TEST REPORT
on
EXHAUST EMISSIONS
from a
COOPER BESSEMER GMVR 12 COMPRESSOR ENGINE
at
FLORIDA GAS TRANSMISSION'S
COMPRESSOR STATION NO. 13
CARYVILLE, WASHINGTON COUNTY, FLORIDA

Prepared For

FLORIDA GAS TRANSMISSION COMPANY

April 1992

Prepared by

Cubix Corporation

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

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INTRODUCTION

One Cooper Bessemer GMVR 12 compressor engine was tested to determine the quantity of emissions released into the atmosphere. The tests were conducted on March 18, 1992 at Compressor Station No. 13 located near Caryville, in Washington 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 67-189220.

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

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

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

Florida Gas Transmission Co.

Cubix Corporation

Table 1
Background Data

Source Owner/Operator:	**Florida Gas Transmission Co.** 601 South Lake Destiny Drive Maitland, Florida 32751 (407) 875-5816 TEL (407) 875-5896 FAX Attn: Allan Weatherford
Testing Organization	**Cubix Corporation** 9225 Lockhart Hwy Austin, Texas 78747 (512) 243-0202 TEL (512) 243-0222 FAX Attn: Lowell Faulkner
Test Participants:	**Florida Gas Transmission Co.** Allan Weatherford Jerry Thomas Fred Griffin **Cooper Bessemer** Carl McCluney **Cubix Corporation** Lowell Faulkner Norman Franco Tony Sacre
Test Date:	March 18, 1992
Location:	near Caryville in Washington 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 67-189220

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

SUMMARY OF RESULTS

One Cooper Bessemer GMVR 12 compressor engine was tested to determine the quantity of emissions vented to the atmosphere. The emission measurements reported herein result from tests conducted on March 18, 1992 at Compressor Station No. 13 located near Caryville, in Washington County, Florida. The purpose of these tests was to determine the compliance status of this engine with regard to the FDER permit.

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

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

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

The average emissions over the three test runs for NOx were found to be 1.56 lbs/hr, 6.84 tons/yr, and 0.27 g/hp-hr. By comparison, permit limits are 10.6 lbs/hr, 46.3 tons/yr, and 2.0 g/hp-hr. CO emissions averaged 7.79 lbs/hr, 34.1 tons/yr, and 1.33 g/hp-hr and are limited by the permit to 11.1 lbs/hr, 48.7 tons/yr, and 2.1 g/hp-hr. The tons/yr emission rates are based on 8760 hrs/year operation of the engine.

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

10 grains/100 DSCF. The mass emission rate of SO_2 presented in Table 2 was calculated from the estimated fuel flow to the engine assuming that all sulfur in the fuel was oxidized to SO_2. The SO_2 emission rate based on this calculation averaged <0.0016 lbs/hr or <0.0069 tons/yr. The permit limits for SO_2 mass emissions are 0.46 lbs/hr and 2.0 tons/yr.

Nonmethane hydrocarbon (i.e. VOC) concentrations were measured as required by the permit using EPA Method 25. Table 2 contains the results of those measurements. The average VOC emissions using Method 25 were 7.26 lbs/hr, 31.8 tons/yr, and 1.24 g/hp-hr. The permit limits nonmethane hydrocarbon emissions to 2.6 lbs/hr, 11.6 tons/yr, and 0.5 g/hp-hr.

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

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

Examination of the data in Appendix I shows that the VOC emissions using the alternate methods averaged 1.91 lbs/hr (5.43 tons/yr and 0.33 g/hp-hr). When compared with the data obtained from Method 25, one can see that the CO_2 and moisture interferents may have biased the VOC concentrations high. In addition, the alternate methods are much less labor intensive, which eliminates a lot of the possibility of human error from the field or lab personnel.

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

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

Data showing the use of stoichiometric calculations for determination of stack flow rate (i.e. F-factors and carbon balance) as well as for the stack moisture content included in Appendix I demonstrates that alternate methods are in agreement with the pitot tube traverse technique. During all three test runs on this engine, the moisture content obtained from stoichiometric calculations showed agreement within 5% of that obtained using EPA Method 4. The flow rate determination using F-factors agreed with the pitot tube measurements within 15%, averaged over the three test runs, and the carbon balance provided agreement within 10%.

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

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

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

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

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

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

TABLE 2
SUMMARY OF RESULTS

Operator/ Plant	Florida Gas Carryville Compressor Station
Location	Washington County, Florida
Source	Cooper Bessemer Compressor Engine
Technicians	LF,NF,TS

Test Run No.	**C-1**	**C-2**	**C-3**
Date	3/18/92	3/18/92	3/18/92
Start Time	11:08	12:22	13:30
Stop Time	12:08	13:22	.14:30
Engine/Compressor Operation			
Engine Speed (rpm)	330	330	330
Ignition Timing (°BTDC)	4	4	4
Air Manifold Pressure (psig)	13.2	12.9	13.4
Air Manifold Temperature (°F)	105	104	104
Fuel Manifold Pressure (psig)	38.5	39	38.5
Estimated Fuel Flow (SCFH)	18820	18623	18680
Pre Combustion Chamber Pressure (psig)	unavailable	38	39
Loading Step (pockets open out of 16 total)	14	14	14
Suction Pressure (psig)	702	700	700
Suction Temperature (°F)	65	65	65
Discharge Pressure (psig)	908	907	904
Discharge Temperature (°F)	101	101	100
Engine Load (BHP)	2650	2660	2679
Torque (%)	98.5	98.6	99.4
Turbo Exhaust Temperature (°F)	380/484	unavailable	381/465
Ambient Conditions			
Atmospheric Pressure (in. Hg)	29.98	29.95	29.86
Temperature (°F) : Dry bulb	66	71	69
(°F) Wet bulb	62	65	65
Humidity (lb/lb air)	0.0107	0.0116	0.0121
Measured Emissions			
NOx (ppmv)	22.4	24.0	23.4
CO (ppmv)	190	188	194
O2 (%)	15.6	15.6	15.6
CO2 (%)	3.05	3.16	3.13
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)	292	372	267
SO2 in fuel (grains/100 DSCF)	<0.059	<0.059	<0.059
Stack Volumetric Flow Rates			
via Pitot Tube (SCFH, dry)	5.62E+05	5.71E+05	5.53E+05
Calculated Emission Rates (via pitot tube)			
NOx (lbs/hr)	1.50	1.64	1.55
CO (lbs/hr)	7.76	7.80	7.80
VOC (lbs/hr)	6.82	8.83	6.13
SO2 (lbs/hr)	<0.0016	<0.0016	<0.0016
NOx (tons/yr)	6.59	7.17	6.77
CO (tons/yr)	34.0	34.2	34.2
VOC (tons/yr)	29.9	38.7	26.8
SO2 (tons/yr)	<0.0069	<0.0069	<0.0069
NOx (g/hp-hr)	0.26	0.28	0.26
CO (g/hp/hr)	1.33	1.33	1.32
VOC (g/hp-hr)	1.17	1.51	1.04

PROCESS DESCRIPTION

Florida Gas Transmission Co. owns and operates Compressor Station No. 13 located near Caryville, Florida. This plant uses engines to compress natural gas to allow for transportation in the main pipeline system. This compressor station is a part of a system developed by Florida Gas Transmission Company to allow the transport of natural gas from reserves in Texas to the Florida market.

The engine tested is a Cooper Bessemer GMVR 12 compressor engine bearing the serial number 48488. The engine is rated at 2700 BHP. It is a lean burn, high air/fuel ratio engine including a precombustion chamber on each cylinder, main chamber mixture regulation, and a variable timing spark control responsive to speed, torque, and air temperature.

The engine emissions are vented to the atmosphere through a 23.0" ID exhaust pipe at approximately 45 feet above grade. Two sample ports were installed in a straight horizontal section of the exhaust pipe between the engine and the silencer. The ports met EPA Method 1 criteria with regard to location. A field diagram of the sampling location can be found in Appendix A.

ANALYTICAL TECHNIQUE

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

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

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

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

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

EPA Method 1 was used to determine the velocity traverse point locations. The stack diagram of Appendix A shows that the sample ports did meet the location criteria set forth by the method. The sample ports were located approximately 4 diameters downstream and 3 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 approximately 15% higher than those obtained by the pitot tube measurement. AGA's carbon balance technique yielded results approximately 5% higher than those of EPA Methods 1-4. Both of these methods use stoichiometric relationships based on the estimated fuel flow, fuel composition, and excess air concentration for calculation of the stack flow rates. The *Summary of Results* uses the pitot tube values in all calculations to be consistent with the permit provisions. However, the alternate methods provided for a check of the pitot tube traverse results.

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

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

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

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

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

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

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

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

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

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

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

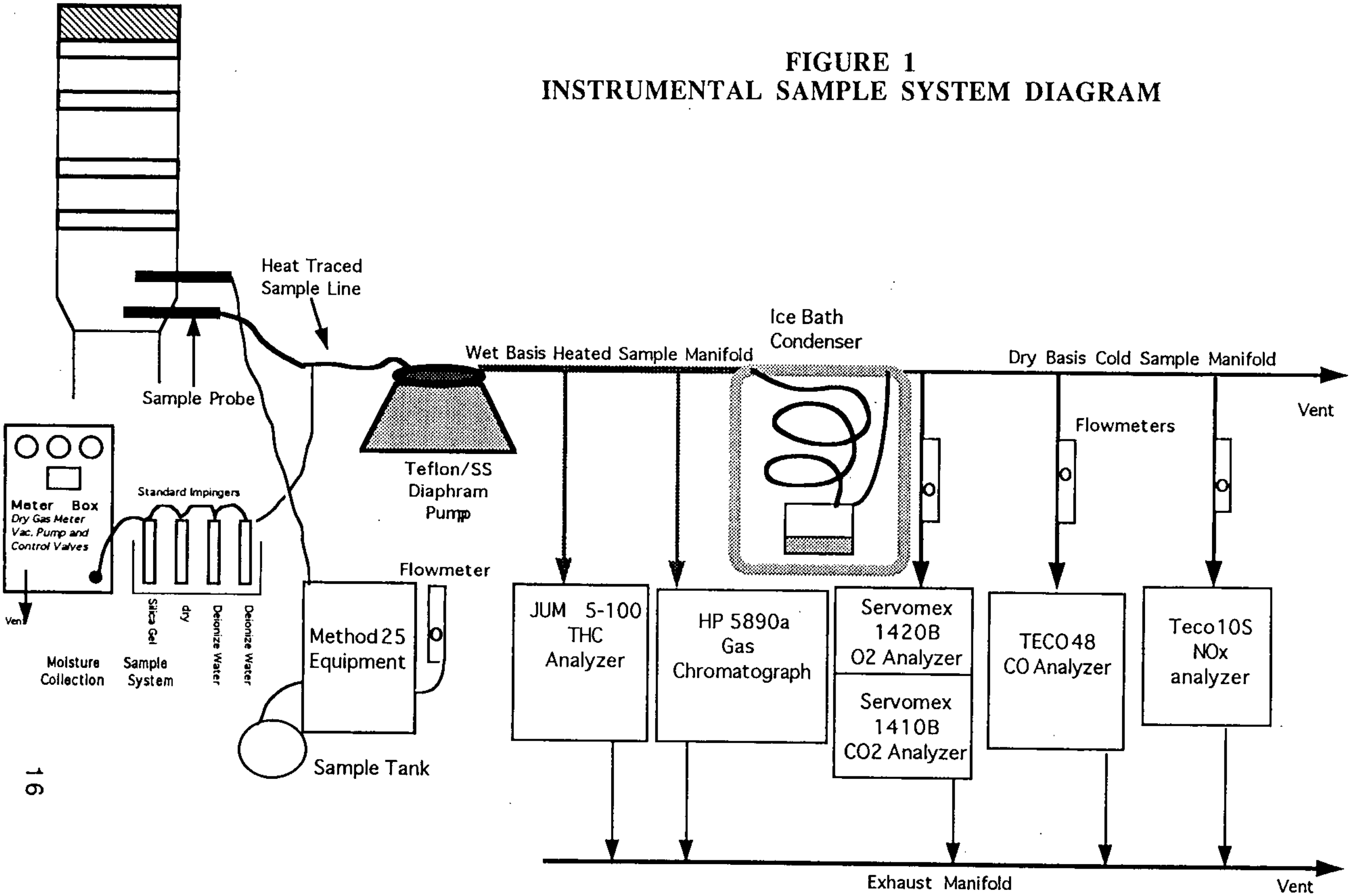
During the tests, the engine and compressor operational data was collected by Florida Gas personnel and is presented in Appendix A. Key operational data collected include compressor discharge pressures, compressor suction pressures, engine manifold pressure, engine speed, timing, and horsepower. Florida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

TABLE 3
ANALYTICAL INSTRUMENTATION

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

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

FIGURE 1
INSTRUMENTAL SAMPLE SYSTEM DIAGRAM



QUALITY ASSURANCE ACTIVITIES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The observer for the opacity measurements was certified by the Texas Air Control Board. The certification for the observer can be found in Appendix G.

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

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

APPENDIX A: FIELD DATA SHEETS AND OPERATIONAL DATA

SIGN IN SHEET

JOB NAME: ~~[illegible]~~ FGT

DATE: 3 / 18 / 93

LOCATION: Carryville, FL

PERMIT # AC 67-189220

SOURCE(S): Cooper-Bessemer Engine

PSD-FL-158

PARTICIPANTS: Cubix Corporation

FLORIDA GAS

ENRON

COOPER

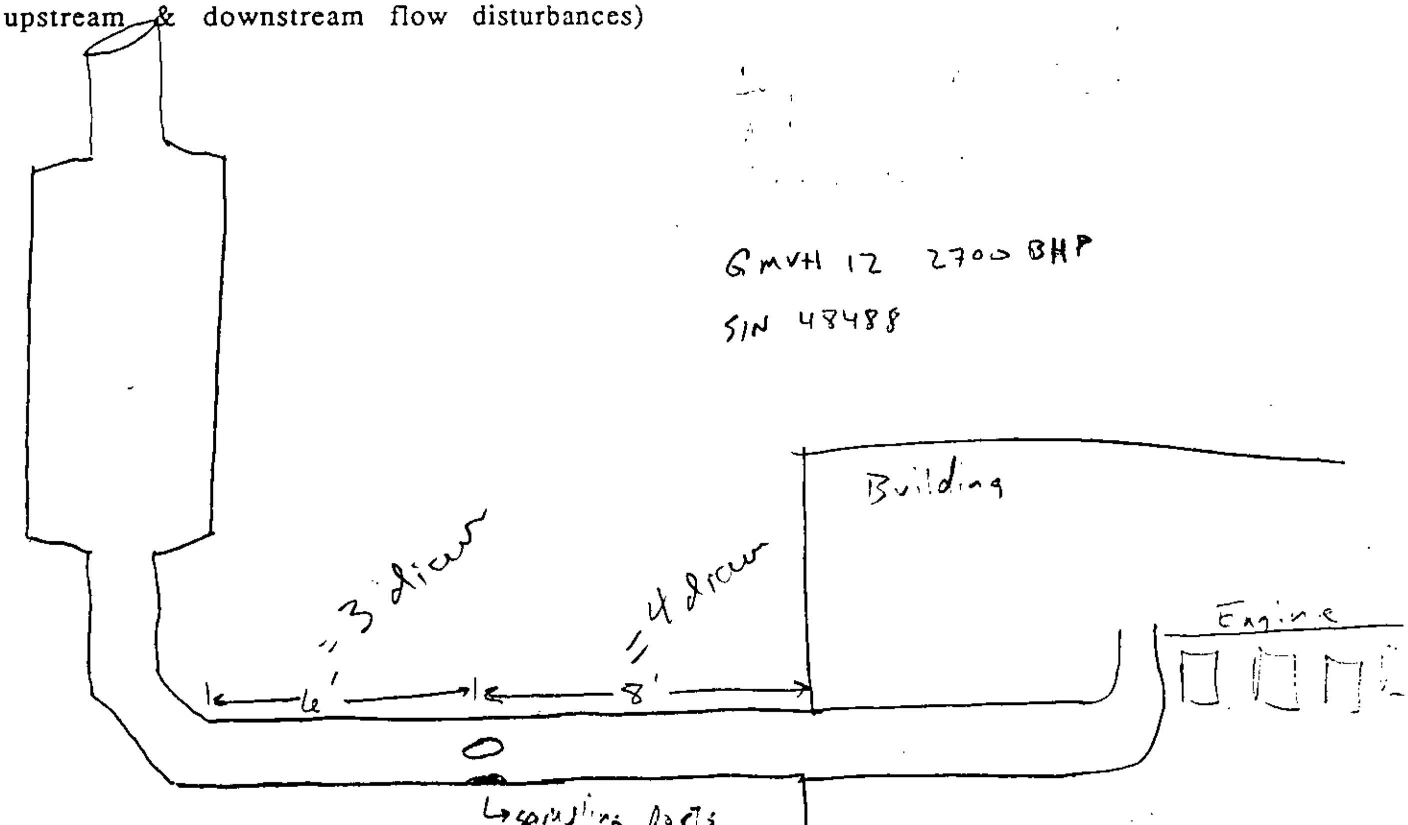
NAME:	AFFILIATION:	PHONE NUMBER:
ALLAN WEATHERFORD	FLA. GAS	407 875-5816
Lowell Faulkner	CUBIX	512 243 0202
Jerry Thomas	Enron	713-853-7331
CARL McCLUNEY	COOPER	504-465-0260
[signature]	Cubix	512 243 0202
Tony [signature]	"	"

Circular Stack Sampling Traverse Point Layout
(EPA Method 1)

Date: 3-18-92
Plant: Florida Gas/
Source: Cooper Bessemer Compressor/Engine
Technician(s) LF, NF, TS

Port + Stack ID: 32.0 in.
Port Extension 8.5 in.
Stack ID: 23.5 in.
Stack Area 3.546 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)



Traverse Point Number	Length Factor (% of diameter) Number of traverse pts./diameter 4	6	8	12	Distance from Reference Point (inches)
1	6.7	4.4	3.2	2.1	.8 ≈ 1.0
2	25.0	14.6	10.5	8.2	2.5
3	75.0	29.6	19.4	11.8	4.6
4	93.3	70.4	32.3	17.7	7.6
5		85.4	67.7	25.0	15.9
6		95.6	80.6	35.6	18.9
7			89.5	64.4	21.0
8			96.8	75.0	22.7 ≈ 22.5
9				82.3	
10				88.2	
11				93.3	
12				97.9	

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 2-18-92
Plant/Operator: FGT Cayville
Source: Cooper Eng
Technicians: LF, NF, TS
Atm. Pres. 29.98 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. -.09 in.H2O(Pg)
Average Stack Temp. 525 °F(Ts)

Pre-test Leak check OK	0 ft.3/min at 18" in. Hg Vacuum	Impinger #	Contents	Initial Weight	Final Weight
		1	H_2O	638.9	690.6
Post-test Leak check OK	0 ft.3/min at 17 in. Hg Vacuum	2	H_2O	558.8	539.1
		3	MT	484.7	487.9
		4	Silica	797.7	814.8
		5			
		6			
		Totals		2480.1	2532.4

Moisture Train

	Initial	Final
Time:	1100	12:12
Meter Reading (ft3 or L)	482.062	524.380
Meter Temp. (°F)	82	100
Sample Box #	TK7 B O OKJ A4	
O2 %	16.0	
CO2 %	3.0	

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	ΔP (" H2O)	°F	ß	ΔP (" H2O)	°F	ß
1	1.6			2.0		
2	1.7			2.1		
3	1.8			2.1		
4	1.6			1.9		
5	1.7			1.7		
6	1.9			1.8		
7	1.7			1.7		
8	1.4			1.6		
9						
10						
11						
12						

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3-18-92	Dry Gas Meter ID: ISGU1
Plant/Operator: Florida Gas / Caryville	Dry Gas Meter Factor: 0.9904 (Kd)
Source: Cooper Bessemer	Pitot Tube #/Type: S-Type
Technicians: LF, NF, TS	Pitot Tube Factor: 0.84 (Kp)
Atm. Pres. 29.95 in.Hg(Pb)	Static Pres. -0.25 in.H2O(Pg)
Test Run # C-2	Average Stack Temp. 529 °F(Ts)

Pre-test Leak check Ok	0.000 ft.3/min at 15.5 in. Hg Vacuum	Impinger #	Contents	Initial Weight	Final Weight
		1	H_2O	696.6	717.1
Post-test Leak check Ok	0.000 ft.3/min at 9.2 in. Hg Vacuum	2	H_2O	539.1	540.2
		3	MT	487.9	489.4
		4	Si Gel	814.8	821.4
		5			
		6			
		Totals		2538.4	2568.1

Moisture Train

	Initial	Final
Time:	12:30	1325
Meter Reading (ft3 or L)	524.610	549.695
Meter Temp. (°F)	100	106
Sample Box #	TR 7 BOX	

DESAT

O2 %	16.0
CO2 %	3.0

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	ΔP (" H2O)	°F	ß	ΔP (" H2O)	°F	ß
1	1.5			1.9		
2	1.7			2.3		
3	1.5			2.4		
4	1.7			1.7		
5	1.7			1.6		
6	1.9			1.6		
7	2.3			1.8		
8	2.2			1.6		
9						
10						
11						
12						

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3-19-92
Plant/Operator: Florida Gas Caryville St
Source: Cooper Bessemer Engine / Compressor
Technicians: LF 45 NF
Atm. Pres. 29.86 in.Hg(Pb)
Test Run # C-3

Dry Gas Meter ID: Isgur
Dry Gas Meter Factor: 0.9904 (Kd)
Pitot Tube #/Type: S-Type
Pitot Tube Factor: 0.84 (Kp)
Static Pres. -0.27 in.H2O(Pg)
Average Stack Temp. 533 °F(Ts)

Pre-test Leak check OK	0.000 ft.3/min at 21 in. Hg Vacuum	
Post-test Leak check OK	0.000 ft.3/min at 16.0 in. Hg Vacuum	

Impinger #	Contents	Initial Weight	Final Weight
1	H_2O	734.1	744.4
2	H_2O	548.2	542.9
3	MT	489.4	490.6
4	Si Gel	827.4	826.4
5			
6			
Totals	X	2599.1	2624.3

Moisture Train

	Initial	Final
Time:	1335	14:25
Meter Reading (ft3 or L)	549.810	571.256
Meter Temp. (°F)	98	100
Sample Box #	TRC 7 Box	

OK @ 4 F

O2 %	16.0
CO2 %	3.0

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	ΔP (" H2O)	°F	ß	ΔP (" H2O)	°F	ß
1	1.7			2.0		
2	1.8			2.2		
3	1.6			1.9		
4	1.7			1.7		
5	1.6			1.6		
6	1.8			1.6		
7	1.9			1.5		
8	1.4			1.7		
9						
10						
11						
12						

