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 20-189438 (PSD-FL-159) to install one natural gas-fired engine at the Florida Gas Transmission facility in Gadsden 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:

J. Preece, NWD
D. Buff, P.E.
B. Beals, U.S. EPA
C. Shaver, NPS

CERTIFICATE OF SERVICE

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

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

Kim Tober — Clerk

5-10-91 — Date

Final Determination

Florida Gas Transmission Company
Gadsden County, Florida

Natural Gas Engine
AC 20-189438
PSD-FL-159

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 natural gas engine at the Florida Gas Transmission Company's facility 8 miles southwest of Quincy on SR 65 in Gadsden County, Florida, was distributed on March 15, 1991. The Notice of Intent to Issue was published in the Tallahassee Democrat on March 21, 1991. Copies of the evaluation were available for public inspection at the Department of Environmental Regulation, Bureau of Air Regulation, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400 and the Department of Environmental Regulation, Northwest District Office, 160 Governmental Center, Pensacola, Florida 32501-5794.

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 20-189438, PSD-FL-159 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 20-189438
PSD-FL-159
Expiration Date: June 30, 1992
County: Gadsden
Latitude/Longitude: 30°30'38"N
84°42'28"W
Project: Natural Gas Compressor Engine (Unit No. 6) Station No. 14

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 8 miles southwest of Quincy on SR 65. The UTM coordinates are Zone 16, 719.97 km East and 3377.39 km North.

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

Attachments are listed below:

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

GENERAL CONDITIONS:

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

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

3. As provided in Subsections 403.087(6) and 403.722(5), Florida Statutes, the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

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

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

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

GENERAL CONDITIONS:

This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

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

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

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

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

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

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

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

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

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

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source

GENERAL CONDITIONS:

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

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

11. This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 17-4.120 and 17-730.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

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

13. This permit also constitutes:

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

14. The permittee shall comply with the following:

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

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

GENERAL CONDITIONS:

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

c. Records of monitoring information shall include:

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

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

SPECIFIC CONDITIONS:

Emission Limits

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

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

2. Visible emissions shall not exceed 10% opacity.

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 16,154 scf/hr.
- Maximum heat input shall not exceed 16.80 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

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

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

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

SPECIFIC CONDITIONS:

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

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 Northwest 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 Northwest 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 Northwest 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 20-189438
PSD-FL-159
Expiration Date: June 30, 1992

SPECIFIC CONDITIONS:

17. An application for an operation permit must be submitted to the Northwest 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 [signature]
Carol M. Browner, Secretary

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

The applicant proposes to expand its existing natural gas pipeline compressor station No. 14 near the town of Quincy in Gadsden County, Florida. The proposed expansion consists of adding one new 2,400 brake horsepower (BHP) natural-gas-fired, reciprocating internal combustion engine.

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

Pollutant	Max. Net Increase in Emissions (TPY)	PSD Significant Emission Rate (TPY)
NOx	46.3	40
SO_2	2.02	40
PM/PM_{10}	0.35	25/15
CO	48.7	100
VOC	11.6	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:

Pollutant	Determination
NOx	2.0 g/bhp-hr

Date of Receipt of a BACT Application

December 18, 1990

Review Group Members

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

BACT Determination Procedure

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

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

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

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

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

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

BACT Analysis

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

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

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

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

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

The applicant has indicated that the total levelized annual cost (operating plus amortized capital cost) to install SCR at 100 percent capacity factor is $406,225. Taking into consideration the total levelized annual cost, a cost/benefit analysis of using SCR can now be developed.

Based on the information supplied by the applicant, it is estimated that the maximum annual NOx emissions with the proposed compressor engines will be 46.3 tons/year. Assuming that SCR would reduce NOx emissions by an additional 80%, the SCR would control 37 tons of NOx annually. When this reduction is taken into consideration with the total levelized annual cost of $406,225, the cost per ton of controlling NOx is $10,979. This cost ($10,979/ton) is not representative of costs that have been previously justified as BACT and is judged to be cost prohibitive for this facility.

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

Environmental Impact Analysis

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

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

BACT Determination by DER

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

Pollutant	Emission Limit
NOx	2.0 grams/bhp-hr

Details of the Analysis May be Obtained by Contacting:

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

Recommended by:

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

5/8/91 1991
Date

Approved by:

for Steve Smallwood, Director DARM
Carol M. Browner, Secretary
Dept. of Environmental Regulation

May 8 1991
Date

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. Heron

CM: P 446 688 053
4-2-91
Maitland, FL

File Copy
AC20-189438
PSD-FL-159

Florida Gas Transmission Company

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

Certified Mail

April 01, 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 14, Quincy, Fl

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

Sincerely,

Allan Weatherford

Allan Weatherford
Compliance Environmentalist

RECEIVED

APR 4 - 1991

DER - BAQM

AW:kb
letter.36

cc: Chuck Truby
Raymond Young
Glenn Sellars
James Dollar
Joe Kolb
Bill Osborne
E. Andersen Olson
Teresa Heron
E. Middleswort, NWD } 4-5-91

Tallahassee Democrat

PUBLISHED DAILY

TALLAHASSEE - LEON - FLORIDA

STATE OF FLORIDA
COUNTY OF LEON:

Before the undersigned authority personally appeared Carrie Coons who on oath says that she is Legal Advertising Representative of the Tallahassee Democrat, a daily newspaper published at Tallahassee in Leon County, Florida; that the attached copy of advertising being a Legal Ad in the matter of

State of Florida
Department of Environmental Regulation
Notice of Intent to Issue

in the Court, was published in said newspaper in the issues of:

MARCH 21, 1991

Affiant further says that the said Tallahassee Democrat is a newspaper published at Tallahassee, in the said Leon County, Florida, and that the said newspaper has heretofore been continuously published in said Leon County, Florida, each day and has been entered as second class mail matter at the post office in Tallahassee, in said Leon County, Florida, for a period of one year next preceding the first publication of the attached copy of advertisement; and affiant further says that she has neither paid nor promised any person, firm or corporation any discount, rebate, commission or refund for the purpose of securing this publication in the said newspaper.

Carrie Coons

Carrie Coons,
Legal Advertising Representative

Sworn To And Subscribed Before Me This 21st **Day of** March **A.D. 19**91

(SEAL)

Judy Haskins
Notary Public

Notary Public, State of Florida
My Commission Expires Sept. 27, 1992
Bonded Thru Troy Fain - Insurance Inc.

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 8 miles Southwest of Quincy on SR 65 in Gadsden County, Florida. The maximum annual NO2 Class I increment consumed in the Bradwell Bay and St. Marks National Wilderness Areas is less than one percent. The maximum annual NO2 Class II increment consumed is 4.0%. 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 determination (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 hose 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
Northwest District
160 Governmental Center
Pensacola, Florida 32501-5794

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. A public hearing can be requested by any person. Such requests must be submitted within 30 days of this notice.

MARCH 21, 1991 AD NO. 3J640030

RECEIVED
APR 4 - 1991
DER BAQM

PM
4-2-91
Gainesville, FL

File Copy

KBN

April 2, 1991

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

RECEIVED
APR 3 1991
DER - BAQM

Re: AC 20-189438; PSD-FL-159
Florida Gas Transmission Co.
Station 14, Unit No. 6
Gadsen County; Quincy, Florida

Dear Mr. Fancy:

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

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

Thank you for consideration of these comments.

Sincerely,

David A. Buff

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

cc: Bill Osborne
Jim Alves
Teresa Heron
BA/CHF
Ed Middleswort, NWD
} 4-4-91

KBN ENGINEERING AND APPLIED SCIENCES, INC.
1034 Northwest 57th Street Gainesville, Florida 32605 904/331-9000 FAX: 904/332-4189

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: Jack Preece, NWD
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 20-189438
PSD-FL-159

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 19, 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:

Jack Preece, NWD
David Buff, P.E.
Brian Beals, U.S. EPA
Chris Shaver, NPS

BEST AVAILABLE COPY

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.

Kim Tober 3-15-91

Clerk 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 8 miles southwest of Quincy on SR 65 in Gadsden County, Florida. The maximum annual NO_2 Class I increment consumed in the Bradwell Bay and St. Marks National Wilderness Areas is less than one percent. The maximum annual NO_2 Class II increment consumed is 4.0%. 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
Northwest District
160 Governmental Center
Pensacola, Florida 32501-5794

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
Gadsden County
Quincy, Florida
Station No. 14

Natural Gas Compressor Engine
Permit No. AC 20-189438
PSD-FL-159

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 8 miles southwest of Quincy on SR 65 in Gadsden County, Florida. The UTM coordinates are Zone 16, 719.97 km E and 3377.39 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 Quincy, 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 46 tons per year and CO emissions by 49 tons per year. The total permitted emissions for this facility shall not exceed 1109 tons NO_x per year and 184 tons CO per year.

III. PROJECT DESCRIPTION

The FGTC proposed to install one natural gas fired engine (Copper-Bessemer Model GMVR-12C2 integral engine compressor unit). The engine has 12 power cylinders and is rated at 2,400 bhp at 330 revolutions per minute (rpm). The engine is turbocharged, increasing the air inlet manifold pressure, which allows the engine to operate at a high air-to-fuel ratio. This turbocharging 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 1959, 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 (Gadsden 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.

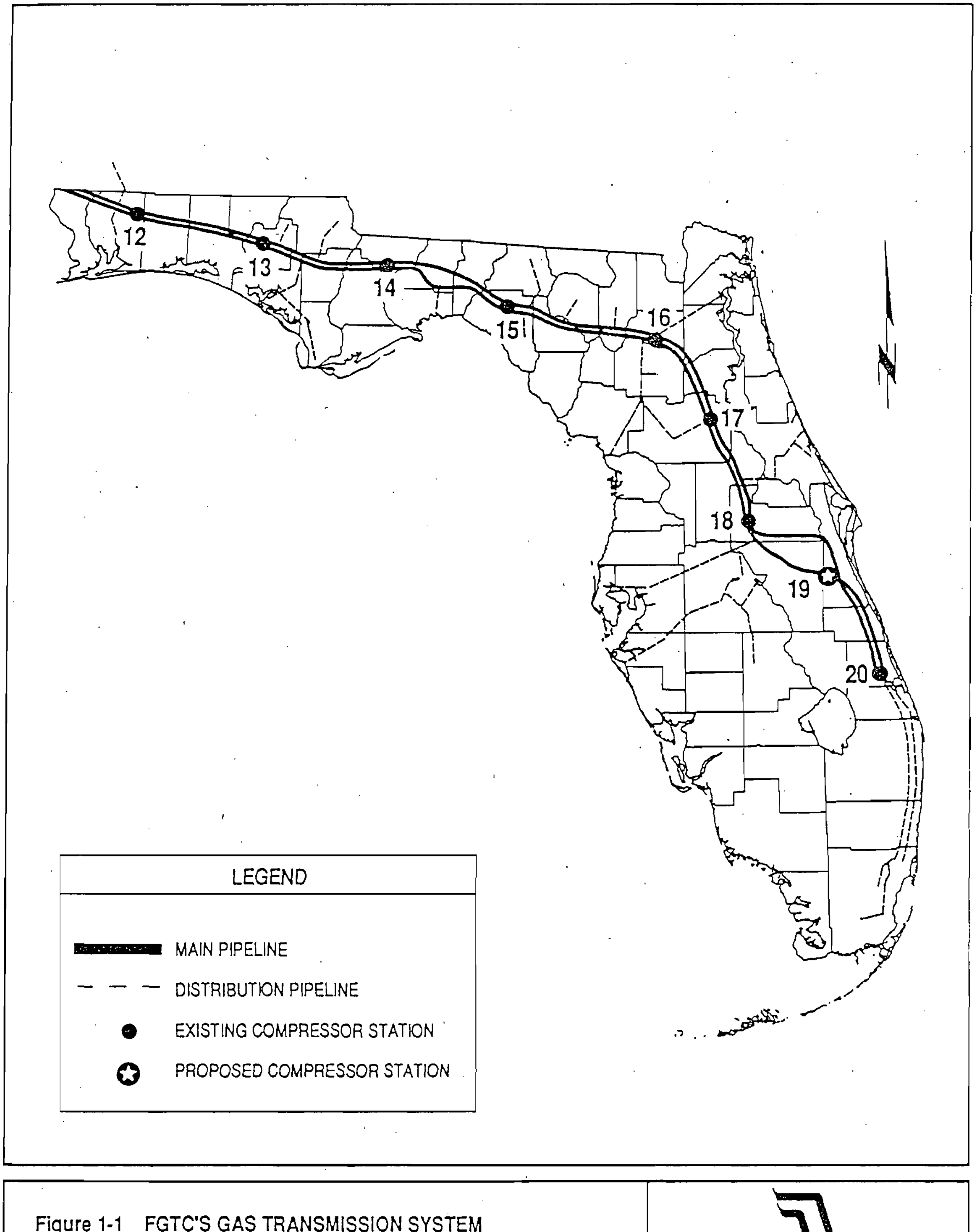

Figure 1-1 FGTC'S GAS TRANSMISSION SYSTEM

Florida Gas Transmission Company

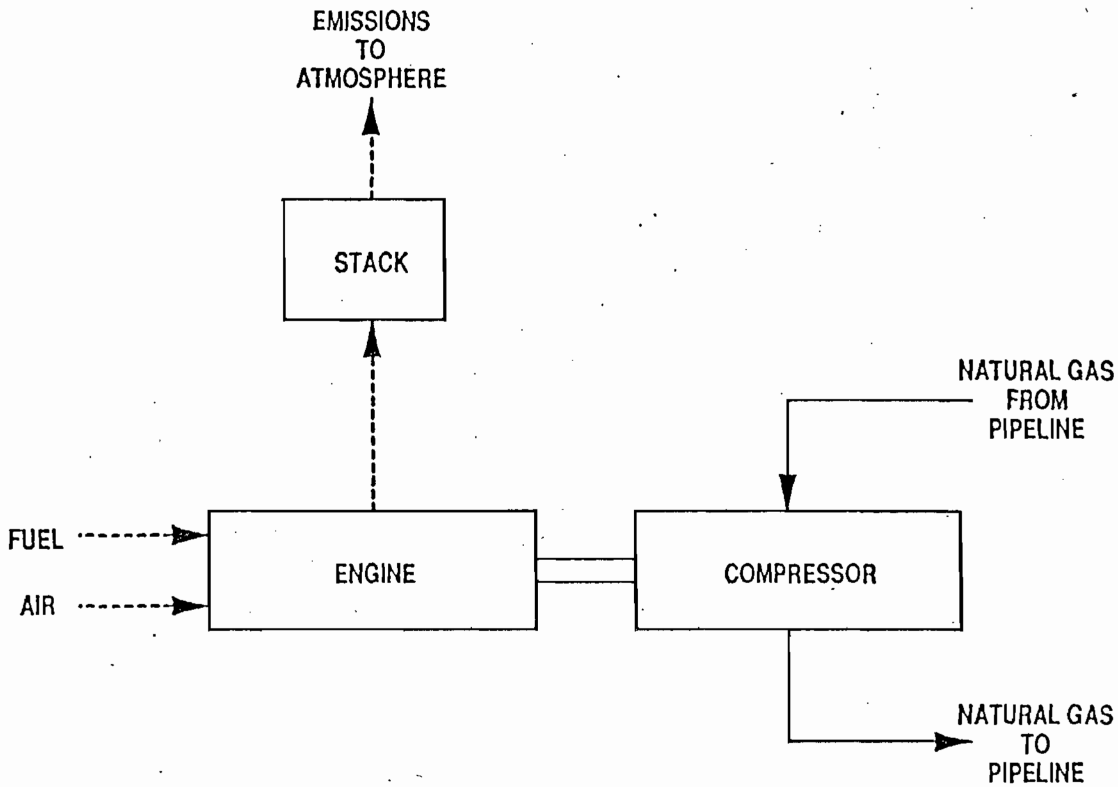

Figure 2-2 PROCESS FLOW DIAGRAM OF AN INTEGRAL ENGINE-COMPRESSOR UNIT

Florida Gas Transmission Company

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 SO_2 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

Pollutant	Maximum Potential Emissions From Proposed Compressor Engine (lbs/hr)	(TPY)	Significant Emission Rate (TPY)
Nitrogen Oxides	10.6	46.3	40
Carbon Monoxide	11.1	48.9	100
Volatile Organic Compounds (non-methane)	2.6	11.6	40
Particulate Matter (TSP)	0.08	0.4	25
Particulate Matter (PM_{10})	0.08	0.4	15
Sulfur Dioxide	0.46	2.0	40

TABLE II
SUMMARY OF EXISTING EMISSIONS
(Unit Nos. 1 through 5)

Pollutant	Per Each Engine (lbs/hr)	Per Each Engine (TPY)	Total (TPY)
NOx	48.5	212.4	1062.2
CO	6.2	27.0	135.0
VOC (non-methane hydrocarbon)	1.9	8.5	42.5
PM	0.07	0.3	1.6
SO_2	0.4	1.8	9.0

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 0.99 ug/m^3, annual average which is less than the de minimus concentration for NOx of 14 ug/m^3 annual coverge. 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 NOx 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, windspread 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 NOx 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 NOx. 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 NO_2 impact from this modeling was 0.99 ug/m^3, which is less than the NO_2 significant impact level of 1 ug/m^3 annual average concentration. Because the maximum predicted NO_2 concentration is less than the significant impact level, further modeling for NO_2 for comparison with the AAQS and the Class II PSD increment was not required in this case. The maximum predicted NO_2 increment consumption by this project in the Class I Bradwell Bay National Wilderness Area located 40 km away is 0.01 ug/m^3 while the maximum predicted increment consumption in the St. Marks National Wilderness Area located 58 km away is 0.01 ug/m^3. These predicted values include the projected maximum NO_2 increment consumption by the FGT No. 15 engine proposed to be located in Taylor County, Florida.

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 Bradwell Bay and St. Marks National Wilderness Areas. 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 NOx 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 D. Andrews
36024
3-15-91

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 Bradwell Bay and St. Marks National Wilderness Areas. 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 NOx 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 D. Andrews

BARRY D. ANDREWS
CERTIFICATE
NO. 36024
STATE OF
FLORIDA
REGISTERED ENGINEER

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 20-189438
PSD-FL-159
Expiration Date: June 30, 1992
County: Gadsden
Latitude/Longitude: 30°30'38"N
84°42'28"W
Project: Natural Gas Compressor Engine (Unit No. 6) Station No. 14

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 8 miles southwest of Quincy on SR 65. The UTM coordinates are Zone 16, 719.97 km East and 3377.39 km North.

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

Attachments are listed below:

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

GENERAL CONDITIONS:

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

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

3. As provided in Subsections 403.087(6) and 403.722(5), Florida Statutes, the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. This permit is not a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.

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

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

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

GENERAL CONDITIONS:

This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

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

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

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

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

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

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

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

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

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

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source

GENERAL CONDITIONS:

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

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

11. This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 17-4.120 and 17-730.300, F.A.C., as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.

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

13. This permit also constitutes:

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

14. The permittee shall comply with the following:

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

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

GENERAL CONDITIONS:

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

c. Records of monitoring information shall include:

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

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

SPECIFIC CONDITIONS:

Emission Limits

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

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

2. Visible emissions shall not exceed 10% opacity.

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 16,154 scf/hr.
- Maximum heat input shall not exceed 16.80 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, SO_2, CO, and VOC standards shall be determined by the following reference methods as described in 40 CFR 60, Appendix A (July 1, 1988) and adopted by reference in F.A.C. Rule 17-2.700.

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

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

SPECIFIC CONDITIONS:

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

11. Test results will be the average of 3 valid runs. The Northwest 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 Northwest 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 Northwest 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 Northwest District office at least 90 days prior to the expiration date of this construction permit or within 45 days after completion of compliance testing, whichever occurs first. To properly apply

SPECIFIC CONDITIONS:

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

Issued this ______ day
of ______________, 1991

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL REGULATION

____
Carol M. Browner, Secretary

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

The applicant proposes to expand its existing natural gas pipeline compressor station No. 14 near the town of Quincy in Gadsden County, Florida. The proposed expansion consists of adding one new 2,400 brake horsepower (BHP) natural-gas-fired, reciprocating internal combustion engine.

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

Pollutant	Max. Net Increase in Emissions (TPY)	PSD Significant Emission Rate (TPY)
NOx	46.3	40
SO_2	2.02	40
PM/PM_{10}	0.35	25/15
CO	48.7	100
VOC	11.6	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.

<u>BACT Determination Requested by the Applicant</u>

The BACT Determination requested by the applicant is given below:

Pollutant	Determination
NOx	2.0 g/bhp-hr

<u>Date of Receipt of a BACT Application</u>

December 18, 1990

<u>Review Group Members</u>

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

BACT Determination Procedure

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

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

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

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

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

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

BACT Analysis

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

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

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

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

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

The applicant has indicated that the total levelized annual cost (operating plus amortized capital cost) to install SCR at 100 percent capacity factor is $406,225. Taking into consideration the total levelized annual cost, a cost/benefit analysis of using SCR can now be developed.

Based on the information supplied by the applicant, it is estimated that the maximum annual NOx emissions with the proposed compressor engines will be 46.3 tons/year. Assuming that SCR would reduce NOx emissions by an additional 80%, the SCR would control 37 tons of NOx annually. When this reduction is taken into consideration with the total levelized annual cost of $406,225, the cost per ton of controlling NOx is $10,979. This cost ($10,979/ton) is not representative of costs that have been previously justified as BACT and is judged to be cost prohibitive for this facility.

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

Environmental Impact Analysis

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

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

BACT Determination by DER

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

Pollutant	Emission Limit
NOx	2.0 grams/bhp-hr

Details of the Analysis May be Obtained by Contacting:

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

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

Department of Environmental Protection

Jeb Bush
Governor

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

David B. Struhs
Secretary

May 20, 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 - Gadsden Compressor Station No. 14
2nd Extension of Air Construction Permit Expiration Date
Air Permit No. 0390029-003-AC

Dear Mr. Pribble:

On May 15, 2002, Florida Gas Transmission Company (FGTC) requested an extension of the expiration date of air construction Permit No. 0390029-003-AC for the Gadsden Compressor Station No. 14 located at Route 3, Box 3390, on Highway 65 South near Quincy in Gadsden County, Florida. FGTC requests the additional time to complete construction, perform the required tests and submit a timely Title V operation permit. Specifically, FGTC requests additional time to complete shakedown of the Pignone Model PGT-10B gas turbine (Unit No. 1408) to ensure its capability of operation at the manufacturer's rated capacity. The Department approves this request.

The expiration date is hereby extended from **October 1, 2002** to **April 1, 2003** to provide the necessary time to complete construction, testing and submittal of 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.)

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

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 5/23/02 to the person(s) listed:

Mr. Danny Pribble, FGTC*
Mr. Jim Thompson, FGTC
Mr. Kevin McGlynn, McGlynn Consulting Co.
Mr. V. Duane Pierce, AQMcs
Ms. Sandra Veazey, NWD

Clerk Stamp

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

Victoria Gibson May 23, 2002
(Clerk) (Date)

Florida Gas Transmission Company

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

May 10, 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 Blairstone Road
Tallahassee, FL 32399-2400

RECEIVED
MAY 15 2002
BUREAU OF AIR REGULATION

Reference: Permit No. 1130037-003-AC
FGT Compressor Station No. 12, Santa Rosa County

Permit No. 0390029-003-AC
Compressor Station No. 14, Gadsden County

Dear Mr. Koerner:

Subject: Extension of Construction Permit Expiration

The above referenced construction permits have extended expiration dates of October 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 90 days before their expiration dates.

The initial emissions tests that were scheduled for Engine Nos. 1208 and 1408 at the above referenced facilities have been delayed due to continuing problems with engine performance. All four of the Nuovo Pignone PGT-10B turbines that Florida Gas Transmission Company has purchased are still having problems. This includes not being able to reach their normal operating capacity of 15,700 bhp ISO. Several manufacturer representatives are currently working to resolve these problems. It is anticipated that all problems will be resolved and emissions testing can be completed by July 1, 2002.

FGT requests another 90-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

Jim Thompson
Project Manager, Environmental

ATTACHMENTS

CC: Frank Diemont
Jake Krautsch
Duane Pierce
CS 12
CS 14

Memorandum

Florida Department of
Environmental Protection

TO: Howard Rhodes

THRU: Clair Fancy CHF
Al Linero AAL

FROM: Jeff Koerner JFK

DATE: May 20, 2002

SUBJECT: Florida Gas Transmission Company - Gadsden Compressor Station No. 14
Extension of Air Construction Permit Expiration Date
Air Permit No. 0390029-003-AC

Attached for your approval and signature is a permit modification that extends the permit expiration date for the above referenced project. This is the second extension for this permit. The requests have been the direct result of problems with the Pignone PGT-10B gas turbine attaining the manufacturer's rated capacity, which has caused delays in the testing schedule.

Day 74 is July 27, 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

May 10, 2002

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

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New Source Review Section
Bureau of Air Regulation
Florida Department of Environmental Protection
Twin Towers Office Bldg.
2600 Blairstone Road
Tallahassee, FL 32399-2400

RECEIVED
MAY 15 2002
BUREAU OF AIR REGULATION

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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

Jim Thompson
Project Manager, Environmental

ATTACHMENTS

CC: Frank Diemont
Jake Krautsch
Duane Pierce
CS 12
CS 14

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
P.O. Box 1188
Houston, TX 77251

COMPLETE THIS SECTION ON DELIVERY

A. Received by *(Please Print Clearly)* B. Wyatt

B. Date of Delivery MAY 28 2002

C. Signature

X B. Wyatt

☐ Agent
☐ Addressee

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

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 8758

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)

OFFICIAL USE

7001 0320 0001 3692 8758

Postage	$
Certified Fee	
Return Receipt Fee (Endorsement Required)	
Restricted Delivery Fee (Endorsement R[illegible])	
Total Postag[illegible]	

Postmark Here

Sent To Mr. Danny Pribble
Vice President of Operations
Florida Gas Transmission Company

Street, Apt. No. or PO Box No. P.O. Box 1188

City, State, ZIP Houston, TX 77251

PS Form 3800, January 2001 See Reverse for Instructions

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
P.O. Box 1188
Houston, TX 77251

COMPLETE THIS SECTION ON DELIVERY

A. Received by (*Please Print Clearly*) D. Wyatt
B. Date of Delivery MAY 28 2002

C. Signature
X D. Wyatt
☐ Agent
☐ Addressee

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

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 8758

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)

OFFICIAL USE

7001 0320 0001 3692 8758

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

Postmark Here

Sent To: Mr. Danny Pribble
Vice President of Operations
Street, Apt. No. or PO Box No.: Florida Gas Transmission Company
P.O. Box 1188
City, State, ZIP: Houston, TX 77251

PS Form 3800, January 2001 See Reverse for Instructions

Florida Gas Transmission Company

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

February 29, 2000

OVERNIGHT

RECEIVED

MAR 03 2000

BUREAU OF AIR REGULATION

Mr. Bob Kriegel
Northwest District
Florida Department of Environmental Protection
160 Govermental Center
Pensacola, Florida 32501-5794

Reference: File No. 1130037-002-AC
Facility: 1130037
Compressor Station No. 12, Santa Rosa County
File No. 0390029-002-AC
Facility: 0390029
Compressor Station No. 14, Gadsden County

Dear Mr. Kriegel:

Subject: Comments on Draft Permit

Thank you for taking time to meet with us at FGT's Mt. Vernon Compressor Station. We hope it was informative. While we were there, we reviewed and discussed the draft air permit applications for Compressor Stations No. 12 and 14. During this review of the draft permit a number of items were discussed. This letter addresses each of these items and FGT's viewpoint.

FGT respectfully, submits the following comments.

<u>Item 1 Reference</u>

Page [3]
Section II. Facility-wide Conditions
6. General Pollutant Limiting Standards. Volatile Organic Compounds (VOC) Emissions or Organic Solvents (OS) Emissions

<u>Item 1 Comment</u>:

The words: "[insert any required systems]" appear to be left by error and need to be removed.

<u>Item 2 Reference</u>

Page [6]
Section III. Emission Unit(s) and Conditions

First Paragraph. Last Sentence.

Item 2 Comment:

The stack exit diameter is listed as "8.74 feet." This is the equivalent diameter (De) of the stack. The stack is rectangular in cross section with dimensions of 7.5 x 8 feet. FGT suggest clarifying this by either indicating that 8.74 is an equivalent diameter or by giving the actual dimensions.

Item 3

Page [6]
Section III. Emission Unit(s) and Conditions
Essential Potential to emit (PTE) Parameters
[A].1. Capacity

Item 3 Comment:

The word "either" should be deleted.

The value of 88.6 MMBtu/hr is based on heat input at ISO conditions. FGT suggests that this be stated for correctness.

Finally, since the curve attached to the permit expresses heat input as fuel flow in units of lbM/hr, FGT suggest that the value of 4256.8 lbM/hr be substituted or used in addition to the MMBtu/hr value in this condition to facilitate understanding by others.

Item 4 Reference

Page [8]
Section III. Emission Unit(s) and Conditions
Test Requirements, Methods and Procedures
[A].8.

Item 4 Comment:

The schedule, as written, would be difficult to meet. This is particularly true of notifying the DEP 15 days prior to testing when testing is required to be done within 30 days after initial operation. That allows two weeks to establish a test schedule with a qualified testing company. Additionally, 30 days after initial operation does not allow for any start-up problems that may take more than 30 days to correct.

FGT suggest that the requirement to test "within thirty (30) days after initial operation" be changed to the schedule given in 40 CFR Part 60.8 Performance Tests since the new emission unit will be subject to 40 CFR 60 Subpart GG and the requirements of 60.8(a). 40 CFR 60.8(a) requires that testing be performed "within 60 days after achieving the maximum production rate at which the affected facility will be operated, but not later than 180 days after initial startup of such facility…"

Item 5 Reference

Page [8]
Section III. Emission Unit(s) and Conditions
Test Requirements, Methods and Procedures
[A].10.
First Sentence.

Item 5 Comment:

The first sentence requires testing at four different loads. FGT requests that this requirement be changed to require peak load only since testing at different loads is intended to establish operating conditions for turbines with water injection and this turbine will not have water injection.

Item 6 Reference

Page [8]
Section III. Emission Unit(s) and Conditions
Test Requirements, Methods and Procedures
[A].10.
Second Sentence.

Item 6 Comment:

The word "corrected" is misspelled.

Item 7 Reference

Page [8]
Section III. Emission Unit(s) and Conditions
Test Requirements, Methods and Procedures
[A].10.
Last Sentence.

Item 7 Comment:

This sentence refers to the attached curve. The use of this curve is not clear from the permit condition as written in the draft permit. From our discussion, FGT's understanding is that emissions will be limited to 8.8 lb/hr at inlet temperatures below ISO conditions and to the value on the curve for inlet temperatures above ISO conditions.

FGT believes that this is an unreasonable requirement and inappropriate application of this curve. The curve clearly indicates that emissions could exceed 8.8 lb/hr at inlet temperatures below ISO conditions. Limiting emissions to 8.8 lb/hr below ISO conditions could potentially lead to non-compliance situations whenever lower inlet temperatures occur. Additionally, use of the curve instead of 8.8 lb/hr at higher inlet temperatures is inconsistent.

FGT requests that lb/hr emission rates be limited to the curve value for a given inlet temperature. The 8.8 lb/hr emission rate represents a nominal short-term emission rate that is based on the expected tons per year (tpy) emission rate at ISO conditions. Emissions at ISO conditions are a slightly conservative estimate of annual emissions compared to the average annual site conditions. The curve shows that a maximum short-term emission rate of approximately 9.6 lb/hr could occur at extremely low inlet temperatures. FGT suggests that a separate maximum lb/hr emission rate of 9.6 lb/hr be identified in the permit along with the nominal 8.8 lb/hr.

FGT would like to point out that the National Ambient Air Quality Standard (NAAQS) for NO_x is an annual standard only. Impacts of NO_x emissions on this standard are assessed using tpy emission rates. There is no short-term NAAQS for NO_x. Also, Prevention of Significant Deterioration (PSD) is based on annual ton per year emission rates and not short-term, lb/hr emission rates. Finally, the New Source Performance Standards (40 CFR 60 Subpart GG) for NOx is a concentration standard (ppmv) and not a mass rate standard. Likewise, Best Available Control Technology for stationary gas-fired turbines under PSD is normally established as a concentration (ppmv). Severely limiting short-term emission rates (lb/hr) of NO_x, as this permit condition does, is inconsistent with the established regulations and standards pertaining to NO_x and stationary turbines.

Item 8

Page [9]
Section III. Emission Unit(s) and Conditions
Recordkeeping and Reporting Requirements
[A].12. Custom Fuel Monitoring Schedule

Item 8 Comment:

FGT accepts the schedule as given; however, there is a question as to the correct procedure for approval of this schedule. It is FGT's understanding that custom fuel monitoring schedules cannot be used until approved and that individual requests must be made to the Administrator and approvals given on a case-by-case basis. FGT further understands that the Administrator, in this case, is considered to be the USEPA Regional Office. If this is the true, then this permit condition would not be valid until such a request is made and subsequent approval given.

Please confirm that FGT can legally use this custom fuel monitoring schedule prior to approval from the Administrator.

Thank you for the opportunity to comment on the draft permit. FGT trusts that this letter clearly presents FGT's view on these matters. If you have any need to further discuss these items or need additional information, please call me at (407) 838-7119.

Sincerely,

David H. Parham, P.E.

Attachments

CC: Jordan Hunter, FGT w/o attachments
Glenn Sellars, FGT
Arnold Eisenstein, Enron
Frank Diemont, Enron
Clay Roesler, FGT
Alvero Linero, FDEP - Tallahassee
V. Duane Pierce, Ph.D., AQMcs, LLC
Compressor Station No. 12
Compressor Station No. 14
Project file

ENV2398

Florida Department of
Environmental Protection

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

Lawton Chiles
Governor

Virginia B. Wetherell
Secretary

December 9, 1993

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

Dear Mr. Weatherford:

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

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

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

SPECIFIC CONDITION NO. 8

FROM:

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

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

TO:

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

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

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) in accordance with Section 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400. Petitions filed by the applicant of the amendment request/application and the parties listed below must be filed within 14 days of receipt of this amendment. Petitions filed by other persons must be filed within 14 days of the amendment issuance or within 14 days of their receipt of this amendment, whichever occurs first. Petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. Failure to file a petition within this time period shall constitute a waiver of any right such person may have to request an administrative determination (hearing) under Section 120.57, Florida Statutes.

The Petition shall contain the following information:

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

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

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

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

Sincerely,

Howard L Rhodes

Howard Rhodes
Director
Division of Air Resources
Management

Attachment to be Incorporated

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

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

CERTIFICATE OF SERVICE

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

Clerk Stamp

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

Barbara J. Boutwell 12/21/93

Clerk Date

ENSR

ENSR Consulting
and Engineering

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

December 3, 1993

RECEIVED
DEC - 6 1993
Division of Air
Resources Management

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

Dear Clair:

RE: Request for Amendments to Permits
Florida Gas Transmission Company

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

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

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

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

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

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

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

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

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

ENSR

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

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

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

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

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

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

Sincerely,

Barry Andrews

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

cc : Alan Weatherford

Enclosure

Florida Department of
Environmental Protection

Lawton Chiles
Governor

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

Virginia B. Wetherell
Secretary

September 17, 1993

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

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

Dear Mr. Weatherford:

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

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

The following changes are allowed by the Department:

COMPRESSOR STATION NO. 12 - SANTA ROSA COUNTY:

Description

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

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

Specific Condition No. 1

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

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

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

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

Specific Condition No. 5

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

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

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

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

COMPRESSOR STATION NO. 13 - WASHINGTON COUNTY:

Description

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

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

Specific Condition No. 1

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

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

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

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

Specific Condition No. 5

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

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

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

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

COMPRESSOR STATION NO. 14 - GADSDEN COUNTY:

Description

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

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

Specific Condition No. 1

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

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

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

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

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

Specific Condition No. 5

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

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

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

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

COMPRESSOR STATION NO. 18 - ORANGE COUNTY:

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

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

Specific Condition No. 1

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

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

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

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

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

Specific Condition No. 5

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

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

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

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

COMPRESSOR STATION NO. 19 - BREVARD COUNTY:

Description

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

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

Specific Condition No. 1

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

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

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

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

Specific Condition No. 5

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

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

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

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

COMPRESSOR STATION NO. 15 - TAYLOR COUNTY:

Specific Condition No. 1

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

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

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

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

Specific Condition No. 5

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

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

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

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

COMPRESSOR STATION NO. 16 - BRADFORD COUNTY:

Specific Condition No. 1

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

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

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

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

Specific Condition No. 5

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

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

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

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

COMPRESSOR STATION NO. 17 - MARION COUNTY

Specific Condition No. 1

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

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

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

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

Specific Condition No. 5

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

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

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

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

COMPRESSOR STATION NO. 20 - ST. LUCIE COUNTY

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

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

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

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

Specific Condition No. 5

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

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

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

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

Expiration Date

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

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

Sincerely,

Howard L. Rhodes

Howard L. Rhodes
Director
Division of Air Resources Management

HLR/TH/plm

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

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

STATION 14

QUINCY, FLORIDA

Station	Model Run Factor	MAXIMUM 1-HR CONCENTRATION (ug/m**3) NOx	CO	VOCs	Particulates	SO2	Maximum Emission (lb/hr) NOx	CO	VOCs	Particulates	SO2
14 Permitted	3.888	41.213	43.157	10.109	0.311	1.788	10.60	11.10	2.60	0.08	0.46
14 Revised	3.827	45.541	47.838	11.404	0.421	2.067	11.90	12.50	2.98	0.11	0.54

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).

1

04-06-93
15:52:40

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

Station 14--Permit--Simple Terrain, no Downwash

SIMPLE TERRAIN INPUTS:

SOURCE TYPE	=	POINT
EMISSION RATE (G/S)	=	.1260
STACK HEIGHT (M)	=	15.24
STK INSIDE DIAM (M)	=	.44
STK EXIT VELOCITY (M/S)	=	23.49
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.	1.005	1	3.0	3.1	960.0	39.4	27.4	15.0	NO
200.	3.673	2	5.0	5.1	1600.0	29.7	36.4	20.7	NO
300.	3.888	3	5.0	5.2	1600.0	29.6	34.5	20.7	NO
400.	3.728	3	3.0	3.1	960.0	39.1	45.2	27.3	NO
500.	3.493	3	3.0	3.1	960.0	39.1	55.2	33.1	NO

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

300.	3.888	3	5.0	5.2	1600.0	29.6	34.5	20.7	NO

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

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

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	3.888	300.	0.

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

04-06-93
15:55:27

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

Station 14--Actual--Simple Terrain, no Downwash

SIMPLE TERRAIN INPUTS:

SOURCE TYPE	=	POINT
EMISSION RATE (G/S)	=	.1260
STACK HEIGHT (M)	=	15.47
STK INSIDE DIAM (M)	=	.66
STK EXIT VELOCITY (M/S)	=	10.35
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.	.9683	1	3.0	3.1	960.0	39.6	27.4	15.0	NO
200.	3.614	2	5.0	5.2	1600.0	30.0	36.4	20.7	NO
300.	3.827	3	5.0	5.2	1600.0	29.8	34.5	20.7	NO
400.	3.686	3	4.0	4.2	1280.0	33.3	44.9	26.9	NO
500.	3.464	3	3.0	3.1	960.0	39.3	55.2	33.1	NO
600.	3.210	3	2.0	2.1	640.0	51.2	65.5	39.7	NO

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

303.	3.827	3	5.0	5.2	1600.0	29.8	35.0	21.0	NO

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

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

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	3.827	303.	0.

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

Air Emissions Estimates for Permitting

Station 14; Quincy, FL

	NOX (TPY)	CO (TPY)	NMHC (TPY)	SO2 (TPY)	PM (TPY)
Engines					
Compressor Engine 1	212.5	27.0	8.5	1.8	0.3
Compressor Engine 2	212.5	27.0	8.5	1.8	0.3
Compressor Engine 3	212.5	27.0	8.5	1.8	0.3
Compressor Engine 4	212.5	27.0	8.5	1.8	0.3
Compressor Engine 5	212.5	27.0	8.5	1.8	0.3
Compressor Engine 6	46.4	48.7	23.2	2.1	0.4
Emergency Generator Engine 1	2.3	0.2	0.1	0.0	0.0
Emergency Generator Engine 2	1.9	0.2	0.1	0.0	0.0
Air Compressor Engine 1	5.0	0.5	0.2	0.0	0.0
Tanks					
Oil and Water Separator 1	0.0	0.0	0.2	0.0	0.0
Oil and Water Separator 2	0.0	0.0	0.2	0.0	0.0
Pipeline Condensate Tank 1	0.0	0.0	0.1	0.0	0.0
Waste Oil Storage Tank 1	0.0	0.0	0.0	0.0	0.0
Diesel Storage Tank 1 (removed)	0.0	0.0	0.0	0.0	0.0
Diesel Storage Tank 2 (de minimus)	0.0	0.0	0.0	0.0	0.0
Lube Oil Storage Tank 1 (de minimus)	0.0	0.0	0.0	0.0	0.0
Lube Oil Waste Tank 1 (de minimus)	0.0	0.0	0.0	0.0	0.0
Lube Oil Rundown Tank 1 (de minimus)	0.0	0.0	0.0	0.0	0.0
Machines					
Parts Cleaning Machine 1	?	?	?	?	?
Parts Cleaning Machine 2	?	?	?	?	?
Paint Cleaning Machine 1 (removed)	0.0	0.0	0.0	0.0	0.0
Blowdowns					
ESD and Maintenance blowdowns	0.0	0.0	1.6	0.0	0.0
Fugitive Emissions					
Valves	?	?	?	?	?
Flanges	?	?	?	?	?
Total Emissions	1117.9	184.8	68.2	11.0	2.0

Engine Emission Calculation Worksheet

Station 14; Quincy, FL

Emergency Generator Engine 1

Engine data

Annual use (maximum); hr./yr.	400 hr./yr.
Power; Hp	235 Hp
Power; Btu/hr. (@ 8026 (Btu/hr.)/Hp)	1886110 Btu/hr.
Fuel consumption; scf/hr. (@ 1040 Btu/scf)	1814 scf/hr.

Emissions data

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

Emissions calulations

NOx	2.3 TPY
CO	0.2 TPY
NMHC	0.1 TPY
SO2	0.0 TPY
PM	0.0 TPY

Engine Emission Calculation Worksheet

Station 14; Quincy, FL

Emergency Generator Engine 2

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.

Emissions data

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

Emissions calulations

NOx	1.9 TPY
CO	0.2 TPY
NMHC	0.1 TPY
SO2	0.0 TPY
PM	0.0 TPY

Engine Emission Calculation Worksheet

Station 14; Quincy, FL

Air Compressor Engine 1

Engine data

Annual use (maximum); hr./yr.	2555 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.

Emissions data

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

Emissions calulations

NOx	5.0 TPY
CO	0.5 TPY
NMHC	0.2 TPY
SO2	0.0 TPY
PM	0.0 TPY

FIXED ROOF TANK VOLATILE ORGANIC COMPOUND EMISSIONS

COMPANY: **Florida Gas Transmission Co.** DATE: **5/9/93**

LOCATION: **Station 14; Quincy, FL**

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

TANK PHYSICAL DATA	
TANK IDENTIFICATION NUMBER	**Oil and Water Seperator 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, Fp	**1.58**
TANK CAPACITY (BBLS), VB	210
TANK CAPACITY (GALLONS), V	8812
ADJUSTMENT FACTOR FOR DIA., C	**0.5**
WEATHER DATA	
AVG. DAILY TEMP. CHANGE (DEG F), DeltaT	**20.0**
STORAGE TEMP. (DEG. F)	**72.4**
AVG. ATM. PRESS. (PSIA), Pa	**14.7**
PRODUCT PHYSICAL DATA	
MATERIAL STORED	**Condensate, oil, water**
MOLECULAR WEIGHT (#/#MOLE) Mv	**53.0**
VAPOR PRESS. AT STG. TEMP. (DEG. F), P	**2.8**
PRODUCT FACTOR, KsubC (CRUDE 0.65, OTHER 1.0)	**1.0**
THROUGHPUT DATA	
DAYS IN SERVICE, Ds	**365**
VAPOR SPACE HEIGHT (FT), VH	**7.5**
TANK THROUGHPUT (BBLS FOR DAYS IN SERVICE), TT	**1000**
FILLING RATE (BBLS/HR), FR	**40**
NUMBER OF TURNOVERS FOR DAYS IN SERVICE, N	4.8
TURNOVER FACTOR, Kn	**1**

FIXED ROOF TANK BREATHING LOSS, # Lb =
0.0226*Mv*((P/(Pa-P))^0.68)*(D^1.73)*(VH^0.51)*
(DeltaT^0.5)*Fp*C*Kc*Ds/365*(100-%eff)/100

FIXED ROOF TANK WORKING LOSS, # Lw =
0.000024*Mv*P*V*N*Kn*Kc*(100-%eff)/100

VOLATILE ORGANIC COMPOUND LOSSES	BREATHING	WORKING	TOTAL
POUNDS FOR DAYS SERVICE =	237.4	149.6	387.0
TONS FOR DAYS SERVICE =	0.1	0.1	0.2
POUNDS PER YEAR =	237.4	149.6	387.0
TONS PER YEAR =	**0.1**	0.1	0.2
AVERAGE POUNDS PER HOUR =	**0.0**	0.0	0.0
MAXIMUM POUNDS PER HOUR =	0.1	6.0	6.0

FIXED ROOF TANK VOLATILE ORGANIC COMPOUND EMISSIONS

COMPANY: **Florida Gas Transmission Co.** DATE: **5/9/93**

LOCATION: **Station 14; Quincy, FL**

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

TANK PHYSICAL DATA	
TANK IDENTIFICATION NUMBER	**Oil and Water Seperator 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, Fp	**1.58**
TANK CAPACITY (BBLS), VB	210
TANK CAPACITY (GALLONS), V	8812
ADJUSTMENT FACTOR FOR DIA., C	**0.5**
WEATHER DATA	
AVG. DAILY TEMP. CHANGE (DEG F), DeltaT	**20.0**
STORAGE TEMP. (DEG. F)	**72.4**
AVG. ATM. PRESS. (PSIA), Pa	**14.7**
PRODUCT PHYSICAL DATA	
MATERIAL STORED	**Condensate, oil, water**
MOLECULAR WEIGHT (#/#MOLE) Mv	**53.0**
VAPOR PRESS. AT STG. TEMP. (DEG. F), P	**2.8**
PRODUCT FACTOR, KsubC (CRUDE 0.65, OTHER 1.0)	**1.0**
THROUGHPUT DATA	
DAYS IN SERVICE, Ds	**365**
VAPOR SPACE HEIGHT (FT), VH	**7.5**
TANK THROUGHPUT (BBLS FOR DAYS IN SERVICE), TT	**1000**
FILLING RATE (BBLS/HR), FR	**40**
NUMBER OF TURNOVERS FOR DAYS IN SERVICE, N	4.8
TURNOVER FACTOR, Kn	**1**

FIXED ROOF TANK BREATHING LOSS, # Lb =
0.0226*Mv*((P/(Pa-P))^0.68)*(D^1.73)*(VH^0.51)*
(DeltaT^0.5)*Fp*C*Kc*Ds/365*(100-%eff)/100

FIXED ROOF TANK WORKING LOSS, # Lw =
0.000024*Mv*P*V*N*Kn*Kc*(100-%eff)/100

VOLATILE ORGANIC COMPOUND LOSSES	BREATHING	WORKING	TOTAL
POUNDS FOR DAYS SERVICE =	237.4	149.6	387.0
TONS FOR DAYS SERVICE =	0.1	0.1	0.2
POUNDS PER YEAR =	237.4	149.6	387.0
TONS PER YEAR =	0.1	0.1	0.2
AVERAGE POUNDS PER HOUR =	0.0	0.0	0.0
MAXIMUM POUNDS PER HOUR =	0.1	6.0	6.0

FIXED ROOF TANK VOLATILE ORGANIC COMPOUND EMISSIONS

COMPANY: **Florida Gas Transmission Co.** DATE: **5/9/93**

LOCATION: **Station 14; Quincy, FL**

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, Fp	**1.58**
TANK CAPACITY (BBLS), VB	210
TANK CAPACITY (GALLONS), V	8812
ADJUSTMENT FACTOR FOR DIA., C	**0.5**
WEATHER DATA	
AVG. DAILY TEMP. CHANGE (DEG F), DeltaT	**20.0**
STORAGE TEMP. (DEG. F)	**72.4**
AVG. ATM. PRESS. (PSIA), Pa	**14.7**
PRODUCT PHYSICAL DATA	
MATERIAL STORED	**Condensate**
MOLECULAR WEIGHT (#/#MOLE) Mv	**53.0**
VAPOR PRESS. AT STG. TEMP. (DEG. F), P	**2.8**
PRODUCT FACTOR, KsubC (CRUDE 0.65, OTHER 1.0)	**1.0**
THROUGHPUT DATA	
DAYS IN SERVICE, Ds	**365**
VAPOR SPACE HEIGHT (FT), VH	**7.5**
TANK THROUGHPUT (BBLS FOR DAYS IN SERVICE), TT	**100**
FILLING RATE (BBLS/HR), FR	**40**
NUMBER OF TURNOVERS FOR DAYS IN SERVICE, N	0.5
TURNOVER FACTOR, Kn	1

FIXED ROOF TANK BREATHING LOSS, # Lb =
0.0226*Mv*((P/(Pa-P))^0.68)*(D^1.73)*(VH^0.51)*
(DeltaT^0.5)*Fp*C*Kc*Ds/365*(100-%eff)/100

FIXED ROOF TANK WORKING LOSS, # Lw =
0.000024*Mv*P*V*N*Kn*Kc*(100-%eff)/100

VOLATILE ORGANIC COMPOUND LOSSES	BREATHING	WORKING	TOTAL
POUNDS FOR DAYS SERVICE =	237.4	15.0	252.4
TONS FOR DAYS SERVICE =	0.1	0.0	0.1
POUNDS PER YEAR =	237.4	15.0	252.4
TONS PER YEAR =	0.1	0.0	0.1
AVERAGE POUNDS PER HOUR =	0.0	0.0	0.0
MAXIMUM POUNDS PER HOUR =	0.1	6.0	6.0

FIXED ROOF TANK VOLATILE ORGANIC COMPOUND EMISSIONS

COMPANY: **Florida Gas Transmission Co.** DATE: **5/9/93**

LOCATION: **Station 14; Quincy, FL**

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

TANK PHYSICAL DATA	
TANK IDENTIFICATION NUMBER	**Waste Oil 1**
EMISSION CONTROLS	**None**
PERCENT EFFICIENCY	**0**
TANK PAINT COLOR	**Black**
TANK DIAMETER (FT), D	**8.0**
TANK HEIGHT (FT), H	**10.0**
PAINT FACTOR, Fp	**1.58**
TANK CAPACITY (BBLS), VB	90
TANK CAPACITY (GALLONS), V	3760
ADJUSTMENT FACTOR FOR DIA., C	**0.4**
WEATHER DATA	
AVG. DAILY TEMP. CHANGE (DEG F), DeltaT	**20.0**
STORAGE TEMP. (DEG. F)	**72.4**
AVG. ATM. PRESS. (PSIA), Pa	**14.7**
PRODUCT PHYSICAL DATA	
MATERIAL STORED	**Waste oil**
MOLECULAR WEIGHT (#/#MOLE) Mv	**190.0**
VAPOR PRESS. AT STG. TEMP. (DEG. F), P	**0.0019**
PRODUCT FACTOR, KsubC (CRUDE 0.65, OTHER 1.0)	**1.0**
THROUGHPUT DATA	
DAYS IN SERVICE, Ds	**365**
VAPOR SPACE HEIGHT (FT), VH	**7.5**
TANK THROUGHPUT (BBLS FOR DAYS IN SERVICE), TT	**10**
FILLING RATE (BBLS/HR), FR	**15**
NUMBER OF TURNOVERS FOR DAYS IN SERVICE, N	0.1
TURNOVER FACTOR, Kn	**1**

FIXED ROOF TANK BREATHING LOSS, # Lb =
0.0226*Mv*((P/(Pa-P))^0.68)*(D^1.73)*(VH^0.51)*
(DeltaT^0.5)*Fp*C*Kc*Ds/365*(100-%eff)/100

FIXED ROOF TANK WORKING LOSS, # Lw =
0.000024*Mv*P*V*N*Kn*Kc*(100-%eff)/100

VOLATILE ORGANIC COMPOUND LOSSES	BREATHING	WORKING	TOTAL
POUNDS FOR DAYS SERVICE =	2.8	0.0	2.8
TONS FOR DAYS SERVICE =	0.0	0.0	0.0
POUNDS PER YEAR =	2.8	0.0	2.8
TONS PER YEAR =	0.0	0.0	0.0
AVERAGE POUNDS PER HOUR =	0.0	0.0	0.0
MAXIMUM POUNDS PER HOUR =	0.0	0.0	0.0

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

BEST AVAILABLE COPY

FGTC COMPR[illegible] STATION 14
CURREN[illegible]ENTORY

UNIT	Included In Most Recent Operating Permit As	Required to be In Title V Operating Permit	In Compliance with Current Regulations	Information Required For New Permit Application
WORTH. SEHG-8	Engine 1	X	Yes	None
WORTH. SEHG-8	Engine 2	X	Yes	None
WORTH. SEHG-8	Engine 3	X	Yes	None
WORTH. SEHG-8	Engine 4	X	Yes	None
WORTH. SEHG-8	Engine 5	X	Yes	None
CB GMVR-12	Engine 6	X	Yes	None
Emergency Generator # 1	Omitted	X	No	Btu/hp-hr, Stack temp., Emission rates for NOx, CO, NM-NE HC, SO2, and PM
Emergency Generator # 2	Omitted	X	No	Btu/hp-hr, Stack temp., Horsepower, Emission rates for NOx, CO, NM-NE HC, SO2, and PM
Air Compressor # 1	Omitted	X	No	Stack Parameters, Emission rates for NOx, CO, NM-NE HC, SO2, and PM
Oil and Water Separator # 1	Omitted	X	No	Emission rate for NM-NE HC, Throughput, Tank Dimensions, Tank Condition, Vent data, Fill rate
Oil and Water Separator # 2	Omitted	X	No	See O&W Separtator # 1
Waste Oil Storage # 1	Omitted	X	No	Emission rate for NM-NE HC, Throughput, Tank Dimensions, Tank Condition, Vent data, Fill rate
Pipeline Condensate # 1	Omitted	X	No	Emission rate for NM-NE HC, Throughput, Tank Dimensions, Tank Condition, Vent data, Fill rate
Lube Oil Storage # 1	Omitted	X	No	Emission rate for NM-NE HC, Throughput, Tank Dimensions, Tank Condition, Vent data, Fill rate
Lube Oil Waste Tank # 1	Omitted	X	No	Emission rate for NM-NE HC, Throughput, Tank Dimensions, Tank Condition, Vent data, Fill rate
Lube Oil Rundown Tank # 1	Omitted	X	No	Emission rate for NM-NE HC, Throughput, Tank Dimensions, Tank Condition, Vent data, Fill rate
(removed) → Diesel Tank # 1	Omitted	X	No	Emission rate for VOC's, Throughput, Tank Dimensions, Tank Condition, Vent data, Fill rate
Diesel Tank # 2	Omitted	X	No	Emission rate for VOC's, Throughput, Tank Dimensions, Tank Condition, Vent data, Fill rate
Part Cleaner # 1	Omitted	X	No	Emission rate for VOC's, Manf., Model
Part Cleaner # 2	Omitted	X	No	Emission rate for VOC's, Manf., Model
(removed) → Paint Cleaner # 1	Omitted	X	No	Emission rate for VOC's
ESD & Blowdown Stacks	Omitted	X	No	Emission rates, Volume B/D, Stack Information

ESD suction : 10', 10" dia
ESD discharge : 10', 10" dia

FGTC
NATURAL GAS COMPRESSION FACILITY
STATION 14
QUINCY, FLORIDA

PURPOSE OF ENGINES: THE ENGINES ACT AS PRIME MOVERS FOR THE NATURAL GAS COMPRESSORS

EMISSION SOURCE	CURRENT PERMIT STATUS	SOURCE ID	SERIAL NUMBER	HP	BTU/HP*HR	PERMIT EMISSION RATES (TPY)				
						NOX	NMHC	CO	SO2	PM
ENGINE # 1	PERMITTED UNIT	____________	G-2369	2000	6350	212.5	8.5	27	1.79	0.31
ENGINE # 2	PERMITTED UNIT	____________	G-2370	2000	6350	212.5	8.5	27	1.79	0.31
ENGINE # 3	PERMITTED UNIT	____________	G-2371	2000	6350	212.5	8.5	27	1.79	0.31
ENGINE # 4	PERMITTED UNIT	____________	G-2662	2000	6350	212.5	8.5	27	1.79	0.31
ENGINE # 5	PERMITTED UNIT	____________	G-2779	2000	6350	212.5	8.5	27	1.79	0.31
ENGINE # 6	PERMITTED UNIT	____________	48489	2400	7000	46.36	23.2	48.68	2.1	0.41
						1109	66	184	11	2

Phase I Station Characteristics

Compressor Station: Number 14
Name: Quincy
County: Gadsden
Nearest City: Quincy
Compressor Supervisor: James Dollar
Mailing Address: Route 3, Box 3390
Quincy, Florida 32351–9803
Telephone: 904–627–8090
Latitude: 30–30–38
Longitude: 84–42–28
UTM Zone: 16
UTM Easting: 719.97 km
UTM Northing: 3,377.39 km
Elevation (ft): 260

Phase I Engine Characteristics

Engine Identification	1	2	3	4	5
Permit Number					
Serial Nnumber	G–2369	G–2370	G–2371	G–2662	G–2779
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 (af/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)	0.0144	0.0144	0.0144	0.0144	0.0144
Max. Fuel Consumption (MMCF/Hr) (b)	0.0144	0.0144	0.0144	0.0144	0.0144
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	← Same	← Same	← Same	← Same
Building Length (ft) (c)	240 ~~200.00~~	←	←	←	←
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)	1040	1040	1040	1040	1040
Heat Capacity (BTU/lb)	22857	22857	22857	22857	22857
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

08-Jun-92
CS14.WK1

Phase I Emissions Rates by Engine for Station 14

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

08-Jun-92
CS14.WK1

Compressor Station:	Number 14
Name:	Quincy
County:	Gadsden
Nearest City:	Quincy
Compressor Supervisor:	James Dollar
Mailing Address:	Route 3, Box 3390 Quincy, Florida 32351-9803
Telephone:	904-627-8090
Latitude:	30-30-38
Longitude:	84-42-28
UTM Zone:	16
UTM Easting:	719.97 km
UTM Northing:	3,377.39 km
Elevation (ft):	260

Phase II Engine Characteristics

Engine Identification	6
Permit Number	
Serial Nnumber	48489
Operating Time	
Hours/Day	24
Days/Week	7
Weeks/Year	52
Engine Type	Recip
Date of Installation	1991
Engine Make	Cooper-Bessemer
Engine Model	GMVR-12 C2
Horsepower Rating	~~2400~~ 2700
Air Charging	Turbo.
Exhaust Temperature (F)	550
Mass Flow Rate (lbs/hr) (a)	36860
Volumetric Flow Rate (acfm)	15857
Volumetric Flow Rate (dscfm)	7511
Exit Velocity (af/s)	71.68
Water Vapor Content (%)	8
Ave. Fuel Consumption (MMCF/Hr) (b)	0.0162
Max. Fuel Consumption (MMCF/Hr) (b)	0.0162
Specific Fuel Consump. (BTU/bhp-hr)	7000
Maximum Heat Input (MMBTU/Hr)	16.8
Stack Height (ft)	50.75
Stack Diameter (in)	26
Stack to Building Offset (ft)	17.00
Building Height (ft) (c)	31.75
Building Length (ft) (c)	240.00
Building Width (ft) (c)	55.00

Phase II Fuel Characteristics

Fuel Type	N.G.
Heating Value (BTU/CF)	1040
Heat Capacity (BTU/lb)	22857
Density (lb/cubic ft)	0.0455
Percent Sulfur (%) (d)	0.031
Percent Ash (%)	N/A

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30-Jul-92
CS14.WK1

Phase II Emissions Rates by Engine for Station 14

Engine Identification		6	
Grams/BHP-Hour			
	NOX	2.000	
	CO	2.100	
	NMHC	1.000	0.500
	SO2 (e)	0.090	
	PM (f)	0.018	
Pounds/Hour			
	NOX	10.58	
	CO	11.11	
	NMHC	5.29	2.65
	SO2	0.48	
	PM	0.09	
Tons/Year			
	NOX	46.36	
	CO	48.68	
	NMHC	23.18	11.59
	SO2	2.09	
	PM	0.41	

Phase II Emissions Rates for Total Station

Grams/BHP-Hour		
	NOX	9.258
	CO	1.535
	NMHC	0.548
	SO2	0.092
	PM	0.016
Pounds/Hour		
	NOX	253.13
	CO	41.98
	NMHC	14.99
	SO2	2.52
	PM	0.45
Tons/Year		
	NOX	1108.73
	CO	183.89
	NMHC	65.67
	SO2	11.03
	PM	1.97

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.

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NATURAL GAS COMPRESSION FACILITY
STATION 14
QUINCY, FLORIDA

PURPOSE OF EMERGENCY GENERATOR: THE EMERGENCY GENERATOR USED IN THE CASES OF POWER FAILURE

PURPOSE OF AIR COMPRESSOR: TO PROVIDE AIR FOR TIRES, ETC...

EMISSION SOURCE	CURRENT PERMIT STATUS	SOURCE ID	SERIAL NUMBER	HP	BTU/HP*HR	PERMIT EMISSION RATES (TPY) NOX	NMHC	CO	SO2	PM
EMERGENCY GENERATOR # 1	NOT PERMITTED			235						
EMERGENCY GENERATOR # 2	NOT PERMITTED									
AIR COMPRESSOR # 1	NOT PERMITTED			80						
						0	0	0	0	0

FLORIDA GAS TRANSMISSION COMPANY
COMPRESSOR STATION EMISSIONS QUESTIONAIRE
STATION No. 14

GENERATORS SETS

UNIT NUMBER 1	1085560
Installed	EXISTING
Permitted	YES
Internal Combustion Engine	YES
If Int. Comb. Engine, Is Catalytic Converter present	NO
Manufacturer	Waukesha
Model	6WAK
Actual Maximum Hours of Operation (Hr / Year)	~~250~~ 400
If Internal Combustion Engine Complete the following information:	
Type of Fuel Used	N.G.
BTU Rating (MMBTU/HR)	
Horse Power Rating	235
Stack Height Above Grade (ft)	10'
Stack Diameter (inch)	~~14"~~ 2" ; horiz
Location of Stack(s)	Outside Wall Aux. Bldg.
Stack Temperature (F)	405

UNIT NUMBER 2	05089A-02-RG
Installed	PHASE II
Permitted	NO
Internal Combustion Engine	YES
If Int. Comb. Engine, Is Catalytic Converter present	NO
Manufacturer	Ford
Model	LSG-875 R
Actual Maximum Hours of Operation (Hr / Year)	400
If Internal Combustion Engine Complete the following information:	
Type of Fuel Used	N.G.
BTU Rating (MMBTU/HR)	
Horse Power Rating	200
Stack Height Above Grade (ft)	~~8'~~ 10'3"
Stack Diameter (inch)	~~12"~~ 4" ; vert.
Location of Stack(s)	Above Unit
Stack Temperature (F)	

FLORIDA GAS TRANSMISSION COMPANY
COMPRESSOR STATION EMISSIONS QUESTIONAIRE
STATION No. 14

OTHER SOURCES

221C424054905

Unit No. 1	EXISTING
Permitted	YES
Purpose of Unit	Drive – Worth. Air Compressor
Type	6 cyl.
Manufacturer	International
Model	UC221
Size (BTU ,or HP ,or Kw)	80 HP
Fuel Used (if applicable)	N.G.
Stack Parameters (ft)	11'5" ; 570°F, vent

2555 hrs/yr

OTHER.

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NATURAL GAS COMPRESSION FACILITY
STATION 14
QUINCY, FLORIDA

PURPOSE OF OIL/WATER SEPARATOR TANKS: TO SEPARATE AN OIL AND WATER MIXTURE IN ORDER TO REUSE THE WATER.

PURPOSE OF WASTE OIL TANK: TO STORE EXCESS OIL COLLECTED IN COMPRESSOR STATION PROCESSES.

PURPOSE OF PIPELINE CONDENSATE TANK: TO STORE LIGHT HYDROCARBON LIQUID OBTAINED BY CONDENSATION OF HYDROCARBON VAPORS.

PURPOSE OF LUBE OIL STORAGE TANKS: TO STORE LUBE OIL USED FOR ENGINE OPERATIONS.

PURPOSE OF LUBE OIL WASTE TANK: TO STORE WASTE LUBE OIL FROM ENGINE OPERATIONS.

PURPOSE OF THE LUBE OIL RUNDOWN TANK: TO CAPTURE EXCESS LUBE OIL FROM ENGINE OPERATIONS.

PURPOSE OF DIESEL TANKS: TO STORE FUEL FOR EQUIPMENT USAGE.

VESSEL	PERMIT STATUS	SOURCE ID	CAPACITY (GAL)	PERMIT FUGITIVE EMISSION RATES (TPY) NMHC
OIL/WATER SEPARATOR # 1	NOT PERMITTED		8820	
OIL/WATER SEPARATOR # 2	NOT PERMITTED		8820	
WASTE OIL TANK # 1	NOT PERMITTED		3780	
PIPELINE CONDENSATE # 1	NOT PERMITTED		8820	
LUBE OIL STORAGE # 1	NOT PERMITTED		10000	
LUBE OIL WASTE TANK # 1	NOT PERMITTED		150	
LUBE OIL RUNDOWN TANK # 1	NOT PERMITTED			
DIESEL TANK # 1	NOT IN USE		N/A	
DIESEL TANK # 2	NOT PERMITTED		353	
				0

FLORIDA GAS TRANSMISSION

AN ENRON/SONAT AFFILIATE

TELECOPIER TRANSMITTAL SHEET

DESTINATION FAX #	
ATTN: BILL LEFFLER	DATE: 7/23/93
FROM: ALLAN WEATHERFORD	TIME: 2:30

NUMBER OF PAGES (INCLUDING THIS TRANSMITTAL SHEET) 6

SENT VIA: PITNEY BOWES 9200F

IF YOU DO NOT RECEIVE ALL OF THE PAGES OR IF THEY ARE NOT COMING IN CLEARLY, PLEASE CALL 407/875-5821.

Bill:

Engine operating parameters are documented in Table 2. Please call me if you need any additional info.

Al

SUMMARY OF RESULTS

One Dresser Rand 10TCV 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 17, 1992 at Compressor Station No. 12 located near Munson, in Santa Rosa County, Florida. The purpose of these tests was to determine the compliance status of this engine with regard to the FDER permit.

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

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

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

The average emissions over the three test runs for NOx were found to be 9.27 lbs/hr, 40.7 tons/yr, and 1.01 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 20.6 lbs/hr, 90.4 tons/yr, and 2.25 g/hp-hr and are limited by the permit to 22.1 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 less than 0.059 grains/100 DSCF. The permit limits the sulfur content of the fuel to

10 grains/100 DSCF. The mass emission rate of SO_2 presented in Table 2 was calculated from the estimated fuel flow to the engine assuming that all sulfur in the fuel was oxidized to SO_2. The SO_2 emission rate based on this calculation averaged <0.0026 lbs/hr or <0.012 tons/yr. The permit limits for SO_2 mass emissions are 0.8 lbs/hr and 3.5 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 15.3 lbs/hr, 67.0 tons/yr, and 1.66 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 CO_2 and moisture interferents, both of which are present in percent levels in engine exhaust. These interferences would be expected to cause a high bias of the VOC concentration measurements. Even under ideal circumstances (i.e. measurements made from a matrix of air containing little or no CO_2 or moisture), the minimum detection limit of this method is 50 ppmv as compared to a minimum detection limit of <1.0 ppmv using other EPA test methods. For this reason, Cubix chose to also conduct VOC testing on this source using alternate, more appropriate methods.

Appendix I contains the unofficial 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 3.53 lbs/hr (15.4 tons/yr and 0.38 g/hp-hr). When compared with the data obtained from Method 25, one can see that the CO_2 and moisture interferents may have biased the VOC concentrations high. In addition, the alternate methods are much less labor intensive, which eliminates a lot of the possibility of human error from the field or lab personnel.

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

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

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

Cubix used the flow measurement technique that resulted in the highest calculated mass emission rates. In this case, the pitot tube technique provided the worst case scenario. The higher pitot tube flow is believed to be due to the turbulent exhaust flow causing the pitot tube readings to be biased high. However, the data of Appendix I shows that alternate flow rate measurement techniques can produce good results when pitot tube traverses are impractical. The data from the stoichiometry provides a good check of the pitot tube data.

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.

TABLE 2
SUMMARY OF RESULTS

Operator/Plant	Florida Gas Munson Compressor Station
Location	Santa Rosa County, Florida
Source	Dresser Rand Compressor Engine
Technicians	LF,TS,NF

Test Run No.	C-1	C-2	C-3
Date	3/17/92	3/17/92	3/17/92
Start Time	14:15	15:35	16:52
Stop Time	15:15	16:35	17:52
Engine/Compressor Operation			
✓ Engine Speed (rpm)	330	330	330
Ignition Timing (°BTDC)	8	8	8
Air Manifold Pressure (psig)	16	16	16
Air Manifold Temperature (°F)	124	124	124
Estimated Fuel Flow AT 7600 BTU/hp-hr (SCFH)	31386	31386	31386
Fuel Temperature (°F)	48	47	46
Fuel Manifold-Pressure (psig)	35	35.5	35
Loading Step (pockets open out of 10 total)	9	9	9
✓ Suction Pressure (psig)	681	680	679
Suction Temperature (°F)	63	63	62
✓ Discharge Pressure (psig)	919	920	918
Discharge Temperature (°F)	105	105	105
✓ Engine Load (BHP)	4171	4171	4171
✓ Torque (%)	[illegible]	00	[illegible]
Ambient Conditions			
Atmospheric Pressure (in. Hg)	29.95	29.92	29.92
Temperature (°F) : Dry bulb	78	78	71
(°F) Wet bulb	73	76	66
Humidity (lb/lb air)	0.0159	0.0184	0.0123
Measured Emissions			
NOx (ppmv)	68.0	66.0	62.0
CO (ppmv)	240	236	240
O2 via EPA Method 3 (vol %)	15.00	15.50	15.50
CO2 via EPA Method 3 (vol %)	3.00	3.00	3.00
VOC via EPA Method 25 (ppmv)	318.0	331.6	277.7
SO2 in fuel (grains/100 SCF)	<0.059	<0.059	<0.059
Stack Volumetric Flow Rates			
via Pitot Tube (SCFH, dry)	1.21E+06	1.20E+06	1.16E+06
Calculated Emission Rates (via pitot tube)			
NOx (lbs/hr)	9.83	9.43	8.60
CO (lbs/hr)	21.1	20.5	20.3
VOC (lbs/hr)	16.0	16.5	13.4
SO2 (lbs/hr)	<0.0026	<0.0026	<0.0026
NOx (tons/yr)	43.1	41.3	37.7
CO (tons/yr)	92.5	89.9	88.8
VOC (tons/yr)	70.0	72.2	58.7
SO2 (tons/yr)	<0.012	<0.012	<0.013
NOx (g/hp-hr)	1.07	1.03	0.94
CO (g/hp/hr)	2.30	2.23	2.21
VOC (g/hp-hr)	1.74	1.79	1.46

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Co. DARM	Co. NW-DEP
Dept.	Phone # 436-8364
Fax # 922-6979	Fax #

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

EMISSION TEST PLAN

Caryville Compressor Station
Florida Gas Transmission Company

Sources: One Natural Gas Fired Compressor Engine, 2400 Hp, Cooper Bessemer, Model GMVR-12C2, Unit #6.

Location: 9 miles south of Caryville, Washington County, Florida.

Applicable Permits and Regulations: Florida Department of Environmental Protection Permit No. AC 67-189220

Owner/Operator:
Florida Gas Transmission Company
601 South Lake Destiny Drive
Maitland, Florida 32751
Attn: Allan Weatherford
(407) 875-5816 TEL
(407) 875-5896 FAX

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DEP

Test Contractor:
Cubix Corporation
9225 Lockhart Highway
Austin, Texas 78747
Attn: Rick J. Krenzke
(512) 243-0202 TEL
(512) 243-0222 FAX

Proposed Test Dates: July 27, 1993
This is the 2nd of 9 compressor stations tested along the pipeline during this project, so delays at prior test sites could affect the proposed test date.

Test Protocol

I) Test Matrix

A) Three test runs of 60-minutes each shall be conducted on one unit (#6) during which NOx, CO, and O_2 shall be continuously monitored.
B) One pitot tube traverse shall be conducted before each test run.
C) Moisture determinations as required for stack gas flow rate calculations shall be determined stoichiometrically based on the fuel's combustion moisture content, excess air dilution factor, and combustion air humidity due to ambient conditions. One moisture train shall be run throughout the three test runs to verify the validity of the stoichiometric calculations.
D) Three 6-minute opacity observations shall be conducted on the engine.

II) Test Measurements by Cubix
A) EPA Method 1 for traverse point layout.
B) EPA Method 2 for stack gas velocity and volumetric flow rate.
C) EPA Method 3a for O_2 and CO_2 concentrations.
D) Stoichiometric calculation of moisture content.
E) EPA Method 4 for moisture content.
F) EPA Method 7e for NOx concentrations.
G) EPA Method 9 for opacity observations
H) EPA Method 10 for CO concentrations
I) Ambient conditions
1) temperature
2) barometric pressure
3) humidity

III) Operational Data to be provided by Florida Gas
A) Fuel flow (if available)
B) Recent fuel composition analysis
C) Suction and discharge pressures
D) Gas flow
E) Engine speed
F) Ignition timing
G) Fuel and air manifold temperatures and pressures
H) Engine load
I) Any other data available to document each test run

IV) Quality Assurance/ Quality Control
(as appropriate for the test methods listed above).
A) Sample system leak check.
B) Calibration of O_2, CO, and CO_2 analyzers with vendor certified calibration gases.

C) Calibration of NOx analyzers with gases traceable via EPA protocol #1.
D) Analyze audit samples provided by regulatory agency (if available).
E) NOx converter efficiency test.
F) Pitot tube meeting EPA criteria and wind tunnel tested.
G) Zero and span analyzer calibration drift tests between each test run.
H) Multipoint calibration to demonstrate instrument linearity.
I) Sampling system bias check (using NOx).
J) Interference response documentation.
K) Sample system response time data.

