TEST REPORT
on
EXHAUST EMISSIONS
from a
COOPER BESSEMER 8W330C2 COMPRESSOR ENGINE
at
FLORIDA GAS TRANSMISSION'S
COMPRESSOR STATION NO. 15
PERRY, TAYLOR COUNTY, FLORIDA

Prepared For

FLORIDA GAS TRANSMISSION COMPANY

April 1992

Prepared by

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INTRODUCTION

One Cooper Bessemer 8W330-C2 compressor engine was tested to determine the quantity of emissions released into the atmosphere. The tests were conducted on March 20, 1992 at Compressor Station No. 15 located near Perry, in Taylor 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 62-189439.

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

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

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

Florida Gas Transmission Co. | Cubix Corporation

Table 1
Background Data

Source Owner/Operator:	**Florida Gas Transmission Co.** 601 South Lake Destiny Drive Maitland, Florida 32751 (407) 875-5816 TEL (407) 875-5896 FAX Attn: Allan Weatherford
Testing Organization	**Cubix Corporation** 9225 Lockhart Hwy Austin, Texas 78747 (512) 243-0202 TEL (512) 243-0222 FAX Attn: Lowell Faulkner
Test Participants:	**Florida Gas Transmission Co.** Allan Weatherford Fred Griffin **Cooper Bessemer** Carl McCluney **Cubix Corporation** Norman Franco Tony Sacre
Test Date:	March 20, 1992
Location:	near Perry in Taylor 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 62-189439

<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 8W330-C2 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 20, 1992 at Compressor Station No. 15 located near Perry, in Taylor 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 measured fuel flow.

The average emissions over the three test runs for NOx were found to be 9.2 lbs/hr, 40.4 tons/yr, and 1.05 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 8.2 lbs/hr, 35.8 tons/yr, and 0.93 g/hp-hr and are limited by the permit to 22.0 lbs/hr, 96.6 tons/yr, and 2.5 g/hp-hr. The tons/yr emission rates are based on 8760 hrs/year operation of the engine.

The total sulfur content of the fuel was determined via laboratory analysis by Southern Petroleum Labs of Houston, Texas. The result of that analysis is contained in Appendix H and show that the fuel contained 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 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 <0.0024 lbs/hr or <0.0103 tons/yr. The permit limits for SO_2 mass emissions are 0.75 lbs/hr and 3.3 tons/yr.

Nonmethane hydrocarbon (i.e. VOC) concentrations were measured as required by the permit using EPA Method 25. Table 2 contains the results of those measurements. The average VOC emissions using Method 25 over all three test runs were 18.8 lbs/hr, 82.3 tons/yr, and 2.14 g/hp-hr. The Method 25 analyses contained in Appendix A note that a laboratory leak could have caused an erroneously high concentration to be measured during test run C-1. Excluding the results of C-1, the average VOC emissions using Method 25 were 8.7 lbs/hr (38.1 tons/yr and 0.99 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 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 2.43 lbs/hr (10.6 tons/yr and 0.28 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 as well as carbon balance agreed with the pitot tube measurements within 5%, averaged over the three test runs.

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

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

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

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

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

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

TABLE 2
SUMMARY OF RESULTS

Operator/Plant	Florida Gas Perry Compressor Station
Location	Taylor County, Florida
Source	Cooper-Bessamer 8W330-C2
Technicians	TS,NF

Test Run No.	**C-1**	**C-2**	**C-3**
Date	3/20/92	3/20/92	3/20/92
Start Time	08:45	09:55	11:13
Stop Time	09:45	10:55	12:13
Engine/Compressor Operation			
Engine Speed (rpm)	328	328	328
Ignition Timing (°BTDC)	3	3	3
Air Manifold Pressure (psig)	12	12	12
Air Manifold Temperature (°F)	112	111	111
Fuel Flow (SCFH)	28025	28130	27990
Fuel Manifold Pressure (psig)	55	56	56
Pre-Combustion Chamber Pressure (psig)	45.5	45.5	45.5
Loading Step (pockets open out of 12 total)	6	6	6
Suction Pressure (psig)	690	691	697
Suction Temperature (°F)	63	63	63
Discharge Pressure (psig)	910	912	910
Discharge Temperature (°F)	103	103	103
Engine Load (BHP)	3980	4004	3992
Torque (%)	99.8	100	98.8
Turbo Exhaust Temperature (°F)	510	510	510
Ambient Conditions			
Atmospheric Pressure (in. Hg)	29.67	29.67	29.67
Temperature (°F) : Dry bulb	58	63	63
(°F) Wet bulb	52	57	56
Humidity (lb/lb air)	0.0068	0.0085	0.0079
Measured Emissions			
NOx (ppmv)	72.0	82.0	74.0
CO (ppmv)	110	110	112.5
O2 via EPA Method 3 (vol %)	16.0	16.0	16.0
CO2 via EPA Method 3 (vol %)	3.0	3.0	3.0
VOC via EPA Method 25 (ppmv)	962.0	194.3	211.0
SO2 in fuel (grains/100 DSCF)	<0.059	<0.059	<0.059
Stack Volumetric Flow Rates			
via Pitot Tube (SCFH, dry)	9.76E+05	1.02E+06	1.04E+06
Calculated Emission Rates (via pitot tube)			
NOx (lbs/hr)	8.39	10.0	9.22
CO (lbs/hr)	7.80	8.18	8.53
VOC (lbs/hr)	39.0	8.25	9.14
SO2 (lbs/hr)	<0.0024	<0.0024	<0.0024
NOx (tons/yr)	36.8	43.9	40.4
CO (tons/yr)	34.2	35.8	37.4
VOC (tons/yr)	170.8	36.1	40.0
SO2 (tons/yr)	<0.0103	<0.0104	<0.0103
NOx (g/hp-hr)	0.96	1.14	1.05
CO (g/hp/hr)	0.89	0.93	0.97
VOC (g/hp-hr)	4.45	0.94	1.04

PROCESS DESCRIPTION

Florida Gas Transmission Co. owns and operates Compressor Station No. 15 located near Perry, 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 8W330-C2 compressor engine bearing the serial number of 49116. The engine is rated at 4000 BHP at 330 rpm. 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 34" 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 6 diameters downstream and 1.5 diameters upstream of the nearest flow disturbances.

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

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

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

Means, in addition to EPA Methods 1-4, were also employed to obtain the stack gas flow rate. The F-factor calculations of EPA Method 19 provided results that were less than 5% higher than those obtained by the pitot tube measurement. AGA's carbon balance technique yielded results approximately 5% lower 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 as well as to present the worst case scenario (i.e. the pitot tube values were generally slightly higher than the stoichiometric results). 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, 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.

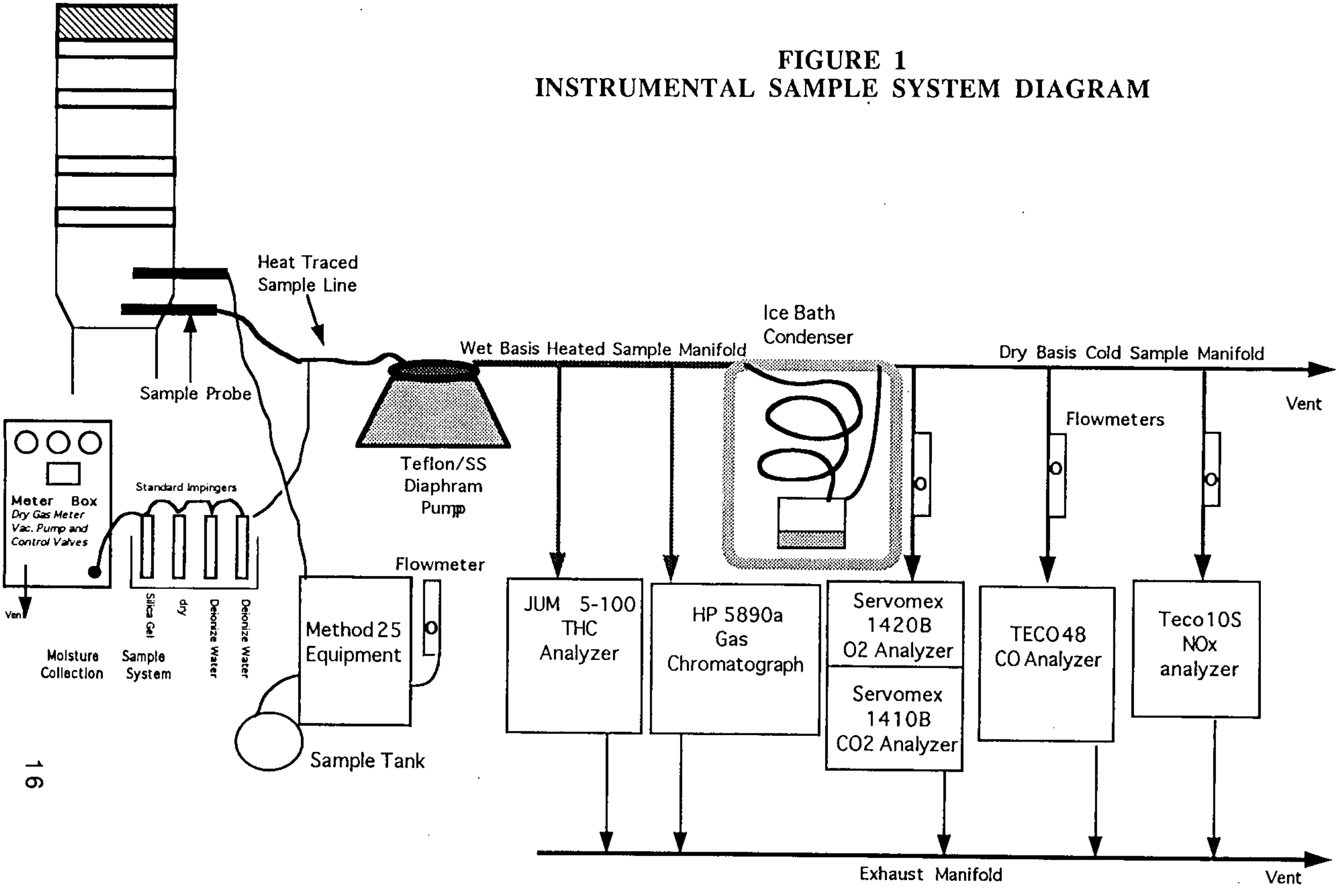
During the tests, the engine and compressor operational data was collected by Florida Gas personnel. Key operational data collected include compressor discharge pressures, compressor suction pressures, engine manifold pressure, engine speed, timing, and horsepower. Florida Gas also provided a recent 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

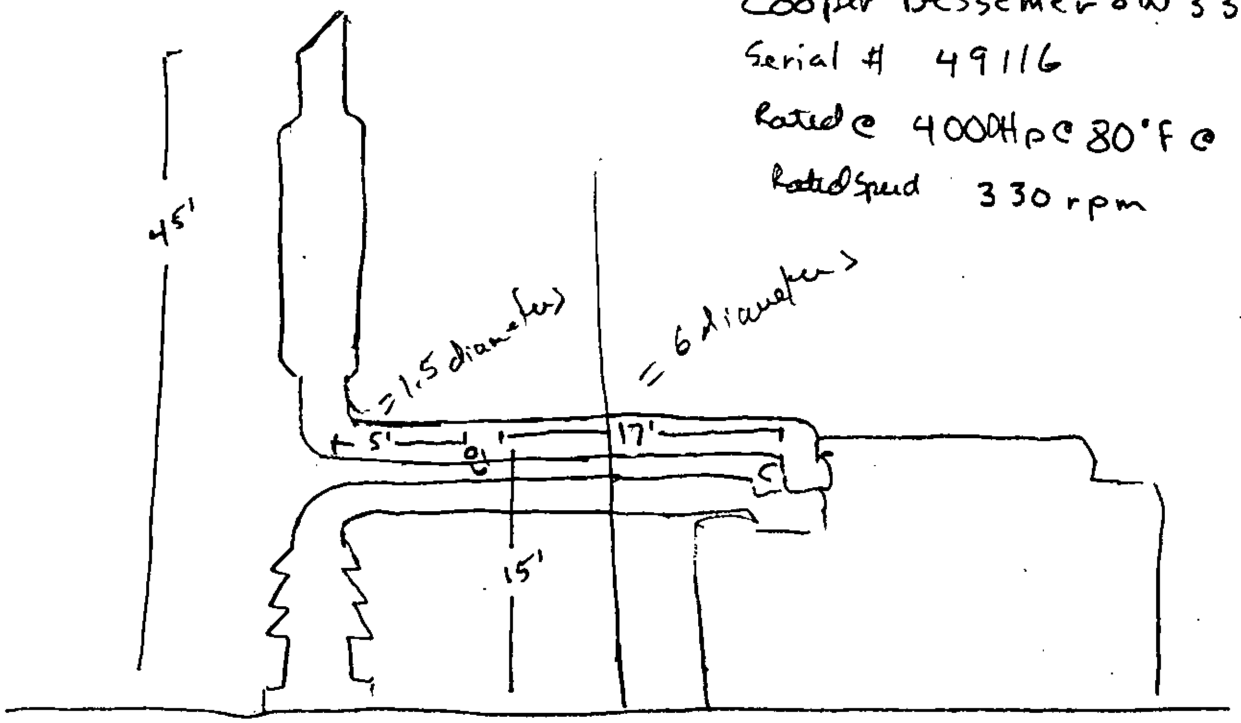
Circular Stack Sampling Traverse Point Layout
(EPA Method 1)

Date: 3/19/92
Plant: Perry
Source: Cooper
Technician(s) NF, TS

Port + Stack ID: 46 in.
Port Extension 12 in.
Stack ID: 34 in.
Stack Area 6.31 ft^2
Total Req'd Traverse Pts. 16
No. of Traverse Pts. 8 /diam.
No. of Traverse Pts. 8 /port

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

Cooper Bessemer 8W330C2
Serial # 49116
Rated @ 4000Hp @ 80°F @ 50'
Rated Speed 330 rpm



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	11.088
2	25.0	14.6	10.5	8.2	13.57
3	75.0	29.6	19.4	11.8	16.594
4	93.3	70.4	32.3	17.7	20.982
5		85.4	67.7	25.0	33.018
6		95.6	80.6	35.6	37.404
7			89.5	64.4	40.430
8			96.8	75.0	42.912
9				82.3	
10				88.2	
11				93.3	
12				97.9	

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3/20/92
Plant/Operator: FGT/Perry
Source: Cooper Eng.
Technicians: NF TS
Atm. Pres. 29.67 in.Hg(Pb)
Test Run # C-1

Dry Gas Meter ID: Anderson
Dry Gas Meter Factor: 0.9904 (Kd)
Pitot Tube #/Type: 107 S-type
Pitot Tube Factor: 0.84 (Kp)
Static Pres. − 0.70 in.H2O(Pg)
Average Stack Temp. 526 °F(Ts)

Pre-test Leak check OK	0.000 17.0	ft.3/min at in. Hg Vacuum
Post-test Leak check OK	0.000 16.5	ft.3/min at in. Hg Vacuum

Impinger #	Contents	Initial Weight	Final Weight
1	d H_2O	695.7	723.4
2	d H_2O	548.8	545.2
3	MT	491.9	488.9
4	Si Gel	752.1	754.3
5			
6			
Totals	X	2488.5	2511.8

Moisture Train

	Initial	Final
Time:	8:45	938
Meter Reading (ft3 or L)	656.795	678.805
Meter Temp. (°F)	70	102
Sample Box #	Tr 7 Run 6 / 5a	

O2 %	16.0
CO2 %	3.0

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	ΔP (" H2O)	°F	ß	ΔP (" H2O)	°F	ß
1	1.2			1.4		
2	1.4			1.4		
3	1.3			1.5		
4	1.1			1.6		
5	1.2			1.4		
6	0.9			1.2		
7	0.85			1.0		
8	1.0			1.1		
9						
10						
11						
12						

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3/20/92
Plant/Operator: FGT/Perry
Source: Cooper Eng 1504
Technicians: NF TS
Atm. Pres. 29.07 in.Hg(Pb)
Test Run # 6-2

Dry Gas Meter ID: Anderson
Dry Gas Meter Factor: 0.9904 (Kd)
Pitot Tube #/Type: 167 S-type
Pitot Tube Factor: 0.84 (Kp)
Static Pres. -0.74 in.H2O(Pg)
Average Stack Temp. 531 °F(Ts)

Pre-test Leak check OK	0.000 20.0	ft.3/min at in. Hg Vacuum
Post-test Leak check OK	0.000 16.0	ft.3/min at in. Hg Vacuum

Impinger #	Contents	Initial Weight	Final Weight
1	H_2O	723.4	731.2
2	H_2O	545.2	548.2
3	MT	488.9	490.0
4	S. Gel	751.3	764.6
5			
6			
Totals	X	2511.8	2534

Moisture Train

	Initial	Final
Time:	9:55	10:42
Meter Reading (ft3 or L)	678.892	700.062
Meter Temp. (°F)	84	105
Sample Box #	Tr 7 Bcm	

Orsat

O2 %	16.0
CO2 %	3.0

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	ΔP (" H2O)	°F	ß	ΔP (" H2O)	°F	ß
1	1.3			1.4		
2	1.4			1.4		
3	1.5			1.6		
4	1.5			1.5		
5	1.3			1.4		
6	1.2			1.3		
7	1.2			1.2		
8	1.2			1.1		
9						
10						
11						
12						

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3-20-92
Plant/Operator: Florida Gas/Perry St
Source: Cooper Bessamer 1500
Technicians: NFTS
Atm. Pres. 29.97 in.Hg(Pb)
Test Run # C-3

Dry Gas Meter ID: Issur
Dry Gas Meter Factor: 0.9901 (Kd)
Pitot Tube #/Type: S-Type
Pitot Tube Factor: 0.84 (Kp)
Static Pres. -.77 in.H2O(Pg)
Average Stack Temp. 509 °F(Ts)

Pre-test Leak check OK	0.000 ft.3/min at 15.0 in. Hg Vacuum	Impinger #	Contents	Initial Weight	Final Weight
		1	H_2O	589.0	599.2
Post-test Leak check OK	0.000 ft.3/min at 15.5 in. Hg Vacuum	2	H_2O	548.2	550.3
		3	MT	490.0	493.8
		4	S Gel	764.6	770.1
		5			
		6			
		Totals		2391.8	2413.4