Carryville Compressor Station: Moisture,Molecular Weight, Stack Flow RAte

Operator/ Plant	Florida Gas Carryville Compressor Station
Location	Washington County, Florida
Source	Cooper Bessemer Compressor Engine
Technicians	LF,NF,TS

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)	482.062	524.610	549.810
Ending Meter Reading (ft3)	524.386	549.695	571.256
Beginning Impinger Wt (g)	2480.1	2538.4	2599.1
Ending Impinger Wt. (g)	2532.4	2568.1	2624.3
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	82	100	98
Dry Gas Meter Temperature (°F end)	100	106	100
Atmospheric Pressure (in Hg, abs.)	29.98	29.95	29.86
Stack Gas Moisture (% volume)	5.78	5.67	5.60
Dry Gas Fraction	0.942	0.943	0.944
Stack Gas Molecular Wt. (lbs/lb-mole)	28.48	28.49	28.50
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	1.60	1.50	1.70
ΔP #2	1.70	1.70	1.80
ΔP #3	1.80	1.50	1.60
ΔP #4	1.60	1.70	1.70
ΔP #5	1.70	1.70	1.60
ΔP #6	1.90	1.90	1.80
ΔP #7	1.70	2.30	1.90
ΔP #8	1.40	2.20	1.40
ΔP #9	2.00	1.90	2.00
ΔP #10	2.10	2.30	2.20
ΔP #11	2.10	2.40	1.90
ΔP #12	1.90	1.70	1.70
ΔP #13	1.70	1.60	1.60
ΔP #14	1.80	1.60	1.60
ΔP #15	1.70	1.80	1.50
ΔP #16	1.60	1.60	1.70
Sum of Square Root of ΔP's	21.2	21.6	21.0
Number of Traverse Points	16	16	16
Average Square Root of ΔP's	1.33	1.35	1.31
Average Temperature (°F)	525	529	533
Static Pressure (in. H2O)	-0.09	-0.25	-0.27
Stack Diameter (in.)	23.5	23.5	23.5
Stack Area (ft2)	3.01	3.01	3.01
Stack Velocity (ft/min)	6146	6270	6116
Stack Flow,wet (ACFM)	18514	18887	18423
Stack Flow,dry (SCFH)	5.62E+05	5.71E+05	5.53E+05

Volatile Organic Carbon by Method 25

Client:	FGT	Project #:	
Plant:	Cantonville, F	Sample Location:	Centroid
Operator:	LF, NF, JS	Date:	3/18/92
Run Number:	C-1	Sample ID:	C-1
Tank Number:	4T248	Trap Number:	No. 19
Sampling Train ID#:	~~EX~~ 25	% CO2:	3%
Side: Left / Right:	H	% H2O:	6%
Start Time:	1100	Stop Time:	1200

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	22.90	29.8	~~[illegible]~~ 29.98	68
Post Test	10.50	10.9	29.98	69

Leak Rate	Tank (in Hg) Allowable	Tank (in Hg) Actual	Trap black ball reading
Pre Test	1.05	18.8 start 17.8 end = .3	0
Post Test	1.05	0.4	0

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

$.01 \cdot 35 \cdot 29.98 \cdot 10 / 100$

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

Clock Time	Gauge Vacuum (in Hg)	Flowmeter Setting (silver ball)	Probe Temp C / F	Filter Temp C / F	Notes
1100	29.8	35	786	252	Don't trust probe temp ?
1105	27.6	36	822	251	Stack T = 522 & set point
1110	25.9	35	880	249	is 265 so how is
1115	23.7	37	870	250	probe @ 822
1120	21.9	38	876	251	
1125	20.9	39	907	252	
1130	19.7	38	910	250	
1135	17.2	39	894	249	
1140	16.1	40	880	252	
1145	15.0	39	885	254	
1150	14.2	39	888	251	
1155	12.8	38	870	252	
1200	10.9	38	875	253	

Volatile Organic Carbon by Method 25

Client: F&T
Plant: Campville
Operator: LF, NF, TS
Run Number: C-2
Tank Number: 4T19
Sampling Train ID#: CE 2610
Side: Left / Right: #1
Start Time: 1210

Project #:
Sample Location: Centroid
Date: 3/18/92
Sample ID: C-2
Trap Number: unmarked RO02 three whitelines on long arm
% CO2: 3%
% H2O: 6%
Stop Time: 1310

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	28.8	29.98	68
Post Test	5.5	11.9	29.99	69

Leak Rate	Tank* (in Hg) Allowable	Tank* (in Hg) Actual	Trap black ball reading
Pre Test	0.59	0.10	0
Post Test	0.59	0.10	0

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

$$\frac{.01(40)(29.98)(5)}{100}$$

ΔP = Pressure Change (in Hg)
F = Sampling Flow Rate cc / min ~40
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
1210	28.8	40	270	260	
1215	26.8	40	271	255	
1220	24.2	40	272	254	
1225	22.0	40	273	252	Adj. flow rate
1230	20.3	39	270	251	Adj. flow
1235	18.2	10	265	251	Bad flow
1240	15.0	40	265	255	Good flow
1245	11.5	41	264	254	
1250	8.4	41	265	253	
1255	6.8	40	265	255	
1300	5.5	39	268	256	
1305	4.8	40	270	257	
1310	1.9	40	275	258	

Volatile Organic Carbon by Method 25

Client:	FGt	Project #:	
Plant:	Carrville	Sample Location:	Centroid
Operator:	LFNRTS	Date:	3/18/92
Run Number:	C-3	Sample ID:	C-3
Tank Number:	4T22	Trap Number:	NO. 21
Sampling Train ID#:	CE 2610	% CO2:	3%
Side: Left / Right:	#1	% H2O:	6%
Start Time:	1325	Stop Time:	1425

Pressure Readings	Tank Vacuum Manometer mm Hg / (in Hg)	Tank Vacuum Gauge mm Hg / (in Hg)	Barometric Pressure mm Hg / (in Hg)	Ambient Temperature C / (F)
Pre Test	28.0	28.9	29.99	67
Post Test	4.2	4.0	29.99	67

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
1325	28.9	40	270	255	
1330	27.8	40	275	260	
1335	25.2	40	277	261	
1340	22.9	40	278	264	
1345	19.0	40	280	266	
1350	17.3	39	285	267	
1355	14.9	40	285	265	
1400	12.3	35	280	264	
1405	10.9	37	275	260	
1410	9.9	37	270	255	
1415	6.1	38	271	255	
1420	4.9	39	270	257	
1425	4.0	39	270	255	

4335

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME	NO. OF CON-TAINERS	REMARKS
DEPT. NO. 8151	Cubix Corp		
SAMPLERS: (Signature) [signature] Joseph Rudyk			

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CON-TAINERS	CO2 BLANK VALUE (ppm vc)					REMARKS
→	C-2	3/20/92	1000	Trap # X13 @ Brooker		1.8					Perry - Fla. GAS ✓
				X14		0.9					
				X16		2.3					
	Audit-1	3/26/92		X23		2.6					Melbourne
				X27		1.8					
				X28		8.0					
	C-3	3/24/92	1100	X32		3.3					Melbourne - Fla. GAS ✓
	C-1	3/24/92	1000	X48		9.0					Silver Springs - Fla. GAS ✓
	C-4	3/27/92		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					~~Monson~~ - Fla. GAS ✓
	C-4	3/18/92	1100	N19 LAB 4/2		3.0					Gainville - Fla. GAS ✓

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

REMARKS:

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

4334

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME	NO. OF CONTAINERS	REMARKS
DEPT. NO. 8151	Cubix Corp.		

SAMPLERS: (Signature) [signature] Joseph Rudyk

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	CO₂ BLANK VALUE (ppmV)						REMARKS
	C-1	3/26/92	830	Trap # B35		3.0						Melbourne - Fla. GAS ✓
	C-2	3/7/92	1530	B53		4.5						MUNSON - Fla. GAS ✓
	C-5	3/27/92		B233		1.3						Melbourne
	C-2	3/24/92	1130	C1		2.4						Silver Springs - Fla. GAS ✓
	C-1	3/19/92	900	C3		3.5						Quincy - Fla. GAS ✓
	Audit-2	3/26/92		C7		0.8						Melbourne
	→ C-3	3/29/92	1120	C10		6.6						Perry - Fla. GAS ✓
	C-3	3/17/92	1643	C13		3.6						MUNSON - Fla. GAS ✓
	C-3			C15		3.6						Brooker
	~~C-2~~	~~3/6/92~~	~~955~~	~~C37~~		~~0.8~~						~~Melbourne - Fla. GAS ✓~~
	~~C-2~~	~~3/18~~	~~1300~~	~~R002~~		~~4.3~~						Cathy will [illegible]
				R004		1.2						
				R008		2.5						
				X1		2.6						
	→ C-1	3/20/92	830	X10		2.5						Perry - Fla. GAS ✓

LAB 4/12

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

REMARKS:

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

4336

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME	NO. OF CONTAINERS	CO_2 BLANK VALUE (ppmv)	NMHC BLANK VALUE (ppmv)				REMARKS
DEPT. NO. 8151	Cubix Corp							

SAMPLERS: (Signature) [signature] Joseph Rudyk

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	CO_2	BLANK VALUE (ppmv)	NMHC BLANK VALUE (ppmv)				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 ✓
→	C-3	3/20/92	1120	4T81			0.2					Perry - Fla. GAS ✓
	C-1	3/24/92	1000	4T89			0.7					Silver Springs - Fla. GAS ?
→	C-2	3/20/92	1000	4T91			0.1					Perry - Fla. GAS ✓
	C-2	3/26/92	955	4T103 LAB 4/2			0.5					Melbourne - Fla. GAS

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

REMARKS:

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

4558

CHAIN OF CUSTODY RECORD

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	NMHC BLANK VALUE (ppmv)						REMARKS
				TANK # 4T206		1.1						
	C-2	3/19/92	1020	4T210		0.7						QUINCY - Fla GAS ?
				4T217		0.4						
	C-2	3/17/92	1530	4T222		0.0						MUNSON - Fla GAS
	C-1	3/17/92	1425	4T238		1.6						MUNSON - Fla GAS
	C-1	3/18/92	1100	4T248		0.3						CARYVILLE Fla. GAS
	C-3	3/17/92	1643	4T254		0.1						MUNSON - Fla GAS

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
[signature]	4/1/92 1:42	Tom Grossman LAB 4/2			
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by:	Date / Time		

REMARKS:

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

Table of Carbon Concentration for Method 25.
Samples collected by Cubix Corp. at Florida
Gas & Trans on 3/18/92 and reported on 4/30/92.

		Carbon Concentration			
Source	Sample - Run ID #	Total (Mc) (mg/dscm)	Total (C) (ppmv)	Condensible (Ccm) (ppmv)	Noncondensible (Ctm) (ppmv)
CARYVILLE STATION	C-1	145.8	292.1	288.4	3.7
	C-2	185.9	372.3	365.0	7.3
	C-3	133.1	266.6	263.4	3.2

Compiled By: [signature] On: 4-30-92

Page 1

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

Job No.	8160	Plant: Florida Gas & Trans.
Client	Cubix	Sample Loc. Caryville Station
Disk/File	8160C	(In/Out) Centroid
Page No.	2	Date 3/18/92

Preliminary Data				
Run No.		C-1	C-2	C-3
Tank No.		4T248	4T19	4T22
Trap No.		NO 19	ROO2	NO 21
Tank Volume V(cc)		4280	4012	4049
Field Data				
PTI	(mm Hg)	-582	-673	-711
TTI	(F)	68	68	69
PbI	(mm Hg)	761	762	762
PT	(mm Hg)	-267	-140	-107
TT	(F)	69	69	67
Pb	(mm Hg)	761	762	762
Noncondensible Organics				
PT(Lab)	(mm Hg)	-137	-86	-114
TT(Lab)	(F)	78	76	76
Pb(Lab)	(mm Hg)	749	750	749
PTF	(mm Hg)	920	930	920
TTF	(F)	78	76	76
PbF	(mm Hg)	749	750	749
Ba	(ppmv C)	0.3	0.0	0.0
Ctm 1	(ppmv C)	1.0	2.9	1.6
Ctm 2	(ppmv C)	1.0	2.9	1.2
Ctm 3	(ppmv C)	1.0	1.2	0.7
Avg. Ctm	(ppmv C)	1.0	2.3	1.2
RSD Ctm	(%)	0.0	42.1	38.7
Condensible Organics				
ICV Tank No.		4T226	4T127	4T137
ICV Tank, Vv (cc)		4255	4035	4038
PFI	(mm Hg)	-741	-740	-740
TFI	(F)	78	76	76
PbFI	(mm Hg)	749	750	749
PF	(mm Hg)	920	920	940
TF	(F)	78	76	76
PbFf	(mm Hg)	749	750	749
Bt	(ppmv C)	3.0	4.3	1.8
Ccm 1	(ppmv C)	58.1	122.3	98.1
Ccm 2	(ppmv C)	59.3	120.3	97.4
Ccm 3	(ppmv C)	58.5	122.3	98.2
Avg. Ccm	(ppmv C)	58.6	121.6	97.9
RSD Ccm	(%)	1.0	0.9	0.4
Total Gaseous Nonmethane Organics (TGNMO)				
Vs	(cc)	1769	2809	3227
Dil. Factor (Non)		5.215	3.112	2.716
Dil. Factor (Con)		5.185	3.111	2.741
Ct	(ppmv C)	3.7	7.3	3.2
Cc	(ppmv C)	288.4	365.0	263.4
Ct+Cc= C	(ppmv C)	292.1	372.3	266.6
Mc	(mg C/dscm)	145.8	185.9	133.1

ENGINE/COMPRESSOR PERFORMANCE
EMISSION & PERFORMANCE TEST FORM

STATION CARYVILLE
STA. EL. -

	10:40 AM	11:15 A	12:25	TEST NO. 3:13 PM	4:10P			
ENGINE END ANALYSIS	1st	1-B	2	3	4			
ENGINE SPEED - RPM	330	330	330	330	330			
IGN. TIMING - BTDC	4°	4	4	4	4			
AMP - PSIG / "Hg	13.05	13.2	12.9	13.4	12.7			
AMT - F	105°	105	104	104	116			
~~FUEL STATIC PR. - PSIA~~								
~~FUEL DIFF. - "H2O~~								
~~FUEL TEMP. - F~~								
FMP - PSIG	38	38.5	39.0	39.5	38.0			
FUEL FLOW - SCFH	18792	18820	66.2 18623	18680	65.4 18538			
AMBIENT TEMP. - F	62°	66	71	69	68			
~~O2 - %~~ PCC - psig			37.5	39	36.5			
CO - ppm								
CO2 - %								
NO - ppm								
NO2 - ppm								
THC - (ppmv as C1)								

COMPRESSOR END ANALYSIS								
LOADING STEP 16 step total # pockets open	14	14	14	14	14			
SUCTION PRESSURE - PSIG	702	702	700	700	696			
SUCTION TEMP. - F	65	65	65	65	65			
DISCHARGE PRESSURE-PSIG	909	908	907	909	900			
DISCHARGE TEMP. - F	100	101	101	100	101			
COMPRESSOR FLOW - MMCFD								
TESTED BHP	2646	2650	2660	2679	2640			
TESTED TORQUE - %	98.3	98.5	98.6	99.4	96.5			
~~SFC - BTU/BHP-HR~~								
Turbo exhaust 66.4	380 494			381 465				

4531

APPENDIX B:
EXAMPLE CALCULATIONS

MOISTURE CONTENT
refers to test run C-1

V_1 = initial dry gas meter reading = 482.062 ft^3
V_2 = final dry gas meter reading = 524.386 ft^3
V_{net} = total gas sample volume collected (ft^3)
= V_2-V_1
= 524.386-482.062 = 42.324 ft^3

M_1 = initial weight of impinger train = 2480.1 g
M_2 = final weight of impinger train = 2532.4g

MWC = total weight gain of all impingers (g)
= M_2 - M_1 = 2532.4-2480.1
= 52.3 g

K_d = dry gas meter factor (unitless) = 0.9904

$V_{corrected} = V_{net} \times K_d =$ x
= 42.324 x 0.9904 = 41.9177 ft^3

1.335 liters weighs 1 gram at standard conditions
499.4 = Gas constant
P_{bar} = barometric pressure (in Hg) = 29.98
T = temperature of gas DGM (F^o) = 91

F_w = moisture fraction by volume

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

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

$$= \frac{(52.3 \times 1.335)}{(52.3 \times 1.335) + (((41.9177 \times 29.98) / (91 + 460)) \times 499.4)}$$

= 0.0578 moisture

MOLECULAR WEIGHT
refers to test run C-1 a

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 = 0.0578
F_d = dry gas fraction = 1 - Fw = 0.9422

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

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

$$= (18 \times 0.0578) + (0.9422 \times ((44 \times 0.03) + (32 \times 0.16) + (28 \times 0.81)))$$

$$= 28.48 \text{ lb/lb-mole}$$

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 = 1.328108
T_s = stack temperature = 525F° = 985 R°
P_b = atmospheric pressure (in Hg) = 29.98
P_g = stack static pressure (in. H_2O) = -0.09
Ps = absolute stack pressure
= P_b + (Pg x .0735 in.Hg / in.H_2O) = 29.973 in. Hg

V = stack velocity (ft/min)

= 5128.8 x Kp x $(\sqrt{\Delta P})avg$ x $\sqrt{(Ts / (Ps \times MW))}$

= 5128.8 x .84 x 1.3281 x $\sqrt{(985/ (29.973 \times 28.48)}$
= 6146 ft/min

Q_a = stack flow rate (ft^3/min)
= V x A , where A= area of stack = 3.01 ft^2
= 6146 x 3.01 = 18500 ft^3/min

Qd= stack flow rate on dry basis at standard conditions (SCFH)
= Q_a x 1059 x (Ps / Ts) x Fd
= 18500 x 1059 x (29.973/ 985) x 0.9422
= 5.62×10^5 SCFH

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

Q_f = fuel flow = 18820 SCF/hr
F_{BTU} = heating value of gas = 1026 BTU/SCF
F = O_2 F factor = 8635 SCF/MMBTU
C_{O_2} = concentration of O_2 = 15.6 %(from analyzer)

Q_d = stack flow rate on dry basis at standard conditions (SCFH)
$= Q_f \times F_{BTU} \times 10^{-6} \times F \times 20.9 / (20.9 - C_{O_2})$
$= 18820 \times 1026 \times 10^{-6} \times 8635 \times 20.9 / (20.9 - 15.6)$
$= 6.58 \times 10^5$ SCFH

With CO2 F-factor (i.e. F=1023), same calculation is used except for final term......
$Q_d = Q_f \times F_{BTU} \times 10^{-6} \times F \times 100/C_{CO_2}$
$= 18820 \times 1026 \times 10^{-6} \times 1023 \times 100/3.05$
$= 6.48 \times 10^5$ SCFH

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

MASS EMISSION RATES
refers to test run C-1

NOx = concentration of NOx (uncorrected)= 22.4 ppmv
CO = observed concentration of CO = 190 ppmv
VOC = observed concentration via EPA Method 25 and 18
= 91.4 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
E_{NOx} = mass emission rate of NOx (lb/hr)
$= NOx \times Qd \times 11.94 \times 10^{-8}$
$E_{NOx} = 22.4 \times 5.62 \times 10^{5} \times 11.94 \times 10^{-8}$

E_{NOx}= 1.5 lb/hr
E_{CO} = 7.8 lb/hr
E_{VOC}= 2.0 lb/hr

HP = engine horsepower = 2650 hp
454 g = 1.0 lb

$E_{NOx\ (g/hp\text{-}hr)} = E_{NOx} \times 454 / HP$
$= 1.5 \times 454 / 2650$
$E_{NOx\ (g/hp\text{-}hr)}$= 0.26 g/hp-hr
$E_{CO\ (g/hp\text{-}hr)}$= 1.33 g/hp-hr
$E_{VOC\ (g/hp\text{-}hr)}$= 0.34 g/hp-hr

Stack Gas Flow Rate via AGA Carbon Balance Method

Refers to Test Run #C-1

Q_f = estimated fuel flow = 18820 SCF/hr
Cf = carbon content of fuel (from fuel analysis) = 1.026
Ce = exhaust gas carbon content
= CO + THC (as C1) + CO2
= (190+ 1400) / 10000 + 3.05 = 3.209 %

Q = stack flow rate
= Qf x Cf x 100 / Ce
= 18820 x 1.026 x 100 / 3.209
= 6.02×10^5 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 = 18820 SCF/hr

SO2 = mass emission rate of SO2

$= S / 100 / 7000 \times Q_f$

$= <.059 / 100 / 7000 \times 18820$

$= <0.0016$ lbs/hr

Moisture Content via Stoichiometry
Refers to test run #1

H = Ambient humidity (via psychrometer) = 0.0107 lb/lb air
O2 = O2 concentration in stack = 15.6%
F = wet basis O2 F-factor (from fuel calcs)
= 10641 DSCF/MMBTU
FW = moisture F-factor = 2006 SCF of H_2O/MMBTU
CM = combustion moisture % at 0% O2
= Fw / F x 100 = 2006 / 10641 x 100
= 18.85 %

Fw = moisture content
= (CM x (20.9 - O2)/20.9) + (H x 64.3)
= (18.85 x (20.9 - 15.6)/20.9) + (.0107 x 64.3)
= 5.47 %