Test Report

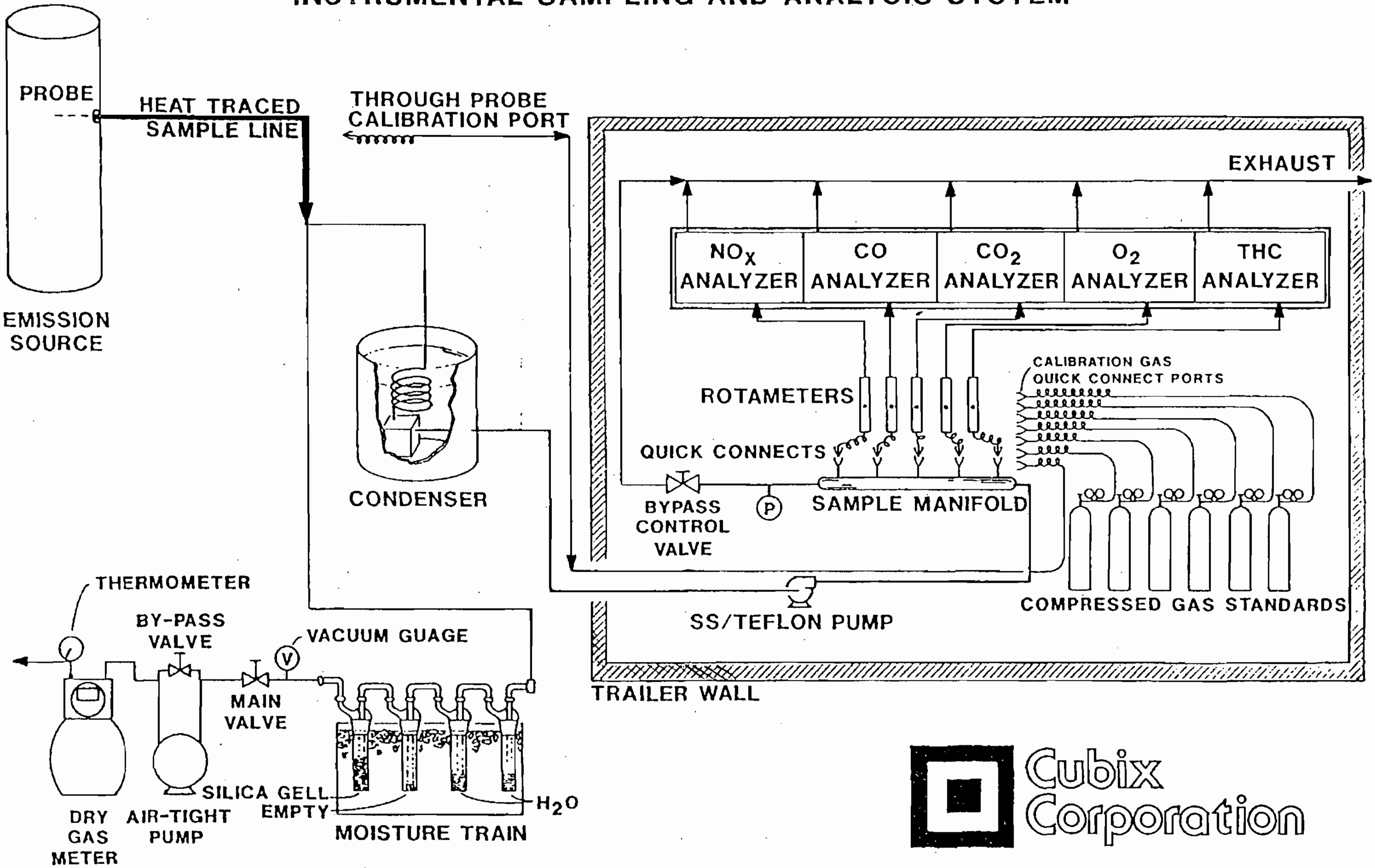
A) Summary of Results
  1) Tabular summary of each test run showing NOx emissions in ppmv, lbs/hr, tons/year, and g/hp-hr for comparison with permit limits.
  2) Operating conditions reported in tabular summary.
B) Process Description
C) Description of Analytical Techniques
D) Quality Assurance Activities
E) Appendices:
  Documentation including field data forms, strip charts, calibration gas certifications, equipment calibrations, example calculations, audit sample results, etc...

Miscellaneous

1) It is assumed that Florida Gas will provide adequate sampling facilities and safe access to same. (see enclosed information regarding requirements for stack testing)

Attachments:
Sampling System Diagram
Analytical Instrumentation
Requirements for Emission Testing
Engine Sample Port Requirements Diagram

INSTRUMENTAL SAMPLING AND ANALYSIS SYSTEM



Cubix Corporation

Analytical Instrumentation

Parameter	Model and Manufacturer	Common Use Ranges	Sensitivity	Response Time (sec.)	Detection Principle
NOx	TECO 10AR	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, microprocessor 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.

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

SUPPORT REQUIREMENTS FOR EMISSIONS TESTING

The following should be provided by the client. If any of these specifications cannot be met, please advise Cubix as soon as possible so other arrangements can be made and the field work is not delayed.

Lab Parking: A level parking site is needed for the mobile laboratory/trailer within 80 feet of the emission source. The location selected should have no traffic between the stack and the mobile lab.

Electrical: Electrical power for the mobile lab is to be provided within 100 feet of the parking site. Three 20-amp, 120 volt, 60 Hz, single-phase circuits are needed. NEMA 5-20R or NEMA 5-15R outlets should be provided to accept the standard household three-prong plugs on Cubix's extension cords. Pigtail adapter plugs should be provided to adapt to explosion-proof receptacles. To avoid delays, please check that the electrical power is in place and operational before the test team arrives.

Unit Operation: Operation of the source at the load conditions required for testing (e.g., maximum normal load), and instrumentation for collection of operating data (e.g., fuel consumption, load, pressures, etc.). These operating data will be included in the report to document the test conditions.

Access: A safe means of access to the sampling ports is to be provided for test personnel and equipment (platform, ladders, scaffolding, etc.). Scaffold must meet OSHA guidelines. Cubix retains the right to inspect scaffold, ladders and platform.

Sample Ports: There are two basic methods that allow measurement of stack flow rates from combustion processes. The port location requirements for the two methods are slightly different. Selection of the flow measurement technique depends on the stack's physical constraints and may be subject to regulatory agency approval.

Port Location for Pitot Tube Flow Measurements
Flue gas volumetric flow may be measured using a pitot tube per EPA Methods 1 & 2. The regulatory agencies are more familiar with this method. However, pitot tubes are not accurate if the flow rate is less than 600 ft/min., or if the flow is turbulent. If this method is used, the sample ports must be located a minimum of 2 diameters downstream and 0.5 diameters upstream of the nearest flow disturbance. Two ports should be installed at 90^0 angles to each other and horizontal to the ground. This type of port installation must be used if particulate testing is required. On some sources (e.g. engines) this is not possible because the stack itself is horizontal. For horizontal stacks, install one port vertically, on top of the stack, and install the second port horizontally, on the side of the stack.

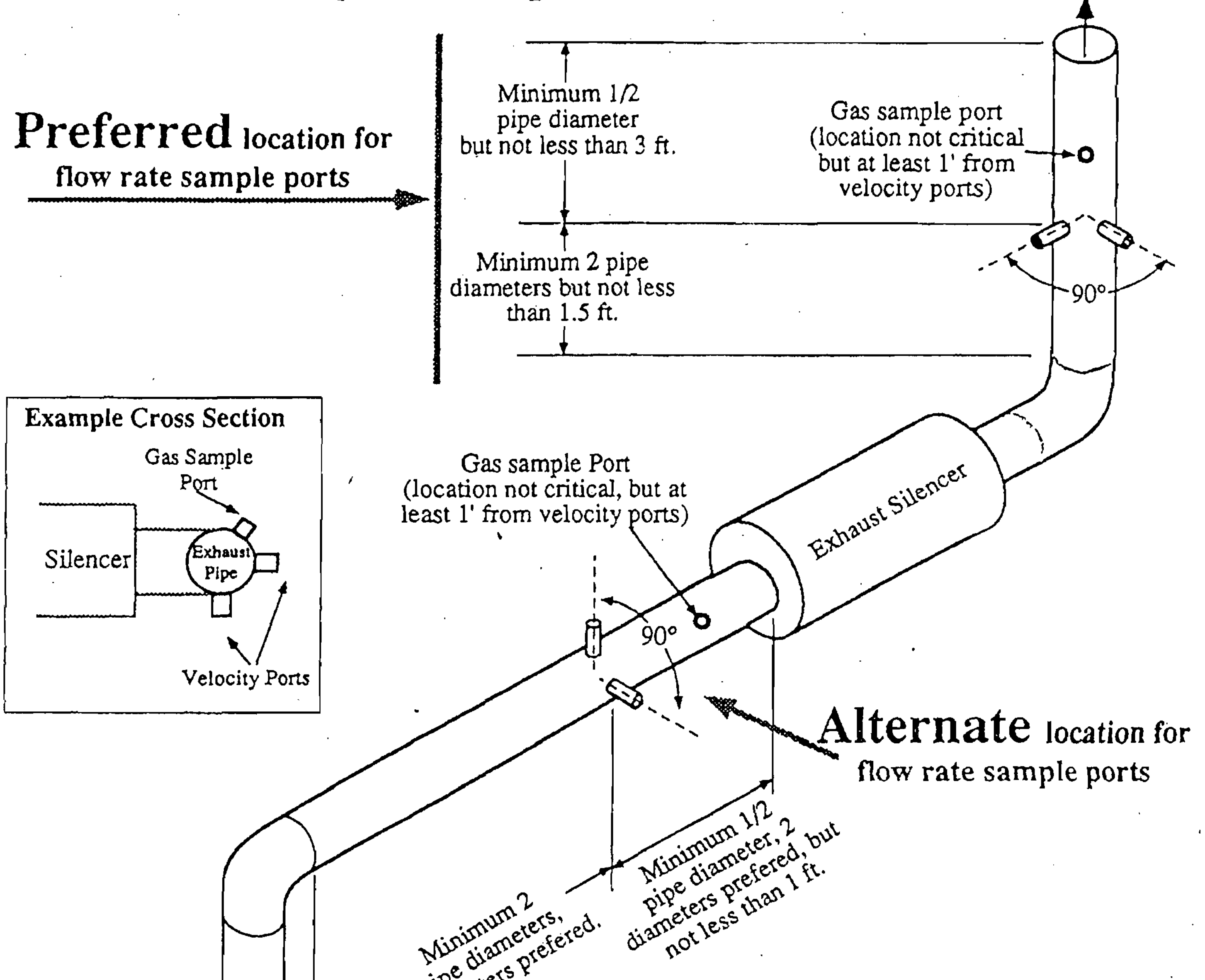
Port Location for Stoichiometric Flow Measurements
This method determines pollutant mass emission rates based on a fuel composition, the fuel flow, and a carbon balance or oxygen balance of the source. If this method is used, the location and size of a single port in the stack is not critical, if the sample is well-mixed and the location is out of the combustion zone. Accurate fuel flow and composition data must be available to use this method.

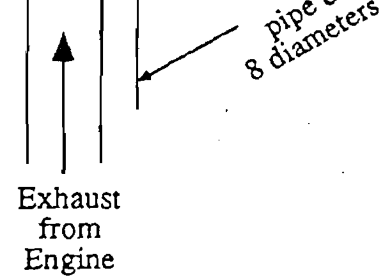
Port Construction
For larger stacks (i.e. 36" diameter and larger) and when manual sampling equipment is to be used (e.g. for particulate matter tests) ports should be constructed of 3" or 4" diameter pipe. The ports should be approximately 6 inches long and mounted flush with the inside wall. The pipe can be threaded with male NPT and closed with a pipe cap. The threads should be coated with high temperature anti-seize compound and the cap should be hand-tightened only. Alternately, a blind flange fitting may be used instead threaded pipe. If manual sampling equipment is to be used (i.e. for particulate matter tests), then hard monorail attach points must be provided 32" to 48" above each sample port. Four sample ports may be required if the stack diameter is greater than 8 ft..

For smaller stacks and vents (<36" diameter) that do not require the use of manual sampling equipment (i.e. particulate matter tests, etc.), the sample ports must be at least 1" diameter to allow insertion of pitot tube, sample probe, etc. These smaller ports may be constructed from a surface weld fitting and closed with a bull plug.

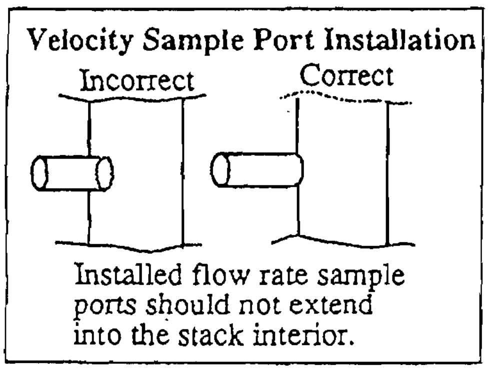
Cubix
Corporation

Engine Sample Port Locations





Choose either the "preferred" or "alternate" locations for installing sample ports, depending on which offers easier access. Ask Cubix for special instructions for engines with catalytic converters.



Flow rate sample ports (via pitot tube)
Sample ports may be constructed of a 1" collar or "threadolet" may be welded on the exhaust pipe and closed off with a bull plug. Alternately, use a 1" x 6" pipe nipple, closed with a pipe cap. Threaded connections should be made <u>hand tight only</u> and threads should be coated with a <u>high temperature anti-seize</u> compound. There should be no obstructions within 2 pipe diameters of the direction pointed by the port.

Gas sample ports (concentration measurements)
Gas sample ports may be constructed by welding a 1/2" to 1" collar or threadolet on the exhaust pipe and closing it off with a bull plug. The <u>location of these ports is not critical</u> provided a representative sample can be obtained. Flow rate sample ports may be used to collect gas samples but this will slow the testing process by interupting the concentration measurements.

Cubix Corporation

BEST AVAILABLE COPY

Post-it™ brand fax transmittal memo 7671	# of pages ›
To Bill Loeffler	From Bob Kriegel
Co. DARM	Co. NW Dist
Dept.	Phone # 436-8364
Fax # 7-292-6979	Fax #

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

EMISSION TEST PLAN

Quincy Compressor Station
Florida Gas Transmission Company

Sources: One Natural Gas Fired Compressor Engine, 2400 Hp, Cooper Bessemer, Model GMVR-12C2, Unit #6.

Location: 8 miles southwest of Quincy, Gadsden County, Florida

Applicable Permits and Regulations: Florida Department of Environmental Protection Permit No. AC 20-189438

Owner/Operator: Florida Gas Transmission Company
601 South Lake Destiny Drive
Maitland, Florida 32751
Attn: Allan Weatherford
(407) 875-5816 TEL
(407) 875-5896 FAX

Test Contractor: Cubix Corporation
9225 Lockhart Highway
Austin, Texas 78747
Attn: Rick J. Krenzke
(512) 243-0202 TEL
(512) 243-0222 FAX

Proposed Test Dates: July 28, 1993
This is the 3rd of 9 compressor stations tested along the pipeline during this project, so delays at prior test sites could affect the proposed test date.

Test Protocol

I) Test Matrix

RECEIVED
JUL 20 1993
Northwest Florida DEP.

A) Three test runs of 60-minutes each shall be conducted on one unit (#6) during which NOx, CO, and O_2 shall be continuously monitored.

B) One pitot tube traverse shall be conducted before each test run.

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- A) Fuel flow (if available)
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(as appropriate for the test methods listed above).

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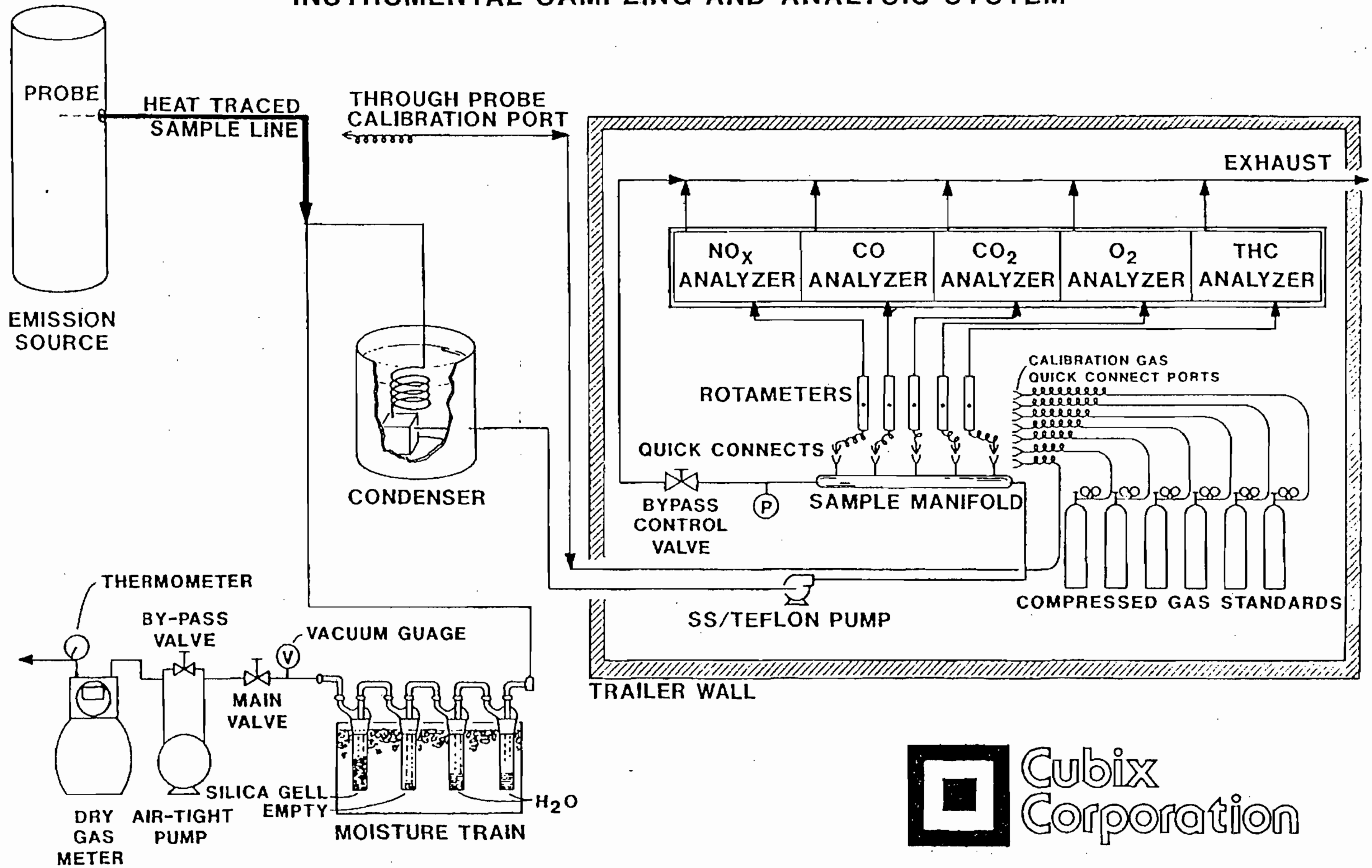

Cubix Corporation

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BEST AVAILABLE COPY

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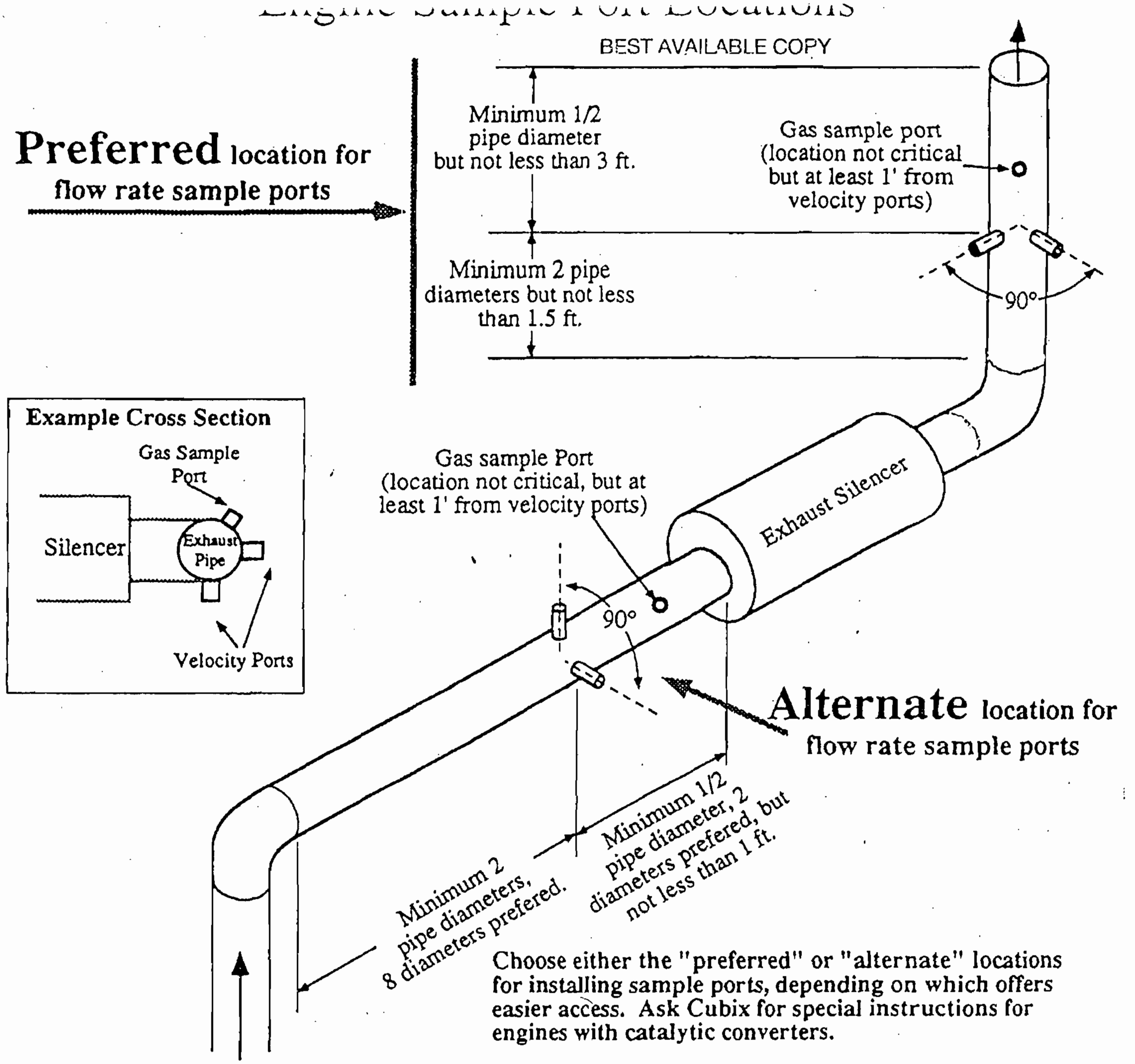
Cubix Corporation

Engine Sample Port Locations



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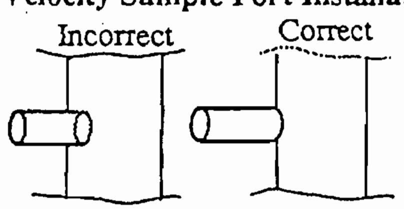
Velocity Sample Port Installation



Installed flow rate sample ports should not extend into the stack interior.

Gas sample ports (concentration measurements)
Gas sample ports may be constructed by welding a 1/2" to 1" collar or threadolet on the exhaust pipe and closing it off with a bull plug. The location of these ports is not critical provided a representative sample can be obtained. Flow rate sample ports may be used to collect gas samples but this will slow the testing process by interupting the concentration measurements.

Cubix Corporation

Construction Permits to Add Compressors

Built Oversize Compressors

No Testing — No OP Application —

Applied for operating permits

Never Amended AC — Loan At Utility Application for Amended AC — Filed Late

Orig CP Reqd test for NOx & CO — Not Passed

Challenge to test Method — ASP Granted

Caroline Robinson   406 547 2904

Austin Pickens

TO:	Mike Hewett TAL	(HEWETT_M)
TO:	Mike Harley TAL	(HARLEY_M)
TO:	John Brown TAL	(BROWN_J)
TO:	Jim Pennington TAL	(PENNINGTON_J)

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

This file contains all the attachments related to this correspondence.

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

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

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

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

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

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

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

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

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

Florida Department of Environmental Regulation

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

Lawton Chiles, Governor

Carol M. Browner, Secretary

February 12, 1993

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

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

Dear Mr. Weatherford:

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

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

Specific Condition No. 10:

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

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

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) in accordance with Section 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400. Petitions filed by the permit applicant and the parties listed below must be filed within

14 days of receipt of this intent. Petitions filed by other persons must be filed within 14 days of publication of the public notice or within 14 days of their receipt of this intent, whichever first occurs. Petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. Failure to file a petition within this time period shall constitute a waiver of any right such person may have to request an administrative determination (hearing) under Section 120.57, Florida Statutes.

The Petition shall contain the following information:

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

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

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

Sincerely,

Howard L. Rhodes

Howard L. Rhodes
Director
Division of Air Resources
Management

HLR/TH/plm

<u>Attachment to be Incorporated</u>:
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
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Florida Gas Transmission Company, Station 19
Melbourne, Brevard County, Florida

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

RECEIVED

DEC 17 1992

Division of Air
Resources Management

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

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 <u>25A,</u> thereafter, compliance with the VOC emission limits will be assumed, provided the CO allowable emission rate is achieved."

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

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

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

Sincerely,

Allan Weatherford

Allan Weatherford
Compliance Environmentalist

bc
aw1207cf

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

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 9, 1992

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

Re: Air Permit AC20-189438, AC57-188869 and AC67-189220.
Florida Gas Transmission Company - Station 14, 12, and 13, respectively.

Dear Mr. Weatherford:

This letter is in reference to your letter of February 25, 1992 regarding air emissions testing at the above referenced facilities.

The testing protocol submitted by the Cubix Corporation does not reflect the specific conditions for determing compliance as required in the above mentioned construction permits. Any deviations from the testing methods specified in the permit would require an alternate sampling procedures request, as outlined in F.A.C. 17-2.700(3). The utilization of EPA Methods 3A and 25A would require such a request.

The minimum sampling time for each test run shall be 60 minutes in accordance with 17-2.700(d)1a, unless a shorter time has been approved for the EPA test method, and is specified in 40 CFR 60, Appendix A.

In addition, the minimum period for opacity observations shall be 60 minutes, and three 60-minutes opacity observations for the purpose of demonstrating initial compliance is required as specified in 40 CFR 60.11(b).

If there are any additional questions, please call me at (904)488-1344 or write to me at the letterhead address.

Sincerely,

Syed Arif

Syed Arif
Compliance Engineer

SA:cjh

cc: Teresa Heron, Permit Engineer; Tallahassee
Rick Prusa, Permit Engineer; Pensacola

TEST REPORT
on
EXHAUST EMISSIONS
from a
COOPER BESSEMER GMVH 12 COMPRESSOR ENGINE
at
FLORIDA GAS TRANSMISSION'S
COMPRESSOR STATION NO. 14
QUINCY, GADSDEN COUNTY, FLORIDA

Prepared For

FLORIDA GAS TRANSMISSION COMPANY

April 1992

Prepared by

Cubix Corporation

9225 Lockhart Hwy., Austin, Texas 78747
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INTRODUCTION

One Cooper Bessemer GMVR 12 compressor engine was tested to determine the quantity of emissions released into the atmosphere. The tests were conducted on March 19, 1992 at Compressor Station No. 14 located near Quincy, in Gadsden 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 20-189438.

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

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

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

Florida Gas Transmission Co. | Cubix Corporation

Table 1
Background Data

Source Owner/Operator:	**Florida Gas Transmission Co.** 601 South Lake Destiny Drive Maitland, Florida 32751 (407) 875-5816 TEL (407) 875-5896 FAX Attn: Allan Weatherford
Testing Organization	**Cubix Corporation** 9225 Lockhart Hwy Austin, Texas 78747 (512) 243-0202 TEL (512) 243-0222 FAX Attn: Lowell Faulkner
Test Participants:	**Florida Gas Transmission Co.** Allan Weatherford Jerry Thomas Fred Griffin **Cooper Bessemer** Carl McCluney **Cubix Corporation** Lowell Faulkner Norman Franco Tony Sacre
Test Date:	March 19, 1992
Location:	near Quincy in Gadsden County, Florida
Process Description:	Cooper Bessemer compressor engine
Sampling Points:	Exhaust stack of compressor engine (See Appendix A)
Regulatory Application:	Florida Department of Environmental Regulation Permit No. AC 20-189438

<u>Required Test Methods:</u>	EPA Method 1 for traverse point layout EPA Method 2 for stack gas velocity EPA Method 3 for O_2 and CO_2 concentrations EPA Method 4 for moisture content EPA Method 7e for NOx concentrations EPA Method 9 for opacity observations EPA Method 10 for CO concentrations EPA Method 25 for VOC concentration ASTM D-3246 for indirect measurement of SO_2 emissions
<u>Alternate Test Methods:</u> (conducted for comparison purposes)	EPA Method 3a for CO_2 and O_2 concentrations Stoichiometric calculation of moisture content EPA Method 18 for VOC portion of THC concentration EPA Method 19 for calculation of stack flow rate EPA Method 25a for THC concentration AGA Carbon Balance Method for stack flow rate calculation

SUMMARY OF RESULTS

One Cooper Bessemer GMVR 12 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 19, 1992 at Compressor Station No. 14 located near Quincy, in Gadsden County, Florida. The purpose of these tests was to determine the compliance status of this engine with regard to the FDER permit.

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

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

The sulfur content of the fuel provided an indirect measurement of SO_2 emissions. The SO_2 emission rate is calculated from the total sulfur in the fuel and the fuel flow.

The average emissions over the three test runs for NOx were found to be 1.43 lbs/hr, 5.98 tons/yr, and 0.24 g/hp-hr. By comparison, permit limits are 10.6 lbs/hr, 46.3 tons/yr, and 2.0 g/hp-hr. CO emissions averaged 9.58 lbs/hr, 41.9 tons/yr, and 1.62 g/hp-hr and are limited by the permit to 11.1 lbs/hr, 48.7 tons/yr, and 2.1 g/hp-hr. The tons/yr emission rates are based on 8760 hrs/year operation of the engine.

The total sulfur content of the fuel was determined via laboratory analysis by Southern Petroleum Labs of Houston, Texas. The result of that analysis is contained in Appendix H and show that the fuel contained less than 0.059 grains/100 DSCF. The permit limits the sulfur content of the fuel to 10 grains/100 DSCF. The mass emission rate of SO_2 presented in Table 2 was calculated from the measured fuel flow to the engine assuming that all sulfur in the fuel was oxidized to SO_2. The SO_2 emission rate based on this calculation averaged <0.0016 lbs/hr or <0.007 tons/yr. The permit limits for SO_2 mass emissions are 0.46 lbs/hr and 2.0 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 5.44 lbs/hr, 23.8 tons/yr, and 0.92 g/hp-hr. The permit limits nonmethane hydrocarbon emissions to 2.6 lbs/hr, 11.6 tons/yr, and 0.5 g/hp-hr.

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

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

Examination of the data in Appendix I shows that the VOC emissions using the alternate methods averaged 2.26 lbs/hr (9.88 tons/yr and 0.38 g/hp-hr). When compared with the data obtained from Method 25, one can see that the CO_2 and moisture interferents may have biased the VOC concentrations high. In addition, the alternate methods are much less labor intensive, which eliminates a lot of the possibility of human error from the field or lab personnel.

Other alternate methods test results presented in Appendix I include the use of EPA Method 3a for O_2 and CO_2 concentrations rather than the Orsat procedure of EPA Method 3. Since turbulent, pulsating, engine exhaust can sometimes produce questionable flow rate results using a pitot tube, the exhaust flow rates were calculated stoichiometrically using two methods: (1) EPA Method 19 F-factors and (2) American Gas Association's

Carbon Balance Method. Appendix I contains data that compares the flow rate results using these methods with those using the pitot tube traverse techniques of EPA Methods 1-4. The moisture content was also calculated stoichiometrically and compared with that obtained using EPA Method 4.

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

Data showing the use of stoichiometric calculations for determination of stack flow rate (i.e. F-factors and carbon balance) as well as for the stack moisture content included in Appendix I demonstrates that alternate methods are in agreement with the pitot tube traverse technique. During all three test runs on this engine, the moisture content obtained from stoichiometric calculations showed agreement within 5% of that obtained using EPA Method 4. The flow rate determination using F-factors agreed with the pitot tube measurements within 15%, 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 additional 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 Quincy Compressor Station
Location	Gadsden County, Florida
Source	Cooper-Bessamer
Technicians	LF,TS,NF

Test Run No.	**C-1**	**C-2**	**C-3**
Date	3/19/92	3/19/92	3/19/92
Start Time	09:36	10:46	12:02
Stop Time	10:36	11:46	13:02
Engine/Compressor Operation			
Engine Speed (rpm)	329	329	328
Ignition Timing (°BTDC)	3	3	3
Air Manifold Pressure (psig)	13.5	14	14
Air Manifold Temperature (°F)	100	108	108
Fuel Flow (SCFH)	18900	18904	18960
Fuel Temperature (°F)	78	78	79
Fuel Manifold Pressure (psig)	47	47.5	48
Pre-Combustion Chamber Pressure (psig)	42	43.5	43.5
Loading Step (pockets open out of 15 total)	15	14	14
Suction Pressure (psig)	700	700	698
Suction Temperature (°F)	66	66	67
Discharge Pressure (psig)	937	918	918
Discharge Temperature (°F)	98	99	100
Engine Load (BHP)	2645	2710	2683
Torque (%)	98	101	99
Turbo Exhaust Temperature (°F)	511/639	514/647	516/647
Ambient Conditions			
Atmospheric Pressure (in. Hg)	29.65	29.64	29.64
Temperature (°F) : Dry bulb	71	76	79
(°F) Wet bulb	68	67	70
Humidity (lb/lb air)	0.0138	0.0120	0.0135
Measured Emissions			
NOx (ppmv)	16.8	21.6	21.8
CO (ppmv)	248	209	206
O2 via EPA Method 3 (vol %)	16.5	16.0	16.0
CO2 via EPA Method 3 (vol %)	3.0	3.0	3.0
VOC via EPA Method 25 (ppmv)	319.2	259.6	82.7
SO2 in fuel (grains/100 DSCF)	<0.059	<0.059	<0.059
Stack Volumetric Flow Rates			
via Pitot Tube (SCFH, dry)	6.01E+05	5.81E+05	6.06E+05
Calculated Emission Rates (via pitot tube)			
NOx (lbs/hr)	1.21	1.50	1.58
CO (lbs/hr)	10.83	8.83	9.07
VOC (lbs/hr)	7.97	6.27	2.08
SO2 (lbs/hr)	<0.0016	<0.0016	<0.0016
NOx (tons/yr)	5.28	6.57	6.91
CO (tons/yr)	47.4	38.7	39.7
VOC (tons/yr)	34.9	27.5	9.11
SO2 (tons/yr)	<0.0070	<0.0070	<0.0070
NOx (g/hp-hr)	0.21	0.25	0.27
CO (g/hp/hr)	1.86	1.48	1.53
VOC (g/hp-hr)	1.37	1.05	0.35

PROCESS DESCRIPTION

Florida Gas Transmission Co. owns and operates Compressor Station No. 14 located near Quincy, 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 GMVR 12 compressor engine. The engine is rated at 2700 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 NOx, CO, O_2, and CO_2 analyzers through glass and stainless steel rotameters that controlled the flow rate of the sample.

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

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

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

EPA Method 1 was used to determine the velocity traverse point locations. The stack diagram of Appendix A shows that the sample ports did meet the location criteria set forth by the method. The sample ports were located approximately 4-1/2 diameters downstream and 4 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 eight traverse points. The stack temperature was determined with a K-type thermocouple and digital thermometer. Cubix checked for cyclonic flow during the first test run and found that none existed.

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

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

Means, in addition to EPA Methods 1-4, were also employed to obtain the stack gas flow rate. The F-factor calculations of EPA Method 19 provided results that were approximately 15% higher than those obtained by the pitot tube measurement. AGA's carbon balance technique yielded results approximately 5% higher than those of EPA Methods 1-4. Both of these methods use stoichiometric relationships based on the measured fuel flow, fuel composition, and excess air concentration for calculation of the stack flow rates. The *Summary of Results* uses the pitot tube values in all calculations to be consistent with the permit provisions. However, the alternate methods provided for a check of the pitot tube traverse results.

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

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

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

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

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

The data presented in *Summary of Results* reflects the VOC measurements taken using this technique.

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

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

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

One fuel sample was taken at this compressor station and analyzed via ASTM D-3246 to determine the total sulfur content of the fuel. By assuming that all of the sulfur in the fuel was oxidized to SO_2, the SO_2 mass emission rate can be calculated from the fuel flow to the engine. The fuel analysis was conducted by Southern Petroleum Labs of Houston, Texas and a copy of that report is contained in Appendix H.

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

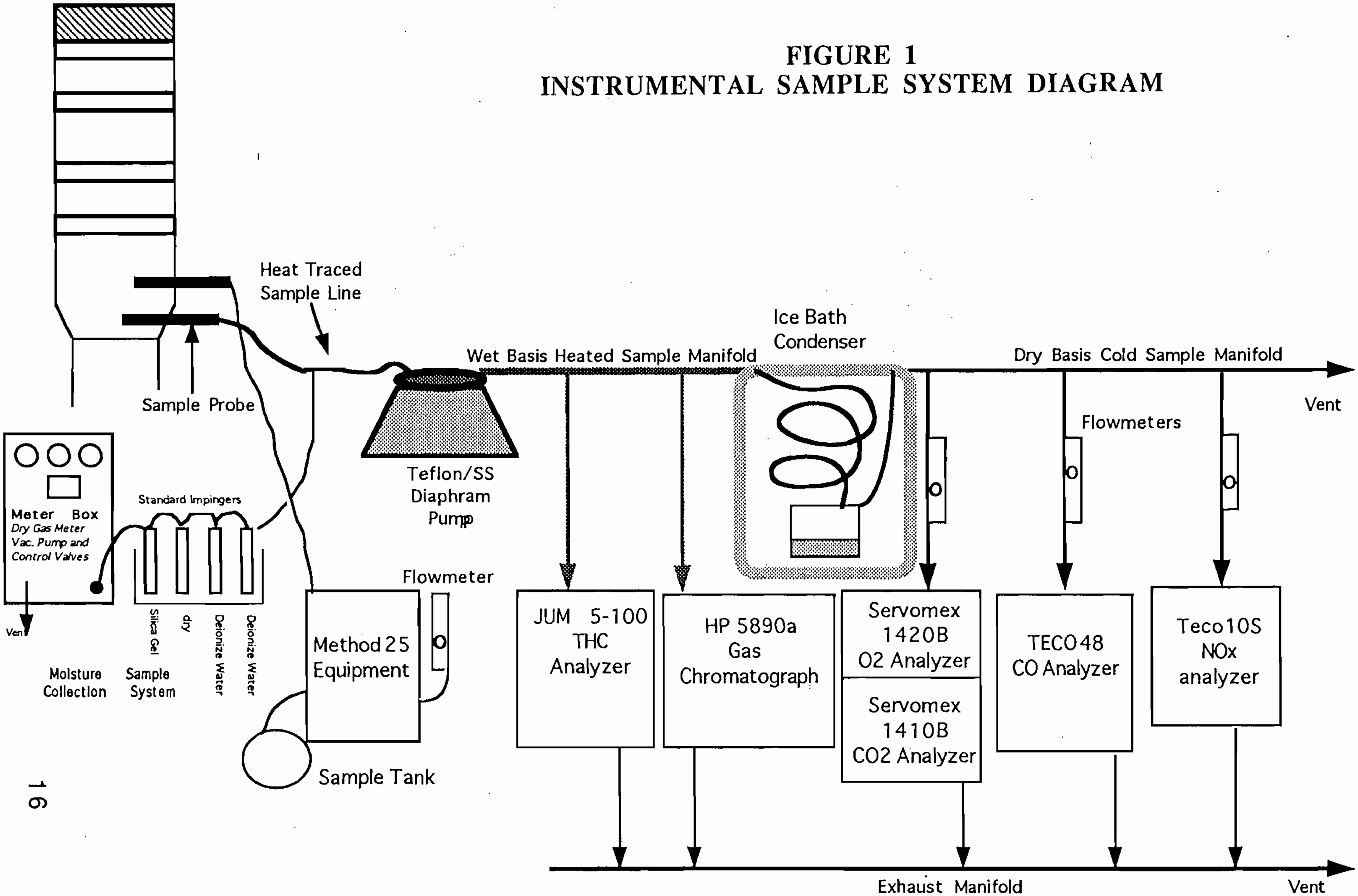
During the tests, the engine and compressor operational data was collected by Florida Gas personnel and is presented in Appendix A. Key operational data collected include compressor discharge pressures, compressor suction pressures, engine manifold pressure, engine speed, timing, and horsepower. Florida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

TABLE 3
ANALYTICAL INSTRUMENTATION

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

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

FIGURE 1
INSTRUMENTAL SAMPLE SYSTEM DIAGRAM



QUALITY ASSURANCE ACTIVITIES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The observer for the opacity measurements was certified by the Texas Air Control Board. 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

Circular Stack Sampling Traverse Point Layout
(EPA Method 1)

Date: 3-19-92

Plant: Florida Gas / Quincy Station

Source: Cooper Bessemer

Technician(s) LF, NF, TS

Port + Stack ID: 30.5 in.

Port Extension 7.0 in.

Stack ID: 23.5 in.

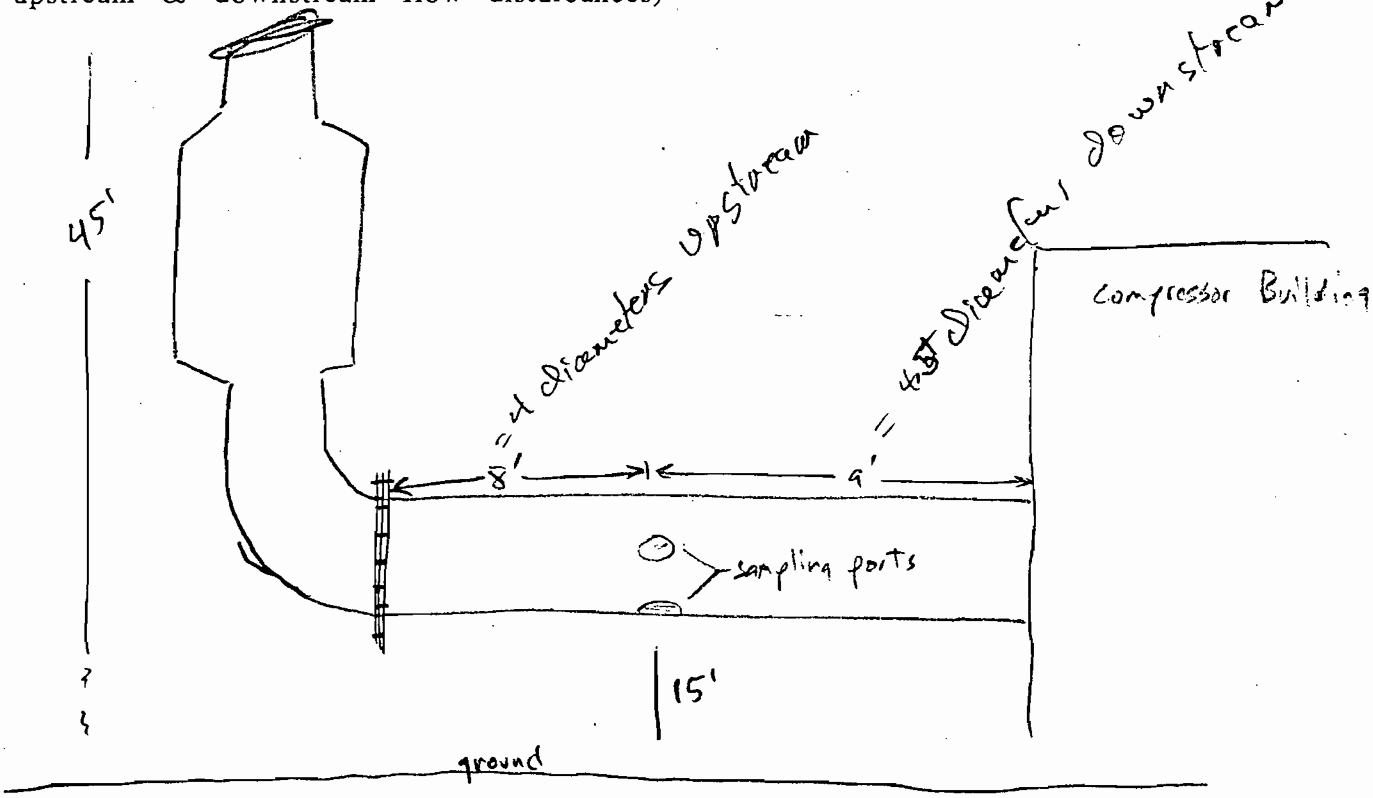
Stack Area 3.012 ft^2

Total Req'd Traverse Pts. 8

No. of Traverse Pts. 4 /diam.

No. of Traverse Pts. 4 /port

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



Traverse Point Number	Length Factor (% of diameter) Number of traverse pts./diameter 4	6	8	12	Distance from Reference Point (inches)
1	6.7	4.4	3.2	2.1	8.575
2	25.0	14.6	10.5	8.2	12.875
3	75.0	29.6	19.4	11.8	24.625
4	93.3	70.4	32.3	17.7	28.925
5		85.4	67.7	25.0	
6		95.6	80.6	35.6	
7			89.5	64.4	
8			96.8	75.0	
9				82.3	
10				88.2	
11				93.3	
12				97.9	

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3-19-92	Dry Gas Meter ID: Anderson / Isgur
Plant/Operator: FGT Quincy	Dry Gas Meter Factor: .9904 (Kd)
Source: Cooper Engine	Pitot Tube #/Type: S-type #107
Technicians: LK TS WA	Pitot Tube Factor: .84 (Kp)
Atm. Pres. 29.65 in.Hg(Pb)	Static Pres. -.10 in.H2O(Pg)
Test Run # C-1	Average Stack Temp. 510 °F(Ts)

Pre-test Leak check OK	0.0 ft.3/min at 21 in. Hg Vacuum
Post-test Leak check OK	0.0 ft.3/min at 15 in. Hg Vacuum

Impinger #	Contents	Initial Weight	Final Weight
1	H_2O	645.2	653.2
2	H_2O	542.3	549.2
3	MT	492.0	493.8
4	Silica	730.2	739.5
5			
6			
Totals			

Moisture Train

	Initial	Final
Time:	9:40	10:25
Meter Reading (ft3 or L)	571.346	593.848
Meter Temp. (°F)	98	116
Sample Box #	Tr 7 box	

Orsat

O2 %	16.5
CO2 %	3.0

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	ΔP (" H2O)	°F	ß	ΔP (" H2O)	°F	ß
1	2.4			1.8		
2	2.5			2.1		
3	1.9			1.8		
4	1.9			1.7		
5						
6						
7						
8						
9						
10						
11						
12						

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3-19-92
Plant/Operator: FGT Quincy
Source: Cooper Engine
Technicians: LF TS NF
Atm. Pres. 29.64 in.Hg(Pb)
Test Run # C-2

Dry Gas Meter ID: Anderson/ 1Sgrw
Dry Gas Meter Factor: .9904 (Kd)
Pitot Tube #/Type: #107 S-type
Pitot Tube Factor: .84 (Kp)
Static Pres. -.16 in.H2O(Pg)
Average Stack Temp. 504 °F(Ts)

		Impinger #	Contents	Initial Weight	Final Weight
Pre-test Leak check OK	0.0 ft.3/min at 21 in. Hg Vacuum	1	H_2O	653.2	671.6
		2	H_2O	549.2	546.7
Post-test Leak check OK	0.0 ft.3/min at 19 in. Hg Vacuum	3	MT	493.8	493.3
		4	Silica Gel	739.5	748.0
		5			
		6			
		Totals			

Moisture Train

	Initial	Final
Time:	1052	1140
Meter Reading (ft3 or L)	594.017	615.354
Meter Temp. (°F)	110	120
Sample Box #	Tp 7 Box	

Orsat

O2 %	16.8
CO2 %	3.0

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	ΔP (" H2O)	°F	ß	ΔP (" H2O)	°F	ß
1	1.7			2.2		
2	1.7			1.7		
3	2.2			1.9		
4	1.6			1.8		
5						
6						
7						
8						
9						
10						
11						
12						

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3-19-92
Plant/Operator: Florida Gas / Quincy St.
Source: Cooper Bessemer /140 W
Technicians: LF NF TS
Atm. Pres. 29.64 in.Hg(Pb)
Test Run # C-3

Dry Gas Meter ID: TSgvr
Dry Gas Meter Factor: 0.9904 (Kd)
Pitot Tube #/Type: S-Type
Pitot Tube Factor: 0.84 (Kp)
Static Pres. -0.10 in.H2O(Pg)
Average Stack Temp. 509 °F(Ts)

Pre-test Leak check c/a	0.000 ft.3/min at 20.0 in. Hg Vacuum
Post-test Leak check O/a	0.0 ft.3/min at 18" in. Hg Vacuum

Impinger #	Contents	Initial Weight	Final Weight
1	H_2O	471.6	492.8
2	H_2O	546.7	548.2
3	MT	493.3	499.3
4	Si Gel	748.0	751.7
5			
6			
Totals	X		

Moisture Train

	Initial	Final
Time:	11:50	12:55
Meter Reading (ft3 or L)	615.515	641.380
Meter Temp. (°F)	110	120
Sample Box #	Trn 7 Bon	

Orsat

O2 %	16.00
CO2 %	3.00

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	ΔP (" H2O)	°F	ß	ΔP (" H2O)	°F	ß
1	1.8			1.9		
2	1.8			1.8		
3	2.2			2.3		
4	2.1			2.4		
5						
6						
7						
8						
9						
10						
11						
12						

Operator/Plant Florida Gas Quincy Compressor Station
Location Gadsden County, Florida
Source Cooper-Bessamer
Technicians LF,TS,NF

Test Run No.	C-1	C-2	C-3
Stack Moisture & Molecular Wt. via EPA Method 4			
CO2 (%)	3.00	3.00	3.00
O2 (%)	16.50	16.00	16.00
Beginning Meter Reading (ft3)	571.346	594.017	615.515
Ending Meter Reading (ft3)	593.848	615.354	641.380
Beginning Impinger Wt (g)	2409.7	2435.7	2459.6
Ending Impinger Wt. (g)	2435.7	2459.6	2490
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	98	110	110
Dry Gas Meter Temperature (°F end)	116	120	120
Atmospheric Pressure (in Hg, abs.)	29.65	29.64	29.64
Stack Gas Moisture (% volume)	5.63	5.54	5.80
Dry Gas Fraction	0.944	0.945	0.942
Stack Gas Molecular Wt. (lbs/lb-mole)	28.51	28.50	28.48
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	2.40	1.70	1.80
ΔP #2	2.50	1.70	1.80
ΔP #3	1.90	2.20	2.20
ΔP #4	1.90	1.60	2.10
ΔP #5	1.80	2.20	1.90
ΔP #6	2.10	1.90	1.80
ΔP #7	1.80	1.90	2.36
ΔP #8	1.70	1.80	2.40
Sum of Square Root of ΔP's	11.3	10.9	11.4
Number of Traverse Points	8	8	8
Average Square Root of ΔP's	1.42	1.37	1.43
Average Temperature (°F)	510	509	509
Static Pressure (in. H2O)	-0.1	-0.15	-0.1
Stack Diameter (in.)	23.5	23.5	23.5
Stack Area (ft2)	3.01	3.01	3.01
Stack Velocity (ft/min)	6533	6309	6591
Stack Flow,wet (ACFM)	19677	19004	19853
Stack Flow,dry (SCFH)	6.01E+05	5.81E+05	6.06E+05

Volatile Organic Carbon by Method 25

Client:	FGT	Project #:	
Plant:	Quincy, Station	Sample Location:	~~[illegible]~~ Centroid
Operator:	LP, NF, TS	Date:	3/19/92
Run Number:	C-1	Sample ID:	C-1
Tank Number:	4T/49	Trap Number:	~~#1~~ C-3 X1 broke while assem.
Sampling Train ID#:	Model EX25	% CO2:	3.0
Side: Left / Right:	#1	% H2O:	~~5~~ 6
Start Time:	9:00	Stop Time:	100

Pressure Readings	Tank Vacuum Manometer mm Hg / in Hg	Tank Vacuum Gauge mm Hg / in Hg	Barometric Pressure mm Hg / in Hg	Ambient Temperature C/F
Pre Test	27.9	28.2	29.67	65
Post Test	1.0	2.5	29.65	70

Leak Rate	Tank* (in Hg) Allowable	Tank* (in Hg) Actual	Trap black ball reading
Pre Test	0.59	0.3	0
Post Test	0.59	0.1	0

$\Delta P = .01 \dfrac{F\,Pb\,\varnothing}{Vt}$

$\dfrac{.01(40)(29.67)(5)}{100}$

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

Clock Time	Gauge Vacuum (in Hg)	Flowmeter Setting (silver ball)	Probe Temp C/F	Filter Temp C/F	Notes
9:00	28.2	40	265	250	
905	27.2	40	262	253	
910	25.0	40	264	257	
915	23.8	40	265	254	
920	20.5	38	266	255	
925	18.2	39	267	254	
930	15.3	39	267	255	
935	13.0	39	268	256	
940	11.2	39	267	256	
945	9.3	40	267	255	
950	7.0	40	268	255	
955	5.1	40	267	254	
1000	2.5	40	267	255	

Client:	~~Quincy, F~~ Florida Gas Trans	Project #:	
Plant:	Quincy, Fl	Sample Location:	Centroid
Operator:	LF/NFTS	Date:	3/19/92
Run Number:	C-2	Sample ID:	C-2
Tank Number:	4T210	Trap Number:	No. 20
Sampling Train ID#:	SX25	% CO2:	3.0
Side: Left / Right:	#1	% H2O:	~~8~~ 6
Start Time:	1020	Stop Time:	1120

Pressure Readings	Tank Vacuum Manometer mm Hg / in Hg	Tank Vacuum Gauge mm Hg / in Hg	Barometric Pressure mm Hg / in Hg	Ambient Temperature C / F
Pre Test	27.9	27.2	29.65	70
Post Test	5.1	4.9	29.64	72

Leak Rate	Tank* (in Hg) Allowable	Tank* (in Hg) Actual	Trap black ball reading
Pre Test	0.59	0.0	0
Post Test	0.57	0.0	0

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

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

Clock Time	Gauge Vacuum (in Hg)	Flowmeter Setting (silver ball)	Probe Temp C / F	Filter Temp C / F	Notes
1020	27.2	40	267	255	
1025	26.3	40	268	256	
1030	25.1	40	266	255	
1035	23.4	40	267	254	
1040	20.2	40	267	253	
1045	18.0	40	268	254	
1050	16.2	39	267	255	
1055	14.5	40	268	255	
1100	12.0	40	270	256	
1105	10.1	39	270	257	
1110	8.0	39	264	257	
1115	5.9	40	268	256	
1120	4.9	35	267	255	

Volatile Organic Carbon by Method 25

Client:	Florida Gas Trans	Project #:	
Plant:	Quincy, Fl	Sample Location:	Centroid
Operator:	LF, NF, TS	Date:	3/19/92
Run Number:	C-3	Sample ID:	C-3
Tank Number:	4T177	Trap Number:	No 2
Sampling Train ID#:	BX 28	% CO2:	3.0
Side: Left / Right:	#1	% H2O:	6
Start Time:	1135	Stop Time:	1235

Pressure Readings	Tank Vacuum Manometer mm Hg / in Hg	Tank Vacuum Gauge mm Hg / in Hg	Barometric Pressure mm Hg / in Hg	Ambient Temperature C / F
Pre Test	28.0	28.2	29.66	75
Post Test	4.0	3.9	29.	~~[illegible]~~ 78

Leak Rate	Tank* (in Hg) Allowable	Tank* (in Hg) Actual	Trap black ball reading
Pre Test	0.59	0.0	0
Post Test	0.59	0.0	0

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

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

Clock Time	Gauge Vacuum (in Hg)	Flowmeter Setting (silver ball)	Probe Temp C / F	Filter Temp C / F	Notes
1135	28.2	40	267	255	
1140	27.1	39.5	268	255	
1145	24.8	40	267	255	
1150	21.2	40	268	256	
1155	19.4	40	269	256	
1200	17.0	40	269	255	
1205	15.0	40	268	256	
1210	13.0	40	268	255	
1215	10.7	40	267	255	
1220	9.1	40	268	256	
1225	7.2	40	267	255	
1230	5.1	35	267	255	
1235	3.9	40	268	254	

4337

CHAIN OF CUSTODY RECORD

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

SAMPLERS: (Signature) Joseph Rudyk

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

LAB 4/2

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
	4/1/92 1:42	Tom Grossan			
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:

CAE
500 W. Wood Street

4335

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME	NO. OF CON-TAINERS	CO_2 BLANK VALUE (ppmv)						REMARKS
DEPT. NO. 8151	Cubix Corp								
SAMPLERS: (Signature)	Joseph Rudyk								

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	CO_2 BLANK VALUE (ppmv)						REMARKS
→	C-2	3/20/92	1000	Trap # X13 ? Brooker		1.8						Perry - Fla. GAS ✓
				X14		0.9						
				X16		2.3						
	Audit-1	3/26/92		X23		2.6						Melbourne
				X27		1.8						
				X28		8.0						
	C-3	3/24/92	1100	X32		3.3						Melbourne - Fla. GAS ✓
	C-1	3/24/92	1000	X48		9.0						Silver Springs - Fla. GAS ✓
	C-4	3/27/92		X4		2.3						Melbourne
	C-3	3/19/92	1135	N2		5.6						Quincy - Fla. GAS ✓
	C-3	3/24/92	1310	N4		3.0						Silver Spring - Fla. GAS ✓
				N7		2.1						
	C-6	3/27/92		N8		2.6						Melbourne
	C-1	3/17/92	1425	N15		8.7						Munson - Fla GAS ✓
	C4	3/18/92	1100	N19		3.0						Caryville - Fla GAS ✓

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[signature]	4/1/92 1:42	[signature] LAB 4/2			
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:

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

4334

CHAIN OF CUSTODY RECORD

PROJ. NO.

DEPT. NO. 8151

PROJECT NAME: Cubix Corp.

SAMPLERS: (Signature) Joseph Rudyk

NO. OF CONTAINERS

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	CO2 BLANK VALUE (ppmv)					REMARKS
	C-1	3/20/92	830	Trap # B35		3.0					Melbourne - Fla. GAS
	C-2	3/7/92	1530	B53		4.5					MUNSON - Fla. GAS
	C-5	3/27/92		B233		1.3					Melbourne
	C-2	3/24/92	1130	C1		2.4					Silver Springs - Fla. GAS
	~~C-1~~	~~3/19/92~~	~~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			C15		3.6					Brooker
	C-2	3/26/92	955	C37		0.8					Melbourne - Fla. GAS
	C-2	3/18	1300	R002		4.3					Coating with C-PG
				R004		1.2					
				R008		2.5					
				X1		2.6					
	C-1	3/20/92	830	X10		2.5					Perry - Fla. GAS

LAB 4/2

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

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

4336

CHAIN OF CUSTODY RECORD

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

SAMPLERS: (Signature) [signature] Joseph Rudyk

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CON-TAINERS	CO_2 BLANK value (ppmvc)	NMHC BLANK value (ppmvc)				REMARKS
	~~C-2~~	~~3/16/92~~	~~1020~~	~~Trap # N20~~		~~1.9~~					~~Quincy - Fla - GAS~~ ✓
	C-3	3/18/92	1325	N21		1.8					~~Caryville - Fla. GAS~~ ✓
				YWR		0.9					
	C-2	3/18/92	1210	Tank # 4T19			0.0				Caryville - Fla GAS ✓
	C-3	3/18/92	1325	4T22			0.0				Caryville - Fla GAS ✓
				4T29			1.8				
	C-3	3/26/92	1100	4T41			2.1				Melbourne - Fla. GAS ✓
				4T66			0.1				
				4T71			0.0				
	C-2	3/24/92	1330	4T80			0.6				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 4/2			0.5				Melbourne - Fla. GAS.

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

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

4558

CHAIN OF CUSTODY RECORD

BEST AVAILABLE COPY

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

SAMPLERS: (Signature) [signature] Joseph Rudyk

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	NHHC BLANK Value (ppmv)						REMARKS
				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						Garyville Fla. GAS ✓
	C-3	3/17/92	1643	4T254		0.1						MUNSON - Fla. GAS ✓

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
[signature]	4/1/92 1:42	LAB 412 Tom Groffen			
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:

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

WHITE-PRINT FILE COPY YELLOW-RECORD FILE COPY PINK- RETAIN COPY GOLD-CUSTOMER COPY

Table of Carbon Concentration for Method 25.
Samples collected by Cubix Corp. at Florida
Gas & Trans on 3/19/92 and reported on 4/30/92.

		Carbon Concentration			
Source	Sample - Run ID #	Total (Mc) (mg/dscm)	Total (C) (ppmv)	Condensible (Ccm) (ppmv)	Noncondensible (Ctm) (ppmv)
QUINCY STATION	C-1	159.4	319.2	247.8	71.5
	C-2	129.6	259.6	193.6	65.9
	C-3	41.3	82.7	15.1	67.7

Compiled By: Arifred Jbey On: 5-1-92

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

Job No. 8160		Plant: Florida Gas & Trans.	
Client Cubix		Sample Loc. Quincy Station	
Disk/File 8160Q		(In/Out) Centroid	
Page No. 2		Date 3/19/92	

Preliminary Data			
Run No.	C-1	C-2	C-3
Tank No.	4T149	4T210	4T177
Trap No.	C3	NO 20	NO 2
Tank Volume V(cc)	4032	3978	3964
Field Data			
PTI (mm Hg)	-709	-708	-711
TTI (F)	65	70	75
PbI (mm Hg)	754	753	753
PT (mm Hg)	-25	-129	-127
TT (F)	70	72	78
Pb (mm Hg)	754	753	753
Noncondensible Organics			
PT(Lab) (mm Hg)	-96	-128	-118
TT(Lab) (F)	76	77	77
Pb(Lab) (mm Hg)	747	747	746
PTF (mm Hg)	920	920	920
TTF (F)	76	77	77
PbF (mm Hg)	747	747	746
Ba (ppmv C)	0.9	0.7	1.1
Ctm 1 (ppmv C)	30.8	25.0	23.9
Ctm 2 (ppmv C)	30.9	22.8	26.6
Ctm 3 (ppmv C)	29.9	23.6	23.8
Avg. Ctm (ppmv C)	30.5	23.8	24.8
RSD Ctm (%)	1.8	4.7	6.4
Condensible Organics			
ICV Tank No.	4T155	4T215	4T227
ICV Tank, Vv (cc)	4034	3994	4265
PFI (mm Hg)	-736	-738	-736
TFI (F)	76	77	77
PbFI (mm Hg)	747	747	746
PF (mm Hg)	920	920	920
TF (F)	76	77	77
PbFf (mm Hg)	747	747	746
Bt (ppmv C)	3.5	1.9	5.6
Ccm 1 (ppmv C)	105.6	70.8	10.1
Ccm 2 (ppmv C)	104.8	67.6	10.4
Ccm 3 (ppmv C)	108.2	70.1	11.0
Avg. Ccm (ppmv C)	106.2	69.5	10.5
RSD Ccm (%)	1.7	2.4	4.4
Total Gaseous Nonmethane Organics (TGNMO)			
Vs (cc)	3614	3008	2990
Dil. Factor (Non)	2.411	2.853	2.859
Dil. Factor (Con)	2.413	2.865	3.076
Ct (ppmv C)	71.5	65.9	67.7
Cc (ppmv C)	247.8	193.6	15.1
Ct+Cc= C (ppmv C)	319.2	259.6	82.7
Mc (mg C/dscm)	159.4	129.6	41.3

OAE

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DATE 3-19-92
UNIT NO. 1806

ENGINE/COMPRESSOR PERFORMANCE
EMISSION & PERFORMANCE TEST FORM

STATION Quincy-14
STA. EL.

	10 AM	11AM	12:15	TEST NO.				
POWER END ANALYSIS	1st	2nd	3rd	4				
ENGINE SPEED - RPM	329	329	328	330				
IGN. TIMING - BTDC	3°	3°	3°	3				
AMP - PSIG / "Hg	13.5	14	14	12.1				
AMT - F	100	108°	108°	110				
~~FUEL STATIC PR. - PSIG~~	74	74	74	74				
~~FUEL DIFF. - "H2O~~	46"	49"	48"	41"				
~~FUEL TEMP. - F~~	78°	78°	79°	81°				
FMP - PSIG	47	47.5	48	43.5				
FUEL FLOW - SCFH		18904	18960	17,638				
AMBIENT TEMP. - F		76°	79°	84°				
~~O2 - %~~ PCC - psig	42	43.5	43.5	39.4				
CO - ppm								
CO2 - %								
NO - ppm								
NO2 - ppm								
THC - (ppmv as C1)								

COMPRESSOR END ANALYSIS								
LOADING STEP 18 step total # pockets open	15	14	14	16				
SUCTION PRESSURE - PSIG	700	700	698	698				
SUCTION TEMP. - F	66	66	67	67				
DISCHARGE PRESSURE-PSIG	939	918	918	915				
DISCHARGE TEMP. - F	98	99	100	104				
COMPRESSOR FLOW - MMCFD								
TESTED BHP	2695	2710	2683	2480				
TESTED TORQUE - %	98%	101%	99%	92				
~~SFC - BTU/BHP-HR~~								

Turbo exhaust 511 514 516 525

1.0" ORIFICE

Ser # - 48489 639 647 ~~649~~ 645

APPENDIX B:
EXAMPLE CALCULATIONS

MOISTURE CONTENT
refers to test run C-1

V_1 = initial dry gas meter reading = 571.346 ft^3
V_2 = final dry gas meter reading = 593.848 ft^3
V_{net} = total gas sample volume collected (ft^3)
= V_2-V_1
= 593.848 - 571.346 = 22.502 ft^3

M_1 = initial weight of impinger train = 2409.7 g
M_2 = final weight of impinger train = 2435.7 g

MWC = total weight gain of all impingers (g)
= M_2 - M_1 = 2414.0 - 2385.7
= 26 g

K_d = dry gas meter factor (unitless) = 0.9904

$V_{corrected}$ = V_{net} x K_d = x
= 22.502 x 0.9904 = 22.29 ft^3

1.335 liters weighs 1 gram at standard conditions
499.4 = Gas constant
P_{bar} = barometric pressure (in Hg) = 29.65
T = temperature of gas DGM (F°) = 107.0

F_w = moisture fraction by volume

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

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

$$= \frac{(26 \times 1.335)}{(26 \times 1.335) + (((22.29 \times 29.65) / (107 + 460)) \times 499.4)}$$

= 0.0563 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 = 3.0(from Orsat
C_{O_2} = concentration of O_2 = 16.5(from Orsat)
C_{N_2} = concentration of N_2 = $1-(C_{CO_2}+C_{O_2})$ = 0..805
Fw = moisture fraction = 0.0563
F_d = dry gas fraction = 1 - Fw = 0.9437

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

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

$$= (18 \times 0.0563) + (0.9437 \times ((44 \times 0.03) + (32 \times 0.165) + (28 \times 0.805)))$$

$$= 28.51 \text{ lb/lb-mole}$$

STACK GAS VELOCITY AND FLOW RATE

refers to test run C-1

K_p = pitot tube factor = .84
ΔP = pressure difference in stack as measured (in. H_2O)
$(\sqrt{\Delta P})avg$ = average of square root of ΔP's = 1.4154
T_s = stack temperature = 510 F° = 970 R°
P_b = atmospheric pressure (in Hg) = 29.65
P_g = stack static pressure (in. H_2O) = -0.10
Ps = absolute stack pressure
= P_b + (Pg x .0735 in.Hg / in.H_2O) = 29.64 in. Hg

V = stack velocity (ft/min)

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

= 5128.8 x .84 x 1.4154 x $\sqrt{(970/ (29.64 \times 28.43)}$
= 6540 ft/min

Q_a = stack flow rate (ft^3/min)
= V x A , where A= area of stack = 3.01 ft^2
= 6540 x 3.01 = 19,700 ft^3/min

Qd= stack flow rate on dry basis at standard conditions (SCFH)
= Q_a x 1059 x (Ps / Ts) x Fd
= 19,700 x 1059 x (29.64/ 970) x 0.9437
= 6.01x 10^5 SCFH

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

Q_f = fuel flow = 18900 SCF/hr
F_{BTU} = heating value of gas = 1029 BTU/SCF
F = O_2 F factor = 8637 SCF/MMBTU
C_{O2} = concentration of O_2 = 15.95 %(from analyzer)

Q_d = stack flow rate on dry basis at standard conditions (SCFH)
$= Q_f \times F_{BTU} \times 10^{-6} \times F \times 20.9 / (20.9 - C_{O2})$
$= 18900 \times 1029 \times 10^{-6} \times 8637 \times 20.9 / (20.9 - 15.95)$
$= 7.09 \times 10^5$ SCFH

With CO2 F-factor (i.e. F=1029), same calculation is used except for final term......
$Q_d = Q_f \times F_{BTU} \times 10^{-6} \times F \times 100/C_{CO2}$
$= 18900 \times 1029 \times 10^{-6} \times 1024 \times 100/2.92$
$= 6.82 \times 10^5$ SCFH

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

MASS EMISSION RATES

refers to test run C-1 at Quincy Station

NOx = concentration of NOx (uncorrected)= 16.8 ppmv
CO = observed concentration of CO = 248 ppmv
VOC = observed concentration via EPA Method 25 and 18
= 114.9 ppmv
1 SCF NOx = 11.94×10^{-8} lbs
1 SCF CO = 7.26×10^{-8} lbs
1 SCF C1(methane) = 4.15×10^{-8} lbs
Qd = stack flow rate = 6.00×10^{5} SCFH
E_{NOx} = mass emission rate of NOx (lb/hr)
$= NOx \times Qd \times 11.94 \times 10^{-8}$
$E_{NOx} = 16.8 \times 6.01 \times 10^{5} \times 11.94 \times 10^{-8}$

E_{NOx}= 1.2 lb/hr
E_{CO} = 10.8 lb/hr
E_{VOC}= 2.87 lb/hr

HP = engine horsepower = 2645 hp
454 g = 1.0 lb

E_{NOx} (g/hp-hr)= $E_{NOx} \times 454 / HP$
= $1.2 \times 454 / 2645$
E_{NOx} (g/hp-hr)= 0.21 g/hp-hr
E_{CO} (g/hp-hr)= 1.86 g/hp-hr
E_{VOC} (g/hp-hr)= 0.49 g/hp-hr

Stack Gas Flow Rate via AGA Carbon Balance Method

Refers to Test Run #C-1

Q_f = estimated fuel flow = 18900 SCF/hr

Cf = carbon content of fuel (from fuel analysis) = 1.03

Ce = exhaust gas carbon content

= CO + THC (as C1) + CO2

= (248 + 1560) / 10000 + 2.92 = 3.1 %

Q = stack flow rate

= Qf x Cf x 100 / Ce

= 18900 x 1.03 x 100 / 3.1

= 6.28×10^5 SCFH

SO2 Emission Rate from Fuel Analysis

Refers to Test Run #C-1

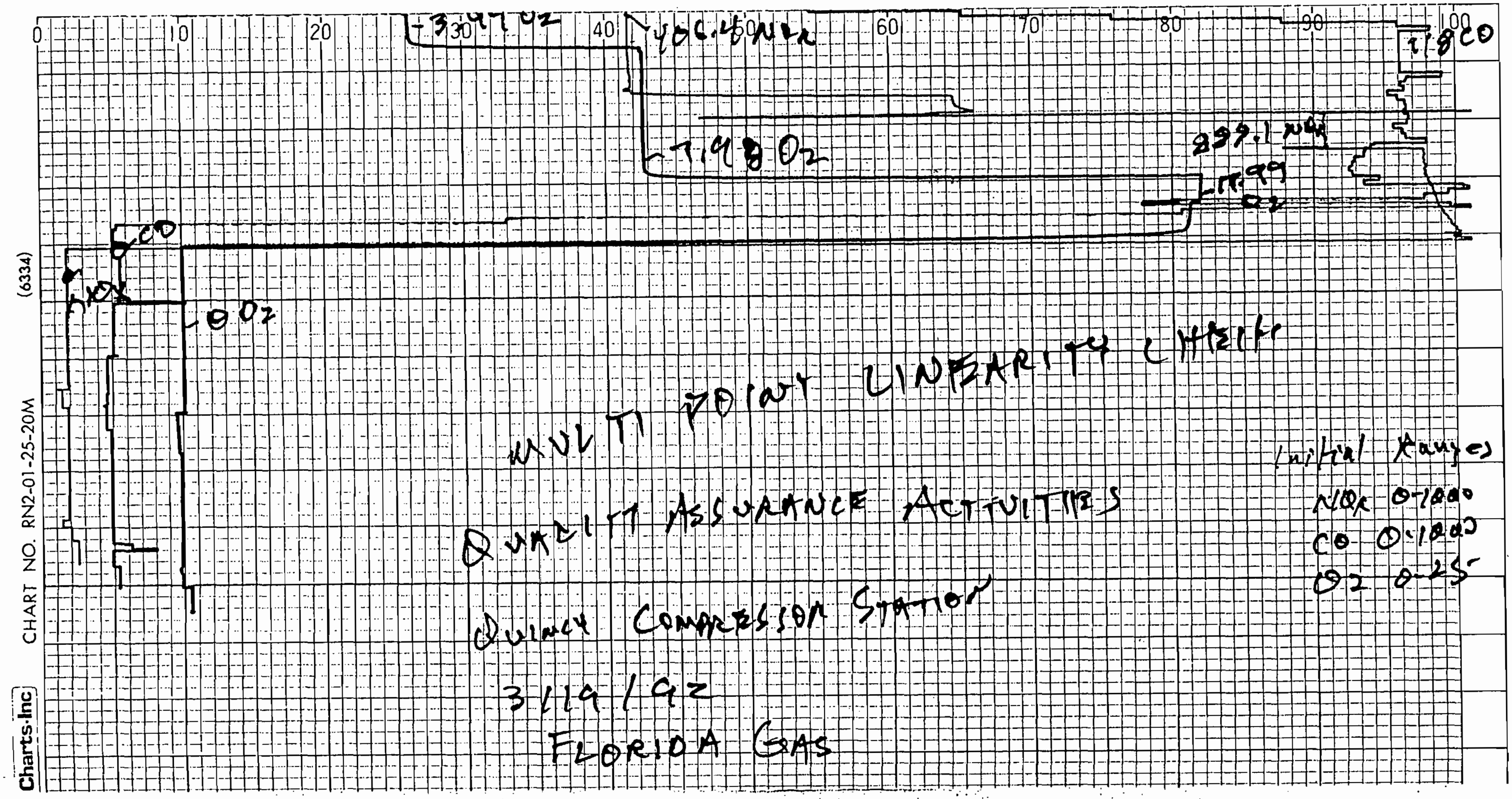
S = sulfur content of fuel = <0.059 grains/100 DSCF
7000 grains = 1.0 lb
Q_f = 18900 SCF/hr
SO2 = mass emission rate of SO2
= S / 100 / 7000 x Q_f
= <.059 /100 / 7000 x 18900
= <0.0016 lbs/hr

