total capital investment is \$252,989. Also 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 \$207,348. In comparison, the annualized differential cost of the lean-burn engine itself is -\$27,910. 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 Cooper-Bessemer 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 (Cooper Industries, Inc., 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 hydrocarbons.

Table 6-6 Capital Cost Estimates for Lean-burn Engine and Rich-burn Engine/NSCR System

Cost Items	Cost Factors	Costs	
		Lean-Burn Engine	Johnson-Matthey NSCR System
DIRECT CAPITAL COSTS (DCC):			
(1) Purchased Equipment			
(a) Differential Engine Cost	See Note 1	\$100,000	\$0
(b) NSCR Converter	Vendor Quote	\$0	\$80,000
(c) Emission Monitoring	0.15 x (1b)	\$0	\$12,000
(d) Structural Support	0.10 x (1b-1c)	\$0	\$9,200
(e) Instrumentation ¹	0.10 x (1a-1c)	\$10,000	\$9,200
(f) Freight ¹	0.05 x (1a-1e)	\$5,500	\$5,520
(g) Sales Tax (Florida)	0.06 x (1a-1e)	\$6,600	\$6,624
(h) Subtotal	(1a-1g)	\$122,100	\$122,544
(2) Direct Installation ¹	0.30 x (1h)	\$36,630	\$36,763
Total DCC:	(1) + (2)	\$158,730	\$159,307
INDIRECT CAPITAL COSTS (ICC):			
(3) Indirect Installation			
(a) Engineering & Supervision ¹	0.10 x (DCC)	\$15,873	\$15,931
(b) Construction & Field Expenses ¹	0.05 x (DCC)	\$7,937	\$7,965
(c) Construction Contractor Fee ¹	0.10 x (DCC)	\$15,873	\$15,931
(d) Contingencies	See Note 2	\$23,810	\$39,827
(4) Other Indirect Costs			
(a) Startup & Testing ¹	0.03 x (DCC)	\$4,762	\$4,779
(b) Working Capital	30-day DOC [*]	\$0	\$9,249
Total ICC:	(3) + (4)	\$68,255	\$93,682
TOTAL CAPITAL INVESTMENT (TCI):	DCC + ICC	\$226,985	\$252,989

* 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 contingency based on no existing installation of NSCR on large-bore rich-burn engine.

Table 6-7 Differential Annualized Cost Estimates for Lean-Burn Engine and Rich-Burn/NSCR System

Cost Items	Basis	Costs	
		Lean-Burn Engine	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	\$7,937	\$7,965
(3) Replacement Parts (include freight & tax)			
Catalyst	(Part+Labor)xCRF; See Note 1	\$0	\$35,867
(4) Fuel			
Fuel credit (gas)	\$2.06/MMBtu; See Note 2	-\$86,619	\$0
Total DOC		-\$78,682	\$110,992
INDIRECT OPERATING COSTS (IOC):			
(7) Overhead ¹	60% of operating labor & maintenance	\$4,762	\$45,075
(8) Property Taxes ¹	1% of total capital investment	\$2,270	\$2,530
(9) Insurance ¹	1% of total capital investment	\$2,270	\$2,530
(10) Administration ¹	2% of total capital investment	\$4,540	\$5,060
Total IOC		\$13,842	\$55,195
CAPITAL RECOVERY COST (CRC)	CRF of 0.1627 times TCI	\$36,930	\$41,161
ANNUALIZED COST (AC):	DOC + IOC + CRC	-\$27,910	\$207,348

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 \$80,000 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 6,800 Btu/bhp-hr times 4,000 bhp = 27.2 MMBtu/hr. Heat input for rich-burn engine is calculated from 8,000 Btu/bhp-hr times 4,000 bhp = 32.0 MMBtu/hr. Therefore, using a better fuel efficient engine results in saving an annual heat input of: (32.0 - 27.2) MMBtu/hr x 8,760 hr/yr = 42,048 MMBtu/yr.

Environmental Effects

Application of this technology would result in lower NO_x emissions and no change in carbon monoxide (CO) emissions, but emissions of hydrocarbons would increase. For instance, Cooper Industries, Inc., has reported a 38.6 TPY emissions reduction of NO_x and no change in CO, with a corresponding emissions increase of 11.6 TPY total hydrocarbons based on a 30 percent derating of the proposed 4,000 lean-burn engine.

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 a 9 percent increase in fuel consumption will occur for a derating of 30 percent (Cooper Industries, Inc., 1990).

Economic Analysis

If derating is employed, a larger engine would be necessary to meet FGTC's power requirement of 4,000 bhp at Compressor Station No. 16. 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 71,100 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-

Table 6-8 Summary of the Operating Parameters for the Proposed Engine, Station No. 16

Parameter	Design Specification
Make and Model	Cooper-Bessemer 8W-330C2
Air/Fuel Ratio	Variable
Exhaust Mass Flow	71,100 lb/hr
Ignition Timing	Variable
Air Manifold Pressure	Variable
Air Manifold Temperature	80 °F
Exhaust Temperature	550 °F
Maximum Allowed Back Pressure	3 inches of water
Specific Fuel Consumption	6,800 Btu/bhp-hr

Source: Cooper Industries, Inc. (1990).

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 550°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).

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 4.8 MMBtu/hr, for a total savings of 42,048 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 4,000-bhp Cooper-Bessemer 8W-330C2 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 Cooper-Bessemer engine is \$100,000, from which the differential direct capital

cost is calculated to be \$158,730, and the indirect capital cost is calculated to be \$68,255. The differential total capital investment is \$226,985.

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 \$7,937 and a fuel credit of \$86,619 for better fuel efficiency operation. The differential annualized cost is -\$27,910 for the lean-burn engine. Thus, the negative annualized cost value indicates an annual savings of \$27,910 by using the proposed lean-burn engine. This savings is more than sufficient to offset the higher differential basic equipment cost (i.e., \$100,000) 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 net fuel credit of 11,651 MMBtu/yr for using the fuel-efficient lean-burn engine. In addition, an annual 8.6 MW-hr of electrical power is required for the ammonia vaporizer and injection system. The next 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 42,048 MMBtu/yr in heat input over the rich-burn engine because of its inherent fuel efficient design. The amount of heat input being saved by using the lean-burn engine is sufficiently significant to result in a lower annualized cost, even though the lean-burn engine is more costly than the conventional rich-burn engine. 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

Table 6-9 Summary of Top-Down BACT Impact Analysis Results for NOx

Control Alternative	Environmental Impacts				Energy Impacts		Economic Impacts			
	Total Emission Reduction (TPY)*	Incremental Emission Reduction (TPY)**	Potential toxic air impact?	Potential adverse environmental impacts?	Incremental increase over baseline		Total Annualized Cost (\$/yr)	Incremental Annualized Cost (\$/yr)	Total Cost Effectiveness (\$/ton)	Incremental Cost Effectiveness (\$/ton)
					Natural gas (MMBtu/yr)	Electricity (MW-hr/yr)				
Lean-Burn Engine with SCR	409.5	27.1	Yes	Yes	-11,651	8.6	\$635,212	\$427,864	\$1,551	\$15,788
Rich-Burn Engine with NSCR	382.4	34.7	No	Yes	0	0	\$207,348	\$235,258	\$542	\$6,780
Lean-Burn Engine	347.7	347.7	No	No	-42,048	0	-\$27,910	-\$27,910	-\$80	-\$80
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.

alternatives: the lean-burn engine/SCR technology has the highest cost effectiveness value of \$1,551 per ton of NO_x removed; the rich-burn engine/NSCR technology is the next highest with \$542 per ton of NO_x removed. The lean-burn engine has a total cost effectiveness value of -\$80 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 \$15,788 and \$6,780 per ton of NO_x removed, respectively. The lean-burn engine has an incremental cost effectiveness of -\$80 per ton of NO_x removed. Therefore, the lean-burn engine is the most cost effective control option.

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 4,000-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 77.2 TPY, and modeling results show an insignificant NO_x impact (less than 1.0 μg/m³). In conclusion, the FGTC's proposed Cooper-Bessemer 8W-3302C 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			Load (Bhp)	NOx Emission Limit*			Control Method	Comments
					Fuel Type	Make	Model		(g/Bhp-hr)	(lb/hr)	(ppm)		
<u>Source Type: Natural Gas Compressor Station</u>													
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.	Caterpillar	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.	Caterpillar		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			Load (Bhp)	NOx Emission Limit*			Control Method	Comments
					Fuel Type	Make	Model		(g/Bhp-hr)	(lb/hr)	(ppm)		
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 Xlox)	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.	Caterpillar		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.

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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 TOTAL CAPITAL INVESTMENT (TCI)

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 Cooper Industries, Inc. 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 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.

The cost of the auxiliary equipment for reheating the exhaust gas accounts for the duct burner system required to bring the exhaust temperature from 495°F to 700°F. Without raising the temperature, the SCR system would not work properly.

Emission monitoring costs include the cost of NO_x and O₂ 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 ANNUALIZED COST (AC)

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 include 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, natural gas for exhaust stack gas reheat, 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. 16**

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

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CARD INPUT FILE IS	ER16LT82.180	
SUMMARY OUTPUT FILE IS	ER16LT82.080	
TITLE OF RUN IS	1982 ENRON STATION 16 / 35 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 =0.1000000E+07
 ACCELERATION OF GRAVITY (METERS/SEC**2) = 9.800
 HEIGHT OF MEASUREMENT OF WIND SPEED (METERS) = 7.620
 CORRECTION ANGLE FOR GRID SYSTEM VERSUS DIRECTION DATA NORTH (DEGREES) = 0.000
 DECAY COEFFICIENT =0.0000000E+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) =	195.00,	204.00,	219.00,	213.00,	180.00,	158.00,				
146.00,	140.00,	137.00,	140.00,	146.00,	158.00,	180.00,	213.00,	247.00,	226.00,	
216.00,	213.00,	216.00,	226.00,	232.00,	207.00,	250.00,	265.00,	253.00,	244.00,	
241.00,	244.00,	256.00,	277.00,	296.00,	250.00,	219.00,	204.00,	195.00,	192.00,	
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	299.0000	299.0000	299.0000	293.0000	287.0000	287.0000

- 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	.222000E+040.	.222000E+040.	.222000E+040.	.222000E+040.	.222000E+040.	.222000E+040.
STABILITY CATEGORY 20	.148000E+040.	.148000E+040.	.148000E+040.	.148000E+040.	.148000E+040.	.148000E+040.
STABILITY CATEGORY 30	.148000E+040.	.148000E+040.	.148000E+040.	.148000E+040.	.148000E+040.	.148000E+040.
STABILITY CATEGORY 40	.148000E+040.	.148000E+040.	.148000E+040.	.148000E+040.	.148000E+040.	.148000E+040.
STABILITY CATEGORY 50	.100000E+050.	.100000E+050.	.100000E+050.	.100000E+050.	.100000E+050.	.100000E+050.
STABILITY CATEGORY 60	.100000E+050.	.100000E+050.	.100000E+050.	.100000E+050.	.100000E+050.	.100000E+050.

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.500MPS)	WIND SPEED CATEGORY 2 (2.500MPS)	WIND SPEED CATEGORY 3 (4.300MPS)	WIND SPEED CATEGORY 4 (6.800MPS)	WIND SPEED CATEGORY 5 (9.500MPS)	WIND SPEED CATEGORY 6 (12.500MPS)
0.000	0.00092100	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00103500	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00149701	0.00125600	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00092200	0.00091300	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00138201	0.00114200	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00080500	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00103400	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00068900	0.00022800	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00115000	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00069000	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00011500	0.00011400	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00069000	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00080500	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00115000	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00069200	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00069200	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 2