APPENDIX C:
QUALITY ASSURANCE ACTIVITIES

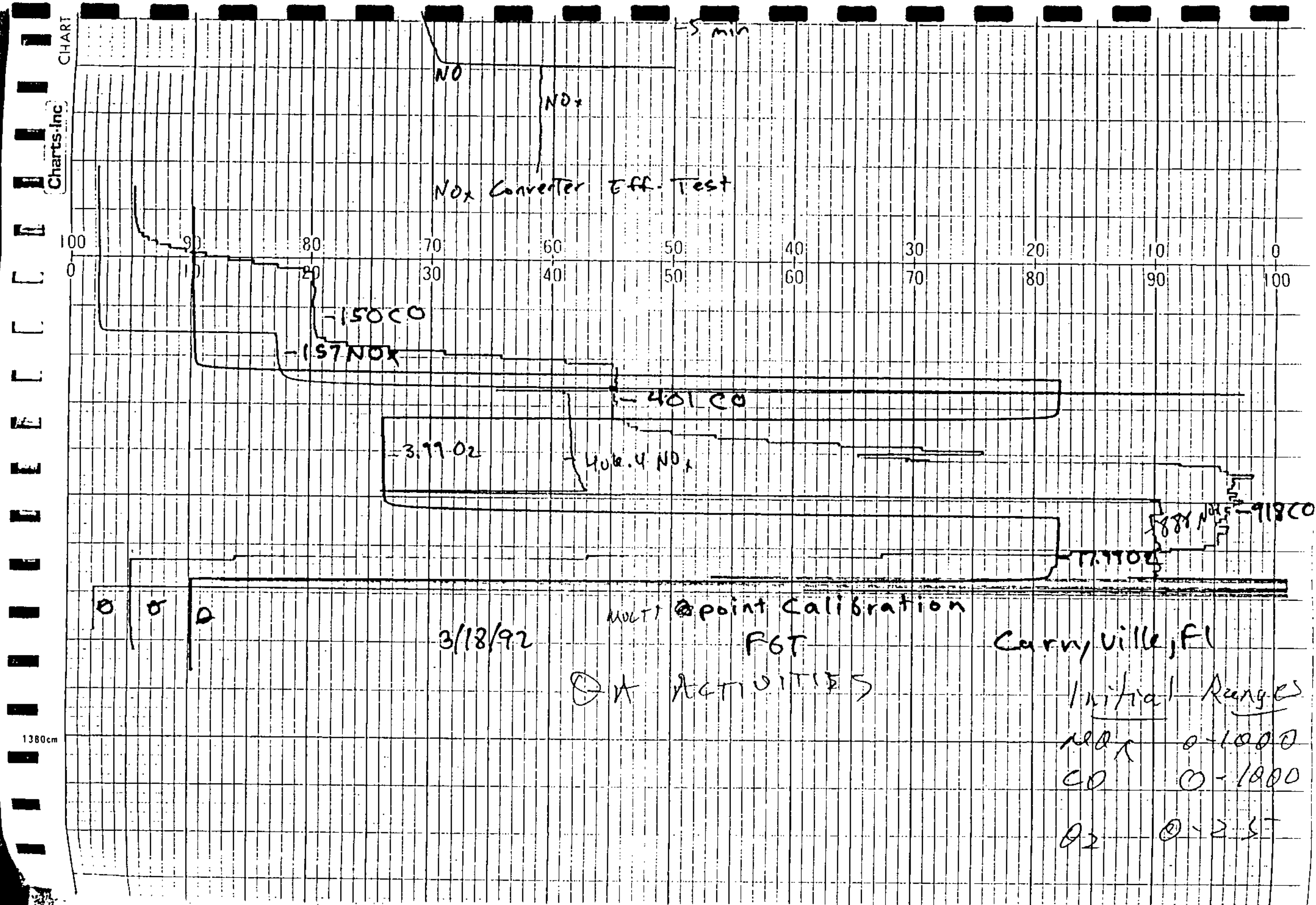
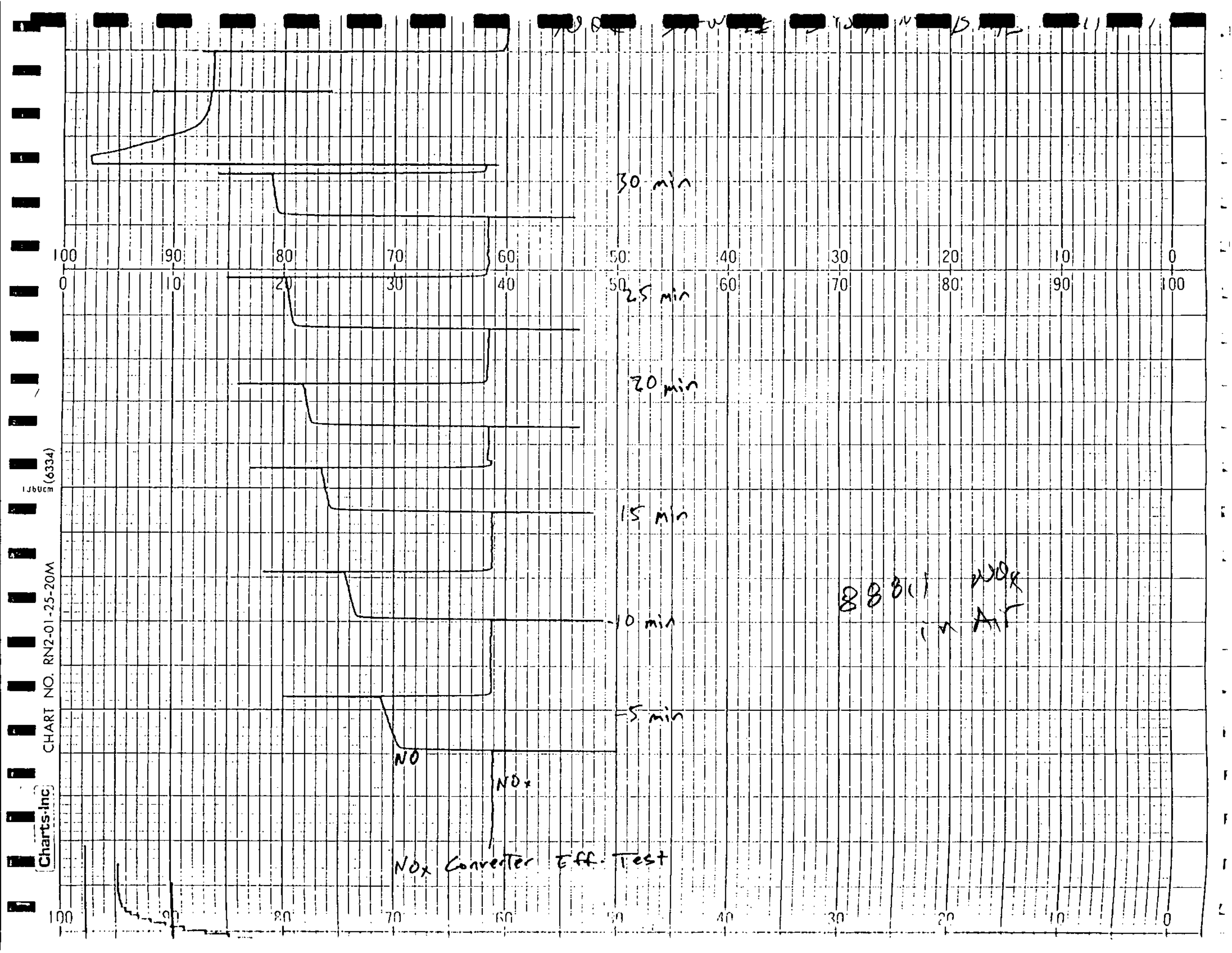


CHART
Charts-Inc
5 min
NO
NOx
NOx Converter Eff. Test
150 CO
157 NOx
401 CO
3.99 O2
406.4 NOx
891 NOx
918 CO
17.99 O2
0 0 0
Multi point Calibration
3/18/92
FGT
Carryville, Fl
QA Activities
Initial Ranges
NOx 0-1000
CO 0-1000
O2 0-25
1380cm



30 min
25 min
20 min
15 min
10 min
5 min
NO
NOx
NOx Converter Eff. Test
NOx in Air
CHART NO. RN2-01-25-20M
(6334)
Charts-Inc
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100

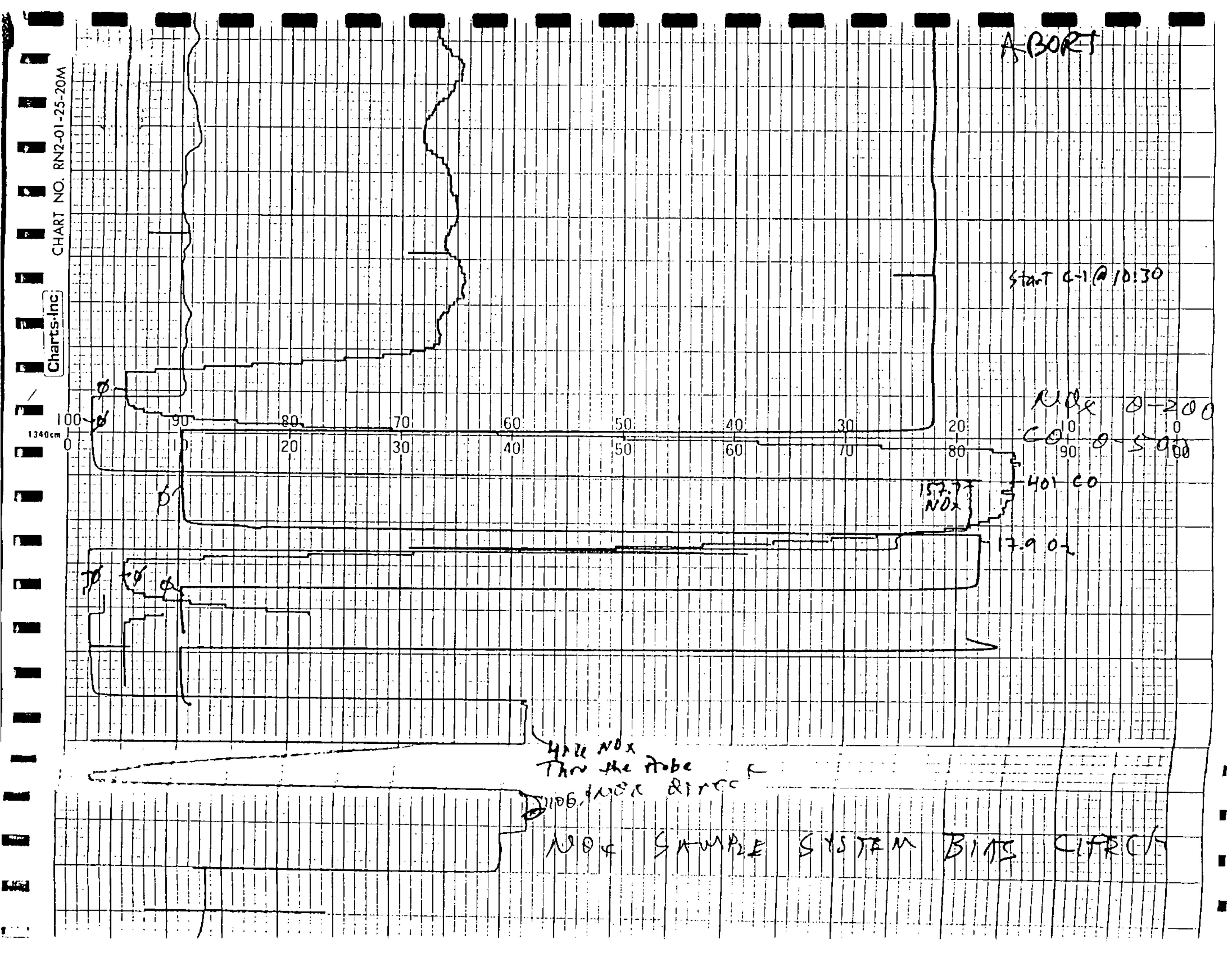
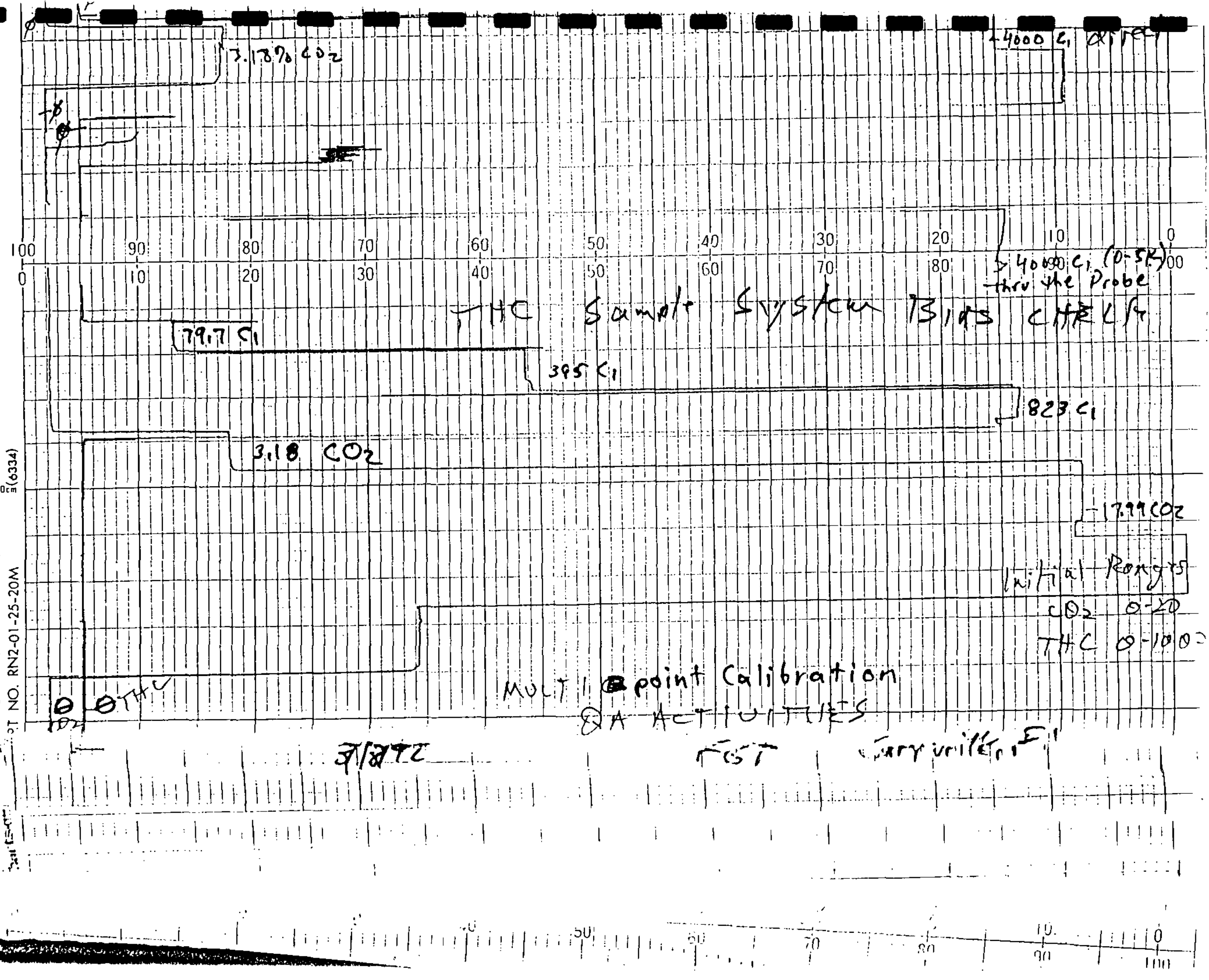


CHART NO. RN2-01-25-20M
Charts-Inc
ABORT
Start C-1 @ 10:30
NOx 0-200
CO 0-500
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
1340cm
401 CO
NOx
Thru the Probe
NOx Sample System Bias Check


3.18% CO_2
4000 C_1 direct
4000 C_1 (0-5K) thru the Probe
THC Sample System Bias Check
79.7 C_1
395 C_1
823 C_1
3.18 CO_2
17.99 CO_2
Initial Ranges
CO_2 0-20
THC 0-1000
Multi point Calibration
QA Activities
0 CO_2
0 THC
3/8/92
FGT
1660cm (6334)

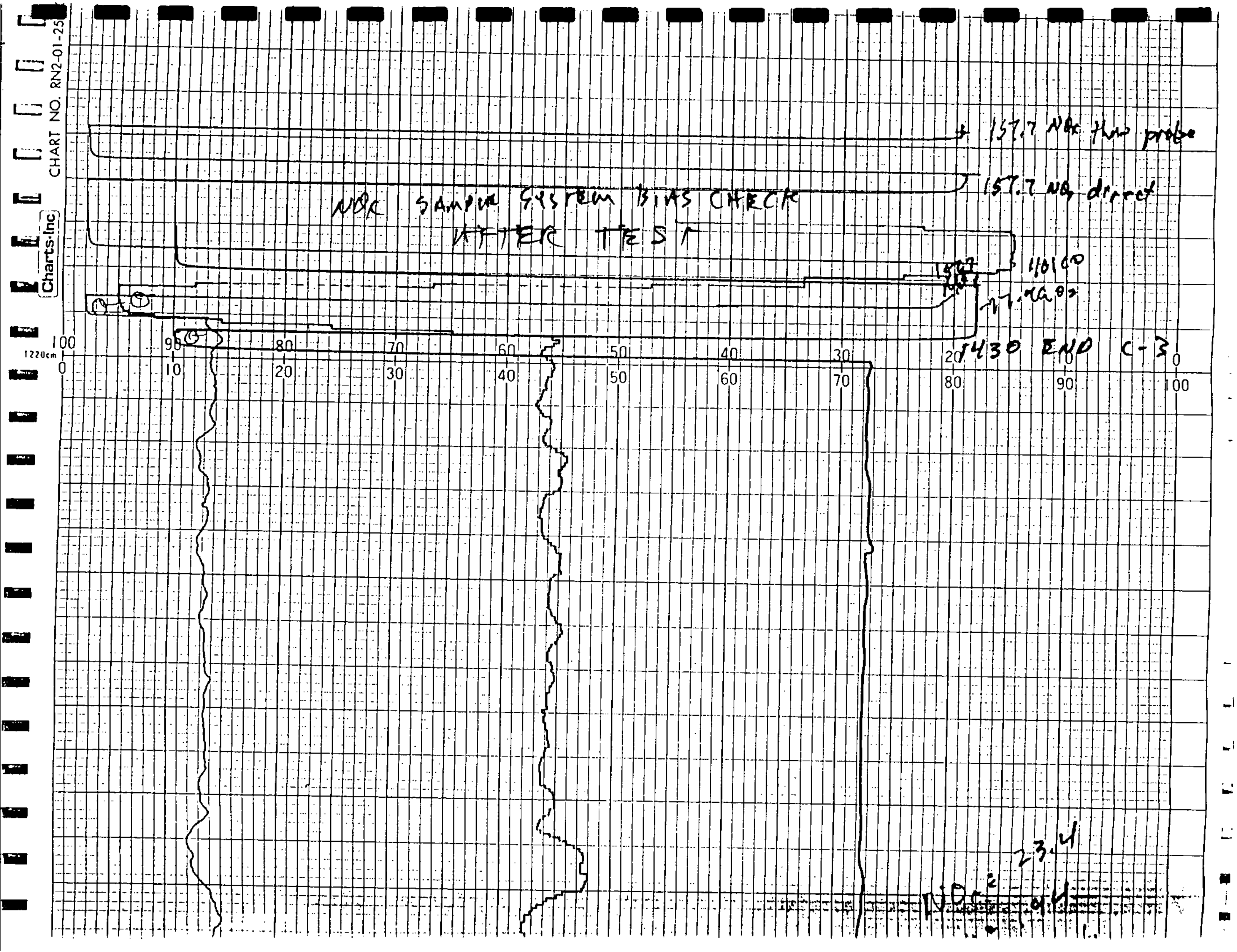
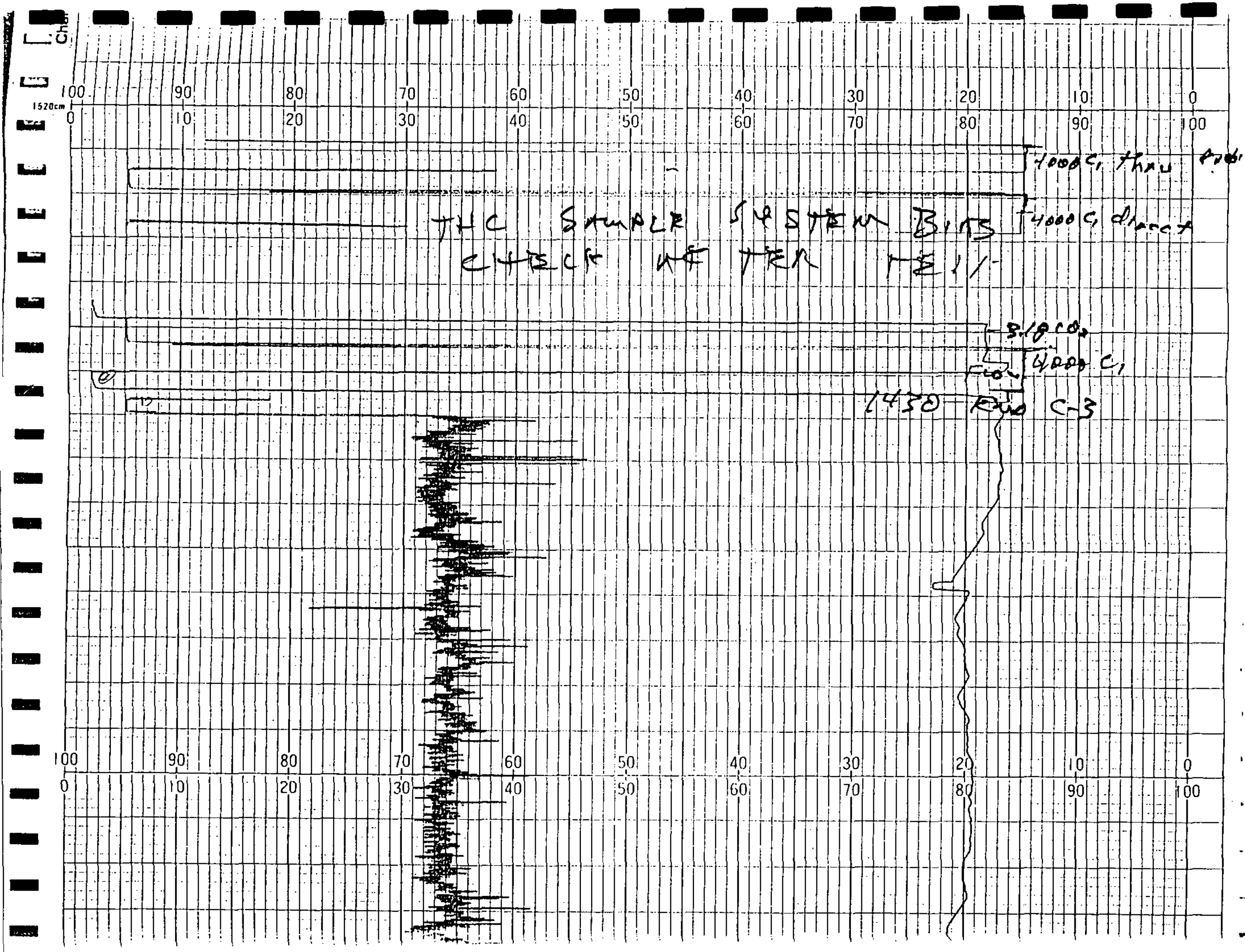


CHART NO. RN2-01-25
Charts·Inc
157.7 NOx thru probe
157.7 NOx direct
NOx SAMPLE SYSTEM BIAS CHECK
AFTER TEST
1430 END C-3
23.4



1520cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
4000 C1 thru Probe
4000 C1 direct
THC SAMPLE SYSTEM BIAS
CHECK AFTER TEST
3.18 CO2
4000 C1
Flow
1430 Run C-3