Moisture Train

	Initial	Final
Time:	11:15	12:02
Meter Reading (ft3 or L)	700.143	722.646
Meter Temp. (°F)	88	121
Sample Box #	4 + 7 Box	

Orsat

O2 %	16.0
CO2 %	3.0

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	ΔP (" H2O)	°F	ß	ΔP (" H2O)	°F	ß
1	1.2			1.5		
2	1.4			1.4		
3	1.6			1.5		
4	1.6			1.6		
5	1.4			1.4		
6	1.1			1.4		
7	1.1			1.2		
8	1.0			1.0		
9						
10						
11						
12						

Perry Compressor Station--Moisture, Molecular Weight. Stack Flow Rate

Operator/Plant Florida Gas Perry Compressor Station
Location Taylor County, Florida
Source Cooper-Bessamer 8W330-C2
Technicians 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 (%)	16.00	16.00	16.00
Beginning Meter Reading (ft3)	656.795	678.892	700.143
Ending Meter Reading (ft3)	678.805	700.062	722.646
Beginning Impinger Wt (g)	2488.5	2511.8	2391.8
Ending Impinger Wt. (g)	2511.8	2534	2413.4
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	70	84	110
Dry Gas Meter Temperature (°F end)	102	105	120
Atmospheric Pressure (in Hg, abs.)	29.67	29.64	29.67
Stack Gas Moisture (% volume)	5.00	5.03	4.78
Dry Gas Fraction	0.950	0.950	0.952
Stack Gas Molecular Wt. (lbs/lb-mole)	28.56	28.56	28.59
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	1.2	1.3	1.2
ΔP #2	1.4	1.4	1.4
ΔP #3	1.3	1.5	1.6
ΔP #4	1.1	1.5	1.6
ΔP #5	1.2	1.3	1.4
ΔP #6	0.9	1.2	1.1
ΔP #7	0.85	1.2	1.1
ΔP #8	1.0	1.2	1
ΔP #9	1.40	1.40	1.50
ΔP #10	1.40	1.40	1.40
ΔP #11	1.50	1.60	1.50
ΔP #12	1.60	1.50	1.60
ΔP #13	1.40	1.40	1.40
ΔP #14	1.20	1.30	1.40
ΔP #15	1.00	1.20	1.40
ΔP #16	1.10	1.10	1.20
Sum of Square Root of ΔP's	17.6	18.5	18.6
Number of Traverse Points	16	16	16
Average Square Root of ΔP's	1.10	1.16	1.16
Average Temperature (°F)	526	531	509
Static Pressure (in. H2O)	-0.7	-0.74	-0.77
Stack Diameter (in.)	34	34	34
Stack Area (ft2)	6.31	6.31	6.31
Stack Velocity (ft/min)	5121	5401	5367
Stack Flow,wet (ACFM)	32288	34056	33841
Stack Flow,dry (SCFH)	9.76E+05	1.02E+06	1.04E+06

Testing By Cubix Corporation, Austin, Texas

Volatile Organic Carbon by Method 25

Client: FGT
Plant: Perry Fl
Operator: LF, RF, TJ
Run Number: C-1
Tank Number: 4174
Sampling Train ID#: 6928
Side: Left / Right: 1
Start Time: 830

Project #:
Sample Location: Centroid
Date: 3/26/92
Sample ID: X-10
Trap Number: X-10
% CO2: 3.0
% H2O: 5.0
Stop Time: 930

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	28.2	27.9	29.67	62
Post Test	2.5	3.2	29.67	62

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

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

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
830	27.9	40	265	255	
835	25.4	40	266	255	
840	23.5	40	270	256	
845	21.0	40	268	256	
850	19.5	40	267	256	
855	17.1	40.	267	256	
900	15.0	40	267	258	
905	13.1	40	268	258	
910	11.7	40	268	258	
915	9.6	40	265	258	
920	7.3	40	265	259	
925	5.4	40	265	259	
930	3.2	40	264	260	

Volatile Organic Carbon by Method 25

Client:	E & J	Project #:	
Plant:	Perry, FL	Sample Location:	Centroid
Operator:	LF, NFB	Date:	3/20/92
Run Number:	C-2	Sample ID:	
Tank Number:	4791	Trap Number:	X-13
Sampling Train ID#:	EX25	% CO2:	13.0
Side: Left / Right:	#1	% H2O:	~5.0
Start Time:	1000	Stop Time:	1100

Pressure Readings	Tank Vacuum Manometer mm Hg / in Hg	Tank Vacuum Gauge mm Hg / in Hg	Barometric Pressure mm Hg / in Hg	Ambient Temperature C/F
Pre Test	26.5	28.2	29.67	64
Post Test	0.30	2.7	29.67	83

Leak Rate	Tank* (in Hg) Allowable	Tank* (in Hg) Actual	Trap black ball reading
Pre Test	0.59	0	0
Post Test	0.59	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
1000	28.2	40	266	257	
1005	28.1	40	267	258	
1010	23.0	40	268	258	
1015	21.4	40	269	259	
1020	19.2	40	270	258	
1025	17.0	40	275	257	
1030	15.2	40	275	260	
1035	12.9	40	270	260	
1040	10.1	40	270	260	
1045	8.2	40	270	261	
1050	6.9	40	271	260	
1055	4.9	40	270	261	
1100	2.7	40	270	261	

Volatile Organic Carbon by Method 25

Client: Florida Gas Trans.	Project #:
Plant: Perry, Fl	Sample Location: Centroid
Operator: LB, NF, TB	Date: 3/20/92
Run Number: C-3	Sample ID:
Tank Number: 4481	Trap Number: C10
Sampling Train ID#: Ex 25	% CO2: 5.0
Side: Left / Right: #1	% H2O: 5.0
Start Time: 1120	Stop Time: 1220

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~~ 27.1	28.5	29.67	65
Post Test	1.9	4.0	29.66	65

Leak Rate	Tank* (in Hg) Allowable	Tank* (in Hg) Actual	Trap black ball reading
Pre Test	.59	0	0
Post Test	.59	0	0

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

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
1120	27.1	40	271	257	
1125	25.0	40	272	258	
1130	23.7	40	272	259	
1135	21.9	40	272	260	
1140	19.4	40	272	260	
1145	17.0	40	273	261	
1150	15.4	40	275	260	
1155	13.0	40	275	261	
1200	11.4	40	275	260	
1205	9.2	40	274	260	
1210	7.4	40	275	261	
1215	5.0	40	276	262	
1220	4.0	40	274	262	

4336

CHAIN OF CUSTODY RECORD

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

SAMPLERS: (Signature) [signature] Joseph Rudyk

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	CO2 BLANK value (ppmvc)	NMHC BLANK value (ppmvc)				REMARKS
	C-2	3/18/92	1020	Trap # N20		1.9					Quincy - Fla - GAS ✓
	C-3	3/18/92	1325	N21		1.8					Caryville - Fla. GAS ✓
				VWR		0.9					
	C-2	3/18/92	1210	TANK # 4T19			0.0				Caryville - Fla GAS ✓
	C-3	3/18/92	1325	4T22			0.0				~~Caryville~~ - Fla GAS ✓
				4T29			1.8				
	C-3	3/26/92	1100	4T41			2.1				Melbourne - Fla. GAS ✓
				4T66			0.1				
				4T71			0.0				
	~~C-2~~	~~3/24/92~~	~~1130~~	~~4T80~~			0.6				~~Silver Springs - Fla. GAS~~ ✓
1	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~~ ?
2	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~~

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

REMARKS:

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

4334

CHAIN OF CUSTODY RECORD

PROJ. NO.

DEPT. NO. 8151

PROJECT NAME: Cubix Corp.

SAMPLERS: (Signature) [signature] Joseph Rudyk

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	CO8 BLANK VALUE (ppMVC)					REMARKS
	C-1	3/20/92	830	Trap # B35		3.0					Melbourne - Fla. GAS ✓
	C-2	3/17/92	1530	B53		4.5					MUNSON - Fla. GAS ✓
	C-5	3/27/92		B233		1.3					Melbourne
	C-2	3/24/92	1130	C1		2.4					Silver Springs - Fla. GAS ✓
	C-1	3/19/92	900	C3		3.5					Quincy - Fla. GAS ✓
	Adit-2	3/26/92		C7		0.8					Melbourne
→	C-3	3/29/92	1120	C10		6.6					Perry - Fla. GAS ✓
	C-3	3/17/92	1645	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-PGI
				R004		1.2					
				R008		2.5					
				X1		2.6					
→	C-1	3/20/92	830	X10		2.5					Perry - Fla. GAS ✓

LAB 4/1/2

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

REMARKS:

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

4335

CHAIN OF CUSTODY RECORD

PROJ. NO.

DEPT. NO. 8151

PROJECT NAME: Cubix Corp

SAMPLERS: (Signature) [signature] Joseph Rudyk

NO. OF CONTAINERS

REMARKS

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	CO_2 BLANK VALUE (ppm v)					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		XY		2.3					Melbourne
	C-3	3/19/92	1135	N2		5.6					Quincy - Fla GAS ✓
	C-3	3/24/92	1310	N4		3.0					Silver Spring - Fla. GAS ✓
				N7		2.1					
	C-6	3/27/92		N8		2.6					Melbourne
	C-1	3/17/92	1425	N13		8.7					Munson - Fla GAS ✓
	C-1	3/18/92	1100	N19 LAB 4/2		3.0					Carryville - Fla GAS ✓

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

REMARKS:

500 W. Wood Street
Palatine, IL 60067

4337

CHAIN OF CUSTODY RECORD

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

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	NMHC BLANK VALUE (ppmC)						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 LAB 4/2		0.1						Melbourne

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

REMARKS:

CAE

500 W. Wood Street

Table of Carbon Concentration for Method 25. Samples collected by Cubix Corp. at Florida Gas & Trans on 3/24/92 and reported on 4/29/92.

		Carbon Concentration			
Source	Sample - Run ID #	Total (Mc) (mg/dscm)	Total (C) (ppmv)	Condensible (Ccm) (ppmv)	Noncondensible (Ctm) (ppmv)
PERRY STATION	C-1 *	480.3	962.0	923.0	39.0
	C-2	97.0	194.3	154.7	39.6
	C-3	105.4	211.0	177.1	33.9

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

Page 1

Approved By: *[initials]* On: 5/1/92

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

Job No.	8160		Plant: Florida Gas & Trans.	
Client	Cubix		Sample Loc. Perry Station	
Disk/File	8160P		(In/Out) Centroid	
Page No.	2		Date	3/28/92

Preliminary Data		C-1	C-2	C-3
Run No.		C-1	C-2	C-3
Tank No.		4T114	4T91	4T81
Trap No.		X10	X13	C10
Tank Volume V(cc)		4272	4255	4265
Field Data				
PTI	(mm Hg)	-717	-673	-688
TTI	(F)	62	64	65
PbI	(mm Hg)	754	754	754
PT	(mm Hg)	-64	-8	-48
TT	(F)	62	63	65
Pb	(mm Hg)	754	754	753
Noncondensible Organics				
PT(Lab)	(mm Hg)	-60	-58	-82
TT(Lab)	(F)	77	77	77
Pb(Lab)	(mm Hg)	742	742	743
PTF	(mm Hg)	920	915	922
TTF	(F)	77	77	77
PbF	(mm Hg)	742	741	743
Ba	(ppmv C)	0.2	0.1	0.2
Ctm 1	(ppmv C)	17.3	16.8	14.8
Ctm 2	(ppmv C)	15.4	16.5	12.8
Ctm 3	(ppmv C)	15.2	16.0	12.9
Avg. Ctm	(ppmv C)	16.0	16.4	13.5
RSD Ctm	(%)	7.3	2.5	8.3
Condensible Organics				
ICV Tank No.		4T141	4T215	4T113
ICV Tank, Vv (cc)		4041	3994	4265
PFI	(mm Hg)	-732	-732	-734
TFI	(F)	77	77	77
PbFI	(mm Hg)	742	741	743
PF	(mm Hg)	920	920	922
TF	(F)	77	77	77
PbFf	(mm Hg)	742	741	743
Bt	(ppmv C)	2.5	1.8	6.6
Ccm 1	(ppmv C)	392.9	69.9	77.1
Ccm 2	(ppmv C)	403.6	69.7	75.0
Ccm 3	(ppmv C)	394.2	69.1	76.3
Avg. Ccm	(ppmv C)	396.9	69.6	76.1
RSD Ccm	(%)	1.5	0.6	1.4
Total Gaseous Nonmethane Organics (TGNMO)				
Vs	(cc)	3714	3761	3608
Dil. Factor (Non)		2.474	2.425	2.547
Dil. Factor (Con)		2.340	2.283	2.547
Ct	(ppmv C)	39.0	39.6	33.9
Cc	(ppmv C)	923.0	154.7	177.1
Ct+Cc= C	(ppmv C)	962.0	194.3	211.0
Mc	(mg C/dscm)	480.3	97.0	105.4

APPENDIX B: EXAMPLE CALCULATIONS

MOISTURE CONTENT
refers to test run C-1

V_1 = initial dry gas meter reading = 656.795 ft^3
V_2 = final dry gas meter reading = 678.805 ft^3
V_{net} = total gas sample volume collected (ft^3)
= $V_2 - V_1$
= 678.805 - 656.795 = 22.01 ft^3

M_1 = initial weight of impinger train = 2488.5 g
M_2 = final weight of impinger train = 2511.8 g

MWC = total weight gain of all impingers (g)
= $M_2 - M_1$ = 2511.8 - 2488.5
= 23.3 g

K_d = dry gas meter factor (unitless) = 0.9904

$V_{corrected} = V_{net} \times K_d = x$
= 22.01 x 0.9904 = 21.799 ft^3

1.335 liters weighs 1 gram at standard conditions
499.4 = Gas constant
P_{bar} = barometric pressure (in Hg) = 29.67
T = temperature of gas DGM (F^o) = 86

F_w = moisture fraction by volume

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

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

$$= \frac{(23.3 \times 1.335)}{(23.3 \times 1.335) + (((21.799 \times 29.67) / (86 + 460)) \times 499.4)}$$

= 0.05 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 = 16.0(from Orsat)
C_{N_2} = concentration of N_2 = $1-(C_{CO_2}+C_{O_2})$ = 0..81
Fw = moisture fraction = 0.05
F_d = dry gas fraction = 1 - Fw = 0.95

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

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

$$= (18 \times 0.05) + (0.95 \times ((44 \times 0.03)+(32 \times 0.16) + (28 \times 0.81)))$$

$$= 28.56 \text{ lb/lb-mole}$$

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 = 1.1011

T_s = stack temperature = 526 F° = 986 R°

P_b = atmospheric pressure (in Hg) = 29.67

P_g = stack static pressure (in. H_2O) = -0.7

Ps = absolute stack pressure

= P_b + (Pg x .0735 in.Hg / in.H_2O) = 29.6186 in. Hg

V = stack velocity (ft/min)

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

$= 5128.8 \times .84 \times 1.1011 \times \sqrt{(986/ (29.6186 \times 28.56)}$

= 5121 ft/min

Q_a = stack flow rate (ft^3/min)

= V x A , where A= area of stack = 6.31 ft^2

= 5121 x 6.31 = 32300 ft^3/min

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

= Q_a x 1059 x (Ps / Ts) x Fd

= 32300 x 1059 x (29.6186/ 986) x 0.95

= 9.76×10^5 SCFH

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

Q_f = fuel flow = 28025 SCF/hr
F_{BTU} = heating value of gas = 1028 BTU/SCF
F = O_2 F factor = 8636 SCF/MMBTU
C_{O2} = concentration of O_2 = 16.05 %(from analyzer)

Q_d = stack flow rate on dry basis at standard conditions (SCFH)
$= Q_f \times F_{BTU} \times 10^{-6} \times F \times 20.9 / (20.9 - C_{O2})$
$= 28025 \times 1028 \times 10^{-6} \times 8636 \times 20.9 / (20.9 - 16.05)$
$= 1.07 \times 10^{6}$ SCFH

With CO2 F-factor (i.e. F=1023), same calculation is used except for final term......
$Q_d = Q_f \times F_{BTU} \times 10^{-6} \times F \times 100/C_{CO2}$
$= 28025 \times 1029 \times 10^{-6} \times 1023 \times 100/2.92$
$= 1.01 \times 10^{6}$ SCFH

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

MASS EMISSION RATES

refers to test run C-1

NOx = concentration of NOx = 72 ppmv
CO = observed concentration of CO = 110 ppmv
VOC = observed concentration via EPA Method 25 and 18
= 50.7 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 x Qd x 11.94×10^{-8}
$E_{NOx} = 72 \times 9.76 \times 10^{5} \times 11.94 \times 10^{-8}$

E_{NOx} = 8.4 lb/hr
E_{CO} = 7.8 lb/hr
E_{VOC} = 2.2 lb/hr

HP = engine horsepower = 3980 hp
454 g = 1.0 lb

$E_{NOx\ (g/hp\text{-}hr)} = E_{NOx} \times 454 / HP$
$= 8.4 \times 454 / 3980$
$E_{NOx\ (g/hp\text{-}hr)}$ = 0.96 g/hp-hr
$E_{CO\ (g/hp\text{-}hr)}$ = 0.89 g/hp-hr
$E_{VOC\ (g/hp\text{-}hr)}$ = 0.25 g/hp-hr

Stack Gas Flow Rate via AGA Carbon Balance Method

Refers to Test Run #C-1

Q_f = fuel flow = 28025 SCF/hr

C_f = carbon content of fuel (from fuel analysis) = 1.029

C_e = exhaust gas carbon content

= CO + THC (as C1) + CO_2

= (110 + 800) / 10000 + 2.92 = 3.01 %

Q = stack flow rate

= Qf x Cf x 100 / Ce

= 28025 x 1.029 x 100 / 3.01

= 9.58×10^5 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 = 28025 SCF/hr
SO2 = mass emission rate of SO2
= S / 100 / 7000 x Q_f
= <.059 /100 / 7000 x 28025
= <0.0024 lbs/hr

Moisture Content via Stoichiometry
Refers to test run #1

H = Ambient humidity (via psychrometer) = 0.0068 lb/lb air
O2 = O2 concentration in stack = 16.05%
F = wet basis O2 F-factor (from fuel calcs)
= 10641 DSCF/MMBTU
FW = moisture F-factor = 2005 SCF of H2O/MMBTU
CM = combustion moisture % at 0% O2
= Fw / F x 100 = 2005 / 10641 x 100
= 18.84 %