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.500MPS)	WIND SPEED CATEGORY 2 (2.500MPS)	WIND SPEED CATEGORY 3 (4.300MPS)	WIND SPEED CATEGORY 4 (6.800MPS)	WIND SPEED CATEGORY 5 (9.500MPS)	WIND SPEED CATEGORY 6 (12.500MPS)
0.000	0.00259901	0.00513702	0.00296801	0.00000000	0.00000000	0.00000000
22.500	0.00228601	0.00308201	0.00171201	0.00000000	0.00000000	0.00000000
45.000	0.00310001	0.00479502	0.00171201	0.00000000	0.00000000	0.00000000
67.500	0.00153301	0.00194101	0.00216901	0.00000000	0.00000000	0.00000000
90.000	0.00323101	0.00513702	0.00228301	0.00000000	0.00000000	0.00000000
112.500	0.00212801	0.00308201	0.00114200	0.00000000	0.00000000	0.00000000
135.000	0.00318001	0.00376701	0.00091300	0.00000000	0.00000000	0.00000000
157.500	0.00177801	0.00216901	0.00102700	0.00000000	0.00000000	0.00000000
180.000	0.00355601	0.00433802	0.00205501	0.00000000	0.00000000	0.00000000
202.500	0.00128700	0.00171201	0.00114200	0.00000000	0.00000000	0.00000000
225.000	0.00119000	0.00228301	0.00102700	0.00000000	0.00000000	0.00000000
247.500	0.00148901	0.00182601	0.00079900	0.00000000	0.00000000	0.00000000
270.000	0.00043700	0.00114200	0.00057100	0.00000000	0.00000000	0.00000000
292.500	0.00103200	0.00228301	0.00148401	0.00000000	0.00000000	0.00000000
315.000	0.00148901	0.00182601	0.00068500	0.00000000	0.00000000	0.00000000
337.500	0.00153301	0.00194101	0.00137001	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	0.00238101	0.00559402	0.00890403	0.00148401	0.00000000	0.00000000
22.500	0.00065900	0.00159801	0.00388101	0.00034200	0.00000000	0.00000000
45.000	0.00113100	0.00308201	0.00662103	0.00022800	0.00000000	0.00000000
67.500	0.00179501	0.00422402	0.00468002	0.00045700	0.00000000	0.00000000
90.000	0.00195101	0.00376701	0.00605002	0.00114200	0.00000000	0.00000000
112.500	0.00180501	0.00331101	0.00251101	0.00011400	0.00000000	0.00000000
135.000	0.00101700	0.00319601	0.00353901	0.00011400	0.00000000	0.00000000
157.500	0.00091300	0.00239701	0.00239701	0.00045700	0.00000000	0.00000000
180.000	0.00175301	0.00456602	0.01095904	0.00091300	0.00000000	0.00000000
202.500	0.00073100	0.00182601	0.00262601	0.00022800	0.00000000	0.00000000
225.000	0.00088200	0.00182601	0.00125600	0.00011400	0.00000000	0.00000000
247.500	0.00076300	0.00239701	0.00148401	0.00011400	0.00000000	0.00000000
270.000	0.00059100	0.00091300	0.00091300	0.00000000	0.00000000	0.00000000
292.500	0.00050800	0.00159801	0.00274001	0.00000000	0.00000000	0.00000000
315.000	0.00069000	0.00216901	0.00137001	0.00057100	0.00000000	0.00000000
337.500	0.00069500	0.00171201	0.00159801	0.00057100	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	0.00325001	0.00958904	0.01769407	0.01027404	0.00000000	0.00000000
22.500	0.00151701	0.00388101	0.00684903	0.00251101	0.00000000	0.00000000
45.000	0.00193601	0.00696303	0.01084504	0.00331101	0.00000000	0.00000000
67.500	0.00256501	0.00764803	0.01164404	0.00388101	0.00000000	0.00000000
90.000	0.00448802	0.01141604	0.01369905	0.00274001	0.00000000	0.00000000
112.500	0.00365001	0.01050204	0.00958904	0.00171201	0.00000000	0.00000000
135.000	0.00356101	0.00913203	0.00547902	0.00239701	0.00022800	0.00000000
157.500	0.00270401	0.00605002	0.00650702	0.00605002	0.00079900	0.00000000
180.000	0.00479802	0.01095904	0.02146108	0.02020508	0.00114200	0.00000000
202.500	0.00187201	0.00411002	0.00331101	0.00194101	0.00022800	0.00000000
225.000	0.00224001	0.00228301	0.00205501	0.00057100	0.00000000	0.00000000
247.500	0.00073600	0.00159801	0.00079900	0.00000000	0.00000000	0.00000000
270.000	0.00199301	0.00296801	0.00102700	0.00057100	0.00000000	0.00000000
292.500	0.00060300	0.00216901	0.00182601	0.00091300	0.00000000	0.00000000
315.000	0.00089500	0.00216901	0.00274001	0.00171201	0.00000000	0.00000000
337.500	0.00212001	0.00342501	0.00559402	0.00319601	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 (1.500MPS)	WIND SPEED CATEGORY 2 (2.500MPS)	WIND SPEED CATEGORY 3 (4.300MPS)	WIND SPEED CATEGORY 4 (6.800MPS)	WIND SPEED CATEGORY 5 (9.500MPS)	WIND SPEED CATEGORY 6 (12.500MPS)
0.000	0.00000000	0.00650702	0.00468002	0.00000000	0.00000000	0.00000000
22.500	0.00000000	0.00239701	0.00091300	0.00000000	0.00000000	0.00000000
45.000	0.00000000	0.00342501	0.00171201	0.00000000	0.00000000	0.00000000
67.500	0.00000000	0.00411002	0.00148401	0.00000000	0.00000000	0.00000000
90.000	0.00000000	0.01107304	0.00159801	0.00000000	0.00000000	0.00000000
112.500	0.00000000	0.00422402	0.00114200	0.00000000	0.00000000	0.00000000
135.000	0.00000000	0.00331101	0.00045700	0.00000000	0.00000000	0.00000000
157.500	0.00000000	0.00182601	0.00057100	0.00000000	0.00000000	0.00000000
180.000	0.00000000	0.00547902	0.00182601	0.00000000	0.00000000	0.00000000
202.500	0.00000000	0.00296801	0.00022800	0.00000000	0.00000000	0.00000000
225.000	0.00000000	0.00114200	0.00022800	0.00000000	0.00000000	0.00000000
247.500	0.00000000	0.00079900	0.00011400	0.00000000	0.00000000	0.00000000
270.000	0.00000000	0.00045700	0.00011400	0.00000000	0.00000000	0.00000000
292.500	0.00000000	0.00091300	0.00045700	0.00000000	0.00000000	0.00000000
315.000	0.00000000	0.00194101	0.00068500	0.00000000	0.00000000	0.00000000
337.500	0.00000000	0.00342501	0.00228301	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 6

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.500MPS)	WIND SPEED CATEGORY 2 (2.500MPS)	WIND SPEED CATEGORY 3 (4.300MPS)	WIND SPEED CATEGORY 4 (6.800MPS)	WIND SPEED CATEGORY 5 (9.500MPS)	WIND SPEED CATEGORY 6 (12.500MPS)
0.000	0.05692022	0.01084504	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00895403	0.00182601	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00980904	0.00251101	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.01174904	0.00262601	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.03450513	0.00707803	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.01129304	0.00205501	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.01266205	0.00171201	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00547502	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.02635010	0.00445202	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.01602706	0.00194101	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.01425905	0.00114200	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00775703	0.00148401	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00809903	0.00114200	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.02498109	0.00479502	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.01967607	0.00445202	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.02977211	0.00513702	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 10.	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
STABILITY CATEGORY 20.	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
STABILITY CATEGORY 30.	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
STABILITY CATEGORY 40.	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000	0.00000E+000
STABILITY CATEGORY 50.	0.20000E-010	0.20000E-010	0.20000E-010	0.20000E-010	0.20000E-010	0.20000E-010
STABILITY CATEGORY 60.	0.35000E-010	0.35000E-010	0.35000E-010	0.35000E-010	0.35000E-010	0.35000E-010

- 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 10.	0.70000E-010	0.70000E-010	0.70000E-010	0.70000E-010	0.70000E-010	0.70000E-010
STABILITY CATEGORY 20.	0.70000E-010	0.70000E-010	0.70000E-010	0.70000E-010	0.70000E-010	0.70000E-010
STABILITY CATEGORY 30.	1.00000E+000	1.00000E+000	1.00000E+000	1.00000E+000	1.00000E+000	1.00000E+000
STABILITY CATEGORY 40.	0.15000E+000	0.15000E+000	0.15000E+000	0.15000E+000	0.15000E+000	0.15000E+000
STABILITY CATEGORY 50.	0.35000E+000	0.35000E+000	0.35000E+000	0.35000E+000	0.35000E+000	0.35000E+000
STABILITY CATEGORY 60.	0.55000E+000	0.55000E+000	0.55000E+000	0.55000E+000	0.55000E+000	0.55000E+000

- SOURCE INPUT DATA -

C T SOURCE SOURCE X Y EMISSION BASE /
 A A NUMBER TYPE COORDINATE COORDINATE HEIGHT ELEV- /
 R P (M) (M) (M) ATION /
 D E (M) /

- SOURCE DETAILS DEPENDING ON TYPE -

X 1 STACK 0.00 0.00 10.67 0.00 GAS EXIT TEMP (DEG K)= 561.00, GAS EXIT VEL. (M/SEC)= 51.90,
 STACK DIAMETER (M)= 0.590, HEIGHT OF ASSO. BLDG. (M)= -9.69, WIDTH OF
 ASSO. BLDG. (M)= 73.46, 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,	73.5,	0	2	9.7,	73.5,	0	3	9.7,	73.5,	0	4	9.7,	73.5,	0
5	9.7,	73.5,	0	6	9.7,	73.5,	0	7	9.7,	73.5,	0	8	9.7,	73.5,	0
9	9.7,	73.5,	0	10	9.7,	73.5,	0	11	9.7,	73.5,	0	12	9.7,	73.5,	0
13	9.7,	73.5,	0	14	9.7,	73.5,	0	15	9.7,	73.5,	0	16	9.7,	73.5,	0

- SOURCE STRENGTHS (GRAMS PER SEC) -

SEASON 1 SEASON 2 SEASON 3 SEASON 4
 2.22000E+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) -
 200.000 300.000 400.000 500.000 750.000 1000.000 1250.000
 Y AXIS (AZIMUTH BEARING, DEGREES) - CONCENTRATION -

360.000	0.612815	0.460534	0.605535	0.754448	0.818707	0.738634	0.633645
337.500	0.233930	0.168910	0.210730	0.259075	0.280106	0.254971	0.221088
315.000	0.135939	0.116634	0.171009	0.231295	0.270815	0.254057	0.225014
292.500	0.114065	0.098441	0.141778	0.194273	0.248364	0.252653	0.235778
270.000	0.277808	0.235107	0.312782	0.392296	0.434911	0.411769	0.372092
247.500	0.236891	0.192851	0.248268	0.303433	0.336900	0.321560	0.288574
225.000	0.220447	0.199057	0.285855	0.369086	0.403103	0.365858	0.315439
202.500	0.178509	0.149508	0.201205	0.252188	0.268025	0.239520	0.204494
180.000	0.452273	0.356053	0.463025	0.573321	0.629738	0.582619	0.512967
157.500	0.167217	0.131526	0.164144	0.197129	0.207898	0.192292	0.171463
135.000	0.111334	0.092328	0.120306	0.147560	0.155137	0.140131	0.122218
112.500	0.119547	0.105708	0.144520	0.177162	0.166337	0.136606	0.112740
90.000	0.050168	0.045232	0.065326	0.083339	0.079633	0.067838	0.058682
67.500	0.065119	0.059800	0.083450	0.106692	0.113837	0.101123	0.086178
45.000	0.076559	0.062840	0.081718	0.103946	0.119111	0.110445	0.096732
22.500	0.137925	0.110967	0.143517	0.174462	0.178584	0.159224	0.138688

- 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
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195.0	10.0	0.403542	204.0	20.0	0.186967	219.0	30.0	0.112242
213.0	40.0	0.087061	180.0	50.0	0.076327	158.0	60.0	0.071795
146.0	70.0	0.065425	140.0	80.0	0.058266	137.0	90.0	0.053067
140.0	100.0	0.084040	146.0	110.0	0.117690	158.0	120.0	0.121638
180.0	130.0	0.115791	213.0	140.0	0.119808	247.0	150.0	0.133755
226.0	160.0	0.186543	216.0	170.0	0.312055	213.0	180.0	0.440445
216.0	190.0	0.317332	226.0	200.0	0.198417	232.0	210.0	0.182563
207.0	220.0	0.208297	250.0	230.0	0.211447	265.0	240.0	0.207699
253.0	250.0	0.218402	244.0	260.0	0.238919	241.0	270.0	0.261028
244.0	280.0	0.190111	256.0	290.0	0.121529	277.0	300.0	0.106304
296.0	310.0	0.112298	250.0	320.0	0.142366	219.0	330.0	0.189869
204.0	340.0	0.270846	195.0	350.0	0.447297	192.0	360.0	0.625827

** 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
750.00	360.00	0.818707
500.00	360.00	0.754448
1000.00	360.00	0.738634
1250.00	360.00	0.633645
750.00	180.00	0.629738
192.00	360.00	0.625827
200.00	360.00	0.612815
400.00	360.00	0.605535
1000.00	180.00	0.582619
500.00	180.00	0.573321

***** 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.

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CARD INPUT FILE IS	ER16LT83.180	
SUMMARY OUTPUT FILE IS	ER16LT83.080	
TITLE OF RUN IS	1983 ENRON STATION 16 / 35 FT STACK	10-29-90

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.500MPS)	WIND SPEED CATEGORY 2 (2.500MPS)	WIND SPEED CATEGORY 3 (4.300MPS)	WIND SPEED CATEGORY 4 (6.800MPS)	WIND SPEED CATEGORY 5 (9.500MPS)	WIND SPEED CATEGORY 6 (12.500MPS)
0.000	0.00032600	0.00079899	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00032600	0.00079899	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00037300	0.00091299	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00034700	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00025400	0.00022800	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00023300	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00028000	0.00068499	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00039400	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00083399	0.00125599	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00066900	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00023300	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00018600	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00009300	0.00022800	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00051300	0.00125599	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00025400	0.00022800	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00028000	0.00068499	0.00000000	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 2