	CERTIFIED GAS INPUT		INITIAL CALIBRATION & LINEARITY CHECK		TEST RUN #C1	ZERO and SPAN CALIBRATION CHECK		TEST RUN #C2	ZERO and SPAN CALIBRATION CHECK		TEST RUN #C3	ZERO and SPAN CALIBRATION CHECK	
	Concentration (% or ppm)	Target (% Chart)	Initial (% Chart)	Difference (% Chart)		Final (% Chart)	Drift (% Chart)		Final (% Chart)	Drift (% Chart)		Final (% Chart)	Drift (% Chart)
NOx					Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	2.0	2.1	0.1	22.4	2.0	0.0	24.0	2.1	0.1	23.4	2.1	0.1
low	157.7	17.8	17.2	-0.6	% Chart	82.4	1.6	% Chart	80.4	-0.4	% Chart	80.2	-0.6
mid	406.4	42.6	41.3	-1.3	13.2	n.a.	n.a.	14.0	n.a.	n.a.	13.7	n.a.	n.a.
high	888.1	90.8	90.6	-0.2		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	1000.0				200.0			200.0			200.0		
CO					Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	5.0	5.2	0.2	190.0	5.0	0.0	188.0	5.0	0.0	194.0	5.1	0.1
low	150.0	20.3	20.2	-0.1	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	401.0	45.3	45.2	-0.1	43.0	85.8	0.6	42.6	85.0	-0.2	43.8	85.2	0.0
high	918.0	96.5	96.5	0.0		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	1000.0				500.0			500.0			500.0		
O2					Avg.%			Avg.%			Avg.%		
zero	0.0	10.0	10.1	0.1	15.60	10.3	0.3	15.60	10.2	0.2	15.60	10.1	0.1
low	3.99	26.0	26.1	0.1	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	n.a.	n.a.	n.a.	n.a.	72.4	n.a.	n.a.	72.4	n.a.	n.a.	72.4	n.a.	n.a.
high	17.99	82.0	82.1	0.1		81.5	-0.5		81.9	-0.1		82.0	0.0
full scale	25.0				25.0			25.0			25.0		
CO2					Avg.%			Avg.%			Avg.%		
zero	0.0	2.0	2.2	0.2	3.05	1.5	-0.5	3.16	2.2	0.2	3.13	2.2	0.2
low	3.18	17.9	17.9	0.0	% Chart	80.2	-1.3	% Chart	80.6	-0.9	% Chart	81.6	0.1
mid	n.a.	n.a.	n.a.	n.a.	78.3	n.a.	n.a.	81.0	n.a.	n.a.	80.3	n.a.	n.a.
high	17.90	91.5	92.0	0.5		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	20				4.0			4.0			4.0		
THC					Avg. ppmv			Avg. ppmv			Avg.ppmv		
zero	0.0	5.0	5.2	0.2	1400.00	5.0	0.0	1400	5.1	0.1	1435	5.0	0.0
low	79.7	13.0	18.2	5.2	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	395	44.5	43.7	-0.8	33.0	n.a.	n.a.	33.0	n.a.	n.a.	33.7	n.a.	n.a.
high	823	87.3	86.6	-0.7		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
high	4000	n.a.	n.a.	n.a.		84.8	-0.2		84.4	-0.6		83.8	-1.2
full scale	1000.00				5000.0			5000			5000		

Thermo Electron CORPORATION

Richard A. Curran
Regional Sales Manager

TR 7

Environmental Instruments Division

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

INTERFERENCE RESPONSE TEST

DATE OF TEST JAN 20, 1992

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

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

Continous Emission Analyzer
Interference Response Tests

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

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

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

(ppmv/% for CO_2/O_2 ratios; ppmv/ppmv for NOx, SO_2, propane ratios)

all interferences are negligible

TR 7 O2 ANALYZER

Continous Emission Analyzer Interference Response Tests

Date: 1/16/92
Technician: LF

Analyzer Type: SERVOMEX O2 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	<.05%	<.5	
SO_2	398 ppm	<.05%	<.5	
CO_2	8%	<.05%	<.5	
NO_x	888 ppm	<.05%	<.5	

TA 7 CO_2 ANALYZER

Continous Emission Analyzer Interference Response Tests

Date: 1/16/92
Technician: LT

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

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

Response Time Data Sheet

Date: 3/24/89

Plant: — Austin Office

Technician: MM/DC

Sample Manifold Press.: 6 psi

Sample Line Length: 140 ft.

Pump Model No.: 6-3 Dia-pump

Analyzer:	NOx Analyzer	Oxygen Analyzer
Model:	TECO 10AR	Teledyne 320 AX
Range:	0 - 1000 ppm	0 - 25 %
Span Gas:	900 ppm NO	Air = 20.9% O_2
Upscale Response	.65 min	.72 min
	.60	.75
	.60	.80
Average	.61 min	.76 min
Downscale Response	.65 min	.90 min
	.65	.90
	.65	.85
Average	.65 min	.88 min

Comments: 3/8" Sample line
Igloo Condenser

Instrumental Analysis
Quality Assurance Data

Date: 3/18/92
Plant: FGT Carryville Compressor Station
Technician: LF TS WT

NOx Analyzer: NO2 to NO Converter Efficiency Test

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

	NOx Concentration (ppm)	% Decrease from Initial Concentration	NO Concentration (ppm)
Initial Concentration	369	n.a.	281
10 minute Concentration	368	.3%	240
20 minute Concentration	364	1.4%	205
30 minute Concentration	364	1.4%	170

Sampling System Bias Check

Analysis	Calibration Gas Concentration (ppm)	Full Scale Span (ppm)	Direct Calibration Response (ppm)	Thru-Probe Sample System Response (ppm)	System Calibration Bias (% of Span)
Zero Gas					
NOx before	406.4	1000	403	394	-0.9%
~~SO2~~					
THC before	4000	5000	4000	4025	+0.5%
NOx (after)	157.7	200	157.6	157.0	-0.3%
THC (after)	4000	5000	4010	4010	0

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

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

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

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

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

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

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

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

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

APPENDIX D:
CALIBRATION CERTIFICATIONS

[redacted] Scott Specialty Gases [redacted] visio[redacted] Scott Environmental Technology, Inc. [redacted] Shi[redacted]rom [redacted]Scot[redacted]igan[redacted]

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

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.	(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.	(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 ________ Approved By ________

Scott Specialty Gases

[redacted]sion[redacted]
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
ITRIC OXIDE	406.4 PPM	1687	ALM-014665	965.5 PPM	BECKMAN	1-15-92	CHEMILUMINESCENCE
		1685	ALM-006700	250.3 PPM	951A		
					270-092895B		

ALANCE GAS : NITROGEN

ITROGEN DIOXIDE 0.00 PPM (FROM SECOND ANALYSIS)

FIRST ANALYSIS — DATE : 1-15-92

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
.00	40.70	406.9	965.5 PPM	96.50	965.5
.00	40.70	406.9		96.50	965.5
.00	40.70	406.9		96.50	965.5

CALCULATED RESULTS 406.9, 406.9, 406.9

AVERAGE : 406.9 PPM

SECOND ANALYSIS — DATE : 1-21-92

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

CALCULATED RESULTS 405.9, 405.9, 405.9 — 405.9 PPM NOX

AVERAGE : 405.9 PPM

CALIBRATION CURVE 1 ST DEGREE

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

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

GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : F. P. Doran (signature)
Approved By : J. Shapiro (signature)

[redacted] oll [redacted] onn [redacted] l Te [redacted] log [redacted].

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

Our Project # : 519062

Your P.O. # : 90347

Expiration Date : 7-28-92

Cylinder Number : ALM-016031

Cylinder Pressure 1900 psig

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

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

PERFORMED ACCORDING TO SECTION 3.0.4

Certified Per Traceability Protocol # 1 Procedure # G1

File # P08133

Certified Accuracy 1 % NBS Traceable

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

BALANCE GAS : NITROGEN

NITROGEN DIOXIDE 5.82 PPM (FROM SECOND ANALYSIS)

CERTIFIED EPA PROTOCOL

FIRST ANALYSIS DATE : 1-21-91

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

CALCULATED RESULTS 889.5, 889.5, 889.5

AVERAGE : 889.5 PPM

SECOND ANALYSIS DATE : 1-28-91

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

CALCULATED RESULTS 886.6, 886.6, 886.6 892.5 PPM NOX

AVERAGE : 886.6 PPM

CALIBRATION CURVE 1 st DEGREE

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

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : Paul P. Doran Approved By : [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. FAX: 713-644-0244 PHONE: 713-644-4820

3714 LAPAS DRIVE, HOUSTON, TEXAS 77023

6/03/91

CUBIX CORPORATION
9225 LOCKHART

PROJECT #: 04-11057
PO #: 91105

AUSTIN TX 78747-0000
KEVUN JANCK

CYLINDER #: ALM006621

ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION		ANALYSIS 1 (MOLES) U/M	
ARBON MONOXIDE	150.0	PPM	150.	PPM
ETHANE	80.0	PPM	79.7	PPM
TROGEN		BALANCE		BALANCE

CERTIFIED

ANALYTICAL METHOD: GRAV.MASTER GAS

DATE OF ANALYSIS: 6/03/91

ANALYST: ______________
ANALYST

APPROVED BY: ______________
SUPERVISOR

Scott Specialty Gases, Inc.

3714 LAFAS 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	
CARBON MONOXIDE	400.0	PPM	401.	PPM
METHANE	400.0	PPM	395.	PPM
NITROGEN	BALANCE		BALANCE	

ANALYTICAL METHOD: ACUBLEND MASTER

DATE OF ANALYSIS: 10/17/91

ANALYST: ______________ ANALYST

APPROVED BY: ______________ SUPERVISOR

Scott Specialty Gases, Inc.

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

10/22/91

CUBIX CORPORATION
9225 LOCKHART HWY

AUSTIN TX 78747-0000

PROJECT #: 04-13836
PO #: 910505

CYLINDER #: AAL13971 ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION		ANALYSIS 1 (MOLES) U/M	
CARBON MONOXIDE	910.0	PPM	918.	PPM
METHANE	820.0	PPM	823.	PPM
NITROGEN	BALANCE		BALANCE	

NOTES: EXP: 11/92

ANALYTICAL METHOD: ACUBLEND MASTER

DATE OF ANALYSIS: 10/22/91

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

CERTIFIED

Scott Specialty Gases

a division of
Scott Environmental Technology, Inc.

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

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

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

Gentlemen:

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

ANALYTICAL REPORT

Cyl No. AAL17750 Analytical Accuracy ±1%

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

Cyl No. ______ Analytical Accuracy ______

Component	Concentration

Cyl No. ______ Analytical Accuracy ______

Component	Concentration

Cyl No. ______ Analytical Accuracy ______

Component	Concentration

Analyst John Lempe

Approved By [signature]

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

Matheson Gas Products

World Leader in Specialty Gases & Equipment

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

RECEIVED JAN 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

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

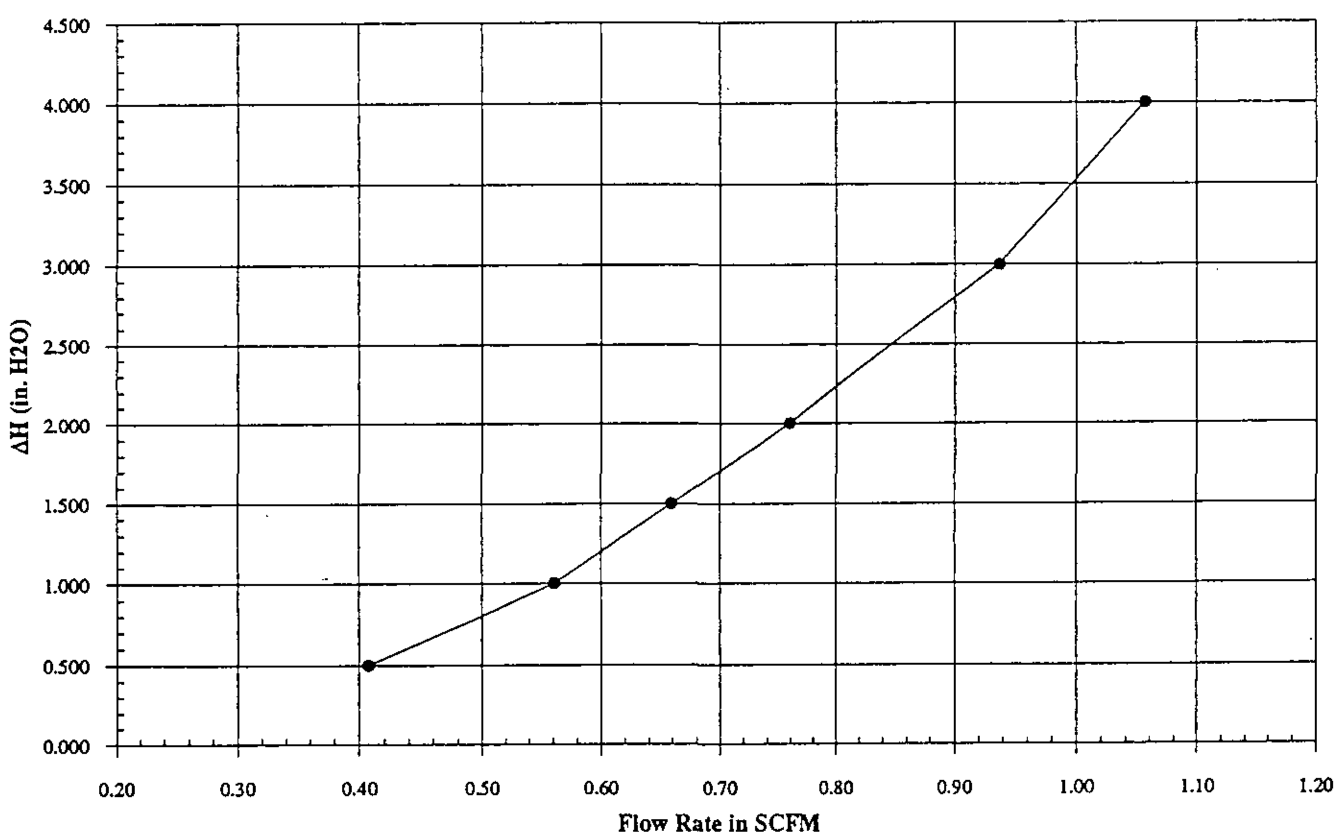
METER BOX DRY GAS METER and ORIFICE CALIBRATION

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

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

		Meter Box				Standard Test Meter					
Orifice Meter Setting ΔH (in. H20)	Elapsed Time (min.)	Starting Reading ft3	Ending Reading ft3	Starting Avg. Temp. °F	Ending Avg. Temp (°F)	Starting Reading (ft3)	Ending Reading (ft3)	Starting Avg. Temp (°F)	Ending Avg. Temp (°F)	Calculated Meter Factor (Kd)	Calculated ΔH@ 0.75 SCFM (" H2O)
0.50	10.00	43.095	47.310	77	86	0.000	4.080	72	72	0.9821	1.704
1.00	10.00	47.310	53.164	86	97	4.080	9.695	72	72	0.9899	1.767
1.50	10.00	53.164	60.138	97	109	9.695	16.300	72	73	0.9956	1.880
2.00	10.00	60.138	68.398	109	114	16.300	23.900	73	73	0.9797	1.868
3.00	10.00	68.398	78.344	114	120	23.900	33.287	73	73	1.0121	1.820
4.00	10.00	78.344	89.968	120	124	33.287	43.872	73	72	0.9834	1.888
	Averages:			101	108			73	73	0.9904	1.845

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



Testing by Cubix Corporation

Trailer #7 Altimeter

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

BFG/C9102

COMPONENT ALTIMETER

PART NO. 5934P-1A.83

SERIAL NO. 3H909

MFG. UNITED WORK ORDER # K0687

☐ Overhaul ☐ Repair ☒ Bench Check & Test

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

[signature]
AUTHORIZED SIGNATURE

FEB 11 1992
DATE

TEL-TRU MANUFACTURING. CO.

408 ST. PAUL STREET ROCHESTER, NY 14605 USA

CERTIFICATE OF CALIBRATION

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

CUSTOMER NUMBER	CUSTOMER P.O. NO.	MANUFACTURING NO.
2-5284500	910537	Stock

QUANTITY	ITEM NUMBER	DESCRIPTION
4	3410026D	BT300R 2.5" Stem 25/125F

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

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

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

APPENDIX E:
STRIP CHART RECORDS

NOx, O_2, CO

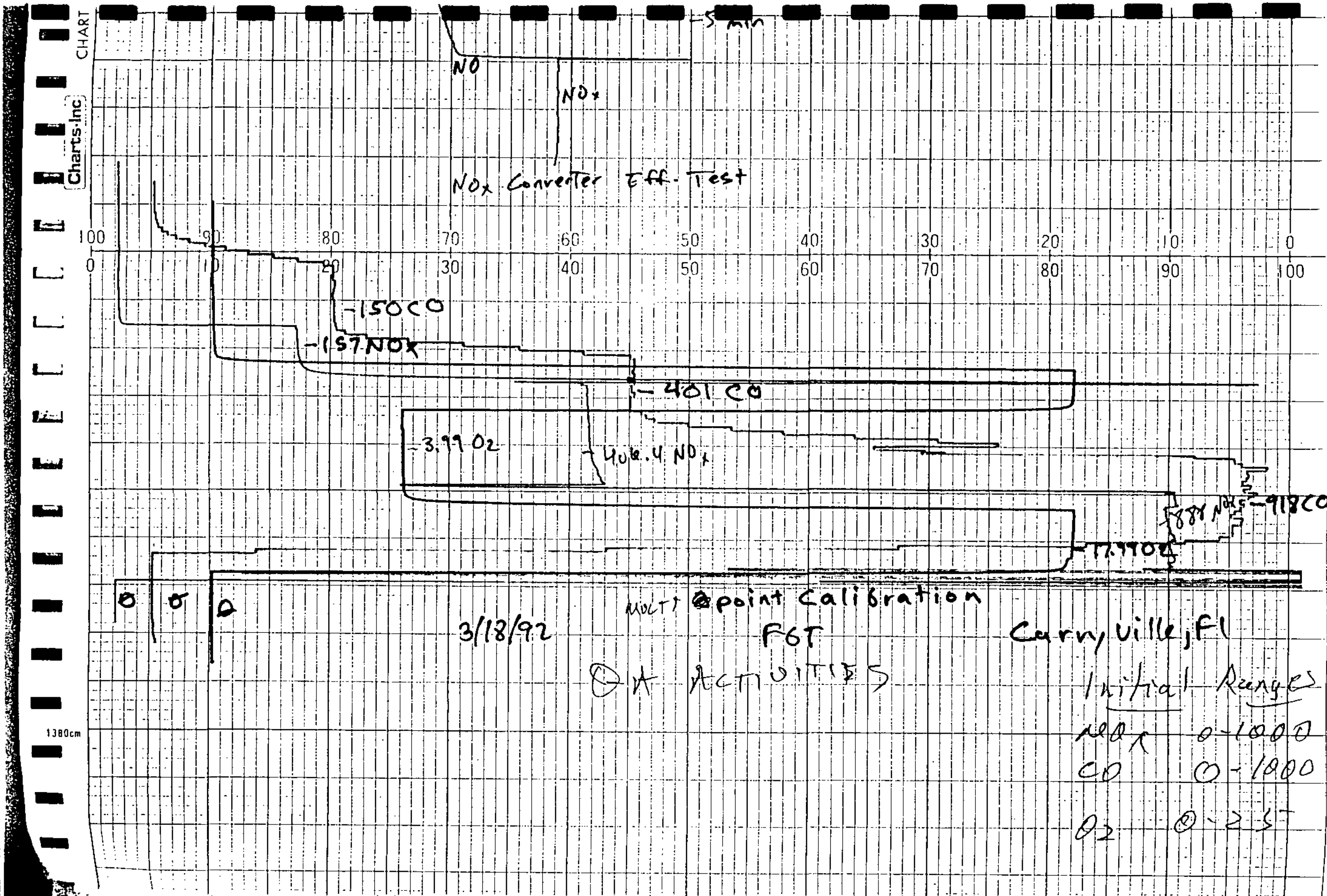
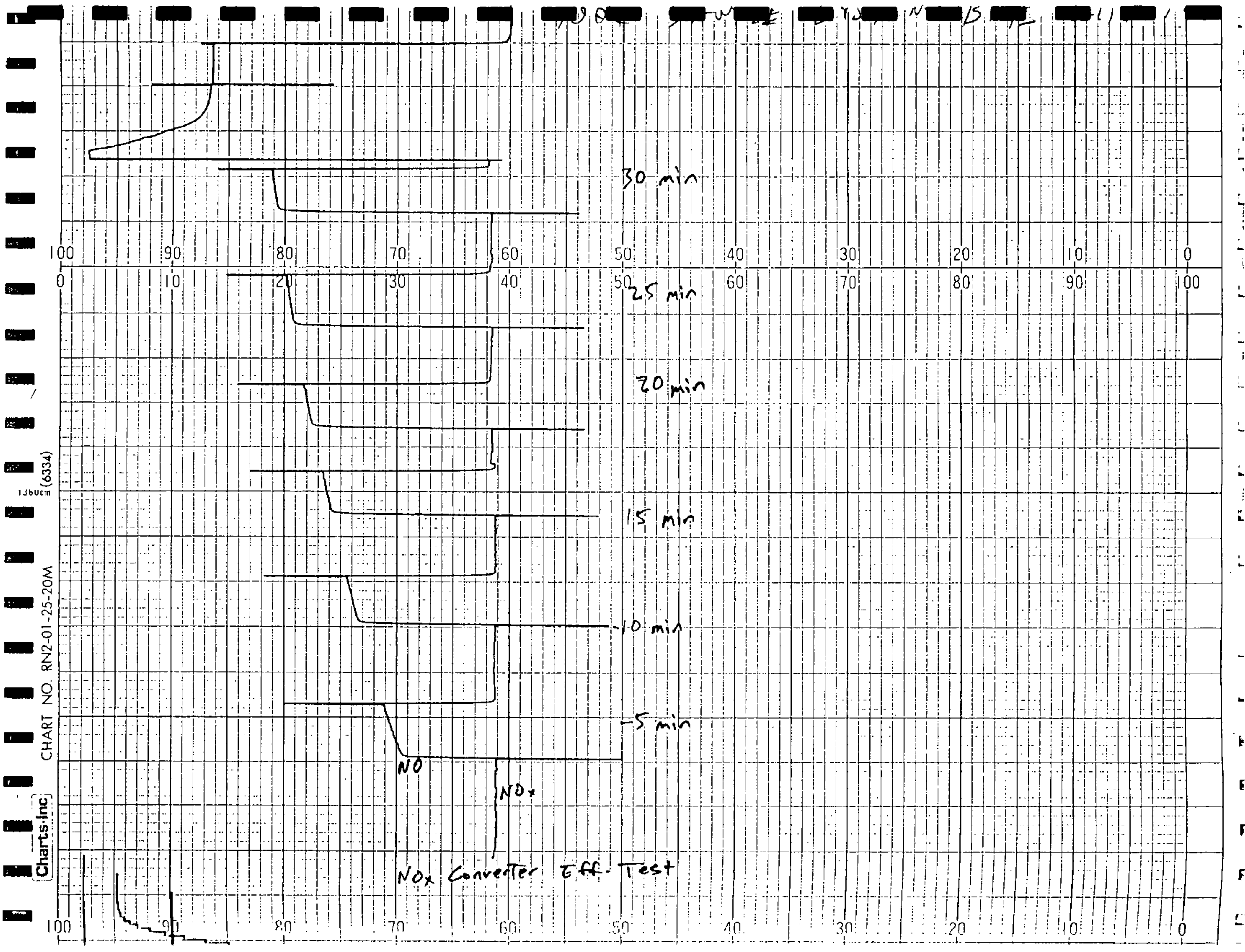