Moisture Content via Stoichiometry
Refers to test run #1

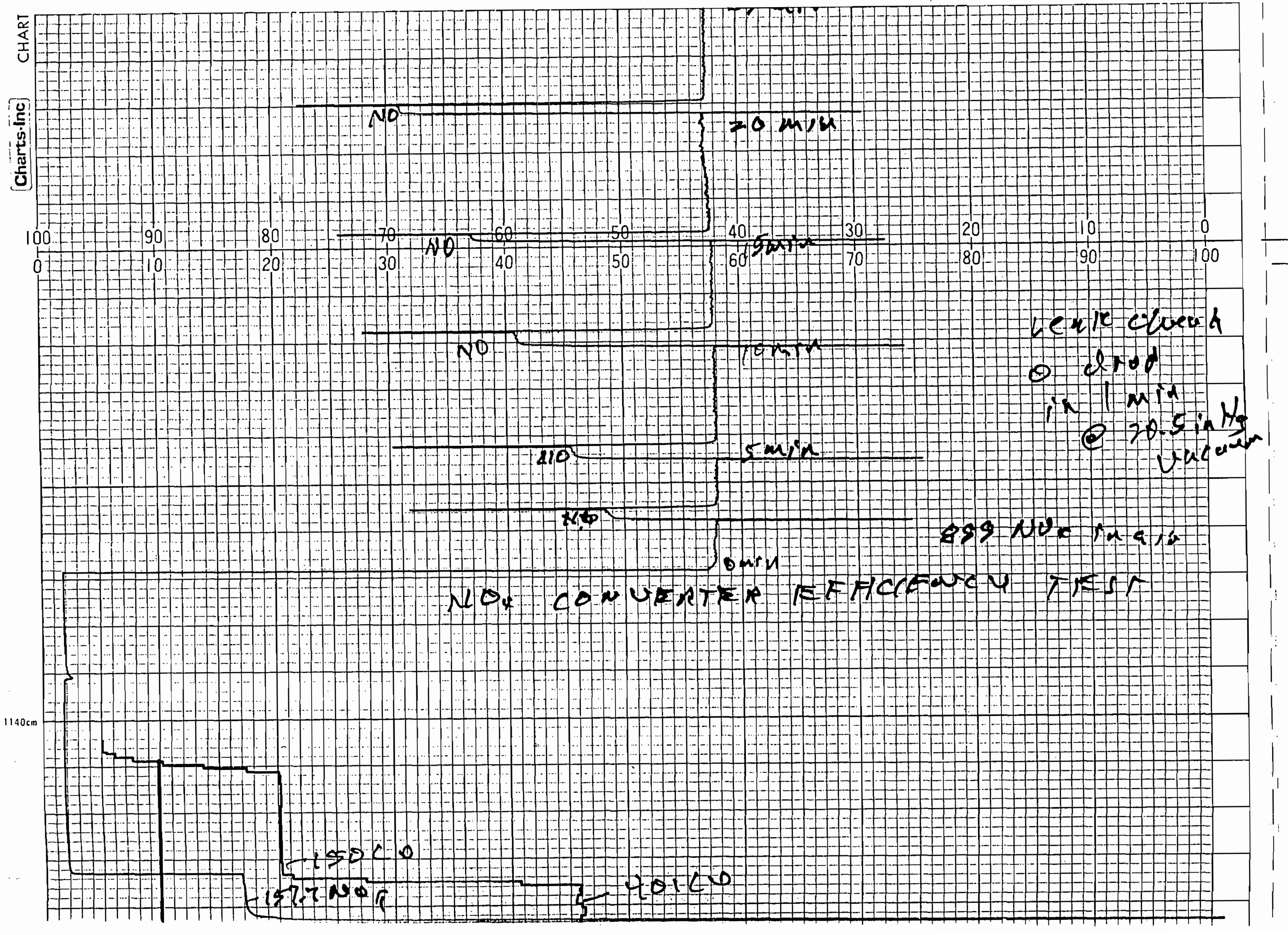
H = Ambient humidity (via psychrometer) = 0.0138 lb/lb air
O2 = O2 concentration in stack = 15.95%
F = wet basis O2 F-factor (from fuel calcs)
= 10641 DSCF/MMBTU
FW = moisture F-factor = 2004 SCF of H2O/MMBTU
CM = combustion moisture % at 0% O2
= Fw / F x 100 = 2004 / 10641 x 100
= 18.83 %

Fw = moisture content
= (CM x (20.9 - O2)/20.9) + (H x 64.3)
= (18.83 x (20.9 - 15.95)/20.9) + (.0138 x 64.3)
= 5.35 %

APPENDIX C: QUALITY ASSURANCE AND QUALITY CONTROL


0 10 20 30 40 50 60 70 80 90 100
(6334)
CHART NO. RN2-01-25-20M
Charts-Inc
406.4 NOx
899.1 NOx
CO
NOx
0 O2
MULTI POINT LINEARITY CHECK
QUALITY ASSURANCE ACTIVITIES
QUINCY COMPRESSION STATION
3/19/92
FLORIDA GAS
Initial Ranges
NOx 0-1000
CO 0-1000
O2 0-25

BEST AVAILABLE COPY



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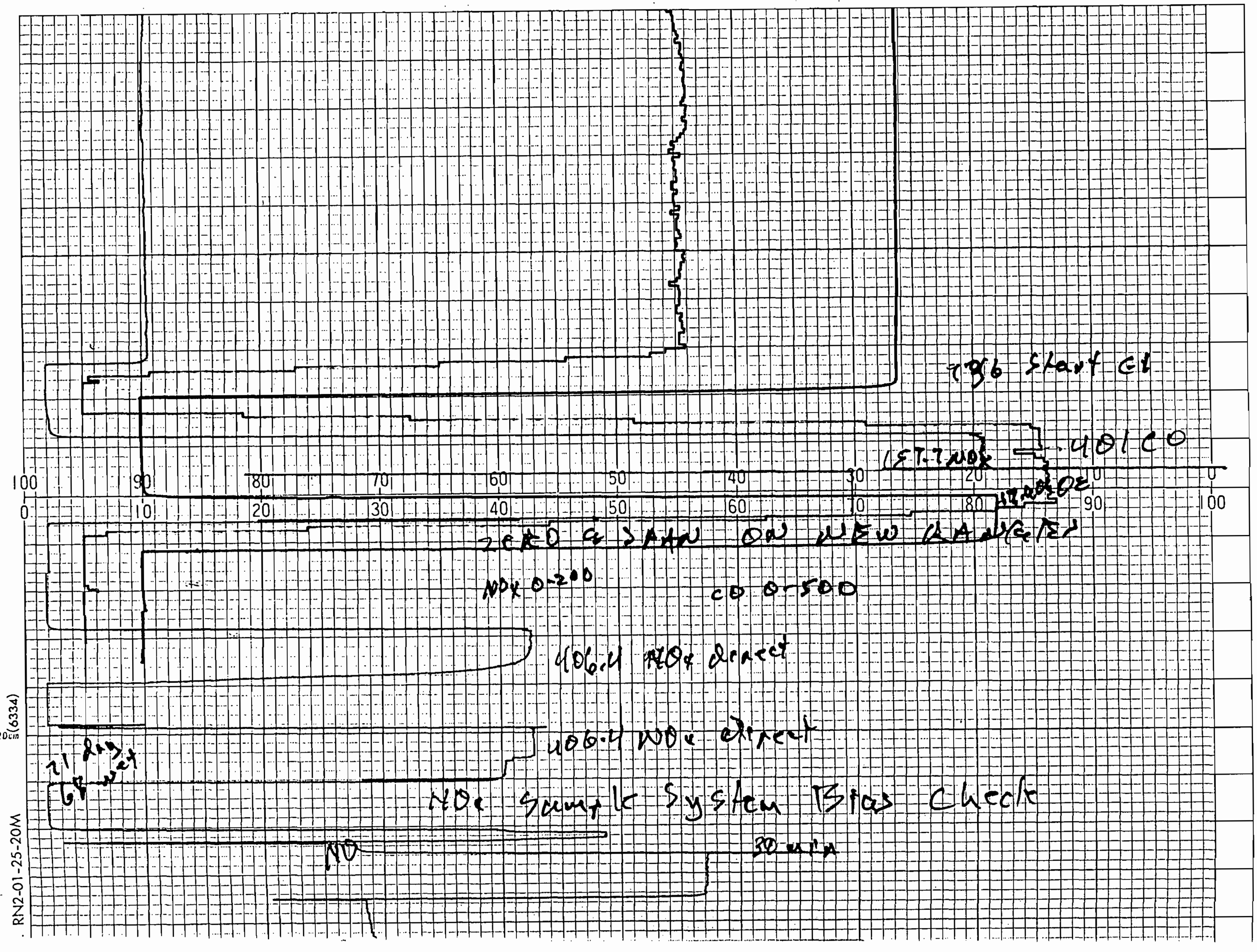

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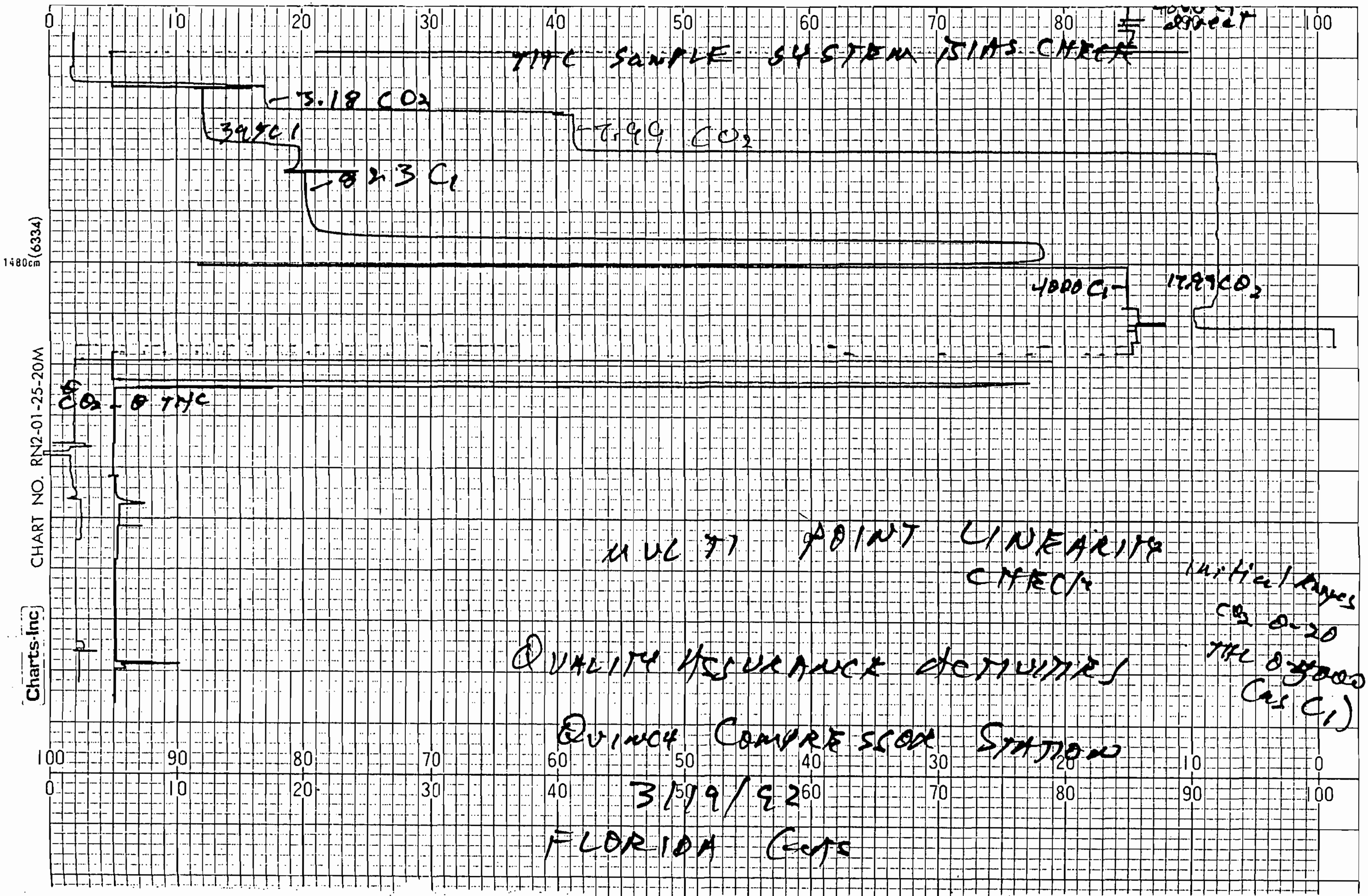

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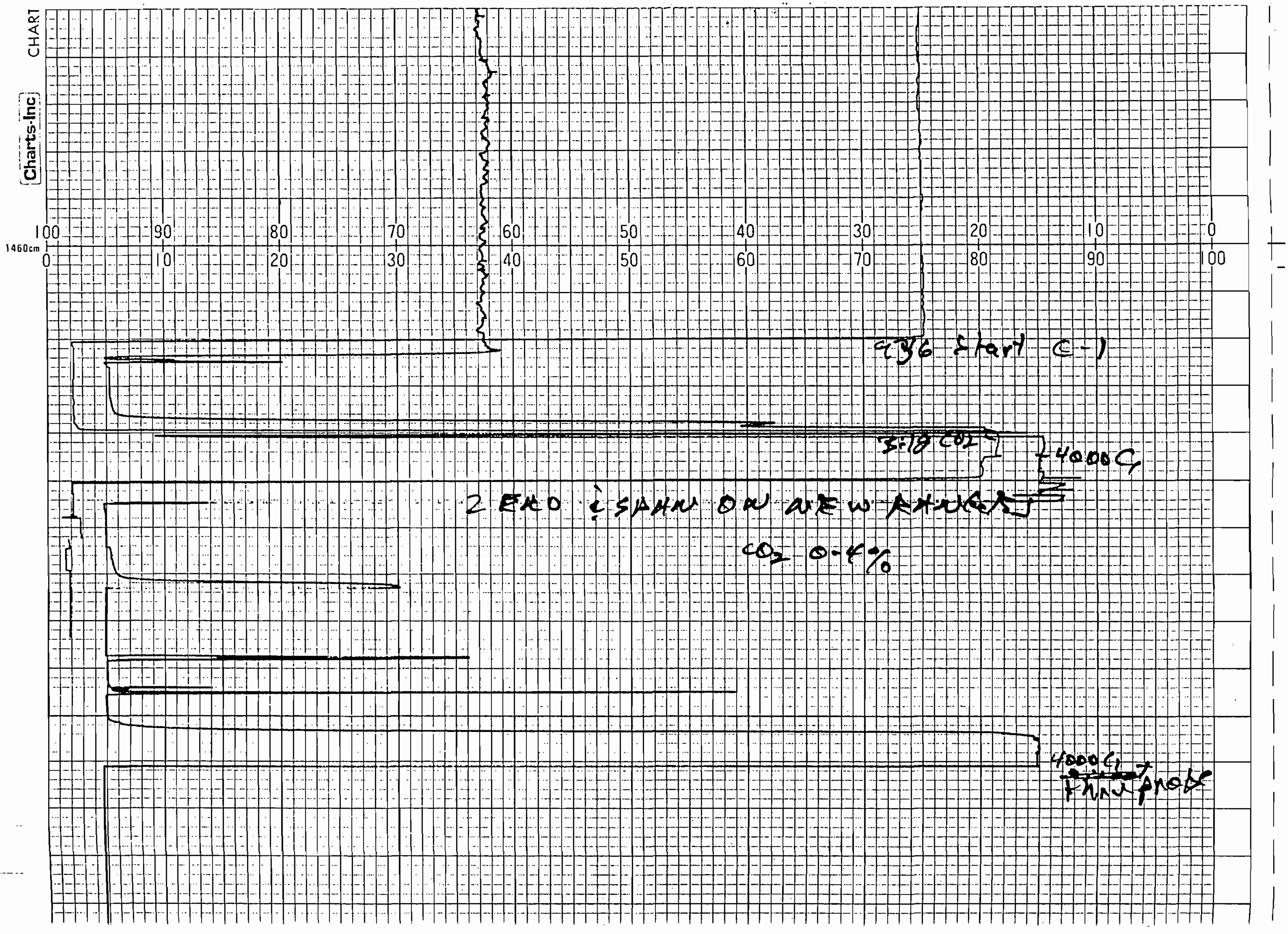

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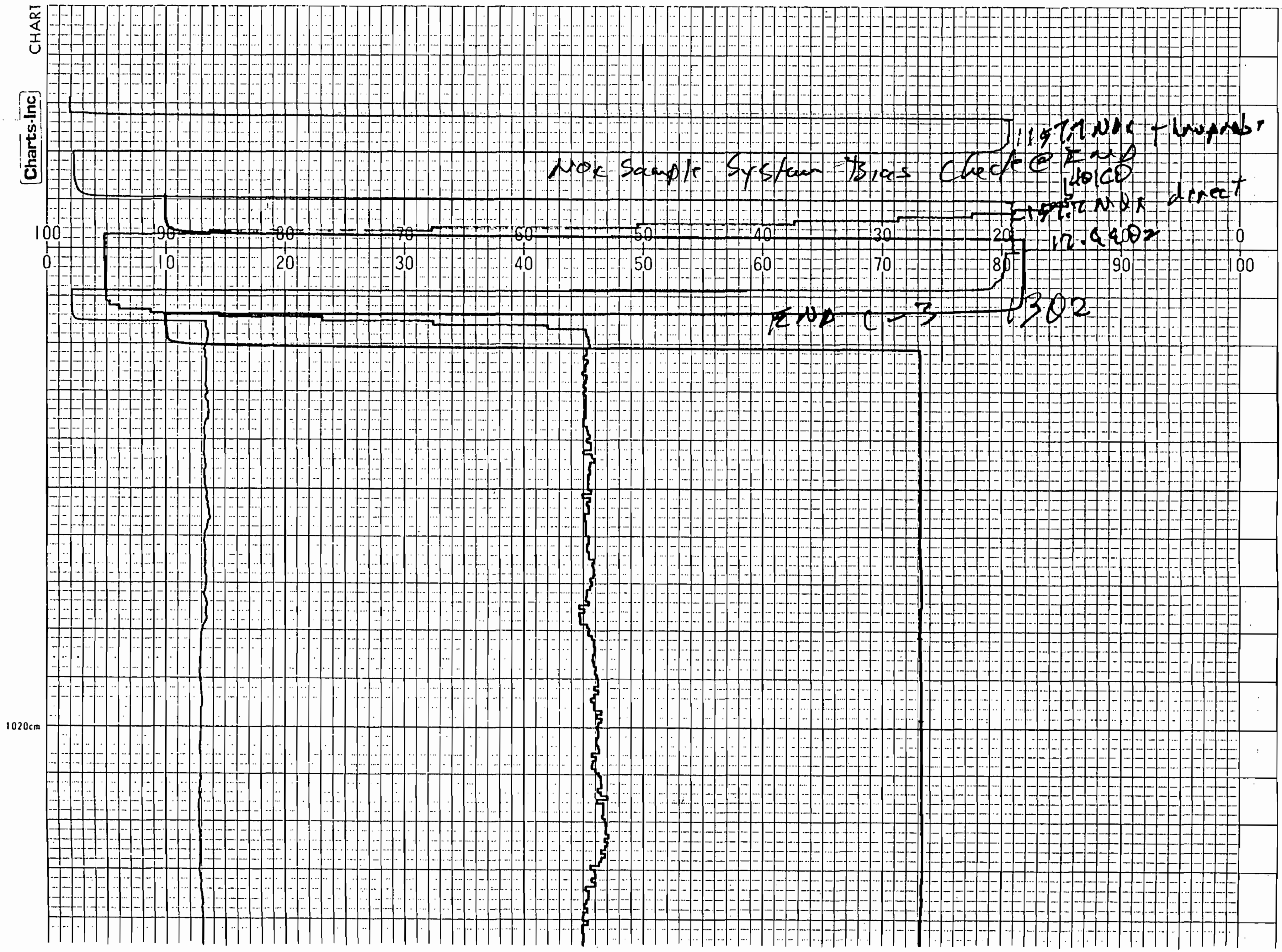

Gaseous Emission QA Worksheet

GASEOUS EMISSION	CERTIFIED GAS INPUT Concentration (% or ppm)	CERTIFIED GAS INPUT Target (% Chart)	INITIAL CALIBRATION & LINEARITY CHECK Initial (% Chart)	INITIAL CALIBRATION & LINEARITY CHECK Difference (% Chart)	TEST RUN C-1	ZERO and SPAN CALIBRATION CHECK Final (% Chart)	ZERO and SPAN CALIBRATION CHECK Drift (% Chart)	TEST RUN C-2	ZERO and SPAN CALIBRATION CHECK Final (% Chart)	ZERO and SPAN CALIBRATION CHECK Drift (% Chart)	TEST RUN C-3	ZERO and SPAN CALIBRATION CHECK Final (% Chart)	ZERO and SPAN CALIBRATION CHECK Drift (% Chart)
NOx					Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	2.0	2.0	0.0	16.8	2.0	0.0	21.6	2.0	0.0	21.8	0.0	0.0
low	157.7	17.8	17.0	-0.8	% Chart			% Chart			% Chart		
mid	406.4	42.6	41.5	-1.1	10.4	81.0	0.5	12.8	80.9	0.4	12.9	81.0	0.5
high	888.1	90.8	90.8	0.0									
full scale	1000.0				200.0			200.0			200.0		
O2					Avg.ppm			Avg. ppm			Avg. %		
zero	0.0	10.0	10.0	0.0	16.0	10.0	0.0	15.80	10.0	0.0	15.80	10.0	0.0
low	3.99	26.0	26.0	0.0	% Chart			% Chart			% Chart		
mid	7.98	41.9	42.6	-0.1	73.8	81.9	0.1	73.2	82.0	0.0	73.2	82.0	0.0
high	17.90	81.6	82.0	0.4									
full scale	25.0				25.0			25			25		
CO					Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	5.0	5.0	0.0	248.0	5.0	0.0	209.0	5.0	0.0	206.0	5.0	0.0
low	150.0	20.0	20.1	0.1	% Chart			% Chart			% Chart		
mid	401.0	45.1	46.0	0.9	54.6	85.5	0.3	46.8	86.0	0.8	46.2	85.5	0.3
high	918.0	96.8	96.0	-0.8									
full scale	1000.0				500.0			500			500		
CO2					Avg. ppm			Avg. ppm			Avg. %		
zero	0.0	2.0	2.0	0.0	2.92	2.0	0.0	2.97	2.0	0.0	2.95	2.0	0.0
low	3.18	17.9	18.0	0.1	% Chart			% Chart			% Chart		
mid	7.99	42.0	41.4	0.0	31.2			31.7			31.5		
high	17.99	92.0	92.0	0.1		81.5	0.0		81.5	0.0		81.4	-0.1
full scale	20.0				10.0			10			10		
THC					Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	5.0	5.0	0.0	1560.0	10.0	5.0	1305.0	10.0	5.0	1480.0	10.0	5.0
low	395.0	12.9	12.1	-0.8	% Chart			% Chart			% Chart		
mid	823.0	21.5	20.5	-1.0	36.2			31.1			34.6		
high	4000.0	85.0	85.0	0.0		85.5	0.5		84.9	-0.1		84.5	-0.5
full scale	5000.0				5000.0			5000			5000		

Thermo Electron Corporation
Richard A. Curran
Regional Sales Manager

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

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

TA 7 CO_2 ANALYZER

Continous Emission Analyzer Interference Response Tests

Date: 1/16/92
Technician: LT

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

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

TR 7 O_2 ANALYZER

Continous Emission Analyzer Interference Response Tests

Date: 1/16/92
Technician: LF

Analyzer Type: SERVOMEX O_2 ANALYZER
Analyzer Model: 1400
Serial Number: 01420 B705 627
Analyzer Test Range: 0-10

Test Gas		Analyzer Response		Response
Type Gas	Concentration	Concentration	% of Range	Ratio
CO	491 ppm	<.05%	<.5	
SO_2	348 ppm	<.05%	<.5	
CO_2	8%	<.05%	<.5	
NO_x	886 ppm	<.05%	<.5	

Continous Emission Analyzer
Interference Response Tests

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

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

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

ppmv/%

ppmv/ppmv

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

Comments: 3/8" Sample line
Igloo Condenser

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Instrumental Analysis
Quality Assurance Data

Date: 3/19/92

Plant: FGT Quincy

Technician: LF

NOx Analyzer: NO2 to NO Converter Efficiency Test

NO Calibration Gas: 888.1 ppm

Dilutent Gas: Air (20.9% oxygen)

	NOx Concentration (ppm)	% Decrease from Initial Concentration	NO Concentration (ppm)
Initial Concentration	558	n.a.	465
10 minute Concentration	558	0	388
20 minute Concentration	550	1.4	~~388~~ 291
30 minute Concentration	551	1.25	255

Sampling System Bias Check

Analysis	Calibration Gas Concentration (ppm)	Full Scale Span (ppm)	Direct Calibration Response (ppm)	Thru-Probe Sample System Response (ppm)	System Calibration Bias (% of Span)
Zero Gas					
NOx before	406.4	1000	406	405	-0.1%
SO2					
THC before	4000	5000	4000	3990	-0.2%
NOx after	157.7	200	157.8	157.2	-0.3%

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

* NOTE: Equati[illegible] EPA Method 6C (40 CFR 60 [illegible])

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

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

Compiled By: Siegfried Fay On: 5-1-92

Approved By: S.F. On: 5/1/92

Job No. 8160		Plant: Florida Gas & Trans
Client Cubix		Sample Loc. Audits
Disk/File 8160		(In/Out)
Page No. 2		Date 3/26/92

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

APPENDIX D:
CALIBRATION CERTIFICATIONS

Scott Specialty Gases

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 GASES ****
PERFORMED ACCORDING TO SECTION 3.0.4
Certified Per Traceability Protocol # 1 Procedure # G1
File # P08274
Certified Accuracy 1 % NBS Traceable

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

EPA PROTOCOL CERTIFIED

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

BALANCE GAS : NITROGEN

NITROGEN DIOXIDE 1.77 PPM

FIRST ANALYSIS DATE : 2-11-91

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	53.30	157.4	236.0 PPM	80.00	236.0
0.00	53.30	157.4		80.00	236.0
0.00	53.30	157.4		80.00	236.0

CALCULATED RESULTS 157.4
157.4
157.4

AVERAGE : 157.4 PPM

SECOND ANALYSIS DATE : 2-18-91

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

CALCULATED RESULTS 158.0
158.0
158.0 159.8 PPM NOX

AVERAGE : 158.0 PPM

CALIBRATION CURVE 2 nd DEGREE

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

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

ANALYST ___ APPROVED BY ___ Shapiro

Scott Specialty Gases

a division of
Scott Environmental Technology, Inc.

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

BEST AVAILABLE COPY

Shipped From : Scott Michigan

Our Project # : 53222B

Your P.O. # : 92 0000

Customer :
CUBIX CORPORATION
9225 LOCKHART HWY
AUSTIN TX 78747

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

Certified For Traceability Procedure # G1
Protocol # 1

File # PO-2143

Certified Accuracy 1 % NBS Traceable

Expiration Date : 7-21-93

Cylinder Number : AAL5112

Cylinder Pressure 1900 psig

1 of 1 Component(s)

ANALYZED CYLINDER		REFERENCE STD			INSTRUMENTATION		
COMPONENT	CERTIFIED CONC.	SRM # (CRM #)	CYLINDER NUMBER	CONC.	INSTR/MODEL/SERIAL #	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
NITRIC OXIDE	406.4 PPM	1687	ALM-014665	965.5 PPM	BECKMAN	1-15-92	CHEMILUMINESCENCE
		1685	ALM-006700	250.3 PPM	951A		
					270-0828998		

BALANCE GAS : NITROGEN

NITROGEN DIOXIDE 0.00 PPM (FROM SECOND ANALYSIS)

FIRST ANALYSIS DATE : 1-15-92

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	40.70	406.9	965.5 PPM	96.50	965.5
0.00	40.70	406.9		96.50	965.5
0.00	40.70	406.9		96.50	965.5

CALCULATED RESULTS 406.9
406.9
406.9

AVERAGE : 406.9 PPM

SECOND ANALYSIS DATE : 1-21-92

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

CALCULATED RESULTS 405.9
405.9
405.9 405.9 PPM NOX

AVERAGE : 405.9 PPM

CALIBRATION CURVE 1 ST DEGREE

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

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

Scott Specialty Gases — a division of Scott Environmental Technology, Inc.

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

Our Project # : 519062

Your P.O. # : 90347

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

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

Certified Per Traceability Protocol # 1

Procedure # G1

File # P08133

Certified Accuracy 1 % NBS Traceable

Expiration Date : 7-28-92

Cylinder Number : ALM-016031

Cylinder Pressure 1900 psig

CERTIFIED EPA PROTOCOL

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

BALANCE GAS : NITROGEN

NITROGEN DIOXIDE 5.82 PPM (FROM SECOND ANALYSIS)

FIRST ANALYSIS DATE : 1-21-91

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

CALCULATED RESULTS 889.5
889.5
889.5

AVERAGE : 889.5 PPM

SECOND ANALYSIS DATE : 1-28-91

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

CALCULATED RESULTS 886.6
886.6
886.6 892.5 PPM NOX

AVERAGE : 886.6 PPM

CALIBRATION CURVE 1 st DEGREE

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

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : Paul P. Doran

Approved By : 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.

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

3714 LAPAS DRIVE, HOUSTON, TEXAS 77023

6/03/91

CUBIX CORPORATION
9225 LOCKHART

AUSTIN TX 78747-0000
KEVUN JANCK

PROJECT #: 04-11057
PO #: 91105

CYLINDER #: ALM006621 ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION		ANALYSIS 1 (MOLES) U/M	
CARBON MONOXIDE	150.0	PPM	150.	PPM
METHANE	80.0	PPM	79.7	PPM
NITROGEN	BALANCE		BALANCE	

CERTIFIED

ANALYTICAL METHOD: GRAV.MASTER GAS

DATE OF ANALYSIS: 6/03/91

ANALYST: John D McCulloch
ANALYST

APPROVED BY: [signature]
SUPERVISOR

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Scott Specialty Gases, Inc.

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

CUBIX CORPORATION
9225 LOCKHART HWY
AUSTIN TX 78747-0000

PROJECT #: 04-13936
PO #: 910523

CYLINDER #: AAL9308 ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION		ANALYSIS 1 (MOLES)	U/M
CARBON MONOXIDE	400.0	PPM	401.	PPM
METHANE	400.0	PPM	395.	PPM
NITROGEN	BALANCE		BALANCE	

ANALYTICAL METHOD: ACUBLEND MASTER

DATE OF ANALYSIS: 10/17/91

ANALYST: ______________ APPROVED BY: ______________
ANALYST SUPERVISOR

PLUMSTEADVILLE, PENNSYLVANIA / TROY, MICHIGAN / HOUSTON, TEXAS / DURHAM, NORTH CAROLINA
SOUTH PLAINFIELD, NEW JERSEY / FREMONT, CALIFORNIA / WAKEFIELD, MASSACHUSETTS / LONGMONT, COLORADO
BATON ROUGE, LOUISIANA

Scott Specialty Gases, Inc.

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

10/22/91

CUBIX CORPORATION
9225 LOCKHART HWY
AUSTIN TX 78747-0000

PROJECT #: 04-13836
PO #: 910505

CYLINDER #: AAL13971 ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION		ANALYSIS 1 (MOLES)	U/M
CARBON MONOXIDE	910.0	PPM	916.	PPM
METHANE	820.0	PPM	823.	PPM
NITROGEN	BALANCE		BALANCE	

NOTES: EXP: 11/92

ANALYTICAL METHOD: ACUBLEND MASTER

DATE OF ANALYSIS: 10/22/91

ANALYST: [signature] ANALYST

APPROVED BY: [signature] 10/23 SUPERVISOR

CERTIFIED

Scott Specialty Gases

a division of
Scott Environmental Technology, Inc.

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

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

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

Gentlemen:

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

ANALYTICAL REPORT

Cyl No. AAL17750 Analytical Accuracy ±1%

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

Cyl No. ______ Analytical Accuracy ______

Component	Concentration

Cyl No. ______ Analytical Accuracy ______

Component	Concentration

Cyl No. ______ Analytical Accuracy ______

Component	Concentration

Analyst John Lempe

Approved By [signature]

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

Matheson Gas Products

World Leader in Specialty Gases & Equipment

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

RECEIVED JAN 1 7 1992

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

Date 1-8-92

Our Invoice # 104-63230

Your P.O. # 04312

Lot No.

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

1R

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

1R

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

1R

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

CYL. # MIXTURE REQ.	ANALYSIS

ACCEPTED BY

WILSON OXYGEN

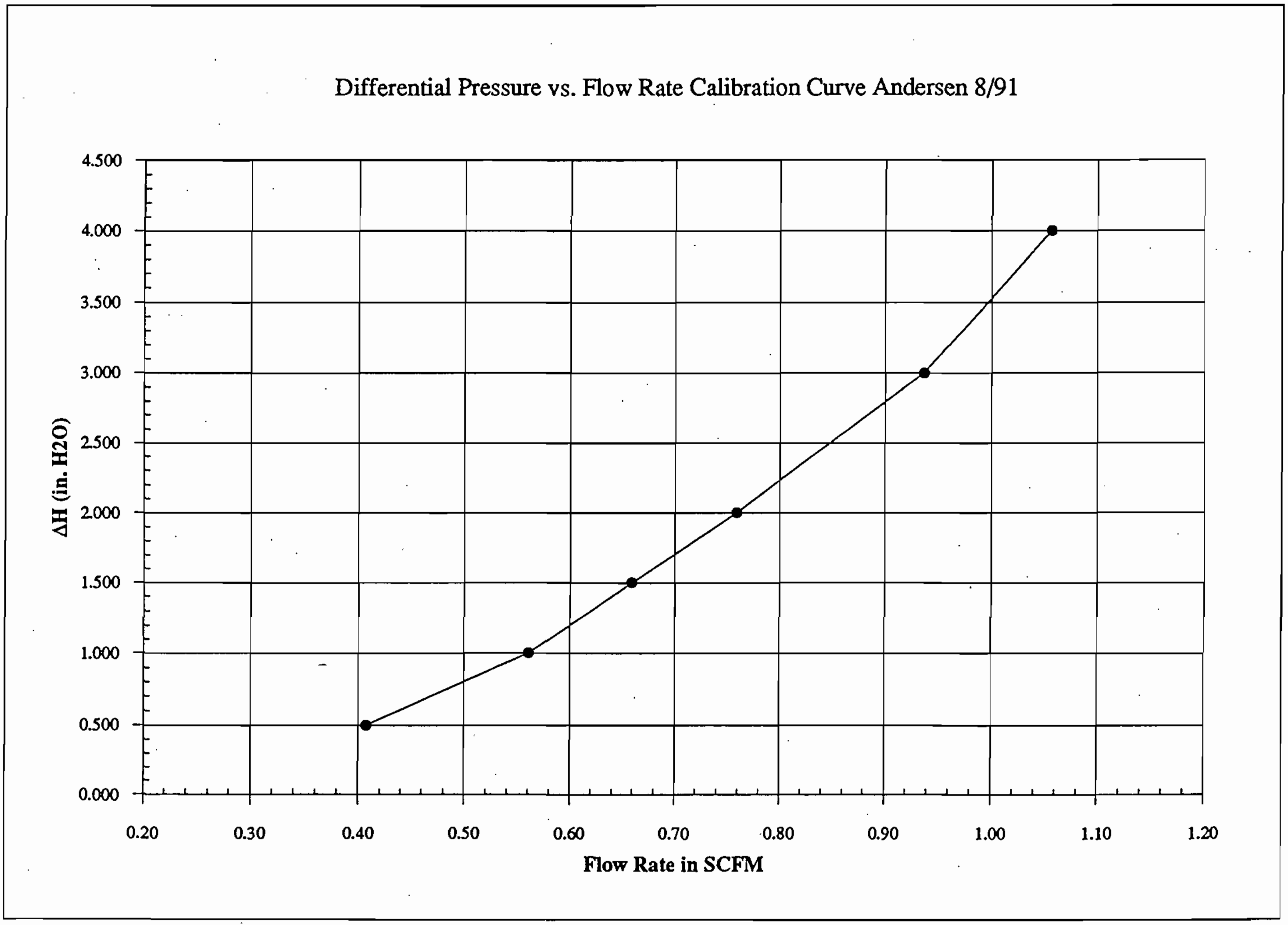
Analyst JOHN K. WRIGHT

METER BOX DRY GAS METER and ORIFICE CALIBRATION

Date: 8/2/91
Prev, Calib. 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

		Meter Box				Standard Test Meter					
Orifice Meter Setting ΔH (in. H20)	Elapsed Time (min.)	Starting Reading ft3	Ending Reading ft3	Starting Avg. Temp. °F	Ending Avg. Temp. (°F)	Starting Reading (ft3)	Ending Reading (ft3)	Starting Avg. Temp (°F)	Ending Avg. Temp (°F)	Calculated Meter Factor (Kd)	Calculated ΔH@ 0.75 SCFM (" H2O)
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



Testing by Cubix Corporation

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

Calibrations Performed by Cubix Corporation, Austin, Texas

Trailer #7 Altimeter

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

BFG/C9102

COMPONENT ALTIMETER

PART NO. 5934P-1A.83

SERIAL NO. 3H909

MFG. UNITED WORK ORDER # K0687

☐ Overhaul ☐ Repair ☒ Bench Check & Test

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

Jay Laurence
AUTHORIZED SIGNATURE

FEB 11 1992
DATE

TEL—TRU MANUFACTURING. CO.

408 ST. PAUL STREET   ROCHESTER, NY 14605 USA

CERTIFICATE OF CALIBRATION

TEL—TRU ORDER NO.	LINE NUMBER	TICKET NO.	ORDER REC WK NO.	SHIP BY WK NO.
23832	1\1		43	47

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

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

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

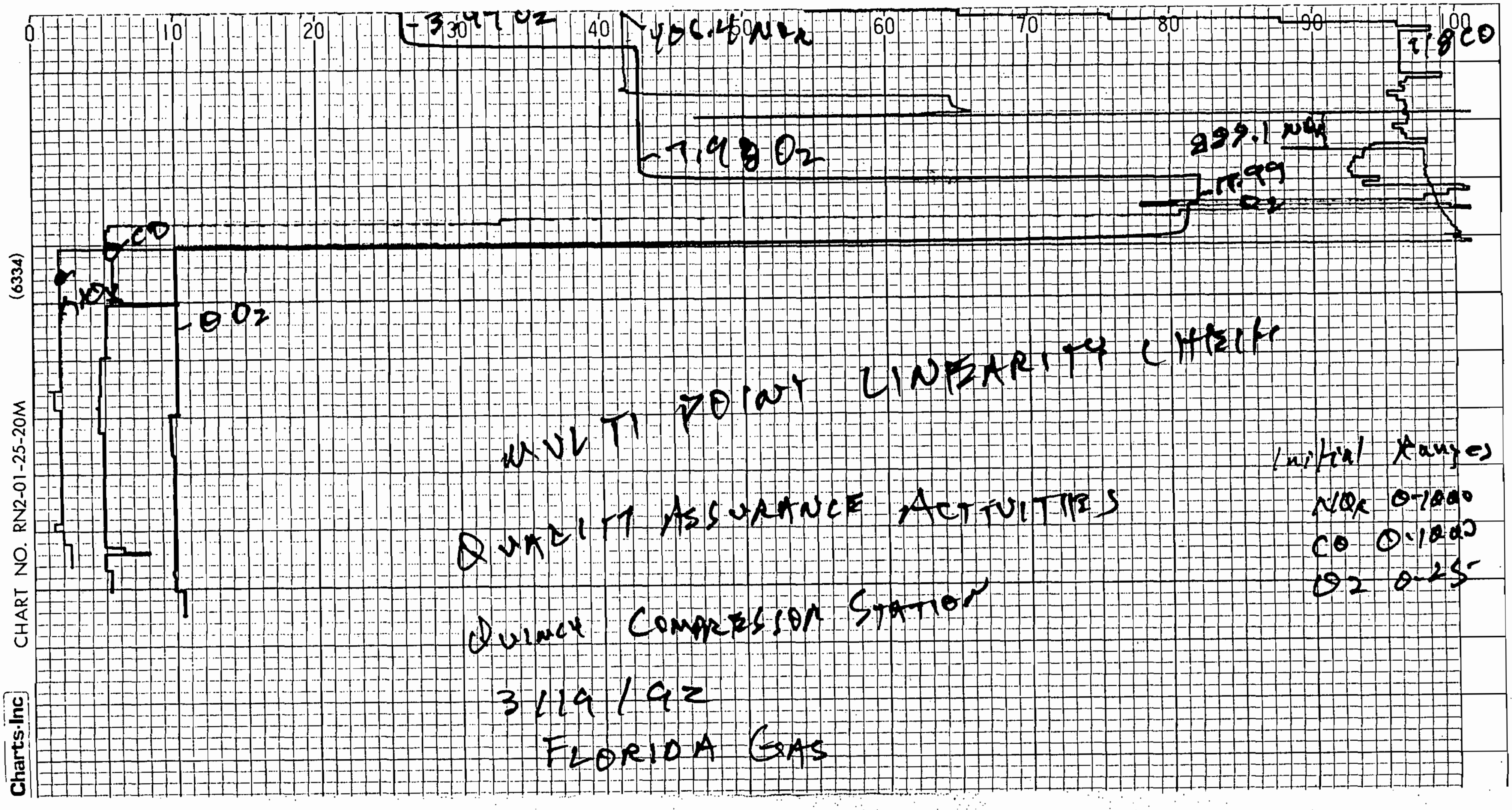
TAG NUMBER	CALIBRATING TEMPERATURE										
	-40°F / -40°C	0°F / -17.8°C	50°F / 10°C	100°F / 37.8°C	140°F / 60°C	160°F / 71°C	200°F / 93°C	220°F / 104°C	295°F / 146°C	400°F / 204°C	750°F / 399°C
1			50.5°F	100°F							
2			50°F	100°F							
3			50°F	100°F							
4			50°F	100°F							

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

APPENDIX E:
STRIP CHART RECORDS

NO_x, O_2, CO

BEST AVAILABLE COPY



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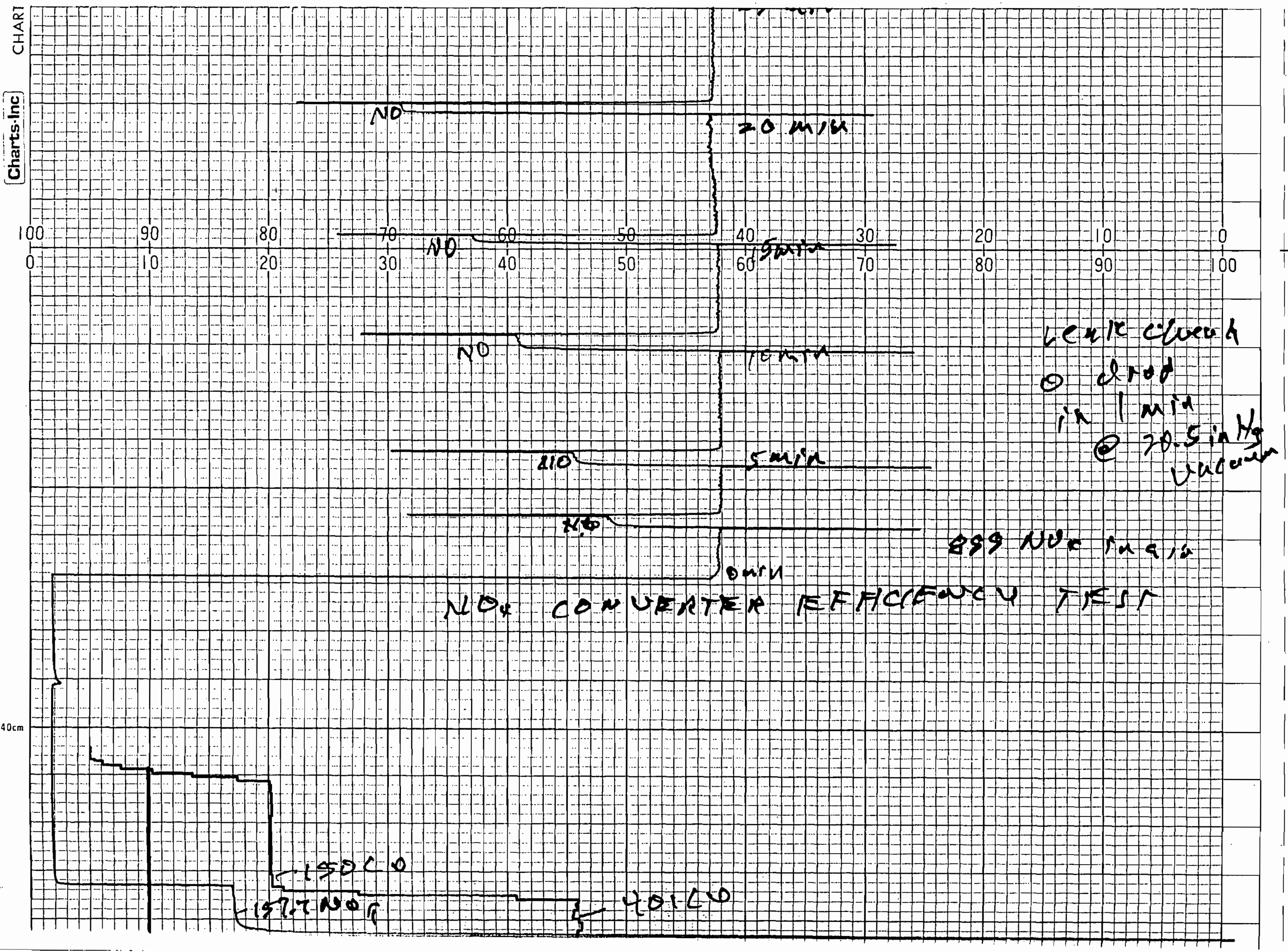

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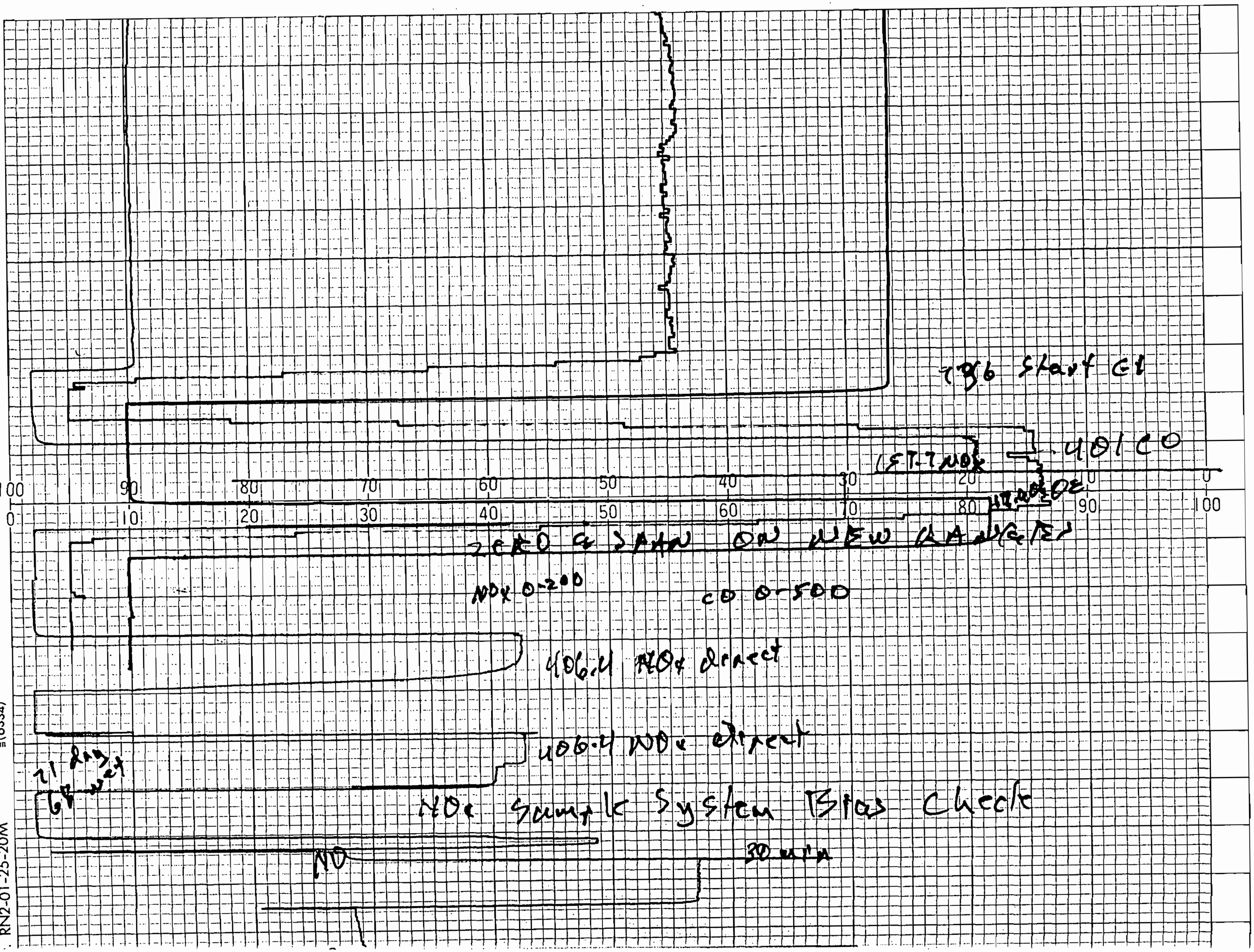

1120cm (6334)

RN2-01-25-20M

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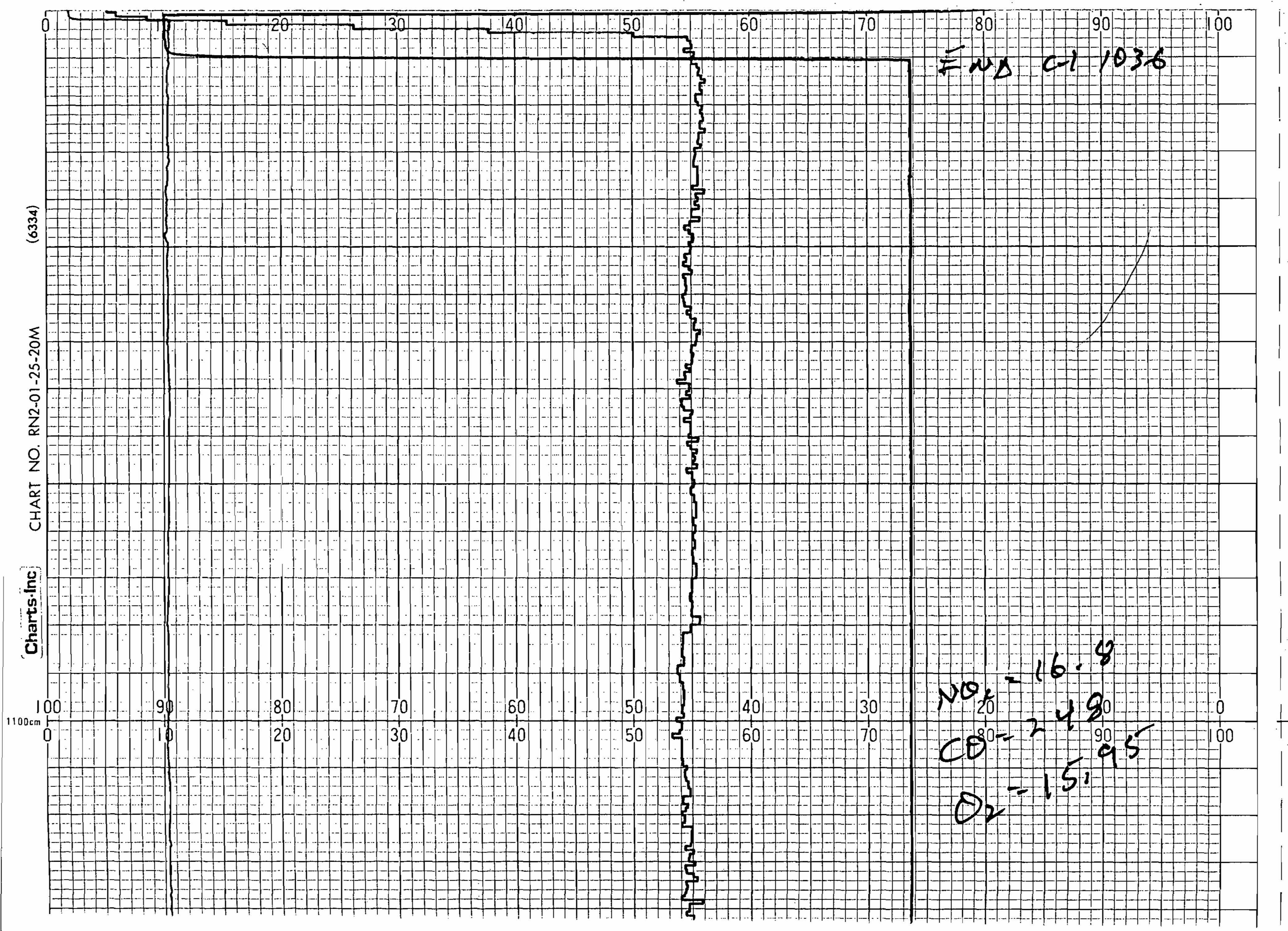

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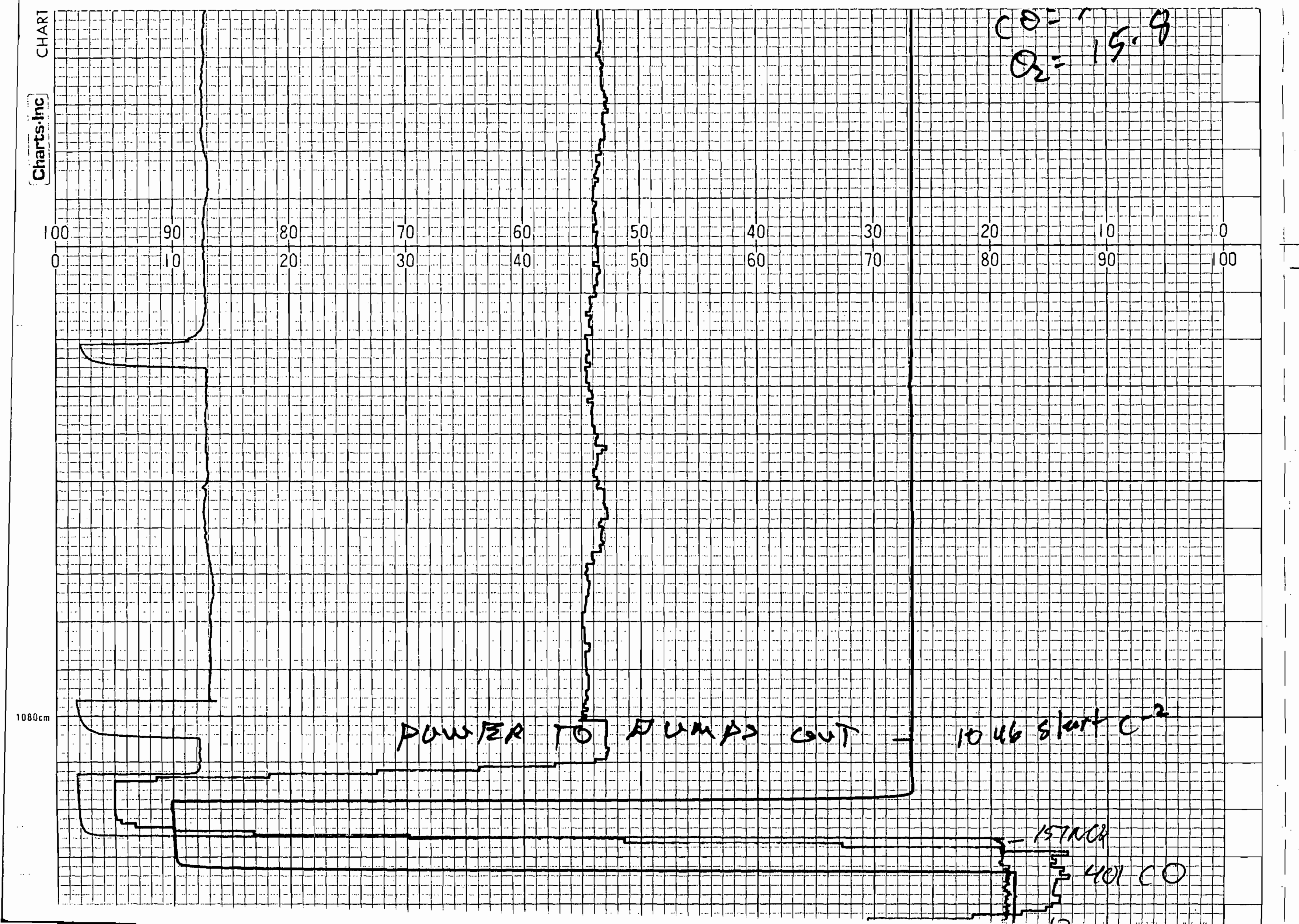
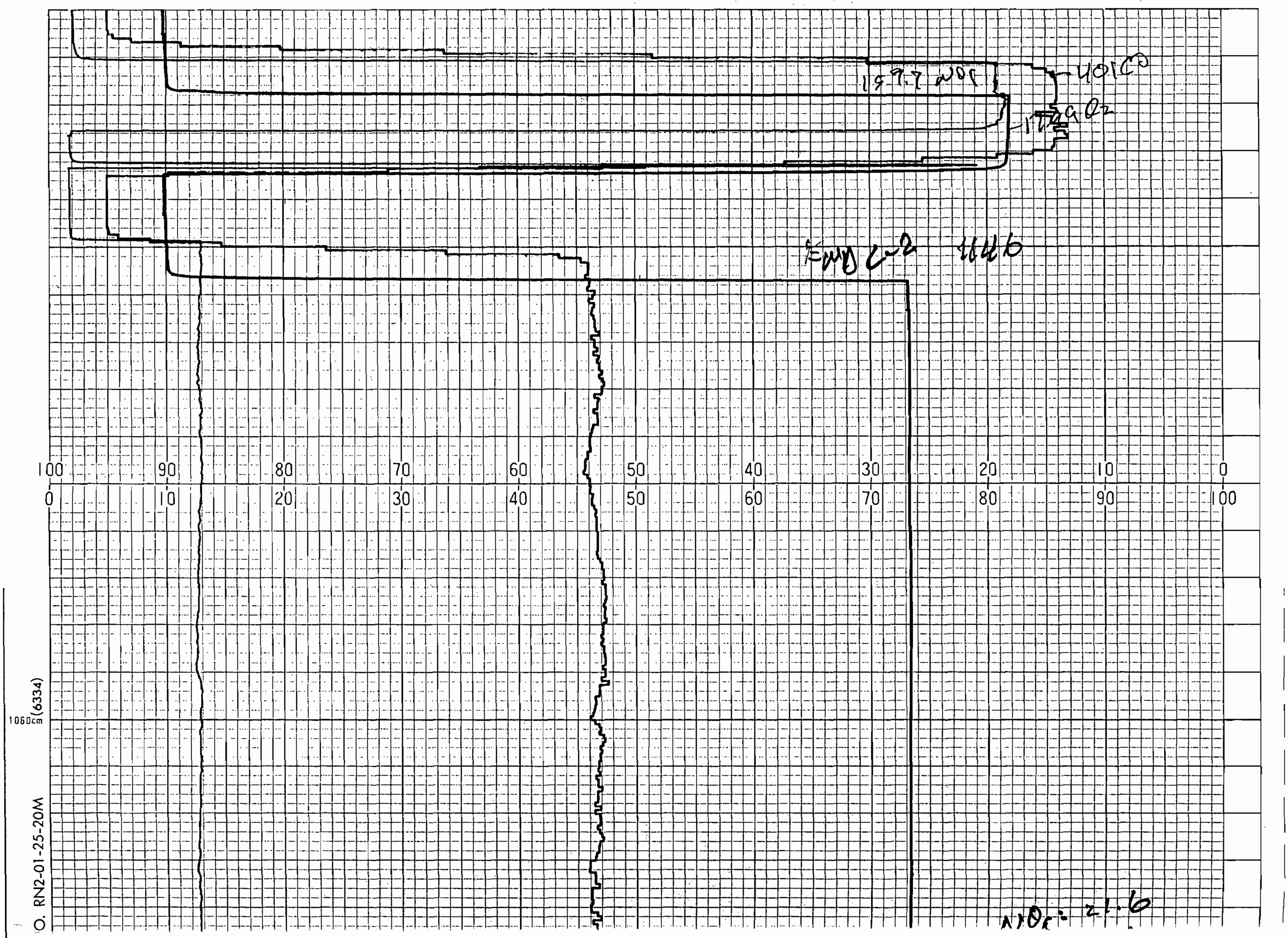
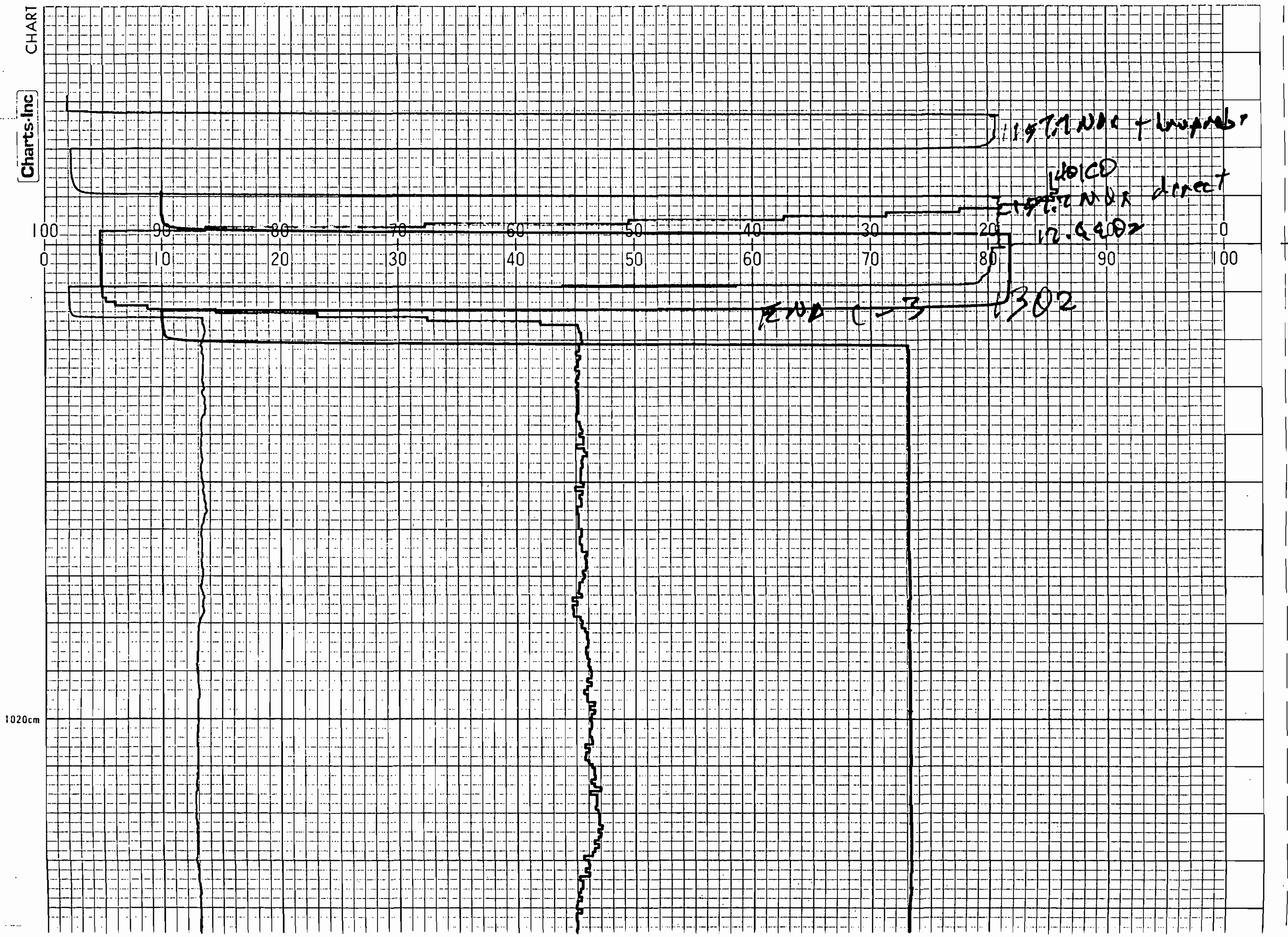