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.500MPS)	WIND SPEED CATEGORY 2 (2.500MPS)	WIND SPEED CATEGORY 3 (4.300MPS)	WIND SPEED CATEGORY 4 (6.800MPS)	WIND SPEED CATEGORY 5 (9.500MPS)	WIND SPEED CATEGORY 6 (12.500MPS)
0.000	0.00225298	0.00433797	0.00285398	0.00000000	0.00000000	0.00000000
22.500	0.00108199	0.00262598	0.00216898	0.00000000	0.00000000	0.00000000
45.000	0.00085199	0.00216898	0.00182599	0.00000000	0.00000000	0.00000000
67.500	0.00101199	0.00228298	0.00125599	0.00000000	0.00000000	0.00000000
90.000	0.00145199	0.00445197	0.00136999	0.00000000	0.00000000	0.00000000
112.500	0.00124099	0.00205499	0.00125599	0.00000000	0.00000000	0.00000000
135.000	0.00110499	0.00273998	0.00148399	0.00000000	0.00000000	0.00000000
157.500	0.00105899	0.00251098	0.00171199	0.00000000	0.00000000	0.00000000
180.000	0.00179199	0.00273998	0.00216898	0.00000000	0.00000000	0.00000000
202.500	0.00073599	0.00159799	0.00045700	0.00000000	0.00000000	0.00000000
225.000	0.00084999	0.00148399	0.00091299	0.00000000	0.00000000	0.00000000
247.500	0.00069000	0.00136999	0.00102699	0.00000000	0.00000000	0.00000000
270.000	0.00124199	0.00273998	0.00159799	0.00000000	0.00000000	0.00000000
292.500	0.00119599	0.00251098	0.00239698	0.00000000	0.00000000	0.00000000
315.000	0.00075899	0.00171199	0.00102699	0.00000000	0.00000000	0.00000000
337.500	0.00071499	0.00216898	0.00136999	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	0.00129299	0.00559396	0.01027393	0.00239698	0.00000000	0.00000000
22.500	0.00051900	0.00251098	0.00570796	0.00057100	0.00000000	0.00000000
45.000	0.00058900	0.00285398	0.00513696	0.00068499	0.00000000	0.00000000
67.500	0.00058600	0.00216898	0.00525096	0.00068499	0.00000000	0.00000000
90.000	0.00084499	0.00342498	0.00650695	0.00125599	0.00000000	0.00000000
112.500	0.00077399	0.00308198	0.00353897	0.00022800	0.00000000	0.00000000
135.000	0.00082199	0.00331098	0.00331098	0.00045700	0.00000000	0.00000000
157.500	0.00044400	0.00148399	0.00410997	0.00091299	0.00022800	0.00000000
180.000	0.00104999	0.00308198	0.00924693	0.00365297	0.00000000	0.00000000
202.500	0.00028300	0.00136999	0.00239698	0.00125599	0.00000000	0.00000000
225.000	0.00062900	0.00171199	0.00228298	0.00045700	0.00000000	0.00000000
247.500	0.00094799	0.00125599	0.00205499	0.00045700	0.00000000	0.00000000
270.000	0.00084099	0.00273998	0.00285398	0.00045700	0.00000000	0.00000000
292.500	0.00100599	0.00353897	0.00365297	0.00068499	0.00000000	0.00000000
315.000	0.00060900	0.00228298	0.00262598	0.00034200	0.00000000	0.00000000
337.500	0.00063300	0.00239698	0.00365297	0.00068499	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	0.00222898	0.00878994	0.01369890	0.01255691	0.00034200	0.00000000
22.500	0.00120499	0.00456597	0.01141592	0.00479497	0.00000000	0.00000000
45.000	0.00125699	0.00490896	0.01198591	0.00422397	0.00000000	0.00000000
67.500	0.00111799	0.00662095	0.01324190	0.00947493	0.00057100	0.00000000
90.000	0.00262498	0.01232891	0.01244291	0.00867594	0.00011400	0.00000000
112.500	0.00165999	0.00673495	0.00730595	0.00376697	0.00022800	0.00000000
135.000	0.00094799	0.00547896	0.00639295	0.00331098	0.00022800	0.00011400
157.500	0.00111999	0.00399497	0.00844694	0.00981693	0.00205499	0.00159799
180.000	0.00202399	0.00741995	0.01940586	0.02054785	0.00216898	0.00011400
202.500	0.00116599	0.00342498	0.00353897	0.00353897	0.00022800	0.00000000
225.000	0.00063700	0.00251098	0.00331098	0.00136999	0.00000000	0.00000000
247.500	0.00102999	0.00251098	0.00194099	0.00114199	0.00000000	0.00000000
270.000	0.00091599	0.00262598	0.00262598	0.00079899	0.00000000	0.00000000
292.500	0.00138799	0.00490896	0.00433797	0.00182599	0.00000000	0.00000000
315.000	0.00123999	0.00479497	0.00399497	0.00205499	0.00000000	0.00000000
337.500	0.00089699	0.00513696	0.00821894	0.00536496	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 (1.500MPS)	WIND SPEED CATEGORY 2 (2.500MPS)	WIND SPEED CATEGORY 3 (4.300MPS)	WIND SPEED CATEGORY 4 (6.800MPS)	WIND SPEED CATEGORY 5 (9.500MPS)	WIND SPEED CATEGORY 6 (12.500MPS)
0.000	0.00000000	0.00639295	0.00490896	0.00000000	0.00000000	0.00000000
22.500	0.00000000	0.00136999	0.00079899	0.00000000	0.00000000	0.00000000
45.000	0.00000000	0.00285398	0.00239698	0.00000000	0.00000000	0.00000000
67.500	0.00000000	0.00262598	0.00239698	0.00000000	0.00000000	0.00000000
90.000	0.00000000	0.01175791	0.00502296	0.00000000	0.00000000	0.00000000
112.500	0.00000000	0.00490896	0.00114199	0.00000000	0.00000000	0.00000000
135.000	0.00000000	0.00490896	0.00079899	0.00000000	0.00000000	0.00000000
157.500	0.00000000	0.00262598	0.00034200	0.00000000	0.00000000	0.00000000
180.000	0.00000000	0.00479497	0.00228298	0.00000000	0.00000000	0.00000000
202.500	0.00000000	0.00308198	0.00045700	0.00000000	0.00000000	0.00000000
225.000	0.00000000	0.00205499	0.00148399	0.00000000	0.00000000	0.00000000
247.500	0.00000000	0.00125599	0.00045700	0.00000000	0.00000000	0.00000000
270.000	0.00000000	0.00159799	0.00022800	0.00000000	0.00000000	0.00000000
292.500	0.00000000	0.00251098	0.00079899	0.00000000	0.00000000	0.00000000
315.000	0.00000000	0.00216898	0.00125599	0.00000000	0.00000000	0.00000000
337.500	0.00000000	0.00433797	0.00239698	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 6

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.500MPS)	WIND SPEED CATEGORY 2 (2.500MPS)	WIND SPEED CATEGORY 3 (4.300MPS)	WIND SPEED CATEGORY 4 (6.800MPS)	WIND SPEED CATEGORY 5 (9.500MPS)	WIND SPEED CATEGORY 6 (12.500MPS)
0.000	0.03910672	0.01301390	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00611196	0.00239698	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00994693	0.00388097	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00647895	0.00273998	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.01539189	0.00410997	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00644295	0.00171199	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00442897	0.00159799	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00594996	0.00114199	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.01288491	0.00342498	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.01168292	0.00285398	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.01988686	0.00422397	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.01872086	0.00467997	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.01963386	0.00376697	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.03159377	0.00776294	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.02152784	0.00719195	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.02888379	0.00799094	0.00000000	0.00000000	0.00000000	0.00000000

- ISCLT INPUT DATA (CONT.) -

- VERTICAL POTENTIAL TEMPERATURE GRADIENT (DEGREES KELVIN/METER) -

	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.	0.000000E+000	.000000E+000	.000000E+000	.000000E+000	.000000E+000	.000000E+00
STABILITY CATEGORY 20.	0.000000E+000	.000000E+000	.000000E+000	.000000E+000	.000000E+000	.000000E+00
STABILITY CATEGORY 30.	0.000000E+000	.000000E+000	.000000E+000	.000000E+000	.000000E+000	.000000E+00
STABILITY CATEGORY 40.	0.000000E+000	.000000E+000	.000000E+000	.000000E+000	.000000E+000	.000000E+00
STABILITY CATEGORY 50.	0.200000E-010	.200000E-010	.200000E-010	.200000E-010	.200000E-010	.200000E-01
STABILITY CATEGORY 60.	0.350000E-010	.350000E-010	.350000E-010	.350000E-010	.350000E-010	.350000E-01

- WIND PROFILE POWER LAW EXPONENTS -

	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.	0.700000E-010	.700000E-010	.700000E-010	.700000E-010	.700000E-010	.700000E-01
STABILITY CATEGORY 20.	0.700000E-010	.700000E-010	.700000E-010	.700000E-010	.700000E-010	.700000E-01
STABILITY CATEGORY 30.	0.100000E+000	.100000E+000	.100000E+000	.100000E+000	.100000E+000	.100000E+00
STABILITY CATEGORY 40.	0.150000E+000	.150000E+000	.150000E+000	.150000E+000	.150000E+000	.150000E+00
STABILITY CATEGORY 50.	0.350000E+000	.350000E+000	.350000E+000	.350000E+000	.350000E+000	.350000E+00
STABILITY CATEGORY 60.	0.550000E+000	.550000E+000	.550000E+000	.550000E+000	.550000E+000	.550000E+00

- SOURCE INPUT DATA -

C T SOURCE SOURCE X Y EMISSION BASE /
 A A NUMBER TYPE COORDINATE COORDINATE HEIGHT ELEV- /
 R P (M) (M) (M) ATION /
 D E (M) /

- SOURCE DETAILS DEPENDING ON TYPE -

 X 1 STACK 0.00 0.00 10.67 0.00 GAS EXIT TEMP (DEG K)= 561.00, GAS EXIT VEL. (M/SEC)= 51.90,
 STACK DIAMETER (M)= 0.590, HEIGHT OF ASSO. BLDG. (M)= -9.69, WIDTH OF
 ASSO. BLDG. (M)= 73.46, 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,	73.5,	0	2	9.7,	73.5,	0	3	9.7,	73.5,	0	4	9.7,	73.5,	0
5	9.7,	73.5,	0	6	9.7,	73.5,	0	7	9.7,	73.5,	0	8	9.7,	73.5,	0
9	9.7,	73.5,	0	10	9.7,	73.5,	0	11	9.7,	73.5,	0	12	9.7,	73.5,	0
13	9.7,	73.5,	0	14	9.7,	73.5,	0	15	9.7,	73.5,	0	16	9.7,	73.5,	0

- SOURCE STRENGTHS (GRAMS PER SEC) -
 SEASON 1 SEASON 2 SEASON 3 SEASON 4
 2.22000E+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) -

200.000 300.000 400.000 500.000 750.000 1000.000 1250.000

Y AXIS (AZIMUTH BEARING, DEGREES)

- CONCENTRATION -

360.000	0.824042	0.588900	0.695996	0.800499	0.792151	0.688779	0.579882
337.500	0.572926	0.383759	0.413125	0.453652	0.425013	0.358564	0.296411
315.000	0.204435	0.160778	0.201242	0.242572	0.260283	0.240083	0.211668
292.500	0.179735	0.143038	0.185128	0.228365	0.256065	0.243023	0.218037
270.000	0.321637	0.250052	0.330485	0.415674	0.463327	0.436170	0.393666
247.500	0.319420	0.239325	0.306607	0.376588	0.411063	0.377633	0.328222
225.000	0.240739	0.195620	0.249914	0.301745	0.328743	0.306852	0.269551
202.500	0.262385	0.212039	0.271455	0.327565	0.349215	0.315995	0.270115
180.000	0.557821	0.426356	0.531118	0.631578	0.655004	0.585014	0.504837
157.500	0.220838	0.173933	0.221518	0.267885	0.285775	0.263680	0.234084
135.000	0.121853	0.098154	0.127488	0.157439	0.172354	0.160644	0.144098
112.500	0.227018	0.186309	0.225882	0.257288	0.249098	0.218812	0.189345
90.000	0.138307	0.112253	0.140044	0.168646	0.178772	0.159349	0.136470
67.500	0.113296	0.091840	0.112472	0.129574	0.126014	0.110415	0.096109
45.000	0.115374	0.095496	0.120539	0.142947	0.148467	0.135696	0.120066
22.500	0.178856	0.136037	0.168750	0.199460	0.194664	0.167845	0.143228

