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

Prepared For

FLORIDA GAS TRANSMISSION COMPANY

April 1992

Prepared by

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INTRODUCTION

One Cooper Bessemer 8W330C2 compressor engine was tested to determine the quantity of emissions released into the atmosphere. The tests were conducted on March 23, 1992 at Compressor Station No. 16 located near Brooker, in Bradford County, Florida. This compressor station is owned and operated by Florida Gas Transmission Company (an affiliate of Enron).

The tests were conducted to determine the unit's compliance status with regard to the Florida Department of Environmental Regulation's Permit No. AC 04-189454.

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

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

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

Florida Gas Transmission Co.

Cubix Corporation

Table 1
Background Data

Source Owner/Operator:	**Florida Gas Transmission Co.** 601 South Lake Destiny Drive Maitland, Florida 32751 (407) 875-5816 TEL (407) 875-5896 FAX Attn: Allan Weatherford
Testing Organization	**Cubix Corporation** 9225 Lockhart Hwy Austin, Texas 78747 (512) 243-0202 TEL (512) 243-0222 FAX Attn: Lowell Faulkner
Test Participants:	**Florida Gas Transmission Co.** Allan Weatherford Fred Griffin **Cooper Bessemer** Carl McCluney **FDER** Stan Mazur Shannon Baruch **Cubix Corporation** Lowell Faulkner Rick Krenzke Joe Rudyk
Test Date:	March 23, 1992
Location:	near Brooker in Bradford 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 04-189454
Required Test Methods:	EPA Method 1 for traverse point layout EPA Method 2 for stack gas velocity EPA Method 3 for O_2 and CO_2 concentrations EPA Method 4 for moisture content EPA Method 7e for NOx concentrations EPA Method 9 for opacity observations EPA Method 10 for CO concentrations EPA Method 25 for VOC concentration ASTM D-3246 for indirect measurement of SO_2 emissions
Alternate Test Methods: (conducted for comparison purposes)	EPA Method 3a for CO_2 and O_2 concentrations Stoichiometric calculation of moisture content EPA Method 18 for VOC portion of THC concentration EPA Method 19 for calculation of stack flow rate EPA Method 25a for THC concentration AGA Carbon Balance Method for stack flow rate calculation

SUMMARY OF RESULTS

One Cooper Bessemer 8W330C2 compressor engine was tested to determine the quantity of emissions vented to the atmosphere. The emission measurements reported herein result from tests conducted on March 23, 1992 at Compressor Station No. 16 located near Brooker, in Bradford County, Florida. The purpose of these tests was to determine the compliance status of this engine with regard to the FDER permit.

The permit required that tests be conducted for 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 5.40 lbs/hr, 23.6 tons/yr, and 0.61 g/hp-hr. By comparison, permit limits are 17.6 lbs/hr, 77.2 tons/yr, and 2.0 g/hp-hr. CO emissions averaged 10.6 lbs/hr, 46.3 tons/yr, and 1.19 g/hp-hr and are limited by the permit to 22.0 lbs/hr, 96.6 tons/yr, and 2.5 g/hp-hr. The tons/yr emission rates are based on 8760 hrs/year operation of the engine.

The total sulfur content of the fuel was determined via laboratory analysis by Southern Petroleum Labs of Houston, Texas. The result of that analysis is contained in Appendix H and show that the fuel contained 0.071 grains/100 DSCF. The permit limits the sulfur content of the fuel to 10 grains/100 DSCF. The mass emission rate of 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 0.0031 lbs/hr or 0.014 tons/yr. The permit limits for SO_2 mass emissions are 0.75 lbs/hr and 3.3 tons/yr.

Nonmethane hydrocarbon (i.e. VOC) concentrations were measured as required by the permit using EPA Method 25. Table 2 contains the results of those measurements. The average VOC emissions using Method 25 were 6.40 lbs/hr, 28.0 tons/yr, and 0.72 g/hp-hr. The permit limits nonmethane hydrocarbon emissions to 8.8 lbs/hr, 38.6 tons/yr, and 1.0 g/hp-hr.

It is Cubix's belief that the applicability of using EPA Method 25 on this type of source is questionable. Method 25 results are affected by 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 3.03 lbs/hr (13.3 tons/yr and 0.34 g/hp-hr). When compared with the data obtained from Method 25, one can see that the CO_2 and moisture interferents may have biased the VOC concentrations high. In addition, the alternate methods are much less labor intensive, which eliminates a lot of the possibility of human error from the field or lab personnel.

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

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

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

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

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

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

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

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

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

TABLE 2
SUMMARY OF RESULTS

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

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

PROCESS DESCRIPTION

Florida Gas Transmission Co. owns and operates Compressor Station No. 16 located near Brooker, Florida. This plant uses engines to compress natural gas to allow for transportation in the main pipeline system. This compressor station is a part of a system developed by Florida Gas Transmission Company to allow the transport of natural gas from reserves in Texas to the Florida market.

The engine tested is a Cooper Bessemer 8W330C2 compressor engine bearing the serial number 49117. The engine is rated at 4000 BHP. It is a lean burn, high air/fuel ratio engine including a precombustion chamber on each cylinder, main chamber mixture regulation, and a variable timing spark control responsive to speed, torque, and air temperature.

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

ANALYTICAL TECHNIQUE

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

Figure 1 depicts the sample system used for the tests. A stainless steel probe was inserted into the sample port of the stack. The gas sample was continuously pulled through the probe and transported via 3/8 inch heat-traced Teflon® tubing to the mobile laboratory located at ground level. To prevent the possibility of condensation of heavier hydrocarbons, the sample was then delivered to the THC analyzer and gas chromatograph portion of the sample manifold via a stainless steel/Teflon® diaphragm pump through more heat-traced sample line (i.e. wet sample). The remaining sample then passed through a stainless steel minimum-contact condenser designed to dry it. The dry sample returned to the sample manifold. From the manifold, the sample was partitioned to the 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 12 diameters upstream of the nearest flow disturbances.

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

The stack gas analyses for 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 10% higher than those obtained by the pitot tube measurement. AGA's carbon balance technique yielded results only 2% higher than those of EPA Methods 1-4. Both of these methods use stoichiometric relationships based on the estimated fuel flow, fuel composition, and excess air concentration for calculation of the stack flow rates. The *Summary of Results* uses the pitot tube values in all calculations to be consistent with the permit provisions. However, the alternate methods provided for a check of the pitot tube traverse results.

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

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

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

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

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

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

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

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

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

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

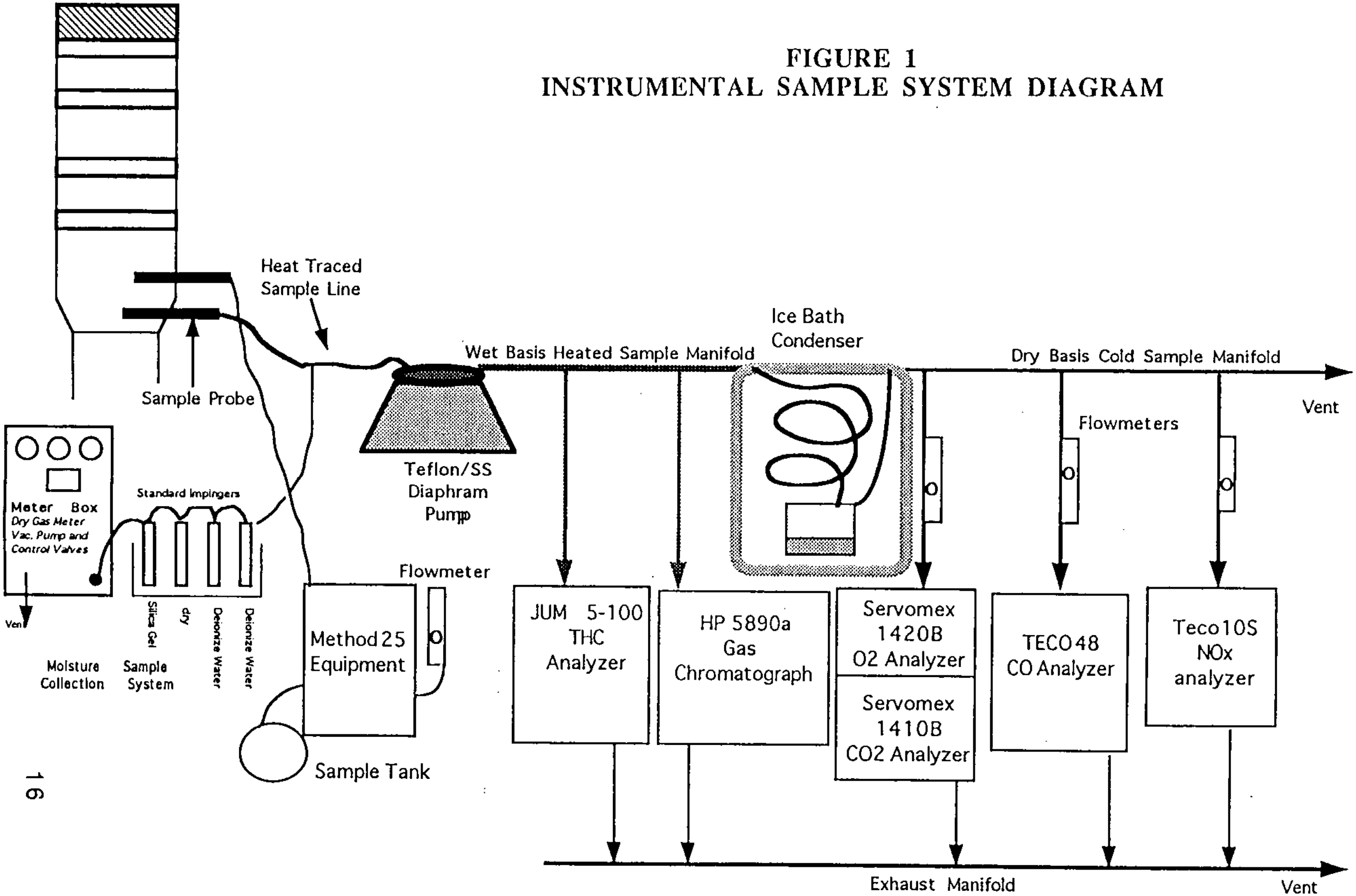
During the tests, the engine and compressor operational data was collected by Florida Gas personnel and is presented in Appendix A. Key operational data collected include compressor discharge pressures, compressor suction pressures, engine manifold pressure, engine speed, timing, and horsepower. Florida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

TABLE 3
ANALYTICAL INSTRUMENTATION

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

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

FIGURE 1
INSTRUMENTAL SAMPLE SYSTEM DIAGRAM



QUALITY ASSURANCE ACTIVITIES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The observer for the opacity measurements was certified in Florida as per EPA Method 9. The certification for the observer can be found in Appendix G.

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

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

APPENDIX A: FIELD DATA SHEETS AND OPERATIONAL DATA

SIGN IN SHEET

JOB NAME: Florida Gas Station # 16 DATE: 3 / 23 / 92

LOCATION: Near Brooker, Florida PERMIT # AC-04-189945

SOURCE(S): Cooper Engine PSD-FL-161

PARTICIPANTS: Cubix Corporation

FGT

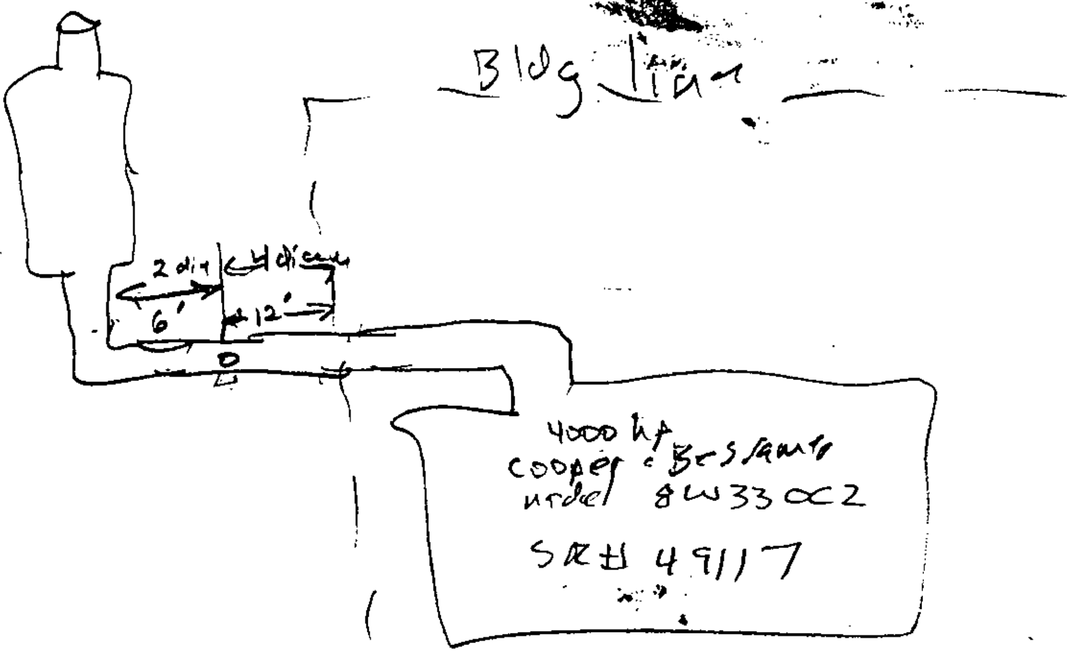
NAME:	AFFILIATION:	PHONE NUMBER:
RICK J. KRENZKE	CUBIX CORP.	512-243-0202
ALLAN WEATHERFORD	FLA. GAS	407 875-5800
FRED GRIFFIN	" "	" " "
STAN MAZUR	FLA. DER - 2 - JACKSONVILLE	(904) 448-4310
SHANNON BARUCH	FLA. DER - GAINESVILLE	(904) 336-2095
Lowell Fowlker	Cubix	512 243 0202
Joe Rudy/?	"	512 243 0202

Circular Stack Sampling Traverse Point Layout
(EPA Method 1)

Date: 3/23/92
Plant: Brooker FGT
Source: Cooper-Bessemer Engine
Technician(s) LF RK JR

Port + Stack ID: 47 in.
Port Extension 12 in.
Stack ID: 35 in.
Stack Area 6.69 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	1.1
2	25.0	14.6	10.5	8.2	3.7
3	75.0	29.6	19.4	11.8	6.8
4	93.3	70.4	32.3	17.7	11.3
5		85.4	67.7	25.0	23.7
6		95.6	80.6	35.6	28.2
7			89.5	64.4	31.3
8			96.8	75.0	33.9
9				82.3	
10				88.2	
11				93.3	
12				97.9	

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3/23/92
Plant/Operator: FGT / Brooker
Source: Cooper Engine
Technicians: LF JK RK
Atm. Pres. 29.69 in.Hg(Pb)
Test Run # C-1

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

		Impinger #	Contents	Initial Weight	Final Weight
Pre-test Leak check OK	0 ft.3/min at 22 in. Hg Vacuum	1	H_2O	563.8	580.4
		2	H_2O	590.8	593.7
Post-test Leak check OK	0 ft.3/min at 23 in. Hg Vacuum	3	MT	473.0	473.8
		4	SILICA	706.4	714.2
		5			
		6			
		Totals		2334	2362.1

Moisture Train

	Initial	Final
Time:	1550	1647
Meter Reading (ft3 or L)	722.403	746.585
Meter Temp. (°F)	75	110
Sample Box #	TR 7 Box	

O2 %	16.2 %
CO2 %	2.8 %

Orsat Results

Pitot Tube Traverse/Stack Temp./Angle

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

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

RJK

MOISTURE AND VELOCITY FIELD DATA SHEETS

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

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

Pre-test Leak check OK	0 ft.3/min at 22 in. Hg Vacuum	
Post-test Leak check OK	0 ft.3/min at 2[illegible] in. Hg Vacuum	

Impinger #	Contents	Initial Weight	Final Weight
1	H_2O	580.4	595.1
2	H_2O	593.7	596.0
3	Dry	473.8	476.5
4	SG	714.2	719.7
5			
6			
Totals		2362.1	2387.3

Moisture Train

	Initial	Final
Time:	1702	1756
Meter Reading (ft3 or L)	746.680	769.23
Meter Temp. (°F)	100°	125°
Sample Box #	T 7 B 09	

ORSAT results	
O2 %	16.00
CO2 %	3.00

Pitot Tube Traverse/Stack Temp./Angle

	N			S		
Traverse Pt.	ΔP (" H2O)	°F	ß	ΔP (" H2O)	°F	ß
1	.95			.91		
2	1.1			1.2		
3	1.2			1.3		
4	1.3			1.3		
5	1.2			1.3		
6	1.1			1.2		
7	1.2			1.2		
8	1.1			1.1		
9						
10						
11						
12						

MOISTURE AND VELOCITY FIELD DATA SHEETS

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

Dry Gas Meter ID: Anderson
Dry Gas Meter Factor: .9904 (Kd)
Pitot Tube #/Type: #107 S-Type
Pitot Tube Factor: .84 (Kp)
Static Pres. +.49 in.H2O(Pg)
Average Stack Temp. 504 °F(Ts)

Leak Check = 0.01 @ 24"

Pre-test Leak check	ft.3/min at in. Hg Vacuum	Impinger #	Contents	Initial Weight	Final Weight
OK	0.01 @ 24"	1	H_2O	597.9	612.5
Post-test Leak check OK	0 ft.3/min at 23 in. Hg Vacuum	2	H_2O	595.9	598.2
		3	Empty	459.4	460.1
		4	SG	715.0	721.2
		5			
		6			
		Totals		2368.2	2392

Moisture Train

	Initial	Final
Time:	1831	1921
Meter Reading (ft3 or L)	771.270	793.175
Meter Temp. (°F)	98	112
Sample Box #	TT 7 B or	

Orsat

O2 %	16.0
CO2 %	3.0

Pitot Tube Traverse/Stack Temp./Angle

	S			N		
Traverse Pt.	ΔP (" H2O)	°F	ß	ΔP (" H2O)	°F	ß
1	1.0			.82		
2	1.1			1.1		
3	1.2			1.1		
4	1.3			1.2		
5	1.2			1.1		
6	1.2			1.2		
7	1.1			1.2		
8	1.2			1.1		
9						
10						
11						
12						

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

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

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

Volatile Organic Carbon by Method 25

Client: Florida GAS TraNS	Project #: 0
Plant: Brooker #16	Sample Location: Center of Stack
Operator: JR, RK, LF	Date: 3-23-92
Run Number: C1	Sample ID:
Tank Number: AT 121 ✓	Trap Number: V3 X-27
Sampling Train ID#:	% CO2: 2.98
Side: Left / Right: SAMPLE 1	% H2O: 5.04
Start Time: 1526	Stop Time: 1026

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

Leak Rate	Tank* (in Hg) Allowable	Tank* (in Hg) Actual	Trap black ball reading
Pre Test	.52	.23	0
Post Test	.52	.22	0

$\Delta P = .01 \frac{F\,Pb\,\varnothing}{Vt}$ = .01 × 35 × 29.9 × 5 / 100

ΔP = Pressure Change (in Hg)
F = Sampling Flow Rate cc / min 35
Pb = Barometric Pressure (in Hg) 29.9
Ø = Leak Check Time Period (min) 5 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
1526	28.80	35cc	265	265	START
1531	27.50	20	265	266	
1536	26.80	18	268	265	Frozen Line
1541	26.80	35	265	265	
1546	25.20	25	265	265	Line open
1551	23.80	35	265	267	Flow Steady
1556	20.30	32	265	265	
1601	18.00	35	265	267	
1606	16.20	35	265	265	
1611	14.60	33	266	265	
1616	12.80	30	265	265	Adjust Flow
1621	10.20	30	265	265	Lube oil
1626	8.50	38	265	265	through out Stack

Volatile Organic Carbon by Method 25

Client:	Florida GAS Trans	Project #:	
Plant:	Brooker #16	Sample Location:	
Operator:	~~JR~~, LF, RK	Date:	3/23/92
Run Number:	C-2	Sample ID:	
Tank Number:	4T108	Trap Number:	X-1[illegible] · used Before
Sampling Train ID#:		% CO2:	2.91
Side: Left / Right:	Sample-1	% H2O:	5.07
Start Time:		Stop Time:	

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

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

$\Delta P = .01 \frac{F\, Pb\, \emptyset}{Vt}$ .01 35 29.69 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
1713	28.50	35	265	265	Start
1718	27.20	35	265	265	
1723	26.10	33	265	265	
1728	24.00	30	265	265	
1733	21.90	30	265	265	
1738	19.90	30	265	265	Adjust Flow
1743	17.20	35	265	265	
1748	14.60	33	263	263	
1753	12.30	30	265	265	
1758	10.20	38	265	265	Adjust Flow
1703	8.90	33	265	265	
1708	7.50	28	265	265	
1713	6.5	20	265	265	

Volatile Organic Carbon by Method 25

Client:	Florida Gas	Project #:	
Plant:	Brooker	Sample Location:	STACK
Operator:	JR, LF, RK	Date:	3/23/92
Run Number:	C-3	Sample ID:	
Tank Number:	ST-182	Trap Number:	C-15
Sampling Train ID#:		% CO2:	2.87
Side: Left / Right:	Sample 1	% H2O:	4.93
Start Time:	1833	Stop Time:	1933

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

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

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

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

Clock Time	Gauge Vacuum (in Hg)	Flowmeter Setting (silver ball)	Probe Temp C / F	Filter Temp C / F	Notes
1833	29.20	35	267	264	Start
1838	27.30	33	267	265	
1843	25.40	35	266	264	
1848	23.60	33	266	264	
1853	21.50	33	267	264	
1858	19.40	33	266	265	
1903	16.00	35	265	263	
1908	14.20	33	266	264	
1913	12.70	30	267	265	
1918	10.90	28	267	266	Adjust Flow
1923	8.90	35	267	266	
1928	7.60	33	267	266	
1933	6.00	30	268	266	

4334

CHAIN OF CUSTODY RECORD

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

SAMPLERS: (Signature) Joseph Rudyk

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	COD BLANK VALUE (ppmv)					REMARKS
	C-1	3/26/92	830	Trap # B35		3.0					Melbourne - Fla. GAS
	C-2	3/17/92	1530	B53		4.5					MUNSON - Fla. GAS
	C-5	3/27/92		B233		1.3					Melbourne
	C-2	3/21/92	1130	C1		2.4					Silver Springs - Fla. GAS
	C-1	3/19/92	900	C3		3.5					Quincy - Fla. GAS
	Adit-2	3/26/92		C7		0.8					Melbourne
	C-3	3/29/92	1120	C10		6.6					Perry - Fla. GAS
	C-3	3/17/92	1643	C13		3.6					MUNSON. - Fla. GAS
	C-3	3/2?		C15		3.6					Brooker
	C-2	3/26/92	955	C37		0.8					Melbourne - Fla. GAS
	G-2	3/18	1300	R002		4.3					Coating with C-PGU
				R004		1.2					
				R008		2.5					
	C-2	3/2?		X1		2.6					Brooker
	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)
	4/1/92 1:42	Tom Grosso			
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

4335

CHAIN OF CUSTODY RECORD

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

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	CO_2 BLANK VALUE						REMARKS
→	C-2	3/20/92	1000	Trap # X13 ? ~~Brooker~~		1.8						Perry - Fla. GAS ✓
				X14		0.9						
				X16		2.3						
	~~Audit A~~	~~3/26/92~~		~~X23~~		~~2.6~~						~~Melbourne~~
	C-1	3/25/92		X27		1.8						Brooker
				~~X28~~		8.0						
	C-3	3/24/92	1100	X32		3.3						Melbourne - Fla. GAS ✓
	C-1	3/24/92	1000	X48		9.0						Silver Springs - Fla. GAS ✓
	C-4	3/27/92		XY		2.3						Melbourne
	C-3	3/19/92	1135	N2		5.6						Quincy - Fla. GAS ✓
	C-3	3/24/92	1310	N4		3.0						Silver Spring - Fla. GAS ✓
				N7		2.1						
	C-6	3/27/92		N8		2.6						Melbourne
	C-1	3/17/92	1425	N13		8.7						Munson - Fla GAS ✓
	C-1	3/18/92	1100	N19 LAB 4/2		3.0						Caryville - 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			
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

4337

CHAIN OF CUSTODY RECORD

PROJ. NO.

DEPT. NO. 8151

PROJECT NAME: Cubix Corp

SAMPLERS: (Signature) [signature] Joseph Rudyk

NO. OF CONTAINERS

NHHC BLANK VALUE (gHVC)

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

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

REMARKS:

CAE

500 W. Wood Street

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

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

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

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

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

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

Preliminary Data				
Run No.		C-1	C-2	C-3
Tank No.		4T121	4T108	4T182
Trap No.		X27	X13	C15
Tank Volume V(cc)		4040	4021	4011
Field Data				
PTI	(mm Hg)	-709	-709	-708
TTI	(F)	71	68	68
PbI	(mm Hg)	753	755	755
PT	(mm Hg)	-191	-150	-150
TT	(F)	72	66	66
Pb	(mm Hg)	753	756	756
Noncondensible Organics				
PT(Lab)	(mm Hg)	-204	-150	-142
TT(Lab)	(F)	78	78	78
Pb(Lab)	(mm Hg)	746	745	745
PTF	(mm Hg)	920	930	1032
TTF	(F)	78	78	78
PbF	(mm Hg)	746	745	745
Ba	(ppmv C)	0.1	0.1	0.1
Ctm 1	(ppmv C)	12.8	15.1	14.3
Ctm 2	(ppmv C)	12.5	14.9	16.1
Ctm 3	(ppmv C)	14.3	15.0	13.9
Avg. Ctm	(ppmv C)	13.2	15.0	14.8
RSD Ctm	(%)	7.3	0.7	7.9
Condensible Organics				
ICV Tank No.		4T240	4T66	4T232
ICV Tank, Vv (cc)		4265	4036	4280
PFI	(mm Hg)	-736	-734	-738
TFI	(F)	78	78	78
PbFI	(mm Hg)	746	745	745
PF	(mm Hg)	920	920	920
TF	(F)	78	78	78
PbFf	(mm Hg)	746	745	745
Bt	(ppmv C)	1.8	2.3	3.6
Ccm 1	(ppmv C)	42.1	20.6	47.9
Ccm 2	(ppmv C)	40.4	20.4	47.7
Ccm 3	(ppmv C)	39.9	20.2	47.9
Avg. Ccm	(ppmv C)	40.8	20.4	47.8
RSD Ccm	(%)	2.8	1.0	0.2
Total Gaseous Nonmethane Organics (TGNMO)				
Vs	(cc)	2734	2976	2964
Dil. Factor (Non)		3.181	2.923	3.107
Dil. Factor (Con)		3.358	2.917	3.106
Ct	(ppmv C)	41.7	43.6	45.6
Cc	(ppmv C)	131.0	52.8	137.4
Ct+Cc= C	(ppmv C)	172.6	96.4	183.0
Mc	(mg C/dscm)	86.2	48.1	91.4

DATE 3-23-92
UNIT NO. 1606

ENGINE/COMPRESSOR PERFORMANCE
EMISSION & PERFORMANCE TEST FORM

STATION 16-Brookey
STA. EL. 100

TEST NO	1 4000 110° 330 RPM	2 4000 110 330	3 4000 110 330	4 ~~4200~~ 95° 330	5 4200 95 330			
POWER END ANALYSIS								
ENGINE SPEED - RPM	328	328	328	328	328			
IGN. TIMING - BTDC	3°	3	3	3	3			
AMP - PSIG / ~~"Hg~~ PSI	14.3	14.1	14.1	15.1	15.9			
AMT - F Rt/Left	106/108	106/107	110/108	95/95	95/95			
FUEL STATIC PR. - PSIA	~~555~~							
FUEL DIFF. - "H2O								
FUEL TEMP. - F								
FMP - PSIG	55.5	55.2	54.9	58.0	57.6			
FUEL FLOW - SCFH								
AMBIENT TEMP. - F	68°	68°	66°	63°	60°			
~~O2 - %~~ PCC	48.4	48.4	47.8	51.0	50.3			
~~CO - ppm~~ Exhaust Temp	663°	666°	670	658	659			
~~CO2 - %~~								
~~NO - ppm~~ TIME	4:17 PM	5 15 PM	6 20 PM	7 13 PM	7 57 PM			
~~NO2 - ppm~~ Turbo Inlet Vac H2O	4.3"	4.3"	4.2"	4.5½	4.5			
THC - (ppmv as C1)								
Turbo RPM	10,260	10,230	10,190					

4010
100.5

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

APPENDIX B: EXAMPLE CALCULATIONS

MOISTURE CONTENT
refers to test run C-1

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

M_1 = initial weight of impinger train = 2334 g
M_2 = final weight of impinger train = 2362.1 g

MWC = total weight gain of all impingers (g)
= $M_2 - M_1$ = 2362.1 - 2334
= 28.1 g

K_d = dry gas meter factor (unitless) = 0.9904

$V_{corrected} = V_{net} \times K_d =$ x
= 23.782 x 0.9904 = 23.554 ft^3

1.335 liters weighs 1 gram at standard conditions
499.4 = Gas constant
P_{bar} = barometric pressure (in Hg) = 29.68
T = temperature of gas DGM (F^o) = 92.5

F_w = moisture fraction by volume

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

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

$$= \frac{(28.1 \times 1.335)}{(28.1 \times 1.335) + (((23.554 \times 29.68) / (92.5 + 460)) \times 499.4)}$$

= 0.056 moisture

MOLECULAR WEIGHT

refers to test run C-1

MW_{H_2O} = molecular wt of H_2O = 18 lb/lb-mole
MW_{CO_2} = molecular wt of CO_2 = 44 lb/lb-mole
MW_{O_2} = molecular wt of O_2 = 32 lb/lb-mole
MW_{N_2} = molecular wt of N_2 = 28 lb/lb-mole
C_{CO_2} = concentration of CO_2 = 2.8 (from Orsat)
C_{O_2} = concentration of O_2 = 16.2(from Orsat)
C_{N_2} = concentration of N_2 = $1-(C_{CO_2}+C_{O_2})$ = 0..81
Fw = moisture fraction = 0.056
F_d = dry gas fraction = 1 - Fw = 0.944

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

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

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

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

STACK GAS VELOCITY AND FLOW RATE

refers to test run C-1

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 = 1.0974
T_s = stack temperature = 503 F° = 963 R°
P_b = atmospheric pressure (in Hg) = 29.68
P_g = stack static pressure (in. H_2O) = 0.43
Ps = absolute stack pressure
$= P_b + (Pg \times .0735 \text{ in.Hg / in.}H_2O) = 29.71$ in. Hg

V = stack velocity (ft/min)

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

$= 5128.8 \times .84 \times 1.0974 \times \sqrt{(963/ (29.71 \times 28.47)}$
= 5044 ft/min

Q_a = stack flow rate (ft^3/min)
= V x A , where A= area of stack = 6.68 ft^2
= 5044 x 6.68 = 33700 ft^3/min

Qd= stack flow rate on dry basis at standard conditions (SCFH)
$= Q_a \times 1059 \times (Ps / Ts) \times Fd$
$= 33700 \times 1059 \times (29.71/ 963) \times 0.944$
$= 1.04 \times 10^6$ SCFH

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

Q_f = estimated fuel flow = 30757 SCF/hr
F_{BTU} = heating value of gas = 1022 BTU/SCF
F = O_2 F factor = 8636 SCF/MMBTU
C_{O2} = concentration of O_2 = 16.0 %(from analyzer)

Q_d = stack flow rate on dry basis at standard conditions (SCFH)
$= Q_f \times F_{BTU} \times 10^{-6} \times F \times 20.9 / (20.9 - C_{O2})$
$= 30757 \times 1022 \times 10^{-6} \times 8636 \times 20.9 / (20.9 - 16.0)$
$= 1.16 \times 10^6$ SCFH

With CO2 F-factor (i.e. F=1022), same calculation is used except for final term......
$Q_d = Q_f \times F_{BTU} \times 10^{-6} \times F \times 100/C_{CO2}$
$= 30757 \times 1022 \times 10^{-6} \times 1022 \times 100/2.92$
$= 1.10 \times 10^6$ SCFH

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

MASS EMISSION RATES

refers to test run C-1

NOx = concentration of NOx = 42.6 ppmv
CO = observed concentration of CO = 145 ppmv
VOC = observed concentration via EPA Method 25 and 18
= 74.2 ppmv
1 SCF NOx = 11.94×10^{-8} lbs
1 SCF CO = 7.26×10^{-8} lbs
1 SCF C1(methane) = 4.15×10^{-8} lbs
Qd = stack flow rate = 1.04×10^{6} SCFH
E_{NOx} = mass emission rate of NOx (lb/hr)
$= NOx \times Qd \times 11.94 \times 10^{-8}$
$E_{NOx} = 42.6 \times 1.04 \times 10^{6} \times 11.94 \times 10^{-8}$

E_{NOx}= 5.29 lb/hr
E_{CO} = 11.0 lb/hr
E_{VOC}= 3.2 lb/hr

HP = engine horsepower = 4030 hp
454 g = 1.0 lb

E_{NOx} (g/hp-hr)= $E_{NOx} \times 454 / HP$
$= 5.29 \times 454 / 4030$
E_{NOx} (g/hp-hr)= 0.6 g/hp-hr
E_{CO} (g/hp-hr)= 1.23 g/hp-hr
E_{VOC} (g/hp-hr)= 0.36 g/hp-hr