CHART
Charts Inc
5 min
NO
NOx
NOx Converter Eff-Test
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
-150 CO
-157 NOx
-401 CO
-3.99 O2
-406.4 NOx
-888 NOx
-918 CO
-17.99 O2
0
0
0
Multi point Calibration
3/18/92
FGT
Carryville, Fl
QA ACTIVITIES
Initial Ranges
NOx 0-1000
CO 0-1000
O2 0-25
1380cm


30 min
25 min
20 min
15 min
10 min
5 min
NO
NOx
NOx Converter Eff. Test
CHART NO. RN2-01-25-20M
(6334)
1360cm
Charts·Inc

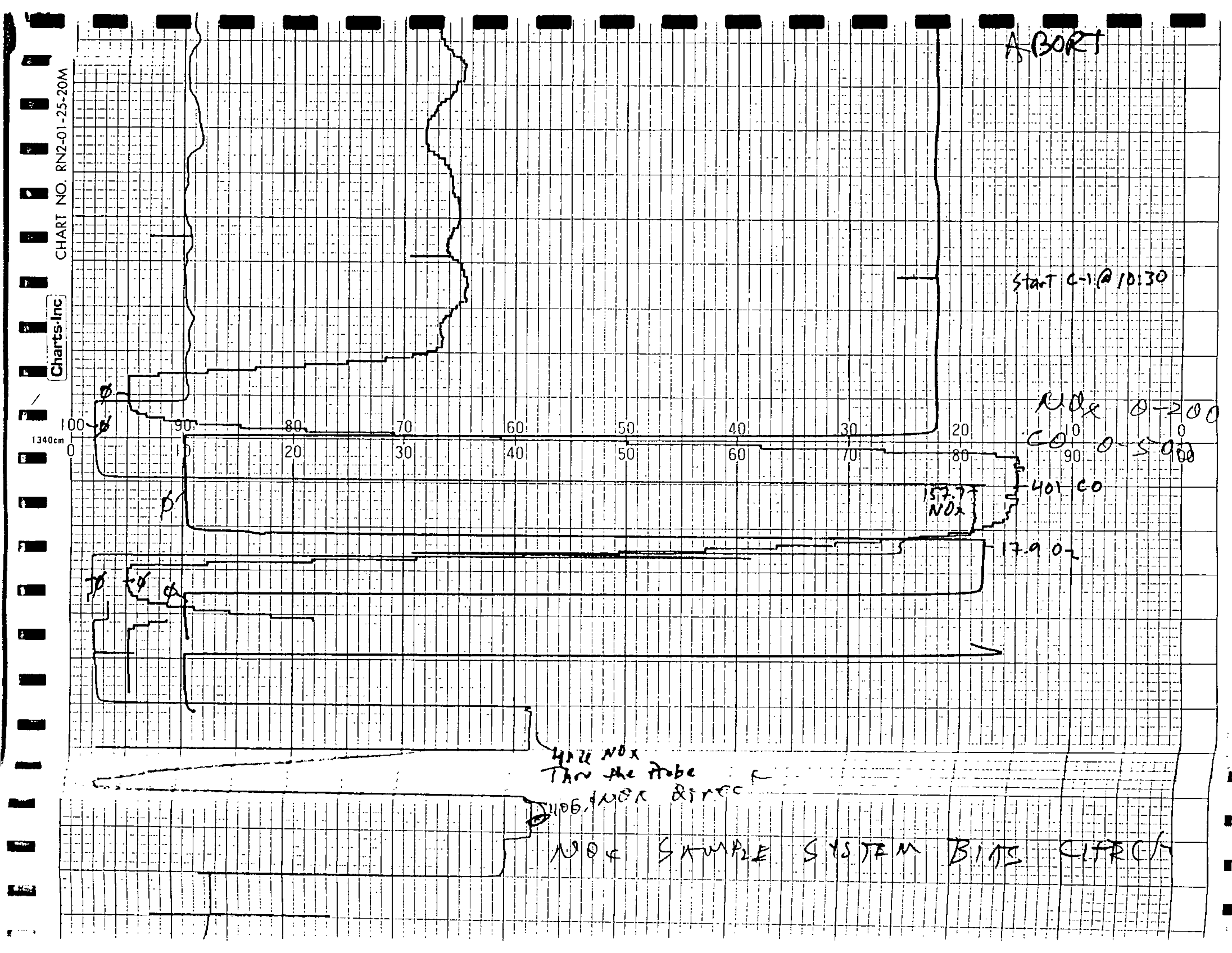
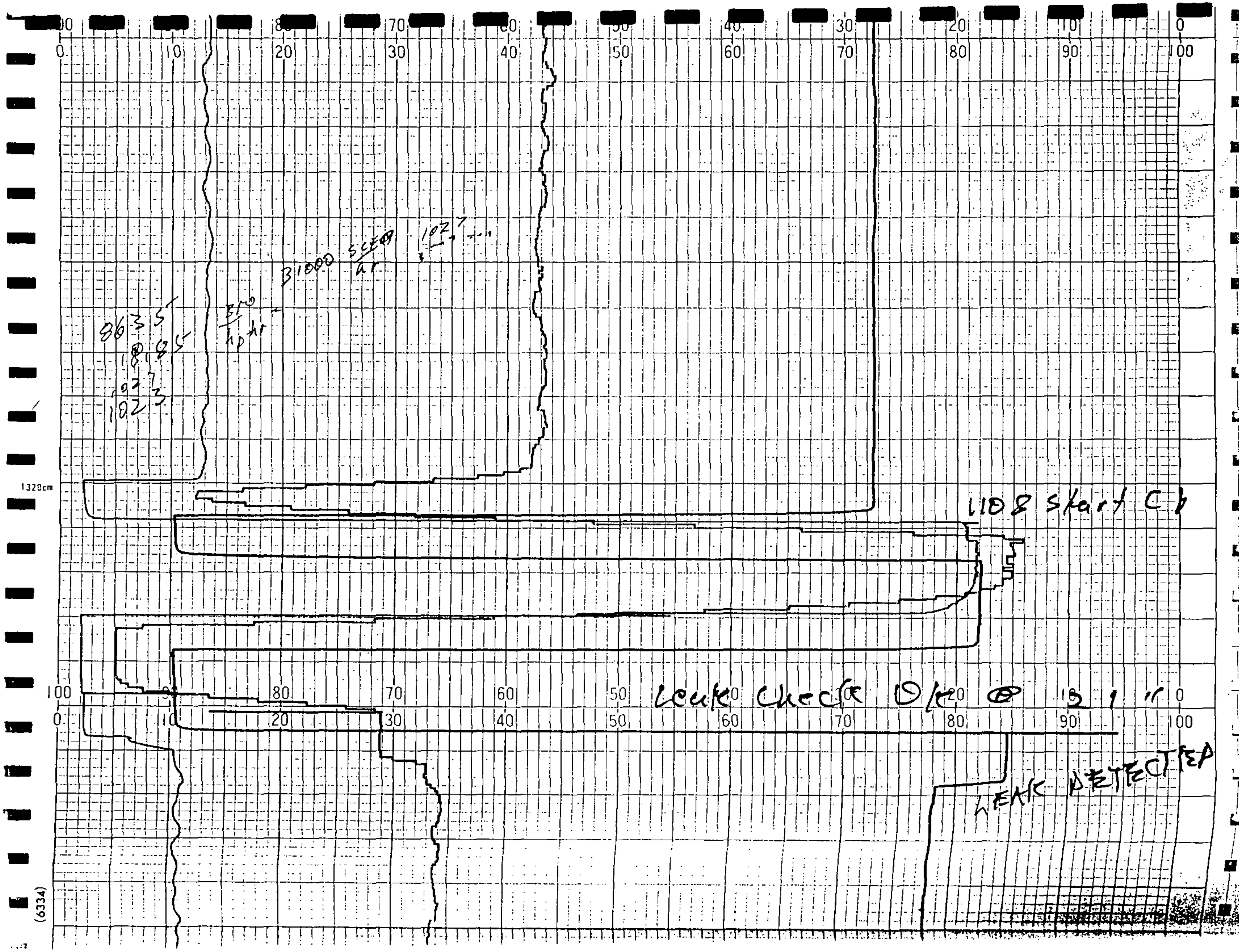
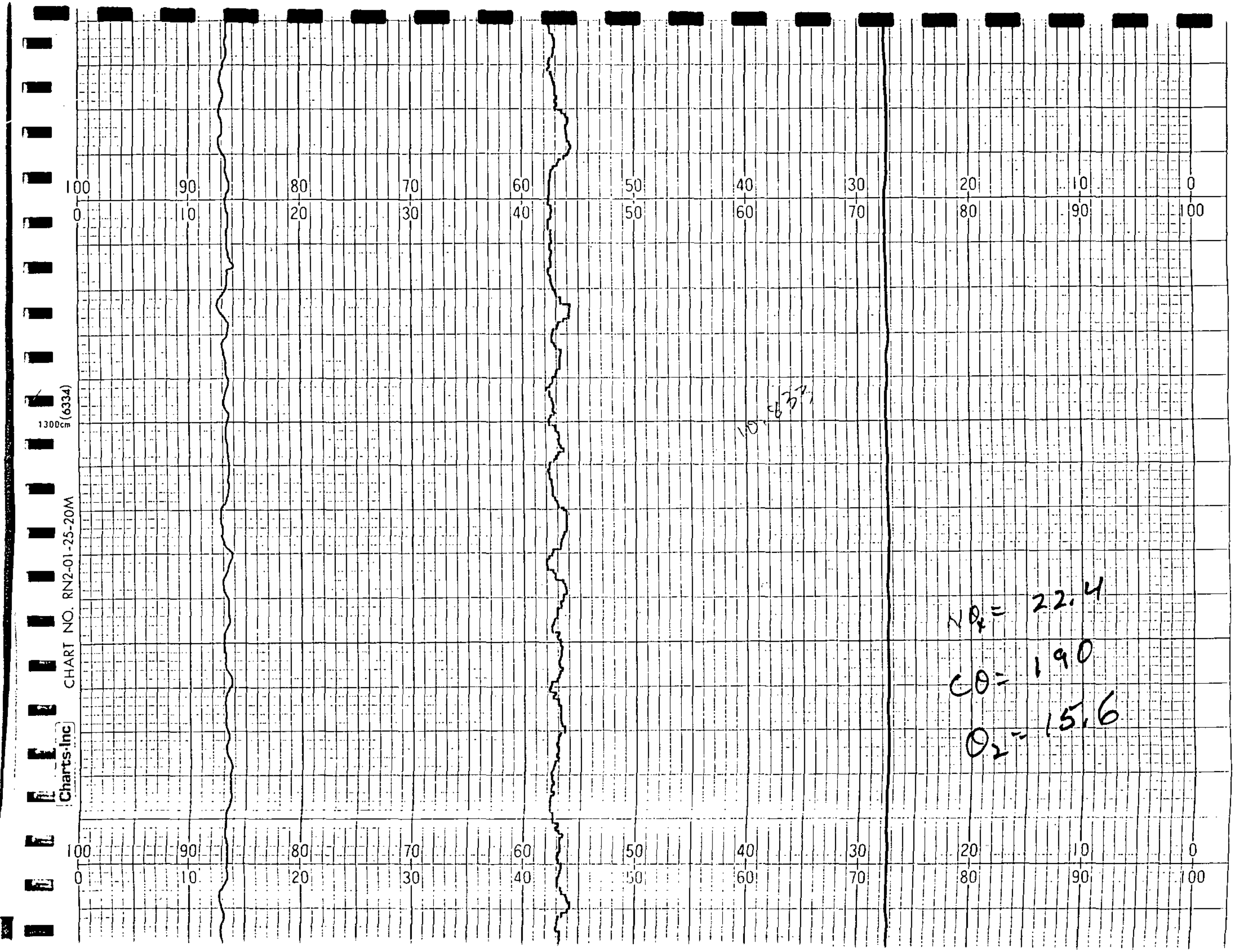


CHART NO. RN2-01-25-20M
Charts-Inc
1340cm
ABORT
Start C-1 @ 10:30
NOx 0-200
CO 0-500
401 CO
157.7 NOx
17.9 O2
NOx SAMPLE SYSTEM BIAS CHECK



1320cm
1108 Start C I
31000 SCFH/hr
Leak Check O/K @
LEAK DETECTED
(6334)



100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
NOx = 22.4
CO = 190
O2 = 15.6
CHART NO. RN2-01-25-20M
Charts-Inc
1300cm (6334)

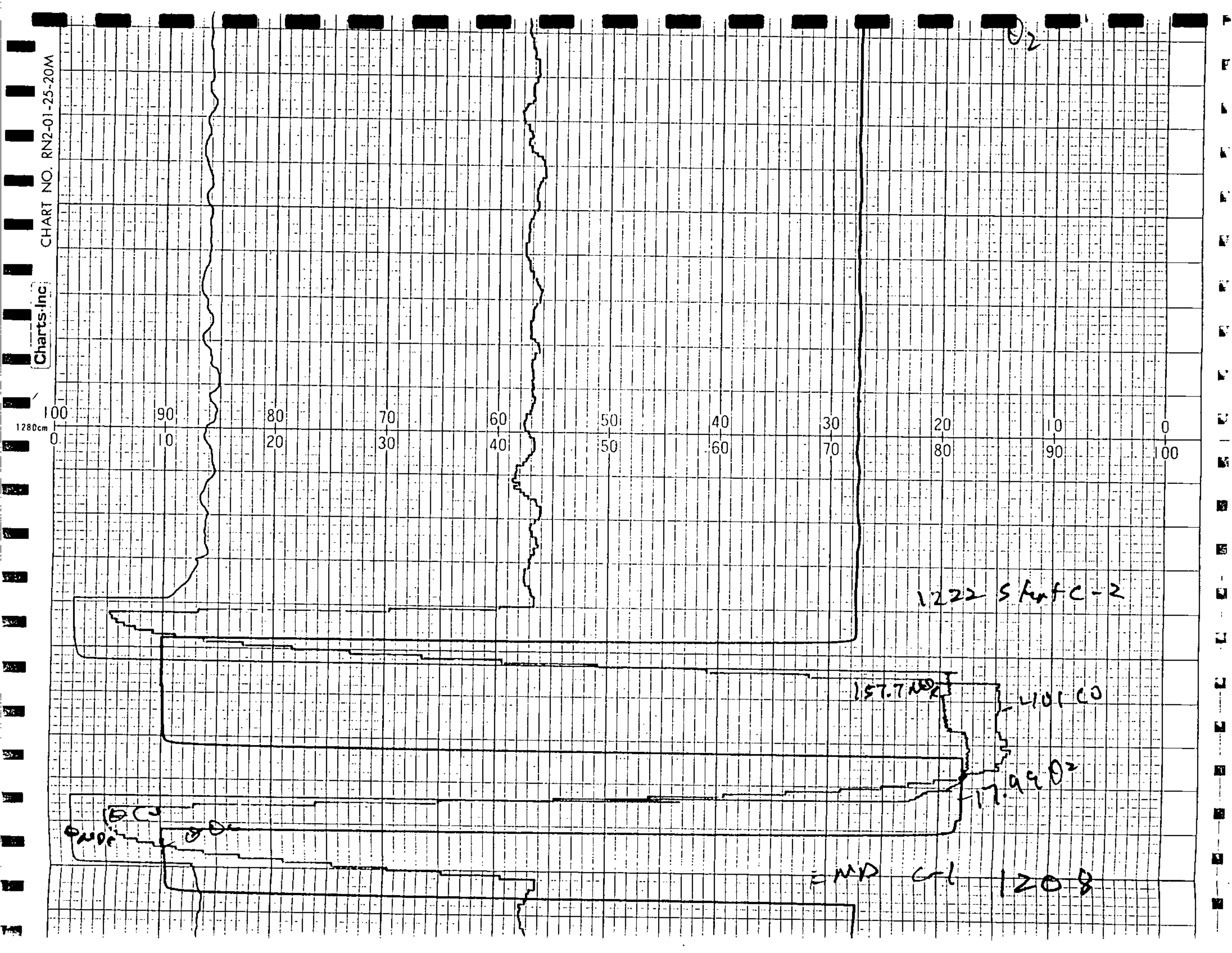
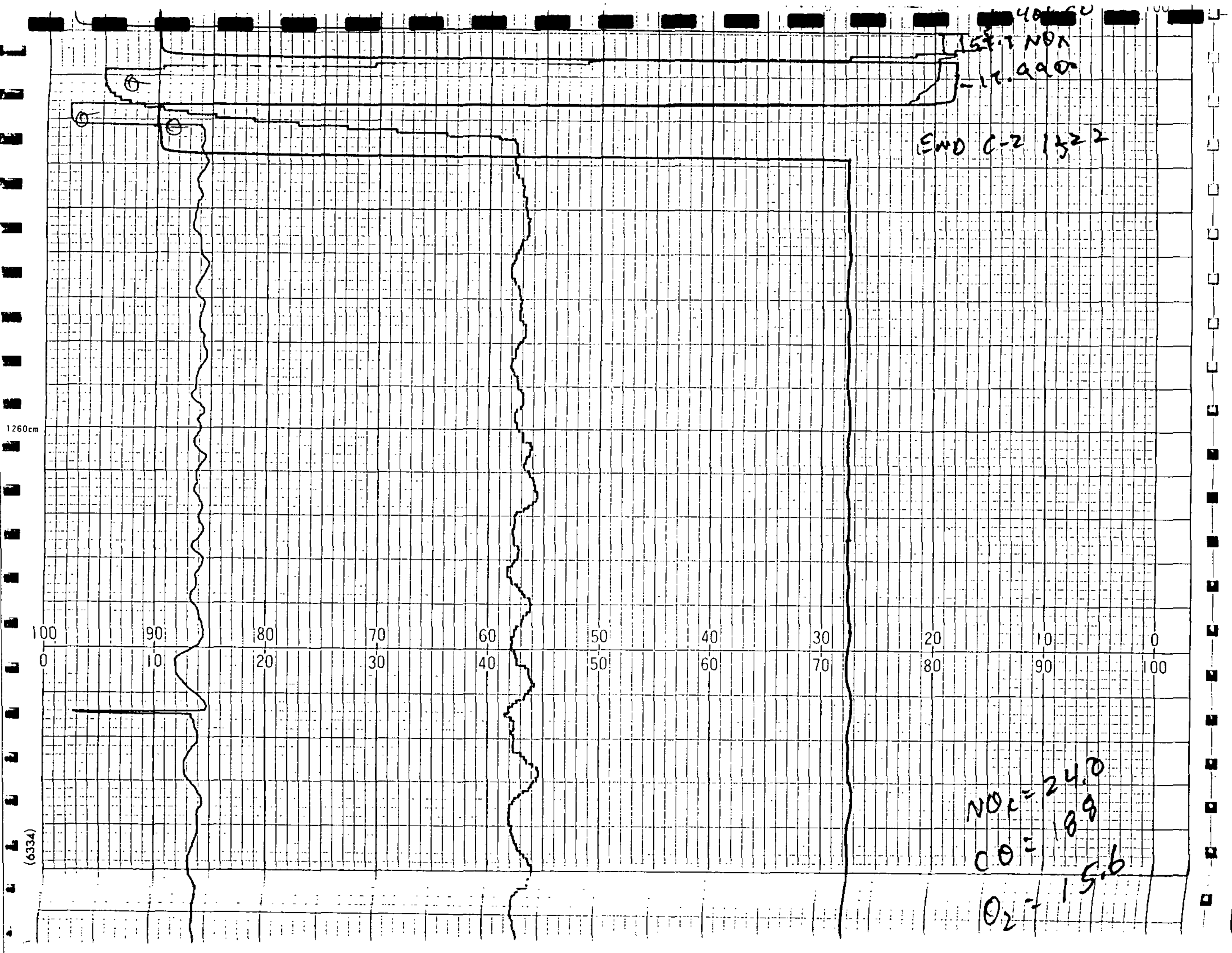
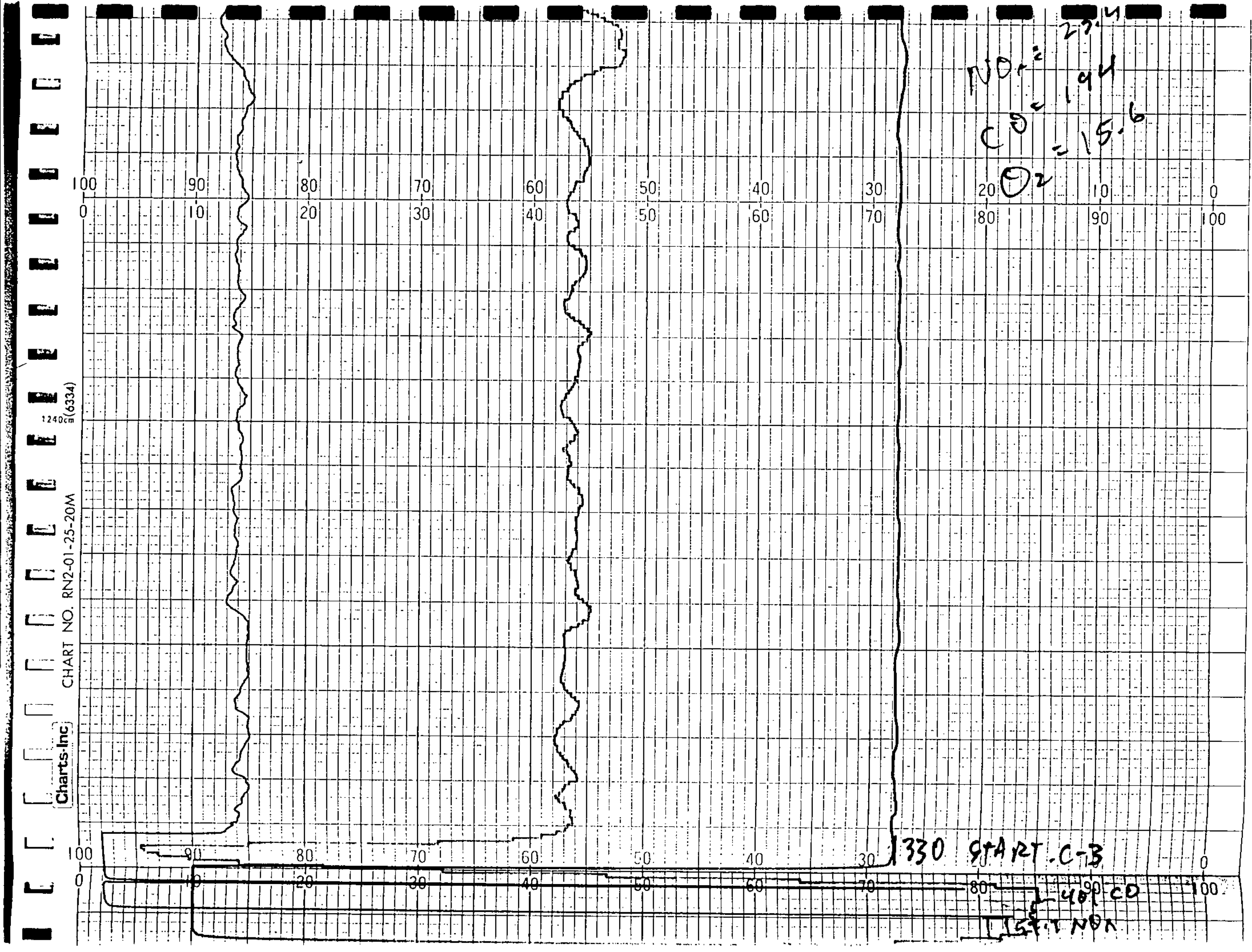