BEST AVAILABLE COPY



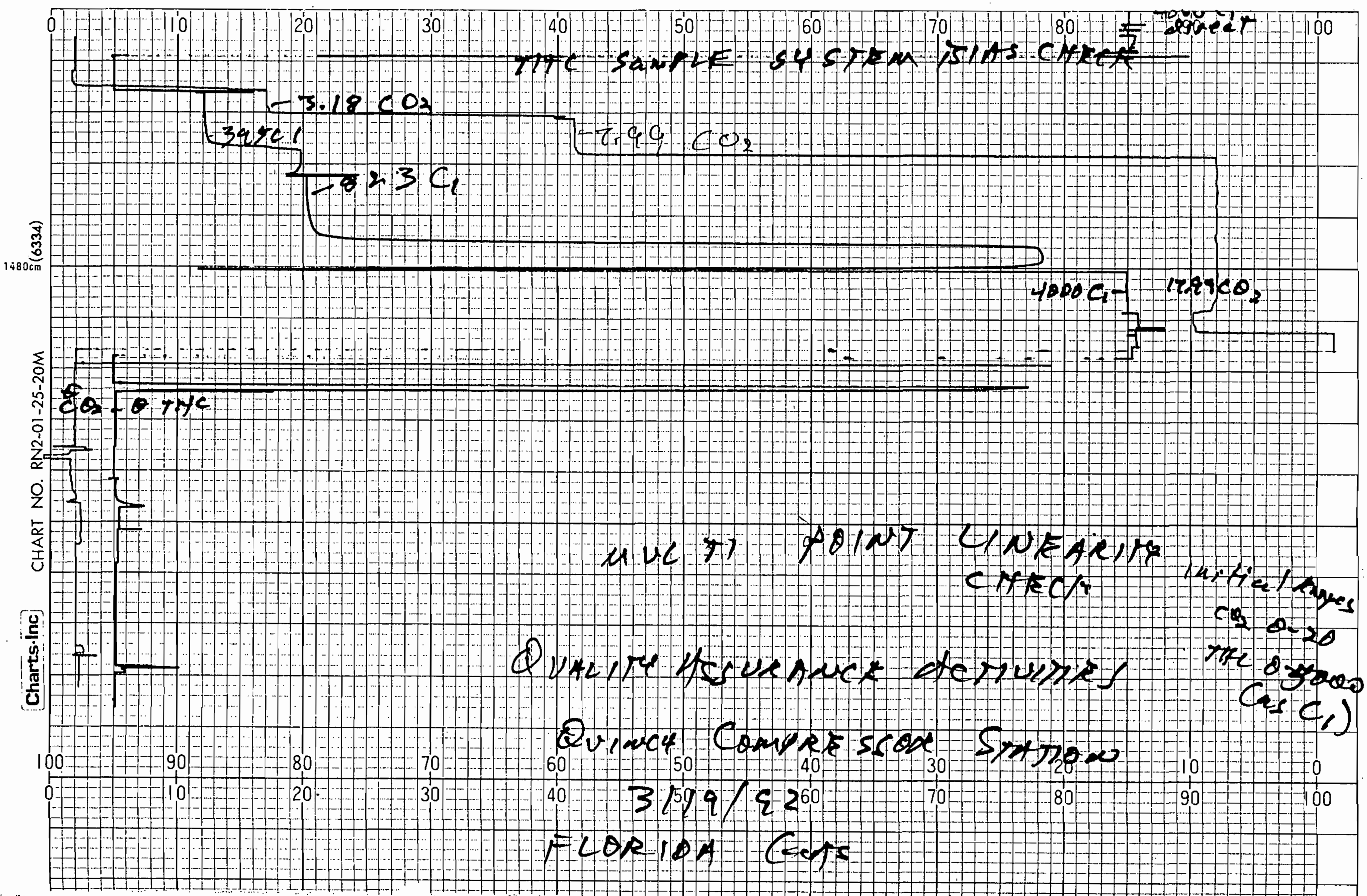
BEST AVAILABLE COPY

BEST AVAILABLE COPY

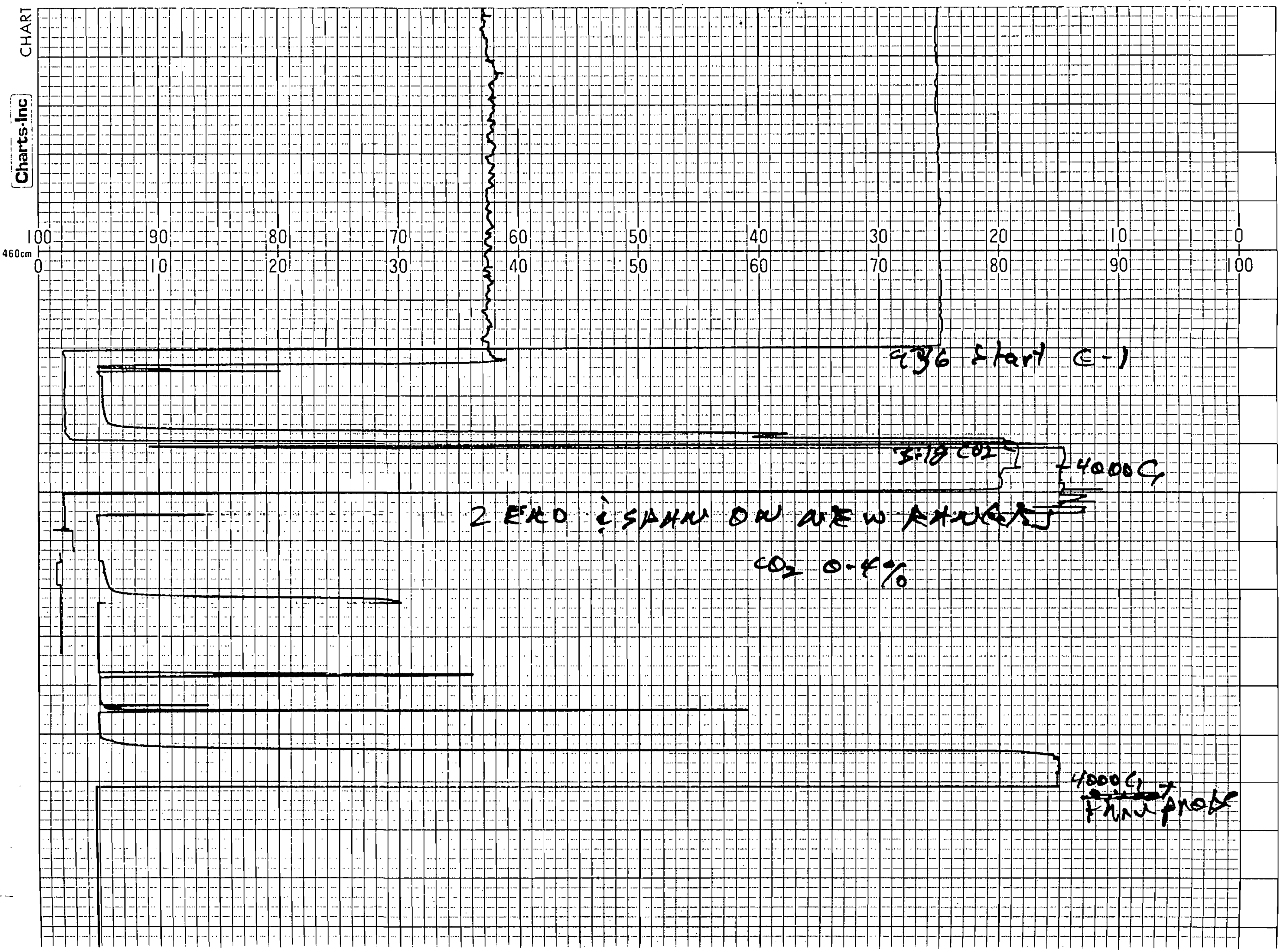


CO_2, THC

BEST AVAILABLE COPY

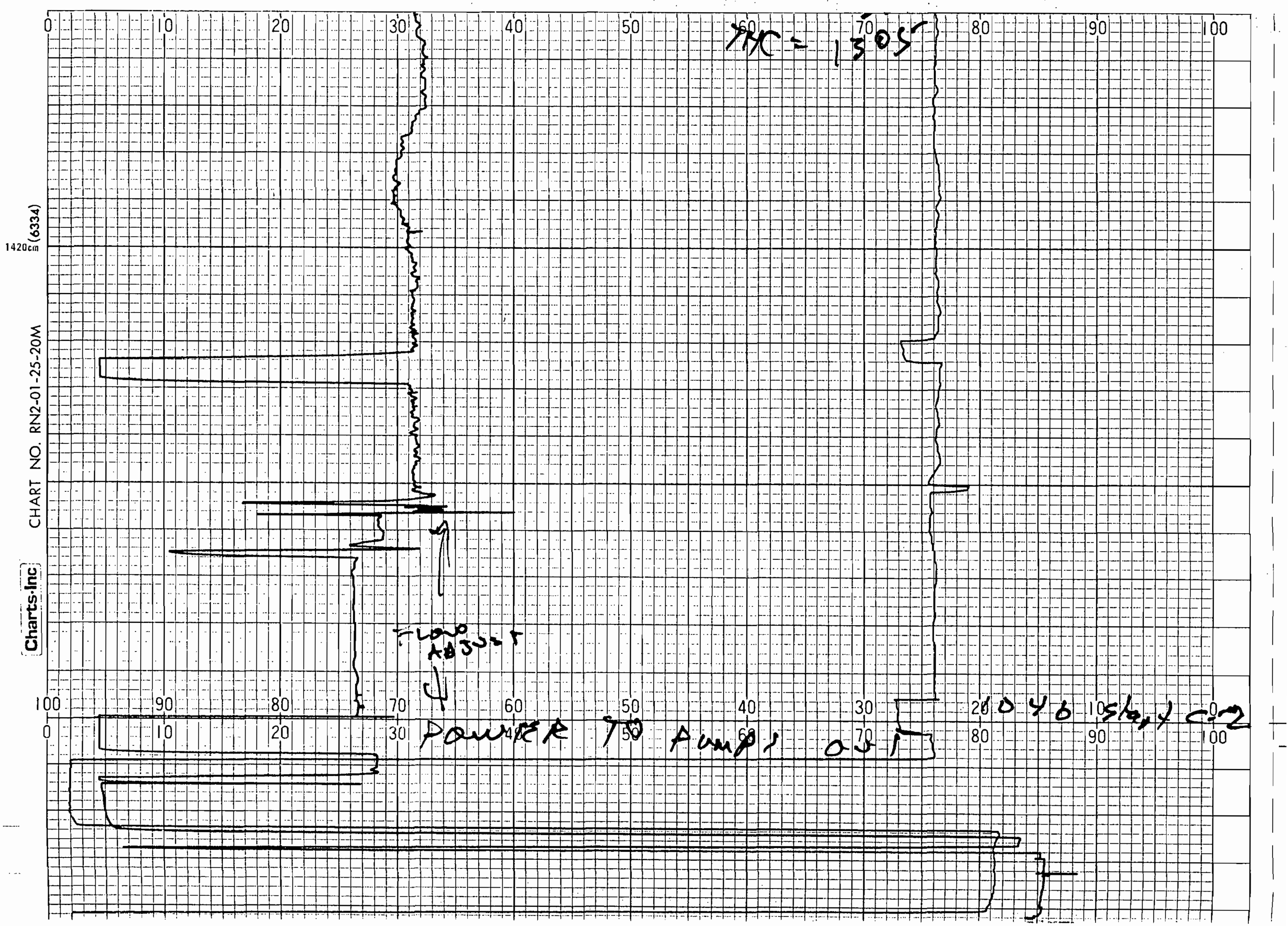


BEST AVAILABLE COPY

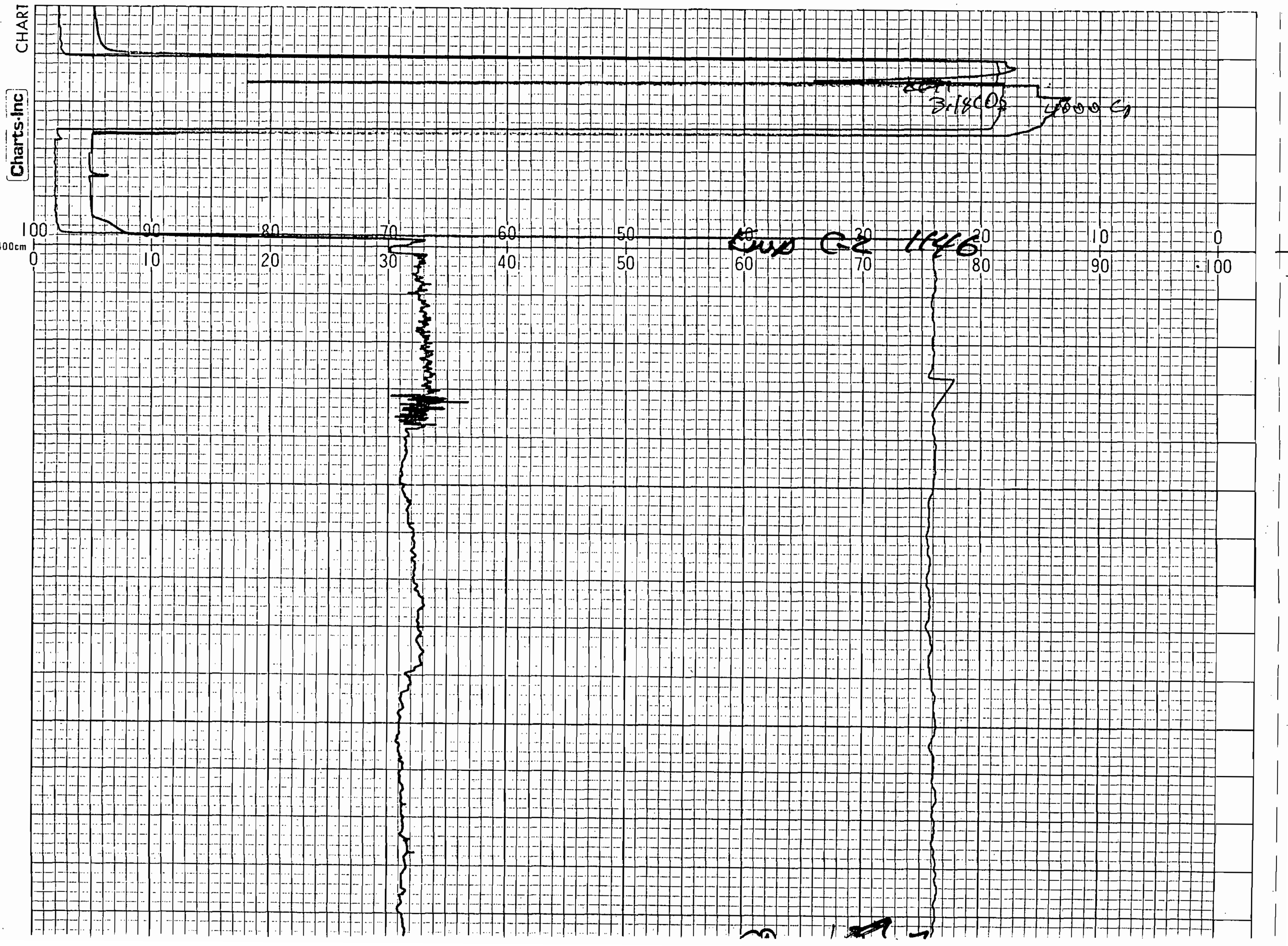


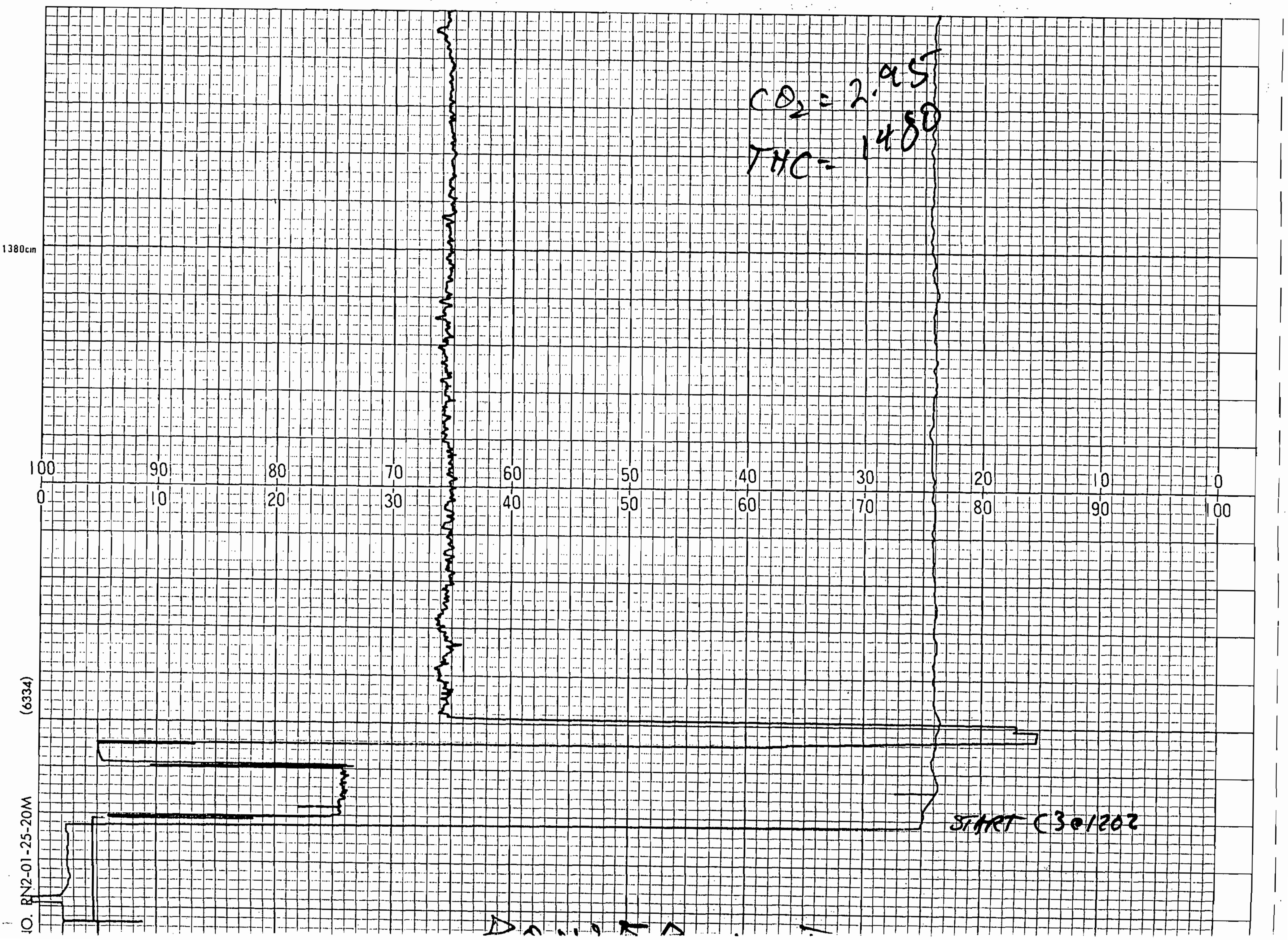
BEST AVAILABLE COPY

BEST AVAILABLE COPY

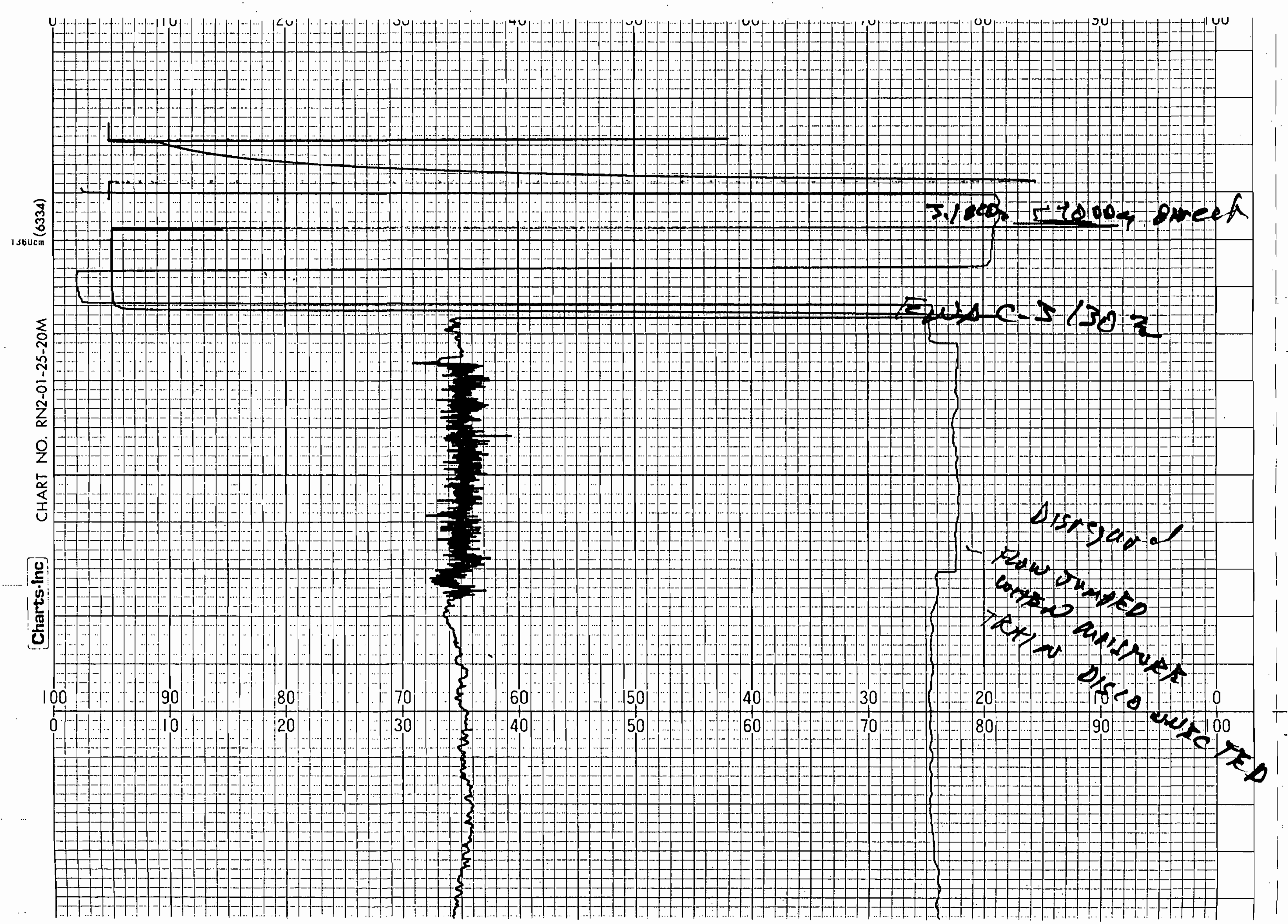


BEST AVAILABLE COPY

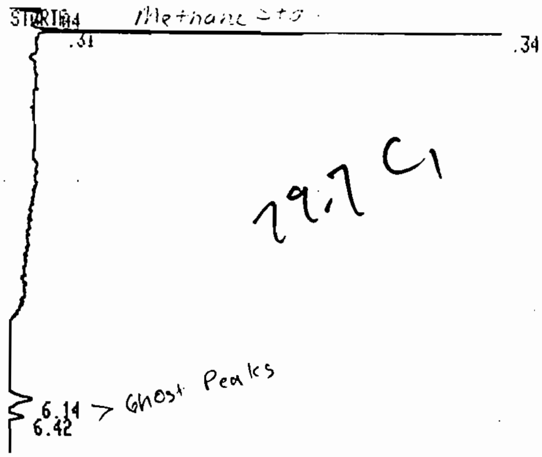



1380cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
CO2 = 2.95
THC = 1480
START C3@1202
(6334)
NO. RN2-01-25-20M

BEST AVAILABLE COPY



APPENDIX F
CHROMATOGRAMS

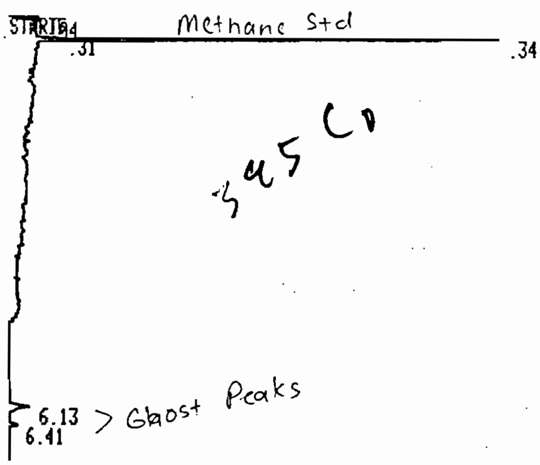


RUN # 81 MAR/19/92 09:28:47
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	872	BB	0.044	4.670
0.31	354	D PV	0.016	1.896
0.34	12180	D VB	0.015	65.235
6.14	3585	BV	0.139	19.201
6.42	1680	VV	0.090	8.998

TOTAL AREA= 18671
MUL FACTOR= 1.0000E+00



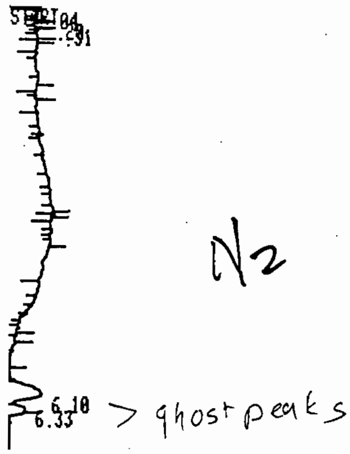
RUN # 82 MAR/19/92 09:40:04
WORKFILE ID:-B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	1387	PV	0.061	2.106
0.31	386	D VV	0.017	0.586
0.34	58926	D VB	0.015	89.454
6.13	3656	VV	0.133	5.550
6.41	1518	VV	0.090	2.304

TOTAL AREA= 65873
MUL FACTOR= 1.0000E+00

************** LOOP UP *****************
OP # 1 @
(M-D-Y)DATE: 3 - 1 9 - 9 2 @
(H-M-S)TIME: 9 - 0 - 0 @
RUN # ? 8 ? 0 @



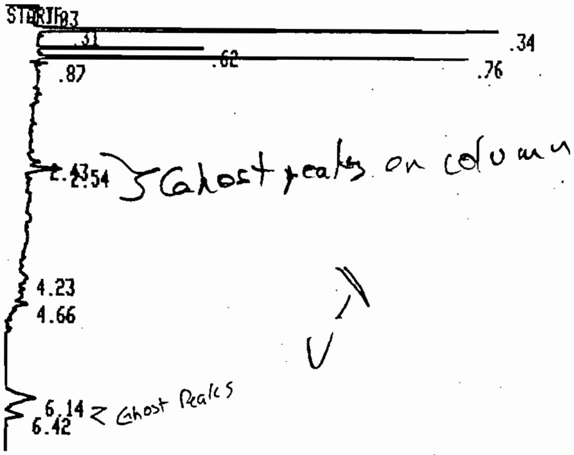
RUN # 80 MAR/19/92 09:15:06
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	1364	PV	0.064	13.161
0.20	998	VV	0.036	9.630
0.31	666	D VV	0.027	6.426
6.10	6939	VP	0.221	66.953
6.33	397	PB	0.068	3.831

TOTAL AREA= 10364
MUL FACTOR= 1.0000E+00

TOTAL AREA=   1464000
MUL FACTOR= 1.0000E+00



RUN # 85   MAR/19/92 10:21:40
WORKFILE ID: B
WORKFILE NAME:

AREA%

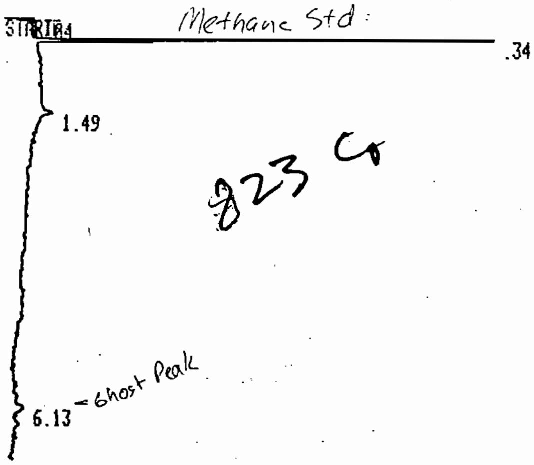
RT	AREA	TYPE	AR/HT	AREA%
~~0.03~~	~~440~~	~~BB~~	~~0.028~~	~~0.172~~
~~0.31~~	~~196~~	~~D PP~~	~~0.010~~	~~0.077~~
C1 0.34	231360	D PB	0.015	90.391 - C1
0.62	3249	D PB	0.019	1.269
0.76	9482	D VB	0.021	3.705
0.87	484	D BV	0.027	0.189
~~2.43~~	~~768~~	~~BV~~	~~0.060~~	~~0.300~~
~~2.54~~	~~2110~~	~~VP~~	~~0.059~~	~~0.824~~
4.23	631	VV	0.063	0.247
4.66	1001	VV	0.062	0.391
~~6.14~~	~~4372~~	~~BV~~	~~0.138~~	~~1.708~~
~~6.42~~	~~1861~~	~~VV~~	~~0.092~~	0.727

VOC

5.801

TOTAL AREA=   255950
MUL FACTOR= 1.0000E+00

5.801 / 5.801 + 90.391 = 6.03% VOC

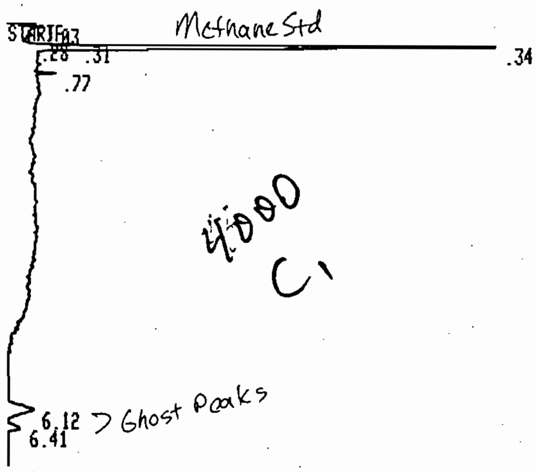


RUN # 83   MAR/19/92 09:49:06
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	835	PV	0.047	0.745
0.34	107210	D PB	0.015	95.693
1.49	2647	VV	0.167	2.363
6.13	1343	VV	0.124	1.199

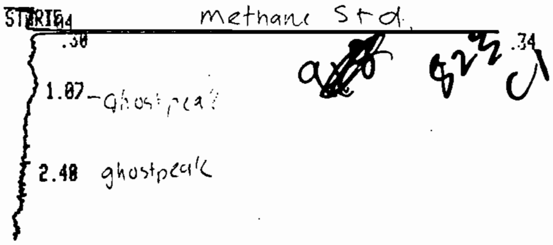
TOTAL AREA=   112030
MUL FACTOR= 1.0000E+00



RUN # 84   MAR/19/92 10:06:42
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.03	1044	BV	0.045	0.071
0.28	252	VV	0.028	0.017
0.31	1111	VH	0.018	0.076
0.34	1452200	DSHB	0.016	99.190
0.77	506	DTPV	0.024	0.035
6.12	6416	VV	0.186	0.438
6.41	2524	VV	0.119	0.172

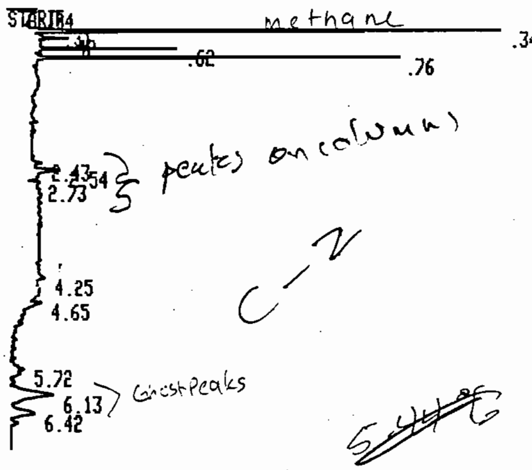


RUN # 87 MAR/19/92 10:44:43
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	623	PV	0.037	0.527
0.30	268	D PV	0.014	0.227
0.34	116320	D VB	0.015	98.397
1.07	743	PV	0.188	0.629
2.40	261	D BP	0.029	0.221

TOTAL AREA= 118210
MUL FACTOR= 1.0000E+00



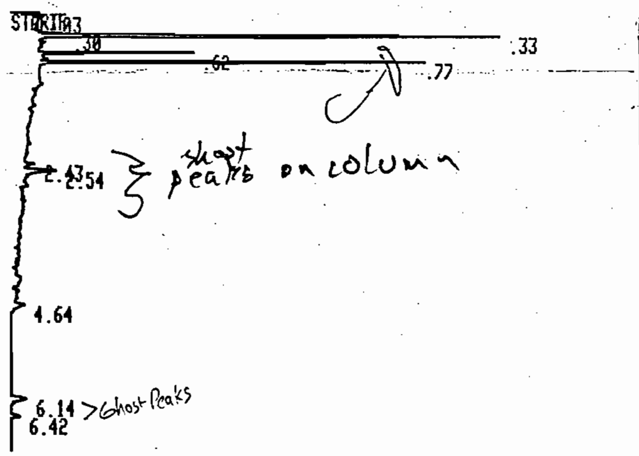
RUN # 83 MAR/19/92 10:56:51
WORKFILE ID: B
WORKFILE NAME:

AREA%

	RT	AREA	TYPE	AR/HT	AREA%
	~~0.04~~	~~1368~~	~~PB~~	~~0.030~~	~~0.651~~
	~~0.31~~	~~118~~	~~D PP~~	~~0.007~~	~~0.056~~
C1	0.34	181380	D PB	0.015	86.313
VOC	0.42	730	D PV	0.021	0.347
	0.62	2808	D VB	0.019	1.336
	0.76	7895	D PB	0.021	3.757
	~~2.43~~	~~543~~	~~PV~~	~~0.047~~	~~0.258~~
	~~2.54~~	~~1956~~	~~VV~~	~~0.064~~	~~0.931~~
	~~2.73~~	~~623~~	~~PV~~	~~0.057~~	~~0.297~~
	4.25	644	PP	0.070	0.307
	4.65	1125	VP	0.077	0.535
	5.72	1568	PV	0.099	0.746
	6.13	6367	VV	0.137	3.030
	6.42	3017	VV	0.113	1.436

$\frac{6.282}{6.282+86.313}$ = 6.78% VOC

TOTAL AREA= 210140



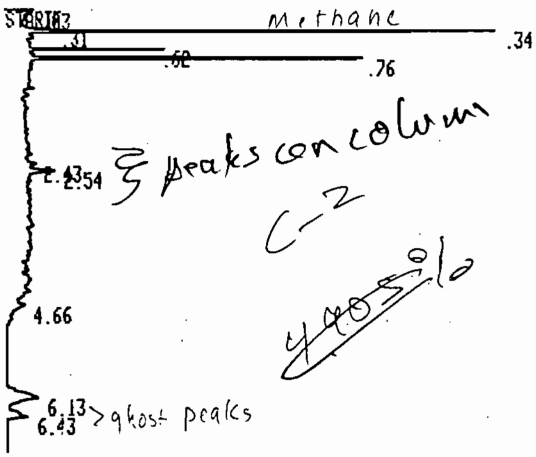
RUN # 86 MAR/19/92 10:32:48
WORKFILE ID: B
WORKFILE NAME:

AREA%

	RT	AREA	TYPE	AR/HT	AREA%
	~~0.03~~	~~668~~	~~PB~~	~~0.047~~	~~0.279~~
	~~0.30~~	~~293~~	~~B PP~~	~~0.014~~	~~0.122~~
C1	0.33	219320	D PB	0.015	91.442
VOC	0.62	3249	D PV	0.020	1.355
	0.77	8608	D VB	0.021	3.589
	~~2.43~~	~~535~~	~~PV~~	~~0.046~~	~~0.223~~
	~~2.54~~	~~2205~~	~~VV~~	~~0.064~~	~~0.919~~
	4.64	1345	VP	0.106	0.561
	~~6.14~~	~~2279~~	~~BP~~	~~0.109~~	~~0.950~~
	~~6.42~~	~~1331~~	~~PV~~	~~0.028~~	~~0.555~~

$\frac{5.51}{5.51+91.4}$ = 5.68% VOC

TOTAL AREA= 239830
MUL FACTOR= 1.0000E+00



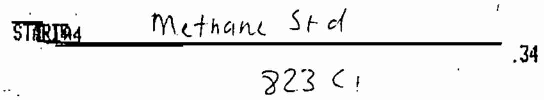
RUN # 89 MAR/19/92 11:15:00
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
~~0.03~~	~~951~~	~~PV~~	~~0.056~~	~~0.460~~
~~0.31~~	~~100~~	~~PV~~	~~0.006~~	~~0.048~~
C1 0.34	182020	D VB	0.015	88.038
VOC 0.62	2744	D PP	0.020	1.327
0.76	7398	D VB	0.021	3.578
~~2.43~~	~~725~~	~~PV~~	~~0.062~~	~~0.351~~
~~2.54~~	~~1687~~	~~VV~~	~~0.056~~	~~0.816~~
4.66	1386	VP	0.107	0.670
~~6.13~~	~~6369~~	~~VV~~	~~0.161~~	~~3.081~~
~~6.43~~	~~3370~~	~~VV~~	~~0.120~~	~~1.630~~

5.575
5.575188
= 5.96% VOC

TOTAL AREA= 206750
MUL FACTOR= 1.0000E+00

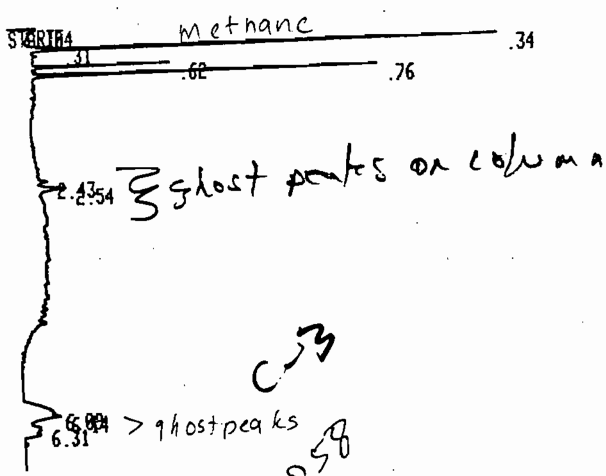


RUN # 90 MAR/19/92 11:28:25
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	970	BV	0.064	0.536
0.34	179950	D PB	0.015	99.464

TOTAL AREA= 180920
MUL FACTOR= 1.0000E+00



RUN # 2 MAR/19/92 12:39:34
WORKFILE ID: B
WORKFILE NAME:

AREA%

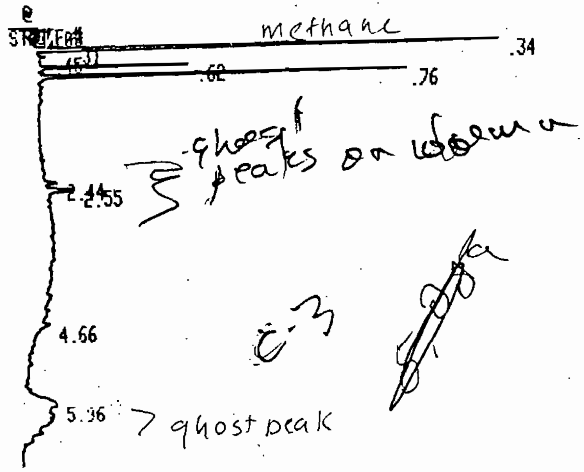
RT	AREA	TYPE	AR/HT	AREA%
~~0.04~~	~~1371~~	~~BV~~	~~0.068~~	~~0.652~~
~~0.31~~	~~341~~	~~D PV~~	~~0.015~~	~~0.162~~
0.34	183480	D VB	0.015	87.309 C-1
VOC 0.62	2624	D PB	0.018	1.249 VOC
0.76	7547	D VB	0.021	3.591
~~2.43~~	~~459~~	~~PP~~	~~0.044~~	~~0.218~~
~~2.54~~	~~1680~~	~~PV~~	~~0.058~~	~~0.799~~
~~6.09~~	~~6177~~	~~PV~~	~~0.160~~	~~2.939~~
~~6.14~~	~~3945~~	~~VV~~	~~0.088~~	~~1.877~~
~~6.31~~	~~2527~~	~~VV~~	~~0.101~~	~~1.203~~

= 5.25% VOC

TOTAL AREA= 210150
MUL FACTOR= 1.0000E+00

************** LOOP UP ****************
INTG # 8 TIME 0 @

OP # 1 @
(M-D-Y)DATE: 3 - 1 9 - 9 2 @
(H-M-S)TIME: 1 2 - 0 7 - 0 0
@



RUN # 1 MAR/19/92 12:14:39
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
~~0.03~~	~~900~~	~~BB~~	~~0.039~~	~~0.399~~
~~0.31~~	~~477~~	~~D PV~~	~~0.017~~	~~0.212~~
0.34	200030	D VB	0.015	88.760 Cl
0.45	123	D BB	0.021	0.055
0.62	3180	D VP	0.020	1.411
0.76	8164	D VB	0.021	3.623
~~2.44~~	~~524~~	~~PV~~	~~0.041~~	~~0.233~~
~~2.55~~	~~1619~~	~~VV~~	~~0.055~~	~~0.718~~
4.66	1301	VP	0.103	0.577
~~5.36~~	~~9042~~	~~VV~~	~~0.260~~	~~4.012~~

voc

6.00% voc

TOTAL AREA= 225360
MUL FACTOR= 1.0000E+00

APPENDIX G
OPACITY DATA SHEETS

The Texas Air Control Board
Certifies That

EDWARD A. SACRE II

Has completed a course conducted by The Texas Air Control Board and has met the requirements for evaluating visible emissions.

September 20, 1991
Date Certified

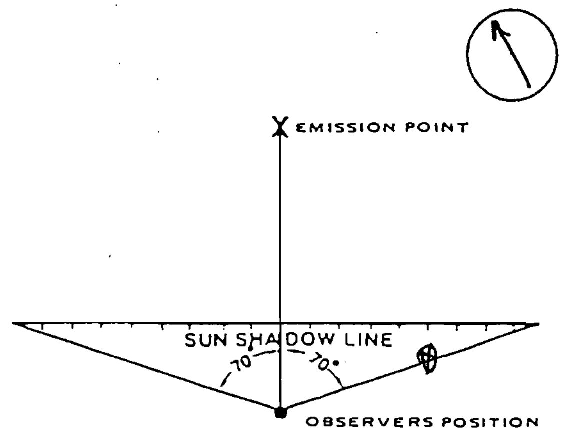
March 21, 1992
This Certificate Expires

[illegible] 9/20/91
Certifying Officer Date

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME	Florida Gas / Quincy Station
OBSERVATION DATE	3-19-92
START TIME	~~9:46~~ 9:36
STOP TIME	~~10:46~~ 10:36
ADDRESS	
CITY	Quincy
STATE	Fl
ZIP	
PHONE	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	Cooper Bessemer
OPERATING MODE	2700 BHP
CONTROL EQUIPMENT	
OPERATING MODE	
DESCRIBE EMISSION POINT	circular stack
HEIGHT ABOVE GROUND LEVEL	~60'
HEIGHT RELATIVE TO OBSERVER	~60'
DISTANCE FROM OBSERVER	~150'
DIRECTION FROM OBSERVER	N-NE
DESCRIBE EMISSIONS	None
EMISSION COLOR	
PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐	
WATER DROPLETS PRESENT	NO ☑ YES ☐
IS WATER DROPLET PLUME	ATTACHED ☐ DETACHED ☐
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED	2 duct diameters downstream of emission point
DESCRIBE BACKGROUND	Sky
BACKGROUND COLOR	Blue/white
SKY CONDITIONS	cloudy
WIND SPEED	10-15 mph
WIND DIRECTION	West
AMBIENT TEMP.	71
WET BULB TEMP.	67
RELATIVE HUMIDITY	71%

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



M \ sec	0	15	30	45	M \ sec	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

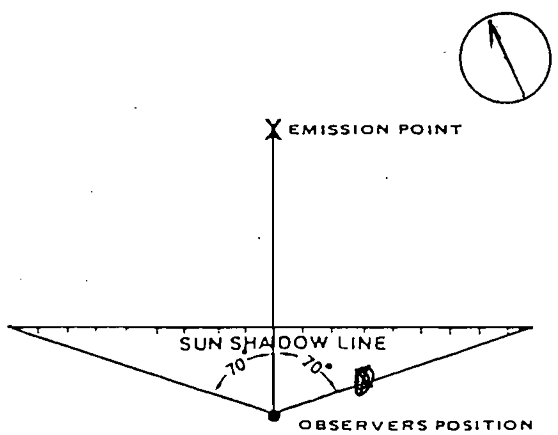
AVERAGE OPACITY FOR HIGHEST PERIOD	0
NUMBER OF READINGS ABOVE	0 % WERE 0
RANGE OF OPACITY READINGS	0 MINIMUM 0 MAXIMUM
COMMENTS	
OBSERVER'S NAME (PRINT)	Tony Sauer
OBSERVER'S SIGNATURE	Tony Sauer
DATE	3-19-92
ORGANIZATION	Cubix
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS — SIGNATURE	
TITLE	
DATE	
CERTIFIED BY	TACB
DATE	9-15-90
VERIFIED BY	
DATE	

EPA TR 0101

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME	Florida Gas / Quincy Station
ADDRESS	
CITY	Quincy
STATE	Fl
ZIP	
PHONE	
SOURCE ID NUMBER	1406
PROCESS EQUIPMENT	Cooper Bessemer
OPERATING MODE	2700 BHP
CONTROL EQUIPMENT	
OPERATING MODE	
DESCRIBE EMISSION POINT	circular stack
HEIGHT ABOVE GROUND LEVEL	~60'
HEIGHT RELATIVE TO OBSERVER	~60'
DISTANCE FROM OBSERVER	~120'
DIRECTION FROM OBSERVER	N
DESCRIBE EMISSIONS	None
EMISSION COLOR	
PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐	
WATER DROPLETS PRESENT	NO ☑ YES ☐
IS WATER DROPLET PLUME	ATTACHED ☐ DETACHED ☐
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED	2 duct diameters downstream from emission point
DESCRIBE BACKGROUND	Sky
BACKGROUND COLOR	Blue / White
SKY CONDITIONS	Partly Cloudy
WIND SPEED	10 mph
WIND DIRECTION	West
AMBIENT TEMP.	76
WET BULB TEMP.	67
RELATIVE HUMIDITY	61%

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVATION DATE	START TIME	STOP TIME
3-19-92	10:46	11:46

M \ sec	0	15	30	45	M \ sec	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

AVERAGE OPACITY FOR HIGHEST PERIOD	
NUMBER OF READINGS ABOVE % WERE	
RANGE OF OPACITY READINGS — MINIMUM	
RANGE OF OPACITY READINGS — MAXIMUM	
OBSERVER'S NAME (PRINT)	Tony Sacre
OBSERVER'S SIGNATURE	Tony Sacre
DATE	3-19-92
ORGANIZATION	Cubix
CERTIFIED BY	TALB
DATE	9-15-90
VERIFIED BY	
DATE	

COMMENTS

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE

TITLE

DATE

EPA TH 0101

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Florida Gas / Quincy Station

ADDRESS:

CITY: Quincy | STATE: Fl | ZIP:

PHONE: | SOURCE ID NUMBER: 1406

PROCESS EQUIPMENT: Cooper Bessemer | OPERATING MODE: 2700 BHP

CONTROL EQUIPMENT: | OPERATING MODE:

DESCRIBE EMISSION POINT: circular stack

HEIGHT ABOVE GROUND LEVEL: ~60' | HEIGHT RELATIVE TO OBSERVER: ~60'

DISTANCE FROM OBSERVER: ~120' | DIRECTION FROM OBSERVER: N-NE

DESCRIBE EMISSIONS: None

EMISSION COLOR: | PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT: NO ☑ YES ☐ | IS WATER DROPLET PLUME ATTACHED ☐ DETACHED ☐

AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED: 2 duct diameters downstream of emission point

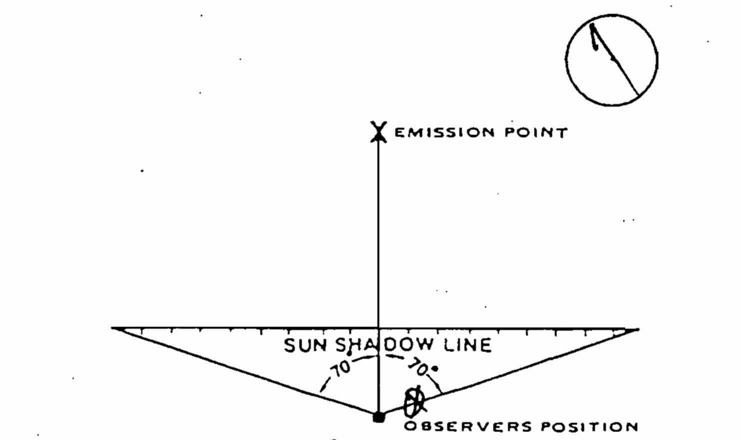
DESCRIBE BACKGROUND: sky

BACKGROUND COLOR: Blue / white | SKY CONDITIONS: Partly Cloudy

WIND SPEED: 10-15 mph | WIND DIRECTION: West

AMBIENT TEMP.: ~~75~~ 79 | WET BULB TEMP.: ~~67~~ 70 | RELATIVE HUMIDITY: ~~66%~~ 64%

SOURCE LAYOUT SKETCH | DRAW NORTH ARROW



OBSERVATION DATE: 3-19-92 | START TIME: 1202 | STOP TIME: 1302

M \ sec	0	15	30	45	M \ sec	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

AVERAGE OPACITY FOR HIGHEST PERIOD: 0 | NUMBER OF READINGS ABOVE 0 % WERE 0

RANGE OF OPACITY READINGS: 0 MINIMUM 0 MAXIMUM

COMMENTS:

OBSERVER'S NAME (PRINT): Tony Sacre

OBSERVER'S SIGNATURE: Tony Sacre | DATE: 3-19-92

ORGANIZATION: CUBIX

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE: | CERTIFIED BY: TACB | DATE: 9-15-90

TITLE: | DATE: | VERIFIED BY: | DATE:

EPA TR 0101

APPENDIX H: FUEL ANALYSES AND CALCULATIONS

CERTIFICATE OF ANALYSIS NUMBER 199902

SAMPLE IDENT.:	QUINCY STATION # 01 FLORIDA GAS TRANS. NATURAL GAS FUEL 03/17/92 @ 10:15	DATE:	APRIL 08, 1992
		P. O. NO.:	92143

FOR: CUBIX CORPORATION
9225 LOCKHART HIGHWAY
AUSTIN, TEXAS 78747

ATTN: MR. JOE RUDYK

ASTM D-3246
TOTAL SULFUR ANALYSIS

< 1 ppm by wt.

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

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

SOUTHERN PETROLEUM LABORATORIES, INC.

J. C. WINFREY

To: Fred Griffin

From: Sta. 16

ANALYSIS

DATE: 03/19/92 ANALYSIS TIME: 345 STREAM SEQUENCE: 12
TIME: 13:48 CYCLE TIME: 360 STREAM#: 1
ANALYZER#: 2 MODE: RUN CYCLE START TIME: 13:41

COMP NAME	COMP CODE	MOLE %	GAL/MCF**	B.T.U.*	SP. GR.*
HEXANE +	151	0.055	0.0240	2.83	0.0018
PROPANE	152	0.291	0.0803	7.35	0.0044
I-BUTANE	153	0.077	0.0253	2.52	0.0016
N-BUTANE	154	0.065	0.0206	2.13	0.0013
IPENTANE	155	0.031	0.0113	1.23	0.0008
NPENTANE	156	0.020	0.0074	0.82	0.0005
NITROGEN	157	0.414	0.0000	0.00	0.0040
METHANE	158	96.401	0.0000	975.86	0.5340
CO2	159	0.684	0.0000	0.00	0.0104
ETHANE	160	1.961	0.5246	34.79	0.0204
TOTALS		100.000	0.6935	1027.54	0.5791

* @ 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) = 1029.7
REAL SPECIFIC GRAVITY = 0.5800
UNNORMALIZED TOTAL = 99.75
ANALOG INPUT CHANNEL 1 = H 2 S 140 = .35292
ANALOG INPUT CHANNEL 2 = WATER 144 = .21972

CTIVE ALARMS

NONE

Hydrogen Sulfide .25

1 Gr = 15.83 ppm

Client: Florida Gas
Sample ID: Quincy Station Fuel Gas

CALCULATION OF DENSITY AND HEATING VALUE

Component	% Volume	Molecular Wt.	Density (lb/ft3)	% volume x Density	weight %	Component Gross Btu/lb	Weight Fract. Btu	Gross Heating Value (Btu/SCF)	Volume Fract. Btu
Hydrogen		2.016	0.0053	0.00000	0.0000	61100	0.00	325	0
Oxygen		32.000	0.0846	0.00000	0.0000	0	0.00	0	
Nitrogen	0.4140	28.016	0.0744	0.00031	0.6945	0	0.00	0	0
CO2	0.6840	44.01	0.117	0.00080	1.8044	0	0.00	0	0
CO		28.01	0.074	0.00000	0.0000	4347	0.00	322	0
Methane	96.4010	16.041	0.0424	0.04087	92.1585	23879	22006.54	1013	976.54
Ethane	1.9610	30.067	0.0803	0.00157	3.5504	22320	792.46	1792	35.141
Ethylene		28.051	0.0746	0.00000	0.0000	21644	0.00	1614	0
Propane	0.2910	44.092	0.1196	0.00035	0.7847	21661	169.98	2590	7.5369
propylene		42.077	0.111	0.00000	0.0000	21041	0.00	2336	0
Isobutane	0.0770	58.118	0.1582	0.00012	0.2747	21308	58.52	3363	2.5895
n-butane	0.0650	58.118	0.1582	0.00010	0.2319	21257	49.28	4016	2.6104
Isobutene		56.102	0.148	0.00000	0.0000	20840	0.00	3068	0
Isopentane	0.0310	72.144	0.1904	0.00006	0.1331	21091	28.07	4008	1.2425
n-pentane	0.0200	72.144	0.1904	0.00004	0.0859	21052	18.08	3993	0.7986
n-hexane	0.0550	86.169	0.2274	0.00013	0.2820	20940	59.05	4762	2.6191
H2S		34.076	0.0911	0.00000	0.0000	7100	0.00	647	0
total	100.00	Average Density		0.04435	100.0000	Gross Heating Value Btu/lb	23182	Gross Heating Value Btu/SCF	1029
		Specific Gravity		0.57976					

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	0.41	11.5986	0	0	0.691821803		
CO2	44.01	0.272273	0	0.68	30.1028	0.48887724	0		1.3054	
CO	28.01	0.42587	0	0.00	0.0000	0	0		0	
Methane	16.041	0.75	0.25	96.40	1546.3684	69.1770465	23.059016			
Ethane	30.067	0.8	0.2	1.96	58.9614	2.8134905	0.7033726			
Ethylene	28.051	0.85714	0.14286	0.00	0.0000	0	0			
Propane	44.092	0.81818	0.18182	0.29	12.8308	0.62616591	0.1391482			
Propene	42.077	0.85714	0.14286	0.00	0.0000	0	0			
Isobutane	58.118	0.82759	0.17247	0.08	4.4751	0.22090441	0.0460365			
n-butane	58.118	0.82759	0.17247	0.07	3.7777	0.18647775	0.038862			
Isobutene	56.102	0.85714	0.14286	0.00	0.0000	0	0			
Isopentane	72.144	0.83333	0.16667	0.03	2.2365	0.11116465	0.0222335			
n-pentane	72.144	0.83333	0.16667	0.02	1.4429	0.07171913	0.0143442			
n-hexane	86.169	0.83721	0.16279	0.06	4.7393	0.23666603	0.0460182			
H2S	34.08	0	0	0.00	0.0000	0	0			0
Totals				99.99900	1676.5335	73.9325121	24.07	0.691821803	1.3054	0
										99.999

CALCULATED VALUES		
O2 F Factor (dry)	**8637**	DSCF of Exhaust/MM Btu of Fuel Burned @ 0% excess air
O2 F Factor (wet)	**10641**	SCF of Exhaust/MM Btu of Fuel Burned @ 0% excess air
Moisture F Factor	**2004**	SCF of Water/MM Btu of Fuel Burned @ 0% excess air
Combust. Moisture	**18.83**	volume % water in flue gas @ 0% excess air
Fo	**1.8**	fuel factor (dimensionless)
VOC Portion of fuel	**2.50**	%
CO2 F Factor	**1024**	DSCF of CO2/MM Btu of Fuel Burned @ 0% excess air

APPENDIX J:
UNOFFICIAL TEST RESULTS

Operator/Plant	Florida Gas Quincy Compressor Station
Location	Gadsden County, Florida
Source	Cooper-Bessamer
Technicians	LF,TS,NF

Test Run No.	C-1	C-2	C-3
Date	3/19/92	3/19/92	3/19/92
Start Time	09:36	10:46	12:02
Stop Time	10:36	11:46	13:02
Engine/Compressor Operation			
Engine Speed (rpm)	329	329	328
Ignition Timing (°BTDC)	3	3	3
Air Manifold Pressure (psig)	13.5	14	14
Air Manifold Temperature (°F)	100	108	108
Fuel Flow (SCFH)	18900	18904	18960
Fuel Temperature (°F)	78	78	79
Fuel Manifold Pressure (psig)	47	47.5	48
Pre-Combustion Chamber Pressure (psig)	42	43.5	43.5
Loading Step (pockets open out of 15 total)	15	14	14
Suction Pressure (psig)	700	700	698
Suction Temperature (°F)	66	66	67
Discharge Pressure (psig)	937	918	918
Discharge Temperature (°F)	98	99	100
Engine Load (BHP)	2645	2710	2683
Torque (%)	98	101	99
Turbo Exhaust Temperature (°F)	511/639	514/647	516/647
Ambient Conditions			
Atmospheric Pressure (in. Hg)	29.65	29.64	29.64
Temperature (°F) : Dry bulb	71	76	79
(°F) Wet bulb	68	67	70
Humidity (lb/lb air)	0.0138	0.0120	0.0135
Measured Emissions			
NOx (ppmv)	16.8	21.6	21.8
CO (ppmv)	248	209	206
O2 via Method 3a (%)	16.0	15.8	15.8
CO2 via Method 3a (%)	2.92	2.97	2.95
THC via EPA Method 25a (ppmv, wet)	1560	1305	1480
VOC via EPA Method 18 (% of THC)	5.86%	6.37%	5.63%
VOC i.e. non methane via EPA 18 (ppmv, wet)	91.3	83.1	83.3
VOC via Methods 25a and 18 (ppmv, dry)	96.8	88.0	88.4
SO2 in fuel (grains/100 DSCF)	<0.059	<0.059	<0.059
Stack Volumetric Flow Rates			
via Pitot Tube (SCFH, dry)	6.01E+05	5.81E+05	6.06E+05
Calculated Emission Rates (via pitot tube)			
NOx (lbs/hr)	1.21	1.50	1.58
CO (lbs/hr)	10.8	8.83	9.07
VOC (lbs/hr)	2.42	2.13	2.22
SO2 (lbs/hr)	<0.0016	<0.0016	<0.0016
NOx (tons/yr)	5.28	6.57	6.91
CO (tons/yr)	47.5	38.7	39.7
VOC (tons/yr)	10.59	9.31	9.74
SO2 (tons/yr)	<0.0070	<0.0070	<0.0070
NOx (g/hp-hr)	0.21	0.25	0.27
CO (g/hp/hr)	1.86	1.48	1.53
VOC (g/hp-hr)	0.41	0.36	0.38

Unofficial Test Results: Quincy Compressor Station

Operator/Plant	Florida Gas Quincy Compressor Station
Location	Gadsden County, Florida
Source	Cooper-Bessamer
Technicians	LF,TS,NF

Test Run No.	C-1	C-2	C-3
Stack Moisture & Molecular Wt. via EPA Method 4			
CO_2 (%)	2.92	2.97	2.95
O_2 (%)	15.95	15.80	15.80
Beginning Meter Reading (ft3)	571.346	594.017	615.515
Ending Meter Reading (ft3)	593.848	615.354	641.380
Beginning Impinger Wt (g)	2409.7	2435.7	2459.6
Ending Impinger Wt. (g)	2435.7	2459.6	2490
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	98	110	110
Dry Gas Meter Temperature (°F end)	116	120	120
Atmospheric Pressure (in Hg, abs.)	29.65	29.64	29.64
Stack Gas Moisture (% volume)	5.63	5.54	5.80
Dry Gas Fraction	0.944	0.945	0.942
Stack Gas Molecular Wt. (lbs/lb-mole)	28.48	28.49	28.46
Stack Moisture & Molecular Wt. via Stoichiometry			
Fuel Moisture Content (vol % @ 0% O_2)	18.83	18.83	18.83
Moisture Content (vol % at stack)	5.35	5.36	5.46
Difference between methods	5%	3%	6%
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	2.40	1.70	1.80
ΔP #2	2.50	1.70	1.80
ΔP #3	1.90	2.20	2.20
ΔP #4	1.90	1.60	2.10
ΔP #5	1.80	2.20	1.90
ΔP #6	2.10	1.90	1.80
ΔP #7	1.80	1.90	2.36
ΔP #8	1.70	1.80	2.40
Sum of Square Root of ΔP's	11.3	10.9	11.4
Number of Traverse Points	8	8	8
Average Square Root of ΔP's	1.42	1.37	1.43
Average Temperature (°F)	510	509	509
Static Pressure (in. H_2O)	-0.1	-0.15	-0.1
Stack Diameter (in.)	23.5	23.5	23.5
Stack Area (ft2)	3.01	3.01	3.01
Stack Velocity (ft/min)	6536	6311	6593
Stack Flow,wet (ACFM)	19688	19008	19858
Stack Flow,dry (SCFH)	6.01E+05	5.81E+05	6.06E+05
Stack Flow Rate via EPA Method 19			
Fuel Flow to Engine (SCFH)	18900	18904	18960
Fuel Heating Value (BTU/SCF)	1029	1029	1029
Fuel O_2 F-Factor (DSCFH/MMBTU)	8637	8637	8637
Fuel CO_2 F-Factor (DSCFH/MMBTU)	1024	1024	1024
Stack Flow Rate, dry via O_2 F-factor (SCFH)	7.09E+05	6.89E+05	6.91E+05
Stack Flow Rate, dry via CO_2 F-factor (SCFH)	6.82E+05	6.71E+05	6.77E+05
Difference between O_2 F-factor and pitot tube	18%	18%	14%
Difference between CO_2 F-factor and pitot tube	13%	15%	12%
Stack Flow Rate via Carbon Balance			
Fuel Carbon Content	1.030	1.030	1.030
Exhaust Carbon Content	3.10	3.12	3.12
Stack Flow Rate, dry via Carbon Balance (SCFH)	6.28E+05	6.24E+05	6.26E+05
Difference between carbon balance and pitot tube (SCFH	4%	7%	3%

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

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

J. Heron
CHF/BT

KBN

December 17, 1990

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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. 14 PSD Permit Application

Dear Ms. Heron:

As you requested, attached is the sheet of emission calculations for FGTC's Compressor Station No. 14. Please feel free to contact me at your convenience if you have further questions concerning this permit application.

Sincerely,

David A. Buff

David A. Buff, P.E.
Principal Engineer

TT/tla

cc: Alan Bowman, ENRON

Attachment

c: T. Heron
B. Andrews
C. Holladay
J. Harper, EPA
J. Pruce, NW Dist
C. Shaver, NPS

90051A1/2

EMISSION CALCULATIONS

FGTC's COMPRESSOR STATION No. 14
GADSDEN COUNTY, FLORIDA

Fuel usage and emission calculations are presented below for the proposed Cooper-Bessemer Model GMVR-12C2 reciprocating IC engine at Compressor Station No. 14.

Fuel Usage:

	(2,400 bhp) x (7,000 Btu/bhp-hr)	= 16.80 x 10^6 Btu/hr
	(16.80 x 10^6 Btu/hr)/(1,040 Btu/scf)	= 16,154 scf/hr

Emission Calculations:

NO_x:	(2.0 g/bhp-hr)(2,400 bhp)(1 lb/453.593 g)	= 10.582 lb/hr
	(10.582 lb/hr)(8,760 hr/yr)(1 ton/2,000 lb)	= 46.3 TPY
CO:	(2.1 g/bhp-hr)(2,400 bhp)(1 lb/453.593 g)	= 11.111 lb/hr
	(11.111 lb/hr)(8,760 hr/yr)(1 ton/2,000 lb)	= 48.7 TPY
VOCs(non-methane hydrocarbon):		
	(0.5 g/bhp-hr)(2,400 bhp)(1 lb/453.593 g)	= 2.646 lb/hr
	(2.646 lb/hr)(8,760 hr/yr)(1 ton/2,000 lb)	= 11.6 TPY
PM:	(5 lb/10^6 scf)(16,154 scf/hr)	= 0.081 lb/hr
	(0.081 lb/hr)(8,760 hr/yr)(1 ton/2,000 lb)	= 0.35 TPY
SO_2:	(10 gr/100 scf)(16,154 scf/hr)(1 lb/7,000 gr)	= 0.231 lb/hr of Sulfur
	(2 lb SO_2/lb Sulfur)(0.231 lb/hr Sulfur)	= 0.462 lb/hr of SO_2
	(0.462 lb/hr)(8,760 hr/yr)(1 ton/2,000 lb)	= 2.02 TPY

BEST AVAILABLE COPY

ENRON
Gas Pipeline Operating Company

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

November 15, 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. 14
Gadsden 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. 14. With net NO_x emissions exceeding 40 tons per year, this addition, a 2,400 horsepower reciprocating compressor engine, constitutes a major modification. The maximum estimated NO_x concentration from the proposed lean burn engine, however, is less than EPA's significant impact level.

This is the third of nine permit applications we plan to submit to FDER as part of FGT's Phase II expansion. We have spent a lot of time and effort to ensure that it is of highest quality. For example, the Best Available Control Technology (BACT) analysis follows EPA's (draft) top-down guideline, and capitalizes on what Enron has learned about guideline interpretation from its Northern Natural Gas Company Waterloo, Iowa station - a recently approved permit application that followed the draft guideline.

Since FGT's Phase II project is designed to bring clean fuel to Floridians by the 1991-92 heating season, and to displace foreign oil imports, we would ask that you review this permit application and issue the construction permit as soon as possible.

If you have any questions concerning this letter, please contact me at (713) 853-7303, or David Buff, KBN Engineering and Applied Sciences, Inc., Gainesville, Florida, at (904) 331-9000.

Sincerely,

W. Alan Bowman

W. Alan Bowman (Room 2570)
Project Environmentalist
Environmental Affairs Department

Enclosures: 8 Copies of Permit Application
Construction Permit Fee

cc: Jerry Murphy, Enron
Kevin McGlynn, Enron
David Buff, KBN

1990 NOV 19 AM 10: 18
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FAN1102wab

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FEDERAL EXPRESS

QUESTIONS? CALL 800-238-5355 TOLL FREE.

[redacted]

AIRBILL
PACKAGE TRACKING NUMBER **8202996185**

205M 8202996185

[redacted]

Date 11-~~15~~ 16-90

RECIPIENT'S COPY

1 From (Your Name) Please Print: David A. Buff
Your Phone Number (Very Important): (904) 331-9000
Company: KBN ENG & APPLIED SCIENCES
Department/Floor No.:
Street Address: 1034 NW 57TH ST
City: GAINESVILLE State: FL ZIP Required: 32605

2 To (Recipient's Name) Please Print: Clair Fancy, P.E.
Recipient's Phone Number (Very Important): (904) 488-4805
Company: Chief, Bureau of Air Regulation
Fla. Dept. of Environmental Regulation
Department/Floor No.:
Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip® Codes.): 2600 Blair Stone Road
City: Tallahassee, State: FL ZIP Required: 32301

YOUR INTERNAL BILLING REFERENCE INFORMATION (First 24 characters will appear on invoice.)
90051

H IF HOLD FOR PICK-UP, Print FEDEX Address Here
Street Address
City State ZIP Required

3 PAYMENT 1 [X] Bill Sender 2 [ ] Bill Recipient's FedEx Acct. No. 3 [ ] Bill 3rd Party FedEx Acct. No. 4 [ ] Bill Credit Card
5 [ ] Cash/Check

[redacted]

4 SERVICES (Check only one box)

Priority Overnight Service (Delivery by next business morning†)	Standard Overnight Service (Delivery by next business afternoon†)
11 [X] YOUR PACKAGING	51 [XX] YOUR PACKAGING — our pkg
16 [ ] FEDEX LETTER*	56 [ ] FEDEX LETTER*
12 [ ] FEDEX PAK*	52 [ ] FEDEX PAK*
13 [ ] FEDEX BOX	53 [ ] FEDEX BOX
14 [ ] FEDEX TUBE	54 [ ] FEDEX TUBE
Economy Distribution Service (formerly Standard Air) (Delivery by second business day†)	**Heavyweight Service** (for Extra Large or any package over 150 lbs.)
	70 [ ] HEAVYWEIGHT**
30 [ ] ECONOMY DIST. SVC.	80 [ ] DEFERRED HEAVYWEIGHT**

† Delivery commitment may be later in some areas.
*Declared Value Limit $100.
**Call for delivery schedule.

DELIVERY AND SPECIAL HANDLING (Check services required)

1 [ ] HOLD FOR PICK-UP (Fill in Box H)
2 [ ] DELIVER WEEKDAY
3 [ ] DELIVER SATURDAY (Extra charge) (Not available to all locations)
4 [ ] DANGEROUS GOODS (Extra charge)
5 [ ]
6 [ ] DRY ICE ______ Lbs
7 [ ] OTHER SPECIAL SERVICE
8 [ ]
9 [ ] SATURDAY PICK-UP (Extra charge)
10 [ ]
11 [ ]
12 [ ] HOLIDAY DELIVERY (If offered) (Extra charge)

PACKAGES	WEIGHT In Pounds Only	YOUR DECLARED VALUE
Total 1	Total 4	Total

DIM SHIPMENT (Chargeable Weight) ______ lbs.

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

FedEx Emp. No.

Emp. No. | Date
[ ] Cash Received
[ ] Return Shipment
[ ] Third Party [ ] Chg To Del [ ] Chg To Hold
Street Address
City State Zip

RECEIVED
NOV 18 1990
DER - BAQM

Received By: X
Date/Time Received | FedEx Employee Number

5 Release Signature:
Date/Time

Federal Express Use
Base Charges
Declared Value Charge
Other 1
Other 2
Total Charges

REVISION DATE 4/90
PART #119500 FXEM 7/90
FORMAT #027
027
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PRINTED IN U.S.A.

CHECK NO.
0822020232

ENRON CORP

ENRON GAS PIPELINE OPERATING COMPANY
P.O. BOX 1188
HOUSTON, TEXAS 77251-1188

DATE OF CHECK
10-19-90

This check is VOID unless printed on BLUE background

AMOUNT OF CHECK

EXACTLY $*******500 DOLLARS 00 CENTS $*******500.00

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

[redacted]

CHECK NO. 0822020232

REMITTANCE STATEMENT
ENRON GAS PIPELINE OPERATING COMPANY

PAGE 001 OF 001

VOUCHER NO.	INVOICE DATE	INVOICE NUMBER	PURCHASE ORDER	AMOUNT GROSS	AMOUNT DISCOUNT	AMOUNT NET
9010001568	101790	CKR10179001		500.00	0.00	500.00
C.S. #14 CONSTRUCTION PERMIT FGT						
					TOTAL	500.00

$25 < Q < 50$ tpy

Special Instructions
CALL SUZY AT EXT 7304

P. O. BOX 1188, HOUSTON,TEXAS 77251-1188
DETACH STATEMENT BEFORE DEPOSITING. ENDORSEMENT OF CHECK ATTACHED ACKNOWLEDGES PAYMENT IN FULL OF ALL ITEMS SHOWN ABOVE. IN CASE OF ERROR OR OMISSION RETURN BOTH CHECK AND STATEMENT.

PSD PERMIT APPLICATION
FLORIDA GAS TRANSMISSION COMPANY
COMPRESSOR STATION NO. 14

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
90051D1/P

STATE OF FLORIDA

Station No. 14

DEPARTMENT OF ENVIRONMENTAL REGULATION

$500 pd.
11-19-90
Rcpt.# 151211

AC 20 - 189438
PSD-FL- 159

APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: Natural Gas Compressor Engine [X] New[1] [ ] Existing[1]

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

COMPANY NAME: Florida Gas Transmission Company COUNTY: Gadsden

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 14, Unit No. 6

SOURCE LOCATION: Street 8 miles southwest of Quincy on SR 65 City Quincy

UTM: East 16:719.97 km North 3377.39 km

Latitude 30 ° 30 ' 38 "N Longitude 84 ° 42 ' 28 "W

APPLICANT NAME AND TITLE: W. Alan Bowman, Project Environmentalist

APPLICANT ADDRESS: P.O. Box 1188, Houston, Texas 77251 Phone: (713) 853-7303

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative* of Florida Gas Transmission Co.

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

*Attach letter of authorization

Signed: [signature]

C.L. Truby, Vice President
Name and Title (Please Type)

Date: 11-7-90 Telephone No. (713) 853-6161

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

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

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

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

Signed David A. Buff

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. 15, 1990 Telephone No. (904) 331-9000

SECTION II: GENERAL PROJECT INFORMATION

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

See PSD report, Section 1.0--Introduction, and
Section 2.0--Project Description

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

Start of Construction March 15, 1991 Completion of Construction 18 months after permit issuance

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

Not applicable

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

Not applicable

E. Requested permitted equipment operating time: hrs/day 24; days/wk 7; wks/yr 52;
If power plant, hrs/yr _____; if seasonal, describe: ______

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

1. Is this source in a non-attainment area for a particular pollutant? No
   a. If yes, has "offset" been applied? ______
   b. If yes, has "Lowest Achievable Emission Rate" been applied? ______
   c. If yes, list non-attainment pollutants. ______
2. Does best available control technology (BACT) apply to this source? If yes, see Section VI. Yes
3. Does the State "Prevention of Significant Deterioration" (PSD) requirement apply to this source? If yes, see Sections VI and VII. Yes
4. Do "Standards of Performance for New Stationary Sources" (NSPS) apply to this source? No
5. Do "National Emission Standards for Hazardous Air Pollutants" (NESHAP) apply to this source? No

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

   a. If yes, for what pollutants? ______
   b. If yes, in addition to the information required in this form, any information requested in Rule 17-2.650 must be submitted.

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

See PSD Report, Section 3.0--Air Quality Review Requirements and Applicability

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

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

Description	Contaminants		Utilization Rate - lbs/hr	Relate to Flow Diagram
	Type	% Wt		
Not applicable				

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

1. Total Process Input Rate (lbs/hr): Not applicable

2. Product Weight (lbs/hr): Not applicable

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

Name of Contaminant	Emission[1]		Allowed[2] Emission Rate per Rule 17-2	Allowable[3] Emission lbs/hr	Potential[4] Emission		Relate to Flow Diagram
	Maximum lbs/hr	Actual T/yr			lbs/hr	T/yr	
NO_x	10.6	46.3	BACT	BACT	10.6	46.3	
CO	11.1	48.7	N/A	N/A	11.1	48.7	
VOCs	2.6	11.6	N/A	N/A	2.6	11.6	
Particulates	0.08	0.35	N/A	N/A	0.08	0.35	
SO_2	0.46	2.02	N/A	N/A	0.46	2.02	

[1]See Section V, Item 2.

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

[3]Calculated from operating rate and applicable standard.

[4]Emission, if source operated with~~out~~ control (See Section V, Item 3).

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

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)
Lean Burn Engine Design	NO_x	80%	N/A	Design and
				AP-42

E. Fuels

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max/hr	
Natural Gas	0.0162	0.0162	16.80

*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/ft^3 lbs/gal Typical Percent Nitrogen: NA

Heat Capacity: 22,857 (based on 1,040 Btu/scf) BTU/lb NA BTU/gal

Other Fuel Contaminants (which may cause air pollution): NA

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

Annual Average Not applicable Maximum

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

Not applicable

*Based on contract limit of 10 gr/100 ft^3 and gas at 0.0455 lb/ft^3

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

Stack Height: 50 ft. Stack Diameter: 1.438 ft.

Gas Flow Rate: 15,857 ACFM 7,511 DSCFM Gas Exit Temperature: 550 °F.

Water Vapor Content: 8 % Velocity: 162.7 FPS

SECTION IV: INCINERATOR INFORMATION

Not Applicable

Type of Waste	Type 0 (Plastics)	Type II (Rubbish)	Type III (Refuse)	Type IV (Garbage)	Type IV (Patholog-ical)	Type V (Liq.& Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Inciner-ated							
Uncon-trolled (lbs/hr)							

Description of Waste ______

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

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

Manufacturer ______

Date Constructed ______ Model No. ______

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

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

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

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

Type of pollution control devices: [ ] Cyclone [ ] Wet Scrubber [ ] Afterburner [ ] Other

(specify) ______

Brief description of operating characteristics of control devices: ______

______

______

______

______

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

______

______

______

______

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

SECTION V: SUPPLEMENTAL REQUIREMENTS

Please provide the following supplements where required for this application.

1. Total process input rate and product weight -- show derivation [Rule 17-2.100(127)]
   Not Applicable
2. To a construction application, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach proposed methods (e.g., FR Part 60 Methods, 1, 2, 3, 4, 5) to show proof of compliance with applicable standards. To an operation application, attach test results or methods used to show proof of compliance. Information provided when applying for an operation permit from a construction permit shall be indicative of the time at which the test was made.
   See PSD Report, Section 2.0, Tables 2-1 and 2-2
3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).
   See PSD Report, Section 2.0
4. With construction permit application, include design details for all air pollution control systems (e.g., for baghouse include cloth to air ratio; for scrubber include cross-section sketch, design pressure drop, etc.)
   Not Applicable
5. With construction permit application, attach derivation of control device(s) efficiency. Include test or design data. Items 2, 3 and 5 should be consistent: actual emissions = potential (1-efficiency).
   Not Applicable
6. An 8 ½" x 11" flow diagram which will, without revealing trade secrets, identify the individual operations and/or processes. Indicate where raw materials enter, where solid and liquid waste exit, where gaseous emissions and/or airborne particles are evolved and where finished products are obtained.
   See PSD Report, Figure 2-2
7. An 8 ½" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Examples: Copy of relevant portion of USGS topographic map).
   See PSD Report, Figure 1-2
8. An 8 ½" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram.
   See PSD Report, Figure 2-1

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

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

SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY

See PSD report, Sections 3.0 and 6.0

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

[ ] Yes [ ] No

Contaminant	Rate or Concentration

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

[ ] Yes [ ] No

Contaminant	Rate or Concentration

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

Contaminant	Rate or Concentration

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

1. Control Device/System:
2. Operating Principles:
3. Efficiency:*
4. Capital Costs:

*Explain method of determining

5. Useful Life: 6. Operating Costs:

7. Energy: 8. Maintenance Cost:

9. Emissions:

Contaminant	Rate or Concentration

10. Stack Parameters

a. Height: ft. b. Diameter ft.

c. Flow Rate: ACFM d. Temperature: °F.

e. Velocity: FPS

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

1.

a. Control Devices: b. Operating Principles:

c. Efficiency:[1] d. Capital Cost:

e. Useful Life: f. Operating Cost:

g. Energy:[2] h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

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

2.

a. Control Device: b. Operating Principles:

c. Efficiency:[1] d. Capital Cost:

e. Useful Life: f. Operating Cost:

g. Energy:[2] h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

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

j. Applicability to manufacturing processes:

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

3.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

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

4.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

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

F. Describe the control technology selected:

1. Control Device:
2. Efficiency:[1]
3. Capital Cost:
4. Useful Life:
5. Operating Cost:
6. Energy:[2]
7. Maintenance Cost:
8. Manufacturer:
9. Other locations where employed on similar processes:

a. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

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

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

Contaminant	Rate or Concentration

(8) Process Rate:[1]

b. (1) Company:

(2) Mailing Address:

(3) City: (4) State:

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

Contaminant	Rate or Concentration

(8) Process Rate:[1]

10. Reason for selection and description of systems:

[1]Applicant must provide this information when available. Should this information not be available, applicant must state the reason(s) why.

SECTION VII - PREVENTION OF SIGNIFICANT DETERIORATION

Refer to PSD report

A. Company Monitored Data

1. ___________ no. sites __________ TSP _________ ( ) SO^{2*} _____________ Wind spd/dir

Period of Monitoring ______ / ___ / ______ to ______ / ___ / ______
month day year month day year

Other data recorded ______________________________

Attach all data or statistical summaries to this application.

*Specify bubbler (B) or continuous (C).

2. Instrumentation, Field and Laboratory

a. Was instrumentation EPA referenced or its equivalent? [ ] Yes [ ] No

b. Was instrumentation calibrated in accordance with Department procedures?

[ ] Yes [ ] No [ ] Unknown

B. Meteorological Data Used for Air Quality Modeling

1. ______ Year(s) of data from ______/____/______ to ______/____/______
month day year month day year

2. Surface data obtained from (location)______________________________

3. Upper air (mixing height) data obtained from (location) ______________________

4. Stability wind rose (STAR) data obtained from (location) ______________________

C. Computer Models Used

1. ______________________________ Modified? If yes, attach description.

2. ______________________________ Modified? If yes, attach description.

3. ______________________________ Modified? If yes, attach description.

4. ______________________________ Modified? If yes, attach description.

Attach copies of all final model runs showing input data, receptor locations, and principle output tables.

D. Applicants Maximum Allowable Emission Data

Pollutant	Emission Rate
TSP	______________________ grams/sec
SO^2	______________________ grams/sec

E. Emission Data Used in Modeling

Attach list of emission sources. Emission data required is source name, description of point source (on NEDS point number), UTM coordinates, stack data, allowable emissions, and normal operating time.

F. Attach all other information supportive to the PSD review.

G. Discuss the social and economic impact of the selected technology versus other applicable technologies (i.e, jobs, payroll, production, taxes, energy, etc.). Include assessment of the environmental impact of the sources.

H. Attach scientific, engineering, and technical material, reports, publications, journals, and other competent relevant information describing the theory and application of the requested best available control technology.

PREVENTION OF SIGNIFICANT DETERIORATION REPORT
FLORIDA GAS TRANSMISSION COMPANY
COMPRESSOR STATION NO. 14

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LIST OF FIGURES

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. 14. 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. 14 is located about 8 miles southwest of the town of Quincy on State Road 65 in Gadsden County, Florida. Figure 1-2 shows the site location of the existing compressor station.

The proposed expansion at this location consists of the addition of one new 2,400 brake horsepower (bhp) natural-gas-fired, reciprocating internal combustion (IC) engine. The proposed engine would be used solely for the purpose of transporting natural gas in the pipeline for distribution in Florida. The proposed engine is a turbocharged Cooper-Bessemer Model GMVR-12C2. Under current federal and state air quality regulations, the proposed engine will constitute a major modification at an existing major stationary source.

This report addresses the requirements of the Prevention of Significant Deterioration (PSD) review procedures pursuant to rules and regulations implementing the Clean Air Act (CAA) Amendments of 1977. The Florida Department of Environmental Regulation (FDER) has PSD review and approval authority in Florida. Based on the proposed emissions from the addition of a 2,400-bhp engine, a PSD review is required for nitrogen oxides (NO_x).