Stack Gas Flow Rate via AGA Carbon Balance Method

Refers to Test Run #C-1

Q_f = fuel flow = 30757 SCF/hr

Cf = carbon content of fuel (from fuel analysis) = 1.022

Ce = exhaust gas carbon content

= CO + THC (as C1) + CO2

= (145 + 890) / 10000 + 2.92 = 3.0235 %

Q = stack flow rate

= Qf x Cf x 100 / Ce

= 30757 x 1.022 x 100 / 3.0235

= 1.04×10^6 SCFH

SO2 Emission Rate from Fuel Analysis

Refers to Test Run #C-1

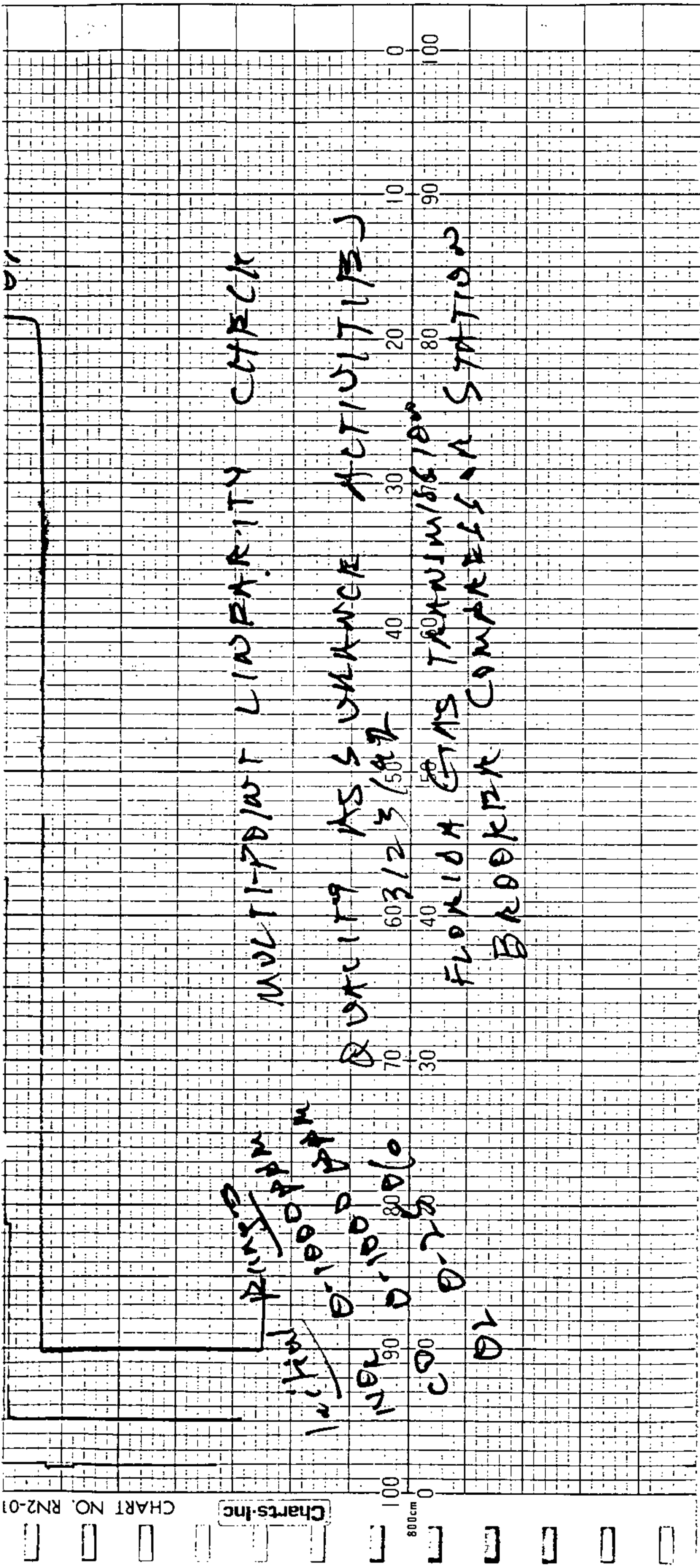
S = sulfur content of fuel = 0.071 grains/100 DSCF
7000 grains = 1.0 lb
Q_f = 30757 SCF/hr
SO2 = mass emission rate of SO2
= S / 100 / 7000 x Q_f
= .071 /100 / 7000 x 30757
= <0.0031 lbs/hr

Moisture Content via Stoichiometry
Refers to test run #1

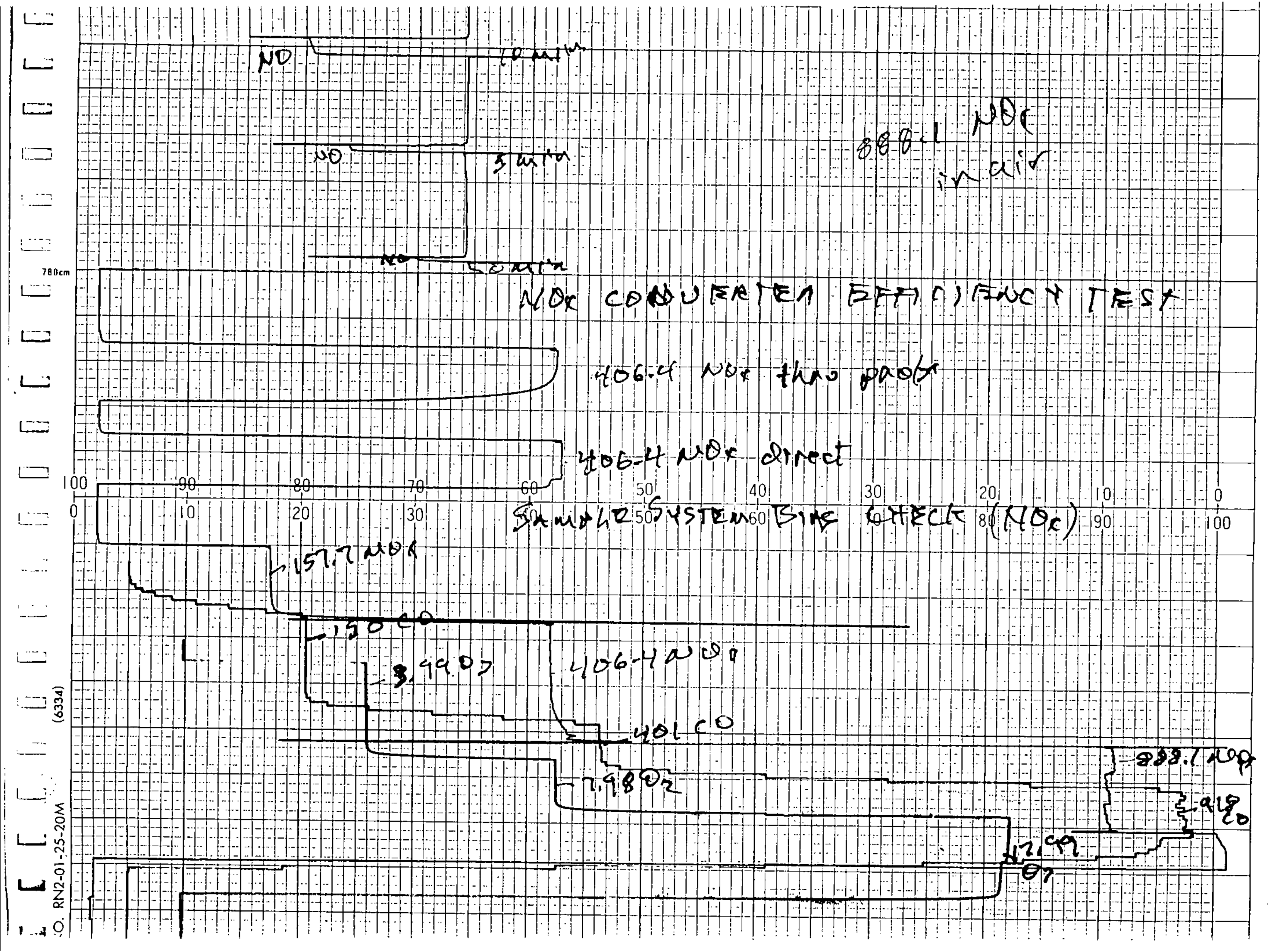
H = Ambient humidity (via psychrometer) = 0.0097 lb/lb air
O2 = O2 concentration in stack = 16.0%
F = wet basis O2 F-factor (from fuel calcs)
= 10641 DSCF/MMBTU
FW = moisture F-factor = 2006 SCF of H2O/MMBTU
CM = combustion moisture % at 0% O2
= Fw / F x 100 = 2006 / 10641 x 100
= 18.86 %

Fw = moisture content
= (CM x (20.9 - O2)/20.9) + (H x 64.3)
= (18.86 x (20.9 - 16.0)/20.9) + (.0097 x 64.3)
= 5.04 %

APPENDIX C: QUALITY ASSURANCE ACTIVITIES



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


NO
10 min
NO
3 min
NO
888.1 NOx in air
780cm
NOx CONVERTER EFFICIENCY TEST
406.4 NOx thru probe
406.4 NOx direct
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
SAMPLE SYSTEM BIAS CHECK (NOx)
157.7 NOx
150 CO
8.99 O2
406.4 NOx
401 CO
888.1 NOx
918 CO
7.98 O2
12.99 O2
(6334)
NO. RN2-01-25-20M

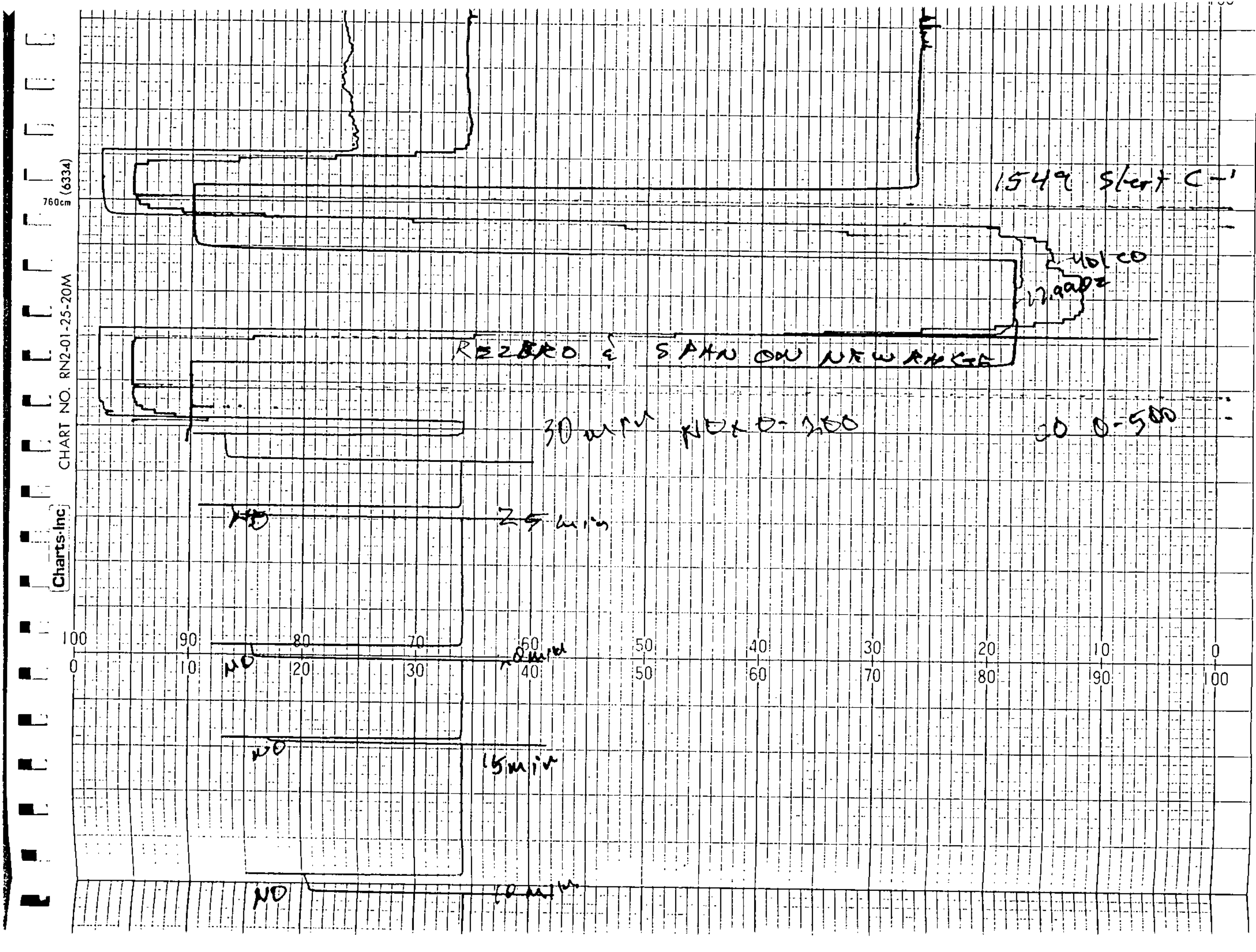
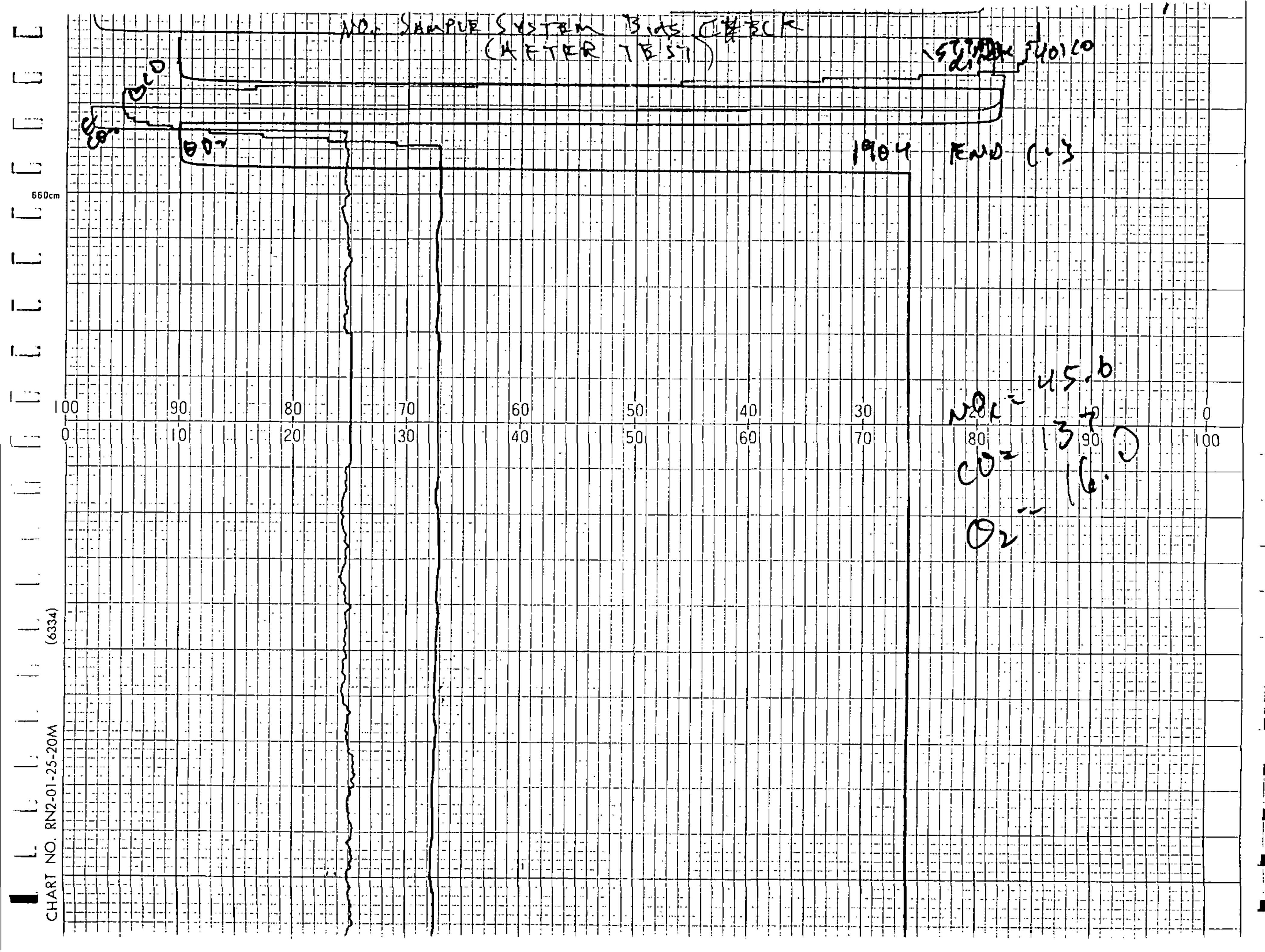
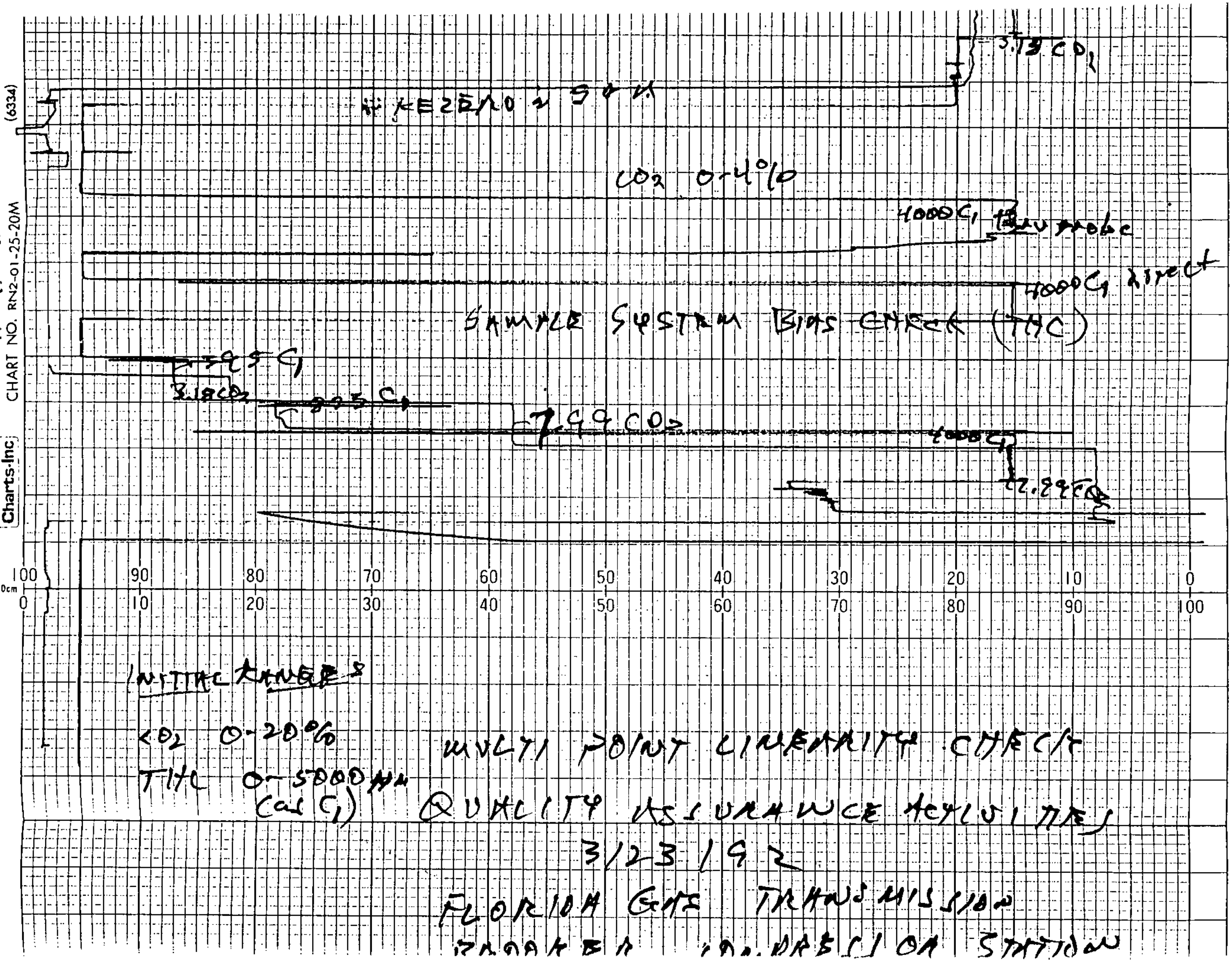


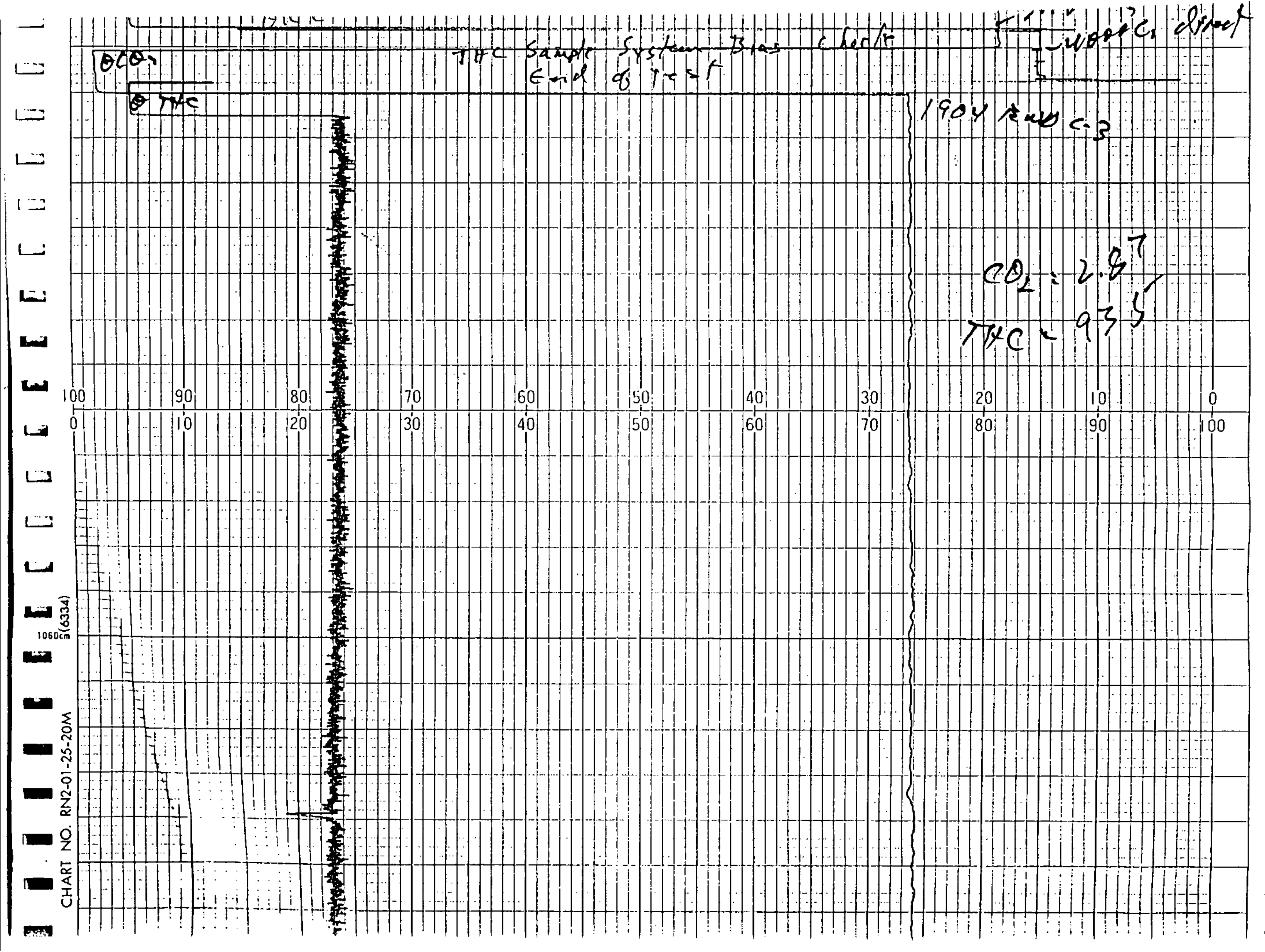
CHART NO. RN2-01-25-20M
Charts-Inc
(6334)
760cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
1549 Start C-1
REZERO & SPAN ON NEW RANGE
30 min NOx 0-200
CO 0-500
ND
25 min
ND
20 min
ND
15 min
ND
10 min



NOx SAMPLE SYSTEM BIAS CHECK
(AFTER TEST)
1904 END C-3
NOx = 45.6
CO2 = 13.7
O2 = 16.0
660cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
(6334)
CHART NO. RN2-01-25-20M



(6334)
CHART NO. RN2-01-25-20M
Charts-Inc
1160cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
3.13 CO_2
REZERO
CO_2 0-4%
4000 C_1 thru probe
4000 C_1 direct
SAMPLE SYSTEM BIAS CHECK (THC)
995 C_1
3.18 CO_2
995 C_1
7.99 CO_2
4000 C_1
12.99 CO_2
INITIAL RANGES
CO_2 0-20%
THC 0-5000 ppm (as C_1)
MULTI POINT LINEARITY CHECK
QUALITY ASSURANCE ACTIVITIES
3/23/92
FLORIDA GAS TRANSMISSION
STATION


THC Sample System Bias Check
End of Test
@CO2
@ THC
~4000 C1 direct
1904 Amb C-3
CO2 = 2.87
THC = 935
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
1060cm (6334)
CHART NO. RN2-01-25-20M

Quality Assurance Worksheet: Brooker Compressor Station

	CERTIFIED GAS INPUT		INITIAL CALIBRATION & LINEARITY CHECK		TEST RUN	ZERO and SPAN CALIBRATION CHECK		TEST RUN	ZERO and SPAN CALIBRATION CHECK		TEST RUN	ZERO and SPAN CALIBRATION CHECK	
	Concentration (% or ppm)	Target (% Chart)	Initial (% Chart)	Difference (% Chart)	RUN #C1	Final (% Chart)	Drift (% Chart)	RUN #C2	Final (% Chart)	Drift (% Chart)	RUN #C3	Final (% Chart)	Drift (% Chart)
NOx					Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	2.0	2.0	0.0	42.6	2.0	0.0	44.2	2.1	0.1	45.6	2.2	0.2
low	157.7	17.8	17.3	-0.5	% Chart	81.1	0.3	% Chart	80.5	-0.3	% Chart	82.1	1.3
mid	406.4	42.6	42.0	-0.6	23.3	n.a.	n.a.	24.1	n.a.	n.a.	24.8	n.a.	n.a.
high	888.1	90.8	91.2	0.4		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	1000.0				200.0			200.0			200.0		
CO					Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	5.0	5.0	0.0	145.0	5.0	0.0	144.0	5.2	0.2	137.0	5.0	0.0
low	150.0	20.3	20.5	0.2	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	401.0	45.3	46.2	0.9	34.0	85.6	0.4	33.8	83.4	-1.8	32.4	85.2	0.0
high	918.0	96.5	97.2	0.7		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	1000.0				500.0			500.0			500.0		
O2					Avg.%			Avg.%			Avg.%		
zero	0.0	10.0	9.9	-0.1	16.00	10.3	0.3	15.95	10.0	0.0	16.00	10.0	0.0
low	3.99	26.0	25.9	-0.1	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	7.98	41.9	42.5	0.6	74.0	n.a.	n.a.	73.8	n.a.	n.a.	74.0	n.a.	n.a.
high	17.90	81.6	82.1	0.5		81.9	0.3		81.8	0.2		81.9	0.3
full scale	25.0				25.0			25.0			25.0		
CO2					Avg.%			Avg.%			Avg.%		
zero	0.0	2.0	2.2	0.2	2.92	2.2	0.2	2.91	2.2	0.2	2.87	2.2	0.2
low	3.18	17.8	17.9	0.1	% Chart	81.3	-0.2	% Chart	81.4	-0.1	% Chart	81.3	-0.2
mid	7.99	42.0	17.9	-24.1	75.0	n.a.	n.a.	74.8	n.a.	n.a.	73.8	n.a.	n.a.
high	17.99	92.0	92.0	0.1		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	20				4.0			4.0			4.0		
THC					Avg. ppmv			Avg. ppmv			Avg.ppmv		
zero	0.0	5.0	5.0	0.0	890	5.1	0.1	885	5.0	0.0	935	5.2	0.2
low	395	12.9	12.9	0.0	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	823	21.5	21.7	0.2	22.8	n.a.	n.a.	22.7	n.a.	n.a.	23.7	n.a.	n.a.
high	4000	85.0	85.0	0.0		85.9	0.9		84.0	-1.0		84.8	-0.2
full scale	5000.00				5000.0			5000			5000		

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

Test Gas		Analyzer Response		Response Ratio
Type Gas	Concentration	Concentration ppmv	% of Range	
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?
NO_x	176 ppmv	0.4		0.002
NO_x	3030 ppmv	0.4		0.0001
SO_2	401 ppmv	-0.2		0.0005
Propane	240 ppmv	0.4		0.002

ppmv/%

ppmv/ppmv

all interferences are negligible

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 B705 627
Analyzer Test Range: 0-10

Test Gas		Analyzer Response		Response
Type Gas	Concentration	Concentration	% of Range	Ratio
CO	491 ppm	5.05%	5.5	
SO_2	346 ppm	5.05%	5.5	
CO_2	8%	5.05%	5.5	
NO_x	886 ppm	5.05%	5.5	

TA 7 CO_2 ANALYZER

Continous Emission Analyzer Interference Response Tests

Date: 1/16/92
Technician: L/

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%	~~<.005~~ <.5	

Response Time Data Sheet

Date: 3/14/89

Plant: — Austin Office

Technician: MM/DC

Sample Manifold Press.: 6 psi

Sample Line Length: 140 ft.

Pump Model No.: 6-3 Dia-pump

Analyzer:	NOx Analyzer	Oxygen Analyzer
Model:	TECO 10AR	Teledyne 320 AX
Range:	0 - 1000 ppm	0 - 25 %
Span Gas:	900 ppm NOx	Air = 20.9% O_2
Upscale Response	.65 min	.72 min
	.60	.75
	.60	.80
Average	.61 min	.76 min
Downscale Response	.65 min	.96 min
	.65	.90
	.65	.85
Average	.65 min	.88 min

Comments: 3/8" Sample line
Igloo Condenser

Instrumental Analysis
Quality Assurance Data

Date: 3/23/92
Plant: FGT Brooker Compressor Station
Technician: CF RK JR

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	322	~~n~~ n.a.	280
10 minute Concentration	322	0	182
20 minute Concentration	320	.6	135
30 minute Concentration	320	1.2	110

Sampling System Bias Check

Analysis	Calibration Gas Concentration (ppm)	Full Scale Span (ppm)	Direct Calibration Response (ppm)	Thru-Probe Sample System Response (ppm)	System Calibration Bias (% of Span)
Zero Gas	~~406.4~~	~~1000~~			
NOx before test	406.4	1000	408	402	-0.6%
SO2					
THC before test	4000	5000	3990	3980	-0.2%
NOx after test	157.7	200	159.8	158	-0.9%
THC after test	4000	5000	4000	4000	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.

Source	Sample - Run ID #	Carbon Concentration: 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: *[initials]* 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

1290 COMBERMERE STREET, TROY, MICHIGAN 48084 (313) [illegible]

Your P.O. # : 90347

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

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

Certified Per Traceability Protocol # 1

Procedure # G1

File # P08133

Certified Accuracy 1 % NBS Traceable

Expiration Date : 7-28-92

Cylinder Number : ALM-016031

Cylinder Pressure 1900 psig

CERTIFIED EPA PROTOCOL

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

BALANCE GAS : NITROGEN

NITROGEN DIOXIDE 5.82 PPM (FROM SECOND ANALYSIS)

FIRST ANALYSIS DATE : 1-21-91

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

CALCULATED RESULTS 889.5
889.5
889.5

AVERAGE : 889.5 PPM

SECOND ANALYSIS DATE : 1-28-91

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

CALCULATED RESULTS 886.6
886.6
886.6 892.5 PPM NOX

AVERAGE : 886.6 PPM

CALIBRATION CURVE 1 st DEGREE

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

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : Paul P. Doran

Approved By : C. Shapiro

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

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

Our Project # : 520006

Your P.O. # : 91004

Expiration Date : 8-18-92

Cylinder Number AAL-9912

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 # P08274

Certified Accuracy 1 % NBS Traceable

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

BALANCE GAS : NITROGEN

NITROGEN DIOXIDE 1.77 PPM

FIRST ANALYSIS DATE : 2-11-91

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

CALCULATED RESULTS 157.4 / 157.4 / 157.4

AVERAGE : 157.4 PPM

SECOND ANALYSIS DATE : 2-18-91

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

CALCULATED RESULTS 158.0 / 158.0 / 158.0 — 159.8 PPM NOX

AVERAGE : 158.0 PPM

CALIBRATION CURVE 2 nd DEGREE

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

GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

ANALYST [signature] APPROVED [signature] Shapiro

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

Shipped From : Scott Michigan

Our Project # : 53222B

Your P.O. # : 92 0000

Expiration Date : 7-21-93

Cylinder Number : AAL5112

Cylinder Pressure 1900 psig

1 of 1 Component(s)

tomer :
CUBIX CORPORATION
9225 LOCKHART HWY
AUSTIN TX 78747

**** CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ****
PERFORMED ACCORDING TO SECTION 3.0.4
Certified For Traceability Procedure # G1
Protocol # 1
File # PD-2143
Certified Accuracy 1 % NBS Traceable

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

NCE GAS : NITROGEN

OGEN DIOXIDE 0.00 PPM (FROM SECOND ANALYSIS)

FIRST ANALYSIS DATE : 1-15-92

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

CALCULATED RESULTS 406.9
406.9
406.9

AVERAGE : 406.9 PPM

SECOND ANALYSIS DATE : 1-21-92

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

CALCULATED RESULTS 405.9
405.9
405.9 405.9 PPM NOX

AVERAGE : 405.9 PPM

CALIBRATION CURVE 1 ST DEGREE

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

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

S - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : F. P. Dore Approved By : F. Shapiro

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

3714 LAPAS DRIVE, HOUSTON, TEXAS 77023

6/03/91

JBIX CORPORATION
225 LOCKHART

PROJECT #: 04-11057
PO #: 91105

JSTIN TX 78747-0000
EVUN JANCK

YLINDER #: ALM006621 ANALYTICAL ACCURACY: +-1%

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

CERTIFIED

NALYTICAL METHOD: GRAV.MASTER GAS

DATE OF ANALYSIS: 6/03/91

ANALYST: ANALYST APPROVED BY: SUPERVISOR

PLUMSTEADVILLE, PENNSYLVANIA / TROY, MICHIGAN / HOUSTON, TEXAS / WHEELING, ILLINOIS
SOUTH PLAINFIELD, NEW JERSEY / FREMONT, CALIFORNIA / WAKEFIELD, MASSACHUSETTS / LONGMONT, COLORADO

Scott Specialty Gases, Inc.

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

10/17/91

CUBIX CORPORATION
9225 LOCKHART HWY

AUSTIN TX 78747-0000

PROJECT #: 04-13936
PO #: 910523

CYLINDER #: AAL9308

ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION		ANALYSIS 1 (MOLES)	U/M
:ON MONOXIDE	400.0	PPM	401.	PPM
IANE	400.0	PPM	395.	PPM
:OGEN		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
N MONOXIDE	910.0	PPM	916.	PPM
NE	820.0	PPM	823.	PPM
GEN	BALANCE		BALANCE	

NOTES: EXP: 11/92

ANALYTICAL METHOD: ACUBLEND MASTER

DATE OF ANALYSIS: 10/22/91

ANALYST: ANALYST APPROVED BY: SUPERVISOR 10/23

CERTIFIED

Matheson Gas Products

rld Leader in Specialty Gases & Equipment

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

RECEIVED JAN 1 7 1992

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

Date 1-8-92

Our Invoice # 104-63230

Your P.O. # 04312

Lot No.

tlemen:

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

LABORATORY REPORT ON GAS ANALYSIS

1R

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

1R

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

1R

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

CYL. # MIXTURE REQ.		ANALYSIS

ACCEPTED BY

WILSON OXYGEN

Analyst JOHN K. WRIGHT

Scott Specialty Gases

a division of
Scott Environmental Technology, Inc.