- 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
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195.0	10.0	0.542410	204.0	20.0	0.245709	219.0	30.0	0.149637
213.0	40.0	0.125314	180.0	50.0	0.118065	158.0	60.0	0.121227
146.0	70.0	0.127171	140.0	80.0	0.140002	137.0	90.0	0.155994
140.0	100.0	0.194270	146.0	110.0	0.237269	158.0	120.0	0.205148
180.0	130.0	0.149306	213.0	140.0	0.138871	247.0	150.0	0.169641
226.0	160.0	0.242862	216.0	170.0	0.390049	213.0	180.0	0.541018
216.0	190.0	0.407926	226.0	200.0	0.279098	232.0	210.0	0.238658
207.0	220.0	0.240520	250.0	230.0	0.232011	265.0	240.0	0.250392
253.0	250.0	0.278991	244.0	260.0	0.286847	241.0	270.0	0.294296
244.0	280.0	0.233426	256.0	290.0	0.173375	277.0	300.0	0.154929
296.0	310.0	0.157357	250.0	320.0	0.245484	219.0	330.0	0.417161
204.0	340.0	0.589660	195.0	350.0	0.722198	192.0	360.0	0.845935

** 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
192.00	360.00	0.845935
200.00	360.00	0.824042
500.00	360.00	0.800499
750.00	360.00	0.792151
195.00	350.00	0.722198
400.00	360.00	0.695996
1000.00	360.00	0.688779
750.00	180.00	0.655004
500.00	180.00	0.631578
204.00	340.00	0.589660

***** 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.

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CARD INPUT FILE IS	ER16LT84.180	
SUMMARY OUTPUT FILE IS	ER16LT84.080	
TITLE OF RUN IS	1984 ENRON STATION 16 / 35 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) = 7.620
 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, 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)=	195.00,	204.00,	219.00,	213.00,	180.00,	158.00,				
	146.00,	140.00,	137.00,	140.00,	146.00,	158.00,	180.00,	213.00,	247.00,	226.00,
	216.00,	213.00,	216.00,	226.00,	232.00,	207.00,	250.00,	265.00,	253.00,	244.00,
	241.00,	244.00,	256.00,	277.00,	296.00,	250.00,	219.00,	204.00,	195.00,	192.00,
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	299.0000	299.0000	299.0000	293.0000	287.0000	287.0000

- 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.	222000E+040.	222000E+040.	222000E+040.	222000E+040.	222000E+040.	222000E+040.
STABILITY CATEGORY 20.	148000E+040.	148000E+040.	148000E+040.	148000E+040.	148000E+040.	148000E+040.
STABILITY CATEGORY 30.	148000E+040.	148000E+040.	148000E+040.	148000E+040.	148000E+040.	148000E+040.
STABILITY CATEGORY 40.	148000E+040.	148000E+040.	148000E+040.	148000E+040.	148000E+040.	148000E+040.
STABILITY CATEGORY 50.	100000E+050.	100000E+050.	100000E+050.	100000E+050.	100000E+050.	100000E+050.
STABILITY CATEGORY 60.	100000E+050.	100000E+050.	100000E+050.	100000E+050.	100000E+050.	100000E+050.

- 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	0.00071600	0.00091100	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00026000	0.00022800	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00021100	0.00011400	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00024400	0.00056900	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00040700	0.00056900	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00009800	0.00022800	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00030900	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00073200	0.00056900	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00055300	0.00091100	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00009800	0.00022800	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00047200	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00019500	0.00045500	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00050400	0.00079700	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00014600	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00014600	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00014600	0.00034200	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	0.00176399	0.00307399	0.00295999	0.00000000	0.00000000	0.00000000
22.500	0.00082900	0.00193499	0.00204899	0.00000000	0.00000000	0.00000000
45.000	0.00114600	0.00341499	0.00193499	0.00000000	0.00000000	0.00000000
67.500	0.00096700	0.00193499	0.00136599	0.00000000	0.00000000	0.00000000
90.000	0.00161699	0.00432598	0.00102500	0.00000000	0.00000000	0.00000000
112.500	0.00148799	0.00307399	0.00068300	0.00000000	0.00000000	0.00000000
135.000	0.00173899	0.00489498	0.00147999	0.00000000	0.00000000	0.00000000
157.500	0.00189399	0.00239099	0.00113800	0.00000000	0.00000000	0.00000000
180.000	0.00231699	0.00500898	0.00330099	0.00000000	0.00000000	0.00000000
202.500	0.00087000	0.00147999	0.00056900	0.00000000	0.00000000	0.00000000
225.000	0.00189399	0.00239099	0.00102500	0.00000000	0.00000000	0.00000000
247.500	0.00080500	0.00182099	0.00136599	0.00000000	0.00000000	0.00000000
270.000	0.00090200	0.00227699	0.00136599	0.00000000	0.00000000	0.00000000
292.500	0.00081300	0.00250499	0.00079700	0.00000000	0.00000000	0.00000000
315.000	0.00066600	0.00182099	0.00102500	0.00000000	0.00000000	0.00000000
337.500	0.00134899	0.00307399	0.00159399	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 (1.500MPS)	WIND SPEED CATEGORY 2 (2.500MPS)	WIND SPEED CATEGORY 3 (4.300MPS)	WIND SPEED CATEGORY 4 (6.800MPS)	WIND SPEED CATEGORY 5 (9.500MPS)	WIND SPEED CATEGORY 6 (12.500MPS)
0.000	0.00145199	0.00637498	0.00899397	0.00136599	0.00011400	0.00000000
22.500	0.00054600	0.00284599	0.00387099	0.00068300	0.00000000	0.00000000
45.000	0.00046500	0.00318799	0.00466798	0.00011400	0.00000000	0.00000000
67.500	0.00026600	0.00182099	0.00500898	0.00125200	0.00000000	0.00000000
90.000	0.00113600	0.00421198	0.00626098	0.00022800	0.00000000	0.00000000
112.500	0.00067800	0.00375699	0.00409798	0.00022800	0.00000000	0.00000000
135.000	0.00090900	0.00443998	0.00432598	0.00068300	0.00000000	0.00000000
157.500	0.00072600	0.00318799	0.00512298	0.00147999	0.00000000	0.00000000
180.000	0.00113600	0.00421198	0.01400295	0.00352899	0.00022800	0.00000000
202.500	0.00028200	0.00193499	0.00455398	0.00034200	0.00000000	0.00000000
225.000	0.00056000	0.00204899	0.00352899	0.00034200	0.00000000	0.00000000
247.500	0.00041300	0.00193499	0.00250499	0.00022800	0.00000000	0.00000000
270.000	0.00056200	0.00295999	0.00318799	0.00011400	0.00000000	0.00000000
292.500	0.00064300	0.00261799	0.00307399	0.00022800	0.00000000	0.00000000
315.000	0.00031600	0.00216299	0.00239099	0.00045500	0.00000000	0.00000000
337.500	0.00061200	0.00330099	0.00432598	0.00102500	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 4

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.500MPS)	WIND SPEED CATEGORY 2 (2.500MPS)	WIND SPEED CATEGORY 3 (4.300MPS)	WIND SPEED CATEGORY 4 (6.800MPS)	WIND SPEED CATEGORY 5 (9.500MPS)	WIND SPEED CATEGORY 6 (12.500MPS)
0.000	0.00399998	0.00637498	0.01138396	0.01092896	0.00011400	0.00000000
22.500	0.00171299	0.00500898	0.00785497	0.00648898	0.00000000	0.00000000
45.000	0.00197299	0.00489498	0.00796897	0.00330099	0.00000000	0.00000000
67.500	0.00244499	0.00398498	0.00842397	0.00307399	0.00000000	0.00000000
90.000	0.00313499	0.00899397	0.01092896	0.00250499	0.00011400	0.00000000
112.500	0.00268499	0.00637498	0.00762797	0.00284599	0.00000000	0.00000000
135.000	0.00289399	0.00762797	0.00626098	0.00387099	0.00011400	0.00000000
157.500	0.00224999	0.00432598	0.00705797	0.00785497	0.00091100	0.00022800
180.000	0.00488698	0.01001796	0.01832893	0.01741793	0.00261799	0.00022800
202.500	0.00276999	0.00409798	0.00478098	0.00432598	0.00056900	0.00000000
225.000	0.00160199	0.00307399	0.00398498	0.00273199	0.00011400	0.00000000
247.500	0.00147299	0.00261799	0.00227699	0.00216299	0.00000000	0.00000000
270.000	0.00097000	0.00239099	0.00170799	0.00147999	0.00000000	0.00000000
292.500	0.00197499	0.00387099	0.00330099	0.00193499	0.00011400	0.00000000
315.000	0.00163599	0.00216299	0.00352899	0.00147999	0.00000000	0.00000000
337.500	0.00195799	0.00432598	0.00466798	0.00261799	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	0.00648898	0.00318799	0.00000000	0.00000000	0.00000000
22.500	0.00000000	0.00136599	0.00102500	0.00000000	0.00000000	0.00000000
45.000	0.00000000	0.00250499	0.00170799	0.00000000	0.00000000	0.00000000
67.500	0.00000000	0.00204899	0.00147999	0.00000000	0.00000000	0.00000000
90.000	0.00000000	0.00796897	0.00489498	0.00000000	0.00000000	0.00000000
112.500	0.00000000	0.00398498	0.00091100	0.00000000	0.00000000	0.00000000
135.000	0.00000000	0.00284599	0.00022800	0.00000000	0.00000000	0.00000000
157.500	0.00000000	0.00284599	0.00056900	0.00000000	0.00000000	0.00000000
180.000	0.00000000	0.00705797	0.00398498	0.00000000	0.00000000	0.00000000
202.500	0.00000000	0.00375699	0.00125200	0.00000000	0.00000000	0.00000000
225.000	0.00000000	0.00261799	0.00102500	0.00000000	0.00000000	0.00000000
247.500	0.00000000	0.00113800	0.00068300	0.00000000	0.00000000	0.00000000
270.000	0.00000000	0.00125200	0.00113800	0.00000000	0.00000000	0.00000000
292.500	0.00000000	0.00182099	0.00068300	0.00000000	0.00000000	0.00000000
315.000	0.00000000	0.00227699	0.00079700	0.00000000	0.00000000	0.00000000
337.500	0.00000000	0.00341499	0.00204899	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	0.03400387	0.00933496	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00504398	0.00159399	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.01091696	0.00352899	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00971296	0.00239099	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.03096188	0.00808297	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.01042896	0.00284599	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00322099	0.00068300	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00505998	0.00079700	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.02293991	0.00478098	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.01805893	0.00341499	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.02088992	0.00409798	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.02015792	0.00443998	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.02025492	0.00239099	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.02666590	0.00535098	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.02108592	0.00546398	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.02918789	0.00751397	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 10.	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000
STABILITY CATEGORY 20.	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000
STABILITY CATEGORY 30.	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000
STABILITY CATEGORY 40.	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000
STABILITY CATEGORY 50.	0.200000E-010	0.200000E-010	0.200000E-010	0.200000E-010	0.200000E-010	0.200000E-010
STABILITY CATEGORY 60.	0.350000E-010	0.350000E-010	0.350000E-010	0.350000E-010	0.350000E-010	0.350000E-010

- 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 10.	0.700000E-010	0.700000E-010	0.700000E-010	0.700000E-010	0.700000E-010	0.700000E-010
STABILITY CATEGORY 20.	0.700000E-010	0.700000E-010	0.700000E-010	0.700000E-010	0.700000E-010	0.700000E-010
STABILITY CATEGORY 30.	0.100000E+000	0.100000E+000	0.100000E+000	0.100000E+000	0.100000E+000	0.100000E+000
STABILITY CATEGORY 40.	0.150000E+000	0.150000E+000	0.150000E+000	0.150000E+000	0.150000E+000	0.150000E+000
STABILITY CATEGORY 50.	0.350000E+000	0.350000E+000	0.350000E+000	0.350000E+000	0.350000E+000	0.350000E+000
STABILITY CATEGORY 60.	0.550000E+000	0.550000E+000	0.550000E+000	0.550000E+000	0.550000E+000	0.550000E+000

- SOURCE INPUT DATA -

C T SOURCE SOURCE X Y EMISSION BASE /
 A A NUMBER TYPE COORDINATE COORDINATE HEIGHT ELEV- /
 R P (M) (M) (M) ATION /
 D E (M) /

- SOURCE DETAILS DEPENDING ON TYPE -

 X 1 STACK 0.00 0.00 10.67 0.00 GAS EXIT TEMP (DEG K)= 561.00, GAS EXIT VEL. (M/SEC)= 51.90,
 STACK DIAMETER (M)= 0.590, HEIGHT OF ASSO. BLDG. (M)= -9.69, WIDTH OF
 ASSO. BLDG. (M)= 73.46, 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,	73.5,	0	2	9.7,	73.5,	0	3	9.7,	73.5,	0	4	9.7,	73.5,	0
5	9.7,	73.5,	0	6	9.7,	73.5,	0	7	9.7,	73.5,	0	8	9.7,	73.5,	0
9	9.7,	73.5,	0	10	9.7,	73.5,	0	11	9.7,	73.5,	0	12	9.7,	73.5,	0
13	9.7,	73.5,	0	14	9.7,	73.5,	0	15	9.7,	73.5,	0	16	9.7,	73.5,	0