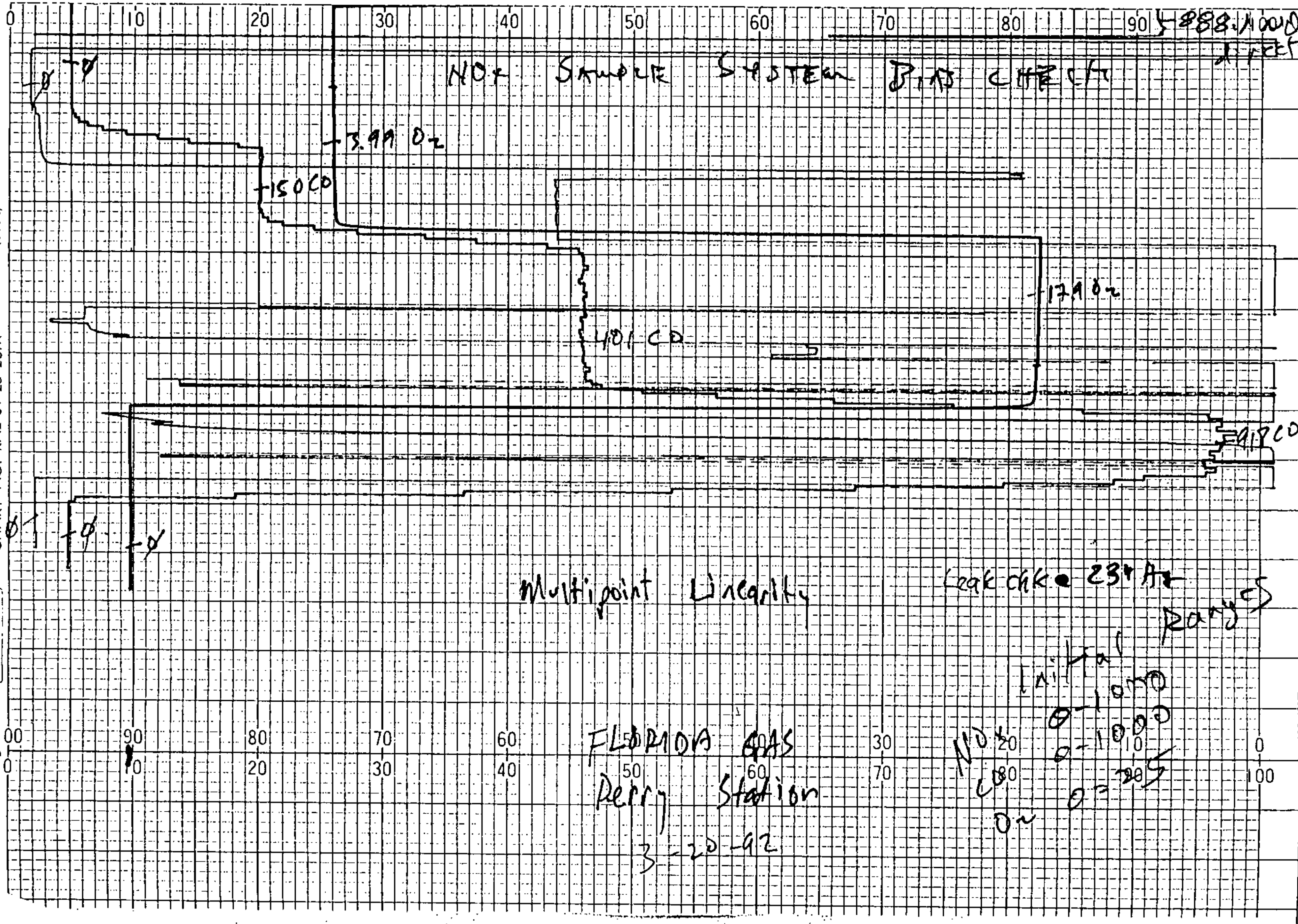
Fw = moisture content
= (CM x (20.9 - O2)/20.9) + (H x 64.3)
= (18.84 x (20.9 - 16.05)/20.9) + (.0068 x 64.3)
= 4.81 %

APPENDIX C: QUALITY ASSURANCE ACTIVITIES

(6334)

CHART NO. RN2-01-25-20M

Charts-Inc



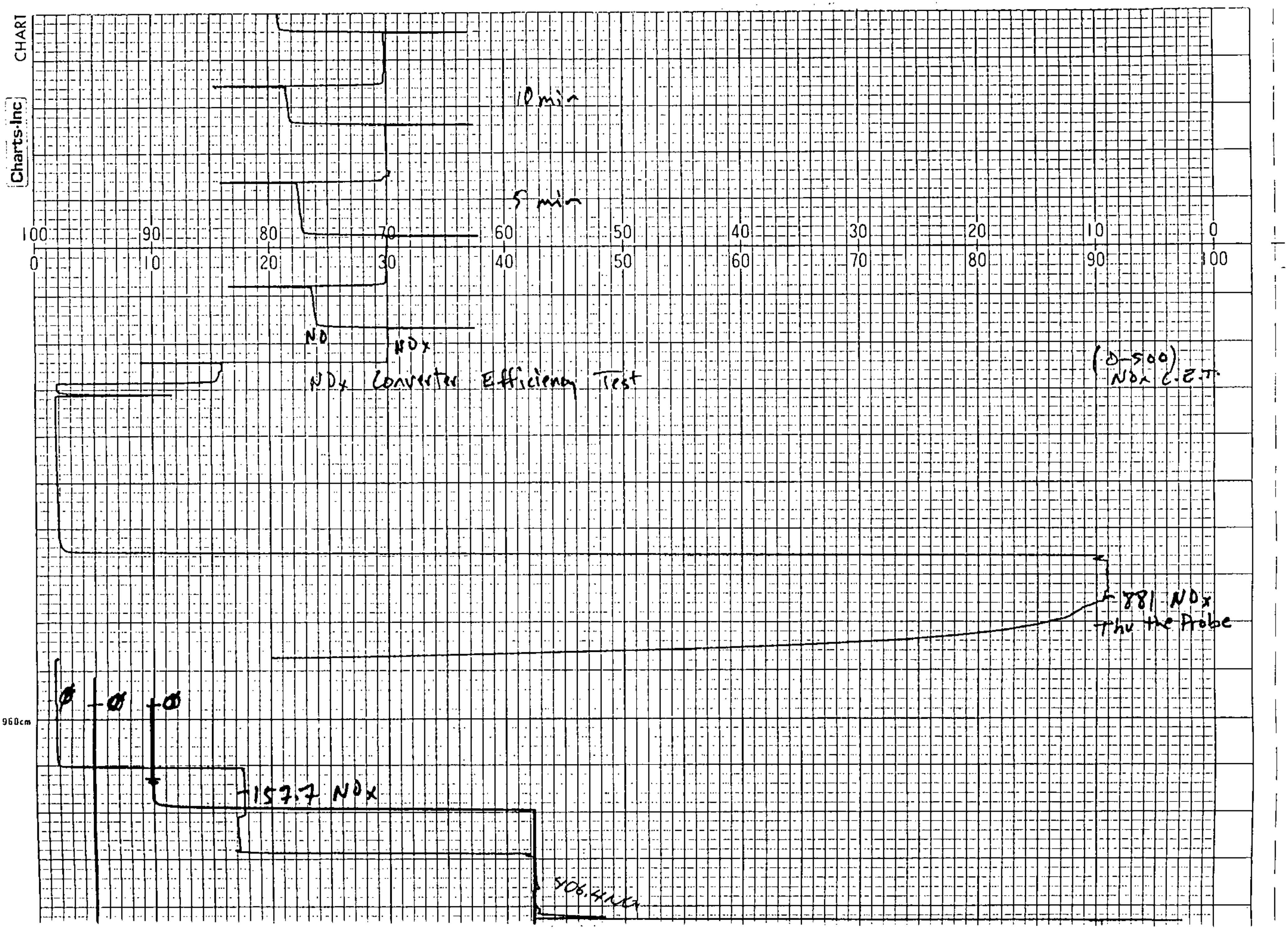
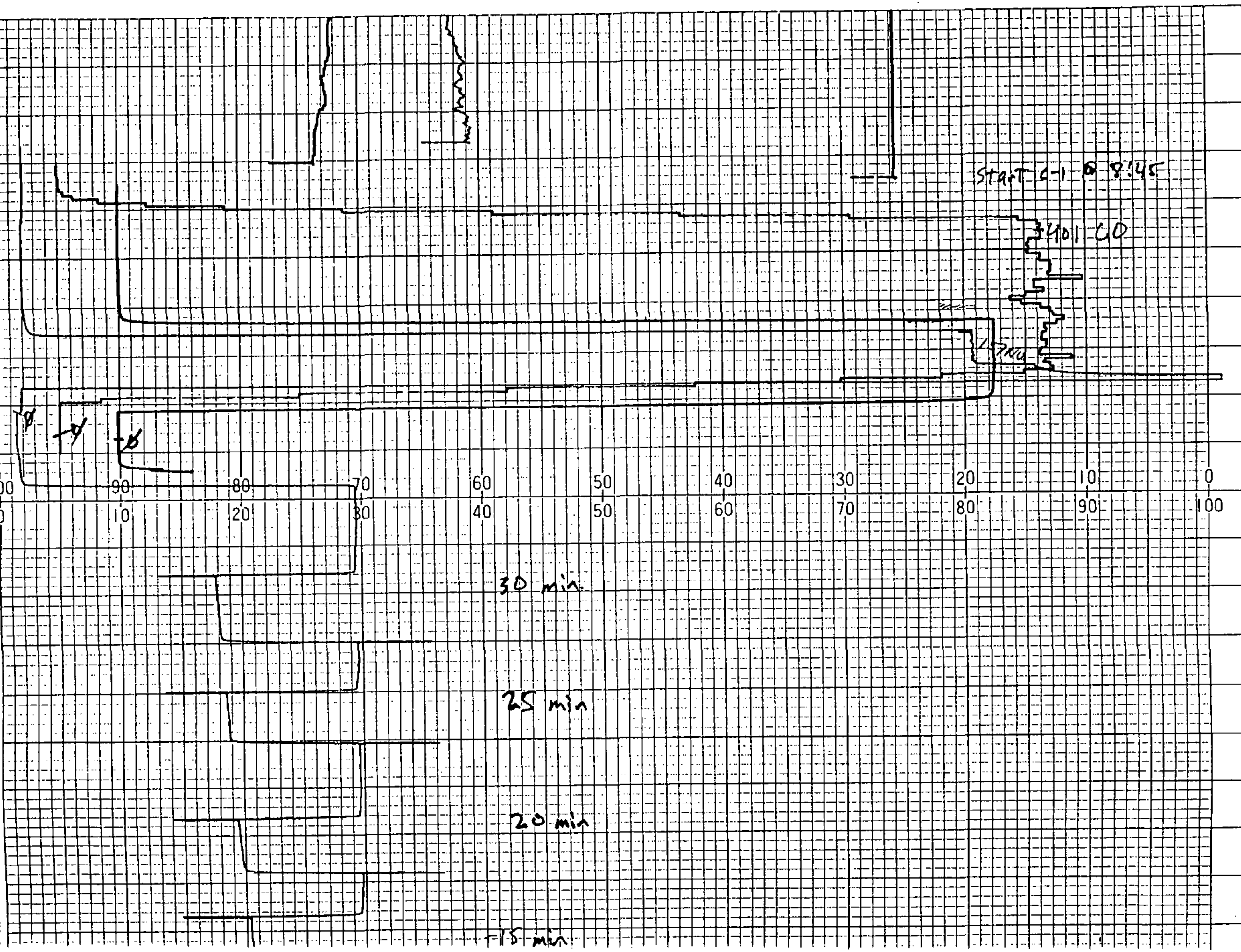
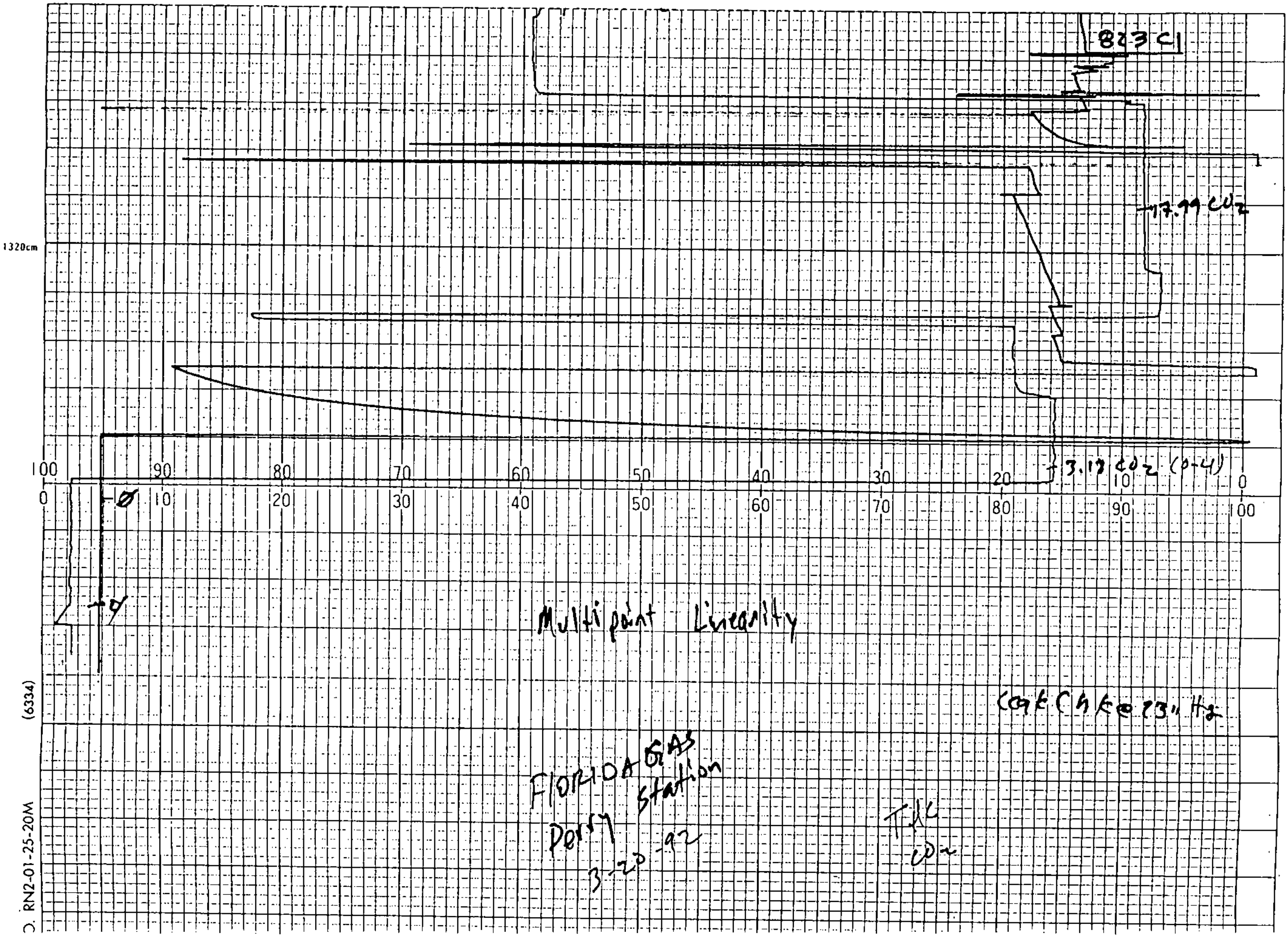


CHART
Charts-Inc
10 min
5 min
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
NO
NOx
NOx Converter Efficiency Test
(D-500)
NOx C.E.T.
881 NOx
thru the Probe
Ø Ø Ø
960cm
157.7 NOx



940cm (6334)
RN2-01-25-20M



1320cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
17.99 CO2
3.17 CO2 (0-4)
Multipoint Linearity
FLORIDA GAS
Perry Station
3-20-92
(6334)
RN2-01-25-20M

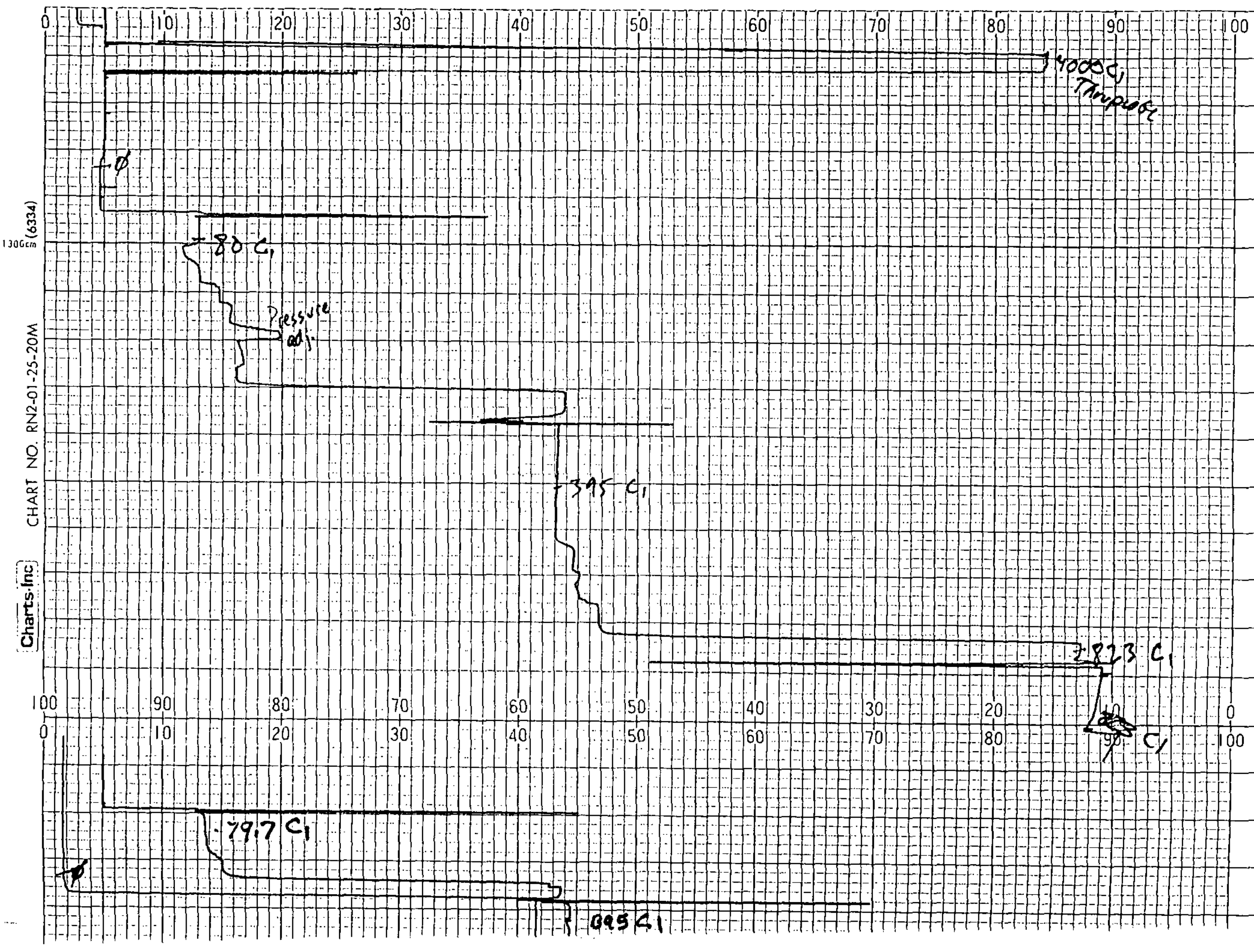


CHART NO. RN2-01-25-20M
Charts Inc
(6334)
4000 C1
80 C1
Pressure adj.
395 C1
2823 C1
79.7 C1