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

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

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

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

ANALYTICAL REPORT

Cyl No. AAL17750 Analytical Accuracy ±1%

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

Cyl No. ______ Analytical Accuracy ______

Component	Concentration

Cyl No. ______ Analytical Accuracy ______

Component	Concentration

Cyl No. ______ Analytical Accuracy ______

Component	Concentration

Analyst John Lempe

Approved By [signature]

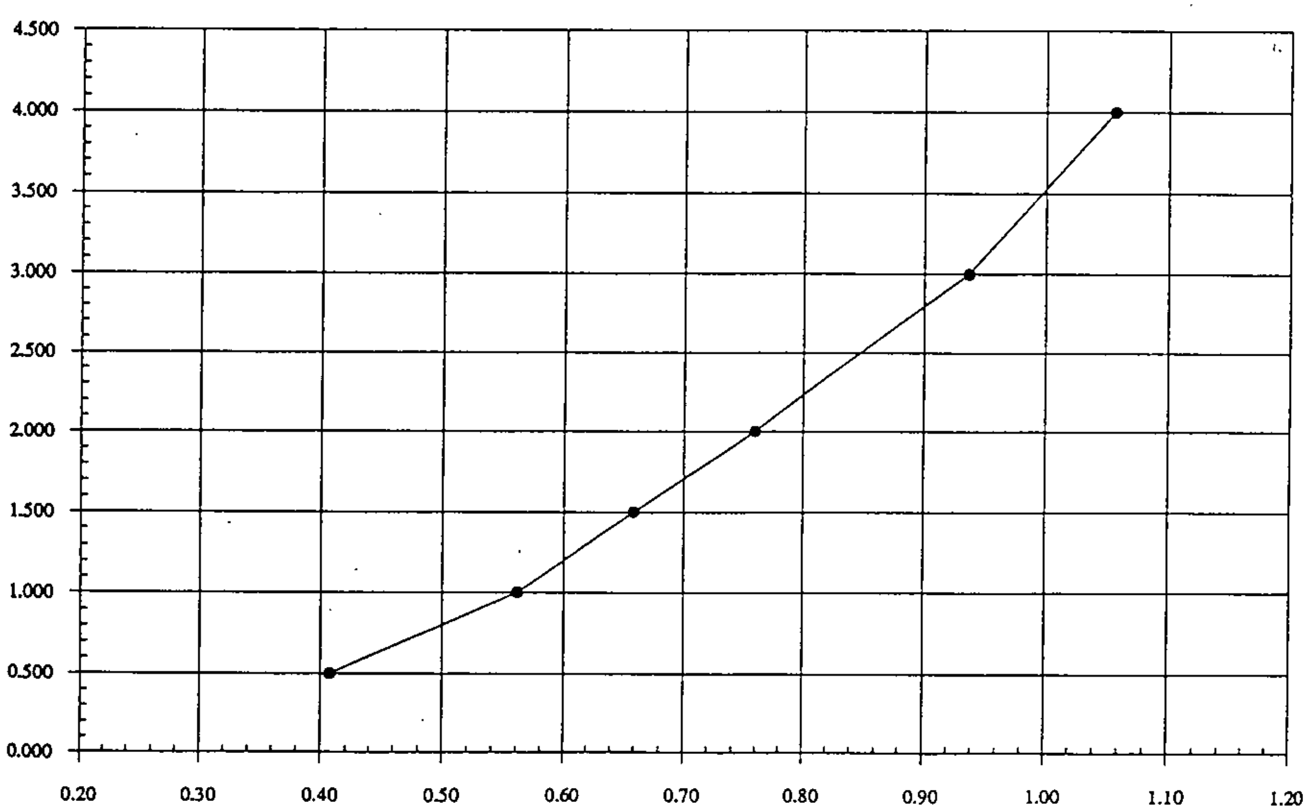
METER BOX DRY GAS METER and ORIFICE CALIBRATION

8/2/91
Calib. Date: 12/27/90
ion: 1713 Fortview, Austin, Tx
ician: DH,LI,JB
No: 1286-3061
Pressure: 29.32

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

		Meter Box				Standard Test Meter					
Meter ting . H20)	Elapsed Time (min.)	Starting Reading ft3	Ending Reading ft3	Starting Avg. Temp. ℉	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)
50	10.00	43.095	47.310	77	86	0.000	4.080	72	72	0.9821	1.704
00	10.00	47.310	53.164	86	97	4.080	9.695	72	72	0.9899	1.767
50	10.00	53.164	60.138	97	109	9.695	16.300	72	73	0.9956	1.880
00	10.00	60.138	68.398	109	114	16.300	23.900	73	73	0.9797	1.868
00	10.00	68.398	78.344	114	120	23.900	33.287	73	73	1.0121	1.820
00	10.00	78.344	89.968	120	124	33.287	43.872	73	72	0.9834	1.888
	Averages:			101	108			73	73	0.9904	1.845

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



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.

Jay Lucene[illegible]

AUTHORIZED SIGNATURE

FEB 11 1992

DATE

Pitot Tube Calibration Sheet

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

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

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

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

Calibrations Performed by Cubix Corporation, Austin, Texas

TEL-TRU MANUFACTURING. CO.

408 ST. PAUL STREET ROCHESTER, NY 14605 USA

CERTIFICATE OF CALIBRATION

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

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

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

TOLERANCE OF ±1% OF RANGE:
EX. 0–200°F = ±2°F

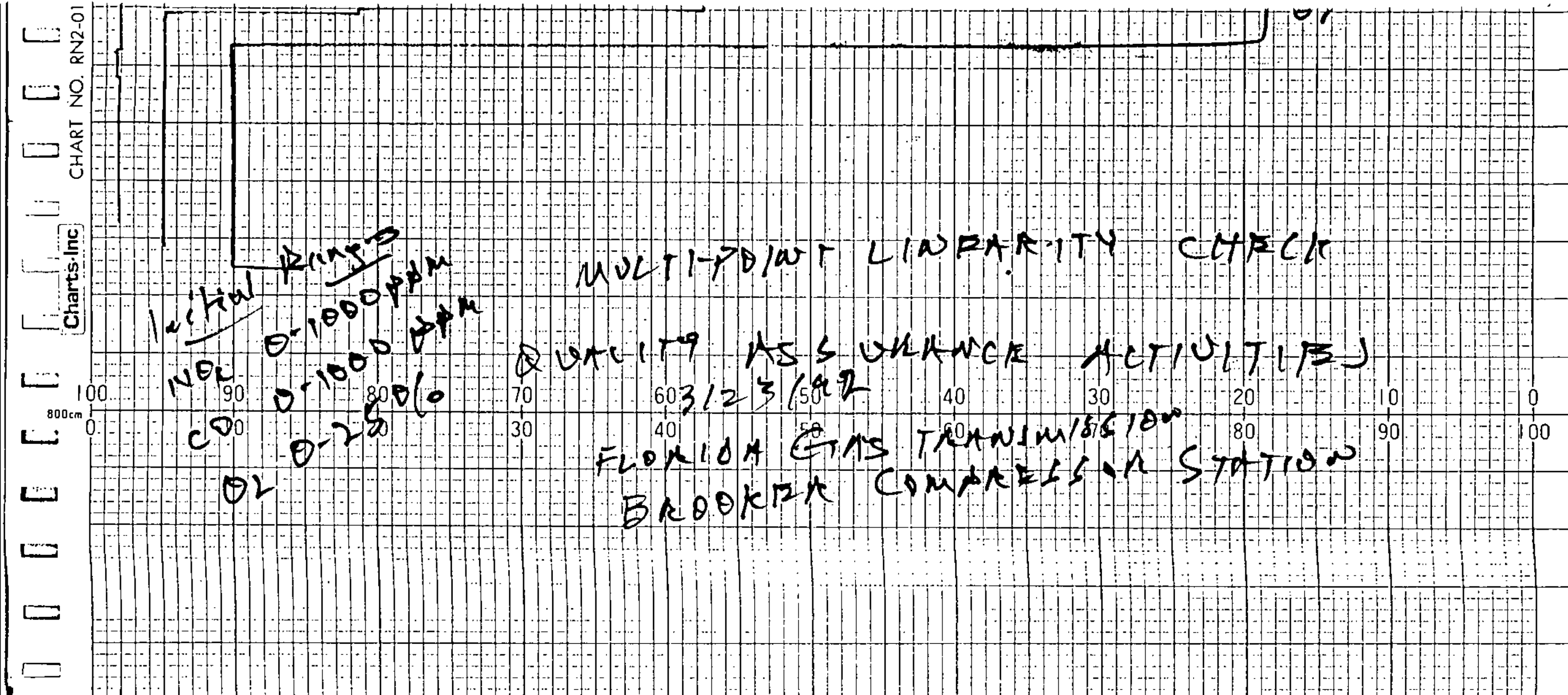
THERMOMETERS CALIBRATED AGAINST MASTER PRECISION THERMOMETERS, DIRECTLY TRACEABLE TO NATIONAL BUREAU OF STANDARDS.

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

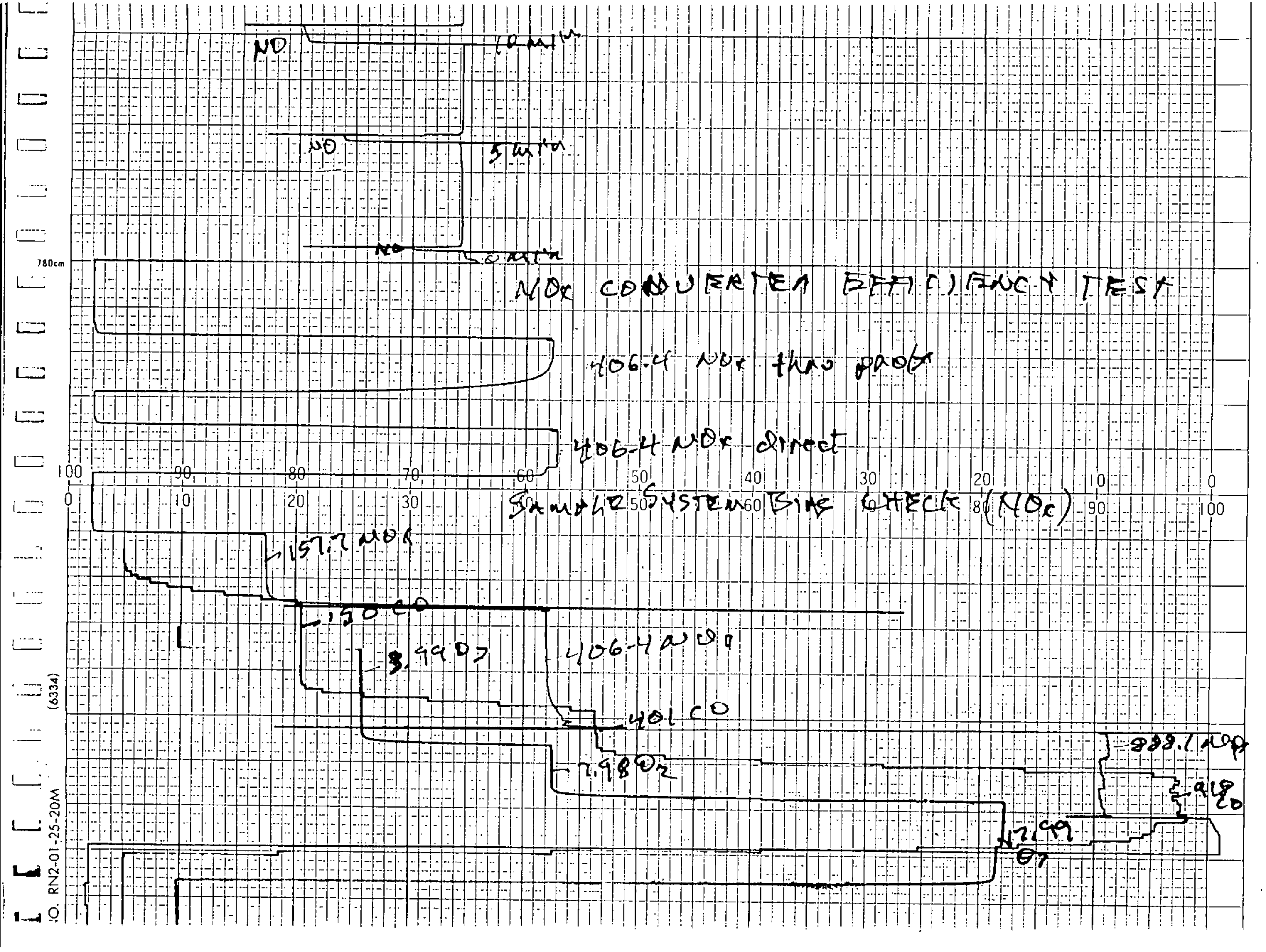
TE: 10-25-91 TESTED BY: BL CHECKED BY:

APPENDIX E:
STRIP CHART RECORDS

NOx, O_2, CO



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


NO
10 min
NO
5 min
2 min
780cm
NOx CONVERTER EFFICIENCY TEST
406.4 NOx thru probe
406.4 NOx direct
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
SAMPLE SYSTEM BIAS CHECK (NOx)
157.7 NOx
150 CO
406.4 NOx
401 CO
7.98 O2
918 CO
12.99 O2
(6334)
NO. RN2-01-25-20M

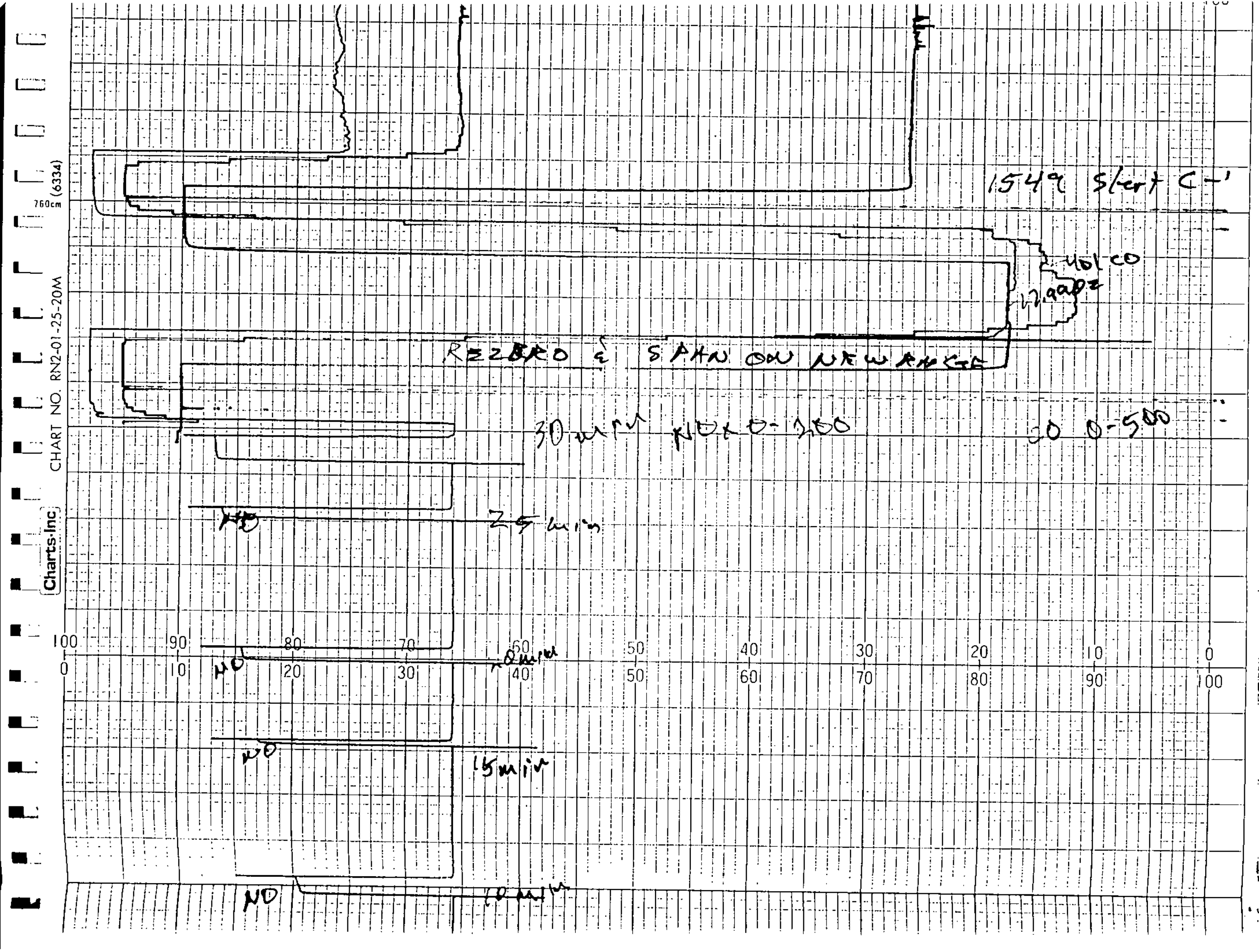
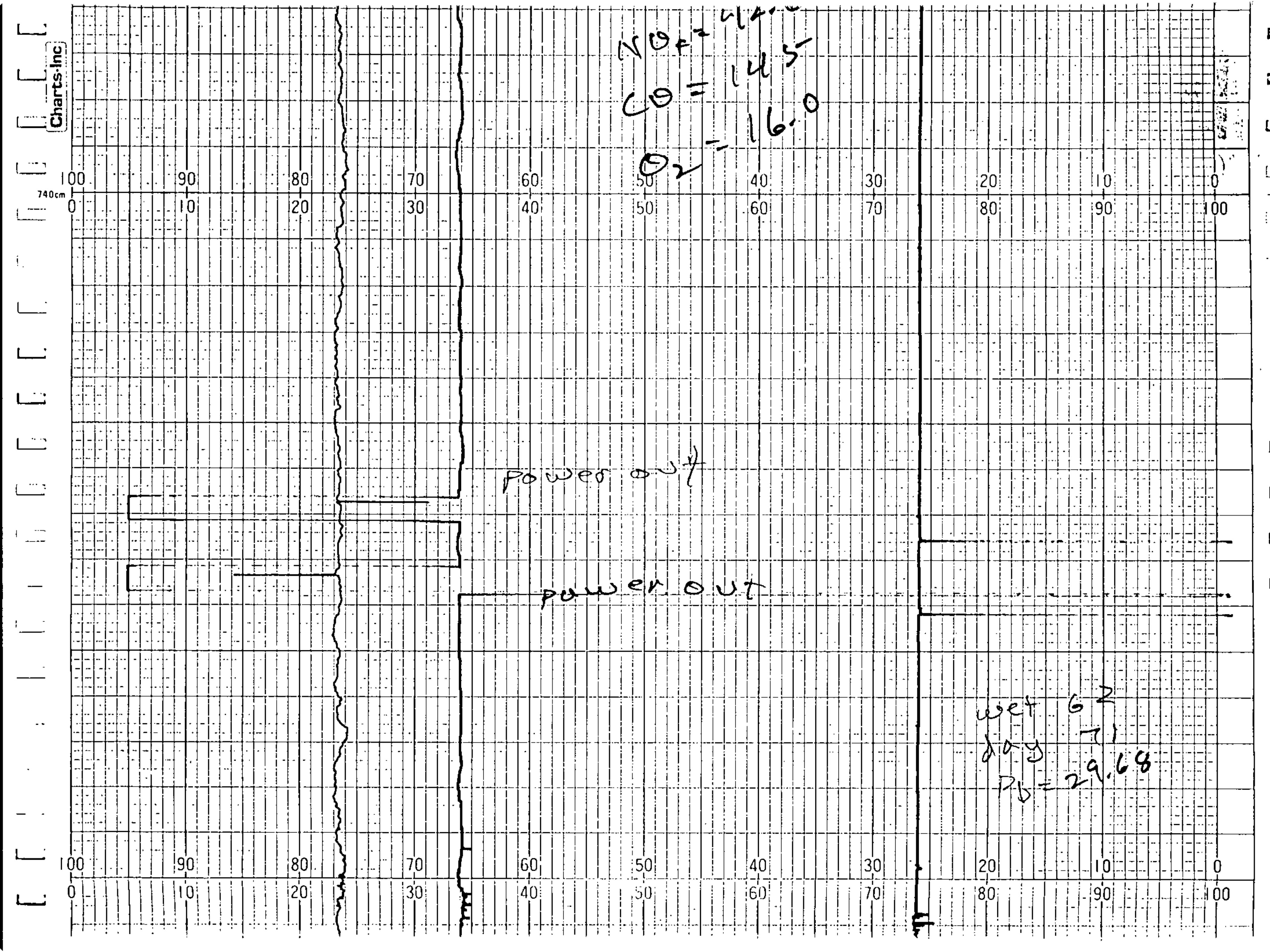
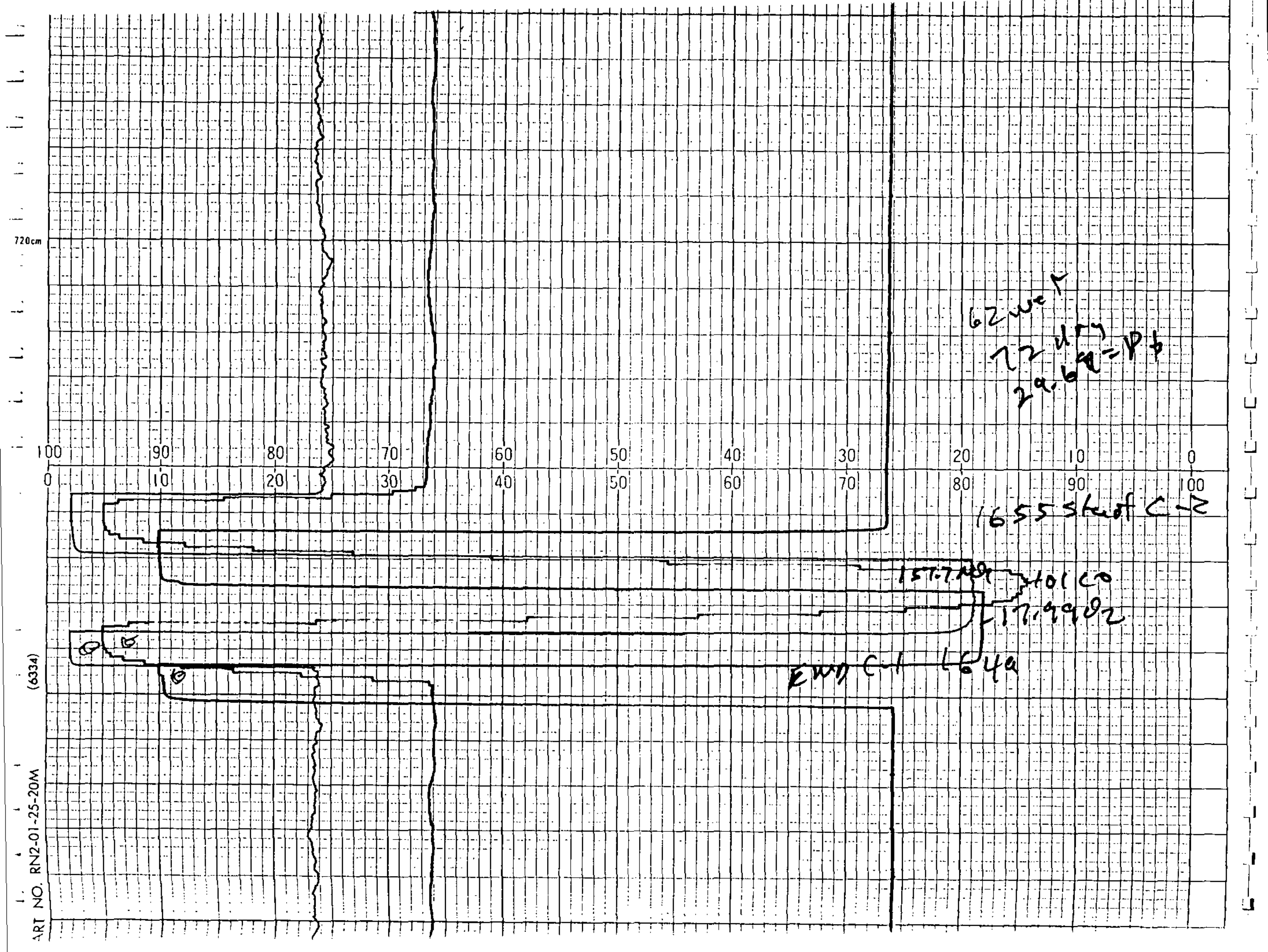
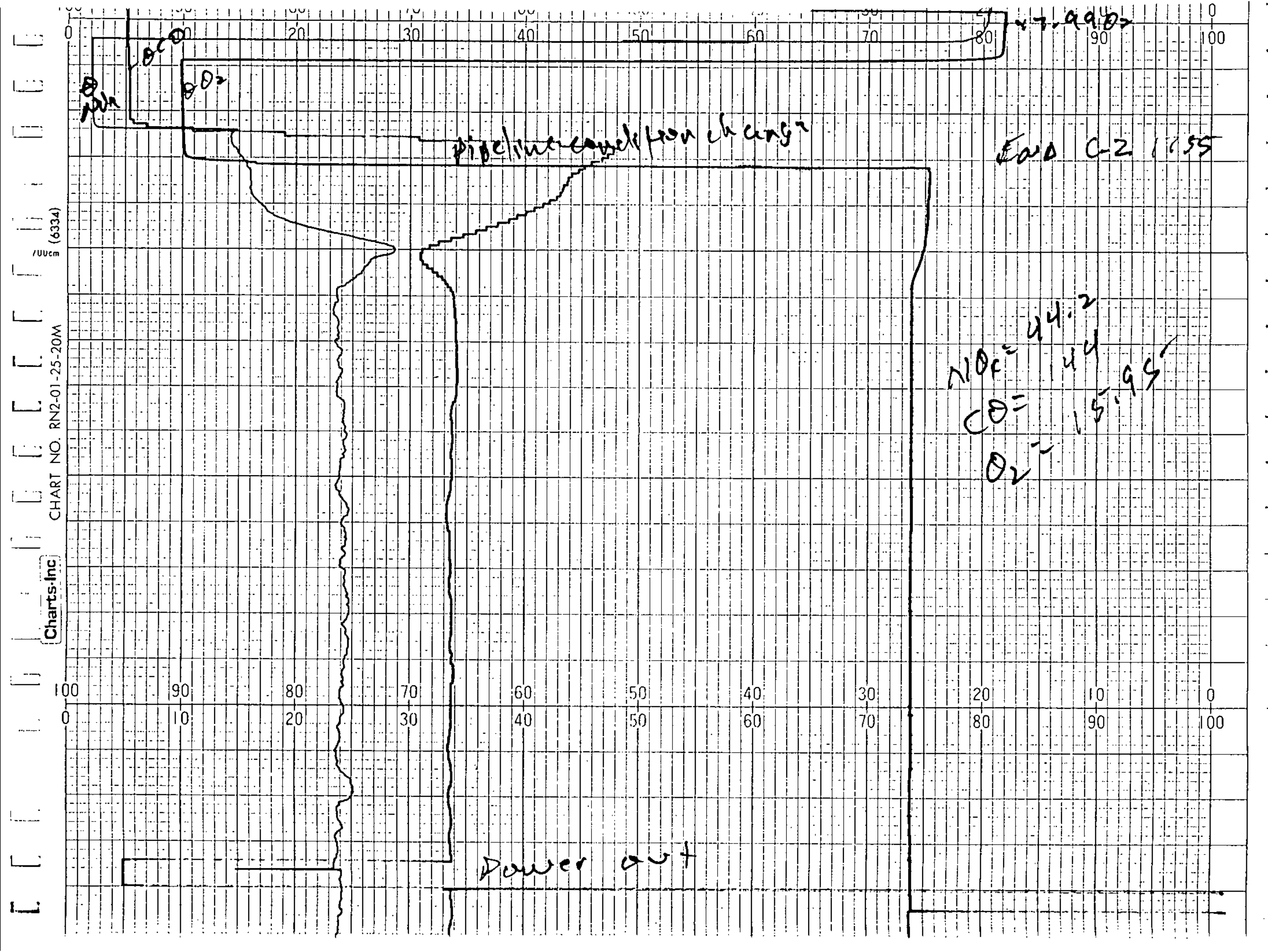


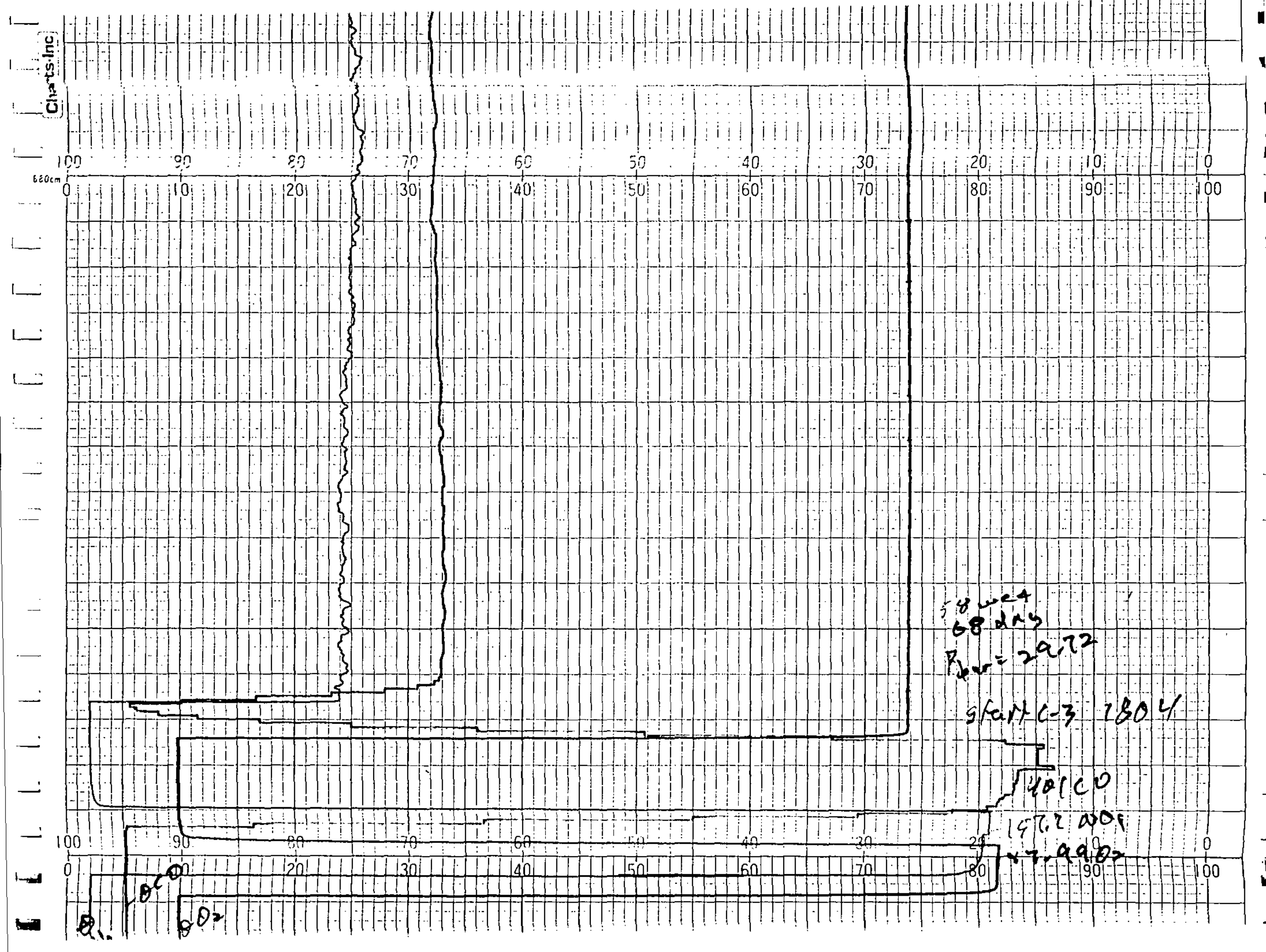
CHART NO. RN2-01-25-20M
Charts·Inc
760cm (6334)
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
1549 Start C-1
30 min
CO 0-500
25 min
ND
15 min


Charts·Inc
740cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
NOx =
CO = 14.5
16.0
O2 =
power out
power out
wet 62
dry 71
Pb = 29.68
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100