- SOURCE STRENGTHS (GRAMS PER SEC) -
 SEASON 1 SEASON 2 SEASON 3 SEASON 4
 2.22000E+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) -

200.000 300.000 400.000 500.000 750.000 1000.000 1250.000

Y AXIS (AZIMUTH BEARING, DEGREES)

- CONCENTRATION -

Y AXIS (AZIMUTH BEARING, DEGREES)	200.000	300.000	400.000	500.000	750.000	1000.000	1250.000
360.000	0.908601	0.658217	0.778656	0.895739	0.881127	0.761242	0.640556
337.500	0.367093	0.268854	0.325685	0.383899	0.387499	0.337133	0.283240
315.000	0.212722	0.172295	0.230588	0.293871	0.327180	0.297009	0.255950
292.500	0.124736	0.107460	0.155652	0.209567	0.258804	0.250457	0.224303
270.000	0.166743	0.149736	0.218472	0.290883	0.348671	0.340768	0.312814
247.500	0.222514	0.177848	0.221653	0.262146	0.273699	0.246986	0.212373
225.000	0.187004	0.152174	0.203339	0.257915	0.290856	0.268293	0.233229
202.500	0.262392	0.197706	0.244644	0.292333	0.308288	0.277095	0.237503
180.000	0.473359	0.366096	0.460809	0.549590	0.568339	0.507242	0.437484
157.500	0.206911	0.165127	0.206978	0.248962	0.262757	0.236714	0.206152
135.000	0.119144	0.096631	0.122287	0.147650	0.157491	0.143078	0.125005
112.500	0.116885	0.097962	0.133051	0.168245	0.184235	0.167218	0.146080
90.000	0.133243	0.115781	0.153286	0.184776	0.182922	0.157196	0.132580
67.500	0.136955	0.110542	0.139142	0.164557	0.164545	0.142807	0.121428
45.000	0.148552	0.121456	0.162872	0.204228	0.220480	0.197868	0.170384
22.500	0.182673	0.140266	0.182153	0.222765	0.236134	0.212292	0.184483

- 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
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195.0	10.0	0.591345	204.0	20.0	0.258243	219.0	30.0	0.162900
213.0	40.0	0.151174	180.0	50.0	0.150471	158.0	60.0	0.150583
146.0	70.0	0.149282	140.0	80.0	0.143497	137.0	90.0	0.140599
140.0	100.0	0.132351	146.0	110.0	0.127047	158.0	120.0	0.124438
180.0	130.0	0.122182	213.0	140.0	0.133919	247.0	150.0	0.160362
226.0	160.0	0.222564	216.0	170.0	0.339735	213.0	180.0	0.459967
216.0	190.0	0.362648	226.0	200.0	0.266631	232.0	210.0	0.218674
207.0	220.0	0.199380	250.0	230.0	0.176391	265.0	240.0	0.183949
253.0	250.0	0.194446	244.0	260.0	0.177930	241.0	270.0	0.161675
244.0	280.0	0.140457	256.0	290.0	0.120970	277.0	300.0	0.132390
296.0	310.0	0.158104	250.0	320.0	0.219563	219.0	330.0	0.297806
204.0	340.0	0.420053	195.0	350.0	0.674486	192.0	360.0	0.932562

** 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
192.00	360.00	0.932562
200.00	360.00	0.908601
500.00	360.00	0.895739
750.00	360.00	0.881127
400.00	360.00	0.778656
1000.00	360.00	0.761242
195.00	350.00	0.674486
300.00	360.00	0.658217
1250.00	360.00	0.640556
195.00	10.00	0.591345

***** 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 :
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GAINESVILLE, FLORIDA
(904)331-9000

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CARD INPUT FILE IS	ER16LT85.180	
SUMMARY OUTPUT FILE IS	ER16LT85.080	
TITLE OF RUN IS	1985 ENRON STATION 16 / 35 FT STACK	10-29-90

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.500MPS)	WIND SPEED CATEGORY 2 (2.500MPS)	WIND SPEED CATEGORY 3 (4.300MPS)	WIND SPEED CATEGORY 4 (6.800MPS)	WIND SPEED CATEGORY 5 (9.500MPS)	WIND SPEED CATEGORY 6 (12.500MPS)
0.000	0.00086099	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00013500	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00072299	0.00102699	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00018000	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00051900	0.00091299	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00042900	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00054300	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00027000	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00133899	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00038400	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00013500	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00033900	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00029400	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00036300	0.00011400	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00022500	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00033900	0.00045700	0.00000000	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 2

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.500MPS)	WIND SPEED CATEGORY 2 (2.500MPS)	WIND SPEED CATEGORY 3 (4.300MPS)	WIND SPEED CATEGORY 4 (6.800MPS)	WIND SPEED CATEGORY 5 (9.500MPS)	WIND SPEED CATEGORY 6 (12.500MPS)
0.000	0.00188499	0.00445197	0.00205499	0.00000000	0.00000000	0.00000000
22.500	0.00139499	0.00216898	0.00182599	0.00000000	0.00000000	0.00000000
45.000	0.00097499	0.00285398	0.00171199	0.00000000	0.00000000	0.00000000
67.500	0.00208399	0.00319598	0.00171199	0.00000000	0.00000000	0.00000000
90.000	0.00285798	0.00308198	0.00262598	0.00000000	0.00000000	0.00000000
112.500	0.00163499	0.00285398	0.00114199	0.00000000	0.00000000	0.00000000
135.000	0.00227698	0.00273998	0.00159799	0.00000000	0.00000000	0.00000000
157.500	0.00135999	0.00194099	0.00102699	0.00000000	0.00000000	0.00000000
180.000	0.00260498	0.00399497	0.00171199	0.00000000	0.00000000	0.00000000
202.500	0.00181599	0.00148399	0.00091299	0.00000000	0.00000000	0.00000000
225.000	0.00190599	0.00205499	0.00045700	0.00000000	0.00000000	0.00000000
247.500	0.00098899	0.00125599	0.00068500	0.00000000	0.00000000	0.00000000
270.000	0.00149199	0.00194099	0.00136999	0.00000000	0.00000000	0.00000000
292.500	0.00069999	0.00194099	0.00125599	0.00000000	0.00000000	0.00000000
315.000	0.00124599	0.00205499	0.00114199	0.00000000	0.00000000	0.00000000
337.500	0.00160599	0.00182599	0.00148399	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	0.00148899	0.00570796	0.00947493	0.00114199	0.00000000	0.00000000
22.500	0.00037300	0.00296798	0.00410997	0.00045700	0.00000000	0.00000000
45.000	0.00025800	0.00205499	0.00467997	0.00068500	0.00000000	0.00000000
67.500	0.00075899	0.00296798	0.00890394	0.00057100	0.00000000	0.00000000
90.000	0.00111599	0.00273998	0.00741995	0.00102699	0.00011400	0.00000000
112.500	0.00078799	0.00319598	0.00376697	0.00045700	0.00000000	0.00000000
135.000	0.00081599	0.00342498	0.00296798	0.00011400	0.00000000	0.00000000
157.500	0.00085799	0.00171199	0.00490896	0.00057100	0.00000000	0.00000000
180.000	0.00078799	0.00422397	0.00707795	0.00171199	0.00000000	0.00000000
202.500	0.00091599	0.00319598	0.00331098	0.00114199	0.00000000	0.00000000
225.000	0.00090199	0.00308198	0.00239698	0.00022800	0.00000000	0.00000000
247.500	0.00100099	0.00182599	0.00148399	0.00011400	0.00000000	0.00000000
270.000	0.00100199	0.00285398	0.00296798	0.00011400	0.00000000	0.00000000
292.500	0.00115899	0.00308198	0.00285398	0.00068500	0.00000000	0.00000000
315.000	0.00094499	0.00342498	0.00422397	0.00068500	0.00000000	0.00000000
337.500	0.00053000	0.00216898	0.00422397	0.00034200	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	0.00249098	0.00616396	0.00947493	0.00947493	0.00068500	0.00000000
22.500	0.00069599	0.00376697	0.00296798	0.00228298	0.00034200	0.00000000
45.000	0.00123199	0.00593596	0.00467997	0.00136999	0.00114199	0.00000000
67.500	0.00192399	0.00821894	0.00844694	0.00319598	0.00011400	0.00045700
90.000	0.00308798	0.01232891	0.01221491	0.00388097	0.00068500	0.00022800
112.500	0.00250998	0.00993193	0.00776294	0.00182599	0.00034200	0.00000000
135.000	0.00199199	0.00639295	0.00433797	0.00205499	0.00068500	0.00034200
157.500	0.00163399	0.00445197	0.00582196	0.00604996	0.00022800	0.00011400
180.000	0.00270498	0.00878994	0.01997686	0.01849287	0.00079899	0.00022800
202.500	0.00229198	0.00582196	0.00616396	0.00273998	0.00011400	0.00011400
225.000	0.00239398	0.00490896	0.00342498	0.00148399	0.00000000	0.00000000
247.500	0.00159999	0.00353897	0.00262598	0.00034200	0.00000000	0.00000000
270.000	0.00219598	0.00456597	0.00365297	0.00114199	0.00011400	0.00000000
292.500	0.00229698	0.00365297	0.00353897	0.00114199	0.00000000	0.00000000
315.000	0.00136299	0.00445197	0.00285398	0.00148399	0.00000000	0.00000000
337.500	0.00177799	0.00376697	0.00547896	0.00342498	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	0.00593596	0.00410997	0.00000000	0.00000000	0.00000000
22.500	0.00000000	0.00194099	0.00102699	0.00000000	0.00000000	0.00000000
45.000	0.00000000	0.00513696	0.00194099	0.00000000	0.00000000	0.00000000
67.500	0.00000000	0.00559396	0.00228298	0.00000000	0.00000000	0.00000000
90.000	0.00000000	0.00844694	0.00331098	0.00000000	0.00000000	0.00000000
112.500	0.00000000	0.00502296	0.00148399	0.00000000	0.00000000	0.00000000
135.000	0.00000000	0.00582196	0.00022800	0.00000000	0.00000000	0.00000000
157.500	0.00000000	0.00239698	0.00034200	0.00000000	0.00000000	0.00000000
180.000	0.00000000	0.00593596	0.00205499	0.00000000	0.00000000	0.00000000
202.500	0.00000000	0.00502296	0.00057100	0.00000000	0.00000000	0.00000000
225.000	0.00000000	0.00228298	0.00068500	0.00000000	0.00000000	0.00000000
247.500	0.00000000	0.00194099	0.00034200	0.00000000	0.00000000	0.00000000
270.000	0.00000000	0.00216898	0.00045700	0.00000000	0.00000000	0.00000000
292.500	0.00000000	0.00205499	0.00079899	0.00000000	0.00000000	0.00000000
315.000	0.00000000	0.00308198	0.00057100	0.00000000	0.00000000	0.00000000
337.500	0.00000000	0.00342498	0.00171199	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	0.03074678	0.00821894	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.01093692	0.00433797	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.01329891	0.00696295	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.01314091	0.00525096	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.02755880	0.01015993	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.01419890	0.00388097	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00933393	0.00251098	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00302498	0.00102699	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.02069285	0.00331098	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.02024486	0.00251098	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.02041185	0.00296798	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.01698288	0.00296798	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.01904986	0.00308198	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.02031085	0.00525096	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.02290984	0.00639295	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.02163185	0.00673495	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 10.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.
STABILITY CATEGORY 20.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.
STABILITY CATEGORY 30.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.
STABILITY CATEGORY 40.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.
STABILITY CATEGORY 50.	0.20000E-010.	0.20000E-010.	0.20000E-010.	0.20000E-010.	0.20000E-010.	0.20000E-010.
STABILITY CATEGORY 60.	0.35000E-010.	0.35000E-010.	0.35000E-010.	0.35000E-010.	0.35000E-010.	0.35000E-010.

- 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 10.	0.70000E-010.	0.70000E-010.	0.70000E-010.	0.70000E-010.	0.70000E-010.	0.70000E-010.
STABILITY CATEGORY 20.	0.70000E-010.	0.70000E-010.	0.70000E-010.	0.70000E-010.	0.70000E-010.	0.70000E-010.
STABILITY CATEGORY 30.	0.10000E+000.	0.10000E+000.	0.10000E+000.	0.10000E+000.	0.10000E+000.	0.10000E+000.
STABILITY CATEGORY 40.	0.15000E+000.	0.15000E+000.	0.15000E+000.	0.15000E+000.	0.15000E+000.	0.15000E+000.
STABILITY CATEGORY 50.	0.35000E+000.	0.35000E+000.	0.35000E+000.	0.35000E+000.	0.35000E+000.	0.35000E+000.
STABILITY CATEGORY 60.	0.55000E+000.	0.55000E+000.	0.55000E+000.	0.55000E+000.	0.55000E+000.	0.55000E+000.