CHART
Charts-Inc
1280cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
Start C-1 @ 8:45
4000 C,

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	72.0	2.0	0.0	82.0	2.0	0.0	74.0	0.0	0.0
low	157.7	17.8	17.8	0.0	% Chart			% Chart			% Chart		
mid	406.4	42.6	42.3	-0.3	38.0	80.5	0.0	43.0	81.0	0.5	39.0	81.0	0.5
high	888.1	90.8	91.7	0.9									
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	16.05	10.0	0.0	16.03	10.0	0.0	16.00	10.0	0.0
low	3.99	26.0	26.0	0.0	% Chart			% Chart			% Chart		
mid	7.98	41.9	42.2	-0.1	74.2	82.3	0.7	74.1	82.3	0.7	74.0	82.3	0.7
high	17.90	81.6	82.3	0.7									
full scale	25.0				25.0			25			25		
CO					Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	5.0	5.0	0.0	110.0	5.0	0.0	110.0	5.0	0.0	113.0	5.0	0.0
low	150.0	20.0	20.1	0.1	% Chart			% Chart			% Chart		
mid	401.0	45.1	45.9	0.8	27.0	85.5	0.3	27.0	85.5	0.3	27.6	85.5	0.3
high	918.0	96.8	96.8	0.0									
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	2.92	2.0	0.0	2.92	2.0	0.0
low				0.0	% Chart			% Chart			% Chart		
mid	7.99	42.0	40.8	0.0	75.0			75.0			75.0		
high	17.99	92.0	91.6	-0.3		81.0	-0.5		81.0	-0.5		80.5	-1.0
full scale	20.0				4.0			4			4		
THC					Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	5.0	5.0	0.0	800.0	10.0	5.0	700.0	10.0	5.0	725.0	10.0	5.0
low	80.0	13.0	13.0	0.0	% Chart			% Chart			% Chart		
mid	395.0	44.5	43.3	-1.2	21.0			19.0			19.5		
high	823.0	87.3	88.5	1.2		85.0	0.0		85.0	0.0		85.0	0.0
full scale	1000.0				5000.0			5000			5000		

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 B619
Analyzer Test Range: 0-25

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

TR 7 O2 ANALYZER

Continous Emission Analyzer Interference Response Tests

Date: 1/16/92
Technician: LF

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

Test Gas		Analyzer Response		Response Ratio
Type Gas	Concentration	Concentration	% of Range	
CO	471 ppm	5.05%	5.5	
SO_2	358 ppm	5.05%	5.5	
CO_2	8%	5.05%	5.5	
NO_x	888 ppm	5.05%	5.5	

Continous Emission Analyzer Interference Response Tests

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

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

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

(Rows 2–4 ratios: ppmv/%; rows 6–9 ratios: ppmv/ppmv)

all interferences are negligible

Thermo Electron CORPORATION

Richard A. Curran
Regional Sales Manager

Environmental Instruments Division

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

TR 7

INTERFERENCE RESPONSE TEST

DATE OF TEST JAN 20, 1992

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

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

Instrumental Analysis
Quality Assurance Data

Date: 3-20-92
Plant: FGT Perry
Technician: NF TS

NOx Analyzer: NO2 to NO Converter Efficiency Test

NO Calibration Gas: 406.4 ppm
Dilutent Gas: Air (20.9% oxygen)

	NOx Concentration (ppm)	% Decrease from Initial Concentration	NO Concentration (ppm)
Initial Concentration	140	n.a.	109
10 minute Concentration	139.5	0.36%	97.5
20 minute Concentration	138	1.4%	87.5
30 minute Concentration	137.5	1.8%	79.5

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	~~888.1~~	~~1000~~	~~889~~		
NOx	888.1	1000	898	889	-0.9%
SO2					
THC	4000	5000	3990	3960	-0.6%

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

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

APPENDIX D: CALIBRATION CERTIFICATIONS

Scott Environmental Technology, Inc.

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

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

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

Analyzed By [signature] Approved By [signature] Shapiro

Scott Specialty Gases — Scott Environmental Technology, Inc.
1290 COMBERMERE STREET, TROY, MICHIGAN 48084 (313) 589-2950

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

Customer :
CUBIX CORPORATION
9225 LOCKHART HWY
AUSTIN TX 78747

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

PERFORMED ACCORDING TO SECTION 3.0.4

Certified Per Traceability Protocol # 1
Procedure # G1
File # PO-2143
Certified Accuracy 1 % NBS Traceable

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.	(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.	(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		0.0000	0.00
		0		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

Approved By : [signature]

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

Our Project # : [illegible]
Your P.O. # : 90347
Expiration Date : 7-28-92
Cylinder Number : ALM-016031
Cylinder Pressure 1900 psig

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

**** CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ****
PERFORMED ACCORDING TO SECTION 3.0.4
Certified Per Traceability Protocol # 1 Procedure # 61
File # P08133
Certified Accuracy 1 % NBS Traceable

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

BALANCE GAS : NITROGEN

NITROGEN DIOXIDE 5.82 PPM (FROM SECOND ANALYSIS)

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 : [signature] Approved By : [signature]

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

CERTIFIED EPA PROTOCOL

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
ON MONOXIDE	150.0	PPM	150.	PPM
ANE	80.0	PPM	79.7	PPM
OGEN	BALANCE		BALANCE	

ANALYTICAL METHOD: GRAV.MASTER GAS

DATE OF ANALYSIS: 6/03/91

ANALYST: [signature] ANALYST APPROVED BY: [signature] SUPERVISOR

CERTIFIED

Scott Specialty Gases, Inc.

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

10/17/91

CUBIX CORPORATION
9225 LOCKHART HWY

AUSTIN TX 78747-0000

PROJECT #: 04-13936
PO #: 910523

CYLINDER #: AAL9308

ANALYTICAL ACCURACY: +-1%

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

ANALYTICAL METHOD: ACUBLEND MASTER

DATE OF ANALYSIS: 10/17/91

ANALYST: ____________ ANALYST

APPROVED BY: ____________ SUPERVISOR

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.

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	
RBON MONOXIDE	910.0	PPM	916.	PPM
THANE	820.0	PPM	823.	PPM
TROGEN		BALANCE		BALANCE

NOTES: EXP: 11/92

CERTIFIED

ANALYTICAL METHOD: ACUBLEND MASTER

DATE OF ANALYSIS: 10/22/91

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

Matheson Gas Products
World Leader in Specialty Gases & Equipment

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

RECEIVED JAN 17 1992

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

Date 1-8-92
Our Invoice # 104-63230
Your P.O. # 04312
Lot No.

Gentlemen:

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

LABORATORY REPORT ON GAS ANALYSIS

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%	7.98% ± .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

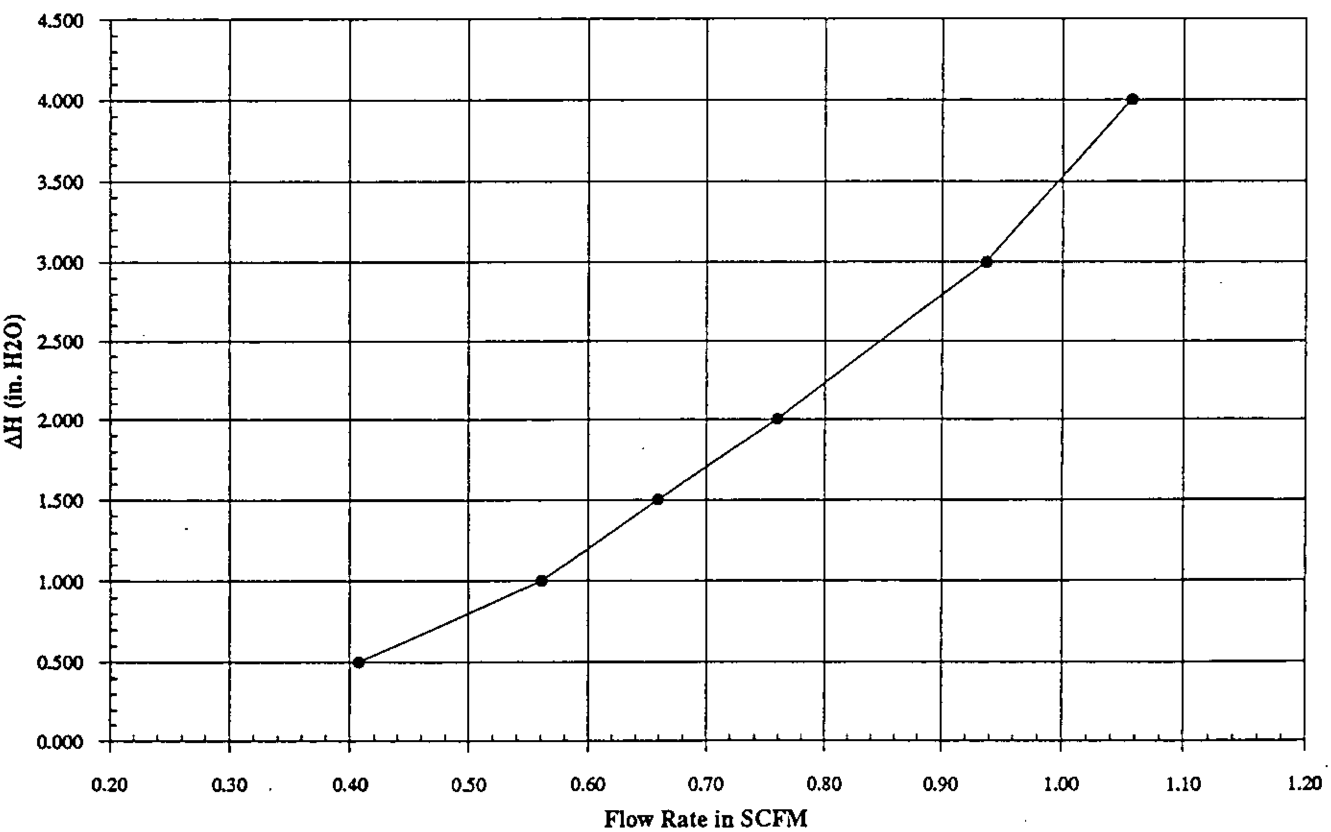
METER BOX DRY GAS METER and ORIFICE CALIBRATION

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. H2O)	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

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



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 Lawrence
AUTHORIZED SIGNATURE

FEB 11 1992
DATE

TEL-TRU MANUFACTURING. CO.

408 ST. PAUL STREET ROCHESTER, NY 14605 USA

CERTIFICATE OF CALIBRATION

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

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

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

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

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

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

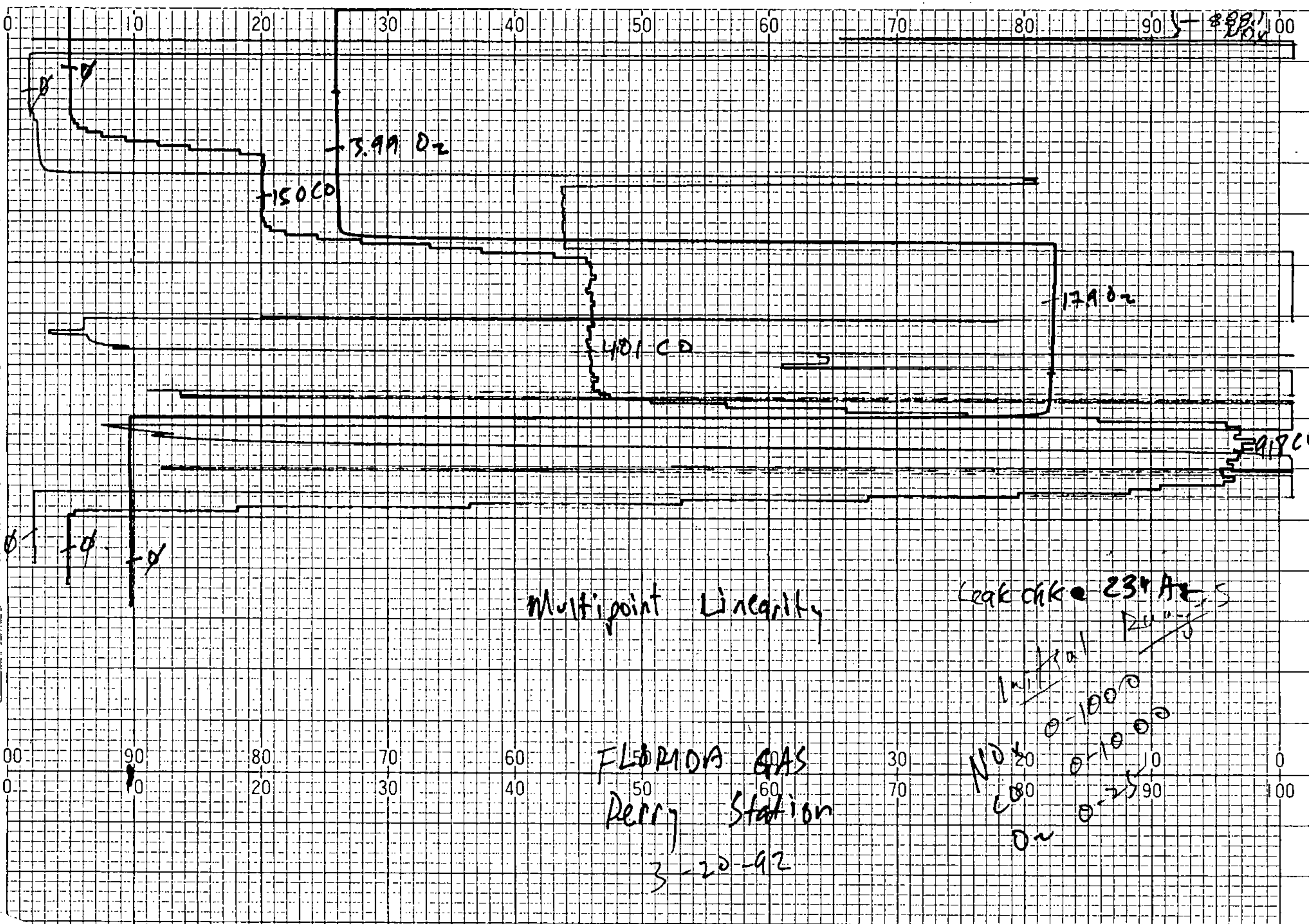
APPENDIX E: STRIP CHART RECORDS

NOx, O_2, CO

(6334)