CHART NO. RN2-01-25-20M
Charts·Inc
1280cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
O2
1222 Start C-2
157.7 NOx
4.101 CO
17.99 O2
END C-1 1208


57.7 NOx
17.990
END C-2 1522
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
1260cm
(6334)
NOx = 24.0
CO = 18.8
O2 = 15.6


100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
1240cm (6334)
CHART NO. RN2-01-25-20M
Charts-Inc
1330 START C-3

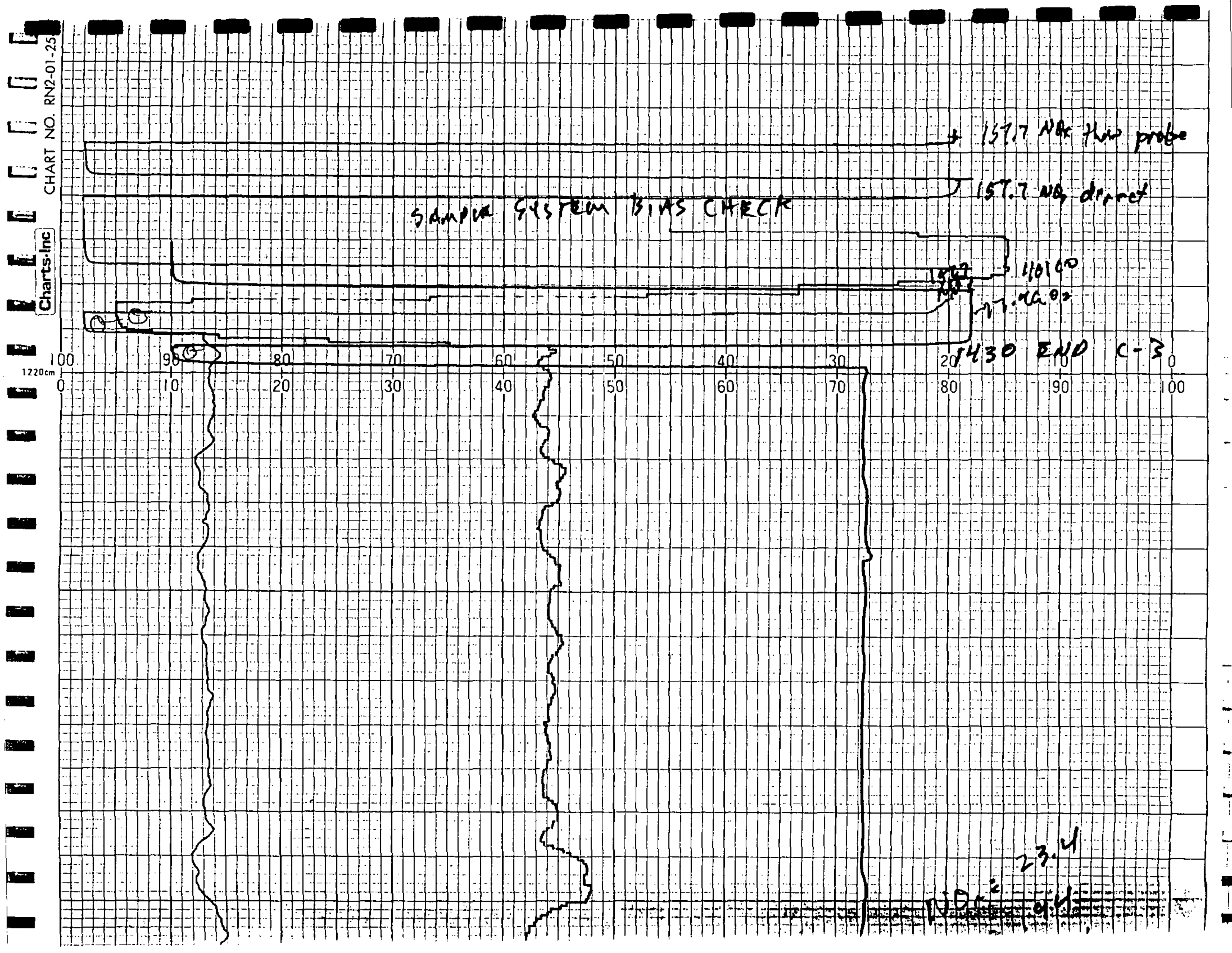
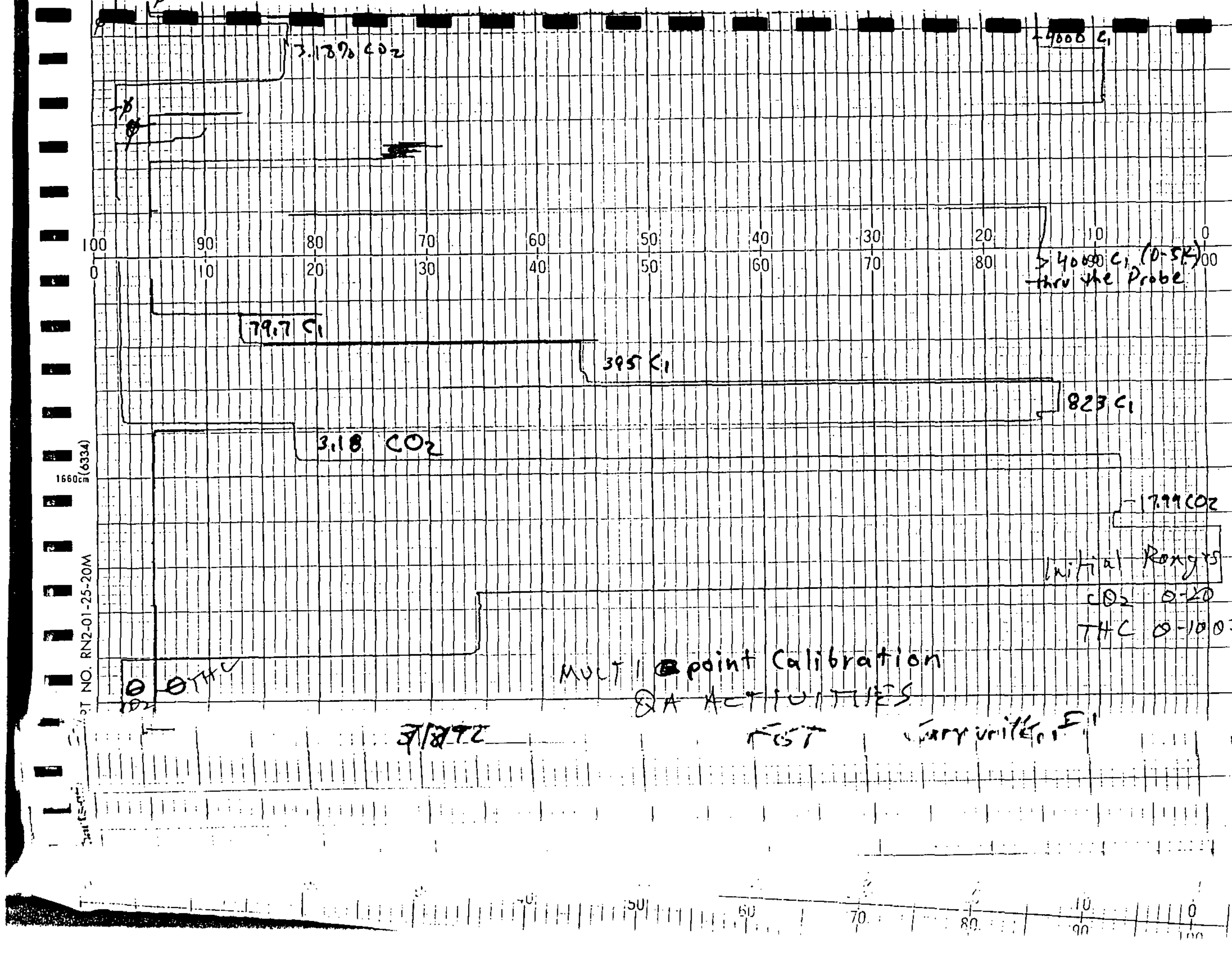
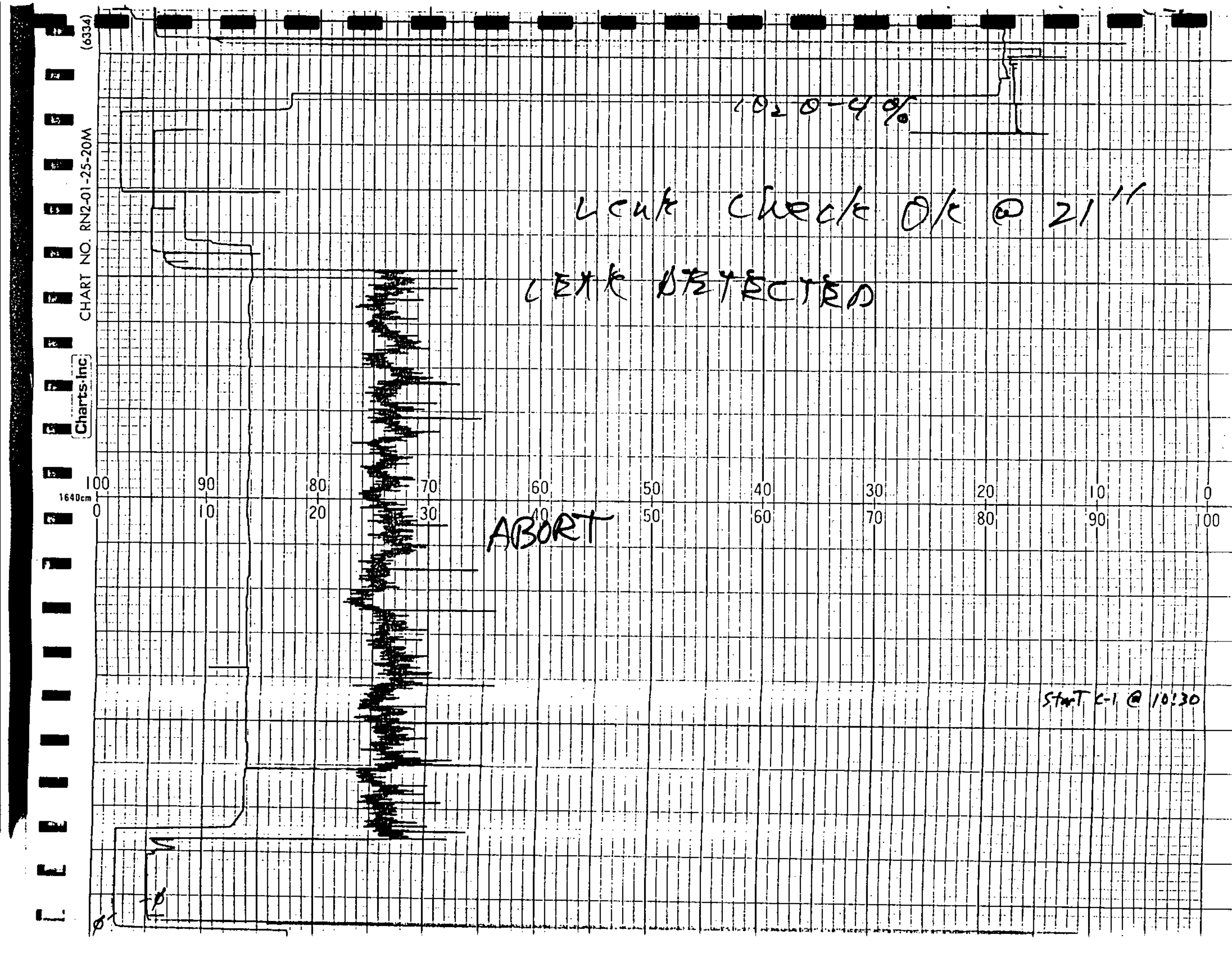


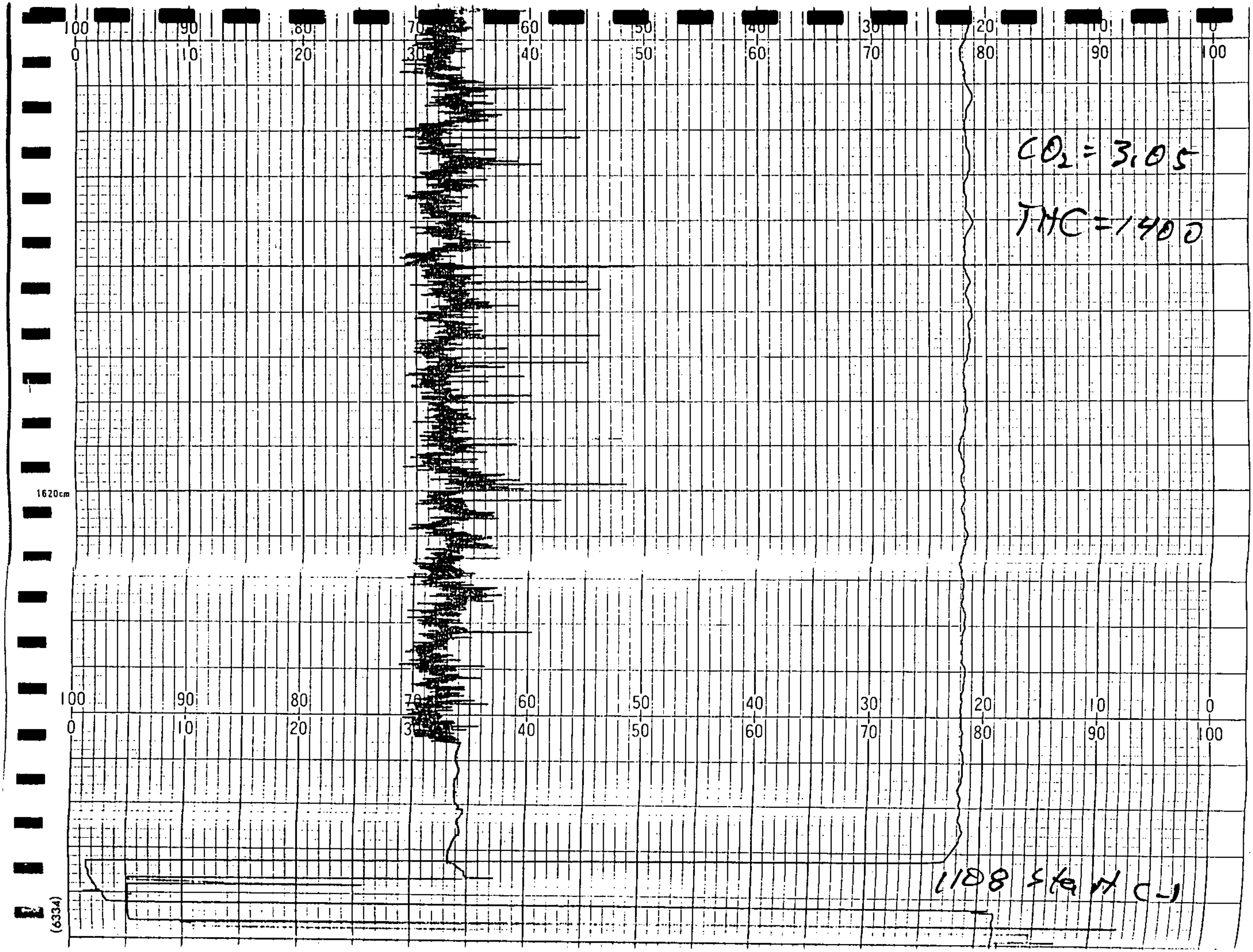
CHART NO. RN2-01-25
Charts·Inc
1220cm
157.7 NOx thru probe
157.7 NOx direct
SAMPLE SYSTEM BIAS CHECK
1430 END C-3
23.4

CO_2, THC

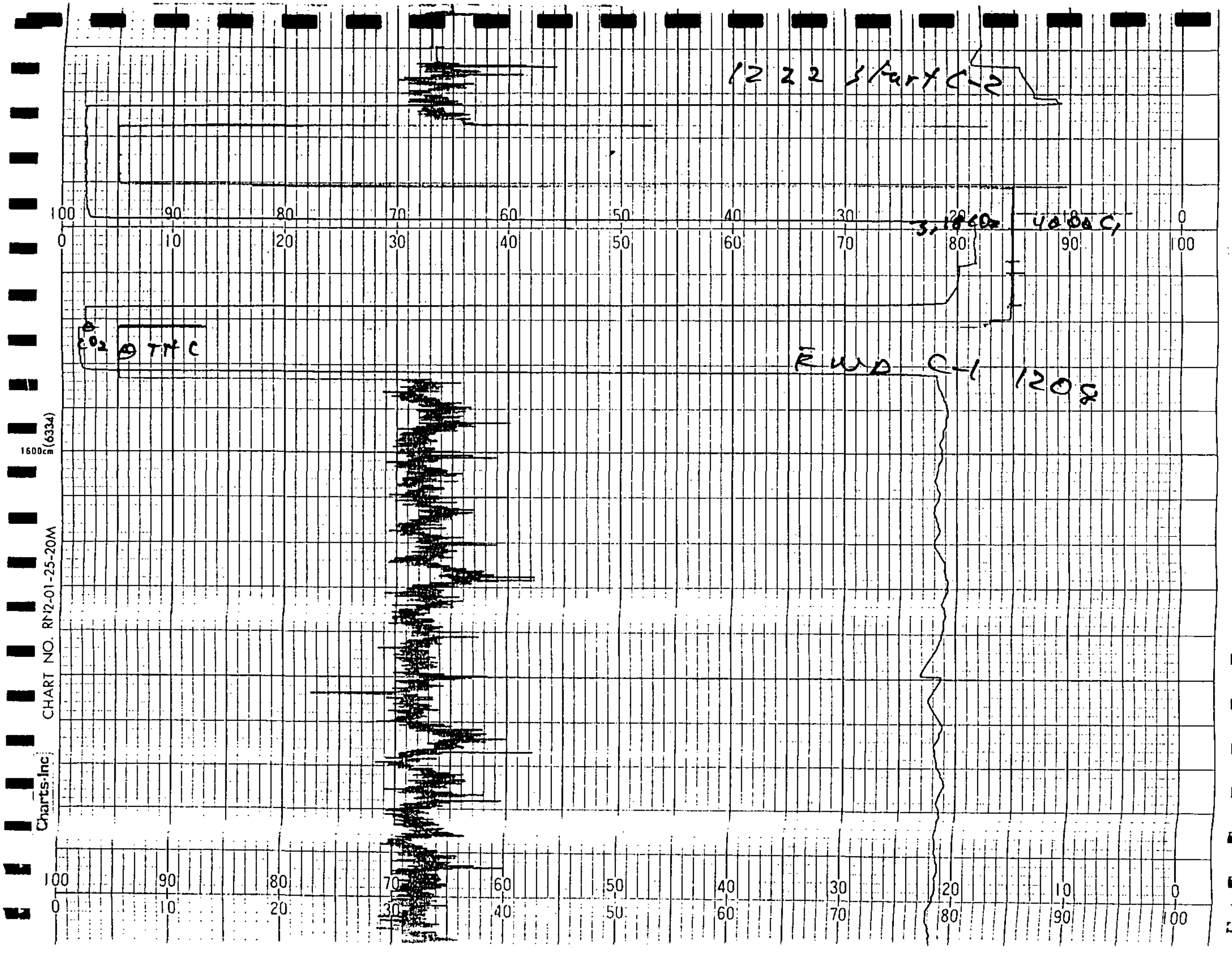


3.18% CO2
4000 C1
> 4000 C1 (0-5K)
thru the Probe
79.7 C1
395 C1
823 C1
3.18 CO2
17.99 CO2
Initial Ranges
CO2 0-20
THC 0-1000
0 THC
MULTI point Calibration
QA ACTIVITIES
FST
1660cm (6334)
NO. RN2-01-25-20M


(6334)
CHART NO. RN2-01-25-20M
Charts·Inc
O2 0-4%
Leak Check O/K @ 21"
LEAK DETECTED
100 90 80 70 60 50 40 30 20 10 0
1640cm
0 10 20 30 40 50 60 70 80 90 100
ABORT
Start C-1 @ 10:30



100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
CO_2 = 3.05
THC = 1400
1620cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
1108 Start C-1
(6334)


1222 start C-2
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
4000 C1
CO2 @ THC
EWD C-1 1200
1600cm (6334)
CHART NO. RN2-01-25-20M
Charts-Inc