- SOURCE INPUT DATA -

C T SOURCE SOURCE X Y EMISSION BASE /
 A A NUMBER TYPE COORDINATE COORDINATE HEIGHT ELEV- /
 R P (M) (M) (M) ATION /
 D E (M) /

- SOURCE DETAILS DEPENDING ON TYPE -

 X 1. STACK 0.00 0.00 10.67 0.00 GAS EXIT TEMP (DEG K)= 561.00, GAS EXIT VEL. (M/SEC)= 51.90,
 STACK DIAMETER (M)= 0.590, HEIGHT OF ASSO. BLDG. (M)= -9.69, WIDTH OF
 ASSO. BLDG. (M)= 73.46, 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,	73.5,	0	2	9.7,	73.5,	0	3	9.7,	73.5,	0	4	9.7,	73.5,	0
5	9.7,	73.5,	0	6	9.7,	73.5,	0	7	9.7,	73.5,	0	8	9.7,	73.5,	0
9	9.7,	73.5,	0	10	9.7,	73.5,	0	11	9.7,	73.5,	0	12	9.7,	73.5,	0
13	9.7,	73.5,	0	14	9.7,	73.5,	0	15	9.7,	73.5,	0	16	9.7,	73.5,	0

- SOURCE STRENGTHS (GRAMS PER SEC) -
 SEASON 1 SEASON 2 SEASON 3 SEASON 4
 2.22000E+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) -
 200.000 300.000 400.000 500.000 750.000 1000.000 1250.000
 Y AXIS (AZIMUTH BEARING, DEGREES) - CONCENTRATION -

	200.000	300.000	400.000	500.000	750.000	1000.000	1250.000
360.000	0.575153	0.420445	0.535561	0.660195	0.712497	0.643782	0.552988
337.500	0.240547	0.188171	0.241174	0.289567	0.295210	0.258328	0.218728
315.000	0.213435	0.160641	0.192980	0.229729	0.244497	0.225217	0.199475
292.500	0.168479	0.138833	0.181625	0.226694	0.257748	0.248768	0.227045
270.000	0.374555	0.288913	0.348471	0.407258	0.427609	0.398471	0.357817
247.500	0.275840	0.224907	0.291482	0.354673	0.377271	0.342093	0.298237
225.000	0.260691	0.202971	0.244261	0.279155	0.262290	0.226152	0.195318
202.500	0.202484	0.157518	0.191943	0.224358	0.227579	0.199515	0.169540
180.000	0.423055	0.330082	0.430689	0.528166	0.550806	0.487766	0.418524
157.500	0.179951	0.145920	0.189129	0.230130	0.245025	0.222681	0.194627
135.000	0.154416	0.129691	0.166952	0.200331	0.208938	0.188161	0.164750
112.500	0.135856	0.108060	0.135512	0.164508	0.176867	0.162885	0.144466
90.000	0.124719	0.102765	0.132696	0.163326	0.180886	0.168755	0.149700
67.500	0.064042	0.056955	0.076215	0.095141	0.107055	0.103439	0.095137
45.000	0.081793	0.071661	0.101758	0.135285	0.167925	0.164019	0.148509
22.500	0.192788	0.149455	0.182220	0.216541	0.237354	0.224681	0.201797

- 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
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195.0	10.0	0.407941	204.0	20.0	0.231244	219.0	30.0	0.148417
213.0	40.0	0.103289	180.0	50.0	0.078599	158.0	60.0	0.071209
146.0	70.0	0.073772	140.0	80.0	0.105167	137.0	90.0	0.139486
140.0	100.0	0.143370	146.0	110.0	0.150139	158.0	120.0	0.151805
180.0	130.0	0.154196	213.0	140.0	0.155606	247.0	150.0	0.156680
226.0	160.0	0.195875	216.0	170.0	0.301849	213.0	180.0	0.411231
216.0	190.0	0.310802	226.0	200.0	0.212287	232.0	210.0	0.203755
207.0	220.0	0.242063	250.0	230.0	0.231987	265.0	240.0	0.234726
253.0	250.0	0.257333	244.0	260.0	0.296226	241.0	270.0	0.337180
244.0	280.0	0.252897	256.0	290.0	0.170294	277.0	300.0	0.151949
296.0	310.0	0.156371	250.0	320.0	0.190176	219.0	330.0	0.219892
204.0	340.0	0.273678	195.0	350.0	0.428982	192.0	360.0	0.589032

** 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
750.00	360.00	0.712497
500.00	360.00	0.660195
1000.00	360.00	0.643782
192.00	360.00	0.589032
200.00	360.00	0.575153
1250.00	360.00	0.552988
750.00	180.00	0.550806
400.00	360.00	0.535561
500.00	180.00	0.528166
1000.00	180.00	0.487766

***** 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.

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CARD INPUT FILE IS	ER16LT86.180	
SUMMARY OUTPUT FILE IS	ER16LT86.080	
TITLE OF RUN IS	1986 ENRON STATION 16 / 35 FT STACK	10-29-90

- 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	0.00076000	0.00239700	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00060300	0.00137000	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00045500	0.00125600	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00063100	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00081400	0.00102700	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00053400	0.00091300	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00010400	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00023600	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00070000	0.00114200	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00021900	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00048200	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00044700	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00010400	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00031500	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00013900	0.00091300	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00076200	0.00068500	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	0.00412800	0.00913199	0.00570799	0.00000000	0.00000000	0.00000000
22.500	0.00217800	0.00445200	0.00239700	0.00000000	0.00000000	0.00000000
45.000	0.00176200	0.00433800	0.00285400	0.00000000	0.00000000	0.00000000
67.500	0.00193500	0.00376700	0.00228300	0.00000000	0.00000000	0.00000000
90.000	0.00350700	0.00365300	0.00205500	0.00000000	0.00000000	0.00000000
112.500	0.00171000	0.00319600	0.00114200	0.00000000	0.00000000	0.00000000
135.000	0.00278600	0.00411000	0.00251100	0.00000000	0.00000000	0.00000000
157.500	0.00180600	0.00296800	0.00125600	0.00000000	0.00000000	0.00000000
180.000	0.00212600	0.00331100	0.00228300	0.00000000	0.00000000	0.00000000
202.500	0.00138900	0.00285400	0.00114200	0.00000000	0.00000000	0.00000000
225.000	0.00137400	0.00194100	0.00114200	0.00000000	0.00000000	0.00000000
247.500	0.00152900	0.00125600	0.00091300	0.00000000	0.00000000	0.00000000
270.000	0.00101300	0.00216900	0.00171200	0.00000000	0.00000000	0.00000000
292.500	0.00236100	0.00148400	0.00114200	0.00000000	0.00000000	0.00000000
315.000	0.00123800	0.00274000	0.00182600	0.00000000	0.00000000	0.00000000
337.500	0.00169100	0.00308200	0.00216900	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	0.00297300	0.00844699	0.01529699	0.00068500	0.00000000	0.00000000
22.500	0.00130500	0.00433800	0.00707799	0.00057100	0.00000000	0.00000000
45.000	0.00100200	0.00262600	0.00411000	0.00022800	0.00000000	0.00000000
67.500	0.00054600	0.00308200	0.00376700	0.00022800	0.00000000	0.00000000
90.000	0.00133900	0.00376700	0.00411000	0.00079900	0.00000000	0.00000000
112.500	0.00059900	0.00262600	0.00319600	0.00068500	0.00000000	0.00000000
135.000	0.00061900	0.00274000	0.00502300	0.00091300	0.00000000	0.00000000
157.500	0.00115700	0.00274000	0.00616399	0.00137000	0.00000000	0.00000000
180.000	0.00094200	0.00228300	0.00616399	0.00148400	0.00000000	0.00000000
202.500	0.00072600	0.00182600	0.00274000	0.00022800	0.00000000	0.00000000
225.000	0.00034300	0.00194100	0.00274000	0.00022800	0.00000000	0.00000000
247.500	0.00033600	0.00114200	0.00137000	0.00011400	0.00000000	0.00000000
270.000	0.00045800	0.00182600	0.00137000	0.00011400	0.00000000	0.00000000
292.500	0.00063200	0.00205500	0.00194100	0.00011400	0.00000000	0.00000000
315.000	0.00044400	0.00251100	0.00194100	0.00000000	0.00000000	0.00000000
337.500	0.00107600	0.00228300	0.00285400	0.00034200	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	0.00836599	0.02077598	0.01986298	0.00776299	0.00011400	0.00000000
22.500	0.00389100	0.01130099	0.01917798	0.00331100	0.00000000	0.00000000
45.000	0.00253700	0.00616399	0.00776299	0.00251100	0.00011400	0.00000000
67.500	0.00179300	0.00525100	0.00719199	0.00194100	0.00011400	0.00000000
90.000	0.00211100	0.00479500	0.00479500	0.00148400	0.00000000	0.00000000
112.500	0.00118700	0.00433800	0.00547899	0.00102700	0.00011400	0.00000000
135.000	0.00215400	0.00433800	0.00741999	0.00228300	0.00000000	0.00000000
157.500	0.00265100	0.00604999	0.00684899	0.00468000	0.00011400	0.00000000
180.000	0.00346600	0.00993199	0.01141599	0.01095899	0.00034200	0.00000000
202.500	0.00129000	0.00285400	0.00559400	0.00194100	0.00000000	0.00000000
225.000	0.00079800	0.00182600	0.00468000	0.00068500	0.00000000	0.00000000
247.500	0.00066000	0.00182600	0.00102700	0.00000000	0.00000000	0.00000000
270.000	0.00142200	0.00216900	0.00102700	0.00045700	0.00000000	0.00000000
292.500	0.00149400	0.00251100	0.00262600	0.00057100	0.00000000	0.00000000
315.000	0.00168000	0.00274000	0.00285400	0.00102700	0.00000000	0.00000000
337.500	0.00228600	0.00365300	0.00411000	0.00091300	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	0.01792198	0.00342500	0.00000000	0.00000000	0.00000000
22.500	0.00000000	0.00376700	0.00159800	0.00000000	0.00000000	0.00000000
45.000	0.00000000	0.00308200	0.00125600	0.00000000	0.00000000	0.00000000
67.500	0.00000000	0.00342500	0.00159800	0.00000000	0.00000000	0.00000000
90.000	0.00000000	0.00730599	0.00068500	0.00000000	0.00000000	0.00000000
112.500	0.00000000	0.00274000	0.00102700	0.00000000	0.00000000	0.00000000
135.000	0.00000000	0.00205500	0.00079900	0.00000000	0.00000000	0.00000000
157.500	0.00000000	0.00445200	0.00091300	0.00000000	0.00000000	0.00000000
180.000	0.00000000	0.00536499	0.00274000	0.00000000	0.00000000	0.00000000
202.500	0.00000000	0.00262600	0.00079900	0.00000000	0.00000000	0.00000000
225.000	0.00000000	0.00228300	0.00148400	0.00000000	0.00000000	0.00000000
247.500	0.00000000	0.00205500	0.00011400	0.00000000	0.00000000	0.00000000
270.000	0.00000000	0.00125600	0.00034200	0.00000000	0.00000000	0.00000000
292.500	0.00000000	0.00125600	0.00045700	0.00000000	0.00000000	0.00000000
315.000	0.00000000	0.00114200	0.00148400	0.00000000	0.00000000	0.00000000
337.500	0.00000000	0.00216900	0.00205500	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	0.06250394	0.01358399	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00799499	0.00205500	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00677099	0.00148400	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.01212199	0.00331100	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.01789798	0.00399500	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.01142099	0.00365300	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00858199	0.00182600	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.01202399	0.00125600	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.02039398	0.00365300	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.01773398	0.00308200	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.01531999	0.00262600	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00938099	0.00102700	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.02057298	0.00239700	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.02448898	0.00422400	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.02401598	0.00433800	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.02592398	0.00422400	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 10.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.
STABILITY CATEGORY 20.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.
STABILITY CATEGORY 30.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.
STABILITY CATEGORY 40.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.	0.00000E+000.
STABILITY CATEGORY 50.	0.20000E-010.	0.20000E-010.	0.20000E-010.	0.20000E-010.	0.20000E-010.	0.20000E-010.
STABILITY CATEGORY 60.	0.35000E-010.	0.35000E-010.	0.35000E-010.	0.35000E-010.	0.35000E-010.	0.35000E-010.

- 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 10.	0.70000E-010.	0.70000E-010.	0.70000E-010.	0.70000E-010.	0.70000E-010.	0.70000E-010.
STABILITY CATEGORY 20.	0.70000E-010.	0.70000E-010.	0.70000E-010.	0.70000E-010.	0.70000E-010.	0.70000E-010.
STABILITY CATEGORY 30.	0.10000E+000.	0.10000E+000.	0.10000E+000.	0.10000E+000.	0.10000E+000.	0.10000E+000.
STABILITY CATEGORY 40.	0.15000E+000.	0.15000E+000.	0.15000E+000.	0.15000E+000.	0.15000E+000.	0.15000E+000.
STABILITY CATEGORY 50.	0.35000E+000.	0.35000E+000.	0.35000E+000.	0.35000E+000.	0.35000E+000.	0.35000E+000.
STABILITY CATEGORY 60.	0.55000E+000.	0.55000E+000.	0.55000E+000.	0.55000E+000.	0.55000E+000.	0.55000E+000.