CHART NO. RN2-01-25-20M

Charts-Inc



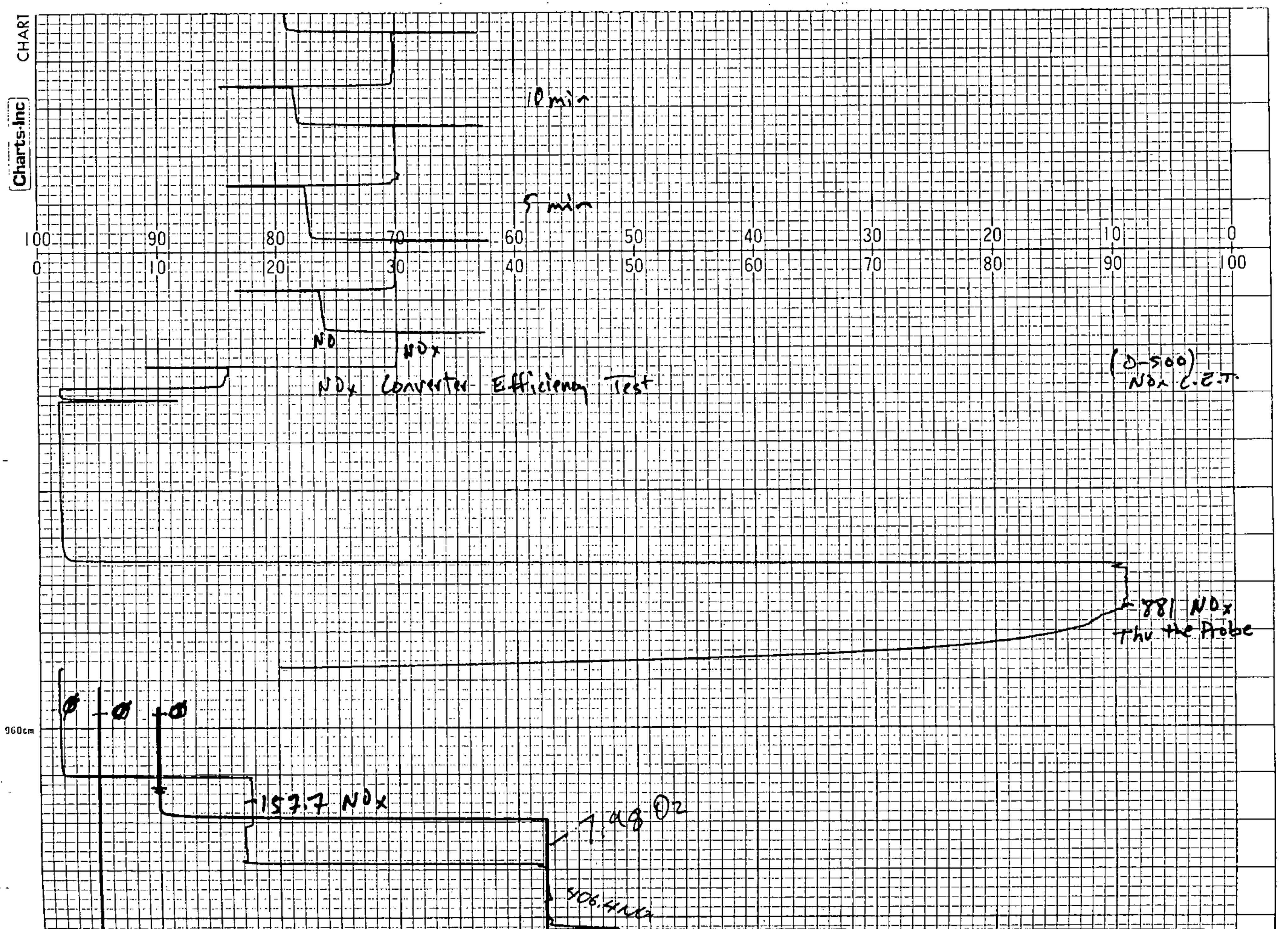
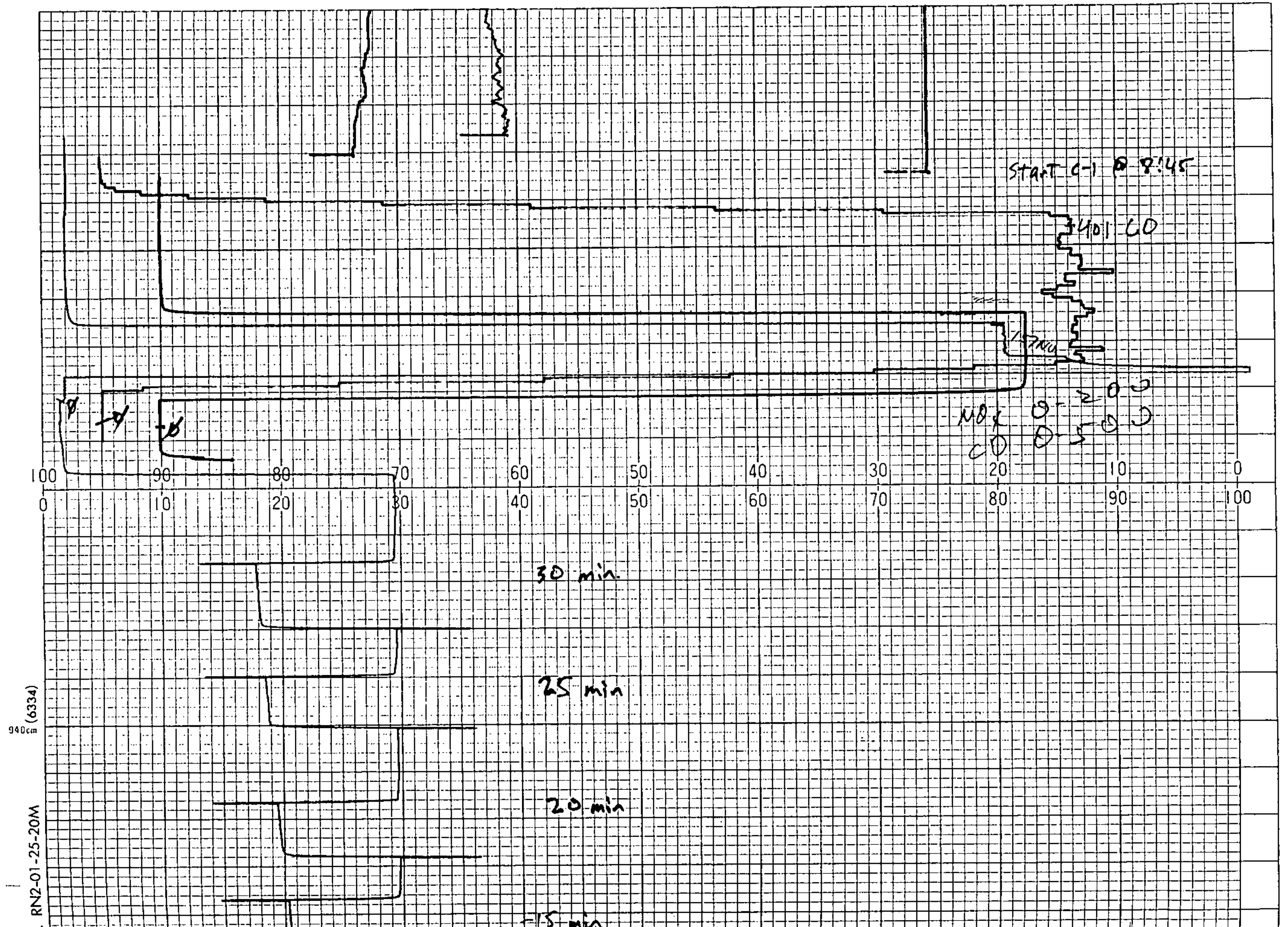


CHART
Charts-Inc
10 min
5 min
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
NO
NOx
NOx Converter Efficiency Test
(0-500)
NOx C.E.T.
881 NOx
thu the Probe
960cm
Ø Ø Ø
157.7 NOx
7.48 O2


Start C-1 @ 8:45
1401 CO
NOx 0-200
CO 0-500
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
30 min
25 min
20 min
15 min
RN2-01-25-20M
(6334)
940cm

0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0
920cm
(6334)
CHART NO. RN2-01-25-20M
Charts-Inc
NOx = 72
CO = 110
O2 = 14.05

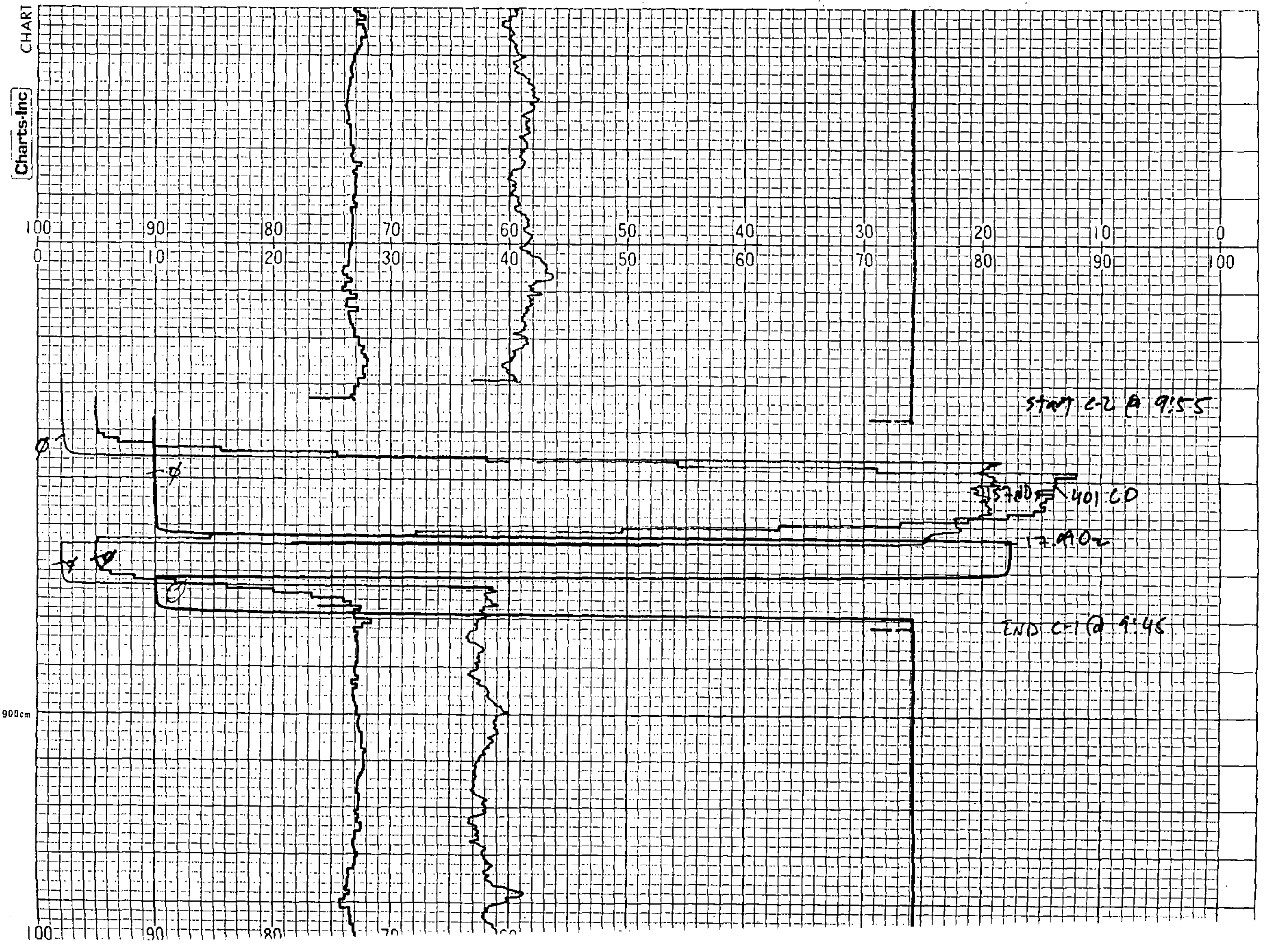
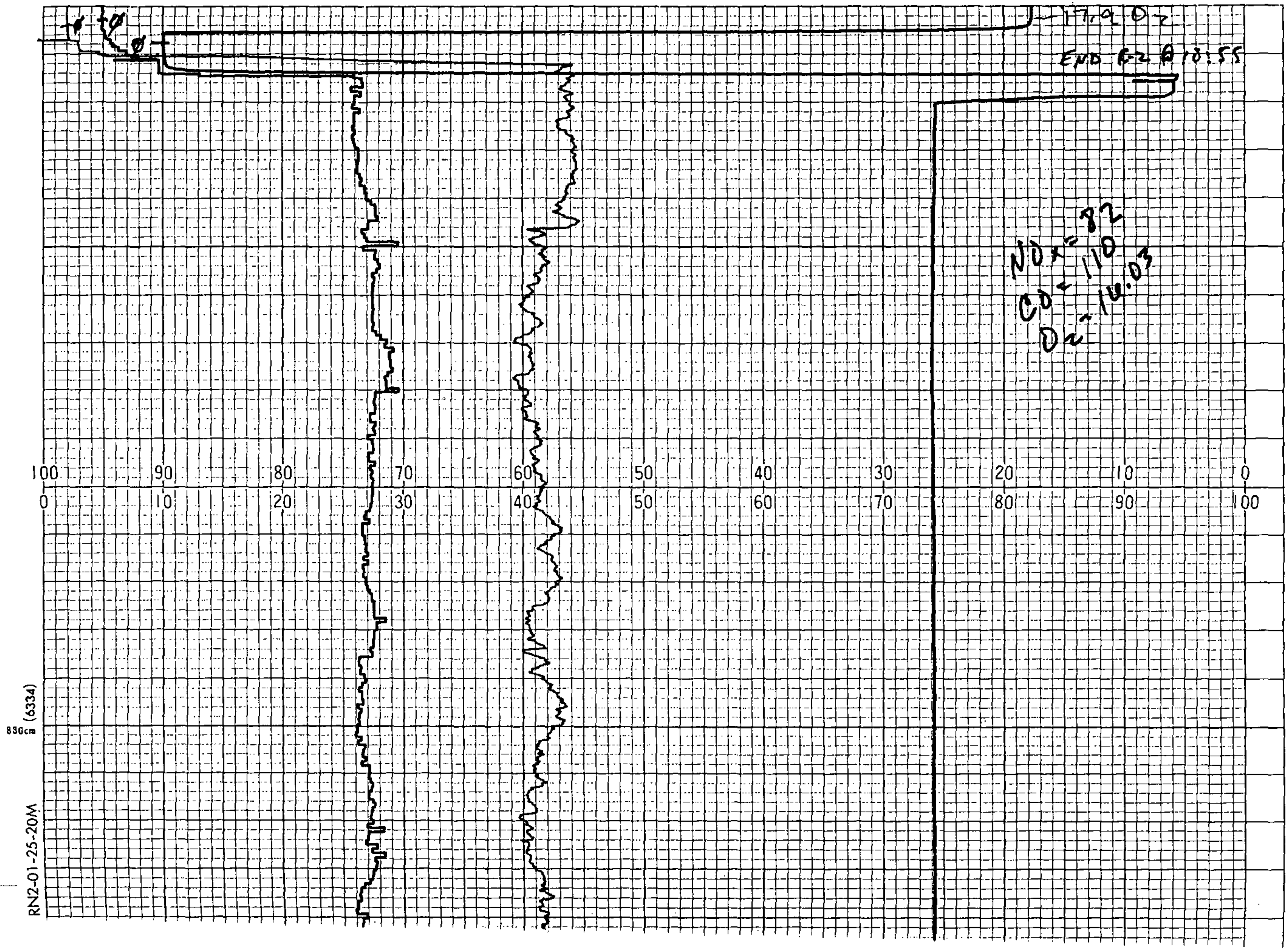
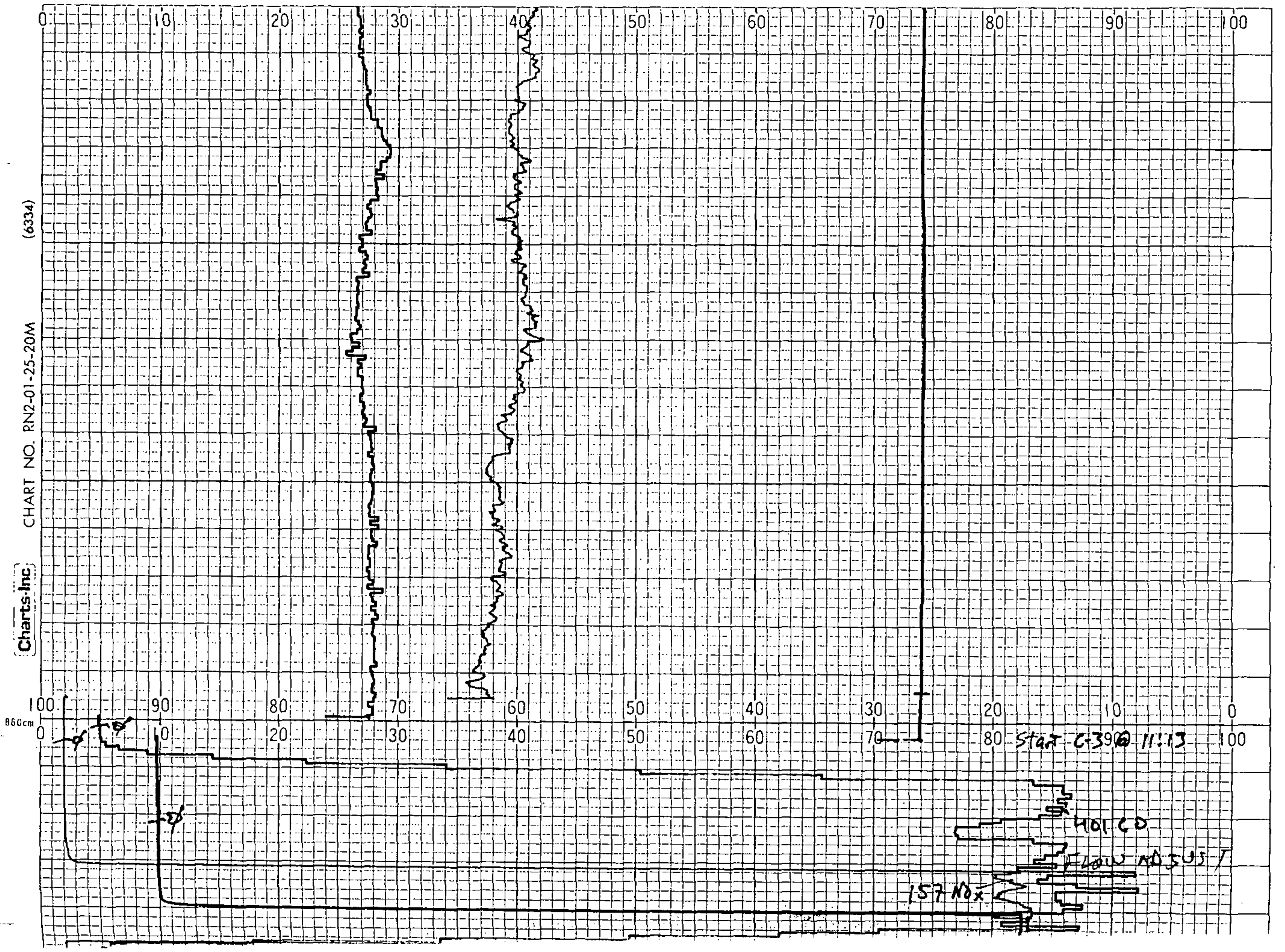
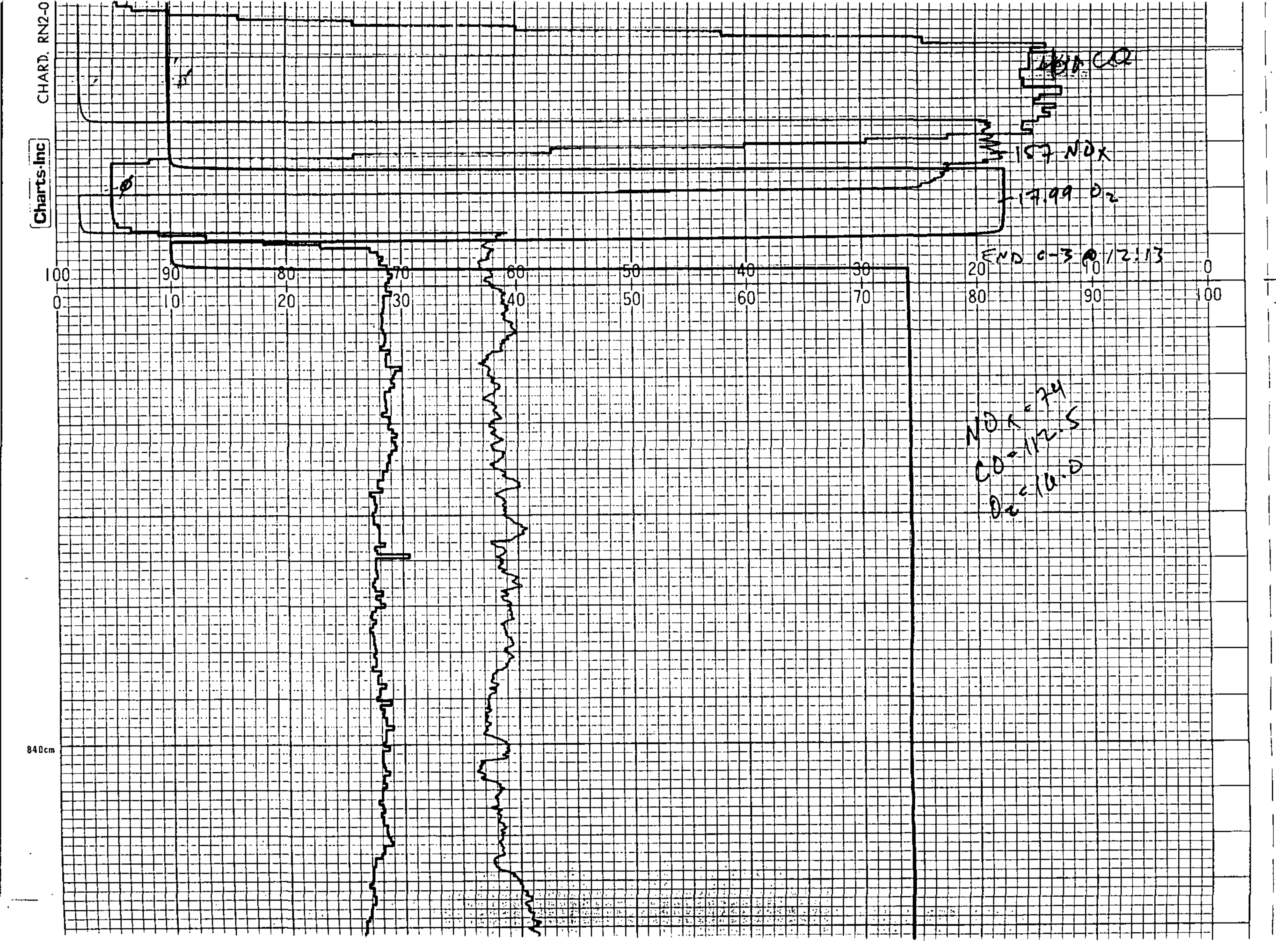