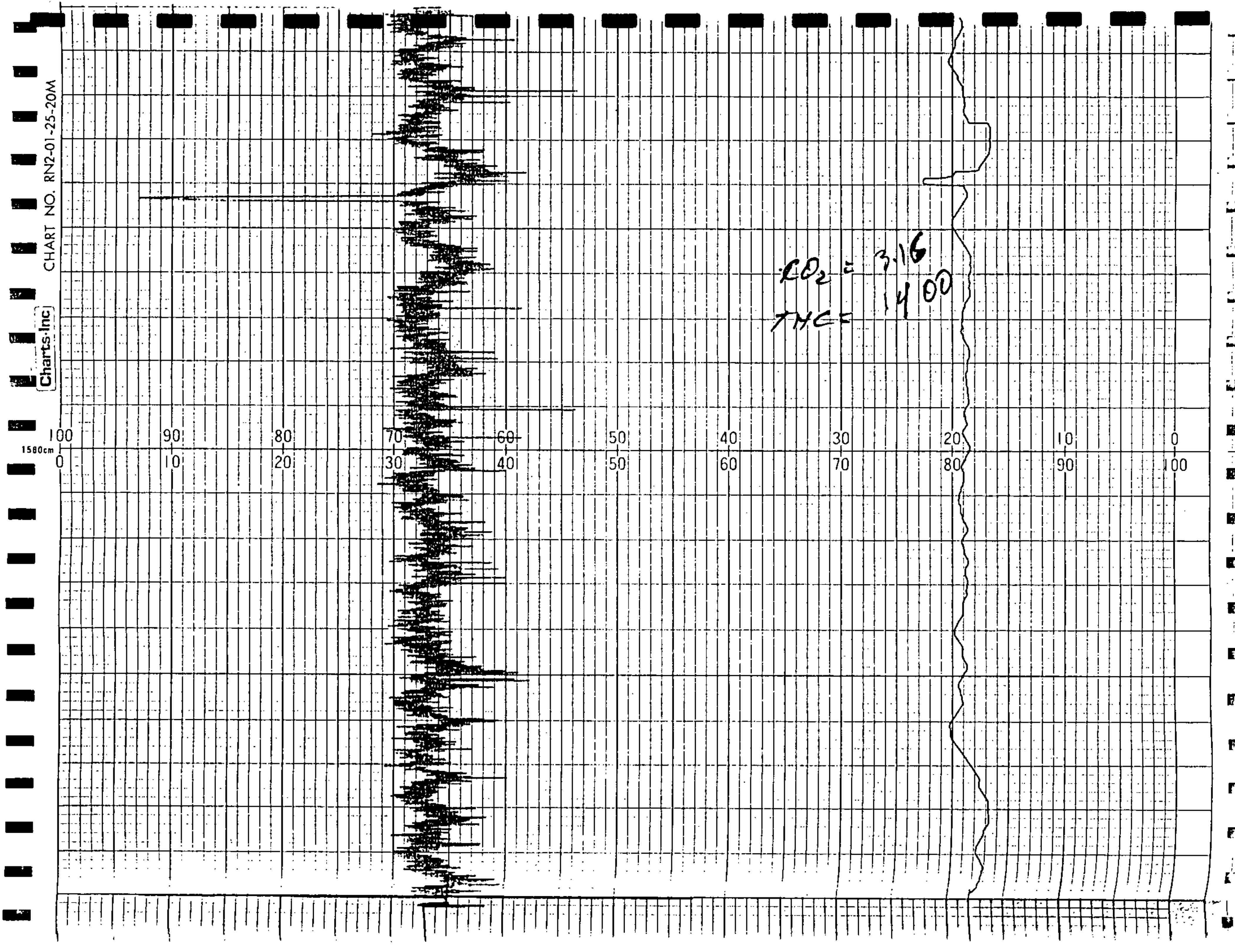
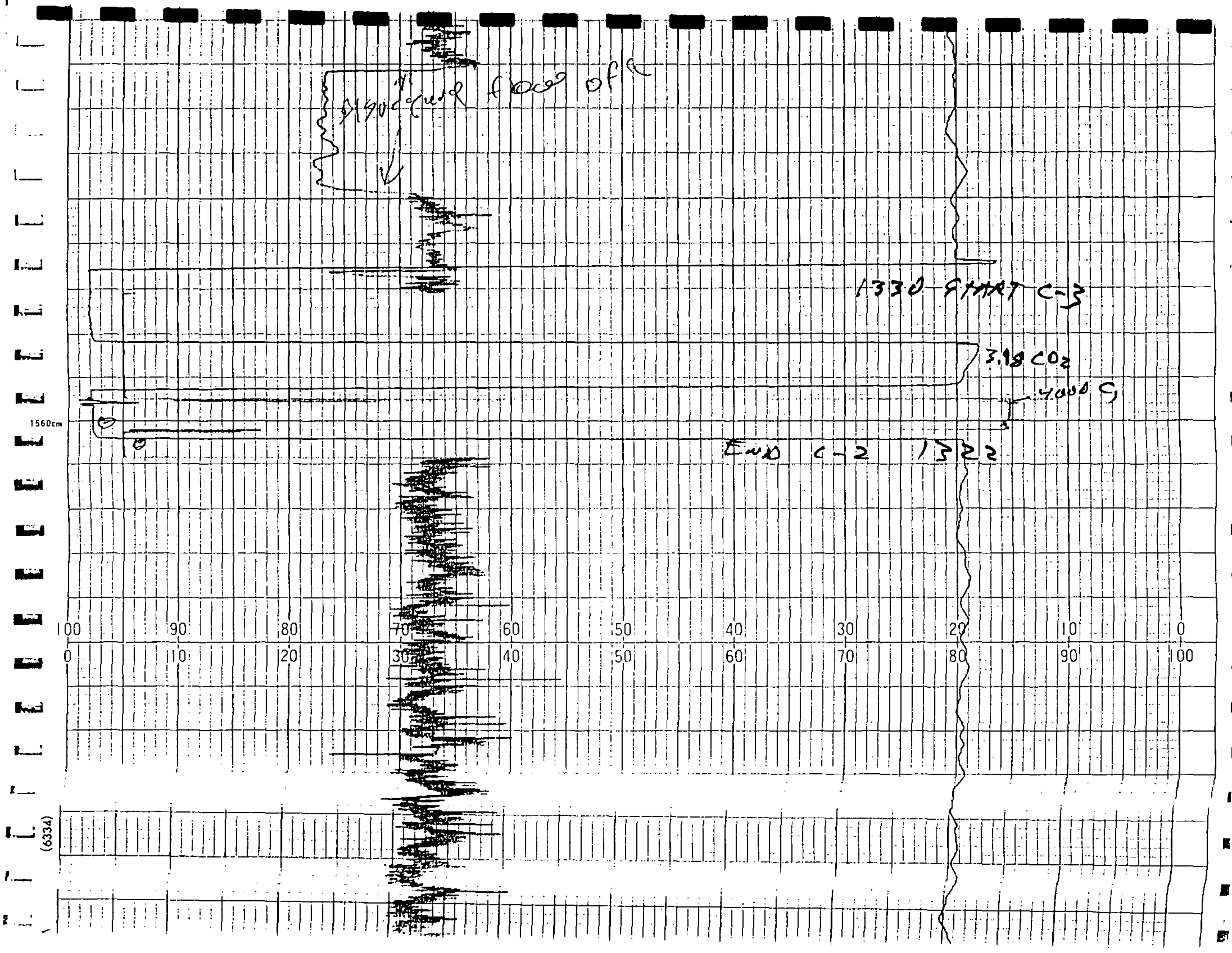
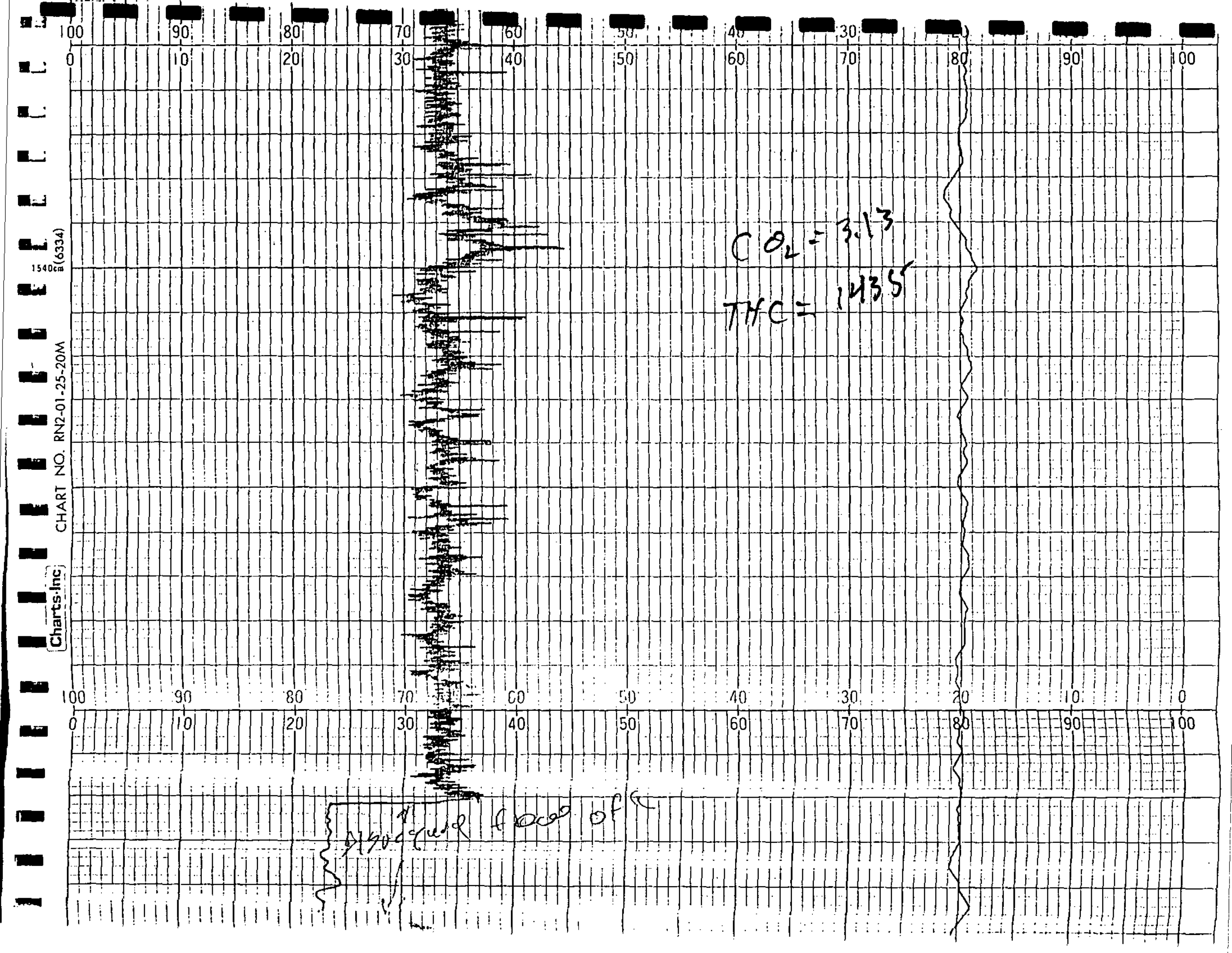


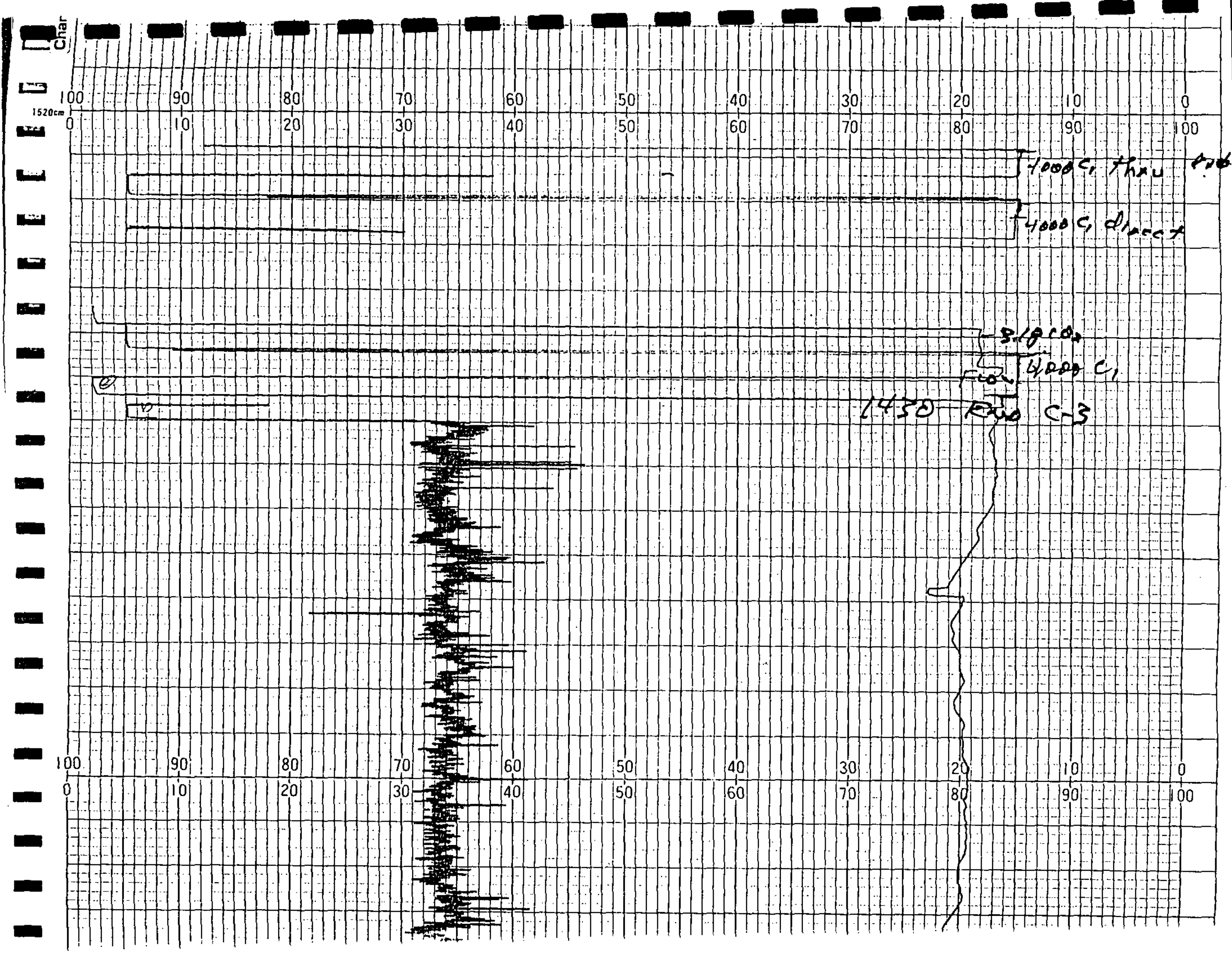
CHART NO. RN2-01-25-20M
Charts-Inc
1580cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
CO2 = 3.16
THC = 1400



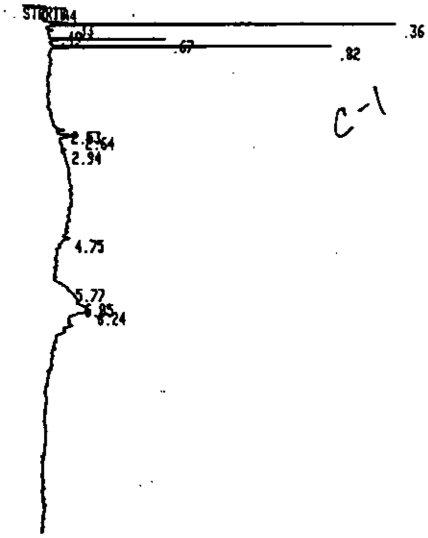
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
1560cm
(6334)
1330 START C-3
3.18 CO_2
END C-2 1322



CO2 = 3.13
THC = 1435
CHART NO. RN2-01-25-20M
Charts-Inc
1540cm (6334)


Char
1520cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
4000 C1 thru
4000 C1 Direct
4,000 C1
1430 Run C-3

APPENDIX F
CHROMATOGRAMS



C-1

RUN # 6 MAR/18/92 11:25:12
WORKFILE ID: B
WORKFILE NAME:

AREA%

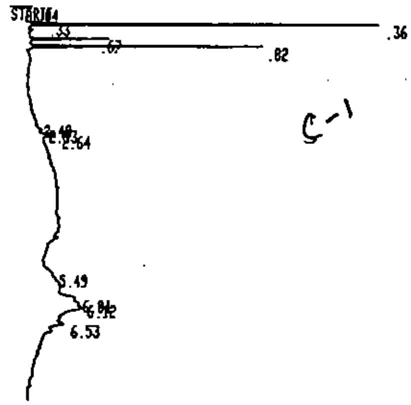
RT	AREA	TYPE	AR/HT	AREA%
0.04	1760	PV	0.085	0.639
0.33	305	D PV	0.014	0.111
0.36	243560	D VB	0.015	88.417 C1
0.49	123	D PB	0.017	0.045
0.67	3046	D BB	0.019	1.106
0.82	8510	D VB	0.022	3.089
2.53	396	BB	0.039	0.144
2.64	1411	BV	0.052	0.512
2.94	446	VB	0.082	0.162
4.75	946	VP	0.072	0.343
5.77	1652	PV	0.103	0.600
6.05	6012	VV	0.250	2.183
6.24	7300	VV	0.204	2.650

6.001

ghost peaks

TOTAL AREA= 275470
MUL FACTOR= 1.0000E+00

$\frac{6.001}{6.001 + 88.417} = 6.36\%$ VOC



C-1

RUN # 5 MAR/18/92 10:33:1
WORKFILE ID: B
WORKFILE NAME:

AREA%

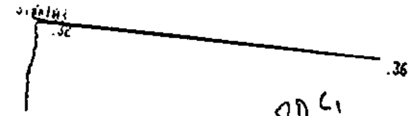
RT	AREA	TYPE	AR/HT	AREA%
0.04	1043	BB	0.058	0.523
0.33	220	D PV	0.012	0.110
0.36	179270	D VB	0.015	89.877 C1
0.67	2186	D BB	0.019	1.096
0.82	6948	D VB	0.021	3.483
2.40	277	PP	0.132	0.139
2.53	213	PB	0.038	0.107
2.64	1072	BB	0.053	0.538
5.49	632	PV	0.098	0.317
6.01	2349	PV	0.090	1.178
6.12	3195	VV	0.098	1.682
6.53	2057	VV	0.091	1.031

5.68

Ghost peaks

TOTAL AREA= 199460
MUL FACTOR= 1.0000E+00

$\frac{5.68}{5.68 + 89.877} = 5.94$



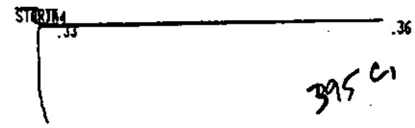
80 C1

RUN # 2 MAR/18/92 09:45:55
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.03	446	PV	0.036	2.471
0.32	290	D PV	0.017	1.607
0.36	17314	D VB	0.016	95.922

TOTAL AREA= 18050
MUL FACTOR= 1.0000E+00



395 C1

RUN # 3 MAR/18/92 10:04:28
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	395	BB	0.035	0.546
0.33	278	D PV	0.018	0.384
0.36	71653	D VB	0.015	99.069

TOTAL AREA= 72326
MUL FACTOR= 1.0000E+00

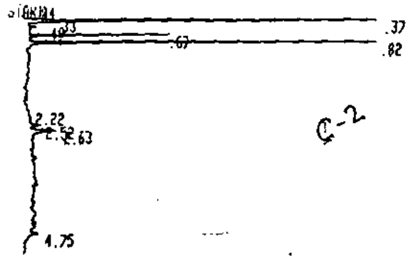
823 C1

RUN # 4 MAR/18/92 10:11:41
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	947	BB	0.066	0.555
0.33	235	D PV	0.015	0.138
0.36	169580	D VB	0.015	99.308

TOTAL AREA= 170770
MUL FACTOR= 1.0000E+00



C-2

RUN # 9 MAR/18/92 12:51:01
WORKFILE ID: B
WORKFILE NAME:

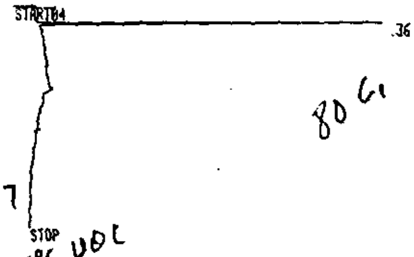
AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	659	BB	0.031	0.205
0.33	378	D PV	0.015	0.118
0.37	301010	D VB	0.015	93.749 C1
0.49	203	D BB	0.022	0.063
0.67	3781	D PB	0.019	1.178
0.82	10446	D VB	0.022	3.253
2.22	468	PV	0.115	0.146
2.52	479	BV	0.043	0.149
2.63	1866	VV	0.054	0.581
4.75	1789	VP	0.110	0.557

} 5.927

TOTAL AREA= 321080
MUL FACTOR= 1.0000E+00

$\frac{5.927}{5.927 + 93.749}$ = 5.95% VOC



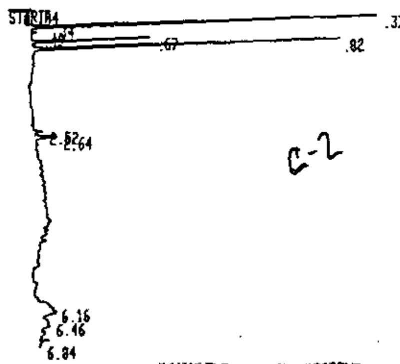
80 G

RUN # 8 MAR/18/92 12:23:03
WORKFILE ID: B
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	613	BV	0.042	4.163
0.36	14111	D PB	0.016	95.837

TOTAL AREA= 14724
MUL FACTOR= 1.0000E+00



C-2

RUN # 10 MAR/18/92 13:15:25
WORKFILE ID: C
WORKFILE NAME:

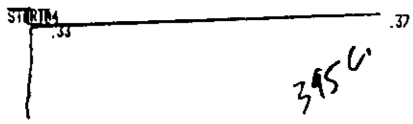
AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	636	PB	0.029	0.232
0.34	0	D PP	0.000	0.000
0.37	251600	D PB	0.015	91.642 C1
0.49	137	D PB	0.018	0.050
0.67	3178	D BB	0.019	1.158
0.82	9263	D VB	0.022	3.374
2.52	699	PV	0.059	0.255
2.64	1536	VV	0.051	0.560
6.16	4176	VV	0.155	1.521
6.46	2288	VV	0.117	0.833
6.84	1020	I VH	0.056	0.372

} 5.397
} X

$\frac{5.397}{91.647 + 5.397}$ = 5.56% VOC

TOTAL AREA= 274540



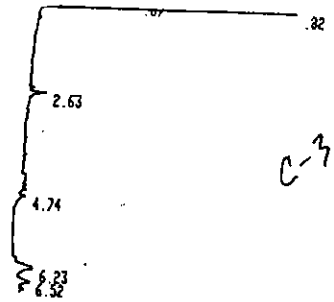
395 C

RUN # 15 MAR/18/92 14:29:25
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	538	BB	0.028	0.735
0.33	258	D PV	0.015	0.353
0.37	72357	D VB	0.015	98.912

TOTAL AREA= 73153
MUL FACTOR= 1.0000E+00



C-3

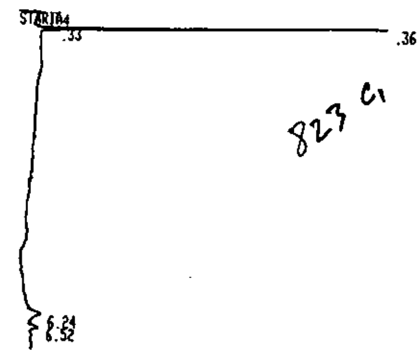
RUN # 13 MAR/18/92 13:59:57
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	531	PB	0.029	0.233
0.33	93	D PP	0.007	0.041
0.36	205570	D PB	0.015	90.068
0.49	183	D PP	0.020	0.080
0.67	2628	D PB	0.019	1.152
0.82	7838	D VB	0.022	3.434
2.63	1252	PB	0.055	0.549
4.74	590	BP	0.062	0.259
6.23	5685	VV	0.191	2.491
6.52	3868	VV	0.151	1.695

5.47
5.73%

TOTAL AREA= 228230
MUL FACTOR= 1.0000E+00



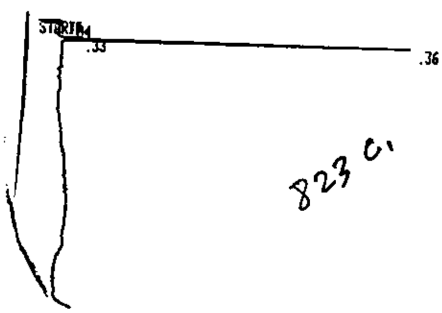
823 C

RUN # 11 MAR/18/92 13:29:07
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	443	PB	0.026	0.263
0.33	208	D PP	0.012	0.124
0.36	163988	D PB	0.015	97.502
6.24	2556	VV	0.139	1.520
6.52	995	BP	0.080	0.592

TOTAL AREA= 168190
MUL FACTOR= 1.0000E+00



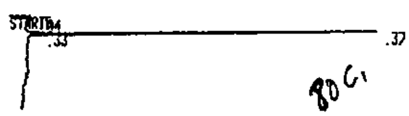
823 C

RUN # 16 MAR/18/92 14:36:04
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	746	BV	0.037	0.449
0.33	321	D PV	0.016	0.193
0.36	165120	D VB	0.015	99.358

TOTAL AREA= 166190
MUL FACTOR= 1.0000E+00



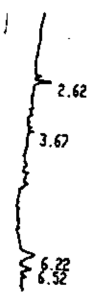
80 C

RUN # 14 MAR/18/92 14:11:14
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	1450	BB	0.055	7.610
0.33	430	D BV	0.020	2.257
0.37	17175	D VB	0.016	90.134

TOTAL AREA= 19055
MUL FACTOR= 1.0000E+00



C-3

RUN # 12 MAR/18/92 13:43:12
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	744	PV	0.035	0.329
0.33	249	D PP	0.014	0.110
0.36	207470	D PB	0.015	91.680 C
0.49	214	D BV	0.026	0.095
0.67	2511	D PB	0.019	1.110
0.81	7383	D VB	0.022	3.263
2.62	1221	PP	0.051	0.540
3.67	154	D PB	0.021	0.068
6.22	4894	PV	0.207	2.163
6.52	1457	VV	0.088	0.644

5.0

TOTAL AREA= 226290
MUL FACTOR= 1.0000E+00

$\frac{5.076}{5.076+91.68} = 5.25\%$ VOC

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.