- SOURCE INPUT DATA -

C T SOURCE SOURCE X Y EMISSION BASE /
 A A NUMBER TYPE COORDINATE COORDINATE HEIGHT ELEV- /
 R P (M) (M) (M) ATION /
 D E (M) /

- SOURCE DETAILS DEPENDING ON TYPE -

 X 1 STACK 0.00 0.00 10.67 0.00 GAS EXIT TEMP (DEG K)= 561.00, GAS EXIT VEL. (M/SEC)= 51.90,
 STACK DIAMETER (M)= 0.590, HEIGHT OF ASSO. BLDG. (M)= -9.69, WIDTH OF
 ASSO. BLDG. (M)= 73.46, 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,	73.5,	0	2	9.7,	73.5,	0	3	9.7,	73.5,	0	4	9.7,	73.5,	0
5	9.7,	73.5,	0	6	9.7,	73.5,	0	7	9.7,	73.5,	0	8	9.7,	73.5,	0
9	9.7,	73.5,	0	10	9.7,	73.5,	0	11	9.7,	73.5,	0	12	9.7,	73.5,	0
13	9.7,	73.5,	0	14	9.7,	73.5,	0	15	9.7,	73.5,	0	16	9.7,	73.5,	0

- SOURCE STRENGTHS (GRAMS PER SEC) -
 SEASON 1 SEASON 2 SEASON 3 SEASON 4
 2.22000E+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) -
 200.000 300.000 400.000 500.000 750.000 1000.000 1250.000
 Y AXIS (AZIMUTH BEARING, DEGREES) - CONCENTRATION -

360.000	0.436217	0.332764	0.414639	0.490683	0.497125	0.441160	0.380813
337.500	0.265905	0.213256	0.272180	0.327117	0.339731	0.302917	0.260768
315.000	0.252144	0.204374	0.253826	0.302870	0.322356	0.288748	0.244740
292.500	0.154488	0.132182	0.172527	0.211545	0.226359	0.206359	0.179551
270.000	0.212432	0.178559	0.228307	0.276197	0.293178	0.267412	0.234732
247.500	0.199668	0.164801	0.212807	0.261735	0.282599	0.258265	0.224657
225.000	0.248468	0.205808	0.258946	0.307412	0.314424	0.280758	0.241525
202.500	0.274135	0.235780	0.314952	0.396170	0.460702	0.444064	0.395554
180.000	0.594324	0.501529	0.656432	0.798003	0.844741	0.774017	0.686273
157.500	0.169959	0.141287	0.178278	0.213383	0.216296	0.192735	0.167487
135.000	0.135376	0.114688	0.142827	0.167693	0.171539	0.153128	0.132104
112.500	0.090405	0.075862	0.097556	0.120873	0.139826	0.132151	0.116638
90.000	0.117959	0.097219	0.115512	0.130267	0.124002	0.105941	0.089580
67.500	0.066643	0.057549	0.074307	0.090034	0.093080	0.082985	0.071761
45.000	0.108651	0.094601	0.125607	0.155527	0.169979	0.156941	0.137074
22.500	0.128404	0.108964	0.145836	0.183207	0.203680	0.187723	0.163820

- 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
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195.0	10.0	0.300121	204.0	20.0	0.160023	219.0	30.0	0.117584
213.0	40.0	0.110219	180.0	50.0	0.101237	158.0	60.0	0.083768
146.0	70.0	0.077596	140.0	80.0	0.103667	137.0	90.0	0.132281
140.0	100.0	0.115445	146.0	110.0	0.101327	158.0	120.0	0.111121
180.0	130.0	0.128798	213.0	140.0	0.139075	247.0	150.0	0.144943
226.0	160.0	0.205537	216.0	170.0	0.392340	213.0	180.0	0.584403
216.0	190.0	0.437411	226.0	200.0	0.297252	232.0	210.0	0.251682
207.0	220.0	0.248956	250.0	230.0	0.216216	265.0	240.0	0.190514
253.0	250.0	0.182081	244.0	260.0	0.189823	241.0	270.0	0.198835
244.0	280.0	0.172332	256.0	290.0	0.147163	277.0	300.0	0.161054
296.0	310.0	0.188804	250.0	320.0	0.229829	219.0	330.0	0.249781
204.0	340.0	0.281208	195.0	350.0	0.361301	192.0	360.0	0.445222

** 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
750.00	180.00	0.844741
500.00	180.00	0.798003
1000.00	180.00	0.774017
1250.00	180.00	0.686273
400.00	180.00	0.656432
200.00	180.00	0.594324
213.00	180.00	0.584403
300.00	180.00	0.501529
750.00	360.00	0.497125
500.00	360.00	0.490683

***** 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.

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GAINESVILLE, FLORIDA
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CARD INPUT FILE IS	ER16RF86.I80
SUMMARY OUTPUT FILE IS	ER16RF86.O80
TITLE OF RUN IS	1986 ENRON STATION 16 / 35 FT STACK / REFINEMENT 10-29-90

- ISCLT INPUT DATA -

NUMBER OF SOURCES = 1
 NUMBER OF X AXIS GRID SYSTEM POINTS = 9
 NUMBER OF Y AXIS GRID SYSTEM POINTS = 9
 NUMBER OF SPECIAL POINTS = 0
 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) = 7.620
 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)= 550.00, 600.00, 650.00, 700.00, 750.00, 800.00,
 850.00, 900.00, 950.00,
 AZIMUTH BEARING Y AXIS GRID SYSTEM POINTS (DEGREES)= 172.00, 174.00, 176.00, 178.00, 180.00, 182.00,
 184.00, 186.00, 188.00,

- AMBIENT AIR TEMPERATURE (DEGREES KELVIN) -

STABILITY STABILITY STABILITY STABILITY STABILITY STABILITY
 CATEGORY 1 CATEGORY 2 CATEGORY 3 CATEGORY 4 CATEGORY 5 CATEGORY 6
 SEASON 1 299.0000 299.0000 299.0000 293.0000 287.0000 287.0000

- 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 10.222000E+040.222000E+040.222000E+040.222000E+040.222000E+040.222000E+04
 STABILITY CATEGORY 20.148000E+040.148000E+040.148000E+040.148000E+040.148000E+040.148000E+04
 STABILITY CATEGORY 30.148000E+040.148000E+040.148000E+040.148000E+040.148000E+040.148000E+04
 STABILITY CATEGORY 40.148000E+040.148000E+040.148000E+040.148000E+040.148000E+040.148000E+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

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.500MPS)	WIND SPEED CATEGORY 2 (2.500MPS)	WIND SPEED CATEGORY 3 (4.300MPS)	WIND SPEED CATEGORY 4 (6.800MPS)	WIND SPEED CATEGORY 5 (9.500MPS)	WIND SPEED CATEGORY 6 (12.500MPS)
0.000	0.00076000	0.00239700	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00060300	0.00137000	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00045500	0.00125600	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.00063100	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.00081400	0.00102700	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.00053400	0.00091300	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00010400	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.00023600	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.00070000	0.00114200	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.00021900	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.00048200	0.00057100	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00044700	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.00010400	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.00031500	0.00034200	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.00013900	0.00091300	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.00076200	0.00068500	0.00000000	0.00000000	0.00000000	0.00000000

SEASON 1

STABILITY CATEGORY 2

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.500MPS)	WIND SPEED CATEGORY 2 (2.500MPS)	WIND SPEED CATEGORY 3 (4.300MPS)	WIND SPEED CATEGORY 4 (6.800MPS)	WIND SPEED CATEGORY 5 (9.500MPS)	WIND SPEED CATEGORY 6 (12.500MPS)
0.000	0.00412800	0.00913199	0.00570799	0.00000000	0.00000000	0.00000000
22.500	0.00217800	0.00445200	0.00239700	0.00000000	0.00000000	0.00000000
45.000	0.00176200	0.00433800	0.00285400	0.00000000	0.00000000	0.00000000
67.500	0.00193500	0.00376700	0.00228300	0.00000000	0.00000000	0.00000000
90.000	0.00350700	0.00365300	0.00205500	0.00000000	0.00000000	0.00000000
112.500	0.00171000	0.00319600	0.00114200	0.00000000	0.00000000	0.00000000
135.000	0.00278600	0.00411000	0.00251100	0.00000000	0.00000000	0.00000000
157.500	0.00180600	0.00296800	0.00125600	0.00000000	0.00000000	0.00000000
180.000	0.00212600	0.00331100	0.00228300	0.00000000	0.00000000	0.00000000
202.500	0.00138900	0.00285400	0.00114200	0.00000000	0.00000000	0.00000000
225.000	0.00137400	0.00194100	0.00114200	0.00000000	0.00000000	0.00000000
247.500	0.00152900	0.00125600	0.00091300	0.00000000	0.00000000	0.00000000
270.000	0.00101300	0.00216900	0.00171200	0.00000000	0.00000000	0.00000000
292.500	0.00236100	0.00148400	0.00114200	0.00000000	0.00000000	0.00000000
315.000	0.00123800	0.00274000	0.00182600	0.00000000	0.00000000	0.00000000
337.500	0.00169100	0.00308200	0.00216900	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	0.00297300	0.00844699	0.01529699	0.00068500	0.00000000	0.00000000
22.500	0.00130500	0.00433800	0.00707799	0.00057100	0.00000000	0.00000000
45.000	0.00100200	0.00262600	0.00411000	0.00022800	0.00000000	0.00000000
67.500	0.00054600	0.00308200	0.00376700	0.00022800	0.00000000	0.00000000
90.000	0.00133900	0.00376700	0.00411000	0.00079900	0.00000000	0.00000000
112.500	0.00059900	0.00262600	0.00319600	0.00068500	0.00000000	0.00000000
135.000	0.00061900	0.00274000	0.00502300	0.00091300	0.00000000	0.00000000
157.500	0.00115700	0.00274000	0.00616399	0.00137000	0.00000000	0.00000000
180.000	0.00094200	0.00228300	0.00616399	0.00148400	0.00000000	0.00000000
202.500	0.00072600	0.00182600	0.00274000	0.00022800	0.00000000	0.00000000
225.000	0.00034300	0.00194100	0.00274000	0.00022800	0.00000000	0.00000000
247.500	0.00033600	0.00114200	0.00137000	0.00011400	0.00000000	0.00000000
270.000	0.00045800	0.00182600	0.00137000	0.00011400	0.00000000	0.00000000
292.500	0.00063200	0.00205500	0.00194100	0.00011400	0.00000000	0.00000000
315.000	0.00044400	0.00251100	0.00194100	0.00000000	0.00000000	0.00000000
337.500	0.00107600	0.00228300	0.00285400	0.00034200	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	0.00836599	0.02077598	0.01986298	0.00776299	0.00011400	0.00000000
22.500	0.00389100	0.01130099	0.01917798	0.00331100	0.00000000	0.00000000
45.000	0.00253700	0.00616399	0.00776299	0.00251100	0.00011400	0.00000000
67.500	0.00179300	0.00525100	0.00719199	0.00194100	0.00011400	0.00000000
90.000	0.00211100	0.00479500	0.00479500	0.00148400	0.00000000	0.00000000
112.500	0.00118700	0.00433800	0.00547899	0.00102700	0.00011400	0.00000000
135.000	0.00215400	0.00433800	0.00741999	0.00228300	0.00000000	0.00000000
157.500	0.00265100	0.00604999	0.00684899	0.00468000	0.00011400	0.00000000
180.000	0.00346600	0.00993199	0.01141599	0.01095899	0.00034200	0.00000000
202.500	0.00129000	0.00285400	0.00559400	0.00194100	0.00000000	0.00000000
225.000	0.00079800	0.00182600	0.00468000	0.00068500	0.00000000	0.00000000
247.500	0.00066000	0.00182600	0.00102700	0.00000000	0.00000000	0.00000000
270.000	0.00142200	0.00216900	0.00102700	0.00045700	0.00000000	0.00000000
292.500	0.00149400	0.00251100	0.00262600	0.00057100	0.00000000	0.00000000
315.000	0.00168000	0.00274000	0.00285400	0.00102700	0.00000000	0.00000000
337.500	0.00228600	0.00365300	0.00411000	0.00091300	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	0.01792198	0.00342500	0.00000000	0.00000000	0.00000000
22.500	0.00000000	0.00376700	0.00159800	0.00000000	0.00000000	0.00000000
45.000	0.00000000	0.00308200	0.00125600	0.00000000	0.00000000	0.00000000
67.500	0.00000000	0.00342500	0.00159800	0.00000000	0.00000000	0.00000000
90.000	0.00000000	0.00730599	0.00068500	0.00000000	0.00000000	0.00000000
112.500	0.00000000	0.00274000	0.00102700	0.00000000	0.00000000	0.00000000
135.000	0.00000000	0.00205500	0.00079900	0.00000000	0.00000000	0.00000000
157.500	0.00000000	0.00445200	0.00091300	0.00000000	0.00000000	0.00000000
180.000	0.00000000	0.00536499	0.00274000	0.00000000	0.00000000	0.00000000
202.500	0.00000000	0.00262600	0.00079900	0.00000000	0.00000000	0.00000000
225.000	0.00000000	0.00228300	0.00148400	0.00000000	0.00000000	0.00000000
247.500	0.00000000	0.00205500	0.00011400	0.00000000	0.00000000	0.00000000
270.000	0.00000000	0.00125600	0.00034200	0.00000000	0.00000000	0.00000000
292.500	0.00000000	0.00125600	0.00045700	0.00000000	0.00000000	0.00000000
315.000	0.00000000	0.00114200	0.00148400	0.00000000	0.00000000	0.00000000
337.500	0.00000000	0.00216900	0.00205500	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	0.06250394	0.01358399	0.00000000	0.00000000	0.00000000	0.00000000
22.500	0.00799499	0.00205500	0.00000000	0.00000000	0.00000000	0.00000000
45.000	0.00677099	0.00148400	0.00000000	0.00000000	0.00000000	0.00000000
67.500	0.01212199	0.00331100	0.00000000	0.00000000	0.00000000	0.00000000
90.000	0.01789798	0.00399500	0.00000000	0.00000000	0.00000000	0.00000000
112.500	0.01142099	0.00365300	0.00000000	0.00000000	0.00000000	0.00000000
135.000	0.00858199	0.00182600	0.00000000	0.00000000	0.00000000	0.00000000
157.500	0.01202399	0.00125600	0.00000000	0.00000000	0.00000000	0.00000000
180.000	0.02039398	0.00365300	0.00000000	0.00000000	0.00000000	0.00000000
202.500	0.01773398	0.00308200	0.00000000	0.00000000	0.00000000	0.00000000
225.000	0.01531999	0.00262600	0.00000000	0.00000000	0.00000000	0.00000000
247.500	0.00938099	0.00102700	0.00000000	0.00000000	0.00000000	0.00000000
270.000	0.02057298	0.00239700	0.00000000	0.00000000	0.00000000	0.00000000
292.500	0.02448898	0.00422400	0.00000000	0.00000000	0.00000000	0.00000000
315.000	0.02401598	0.00433800	0.00000000	0.00000000	0.00000000	0.00000000
337.500	0.02592398	0.00422400	0.00000000	0.00000000	0.00000000	0.00000000