CHART
Charts-Inc
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
START C-2 @ 9:55
401 CO
END C-1 @ 9:45
900cm



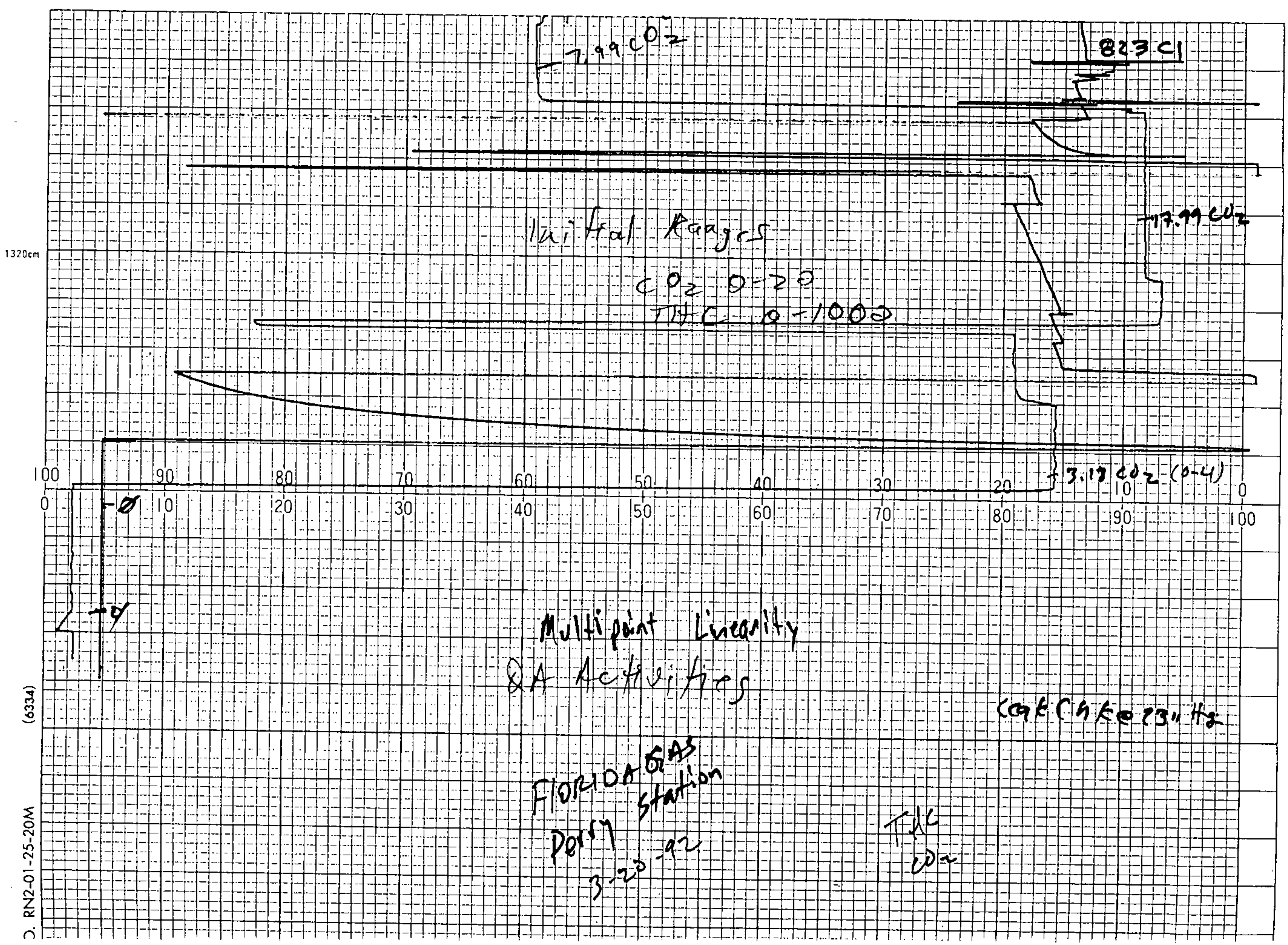
17.9 O2
END F-2 @ 10:55
NOx = 82
CO = 110
O2 = 14.03
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
(6334)
830cm
RN2-01-25-20M


Charts Inc
CHART NO. RN2-01-25-20M
(6334)
860cm
Start C-39 @ 11:13
401 CO
FLOW ADJUST
157 NOx



CHARD. RN2-0
Charts-Inc
CO
157 NOx
17.99 O2
END 0-3 @ 12:13
NOx = 74
CO = 112.5
O2 = 10.0
840cm

CO_2, THC



7.99 CO2
823 C1
17.99 CO2
Initial Ranges
CO2 0-20
THC 0-1000
3.19 CO2 (0-4)
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
-0
Multipoint Linearity
QA Activities
Leak Chk @ 23" Hg
FLORIDA GAS
Perry Station
3-20-92
THC
CO2
1320cm
(6334)
RN2-01-25-20M

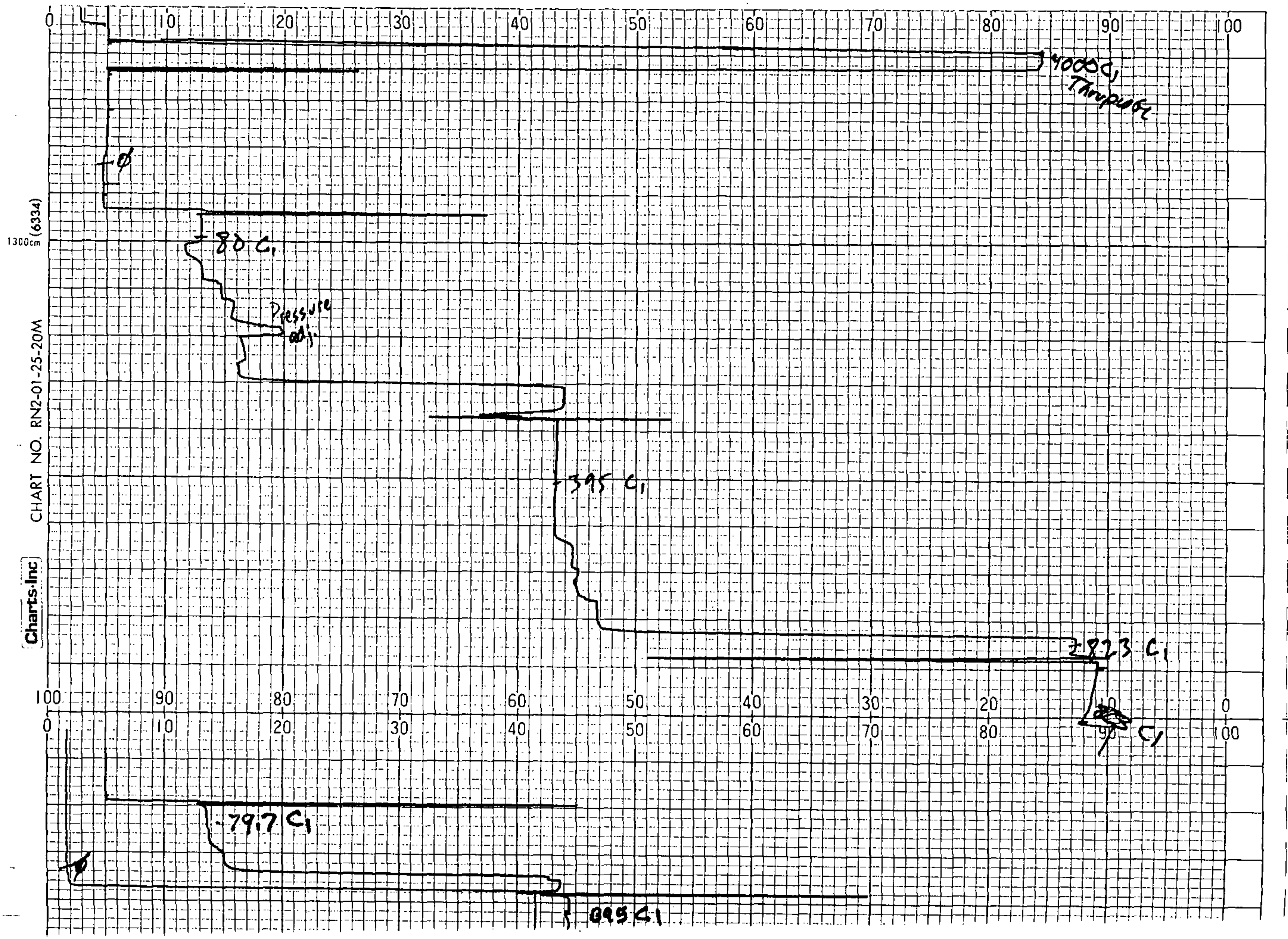
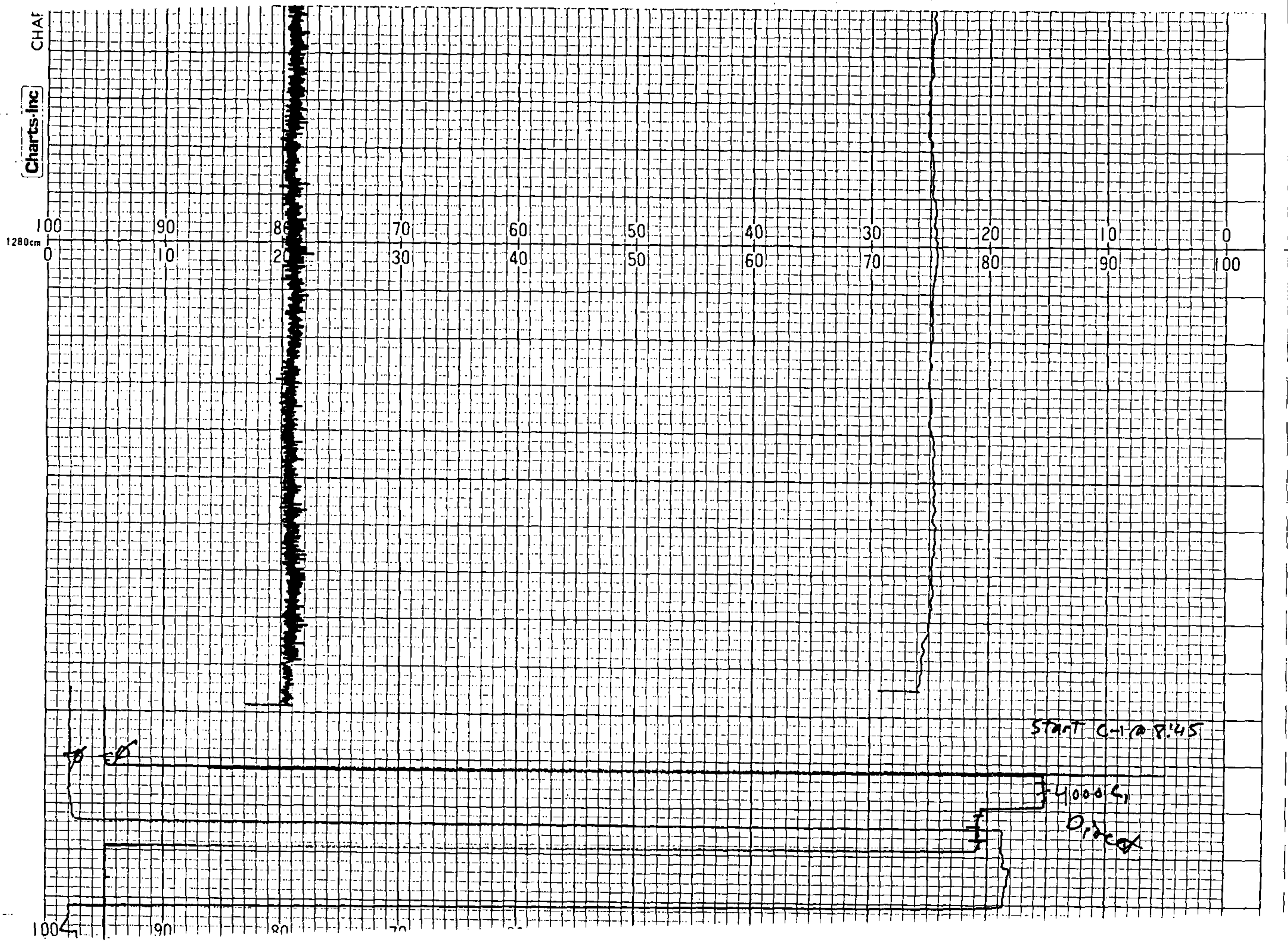
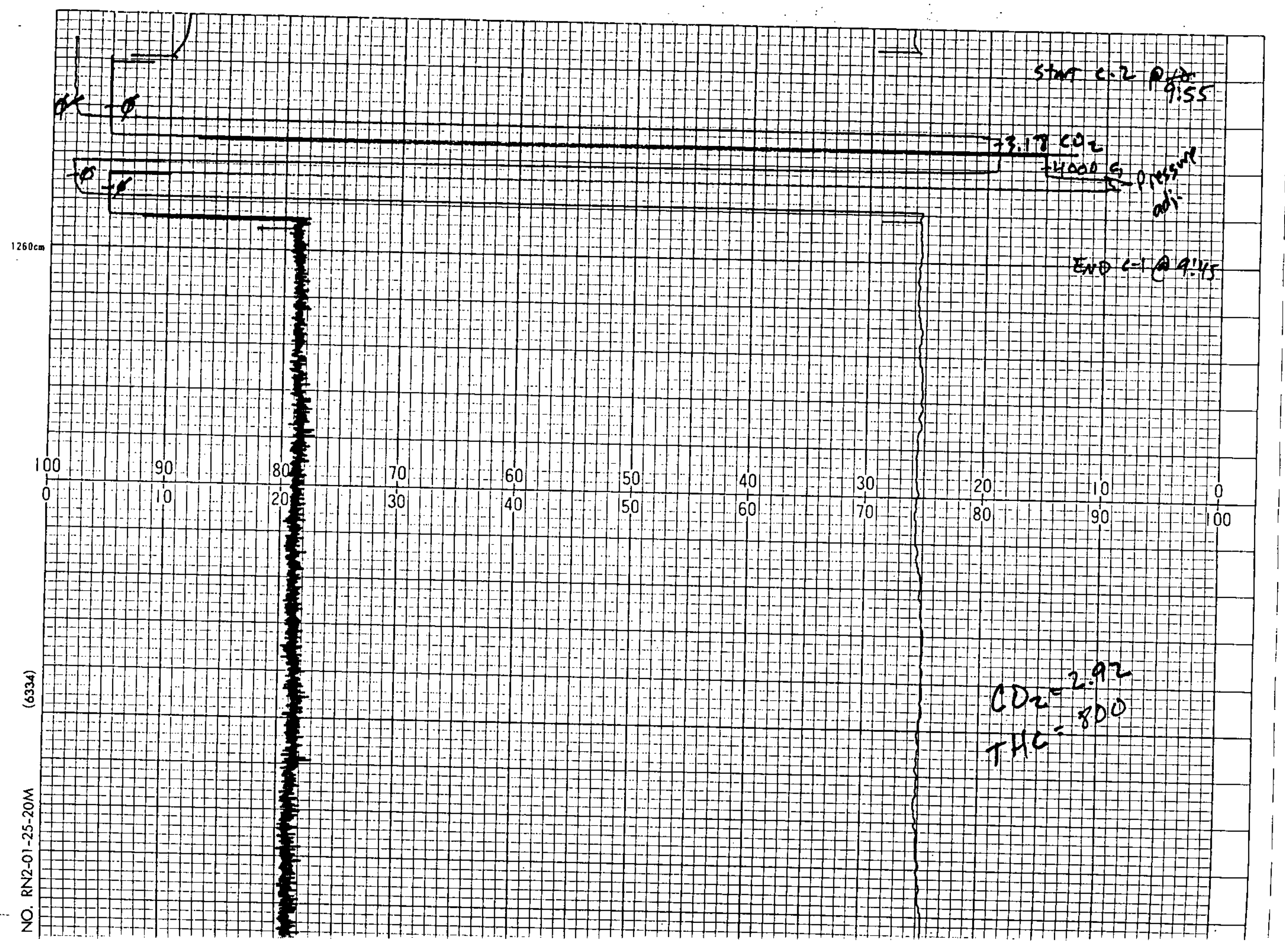