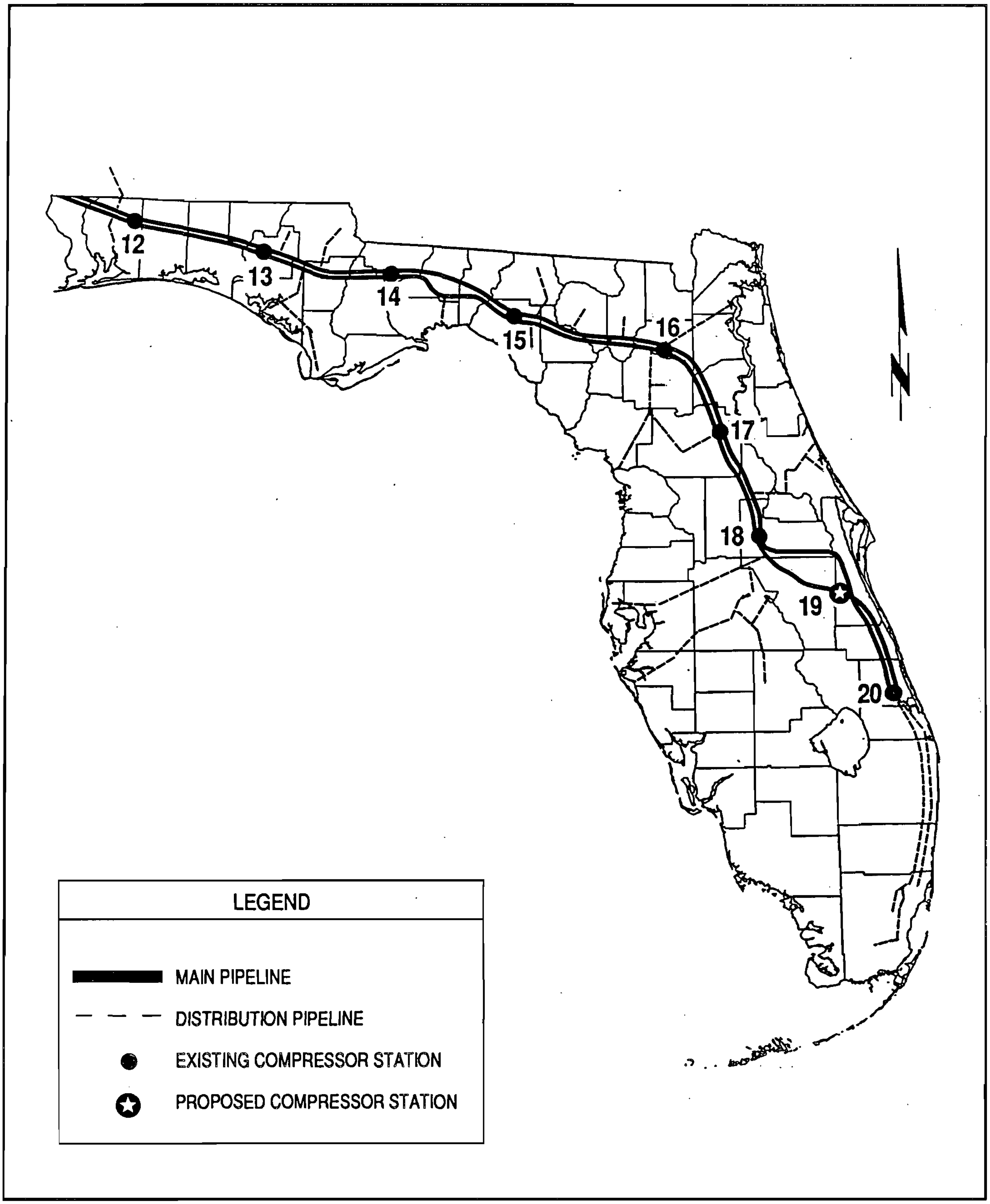

Figure 1-1 FGTC'S GAS TRANSMISSION SYSTEM

Florida Gas Transmission Company

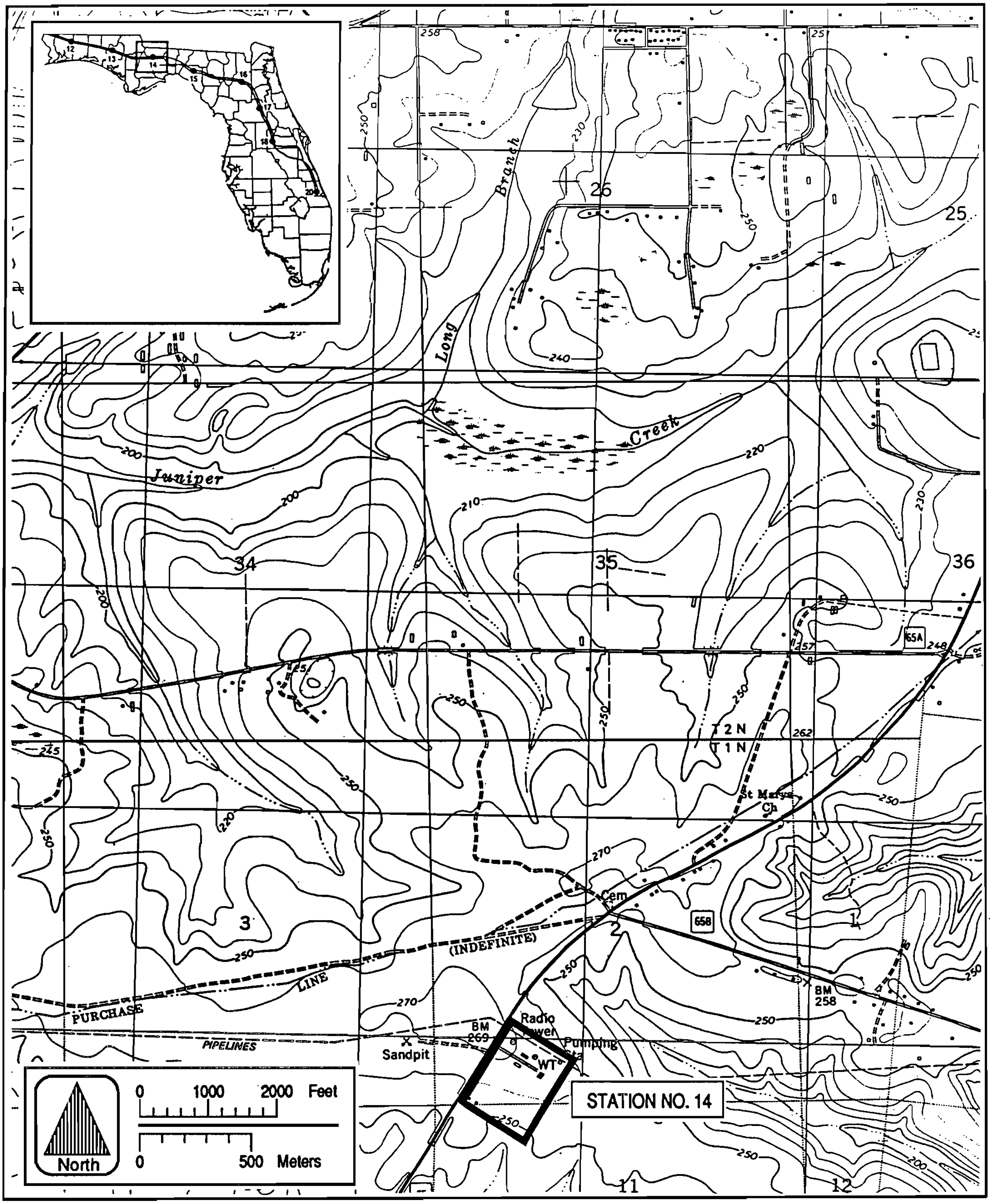

Figure 1-2 SITE LOCATION OF ENRON'S FLORIDA GAS TRANSMISSION LINE COMPRESSOR STATION NO. 14, QUINCY, GADSDEN COUNTY, FLORIDA

Florida Gas Transmission Company

Engineering designs for the proposed expansion project include selection of an engine incorporating lean-burn technology. The lean-burn technology for emission control represents best available control technology (BACT) for the proposed reciprocating IC engine.

This application contains five additional sections. Descriptions of the existing operation at FGTC's Compressor Station No. 14 and the proposed 2,400-bhp engine addition are presented in Section 2.0. The air quality review requirements and source applicability of the proposed engine to the regulations are discussed in Section 3.0. The methodology and results of the air dispersion modeling and air quality impact analysis are presented in Section 4.0, and impacts on soil, vegetation, and visibility are summarized in Section 5.0. The BACT analysis required as part of the PSD permitting process is presented in Section 6.0.

2.0 PROJECT DESCRIPTION

A plot plan of FGTC's Compressor Station No. 14, 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. 14 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 1959; 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. 14. The expansion plan currently calls for installation of a Cooper-Bessemer Model GMVR-12C2 integral engine-compressor unit. The engine has 12 power cylinders and is rated at 2,400 bhp at 330 revolutions per minute (rpm). The engine is turbocharged, increasing the air inlet manifold pressure, which allows the engine to operate at a high air-to-fuel ratio. This turbocharging provides more power output from the engine than would otherwise be attained without having to use a larger size engine. A

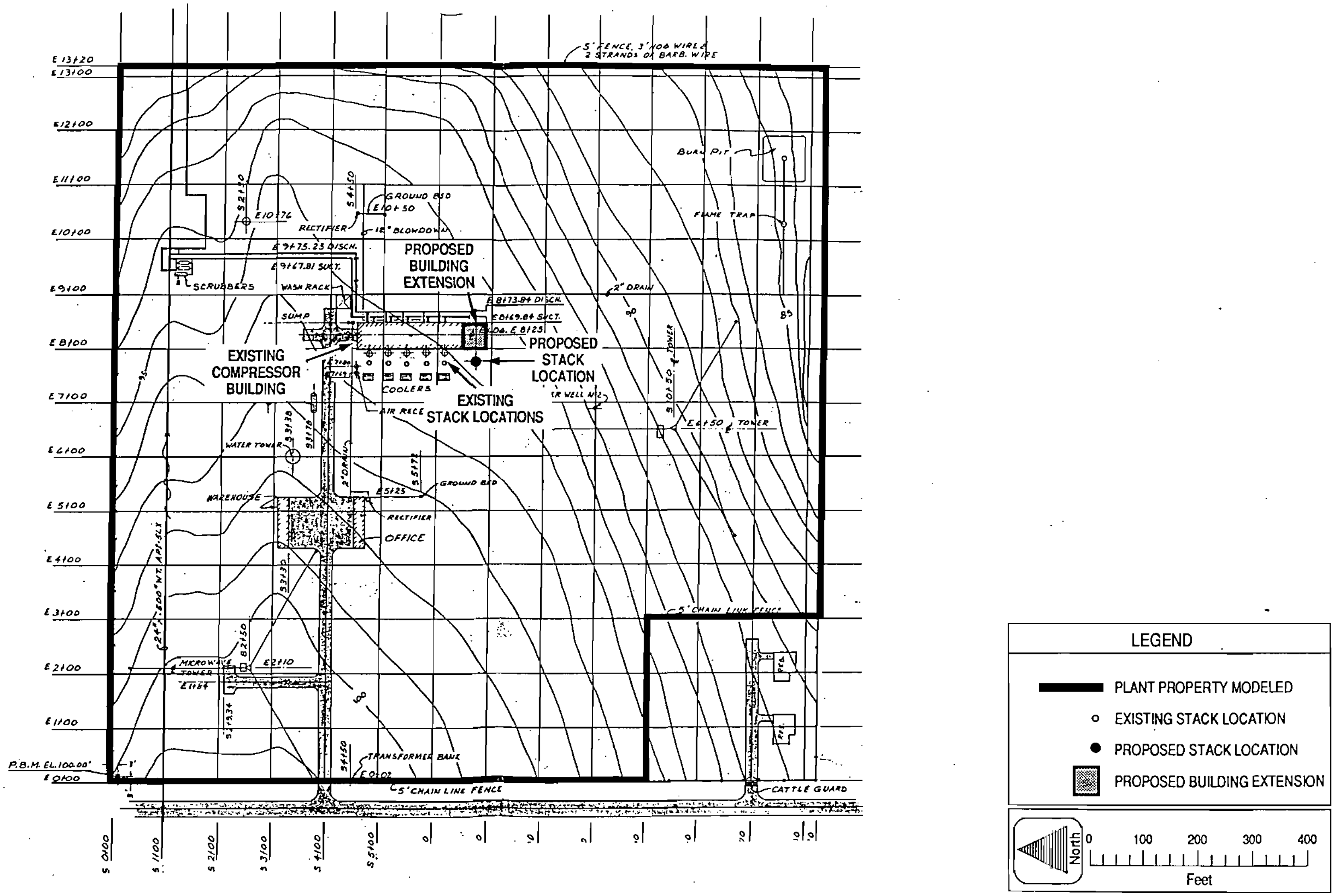

Figure 2-1 PLOT PLAN OF COMPRESSOR STATION NO. 14

Florida Gas Transmission Company

flow diagram of the integral engine compressor unit is presented in Figure 2-2. Fuel fired will be exclusively natural gas, supplied from the FGTC's gas pipeline. Based on the operating characteristics and design, this engine is classified as a high-power, large-bore, slow-speed reciprocating IC engine according to the U.S. Environmental Protection Agency's (EPA's) documented classification (EPA, 1979). Engine specifications and stack parameters for the proposed engine are presented in Table 2-1.

The proposed engine will incorporate "lean-burn" technology, which is state-of-the-art design for minimizing air pollutant concentration in the exhaust gases from gas-fired reciprocating IC engines. In the lean-burn design, a small, fuel-rich mixture is combusted in a pre-ignition chamber. The hot combustion gases from the pre-ignition chamber then pass to the main combustion chamber, where they ignite a lean mixture of fuel. Since most of the fuel entering the engine is burned in a lean state (i.e., high ratio of air to fuel), exhaust NO_x emissions are minimized. However, volatile organic compound (VOC) emissions are approximately 40 to 50 percent higher than the standard "rich-burn" engines.

Maximum hourly and annual emissions of regulated pollutants from the proposed engine are presented in Table 2-2. Emissions of NO_x, carbon monoxide (CO), and VOC are based on the engine manufacturer's guarantee. Particulate matter (PM) emissions are based upon EPA publication AP-42 (EPA, 1988d) emission factors for natural gas combustion in boilers. Emissions of sulfur dioxide (SO_2) are based on ENRON's natural gas specification. According to EPA's publication entitled Toxic Air Pollutant Emission Factors--A Compilation for Selected Air Toxic Compounds and Sources, there are no emission factors for other regulated pollutants due to natural gas combustion in stationary IC engines (EPA, 1988a).

In order to accommodate the new engine at the existing compressor station site, the existing compressor building will be extended. The extent of the addition is shown in Figure 2-1. The new engine will be housed inside the

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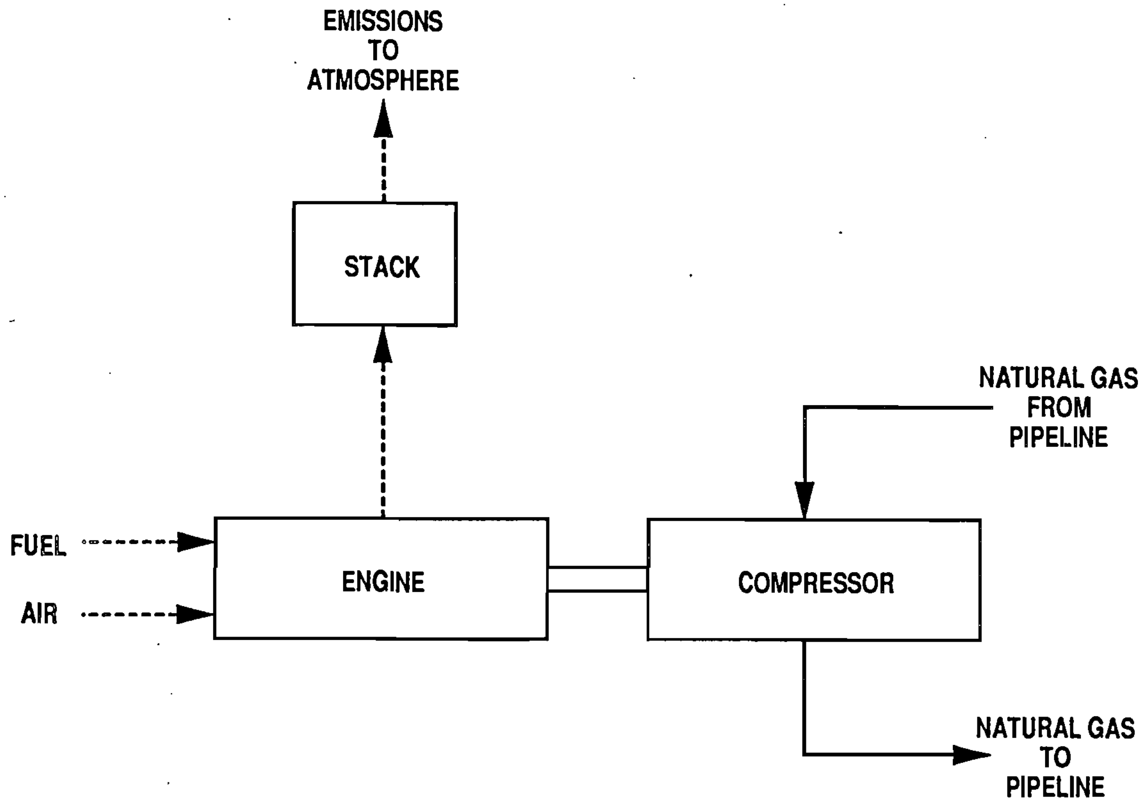

Figure 2-2 PROCESS FLOW DIAGRAM OF AN INTEGRAL ENGINE-COMPRESSOR UNIT

Florida Gas Transmission Company

Table 2-1. Engine Specifications and Stack Parameters for the Proposed Project

Parameter	Design Specification
Engine-Compressor	
Manufacturer	Cooper-Bessemer
Model	GMVR-12C2
Air Charging	Turbocharged
Unit Size	2,400 bhp
Number of Power Cylinders	12 cylinders
Number of Compressor Cylinders	6 cylinders
Power Cylinder Data	
Bore Size	14 inches
Stroke	14 inches
Cylinder Power	200 bhp/cylinder
Specific Heat Input	7,000 Btu/bhp-hr
Maximum Fuel Consumption	16,154 scf/hr[a]
Speed	330 rpm
Stack Parameters	
Stack Height	50 ft
Stack Diameter	17.25 inches
Exhaust Gas FLow	36,860 lb/hr 15,857 acfm
Exhaust Temperature	550°F
Exhaust Gas Velocity	162.7 ft/sec

Note: acfm = actual cubic feet per minute.
bhp = brake horsepower.
Btu/bhp-hr = British thermal units per brake horsepower per hour.
°F = degrees fahrenheit.
ft = feet.
ft/sec = feet per second.
lb/hr = pounds per hour.
scf = standard cubic feet.
rpm = revolutions per minute.

[a]Based on heating value for natural gas of 1,040 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	Maximum Emissions TPY
Nitrogen Oxides	2.0 g/bhp-hr	Manufacturer's guarantee	10.6	46.3
Carbon Monoxide	2.1 g/bhp-hr	Manufacturer's guarantee	11.1	48.7
Volatile Organic Compounds (non-methane)	0.5 g/bhp-hr	Manufacturer's guarantee	2.6	11.6
Particulate Matter	5 lb/MMscf	AP-42, Table 1.4-1	0.08	0.35
Sulfur Dioxide	10 gr/100 scf	ENRON Specification	0.46	2.02

Note: Maximum natural gas consumption is 16,154 standard cubic feet per hour (scf/hr).

g/bhp-hr = grams per brake horsepower per hour.
gr/100scf = grains per one hundred standard cubic feet.
lb/hr = pounds per hour.
lb/MMscf = pounds per million standard cubic feet.
TPY = tons per year.

enlarged building, on the 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 ($\mu g/m^3$)

Pollutant	Averaging Time	AAQS National Primary Standard	AAQS National Secondary Standard	AAQS State of Florida	PSD Increments Class I	PSD Increments Class II	Significant Impact Levels
Particulate Matter (TSP)	Annual Geometric Mean	NA	NA	NA	5	19	1
	24-Hour Maximum[a]	NA	NA	NA	10	37	5
Particulate Matter (PM10)	Annual Arithmetic Mean	50	50	50	4[c]	17[c]	1
	24-Hour Maximum[b]	150	150	150	8[c]	30[c]	5
Sulfur Dioxide	Annual Arithmetic Mean	80	NA	60	2	20	1
	24-Hour Maximum[b]	365	NA	260	5	91	5
	3-Hour Maximum[b]	NA	1,300	1,300	25	512	25
Carbon Monoxide	8-Hour Maximum[b]	10,000	10,000	10,000	NA	NA	500
	1-Hour Maximum[b]	40,000	40,000	40,000	NA	NA	2,000
Nitrogen Dioxide	Annual Arithmetic Mean	100	100	100	2.5	25	1
Ozone	1-Hour Maximum[d]	235	235	235	NA	NA	NA
Lead	Calendar Quarter Arithmetic Mean	1.5	1.5	15	NA	NA	NA

[a]Maximum concentration not to be exceeded more than once per year.
[b]Achieved when the expected number of exceedances per year is less than 1.
[c]Proposed by EPA in the Federal Register on October 5, 1989.
[d]Achieved when the expected number of days per year with concentrations above the standard is less than 1.

Note: Particulate matter (TSP) = total suspended particulate matter.
Particulate matter (PM10) = particulate matter with aerodynamic diameter less than or equal to 10 micrometers.
$\mu g/m^3$ = micrograms per cubic meter.
NA = Not applicable, i.e., no standard exists.

Sources: Federal Register, Vol. 43, No. 118, June 19, 1978.
40 CFR 50.
40 CFR 52.21.
Chapter 17-2.400, F.A.C.

stationary facility that has the potential to emit 250 TPY or more of any pollutant regulated under CAA. A "source" is defined as an identifiable piece of process equipment or emissions unit. "Potential to emit" means the capability, at maximum design capacity, to emit a pollutant considering the application of control equipment and any other federally enforceable limitations on the source's capacity. A "major modification" is defined under PSD regulations as a change at an existing major stationary facility which increases emissions by greater than significant amounts. PSD significant emission rates are shown in Table 3-2.

PSD review is used to determine whether significant air quality deterioration will result from the new or modified facility. Major new facilities and major modifications are required to undergo the following analyses related to PSD for each pollutant emitted in significant amounts:

1. Control technology review,
2. Source impact analysis,
3. Air quality analysis (monitoring),
4. Source information, and
5. Additional impact analyses.

In addition to these analyses, a new facility must also be reviewed with respect to good engineering practices (GEP) stack height regulations. If the proposed new source or modification is located in a nonattainment area for any pollutant, the source may be subject to nonattainment new source review requirements. Discussions concerning each of these requirements are presented in the following sections.

3.2.2 INCREMENTS/CLASSIFICATIONS

The 1977 Clean Air Act (CAA) amendments address PSD of air quality. The law specifies that certain increases in air quality concentrations above the baseline concentration level of sulfur dioxide (SO_2) and particulate matter--total suspended particulates [PM(TSP)]--would constitute

Table 3-2. PSD Significant Emission Rates and De Minimis Monitoring Concentrations

Pollutant	Regulated Under	Significant Emission Rate (TPY)	De Minimis Monitoring Concentration ($\mu g/m^3$)
Sulfur Dioxide	NAAQS, NSPS	40	13, 24-hour
Particulate Matter (TSP)	NAAQS, NSPS	25	10, 24-hour
Particulate Matter (PM10)	NAAQS	15	10, 24-hour
Nitrogen Oxides	NAAQS, NSPS	40	14, annual
Carbon Monoxide	NAAQS, NSPS	100	575, 8-hour
Volatile Organic Compounds (Ozone)	NAAQS, NSPS	40	100 TPY[a]
Lead	NAAQS	0.6	0.1, 3-month
Sulfuric Acid Mist	NSPS	7	NM
Total Fluorides	NSPS	3	0.25, 24-hour
Total Reduced Sulfur	NSPS	10	10, 1-hour
Reduced Sulfur Compounds	NSPS	10	10, 1-hour
Hydrogen Sulfide	NSPS	10	0.2, 1-hour
Asbestos	NESHAP	0.007	NM
Beryllium	NESHAP	0.0004	0.001, 24-hour
Mercury	NESHAP	0.1	0.25, 24-hour
Vinyl Chloride	NESHAP	1	15, 24-hour
Benzene	NESHAP	b	NM
Radionuclides	NESHAP	b	NM
Inorganic Arsenic	NESHAP	b	NM

[a]No de minimis concentration; an increase in VOC emissions of 100 TPY or more will require monitoring analysis for ozone.
[b]Any emission rate of these pollutants.

Note: Ambient monitoring requirements for any pollutant may be exempted if the impact of the increase in emissions is below de minimis monitoring concentrations.

NAAQS = National Ambient Air Quality Standards.
NM = No ambient measurement method.
NSPS = New Source Performance Standards.
NESHAP = National Emission Standards for Hazardous Air Pollutants.
$\mu g/m^3$ = micrograms per cubic meter.

Sources: 40 CFR 52.21.
Chapter 17-2, F.A.C.

significant deterioration. The magnitude of the allowable increment depends on the classification of the area in which a new source (or modification) will be located or will have an impact. Congress also directed EPA to evaluate PSD increments for other criteria pollutants and, if appropriate, promulgate PSD increments for such pollutants.

Three classifications were designated, based on criteria established in the CAA Amendments. Certain types of areas (international parks, national wilderness areas, and memorial parks larger than 5,000 acres, and national parks larger than 6,000 acres) were designated as Class I areas. All other areas of the country were designated as Class II. PSD increments for Class III areas were defined, but no areas were designated as Class III. However, Congress made provisions in the law to allow the redesignation of Class II areas to Class III areas.

In 1977, EPA promulgated PSD regulations related to the requirements for classifications, increments, and area designations as set forth by Congress. PSD increments were initially set for only SO_2 and PM(TSP). However, in 1988, EPA promulgated final PSD regulations for nitrogen oxides (NO_x) and established PSD increments for nitrogen dioxide (NO_2).

The current federal PSD increments are shown in Table 3-1. As shown, Class I increments are the most stringent, allowing the smallest amount of air quality deterioration, while the Class III increments allow the greatest amount of deterioration. FDER has adopted the EPA class designations and allowable PSD increments for PM(TSP), SO_2, and NO_2.

On October 5, 1989, EPA proposed PSD increments for PM10. Those proposed increments are shown in Table 3-1. The PM10 increments as proposed are somewhat lower in magnitude than the current PM(TSP) increments.

The term "baseline concentration" evolves from federal and state PSD regulations and refers to a fictitious concentration level corresponding to a specified baseline date and certain additional baseline sources. By definition in the PSD regulations, baseline concentration means the ambient concentration level that exists in the baseline area at the time of the applicable baseline date. A baseline concentration is determined for each pollutant for which a baseline date is established and includes:

1. The actual emissions representative of sources in existence on the applicable baseline date; and
2. The allowable emissions of major stationary sources that began construction before January 6, 1975, for SO_2 and PM(TSP) sources, or February 8, 1988, for NO_x sources; but which were not in operation by the applicable baseline date.

The following emissions are not included in the baseline concentration and therefore affect PSD increment consumption:

1. Actual emissions from any major stationary source on which construction began after January 6, 1975, for SO_2 and PM(TSP) sources, and after February 8, 1988, for NO_x sources; and
2. Actual emission increases and decreases at any stationary source occurring after the baseline date.

In reference to the baseline concentration, the baseline date actually includes three different dates:

1. The major source baseline date, which is January 6, 1975, in the cases of SO_2 and PM(TSP), and February 8, 1988, in the case of NO_2;
2. The minor source baseline date, which is the earliest date after the trigger date on which a major stationary source or major modification subject to PSD regulations submits a complete PSD application; and
3. The trigger date, which is August 7, 1977, for SO_2 and PM(TSP), and February 8, 1988, for NO_2.

The minor source baseline date for SO_2 and PM(TSP) has been set as December 27, 1977, for the entire state of Florida (Chapter 17-2.450, F.A.C.). The minor source baseline date for NO_2 has been set as March 28, 1988, for all of Florida.

3.2.3 CONTROL TECHNOLOGY REVIEW

The control technology review requirements of the federal and state PSD regulations require that all applicable federal and state emission limiting standards be met and that BACT be applied to control emissions from the source [Chapter 17-2.500(5)(c), F.A.C]. The BACT requirements are applicable to all regulated pollutants for which the increase in emissions from the facility or modification exceeds the significant emission rate (see Table 3-2).

BACT is defined in Chapter 17-2.100(25), F.A.C. as:

> An emissions limitation, including a visible emission standard, based on the maximum degree of reduction of each pollutant emitted which the Department, on a case by case basis, taking into account energy, environmental, and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems, and techniques (including fuel cleaning or treatment or innovative fuel combustion techniques) for control of such pollutant. If the Department determines that technological or economic limitations on the application of measurement methodology to a particular part of a source or facility would make the imposition of an emission standard infeasible, a design, equipment, work practice, operational standard or combination thereof, may be prescribed instead to satisfy the requirement for the application of BACT. Such standard shall, to the degree possible, set forth the emissions reductions achievable by implementation of such design, equipment, work practice, or operation.

The requirements for BACT were promulgated within the framework of PSD in the 1977 amendments of the CAA [Public Law 95-95; Part C, Section 165(a)(4)]. The primary purpose of BACT is to optimize consumption of PSD air quality increments and, thereby, enlarge the potential for future economic growth without significantly degrading air quality (EPA, 1978; 1980). Guidelines for the evaluation of BACT can be found in EPA's Guidelines for Determining Best Available Control Technology (BACT) (EPA, 1978) and in the PSD Workshop Manual (EPA, 1980). These guidelines were promulgated by EPA to provide a consistent approach to BACT and to ensure that the impacts of alternative emission control systems are measured by the same set of parameters. In addition, through implementation of these guidelines, BACT in one area may not be identical to BACT in another area. According to EPA (1980),

> BACT analyses for the same types of emissions unit and the same pollutants in different locations or situations may determine that different control strategies should be applied to the different sites, depending on site-specific factors. Therefore, BACT analyses must be conducted on a case-by-case basis.

The BACT requirements are intended to ensure that the control systems incorporated in the design of a proposed facility reflect the latest in control technologies used in a particular industry and take into consideration existing and future air quality in the vicinity of the proposed facility. BACT must, as a minimum, demonstrate compliance with New Source Performance Standards (NSPS) for a source (if applicable). An evaluation of the air pollution control techniques and systems, including a cost-benefit analysis of alternative control technologies capable of achieving a higher degree of emission reduction than the proposed control technology, is required. The cost-benefit analysis requires the documentation of the materials, energy, and economic penalties associated with the proposed and alternative control systems, as well as the environmental benefits derived from these systems. A decision on BACT is to be based on sound judgment, balancing environmental benefits with energy, economic, and other impacts (EPA, 1978).

Historically, a "bottom-up" approach consistent with the BACT Guidelines and PSD Workshop Manual has been used. With this approach, an initial control level, which is usually NSPS, is evaluated against successively more stringent controls until a BACT level is selected. However, EPA developed a concern that the bottom-up approach was not providing the level of BACT decisions originally intended. As a result, in December 1987, the EPA Assistant Administrator for Air and Radiation mandated changes in the implementation of the PSD program including the adoption of a new "top-down" approach to BACT decision making.

The top-down BACT approach essentially starts with the most stringent (or top) technology and emissions limit that have been applied elsewhere to the same or a similar source category. The applicant must next provide a basis for rejecting this technology in favor of the next most stringent technology or propose to use it. Rejection of control alternatives may be based on technical or economic infeasibility. Such decisions are made on the basis of physical differences (e.g., fuel type), locational differences (e.g., availability of water), or significant differences that may exist in the environmental, economic or energy impacts. The differences between the proposed facility and the facility on which the control technique was applied previously must be justified. Recently, EPA issued a draft guidance document on the top-down approach entitled Top-Down Best Available Control Technology Guidance Document (EPA, 1990a).

3.2.4 AIR QUALITY MONITORING REQUIREMENTS

In accordance with requirements of 40 CFR 52.21(m) and Chapter 17-2.500(f), F.A.C, any application for a PSD permit must contain an analysis of ambient air quality data in the area affected by the proposed major stationary facility or major modification. For a new major facility, the affected pollutants are those that the facility would potentially emit in significant amounts. For a major modification, the pollutants are those for which the net emissions increase exceeds the significant emission rate (see Table 3-2).

Ambient air monitoring for a period of up to 1 year is generally appropriate to satisfy the PSD monitoring requirements. A minimum of

4 months of data is required. Existing data from the vicinity of the proposed source may be utilized if the data meet certain quality assurance requirements; otherwise, additional data may need to be gathered. Guidance in designing a PSD monitoring network is provided in EPA's Ambient Monitoring Guidelines for Prevention of Significant Deterioration (EPA, 1987a).

Under the exemption rule, FDER may exempt a proposed major stationary facility or major modification from the monitoring requirements with respect to a particular pollutant if the emissions increase of the pollutant from the facility or modification would cause, in any area, air quality impacts less than the de minimis levels presented in Table 3-2 [Chapter 17-2.500(3)(e), F.A.C.].

3.2.5 SOURCE IMPACT ANALYSIS

A source impact analysis must be performed for a proposed major source subject to PSD for each pollutant for which the increase in emissions exceeds the significant emission rate (Table 3-2). The PSD regulations specifically provide for the use of atmospheric dispersion models in performing impact analysis, estimating baseline and future air quality levels, and determining compliance with AAQS and allowable PSD increments. Designated EPA models must normally be used in performing the impact analysis. Specific applications for other than EPA-approved models require EPA's consultation and prior approval. Guidance for the use and application of dispersion models is presented in the EPA publication Guideline on Air Quality Models (EPA, 1987b). The source impact analysis for criteria pollutants may be limited to only the new or modified source if the net increase in impacts due to the new or modified source is below significance levels, as presented in Table 3-1.

Various lengths of record for meteorological data can be utilized for impact analysis. A 5-year period can be used with corresponding evaluation of highest, second-highest short-term concentrations for comparison to AAQS or PSD increments. The term "highest, second-highest" (HSH) refers to the highest of the second-highest concentrations at all receptors (i.e., the highest concentration at each receptor is discarded). The second-highest concentration is significant because short-term AAQS specify that the standard should not be exceeded at any location more than once a year. If less than 5 years of meteorological data are used in the modeling analysis, the highest concentration at each receptor must normally be used for comparison to air quality standards.

3.2.6 ADDITIONAL IMPACT ANALYSES

In addition to air quality impact analyses, federal and state of Florida PSD regulations require analysis of the impairment to visibility and the impacts on soils and vegetation that would occur as a result of the proposed source [40 CFR 52.21; Chapter 17-2.500(5)(e), F.A.C.]. These analyses are to be conducted primarily for PSD Class I areas. Impacts due to general commercial, residential, industrial, and other growth associated with the source must also be addressed. These analyses are required for each pollutant emitted in significant amounts (Table 3-2).

3.2.7 GOOD ENGINEERING PRACTICE STACK HEIGHT

The 1977 CAA amendments require that the degree of emission limitation required for control of any pollutant not be affected by a stack height that exceeds GEP, or any other dispersion technique. On July 8, 1985, EPA promulgated final stack height regulations (EPA, 1985). Identical regulations have been adopted by FDER [Chapter 17-2.270, F.A.C.]. GEP stack height is defined as the highest of:

1. 65 meters (m); or
2. A height established by applying the formula:

$$Hg = H + 1.5L$$

where: Hg = GEP stack height,
H = Height of the structure or nearby structure, and
L = Lesser dimension (height or projected width) of nearby structure(s); or

3. A height demonstrated by a fluid model or field study.

"Nearby" is defined as a distance up to five times the lesser of the height or width dimensions of a structure or terrain feature, but not greater than 0.8 kilometers (km). Although GEP stack height regulations require that the stack height used in modeling for determining compliance with AAQS and PSD increments not exceed the GEP stack height, the actual stack height may be greater.

3.3 NONATTAINMENT RULES

Based on the current nonattainment provisions (Chapter 17-2.510, F.A.C.), all major new facilities and modifications to existing major facilities located in a nonattainment area must undergo nonattainment review if the proposed pieces of equipment have the potential to emit 100 TPY or more of the nonattainment pollutant, or if the modification results in a significant net emission increase of the nonattainment pollutant.

For major facilities or major modifications that locate in an attainment or unclassifiable area, the nonattainment review procedures apply if the source or modification is located within the area of influence of a nonattainment area. The area of influence is defined as an area which is outside the boundary of a nonattainment area but within the locus of all points that are 50 km outside the boundary of the nonattainment area. Based on Chapter 17-2.510(2)(a)2.a, F.A.C., all VOC sources which are located within an area of influence are exempt from the provisions of new source review for nonattainment areas. Sources which emit other nonattainment pollutants and are located within the area of influence are subject to nonattainment review unless the maximum allowable emissions from the proposed source do not have a significant impact within the nonattainment area.

3.4 SOURCE APPLICABILITY

3.4.1 PSD REVIEW

3.4.1.1 Pollutant Applicability

FGTC's Compressor Station No. 14 is located in Gadsden County, which has been designated by EPA and FDER as an attainment area for all criteria pollutants. Gadsden County and surrounding counties are designated as PSD Class II areas for SO_2, PM(TSP), and NO_2. The site is located within 100 km of two PSD Class I areas. These Class I areas are the Bradwell Bay and the St. Mark's National Wildlife Refuge, which are approximately 40 km south and 58 km southeast of the compressor station location, respectively.

FGTC's existing Compressor Station No. 14 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. 14, 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. 14

Pollutant	Maximum Potential Emissions From Proposed Compressor Engine (lb/hr)	Maximum Potential Emissions From Proposed Compressor Engine (TPY)	Significant Emission Rate (TPY)	PSD Review Applies?
Nitrogen Oxides	10.6	46.3	40	Yes
Carbon Monoxide	11.1	48.7	100	No
Votatile Organic Compounds (non-methane)	2.6	11.6	40	No
Particulate Matter (TSP)	0.08	0.35	25	No
Particulate Matter (PM10)	0.08	0.35	15	No
Sulfur Dioxide	0.46	2.02	40	No

The maximum annual impact associated with the potential NO_x emissions from the proposed IC engine is 0.99 $\mu g/m^3$. The methodology used to predict this value is presented in Section 4.0, along with the impact analysis result. The de minimis concentration level for NO_x is 14 $\mu g/m^3$ annual average. Since the maximum impact of NO_x is less than its de minimis concentration level, the proposed expansion project is exempted from the PSD preconstruction ambient monitoring requirement for NO_x.

3.4.1.3 GEP Stack Height Analysis

The GEP stack height regulations allow any stack to be at least 65 m (213 ft) high. The proposed stack for the new compressor engine will be 50 ft high (15.24 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. 14 is not located in any nonattainment area or in any area of influence of a nonattainment area. As a result, nonattainment review does not apply to the proposed expansion project.

4.0 SOURCE IMPACT ANALYSIS

4.1 ANALYSIS APPROACH AND ASSUMPTIONS

4.1.1 GENERAL MODELING APPROACH

The general modeling approach follows EPA and FDER modeling guidelines for determining compliance with AAQS and PSD increments. In general, when model predictions are used to determine compliance with AAQS and PSD increments, current EPA and FDER policies stipulate that the highest annual average concentration and highest, second-highest short-term (i.e., 24 hours or less) concentration can be compared to the applicable standard.

Model predictions for annual average NO_x concentrations were performed using the Industrial Source Complex Long-Term (ISCLT) model (Version 90008). A brief description of the Industrial Source Complex (ISC) model is given in Section 4.1.2.

4.1.2 MODEL SELECTION

The ISC dispersion model (EPA, 1988b) was used to evaluate the NO_x emissions from the proposed compressor engine. This model is contained in the EPA User's Network for Applied Modeling of Air Pollution (UNAMAP), Version 6 (EPA, 1988c). The ISC model was selected primarily for the following reasons:

1. EPA and FDER have approved the general use of the model for air quality dispersion analysis because the model assumptions and methods are consistent with those in the Guideline on Air Quality Models (EPA, 1987b);
2. The ISC model is capable of predicting the impacts from stack, area, and volume sources that are spatially distributed over large areas and located in flat or gently rolling terrain; and
3. The results from the ISC model are appropriate for addressing compliance with AAQS and PSD increments.

The ISCLT model is an extension of the Air Quality Display Model (AQDM) and the Climatological Dispersion Model (CDM). The ISCLT model uses joint frequencies of wind direction, windspeed, and atmospheric stability to calculate seasonal and/or annual average ground-level concentrations. Because the input wind directions are for 16 sectors, with each sector defined as 22.5 degrees, the model calculates concentrations by assuming that the pollutant is uniformly distributed in the horizontal plane within a 22.5-degree sector.

Major features of the ISCLT model are presented in Table 4-1. Concentrations due to stack and volume sources are calculated by the model using the steady-state Gaussian plume equation for a continuous source. The area source equation in the ISC model is based on the equation for a continuous and finite crosswind line source.

The ISC model has rural and urban options which affect the windspeed profile exponent law, dispersion rates, and mixing-height formulations used in calculating ground-level concentrations. The criteria used to determine when the rural or urban mode is appropriate are based on land use near the proposed plant's surroundings (Auer, 1978). If the land use is classified as heavy industrial, light-moderate industrial, commercial, or compact residential for more than 50 percent of the area within a 3-km radius circle centered on the proposed source, the urban option is selected. Otherwise, the rural option is used.

For modeling analyses that will undergo regulatory review, such as PSD permit applications, the following model features are recommended by EPA (1987a) and are referred to as the regulatory options in the ISC model:

1. Final plume rise at all receptor locations,
2. Stack-tip downwash,
3. Buoyancy-induced dispersion,
4. Default windspeed profile coefficients for rural or urban option,
5. Default vertical potential temperature gradients, and

Table 4-1. Major Features of the ISCLT Model

ISCLT Model Features
• Polar or Cartesian coordinate systems for receptor locations
• Rural or one of three urban options that affect windspeed profile exponent, dispersion rates, and mixing height calculations
• Plume rise as a result of momentum and buoyancy as a function of downwind distance for stack emissions (Briggs)
• Procedures suggested by Huber and Snyder (1976), Huber (1977), Schulmann and Hanna (1986), and Schulmann and Scire (1980) for evaluating building downwash and wake effects
• Procedures suggested by Briggs for evaluating stack-tip downwash
• Separation of multiple point sources
• Consideration of the effects of gravitational settling and dry deposition on ambient particulate concentrations
• Capability of simulating point, line, volume, and area sources
• Capability to calculate dry deposition
• Variation of windspeed with height (windspeed-profile exponent law)
• Concentration estimates for annual average
• Terrain-adjustment procedures for elevated terrain including a terrain truncation algorithm
• Receptors located above local terrain (i.e., "flagpole" receptors)
• Consideration of time-dependent exponential decay of pollutants
• The method of Pasquill (1976) to account for buoyancy-induced dispersion
• A regulatory default option to set various model options and parameters to EPA recommended values (see text for regulatory options used)

Source: EPA, 1988a.

6. Reducing calculated SO_2 concentrations in urban areas by using a decay half-life of 4 hours (i.e., reduce the SO_2 concentration by 50 percent for every 4 hours of plume travel time).

In this analysis, the EPA regulatory options were used to address maximum impacts. Based on a review of the land use around the facility, the rural mode was selected based on the degree of residential, industrial, and commercial development within 3 km of the plant site.

4.1.3 METEOROLOGICAL DATA

EPA (1987b) recommends the use of 5 years of representative meteorological data for use in air quality modeling. The most recent, readily available 5-year period is preferred. The meteorological data may be collected either onsite or at the nearest National Weather Service (NWS) station.

Meteorological data used in the analysis were selected based on the recommendations of the FDER for the area in which the project is located. The data consisted of a 5-year record of surface weather observations (1982-1986) from the NWS station located at the 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, located approximately 35 km southeast of the site, is the nearest weather station that routinely 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. 14 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. 14 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. 14 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 which had 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	Stack Dimensions (m)		Operating Parameters		Emissions (g/s)
	Height	Diameter	Temperature (K)	Velocity (m/s)	NO_2
1	15.24	0.44	561	49.61	1.33

Table 4-3. Discrete Plant Boundary Receptors, Compressor Station No. 14[a]

Direction	Distance (km)	Direction	Distance (km)
10	0.207	190	0.201
20	0.216	200	0.210
30	0.238	210	0.229
40	0.256	220	0.223
50	0.213	230	0.189
60	0.189	240	0.198
70	0.177	250	0.253
80	0.168	260	0.241
90	0.165	270	0.238
100	0.168	280	0.241
110	0.177	290	0.253
120	0.192	300	0.274
130	0.216	310	0.311
140	0.253	320	0.268
150	0.232	330	0.238
160	0.213	340	0.219
170	0.201	350	0.207
180	0.198	360	0.204

[a]Relative to the proposed stack located at (0,0) meters.

4.1.6 BUILDING DOWNWASH CONSIDERATIONS

Based on the dimensions of the compressor building that will house the proposed engine, the stack for the proposed engine will be less than GEP height. Also, based on the location of the proposed engine's exhaust stack in relation to the compressor building, the stack will be in the influence of the compressor building. Therefore, the potential for building downwash must be considered in the modeling analysis.

The procedures used for addressing the effects of building downwash are those recommended in the ISC Dispersion Model User's Guide. In the ISCLT model, the building height and width are input to the model, which are used to modify the dispersion parameters if the Huber-Snyder building downwash routine is used. The effective width used by the program is the diameter of a circle of equal area to the square of the width input to the model. If a specific width is to be modeled, then the value input to the model must be calculated according to the following formula:

$$M_w = \sqrt{\pi \left(\frac{H_w}{2}\right)^2} = 0.886\ H_w$$

where: M_w = building width input to the model to produce a building width of H_w used in the dispersion calculation.
H_w = the actual building width for which dispersion calculations are desired.

If the Schulman-Scire wake effects method is used, the user inputs the building height and projected width associated with each 22.5-degree wind sector. These building heights and projected widths are the same used for GEP stack height calculations.

A summary of actual and modeled building dimensions is presented in Table 4-4. Due to the proximity of the proposed stack to the compressor building (approximately 17 ft), potential downwash from this structure was assumed to occur. Because the stack-to-building height ratio is

Table 4-4. Building Dimensions used in the ISCLT Modeling, Compressor Station No. 14

Building	Actual Building Dimensions Height (m)	Actual Building Dimensions Length (m)	Actual Building Dimensions Width (m)	Modeled Building Dimensions Height (m)	Modeled Building Dimensions Projected Width[a] (m)
Compressor Building[b]	9.69	73.2	16.8	9.69	75.0

[a]Maximum projected building width was assumed to be applicable in all directions.
[b]Dimensions are for expanded compressor building with proposed engine.

greater than 1.5, the Huber-Snyder downwash method was used in the analysis. This method assumes the same downwash effects in all directions.

4.2 MODEL RESULTS

A summary of the maximum predicted annual NO_2 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 0.99 $\mu g/m^3$, which is less than the NO_2 significance level of 1 $\mu g/m^3$, annual average concentration. This maximum concentration is predicted to occur in a direction of 180° and at a distance of 0.500 km from the proposed engine's stack. Because the predicted maximum NO_2 concentration is less than the significant impact level, further modeling for NO_2 is not required. Computer modeling printouts are provided in Appendix C.

The potential NO_x impacts with respect to the Bradwell Bay and the St. Mark's National Wildlife Refuge areas must also be considered because Compressor Station No. 14 is within 100 km of two designated Class I areas. Since the modeling results showed that maximum impacts are below the significant level (i.e., less than 1 $\mu g/m^3$) at the plant site, potential impacts on the Class I areas located 40 km or more away will be much less than 1 $\mu g/m^3$, annual average concentration.

Table 4-5. Maximum Predicted Annual Average NO_2 Concentrations Due to the Proposed Station 14 Compressor Engine for Comparison to Significant Impact Levels

Year Modeled	Maximum Concentration ($\mu g/m^3$)	Receptor Location Direction (°)	Receptor Location Distance (km)	NO_2 Significant Impact Level ($\mu g/m^3$)
1982	0.84	360	0.500	1
1983	0.79	360	0.400	
1984	0.90	360	0.400	
1985	0.73	360	0.500	
1986	0.99[a]	180	0.500	

[a]Refined concentration and location are identical to the screening concentration and location.

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. 14 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 Class I areas (i.e., Bradwell Bay and St. Mark's National Wildlife Refuge) 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 Bradwell Bay, located about 40 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.

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.

Table 5-1. Visual Effects Screening Analysis for Compressor Station No. 14.

Class I Area: BRADWELL BAY

*** Level-1 Screening ***

Input Emissions for

Particulates	.08	LB /HR
NOx (as NO2)	10.60	LB /HR
Primary NO2	.00	LB /HR
Soot	.00	LB /HR
Primary SO4	.00	LB /HR

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	.04 ppm
Background Visual Range:	25.00 km
Source-Observer Distance:	40.00 km
Min. Source-Class I Distance:	40.00 km
Max. Source-Class I Distance:	55.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area

Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	40.0	84.	2.00	.068	.05	-.000
SKY	140.	84.	40.0	84.	2.00	.022	.05	-.000
TERRAIN	10.	84.	40.0	84.	2.00	.009	.05	.000
TERRAIN	140.	84.	40.0	84.	2.00	.003	.05	.000

Maximum Visual Impacts OUTSIDE Class I Area

Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	75.	38.7	94.	2.00	.068	.05	-.000
SKY	140.	75.	38.7	94.	2.00	.022	.05	-.000
TERRAIN	10.	60.	36.6	109.	2.00	.011	.05	.000
TERRAIN	140.	60.	36.6	109.	2.00	.004	.05	.000

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. 14 as a result of adding the new engine. As a result, there will be no permanent impacts on air quality caused by associated population growth.

6.0 BEST AVAILABLE CONTROL TECHNOLOGY EVALUATION

The potential emissions of NO_x from the proposed engine exceed the PSD significant emission rate of 40-TPY; therefore, BACT analysis for NO_x is required. The complete "top-down" BACT evaluation of NO_x includes a description of natural gas prime movers (Section 6.1), the identification of NO_x control technologies for reciprocating internal combustion engines (Section 6.2), the environmental, energy and economic impact evaluations of all technically feasible methods (Section 6.3), and the BACT analysis summary (Section 6.4).

6.1 NATURAL GAS PRIME MOVERS

The prime movers in the natural gas industry are generally heavy duty natural-gas-fired stationary internal combustion (IC) engines. These engines are applied to power compressors used for pipeline transmission, field collection of gas from wells, underground storage, and gas processing plant activities. Stationary IC engines used include both gas turbines and reciprocating IC engines.

The use of gas turbines at new natural gas pipeline compression stations has increased in recent years for a wide variety of reasons. Their primary benefit is that gas turbines typically emit fewer pollutants than reciprocating IC engines (i.e., on g/bhp-hr basis); however, gas turbines are generally 10 to 15 percent less fuel efficient, requiring higher specific heat input rate (i.e., on Btu/bhp/hr basis). Also, gas turbines have been found to use more fuel to produce the same compression efficiency.

A primary limitation of gas turbines is related to their inability to respond quickly and efficiently to varying load changes in service demand. This often precludes the use of turbines when supplemental compression is required at a given compressor station. Furthermore, the use of gas turbines in conjunction with reciprocating IC engines at existing compressor stations is hindered by operating limitations. The mechanical operation of reciprocating IC engines generates a pulse vibration that can be transferred to adjacent equipment through physical connection to the pipeline. Gas turbines are sensitive to this type of vibration due to the destructive interference nature of this vibrational frequency; therefore, their operation and reliability can be adversely effected. Based on the above discussion, the use of gas turbines for FGTC's proposed expansion is not considered further.

The use of reciprocating IC engines has been more widespread in terms of the number of installations at natural gas pipeline compressor stations. A recent Gas Research Institute research study (GRI, 1990) reports that the number of such engines is five times that of gas turbines. Advantages of using reciprocating IC engines are primarily better fuel and compression efficiencies and their capability to operate at variable loads to meet the fluctuating consumptive demands.

Reciprocating IC engines used in gas pipeline transmission are generally integral engine-compressor units designed specifically for such application. The integral units provide greater gas-moving efficiency than separable compressors and offer greater operating flexibility than gas turbines. The engines are either two-cycle or four-cycle and are rated between 900 to 13,500 bhp. Old existing engines include four-cycle rich-burn or two- and four-cycle lean-burn. New engines installed in pipeline compressor stations are generally of lean-burn combustion design, which can achieve 80 percent or greater NO_x emission reduction compared to the older, rich-burn models.

6.2 IDENTIFICATION OF NO_x CONTROL TECHNOLOGIES FOR RECIPROCATING IC ENGINES

In this section, the control technologies capable of reducing NO_x emissions produced by reciprocating IC engines will be evaluated relative to their potential application as BACT for the proposed 2,400-bhp engine. This BACT analysis follows EPA's most recent draft guideline for the top-down approach (EPA, 1990a).

All potentially applicable control technologies for reciprocating IC engines are reviewed. The technologies can be separated into two major groups:

1. Reducing pollutant emissions by process modification (i.e., "low-NO_x" engine design), and
2. Converting NO_x in the exhaust gas by add-on catalytic exhaust gas treatment devices.

The discussion of each potential NO_x control technology includes a description of the technology and the potential NO_x emission reduction, if the technology is concluded to be technically feasible.

6.2.1 TECHNOLOGIES INVOLVING ENGINE MODIFICATION

The concept of low-NO_x reciprocating IC engines is described in the NSPS Background Information Document (BID) for stationary reciprocating IC engines issued by EPA in July 1979 (EPA, 1979). Five types of engine or process modifications have been recognized by EPA as technically viable for reducing NO_x emissions from such engines:

1. Steam injection,
2. Air-to-fuel ratio changes,
3. Retarded ignition timing,
4. Derating power output, and
5. Exhaust gas recirculation.

Each of these is discussed in the following sections.

6.2.1.1 Steam Injection

The concept of designing a low-NO_x reciprocating IC engine focuses on controlling the combustion temperature, since thermal NO_x generally increases as combustion temperature increases. Favorable conditions for thermal oxidation of molecular nitrogen can be reduced by quenching the flame temperature with low quality steam or water. In this method, water or steam is injected at a location downstream from the combustion zone inside each firing cylinder.

However, water or steam injection to reduce NO_x formation does not work well at the high water injection rate required for reciprocating IC engines. Reciprocating IC engines are typically designed with high gas flow rates and operate at high excess air. Also, experiments with large-bore engines have concluded that steam injection for controlling NO_x emissions can cause irreversible structural damage to the engine block (EPA, 1979). Thus, water or steam injection technology for reciprocating IC engines is considered technically infeasible. As a result, this method will not be discussed further.

Potential NO_x Emission Reduction

Not Applicable for a technically infeasible process.

6.2.1.2 Air-to-Fuel Ratio Changes

The state-of-the-art concept in designing a low-NO_x reciprocating IC engine involves raising the air-to-fuel ratio to create a lean fuel mixture for the combustion process. The peak combustion temperature is lowered due to lower heat of combustion from burning less fuel, and by the high excess air, which tends to dilute the combustion gases. Such combustion results in less pollutants being emitted (i.e., a cleaner burning process). Cooper-Bessemer was the first original equipment manufacturer of reciprocating IC engines to incorporate this concept into engine design, which was appropriately named CleanBurn® technology.

In general, the high air-to-fuel ratio design is referred to as lean-burn technology (LBT) for gas-fired reciprocating IC engines. The name is derived from the lean mixture of air-to-fuel in the main combustion cylinder. The air-to-fuel ratio can reach as high as 200 for some IC engine designs and operating conditions, according to one of the major reciprocating IC engine suppliers (Dresser-Rand, 1990).

LBT is primarily accomplished by increasing the stoichiometric air-to-fuel ratio over the conventional rich-burn engine. In general, small increases in the air-to-fuel ratio (approximately 10 percent) cause a significant reduction in NO_x (approximately 30 percent) with less than 5 percent fuel penalty (EPA, 1979). On turbocharged engines, this can be accomplished by operating at high manifold pressures, which results in lower combustion temperatures and reduces NO_x formation. However, misfiring and erratic combustion can occur at very lean mixtures. The limits to which the air-to-fuel ratio can be increased are related to three major engine design factors:

1. The capability of the turbocharger to produce higher air manifold pressures for rated engine loading,
2. The ability of the ignition system to light-off the leaner mixtures, and
3. The combustion chamber characteristics to maintain efficient combustion with leaner combustible gaseous mixtures.

With current state-of-the-art engine and turbocharger designs coupled with advanced control technology, all three factors can be sufficiently achieved.

Potential NO_x Emission Reduction:

Pollutant	Uncontrolled Emission Level	Guaranteed Emission Level	Potential Percentage Reduction
NO_x	11.0 g/bhp-hr[a]	1.5-2.0 g/bhp-hr	82-86%

Note: [a] Represents emission level for the baseline rich-burn engine.

6.2.1.3 Retarded Ignition Timing

Retarding the spark ignition timing of the reciprocating IC engine reduces the peak combustion pressure and temperature, thereby lowering thermal NO_x formation. The timing delay is measured in degrees in reference to the engine's crankshaft rotation. There are limits to how much the ignition timing can be retarded. In general, retard values range from 2 to 6 degrees, depending on engine, and NO_x reduction per degree of retard decreases for increasing levels of retard.

A study by the American Gas Association showed that the NO_x emissions from 10 different gas-fired naturally aspirated engine models ranged from a 7 percent reduction to a 2 percent increase per degree of ignition retardation (Urban and Springer, 1975). EPA's research (1979) reported the percent of NO_x reduction per degree of retard ranged from 0.6 to 8.5 for turbocharged engines. Overall, EPA's report concluded that retarding ignition timing reduced NO_x emissions 15 percent for gas-fired engines.

Potential NO_x Emission Reduction:

Pollutant	Uncontrolled Emission Level	Achievable Emission Level	Potential Percentage Reduction
NO_x	11.0 g/bhp-hr[a]	9.4 g/bhp-hr	15%
	2.0 g/bhp-hr[b]	1.7 g/bhp-hr	15%

Note: [a] Represents emission level for the baseline rich-burn engine.
[b] Represents emission level for a typical lean-burn engine.

6.2.1.4 Derating Power Output

A reciprocating IC engine can be derated by operating at less than full or 100-percent rated power. The effect of derating on an engine is to reduce peak combustion cylinder temperatures and pressures, thus lowering NO_x formation rates.

Reported NO_x reduction levels achieved by derating vary greatly for different reciprocating IC engines primarily as a result of air charging. Data compiled by EPA (1979) show that non-turbocharged engines achieve the largest reduction because derating has a greater effect on air-to-fuel ratios. In contrast, turbocharged engines operate at an already high air-to-fuel ratio and, therefore, very little NO_x reduction is achieved by derating. Normalized NO_x reduction from derating (i.e., percent of NO_x reduction per percent derate) is reported from 0.25 to 6.2 for normally aspirated or blower-charged engines, and 0.01 to 2.6 for turbocharged engines. The EPA report showed that NO_x reduction ranged from 10 percent increase to 90 percent reduction, and averaged approximately 40 percent reduction at a derating of 75 percent of rated torque.

Potential NO_x Emission Reduction:

Pollutant	Uncontrolled Emission Level	Achievable Emission Level	Potential Percentage Reduction
NO_x	11.0 g/bhp-hr[a]	6.6 g/bhp-hr	40%
	2.0 g/bhp-hr[b]	1.2 g/bhp-hr	40%

Note: [a] Represents emission level for the baseline rich-burn engine.
[b] Represents emission level for a typical lean-burn engine.

6.2.1.5 Exhaust Gas Recirculation

Exhaust gas recirculation (EGR) reduces peak combustion temperatures in a reciprocating IC engine by replacing a fraction of the combustion air with exhaust gases. The recirculated exhaust gases serve to absorb heat without providing as much additional oxygen for the oxidation of nitrogen.

EGR can be accomplished by either introducing exhaust gases into the intake manifold or restricting the exit of gases from the cylinder by internal recirculation. Externally recirculated gases must be cooled prior to being reintroduced into the combustion cylinder in order to provide greater heat absorption per charge.

EGR is most effective in reducing NO_x emission from conventional rich-burn engines because its application can increase the air-to-fuel ratio. EPA's research (1979) reported a NO_x reduction of 34 percent for a gas-fired, blower-charged engine with 6 percent EGR rate. Excessive EGR rates can result in increased fuel consumption, high CO emissions, and misfiring (GRI, 1990).

EGR is not effective for a lean-burn engine with a high air intake flow rate since it cannot significantly further dilute the air/fuel mixture. In addition, no system has been developed to date for the complex control system needed to regulate the recirculation of the exhaust gases. As a result, EGR for lean-burn engines is not considered further.

Potential NO_x Emission Reduction:

Pollutant	Uncontrolled Emission Level	Achievable Emission Level	Potential Percentage Reduction
NO_x	11.0 g/bhp-hr[a]	7.3 g/bhp-hr	34%
	2.0 g/bhp-hr[b]	Not applicable	--

Note: [a] Represents emission level for the baseline rich-burn engine.
[b] Represents emission level for a typical lean-burn engine.

6.2.2 TECHNOLOGIES INVOLVING EXHAUST GAS TREATMENT

6.2.2.1 NO_xOUT Process

The NO_xOUT process originated from the initial research by the Electric Power Research Institute (EPRI) in 1976 on the use of urea to reduce NO_x. EPRI licensed the proprietary process to Fuel Tech, Inc., for commercialization. In the NO_xOUT process, aqueous urea is injected into the flue gas stream ideally within a temperature range of 1,600°F to 1,900°F. In the presence of oxygen, the following reaction occurs:

$$CO(NH_2)_2 + 2NO + \frac{1}{2}O_2 \text{ --> } 2N_2 + CO_2 + 2H_2O$$

The amount of urea required is most cost effective when the treatment rate is 0.5 to 2 moles of urea per mole of NO_x. In addition to the original EPRI urea patents, Fuel Tech claims to have a number of proprietary catalysts capable of expanding the effective temperature range of the reaction to between 1,000°F and 1,950°F. Advantages of the system are:

1. Low capital and operating costs due to utilization of urea injection, and

2. The proprietary catalysts used are nontoxic and nonhazardous, thus eliminating potential disposal problems.

Disadvantages of the system are:

1. Formation of ammonia from excess urea treatment rates and/or improper use of reagent catalysts, and
2. SO_3, if present, will react with ammonia created from the urea to form ammonium bisulfate, potentially plugging the cold end equipment downstream.

Commercial application of the NO_xOUT system is limited to three reported cases:

1. Trial demonstration on a 62.5-ton-per-hour (TPH) stoker-fired wood waste boiler with 60 to 65 percent NO_x reduction,
2. A 600-million-British-thermal-unit (MMBtu) CO boiler with 60 to 70 percent NO_x reduction, and
3. A 75-megawatt (MW) pulverized coal-fired boiler with 65 percent NO_x reduction.

The NO_xOUT system has not been demonstrated on any stationary IC engine.

The NO_xOUT process is not technically feasible for the proposed lean-burn engine due to the high application temperature of 1,000°F to 1,950°F. The exhaust gas temperature of a lean-burn engine is typically between 495°F to 700°F. Raising the exhaust temperature to the required temperature level would essentially require the installation of an auxiliary heater. This would be economically prohibitive and would result in an increase in fuel consumption, an increase in the volume of gases that must be treated by the control system, and an increase in uncontrolled air emissions, including NO_x.

6.2.2.2 <u>THERMAL DeNO$_x$</u>

Thermal DeNO$_x$ is Exxon Research and Engineering Company's patented process for NO_x reduction. The process is a high temperature selective noncatalytic reduction (SNCR) of NO_x using ammonia as the reducing agent. Thermal $DeNO_x$ requires the exhaust gas temperature to be above 1,800°F. However, use of ammonia plus hydrogen lowers the temperature requirement to about 1,000°F. For some applications, this must be achieved by additional firing in the exhaust stream prior to ammonia injection.

The only known commercial applications of Thermal $DeNO_x$ are on industrial boilers, large furnaces, and incinerators which consistently produce exhaust gas temperatures above 1,800°F. There are no known applications or experience in the reciprocating IC engine industry. Temperatures of 1,800°F require alloy materials of construction with very large size piping and components since the exhaust gas volume would be increased by several times. As with the NO_xOUT process, high capital, operating, and maintenance costs are expected due to material of construction specification, additional duct burner system, and fuel consumption. Uncontrolled emissions would increase because of the additional fuel burning.

Thus, the Thermal $DeNO_x$ process will not be considered for the proposed project because it is technically infeasible due to its high application temperature.

6.2.2.3 Combination of Lean-Burn Engine and Nonselective Catalytic Reduction

Certain manufacturers, such as Engelhard and Johnson-Matthey, market a non-selective catalytic reduction system (NSCR) for NO_x control on reciprocating IC engines. The NSCR process requires a low oxygen content in the exhaust gas stream and high temperature (700°F to 1,400°F) in order to be effective. Rich-burn engines typically achieve low oxygen levels of less than 4 percent and the required temperature and, therefore, can use the NSCR process. Lean-burn engines, on the other hand, have a high air-to-fuel ratio, typical exhaust gas oxygen content of 12 to 15 percent, and the exhaust gas temperature is less than 700°F. As a result, NSCR is not a technically feasible add-on NO_x control device for FGTC's proposed lean-burn engine. Therefore, the combination of a lean-burn engine and NSCR was not considered further in the BACT analysis.

6.2.2.4 Selective Catalytic Reduction with Ammonia Injection

The NO_x abatement technology for oil- and gas-fired combustion sources that is currently receiving considerable attention is the selective catalytic reduction (SCR) process with ammonia injection. Engelhard Corporation's discovery in 1957 that ammonia reacts selectively with NO_x in the presence of a catalyst and excess oxygen has led to the commercialization of SCR technology for industrial boilers of various sizes. The technology has been well developed and applied in Japan, especially for control of emissions from gas-, oil-, and coal-fired utility boilers. It has been applied domestically on combustion sources which generate large quantities of NO_x, such as gas turbines.

SCR catalysts consist of two types: metal oxides and zeolite. In the metal oxides catalytic system, either vanadium or titanium is embedded into a ceramic matrix structure; the zeolite catalysts are ceramic molecular sieves extruded into modules of honeycomb shape. The all-ceramic zeolite catalysts are durable, and less susceptible to catalyst masking or poisoning than the noble metal/ceramic base catalysts. All catalysts exhibit advantages and disadvantages in terms of exhaust gas temperatures, ammonia/NO_x ratio, and optimum exhaust gas oxygen concentrations. A common disadvantage for all catalyst systems is the narrow window of temperature between 600°F and 900°F within which the NO_x reduction process takes place (Schorr, 1989; Steuler, 1990; Engelhard, 1990; Johnson-Matthey, 1990). Operating outside this temperature range results in catastrophic harm to the catalyst system. Chemical poisoning occurs at lower temperature conditions, while thermal degradation occurs at higher temperatures. Reactivity can only be restored through catalyst replacement.

Catalysts are subject to loss of activity over time. Since the catalyst is the most costly component of the SCR system, applications require servicing and cleaning of the catalyst surface every 2,000 to 3,000 hours of operation. The cleaning normally consists of blowing the catalyst surfaces with a compressed air gun or water jet. Most catalyst suppliers guarantee a catalyst life of 3 years, assuming certain operating conditions.

Technically, SCR is potentially applicable to further reduce the already low NO_x emissions (2 g/bhp-hr) from the proposed lean-burn reciprocating engine. SCR is capable of achieving NO_x reduction of 70 to 90 percent. For the proposed lean-burn engine, with already low NO_x concentration in the exhaust gases, vendors guarantee a removal rate of 80 percent. This would result in NO_x emissions of 0.4 g/bhp-hr. This represents an overall NO_x reduction of 96 percent compared to a rich-burn engine (at 11.0 g/bhp-hr).

6.2.2.5 Combination of Rich-Burn Engine and NSCR

Although the draft top-down BACT guideline document dated March 15, 1990, does not require an evaluation of processes that have inherently higher emission rates than the proposed process, the option of using a rich-burn engine equipped with NSCR also was considered in the BACT analysis.

Rich-burn reciprocating IC engines are defined as those which contain less than 4 percent oxygen concentration in the exhaust gas. Rich-burn engines typically are naturally aspirated engines with near stoichiometric air-to-fuel ratios and produce exhaust gas temperatures in the range of 1,200°F to 1,300°F.

NSCR technology uses a precious metal to catalyze the reactions of NO_x with CO and unburned hydrocarbon fuel in the exhaust gas streams to form nitrogen, carbon dioxide, and water vapor. A complete NSCR system includes exhaust gas oxygen sensor, exhaust gas monitor, hydrocarbon fuel injector, automatic air/fuel controller, and temperature sensor for automatic shut-down of the engine if overheating occurs. The engine exhaust entering the catalyst bed is maintained slightly fuel-rich to maximize NO_x reduction. The hydrocarbon fuel injector automatically controls an adjustable valve that supplies a small amount of hydrocarbon fuel to compensate for the changes in engine load or ambient conditions.

Technically, NSCR is potentially applicable to reduce 90 percent or more of the NO_x emissions in the exhaust gas of the rich-burn reciprocating IC engine. In general, vendors guarantee a removal rate of 90 percent for an equivalent NO_x emission level of 1.1 g/bhp-hr (i.e., 10 percent of the rich-burn engine NO_x emission rate of 11.0 g/bhp-hr).

6.2.3 SUMMARY OF TECHNICALLY FEASIBLE NO_x CONTROL METHODS

In summary, there are two basic alternatives for reduction of NO_x emissions from reciprocating IC engines: engine modification and add-on control technology. Presented in Table 6-1 is a summary of the technical evaluation of NO_x emission control methods applicable to reciprocating IC engines.

In the engine modification category, only the alternatives of air-to-fuel ratio change, retard ignition timing, derating power output, and EGR are applicable. EGR is applicable to rich-burn engines only. Steam/water injection and EGR (for lean-burn engines) are considered technically infeasible. In the add-on control technology category, only the lean-burn engine/SCR combination and rich-burn engine/NSCR combination are considered technically feasible. Other methods such as the NO_xOUT process, Thermal DeNO_x, and the lean-burn engine/NSCR combination are considered technically infeasible.

6.3 EVALUATION OF TECHNICALLY FEASIBLE NO_x CONTROL METHODS

This section examines all of the technically feasible NO_x control methods identified in the previous discussion. First, all five remaining control alternatives are ranked according to their total removal effectiveness. Each alternative is then examined further in regards to technical issues, environmental effects, energy requirements and impacts, and economic impacts.

Table 6-1 Summary of Technical Feasibility of NOx Emission Controls for Reciprocating Engine

Control Technology	NOx Controlled Emission Rate	Technical Feasibility	Comments
Engine Modification Alternatives			
Steam Injection	Not Applicable	NO	Technically infeasible due to irreversible structural damage to engine block.
Air-to-fuel Ratio Change (or Lean-Burn Technology)	1.5-2.0 g/bhp-hr	YES	Lowest emission rate achievable by engine modification, at least 80% control efficiency.
Retarding Ignition Timing			
Rich-burn Engine	9.4 g/bhp-hr	YES	Engine timing retard between 2° and 6°;
Lean-burn Engine	1.7 g/bhp-hr	YES	average 15% NOx reduction.
Derating Power Output			
Rich-burn Engine	6.6 g/bhp-hr	YES	Average 40% NOx reduction at 25% of engine
Lean-burn Engine	1.2 g/bhp-hr	YES	power derated for gas-fired engines.
Exhaust Gas Recirculation			
Rich-burn Engine	7.3 g/bhp-hr	YES	Maximum 34% NOx reduction for standard engine.
Lean-burn Engine	Not Applicable	NO	Ineffective for lean-burn engine.
Add-on Control Technology*			
NOxOUT Process	Not Applicable	NO	Technically infeasible (1000-1600°F), cost prohibitive for high temperature auxiliary equipment.
THERMAL DeNOx	Not Applicable	NO	Technically infeasible (above 1000°F), cost prohibitive for high temperature auxiliary equipment.
Lean-Burn Engine/NSCR	Not Applicable	NO	Technically infeasible for lean-burn engine, required <4% O2 conc. in the exhaust stream.
Lean-Burn Engine/SCR	0.4 g/bhp-hr	YES	Applicable to lean-burn engine with control efficiency of 80 percent.
Rich-Burn Engine/NSCR	1.1 g/bhp-hr	YES	Applicable to rich-burn engine only, required greater than 4% O2 conc. in exhaust gas stream. control efficiency of 90%.

* Except for the rich-burn engine/NSCR option, all add-on control technologies are for lean-burn engines.

The discussion also reviews current permitting practices for applications similar to FGTC's proposed project. Presented in Table 6-2 is a summary of BACT determinations for NO_x emissions from gas-fired stationary reciprocating IC engines issued since 1985. The information was obtained from BACT/Lowest Achievable Emission Rate (LAER) Clearinghouse documents from 1985 to 1990, as well as from actual permit applications, issued permits, and personal conversations with personnel of air permitting agencies from various states.

6.3.1 RANKING OF FEASIBLE CONTROL TECHNOLOGIES

The top-down BACT approach requires the ranking of the NO_x emission control alternatives in terms of achievable emission level. The five options, in order of removal effectiveness, are as follows: first, the lean-burn engine equipped with SCR; second, the rich-burn engine equipped with NSCR; third, the lean-burn engine with derating; fourth, the lean-burn engine with retard ignition timing; and fifth, the lean-burn engine.

A baseline condition must be established for BACT ranking and economic analysis purposes. The baseline is defined as the uncontrolled rate of the process being reviewed. Therefore, the baseline condition for the control technologies involving stationary reciprocating IC engine would be a conventional rich-burn engine with a NO_x emission level of 11 g/bhp-hr (EPA, 1988d).

Presented in Table 6-3 is the BACT top-down hierarchy of technically feasible NO_x control technologies, their corresponding NO_x emission rates, and their control efficiencies calculated from the baseline emission level. Only control options that result in an NO_x emission rate lower than the proposed lean-burn engine (2.0 g/bhp-hr) are shown in the table. Only these options are evaluated further for BACT.

Table 6-2 Summary of BACT Determinations for NOx Emissions from Gas-fired Reciprocating Engines

Company Name	State	Permit Number	Date of Permit	Engine Specifications: Fuel* Type	Make	Model	Size (Bhp)	NOx Emission Limit** (g/Bhp-hr)	(lb/hr)	(ppm)	Control Method	Comments
Source Type: Natural Gas Compressor Station												
Northern Natural Gas Company	IA		05-Sep-90	N.G.	Cooper		4,000	1.8	15.9		Lean burn engine	
same as above	IA		05-Sep-90	N.G.	Cooper		2,000	1.8	7.9		Lean burn engine	
National Fuel Gas Supply Corp.	PA	53-329-001	13-Jun-89	N.G.	Cooper	8015JHC2	3,000	2.0	13.2		Lean burn engine	
Natural Gas Pipeline Company	IL	85100014	01-Mar-89	N.G.	Worthington	MLV-10	4,000	9.0	79.4		Design & oper. practice	
Tennessee Gas Pipeline Company	PA	53-339-002	21-Jun-88	N.G.	Cooper	GMVH-10C	2,250	3.0	14.9		Lean burn engine	
Consolidated Gas Transmission Corp.	PA	59-399-008	10-May-88	N.G.	Dresser-Rand	TCV-10	4,200	3.0	27.8		Lean burn engine	Air to fuel ratio is 4.5:1
ANR Production Company	VA	11064	03-Mar-88	N.G.	Caterpiller	G398TAA	600	1.2	1.6		Catalytic converter	N.G. Compressor Sta.
Southern Natural Gas Company	AL	406-0003-X	19-Feb-88	N.G.	Dresser-Rand	TCVD-10	4,160	2.2	20.2		Lean burn engine	Per. cond.: stack test
National Fuel Gas Supply Corp.	PA	53-399-002	01-Feb-88	N.G.	Dresser-Rand	412 KEV-1	2,850	3.0	18.8		Lean burn engine	
Shell California Production Co.	CA	147853	14-Oct-86	N.G.			600	3.2	4.2		SCR	70% reduction
Northern Natural Gas Company	IA		04-Feb-86	N.G.			4,000			250	Engine design	
Consolidated Gas Transmission Corp.	PA	18-399-009	11-Dec-85	N.G.	Cooper	12W-330-C2	6,000	3.0	39.7		Lean burn engine	
Shell California Production	CA	0041-6	02-Dec-85	N.G.	Caterpiller		225	0.805	0.4	50	NSCR, rich burn engine	90% reduction
Source Type: Power Cogeneration and Other Uses												
University of Illinois, Ch. Cir. Camp.	IL	applying	1990	N.G.	Cooper	LSVB-GDC	8,000	1.9	33.5		Lean burn engine	
Northeast Landfill Power	RI	999-1014	12-Dec-89	L.G.	Waukesha	12V-AT25GL	2,400	1.3	6.6		Lean burn engine	High-speed (900 rpm)
Worcester Company	RI	988-990	27-Sep-89	N.G.	Superior	12-SGTB	2,000	1.5	6.6		Lean burn engine	High-speed (900 rpm)
City of Ventura	CA	1379-1	31-Dec-86	D.G.			773	2.0	3.4		Engine design	Digestive gas
State of Utah Natural Resources	UT		01-Sep-86	N.G.			4,630	3.5	36.0		Lean burn engine	Turbocharger ups fuel eff.
Tricounty Sun Energy Sheraton Hotel	CA	1369-1	07-Aug-86	N.G.	Caterpiller		200			50	NSCR, rich burn engine	90% reduction
Genstar Gas Recovery Systems	CA	30970	29-Aug-85	L.G.			2,650	1.5	8.8		Lean burn engine	Landfilled gas
same as above	CA	30893	29-Aug-85	L.G.			1,100	1.5	3.6		Lean burn engine	Landfilled gas
Pacific Lighting Energy	CA	30336	01-Mar-85	N.G.	Superior	16-SGTA	2,650	1.5	8.8		Lean burn engine	High-speed (900 rpm)

* N.G. = Natural Gas; L.G. = Landfilled Gas; and D.G. = Digestive Gas.