- ISCLT INPUT DATA (CONT.) -

- VERTICAL POTENTIAL TEMPERATURE GRADIENT (DEGREES KELVIN/METER) -

	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.	0.000000E+000.	0.000000E+000.	0.000000E+000.	0.000000E+000.	0.000000E+000.	0.000000E+000.
STABILITY CATEGORY 20.	0.000000E+000.	0.000000E+000.	0.000000E+000.	0.000000E+000.	0.000000E+000.	0.000000E+000.
STABILITY CATEGORY 30.	0.000000E+000.	0.000000E+000.	0.000000E+000.	0.000000E+000.	0.000000E+000.	0.000000E+000.
STABILITY CATEGORY 40.	0.000000E+000.	0.000000E+000.	0.000000E+000.	0.000000E+000.	0.000000E+000.	0.000000E+000.
STABILITY CATEGORY 50.	0.200000E-010.	0.200000E-010.	0.200000E-010.	0.200000E-010.	0.200000E-010.	0.200000E-010.
STABILITY CATEGORY 60.	0.350000E-010.	0.350000E-010.	0.350000E-010.	0.350000E-010.	0.350000E-010.	0.350000E-010.

- WIND PROFILE POWER LAW EXPONENTS -

	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.	0.700000E-010.	0.700000E-010.	0.700000E-010.	0.700000E-010.	0.700000E-010.	0.700000E-010.
STABILITY CATEGORY 20.	0.700000E-010.	0.700000E-010.	0.700000E-010.	0.700000E-010.	0.700000E-010.	0.700000E-010.
STABILITY CATEGORY 30.	0.100000E+000.	0.100000E+000.	0.100000E+000.	0.100000E+000.	0.100000E+000.	0.100000E+000.
STABILITY CATEGORY 40.	0.150000E+000.	0.150000E+000.	0.150000E+000.	0.150000E+000.	0.150000E+000.	0.150000E+000.
STABILITY CATEGORY 50.	0.350000E+000.	0.350000E+000.	0.350000E+000.	0.350000E+000.	0.350000E+000.	0.350000E+000.
STABILITY CATEGORY 60.	0.550000E+000.	0.550000E+000.	0.550000E+000.	0.550000E+000.	0.550000E+000.	0.550000E+000.

- SOURCE INPUT DATA -

C T	SOURCE	SOURCE	X	Y	EMISSION	BASE /	
A A	NUMBER	TYPE	COORDINATE	COORDINATE	HEIGHT	ELEV-	
R P			(M)	(M)	(M)	ATION /	
D E						(M) /	

- SOURCE DETAILS DEPENDING ON TYPE -

X 1 STACK 0.00 0.00 10.67 0.00 GAS EXIT TEMP (DEG K)= 561.00, GAS EXIT VEL. (M/SEC)= 51.90,
 STACK DIAMETER (M)= 0.590, HEIGHT OF ASSO. BLDG. (M)= -9.69, WIDTH OF
 ASSO. BLDG. (M)= 73.46, 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,	73.5,	0	2	9.7,	73.5,	0	3	9.7,	73.5,	0	4	9.7,	73.5,	0
5	9.7,	73.5,	0	6	9.7,	73.5,	0	7	9.7,	73.5,	0	8	9.7,	73.5,	0
9	9.7,	73.5,	0	10	9.7,	73.5,	0	11	9.7,	73.5,	0	12	9.7,	73.5,	0
13	9.7,	73.5,	0	14	9.7,	73.5,	0	15	9.7,	73.5,	0	16	9.7,	73.5,	0

- SOURCE STRENGTHS (GRAMS PER SEC) -
 SEASON 1 SEASON 2 SEASON 3 SEASON 4
 2.22000E+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) -
 - CONCENTRATION -

Y AXIS (AZIMUTH BEARING, DEGREES)	550.000	600.000	650.000	700.000	750.000	800.000	850.000	900.000	950.000
188.000	0.671109	0.689506	0.698548	0.700810	0.698129	0.691912	0.683266	0.673045	0.661917
186.000	0.710293	0.728384	0.736654	0.737866	0.734003	0.726574	0.716748	0.705426	0.693300
184.000	0.750153	0.767917	0.775378	0.775511	0.770428	0.761745	0.750699	0.738238	0.725072
182.000	0.790564	0.807995	0.814648	0.813682	0.807356	0.797387	0.785088	0.771449	0.757208
180.000	0.831379	0.848509	0.854376	0.852318	0.844741	0.833467	0.819164	0.805029	0.788985
178.000	0.774859	0.790964	0.796492	0.794601	0.787549	0.777041	0.764373	0.750501	0.736163
176.000	0.717981	0.733075	0.738292	0.736597	0.730097	0.720376	0.708634	0.695764	0.682441
174.000	0.660972	0.675059	0.679969	0.678475	0.672538	0.663613	0.652804	0.640938	0.628630
172.000	0.604090	0.617139	0.621725	0.620424	0.615037	0.606899	0.597019	0.586148	0.574856

- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF ALL SOURCES COMBINED -

X COORDINATE RANGE (METERS)	Y COORDINATE AZIMUTH BEARING (DEGREES)	CONCENTRATION
650.00	180.00	0.854376
700.00	180.00	0.852318
600.00	180.00	0.848509
750.00	180.00	0.844741
800.00	180.00	0.833467
550.00	180.00	0.831379
850.00	180.00	0.819164
650.00	182.00	0.814648
700.00	182.00	0.813682
600.00	182.00	0.807995

***** END OF ISCLT PROGRAM, 1 SOURCES PROCESSED *****

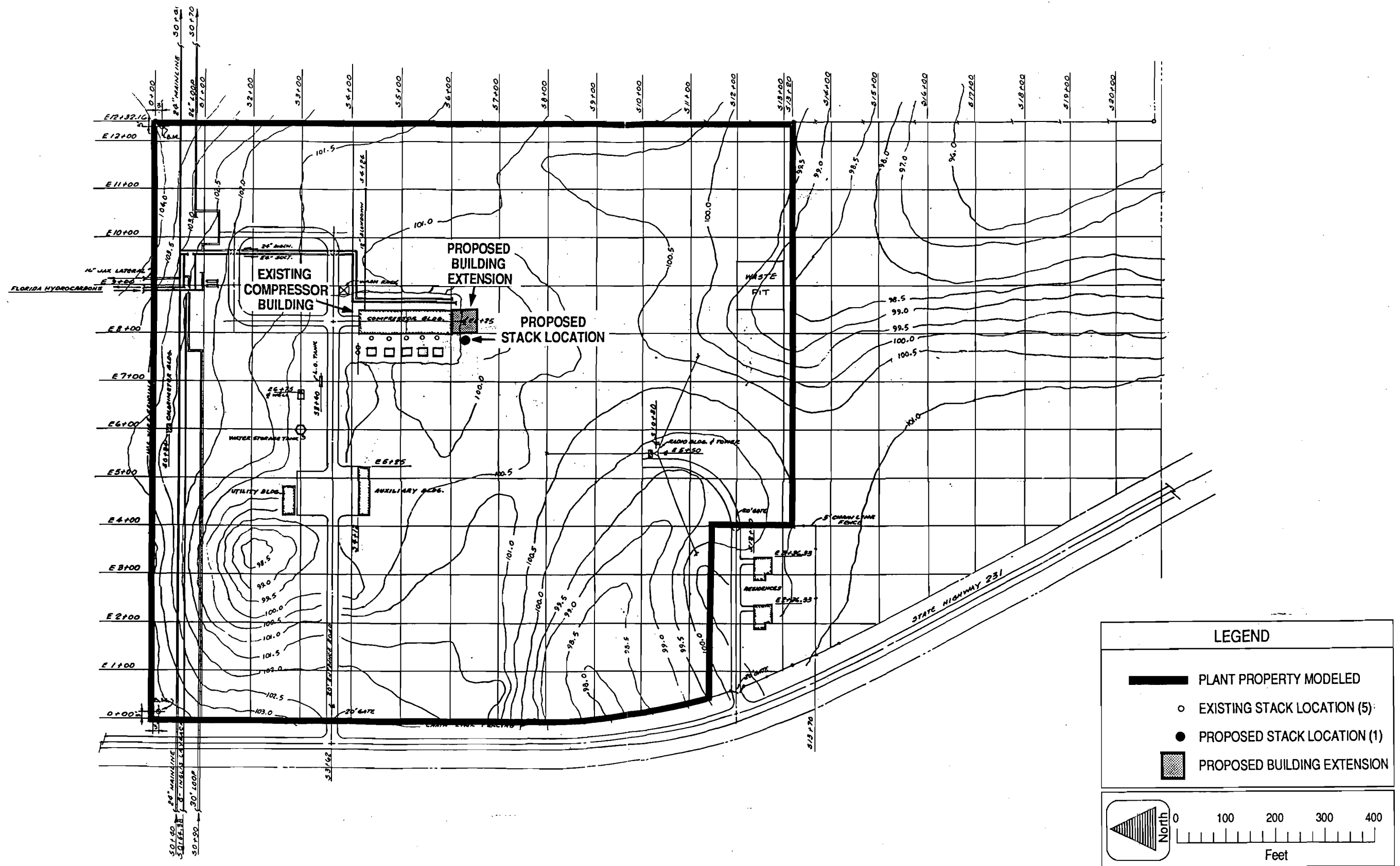


Figure 2-1 PLOT PLAN OF COMPRESSOR STATION NO. 16

No 4845

STATE OF FLORIDA
COUNTY OF ALACHUA

THE GAINESVILLE SUN
Published Daily and Sunday
GAINESVILLE, FLORIDA

Before the undersigned authority personally appearedNaomi Williams.....
who on oath says that he/she isAssistant Classified Mgr. of THE GAINESVILLE SUN, a daily
newspaper published at Gainesville in Alachua County, Florida, that the attached copy of advertisement, being a
Notice of intent to issue permit
in the matter of Station #16
in the Court, was published in said newspaper in the issue of,
3:21 19 91

Affiant further says that the said THE GAINESVILLE SUN is a newspaper published at Gainesville, in said Alachua County, Florida, and that the said newspaper has heretofore been continuously published in said Alachua County, each day, and has been entered as second class mail matter at the post office in Gainesville, in said Alachua 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 corporation any discount for publication in the said newspaper.

Sworn to and subscribed before me this

25 day of MAY, 1991 A.D., 19.....

Martha A. Pattison

(Seal) Notary Public



"OFFICIAL NOTARY SEAL"
MARTHA A. PATTISON
MY COMM. EXP. 4/3/94

mental 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 3 miles north of Brooker on Highway 235 in Bradford County, Florida. The maximum annual NO2 Class I increment consumed in the Okefenokee National Wilderness Area is less than one percent. The maximum annual NO2 Class II increment consumed is 3.7%. 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. Any 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, Northeast District, 7825 Baymeadows Way, Jacksonville, Florida 32256-7577.

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.