CHART NO. RN2-01-25-20M
Charts Inc
1300cm (6334)
4000 C1
80 C1
Pressure adj
395 C1
823 C1
79.7 C1



Charts-Inc
1280cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
Start C-1 @ 8:45
4000 C1



Start C-2 @ 9:55
3.18 CO2
4000 C1
pressure adj.
1260cm
END C-1 @ 9:45
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
CO2 = 2.92
THC = 800
(6334)
NO. RN2-01-25-20M

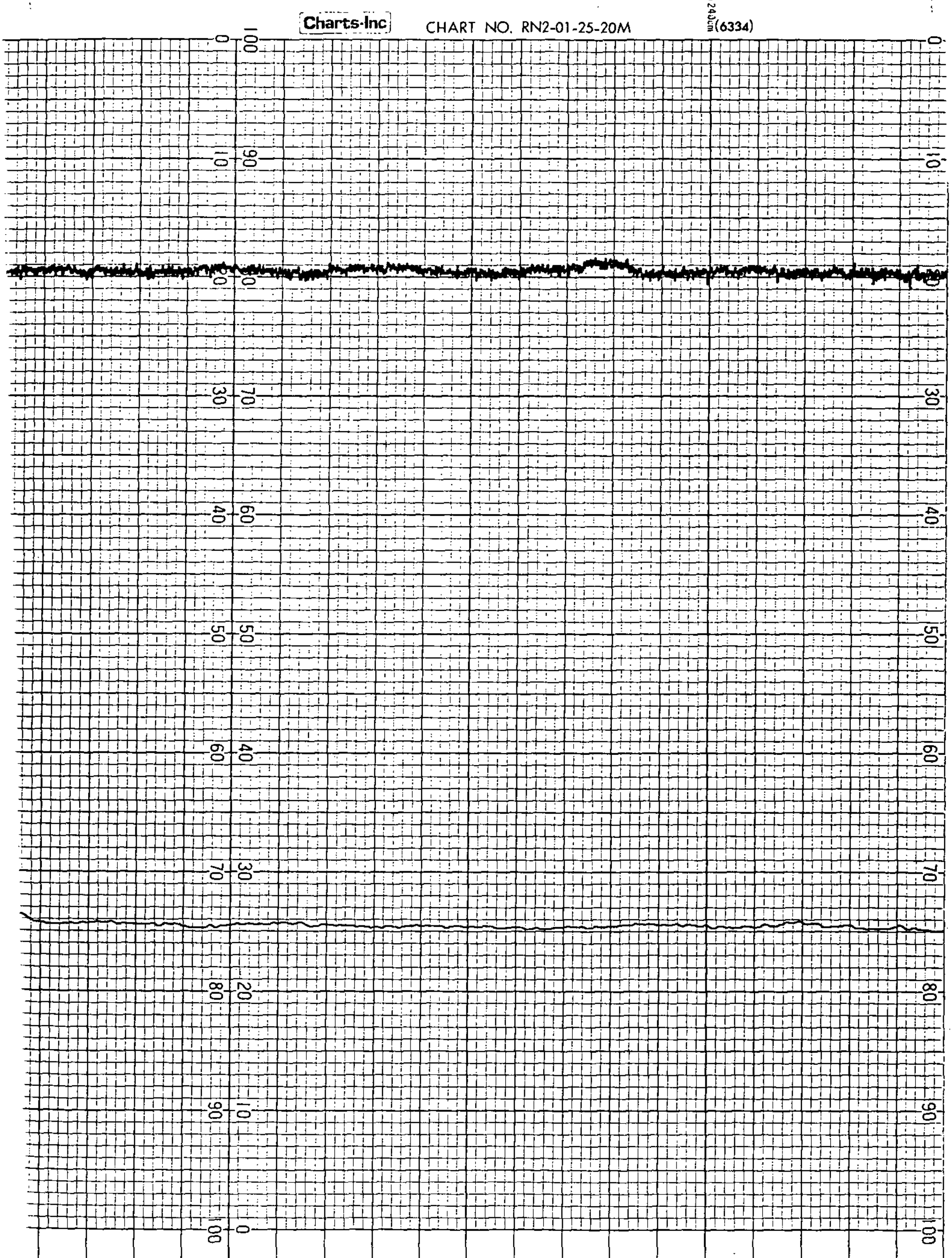
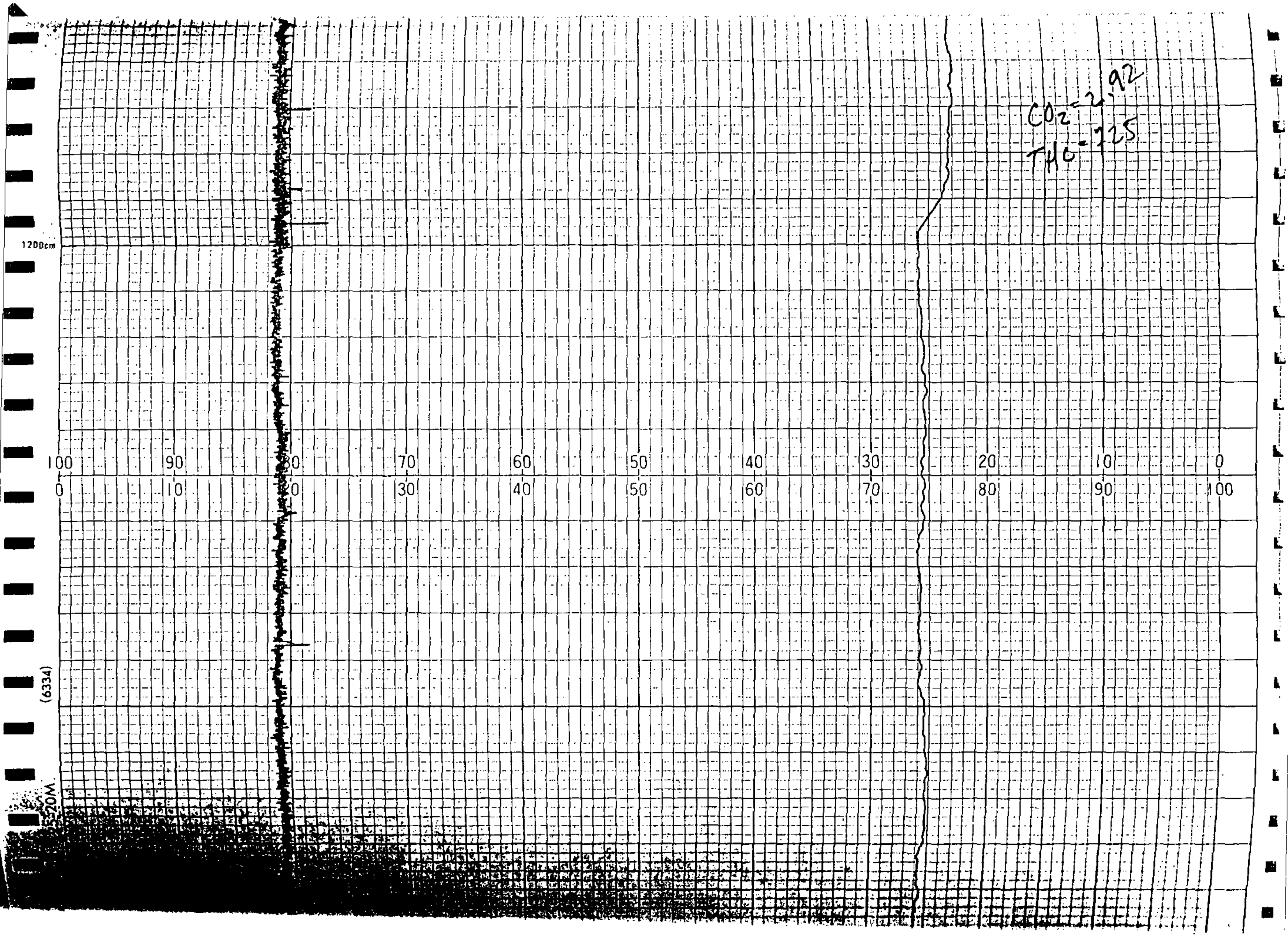
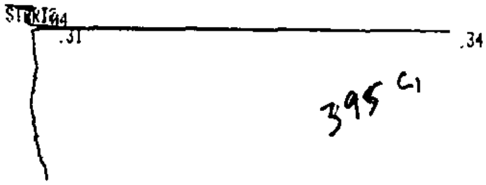

Charts-Inc
CHART NO. RN2-01-25-20M
(6334)


CHART
Charts·Inc
100 90 80 70 60 50 40 30 20 10 0
1220cm
0 10 20 30 40 50 60 70 80 90 100
START C-3 @ 11:13
3.18 CO2
4000 C1
END C-2 @ 10:55
CO2 = 2.92
THC = 400


1200cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
(6334)
CO_2 = 2.92
THC = 225

APPENDIX F
CHROMATOGRAMS

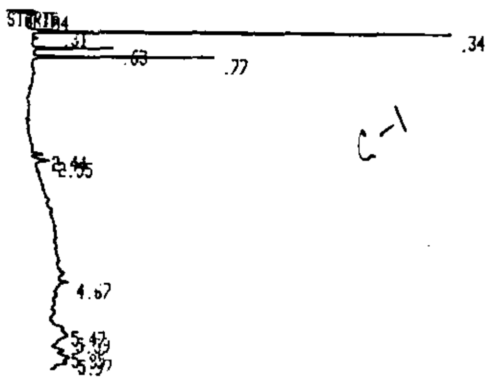


RUN # 83 MAR/20/92 08:36:03
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	426	BB	0.030	0.288
0.31	308	D PV	0.017	0.208
0.34	147160	D VB	0.015	99.504

TOTAL AREA= 147890
MUL FACTOR= 1.0000E+00



RUN # 84 MAR/20/92 09:06:13
WORKFILE ID: B
WORKFILE NAME:

AREA%

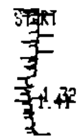
RT	AREA	TYPE	AR/HT	AREA%
0.04	1360	BV	0.066	0.976
0.31	398	D PV	0.015	0.286
0.34	120630	D VB	0.015	86.558 Cl
0.63	1845	D PB	0.020	1.324
0.77	4454	D BB	0.021	3.196
2.44	448	BP	0.036	0.322
2.55	919	PP	0.053	0.659
4.67	1027	VP	0.076	0.737
5.47	1567	BV	0.100	1.124
5.59	3469	VV	0.169	2.489
5.85	1111	VV	0.070	0.797
5.97	2135	VV	0.096	1.532

VOC (0.63–4.67); X (5.47–5.97); 5.48% VOC

TOTAL AREA= 139360
MUL FACTOR= 1.0000E+00

!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHI
JKLMNOPQRSTUVWXYZ↑23456789:;<=>?@ABCDEFGHI

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



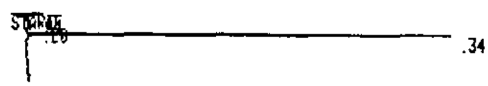
RUN # 90 MAR/20/92 08:19:12
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
1.32	782	PP	0.067	74.053
1.41	274	PV	0.048	25.947

TOTAL AREA= 1056
MUL FACTOR= 1.0000E+00

INTG # 8 TIME 0 @

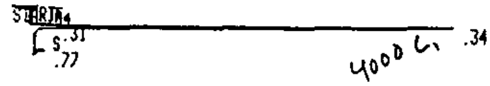


RUN # 91 MAR/20/92 08:24:12
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	586	PV	0.046	4.759
0.20	1496	D VV	0.101	12.149
0.34	10232	D VB	0.016	83.092

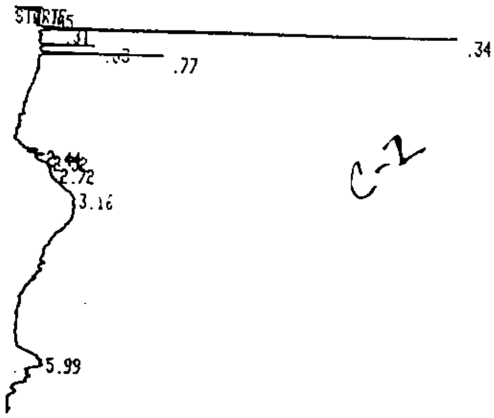
TOTAL AREA= 12314
MUL FACTOR= 1.0000E+00



RUN # 92 MAR/20/92 08:30:13
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	752	BV	0.038	0.094
0.31	536	D PH	0.019	0.067
0.34	798770	DSHB	0.015	99.778
0.77	492	D PV	0.039	0.062



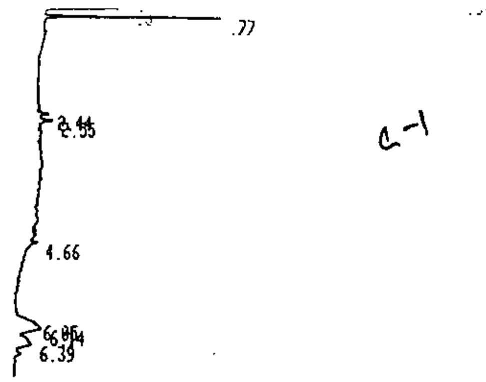
RUN # 86 MAR/20/92 09:57:55
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.05	752	BB	0.054	0.797
0.31	313	D PV	0.016	0.332
0.34	83023	D VB	0.015	88.028 C1
0.63	1269	D PB	0.020	1.346
0.77	3147	D VB	0.022	3.337
2.44	703	PV	0.047	0.745
2.52	782	VV	0.043	0.829
2.72	1990	VV	0.123	2.110
3.16	1949	VV	0.182	2.062
5.99	386	[illegible]	[illegible]	[illegible]

VOC 10.6%

TOTAL AREA= 943[illegible]
MUL FACTOR= 1.0000E+[illegible]



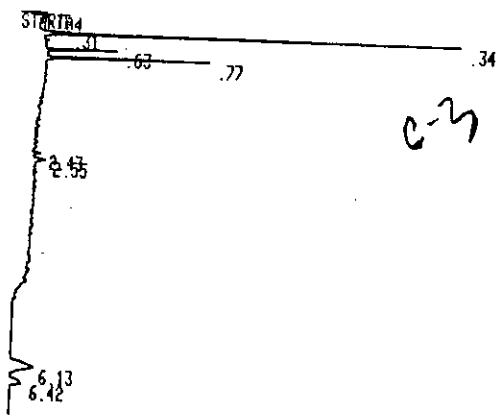
RUN # 85 MAR/20/92 09:28:26
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	570	BV	0.031	0.425
0.31	286	D PV	0.012	0.213
0.34	115370	D VB	0.015	85.984 C1
0.63	1617	D PB	0.019	1.205
0.77	4304	D BB	0.021	3.208
2.44	539	PV	0.043	0.402
2.55	1031	VV	0.061	0.768
4.66	787	VB	0.070	0.587
6.05	2415	PV	0.098	1.800
6.14	4015	VV	0.128	2.992
6.39	3242	VV	0.167	2.416

V, X, 6.20% VOC

TOTAL AREA= 134180
MUL FACTOR= 1.0000E+00



RUN # 87 MAR/20/92 10:17:16
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	1185	BV	0.063	0.931
0.31	303	D PV	0.014	0.238
0.34	109610	D VB	0.015	86.137 C1
0.63	1602	D PB	0.020	1.259
0.77	3975	D VB	0.021	3.124
2.43	291	PV	0.033	0.229
2.55	960	VV	0.062	0.754
6.13	6224	VV	0.174	4.891
6.42	3100	VV	0.140	2.436

VOC, X

APPENDIX G
OPACITY OBSERVATIONS

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

[signature] 9/20/91
Certifying Officer — Date

TEXAS AIR CONTROL BOARD

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Florida Gas / Perry Station

ADDRESS:

CITY: Perry | **STATE:** Fl | **ZIP:**

PHONE: | **SOURCE ID NUMBER:** 1506

PROCESS EQUIPMENT: Cooper Bessemer | **OPERATING MODE:** 3980 BHP

CONTROL EQUIPMENT: | **OPERATING MODE:**

DESCRIBE EMISSION POINT:

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

DISTANCE FROM OBSERVER: ~200' | **DIRECTION FROM OBSERVER:** N-NW

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 diameter downstream from emission point

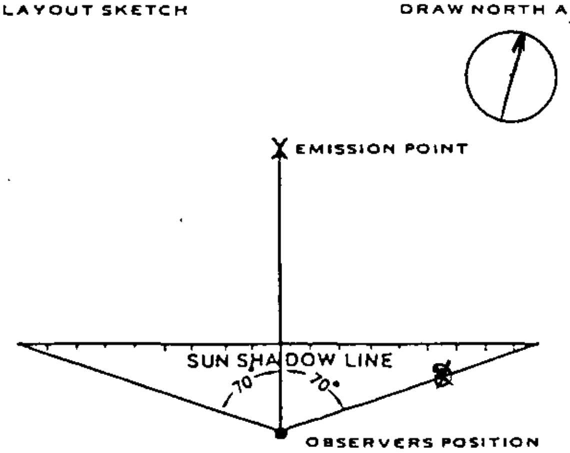
DESCRIBE BACKGROUND: Sky

BACKGROUND COLOR: Blue | **SKY CONDITIONS:** Clear

WIND SPEED: 10-15 mph | **WIND DIRECTION:** SE

AMBIENT TEMP.: 57 | **WET BULB TEMP.:** 52 | **RELATIVE HUMIDITY:** 47%

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVATION DATE: 3-20-92 | **START TIME:** 8:45 | **STOP TIME:** 9:45