** for a single engine.

Table 6-3 BACT "Top-Down" Hierarchy of NOx Control Technologies

BACT Ranking	Technology	Brake Emission Rate (g/bhp-hr)	Annual Emissions (TPY)	Total Emission Reduction (TPY)*	Total Control Efficiency (%)*
First	Lean-burn Engine with SCR	0.4	9.3	245.6	96%
Second	Rich-burn Engine with NSCR	1.1	25.5	229.4	90%
Third	Lean-burn Engine/Derating Power+	1.2	27.8	227.1	89%
Fourth	Lean-burn Engine/Retard Timing	1.7	39.4	215.5	85%
Fifth	Lean-burn Engine	2.0	46.3	208.6	82%
Baseline	Rich-burn Engine	11.0	254.9	----	----

* Total emission reduction and total control effieciency are calculated from baseline emission level.

\+ The range of control effectiveness is dependent on the percent of engine's rated torque. The calculated values are based on 40% NOx reduction at 25% derated power (or at 75% rated torque).

6.3.2 ANALYSIS OF LEAN-BURN ENGINE WITH SCR

Technical Issues

As the most effective NO_x abatement process in terms of removal efficiency, SCR has been a more frequently attempted technology for state-of-the-art reciprocating IC engines. However, the reliability of SCR's performance on reciprocating IC engines has not been consistently demonstrated. Data on sustained NO_x reduction performance for reciprocating IC engines are very limited. Technical issues involved in the use of SCR are the narrow operating temperature range and the possible damage to the catalyst and downstream equipment. 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 1.80 MMBtu/hr is required for stack gas reheating or 15,768 MMBtu/yr. However, using the lean-burn engine will result in better fuel economy than the baseline rich-burn engine. The heat input savings amounts to 2.4 MMBtu/hr or 21,024 MMBtu/yr. Thus, the net fuel savings is 5,256 MMBtu/yr. Also, an addition of 5.1 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 $50,000 (i.e., Item la in Table 6-4) is added to account for the extra cost of the lean-burn engine. The vendor's equipment quote for the Kleenaire system is $137,000. The direct capital cost of the system is calculated to be $405,627, and the indirect capital cost is calculated to be $230,362. The total capital investment is $635,989. The basic

Table 6–4 Capital Cost Estimates for SCR Systems for NOx Emission Control

Cost Items	Cost Factors	Costs: Kleenaire System+	Costs: Engelhard System++
DIRECT CAPITAL COSTS (DCC):			
(1) Purchased Equipment			
(a) Differential Engine Cost	See Note 1	$50,000	$50,000
(b) SCR Basic Equipment	Vendor Quote	$137,000	$168,000
(c) Ammonia System	See Note 2	$13,000	$13,000
(d) Auxiliary Equipment (Reheat)*	0.10 x (1b)	$13,700	$16,800
(e) Emission Monitoring	0.15 x (1b)	$20,550	$25,200
(f) Structure Support	0.10 x (1a-1e)	$23,425	$27,300
(g) Instrumentation & controls[1]	0.10 x (1a-1e)	$23,425	$27,300
(h) Freight[1]	0.05 x (1a-1g)	$14,055	$16,380
(i) Sales Tax (Florida)	0.06 x (1a-1g)	$16,866	$19,656
(j) Subtotal	(1a-1i)	$312,021	$363,636
(2) Direct Installation[1]	0.30 x (1j)	$93,606	$109,091
Total DCC:	(1) + (2)	$405,627	$472,727
INDIRECT CAPITAL COSTS (ICC):			
(3) Indirect Installation			
(a) Engineering & Supervision[1]	0.10 x (DCC)	$40,563	$47,273
(b) Construction & Field Expenses[1]	0.05 x (DCC)	$20,281	$23,636
(c) Contruction Contractor Fee[1]	0.10 x (DCC)	$40,563	$47,273
(d) Contigencies[2]	0.25 x (DCC)	$101,407	$118,182
(4) Other Indirect Costs			
(a) Startup & Testing[1]	0.03 x (DCC)	$12,169	$14,182
(b) Working Capital	30-day DOC**	$15,379	$13,763
Total ICC:	(3) + (4)	$230,362	$264,309
TOTAL CAPITAL INVESTMENT (TCI):	DCC + ICC	$635,989	$737,036

\+ Represents a typical first generation catalyst which is metal oxides embeded 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 2,000-gallon anhydrous ammonia tank, an ammonia evaporator, and a dual-valve pressure regulator.

equipment cost for the Engelhard System is $168,000. Direct capital cost is $472,727 and the indirect capital cost is $264,309 for a total capital investment of $737,036.

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 $406,225 and $409,321 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

<u>Technical Issues</u>

Rich-burn engines operate at near stoichiometric air-to-fuel ratios and, therefore, generate high engine cylinder temperatures in the range of 1,200°F to 1,300°F. Engine manufacturers have found that such high temperatures do not allow loading the engine very high. For greater power output, engine manufacturers have found that engine modifications (i.e., turbocharged engines which can produce more power enhancements with lower emission levels) are the better choice than building larger engine blocks. In the current U.S. market, rich-burn engines over 2,000 bhp are not standard off-the-shelf items; however, a 2,400-bhp engine can be obtained by special order.

All known rich-burn engine/NSCR combination applications are found for small engines of approximately 1,000 bhp or less (i.e., a 600-bhp engine for ANR Production Company, Virginia; a 225-bhp engine for Shell California Production, California; and a 200-bhp engine for Tricounty Sheraton Hotel, California; see Table 6-2).

Table 6-5 Annualized Cost Estimates for SCR Systems for NOx Emission Control

Cost Items	Basis	Costs: Kleenair System+	Costs: Engelhard System++
DIRECT OPERATING COSTS (DOC):			
(1) Operating Labor			
Operator[2]	5,840 hr/yr @ $20/hr	$116,800	$116,800
Supervisor[1]	15% of operator cost	$17,520	$17,520
(2) Maintenance[2]	5% of direct capital cost	$20,281	$23,636
(3) Replacement Parts (include freight & tax)			
(a) Catalyst	(Part+Labor)xCRF; See Note 1	$31,507	$13,297
(b) Guard Bed	(Part+Labor)xCRF; See Note 2	$4,544	$0
(4) Utilities			
(a) Electricity	0.30 MW-hr/ton NH3; $85/MW-hr	$437	$437
(b) Fuel for stack reheat	$2.06/MMBtu; See Note 3	$32,482	$32,482
(c) Fuel credit	$2.06/MMBtu; See Note 4	-$43,309	-$43,309
(5) Ammonia	0.37 lb NH3/lb NOx; $250/ton NH3	$4,287	$4,287
Total DOC		$184,549	$165,150
INDIRECT OPERATING COSTS (IOC):			
(7) Overhead[1]	60% of operating labor & maintenance	$92,761	$94,774
(8) Property Taxes[1]	1% of total capital investment	$6,360	$7,370
(9) Insurance[1]	1% of total capital investment	$6,360	$7,370
(10) Administration[1]	2% of total capital investment	$12,720	$14,741
Total IOC		$118,201	$124,255
CAPITAL RECOVERY COST (CRC)	CRF of 0.1627 times TCI	$103,475	$119,916
ANNUALIZED COST (AC):	DOC + IOC + CRC	$406,225	$409,321

\+ Represents a typical first generation catalyst which is metal oxides embeded in ceramic matrix.
++ Represents second generation all ceramic catalyst extruded in honeycomb shape.

[1] Based on catalytic incinerators, from OAQPS Control Cost Manual, Fourth Edition.
[2] Based on no existing installation of SCR on large-bore and low-speed lean-burn engine: 5.33 hours per shift are devoted to the emission control system operation and maintenance.

Note 1: Catalyst replacement part cost for the Kleenair System is $69,870 with a service life of 3 years.
Catalyst replacement part cost for the Engelhard system is $29,070 with a service life of 3 years.
Combined freight and tax factor is 11%; and CRF for a 3-year recovery period and 10% interest rate is 0.4021.
Replacement labor cost is $50 per hour for two 8-hour days. Total cost includes both material and labor costs.

Note 2: The Kleenair system includes a guard bed which works as a pre-filter upstream from the metal oxides catalyst; the replacement part cost is $10,000 with an estimated service life of 3 years. Required labor is for 4 hours.

Note 3: Assumed heat transfer efficiency of 80%, heat input required to raise exhaust temperature to 700°F is:
Q = (36,860 lb/hr)(0.26 Btu/lb°F for air)(700°F-550°F)/(0.8) = 1.80 MMBtu/hr.
Annual heat input equals 1.80 MMBtu/hr times 8,760 hr/yr = 15,768 MMBtu/yr.

Note 4: Heat input for lean-burn engine is calculated from 7,000 Btu/bhp-hr times 2,400 bhp = 16.8 MMBtu/hr.
Heat input for rich-burn, naturally aspirated engine is calculated from 8,000 Btu/bhp-hr times 2,400 bhp = 19.2 MMBtu/hr.
Therefore, using a better fuel efficient engine results in saving an annual heat input of:
(19.2 - 16.8) MMBtu/hr x 8,760 hr/yr = 21,024 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. Environmental impacts are expected to be minimal for the rich-burn engine/NSCR option since no toxic or hazardous reagents are required. Rich-burn/NSCR technology generally produces lower CO and VOC emissions as compared to a lean-burn engine.

Energy Requirements and Impacts

The NSCR converter does not require any additional fuel other than a small amount of hydrocarbon fuel used for injection into the exhaust gas mixture to ensure fuel rich conditions. However, the fuel economy of the rich-burn, naturally aspirated engine is approximately 8,000 Btu/bhp-hr (EPA, 1979) compared to the 7,000 Btu/bhp-hr for the proposed lean-burn engine. For a 2,400-bhp output, an additional 2.4 MMBtu/hr heat input is required, or approximately 21,024 MMBtu per year for an annual cost of $43,309.

Economic Analysis

Capital and annualized cost estimates were prepared for a NSCR converter. Cost of the NSCR converter was provided by Johnson-Matthey as $48,000. The NSCR can achieve 90 percent NO_x reduction. The resulting NO_x emission rate is 1.1 g/bhp-hr.

The total capital investment cost for a NSCR converter designed for a 2,400-bhp rich-burn engine is tabulated in Table 6-6. The direct capital cost is calculated to be $95,584, and the indirect capital cost is calculated to be $58,453. The total capital investment is $154,037. Also shown in the table is the differential cost of the lean-burn engine over that of the baseline rich-burn engine. The annualized cost for the NSCR converter is given in Table 6-7. The calculation basis for cost items are also given in the table. The resulting annualized cost is $167,910. In comparison, the annualized differential cost of the lean-burn engine itself is -$13,955. As computed from Table 6-7, this negative value of the annualized cost for the lean-burn engine resulted from the fuel credit generated by using the proposed fuel-efficient engine.

6.3.4 ANALYSIS OF LEAN-BURN ENGINE WITH DERATING POWER OUTPUT

Technical Issues

Derating power output does not require additional equipment. Derating is accomplished by restricting the engine torque to a level below its normal operating design rate. This is done by making adjustment to the throttle valve setting in order to change the power output. Although a derated engine produces less NO_x emissions, such practice will also reduce the overall engine's efficiency and shorten its service life as much as 25 percent (Dresser-Rand, 1990). In addition, continuous derating operation would require a bigger, more expensive engine to meet the overall power requirement. Derating power output is not considered BACT for the proposed lean-burn engine because of potential engine reliability problems, shortened engine life, and increased emissions of hydrocarbons.

Environmental Effects

Application of this technology would result in lower NO_x and carbon monoxide (CO) emissions, but emissions of hydrocarbons would increase. For instance, Cooper Industries, Inc., has reported a 23.2 TPY emissions reduction of NO_x and 2.3 TPY decrease in CO with a corresponding emissions

Table 6–6 Capital Cost Estimates for Lean–burn Engine and Rich–burn Engine/NSCR System

Cost Items	Cost Factors	Costs: Lean-Burn Engine	Costs: Johnson-Matthey NSCR System
DIRECT CAPITAL COSTS (DCC):			
(1) Purchased Equipment			
(a) Differential Engine Cost	See Note 1	$50,000	$0
(b) NSCR Converter	Vendor Quote	$0	$48,000
(c) Emission Monitoring	0.15 x (1b)	$0	$7,200
(d) Structural Support	0.10 x (1b-1c)	$0	$5,520
(e) Instrumentation[1]	0.10 x (1a-1c)	$5,000	$5,520
(f) Freight[1]	0.05 x (1a-1e)	$2,750	$3,312
(g) Sales Tax (Florida)	0.06 x (1a-1e)	$3,300	$3,974
(h) Subtotal	(1a-1g)	$61,050	$73,526
(2) Direct Installation[1]	0.30 x (1h)	$18,315	$22,058
Total DCC:	(1) + (2)	$79,365	$95,584
INDIRECT CAPITAL COSTS (ICC):			
(3) Indirect Installation			
(a) Engineering & Supervision[1]	0.10 x (DCC)	$7,937	$9,558
(b) Construction & Field Expenses[1]	0.05 x (DCC)	$3,968	$4,779
(c) Contruction Contractor Fee[1]	0.10 x (DCC)	$7,937	$9,558
(d) Contigencies	See Note 2	$11,905	$23,896
(4) Other Indirect Costs			
(a) Startup & Testing[1]	0.03 x (DCC)	$2,381	$2,868
(b) Working Capital	30-day DOC*	$0	$7,794
Total ICC:	(3) + (4)	$34,128	$58,453
TOTAL CAPITAL INVESTMENT (TCI):	DCC + ICC	$113,493	$154,037

* 30 days of direct operating costs, calculated from the annualized cost Table 6-7 (i.e., total DOC/12 months).

[1] Based on catalytic incinerators, from OAQPS Control Cost Manual, Fourth Edition.

Note 1: Differential engine cost is calculated from vendor's price quotation for a lean-burn engine minus vendor's price quotation for the rich-burn engine being designated as baseline.

Note 2: For lean-burn engine, 15 percent of DCC is used for a guaranteed efficiency and operation. For NSCR application, 25 percent of DCC is used for contigency based on no existing installtion of NSCR on large-bore rich-burn engine.

Table 6–7 Annualized Cost Estimates for Lean-Burn Engine and Rich-Burn/NSCR System

Cost Items	Basis	Costs: Lean-Burn Engine	Costs: Johnson-Matthey NSCR System
DIRECT OPERATING COSTS (DOC):			
(1) Operating Labor			
Operator[2]	$20/hr (2,920 hr/yr for NSCR)	$0	$58,400
Supervisor[1]	15% of operator cost	$0	$8,760
(2) Maintenance[2]	5% of direct capital cost	$3,968	$4,779
(3) Replacement Parts (include freight & tax)			
Catalyst	(Part+Labor)xCRF; See Note 1	$0	$21,585
(4) Fuel			
Fuel credit (gas)	$2.06/MMBtu; See Note 2	-$43,309	$0
Total DOC		-$39,341	$93,524
INDIRECT OPERATING COSTS (IOC):			
(7) Overhead[1]	60% of operating labor & maintenance	$2,381	$43,163
(8) Property Taxes[1]	1% of total capital investment	$1,135	$1,540
(9) Insurance[1]	1% of total capital investment	$1,135	$1,540
(10) Administration[1]	2% of total capital investment	$2,270	$3,081
Total IOC		$6,921	$49,324
CAPITAL RECOVERY COST (CRC)	CRF of 0.1627 times TCI	$18,465	$25,062
ANNUALIZED COST (AC):	DOC + IOC + CRC	-$13,955	$167,910

[1] Based on catalytic incinerators, from OAQPS Control Cost Manual, Fourth Edition.

[2] Based on no existing installation of NSCR on high-load rich-burn engine: 2.667 hours per shift are devoted to the emission control system operation and maintenance.

Note 1: For NSCR, the catalyst accounts for 95% of the basic cost and has a service life of 3 year; therefore, catalyst replacement part cost is $48,000 times 0.95 plus 11% for the combined freight and tax cost. Replacement labor cost is $50 per hour for one 8-hour day. Total cost includes both material and labor costs. Thus, the annualized catalyst replacement cost is equal to the total replacement cost multiplied by the CRF for a 3-year recovery period and an interest rate of 10%. CRF = 0.4021.

Note 2: Heat input for lean-burn engine is calculated from 7,000 Btu/bhp-hr times 2,400 bhp = 16.8 MMBtu/hr. Heat input for rich-burn engine is calculated from 8,000 Btu/bhp-hr times 2,400 bhp = 19.2 MMBtu/hr. Therefore, using a better fuel efficient engine results in saving an annual heat input of:
(19.2 - 16.8) MMBtu/hr x 8,760 hr/yr = 21,024 MMBtu/yr.

increase of 7.0 TPY total hydrocarbons based on a 30 percent derating of the proposed 2,400-bhp 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 an 8 percent increase in fuel consumption will occur for a derating of 30 percent.

Economic Analysis

If derating is employed, a larger engine would be necessary to meet the FGTC power requirement of 2,400 bhp at Compressor Station No. 14. 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.

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 36,860 pounds per hour of exhaust mass flow rate, reduces the residence time of the combustion gases compared to a rich-burn engine, which operates at an air-to-fuel ratio near unity. High mass flow rate also means the engine operates below the peak temperature region for thermal NO_x formation. The exhaust temperature for the proposed engine is 550°F, which is lower than the exhaust temperature of between 1,200°F and 1,300°F for an equivalent

Table 6-8 Summary of the Operating Parameters for the Proposed Engine, Station No. 14

Parameter	Design Specification
Make and Model	Cooper-Bessemer GMVR-12C2
Air/Fuel Ratio	Variable
Exhaust Mass Flow	36,860 lb/hr
Ignition Timing	Variable
Air Manifold Pressure	Variable
Air Ambient Air Temperature	80 °F
Exhaust Temperature	550 °F
Maximum Allowed Back Pressure	3 inches of water
Specific Fuel Consumption	7,000 Btu/bhp-hr

Source: Cooper Industries, Inc. (1990).

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 2.4 MMBtu/hr, for a total savings of 21,024 MMBtu/yr.

Economic Analysis

Capital and annualized cost estimates were prepared for the lean-burn engine. The differential engine cost of the lean-burn engine compared to the baseline rich-burn engine was provided by ENRON for the proposed 2,400-bhp Cooper-Bessemer GMVR-12C2 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 $50,000, from which the differential direct capital cost is calculated to be $79,365, and the indirect capital cost is calculated to be $34,128. The differential total capital investment is $113,493.

The annualized cost is given in Table 6-7. The calculation basis for cost items is also given. The direct operating cost consists of normal maintenance cost of the lean-burn technology parts for $3,968 and a fuel credit of $43,309 for better fuel efficiency operation. The differential annualized cost is -$13,955 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 as a result of 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 5,256 MMBtu/yr for using the fuel-efficient lean-burn engine. In addition, an annual 5.1 MW-hr of electrical power is required for the ammonia vaporizer and injection system. The highest energy requirement is for the rich-burn/NSCR combination. This alternative does not use any additional fuel or energy for operation of the control device. However, the rich-burn engine is less fuel efficient than the proposed lean-burn engine, making the rich-burn engine/NSCR option the worst ranking in terms of energy impacts. The lean-burn engine shows a saving of 21,024 MMBtu/yr in heat input over the rich-burn engine because of its inherent fuel efficient design. Thus, the lean-burn engine is the best alternative in view of the energy impact analysis.

6.4.4 COMPARISON OF ECONOMIC ANALYSIS

Economic analysis is based on the cost effectiveness of the control method. Economic impact is determined by the total and incremental cost effectiveness values. The detailed cost estimating procedure is presented in Appendix B. Results of the economic impact analysis are summarized in Table 6-9 for all three technically feasible NO_x control methods. Comparing the total cost effectiveness of these three NO_x control alternatives: the lean-burn engine/SCR technology has the highest cost effectiveness value of $1,666 per ton of NO_x removed; the rich-burn engine/NSCR technology is the next highest with $732 per ton of NO_x removed. The lean-burn engine has a total cost effectiveness value of -$67 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 $14,810 and $8,744 per ton of NO_x removed, respectively. The lean-burn engine has an

Table 6-9 Summary of Top-Down BACT Impact Analysis Results for NOx

Control Alternative	Total Emission Reduction (TPY)*	Incremental Emission Reduction (TPY)**	Environmental Impacts: Potential toxic air impact?	Environmental Impacts: Potential adverse enviromental impacts?	Energy Impacts (Incremental increase over baseline): Natural gas (MMBtu/yr)	Energy Impacts (Incremental increase over baseline): Electricity (MW-hr/yr)	Economic Impacts: Total Annualized Cost ($/yr)	Economic Impacts: Incremental Annualized Cost ($/yr)	Economic Impacts: Total Cost Effectiveness ($/ton)	Economic Impacts: Incremental Cost Effectiveness ($/ton)
Lean-Burn Engine with SCR	245.7	16.3	Yes	Yes	-5,256	5.1	$409,321	$241,409	$1,666	$14,810
Rich-Burn Engine with NSCR	229.4	20.8	No	Yes	0	0	$167,910	$181,865	$732	$8,744
Lean-Burn Engine	208.6	208.6	No	No	-21,024	0	-$13,955	-$13,955	-$67	-$67
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.

incremental cost effectiveness of -$67 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 2,400-bhp lean-burn engine) have been required to bear a high incremental cost effectiveness to reduce NO_x emissions. Furthermore, the FGTC's proposed lean-burn engine has low NO_x emissions of 46.3 TPY, and modeling results show an insignificant NO_x impact (less than 1.0 $\mu g/m^3$). In conclusion, the FGTC's proposed Cooper-Bessemer GMVR-12C2 lean-burn engine is BACT.

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APPENDIX A

Appendix A Summary of BACT Determinations for NOx Emissions from Stationary Reciprocating Engines (page 1 of 2)

Company Name	State	Permit Number	Date of Permit	Total Capacity	Engine Specifications: Fuel Type	Make	Model	Load (Bhp)	NOx Emission Limit*: (g/Bhp-hr)	(lb/hr)	(ppm)	Control Method	Comments
<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.	Caterpiller	G398TAA	600	1.2	1.6		Catalytic converter	N.G. Compressor Sta.
Southern Natural Gas Company	AL	406-0003-X0	19-Feb-88	4,160 Bhp	N.G.	Dresser-Rand	TCVD-10	4,160	2.2	20.2		Lean burn engine	Per. cond.: stack test
National Fuel Gas Supply Corp.	PA	53-399-002	01-Feb-88	2,850 Bhp	N.G.	Dresser-Rand	412 KEV-1	2,850	3.0	18.8		Lean burn engine	
Shell California Production Co.	CA	147853	14-Oct-86	600 Bhp				600	3.2	4.2		SCR	70% reduction
Northern Natural Gas Company	IA		04-Feb-88	8,000 Bhp	N.G.			4,000			250	Engine design	
Consolidated Gas Transmission Corp.	PA	18-399-009	11-Dec-85	6,000 Bhp	N.G.	Cooper	12W-330-C2	6,000	3.0	39.7		Lean burn engine	
Shell California Production	CA	0041-6	02-Dec-85	225 Bhp	N.G.	Caterpiller		225	0.805	0.4	50	NSCR, rich burn engine	90% reduction

* for a single engine.
N.G. = Natural Gas.

Appendix A Summary of BACT Determinations for NOx Emissions from Stationary Reciprocating Engines (page 2 of 2)

Company Name	State	Permit Number	Date of Permit	Total Capacity	Engine Specifications: Fuel Type	Make	Model	Load (Bhp)	NOx Emission Limit* (g/Bhp-hr)	(lb/hr)	(ppm)	Control Method	Comments
Source Type: Power Cogeneration and Other Uses													
University of Illinois, Ch. Cir. Camp.	IL	applying	1990	16,000 Bhp	N.G.	Cooper	LSVB-GDC	8,000	1.9	33.5		Lean burn engine	
Northeast Landfill Power	RI	999-1014	12-Dec-89	19,200 Bhp	L.G.	Waukesha	12V-AT25GL	2,400	1.3	6.6		Lean burn engine	High-speed (900 rpm)
Pfizer, Inc.	MA	B-87-C-006	16-Nov-89	6,710 Bhp	Dual/Diesel	Cooper	LSVB-16-GDT	6,710	0.7	10.1		SCR	90% reduction
Cogentrix (formerly Xiox)	PA	33-399-004	31-Oct-89	20,904 Bhp	Dual	Wartsila	18V32GD	6,968	5.0	76.8		Engine retardation	
Worcester Company	RI	988-990	27-Sep-89	6,000 Bhp	N.G.	Superior	12-SGTB	2,000	1.5	6.6		Lean burn engine	High-speed (900 rpm)
Citizens Utilities	HI	HI 88-04	19-Sep-89	42,000 Bhp	Diesel			10,500			605	Engine design	
Key West Electric System	FL	PSD-FL-135	05-Jun-89	26,532 Bhp	Diesel			13,266	6.0	175.5		Engine timing retard	
Maui Electric Company, Inc.	HI	HI 87-01	30-Dec-88	33,400 Bhp	Diesel			16,700	7.0	256.1	595	5° ignition retard	20% reduction
Power Ventures	FL	PSD-FL-120	05-Dec-88	8,800 Bhp	Dual	Undetermined			5.0			Engine design	
same as above	FL	PSD-FL-120	05-Dec-88	6,800 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-88	773 Bhp	D.G.			773	2.0	3.4		Engine design	Digestive gas
State of Utah Natural Resources	UT		01-Sep-86	18,000 Bhp	N.G.			4,630	3.5	36.0		Lean burn engine	Turbocharger ups fuel eff.
Tricounty Sun Energy Sheraton Hotel	CA	1369-1	07-Aug-86	200 Bhp	N.G.	Caterpiller		200			50	NSCR, rich burn engine	90% reduction
LaJet Energy Company	CA	85096	17-Jul-86	1,385 Bhp	Diesel	Cummins	KTTA-50CC	1,385	5.4	16.5		Engine design	
3M	TX	PSD-TX-674	30-May-86	8,386 Bhp	Dual	Cooper	LSVG-20-GDT	8,386	5.0	92.4		Engine design	
Genstar Gas Recovery Systems	CA	30970	29-Aug-85	2,650 Bhp	L.G.			2,650	1.5	8.8		Lean burn engine	Landfilled gas
same as above	CA	30893	29-Aug-85	1,100 Bhp	L.G.			1,100	1.5	3.6		Lean burn engine	Landfilled gas
Pacific Lighting Energy	CA	30336	01-Mar-85	2,650 Bhp	N.G.	Superior	16-SGTA	2,650	1.5	8.8		Lean burn engine	High-speed (900 rpm)

* for a single engine. Note: N.G. = Natural Gas; L.G. = Landfilled Gas; D.G. = Digestive Gas.

APPENDIX B

APPENDIX B

ECONOMIC IMPACT ANALYSIS METHODOLOGY

In the "top-down" approach, the economic impact along with environmental and energy impacts is one of three main criteria for BACT evaluation in considering any emission control method. The economic analysis determines the cost effectiveness of each applicable emission control alternative.

The economic analysis is based on the cost estimating procedure outlined in EPA's control cost manual (EPA, 1990b). An overall description of this cost estimating methodology is given as follows:

1. The total capital investment consists of direct capital and indirect capital costs. The direct capital cost includes the purchased equipment cost and the direct installation cost. The indirect capital cost accounts for other indirect expenses pertaining to the installation of the emission control device, such as engineering, construction and field expenses, contractor fee, contingencies, and startup and testing.

2. The annualized cost consists of the direct operating cost, the indirect operating cost, and the capital recovery cost. The direct operating cost includes both annual operating and maintenance costs, cost of replacement parts, and fuel costs. The indirect annual operating cost accounts for items such as overhead, property taxes, insurance, and administration. The capital recovery cost is calculated from the total capital investment cost using a capital recovery factor.

3. The total annual operating cost is divided by the total emission reduction of the control system to result in dollars per ton of pollutant removed (i.e., dollars per ton of NO_x in this case). This value is defined as the cost effectiveness of the control method. Incremental cost effectiveness of one control method over

another is also calculated based on the incremental annual cost and incremental emission reduction.

Detailed descriptions of the cost estimates are presented in the following three sections for the SCR system being evaluated as an add-on control device for the lean-burn engine. The discussion includes economic analyses of the lean-burn engine and the NSCR system for the rich-burn engine. The baseline cost estimate is based on the rich-burn engine since it has been defined as the baseline engine on which all emission calculations are based.

SECTION I <u>TOTAL CAPITAL INVESTMENT (TCI)</u>

The TCI cost for the SCR converter covers a complete turn-key system. The basic purchased equipment costs consist of the differential reciprocating IC engine cost and the SCR system cost. The differential engine cost accounts for the difference in cost between the higher cost lean-burn and the lower cost rich-burn engines as quoted by 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 power output). Emission control basic equipment consists of all catalyst structure, and mechanical and electrical components required for efficient operation of the device. These include such items as internal piping and exhaust gas ductwork.

The storage tank and delivery equipment costs for the ammonia system were obtained from the ammonia supplier. The ammonia system was designed for a typical 3-month supply of anhydrous ammonia and its auxiliary equipment such as ammonia vaporizer/injection components.

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 O_2 continuous monitors, which are not included in the basic equipment costs. These monitors are tied to the ammonia injection system to ensure proper NO_x reduction. These costs are estimated at 15 percent of the SCR basic equipment cost.

Structure support costs account for miscellaneous external piping, auxiliary support, independent flow controllers and indicators for the connection between the basic equipment and the ammonia system. Costs are estimated at 10 percent of the overall equipment cost. Overall equipment includes the engine, emission control device, exhaust reheating heater, monitoring equipment, and any other auxilliary system.

Plant instrumentation and controls are usually not included in the basic equipment cost; typical cost factors range from 10 to 15 percent of the overall equipment cost, depending on the specific application.

The purchased equipment costs are then the basis for determining the direct and indirect installation costs. The installation costs are based on standard cost factors (EPA, 1990b).

The direct installation costs consist of the direct expenditures for materials and labor for site preparation, foundations, structural steel, erection, piping, electrical, painting, and insulation. Direct installation costs are expressed as a percentage of the total basic equipment costs for standard industrial installations.

The indirect capital costs (ICC) typically cover several areas, such as: engineering and supervision, construction and field expenses, construction contractor fee, contingencies, start-up and testing, and working capital. Each of the above items is based on a percentage of the DCC; except for the working capital which is based on the direct operating cost (DOC).

For the proposed lean-burn engine, the TCI cost estimate is also calculated by summing the purchased equipment costs, direct installation costs, and indirect capital costs. In this case, the itemized basic purchased equipment costs only include the differential engine cost, instrumentation, freight, and sales tax. Other direct and indirect installation costs are estimated by multiplying the sum of the basic purchased equipment costs by the standard cost factors.

The TCI cost estimate for the NSCR converter was based on a similar cost estimating procedure. Basic purchased equipment costs for the NSCR system include the basic converter, emission monitoring, structural support, instrumentation, freight, and sales tax. The direct and indirect installation costs follow a similar procedure to the one described above.

SECTION II <u>ANNUALIZED COST (AC)</u>

The AC estimates for each SCR system are comprised of the direct operating costs (DOC), the indirect operating costs (IOC) and the capital recovery cost (CRC). The DOC includes the operating labor, maintenance, replacement catalyst and parts, utilities, and ammonia supply. The IOC includes plant overhead, property taxes, insurance, and administration. The CRC accounts for the annualized cost of the initial capital investment for the emission control system.

In the DOC category, the annual operating labor includes the operator and supervisor costs for continuous operation. The operator cost for the SCR system was calculated based on 5.33 hours per shift devoted to regular maintenance and safety assurance procedure for the emission control system, which 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. 14

```
ISCLTK6L MODEL, A VERSION OF
  ISCLT (VERSION 90008)
  AN AIR QUALITY DISPERSION MODEL IN
  SECTION 1.  GUIDELINE MODELS.
  IN UNAMAP (VERSION 6) JAN 1990.
  SOURCE: FILE 7  ON UNAMAP MAGNETIC TAPE FROM NTIS.


          CONVERTED BY :
KBN ENGINEERING AND APPLIED SCIENCES, INC.
       GAINESVILLE, FLORIDA
            (904)331-9000

          COPYRIGHT 1990 L


  CARD INPUT FILE IS           ER14LT82.183
  SUMMARY OUTPUT FILE IS       ER14LT82.083
  TITLE OF RUN IS              1982 ENRON STATION 14 / 50 FT STACK          10-18-90
```

- ISCLT INPUT DATA -

```
        NUMBER OF SOURCES =    1
        NUMBER OF X AXIS GRID SYSTEM POINTS =    7
        NUMBER OF Y AXIS GRID SYSTEM POINTS =   16
        NUMBER OF SPECIAL POINTS =   36
        NUMBER OF SEASONS =    1
        NUMBER OF WIND SPEED CLASSES =    6
        NUMBER OF STABILITY CLASSES =    6
        NUMBER OF WIND DIRECTION CLASSES =  16
        FILE NUMBER OF DATA FILE USED FOR REPORTS =    1
        THE PROGRAM IS RUN IN RURAL MODE
        CONCENTRATION (DEPOSITION) UNITS CONVERSION FACTOR =0.10000000E+07
        ACCELERATION OF GRAVITY (METERS/SEC**2) =   9.800
        HEIGHT OF MEASUREMENT OF WIND SPEED (METERS) =    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 )=     200.00,     300.00,     400.00,     500.00,     750.00,    1000.00,
           1250.00,
         RANGE X SPECIAL DISCRETE POINTS (METERS )=     207.00,     216.00,     238.00,     256.00,     213.00,     189.00,
          177.00,     168.00,     165.00,     168.00,     177.00,     192.00,     216.00,     253.00,     232.00,     213.00,
          201.00,     198.00,     201.00,     210.00,     229.00,     223.00,     189.00,     198.00,     253.00,     241.00,
          238.00,     241.00,     253.00,     274.00,     311.00,     268.00,     238.00,     219.00,     207.00,     204.00,
 AZIMUTH BEARING Y AXIS GRID SYSTEM POINTS (DEGREES)=     22.50,      45.00,      67.50,      90.00,     112.50,     135.00,
          157.50,     180.00,     202.50,     225.00,     247.50,     270.00,     292.50,     315.00,     337.50,     360.00,
 AZIMUTH BEARING Y SPECIAL DISCRETE POINTS (DEGREES)=     10.00,      20.00,      30.00,      40.00,      50.00,      60.00,
           70.00,      80.00,      90.00,     100.00,     110.00,     120.00,     130.00,     140.00,     150.00,     160.00,
          170.00,     180.00,     190.00,     200.00,     210.00,     220.00,     230.00,     240.00,     250.00,     260.00,
          270.00,     280.00,     290.00,     300.00,     310.00,     320.00,     330.00,     340.00,     350.00,     360.00,
```

- AMBIENT AIR TEMPERATURE (DEGREES KELVIN) -

	STABILITY CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	299.0000	299.0000	299.0000	293.0000	287.0000	287.0000

- MIXING LAYER HEIGHT (METERS) -

SEASON 1

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04
STABILITY CATEGORY 2	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 3	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 4	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 5	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05
STABILITY CATEGORY 6	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05

PSD PERMIT APPLICATION
FLORIDA GAS TRANSMISSION COMPANY
COMPRESSOR STATION NO. 15

Enron #15
36,000 5.86 x .1 = .586 ⇒ .15
85,000 1.53 x .1 = .153 ⇒ .04

.15 + .03 = .18 St Marks
.04 + .08 = .12 Br

St Marks .01590 or .01 ug/m³
Bradwell B. .01033 or .01 ug/m³

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
90051E1/P

STATE OF FLORIDA

Station No. 15

DEPARTMENT OF ENVIRONMENTAL REGULATION

$1,000 pd.
11-19-90
Recpt.#151211

AC 62-189439
PSD-FL-160

APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: Natural Gas Compressor Engine [X] New[1] [ ] Existing[1]

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

COMPANY NAME: Florida Gas Transmission Company COUNTY: Taylor

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 15, Unit No. 6

SOURCE LOCATION: Street 6 miles north of Perry on Pisgah Road City Perry

UTM: East 17:249.02 km North 3339.60 km

Latitude 30 ° 09 ' 50 "N Longitude 83 ° 36 ' 22 "W

APPLICANT NAME AND TITLE: W. Alan Bowman, Project Environmentalist

APPLICANT ADDRESS: P.O. Box 1188, Houston, Texas 77251 Phone: (713) 853-7303

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative* of Florida Gas Transmission Co.

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

*Attach letter of authorization

Signed: [signature]

C.L. Truby, Vice President
Name and Title (Please Type)

Date: 11-12-90 Telephone No. (713) 853-6161

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

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

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

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

Signed David A. Buff

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	0.57	N/A	N/A	0.13	0.57	
SO_2	0.75	3.27	N/A	N/A	0.75	3.27	

[1]See Section V, Item 2.

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

[3]Calculated from operating rate and applicable standard.

[4]Emission, if source operated with~~out~~ control (See Section V, Item 3).

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

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)
Lean Burn Engine Design	NO_x	80%	N/A	Design and
				AP-42

E. Fuels

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max/hr	
Natural Gas	0.0262	0.0262	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/ft^3 lbs/gal Typical Percent Nitrogen: NA

Heat Capacity: 22,857 (based on 1,040 Btu/scf) BTU/lb NA BTU/gal

Other Fuel Contaminants (which may cause air pollution): NA

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

Annual Average Not applicable Maximum

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

Not applicable

*Based on contract limit of 10 gr/100 ft^3 and gas at 0.0455 lb/ft^3

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

Stack Height: 40 ft. Stack Diameter: 1.938 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 (Patholog-ical)	Type V (Liq.& Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Inciner-ated							
Uncon-trolled (lbs/hr)							

Description of Waste ______

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

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

Manufacturer ______

Date Constructed ______ Model No. ______

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

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

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

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

Type of pollution control devices: [ ] Cyclone [ ] Wet Scrubber [ ] Afterburner [ ] Other

(specify) ______

Brief description of operating characteristics of control devices: ____________

____

____

____

____

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

____

____

____

____

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

SECTION V: SUPPLEMENTAL REQUIREMENTS

Please provide the following supplements where required for this application.

1. Total process input rate and product weight -- show derivation [Rule 17-2.100(127)]
   Not Applicable
2. To a construction application, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach proposed methods (e.g., FR Part 60 Methods, 1, 2, 3, 4, 5) to show proof of compliance with applicable standards. To an operation application, attach test results or methods used to show proof of compliance. Information provided when applying for an operation permit from a construction permit shall be indicative of the time at which the test was made.
   See PSD Report, Section 2.0, Tables 2-1 and 2-2
3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).
   See PSD Report, Section 2.0
4. With construction permit application, include design details for all air pollution control systems (e.g., for baghouse include cloth to air ratio; for scrubber include cross-section sketch, design pressure drop, etc.)
   Not Applicable
5. With construction permit application, attach derivation of control device(s) efficiency. Include test or design data. Items 2, 3 and 5 should be consistent: actual emissions = potential (1-efficiency).
   Not Applicable
6. An 8 ½" x 11" flow diagram which will, without revealing trade secrets, identify the individual operations and/or processes. Indicate where raw materials enter, where solid and liquid waste exit, where gaseous emissions and/or airborne particles are evolved and where finished products are obtained.
   See PSD Report, Figure 2-2
7. An 8 ½" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Examples: Copy of relevant portion of USGS topographic map).
   See PSD Report, Figure 1-2
8. An 8 ½" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram.
   See PSD Report, Figure 2-1

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

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

SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY

See PSD report, Sections 3.0 and 6.0

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

[ ] Yes [ ] No

Contaminant	Rate or Concentration

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

[ ] Yes [ ] No

Contaminant	Rate or Concentration

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

Contaminant	Rate or Concentration

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

1. Control Device/System:
2. Operating Principles:
3. Efficiency:*
4. Capital Costs:

*Explain method of determining

5. Useful Life:

6. Operating Costs:

7. Energy:

8. Maintenance Cost:

9. Emissions:

Contaminant	Rate or Concentration

10. Stack Parameters

a. Height: ft.

b. Diameter ft.

c. Flow Rate: ACFM

d. Temperature: °F.

e. Velocity: FPS

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

1.

a. Control Devices:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

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

2.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

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

j. Applicability to manufacturing processes:

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

3.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

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

4.

a. Control Device:

b. Operating Principles:

c. Efficiency:[1]

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:[2]

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

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

F. Describe the control technology selected:

1. Control Device:

2. Efficiency:[1]

3. Capital Cost:

4. Useful Life:

5. Operating Cost:

6. Energy:[2]

7. Maintenance Cost:

8. Manufacturer:

9. Other locations where employed on similar processes:

a. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

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

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

Contaminant	Rate or Concentration

(8) Process Rate:[1]

b. (1) Company:

(2) Mailing Address:

(3) City: (4) State:

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:[1]

Contaminant	Rate or Concentration

(8) Process Rate:[1]

10. Reason for selection and description of systems:

[1]Applicant must provide this information when available. Should this information not be available, applicant must state the reason(s) why.

SECTION VII - PREVENTION OF SIGNIFICANT DETERIORATION

Refer to PSD report

A. Company Monitored Data

1. ____________ no. sites ____________ TSP __________( )__ SO^{2*} ______________ Wind spd/dir

Period of Monitoring ________/____/________ to ____________/____/________
month day year month
day year

Other data recorded ____

Attach all data or statistical summaries to this application.

*Specify bubbler (B) or continuous (C).

2. Instrumentation, Field and Laboratory

a. Was instrumentation EPA referenced or its equivalent? [ ] Yes [ ] No

b. Was instrumentation calibrated in accordance with Department procedures?

[ ] Yes [ ] No [ ] Unknown

B. Meteorological Data Used for Air Quality Modeling

1. ______ Year(s) of data from ______/______/______ to ______/______/______
month day year month day year

2. Surface data obtained from (location)____________________

3. Upper air (mixing height) data obtained from (location) ____________________

4. Stability wind rose (STAR) data obtained from (location) ____________________

C. Computer Models Used

1. ____________________ Modified? If yes, attach description.

2. ____________________ Modified? If yes, attach description.

3. ____________________ Modified? If yes, attach description.

4. ____________________ Modified? If yes, attach description.

Attach copies of all final model runs showing input data, receptor locations, and principle output tables.

D. Applicants Maximum Allowable Emission Data

Pollutant Emission Rate

TSP ____________________ grams/sec

SO^2 ____________________ grams/sec

E. Emission Data Used in Modeling

Attach list of emission sources. Emission data required is source name, description of point source (on NEDS point number), UTM coordinates, stack data, allowable emissions, and normal operating time.

F. Attach all other information supportive to the PSD review.

G. Discuss the social and economic impact of the selected technology versus other applicable technologies (i.e, jobs, payroll, production, taxes, energy, etc.). Include assessment of the environmental impact of the sources.

H. Attach scientific, engineering, and technical material, reports, publications, journals, and other competent relevant information describing the theory and application of the requested best available control technology.

PREVENTION OF SIGNIFICANT DETERIORATION REPORT
FLORIDA GAS TRANSMISSION COMPANY
COMPRESSOR STATION NO. 15

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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. 15. 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. 15 is located about 6 miles north of the town of Perry on Pisgah Road in Taylor 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).

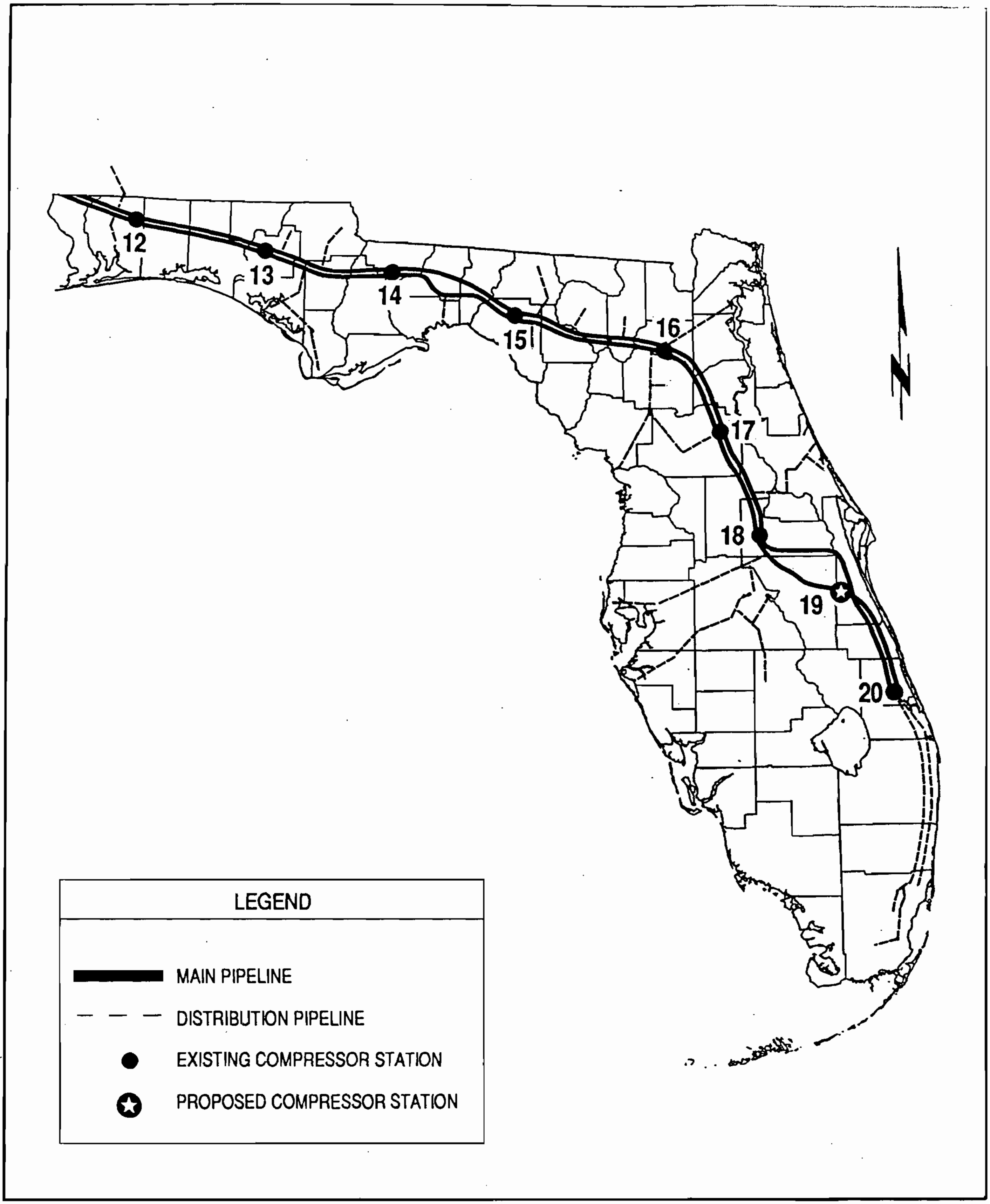

Figure 1-1 FGTC'S GAS TRANSMISSION SYSTEM

Florida Gas Transmission Company

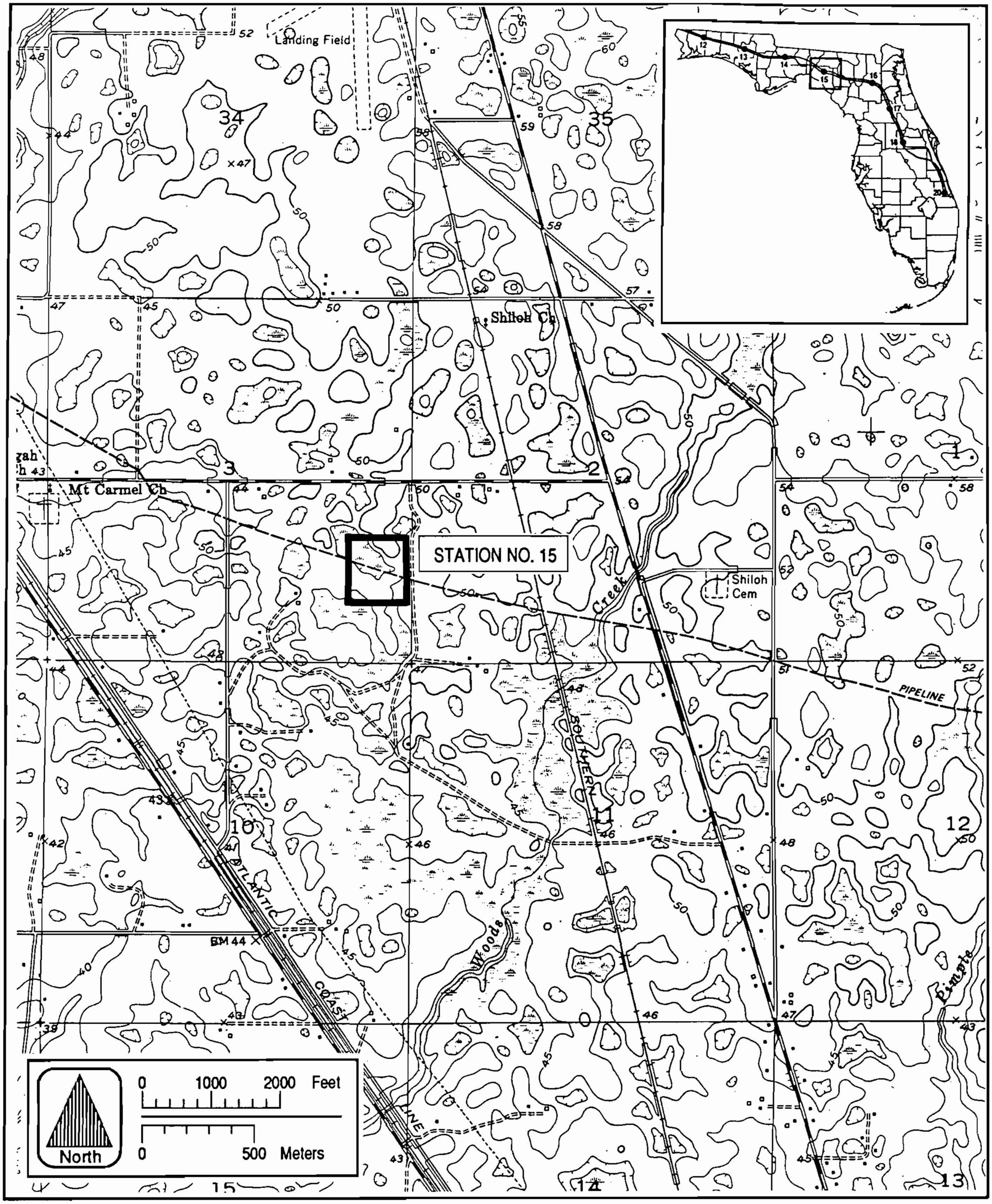

Figure 1-2 SITE LOCATION OF ENRON'S FLORIDA GAS TRANSMISSION LINE COMPRESSOR STATION NO. 15, PERRY, TAYLOR COUNTY, FLORIDA

Florida Gas Transmission Company

Engineering designs for the proposed expansion project include selection of an engine incorporating lean-burn technology. The lean-burn technology for emission control represents best available control technology (BACT) for the proposed reciprocating IC engine.

This application contains five additional sections. Descriptions of the existing operation at FGTC's Compressor Station No. 15 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. 15, 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. 15 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. 15. 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

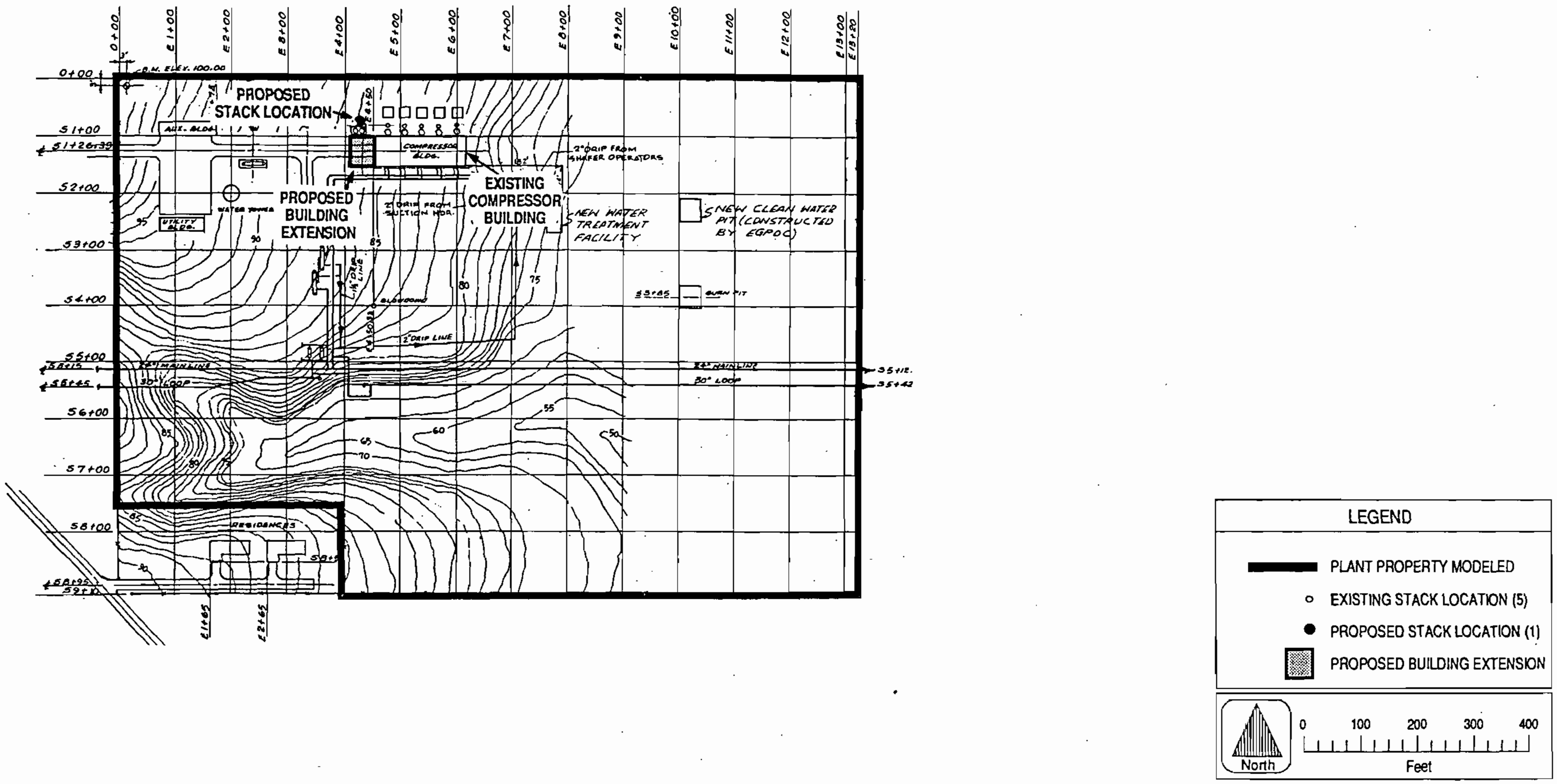

Figure 2-1 PLOT PLAN OF COMPRESSOR STATION NO. 15

Florida Gas Transmission Company

flow diagram of the integral engine compressor unit is presented in Figure 2-2. Fuel fired will be exclusively natural gas, supplied from the FGTC's gas pipeline. Based on the operating characteristics and design, this engine is classified as a high-power, large-bore, slow-speed reciprocating IC engine according to the U.S. Environmental Protection Agency's (EPA's) documented classification (EPA, 1979). Engine specifications and stack parameters for the proposed engine are presented in Table 2-1.

The proposed engine will incorporate "lean-burn" technology, which is state-of-the-art design for minimizing air pollutant concentration in the exhaust gases from gas-fired reciprocating IC engines. In the lean-burn design, a small, fuel-rich mixture is combusted in a pre-ignition chamber. The hot combustion gases from the pre-ignition chamber then pass to the main combustion chamber, where they ignite a lean mixture of fuel. Since most of the fuel entering the engine is burned in a lean state (i.e., high ratio of air to fuel), exhaust NO_x emissions are minimized. However, volatile organic compound (VOC) emissions are approximately 40 to 50 percent higher than the standard "rich-burn" engines.

Maximum hourly and annual emissions of regulated pollutants from the proposed engine are presented in Table 2-2. Emissions of NO_x, carbon monoxide (CO), and VOC are based on the engine manufacturer's guarantee. Particulate matter (PM) emissions are based upon EPA publication AP-42 (EPA, 1988d) emission factors for natural gas combustion in boilers. Emissions of sulfur dioxide (SO_2) are based on ENRON's natural gas specification. According to EPA's publication entitled Toxic Air Pollutant Emission Factors--A Compilation for Selected Air Toxic Compounds and Sources, there are no emission factors for other regulated pollutants due to natural gas combustion in stationary IC engines (EPA, 1988a).

In order to accommodate the new engine at the existing compressor station site, the existing compressor building will be extended. The extent of the addition is shown in Figure 2-1. The new engine will be housed inside the

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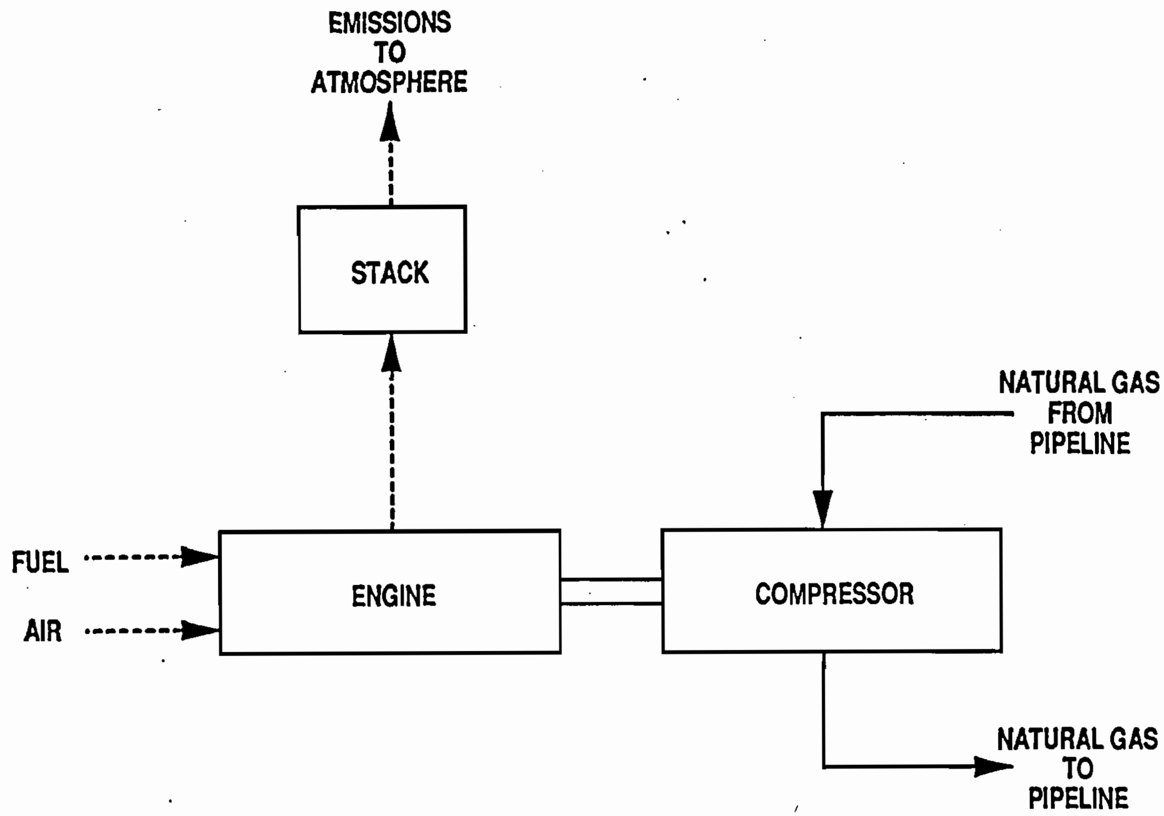

Figure 2-2 PROCESS FLOW DIAGRAM OF AN INTEGRAL ENGINE-COMPRESSOR UNIT

Florida Gas Transmission Company

Table 2-1. Engine Specifications and Stack Parameters for the Proposed Project

Parameter	Design Specification
Engine-Compressor	
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	26,154 scf/hr[a]
Speed	330 rpm
Stack Parameters	
Stack Height	40 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.

[a]Based on heating value for natural gas of 1,040 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	Maximum Emissions 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	0.57
Sulfur Dioxide	10 gr/100 scf	ENRON Specification	0.75	3.27

Note: Maximum natural gas consumption is 26,154 standard cubic feet per hour (scf/hr).

g/bhp-hr = grams per brake horsepower per hour.
gr/100scf = grains per one hundred standard cubic feet.
lb/hr = pounds per hour.
lb/MMscf = pounds per million standard cubic feet.
TPY = tons per year.

enlarged building, on the west end of the existing compressor building. The location of the exhaust stack for the new engine is also shown in Figure 2-1.

3.0 AIR QUALITY REVIEW REQUIREMENTS AND APPLICABILITY

The following discussion pertains to the federal and state air regulatory requirements and their applicability to FGTC's proposed compressor station expansion. These regulations must be satisfied before construction can begin on the proposed source.

3.1 NATIONAL AND STATE AAQS

The existing applicable national and Florida ambient air quality standards (AAQS) are presented in Table 3-1. Primary national AAQS were promulgated to protect the public health, and secondary national AAQS were promulgated to protect the public welfare from any known or anticipated adverse effects associated with the presence of pollutants in the ambient air. Areas of the country in violation of AAQS are designated as "nonattainment" areas, and new sources to be located in or near these areas may be subject to more stringent air permitting requirements.

3.2 PSD REQUIREMENTS

3.2.1 GENERAL REQUIREMENTS

Federal PSD requirements are contained in the Code of Federal Regulations (CFR), 40, 52.21, Prevention of Significant Deterioration of air quality. The state of Florida has adopted PSD regulations [Chapter 17-2.510, Florida Administrative Code (F.A.C.)] that are essentially identical to the federal regulations. PSD regulations require that all new major stationary sources or major modifications to existing major sources of air pollutants regulated under CAA be reviewed and a construction permit issued. Florida's State Implementation Plan (SIP), which contains PSD regulations, has been approved by EPA, and, therefore, PSD approval authority in Florida has been granted to FDER.

A "major facility" is defined under PSD as any one of 28 named source categories which has the potential to emit 100 TPY or more, or any other

Table 3-1. National and State AAQS, Allowable PSD Increments, and Significance Levels ($\mu g/m^3$)

Pollutant	Averaging Time	AAQS National Primary Standard	AAQS National Secondary Standard	AAQS State of Florida	PSD Increments Class I	PSD Increments Class II	Significant Impact Levels
Particulate Matter (TSP)	Annual Geometric Mean	NA	NA	NA	5	19	1
	24-Hour Maximum[a]	NA	NA	NA	10	37	5
Particulate Matter (PM10)	Annual Arithmetic Mean	50	50	50	4[c]	17[c]	1
	24-Hour Maximum[b]	150	150	150	8[c]	30[c]	5
Sulfur Dioxide	Annual Arithmetic Mean	80	NA	60	2	20	1
	24-Hour Maximum[b]	365	NA	260	5	91	5
	3-Hour Maximum[b]	NA	1,300	1,300	25	512	25
Carbon Monoxide	8-Hour Maximum[b]	10,000	10,000	10,000	NA	NA	500
	1-Hour Maximum[b]	40,000	40,000	40,000	NA	NA	2,000
Nitrogen Dioxide	Annual Arithmetic Mean	100	100	100	2.5	25	1
Ozone	1-Hour Maximum[d]	235	235	235	NA	NA	NA
Lead	Calendar Quarter Arithmetic Mean	1.5	1.5	1.5	NA	NA	NA

[a]Maximum concentration not to be exceeded more than once per year.
[b]Achieved when the expected number of exceedances per year is less than 1.
[c]Proposed by EPA in the Federal Register on October 5, 1989.
[d]Achieved when the expected number of days per year with concentrations above the standard is less than 1.

Note: Particulate matter (TSP) = total suspended particulate matter.
Particulate matter (PM10) = particulate matter with aerodynamic diameter less than or equal to 10 micrometers.
$\mu g/m^3$ = micrograms per cubic meter.
NA = Not applicable, i.e., no standard exists.

Sources: Federal Register, Vol. 43, No. 118, June 19, 1978.
40 CFR 50.
40 CFR 52.21.
Chapter 17-2.400, F.A.C.

stationary facility that has the potential to emit 250 TPY or more of any pollutant regulated under CAA. A "source" is defined as an identifiable piece of process equipment or emissions unit. "Potential to emit" means the capability, at maximum design capacity, to emit a pollutant considering the application of control equipment and any other federally enforceable limitations on the source's capacity. A "major modification" is defined under PSD regulations as a change at an existing major stationary facility which increases emissions by greater than significant amounts. PSD significant emission rates are shown in Table 3-2.

PSD review is used to determine whether significant air quality deterioration will result from the new or modified facility. Major new facilities and major modifications are required to undergo the following analyses related to PSD for each pollutant emitted in significant amounts:

1. Control technology review,
2. Source impact analysis,
3. Air quality analysis (monitoring),
4. Source information, and
5. Additional impact analyses.

In addition to these analyses, a new facility must also be reviewed with respect to good engineering practices (GEP) stack height regulations. If the proposed new source or modification is located in a nonattainment area for any pollutant, the source may be subject to nonattainment new source review requirements. Discussions concerning each of these requirements are presented in the following sections.

3.2.2 INCREMENTS/CLASSIFICATIONS

The 1977 Clean Air Act (CAA) amendments address PSD of air quality. The law specifies that certain increases in air quality concentrations above the baseline concentration level of sulfur dioxide (SO_2) and particulate matter--total suspended particulates [PM(TSP)]--would constitute

Table 3-2. PSD Significant Emission Rates and De Minimis Monitoring Concentrations

Pollutant	Regulated Under	Significant Emission Rate (TPY)	De Minimis Monitoring Concentration ($\mu g/m^3$)
Sulfur Dioxide	NAAQS, NSPS	40	13, 24-hour
Particulate Matter (TSP)	NAAQS, NSPS	25	10, 24-hour
Particulate Matter (PM10)	NAAQS	15	10, 24-hour
Nitrogen Oxides	NAAQS, NSPS	40	14, annual
Carbon Monoxide	NAAQS, NSPS	100	575, 8-hour
Volatile Organic Compounds (Ozone)	NAAQS, NSPS	40	100 TPY[a]
Lead	NAAQS	0.6	0.1, 3-month
Sulfuric Acid Mist	NSPS	7	NM
Total Fluorides	NSPS	3	0.25, 24-hour
Total Reduced Sulfur	NSPS	10	10, 1-hour
Reduced Sulfur Compounds	NSPS	10	10, 1-hour
Hydrogen Sulfide	NSPS	10	0.2, 1-hour
Asbestos	NESHAP	0.007	NM
Beryllium	NESHAP	0.0004	0.001, 24-hour
Mercury	NESHAP	0.1	0.25, 24-hour
Vinyl Chloride	NESHAP	1	15, 24-hour
Benzene	NESHAP	b	NM
Radionuclides	NESHAP	b	NM
Inorganic Arsenic	NESHAP	b	NM

[a]No de minimis concentration; an increase in VOC emissions of 100 TPY or more will require monitoring analysis for ozone.
[b]Any emission rate of these pollutants.

Note: Ambient monitoring requirements for any pollutant may be exempted if the impact of the increase in emissions is below de minimis monitoring concentrations.

NAAQS = National Ambient Air Quality Standards.
NM = No ambient measurement method.
NSPS = New Source Performance Standards.
NESHAP = National Emission Standards for Hazardous Air Pollutants.
$\mu g/m^3$ = micrograms per cubic meter.

Sources: 40 CFR 52.21.
Chapter 17-2, F.A.C.

significant deterioration. The magnitude of the allowable increment depends on the classification of the area in which a new source (or modification) will be located or will have an impact. Congress also directed EPA to evaluate PSD increments for other criteria pollutants and, if appropriate, promulgate PSD increments for such pollutants.

Three classifications were designated, based on criteria established in the CAA Amendments. Certain types of areas (international parks, national wilderness areas, and memorial parks larger than 5,000 acres, and national parks larger than 6,000 acres) were designated as Class I areas. All other areas of the country were designated as Class II. PSD increments for Class III areas were defined, but no areas were designated as Class III. However, Congress made provisions in the law to allow the redesignation of Class II areas to Class III areas.

In 1977, EPA promulgated PSD regulations related to the requirements for classifications, increments, and area designations as set forth by Congress. PSD increments were initially set for only SO_2 and PM(TSP). However, in 1988, EPA promulgated final PSD regulations for nitrogen oxides (NO_x) and established PSD increments for nitrogen dioxide (NO_2).

The current federal PSD increments are shown in Table 3-1. As shown, Class I increments are the most stringent, allowing the smallest amount of air quality deterioration, while the Class III increments allow the greatest amount of deterioration. FDER has adopted the EPA class designations and allowable PSD increments for PM(TSP), SO_2, and NO_2.

On October 5, 1989, EPA proposed PSD increments for PM10. Those proposed increments are shown in Table 3-1. The PM10 increments as proposed are somewhat lower in magnitude than the current PM(TSP) increments.

The term "baseline concentration" evolves from federal and state PSD regulations and refers to a fictitious concentration level corresponding to a specified baseline date and certain additional baseline sources. By definition in the PSD regulations, baseline concentration means the ambient concentration level that exists in the baseline area at the time of the applicable baseline date. A baseline concentration is determined for each pollutant for which a baseline date is established and includes:

1. The actual emissions representative of sources in existence on the applicable baseline date; and
2. The allowable emissions of major stationary sources that began construction before January 6, 1975, for SO_2 and PM(TSP) sources, or February 8, 1988, for NO_x sources; but which were not in operation by the applicable baseline date.

The following emissions are not included in the baseline concentration and therefore affect PSD increment consumption:

1. Actual emissions from any major stationary source on which construction began after January 6, 1975, for SO_2 and PM(TSP) sources, and after February 8, 1988, for NO_x sources; and
2. Actual emission increases and decreases at any stationary source occurring after the baseline date.

In reference to the baseline concentration, the baseline date actually includes three different dates:

1. The major source baseline date, which is January 6, 1975, in the cases of SO_2 and PM(TSP), and February 8, 1988, in the case of NO_2;
2. The minor source baseline date, which is the earliest date after the trigger date on which a major stationary source or major modification subject to PSD regulations submits a complete PSD application; and
3. The trigger date, which is August 7, 1977, for SO_2 and PM(TSP), and February 8, 1988, for NO_2.

The minor source baseline date for SO_2 and PM(TSP) has been set as December 27, 1977, for the entire state of Florida (Chapter 17-2.450, F.A.C.). The minor source baseline date for NO_2 has been set as March 28, 1988, for all of Florida.

3.2.3 CONTROL TECHNOLOGY REVIEW

The control technology review requirements of the federal and state PSD regulations require that all applicable federal and state emission limiting standards be met and that BACT be applied to control emissions from the source [Chapter 17-2.500(5)(c), F.A.C]. The BACT requirements are applicable to all regulated pollutants for which the increase in emissions from the facility or modification exceeds the significant emission rate (see Table 3-2).

BACT is defined in Chapter 17-2.100(25), F.A.C. as:

> An emissions limitation, including a visible emission standard, based on the maximum degree of reduction of each pollutant emitted which the Department, on a case by case basis, taking into account energy, environmental, and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems, and techniques (including fuel cleaning or treatment or innovative fuel combustion techniques) for control of such pollutant. If the Department determines that technological or economic limitations on the application of measurement methodology to a particular part of a source or facility would make the imposition of an emission standard infeasible, a design, equipment, work practice, operational standard or combination thereof, may be prescribed instead to satisfy the requirement for the application of BACT. Such standard shall, to the degree possible, set forth the emissions reductions achievable by implementation of such design, equipment, work practice, or operation.

The requirements for BACT were promulgated within the framework of PSD in the 1977 amendments of the CAA [Public Law 95-95; Part C, Section 165(a)(4)]. The primary purpose of BACT is to optimize consumption of PSD air quality increments and, thereby, enlarge the potential for future economic growth without significantly degrading air quality (EPA, 1978; 1980). Guidelines for the evaluation of BACT can be found in EPA's Guidelines for Determining Best Available Control Technology (BACT) (EPA, 1978) and in the PSD Workshop Manual (EPA, 1980). These guidelines were promulgated by EPA to provide a consistent approach to BACT and to ensure that the impacts of alternative emission control systems are measured by the same set of parameters. In addition, through implementation of these guidelines, BACT in one area may not be identical to BACT in another area. According to EPA (1980),

> BACT analyses for the same types of emissions unit and the same pollutants in different locations or situations may determine that different control strategies should be applied to the different sites, depending on site-specific factors. Therefore, BACT analyses must be conducted on a case-by-case basis.

The BACT requirements are intended to ensure that the control systems incorporated in the design of a proposed facility reflect the latest in control technologies used in a particular industry and take into consideration existing and future air quality in the vicinity of the proposed facility. BACT must, as a minimum, demonstrate compliance with New Source Performance Standards (NSPS) for a source (if applicable). An evaluation of the air pollution control techniques and systems, including a cost-benefit analysis of alternative control technologies capable of achieving a higher degree of emission reduction than the proposed control technology, is required. The cost-benefit analysis requires the documentation of the materials, energy, and economic penalties associated with the proposed and alternative control systems, as well as the environmental benefits derived from these systems. A decision on BACT is to be based on sound judgment, balancing environmental benefits with energy, economic, and other impacts (EPA, 1978).

Historically, a "bottom-up" approach consistent with the BACT Guidelines and PSD Workshop Manual has been used. With this approach, an initial control level, which is usually NSPS, is evaluated against successively more stringent controls until a BACT level is selected. However, EPA developed a concern that the bottom-up approach was not providing the level of BACT decisions originally intended. As a result, in December 1987, the EPA Assistant Administrator for Air and Radiation mandated changes in the implementation of the PSD program including the adoption of a new "top-down" approach to BACT decision making.

The top-down BACT approach essentially starts with the most stringent (or top) technology and emissions limit that have been applied elsewhere to the same or a similar source category. The applicant must next provide a basis for rejecting this technology in favor of the next most stringent technology or propose to use it. Rejection of control alternatives may be based on technical or economic infeasibility. Such decisions are made on the basis of physical differences (e.g., fuel type), locational differences (e.g., availability of water), or significant differences that may exist in the environmental, economic or energy impacts. The differences between the proposed facility and the facility on which the control technique was applied previously must be justified. Recently, EPA issued a draft guidance document on the top-down approach entitled Top-Down Best Available Control Technology Guidance Document (EPA, 1990a).

3.2.4 AIR QUALITY MONITORING REQUIREMENTS

In accordance with requirements of 40 CFR 52.21(m) and Chapter 17-2.500(f), F.A.C, any application for a PSD permit must contain an analysis of ambient air quality data in the area affected by the proposed major stationary facility or major modification. For a new major facility, the affected pollutants are those that the facility would potentially emit in significant amounts. For a major modification, the pollutants are those for which the net emissions increase exceeds the significant emission rate (see Table 3-2).