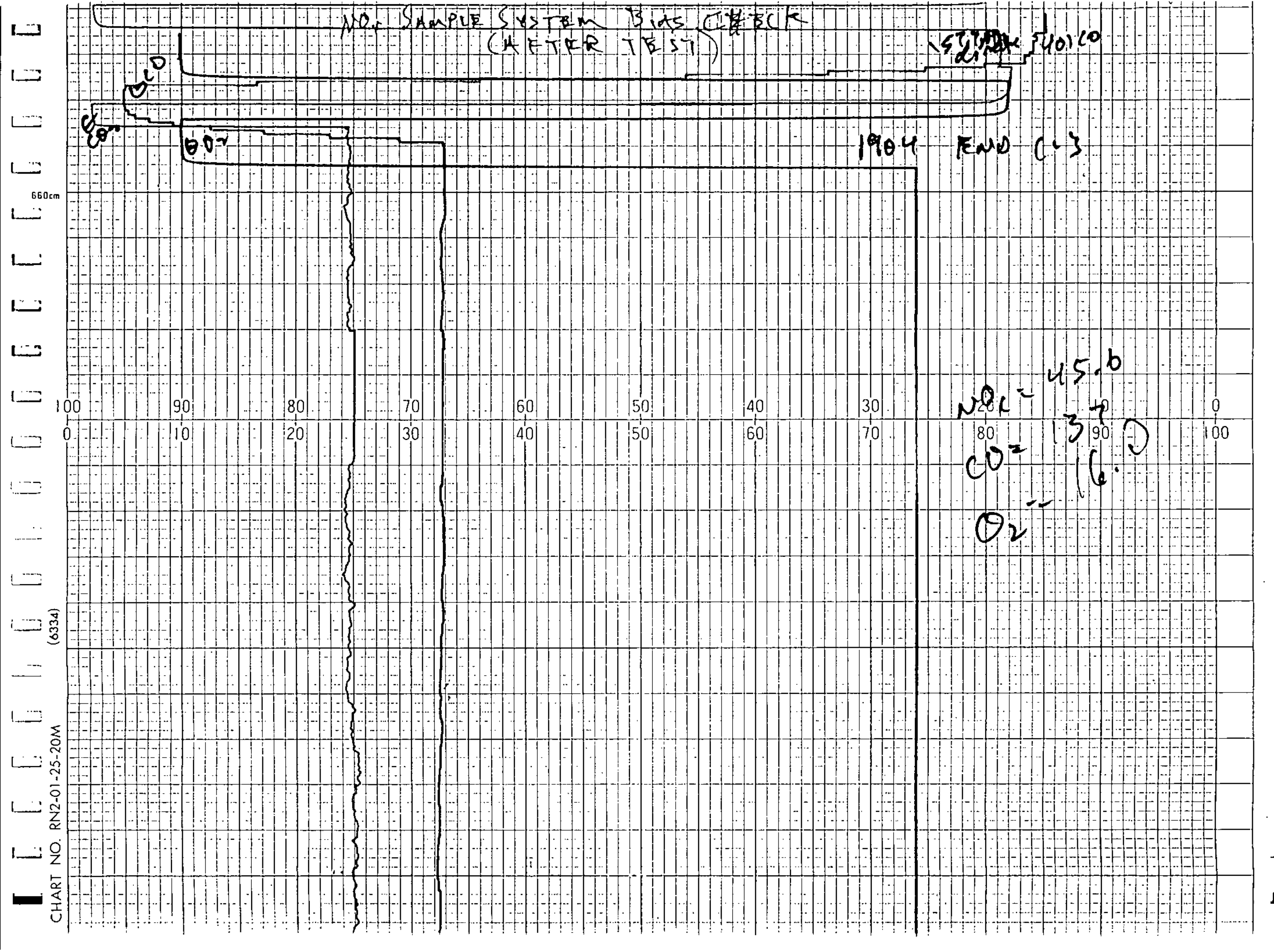

720cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
62 wet
72 dry
29.6 g = Pb
1655 Start C-2
101 CO
17.99 O2
END C-1 1649
(6334)
ART NO. RN2-01-25-20M



0 NOx
0 CO
0 O2
47.99 O2
pipeline condition change
End C-2 1655
NOx = 44.2
44
CO = 15.95
O2 =
Power out
CHART NO. RN2-01-25-20M
(6334)
Charts Inc

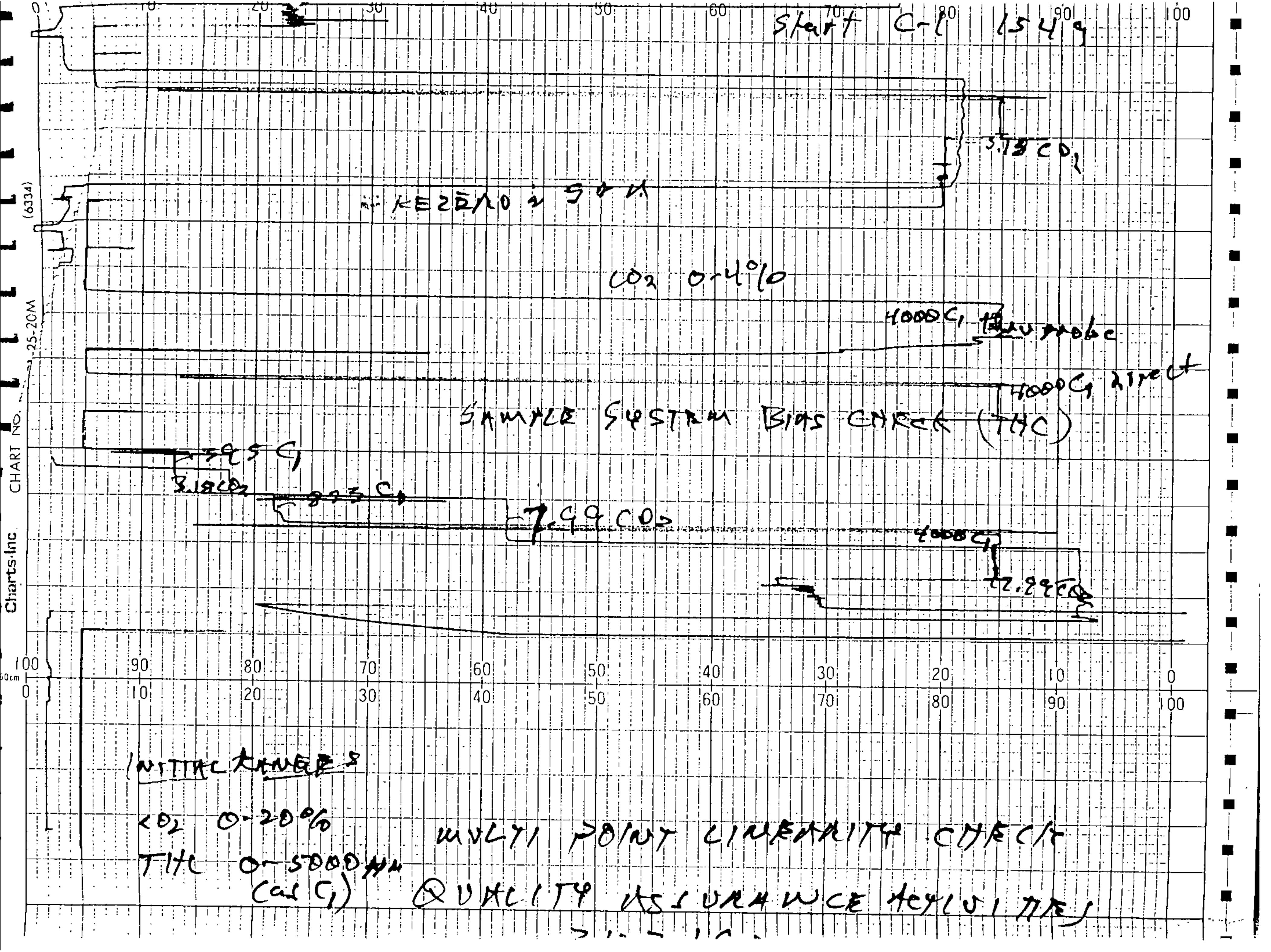


Charts·Inc
68 days
start C-3 1804



NOx SAMPLE SYSTEM BIAS CHECK
(AFTER TEST)
1904 END
660cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
(6334)
CHART NO. RN2-01-25-20M

CO_2, THC


Start C-1 154g
3.18 CO2
REZERO & SPAN
CO2 0-4%
4000 C1 thru probe
4000 C1 direct
SAMPLE SYSTEM BIAS CHECK (THC)
995 C1
3.18 CO2
7.99 CO2
4000 C1
INITIAL RANGES
CO2 0-20%
THC 0-5000 ppm (as C1)
MULTI POINT LINEARITY CHECK
QUALITY ASSURANCE ACTIVITIES
CHART NO. 25-20M
(6334)
Charts Inc

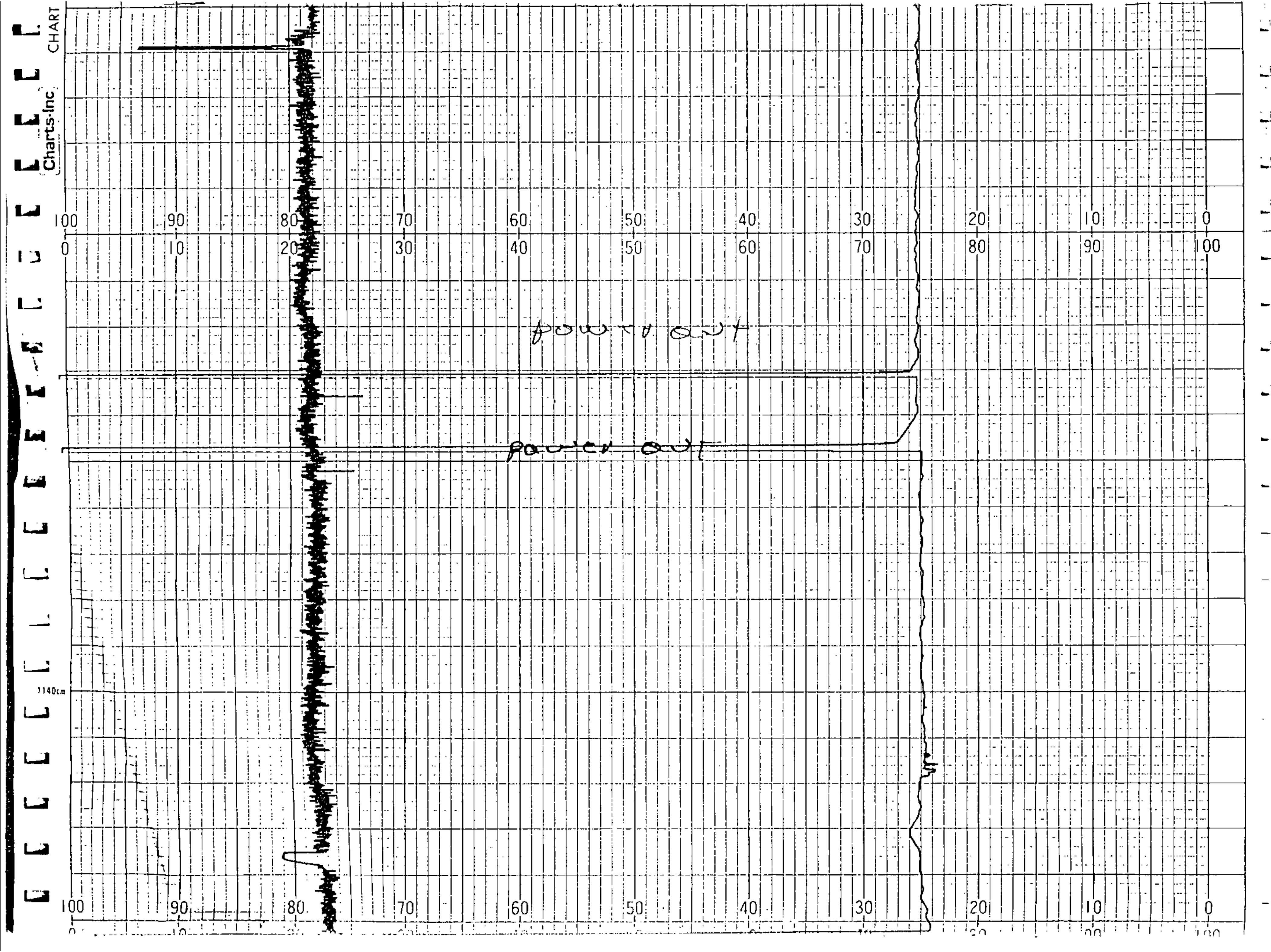
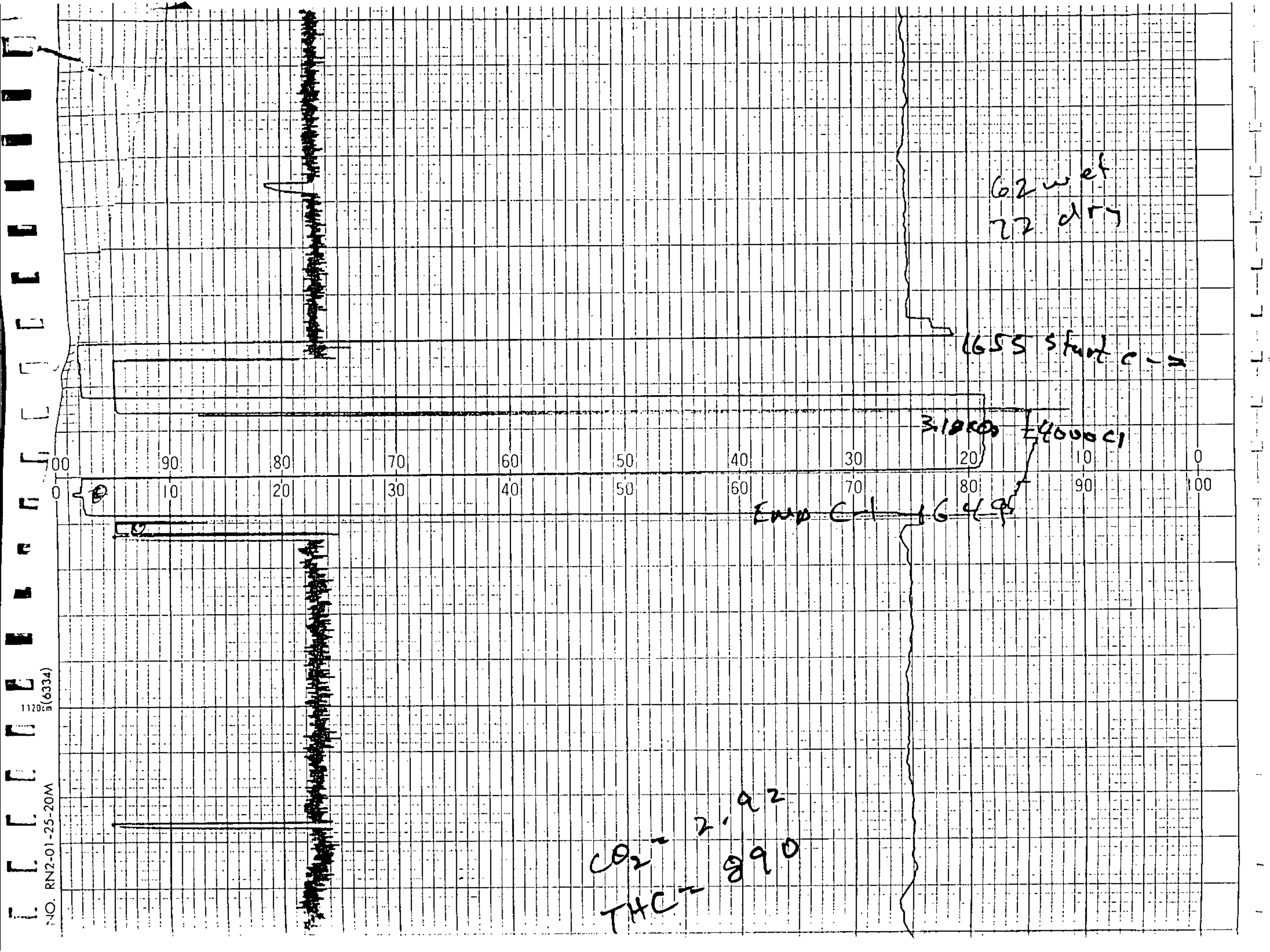
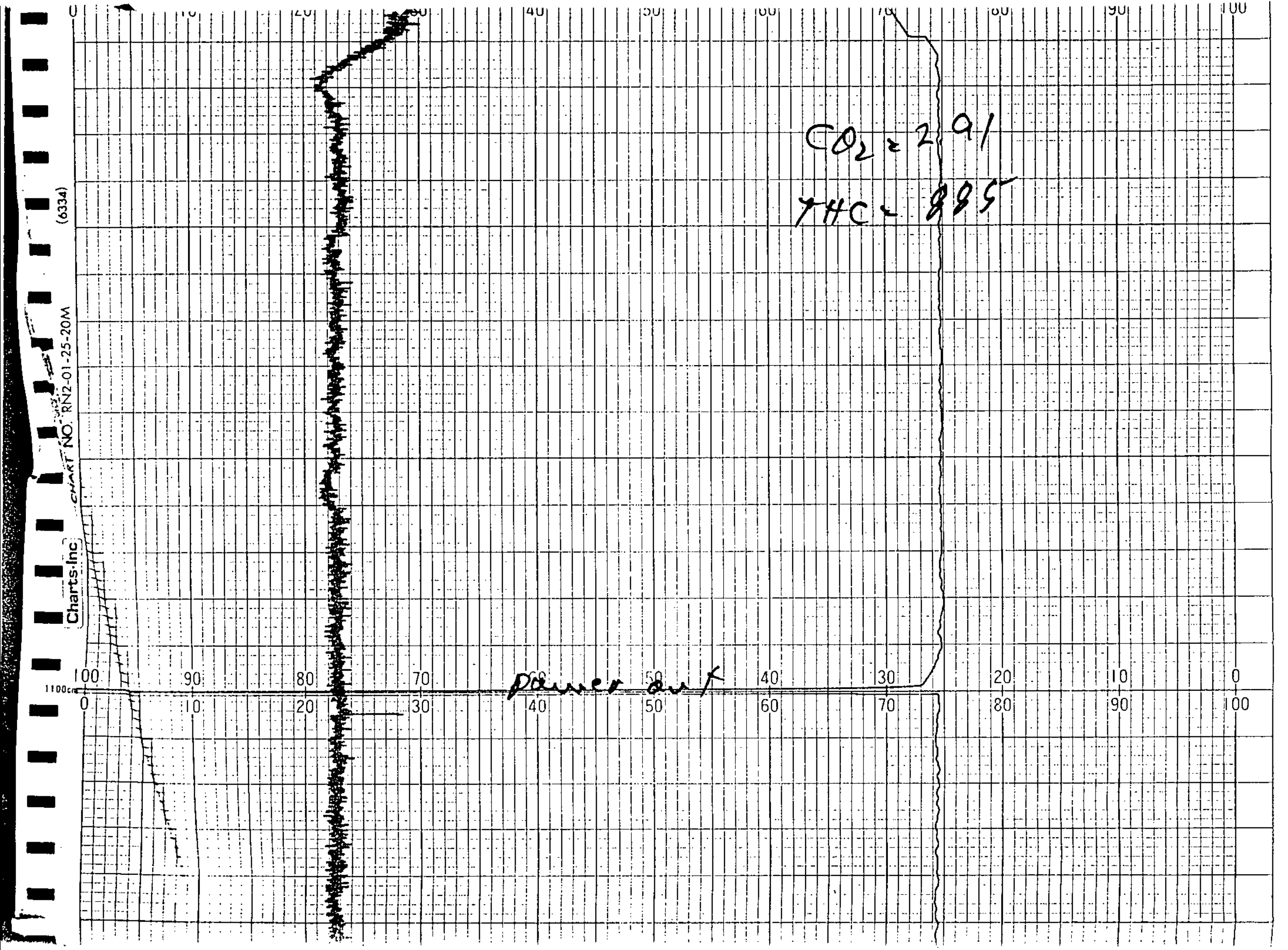
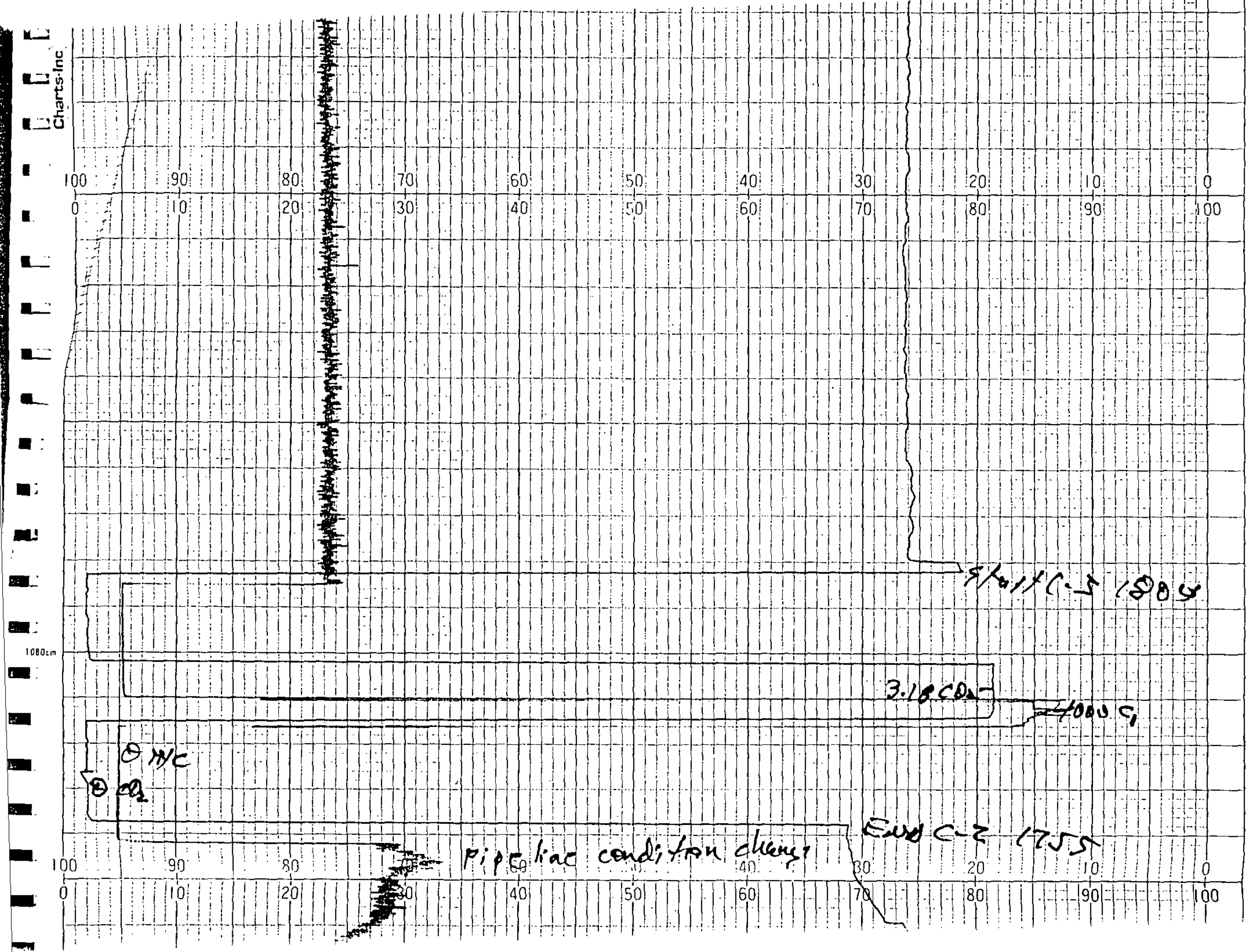
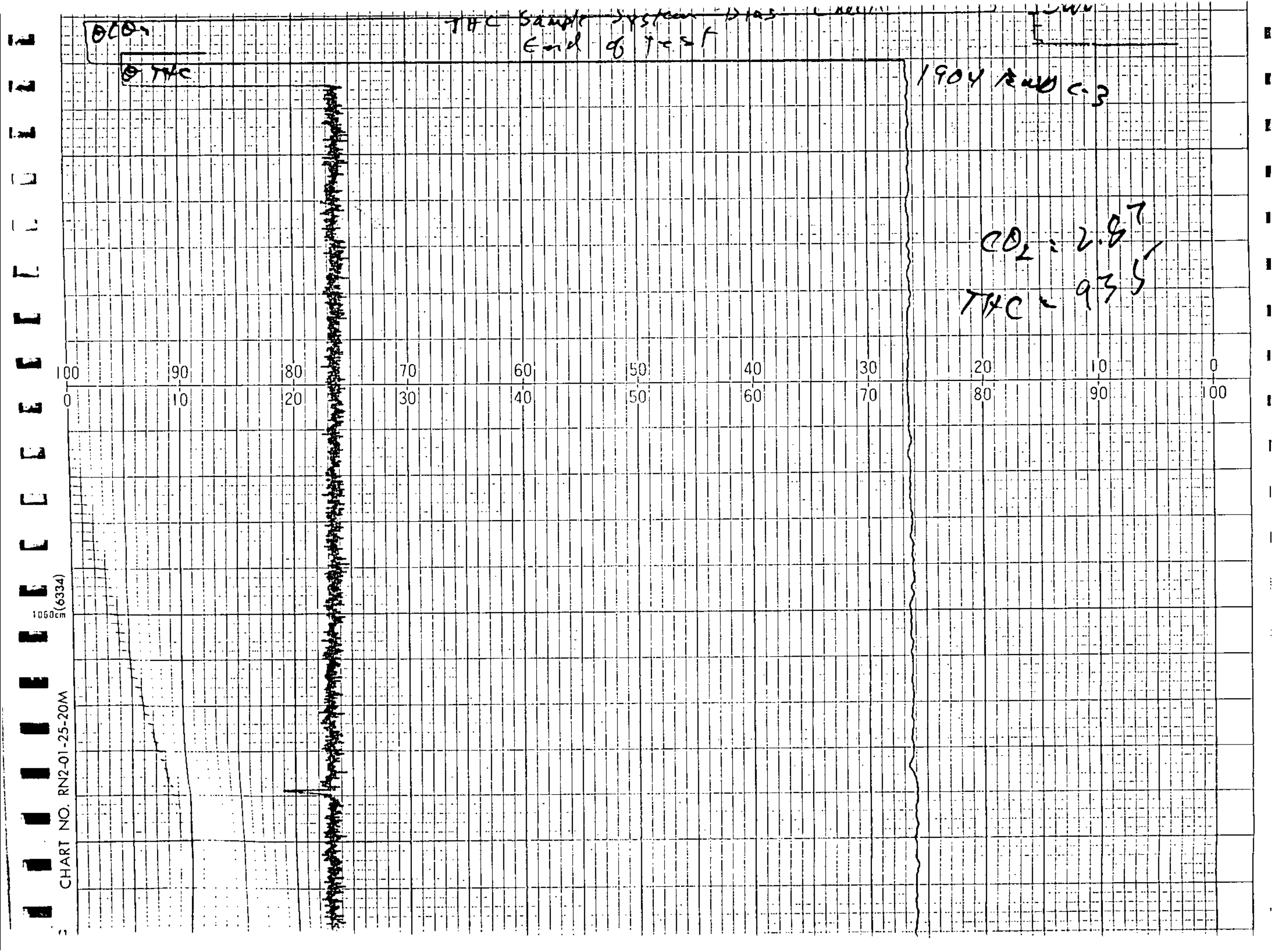


CHART
Charts·Inc
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
POWER OUT
POWER OUT
1140cm
100 90 80 70 60 50 40 30 20 10 0


62 wet
27 dry
1655 Start c-2
3.18 CO2
4000 C1
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
End C-1 1649
CO2 = 2.92
THC = 890
1120cm (6334)
NO. RN2-01-25-20M

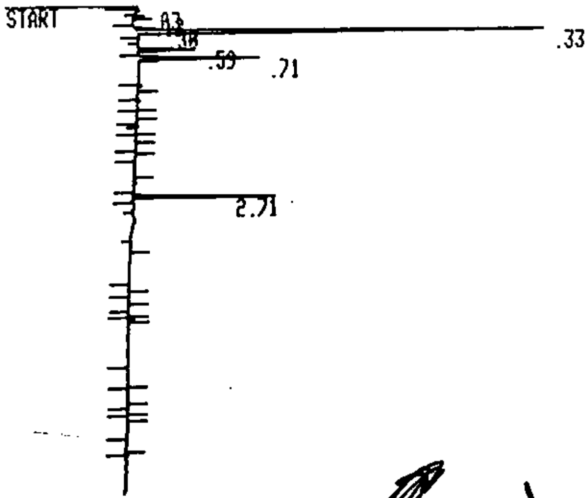

CO2 = 291
THC = 885
power out
CHART NO. RN2-01-25-20M
Charts·Inc
(6334)
1100cm


Charts-Inc
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
Start C-2 1809
1080cm
3.18 CO2
4000 C1
⊖ H/C
⊕ CO2
End C-2 1755
pipeline condition change



THC Sample System Bias Check
End of Test
CO2
THC
1904 Run C-3
CO2 : 2.87
THC = 935
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
1060cm (6334)
CHART NO. RN2-01-25-20M

APPENDIX F
CHROMATOGRAMS



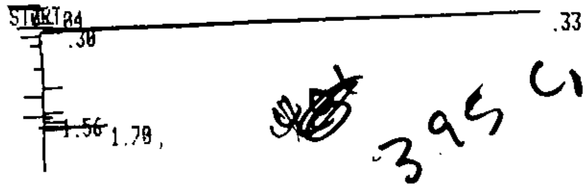
C-1

RUN # 3
WORKFILE ID: C
WORKFILE NAME:

AREA%

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

TOTAL AREA= 71325 7.87% VOC
MUL FACTOR= 1.0000E+00



395 C1

RUN # 1
WORKFILE ID: A
WORKFILE NAME:

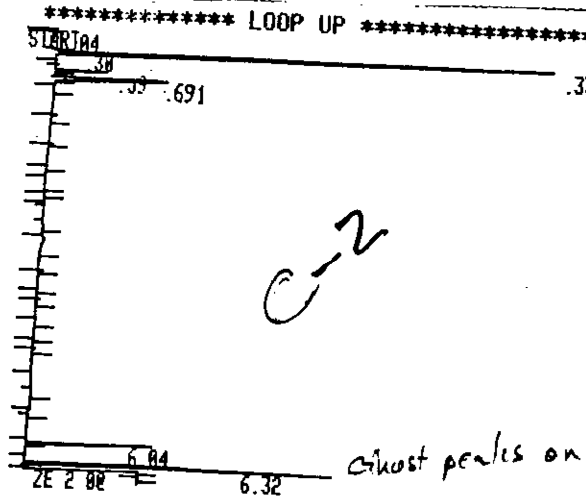
AREA%

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

TOTAL AREA= 34909
MUL FACTOR= 1.0000E+00

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

************** LOOP UP *****************



C-2

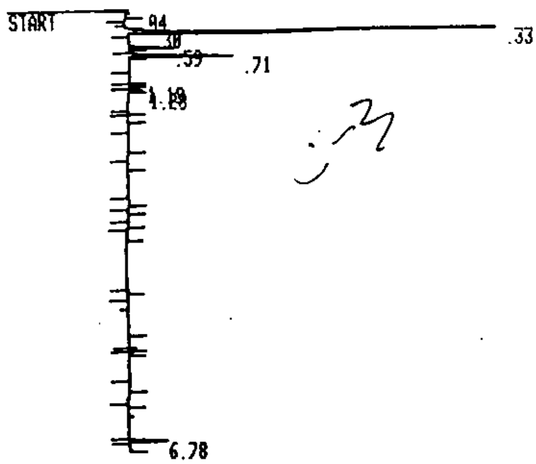
Ghost peaks on column

RUN # 2
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
~~0.04~~	~~1499~~	~~BP~~	~~0.093~~	~~2.006~~
~~0.30~~	~~253~~	~~D PV~~	~~0.014~~	~~0.339~~
0.33	62388	D VB	0.015	83.493 C1
0.59	968	D PB	0.019	1.296
0.69	1560	BV	0.015	2.088
0.71	2182	D VB	0.020	2.920
~~6.04~~	~~1846~~	~~D PB~~	~~0.015~~	~~2.471~~
~~6.32~~	~~4026~~	~~D BB~~	~~0.015~~	~~5.388~~

TOTAL AREA= 74722 7.02% VOC
MUL FACTOR= 1.0000E+00



C-3

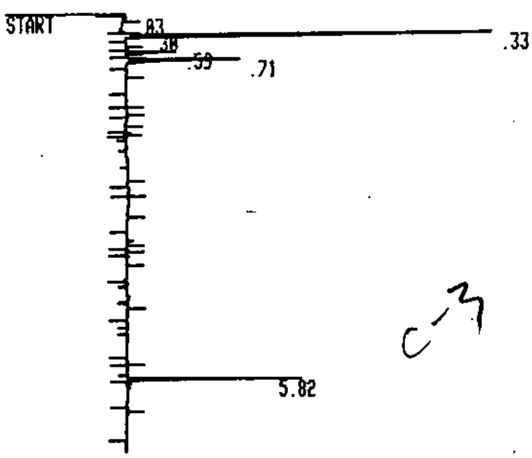
5.58% VOC

RUN # 7
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%	
~~0.04~~	~~687~~	~~PB~~	~~0.048~~	~~1.019~~	
~~0.30~~	~~303~~	~~D PV~~	~~0.016~~	~~0.449~~	
0.33	62196	D VB	0.015	92.239	C1
0.59	940	D BB	0.019	1.394	
0.71	2369	D BB	0.022	3.513	
1.19	163	D PB	0.014	0.242	
1.28	206	D PB	0.015	0.306	
~~6.78~~	~~563~~	~~D BB~~	~~0.015~~	~~0.838~~	

TOTAL AREA= 67429
MUL FACTOR= 1.0000E+00



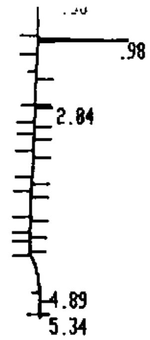
C-3

8.48% VOC

RUN # 8
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%	
~~0.03~~	~~494~~	~~PB~~	~~0.039~~	~~0.684~~	
~~0.30~~	~~275~~	~~D BV~~	~~0.015~~	~~0.381~~	
0.33	65411	D VB	0.015	90.541	C1
0.59	969	D BB	0.018	1.341	
0.71	2500	D BB	0.021	3.460	
5.82	2596	D PB	0.016	3.593	



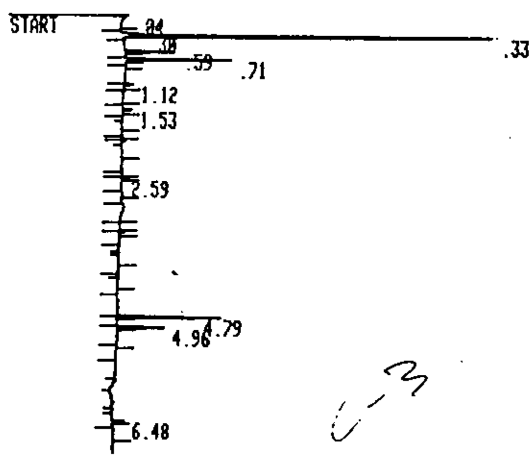
3019 C1

RUN # 5
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	1460	BB	0.095	3.896
0.30	271	D PV	0.017	0.723
0.33	32344	D VB	0.015	86.301
0.98	1415	D BB	0.016	3.776
2.04	220	D BB	0.015	0.587
4.89	1633	BV	0.544	4.357
5.34	135	D BB	0.013	0.360

TOTAL AREA= 37478
MUL FACTOR= 1.0000E+00



C-3

RUN # 6
WORKFILE ID: C
WORKFILE NAME:

8.70% VOC

AREA%

RT	AREA	TYPE	AR/HT	AREA%	
~~0.04~~	~~1402~~	~~BB~~	~~0.087~~	~~1.922~~	
~~0.30~~	~~285~~	~~D PV~~	~~0.016~~	~~0.391~~	
0.33	64873	D VB	0.015	88.941	C1
0.59	1063	D PB	0.020	1.457	
0.71	2417	D PB	0.021	3.314	
1.12	200	D BB	0.019	0.274	
1.53	168	D PB	0.016	0.230	
2.59	109	D PB	0.013	0.149	
4.79	1516	D BB	0.015	2.078	
4.96	710	D PB	0.016	0.973	
~~6.48~~	~~196~~	~~D PB~~	~~0.016~~	~~0.269~~	

TOTAL AREA= 72939

APPENDIX G
OPACITY OBSERVATIONS

VISIBLE EMISSIONS EVALUATOR

This is to certify that

Rick J. Krenzke

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

Thomas Rose
President

232749
Certificate Number

Vice President

Orlando
Location

David B. Savage, Jr.
Program Manager

February 26, 1992
Date of Issue

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Florida Gas BROOKER Comp. St. #6

OBSERVATION DATE: 3/23/92 | **START TIME:** 1530 | **STOP TIME:** 1630

ADDRESS: P.O. Box 8

3 mils North of BROOKER on Hgw 235

CITY: Brooker | **STATE:** Florida | **ZIP:** 32622-0008

PHONE: 904-485-1211 | **SOURCE ID NUMBER:** Unit #6 (Ser. # 49117)

PROCESS EQUIPMENT: CB Model 8 W-330C2 | **OPERATING MODE:** Full load

CONTROL EQUIPMENT: NA | **OPERATING MODE:** NA

DESCRIBE EMISSION POINT: Exhaust Stack of Comp. Engine

HEIGHT ABOVE GROUND LEVEL: 65' | **HEIGHT RELATIVE TO OBSERVER:** ≈ 60'

DISTANCE FROM OBSERVER: 150' | **DIRECTION FROM OBSERVER:** NE

DESCRIBE EMISSIONS: None Visible

EMISSION COLOR: None Visible | **PLUME TYPE:** CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐

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

AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED: Exit of exhaust stack

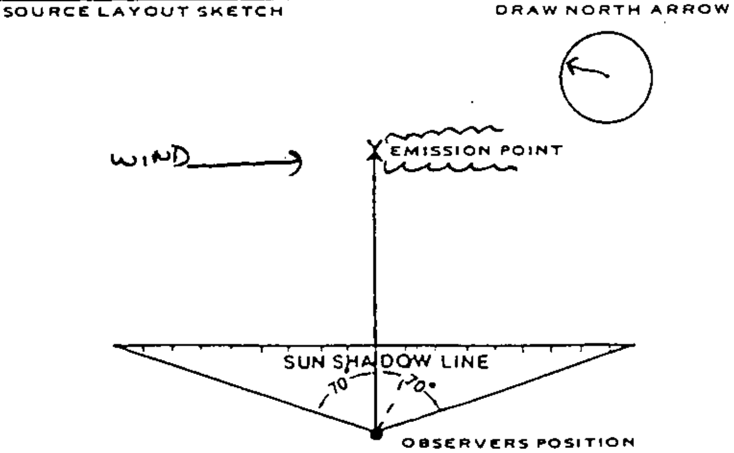
DESCRIBE BACKGROUND: Sky

BACKGROUND COLOR: gray/Blue | **SKY CONDITIONS:** 40% Dark Clouds

WIND SPEED: ≈ 10-15 MPH | **WIND DIRECTION:** NNW

AMBIENT TEMP.: 71 | **WET BULB TEMP.:** 62 | **RELATIVE HUMIDITY:**

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



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

AVERAGE OPACITY FOR HIGHEST PERIOD: 0 | **NUMBER OF READINGS ABOVE** 0 **% WERE** 0

RANGE OF OPACITY READINGS: MINIMUM 0 MAXIMUM 0

COMMENTS: No emission visible from IC engine.