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: MINIMUM 0 MAXIMUM 0

COMMENTS:

OBSERVER'S NAME (PRINT): Tony Saere

OBSERVER'S SIGNATURE: Tony Saere | **DATE:** 3-20-92

ORGANIZATION: Cubix

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE:

TITLE: | **DATE:**

CERTIFIED BY: TACB | **DATE:** 6-15-90

VERIFIED BY: | **DATE:**

EPA TR 0101

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Florida Gas / Perry Station

ADDRESS:

CITY: Perry | **STATE:** Fl | **ZIP:**

PHONE: | **SOURCE ID NUMBER:** 1506

PROCESS EQUIPMENT: Cooper Bessamer Eng | **OPERATING MODE:** 4004 BHP

CONTROL EQUIPMENT: | **OPERATING MODE:**

DESCRIBE EMISSION POINT: circular stack

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

DISTANCE FROM OBSERVER: ~200' | **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 of emission point

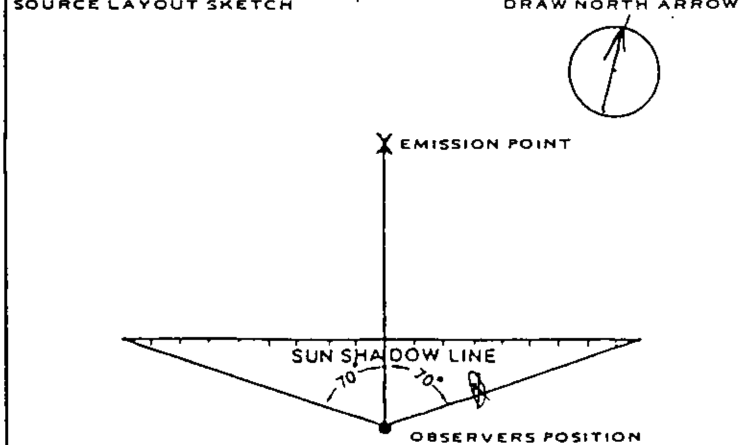
DESCRIBE BACKGROUND: SKY

BACKGROUND COLOR: Blue | **SKY CONDITIONS:** Clear

WIND SPEED: 10-15 mph | **WIND DIRECTION:**

AMBIENT TEMP.: 63 | **WET BULB TEMP.:** 57 | **RELATIVE HUMIDITY:** 67%

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



COMMENTS:

OBSERVATION DATE: 3-20-92 | **START TIME:** 955 | **STOP TIME:** 10:55

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

OBSERVER'S NAME (PRINT): Tony Sacie

OBSERVER'S SIGNATURE: Tony Sa[signature] | **DATE:** 3-20-92

ORGANIZATION: CUBIX

CERTIFIED BY: TACB | **DATE:** 9-15-92

VERIFIED BY: | **DATE:**

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE:

TITLE: | **DATE:**

EPA TH 0101

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Florida Gas / Perry Station

ADDRESS:

CITY: Perry | **STATE:** Fl | **ZIP:**

PHONE: | **SOURCE ID NUMBER:** 1506

PROCESS EQUIPMENT: Cooper Bessamer | **OPERATING MODE:** 4000 BHP

CONTROL EQUIPMENT: | **OPERATING MODE:**

DESCRIBE EMISSION POINT: Circular Stack

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

DISTANCE FROM OBSERVER: ~200' | **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 of emission point

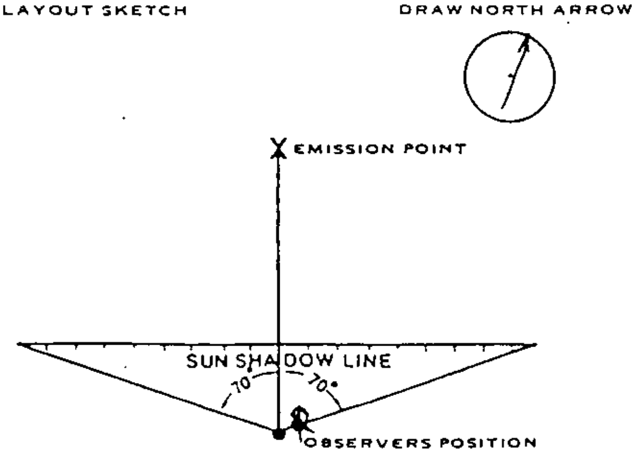
DESCRIBE BACKGROUND: Sky

BACKGROUND COLOR: Blue | **SKY CONDITIONS:** Clear

WIND SPEED: 10-15 mph | **WIND DIRECTION:** SE

AMBIENT TEMP.: 63 | **WET BULB TEMP.:** 54 | **RELATIVE HUMIDITY:** 65

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



COMMENTS:

OBSERVATION DATE: 3-20-92 | **START TIME:** 11:13 | **STOP TIME:** 12:13

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: MINIMUM 0 MAXIMUM 0

OBSERVER'S NAME (PRINT): Tony Sacie

OBSERVER'S SIGNATURE: Tony Sacie | **DATE:** 3-20-92

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

APPENDIX H: FUEL ANALYSES AND CALCULATIONS

CERTIFICATE OF ANALYSIS NUMBER 199908

SAMPLE IDENT.: PERRY COMP. STA. 2055
FLORIDA GAS TRANS.
NATURAL GAS F.G.T.
03/20/92 @ 11:00

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

Client: Florida Gas
Sample ID: Perry 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	0.3720	28.016	0.0744	0.00028	0.6251	0	0.00	0	0
CO2	0.6730	44.01	0.117	0.00079	1.7784	0	0.00	0	0
CO		28.01	0.074	0.00000	0.0000	4347	0.00	322	0
Methane	96.5510	16.041	0.0424	0.04094	92.4608	23879	22078.72	1013	978.06
Ethane	1.9070	30.067	0.0803	0.00153	3.4586	22320	771.96	1792	34.173
Ethylene		28.051	0.0746	0.00000	0.0000	21644	0.00	1614	0
Propane	0.2620	44.092	0.1196	0.00031	0.7077	21661	153.30	2590	6.7858
propylene		42.077	0.111	0.00000	0.0000	21041	0.00	2336	0
Isobutane	0.0700	58.118	0.1582	0.00011	0.2501	21308	53.29	3363	2.3541
n-butane	0.0580	58.118	0.1582	0.00009	0.2072	21257	44.05	4016	2.3293
Isobutene		56.102	0.148	0.00000	0.0000	20840	0.00	3068	0
Isopentane	0.0270	72.144	0.1904	0.00005	0.1161	21091	24.49	4008	1.0822
n-pentane	0.0180	72.144	0.1904	0.00003	0.0774	21052	16.30	3993	0.7187
n-hexane	0.0620	86.169	0.2274	0.00014	0.3184	20940	66.68	4762	2.9524
H2S		34.076	0.0911	0.00000	0.0000	7100	0.00	647	0
total	100.00	Average Density		0.04428	100.0000	Gross Heating Value Btu/lb	23209	Gross Heating Value Btu/SCF	1028
		Specific Gravity		0.57877					

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	0.37	10.4220	0	0	0.622677016		
CO2	44.01	0.272273	0	0.67	29.6187	0.48181995	0		1.2865	
CO	28.01	0.42587	0	0.00	0.0000	0	0		0	
Methane	16.041	0.75	0.25	96.55	1548.7746	69.4006033	23.133534			
Ethane	30.067	0.8	0.2	1.91	57.3378	2.740593	0.6851483			
Ethylene	28.051	0.85714	0.14286	0.00	0.0000	0	0			
Propane	44.092	0.81818	0.18182	0.26	11.5521	0.56470771	0.1254908			
Propene	42.077	0.85714	0.14286	0.00	0.0000	0	0			
Isobutane	58.118	0.82759	0.17247	0.07	4.0683	0.20115818	0.0419214			
n-butane	58.118	0.82759	0.17247	0.06	3.3708	0.16667392	0.0347349			
Isobutene	56.102	0.85714	0.14286	0.00	0.0000	0	0			
Isopentane	72.144	0.83333	0.16667	0.03	1.9479	0.09698281	0.019397			
n-pentane	72.144	0.83333	0.16667	0.02	1.2986	0.06465521	0.0129314			
n-hexane	86.169	0.83721	0.16279	0.06	5.3425	0.26723351	0.0519618			
H2S	34.08	0	0	0.00	0.0000	0	0			0
Totals				#######	1673.7332	73.9844275	24.11	0.622677016	1.2865	0
										99.999

CALCULATED VALUES		
O2 F Factor (dry)	8636	DSCF of Exhaust/MM Btu of Fuel Burned @ 0% excess air
O2 F Factor (wet)	10641	SCF of Exhaust/MM Btu of Fuel Burned @ 0% excess air
Moisture F Factor	2005	SCF of Water/MM Btu of Fuel Burned @ 0% excess air
Combust. Moisture	18.84	volume % water in flue gas @ 0% excess air
Fo	1.8	fuel factor (dimensionless)
VOC Portion of fuel	2.40	%
CO2 F Factor	1023	DSCF of CO2/MM Btu of Fuel Burned @ 0% excess air

To: Fred Griffin

Perry Compressor Station

rom: Elery Griffis - Sta 16

ANALYSIS

ATE: 03/20/92		ANALYSIS TIME:	345	STREAM SEQUENCE: 12	
IME: 09:09		CYCLE TIME:	360	STREAM#: 1	
NALYZER#:	2	MODE:	RUN	CYCLE START TIME: 09:03	

OMP NAME	COMP CODE	MOLE %	GAL/MCF**	B.T.U.*	SP. GR.*
EXANE +	151	0.062	0.0270	3.19	0.0020
ROPANE	152	0.262	0.0722	6.61	0.0040
-BUTANE	153	0.070	0.0229	2.28	0.0014
-BUTANE	154	0.058	0.0181	1.88	0.0012
PENTANE	155	0.027	0.0098	1.08	0.0007
PENTANE	156	0.018	0.0066	0.73	0.0005
ITROGEN	157	0.372	0.0000	0.00	0.0036
ETHANE	158	96.551	0.0000	977.39	0.5348
O2	159	0.673	0.0000	0.00	0.0102
THANE	160	1.907	0.5101	33.82	0.0198
OTALS		100.000	0.6668	1026.98	0.5781

@ 14.730 PSIA DRY & UNCORRECTED FOR COMPRESSIBILITY

@ 14.730 & 60 DEG. F

OMPRESSIBILITY FACTOR (1/Z)	= 1.0021
RY B.T.U. @ 14.730 PSIA & 60 DEG. F CORRECTED FOR (1/Z)	= 1029.2
EAL SPECIFIC GRAVITY	= 0.5790
NNORMALIZED TOTAL	= 100.03
NALOG INPUT CHANNEL 1 = H 2 S 140	= .23208
NALOG INPUT CHANNEL 2 = WATER 144	= .21972

TIVE ALARMS

NE

Btu/scf 1028

O_2 F Factor 8637

Hydrogen Sulfide - .2 grain/ccf

CO_2 F factor 1023

1 gr = 15.83 PPM

APPENDIX I: ALTERNATIVE COMPLIANCE TEST DATA

Perry Compressor Station--Unofficial Data

Operator/Plant	Florida Gas Perry Compressor Station
Location	Taylor County, Florida
Source	Cooper-Bessamer 8W330-C2
Technicians	TS,NF

Test Run No.	**C-1**	**C-2**	**C-3**
Date	3/20/92	3/20/92	3/20/92
Start Time	08:45	09:55	11:13
Stop Time	09:45	10:55	12:13
Engine/Compressor Operation			
Engine Speed (rpm)	328	328	328
Ignition Timing (°BTDC)	3	3	3
Air Manifold Pressure (psig)	12	12	12
Air Manifold Temperature (°F)	112	111	111
Fuel Flow (SCFH)	28025	28130	27990
Fuel Manifold Pressure (psig)	55	56	56
Pre-Combustion Chamber Pressure (psig)	45.5	45.5	45.5
Loading Step (pockets open out of 12 total)	6	6	6
Suction Pressure (psig)	690	691	697
Suction Temperature (°F)	63	63	63
Discharge Pressure (psig)	910	912	910
Discharge Temperature (°F)	103	103	103
Engine Load (BHP)	3980	4004	3992
Torque (%)	99.8	100	98.8
Turbo Exhaust Temperature (°F)	510	510	510
Ambient Conditions			
Atmospheric Pressure (in. Hg)	29.67	29.67	29.67
Temperature (°F) : Dry bulb	58	63	63
(°F) Wet bulb	52	57	56
Humidity (lb/lb air)	0.0068	0.0085	0.0079
Measured Emissions			
NOx (ppmv)	72.0	82.0	74.0
CO (ppmv)	110	110	112.5
O2 via Method 3a (%)	16.1	16.0	16.0
CO2 via Method 3a (%)	2.92	2.92	2.90
THC via EPA Method 25a (ppmv, wet)	800	700	725
VOC via EPA Method 18 (% of THC)	6.34%	10.60%	5.37%
VOC i.e. non methane via EPA 18 (ppmv, wet)	50.7	74.2	38.9
VOC via Methods 25a and 18 (ppmv, dry)	53.4	78.1	40.9
SO2 in fuel (grains/100 DSCF)	<0.059	<0.059	<0.059
Stack Volumetric Flow Rates			
via Pitot Tube (SCFH, dry)	9.76E+05	1.02E+06	1.04E+06
Calculated Emission Rates (via pitot tube)			
NOx (lbs/hr)	8.39	10.0	9.22
CO (lbs/hr)	7.80	8.18	8.53
VOC (lbs/hr)	2.16	3.32	1.77
SO2 (lbs/hr)	<0.0024	<0.0024	<0.0024
NOx (tons/yr)	36.8	43.9	40.4
CO (tons/yr)	34.2	35.8	37.4
VOC (tons/yr)	9.48	14.5	7.76
SO2 (tons/yr)	<0.0103	<0.0104	<0.0103
NOx (g/hp-hr)	0.96	1.14	1.05
CO (g/hp/hr)	0.89	0.93	0.97
VOC (g/hp-hr)	0.25	0.38	0.20

Testing By Cubix Corporation, Austin, Texas

Perry Compressor Station--Unofficial Data

Operator/Plant	Florida Gas Perry Compressor Station
Location	Taylor County, Florida
Source	Cooper-Bessamer 8W330-C2
Technicians	TS,NF

Test Run No.	C-1	C-2	C-3
Stack Moisture & Molecular Wt. via EPA Method 4			
CO_2 (%)	2.92	2.92	2.90
O_2 (%)	16.05	16.03	16.00
Beginning Meter Reading (ft3)	656.795	678.892	700.143
Ending Meter Reading (ft3)	678.805	700.062	722.646
Beginning Impinger Wt (g)	2488.5	2511.8	2391.8
Ending Impinger Wt. (g)	2511.8	2534	2413.4
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	70	84	110
Dry Gas Meter Temperature (°F end)	102	105	120
Atmospheric Pressure (in Hg, abs.)	29.67	29.64	29.67
Stack Gas Moisture (% volume)	5.00	5.03	4.78
Dry Gas Fraction	0.950	0.950	0.952
Stack Gas Molecular Wt. (lbs/lb-mole)	28.55	28.55	28.57
Stack Moisture & Molecular Wt. via Stoichiometry			
Fuel Moisture Content (vol % @ 0% O_2)	18.84	18.84	18.84
Moisture Content (vol %)	4.81	4.94	4.92
Difference between methods	4%	2%	3%
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	1.2	1.3	1.2
ΔP #2	1.4	1.4	1.4
ΔP #3	1.3	1.5	1.6
ΔP #4	1.1	1.5	1.6
ΔP #5	1.2	1.3	1.4
ΔP #6	0.9	1.2	1.1
ΔP #7	0.85	1.2	1.1
ΔP #8	1.0	1.2	1
ΔP #9	1.40	1.40	1.50
ΔP #10	1.40	1.40	1.40
ΔP #11	1.50	1.60	1.50
ΔP #12	1.60	1.50	1.60
ΔP #13	1.40	1.40	1.40
ΔP #14	1.20	1.30	1.40
ΔP #15	1.00	1.20	1.40
ΔP #16	1.10	1.10	1.20
Sum of Square Root of ΔP's	17.6	18.5	18.6
Number of Traverse Points	16	16	16
Average Square Root of ΔP's	1.10	1.16	1.16
Average Temperature (°F)	526	531	509
Static Pressure (in. H_2O)	-0.7	-0.74	-0.77
Stack Diameter (in.)	34	34	34
Stack Area (ft2)	6.31	6.31	6.31
Stack Velocity (ft/min)	5122	5402	5369
Stack Flow,wet (ACFM)	32294	34062	33850
Stack Flow,dry (SCFH)	9.76E+05	1.02E+06	1.04E+06
Stack Flow Rate via EPA Method 19			
Fuel Flow to Engine (SCFH)	28025	28130	27990
Fuel Heating Value (BTU/SCF)	1028	1029	1029
Fuel O_2 F-Factor (DSCFH/MMBTU)	8636	8636	8636
Fuel CO_2 F-Factor (DSCFH/MMBTU)	1023	1024	1024
Stack Flow, dry via O_2 F-factor (SCFH)	1.07E+06	1.07E+06	1.06E+06
Stack Flow, dry via CO_2 F-factor (SCFH)	1.01E+06	1.02E+06	1.02E+06
Difference between O_2 F-factor and pitot tube	10%	5%	2%
Difference between CO_2 F-factor and pitot tube	3%	1%	2%
Stack Flow Rate via Carbon Balance			
Fuel Carbon Content	1.029	1.029	1.029
Exhaust Carbon Content	3.01	3.00	2.98
Stack Flow, dry via carbon balance (SCFH)	9.58E+05	9.65E+05	9.66E+05
Difference between carbon balance and pitot tube	2%	6%	7%

Testing By Cubix Corporation, Austin, Texas

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

4APT-AEB

MAY 31 1991

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

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

RECEIVED
JUN 03 1991
Division of Air
Resources Management

Dear Mr. Fancy:

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

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

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

Sincerely yours,

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

cc: ... CHF/BT