TEXAS AIR CONTROL BOARD

September 20, 1991

Date Certified

March 21, 1992

This Certificate Expires

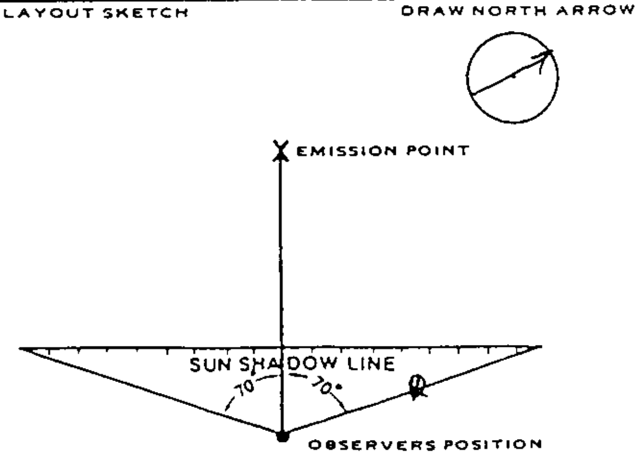
[illegible] 9/20/91

Certifying Officer Date

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME	Florida Gas / Caryville Station
ADDRESS	
CITY	Caryville
STATE	FL
ZIP	
PHONE	
SOURCE ID NUMBER	GMVH 12
PROCESS EQUIPMENT	
OPERATING MODE	2700 BHP
CONTROL EQUIPMENT	
OPERATING MODE	
DESCRIBE EMISSION POINT	Circular Stack ~2' diameter
HEIGHT ABOVE GROUND LEVEL	~75'
HEIGHT RELATIVE TO OBSERVER	~75'
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 diameters downstream of emission point
DESCRIBE BACKGROUND	Sky
BACKGROUND COLOR	Grey
SKY CONDITIONS	Overcast
WIND SPEED	10 mph
WIND DIRECTION	SE
AMBIENT TEMP.	66
WET BULB TEMP.	62
RELATIVE HUMIDITY	80%

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVATION DATE: 3-18-92 — START TIME: 1100 — STOP TIME: 1200

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 Sacre

OBSERVER'S SIGNATURE: Tony Sacre — DATE: 3-18-92

ORGANIZATION: Cubix

CERTIFIED BY: TACB — DATE: ~~9-15-90~~ 9/20/91

VERIFIED BY: — DATE:

COMMENTS

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE

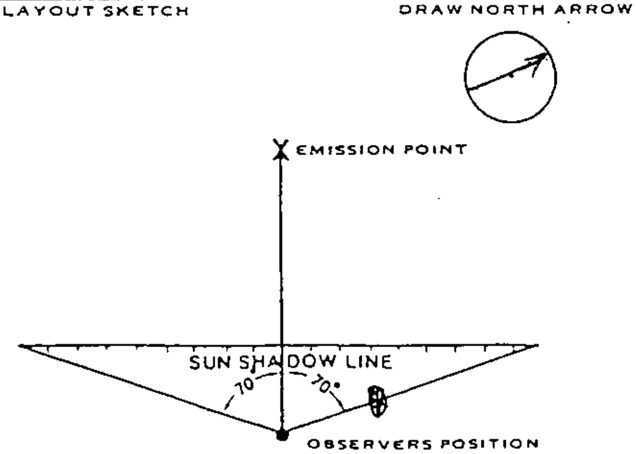
TITLE — DATE

EPA TR 0101

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME	Florida Gas / Caryville Station
ADDRESS	
CITY	Caryville
STATE	FL
ZIP	
PHONE	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	
OPERATING MODE	
CONTROL EQUIPMENT	
OPERATING MODE	
DESCRIBE EMISSION POINT	Circular Stack ~2' diameter
HEIGHT ABOVE GROUND LEVEL	~75'
HEIGHT RELATIVE TO OBSERVER	~75'
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 diameters downstream of emission
DESCRIBE BACKGROUND	Sky
BACKGROUND COLOR	Grey
SKY CONDITIONS	Overcast
WIND SPEED	5-10 mph
WIND DIRECTION	SE
AMBIENT TEMP.	71
WET BULB TEMP.	65
RELATIVE HUMIDITY	71%

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVATION DATE	START TIME	STOP TIME
3-18-92	12:22	13:22

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 Sacre
OBSERVER'S SIGNATURE	Tony Sacre
DATE	3-18-92
ORGANIZATION	Cubix
CERTIFIED BY	TACB
DATE	~~9-13-90~~ 9/20/91
VERIFIED BY	
DATE	

COMMENTS

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SIGNATURE

TITLE	DATE

EPA 1H 0101

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Florida Gas / Caryville Station

ADDRESS:

CITY: Caryville | **STATE:** FL | **ZIP:**

PHONE: | **SOURCE ID NUMBER:**

PROCESS EQUIPMENT: | **OPERATING MODE:**

CONTROL EQUIPMENT: | **OPERATING MODE:**

DESCRIBE EMISSION POINT: Circular Stack ~2' diameter

HEIGHT ABOVE GROUND LEVEL: ~75' | **HEIGHT RELATIVE TO OBSERVER:** ~75'

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

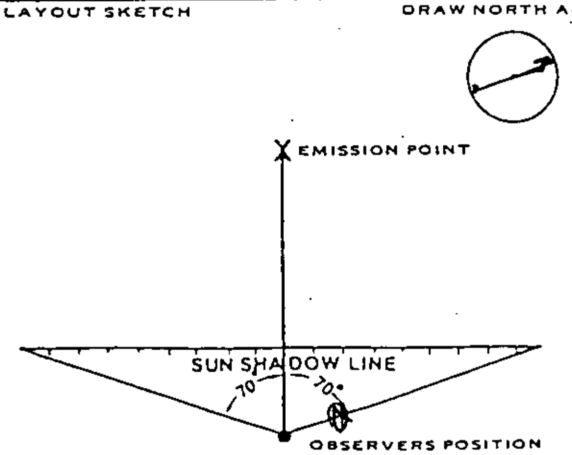
DESCRIBE BACKGROUND: Sky

BACKGROUND COLOR: Grey | **SKY CONDITIONS:** Overcast

WIND SPEED: 10-20 mph | **WIND DIRECTION:** SE

AMBIENT TEMP.: 65 | **WET BULB TEMP.:** 65 | **RELATIVE HUMIDITY:** 100%

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



OBSERVATION DATE: 3-18-92 | **START TIME:** 13:30 | **STOP TIME:** 14:30

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 Sacre

OBSERVER'S SIGNATURE: Tony Sacre | **DATE:** 3-18-92

ORGANIZATION: Cubix

CERTIFIED BY: TACB | **DATE:** ~~9-20-90~~ 9/20/91

VERIFIED BY: | **DATE:**

COMMENTS:

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE:

TITLE: | **DATE:**

EPA TR 0101

APPENDIX H: FUEL ANALYSES AND CALCULATIONS

To: Fred Griffin - Carryville 15 ✱
(Sta. 16) NOT 16 ✱

ANALYSIS

DATE: 03/18/92	ANALYSIS TIME: 345	STREAM SEQUENCE: 12
TIME: 17:15	CYCLE TIME: 360	STREAM#: 1
ANALYZER#: 2	MODE: RUN	CYCLE START TIME: 17:09

COMP NAME	COMP CODE	MOLE %	GAL/MCF**	B.T.U.*	SP. GR.
HEXANE +	151	0.053	0.0230	2.71	0.00
PROPANE	152	0.224	0.0617	5.65	0.00
I-BUTANE	153	0.063	0.0207	2.06	0.00
N-BUTANE	154	0.052	0.0165	1.71	0.00
IPENTANE	155	0.024	0.0087	0.95	0.00
NPENTANE	156	0.016	0.0057	0.63	0.00
NITROGEN	157	0.355	0.0000	0.00	0.00
METHANE	158	96.770	0.0000	979.61	0.53
CO2	159	0.689	0.0000	0.00	0.01
ETHANE	160	1.753	0.4690	31.10	0.01
TOTALS		100.000	0.6053	1024.43	0.57

* @ 14.730 PSIA DRY & UNCORRECTED FOR COMPRESSIBILITY

** @ 14.730 & 60 DEG. F

COMPRESSIBILITY FACTOR (1/Z)	= 1.0021
DRY B.T.U. @ 14.730 PSIA & 60 DEG. F CORRECTED FOR (1/Z)	= 1026.6
REAL SPECIFIC GRAVITY	= 0.5775
UNNORMALIZED TOTAL	= 99.56
ANALOG INPUT CHANNEL 1 = H 2 S 140	= .28152
ANALOG INPUT CHANNEL 2 = WATER 144	= .21972

ACTIVE ALARMS

NONE

Hydrogen Sulfide .1 to .2

15.88 PPM

Analysis for Carryville
Sta 15

Client: Florida Gas
Sample ID: Carryville 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	0.3550	28.016	0.0744	0.00026	0.5982	0	0.00	0	0
CO2	0.6890	44.01	0.117	0.00081	1.8257	0	0.00	0	0
CO		28.01	0.074	0.00000	0.0000	4347	0.00	322	0
Methane	96.7700	16.041	0.0424	0.04103	92.9239	23879	22189.31	1013	980.28
Ethane	1.7530	30.067	0.0803	0.00141	3.1880	22320	711.56	1792	31.414
Ethylene		28.051	0.0746	0.00000	0.0000	21644	0.00	1614	0
Propane	0.2240	44.092	0.1196	0.00027	0.6067	21661	131.43	2590	5.8016
propylene		42.077	0.111	0.00000	0.0000	21041	0.00	2336	0
Isobutane	0.0630	58.118	0.1582	0.00010	0.2257	21308	48.10	3363	2.1187
n-butane	0.0520	58.118	0.1582	0.00008	0.1863	21257	39.60	4016	2.0883
Isobutene		56.102	0.148	0.00000	0.0000	20840	0.00	3068	0
Isopentane	0.0240	72.144	0.1904	0.00005	0.1035	21091	21.83	4008	0.9619
n-pentane	0.0160	72.144	0.1904	0.00003	0.0690	21052	14.52	3993	0.6389
n-hexane	0.0530	86.169	0.2274	0.00012	0.2730	20940	57.16	4762	2.5239
H2S		34.076	0.0911	0.00000	0.0000	7100	0.00	647	0
total	100.00	Average Density		0.04415	100.0000	Gross Heating Value Btu/lb	23214	Gross Heating Value Btu/SCF	1026
		Specific Gravity		0.57719					

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	0.36	9.9457	0	0	0.59580783		
CO2	44.01	0.272273	0	0.69	30.3229	0.49459178	0		1.3206	
CO	28.01	0.42587	0	0.00	0.0000	0	0		0	
Methane	16.041	0.75	0.25	96.77	1552.2876	69.7437295	23.24791			
Ethane	30.067	0.8	0.2	1.75	52.7075	2.5260022	0.6315006			
Ethylene	28.051	0.85714	0.14286	0.00	0.0000	0	0			
Propane	44.092	0.81818	0.18182	0.22	9.8766	0.48409255	0.1075763			
Propene	42.077	0.85714	0.14286	0.00	0.0000	0	0			
Isobutane	58.118	0.82759	0.17247	0.06	3.6614	0.18152572	0.03783			
n-butane	58.118	0.82759	0.17247	0.05	3.0221	0.14983075	0.0312248			
Isobutene	56.102	0.85714	0.14286	0.00	0.0000	0	0			
Isopentane	72.144	0.83333	0.16667	0.02	1.7315	0.0864371	0.0172878			
n-pentane	72.144	0.83333	0.16667	0.02	1.1543	0.05762474	0.0115252			
n-hexane	86.169	0.83721	0.16279	0.05	4.5670	0.22905145	0.0445376			
H2S	34.08	0	0	0.00	0.0000	0	0			0
Totals				99.99900	1669.2765	73.9528858	24.13	0.59580783	1.3206	0
										99.999

CALCULATED VALUES		
O2 F Factor (dry)	8635	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	2006	SCF of Water/MM Btu of Fuel Burned @ 0% excess air
Combust. Moisture	18.85	volume % water in flue gas @ 0% excess air
Fo	1.8	fuel factor (dimensionless)
VOC Portion of fuel	2.19	%
CO2 F Factor	1023	DSCF of CO2/MM Btu of Fuel Burned @ 0% excess air

SPL

CERTIFICATE OF ANALYSIS NUMBER 199903

SAMPLE IDENT.: CARYVILLE STATION F-22
FLORIDA GAS TRANS.
ENGINE FUEL GAS
03/18/92 @ 16:30

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

APPENDIX I: ALTERNATIVE COMPLIANCE TEST DATA

Operator/ Plant	Florida Gas Carryville Compressor Station
Location	Washington County, Florida
Source	Cooper Bessemer Compressor Engine
Technicians	LF,NF,TS

Test Run No.	**C-1**	**C-2**	**C-3**
Date	3/18/92	3/18/92	3/18/92
Start Time	11:08	12:22	13:30
Stop Time	12:08	13:22	14:30
Engine/Compressor Operation			
Engine Speed (rpm)	330	330	330
Ignition Timing (°BTDC)	4	4	4
Air Manifold Pressure (psig)	13.2	12.9	13.4
Air Manifold Temperature (°F)	105	104	104
Fuel Manifold Pressure (psig)	38.5	39	38.5
Estimated Fuel Flow (SCFH)	18820	18623	18680
Pre CombustionChamber Pressure (psig)	unavailable	38	39
Loading Step (pockets open out of 16 total)	14	14	14
Suction Pressure (psig)	702	700	700
Suction Temperature (°F)	65	65	65
Discharge Pressure (psig)	908	907	904
Discharge Temperature (°F)	101	101	100
Engine Load (BHP)	2650	2660	2679
Torque (%)	98.5	98.6	99.4
Turbo Exhaust Temperature (°F)	380/484	unavailable	381/465
Ambient Conditions			
Atmospheric Pressure (in. Hg)	29.98	29.95	29.86
Temperature (°F) : Dry bulb	66	71	69
(°F) Wet bulb	62	65	65
Humidity (lb/lb air)	0.0107	0.0116	0.0121
Measured Emissions			
NOx (ppmv)	22.4	24.0	23.4
CO (ppmv)	190	188	194
O2 via Method 3a (%)	15.6	15.6	15.6
CO2 via Method 3a (%)	3.05	3.16	3.13
THC via EPA Method 25a (ppmv)	1400	1400	1435
VOC via EPA Method 18 (% of THC)	6.15%	5.76%	5.49%
VOC i.e. non methane via EPA 18 (ppmv, wet)	86.1	80.6	78.8
VOC via EPA 18 and 25a (ppmv, dry)	91.4	85.4	83.5
SO2 in fuel (grains/100 DSCF)	<0.159	<0.159	<0.159
Stack Volumetric Flow Rates			
via Pitot Tube (SCFH, dry)	5.62E+05	5.71E+05	5.53E+05
Calculated Emission Rates (via pitot tube)			
NOx (lbs/hr)	1.50	1.64	1.55
CO (lbs/hr)	7.76	7.80	7.80
VOC (lbs/hr)	2.01	1.91	1.81
SO2 (lbs/hr)	<0.0016	<0.0016	<0.0016
NOx (tons/yr)	6.59	7.17	6.77
CO (tons/yr)	34.0	34.2	34.2
VOC (tons/yr)	8.8	8.4	7.9
SO2 (tons/yr)	<0.0069	<0.0069	<0.0069
NOx (g/hp-hr)	0.26	0.28	0.26
CO (g/hp/hr)	1.33	1.33	1.32
VOC (g/hp-hr)	0.34	0.33	0.31

Carryville Compressor Station--Unofficial Data

Operator/ Plant Florida Gas Carryville Compressor Station
Location Washington County, Florida
Source Cooper Bessemer Compressor Engine
Technicians LF,NF,TS

Test Run No.	C-1	C-2	C-3
Stack Moisture & Molecular Wt. via EPA Method 4			
CO2 (%)	3.05	3.16	3.13
O2 (%)	15.60	15.60	15.60
Beginning Meter Reading (ft3)	482.062	524.610	549.810
Ending Meter Reading (ft3)	524.386	549.695	571.256
Beginning Impinger Wt (g)	2480.1	2538.4	2599.1
Ending Impinger Wt. (g)	2532.4	2568.1	2624.3
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	82	100	98
Dry Gas Meter Temperature (°F end)	100	106	100
Atmospheric Pressure (in Hg, abs.)	29.98	29.95	29.86
Stack Gas Moisture (% volume)	5.78	5.67	5.60
Dry Gas Fraction	0.942	0.943	0.944
Stack Gas Molecular Wt. (lbs/lb-mole)	28.47	28.50	28.50
Stack Moisture & Molecular Wt. via Stoichiometry			
Fuel Moisture Content (vol % @ 0% O2)	18.85	18.85	18.85
Moisture Content (vol % at stack)	5.47	5.52	5.56
Difference between methods	5%	3%	1%
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	1.60	1.50	1.70
ΔP #2	1.70	1.70	1.80
ΔP #3	1.80	1.50	1.60
ΔP #4	1.60	1.70	1.70
ΔP #5	1.70	1.70	1.60
ΔP #6	1.90	1.90	1.80
ΔP #7	1.70	2.30	1.90
ΔP #8	1.40	2.20	1.40
ΔP #9	2.00	1.90	2.00
ΔP #10	2.10	2.30	2.20
ΔP #11	2.10	2.40	1.90
ΔP #12	1.90	1.70	1.70
ΔP #13	1.70	1.60	1.60
ΔP #14	1.80	1.60	1.60
ΔP #15	1.70	1.80	1.50
ΔP #16	1.60	1.60	1.70
Sum of Square Root of ΔP's	21.2	21.6	21.0
Number of Traverse Points	16	16	16
Average Square Root of ΔP's	1.33	1.35	1.31
Average Temperature (°F)	525	529	533
Static Pressure (in. H2O)	-0.09	-0.25	-0.27
Stack Diameter (in.)	23.5	23.5	23.5
Stack Area (ft2)	3.01	3.01	3.01
Stack Velocity (ft/min)	6147	6269	6116
Stack Flow,wet (ACFM)	18516	18884	18421
Stack Flow,dry (SCFH)	5.62E+05	5.71E+05	5.53E+05
Stack Flow Rate via EPA Method 19			
Fuel Flow to Engine (SCFH)	18820	18623	18680
Fuel Heating Value (BTU/SCF)	1026	1026	1026
Fuel O2 F-Factor (DSCF/MMBTU)	8635	8635	8635
Fuel CO2 F-Factor (DSCF/MMBTU)	1023	1023	1023
Stack Flow Rate, dry via O2 F-factor (SCFH)	6.58E+05	6.51E+05	6.53E+05
Stack Flow Rate, dry via CO2 F-factor (SCFH)	6.48E+05	6.19E+05	6.26E+05
Difference between O2 F-factor and pitot tube	17%	14%	18%
Difference between CO2 F-factor and pitot tube	15%	8%	13%
Stack Flow Rate via Carbon Balance			
Fuel Carbon Content	1.026	1.026	1.026
Exhaust Carbon Content	3.21	3.32	3.29
Stack Flow Rate, dry via Carbon Balance (SCFH)	6.02E+05	5.76E+05	5.82E+05
Difference between carbon balance and pitot tube	7%	1%	5%

Testing By Cubix Corporation, Austin, Texas

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

March 9, 1992

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

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

Dear Mr. Weatherford:

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

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

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

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

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

Sincerely,

Syed Arif

Syed Arif
Compliance Engineer

SA:cjh

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

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

4APT-AEB

MAY 31 1991

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

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

RECEIVED
JUN 03 1991
Division of Air
Resources Management

Dear Mr. Fancy:

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

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

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

Sincerely yours,

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

J. Heron
CHF/BA