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

OBSERVER'S SIGNATURE: Rick J. Krenzke | **DATE:** 3-23-92

ORGANIZATION: CUBIX CORP.

CERTIFIED BY: Eastern Tech. Assoc. | **DATE:** 2-27-92

VERIFIED BY: | **DATE:**

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SIGNATURE:

TITLE: | **DATE:**

EPA TH 0101

VISIBLE EMISSION OBSERVATION FORM

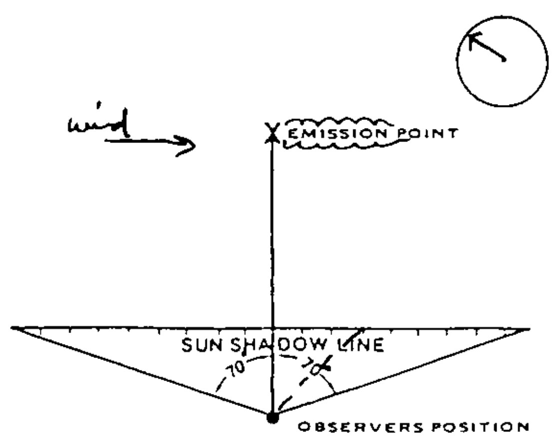
SOURCE NAME	Florida Gas Brooker Comp. St. #16
ADDRESS	P.O. Box 8
	3 miles North of Brooker on Hyw 235
CITY	BROOKER,
STATE	Florida
ZIP	32622-0008
PHONE	904-485-1211
SOURCE ID NUMBER	Unit #6 (Ser. # 49117)
PROCESS EQUIPMENT	CB Model 8W-330C2
OPERATING MODE	Full Load
CONTROL EQUIPMENT	NA
OPERATING MODE	NA
DESCRIBE EMISSION POINT	Exhaust Stack of Comp. Engine
HEIGHT ABOVE GROUND LEVEL	65'
HEIGHT RELATIVE TO OBSERVER	≈ 60'
DISTANCE FROM OBSERVER	150'
DIRECTION FROM OBSERVER	NE
DESCRIBE EMISSIONS	None Visible
EMISSION COLOR	None Visible
PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐	
WATER DROPLETS PRESENT	NO ☑ YES ☐
IS WATER DROPLET PLUME	ATTACHED ☐ DETACHED ☐
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED	Exit of exhaust stack
DESCRIBE BACKGROUND	Sky
BACKGROUND COLOR	White/Blue
SKY CONDITIONS	30% Clouds
WIND SPEED	≈ 10-15 MPH
WIND DIRECTION	NNW
AMBIENT TEMP.	72
WET BULB TEMP.	61
RELATIVE HUMIDITY	

OBSERVATION DATE	START TIME	STOP TIME
3/23/92	1635	1735

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

SOURCE LAYOUT SKETCH

DRAW NORTH ARROW



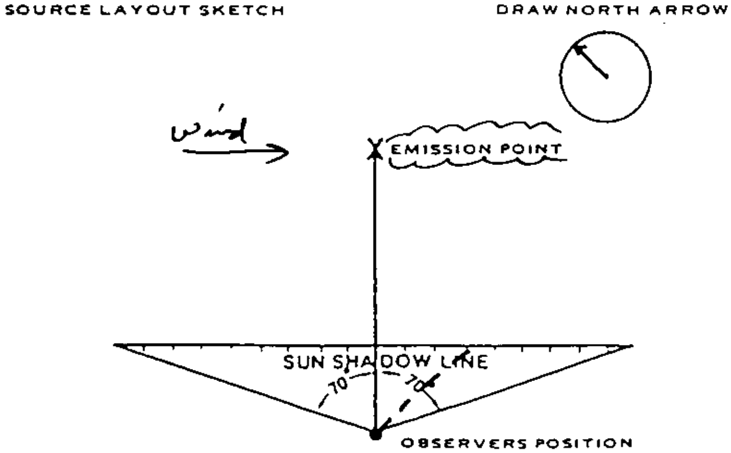
AVERAGE OPACITY FOR HIGHEST PERIOD	0
NUMBER OF READINGS ABOVE 0 % WERE	0
RANGE OF OPACITY READINGS	MINIMUM 0 MAXIMUM 0
COMMENTS	No visible emissions
OBSERVER'S NAME (PRINT)	RICK J. KRENZKE
OBSERVER'S SIGNATURE	Rick J. Krenzke
DATE	3-23-92
ORGANIZATION	CUBIX CORP
CERTIFIED BY	State of Florida by ETA
DATE	2-27-92
VERIFIED BY	
DATE	
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS	
SIGNATURE	
TITLE	
DATE	

EPA 1H 0101

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME	Florida Gas - Brooker Comp. St. #16
ADDRESS	P.O. Box 8
	3 miles North of Brooker, on Hyw 235
CITY	Brooker
STATE	Florida
ZIP	32622-0008
PHONE	904-485-1211
SOURCE ID NUMBER	Unit #6 (Ser. # 49,117)
PROCESS EQUIPMENT	CB Model 8W-330C2
OPERATING MODE	Full Load
CONTROL EQUIPMENT	NA
OPERATING MODE	NA
DESCRIBE EMISSION POINT	Exhaust Stack of Comp. Engine
HEIGHT ABOVE GROUND LEVEL	65'
HEIGHT RELATIVE TO OBSERVER	≈ 60
DISTANCE FROM OBSERVER	150'
DIRECTION FROM OBSERVER	NE
DESCRIBE EMISSIONS	None Visible
EMISSION COLOR	None Visible
PLUME TYPE: CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐	
WATER DROPLETS PRESENT	NO ☑ YES ☐
IS WATER DROPLET PLUME	ATTACHED ☐ DETACHED ☐
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED	Exit of exhaust stack
DESCRIBE BACKGROUND	Sky
BACKGROUND COLOR	Blue
SKY CONDITIONS	Clear
WIND SPEED	≈ 15-20
WIND DIRECTION	NNW
AMBIENT TEMP.	72
WET BULB TEMP.	62
RELATIVE HUMIDITY	

SOURCE LAYOUT SKETCH



COMMENTS

No Visible Emission

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SIGNATURE

TITLE

DATE

OBSERVATION DATE	START TIME	STOP TIME
3/23/92	1740	1840

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, MAXIMUM 0
OBSERVER'S NAME (PRINT)	RICK J. KRENZKE
OBSERVER'S SIGNATURE	Rick J. Krenzke
DATE	3/23/92
ORGANIZATION	CUBIX CORP.
CERTIFIED BY	State of Florida by ETA
DATE	2/27/92
VERIFIED BY	
DATE	

EPA TH 0101

APPENDIX H: FUEL ANALYSES AND CALCULATIONS

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

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

@ 14.730 PSIA DRY & UNCORRECTED FOR COMPRESSIBILITY

* @ 14.730 & 60 DEG. F

COMPRESSIBILITY FACTOR (1/Z) = 1.0021
DRY B.T.U. @ 14.730 PSIA & 60 DEG. F CORRECTED FOR (1/Z) = 1022.9
REAL SPECIFIC GRAVITY = 0.5769
UNNORMALIZED TOTAL = 100.01
ANALOG INPUT CHANNEL 1 = H 2 S 140 = .18264
ANALOG INPUT CHANNEL 2 = WATER 144 = 2.9113

CTIVE ALARMS

ONE

Sulphur .01

.022
9636
8 18.86
2.23 01
102

SPL

CERTIFICATE OF ANALYSIS NUMBER 199906

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

FOR: CUBIX CORPORATION
9225 LOCKHART HIGHWAY
AUSTIN, TEXAS 78747

ATTN: MR. JOE RUDYK

ASTM D-3246
<u>TOTAL SULFUR ANALYSIS</u>

1.2 ppm by wt.

0.071 Grains/100 cu. ft. by vol.

0.127 Grains/100 cu. ft. by wt.

SOUTHERN PETROLEUM LABORATORIES, INC.

J C Winfrey

J. C. WINFREY

Client: Florida Gas
Sample ID: Brooker 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	0.4430	28.016	0.0744	0.00033	0.7470	0	0.00	0	0
CO2	0.7440	44.01	0.117	0.00087	1.9730	0	0.00	0	0
CO		28.01	0.074	0.00000	0.0000	4347	0.00	322	0
Methane	96.4810	16.041	0.0424	0.04091	92.7199	23879	22140.60	1013	977.35
Ethane	2.0380	30.067	0.0803	0.00164	3.7092	22320	827.90	1792	36.521
Ethylene		28.051	0.0746	0.00000	0.0000	21644	0.00	1614	0
Propane	0.2520	44.092	0.1196	0.00030	0.6831	21661	147.97	2590	6.5268
propylene		42.077	0.111	0.00000	0.0000	21041	0.00	2336	0
Isobutane	0.0190	58.118	0.1582	0.00003	0.0681	21308	14.52	3363	0.639
n-butane	0.0100	58.118	0.1582	0.00002	0.0359	21257	7.62	4016	0.4016
Isobutene		56.102	0.148	0.00000	0.0000	20840	0.00	3068	0
Isopentane	0.0016	72.144	0.1904	0.00000	0.0070	21091	1.47	4008	0.0649
n-pentane		72.144	0.1904	0.00000	0.0000	21052	0.00	3993	0
n-hexane	0.0110	86.169	0.2274	0.00003	0.0567	20940	11.87	4762	0.5238
H2S		34.076	0.0911	0.00000	0.0000	7100	0.00	647	0
total	100.00	Average Density		0.04412	100.0000	Gross Heating Value		Gross Heating Value	
		Specific Gravity		0.57673		Btu/lb	23152	Btu/SCF	1022

CALCULATION OF F FACTORS

Component	Mol. Wt.	C Factor	H Factor	% volume	Fract. Wt.	Weight Percents: Carbon	Hydrogen	Nitrogen	Oxygen	Sulfur
Hydrogen	2.016	0	1	0.00	0.0000	0	0			
Oxygen	32	0	0	0.00	0.0000				0	
Nitrogen	28.016	0	0	0.44	12.4111	0	0	0.744094988		
CO2	44.01	0.272273	0	0.74	32.7434	0.53449963	0		1.4272	
CO	28.01	0.42587	0	0.00	0.0000	0	0		0	
Methane	16.041	0.75	0.25	96.48	1547.6517	69.5909913	23.196997			
Ethane	30.067	0.8	0.2	2.04	61.2765	2.93902167	0.7347554			
Ethylene	28.051	0.85714	0.14286	0.00	0.0000	0	0			
Propane	44.092	0.81818	0.18182	0.25	11.1112	0.54503918	0.12112			
Propene	42.077	0.85714	0.14286	0.00	0.0000	0	0			
Isobutane	58.118	0.82759	0.17247	0.02	1.1042	0.05478959	0.0114182			
n-butane	58.118	0.82759	0.17247	0.01	0.5812	0.02883662	0.0060096			
Isobutene	56.102	0.85714	0.14286	0.00	0.0000	0	0			
Isopentane	72.144	0.83333	0.16667	0.00	0.1168	0.00583444	0.0011669			
n-pentane	72.144	0.83333	0.16667	0.00	0.0000	0	0			
n-hexane	86.169	0.83721	0.16279	0.01	0.9479	0.04757696	0.009251			
H2S	34.08	0	0	0.00	0.0000	0	0			0
Totals				99.99962	1667.9440	73.7465894	24.08	0.744094988	1.4272	0
										99.999

CALCULATED VALUES		
O2 F Factor (dry)	8636	DSCF of Exhaust/MM Btu of Fuel Burned @ 0% excess air
O2 F Factor (wet)	10643	SCF of Exhaust/MM Btu of Fuel Burned @ 0% excess air
Moisture F Factor	2007	SCF of Water/MM Btu of Fuel Burned @ 0% excess air
Combust. Moisture	18.86	volume % water in flue gas @ 0% excess air
Fo	1.8	fuel factor (dimensionless)
VOC Portion of fuel	2.33	%
CO2 F Factor	1022	DSCF of CO2/MM Btu of Fuel Burned @ 0% excess air

APPENDIX I: ALTERNATIVE COMPLIANCE TEST DATA

Brooker Compressor Station--Unofficial Data

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

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

Testing By Cubix Corporation, Austin, Texas

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

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

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

Prepared For

FLORIDA GAS TRANSMISSION COMPANY

April 1992

Prepared by

Cubix Corporation

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

TABLE OF CONTENTS

INTRODUCTION

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

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

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

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

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

Florida Gas Transmission Co.

Cubix Corporation

INTEROFFICE MEMORANDUM

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

TO: See Below

Subject: Florida GAs Transmission Co Compliance Issues Phone Conf.

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

Possible agenda items:

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

10 Participation in Alan Weatehrford's proposed technical resolution conference.

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

Distribution:

TO:	Clair Fancy TAL	(FANCY_C)
TO:	Jim Pennington TAL	(PENNINGTON_J)
TO:	Mike Harley TAL	(HARLEY_M)
TO:	Teresa Heron TAL	(HERON_T)
TO:	Bob Leetch JAX	(LEETCH_B @ A1 @ JAX1)
TO:	Shannon Baruch GNSV	(BARUCH_S)
TO:	Charles Collins ORL	(COLLINS_C @ A1 @ ORL1)
TO:	Caroline Shine ORL	(SHINE_C @ A1 @ ORL1)
TO:	Thomas Tittle WPB	(TITTLE_T)
TO:	Isidore Goldman WPB	(GOLDMAN_I)
TO:	Carolyn Salmon PEN	(SALMON_C @ A1 @ PNS1)
TO:	Robert Kriegel PEN	(KRIEGEL_R @ A1 @ PNS1)
TO:	Benjamin_m	(BENEFIELD_D @ A1 @ JAX1)

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

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TO:	Isidore Goldman WPB	(GOLDMAN_I)
TO:	Carolyn Salmon PEN	(SALMON_C @ A1 @ PNS1)
TO:	Robert Kriegel PEN	(KRIEGEL_R @ A1 @ PNS1)
TO:	Benjamin_m	(BENEFIELD_D @ A1 @ JAX1)

Table 1
Background Data

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

Regulatory Application:	Florida Department of Environmental Regulation Permit No. AC 05-189665
Required Test Methods:	EPA Method 1 for traverse point layout EPA Method 2 for stack gas velocity EPA Method 3 for O_2 and CO_2 concentrations EPA Method 4 for moisture content EPA Method 7e for NOx concentrations EPA Method 9 for opacity observations EPA Method 10 for CO concentrations EPA Method 25 for VOC concentration ASTM D-3246 for indirect measurement of SO_2 emissions
Alternate Test Methods: (conducted for comparison purposes)	EPA Method 3a for CO_2 and O_2 concentrations Stoichiometric calculation of moisture content EPA Method 18 for VOC portion of THC concentration EPA Method 19 for calculation of stack flow rate EPA Method 25a for THC concentration AGA Carbon Balance Method for stack flow rate calculation

SUMMARY OF RESULTS

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

The permit required that tests be conducted for 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 each engine while operating at their rated horsepower of full load and full speed.

The results from these three test runs on Engines 1 and 2 are presented in Tables 2 and 3, respectively. These tables include the operating data and ambient conditions for each test run. The measured concentrations of NOx, CO, O_2, CO_2, VOC, and the stack flow rates are presented in the same units and using the same test methods listed in the permit. The calculated mass emission rates of NOx, CO, and VOC are presented in terms of lbs/hr, TPY, and g/hp-hr for comparison with the permit limits.

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

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

CO emissions averaged 11.9 lbs/hr, 52.3 tons/yr, and 2.0 g/hp-hr on Engine 1 and 11.8 lbs/hr, 51.7 tons/yr, and 2.06 g/hp-hr. CO emissions are limited by the permit to 15.4 lbs/hr, 67.6 tons/yr, and 2.8 g/hp-hr on each engine.

The total sulfur content of the fuel was determined via laboratory analysis by Southern Petroleum Labs of Houston, Texas. The result of that analysis is contained in Appendix H and show that the fuel contained 0.107 grains/100 DSCF. The permit limits the sulfur content of the fuel to 10 grains/100 DSCF. The mass emission rates of SO_2 presented in Tables 2 and 3 were calculated from the measured fuel flow to the engines assuming that all sulfur in the fuel was oxidized to SO_2. The SO_2 emission rate based on this calculation averaged 0.0026 lbs/hr or 0.011 tons/yr on Engine 1 and 0.0031 lbs/hr and 0.014 tons/yr on Engine 2. The permit limits for SO_2 mass emissions are 0.51 lbs/hr and 2.2 tons/yr.

Nonmethane hydrocarbon (i.e. VOC) concentrations were measured as required by the permit using EPA Method 25. Tables 2 and 3 contain the results of those measurements. The average VOC emissions using Method 25 on Engine 1 were 13.5 lbs/hr, 59.2 tons/yr, and 2.27 g/hp-hr. The laboratory results for the Method 25 analyses contained in Appendix A note that a laboratory leak on the analysis of the sample from test run C-2 could have biased that number high. If that measurement is not included in the average emissions, Engine 1 emissions averaged 7.85 lbs/hr, 34.4 tons/yr, and 1.32 g/hp-hr. Engine 2 VOC emissions averaged 6.05 lbs/hr, 26.5 tons/yr, and 1.05 g/hp-hr over the three test runs. The permit limits nonmethane hydrocarbon emissions to 9.4 lbs/hr, 41.0 tons/yr, and 1.7 g/hp-hr.

It is Cubix's belief that the applicability of using EPA Method 25 on this type of source is questionable. Method 25 results are affected by 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 1.61 lbs/hr (7.03 tons/yr and 0.27 g/hp-hr) on Engne 1. Engine 2 averge VOC emissions were 2.29 lbs/hr, 10.1 tons/yr, and 0.40 g/hp-hr. When compared with the data obtained from Method 25, one can see that the 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 both engines, the moisture content obtained from stoichiometric calculations showed agreement within 10% of that obtained using EPA Method 4. The flow rate determination using F-factors and carbon balance agreed with the pitot tube measurements within 10%, averaged over the three test runs on Engine 2. The agreement on Engine 1 was poor, indicating a faulty fuel flow meter as can be seen from a comparison of the fuel consumption for both engines at the same loads.

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

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

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

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

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

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

TABLE 2
ENGINE 1
SUMMARY OF RESULTS

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

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

TABLE 3
ENGINE 2
SUMMARY OF RESULTS

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

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

PROCESS DESCRIPTION

Florida Gas Transmission Co. owns and operates Compressor Station No. 19 located near Melbourne, Florida. This plant uses engines to compress natural gas to allow for transportation in the main pipeline system. This compressor station is a part of a system developed by Florida Gas Transmission Company to allow the transport of natural gas from reserves in Texas to the Florida market.

The engines tested are identical Dresser Rand 412KVSR compressor engines The serial numbers for Engines 1 and 2 are 229AP and 228AP, respectively. The engines are rated at 2600 BHP. They are lean burn, high air/fuel ratio engines including a precombustion chamber on each cylinder, main chamber mixture regulation, and a variable timing spark control responsive to speed, torque, and air temperature.

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

ANALYTICAL TECHNIQUE

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

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

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

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

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

EPA Method 1 was used to determine the velocity traverse point locations. The stack diagram of Appendix A shows that the sample ports did meet the location criteria set forth by the method. The sample ports were located approximately 5 diameters downstream and 53 diameters upstream of the nearest flow disturbances.

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

The stack gas analyses for 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 10% less than those obtained by the pitot tube measurement. On Engine 2, AGA's carbon balance technique yielded results approximately 15% lower than those of EPA Methods 1-4. Both of these methods use stoichiometric relationships based on the estimated fuel flow, fuel composition, and excess air concentration for calculation of the stack flow rates. The stoichiometric techniques used on Engine 1, yielded results over 30% lower than the pitot tube results. Comparison of the fuel consumption of the identical engines at equal loads show that the poor agreement between flow rate measurement techniques on Engine 1 can be attributed to a faulty fuel meter. The *Summary of Results* uses the pitot tube values in all calculations to be consistent with the permit provisions. However, the alternate methods provided for a check of the pitot tube traverse results.

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

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

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

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

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

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

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

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

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

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

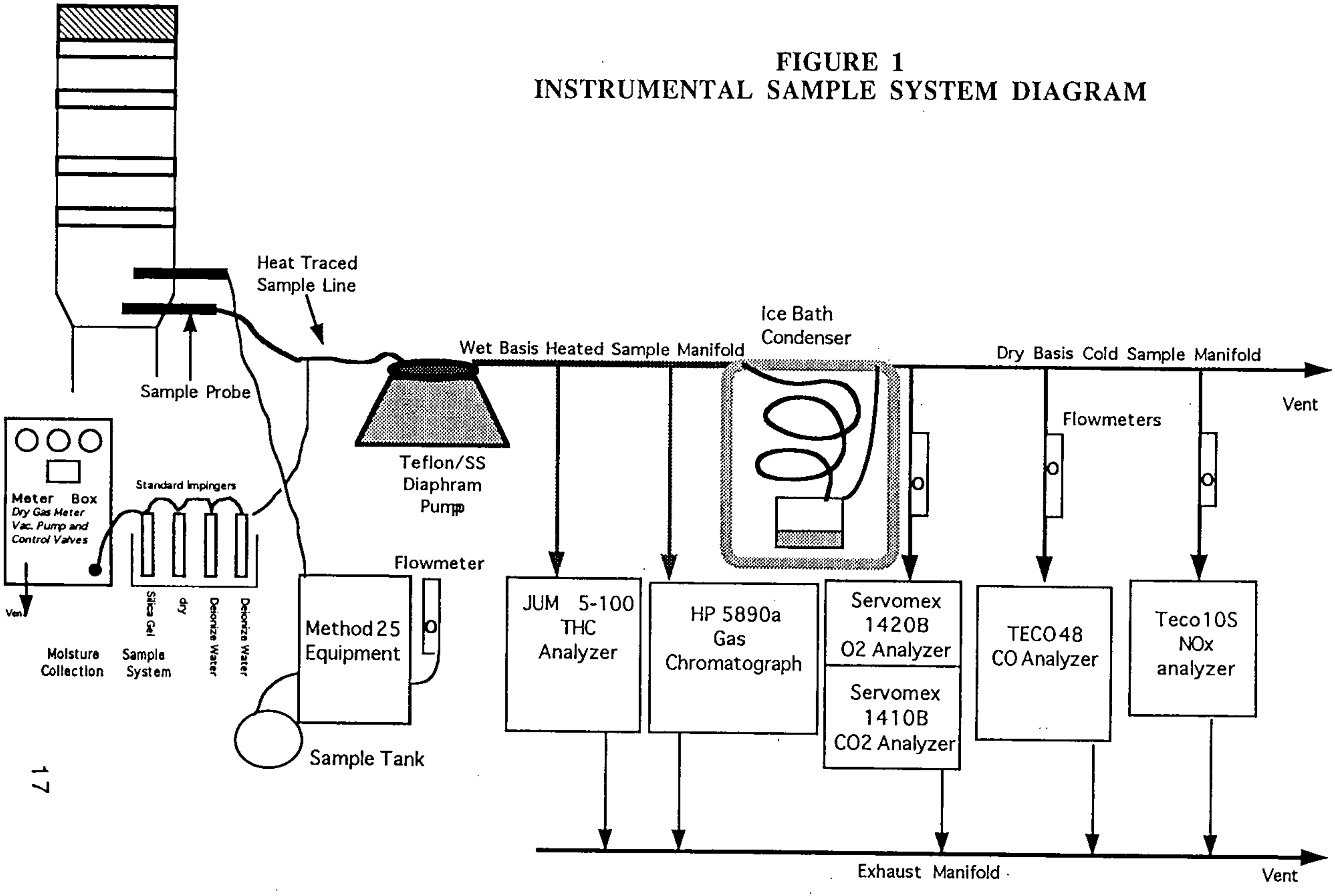
During the tests, the engine and compressor operational data was collected by Florida Gas personnel. Key operational data collected include compressor discharge pressures, compressor suction pressures, engine manifold pressure, engine speed, timing, and horsepower. Florida Gas also provided a recent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

TABLE 4
ANALYTICAL INSTRUMENTATION

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

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

FIGURE 1
INSTRUMENTAL SAMPLE SYSTEM DIAGRAM



QUALITY ASSURANCE ACTIVITIES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

APPENDIX A:
FIELD DATA SHEETS

SIGN IN SHEET

JOB NAME: FLORIDA GAS

DATE: 3 / 26 / 92

LOCATION: MELBOURNE

PERMIT #: AC05-189665

SOURCE(S): Dresser Rand Engines (2)

PARTICIPANTS: Cubix Corporation

FGT

Dresser

FDER

PLEASE PRINT

NAME:	AFFILIATION:	PHONE NUMBER:
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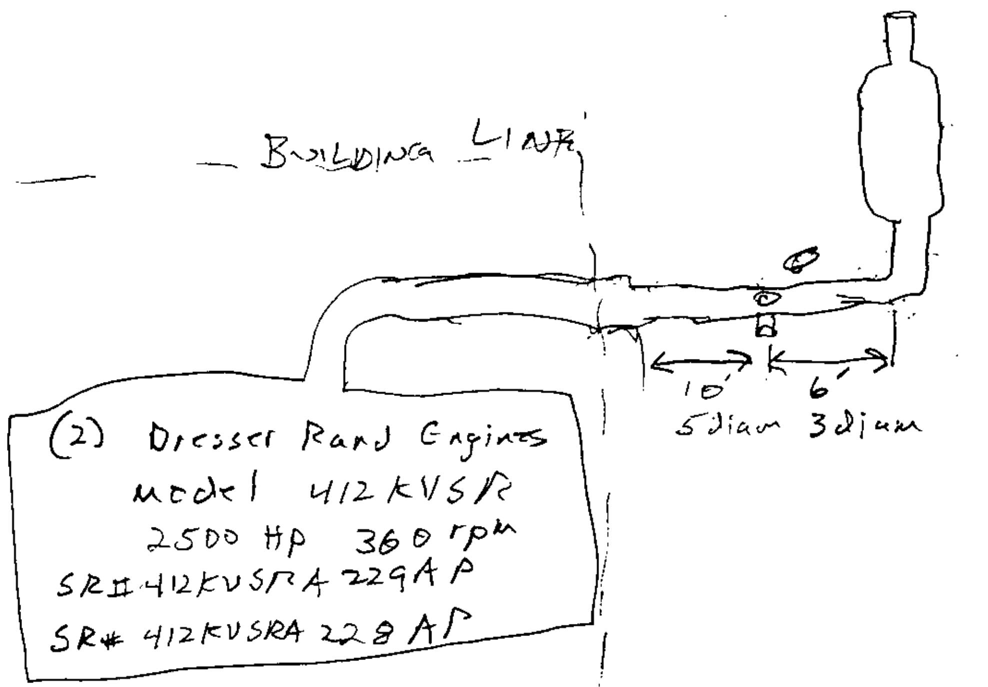
Rick J. Krenzke	Cubix Corp.	512-243-0202
Joe Rudyk	" "	"
Garry Kuberski	Florida DER	407-894-7555
Allan Weatherford	FGT	
Fred Griffin	FGT	

Circular Stack Sampling Traverse Point Layout
(EPA Method 1)

Date: 3-26-92
Plant: EGT / Melbourne
Source: 2 Dresser Rand Engines
Technician(s) LF AK SR

Port + Stack ID: 31 1/2 in.
Port Extension 8 in.
Stack ID: 23 1/2 in.
Stack Area 3.012 ft²
Total Req'd Traverse Pts. 16
No. of Traverse Pts. 8 /diam.
No. of Traverse Pts. 8 /port

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



Traverse Point Number	Length Factor (% of diameter) Number of traverse pts./diameter 4	6	8	12	Distance from Reference Point (inches)
1	6.7	4.4	3.2	2.1	.75 = 1.0
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

St. #19

Date: 3-26-92
Plant/Operator: FGT/Melbourne St.
Source: Dresser 412 KVSR Recip Unit #
Technicians: RK, LF, JR
Atm. Pres. 29.96 in.Hg(Pb)
Test Run # C-1

Dry Gas Meter ID: Anderson # 12863061
Dry Gas Meter Factor: .9904 (Kd)
Pitot Tube #/Type: #107 S-type
Pitot Tube Factor: .84 (Kp)
Static Pres. + 2.0 in.H2O(Pg)
Average Stack Temp. 652 °F(Ts)

Pre-test Leak check OK	0 ft.3/min at 23 in. Hg Vacuum
Post-test Leak check OK	0 ft.3/min at 26 in. Hg Vacuum

Impinger #	Contents	Initial Weight	Final Weight
1	H_2O	608.4	659.4
2	H_2O	608.6	594.4
3	MT	459.7	462.1
4	SG	778.4	786.4
5			
6			
Totals	X		

Moisture Train

	Initial	Final
Time:	0837	936
Meter Reading (ft3 or L)	913.010	938.500
Meter Temp. (°F)	72	134
Sample Box #		

O2 %	13.0
CO2 %	5.0

Orsat Results

Pitot Tube Traverse/Stack Temp./Angle

Ports – Bottom, Side

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

MOISTURE AND VELOCITY FIELD DATA SHEETS

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

Dry Gas Meter ID: Anderson # 1286306/
Dry Gas Meter Factor: .9904 (Kd)
Pitot Tube #/Type: #107 S-type
Pitot Tube Factor: .84 (Kp)
Static Pres. +1.8 in.H2O(Pg)
Average Stack Temp. 662 °F(Ts)

Pre-test Leak check OK	0 ft.3/min at 25 in. Hg Vacuum	
Post-test Leak check OK	0 ft.3/min at 24 in. Hg Vacuum	

Impinger #	Contents	Initial Weight	Final Weight
1	H_2O	659.4	692.7
2	H_2O	594.4	597.8
3	MT	462.1	463.3
4	SG	786.4	792.6
5			
6			
Totals			

Moisture Train

	Initial	Final
Time:	955	1040
Meter Reading (ft3 or L)	940.35	961.880
Meter Temp. (°F)	85	121
Sample Box #	TR 7530R	

O2 %	12.0
CO2 %	5.0

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	ΔP (" H2O)	°F	ß	ΔP (" H2O)	°F	ß
1	1.6			1.3		
2	1.6			1.5		
3	1.6			1.4		
4	1.4			1.4		
5	1.6			1.5		
6	1.7			1.5		
7	1.6			1.5		
8	1.5			1.5		
9						
10						
11						
12						

MOISTURE AND VELOCITY FIELD DATA SHEETS

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

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

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

Impinger #	Contents	Initial Weight	Final Weight
1	H_2O	692.7	720.9
2	H_2O	594.4	602.8
3	MT	462.1	464.4
4	SG	786.4	789.4
5			
6			
Totals			

Moisture Train

	Initial	Final
Time:	11:00am	1150
Meter Reading (ft3 or L)	962.200	985.750
Meter Temp. (°F)	118	141
Sample Box #	TR 7 Box	