Ambient air monitoring for a period of up to 1 year is generally appropriate to satisfy the PSD monitoring requirements. A minimum of

4 months of data is required. Existing data from the vicinity of the proposed source may be utilized if the data meet certain quality assurance requirements; otherwise, additional data may need to be gathered. Guidance in designing a PSD monitoring network is provided in EPA's Ambient Monitoring Guidelines for Prevention of Significant Deterioration (EPA, 1987a).

Under the exemption rule, FDER may exempt a proposed major stationary facility or major modification from the monitoring requirements with respect to a particular pollutant if the emissions increase of the pollutant from the facility or modification would cause, in any area, air quality impacts less than the de minimis levels presented in Table 3-2 [Chapter 17-2.500(3)(e), F.A.C.].

3.2.5 SOURCE IMPACT ANALYSIS

A source impact analysis must be performed for a proposed major source subject to PSD for each pollutant for which the increase in emissions exceeds the significant emission rate (Table 3-2). The PSD regulations specifically provide for the use of atmospheric dispersion models in performing impact analysis, estimating baseline and future air quality levels, and determining compliance with AAQS and allowable PSD increments. Designated EPA models must normally be used in performing the impact analysis. Specific applications for other than EPA-approved models require EPA's consultation and prior approval. Guidance for the use and application of dispersion models is presented in the EPA publication Guideline on Air Quality Models (EPA, 1987b). The source impact analysis for criteria pollutants may be limited to only the new or modified source if the net increase in impacts due to the new or modified source is below significance levels, as presented in Table 3-1.

Various lengths of record for meteorological data can be utilized for impact analysis. A 5-year period can be used with corresponding evaluation of highest, second-highest short-term concentrations for comparison to AAQS or PSD increments. The term "highest, second-highest" (HSH) refers to the highest of the second-highest concentrations at all receptors (i.e., the highest concentration at each receptor is discarded). The second-highest concentration is significant because short-term AAQS specify that the standard should not be exceeded at any location more than once a year. If less than 5 years of meteorological data are used in the modeling analysis, the highest concentration at each receptor must normally be used for comparison to air quality standards.

3.2.6 ADDITIONAL IMPACT ANALYSES

In addition to air quality impact analyses, federal and state of Florida PSD regulations require analysis of the impairment to visibility and the impacts on soils and vegetation that would occur as a result of the proposed source [40 CFR 52.21; Chapter 17-2.500(5)(e), F.A.C.]. These analyses are to be conducted primarily for PSD Class I areas. Impacts due to general commercial, residential, industrial, and other growth associated with the source must also be addressed. These analyses are required for each pollutant emitted in significant amounts (Table 3-2).

3.2.7 GOOD ENGINEERING PRACTICE STACK HEIGHT

The 1977 CAA amendments require that the degree of emission limitation required for control of any pollutant not be affected by a stack height that exceeds GEP, or any other dispersion technique. On July 8, 1985, EPA promulgated final stack height regulations (EPA, 1985). Identical regulations have been adopted by FDER [Chapter 17-2.270, F.A.C.]. GEP stack height is defined as the highest of:

1. 65 meters (m); or
2. A height established by applying the formula:

   $$Hg = H + 1.5L$$

   where: Hg = GEP stack height,
   H = Height of the structure or nearby structure, and
   L = Lesser dimension (height or projected width) of nearby structure(s); or
3. A height demonstrated by a fluid model or field study.

"Nearby" is defined as a distance up to five times the lesser of the height or width dimensions of a structure or terrain feature, but not greater than 0.8 kilometers (km). Although GEP stack height regulations require that the stack height used in modeling for determining compliance with AAQS and PSD increments not exceed the GEP stack height, the actual stack height may be greater.

3.3 NONATTAINMENT RULES

Based on the current nonattainment provisions (Chapter 17-2.510, F.A.C.), all major new facilities and modifications to existing major facilities located in a nonattainment area must undergo nonattainment review if the proposed pieces of equipment have the potential to emit 100 TPY or more of the nonattainment pollutant, or if the modification results in a significant net emission increase of the nonattainment pollutant.

For major facilities or major modifications that locate in an attainment or unclassifiable area, the nonattainment review procedures apply if the source or modification is located within the area of influence of a nonattainment area. The area of influence is defined as an area which is outside the boundary of a nonattainment area but within the locus of all points that are 50 km outside the boundary of the nonattainment area. Based on Chapter 17-2.510(2)(a)2.a, F.A.C., all VOC sources which are located within an area of influence are exempt from the provisions of new source review for nonattainment areas. Sources which emit other nonattainment pollutants and are located within the area of influence are subject to nonattainment review unless the maximum allowable emissions from the proposed source do not have a significant impact within the nonattainment area.

3.4 SOURCE APPLICABILITY

3.4.1 PSD REVIEW

3.4.1.1 Pollutant Applicability

FGTC's Compressor Station No. 15 is located in Taylor County, which has been designated by EPA and FDER as an attainment area for all criteria pollutants. Taylor County and surrounding counties are designated as PSD Class II areas for SO_2, PM(TSP), and NO_2. The site is located within 100 km of two PSD Class I areas. These Class I areas are the Bradwell Bay and the St. Mark's National Wildlife Refuge, which are approximately 85 km west and 36 km west of the compressor station location, respectively.

FGTC's existing Compressor Station No. 15 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. 15, 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. 15

Pollutant	Maximum Potential Emissions From Proposed Compressor Engine (lb/hr)	(TPY)	Significant Emission Rate (TPY)	PSD Review Applies?
Nitrogen Oxides	17.6	77.2	40	Yes
Carbon Monoxide	22.0	96.6	100	No
Votatile Organic Compounds (non-methane)	8.8	38.6	40	No
Particulate Matter (TSP)	0.13	0.57	25	No
Particulate Matter (PM10)	0.13	0.57	15	No
Sulfur Dioxide	0.75	3.27	40	No

The maximum annual impact associated with the potential NO_x emissions from the proposed IC engine is 0.83 $\mu g/m^3$. The methodology used to predict this value is presented in Section 4.0, along with the impact analysis result. The de minimis concentration level for NO_x is 14 $\mu g/m^3$ annual average. Since the maximum impact of NO_x is less than its de minimis concentration level, the proposed expansion project is exempted from the PSD preconstruction ambient monitoring requirement for NO_x.

3.4.1.3 GEP Stack Height Analysis

The GEP stack height regulations allow any stack to be at least 65 m (213 ft) high. The proposed stack for the new compressor engine will be 40 ft high (12.19 m) and, therefore, does not exceed the GEP stack height. The potential for downwash of the engines' emissions due to nearby structures is discussed in Section 4.0, Source Impact Analysis.

3.4.2 NONATTAINMENT REVIEW

FGTC's Compressor Station No. 15 is not located in any nonattainment area or in any area of influence of a nonattainment area. As a result, nonattainment review does not apply to the proposed expansion project.

4.0 SOURCE IMPACT ANALYSIS

4.1 ANALYSIS APPROACH AND ASSUMPTIONS

4.1.1 GENERAL MODELING APPROACH

The general modeling approach follows EPA and FDER modeling guidelines for determining compliance with AAQS and PSD increments. In general, when model predictions are used to determine compliance with AAQS and PSD increments, current EPA and FDER policies stipulate that the highest annual average concentration and highest, second-highest short-term (i.e., 24 hours or less) concentration can be compared to the applicable standard.

Model predictions for annual average NO_x concentrations were performed using the Industrial Source Complex Long-Term (ISCLT) model (Version 90008). A brief description of the Industrial Source Complex (ISC) model is given in Section 4.1.2.

4.1.2 MODEL SELECTION

The ISC dispersion model (EPA, 1988b) was used to evaluate the NO_x emissions from the proposed compressor engine. This model is contained in the EPA User's Network for Applied Modeling of Air Pollution (UNAMAP), Version 6 (EPA, 1988c). The ISC model was selected primarily for the following reasons:

1. EPA and FDER have approved the general use of the model for air quality dispersion analysis because the model assumptions and methods are consistent with those in the Guideline on Air Quality Models (EPA, 1987b);
2. The ISC model is capable of predicting the impacts from stack, area, and volume sources that are spatially distributed over large areas and located in flat or gently rolling terrain; and
3. The results from the ISC model are appropriate for addressing compliance with AAQS and PSD increments.

The ISCLT model is an extension of the Air Quality Display Model (AQDM) and the Climatological Dispersion Model (CDM). The ISCLT model uses joint frequencies of wind direction, windspeed, and atmospheric stability to calculate seasonal and/or annual average ground-level concentrations. Because the input wind directions are for 16 sectors, with each sector defined as 22.5 degrees, the model calculates concentrations by assuming that the pollutant is uniformly distributed in the horizontal plane within a 22.5-degree sector.

Major features of the ISCLT model are presented in Table 4-1. Concentrations due to stack and volume sources are calculated by the model using the steady-state Gaussian plume equation for a continuous source. The area source equation in the ISC model is based on the equation for a continuous and finite crosswind line source.

The ISC model has rural and urban options which affect the windspeed profile exponent law, dispersion rates, and mixing-height formulations used in calculating ground-level concentrations. The criteria used to determine when the rural or urban mode is appropriate are based on land use near the proposed plant's surroundings (Auer, 1978). If the land use is classified as heavy industrial, light-moderate industrial, commercial, or compact residential for more than 50 percent of the area within a 3-km radius circle centered on the proposed source, the urban option is selected. Otherwise, the rural option is used.

For modeling analyses that will undergo regulatory review, such as PSD permit applications, the following model features are recommended by EPA (1987a) and are referred to as the regulatory options in the ISC model:

1. Final plume rise at all receptor locations,
2. Stack-tip downwash,
3. Buoyancy-induced dispersion,
4. Default windspeed profile coefficients for rural or urban option,
5. Default vertical potential temperature gradients, and

Table 4-1. Major Features of the ISCLT Model

ISCLT Model Features
• Polar or Cartesian coordinate systems for receptor locations
• Rural or one of three urban options that affect windspeed profile exponent, dispersion rates, and mixing height calculations
• Plume rise as a result of momentum and buoyancy as a function of downwind distance for stack emissions (Briggs)
• Procedures suggested by Huber and Snyder (1976), Huber (1977), Schulmann and Hanna (1986), and Schulmann and Scire (1980) for evaluating building downwash and wake effects
• Procedures suggested by Briggs for evaluating stack-tip downwash
• Separation of multiple point sources
• Consideration of the effects of gravitational settling and dry deposition on ambient particulate concentrations
• Capability of simulating point, line, volume, and area sources
• Capability to calculate dry deposition
• Variation of windspeed with height (windspeed-profile exponent law)
• Concentration estimates for annual average
• Terrain-adjustment procedures for elevated terrain including a terrain truncation algorithm
• Receptors located above local terrain (i.e., "flagpole" receptors)
• Consideration of time-dependent exponential decay of pollutants
• The method of Pasquill (1976) to account for buoyancy-induced dispersion
• A regulatory default option to set various model options and parameters to EPA recommended values (see text for regulatory options used)

Source: EPA, 1988a.

6. Reducing calculated SO_2 concentrations in urban areas by using a decay half-life of 4 hours (i.e., reduce the SO_2 concentration by 50 percent for every 4 hours of plume travel time).

In this analysis, the EPA regulatory options were used to address maximum impacts. Based on a review of the land use around the facility, the rural mode was selected based on the degree of residential, industrial, and commercial development within 3 km of the plant site.

4.1.3 METEOROLOGICAL DATA

EPA (1987b) recommends the use of 5 years of representative meteorological data for use in air quality modeling. The most recent, readily available 5-year period is preferred. The meteorological data may be collected either onsite or at the nearest National Weather Service (NWS) station.

Meteorological data used in the analysis were selected based on the recommendations of the FDER for the area in which the project is located. The data consisted of a 5-year record of surface weather observations (1982-1986) from the NWS station located at the 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, located approximately 75 km northwest of the site, is the nearest weather station that routinely 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. 15 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. 15 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, 128 receptors were located on 16 radials centered on the proposed engine's stack location and at downwind distances of 100, 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. 15 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 which had 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	Stack Dimensions (m)		Operating Parameters		Emissions (g/s)
	Height	Diameter	Temperature (K)	Velocity (m/s)	NO_2
1	12.19	0.59	561	51.90	2.22

Table 4-3. Discrete Plant Boundary Receptors, Compressor Station No. 15[a]

Direction	Distance (km)	Direction	Distance (km)
10	0.030	190	0.204
20	0.030	200	0.216
30	0.030	210	0.235
40	0.034	220	0.207
50	0.040	230	0.174
60	0.049	240	0.152
70	0.073	250	0.140
80	0.146	260	0.134
90	0.271	270	0.131
100	0.274	280	0.134
110	0.290	290	0.073
120	0.314	300	0.049
130	0.354	310	0.040
140	0.326	320	0.034
150	0.290	330	0.030
160	0.265	340	0.030
170	0.256	350	0.030
180	0.253	360	0.030

[a]Relative to the proposed stack located at (0,0) meters.

4.1.6 BUILDING DOWNWASH CONSIDERATIONS

Based on the dimensions of the compressor building that will house the proposed engine, the stack for the proposed engine will be less than GEP height. Also, based on the location of the proposed engine's exhaust stack in relation to the compressor building, the stack will be in the influence of the compressor building. Therefore, the potential for building downwash must be considered in the modeling analysis.

The procedures used for addressing the effects of building downwash are those recommended in the ISC Dispersion Model User's Guide. In the ISCLT model, the building height and width are input to the model, which are used to modify the dispersion parameters if the Huber-Snyder building downwash routine is used. The effective width used by the program is the diameter of a circle of equal area to the square of the width input to the model. If a specific width is to be modeled, then the value input to the model must be calculated according to the following formula:

$$M_w = \sqrt{\pi\left(\frac{H_w}{2}\right)^2} = 0.886\ H_w$$

where: M_w = building width input to the model to produce a building width of H_w used in the dispersion calculation.
H_w = the actual building width for which dispersion calculations are desired.

If the Schulman-Scire wake effects method is used, the user inputs the building height and projected width associated with each 22.5-degree wind sector. These building heights and projected widths are the same used for GEP stack height calculations.

A summary of actual and modeled building dimensions is presented in Table 4-4. Because of the proximity of the proposed stack to the compressor building (approximately 17 ft) and the low ratio of stack height to building height, potential downwash from this structure was assumed to occur. Because the stack-to-building height ratio is less than 1.5, the

Table 4-4. Building Dimensions used in the ISCLT Modeling, Compressor Station No. 15

Building	Actual Building Dimensions			Modeled Building Dimensions	
	Height (m)	Length (m)	Width (m)	Height (m)	Projected Width[a] (m)
Compressor Building[b]	9.69	67.1	16.8	9.69	69.2

[a]Maximum projected building width was assumed to be applicable in all directions.
[b]Dimensions are for expanded compressor building with proposed engine.

Schulman-Scire downwash method was used in the analysis. Therefore, directional specific building height and width for each 22.5-degree wind sector was determined for use as input values in this algorithm. In order to be conservative, the building diagonal was used as the input value for width in all 16 wind sectors.

4.2 MODEL RESULTS

A summary of the five-year maximum annual NO_2 impact concentrations predicted for the proposed compressor engine is presented in Table 4-5. As shown in this table, the maximum annual average NO_2 impact concentration is 0.83 $\mu g/m^3$. This value was obtained from additional refinement modeling of the three highest screening values (i.e., the maximum screening value and two other values that were within 10 percent of the maximum value). The refinement modeling was necessary because the separation distances between the receptors used in the screening modeling were greater than 100 m. The refined maximum concentration is predicted to occur in a direction of 360° and at a distance of 0.650 km from the proposed engine's stack. Since the predicted maximum NO_2 impact concentration is less than the significant impact level of 1 $\mu g/m^3$, further modeling of potential NO_2 impacts to the local surroundings of the compressor station is not required. The computer modeling printouts are provided in Appendix C.

The potential NO_x impacts with respect to the Bradwell Bay and the St. Mark's National Wildlife Refuge areas must also be considered because Compressor Station No. 15 is within 100 km of these two designated Class I areas. Since the modeling results showed that maximum impacts are below the significant level (i.e., less than 1 $\mu g/m^3$) at the plant site, potential impacts on the Class I areas located 40 km or more away will be much less than 1 $\mu g/m^3$, annual average concentration.

Table 4-5. Maximum Predicted Annual Average NO_2 Concentrations Due to the Proposed Station 15 Compressor Engine for Comparison to Significant Impact Levels

Year Modeled	Maximum Concentration ($\mu g/m^3$)	Receptor Location Direction (°)	Receptor Location Distance (km)	NO_2 Significant Impact Level ($\mu g/m^3$)
1982	0.75[a]	360	0.750	1
1983	0.72	360	0.750	
1984	0.83[a]	360	0.650	
1985	0.65	360	0.750	
1986	0.80[a]	180	0.700	

[a]Refined concentration and location are identical to the screening concentration and location.

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. 15 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 Class I areas (i.e., Bradwell Bay and St. Mark's National Wildlife Refuge) 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 St. Mark's National Wildlife Refuge, located about 36 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. 15

Class I Area: ST. MARKS NWR

*** 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:	36.00 km
Min. Source-Class I Distance:	36.00 km
Max. Source-Class I Distance:	76.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area

Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	36.0	84.	2.00	.138	.05	-.001
SKY	140.	84.	36.0	84.	2.00	.045	.05	-.001
TERRAIN	10.	84.	36.0	84.	2.00	.021	.05	.000
TERRAIN	140.	84.	36.0	84.	2.00	.007	.05	.000

Maximum Visual Impacts OUTSIDE Class I Area

Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	75.	34.8	94.	2.00	.139	.05	-.001
SKY	140.	75.	34.8	94.	2.00	.045	.05	-.001
TERRAIN	10.	55.	32.2	114.	2.00	.026	.05	.000
TERRAIN	140.	55.	32.2	114.	2.00	.009	.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. 15 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 the current state-of-the-art engine and turbocharger designs coupled with advanced control technology, all of these three factors can be sufficiently achieved.

Potential NO_x Emission Reduction:

Pollutant	Uncontrolled Emission Level	Guaranteed Emission Level	Potential Percentage Reduction
NO_x	11.0 g/bhp-hr[a]	1.5-2.0 g/bhp-hr	82-86%

Note: [a] Represents emission level for the baseline rich-burn engine.

6.2.1.3 Retarded Ignition Timing

Retarding the spark ignition timing of the reciprocating IC engine reduces the peak combustion pressure and temperature, thereby lowering thermal NO_x formation. The timing delay is measured in degrees in reference to the engine's crankshaft rotation. There are limits to how much the ignition timing can be retarded. In general, retard values range from 2 to 6 degrees, depending on engine, and NO_x reduction per degree of retard decreases for increasing levels of retard.

A study by the American Gas Association showed that the NO_x emissions from 10 different gas-fired naturally aspirated engine models ranged from a 7 percent reduction to a 2 percent increase per degree of ignition retardation (Urban and Springer, 1975). EPA's research (1979) reported the percent of NO_x reduction per degree of retard ranged from 0.6 to 8.5 for turbocharged engines. Overall, EPA's report concluded that retarding ignition timing reduced NO_x emissions 15 percent for gas-fired engines.

Potential NO_x Emission Reduction:

Pollutant	Uncontrolled Emission Level	Achievable Emission Level	Potential Percentage Reduction
NO_x	11.0 g/bhp-hr [a]	9.4 g/bhp-hr	15%
	2.0 g/bhp-hr [b]	1.7 g/bhp-hr	15%

Note: [a] Represents emission level for the baseline rich-burn engine.
[b] Represents emission level for a typical lean-burn engine.

6.2.1.4 Derating Power Output

A reciprocating IC engine can be derated by operating at less than full or 100-percent rated power. The effect of derating on an engine is to reduce peak combustion cylinder temperatures and pressures, thus lowering NO_x formation rates.

Reported NO_x reduction levels achieved by derating vary greatly for different reciprocating IC engines primarily as a result of air charging. Data compiled by EPA (1979) show that non-turbocharged engines achieve the largest reduction because derating has a greater effect on air-to-fuel ratios. In contrast, turbocharged engines operate at an already high air-to-fuel ratio and, therefore, very little NO_x reduction is achieved by derating. Normalized NO_x reduction from derating (i.e., percent of NO_x reduction per percent derate) is reported from 0.25 to 6.2 for normally aspirated or blower-charged engines, and 0.01 to 2.6 for turbocharged engines. The EPA report showed that NO_x reduction ranged from 10 percent increase to 90 percent reduction, and averaged approximately 40 percent reduction at a derating of 75 percent of rated torque.

Potential NO_x Emission Reduction:

Pollutant	Uncontrolled Emission Level	Achievable Emission Level	Potential Percentage Reduction
NO_x	11.0 g/bhp-hr[a]	6.6 g/bhp-hr	40%
	2.0 g/bhp-hr[b]	1.2 g/bhp-hr	40%

Note: [a] Represents emission level for the baseline rich-burn engine.
[b] Represents emission level for a typical lean-burn engine.

6.2.1.5 Exhaust Gas Recirculation

Exhaust gas recirculation (EGR) reduces peak combustion temperatures in a reciprocating IC engine by replacing a fraction of the combustion air with exhaust gases. The recirculated exhaust gases serve to absorb heat without providing as much additional oxygen for the oxidation of nitrogen.

EGR can be accomplished by either introducing exhaust gases into the intake manifold or restricting the exit of gases from the cylinder by internal recirculation. Externally recirculated gases must be cooled prior to being reintroduced into the combustion cylinder in order to provide greater heat absorption per charge.

EGR is most effective in reducing NO_x emission from conventional rich-burn engines because its application can increase the air-to-fuel ratio. EPA's research (1979) reported a NO_x reduction of 34 percent for a gas-fired, blower-charged engine with 6 percent EGR rate. Excessive EGR rates can result in increased fuel consumption, high CO emissions, and misfiring (GRI, 1990).

EGR is not effective for a lean-burn engine with a high air intake flow rate since it cannot significantly further dilute the air/fuel mixture. In addition, no system has been developed to date for the complex control system needed to regulate the recirculation of the exhaust gases. As a result, EGR for lean-burn engines is not considered further.

Potential NO_x Emission Reduction:

Pollutant	Uncontrolled Emission Level	Achievable Emission Level	Potential Percentage Reduction
NO_x	11.0 g/bhp-hr[a]	7.3 g/bhp-hr	34%
	2.0 g/bhp-hr[b]	Not applicable	--

Note: [a] Represents emission level for the baseline rich-burn engine.
[b] Represents emission level for a typical lean-burn engine.

6.2.2 TECHNOLOGIES INVOLVING EXHAUST GAS TREATMENT

6.2.2.1 NO_xOUT Process

The NO_xOUT process originated from the initial research by the Electric Power Research Institute (EPRI) in 1976 on the use of urea to reduce NO_x. EPRI licensed the proprietary process to Fuel Tech, Inc., for commercialization. In the NO_xOUT process, aqueous urea is injected into the flue gas stream ideally within a temperature range of 1,600°F to 1,900°F. In the presence of oxygen, the following reaction occurs:

$$CO(NH_2)_2 + 2NO + \frac{1}{2}O_2 \dashrightarrow 2N_2 + CO_2 + 2H_2O$$

The amount of urea required is most cost effective when the treatment rate is 0.5 to 2 moles of urea per mole of NO_x. In addition to the original EPRI urea patents, Fuel Tech claims to have a number of proprietary catalysts capable of expanding the effective temperature range of the reaction to between 1,000°F and 1,950°F. Advantages of the system are:

1. Low capital and operating costs due to utilization of urea injection, and

2. The proprietary catalysts used are nontoxic and nonhazardous, thus eliminating potential disposal problems.

Disadvantages of the system are:

1. Formation of ammonia from excess urea treatment rates and/or improper use of reagent catalysts, and
2. SO_3, if present, will react with ammonia created from the urea to form ammonium bisulfate, potentially plugging the cold end equipment downstream.

Commercial application of the NO_xOUT system is limited to three reported cases:

1. Trial demonstration on a 62.5-ton-per-hour (TPH) stoker-fired wood waste boiler with 60 to 65 percent NO_x reduction,
2. A 600-million-British-thermal-unit (MMBtu) CO boiler with 60 to 70 percent NO_x reduction, and
3. A 75-megawatt (MW) pulverized coal-fired boiler with 65 percent NO_x reduction.

The NO_xOUT system has not been demonstrated on any stationary IC engine.

The NO_xOUT process is not technically feasible for the proposed lean-burn engine due to the high application temperature of 1,000°F to 1,950°F. The exhaust gas temperature of a lean-burn engine is typically between 495°F to 700°F. Raising the exhaust temperature to the required temperature level would essentially require the installation of an auxiliary heater. This would be economically prohibitive and would result in an increase in fuel consumption, an increase in the volume of gases that must be treated by the control system, and an increase in uncontrolled air emissions, including NO_x.

6.2.2.2 <u>THERMAL DeNO$_x$</u>

Thermal DeNO$_x$ is Exxon Research and Engineering Company's patented process for NO_x reduction. The process is a high temperature selective noncatalytic reduction (SNCR) of NO_x using ammonia as the reducing agent. Thermal $DeNO_x$ requires the exhaust gas temperature to be above 1,800°F. However, use of ammonia plus hydrogen lowers the temperature requirement to about 1,000°F. For some applications, this must be achieved by additional firing in the exhaust stream prior to ammonia injection.

The only known commercial applications of Thermal $DeNO_x$ are on industrial boilers, large furnaces, and incinerators which consistently produce exhaust gas temperatures above 1,800°F. There are no known applications or experience in the reciprocating IC engine industry. Temperatures of 1,800°F require alloy materials of construction with very large size piping and components since the exhaust gas volume would be increased by several times. As with the NO_xOUT process, high capital, operating, and maintenance costs are expected due to material of construction specification, additional duct burner system, and fuel consumption. Uncontrolled emissions would increase because of the additional fuel burning.

Thus, the Thermal $DeNO_x$ process will not be considered for the proposed project because it is technically infeasible due to its high application temperature.

6.2.2.3 Combination of Lean-Burn Engine and Nonselective Catalytic Reduction

Certain manufacturers, such as Engelhard and Johnson-Matthey, market a non-selective catalytic reduction system (NSCR) for NO_x control on reciprocating IC engines. The NSCR process requires a low oxygen content in the exhaust gas stream and high temperature (700°F to 1,400°F) in order to be effective. Rich-burn engines typically achieve low oxygen levels of less than 4 percent and the required temperature and, therefore, can use the NSCR process. Lean-burn engines, on the other hand, have a high air-to-fuel ratio, typical exhaust gas oxygen content of 12 to 15 percent, and the exhaust gas temperature is less than 700°F. As a result, NSCR is not a technically feasible add-on NO_x control device for FGTC's proposed lean-burn engine. Therefore, the combination of a lean-burn engine and NSCR was not considered further in the BACT analysis.

6.2.2.4 Selective Catalytic Reduction with Ammonia Injection

The NO_x abatement technology for oil- and gas-fired combustion sources that is currently receiving considerable attention is the selective catalytic reduction (SCR) process with ammonia injection. Engelhard Corporation's discovery in 1957 that ammonia reacts selectively with NO_x in the presence of a catalyst and excess oxygen has led to the commercialization of SCR technology for industrial boilers of various sizes. The technology has been well developed and applied in Japan, especially for control of emissions from gas-, oil-, and coal-fired utility boilers. It has been applied domestically on combustion sources which generate large quantities of NO_x, such as gas turbines.

SCR catalysts consist of two types: metal oxides and zeolite. In the metal oxides catalytic system, either vanadium or titanium is embedded into a ceramic matrix structure; the zeolite catalysts are ceramic molecular sieves extruded into modules of honeycomb shape. The all-ceramic zeolite catalysts are durable, and less susceptible to catalyst masking or poisoning than the noble metal/ceramic base catalysts. All catalysts exhibit advantages and disadvantages in terms of exhaust gas temperatures, ammonia/NO_x ratio, and optimum exhaust gas oxygen concentrations. A common disadvantage for all catalyst systems is the narrow window of temperature between 600°F and 900°F within which the NO_x reduction process takes place (Schorr, 1989; Steuler, 1990; Engelhard, 1990; Johnson-Matthey, 1990). Operating outside this temperature range results in catastrophic harm to the catalyst system. Chemical poisoning occurs at lower temperature conditions, while thermal degradation occurs at higher temperatures. Reactivity can only be restored through catalyst replacement.

Catalysts are subject to loss of activity over time. Since the catalyst is the most costly component of the SCR system, applications require servicing and cleaning of the catalyst surface every 2,000 to 3,000 hours of operation. The cleaning normally consists of blowing the catalyst surfaces with a compressed air gun or water jet. Most catalyst suppliers guarantee a catalyst life of 3 years, assuming certain operating conditions.

Technically, SCR is potentially applicable to further reduce the already low NO_x emissions (2 g/bhp-hr) from the proposed lean-burn reciprocating engine. SCR is capable of achieving NO_x reduction of 70 to 90 percent. For the proposed lean-burn engine, with already low NO_x concentration in the exhaust gases, vendors guarantee a removal rate of 80 percent. This would result in NO_x emissions of 0.4 g/bhp-hr. This represents an overall NO_x reduction of 96 percent compared to a rich-burn engine (at 11.0 g/bhp-hr).

6.2.2.5 Combination of Rich-Burn Engine and NSCR

Although the draft top-down BACT guideline document dated March 15, 1990, does not require an evaluation of processes that have inherently higher emission rates than the proposed process, the option of using a rich-burn engine equipped with NSCR also was considered in the BACT analysis.

Rich-burn reciprocating IC engines are defined as those which contain less than 4 percent oxygen concentration in the exhaust gas. Rich-burn engines typically are naturally aspirated engines with near stoichiometric air-to-fuel ratios and produce exhaust gas temperatures in the range of 1,200°F to 1,300°F.

NSCR technology uses a precious metal to catalyze the reactions of NO_x with CO and unburned hydrocarbon fuel in the exhaust gas streams to form nitrogen, carbon dioxide, and water vapor. A complete NSCR system includes exhaust gas oxygen sensor, exhaust gas monitor, hydrocarbon fuel injector, automatic air/fuel controller, and temperature sensor for automatic shut-down of the engine if overheating occurs. The engine exhaust entering the catalyst bed is maintained slightly fuel-rich to maximize NO_x reduction. The hydrocarbon fuel injector automatically controls an adjustable valve that supplies a small amount of hydrocarbon fuel to compensate for the changes in engine load or ambient conditions.

Technically, NSCR is potentially applicable to reduce 90 percent or more of the NO_x emissions in the exhaust gas of the rich-burn reciprocating IC engine. In general, vendors guarantee a removal rate of 90 percent for an equivalent NO_x emission level of 1.1 g/bhp-hr (i.e., 10 percent of the rich-burn engine NO_x emission rate of 11.0 g/bhp-hr).

6.2.3 SUMMARY OF TECHNICALLY FEASIBLE NO_x CONTROL METHODS

In summary, there are two basic alternatives for reduction of NO_x emissions from reciprocating IC engines: engine modification and add-on control technology. Presented in Table 6-1 is a summary of the technical evaluation of NO_x emission control methods applicable to reciprocating IC engines.

In the engine modification category, only the alternatives of air-to-fuel ratio change, retard ignition timing, derating power output, and EGR are applicable. EGR is applicable to rich-burn engines only. Steam/water injection and EGR (for lean-burn engines) are considered technically infeasible. In the add-on control technology category, only the lean-burn engine/SCR combination and rich-burn engine/NSCR combination are considered technically feasible. Other methods such as the NO_xOUT process, Thermal DeNO_x, and the lean-burn engine/NSCR combination are considered technically infeasible.

6.3 EVALUATION OF TECHNICALLY FEASIBLE NO_x CONTROL METHODS

This section examines all of the technically feasible NO_x control methods identified in the previous discussion. First, all five remaining control alternatives are ranked according to their total removal effectiveness. Each alternative is then examined further in regards to technical issues, environmental effects, energy requirements and impacts, and economic impacts.

Table 6-1 Summary of Technical Feasibility of NOx Emission Controls for Reciprocating Engine

Control Technology	NOx Controlled Emission Rate	Technical Feasibility	Comments
<u>Engine Modification Alternatives</u>			
Steam Injection	Not Applicable	NO	Technically infeasible due to irreversible structural damage to engine block.
Air-to-fuel Ratio Change (or Lean-Burn Technology)	1.5-2.0 g/bhp-hr	YES	Lowest emission rate achievable by engine modification, at least 80% control efficiency.
Retarding Ignition Timing			
Rich-burn Engine	9.4 g/bhp-hr	YES	Engine timing retard between 2° and 6°;
Lean-burn Engine	1.7 g/bhp-hr	YES	average 15% NOx reduction.
Derating Power Output			
Rich-burn Engine	6.6 g/bhp-hr	YES	Average 40% NOx reduction at 25% of engine
Lean-burn Engine	1.2 g/bhp-hr	YES	power derated for gas-fired engines.
Exhaust Gas Recirculation			
Rich-burn Engine	7.3 g/bhp-hr	YES	Maximum 34% NOx reduction for standard engine.
Lean-burn Engine	Not Applicable	NO	Ineffective for lean-burn engine.
<u>Add-on Control Technology*</u>			
NOxOUT Process	Not Applicable	NO	Technically infeasible (1000-1600°F), cost prohibitive for high temperature auxiliary equipment.
THERMAL DeNOx	Not Applicable	NO	Technically infeasible (above 1000°F), cost prohibitive for high temperature auxiliary equipment.
Lean-Burn Engine/NSCR	Not Applicable	NO	Technically infeasible for lean-burn engine, required <4% O2 conc. in the exhaust stream.
Lean-Burn Engine/SCR	0.4 g/bhp-hr	YES	Applicable to lean-burn engine with control efficiency of 80 percent.
Rich-Burn Engine/NSCR	1.1 g/bhp-hr	YES	Applicable to rich-burn engine only, required greater than 4% O2 conc. in exhaust gas stream. control efficiency of 90%.

* Except for the rich-burn engine/NSCR option, all add-on control technologies are for lean-burn engines.

The discussion also reviews current permitting practices for applications similar to FGTC's proposed project. Presented in Table 6-2 is a summary of BACT determinations for NO_x emissions from gas-fired stationary reciprocating IC engines issued since 1985. The information was obtained from BACT/Lowest Achievable Emission Rate (LAER) Clearinghouse documents from 1985 to 1990, as well as from actual permit applications, issued permits, and personal conversations with personnel of air permitting agencies from various states.

6.3.1 RANKING OF FEASIBLE CONTROL TECHNOLOGIES

The top-down BACT approach requires the ranking of the NO_x emission control alternatives in terms of achievable emission level. The five options, in order of removal effectiveness, are as follows: first, the lean-burn engine equipped with SCR; second, the rich-burn engine equipped with NSCR; third, the lean-burn engine with derating; fourth, the lean-burn engine with retard ignition timing; and fifth, the lean-burn engine.

A baseline condition must be established for BACT ranking and economic analysis purposes. The baseline is defined as the uncontrolled rate of the process being reviewed. Therefore, the baseline condition for the control technologies involving stationary reciprocating IC engine would be a conventional rich-burn engine with a NO_x emission level of 11 g/bhp-hr (EPA, 1988d).

Presented in Table 6-3 is the BACT top-down hierarchy of technically feasible NO_x control technologies, their corresponding NO_x emission rates, and their control efficiencies calculated from the baseline emission level. Only control options that result in an NO_x emission rate lower than the proposed lean-burn engine (2.0 g/bhp-hr) are shown in the table. Only these options are evaluated further for BACT.

Table 6-2 Summary of BACT Determinations for NOx Emissions from Gas-fired Reciprocating Engines

Company Name	State	Permit Number	Date of Permit	Engine Specifications: Fuel* Type	Make	Model	Size (Bhp)	NOx Emission Limit**: (g/Bhp-hr)	(lb/hr)	(ppm)	Control Method	Comments
Source Type: Natural Gas Compressor Station												
Northern Natural Gas Company	IA		05-Sep-90	N.G.	Cooper		4,000	1.8	15.9		Lean burn engine	
same as above	IA		05-Sep-90	N.G.	Cooper		2,000	1.8	7.9		Lean burn engine	
National Fuel Gas Supply Corp.	PA	53-329-001	13-Jun-89	N.G.	Cooper	8015JHC2	3,000	2.0	13.2		Lean burn engine	
Natural Gas Pipeline Company	IL	85100014	01-Mar-89	N.G.	Worthington	MLV-10	4,000	9.0	79.4		Design & oper. practice	
Tennessee Gas Pipeline Company	PA	53-339-002	21-Jun-88	N.G.	Cooper	GMVH-10C	2,250	3.0	14.9		Lean burn engine	
Consolidated Gas Transmission Corp.	PA	59-399-008	10-May-88	N.G.	Dresser-Rand	TCV-10	4,200	3.0	27.8		Lean burn engine	Air to fuel ratio is 4.5:1
ANR Production Company	VA	11064	03-Mar-88	N.G.	Caterpiller	G398TAA	600	1.2	1.6		Catalytic converter	N.G. Compressor Sta.
Southern Natural Gas Company	AL	406-0003-X	19-Feb-88	N.G.	Dresser-Rand	TCVD-10	4,160	2.2	20.2		Lean burn engine	Per. cond.: stack test
National Fuel Gas Supply Corp.	PA	53-399-002	01-Feb-88	N.G.	Dresser-Rand	412 KEV-1	2,850	3.0	18.8		Lean burn engine	
Shell California Production Co.	CA	147853	14-Oct-86	N.G.			600	3.2	4.2		SCR	70% reduction
Northern Natural Gas Company	IA		04-Feb-86	N.G.			4,000			250	Engine design	
Consolidated Gas Transmission Corp.	PA	18-399-009	11-Dec-85	N.G.	Cooper	12W-330-C2	6,000	3.0	39.7		Lean burn engine	
Shell California Production	CA	0041-6	02-Dec-85	N.G.	Caterpiller		225	0.805	0.4	50	NSCR, rich burn engine	90% reduction
Source Type: Power Cogeneration and Other Uses												
University of Illinois, Ch. Cir. Camp.	IL	applying	1990	N.G.	Cooper	LSVB-GDC	8,000	1.9	33.5		Lean burn engine	
Northeast Landfill Power	RI	999-1014	12-Dec-89	L.G.	Waukesha	12V-AT25GL	2,400	1.3	6.6		Lean burn engine	High-speed (900 rpm)
Worcester Company	RI	988-990	27-Sep-89	N.G.	Superior	12-SGTB	2,000	1.5	6.6		Lean burn engine	High-speed (900 rpm)
City of Ventura	CA	1379-1	31-Dec-86	D.G.			773	2.0	3.4		Engine design	Digestive gas
State of Utah Natural Resources	UT		01-Sep-86	N.G.			4,630	3.5	36.0		Lean burn engine	Turbocharger ups fuel eff.
Tricounty Sun Energy Sheraton Hotel	CA	1369-1	07-Aug-86	N.G.	Caterpiller		200			50	NSCR, rich burn engine	90% reduction
Genstar Gas Recovery Systems	CA	30970	29-Aug-85	L.G.			2,650	1.5	8.8		Lean burn engine	Landfilled gas
same as above	CA	30893	29-Aug-85	L.G.			1,100	1.5	3.6		Lean burn engine	Landfilled gas
Pacific Lighting Energy	CA	30336	01-Mar-85	N.G.	Superior	16-SGTA	2,650	1.5	8.8		Lean burn engine	High-speed (900 rpm)

* N.G. = Natural Gas; L.G. = Landfilled Gas; and D.G. = Digestive Gas.

** for a single engine.

Table 6-3 BACT "Top-Down" Hierarchy of NOx Control Technologies

BACT Ranking	Technology	Brake Emission Rate (g/bhp-hr)	Annual Emissions (TPY)	Total Emission Reduction (TPY)*	Total Control Efficiency (%)*
First	Lean-burn Engine with SCR	0.4	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 effieciency are calculated from baseline emission level.

\+ The range of control effectiveness is dependent on the percent of engine's rated torque. The calculated values are based on 40% NOx reduction at 25% derated power (or at 75% rated torque).

6.3.2 ANALYSIS OF LEAN-BURN ENGINE WITH SCR

Technical Issues

As the most effective NO_x abatement process in terms of removal efficiency, SCR has been a more frequently attempted technology for state-of-the-art reciprocating IC engines. However, the reliability of SCR's performance on reciprocating IC engines has not been consistently demonstrated. Data on sustained NO_x reduction performance for reciprocating IC engines are very limited.

Technical issues involved in the use of SCR are the narrow operating temperature range and the possible damage to the catalyst and downstream equipment. 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.

<u>Economic Analysis</u>

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 la in Table 6-4) is added to account for the extra cost of the lean-burn engine. The vendor's equipment quote for the Kleenaire system is $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 cost is $1,040,650 and the indirect capital cost is $567,990 for a total capital investment of $1,608,640.

Table 6–4 Capital Cost Estimates for SCR Systems for NOx Emission Control

Cost Items	Cost Factors	Costs: Kleenaire System+	Costs: 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) Contruction Contractor Fee[1]	0.10 x (DCC)	$96,537	$104,065
(d) Contigencies[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 embeded 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.

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).

A significant technical consideration in the use of the rich-burn engine with NSCR is the NSCR's effect upon maintenance, operation, and reliability of the overall system. Any add-on technology requires substantially more maintenance, controls, monitors, and operating personnel compared to a

Table 6-5 Annualized Cost Estimates for SCR Systems for NOx Emission Control

Cost Items	Basis	Costs: Kleenair System+	Costs: Engelhard System++
DIRECT OPERATING COSTS (DOC):			
(1) Operating Labor			
Operator[2]	5,840 hr/yr @ $20/hr	$116,800	$116,800
Supervisor[1]	15% of operator cost	$17,520	$17,520
(2) Maintenance[2]	5% of direct capital cost	$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 NH3; $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 NH3/lb NOx; $250/ton NH3	$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 lb/hr)(0.26 Btu/lb°F for air)(700°F-550°F)/(0.8) = 3.47 MMBtu/hr.
Annual heat input equals 3.47 MMBtu/hr times 8,760 hr/yr = 30,397 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) MMBtu/hr x 8,760 hr/yr = 42,048 MMBtu/yr.

system without add-on technology (i.e., lean-burn engine). The system will have a much greater frequency of downtime and malfunctioning such that the system will have far less operating reliability. Reliability is an extremely important consideration for a compressor station engine, which must be operated nearly continuously throughout the year and usually is located in a remote area.

Environmental Effects

Catalyst disposal may be required when using NSCR, depending on the catalyst type. Most vendors guarantee a service life of 3 years for the catalyst system. 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

Table 6-6 Capital Cost Estimates for Lean-burn Engine and Rich-burn Engine/NSCR System

Cost Items	Cost Factors	Costs: Lean-Burn Engine	Costs: Johnson-Matthey NSCR System
DIRECT CAPITAL COSTS (DCC):			
(1) Purchased Equipment			
(a) Differential Engine Cost	See Note 1	$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) Contruction Contractor Fee[1]	0.10 x (DCC)	$15,873	$15,931
(d) Contigencies	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 contigency based on no existing installtion of NSCR on large-bore rich-burn engine.

shown in the table is the differential cost of the lean-burn engine over that of the baseline rich-burn engine.

The annualized cost for the NSCR converter is given in Table 6-7. The calculation basis for cost items are also given in the table. The resulting annualized cost is $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.

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.

Table 6-7 Differential Annualized Cost Estimates for Lean-Burn Engine and Rich-Burn/NSCR System

Cost Items	Basis	Costs: Lean-Burn Engine	Costs: Johnson-Matthey NSCR System
DIRECT OPERATING COSTS (DOC):			
(1) Operating Labor			
Operator[2]	$20/hr (2,920 hr/yr for NSCR)	$0	$58,400
Supervisor[1]	15% of operator cost	$0	$8,760
(2) Maintenance[2]	5% of direct capital cost	$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.

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. 15. 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-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).

Table 6-8 Summary of the Operating Parameters for the Proposed Engine, Station No. 15

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).

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 lea-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 non-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 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.

Table 6-9 Summary of Top-Down BACT Impact Analysis Results for NOx

			Environmental Impacts		Energy Impacts: Incremental increase over baseline		Economic Impacts			
Control Alternative	Total Emission Reduction (TPY)*	Incremental Emission Reduction (TPY)**	Potential toxic air impact?	Potential adverse enviromental impacts?	Natural gas (MMBtu/yr)	Electricity (MW-hr/yr)	Total Annualized Cost ($/yr)	Incremental Annualized Cost ($/yr)	Total Cost Effectiveness ($/ton)	Incremental Cost Effectiveness ($/ton)
Lean-Burn Engine with SCR	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.

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 $\mu g/m^3$). 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: Fuel Type	Make	Model	Load (Bhp)	NOx Emission Limit*: (g/Bhp-hr)	(lb/hr)	(ppm)	Control Method	Comments
Source Type: Natural Gas Compressor Station													
Northern Natural Gas Company	IA		05-Sep-90	4,000 Bhp	N.G.	Cooper		4,000	1.8	15.9		Lean burn engine	
same as above	IA		05-Sep-90	4,000 Bhp	N.G.	Cooper		2,000	1.8	7.9		Lean burn engine	
National Fuel Gas Supply Corp.	PA	53-329-001	13-Jun-89	6,000 Bhp	N.G.	Cooper	8015JHC2	3,000	2.0	13.2		Lean burn engine	
Natural Gas Pipeline Company	IL	85100014	01-Mar-89	1,600 Bhp	N.G.	Worthington	MLV-10	4,000	9.0	79.4		Design & oper. practice	
Tennessee Gas Pipeline Company	PA	53-339-002	21-Jun-88	2,250 Bhp	N.G.	Cooper	GMVH-10C	2,250	3.0	14.9		Lean burn engine	
Consolidated Gas Transmission Corp.	PA	59-399-008	10-May-88	8,400 Bhp	N.G.	Dresser-Rand	TCV-10	4,200	3.0	27.8		Lean burn engine	Air to fuel ratio is 4.5:1
ANR Production Company	VA	11064	03-Mar-88	1,800 Bhp	N.G.	Caterpiller	G398TAA	600	1.2	1.6		Catalytic converter	N.G. Compressor Sta.
Southern Natural Gas Company	AL	406-0003-X0	19-Feb-88	4,160 Bhp	N.G.	Dresser-Rand	TCVD-10	4,160	2.2	20.2		Lean burn engine	Per. cond.: stack test
National Fuel Gas Supply Corp.	PA	53-399-002	01-Feb-88	2,850 Bhp	N.G.	Dresser-Rand	412 KEV-1	2,850	3.0	18.8		Lean burn engine	
Shell California Production Co.	CA	147853	14-Oct-86	600 Bhp				600	3.2	4.2		SCR	70% reduction
Northern Natural Gas Company	IA		04-Feb-86	8,000 Bhp	N.G.			4,000			250	Engine design	
Consolidated Gas Transmission Corp.	PA	18-399-009	11-Dec-85	6,000 Bhp	N.G.	Cooper	12W-330-C2	6,000	3.0	39.7		Lean burn engine	
Shell California Production	CA	0041-6	02-Dec-85	225 Bhp	N.G.	Caterpiller		225	0.805	0.4	50	NSCR, rich burn engine	90% reduction

* for a single engine.
N.G. = Natural Gas.

Appendix A Summary of BACT Determinations for NOx Emissions from Stationary Reciprocating Engines (page 2 of 2)

Company Name	State	Permit Number	Date of Permit	Total Capacity	Engine Specifications: Fuel Type	Make	Model	Load (Bhp)	NOx Emission Limit*: (g/Bhp-hr)	(lb/hr)	(ppm)	Control Method	Comments
Source Type: Power Cogeneration and Other Uses													
University of Illinois, Ch. Cir. Camp.	IL	applying	1990	16,000 Bhp	N.G.	Cooper	LSVB-GDC	8,000	1.9	33.5		Lean burn engine	
Northeast Landfill Power	RI	999-1014	12-Dec-89	19,200 Bhp	L.G.	Waukesha	12V-AT25GL	2,400	1.3	6.6		Lean burn engine	High-speed (900 rpm)
Pfizer, Inc.	MA	B-87-C-006	16-Nov-89	6,710 Bhp	Dual/Diesel	Cooper	LSVB-16-GDT	6,710	0.7	10.1		SCR	90% reduction
Cogentrix (formerly Xiox)	PA	33-399-004	31-Oct-89	20,904 Bhp	Dual	Wartsila	18V32GD	6,968	5.0	76.8		Engine retardation	
Worcester Company	RI	988-990	27-Sep-89	6,000 Bhp	N.G.	Superior	12-SGTB	2,000	1.5	6.6		Lean burn engine	High-speed (900 rpm)
Citizens Utilities	HI	HI 88-04	19-Sep-89	42,000 Bhp	Diesel			10,500			605	Engine design	
Key West Electric System	FL	PSD-FL-135	05-Jun-89	26,532 Bhp	Diesel			13,266	6.0	175.5		Engine timing retard	
Maui Electric Company, Inc.	HI	HI 87-01	30-Dec-88	33,400 Bhp	Diesel			16,700	7.0	256.1	595	5° ignition retard	20% reduction
Power Ventures	FL	PSD-FL-120	05-Dec-88	8,800 Bhp	Dual	Undetermined			5.0			Engine design	
same as above	FL	PSD-FL-120	05-Dec-88	8,800 Bhp	Diesel	Undetermined			12.0			Engine design	
Maui Pineapple Co., Ltd.	HI	HI 87-02	17-May-88	4,020 Bhp	Diesel			2,010	5.2	23.0	536	2° ignition retard	
same as above	HI	HI 87-02	17-May-88	6,040 Bhp	Diesel			3,020	5.3	35.0	520	2° ignition retard	
Maui Electric Company, Inc.	HI	HI 86-02	17-Nov-67	6,700 Bhp	Diesel			3,350	9.3	68.4	600	4° ignition retard	20% reduction
Hawaii Electric Light Co., Inc.	HI	HI 85-03	17-Nov-87	10,050 Bhp	Diesel			3,350	9.3	68.4	600	4° engine retard	20% reduction
City of Ventura	CA	1379-1	31-Dec-86	773 Bhp	D.G.			773	2.0	3.4		Engine design	Digestive gas
State of Utah Natural Resources	UT		01-Sep-86	18,000 Bhp	N.G.			4,630	3.5	36.0		Lean burn engine	Turbocharger ups fuel eff.
Tricounty Sun Energy Sheraton Hotel	CA	1369-1	07-Aug-86	200 Bhp	N.G.	Caterpiller		200			50	NSCR, rich burn engine	90% reduction
LaJet Energy Company	CA	85096	17-Jul-86	1,385 Bhp	Diesel	Cummins	KTTA-50CC	1,385	5.4	16.5		Engine design	
3M	TX	PSD-TX-674	30-May-86	8,386 Bhp	Dual	Cooper	LSVG-20-GDT	8,386	5.0	92.4		Engine design	
Genstar Gas Recovery Systems	CA	30970	29-Aug-85	2,650 Bhp	L.G.			2,650	1.5	8.8		Lean burn engine	Landfilled gas
same as above	CA	30893	29-Aug-85	1,100 Bhp	L.G.			1,100	1.5	3.6		Lean burn engine	Landfilled gas
Pacific Lighting Energy	CA	30336	01-Mar-85	2,650 Bhp	N.G.	Superior	16-SGTA	2,650	1.5	8.8		Lean burn engine	High-speed (900 rpm)

* for a single engine. Note: N.G. = Natural Gas; L.G. = Landfilled Gas; D.G. = Digestive Gas.

APPENDIX B

APPENDIX B

ECONOMIC IMPACT ANALYSIS METHODOLOGY

In the "top-down" approach, the economic impact along with environmental and energy impacts is one of three main criteria for BACT evaluation in considering any emission control method. The economic analysis determines the cost effectiveness of each applicable emission control alternative.

The economic analysis is based on the cost estimating procedure outlined in EPA's control cost manual (EPA, 1990b). An overall description of this cost estimating methodology is given as follows:

1. The total capital investment consists of direct capital and indirect capital costs. The direct capital cost includes the purchased equipment cost and the direct installation cost. The indirect capital cost accounts for other indirect expenses pertaining to the installation of the emission control device, such as engineering, construction and field expenses, contractor fee, contingencies, and startup and testing.

2. The annualized cost consists of the direct operating cost, the indirect operating cost, and the capital recovery cost. The direct operating cost includes both annual operating and maintenance costs, cost of replacement parts, and fuel costs. The indirect annual operating cost accounts for items such as overhead, property taxes, insurance, and administration. The capital recovery cost is calculated from the total capital investment cost using a capital recovery factor.

3. The total annual operating cost is divided by the total emission reduction of the control system to result in dollars per ton of pollutant removed (i.e., dollars per ton of NO_x in this case). This value is defined as the cost effectiveness of the control method. Incremental cost effectiveness of one control method over

another is also calculated based on the incremental annual cost and incremental emission reduction.

Detailed descriptions of the cost estimates are presented in the following three sections for the SCR system being evaluated as an add-on control device for the lean-burn engine. The discussion includes economic analyses of the lean-burn engine and the NSCR system for the rich-burn engine. The baseline cost estimate is based on the rich-burn engine since it has been defined as the baseline engine on which all emission calculations are based.

SECTION I 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 O_2 continuous monitors, which are not included in the basic equipment costs. These monitors are tied to the ammonia injection system to ensure proper NO_x reduction. These costs are estimated at 15 percent of the SCR basic equipment cost.

Structure support costs account for miscellaneous external piping, auxiliary support, independent flow controllers and indicators for the connection between the basic equipment and the ammonia system. Costs are estimated at 10 percent of the overall equipment cost. Overall equipment includes the engine, emission control device, exhaust reheating heater, monitoring equipment, and any other auxiliary system.

Plant instrumentation and controls are usually not included in the basic equipment cost; typical cost factors range from 10 to 15 percent of the overall equipment cost, depending on the specific application.

The purchased equipment costs are then the basis for determining the direct and indirect installation costs. The installation costs are based on standard cost factors (EPA, 1990b).

The direct installation costs consist of the direct expenditures for materials and labor for site preparation, foundations, structural steel, erection, piping, electrical, painting, and insulation. Direct installation costs are expressed as a percentage of the total basic equipment costs for standard industrial installations.

The indirect capital costs (ICC) typically cover several areas, such as: engineering and supervision, construction and field expenses, construction contractor fee, contingencies, start-up and testing, and working capital. Each of the above items is based on a percentage of the DCC; except for the working capital which is based on the direct operating cost (DOC).

For the proposed lean-burn engine, the TCI cost estimate is also calculated by summing the purchased equipment costs, direct installation costs, and indirect capital costs. In this case, the itemized basic purchased equipment costs only include the differential engine cost, instrumentation, freight, and sales tax. Other direct and indirect installation costs are estimated by multiplying the sum of the basic purchased equipment costs by the standard cost factors.

The TCI cost estimate for the NSCR converter was based on a similar cost estimating procedure. Basic purchased equipment costs for the NSCR system include the basic converter, emission monitoring, structural support, instrumentation, freight, and sales tax. The direct and indirect installation costs follow a similar procedure to the one described above.

SECTION II 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 <u>COST EFFECTIVENESS</u>

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 COMPANY
COMPRESSOR STATION NO. 15

ISCLTK6L MODEL, A VERSION OF
ISCLT (VERSION 90008)
AN AIR QUALITY DISPERSION MODEL IN
SECTION 1. GUIDELINE MODELS.
IN UNAMAP (VERSION 6) JAN 1990.
SOURCE: FILE 7 ON UNAMAP MAGNETIC TAPE FROM NTIS.

CONVERTED BY :
KBN ENGINEERING AND APPLIED SCIENCES, INC.
GAINESVILLE, FLORIDA
(904)331-9000

CARD INPUT FILE IS ER15LT82.I81
SUMMARY OUTPUT FILE IS ER15LT82.O81
TITLE OF RUN IS 1982 ENRON STATION 15 / 40 FT STACK 10-29-90

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                              - ISCLT INPUT DATA -

      NUMBER OF SOURCES =    1
      NUMBER OF X AXIS GRID SYSTEM POINTS =    8
      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, 0, 1, 0, 1, 0, 0, 1, 1, 0,
 0,
        RANGE X AXIS GRID SYSTEM POINTS (METERS )=     100.00,     200.00,     300.00,     400.00,     500.00,     750.00,
          1000.00,    1250.00,
        RANGE X SPECIAL DISCRETE POINTS (METERS )=      30.00,      30.00,      30.00,      34.00,      40.00,      49.00,
            73.00,     146.00,     271.00,     274.00,     290.00,     314.00,     354.00,     326.00,     290.00,     265.00,
           256.00,     253.00,     204.00,     216.00,     235.00,     207.00,     174.00,     152.00,     140.00,     134.00,
           131.00,     134.00,      73.00,      49.00,      40.00,      34.00,      30.00,      30.00,      30.00,      30.00,
  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+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
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- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00092100	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 (1.5000MPS)	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	0.00259901	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 (1.5000MPS)	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	0.00650702	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 (1.5000MPS)	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	0.05692022	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 1	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 2	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 3	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 5	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01
STABILITY CATEGORY 6	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01

- WIND PROFILE POWER LAW EXPONENTS -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 2	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 3	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00
STABILITY CATEGORY 4	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00
STABILITY CATEGORY 5	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00
STABILITY CATEGORY 6	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		1	STACK	0.00	0.00	12.19	0.00	GAS EXIT TEMP (DEG K)= 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)= 69.17, 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,	69.2,	0	2	9.7,	69.2,	0	3	9.7,	69.2,	0	4	9.7,	69.2,	0
5	9.7,	69.2,	0	6	9.7,	69.2,	0	7	9.7,	69.2,	0	8	9.7,	69.2,	0
9	9.7,	69.2,	0	10	9.7,	69.2,	0	11	9.7,	69.2,	0	12	9.7,	69.2,	0
13	9.7,	69.2,	0	14	9.7,	69.2,	0	15	9.7,	69.2,	0	16	9.7,	69.2,	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) -

Y AXIS (AZIMUTH BEARING, DEGREES)	100.000	200.000	300.000	400.000	500.000	750.000	1000.000	1250.000
	- CONCENTRATION -							
360.000	0.226773	0.339062	0.324631	0.485281	0.646916	0.749433	0.691954	0.598195
337.500	0.114040	0.137819	0.122371	0.171512	0.224783	0.258293	0.240159	0.209786
315.000	0.066689	0.093090	0.094693	0.150808	0.211977	0.256140	0.242587	0.215272
292.500	0.063751	0.084016	0.082859	0.126548	0.177883	0.232230	0.238525	0.223295
270.000	0.155774	0.210525	0.201218	0.282365	0.362410	0.408752	0.388496	0.350381
247.500	0.129567	0.170841	0.159760	0.218339	0.274590	0.313304	0.302772	0.272866
225.000	0.104085	0.161511	0.168103	0.256367	0.340034	0.379580	0.347477	0.300357
202.500	0.100756	0.131865	0.125884	0.179698	0.231734	0.252309	0.227491	0.194663
180.000	0.211937	0.296748	0.278366	0.393449	0.509089	0.583247	0.547743	0.484140
157.500	0.089813	0.116061	0.106438	0.142344	0.177225	0.193195	0.180553	0.161081
135.000	0.055209	0.079205	0.076485	0.106688	0.135298	0.146485	0.133476	0.116433
112.500	0.076385	0.096612	0.093882	0.133744	0.167257	0.159568	0.131679	0.108632
90.000	0.029778	0.039141	0.039547	0.060061	0.078407	0.076200	0.065337	0.056621
67.500	0.043993	0.055975	0.055026	0.079149	0.102548	0.110525	0.098428	0.083834
45.000	0.054342	0.061229	0.055161	0.074802	0.097272	0.113769	0.106177	0.093077
22.500	0.079126	0.098651	0.091596	0.126873	0.159575	0.168368	0.151377	0.131863

- 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
30.0	10.0	0.004017	30.0	20.0	0.001764	30.0	30.0	0.000842
34.0	40.0	0.000338	40.0	50.0	0.000088	49.0	60.0	0.001057
73.0	70.0	0.028408	146.0	80.0	0.043140	271.0	90.0	0.040022
274.0	100.0	0.063586	290.0	110.0	0.088074	314.0	120.0	0.086356
354.0	130.0	0.088889	326.0	140.0	0.080752	290.0	150.0	0.096590
265.0	160.0	0.130694	256.0	170.0	0.210934	253.0	180.0	0.295367
204.0	190.0	0.219654	216.0	200.0	0.148623	235.0	210.0	0.141102
207.0	220.0	0.154322	174.0	230.0	0.155176	152.0	240.0	0.154385
140.0	250.0	0.162274	134.0	260.0	0.172071	131.0	270.0	0.190217
134.0	280.0	0.137405	73.0	290.0	0.047348	49.0	300.0	0.002742
40.0	310.0	0.002140	34.0	320.0	0.002503	30.0	330.0	0.003340
30.0	340.0	0.004620	30.0	350.0	0.005369	30.0	360.0	0.006491

** 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	0.749433
1000.00	360.00	0.691954
500.00	360.00	0.646916
1250.00	360.00	0.598195
750.00	180.00	0.583247
1000.00	180.00	0.547743
500.00	180.00	0.509089
400.00	360.00	0.485281
1250.00	180.00	0.484140
750.00	270.00	0.408752

*** END OF ISCLT PROGRAM,   1 SOURCES PROCESSED ***

ISCLTK6L MODEL, A VERSION OF
ISCLT (VERSION 90008)
AN AIR QUALITY DISPERSION MODEL IN
SECTION 1. GUIDELINE MODELS.
IN UNAMAP (VERSION 6) JAN 1990.
SOURCE: FILE 7 ON UNAMAP MAGNETIC TAPE FROM NTIS.

CONVERTED BY :
KBN ENGINEERING AND APPLIED SCIENCES, INC.
GAINESVILLE, FLORIDA
(904)331-9000

CARD INPUT FILE IS ER15LT83.I81
SUMMARY OUTPUT FILE IS ER15LT83.O81
TITLE OF RUN IS 1983 ENRON STATION 15 / 40 FT STACK 10-29-90

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                                   - ISCLT INPUT DATA (CONT.) -

        NUMBER OF SOURCES =    1
        NUMBER OF X AXIS GRID SYSTEM POINTS =    8
        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, 0, 1, 0, 1, 0, 0, 1, 1, 0,
 0,
          RANGE X AXIS GRID SYSTEM POINTS (METERS )=     100.00,     200.00,     300.00,     400.00,     500.00,     750.00,
            1000.00,    1250.00,
          RANGE X SPECIAL DISCRETE POINTS (METERS )=      30.00,      30.00,      30.00,      34.00,      40.00,      49.00,
              73.00,     146.00,     271.00,     274.00,     290.00,     314.00,     354.00,     326.00,     290.00,     265.00,
             256.00,     253.00,     204.00,     216.00,     235.00,     207.00,     174.00,     152.00,     140.00,     134.00,
             131.00,     134.00,      73.00,      49.00,      40.00,      34.00,      30.00,      30.00,      30.00,      30.00,
  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+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 (1.5000MPS)	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	0.00032600	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 (1.5000MPS)	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	0.00225298	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 (1.5000MPS)	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	0.00639295	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 (1.5000MPS)	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	0.03910672	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 10.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 20.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 30.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 40.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 50.200000E-010.200000E-010.200000E-010.200000E-010.200000E-010.200000E-01
STABILITY CATEGORY 60.350000E-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 10.700000E-010.700000E-010.700000E-010.700000E-010.700000E-010.700000E-01
STABILITY CATEGORY 20.700000E-010.700000E-010.700000E-010.700000E-010.700000E-010.700000E-01
STABILITY CATEGORY 30.100000E+000.100000E+000.100000E+000.100000E+000.100000E+000.100000E+00
STABILITY CATEGORY 40.150000E+000.150000E+000.150000E+000.150000E+000.150000E+000.150000E+00
STABILITY CATEGORY 50.350000E+000.350000E+000.350000E+000.350000E+000.350000E+000.350000E+00
STABILITY CATEGORY 60.550000E+000.550000E+000.550000E+000.550000E+000.550000E+000.550000E+00
```

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		1	STACK	0.00	0.00	12.19	0.00	GAS EXIT TEMP (DEG K)= 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)= 69.17, 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,	69.2,	0	2	9.7,	69.2,	0	3	9.7,	69.2,	0	4	9.7,	69.2,	0
5	9.7,	69.2,	0	6	9.7,	69.2,	0	7	9.7,	69.2,	0	8	9.7,	69.2,	0
9	9.7,	69.2,	0	10	9.7,	69.2,	0	11	9.7,	69.2,	0	12	9.7,	69.2,	0
13	9.7,	69.2,	0	14	9.7,	69.2,	0	15	9.7,	69.2,	0	16	9.7,	69.2,	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) -

Y AXIS (AZIMUTH BEARING, DEGREES)	100.000	200.000	300.000	400.000	500.000	750.000	1000.000	1250.000
	- CONCENTRATION -							
360.000	0.373352	0.485878	0.426173	0.561418	0.685812	0.722752	0.643275	0.545886
337.500	0.390431	0.364294	0.285772	0.338137	0.392717	0.390401	0.336331	0.280048
315.000	0.115672	0.142769	0.130419	0.175143	0.218905	0.243199	0.226638	0.200001
292.500	0.088777	0.119678	0.113068	0.158444	0.203612	0.237658	0.228459	0.205425
270.000	0.129216	0.195734	0.187127	0.274230	0.364265	0.426740	0.406851	0.367280
247.500	0.129858	0.184818	0.172819	0.248123	0.323750	0.375034	0.352296	0.308617
225.000	0.121320	0.169288	0.159778	0.217657	0.271003	0.304158	0.287745	0.253967
202.500	0.135352	0.184046	0.172674	0.235941	0.294183	0.324183	0.297866	0.256256
180.000	0.255873	0.357560	0.327741	0.445952	0.556604	0.606338	0.550451	0.476735
157.500	0.099133	0.142987	0.135133	0.187009	0.236323	0.263348	0.246613	0.219510
135.000	0.065369	0.086261	0.080320	0.111536	0.142647	0.161387	0.152040	0.136579
112.500	0.143421	0.178598	0.162601	0.205955	0.239580	0.236509	0.209127	0.181004
90.000	0.093882	0.110365	0.098446	0.128211	0.157858	0.170876	0.153277	0.131319
67.500	0.067223	0.086055	0.078466	0.101194	0.119696	0.119421	0.105512	0.091891
45.000	0.062844	0.085860	0.080816	0.107803	0.131298	0.139642	0.128516	0.113665
22.500	0.079420	0.113799	0.104573	0.142728	0.177237	0.181011	0.158181	0.135171

- 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
30.0	10.0	0.008944	30.0	20.0	0.002656	30.0	30.0	0.000848
34.0	40.0	0.000343	40.0	50.0	0.000101	49.0	60.0	0.001383
73.0	70.0	0.044597	146.0	80.0	0.096809	271.0	90.0	0.102992
274.0	100.0	0.130310	290.0	110.0	0.157045	314.0	120.0	0.131839
354.0	130.0	0.105780	326.0	140.0	0.088972	290.0	150.0	0.117094
265.0	160.0	0.163431	256.0	170.0	0.254956	253.0	180.0	0.352073
204.0	190.0	0.275539	216.0	200.0	0.201517	235.0	210.0	0.176650
207.0	220.0	0.170568	174.0	230.0	0.166713	152.0	240.0	0.164775
140.0	250.0	0.165251	134.0	260.0	0.161032	131.0	270.0	0.166179
134.0	280.0	0.137751	73.0	290.0	0.060493	49.0	300.0	0.007995
40.0	310.0	0.006564	34.0	320.0	0.018961	30.0	330.0	0.040979
30.0	340.0	0.055165	30.0	350.0	0.033820	30.0	360.0	0.015681

** 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	0.722752
500.00	360.00	0.685812
1000.00	360.00	0.643275
750.00	180.00	0.606338
400.00	360.00	0.561418
500.00	180.00	0.556604
1000.00	180.00	0.550451
1250.00	360.00	0.545886
200.00	360.00	0.485878
1250.00	180.00	0.476735

*** END OF ISCLT PROGRAM,   1 SOURCES PROCESSED ***

ISCLTK6L MODEL, A VERSION OF
ISCLT (VERSION 90008)
AN AIR QUALITY DISPERSION MODEL IN
SECTION 1. GUIDELINE MODELS.
IN UNAMAP (VERSION 6) JAN 1990.
SOURCE: FILE 7 ON UNAMAP MAGNETIC TAPE FROM NTIS.

CONVERTED BY :
KBN ENGINEERING AND APPLIED SCIENCES, INC.
GAINESVILLE, FLORIDA
(904)331-9000

CARD INPUT FILE IS	ER15LT84.I81	
SUMMARY OUTPUT FILE IS	ER15LT84.O81	
TITLE OF RUN IS	1984 ENRON STATION 15 / 40 FT STACK	10-29-90

- ISCLT INPUT DATA (CONT.) -

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NUMBER OF SOURCES =   1
NUMBER OF X AXIS GRID SYSTEM POINTS =    8
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, 0, 1, 0, 1, 0, 0, 1, 1, 0,
0,
  RANGE X AXIS GRID SYSTEM POINTS (METERS )=    100.00,    200.00,    300.00,    400.00,    500.00,    750.00,
    1000.00,   1250.00,
  RANGE X SPECIAL DISCRETE POINTS (METERS )=     30.00,     30.00,     30.00,     34.00,     40.00,     49.00,
     73.00,    146.00,    271.00,    274.00,    290.00,    314.00,    354.00,    326.00,    290.00,    265.00,
    256.00,    253.00,    204.00,    216.00,    235.00,    207.00,    174.00,    152.00,    140.00,    134.00,
    131.00,    134.00,     73.00,     49.00,     40.00,     34.00,     30.00,     30.00,     30.00,     30.00,
AZIMUTH BEARING Y AXIS GRID SYSTEM POINTS (DEGREES)=     22.50,     45.00,     67.50,     90.00,    112.50,    135.00,
    157.50,    180.00,    202.50,    225.00,    247.50,    270.00,    292.50,    315.00,    337.50,    360.00,
AZIMUTH BEARING Y SPECIAL DISCRETE POINTS (DEGREES)=     10.00,     20.00,     30.00,     40.00,     50.00,     60.00,
     70.00,     80.00,     90.00,    100.00,    110.00,    120.00,    130.00,    140.00,    150.00,    160.00,
    170.00,    180.00,    190.00,    200.00,    210.00,    220.00,    230.00,    240.00,    250.00,    260.00,
    270.00,    280.00,    290.00,    300.00,    310.00,    320.00,    330.00,    340.00,    350.00,    360.00,
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- AMBIENT AIR TEMPERATURE (DEGREES KELVIN) -

	STABILITY CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	299.0000	299.0000	299.0000	293.0000	287.0000	287.0000

- MIXING LAYER HEIGHT (METERS) -

SEASON 1

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04
STABILITY CATEGORY 2	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 3	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 4	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 5	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05
STABILITY CATEGORY 6	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00071600	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 (1.5000MPS)	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	0.00145199	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 (1.5000MPS)	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	0.00399998	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) -

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                         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 10.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 20.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 30.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 40.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 50.200000E-010.200000E-010.200000E-010.200000E-010.200000E-010.200000E-01
STABILITY CATEGORY 60.350000E-010.350000E-010.350000E-010.350000E-010.350000E-010.350000E-01
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- WIND PROFILE POWER LAW EXPONENTS -

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                         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 10.700000E-010.700000E-010.700000E-010.700000E-010.700000E-010.700000E-01
STABILITY CATEGORY 20.700000E-010.700000E-010.700000E-010.700000E-010.700000E-010.700000E-01
STABILITY CATEGORY 30.100000E+000.100000E+000.100000E+000.100000E+000.100000E+000.100000E+00
STABILITY CATEGORY 40.150000E+000.150000E+000.150000E+000.150000E+000.150000E+000.150000E+00
STABILITY CATEGORY 50.350000E+000.350000E+000.350000E+000.350000E+000.350000E+000.350000E+00
STABILITY CATEGORY 60.550000E+000.550000E+000.550000E+000.550000E+000.550000E+000.550000E+00
```

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		1	STACK	0.00	0.00	12.19	0.00	GAS EXIT TEMP (DEG K)= 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)= 69.17, 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,	69.2,	0	2	9.7,	69.2,	0	3	9.7,	69.2,	0	4	9.7,	69.2,	0
5	9.7,	69.2,	0	6	9.7,	69.2,	0	7	9.7,	69.2,	0	8	9.7,	69.2,	0
9	9.7,	69.2,	0	10	9.7,	69.2,	0	11	9.7,	69.2,	0	12	9.7,	69.2,	0
13	9.7,	69.2,	0	14	9.7,	69.2,	0	15	9.7,	69.2,	0	16	9.7,	69.2,	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) -

Y AXIS (AZIMUTH BEARING, DEGREES)	100.000	200.000	300.000	400.000	500.000	750.000	1000.000	1250.000
	- CONCENTRATION -							
360.000	0.473381	0.574611	0.497903	0.647903	0.785000	0.813539	0.715413	0.605096
337.500	0.182264	0.227099	0.201213	0.270024	0.336520	0.358974	0.318260	0.268943
315.000	0.107656	0.145673	0.138657	0.200582	0.266291	0.307997	0.283162	0.244919
292.500	0.049061	0.081889	0.085117	0.134292	0.188463	0.241639	0.236662	0.212492
270.000	0.073928	0.118696	0.124334	0.193996	0.265980	0.325978	0.320207	0.293532
247.500	0.113538	0.158475	0.146183	0.194300	0.237055	0.254874	0.232802	0.201002
225.000	0.105483	0.133638	0.124955	0.178013	0.233573	0.271959	0.253788	0.221338
202.500	0.131708	0.169928	0.152082	0.204390	0.256180	0.284332	0.260765	0.225143
180.000	0.224370	0.308421	0.284413	0.389214	0.486067	0.527002	0.477824	0.413436
157.500	0.115300	0.150553	0.137265	0.183053	0.227514	0.247621	0.224916	0.195806
135.000	0.067724	0.088071	0.081187	0.108790	0.135222	0.148192	0.135681	0.118499
112.500	0.057610	0.081537	0.079997	0.116878	0.153337	0.173707	0.159331	0.139415
90.000	0.075960	0.102842	0.100214	0.139296	0.172170	0.174487	0.151004	0.127400
67.500	0.078538	0.099809	0.092026	0.122856	0.150094	0.155199	0.136247	0.116084
45.000	0.073447	0.101708	0.097884	0.141864	0.185125	0.207314	0.188034	0.162078
22.500	0.077991	0.110159	0.104391	0.151246	0.195610	0.218638	0.199549	0.173780

- 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
30.0	10.0	0.013418	30.0	20.0	0.005014	30.0	30.0	0.002297
34.0	40.0	0.001506	40.0	50.0	0.001146	49.0	60.0	0.002395
73.0	70.0	0.051811	146.0	80.0	0.093834	271.0	90.0	0.102997
274.0	100.0	0.092207	290.0	110.0	0.082214	314.0	120.0	0.078554
354.0	130.0	0.088158	326.0	140.0	0.089804	290.0	150.0	0.119165
265.0	160.0	0.160419	256.0	170.0	0.230301	253.0	180.0	0.304398
204.0	190.0	0.242557	216.0	200.0	0.182687	235.0	210.0	0.153968
207.0	220.0	0.139752	174.0	230.0	0.136020	152.0	240.0	0.141573
140.0	250.0	0.140399	134.0	260.0	0.113929	131.0	270.0	0.095134
134.0	280.0	0.080378	73.0	290.0	0.031312	49.0	300.0	0.002011
40.0	310.0	0.001190	34.0	320.0	0.003619	30.0	330.0	0.008038
30.0	340.0	0.012805	30.0	350.0	0.017109	30.0	360.0	0.022529

** 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	0.813539
500.00	360.00	0.785000
1000.00	360.00	0.715413
400.00	360.00	0.647903
1250.00	360.00	0.605096
200.00	360.00	0.574611
750.00	180.00	0.527002
300.00	360.00	0.497903
500.00	180.00	0.486067
1000.00	180.00	0.477824

*** END OF ISCLT PROGRAM,   1 SOURCES PROCESSED ***

ISCLTK6L MODEL, A VERSION OF
ISCLT (VERSION 90008)
AN AIR QUALITY DISPERSION MODEL IN
SECTION 1. GUIDELINE MODELS.
IN UNAMAP (VERSION 6) JAN 1990.
SOURCE: FILE 7 ON UNAMAP MAGNETIC TAPE FROM NTIS.