O2 %	12.0
CO2 %	5.0

orsat results

Pitot Tube Traverse/Stack Temp./Angle

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

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

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

Test Run No.	**C-1**	**C-2**	**C-3**
Stack Moisture & Molecular Wt. via EPA Method 4			
CO2 (%)	5.0	5.0	5.0
O2 (%)	12.0	12.0	12.0
Beginning Meter Reading (ft3)	913.010	940.350	962.200
Ending Meter Reading (ft3)	938.500	961.880	985.750
Beginning Impinger Wt (g)	2455.1	2502.3	2535.6
Ending Impinger Wt. (g)	2502.3	2546.4	2577.5
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	72	85	118
Dry Gas Meter Temperature (°F end)	134	121	141
Atmospheric Pressure (in Hg, abs.)	29.96	29.99	29.99
Stack Gas Moisture (% volume)	8.59	9.40	8.63
Dry Gas Fraction	0.914	0.906	0.914
Stack Gas Molecular Wt. (lbs/lb-mole)	28.31	28.22	28.31
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	1.10	1.60	1.20
ΔP #2	1.30	1.60	1.50
ΔP #3	1.40	1.60	1.50
ΔP #4	1.30	1.40	1.50
ΔP #5	1.50	1.60	1.40
ΔP #6	1.50	1.70	1.60
ΔP #7	1.50	1.60	1.60
ΔP #8	1.40	1.50	1.50
ΔP #9	1.50	1.30	1.50
ΔP #10	1.50	1.50	1.60
ΔP #11	1.60	1.40	1.70
ΔP #12	1.60	1.40	1.50
ΔP #13	1.50	1.50	1.50
ΔP #14	1.50	1.50	1.60
ΔP #15	1.60	1.50	1.60
ΔP #16	1.60	1.50	1.60
Sum of Square Root of ΔP's	19.3	19.7	19.7
Number of Traverse Points	16	16	16
Average Square Root of ΔP's	1.21	1.23	1.23
Average Temperature (°F)	652	662	669
Static Pressure (in. H2O)	2	1.8	2
Stack Diameter (in.)	23.5	23.5	23.5
Stack Area (ft2)	3.01	3.01	3.01
Stack Velocity (ft/min)	5944	6084	6116
Stack Flow,wet (ACFM)	17905	18325	18423
Stack Flow,dry (SCFH)	4.69E+05	4.72E+05	4.76E+05

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date:	3-27-92	Dry Gas Meter ID:	Anderson #1286306l
Plant/Operator:	FGT/Melbourne #19	Dry Gas Meter Factor:	.9904 (Kd)
Source:	Dresser 412 KVSR	Pitot Tube #/Type:	#107 S-Type
Technicians:	RK, LF, JR	Pitot Tube Factor:	.84 (Kp)
Atm. Pres.	30.12 in.Hg(Pb)	Static Pres.	+2.1 in.H2O(Pg)
Test Run #	C-4	Average Stack Temp.	670 °F(Ts)

Pre-test Leak check OK	0.0 ft.3/min at 25 in. Hg Vacuum
Post-test Leak check	0.0 ft.3/min at @ 23" in. Hg Vacuum

Impinger #	Contents	Initial Weight	Final Weight
1	H_2O	582.0	607.1
2	H_2O	602.8	622.2
3	MT	464.4	465.6
4	SG	799.4	806.2
5			
6			
Totals	X		

Moisture Train

	Initial	Final
Time:	1020	1124
Meter Reading (ft3 or L)	985.405	1013.728
Meter Temp. (°F)	83	120
Sample Box #	TR 1 Box	

O2 %	12.5
CO2 %	5.0

Orsat

Pitot Tube Traverse/Stack Temp./Angle

	B			S		
Traverse Pt.	ΔP (" H2O)	°F	ß	ΔP (" H2O)	°F	ß
1	1.6			1.3		
2	1.7			1.7		
3	1.4			1.6		
4	1.4			1.6		
5	1.5			1.5		
6	1.6			1.5		
7	1.6			1.7		
8	1.6			1.6		
9						
10						
11						
12						

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3-27-92
Plant/Operator: FGT/Melbourne #19
Source: Dresser 412 KVSR
Technicians: AK, LF, JR
Atm. Pres. 30.12 in.Hg(Pb)
Test Run # C-5

Dry Gas Meter ID: Anderson #12863061
Dry Gas Meter Factor: .9904 (Kd)
Pitot Tube #/Type: #107 S-Type
Pitot Tube Factor: .84 (Kp)
Static Pres. +2.0 in.H2O(Pg)
Average Stack Temp. 667 °F(Ts)

Pre-test Leak check OK	0.0 ft.3/min at @ 24" in. Hg Vacuum
Post-test Leak check	0.0 ft.3/min at @ 22.5" in. Hg Vacuum

Impinger #	Contents	Initial Weight	Final Weight
1	H_2O	607.1	637.8
2	H_2O	622.2	627.0
3	MT	465.6	466.5
4	SG	955.2	961.4
5			
6			
Totals			

Moisture Train

	Initial	Final
Time:	1140	1235
Meter Reading (ft3 or L)	013.90	035.880
Meter Temp. (°F)	115	118
Sample Box #	TR 7	

O2 %	12.5
CO2 %	4.8

ORSAT

Pitot Tube Traverse/Stack Temp./Angle

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

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3-27-92
Plant/Operator: F6T - Melbourne #19
Source: Dresser 412 KVSR
Technicians: RK, LF, JR
Atm. Pres. 30.12 in.Hg(Pb)
Test Run # C-6

Dry Gas Meter ID: Anderson #1286306l
Dry Gas Meter Factor: .9904 (Kd)
Pitot Tube #/Type: #107 S-Type
Pitot Tube Factor: .84 (Kp)
Static Pres. + 2.1 in.H2O(Pg)
Average Stack Temp. 672 °F(Ts)

		Impinger #	Contents	Initial Weight	Final Weight
Pre-test Leak check OK	0.0 ft.3/min at in. Hg Vacuum @ 25"	1	H_2O	637.8	669.5
Post-test Leak check OK	0 ft.3/min at 25 in. Hg Vacuum	2	H_2O	627.0	631.1
		3	MT	466.5	467.2
		4	SG	961.4	964.1
		5			
		6			
		Totals			

Moisture Train

	Initial	Final
Time:	1240	1335
Meter Reading (ft3 or L)	35.900	58.61
Meter Temp. (°F)	118	126
Sample Box #		
O2 %	12.5	
CO2 %	4.08	

orsat Results

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	B ΔP (" H2O)	°F	ß	S ΔP (" H2O)	°F	ß
1	1.6			1.3		
2	1.8			1.6		
3	1.7			1.6		
4	1.6			1.5		
5	1.5			1.6		
6	1.6			1.6		
7	1.7			1.5		
8	1.8			1.5		
9						
10						
11						
12						

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

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

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

Volatile Organic Carbon by Method 25

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

Project #:
Sample Location: Engine 1
Date: 3-26-92
Sample ID: C-1
Trap Number: B35
% CO2: 5.0
% H2O: ~~[illegible]~~ 8.6
Stop Time: 930

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

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

$\Delta P = .01 \frac{F\,Pb\,ø}{Vt}$ = $\frac{.01 * 35 * 29.96 * 10}{100}$

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
830	28.70	35	263	265	
835	27.50	35	263	265	
840	25.40	35	263	265	
845	23.20	35	264	265	
850	21.10	35	264	265	
855	19.00	35	265	266	
900	17.00	30	265	266	
905	15.80	29	265	266	Adjust Flow
910	13.70	33	266	266	
915	12.30	30	267	267	
920	11.20	25	267	265	Adjust Flow
925	10.20	37	267	265	
930	7.50	29	267	265	

Volatile Organic Carbon by Method 25

Client: Florida Gas Trans
Plant: Melbourne #
Operator: JR, LF, RK
Run Number: C-2
Tank Number: 4 T-103
Sampling Train ID#: C 2610
Side: Left / Right: Sample 1
Start Time: 955

Project #:
Sample Location: Engine 1
Date: 3-26-92
Sample ID: C-2
Trap Number: C-37
% CO2: 5
% H2O: 9.4
Stop Time: 1055

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

Leak Rate	Tank* (in Hg) Allowable	Actual	Trap black ball reading
Pre Test	1.0496	0	0
Post Test	1.0496	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
955	28.60	35	265	265	start
1000	27.70	35	266	266	
1005	25.60	35	267	266	
1010	23.60	30	267	267	Adjust Flow
1015	21.50	35	267	267	
1020	19.20	35	267	267	
1025	17.10	35	267	267	
1030	15.80	33	267	267	
1035	14.20	30	267	267	
1040	13.70	28	267	267	
1045	12.80	25	267	267	Adjust Flow
1050	9.90	37	267	267	
1055	7.00	35	267	267	
~~1055~~					

Volatile Organic Carbon by Method 25

Client:	Fla GAS TRANS	Project #:	
Plant:	Melbourne # 19	Sample Location:	Engine 1
Operator:	SR, LF, RK	Date:	3-26-92
Run Number:	C-3	Sample ID:	C-3
Tank Number:	4T 41	Trap Number:	X-32
Sampling Train ID#:	2610	% CO2:	5.0
Side: Left / Right:	SAMPLE -1	% H2O:	~~8~~ 9.0
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	28.20	29.00	29.99	78
Post Test	6.40	6.00	30.00	84

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

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

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

Clock Time	Gauge Vacuum (in Hg)	Flowmeter Setting (silver ball)	Probe Temp C/F	Filter Temp C/F	Notes
1100	28.20	35	267	267	
1105	27.10	33	267	267	
1110	26.20	30	267	267	
1115	24.80	30	267	267	
1120	22.90	35	267	267	
1125	20.80	33	267	267	
1130	18.00	30	267	267	
1135	16.40	28	267	267	Adjust Flow
1140	14.00	35	267	267	
1145	12.30	33	267	267	
1150	10.50	35	267	267	
1155	8.70	35	267	267	
1200	6.20	33	267	267	

Volatile Organic Carbon by Method 25

Client:	Florida GAS TRANS	Project #:	
Plant:	Melbourne	Sample Location:	Engine - 2
Operator:	JR, LF, RK	Date:	3/27/92
Run Number:	C-4	Sample ID:	C-4
Tank Number:	4 T 193	Trap Number:	X - Y
Sampling Train ID#:	2612	% CO2:	5.0
Side: Left / Right:	Sample - 1	% H2O:	8.5
Start Time:	1017	Stop Time:	1117

Pressure Readings	Tank Vacuum Manometer mm Hg / in Hg	Tank Vacuum Gauge mm Hg / in Hg	Barometric Pressure mm Hg / in Hg	Ambient Temperature C/F
Pre Test	27.90	28.00	30.11	69
Post Test	5.30	5.20	30.12	76

Leak Rate	Tank* (in Hg) Allowable	Tank* (in Hg) Actual	Trap black ball reading
Pre Test	1.05	0	0
Post Test	1.05	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
1017	27.80	35	267	268	
1022	25.50	33	267	267	
1027	23.90	30	267	268	
1032	22.80	28	267	269	
1037	21.20	25	267	268	Adjust Flow
1042	19.80	35	267	268	
1047	17.40	35	267	268	
1052	15.20	33	267	269	
1057	13.10	35	267	268	
1102	11.40	35	267	268	
1107	9.20	33	267	268	
1112	7.30	30	267	268	
1117	5.40	35	267	269	

Volatile Organic Carbon by Method 25

Client: Florida GAS
Plant: Melbourne
Operator: JR LF BK
Run Number: C-5
Tank Number: 4 T 197
Sampling Train ID#: 2610
Side: Left / Right: sample-1
Start Time: 1120

Project #: Engine 2
Sample Location: stack
Date: 3-27-92
Sample ID:
Trap Number: B 233
% CO2: 4.9
% H2O: 9.1
Stop Time: 1220

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

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

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

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

Clock Time	Gauge Vacuum (in Hg)	Flowmeter Setting (silver ball)	Probe Temp C / F	Filter Temp C / F	Notes
1120	27.90	35	267	265	
1125	25.90	35	267	266	
1130	23.80	35	267	266	
1135	21.90	35	267	266	
1140	19.80	35	267	267	
1145	17.60	35	267	267	
1150	15.50	35	267	268	
1155	13.70	35	267	268	
1200	11.80	35	267	269	
1205	9.90	35	267	269	
1210	7.70	35	267	271	
1215	5.80	35	267	271	
1220	3.90	35	267	271	

Volatile Organic Carbon by Method 25

Client:	Florida GAS Trans	Project #:	
Plant:	Melbourne	Sample Location:	Stack Eng 2
Operator:	JK, LF, RK	Date:	3/27/92
Run Number:	C-6	Sample ID:	
Tank Number:	4T-119	Trap Number:	NO 8
Sampling Train ID#:		% CO2:	4.8
Side: Left / Right:	SAMPLE-1	% H2O:	8.3
Start Time:	1230	Stop Time:	1330

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

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

$\Delta P = .01 \frac{F\ Pb\ \varnothing}{Vt}$ 0

ΔP = Pressure Change (in Hg)
F = Sampling Flow Rate cc / min
Pb = Barometric Pressure (in Hg)
$\varnothing$ = 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
1230	29.00	35	267	267	
1235	27.20	35	267	267	
1240	25.00	35	267	267	
1245	23.30	35	267	267	
1250	21.40	35	267	267	
1255	19.60	35	267	267	
1300	17.90	35	267	267	
1305	15.60	35	267	267	
1310	13.40	35	267	267	
1315	11.50	35	267	267	
1320	9.40	35	267	267	
1325	7.30	35	267	267	
1330	5.00	35	267	267	

4335

CHAIN OF CUSTODY RECORD

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

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	CO_2	BLANK VALUE (PPHV)					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~~	~~X28~~		~~9.0~~						~~Silver Springs Fla. GAS~~ ✓
	C-4	3/27/92		X4		2.3						Melbourne
	~~C-3~~	~~3/19/92~~	~~1135~~	N2		5.6						~~Quincy – Fla. GAS~~ ✓
	C-3	3/24/92	1310	N4		3.0						Silver Spring – Fla. GAS ✓
				~~N7~~		~~2.1~~						
	C-6	3/27/92		N8		2.6						Melbourne
	C-1	3/1/92	1425	N15		8.7						Munson – Fla GAS ✓
	C-1	3/18/92	1100	N19 LAB 4/2		3.0						Caryville – Fla GAS ✓

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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

4337

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME				NO. OF CON-TAINERS	NMHC BLANK VALUE (PPMC)						REMARKS
DEPT. NO. 8151	Cubix Corp											
SAMPLERS: (Signature)	Joseph Rudyk											
LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION								
	Audit-2	3/26/92		TANK # 4T107		0.1						Melbourne
	C-2	3/23/92	1773	4T108		0.1						Brooker - Fla. GAS ✓
	C-1	3/20/92	930	4T114		0.2						Perry - Fla. GAS ✓
	C-6	3/27/92		4T119		0.7						Melbourne
	C-1	3/23/92	326	4T121		0.1						Brooker - Fla. GAS ✓
				4T127		0.4						
	Audit 1	3/26/92		4T128		0.2						Melbourne
	C-1	3/19/92	900	4T149		0.9						Quincy - Fla. GAS ✓
				4T159		1.1						
	C-3	3/19/92	1135	4T177		1.1						Quincy - Fla. GAS ✓
	C-3	3/23/92	1833	4T182		0.1						Brooker - Fla. GAS ✓
	C-3	3/24/92	1310	4T187		1.5						Silver Springs Fla. GAS ✓
	C-4	3/27/92		4T193		0.2						Melbourne
	C-1	3/26/92	8:30	4T194		0.1						Melbourne - Fla. GAS ✓
	C-5	3/27/92		4T197		0.1						Melbourne

LAB 4/2

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

REMARKS:

CAE

500 W. Wood Street

4338

CHAIN OF CUSTODY RECORD

PROJ. NO.

DEPT. NO. 8151

PROJECT NAME: Cubix Corp

SAMPLERS: (Signature) Joseph Rudyk

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	NHHC BLANK Value (ppmvc)					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

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	4/1/92 1:42	Tom Grotts… LAB 412			
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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

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4336

CHAIN OF CUSTODY RECORD

PROJ. NO.

DEPT. NO. 8151

PROJECT NAME: Cubix Corp

SAMPLERS: (Signature) Joseph Rudyk

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	CO_2 BLANK VALUE (ppmvc)	NMHC BLANK VALUE (ppmvc)					REMARKS
	C-2	3/19/92	1020	TRAP # N20		1.9						Quincy - Fla - GAS ✓
	C-3	3/18/92	1325	N21		1.8						Caryville - Fla. GAS ✓
				VWR		0.9						
	C-2	3/18/92	1210	TANK # 4T19			0.0					Caryville - Fla GAS ✓
	C-3	3/18/92	1325	4T22			0.0					Caryville - Fla GAS ✓
				4T29			1.8					
	C-3	3/26/92	1100	4T41			2.1					Melbourne - Fla. GAS ✓
				4T66			0.1					
				4T71			0.0					
	C-2	3/24/92	1330	4T80			0.6					Silver Springs - Fla. GAS ✓
	C-3	3/20/92	1120	4T81			0.2					Perry - Fla. GAS ✓
	C-1	3/24/92	1000	4T89			0.7					Silver Springs - Fla. GAS ?
	C-2	3/20/92	1000	4T91			0.1					Perry - Fla. GAS ✓
	C-2	3/26/92	955	4T103 LAB 4/2			0.5					Melbourne - Fla. GAS

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	4/1/92 1:42				

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

REMARKS:

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

4334

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME	NO. OF CON-TAINERS	CO8 BLANK VALUE (PPHVC)						REMARKS
DEPT. NO. 8151	Cubix Corp.								
SAMPLERS: (Signature)	Joseph Rudyk								

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	CO8 BLANK VALUE (PPHVC)						REMARKS
	~~C-1~~	~~3/20/92~~	~~830~~	~~Trap # B35~~		~~3.0~~						~~Melbourne - Fla. GAS~~ ✓
	~~C-2~~	~~3/7/92~~	~~1530~~	~~B53~~		~~4.5~~						~~MUNSON - Fla. GAS~~ ✓
	~~C-5~~	~~3/24/92~~		~~B233~~		~~1.3~~						~~Melbourne~~
	C-2	3/24/92	1130	C1		2.4						Silver Springs - Fla. GAS ✓
	~~C-1~~	~~3/19/92~~	~~900~~	~~C3~~		3.5						~~Quincy~~ - Fla. GAS ✓
	~~Adit-2~~	~~3/26/92~~		~~C7~~		~~0.8~~						~~Melbourne~~
	C-3	3/29/92	1120	C10		6.6						Perry - Fla. GAS ✓
	C-3	3/17/92	1643	C13		3.6						MUNSON. - Fla. GAS ✓
	~~C-3~~			~~C15~~		~~3.6~~						Brooker
	~~C-2~~	~~3/6/92~~	~~955~~	~~C37~~		~~0.8~~						~~Melbourne - Fla. GAS~~
	C-2	3/18	1300	R002		4.3						Coating w/ C - FGT
				R004		1.2						
				R008		2.5						
				X1		2.6						
	C-1	3/20/92	830	X10		2.5						Perry - Fla. GAS ✓

LAB 4/2

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Relinquished by: (Signature)	Date / Time	Received 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 3/26/92 and reported on 4/30/92.

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

Compiled By: Sheifeal Fury On: 5-1-92

Page 1

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

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

Job No. 8160	Plant: Florida Gas & Trans.
Client Cubix	Sample Loc. Melbourne Station
Disk/File 8160M1	(In/Out) Engine #1
Page No. 2	Date 3/26/92

Preliminary Data				
Run No.		C-1	C-2	C-3
Tank No.		4T194	4T103	4T41
Trap No.		B35	C37	X32
Tank Volume V(cc)		4034	4016	4022
Field Data				
PTI	(mm Hg)	-711	-711	-716
TTI	(F)	69	73	78
PbI	(mm Hg)	761	762	762
PT	(mm Hg)	-168	-163	-163
TT	(F)	72	78	84
Pb	(mm Hg)	762	762	762
Noncondensible Organics				
PT(Lab)	(mm Hg)	-202	-200	-192
TT(Lab)	(F)	77	77	77
Pb(Lab)	(mm Hg)	743	743	743
PTF	(mm Hg)	936	922	948
TTF	(F)	77	77	77
PbF	(mm Hg)	743	743	743
Ba	(ppmv C)	0.1	0.5	2.1
Ctm 1	(ppmv C)	4.4	4.4	3.7
Ctm 2	(ppmv C)	5.3	4.8	4.0
Ctm 3	(ppmv C)	4.7	4.0	3.3
Avg. Ctm	(ppmv C)	4.8	4.4	3.7
RSD Ctm	(%)	9.5	9.1	9.6
Condensible Organics				
ICV Tank No.		4T5	4T224	4T120
ICV Tank, Vv (cc)		4008	4262	4043
PFI	(mm Hg)	-736	-734	-728
TFI	(F)	77	77	77
PbFI	(mm Hg)	743	743	743
PF	(mm Hg)	924	922	920
TF	(F)	77	77	77
PbFf	(mm Hg)	743	743	743
Bt	(ppmv C)	3.0	0.8	3.3
Ccm 1	(ppmv C)	141.1	381.2	124.0
Ccm 2	(ppmv C)	143.5	387.8	121.4
Ccm 3	(ppmv C)	141.0	398.4	118.2
Avg. Ccm	(ppmv C)	141.9	389.1	121.2
RSD Ccm	(%)	1.0	2.2	2.4
Total Gaseous Nonmethane Organics (TGNMO)				
Vs	(cc)	2866	2841	2839
Dil. Factor (Non)		3.059	3.047	3.101
Dil. Factor (Con)		3.018	3.233	3.065
Ct	(ppmv C)	14.4	11.9	4.9
Cc	(ppmv C)	419.1	1255.6	361.4
Ct+Cc= C	(ppmv C)	433.4	1267.5	366.2
Mc	(mg C/dscm)	216.4	632.8	182.9

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

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

Compiled By: Shrifred Jung On: 5-1-92

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

Job No.	8160	Plant: Florida Gas & Trans.		
Client	Cubix	Sample Loc. Melbourne Station		
Disk/File	8160M2	(In/Out) Engine #2		
Page No.	2	Date 3/27/92		

Preliminary Data				
Run No.		C-4	C-5	C-6
Tank No.		4T193	4T197	4T119
Trap No.		XY	B233	NO 8
Tank Volume V(cc)		4006	3967	4043
Field Data				
PTI	(mm Hg)	-709	-711	-709
TTI	(F)	69	82	82
PbI	(mm Hg)	765	765	765
PT	(mm Hg)	-135	-86	-124
TT	(F)	76	82	84
Pb	(mm Hg)	765	765	765
Noncondensible Organics				
PT(Lab)	(mm Hg)	-162	-134	-164
TT(Lab)	(F)	78	77	77
Pb(Lab)	(mm Hg)	750	750	750
PTF	(mm Hg)	926	928	930
TTF	(F)	77	77	77
PbF	(mm Hg)	750	750	750
Ba	(ppmv C)	0.2	0.1	0.7
Ctm 1	(ppmv C)	24.8	23.7	22.4
Ctm 2	(ppmv C)	22.9	23.2	22.2
Ctm 3	(ppmv C)	23.3	23.2	24.0
Avg. Ctm	(ppmv C)	23.7	23.4	22.9
RSD Ctm	(%)	4.2	1.2	4.3
Condensible Organics				
ICV Tank No.		4T188	4T252	4T80
ICV Tank, Vv (cc)		3971	4260	4047
PFI	(mm Hg)	-740	-740	-740
TFI	(F)	78	77	77
PbFI	(mm Hg)	750	750	750
PF	(mm Hg)	920	922	930
TF	(F)	77	77	77
PbFf	(mm Hg)	750	750	750
Bt	(ppmv C)	2.3	1.3	2.6
Ccm 1	(ppmv C)	68.8	88.8	92.9
Ccm 2	(ppmv C)	69.9	89.0	91.9
Ccm 3	(ppmv C)	68.8	89.3	95.4
Avg. Ccm	(ppmv C)	69.2	89.0	93.4
RSD Ccm	(%)	0.9	0.3	1.9
Total Gaseous Nonmethane Organics (TGNMO)				
Vs	(cc)	2979	3179	3017
Dil. Factor (Non)		2.917	2.710	2.914
Dil. Factor (Con)		2.881	2.900	2.917
Ct	(ppmv C)	68.4	63.1	64.6
Cc	(ppmv C)	192.6	254.5	264.9
Ct+Cc= C	(ppmv C)	261.1	317.5	329.5
Mc	(mg C/dscm)	130.4	158.5	164.5

APPENDIX B: EXAMPLE CALCULATIONS

MOISTURE CONTENT
refers to test run C-1

V_1 = initial dry gas meter reading = 913.010 ft^3
V_2 = final dry gas meter reading = 938.500 ft^3
V_{net} = total gas sample volume collected (ft^3)
= V_2-V_1
= 938.5- 913.01 = 25.49 ft^3

M_1 = initial weight of impinger train = 2455.1g
M_2 = final weight of impinger train = 2502.3g

MWC = total weight gain of all impingers (g)
= M_2 - M_1 = 2502.3 - 2455.1
= 47.2 g

K_d = dry gas meter factor (unitless) = 0.9904

$V_{corrected}$ = V_{net} x K_d = x
= 25.49 x 0.9904 = 25.245 ft^3

1.335 liters weighs 1 gram at standard conditions
499.4 = Gas constant
P_{bar} = barometric pressure (in Hg) = 29.96
T = temperature of gas DGM (F^o) = 103

F_w = moisture fraction by volume

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

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

$$= \frac{(47.2 \text{ x } 1.335)}{(47.2 \text{ x } 1.335) + (((25.245 \text{ x } 29.96) / (103 + 460)) \text{ x } 499.4)}$$

= 0.086 moisture

MOLECULAR WEIGHT
refers to test run C-1

MW_{H_2O} = molecular wt of H_2O = 18 lb/lb-mole
MW_{CO_2} = molecular wt of CO_2 = 44 lb/lb-mole
MW_{O_2} = molecular wt of O_2 = 32 lb/lb-mole
MW_{N_2} = molecular wt of N_2 = 28 lb/lb-mole
C_{CO_2} = concentration of CO_2 = 5.0(from Orsat)
C_{O_2} = concentration of O_2 = 12.0(from Orsat)
C_{N_2} = concentration of $N_2 = 1-(C_{CO_2}+C_{O_2}) = 0.83$
Fw = moisture fraction = 0.0860
F_d = dry gas fraction = 1 - Fw = 0.914

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

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

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

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

STACK GAS VELOCITY AND FLOW RATE

refers to test run C-1

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 = 1.208

T_s = stack temperature = 652 F° = 1112 R°

P_b = atmospheric pressure (in Hg) = 29.96

P_g = stack static pressure (in. H_2O) = 2.0

Ps = absolute stack pressure

$= P_b + (Pg \times .0735 \text{ in.Hg / in.}H_2O) = 30.107$ in. Hg

V = stack velocity (ft/min)

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

$= 5128.8 \times .84 \times 1.208 \times \sqrt{(1112/ (30.107 \times 28.31)}$

= 5944.43 ft/min

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

= V x A , where A= area of stack = 3.01 ft^2

= 5944.43x 3.012 =17904.62 ft^3/min

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

$= Q_a \times 1059 \times (Ps / Ts) \times Fd$

$= 17904.62 \times 1059 \times (30.107/1112) \times 0.914$

$= 4.69 \times 10^5$ SCFH

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

Q_f = estimated fuel flow = 16730 SCF/hr
F_{BTU} = heating value of gas = 1022 BTU/SCF
F = O_2 F factor = 8635 SCF/MMBTU
C_{O_2} = concentration of O_2 = 12.20 %(from analyzer)

Q_d = stack flow rate on dry basis at standard conditions (SCFH)
$= Q_f \times F_{BTU} \times 10^{-6} \times F \times 20.9 / (20.9 - C_{O_2})$
$= 16730 \times 1022 \times 10^{-6} \times 8635 \times 20.9 / (20.9 - 12.20)$
$= 3.55 \times 10^5$ SCFH

With CO2 F-factor (i.e. F=1022), same calculation is used except for final term......
$Q_d = Q_f \times F_{BTU} \times 10^{-6} \times F \times 100/C_{CO_2}$
$= 16730 \times 1022 \times 10^{-6} \times 1022 \times 100/5.04$
$= 3.47 \times 10^5$ 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 = 136 ppmv
CO = observed concentration of CO = 342 ppmv
VOC = observed concentration via EPA Method 25 and 18
= 43.0 ppmv
1 SCF NOx = 11.94×10^{-8} lbs
1 SCF CO = 7.26×10^{-8} lbs
1 SCF C1(methane) = 4.15×10^{-8} lbs
Qd = stack flow rate = 4.69×10^{5} SCFH
E_{NOx} = mass emission rate of NOx (lb/hr)
=NOx x Qd x 11.94×10^{-8}
$E_{NOx} = 136 \times 4.69 \times 10^{5} \times 11.94 \times 10^{-8}$

E_{NOx}= 7.61 b/hr
E_{CO} = 11.64 lb/hr
E_{VOC}= 0.836 lb/hr

HP = engine horsepower = 2708 hp
454 g = 1.0 lb

E_{NOx} (g/hp-hr)= E_{NOx} x 454 / HP
= 7.61 x 454 / 2708
E_{NOx} (g/hp-hr)= 1.275 g/hp-hr
E_{CO} (g/hp-hr)= 1.95 g/hp-hr
E_{VOC} (g/hp-hr)= 0.140 g/hp-hr

Stack Gas Flow Rate via AGA Carbon Balance Method

Refers to Test Run #C-1

Q_f = fuel flow = 16730 SCF/hr

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

Ce = exhaust gas carbon content

= CO + THC /(as C1) + CO2

= (342 + 1242) / 10000 + 5.04 = 5.198 %

Q = stack flow rate

= Qf x Cf x 100 / Ce

= 16730 x 1.023 x 100 / 5.198

= 3.29×10^5 SCFH

SO2 Emission Rate from Fuel Analysis

Refers to Test Run #C-1

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

7000 grains = 1.0 lb

Q_f = 16730 SCF/hr

SO_2 = mass emission rate of SO_2

$= S / 100 / 7000 \times Q_f$

$= 0.107 / 100 / 7000 \times 16730$

$= 0.0026$ lbs/hr

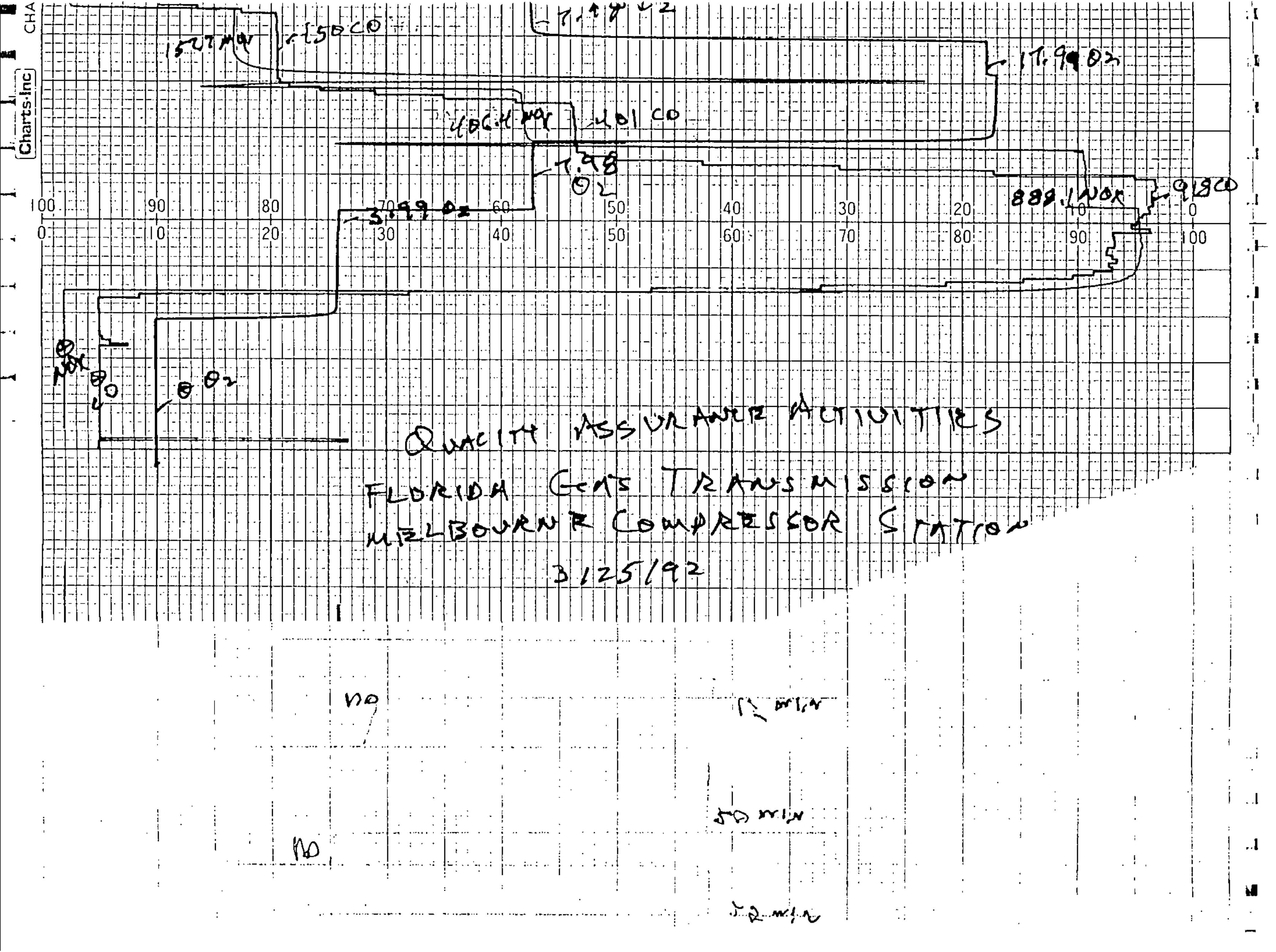
Moisture Content via Stoichiometry

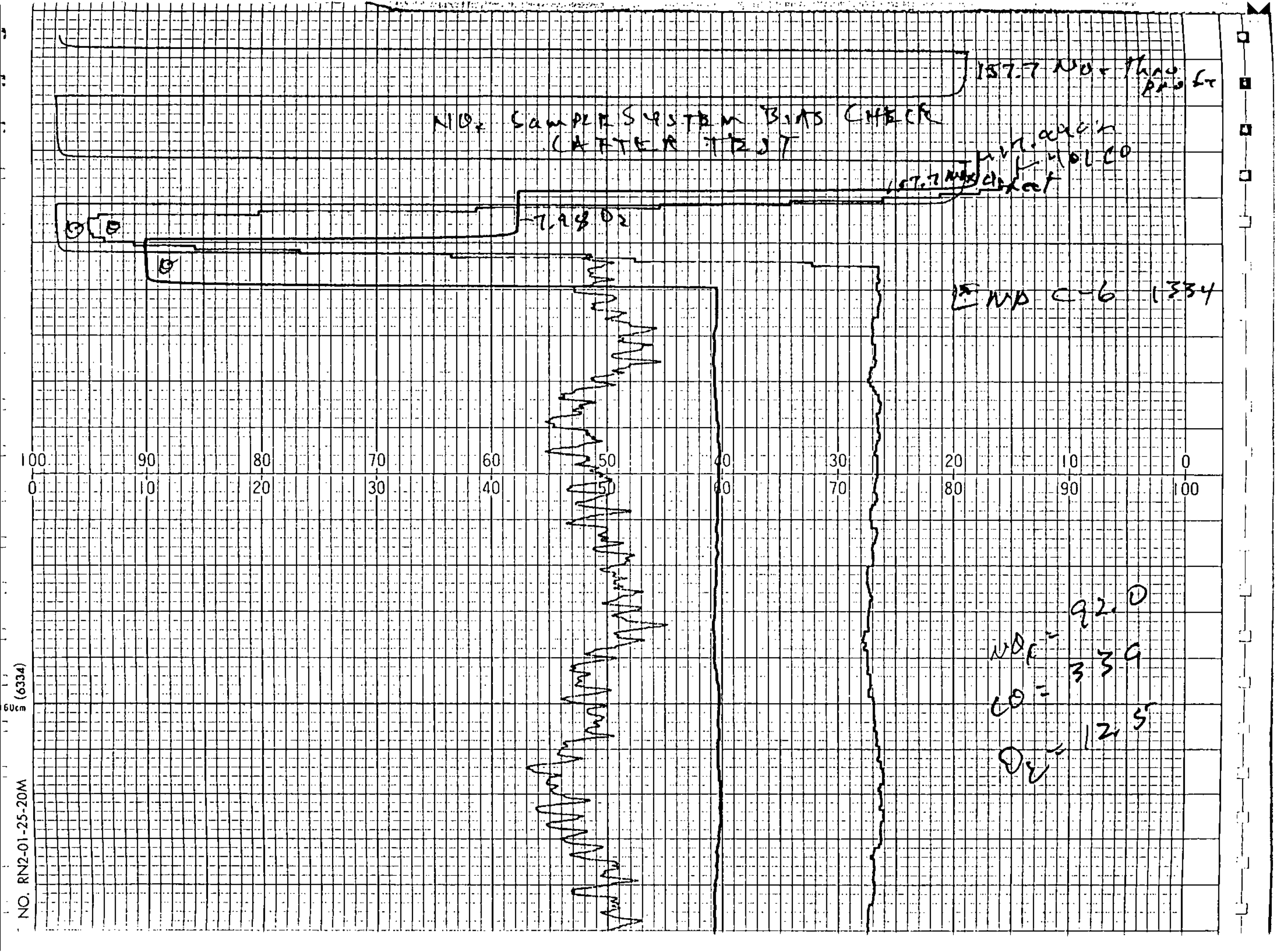
Refers to test run #1

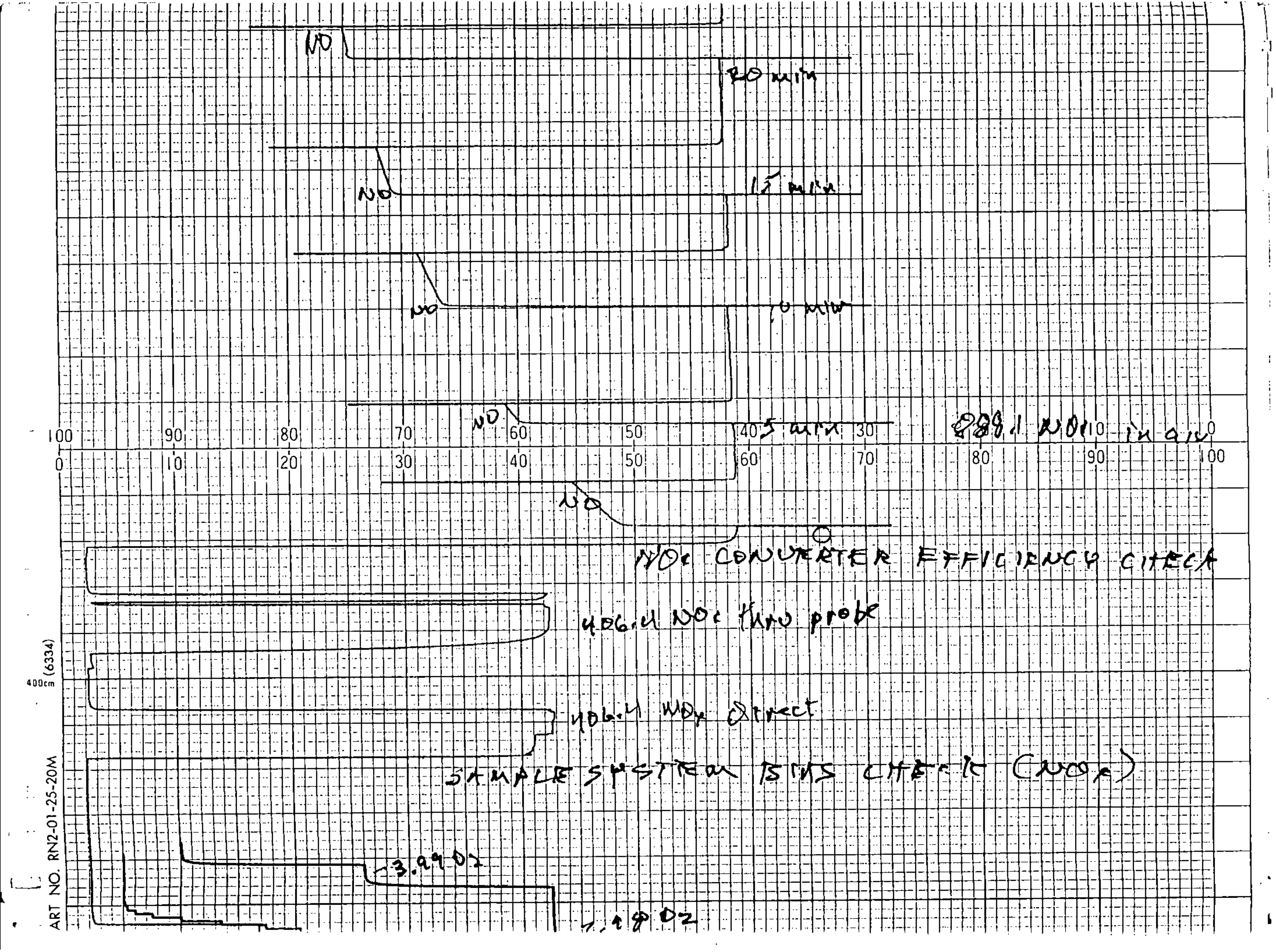
H = Ambient humidity (via psychrometer) = 0.0107 lb/lb air
O_2 = O_2 concentration in stack = 12.20%
F = wet basis O_2 F-factor (from fuel calcs)
= 10643 SCF/MMBTU
FW = moisture F-factor = 2008 SCF of H_2O/MMBTU
CM = combustion moisture % at 0% O_2
= Fw / F x 100 = 2008 / 10643 x 100
= 18.86 %

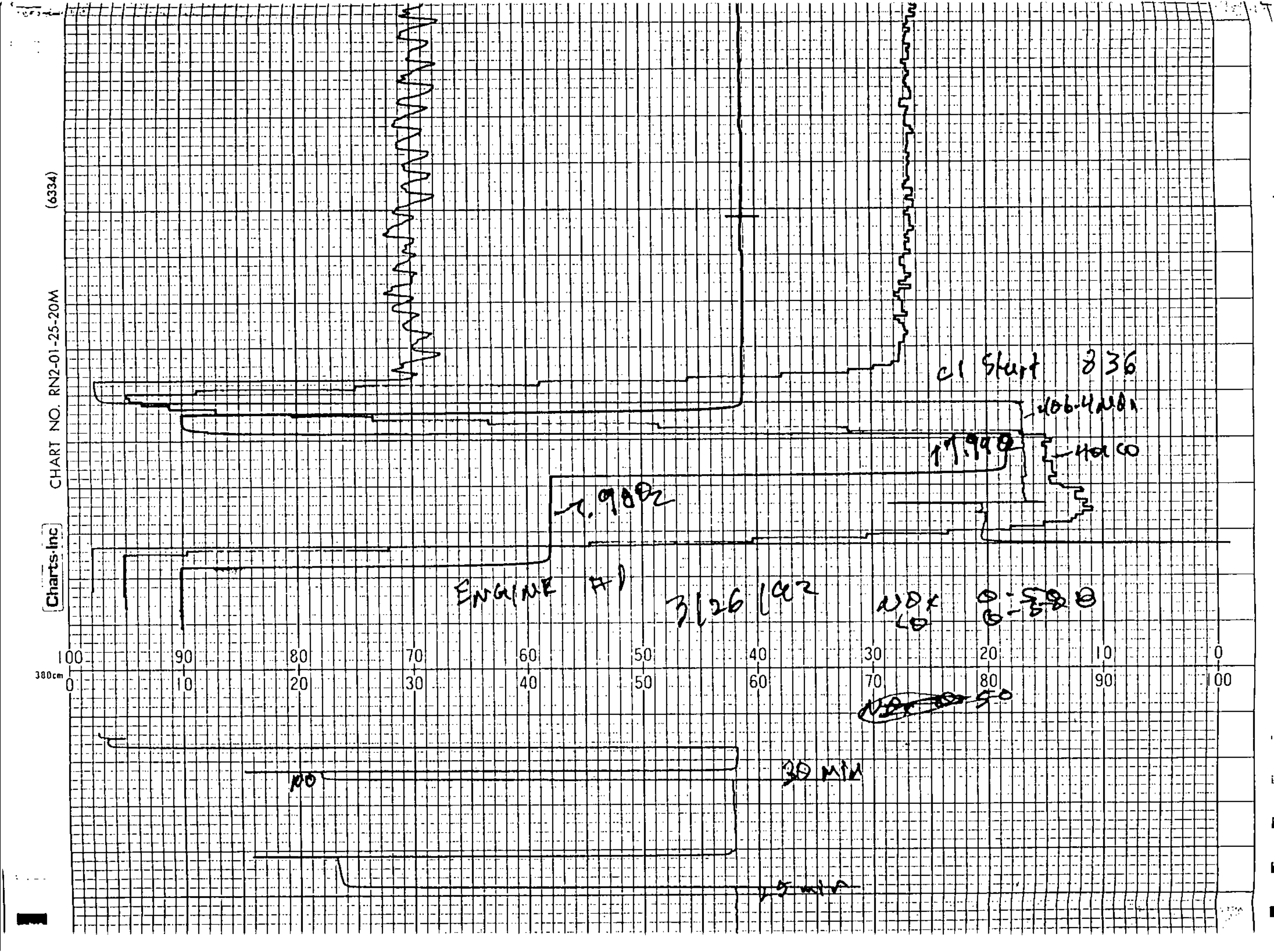
Fw = moisture content
= (CM x (20.9 - O2)/20.9) + (H x 64.3)
= (18.86 x (20.9 - 12.20)/20.9) + (.0107 x 64.3)
= 8.54%

APPENDIX C:
QUALITY ASSURANCE ACTIVITIES

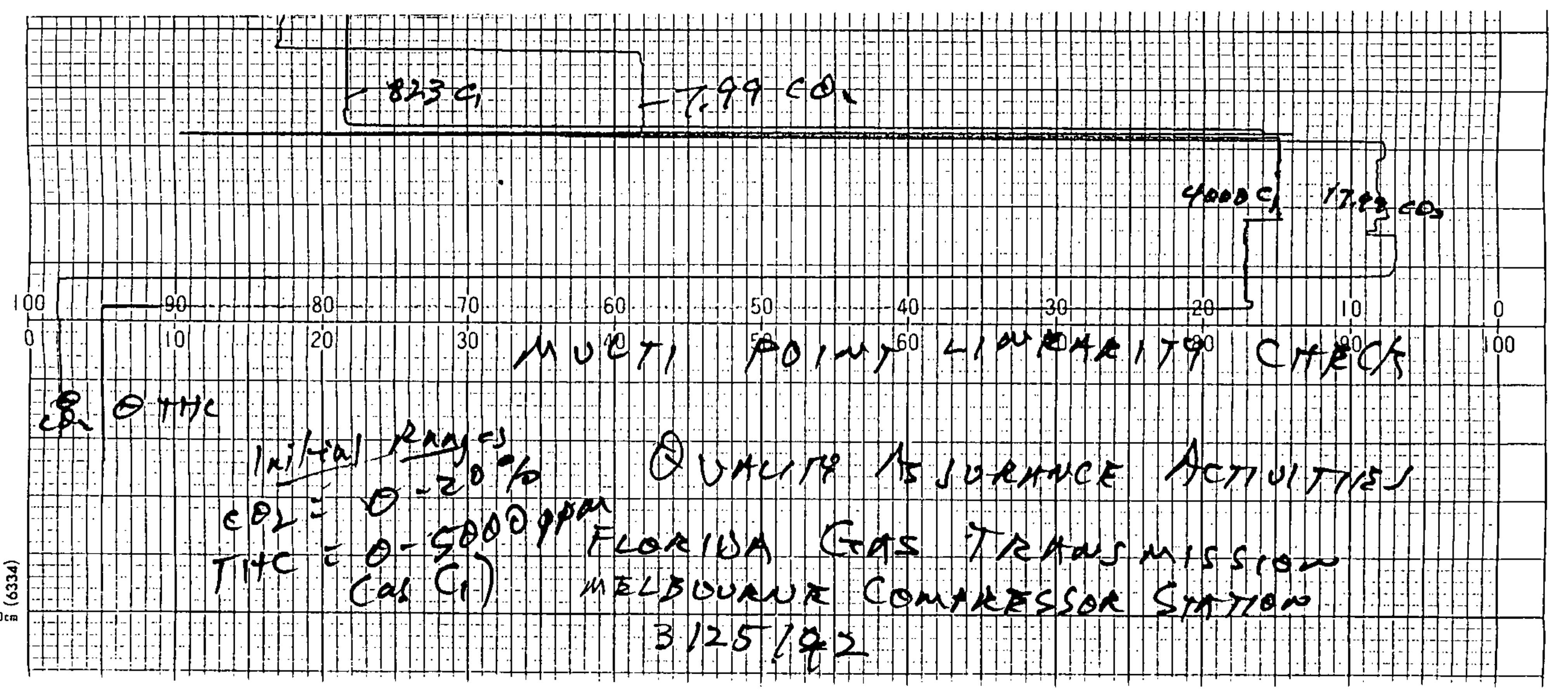

Charts·Inc
152.7 NOx
150 CO
17.99 O2
406.4 NOx
401 CO
7.98 O2
3.99 O2
889.1 NOx
918 CO
0 NOx
0 CO
0 O2
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
QUALITY ASSURANCE ACTIVITIES
FLORIDA GAS TRANSMISSION
MELBOURNE COMPRESSOR STATION
3/25/92
NO
NO


NOx SAMPLE SYSTEM BIAS CHECK
(AFTER TEST)
157.7
7.98 O2
NO C-6 1334
NOx = 92.0
CO = 339
O2 = 12.5
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
NO. RN2-01-25-20M
(6334)
60cm


NO
20 min
NO
15 min
NO
10 min
NO
5 min
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
NO in air
NO
NOx CONVERTER EFFICIENCY CHECK
406.4 NOx thru probe
406.4 NOx direct
SAMPLE SYSTEM BIAS CHECK (NOx)
3.99 O2
(6334)
400cm
ART NO. RN2-01-25-20M



(6334)
CHART NO. RN2-01-25-20M
Charts·Inc
cl Start 836
ENGINE #1
30 MIN
NO
100 90 80 70 60 50 40 30 20 10 0
380cm 0 10 20 30 40 50 60 70 80 90 100


823 C1
7.99 CO2
4000 C1
17.98 CO2
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
MULTI POINT LINEARITY CHECK
CO2 0 THC
Initial Ranges
CO2 = 0-20%
THC = 0-5000 ppm
Cal C1
QUALITY ASSURANCE ACTIVITIES
FLORIDA GAS TRANSMISSION
MELBOURNE COMPRESSOR STATION
3/25/92
(6334)
320cm

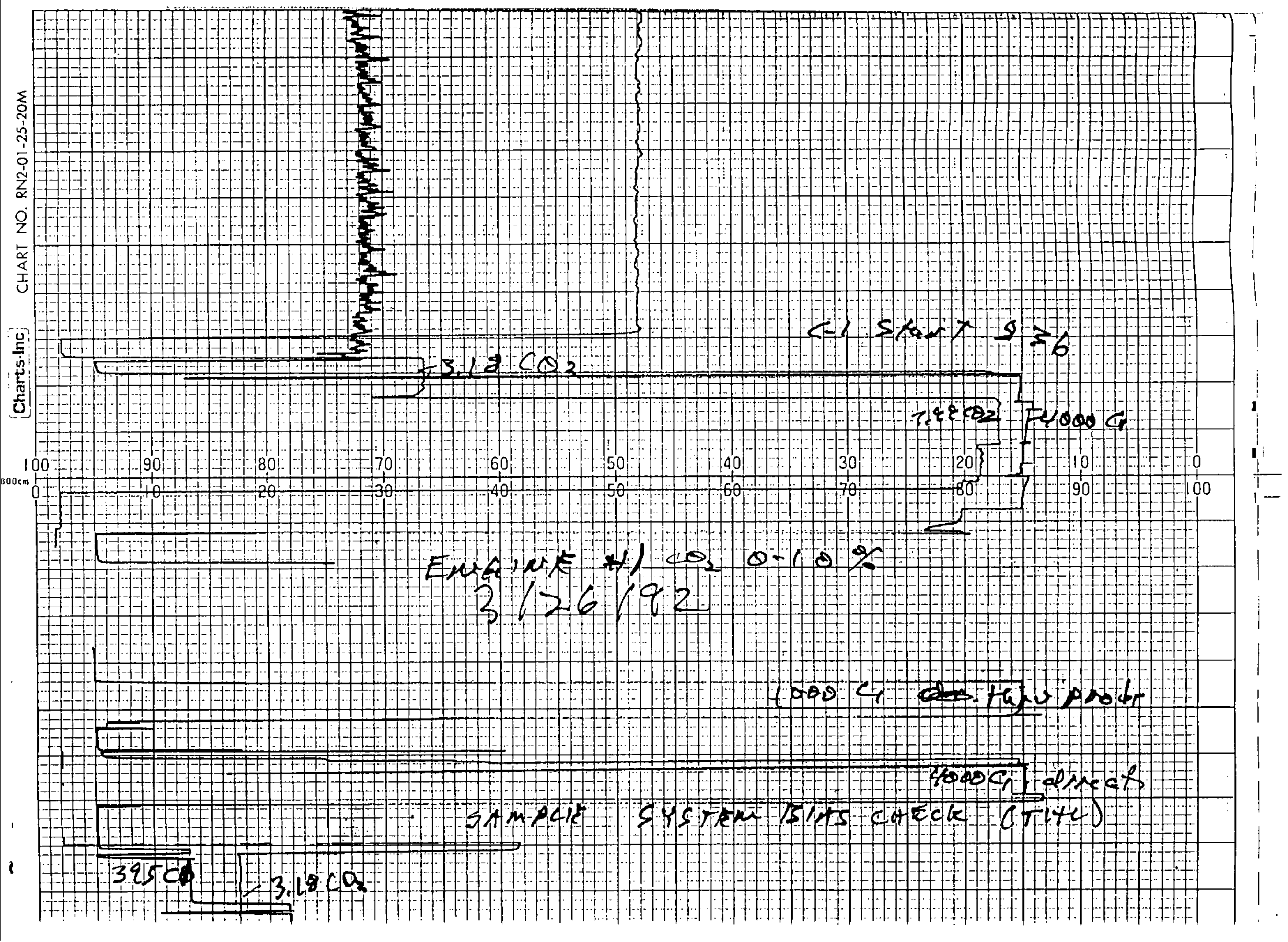
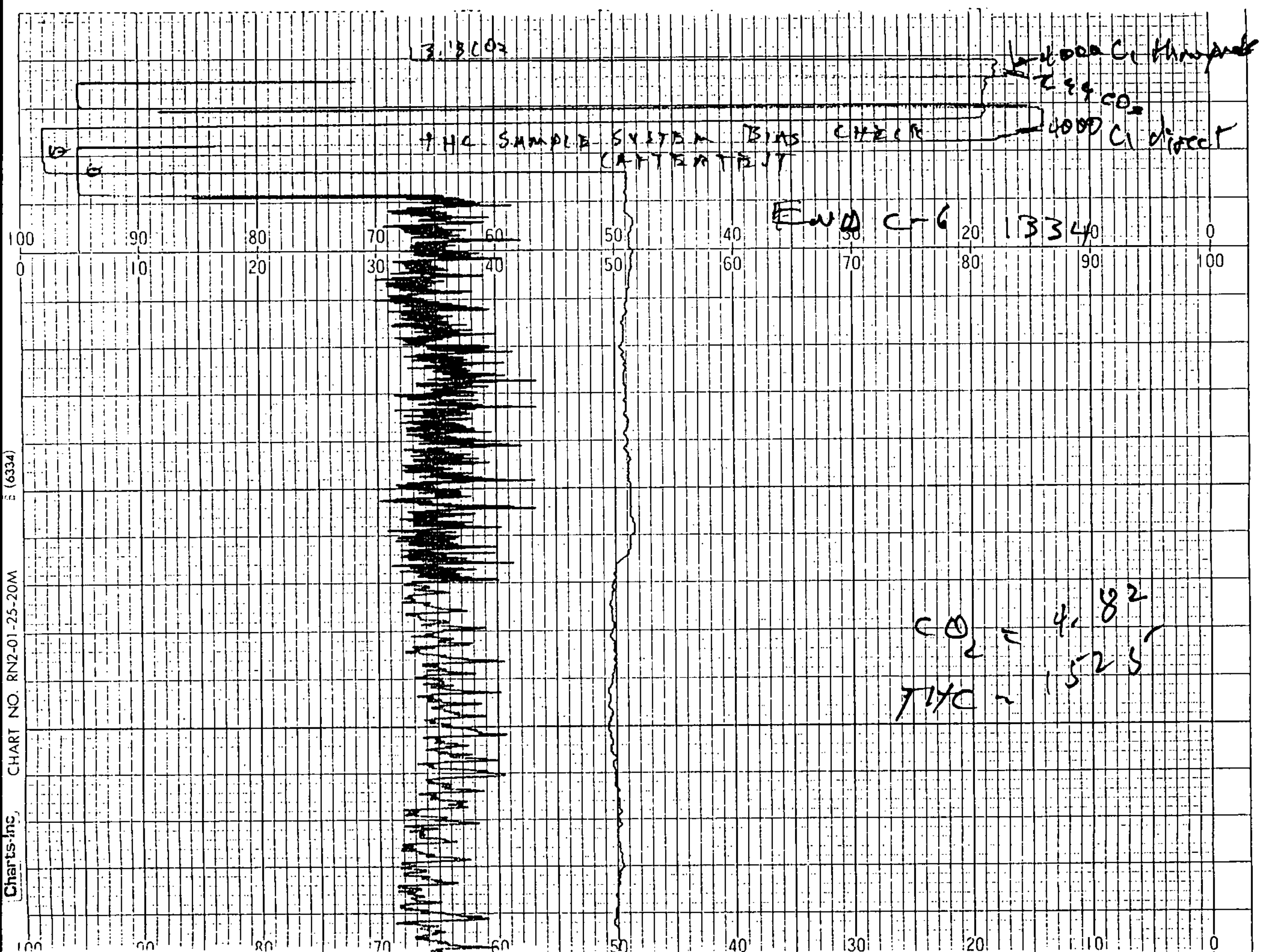


CHART NO. RN2-01-25-20M
Charts Inc
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
800cm
C1 Start 9 36
3.18 CO2
7.88 CO2
4000 C1
ENGINE #1 CO2 0-10%
3/26/92
4000 C1 thru probe
4000 C1 direct
SAMPLE SYSTEM BIAS CHECK (T144)
395 CO2
3.18 CO2



3.18 CO2
4000 C1 thru probe
4000 C1 direct
THC SAMPLE SYSTEM BIAS CHECK
(AFTER TEST)
END C-6 1334
CO2 = 4.82
THC ≈ 1525
100 90 80 70 60 50 40 30 20 0
0 10 20 30 40 50 60 70 80 90 100
Charts-Inc. CHART NO. RN2-01-25-20M (6334)

Quality Assurance Worksheet: Melbourne Compressor Station

	CERTIFIED GAS INPUT		INITIAL CALIBRATION & LINEARITY CHECK		TEST	ZERO and SPAN CALIBRATION CHECK		TEST	ZERO and SPAN CALIBRATION CHECK		TEST	ZERO and SPAN CALIBRATION CHECK	
	Concentration (% or ppm)	Target (% Chart)	Initial (% Chart)	Difference (% Chart)	RUN #C1	Final (% Chart)	Drift (% Chart)	RUN #C2	Final (% Chart)	Drift (% Chart)	RUN #C3	Final (% Chart)	Drift (% Chart)
NOx					Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	2.0	2.0	0.0	136.0	2.3	0.3	141.0	2.0	0.0	147.0	2.2	0.2
low	157.7	17.8	17.8	0.0	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	406.4	42.6	41.9	-0.7	29.2	81.6	-1.7	30.2	83.4	0.1	31.4	84.0	0.7
high	888.1	90.8	90.7	-0.1		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	1000.0				500.0			500.0			500.0		
CO					Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	5.0	5.0	0.0	342.0	5.0	0.0	345.0	5.0	0.0	355.0	5.0	0.0
low	150.0	20.3	20.6	0.3	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	401.0	45.3	46.3	1.0	73.4	85.6	0.4	74.0	85.2	0.0	76.0	85.4	0.2
high	918.0	96.5	96.5	0.0		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	1000.0				500.0			500.0			500.0		
O2					Avg.%			Avg.%			Avg.%		
zero	0.0	10.0	10.0	0.0	12.20	10.0	0.0		10.1	0.1	11.90	10.1	0.1
low	3.99	26.0	26.1	0.1	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	7.98	41.9	42.5	0.6	58.8	42.3	0.4	10.0	42.4	0.5	57.6	42.3	0.4
high	17.90	81.6	82.1	0.5		82.0	0.4		82.0	0.4		82.0	0.4
full scale	25.0				25.0			25.0			25.0		
CO2					Avg.%			Avg.%			Avg.%		
zero	0.0	2.0	2.0	0.0	5.04	2.2	0.2	5.10	2.0	0.0	5.08	2.0	0.0
low	3.18	17.8	17.4	-0.4	% Chart	33.0	-0.8	% Chart	33.2	-0.6	% Chart	33.0	-0.8
mid	7.99	42.0	41.9	-0.1	52.4	82.9	1.0	53.0	81.4	-0.5	52.8	81.2	-0.7
high	17.99	92.0	91.8	-0.1		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	20				10.0			10.0			10.0		
THC					Avg. ppmv			Avg. ppmv			Avg. ppmv		
zero	0.0	5.0	5.0	0.0	1135	5.0	0.0	1195	5.0	0.0	1140	6.8	1.8
low	395	12.9	13.1	0.2	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	823	21.5	21.8	0.3	27.7	n.a.	n.a.	28.9	n.a.	n.a.	27.8	n.a.	n.a.
high	4000	85.0	85.0	0.0		84.4	-0.6		85.7	0.7		86.7	1.7
full scale	5000				5000			5000			5000		

	CERTIFIED GAS INPUT		TEST RUN #C4	ZERO and SPAN CALIBRATION CHECK		TEST RUN #C5	ZERO and SPAN CALIBRATION CHECK		TEST RUN #C6	ZERO and SPAN CALIBRATION CHECK	
	Concentration (% or ppm)	Target (% Chart)		Final (% Chart)	Drift (% Chart)		Final (% Chart)	Drift (% Chart)		Final (% Chart)	Drift (% Chart)
NOx			Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	2.0	66.0	2.0	0.0	79.4	1.8	-0.2	92.0	2.1	0.1
low	157.7	17.8	% Chart	n.a..	n.a.	% Chart	81.6	0.8	% Chart	81.0	0.2
mid	406.4	42.6	15.2	81.4	-1.9	41.7	n.a.	n.a.	48.0	n.a.	n.a.
high	888.1	90.8		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	1000.0		500.0			200.0			200.0		
CO			Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	5.0	334.0	5.0	0.0	340.0	5.0	0.0	339.0	5.0	0.0
low	150.0	20.3	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	401.0	45.3	71.8	85.4	0.2	73.0	85.4	0.2	72.8	85.5	0.3
high	918.0	96.5		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	1000.0		500.0			500.0			500.0		
O2			Avg.%			Avg.%			Avg.%		
zero	0.0	10.0	12.53	10.0	0.0	12.48	10.0	0.0	12.50	10.0	0.0
low	3.99	26.0	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	7.98	41.9	60.1	42.3	0.4	59.9	42.3	0.4	60.0	42.2	0.3
high	17.90	81.6		82.2	0.6		82.2	0.6		82.1	0.5
full scale	25.0		25.0			25.0			25.0		
CO2			Avg.%			Avg.%			Avg.%		
zero	0.0	2.0	4.85	2.0	0.0	4.74	2.0	0.0	4.82	2.1	0.1
low	3.18	17.8	% Chart	32.9	-0.9	% Chart	32.8	-1.0	% Chart	33.1	-0.7
mid	7.99	42.0	50.5	83.2	1.3	49.4	81.6	-0.3	50.2	81.2	-0.7
high	17.99	92.0		n.a.	n.a.		n.a.	n.a.		n.a.	n.a.
full scale	20		10.0			10.0			10.0		
THC			Avg. ppmv			Avg. ppmv			Avg. ppmv		
zero	0.0	5.0	1350	5.0	0.0	1550	5.0	0.0	1525	5.0	0.0
low	395	12.9	% Chart	n.a.	n.a	% Chart	n.a.	n.a.	% Chart	n.a.	n.a.
mid	823	21.5	32.0	n.a.	n.a.	36.0	n.a.	n.a.	35.5	n.a.	n.a.
high	4000	85.0		84.7	-0.3		86.1	1.1		86.0	1.0
full scale	5000		5000			5000			5000		

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: Type Gas	Test Gas: Concentration	Analyzer Response: Concentration (ppmv)	Analyzer Response: % of Range	Response Ratio	
Air	CO Free	0.0	N/A		
CO_2/O_2	4%/18%	0.0		0.000	ppmv/%
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	ppmv/ppmv
NOx	3030 ppmv	0.4		0.0001	
SO_2	401 ppmv	-0.2		0.0005	
Propane	240 ppmv	0.4		0.002	

all interferences are negligible

TR 7 O_2 ANALYZER

Continous Emission Analyzer Interference Response Tests

Date: 1/16/92
Technician: LF

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

Test Gas		Analyzer Response		Response
Type Gas	Concentration	Concentration	% of Range	Ratio
CO	471 ppm	<.05%	<.5	
SO_2	348 ppm	<.05%	<.5	
CO_2	8%	<.05%	<.5	
NO_x	898 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: 0-24

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

Response Time Data Sheet

Date: 3/14/89
Plant: — Austin Office
Technician: MM/DC
Sample Manifold Press.: 6 psi
Sample Line Length: 140 ft.
Pump Model No.: 6-3 Dia-pump

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

Comments:

3/8" Sample line
Igloo Condenser

Instrumental Analysis
Quality Assurance Data

Date: 3/25/92
Plant: FGT MELBOURNE COMPRESSOR STATION
Technician: LF JR R/C

NOx Analyzer: NO2 to NO Converter Efficiency Test

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

	NOx Concentration (ppm)	% Decrease from Initial Concentration	NO Concentration (ppm)
Initial Concentration	568	n.a.	425
10 minute Concentration	563	0.9	370
20 minute Concentration	559	1.6	230
30 minute Concentration	558	1.8	196

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					
Before	NOx	406.4	1000	408.0	405.0	-0.3%
	SO2					
After	NOx	157.7	200	158	158	0%
Before	THC	4000	5000	4000	4000	0%
After	THC	4000	5000	4050	3925	-2.5%

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

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

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

Page 1

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

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

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

APPENDIX D:
CALIBRATION CERTIFICATIONS

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

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

Shipped From : Scott Michigan

Our Project # : 520006

Your P.O. # : 91004

Expiration Date : 8-18-92

Cylinder Number AAL-9912

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 # 81

File # P08274

Certified Accuracy 1 % NBS Traceable

EPA PROTOCOL CERTIFIED

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

BALANCE GAS : NITROGEN

NITROGEN DIOXIDE 1.77 PPM

FIRST ANALYSIS DATE : 2-11-91

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	(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.

Analyst ... Approved ... Shapiro

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

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

Shipped From : Scott Michigan

Our Project # : 532228

Your P.O. # : 92 0000

Expiration Date : 7-21-93

Cylinder Number : AAL5112

Cylinder Pressure 1900 psig

1 of 1 Component(s)

Customer :
CUBIX CORPORATION
9225 LOCKHART HWY
AUSTIN TX 78747

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

Certified Per Traceability Protocol # 1

Procedure # G1

File # PO-2143

Certified Accuracy 1 % NBS Traceable

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

BALANCE GAS : NITROGEN

NITROGEN DIOXIDE 0.00 PPM (FROM SECOND ANALYSIS)

FIRST ANALYSIS DATE : 1-15-92

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

CALCULATED RESULTS 406.9 / 406.9 / 406.9

AVERAGE : 406.9 PPM

SECOND ANALYSIS DATE : 1-21-92

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

CALCULATED RESULTS 405.9 / 405.9 / 405.9 405.9 PPM NOX

AVERAGE : 405.9 PPM

CALIBRATION CURVE 1 ST DEGREE

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

Scott Specialty Gases Scott Environmental Technology, Inc.

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)

FIRST ANALYSIS DATE : 1-21-91

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	(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.	(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

CERTIFIED EPA PROTOCOL

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : Paul P. Doran

Approved By : J. Shapiro

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

CERTIFIED

ANALYTICAL METHOD: GRAV.MASTER GAS

DATE OF ANALYSIS: 6/03/91

ANALYST: John D McCulloch
ANALYST

APPROVED BY: [signature]
SUPERVISOR

Scott Specialty Gases, Inc.