CONVERTED BY :
KBN ENGINEERING AND APPLIED SCIENCES, INC.
GAINESVILLE, FLORIDA
(904)331-9000

CARD INPUT FILE IS ER15LT85.I81
SUMMARY OUTPUT FILE IS ER15LT85.O81
TITLE OF RUN IS 1985 ENRON STATION 15 / 40 FT STACK 10-29-90

- ISCLT INPUT DATA (CONT.) -

NUMBER OF SOURCES = 1
NUMBER OF X AXIS GRID SYSTEM POINTS = 8
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, 0, 1, 0, 1, 0, 0, 1, 1, 0,
0,

RANGE X AXIS GRID SYSTEM POINTS (METERS)= 100.00, 200.00, 300.00, 400.00, 500.00, 750.00,
1000.00, 1250.00,
RANGE X SPECIAL DISCRETE POINTS (METERS)= 30.00, 30.00, 30.00, 34.00, 40.00, 49.00,
73.00, 146.00, 271.00, 274.00, 290.00, 314.00, 354.00, 326.00, 290.00, 265.00,
256.00, 253.00, 204.00, 216.00, 235.00, 207.00, 174.00, 152.00, 140.00, 134.00,
131.00, 134.00, 73.00, 49.00, 40.00, 34.00, 30.00, 30.00, 30.00, 30.00,
AZIMUTH BEARING Y AXIS GRID SYSTEM POINTS (DEGREES)= 22.50, 45.00, 67.50, 90.00, 112.50, 135.00,
157.50, 180.00, 202.50, 225.00, 247.50, 270.00, 292.50, 315.00, 337.50, 360.00,
AZIMUTH BEARING Y SPECIAL DISCRETE POINTS (DEGREES)= 10.00, 20.00, 30.00, 40.00, 50.00, 60.00,
70.00, 80.00, 90.00, 100.00, 110.00, 120.00, 130.00, 140.00, 150.00, 160.00,
170.00, 180.00, 190.00, 200.00, 210.00, 220.00, 230.00, 240.00, 250.00, 260.00,
270.00, 280.00, 290.00, 300.00, 310.00, 320.00, 330.00, 340.00, 350.00, 360.00,

- AMBIENT AIR TEMPERATURE (DEGREES KELVIN) -

	STABILITY CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	299.0000	299.0000	299.0000	293.0000	287.0000	287.0000

- MIXING LAYER HEIGHT (METERS) -

SEASON 1

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04
STABILITY CATEGORY 2	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 3	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 4	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 5	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05
STABILITY CATEGORY 6	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00086099	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 (1.5000MPS)	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	0.00188499	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 1	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 2	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 3	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 5	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01
STABILITY CATEGORY 6	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01

- WIND PROFILE POWER LAW EXPONENTS -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 2	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 3	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00
STABILITY CATEGORY 4	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00
STABILITY CATEGORY 5	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00
STABILITY CATEGORY 6	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		1	STACK	0.00	0.00	12.19	0.00	GAS EXIT TEMP (DEG K)= 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)= 69.17, 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,	69.2,	0	2	9.7,	69.2,	0	3	9.7,	69.2,	0	4	9.7,	69.2,	0
5	9.7,	69.2,	0	6	9.7,	69.2,	0	7	9.7,	69.2,	0	8	9.7,	69.2,	0
9	9.7,	69.2,	0	10	9.7,	69.2,	0	11	9.7,	69.2,	0	12	9.7,	69.2,	0
13	9.7,	69.2,	0	14	9.7,	69.2,	0	15	9.7,	69.2,	0	16	9.7,	69.2,	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) -

Y AXIS (AZIMUTH BEARING, DEGREES)	100.000	200.000	300.000	400.000	500.000	750.000	1000.000	1250.000
	- CONCENTRATION -							
360.000	0.229599	0.320251	0.295170	0.426474	0.563245	0.649849	0.601087	0.520161
337.500	0.103772	0.149804	0.142965	0.201708	0.254791	0.273547	0.243832	0.207617
315.000	0.151108	0.154302	0.132396	0.170630	0.210446	0.231108	0.214146	0.189286
292.500	0.093434	0.122291	0.115885	0.161683	0.207661	0.241734	0.235007	0.214635
270.000	0.234365	0.272225	0.239372	0.307643	0.370596	0.399595	0.375105	0.336786
247.500	0.160917	0.200772	0.186844	0.258207	0.324207	0.354778	0.324215	0.282733
225.000	0.167757	0.192330	0.170650	0.219560	0.258538	0.248251	0.214463	0.184537
202.500	0.125644	0.148228	0.131095	0.169936	0.205340	0.215294	0.190627	0.162220
180.000	0.192122	0.268363	0.253318	0.363900	0.469250	0.512876	0.460631	0.396207
157.500	0.091486	0.125235	0.118332	0.164335	0.207386	0.228851	0.210278	0.183947
135.000	0.082939	0.116409	0.110578	0.150377	0.185481	0.198598	0.180051	0.157490
112.500	0.084747	0.103549	0.092222	0.122028	0.152167	0.167488	0.155390	0.137919
90.000	0.079714	0.096145	0.088432	0.119999	0.151381	0.171564	0.161272	0.143216
67.500	0.039158	0.052150	0.050825	0.070587	0.089449	0.101797	0.098713	0.090709
45.000	0.034474	0.056636	0.058613	0.089562	0.123484	0.158571	0.156452	0.141864
22.500	0.102172	0.133986	0.120877	0.158422	0.195248	0.221738	0.212101	0.190643

- 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
30.0	10.0	0.007828	30.0	20.0	0.004717	30.0	30.0	0.002666
34.0	40.0	0.000982	40.0	50.0	0.000063	49.0	60.0	0.000831
73.0	70.0	0.028343	146.0	80.0	0.072786	271.0	90.0	0.091981
274.0	100.0	0.092521	290.0	110.0	0.092660	314.0	120.0	0.095512
354.0	130.0	0.116794	326.0	140.0	0.108428	290.0	150.0	0.115679
265.0	160.0	0.138310	256.0	170.0	0.201252	253.0	180.0	0.268602
204.0	190.0	0.211271	216.0	200.0	0.158538	235.0	210.0	0.156361
207.0	220.0	0.179994	174.0	230.0	0.193252	152.0	240.0	0.190897
140.0	250.0	0.197112	134.0	260.0	0.227314	131.0	270.0	0.267349
134.0	280.0	0.194871	73.0	290.0	0.070712	49.0	300.0	0.015788
40.0	310.0	0.018581	34.0	320.0	0.014533	30.0	330.0	0.007432
30.0	340.0	0.005296	30.0	350.0	0.008102	30.0	360.0	0.011411

** 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	0.649849
1000.00	360.00	0.601087
500.00	360.00	0.563245
1250.00	360.00	0.520161
750.00	180.00	0.512876
500.00	180.00	0.469250
1000.00	180.00	0.460631
400.00	360.00	0.426474
750.00	270.00	0.399595
1250.00	180.00	0.396207

** END OF ISCLT PROGRAM,   1 SOURCES PROCESSED **

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ISCLTK6L MODEL, A VERSION OF
  ISCLT (VERSION 90008)
  AN AIR QUALITY DISPERSION MODEL IN
  SECTION 1.  GUIDELINE MODELS.
  IN UNAMAP (VERSION 6) JAN 1990.
  SOURCE: FILE 7  ON UNAMAP MAGNETIC TAPE FROM NTIS.


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       GAINESVILLE, FLORIDA
           (904)331-9000

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  CARD INPUT FILE IS          ER15LT86.I81
  SUMMARY OUTPUT FILE IS      ER15LT86.081
  TITLE OF RUN IS             1986 ENRON STATION 15 / 40 FT STACK           10-29-90
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- ISCLT INPUT DATA (CONT.) -

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NUMBER OF SOURCES =    1
NUMBER OF X AXIS GRID SYSTEM POINTS =    8
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, 0, 1, 0, 1, 0, 0, 1, 1, 0,
0,
  RANGE X AXIS GRID SYSTEM POINTS (METERS )=    100.00,    200.00,    300.00,    400.00,    500.00,    750.00,
    1000.00,   1250.00,
  RANGE X SPECIAL DISCRETE POINTS (METERS )=    30.00,     30.00,     30.00,     34.00,     40.00,     49.00,
      73.00,    146.00,    271.00,    274.00,    290.00,    314.00,    354.00,    326.00,    290.00,    265.00,
     256.00,    253.00,    204.00,    216.00,    235.00,    207.00,    174.00,    152.00,    140.00,    134.00,
     131.00,    134.00,     73.00,     49.00,     40.00,     34.00,     30.00,     30.00,     30.00,     30.00,
AZIMUTH BEARING Y AXIS GRID SYSTEM POINTS (DEGREES)=    22.50,     45.00,     67.50,     90.00,    112.50,    135.00,
     157.50,    180.00,    202.50,    225.00,    247.50,    270.00,    292.50,    315.00,    337.50,    360.00,
AZIMUTH BEARING Y SPECIAL DISCRETE POINTS (DEGREES)=    10.00,     20.00,     30.00,     40.00,     50.00,     60.00,
      70.00,     80.00,     90.00,    100.00,    110.00,    120.00,    130.00,    140.00,    150.00,    160.00,
     170.00,    180.00,    190.00,    200.00,    210.00,    220.00,    230.00,    240.00,    250.00,    260.00,
     270.00,    280.00,    290.00,    300.00,    310.00,    320.00,    330.00,    340.00,    350.00,    360.00,
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- AMBIENT AIR TEMPERATURE (DEGREES KELVIN) -

	STABILITY CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	299.0000	299.0000	299.0000	293.0000	287.0000	287.0000

- MIXING LAYER HEIGHT (METERS) -

SEASON 1

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04
STABILITY CATEGORY 2	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 3	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 4	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 5	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05
STABILITY CATEGORY 6	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00076000	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 1	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 2	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 3	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 5	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01
STABILITY CATEGORY 6	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01

- WIND PROFILE POWER LAW EXPONENTS -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 2	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 3	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00
STABILITY CATEGORY 4	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00
STABILITY CATEGORY 5	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00
STABILITY CATEGORY 6	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00

- SOURCE INPUT DATA -

C T CARD	A A TYPE	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		1	STACK	0.00	0.00	12.19	0.00	GAS EXIT TEMP (DEG K)= 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)= 69.17, 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,	69.2,	0	2	9.7,	69.2,	0	3	9.7,	69.2,	0	4	9.7,	69.2,	0
5	9.7,	69.2,	0	6	9.7,	69.2,	0	7	9.7,	69.2,	0	8	9.7,	69.2,	0
9	9.7,	69.2,	0	10	9.7,	69.2,	0	11	9.7,	69.2,	0	12	9.7,	69.2,	0
13	9.7,	69.2,	0	14	9.7,	69.2,	0	15	9.7,	69.2,	0	16	9.7,	69.2,	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) -

Y AXIS (AZIMUTH BEARING, DEGREES)	100.000	200.000	300.000	400.000	500.000	750.000	1000.000	1250.000
	- CONCENTRATION -							
360.000	0.195501	0.273277	0.252651	0.345282	0.429648	0.458067	0.413855	0.358917
337.500	0.121704	0.179844	0.170462	0.235191	0.294222	0.317809	0.286922	0.247574
315.000	0.156410	0.193920	0.175552	0.228875	0.279806	0.304890	0.275588	0.234248
292.500	0.087544	0.119229	0.114593	0.157393	0.197234	0.214565	0.196607	0.171094
270.000	0.130226	0.167190	0.156088	0.209020	0.258513	0.279572	0.255392	0.223137
247.500	0.129098	0.154478	0.142199	0.192645	0.242408	0.266788	0.245343	0.213541
225.000	0.158750	0.192949	0.178131	0.234534	0.284539	0.296749	0.266950	0.230060
202.500	0.147124	0.206192	0.200827	0.282096	0.362257	0.429201	0.418416	0.374674
180.000	0.331548	0.444276	0.424975	0.586794	0.732481	0.794669	0.732565	0.648610
157.500	0.118598	0.138565	0.125754	0.164856	0.200819	0.206109	0.184194	0.159875
135.000	0.092204	0.110299	0.102112	0.131687	0.157291	0.163434	0.146643	0.126499
112.500	0.061193	0.073197	0.067200	0.089805	0.113373	0.133499	0.126937	0.112070
90.000	0.087956	0.099124	0.088083	0.107975	0.123704	0.119522	0.102430	0.086429
67.500	0.048848	0.057372	0.052909	0.070341	0.086329	0.090021	0.080080	0.068834
45.000	0.066384	0.087076	0.083536	0.115485	0.145411	0.160767	0.148940	0.129962
22.500	0.068364	0.093921	0.091363	0.129628	0.167563	0.191233	0.177827	0.155388

- 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
30.0	10.0	0.001056	30.0	20.0	0.000196	30.0	30.0	0.000007
34.0	40.0	0.000013	40.0	50.0	0.000101	49.0	60.0	0.001201
73.0	70.0	0.035519	146.0	80.0	0.080081	271.0	90.0	0.092091
274.0	100.0	0.080831	290.0	110.0	0.069985	314.0	120.0	0.076657
354.0	130.0	0.101958	326.0	140.0	0.103357	290.0	150.0	0.118223
265.0	160.0	0.163274	256.0	170.0	0.300817	253.0	180.0	0.443844
204.0	190.0	0.332656	216.0	200.0	0.231327	235.0	210.0	0.199629
207.0	220.0	0.193150	174.0	230.0	0.183017	152.0	240.0	0.162668
140.0	250.0	0.150852	134.0	260.0	0.150007	131.0	270.0	0.155722
134.0	280.0	0.131839	73.0	290.0	0.057529	49.0	300.0	0.003460
40.0	310.0	0.000476	34.0	320.0	0.000195	30.0	330.0	0.000435
30.0	340.0	0.000775	30.0	350.0	0.001330	30.0	360.0	0.001967

** 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	0.794669
1000.00	180.00	0.732565
500.00	180.00	0.732481
1250.00	180.00	0.648610
400.00	180.00	0.586794
750.00	360.00	0.458067
200.00	180.00	0.444276
253.00	180.00	0.443844
500.00	360.00	0.429648
750.00	202.50	0.429201

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******************************************* END OF ISCLT PROGRAM,     1 SOURCES PROCESSED *******************************************
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ISCLTK6L MODEL, A VERSION OF
  ISCLT (VERSION 90008)
  AN AIR QUALITY DISPERSION MODEL IN
  SECTION 1.  GUIDELINE MODELS.
  IN UNAMAP (VERSION 6) JAN 1990.
  SOURCE: FILE 7  ON UNAMAP MAGNETIC TAPE FROM NTIS.


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           (904)331-9000

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  CARD INPUT FILE IS         ER15RF82.I81
  SUMMARY OUTPUT FILE IS     ER15RF82.O81
  TITLE OF RUN IS            1982 ENRON STATION 15 / 40 FT STACK / REFINEMENT 10-29-90
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- 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)= 352.00, 354.00, 356.00, 358.00, 360.00, 2.00,
4.00, 6.00, 8.00,

- AMBIENT AIR TEMPERATURE (DEGREES KELVIN) -

	STABILITY CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	299.0000	299.0000	299.0000	293.0000	287.0000	287.0000

- MIXING LAYER HEIGHT (METERS) -

SEASON 1

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04
STABILITY CATEGORY 2	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 3	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 4	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 5	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05
STABILITY CATEGORY 6	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00092100	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 (1.5000MPS)	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	0.00259901	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 (1.5000MPS)	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	0.00650702	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 (1.5000MPS)	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	0.05692022	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  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                         CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
STABILITY CATEGORY 10.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 20.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 30.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 40.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 50.200000E-010.200000E-010.200000E-010.200000E-010.200000E-010.200000E-01
STABILITY CATEGORY 60.350000E-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 10.700000E-010.700000E-010.700000E-010.700000E-010.700000E-010.700000E-01
STABILITY CATEGORY 20.700000E-010.700000E-010.700000E-010.700000E-010.700000E-010.700000E-01
STABILITY CATEGORY 30.100000E+000.100000E+000.100000E+000.100000E+000.100000E+000.100000E+00
STABILITY CATEGORY 40.150000E+000.150000E+000.150000E+000.150000E+000.150000E+000.150000E+00
STABILITY CATEGORY 50.350000E+000.350000E+000.350000E+000.350000E+000.350000E+000.350000E+00
STABILITY CATEGORY 60.550000E+000.550000E+000.550000E+000.550000E+000.550000E+000.550000E+00
```

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		1	STACK	0.00	0.00	12.19	0.00	GAS EXIT TEMP (DEG K)= 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)= 69.17, 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,	69.2,	0	2	9.7,	69.2,	0	3	9.7,	69.2,	0	4	9.7,	69.2,	0
5	9.7,	69.2,	0	6	9.7,	69.2,	0	7	9.7,	69.2,	0	8	9.7,	69.2,	0
9	9.7,	69.2,	0	10	9.7,	69.2,	0	11	9.7,	69.2,	0	12	9.7,	69.2,	0
13	9.7,	69.2,	0	14	9.7,	69.2,	0	15	9.7,	69.2,	0	16	9.7,	69.2,	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) -

Y AXIS (AZIMUTH BEARING, DEGREES)	550.000	600.000	650.000	700.000	750.000	800.000	850.000	900.000	950.000
	- CONCENTRATION -								
8.000	0.497294	0.519041	0.531396	0.536748	0.536845	0.533027	0.526342	0.517621	0.507504
6.000	0.546745	0.570617	0.584194	0.590066	0.590144	0.585899	0.578487	0.568823	0.557614
4.000	0.596256	0.622227	0.637017	0.643403	0.643457	0.638781	0.630645	0.620039	0.607743
2.000	0.645547	0.673630	0.689642	0.696558	0.696608	0.691526	0.682684	0.671152	0.657789
360.000	0.694367	0.724582	0.741853	0.749343	0.749433	0.743985	0.733824	0.722056	0.707029
358.000	0.651203	0.679873	0.696353	0.703626	0.703930	0.699012	0.690255	0.678758	0.665366
356.000	0.607869	0.635022	0.650740	0.657819	0.658357	0.653987	0.646004	0.635431	0.623068
354.000	0.564595	0.590227	0.605179	0.612062	0.612836	0.609014	0.601802	0.592158	0.580822
352.000	0.521607	0.545686	0.559847	0.566514	0.567500	0.564207	0.557752	0.549019	0.538698

- 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	0.749433
700.00	360.00	0.749343
800.00	360.00	0.743985
650.00	360.00	0.741853
850.00	360.00	0.733824
600.00	360.00	0.724582
900.00	360.00	0.722056
950.00	360.00	0.707029
750.00	358.00	0.703930
700.00	358.00	0.703626

```
***************************************** END OF ISCLT PROGRAM,     1 SOURCES PROCESSED *****************************************
```

ISCLTK6L MODEL, A VERSION OF
ISCLT (VERSION 90008)
AN AIR QUALITY DISPERSION MODEL IN
SECTION 1. GUIDELINE MODELS.
IN UNAMAP (VERSION 6) JAN 1990.
SOURCE: FILE 7 ON UNAMAP MAGNETIC TAPE FROM NTIS.

CONVERTED BY :
KBN ENGINEERING AND APPLIED SCIENCES, INC.
GAINESVILLE, FLORIDA
(904)331-9000

CARD INPUT FILE IS	ER15RF84.I81
SUMMARY OUTPUT FILE IS	ER15RF84.O81
TITLE OF RUN IS	1984 ENRON STATION 15 / 40 FT STACK / REFINEMENT 10-29-90

- ISCLT INPUT DATA (CONT.) -

```
        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)=     352.00,     354.00,     356.00,     358.00,     360.00,       2.00,
               4.00,       6.00,       8.00,
```

- AMBIENT AIR TEMPERATURE (DEGREES KELVIN) -

	STABILITY CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	299.0000	299.0000	299.0000	293.0000	287.0000	287.0000

- MIXING LAYER HEIGHT (METERS) -

SEASON 1

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04
STABILITY CATEGORY 2	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 3	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 4	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 5	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05
STABILITY CATEGORY 6	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00071600	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 (1.5000MPS)	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	0.00145199	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 (1.5000MPS)	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	0.00399998	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 1	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 2	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 3	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 5	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01
STABILITY CATEGORY 6	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01

- WIND PROFILE POWER LAW EXPONENTS -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 2	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 3	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00
STABILITY CATEGORY 4	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00
STABILITY CATEGORY 5	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00
STABILITY CATEGORY 6	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		1	STACK	0.00	0.00	12.19	0.00	GAS EXIT TEMP (DEG K)= 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)= 69.17, 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,	69.2,	0	2	9.7,	69.2,	0	3	9.7,	69.2,	0	4	9.7,	69.2,	0
5	9.7,	69.2,	0	6	9.7,	69.2,	0	7	9.7,	69.2,	0	8	9.7,	69.2,	0
9	9.7,	69.2,	0	10	9.7,	69.2,	0	11	9.7,	69.2,	0	12	9.7,	69.2,	0
13	9.7,	69.2,	0	14	9.7,	69.2,	0	15	9.7,	69.2,	0	16	9.7,	69.2,	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) -

Y AXIS (AZIMUTH BEARING, DEGREES)	550.000	600.000	650.000	700.000	750.000	800.000	850.000	900.000	950.000
	- CONCENTRATION -								
8.000	0.589594	0.602534	0.606286	0.603475	0.596025	0.585375	0.572608	0.558540	0.543810
6.000	0.646170	0.659398	0.662720	0.658996	0.650317	0.638240	0.623930	0.608265	0.591931
4.000	0.702944	0.716438	0.719317	0.714666	0.704742	0.691220	0.675360	0.658087	0.640144
2.000	0.759682	0.773472	0.775916	0.770345	0.759184	0.744226	0.726817	0.707937	0.688389
360.000	0.816179	0.830310	0.832365	0.825911	0.813539	0.797167	0.777536	0.757756	0.735962
358.000	0.771570	0.785611	0.788103	0.782448	0.771112	0.755915	0.738215	0.719022	0.699123
356.000	0.727098	0.741051	0.743982	0.739123	0.728813	0.714781	0.698314	0.680373	0.661714
354.000	0.682928	0.696762	0.700102	0.696012	0.686706	0.673814	0.658558	0.641853	0.624412
352.000	0.639221	0.652875	0.656578	0.653213	0.644869	0.633081	0.619005	0.603504	0.587258

- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF ALL SOURCES COMBINED -

X COORDINATE RANGE (METERS)	Y COORDINATE AZIMUTH BEARING (DEGREES)	CONCENTRATION
650.00	360.00	0.832365
600.00	360.00	0.830310
700.00	360.00	0.825911
550.00	360.00	0.816179
750.00	360.00	0.813539
800.00	360.00	0.797167
650.00	358.00	0.788103
600.00	358.00	0.785611
700.00	358.00	0.782448
850.00	360.00	0.777536

** END OF ISCLT PROGRAM,   1 SOURCES PROCESSED **

ISCLTK6L MODEL, A VERSION OF
ISCLT (VERSION 90008)
AN AIR QUALITY DISPERSION MODEL IN
SECTION 1. GUIDELINE MODELS.
IN UNAMAP (VERSION 6) JAN 1990.
SOURCE: FILE 7 ON UNAMAP MAGNETIC TAPE FROM NTIS.

CONVERTED BY :
KBN ENGINEERING AND APPLIED SCIENCES, INC.
GAINESVILLE, FLORIDA
(904)331-9000

CARD INPUT FILE IS ER15RF86.I81
SUMMARY OUTPUT FILE IS ER15RF86.081
TITLE OF RUN IS 1986 ENRON STATION 15 / 40 FT STACK / REFINEMENT 10-29-90

- ISCLT INPUT DATA (CONT.) -

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 CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	299.0000	299.0000	299.0000	293.0000	287.0000	287.0000

- MIXING LAYER HEIGHT (METERS) -

SEASON 1

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04
STABILITY CATEGORY 2	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 3	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 4	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 5	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05
STABILITY CATEGORY 6	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00076000	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 1	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 2	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 3	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 5	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01
STABILITY CATEGORY 6	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01

- WIND PROFILE POWER LAW EXPONENTS -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 2	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 3	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00
STABILITY CATEGORY 4	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00
STABILITY CATEGORY 5	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00
STABILITY CATEGORY 6	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		1	STACK	0.00	0.00	12.19	0.00	GAS EXIT TEMP (DEG K)= 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)= 69.17, 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,	69.2,	0	2	9.7,	69.2,	0	3	9.7,	69.2,	0	4	9.7,	69.2,	0
5	9.7,	69.2,	0	6	9.7,	69.2,	0	7	9.7,	69.2,	0	8	9.7,	69.2,	0
9	9.7,	69.2,	0	10	9.7,	69.2,	0	11	9.7,	69.2,	0	12	9.7,	69.2,	0
13	9.7,	69.2,	0	14	9.7,	69.2,	0	15	9.7,	69.2,	0	16	9.7,	69.2,	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) -

Y AXIS (AZIMUTH BEARING, DEGREES)	550.000	600.000	650.000	700.000	750.000	800.000	850.000	900.000	950.000
	- CONCENTRATION -								
188.000	0.619456	0.639999	0.651210	0.655594	0.654929	0.650571	0.643598	0.634852	0.624984
186.000	0.656056	0.676584	0.687274	0.690814	0.689121	0.683663	0.675580	0.665771	0.654913
184.000	0.693289	0.713785	0.723924	0.726593	0.723843	0.717247	0.708021	0.697113	0.685226
182.000	0.731028	0.751488	0.761078	0.762865	0.759042	0.751283	0.740887	0.728849	0.715902
180.000	0.769122	0.789577	0.798647	0.799566	0.794669	0.785738	0.773468	0.760950	0.746260
178.000	0.717118	0.736290	0.744774	0.745630	0.741055	0.732713	0.721892	0.709556	0.696443
176.000	0.664764	0.682664	0.690587	0.691408	0.687181	0.679452	0.669411	0.657961	0.645773
174.000	0.612283	0.628912	0.636275	0.637069	0.633200	0.626092	0.616840	0.606277	0.595017
172.000	0.559926	0.575253	0.582040	0.582795	0.579273	0.572779	0.564312	0.554629	0.544296

- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF ALL SOURCES COMBINED -

X COORDINATE RANGE (METERS)	Y COORDINATE AZIMUTH BEARING (DEGREES)	CONCENTRATION
700.00	180.00	0.799566
650.00	180.00	0.798647
750.00	180.00	0.794669
600.00	180.00	0.789577
800.00	180.00	0.785738
850.00	180.00	0.773468
550.00	180.00	0.769122
700.00	182.00	0.762865
650.00	182.00	0.761078
900.00	180.00	0.760950

** END OF ISCLT PROGRAM,   1 SOURCES PROCESSED ***

- 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	0.00092100	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 (1.5000MPS)	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	0.00259901	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 (1.5000MPS)	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	0.00650702	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 (1.5000MPS)	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	0.05692022	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  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                    CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
STABILITY CATEGORY 10.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 20.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 30.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 40.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 50.200000E-010.200000E-010.200000E-010.200000E-010.200000E-010.200000E-01
STABILITY CATEGORY 60.350000E-010.350000E-010.350000E-010.350000E-010.350000E-010.350000E-01
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- WIND PROFILE POWER LAW EXPONENTS -

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                    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 10.700000E-010.700000E-010.700000E-010.700000E-010.700000E-010.700000E-01
STABILITY CATEGORY 20.700000E-010.700000E-010.700000E-010.700000E-010.700000E-010.700000E-01
STABILITY CATEGORY 30.100000E+000.100000E+000.100000E+000.100000E+000.100000E+000.100000E+00
STABILITY CATEGORY 40.150000E+000.150000E+000.150000E+000.150000E+000.150000E+000.150000E+00
STABILITY CATEGORY 50.350000E+000.350000E+000.350000E+000.350000E+000.350000E+000.350000E+00
STABILITY CATEGORY 60.550000E+000.550000E+000.550000E+000.550000E+000.550000E+000.550000E+00
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NOTE THAT BUILDING DIMENSIONS ON CARD GROUP 17 FOR SOURCE NO. 1 DO NOT MEET THE SCHULMAN-SCIRE CRITERIA.
THEREFORE, DIRECTION SPECIFIC BUILDING DIMENSIONS WILL BE READ, BUT NOT USED BY THE MODEL.

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		1	STACK	0.00	0.00	15.24	0.00	GAS EXIT TEMP (DEG K)= 561.00, GAS EXIT VEL. (M/SEC)= 49.61, STACK DIAMETER (M)= 0.440, HEIGHT OF ASSO. BLDG. (M)= 9.69, WIDTH OF ASSO. BLDG. (M)= 75.04, WAKE EFFECTS FLAG = 0

- SOURCE STRENGTHS (GRAMS PER SEC) -

SEASON 1	SEASON 2	SEASON 3	SEASON 4
1.33000E+00			

WARNING - HW/HB > 5 FOR SOURCE 1 PROG. USES LATERAL VIRTUAL DIST. FOR UPPER BOUND OF CONCENTRATION (DEPOSITION). IF LOWER BOUND IS DESIRED SET WAKE EFFECTS FLAG (WAKE) = 1 AND RERUN

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 **

- GRID SYSTEM RECEPTORS -

- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	200.000	300.000	400.000	500.000	750.000	1000.000	1250.000
	- CONCENTRATION -						
360.000	0.510419	0.706615	0.816286	0.842917	0.753397	0.635141	0.531350
337.500	0.179198	0.253521	0.294638	0.306529	0.276931	0.235784	0.197474
315.000	0.126121	0.246697	0.312799	0.336529	0.311705	0.270306	0.230552
292.500	0.109857	0.216492	0.281954	0.314899	0.317855	0.290171	0.253751
270.000	0.225984	0.410188	0.499772	0.528454	0.492149	0.437713	0.384618
247.500	0.187395	0.310417	0.372669	0.393860	0.367990	0.320904	0.273414
225.000	0.205050	0.379474	0.459361	0.475899	0.412522	0.340202	0.279725
202.500	0.145373	0.256270	0.304665	0.312529	0.266928	0.218757	0.180070
180.000	0.383619	0.573338	0.671411	0.699998	0.639513	0.556031	0.483384
157.500	0.146520	0.212198	0.240434	0.246180	0.221621	0.196968	0.177048
135.000	0.098637	0.160848	0.187864	0.191912	0.165937	0.141300	0.123227
112.500	0.096585	0.182558	0.211240	0.207187	0.163317	0.133606	0.115857
90.000	0.045955	0.089088	0.105880	0.106504	0.090637	0.079354	0.070117
67.500	0.055407	0.120318	0.148378	0.153007	0.127346	0.102078	0.083570
45.000	0.058762	0.115338	0.142251	0.150989	0.137713	0.119085	0.103477
22.500	0.102751	0.175906	0.207685	0.213045	0.187678	0.162172	0.140948

- 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
207.0	10.0	0.327205	216.0	20.0	0.158064	238.0	30.0	0.114304
256.0	40.0	0.102690	213.0	50.0	0.065295	189.0	60.0	0.044415
177.0	70.0	0.034883	168.0	80.0	0.027139	165.0	90.0	0.028230
168.0	100.0	0.040667	177.0	110.0	0.065456	192.0	120.0	0.084953
216.0	130.0	0.107739	253.0	140.0	0.142193	232.0	150.0	0.149388
213.0	160.0	0.178929	201.0	170.0	0.270561	198.0	180.0	0.380282
201.0	190.0	0.268939	210.0	200.0	0.181084	229.0	210.0	0.201696
223.0	220.0	0.231465	189.0	230.0	0.175084	198.0	240.0	0.180814
253.0	250.0	0.262419	241.0	260.0	0.271006	238.0	270.0	0.308250
241.0	280.0	0.234301	253.0	290.0	0.183986	274.0	300.0	0.193114
311.0	310.0	0.243475	268.0	320.0	0.211348	238.0	330.0	0.189737
219.0	340.0	0.224064	207.0	350.0	0.360116	204.0	360.0	0.515242

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 (CONT.) **

- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF ALL SOURCES COMBINED -

X COORDINATE RANGE (METERS)	Y COORDINATE AZIMUTH BEARING (DEGREES)	CONCENTRATION
500.00	360.00	0.842917
400.00	360.00	0.816286
750.00	360.00	0.753397
300.00	360.00	0.706615
500.00	180.00	0.699998
400.00	180.00	0.671411
750.00	180.00	0.639513
1000.00	360.00	0.635141
300.00	180.00	0.573338
1000.00	180.00	0.556031

*** END OF ISCLT PROGRAM,   1 SOURCES PROCESSED ***

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                   *** RUN TIME STATISTICS ***


BEGINNING HOUR,MINUTE,SECOND  - - - - - - - - : 13:22:03
BEGINNING MONTH,DAY,YEAR  - - - - - - - - - - : 10/18/90


ENDING HOUR,MINUTE,SECOND   - - - - - - - - - : 13:24:16
ENDING MONTH,DAY,YEAR   - - - - - - - - - - - : 10/18/90


TOTAL CPU SECONDS   - - - - - - - - - - - - - :          133.


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 ISCLTK6L MODEL, A VERSION OF
   ISCLT (VERSION 90008)
   AN AIR QUALITY DISPERSION MODEL IN
   SECTION 1.  GUIDELINE MODELS.
   IN UNAMAP (VERSION 6) JAN 1990.
   SOURCE: FILE 7  ON UNAMAP MAGNETIC TAPE FROM NTIS.


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        GAINESVILLE, FLORIDA
             (904)331-9000

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   CARD INPUT FILE IS          ER14LT83.I83
   SUMMARY OUTPUT FILE IS      ER14LT83.O83
   TITLE OF RUN IS             1983 ENRON STATION 14 / 50 FT STACK            10-18-90
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- ISCLT INPUT DATA (CONT.) -

NUMBER OF SOURCES = 1
NUMBER OF X AXIS GRID SYSTEM POINTS = 7
NUMBER OF Y AXIS GRID SYSTEM POINTS = 16
NUMBER OF SPECIAL POINTS = 36
NUMBER OF SEASONS = 1
NUMBER OF WIND SPEED CLASSES = 6
NUMBER OF STABILITY CLASSES = 6
NUMBER OF WIND DIRECTION CLASSES = 16
FILE NUMBER OF DATA FILE USED FOR REPORTS = 1
THE PROGRAM IS RUN IN RURAL MODE
CONCENTRATION (DEPOSITION) UNITS CONVERSION FACTOR =0.10000000E+07
ACCELERATION OF GRAVITY (METERS/SEC**2) = 9.800
HEIGHT OF MEASUREMENT OF WIND SPEED (METERS) = 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)= 200.00, 300.00, 400.00, 500.00, 750.00, 1000.00,
1250.00,

RANGE X SPECIAL DISCRETE POINTS (METERS)= 207.00, 216.00, 238.00, 256.00, 213.00, 189.00,
177.00, 168.00, 165.00, 168.00, 177.00, 192.00, 216.00, 253.00, 232.00, 213.00,
201.00, 198.00, 201.00, 210.00, 229.00, 223.00, 189.00, 198.00, 253.00, 241.00,
238.00, 241.00, 253.00, 274.00, 311.00, 268.00, 238.00, 219.00, 207.00, 204.00,

AZIMUTH BEARING Y AXIS GRID SYSTEM POINTS (DEGREES)= 22.50, 45.00, 67.50, 90.00, 112.50, 135.00,
157.50, 180.00, 202.50, 225.00, 247.50, 270.00, 292.50, 315.00, 337.50, 360.00,

AZIMUTH BEARING Y SPECIAL DISCRETE POINTS (DEGREES)= 10.00, 20.00, 30.00, 40.00, 50.00, 60.00,
70.00, 80.00, 90.00, 100.00, 110.00, 120.00, 130.00, 140.00, 150.00, 160.00,
170.00, 180.00, 190.00, 200.00, 210.00, 220.00, 230.00, 240.00, 250.00, 260.00,
270.00, 280.00, 290.00, 300.00, 310.00, 320.00, 330.00, 340.00, 350.00, 360.00,

- AMBIENT AIR TEMPERATURE (DEGREES KELVIN) -

	STABILITY CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	299.0000	299.0000	299.0000	293.0000	287.0000	287.0000

- MIXING LAYER HEIGHT (METERS) -

SEASON 1

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04
STABILITY CATEGORY 2	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 3	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 4	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 5	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05
STABILITY CATEGORY 6	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00032600	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 (1.5000MPS)	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	0.00225298	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 (1.5000MPS)	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	0.00639295	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 (1.5000MPS)	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	0.03910672	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 CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 2	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 3	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 4	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
STABILITY CATEGORY 5	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01	0.200000E-01
STABILITY CATEGORY 6	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01	0.350000E-01

- WIND PROFILE POWER LAW EXPONENTS -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 2	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01	0.700000E-01
STABILITY CATEGORY 3	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00	0.100000E+00
STABILITY CATEGORY 4	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00	0.150000E+00
STABILITY CATEGORY 5	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00	0.350000E+00
STABILITY CATEGORY 6	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00	0.550000E+00

NOTE THAT BUILDING DIMENSIONS ON CARD GROUP 17 FOR SOURCE NO. 7 DO NOT MEET THE SCHULMAN-SCIRE CRITERIA.
THEREFORE, DIRECTION SPECIFIC BUILDING DIMENSIONS WILL BE READ, BUT NOT USED BY THE MODEL.

- SOURCE INPUT DATA -

```
C T SOURCE SOURCE     X           Y       EMISSION  BASE /
A A NUMBER  TYPE  COORDINATE  COORDINATE  HEIGHT  ELEV- /             - SOURCE DETAILS DEPENDING ON TYPE -
R P                  (M)         (M)        (M)    ATION /
D E                                                 (M)  /
--------------------------------------------------------------------------------------------------------------------------
X        7  STACK       0.00        0.00  15.24    0.00 GAS EXIT TEMP (DEG K)= 561.00, GAS EXIT VEL. (M/SEC)= 49.61,
                                                        STACK DIAMETER (M)= 0.440, HEIGHT OF ASSO. BLDG. (M)=   9.69, WIDTH OF
                                                        ASSO. BLDG. (M)=  75.04, WAKE EFFECTS FLAG = 0
                                                              - SOURCE STRENGTHS ( GRAMS PER SEC                         ) -
                                                                   SEASON 1     SEASON 2     SEASON 3     SEASON 4
                                                                  1.33000E+00
```

WARNING - HW/HB > 5 FOR SOURCE 7 PROG. USES LATERAL VIRTUAL DIST. FOR UPPER BOUND OF CONCENTRATION (DEPOSITION). IF LOWER BOUND IS DESIRED SET WAKE EFFECTS FLAG (WAKE) = 1 AND RERUN

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 7 **

- GRID SYSTEM RECEPTORS -

- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	200.000	300.000	400.000	500.000	750.000	1000.000	1250.000
	- CONCENTRATION -						
360.000	0.592434	0.728664	0.787733	0.780699	0.663718	0.544864	0.447126
337.500	0.327213	0.399732	0.425094	0.415301	0.342442	0.276376	0.224408
315.000	0.154021	0.246277	0.288666	0.298866	0.267945	0.227440	0.190406
292.500	0.146261	0.231736	0.276506	0.292403	0.274116	0.239752	0.204637
270.000	0.294873	0.416403	0.485407	0.509793	0.478485	0.424629	0.368875
247.500	0.265169	0.356766	0.407909	0.421995	0.382999	0.325383	0.271590
225.000	0.194892	0.299997	0.349242	0.362128	0.327768	0.279046	0.234501
202.500	0.197929	0.315999	0.367791	0.377471	0.331263	0.273653	0.224017
180.000	0.442797	0.611987	0.690089	0.701344	0.616152	0.521910	0.445197
157.500	0.190567	0.269379	0.305957	0.314659	0.287335	0.254170	0.225150
135.000	0.100305	0.162456	0.193667	0.203790	0.190932	0.171770	0.154163
112.500	0.161570	0.268543	0.304311	0.304407	0.261402	0.224562	0.197179
90.000	0.093858	0.175016	0.209370	0.216341	0.188527	0.157927	0.134923
67.500	0.081655	0.132635	0.150855	0.152003	0.133301	0.116885	0.104587
45.000	0.095699	0.150760	0.173428	0.177444	0.158082	0.138049	0.122305
22.500	0.136890	0.192359	0.215064	0.213970	0.181071	0.153059	0.131191

- 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
207.0	10.0	0.384641	216.0	20.0	0.190754	238.0	30.0	0.141417
256.0	40.0	0.135254	213.0	50.0	0.098589	189.0	60.0	0.076159
177.0	70.0	0.066633	168.0	80.0	0.060410	165.0	90.0	0.061273
168.0	100.0	0.083222	177.0	110.0	0.121411	192.0	120.0	0.127096
216.0	130.0	0.122620	253.0	140.0	0.153083	232.0	150.0	0.180119
213.0	160.0	0.224418	201.0	170.0	0.322562	198.0	180.0	0.440309
201.0	190.0	0.324668	210.0	200.0	0.233731	229.0	210.0	0.226290
223.0	220.0	0.217310	189.0	230.0	0.196733	198.0	240.0	0.233996
253.0	250.0	0.313331	241.0	260.0	0.313169	238.0	270.0	0.340107
241.0	280.0	0.263502	253.0	290.0	0.208870	274.0	300.0	0.209992
311.0	310.0	0.244351	268.0	320.0	0.249208	238.0	330.0	0.290837
219.0	340.0	0.358845	207.0	350.0	0.467145	204.0	360.0	0.593742

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 7 (CONT.) **

- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF ALL SOURCES COMBINED -

X COORDINATE RANGE (METERS)	Y COORDINATE AZIMUTH BEARING (DEGREES)	CONCENTRATION
400.00	360.00	0.787733
500.00	360.00	0.780699
300.00	360.00	0.728664
500.00	180.00	0.701344
400.00	180.00	0.690089
750.00	360.00	0.663718
750.00	180.00	0.616152
300.00	180.00	0.611987
204.00	360.00	0.593742
200.00	360.00	0.592434

```
****************************************** END OF ISCLT PROGRAM,     1 SOURCES PROCESSED ******************************************
```

```
**************************************************************************

               *** RUN TIME STATISTICS ***


BEGINNING HOUR,MINUTE,SECOND  - - - - - - - - : 13:24:17
BEGINNING MONTH,DAY,YEAR  - - - - - - - - - - : 10/18/90


ENDING HOUR,MINUTE,SECOND   - - - - - - - - - : 13:26:32
ENDING MONTH,DAY,YEAR   - - - - - - - - - - - : 10/18/90


TOTAL CPU SECONDS   - - - - - - - - - - - - - :          135.


**************************************************************************
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ISCLTK6L MODEL, A VERSION OF
ISCLT (VERSION 90008)
AN AIR QUALITY DISPERSION MODEL IN
SECTION 1. GUIDELINE MODELS.
IN UNAMAP (VERSION 6) JAN 1990.
SOURCE: FILE 7 ON UNAMAP MAGNETIC TAPE FROM NTIS.

CONVERTED BY :
KBN ENGINEERING AND APPLIED SCIENCES, INC.
GAINESVILLE, FLORIDA
(904)331-9000

CARD INPUT FILE IS	ER14LT84.I83
SUMMARY OUTPUT FILE IS	ER14LT84.083
TITLE OF RUN IS	1984 ENRON STATION 14 / 50 FT STACK 10-18-90

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                         - ISCLT INPUT DATA (CONT.) -

     NUMBER OF SOURCES =    1
     NUMBER OF X AXIS GRID SYSTEM POINTS =    7
     NUMBER OF Y AXIS GRID SYSTEM POINTS =   16
     NUMBER OF SPECIAL POINTS =   36
     NUMBER OF SEASONS =    1
     NUMBER OF WIND SPEED CLASSES =    6
     NUMBER OF STABILITY CLASSES =    6
     NUMBER OF WIND DIRECTION CLASSES =  16
     FILE NUMBER OF DATA FILE USED FOR REPORTS =    1
     THE PROGRAM IS RUN IN RURAL MODE
     CONCENTRATION (DEPOSITION) UNITS CONVERSION FACTOR =0.10000000E+07
     ACCELERATION OF GRAVITY (METERS/SEC**2) =  9.800
     HEIGHT OF MEASUREMENT OF WIND SPEED (METERS) =   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 )=    200.00,    300.00,    400.00,    500.00,    750.00,   1000.00,
        1250.00,
      RANGE X SPECIAL DISCRETE POINTS (METERS )=    207.00,    216.00,    238.00,    256.00,    213.00,    189.00,
         177.00,    168.00,    165.00,    168.00,    177.00,    192.00,    216.00,    253.00,    232.00,    213.00,
         201.00,    198.00,    201.00,    210.00,    229.00,    223.00,    189.00,    198.00,    253.00,    241.00,
         238.00,    241.00,    253.00,    274.00,    311.00,    268.00,    238.00,    219.00,    207.00,    204.00,
 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+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 (1.5000MPS)	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 (1.5000MPS)	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	0.00145199	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 (1.5000MPS)	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	0.00399998	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  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                        CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
STABILITY CATEGORY 10.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 20.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 30.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 40.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 50.200000E-010.200000E-010.200000E-010.200000E-010.200000E-010.200000E-01
STABILITY CATEGORY 60.350000E-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 10.700000E-010.700000E-010.700000E-010.700000E-010.700000E-010.700000E-01
STABILITY CATEGORY 20.700000E-010.700000E-010.700000E-010.700000E-010.700000E-010.700000E-01
STABILITY CATEGORY 30.100000E+000.100000E+000.100000E+000.100000E+000.100000E+000.100000E+00
STABILITY CATEGORY 40.150000E+000.150000E+000.150000E+000.150000E+000.150000E+000.150000E+00
STABILITY CATEGORY 50.350000E+000.350000E+000.350000E+000.350000E+000.350000E+000.350000E+00
STABILITY CATEGORY 60.550000E+000.550000E+000.550000E+000.550000E+000.550000E+000.550000E+00
      NOTE THAT BUILDING DIMENSIONS ON CARD GROUP 17 FOR SOURCE NO.     1 DO NOT MEET THE SCHULMAN-SCIRE CRITERIA.
      THEREFORE, DIRECTION SPECIFIC BUILDING DIMENSIONS WILL BE READ, BUT NOT USED BY THE MODEL.
```

- SOURCE INPUT DATA -

```
C T SOURCE SOURCE     X           Y       EMISSION  BASE /
A A NUMBER  TYPE  COORDINATE  COORDINATE   HEIGHT  ELEV- /              - SOURCE DETAILS DEPENDING ON TYPE -
R P                   (M)         (M)        (M)   ATION /
D E                                                 (M)  /
------------------------------------------------------------------------------------------------------------------------------
X       1  STACK       0.00        0.00   15.24    0.00 GAS EXIT TEMP (DEG K)= 561.00, GAS EXIT VEL. (M/SEC)= 49.61,
                                                        STACK DIAMETER (M)= 0.440, HEIGHT OF ASSO. BLDG. (M)=   9.69, WIDTH OF
                                                        ASSO. BLDG. (M)=  75.04, WAKE EFFECTS FLAG = 0
                                                             - SOURCE STRENGTHS ( GRAMS PER SEC                          ) -
                                                                   SEASON 1     SEASON 2     SEASON 3     SEASON 4
                                                                 1.33000E+00
```

WARNING - HW/HB > 5 FOR SOURCE 1 PROG. USES LATERAL VIRTUAL DIST. FOR UPPER BOUND OF CONCENTRATION (DEPOSITION). IF LOWER BOUND IS DESIRED SET WAKE EFFECTS FLAG (WAKE) = 1 AND RERUN

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 **

- GRID SYSTEM RECEPTORS -

- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	200.000	300.000	400.000	500.000	750.000	1000.000	1250.000
	- CONCENTRATION -						
360.000	0.618706	0.817761	0.900803	0.897775	0.763076	0.629419	0.521514
337.500	0.260608	0.360055	0.405512	0.408382	0.345481	0.280386	0.227881
315.000	0.172421	0.300495	0.363659	0.380609	0.338512	0.282147	0.232109
292.500	0.118190	0.216554	0.275152	0.300362	0.287759	0.251710	0.215183
270.000	0.178335	0.310915	0.385882	0.417076	0.401105	0.361285	0.320363
247.500	0.164253	0.252659	0.291498	0.298646	0.263991	0.222565	0.186772
225.000	0.151976	0.259167	0.312362	0.327968	0.295376	0.249317	0.209064
202.500	0.199690	0.282223	0.320828	0.327845	0.289631	0.241922	0.199938
180.000	0.373743	0.534806	0.607698	0.617200	0.539389	0.456041	0.388833
157.500	0.160202	0.254528	0.296264	0.305254	0.270940	0.233687	0.204743
135.000	0.091667	0.151658	0.178082	0.183746	0.164295	0.143396	0.127440
112.500	0.098682	0.172568	0.208073	0.217574	0.197831	0.174169	0.155182
90.000	0.111664	0.194235	0.223935	0.223422	0.183704	0.150737	0.128091
67.500	0.104930	0.167692	0.190793	0.191576	0.163706	0.139283	0.121812
45.000	0.124333	0.206973	0.246093	0.254578	0.223034	0.188619	0.162136
22.500	0.142705	0.208571	0.242933	0.251400	0.227910	0.199075	0.174071

- 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
207.0	10.0	0.403769	216.0	20.0	0.200193	238.0	30.0	0.159162
256.0	40.0	0.171602	213.0	50.0	0.128357	189.0	60.0	0.098801
177.0	70.0	0.087202	168.0	80.0	0.078666	165.0	90.0	0.078320
168.0	100.0	0.075749	177.0	110.0	0.080943	192.0	120.0	0.086587
216.0	130.0	0.102031	253.0	140.0	0.141865	232.0	150.0	0.163131
213.0	160.0	0.194378	201.0	170.0	0.270852	198.0	180.0	0.371001
201.0	190.0	0.288521	210.0	200.0	0.222640	229.0	210.0	0.204354
223.0	220.0	0.184070	189.0	230.0	0.139070	198.0	240.0	0.152103
253.0	250.0	0.216258	241.0	260.0	0.214406	238.0	270.0	0.234422
241.0	280.0	0.195569	253.0	290.0	0.178713	274.0	300.0	0.211079
311.0	310.0	0.285209	268.0	320.0	0.272511	238.0	330.0	0.265338
219.0	340.0	0.311253	207.0	350.0	0.455210	204.0	360.0	0.624138

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 (CONT.) **

- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF ALL SOURCES COMBINED -

X COORDINATE RANGE (METERS)	Y COORDINATE AZIMUTH BEARING (DEGREES)	CONCENTRATION
400.00	360.00	0.900803
500.00	360.00	0.897775
300.00	360.00	0.817761
750.00	360.00	0.763076
1000.00	360.00	0.629419
204.00	360.00	0.624138
200.00	360.00	0.618706
500.00	180.00	0.617200
400.00	180.00	0.607698
750.00	180.00	0.539389

```
******************************************** END OF ISCLT PROGRAM,     1 SOURCES PROCESSED ********************************************
```

```
****************************************************************************

                 *** RUN TIME STATISTICS ***


BEGINNING HOUR,MINUTE,SECOND  - - - - - - - : 13:26:33
BEGINNING MONTH,DAY,YEAR  - - - - - - - - - : 10/18/90


ENDING HOUR,MINUTE,SECOND   - - - - - - - - : 13:28:48
ENDING MONTH,DAY,YEAR   - - - - - - - - - - : 10/18/90


TOTAL CPU SECONDS   - - - - - - - - - - - - :         135.

****************************************************************************
```

ISCLTK6L MODEL, A VERSION OF
ISCLT (VERSION 90008)
AN AIR QUALITY DISPERSION MODEL IN
SECTION 1. GUIDELINE MODELS.
IN UNAMAP (VERSION 6) JAN 1990.
SOURCE: FILE 7 ON UNAMAP MAGNETIC TAPE FROM NTIS.

CONVERTED BY :
KBN ENGINEERING AND APPLIED SCIENCES, INC.
GAINESVILLE, FLORIDA
(904)331-9000

CARD INPUT FILE IS ER14LT85.I83
SUMMARY OUTPUT FILE IS ER14LT85.O83
TITLE OF RUN IS 1985 ENRON STATION 14 / 50 FT STACK 10-18-90

- 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, 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 )=     207.00,     216.00,     238.00,     256.00,     213.00,     189.00,
             177.00,     168.00,     165.00,     168.00,     177.00,     192.00,     216.00,     253.00,     232.00,     213.00,
             201.00,     198.00,     201.00,     210.00,     229.00,     223.00,     189.00,     198.00,     253.00,     241.00,
             238.00,     241.00,     253.00,     274.00,     311.00,     268.00,     238.00,     219.00,     207.00,     204.00,
   AZIMUTH BEARING Y AXIS GRID SYSTEM POINTS (DEGREES)=      22.50,      45.00,      67.50,      90.00,     112.50,     135.00,
             157.50,     180.00,     202.50,     225.00,     247.50,     270.00,     292.50,     315.00,     337.50,     360.00,
   AZIMUTH BEARING Y SPECIAL DISCRETE POINTS (DEGREES)=      10.00,      20.00,      30.00,      40.00,      50.00,      60.00,
              70.00,      80.00,      90.00,     100.00,     110.00,     120.00,     130.00,     140.00,     150.00,     160.00,
             170.00,     180.00,     190.00,     200.00,     210.00,     220.00,     230.00,     240.00,     250.00,     260.00,
             270.00,     280.00,     290.00,     300.00,     310.00,     320.00,     330.00,     340.00,     350.00,     360.00,
```

- AMBIENT AIR TEMPERATURE (DEGREES KELVIN) -

	STABILITY CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	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 (1.5000MPS)	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	0.00086099	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 (1.5000MPS)	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	0.00188499	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  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                      CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
STABILITY CATEGORY 10.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 20.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 30.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 40.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 50.200000E-010.200000E-010.200000E-010.200000E-010.200000E-010.200000E-01
STABILITY CATEGORY 60.350000E-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 10.700000E-010.700000E-010.700000E-010.700000E-010.700000E-010.700000E-01
STABILITY CATEGORY 20.700000E-010.700000E-010.700000E-010.700000E-010.700000E-010.700000E-01
STABILITY CATEGORY 30.100000E+000.100000E+000.100000E+000.100000E+000.100000E+000.100000E+00
STABILITY CATEGORY 40.150000E+000.150000E+000.150000E+000.150000E+000.150000E+000.150000E+00
STABILITY CATEGORY 50.350000E+000.350000E+000.350000E+000.350000E+000.350000E+000.350000E+00
STABILITY CATEGORY 60.550000E+000.550000E+000.550000E+000.550000E+000.550000E+000.550000E+00
      NOTE THAT BUILDING DIMENSIONS ON CARD GROUP 17 FOR SOURCE NO.     1 DO NOT MEET THE SCHULMAN-SCIRE CRITERIA.
      THEREFORE, DIRECTION SPECIFIC BUILDING DIMENSIONS WILL BE READ, BUT NOT USED BY THE MODEL.
```

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		1	STACK	0.00	0.00	15.24	0.00	GAS EXIT TEMP (DEG K)= 561.00, GAS EXIT VEL. (M/SEC)= 49.61, STACK DIAMETER (M)= 0.440, HEIGHT OF ASSO. BLDG. (M)= 9.69, WIDTH OF ASSO. BLDG. (M)= 75.04, WAKE EFFECTS FLAG = 0

- SOURCE STRENGTHS (GRAMS PER SEC) -

SEASON 1	SEASON 2	SEASON 3	SEASON 4
1.33000E+00			

WARNING - HW/HB > 5 FOR SOURCE 1 PROG. USES LATERAL VIRTUAL DIST. FOR UPPER BOUND OF CONCENTRATION (DEPOSITION). IF LOWER BOUND IS DESIRED SET WAKE EFFECTS FLAG (WAKE) = 1 AND RERUN

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 **

- GRID SYSTEM RECEPTORS -

- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	200.000	300.000	400.000	500.000	750.000	1000.000	1250.000
	- CONCENTRATION -						
360.000	0.473172	0.623983	0.709895	0.728217	0.645902	0.542483	0.452541
337.500	0.187378	0.273388	0.310211	0.313473	0.269216	0.221630	0.181661
315.000	0.136870	0.234996	0.281442	0.294257	0.265612	0.228339	0.194397
292.500	0.135692	0.238215	0.292196	0.313639	0.301904	0.271777	0.237876
270.000	0.258517	0.403517	0.471455	0.492418	0.459369	0.409482	0.359637
247.500	0.198294	0.338944	0.406007	0.423525	0.380861	0.324489	0.274412
225.000	0.172092	0.274037	0.308456	0.305864	0.257033	0.217885	0.187272
202.500	0.137323	0.222125	0.256541	0.260519	0.222345	0.182797	0.152089
180.000	0.347808	0.512710	0.590739	0.601528	0.519186	0.433197	0.365810
157.500	0.146944	0.230688	0.268721	0.277451	0.247768	0.213824	0.186233
135.000	0.115251	0.203895	0.243189	0.251799	0.224905	0.194609	0.170244
112.500	0.096945	0.169172	0.204315	0.214651	0.197182	0.173720	0.153421
90.000	0.091065	0.171144	0.210022	0.222819	0.206386	0.181006	0.158096
67.500	0.053717	0.106314	0.132003	0.141478	0.135646	0.123907	0.111962
45.000	0.080097	0.150353	0.191752	0.210453	0.204082	0.182510	0.161107
22.500	0.139626	0.219622	0.262243	0.277726	0.261754	0.232457	0.203618

- 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
207.0	10.0	0.321624	216.0	20.0	0.186206	238.0	30.0	0.146908
256.0	40.0	0.132296	213.0	50.0	0.081979	189.0	60.0	0.051848
177.0	70.0	0.041012	168.0	80.0	0.047572	165.0	90.0	0.061139
168.0	100.0	0.065110	177.0	110.0	0.077160	192.0	120.0	0.091239
216.0	130.0	0.124630	253.0	140.0	0.169463	232.0	150.0	0.161969
213.0	160.0	0.178084	201.0	170.0	0.251109	198.0	180.0	0.345014
201.0	190.0	0.246694	210.0	200.0	0.167215	229.0	210.0	0.173856
223.0	220.0	0.188168	189.0	230.0	0.158391	198.0	240.0	0.179213
253.0	250.0	0.282781	241.0	260.0	0.286361	238.0	270.0	0.321873
241.0	280.0	0.252658	253.0	290.0	0.207301	274.0	300.0	0.207830
311.0	310.0	0.237255	268.0	320.0	0.212120	238.0	330.0	0.200994
219.0	340.0	0.230767	207.0	350.0	0.342370	204.0	360.0	0.475829

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 (CONT.) **

- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF ALL SOURCES COMBINED -

X COORDINATE RANGE (METERS)	Y COORDINATE AZIMUTH BEARING (DEGREES)	CONCENTRATION
500.00	360.00	0.728217
400.00	360.00	0.709895
750.00	360.00	0.645902
300.00	360.00	0.623983
500.00	180.00	0.601528
400.00	180.00	0.590739
1000.00	360.00	0.542483
750.00	180.00	0.519186
300.00	180.00	0.512710
500.00	270.00	0.492418

** END OF ISCLT PROGRAM,   1 SOURCES PROCESSED **

ISCLTK6L MODEL, A VERSION OF
ISCLT (VERSION 90008)
AN AIR QUALITY DISPERSION MODEL IN
SECTION 1. GUIDELINE MODELS.
IN UNAMAP (VERSION 6) JAN 1990.
SOURCE: FILE 7 ON UNAMAP MAGNETIC TAPE FROM NTIS.

CONVERTED BY :
KBN ENGINEERING AND APPLIED SCIENCES, INC.
GAINESVILLE, FLORIDA
(904)331-9000

CARD INPUT FILE IS	ER14LT86.183	
SUMMARY OUTPUT FILE IS	ER14LT86.083	
TITLE OF RUN IS	1986 ENRON STATION 14 / 50 FT STACK	10-18-90

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                              - ISCLT INPUT DATA (CONT.) -

       NUMBER OF SOURCES =    1
       NUMBER OF X AXIS GRID SYSTEM POINTS =    7
       NUMBER OF Y AXIS GRID SYSTEM POINTS =   16
       NUMBER OF SPECIAL POINTS =   36
       NUMBER OF SEASONS =    1
       NUMBER OF WIND SPEED CLASSES =   6
       NUMBER OF STABILITY CLASSES =   6
       NUMBER OF WIND DIRECTION CLASSES =  16
       FILE NUMBER OF DATA FILE USED FOR REPORTS =    1
       THE PROGRAM IS RUN IN RURAL MODE
       CONCENTRATION (DEPOSITION) UNITS CONVERSION FACTOR =0.10000000E+07
       ACCELERATION OF GRAVITY (METERS/SEC**2) =  9.800
       HEIGHT OF MEASUREMENT OF WIND SPEED (METERS) =   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 )=     200.00,     300.00,     400.00,     500.00,     750.00,    1000.00,
          1250.00,
        RANGE X SPECIAL DISCRETE POINTS (METERS )=     207.00,     216.00,     238.00,     256.00,     213.00,     189.00,
           177.00,     168.00,     165.00,     168.00,     177.00,     192.00,     216.00,     253.00,     232.00,     213.00,
           201.00,     198.00,     201.00,     210.00,     229.00,     223.00,     189.00,     198.00,     253.00,     241.00,
           238.00,     241.00,     253.00,     274.00,     311.00,     268.00,     238.00,     219.00,     207.00,     204.00,
 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+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
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- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00076000	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  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                     CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
STABILITY CATEGORY 10.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 20.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 30.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 40.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 50.200000E-010.200000E-010.200000E-010.200000E-010.200000E-010.200000E-01
STABILITY CATEGORY 60.350000E-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 10.700000E-010.700000E-010.700000E-010.700000E-010.700000E-010.700000E-01
STABILITY CATEGORY 20.700000E-010.700000E-010.700000E-010.700000E-010.700000E-010.700000E-01
STABILITY CATEGORY 30.100000E+000.100000E+000.100000E+000.100000E+000.100000E+000.100000E+00
STABILITY CATEGORY 40.150000E+000.150000E+000.150000E+000.150000E+000.150000E+000.150000E+00
STABILITY CATEGORY 50.350000E+000.350000E+000.350000E+000.350000E+000.350000E+000.350000E+00
STABILITY CATEGORY 60.550000E+000.550000E+000.550000E+000.550000E+000.550000E+000.550000E+00
       NOTE THAT BUILDING DIMENSIONS ON CARD GROUP 17 FOR SOURCE NO.      1 DO NOT MEET THE SCHULMAN-SCIRE CRITERIA.
       THEREFORE, DIRECTION SPECIFIC BUILDING DIMENSIONS WILL BE READ, BUT NOT USED BY THE MODEL.
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- SOURCE INPUT DATA -

```
C T SOURCE SOURCE     X           Y       EMISSION  BASE /
A A NUMBER  TYPE  COORDINATE  COORDINATE  HEIGHT   ELEV- /            - SOURCE DETAILS DEPENDING ON TYPE -
R P                  (M)         (M)        (M)    ATION /
D E                                                  (M)  /
-----------------------------------------------------------------------------------------------------------------------------
X       1  STACK       0.00        0.00  15.24     0.00 GAS EXIT TEMP (DEG K)= 561.00, GAS EXIT VEL. (M/SEC)= 49.61,
                                                        STACK DIAMETER (M)= 0.440, HEIGHT OF ASSO. BLDG. (M)=   9.69, WIDTH OF
                                                        ASSO. BLDG. (M)=  75.04, WAKE EFFECTS FLAG = 0
                                                              - SOURCE STRENGTHS ( GRAMS PER SEC                            ) -
                                                                    SEASON 1     SEASON 2     SEASON 3     SEASON 4
                                                                   1.33000E+00
```

WARNING - HW/HB > 5 FOR SOURCE   1 PROG. USES LATERAL VIRTUAL DIST. FOR UPPER BOUND OF CONCENTRATION (DEPOSITION). IF LOWER BOUND IS DESIRED SET WAKE EFFECTS FLAG (WAKE) = 1 AND RERUN

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 **

- GRID SYSTEM RECEPTORS -

- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	200.000	300.000	400.000	500.000	750.000	1000.000	1250.000
	- CONCENTRATION -						
360.000	0.352391	0.478408	0.531107	0.534572	0.468933	0.400774	0.341353
337.500	0.203474	0.317595	0.368490	0.378035	0.332676	0.280084	0.234948
315.000	0.178156	0.308504	0.362444	0.372452	0.320632	0.260520	0.211894
292.500	0.125246	0.224395	0.266914	0.275308	0.240266	0.201271	0.169067
270.000	0.161983	0.296427	0.353875	0.365676	0.318655	0.267655	0.226690
247.500	0.155667	0.275029	0.326555	0.337468	0.295783	0.247860	0.207709
225.000	0.187494	0.320676	0.369025	0.373331	0.320199	0.265694	0.219842
202.500	0.222553	0.405190	0.498539	0.533791	0.503651	0.436421	0.367040
180.000	0.464789	0.809941	0.959154	0.994553	0.903808	0.793061	0.692423
157.500	0.133106	0.231020	0.267567	0.271601	0.233373	0.199010	0.173370
135.000	0.110162	0.187590	0.213859	0.215465	0.184386	0.156734	0.137004
112.500	0.069096	0.134446	0.166860	0.178569	0.164561	0.143527	0.127010
90.000	0.081438	0.143519	0.161191	0.159317	0.132219	0.111673	0.098201
67.500	0.047988	0.098552	0.118898	0.122186	0.103861	0.086457	0.073565
45.000	0.091690	0.165470	0.197929	0.205067	0.179273	0.150570	0.128209
22.500	0.109807	0.191621	0.228785	0.238222	0.212766	0.181357	0.155515

- 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
207.0	10.0	0.243593	216.0	20.0	0.149509	238.0	30.0	0.134117
256.0	40.0	0.138940	213.0	50.0	0.091257	189.0	60.0	0.050374
177.0	70.0	0.033881	168.0	80.0	0.038163	165.0	90.0	0.049945
168.0	100.0	0.046084	177.0	110.0	0.050562	192.0	120.0	0.070850
216.0	130.0	0.114757	253.0	140.0	0.161603	232.0	150.0	0.157404
213.0	160.0	0.182914	201.0	170.0	0.305207	198.0	180.0	0.456341
201.0	190.0	0.342610	210.0	200.0	0.265177	229.0	210.0	0.259922
223.0	220.0	0.229908	189.0	230.0	0.156617	198.0	240.0	0.154690
253.0	250.0	0.225767	241.0	260.0	0.212109	238.0	270.0	0.224337
241.0	280.0	0.195120	253.0	290.0	0.187834	274.0	300.0	0.221384
311.0	310.0	0.292531	268.0	320.0	0.270740	238.0	330.0	0.237899
219.0	340.0	0.239847	207.0	350.0	0.284475	204.0	360.0	0.356596

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 (CONT.) **

- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF ALL SOURCES COMBINED -

X COORDINATE RANGE (METERS)	Y COORDINATE AZIMUTH BEARING (DEGREES)	CONCENTRATION
500.00	180.00	0.994553
400.00	180.00	0.959154
750.00	180.00	0.903808
300.00	180.00	0.809941
1000.00	180.00	0.793061
1250.00	180.00	0.692423
500.00	360.00	0.534572
500.00	202.50	0.533791
400.00	360.00	0.531107
750.00	202.50	0.503651

*** END OF ISCLT PROGRAM,   1 SOURCES PROCESSED ***

```
*******************************************************************************

                  *** RUN TIME STATISTICS ***

BEGINNING HOUR,MINUTE,SECOND  - - - - - - - - : 13:31:07
BEGINNING MONTH,DAY,YEAR  - - - - - - - - - - : 10/18/90

ENDING HOUR,MINUTE,SECOND  - - - - - - - - - : 13:33:20
ENDING MONTH,DAY,YEAR  - - - - - - - - - - - : 10/18/90

TOTAL CPU SECONDS  - - - - - - - - - - - - - :          133.

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ISCLTK6L MODEL, A VERSION OF
ISCLT (VERSION 90008)
AN AIR QUALITY DISPERSION MODEL IN
SECTION 1. GUIDELINE MODELS.
IN UNAMAP (VERSION 6) JAN 1990.
SOURCE: FILE 7 ON UNAMAP MAGNETIC TAPE FROM NTIS.

CONVERTED BY :
KBN ENGINEERING AND APPLIED SCIENCES, INC.
GAINESVILLE, FLORIDA
(904)331-9000

CARD INPUT FILE IS ER14RF86.I83
SUMMARY OUTPUT FILE IS ER14RF86.O83
TITLE OF RUN IS 1986 ENRON STATION 14 / 50 FT STACK / REFINEMENT 10-18-90

- ISCLT INPUT DATA -

NUMBER OF SOURCES = 1
NUMBER OF X AXIS GRID SYSTEM POINTS = 6
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)= 450.00, 500.00, 550.00, 600.00, 650.00, 700.00,

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 CATEGORY 1	STABILITY CATEGORY 2	STABILITY CATEGORY 3	STABILITY CATEGORY 4	STABILITY CATEGORY 5	STABILITY CATEGORY 6
SEASON 1	299.0000	299.0000	299.0000	293.0000	287.0000	287.0000

- MIXING LAYER HEIGHT (METERS) -

SEASON 1

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04	0.222000E+04
STABILITY CATEGORY 2	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 3	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 4	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04	0.148000E+04
STABILITY CATEGORY 5	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05
STABILITY CATEGORY 6	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05	0.100000E+05

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (1.5000MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
0.000	0.00076000	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  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED  WIND SPEED
                          CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
STABILITY CATEGORY 10.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 20.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 30.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 40.000000E+000.000000E+000.000000E+000.000000E+000.000000E+000.000000E+00
STABILITY CATEGORY 50.200000E-010.200000E-010.200000E-010.200000E-010.200000E-010.200000E-01
STABILITY CATEGORY 60.350000E-010.350000E-010.350000E-010.350000E-010.350000E-010.350000E-01
```

- WIND PROFILE POWER LAW EXPONENTS -

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                          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 10.700000E-010.700000E-010.700000E-010.700000E-010.700000E-010.700000E-01
STABILITY CATEGORY 20.700000E-010.700000E-010.700000E-010.700000E-010.700000E-010.700000E-01
STABILITY CATEGORY 30.100000E+000.100000E+000.100000E+000.100000E+000.100000E+000.100000E+00
STABILITY CATEGORY 40.150000E+000.150000E+000.150000E+000.150000E+000.150000E+000.150000E+00
STABILITY CATEGORY 50.350000E+000.350000E+000.350000E+000.350000E+000.350000E+000.350000E+00
STABILITY CATEGORY 60.550000E+000.550000E+000.550000E+000.550000E+000.550000E+000.550000E+00
       NOTE THAT BUILDING DIMENSIONS ON CARD GROUP 17 FOR SOURCE NO.     1 DO NOT MEET THE SCHULMAN-SCIRE CRITERIA.
       THEREFORE, DIRECTION SPECIFIC BUILDING DIMENSIONS WILL BE READ, BUT NOT USED BY THE MODEL.
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                                         - SOURCE INPUT DATA -

C T SOURCE SOURCE     X           Y        EMISSION  BASE /
A A NUMBER  TYPE  COORDINATE  COORDINATE   HEIGHT   ELEV- /                 - SOURCE DETAILS DEPENDING ON TYPE -
R P                  (M)         (M)         (M)    ATION /
D E                                                  (M)  /
---------------------------------------------------------------------------------------------------------------------------
X        1  STACK       0.00        0.00  15.24    0.00 GAS EXIT TEMP (DEG K)= 561.00, GAS EXIT VEL. (M/SEC)= 49.61,
                                                        STACK DIAMETER (M)= 0.440, HEIGHT OF ASSO. BLDG. (M)=   9.69, WIDTH OF
                                                        ASSO. BLDG. (M)=  75.04, WAKE EFFECTS FLAG = 0
                                                             - SOURCE STRENGTHS ( GRAMS PER SEC                          ) -
                                                                  SEASON 1     SEASON 2     SEASON 3     SEASON 4
                                                                 1.33000E+00

WARNING - HW/HB > 5 FOR SOURCE     1 PROG. USES LATERAL VIRTUAL DIST. FOR UPPER BOUND OF CONCENTRATION (DEPOSITION). IF LOWER
BOUND IS DESIRED SET WAKE EFFECTS FLAG (WAKE) = 1 AND RERUN
```

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 **

- GRID SYSTEM RECEPTORS -

- X AXIS (RANGE , METERS) -

Y AXIS (AZIMUTH BEARING, DEGREES)	450.000	500.000	550.000	600.000	650.000	700.000
	- CONCENTRATION -					
188.000	0.806927	0.817538	0.815243	0.805284	0.790876	0.772855
186.000	0.851089	0.860921	0.857388	0.846078	0.830326	0.810977
184.000	0.895967	0.904952	0.900103	0.887384	0.870224	0.849494
182.000	0.941420	0.949530	0.943319	0.929131	0.910515	0.888407
180.000	0.987317	0.994553	0.986944	0.971252	0.951140	0.927492
178.000	0.921469	0.928318	0.921240	0.906527	0.887654	0.865505
176.000	0.855249	0.861756	0.855238	0.841515	0.823899	0.803119
174.000	0.788902	0.795074	0.789108	0.776382	0.760025	0.740691
172.000	0.722697	0.728498	0.723057	0.711303	0.696195	0.678303

- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF ALL SOURCES COMBINED -

X COORDINATE RANGE (METERS)	Y COORDINATE AZIMUTH BEARING (DEGREES)	CONCENTRATION
500.00	180.00	0.994553
450.00	180.00	0.987317
550.00	180.00	0.986944
600.00	180.00	0.971252
650.00	180.00	0.951140
500.00	182.00	0.949530
550.00	182.00	0.943319
450.00	182.00	0.941420
600.00	182.00	0.929131
500.00	178.00	0.928318

** END OF ISCLT PROGRAM,   1 SOURCES PROCESSED **

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              *** RUN TIME STATISTICS ***


BEGINNING HOUR,MINUTE,SECOND  - - - - - - - - : 13:28:49
BEGINNING MONTH,DAY,YEAR  - - - - - - - - - - : 10/18/90


ENDING HOUR,MINUTE,SECOND   - - - - - - - - - : 13:31:06
ENDING MONTH,DAY,YEAR   - - - - - - - - - - - : 10/18/90


TOTAL CPU SECONDS   - - - - - - - - - - - - - :         137.


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