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

10/17/91

CUBIX CORPORATION
9225 LOCKHART HWY

AUSTIN TX 78747-0000

PROJECT #: 04-13936
PO #: 910523

CYLINDER #: AAL9308

ANALYTICAL ACCURACY: +-1%

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

ANALYTICAL METHOD: ACUBLEND MASTER

DATE OF ANALYSIS: 10/17/91

ANALYST: John R McCulloch
ANALYST

APPROVED BY: [signature]
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	
ARBON MONOXIDE	910.0	PPM	816.	PPM
ETHANE	820.0	PPM	823.	PPM
ITROGEN	BALANCE		BALANCE	

NOTES: EXP: 11/92

CERTIFIED

ANALYTICAL METHOD: ACUBLEND MASTER

DATE OF ANALYSIS: 10/22/91

ANALYST: [signature]
ANALYST

APPROVED BY: [signature] 10/23
SUPERVISOR

Scott Specialty Gases

a division of
Scott Environmental Technology, Inc.

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

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

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

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

ANALYTICAL REPORT

Cyl No. AAL17750 Analytical Accuracy ±1%

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

Cyl No. ______ Analytical Accuracy ______

Component	Concentration

Cyl No. ______ Analytical Accuracy ______

Component	Concentration

Cyl No. ______ Analytical Accuracy ______

Component	Concentration

Analyst John Lempe

Approved By [signature]

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

Matheson
Gas Products
World Leader in Specialty Gases & Equipment

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

RECEIVED JAN 1 7 1992

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

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

Gentlemen:

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

LABORATORY REPORT ON GAS ANALYSIS

1R | CYL. # SX-23633

	MIXTURE REQ.	ANALYSIS
CARBON DIOXIDE	3.20%	3.18% ± .02
OXYGEN	18.00%	17.9% ± .02
NITROGEN	BALANCE	BALANCE

1R | CYL. # SX-23625

	MIXTURE REQ.	ANALYSIS
CARBON DIOXIDE	8.00%	7.98% ± .02
OXYGEN	8.00%	7.98% ± .02
NITROGEN	BALANCE	BALANCE

1R | CYL. # SX-23652

	MIXTURE REQ.	ANALYSIS
CARBON DIOXIDE	18.00%	17.99% ± .02
OXYGEN	4.00%	3.99% ± .02
NITROGEN	BALANCE	BALANCE

CYL. # MIXTURE REQ. ANALYSIS

ACCEPTED BY

WILSON OXYGEN

Analyst JOHN K. WRIGHT

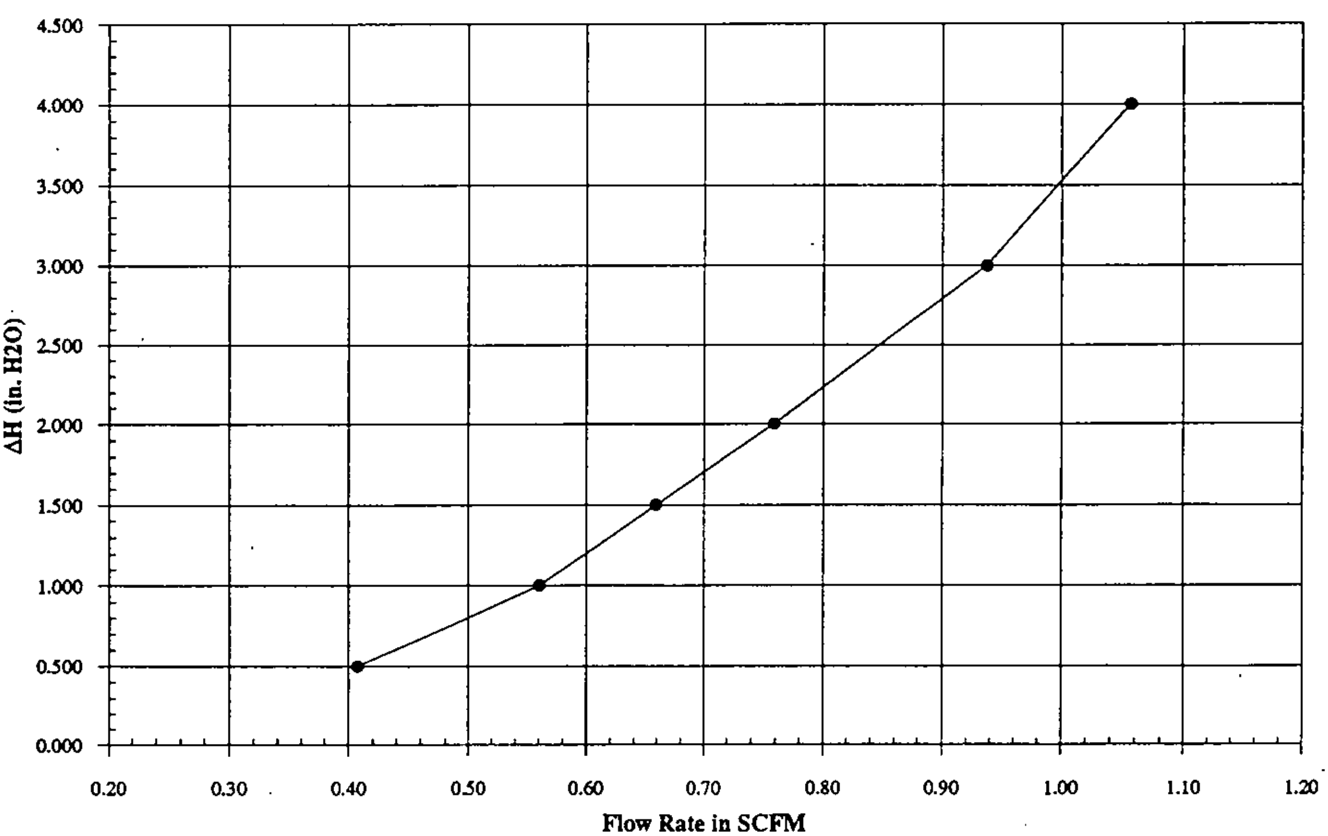
METER BOX DRY GAS METER and ORIFICE CALIBRATION

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

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

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

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



Testing by Cubix Corporation

Pitot Tube Calibration Sheet

Date: **10/22/91**
Technician: JB
Calibration pitot tube
Type: std
Size (OD): 1/4"
ID number: 450
Cp (std): 0.99
S-Type pitot tube
Size (OD): 1/4"
ID Number: 107

A-Side Calibration

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

B-Side Calibration

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

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

Calibrations Performed by Cubix Corporation, Austin, Texas

Trailer #7 Altimeter

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

BFG/C9102

COMPONENT ALTIMETER

PART NO. 5934P-1A.83

SERIAL NO. 3H909

MFG. UNITED WORK ORDER # K0687

☐ Overhaul ☐ Repair ☒ Bench Check & Test

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

Joy Lawrence
AUTHORIZED SIGNATURE

FEB 11 1992
DATE

TEL—TRU MANUFACTURING. CO.

408 ST. PAUL STREET   ROCHESTER, NY 14605 USA

CERTIFICATE OF CALIBRATION

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

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

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

TOLERANCE OF ±1% OF RANGE:
EX. 0–200°F = ±2°F

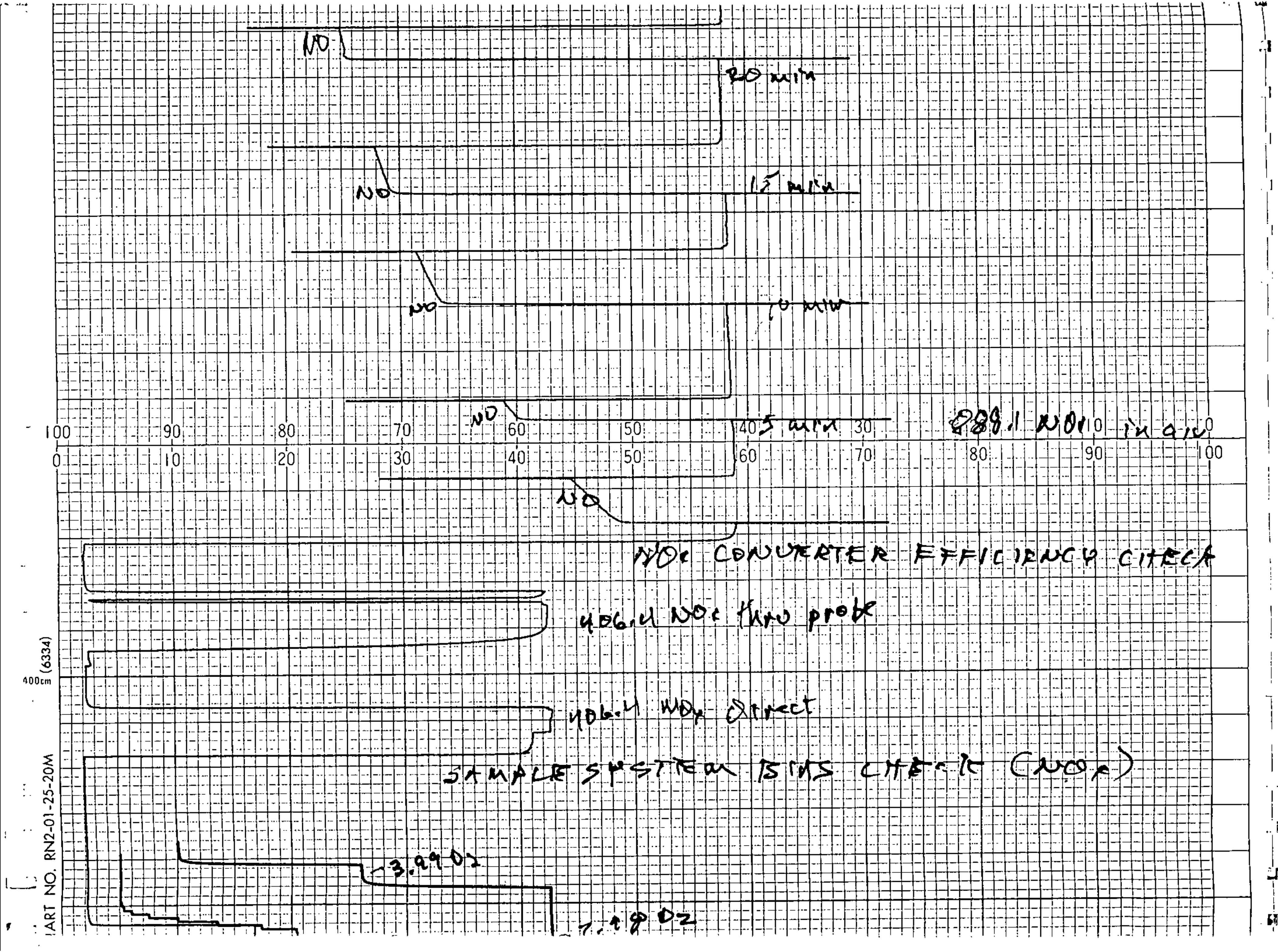
THERMOMETERS CALIBRATED AGAINST MASTER PRECISION THERMOMETERS, DIRECTLY TRACEABLE TO NATIONAL BUREAU OF STANDARDS.

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°F	100°F							
2			50°F	100°F							
3			50°F	100°F							
4			50°F	100°F							

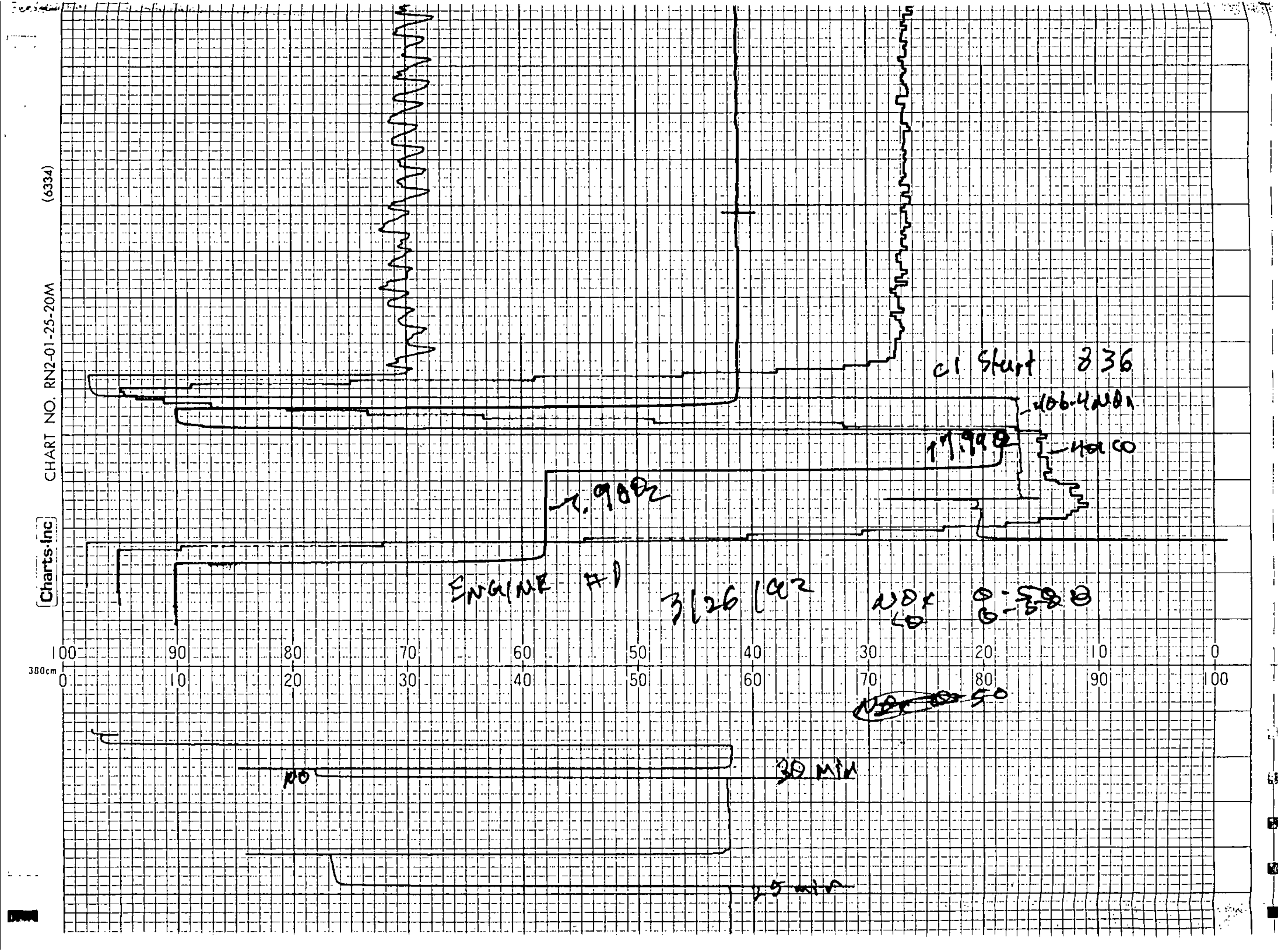
TE: 10-25-91   TESTED BY: BL   CHECKED BY:

APPENDIX E: STRIP CHART RECORDS

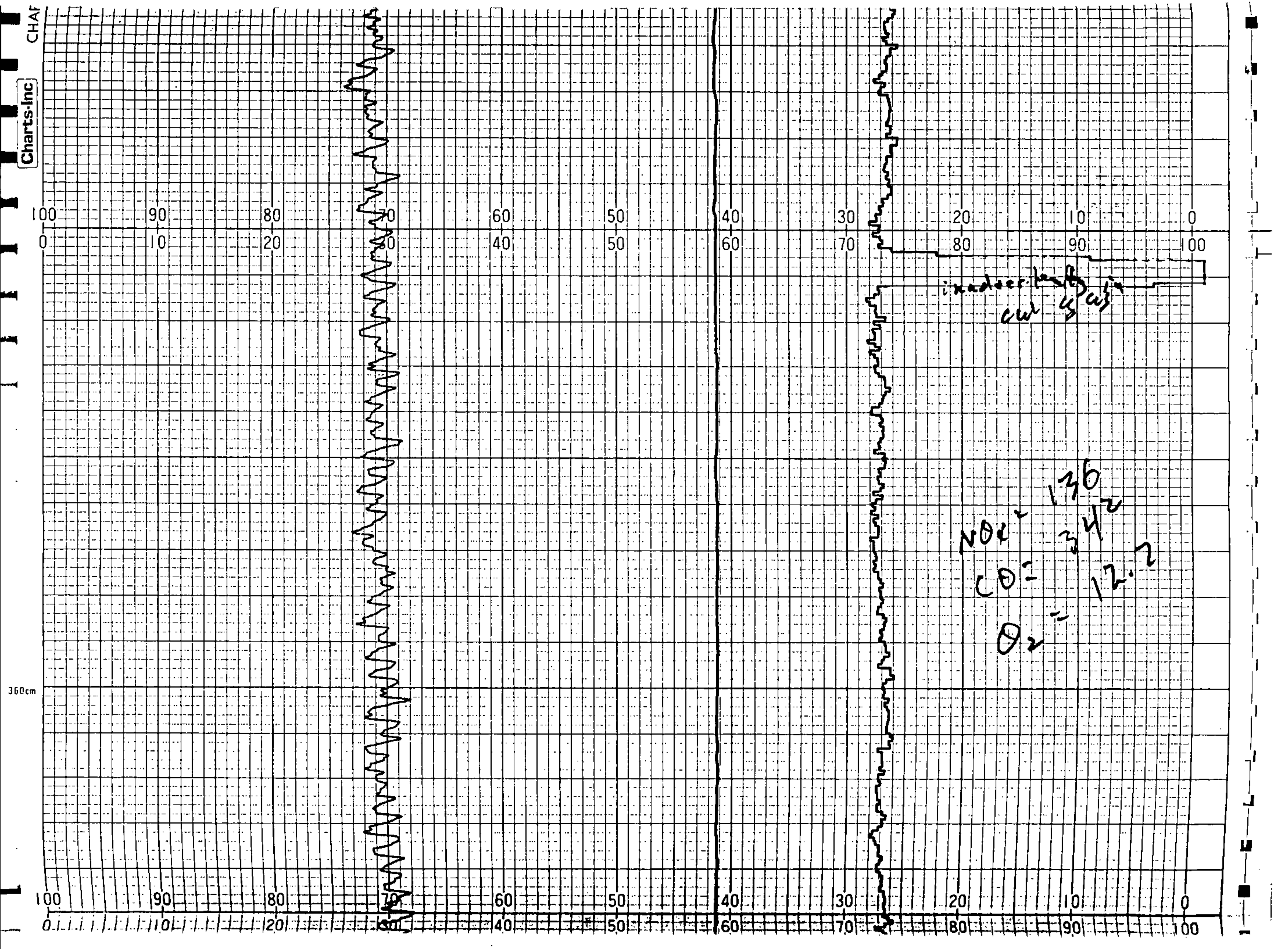
NO_x, O_2, CO

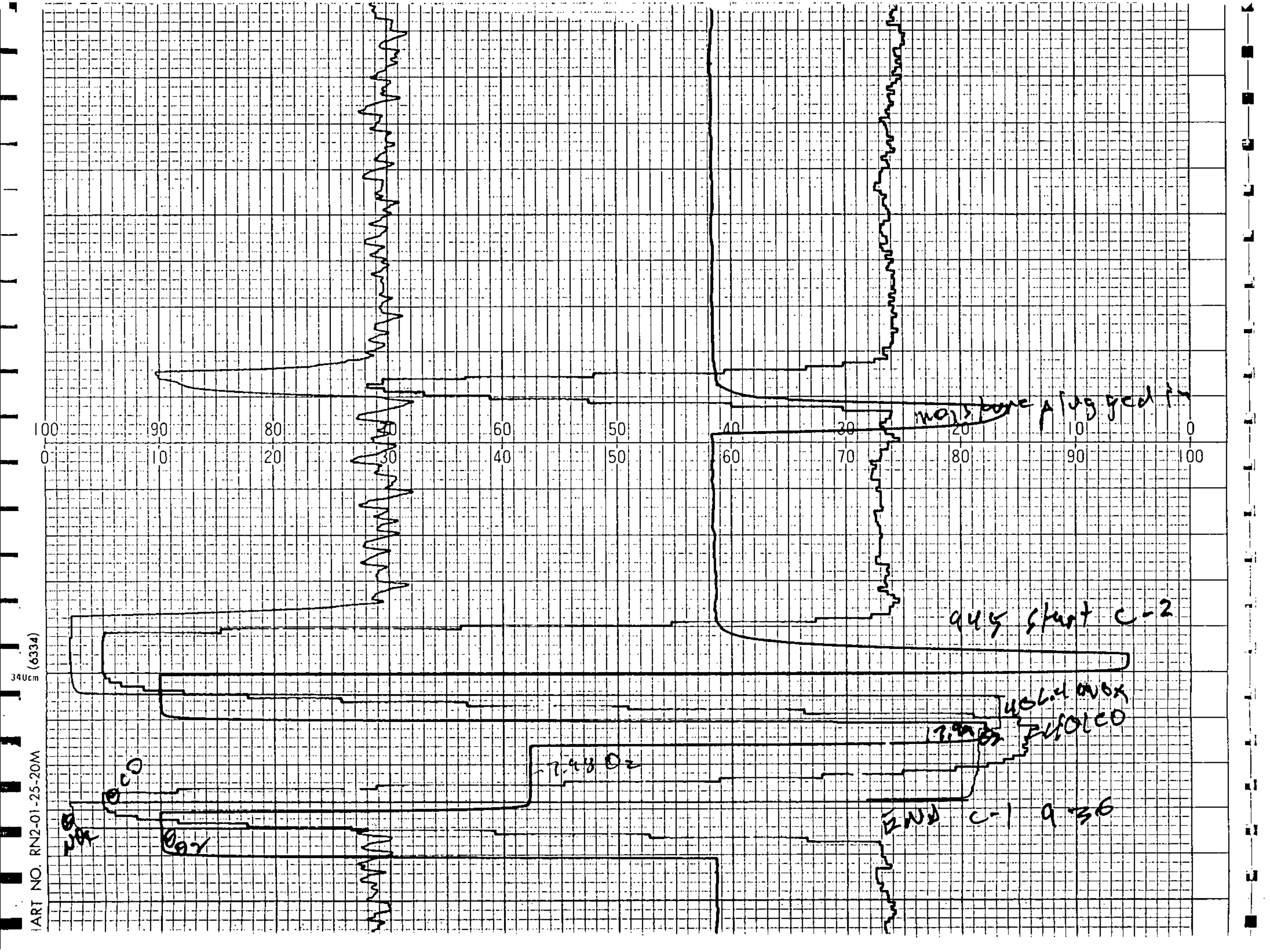


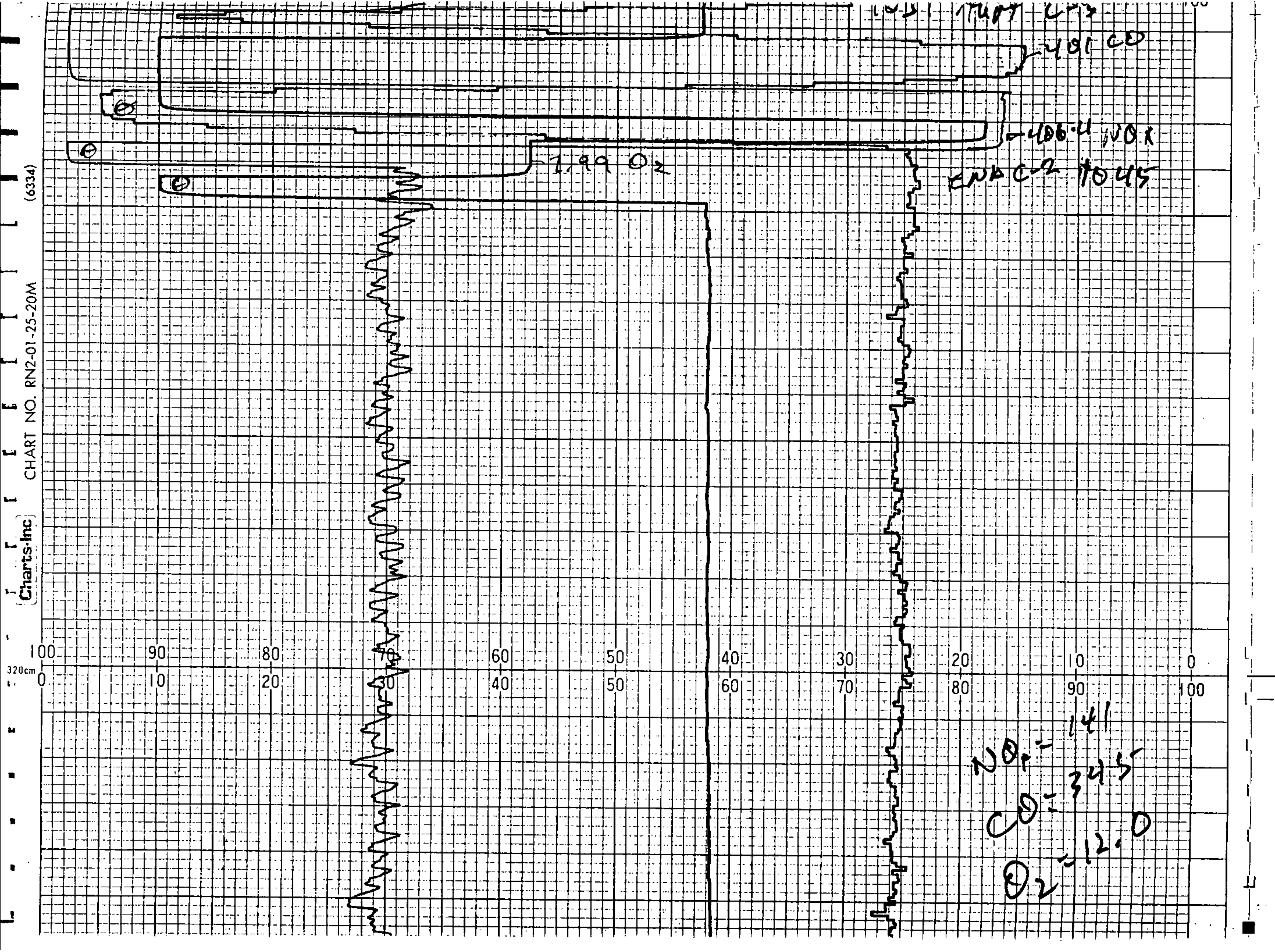
NO
20 min
NO
15 min
NO
10 min
NO
5 min
888.1 NOx in air
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
NO
NOx CONVERTER EFFICIENCY CHECK
406.4 NOx thru probe
406.4 NOx direct
SAMPLE SYSTEM BIAS CHECK (NOx)
3.99 O2
(6334)
400cm
ART NO. RN2-01-25-20M

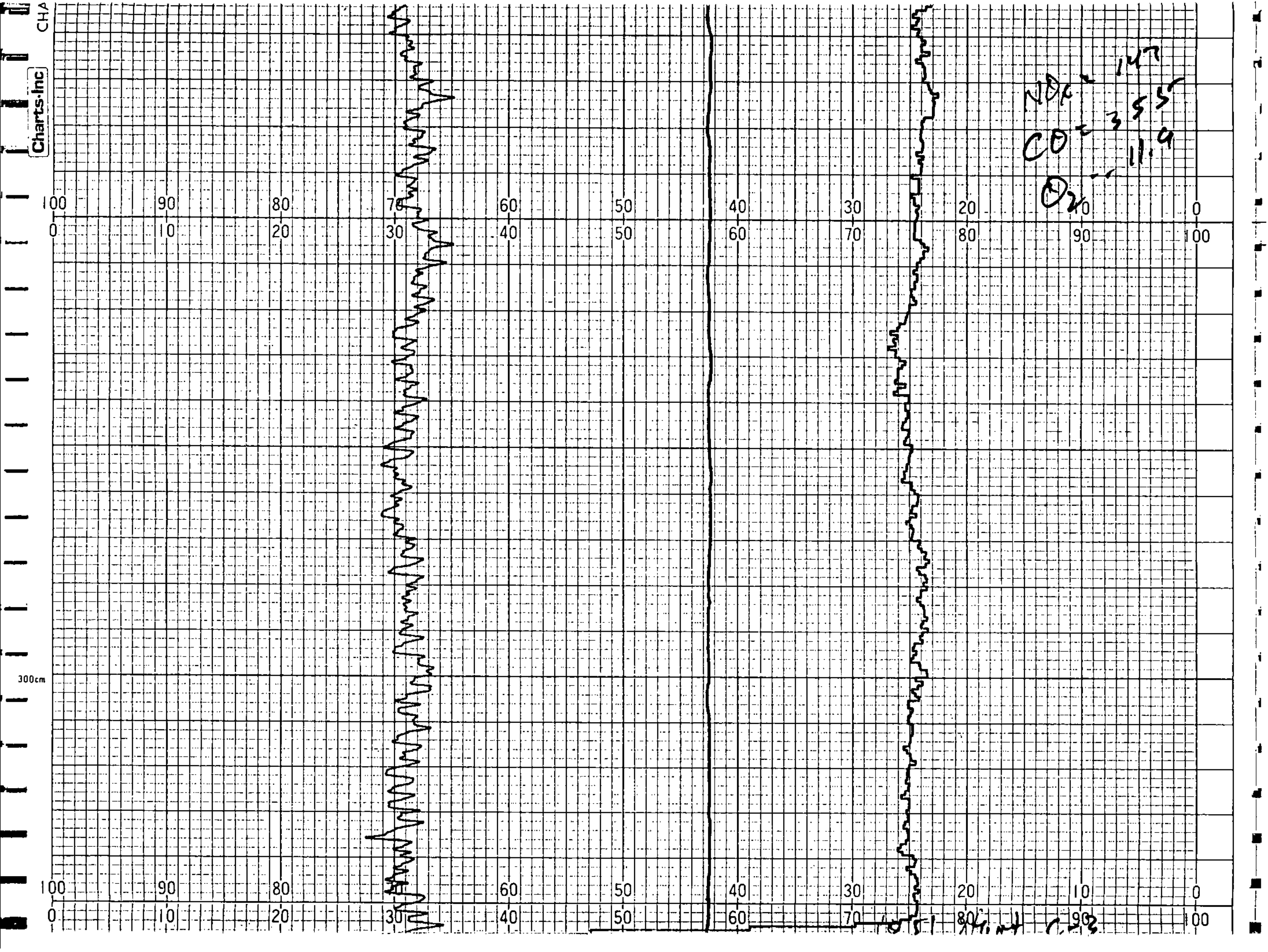


(6334)
CHART NO. RN2-01-25-20M
Charts-Inc
100 90 80 70 60 50 40 30 20 10 0
380cm
0 10 20 30 40 50 60 70 80 90 100
ENGINE #1
3/26/02
NOx
30 MIN
NO

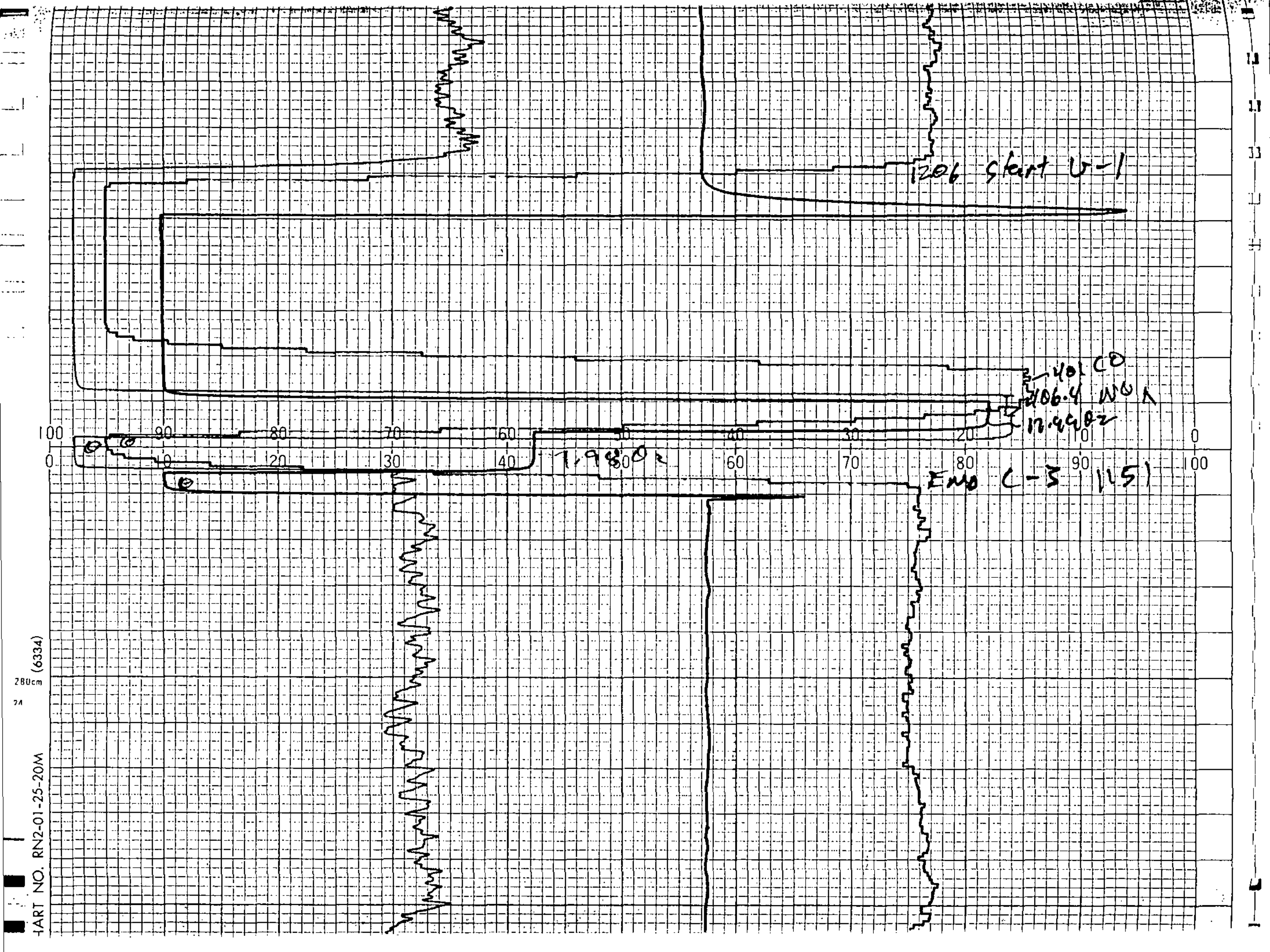

Charts-Inc
CHA
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
360cm
NOx 136
CO 34.2
O2 12.2

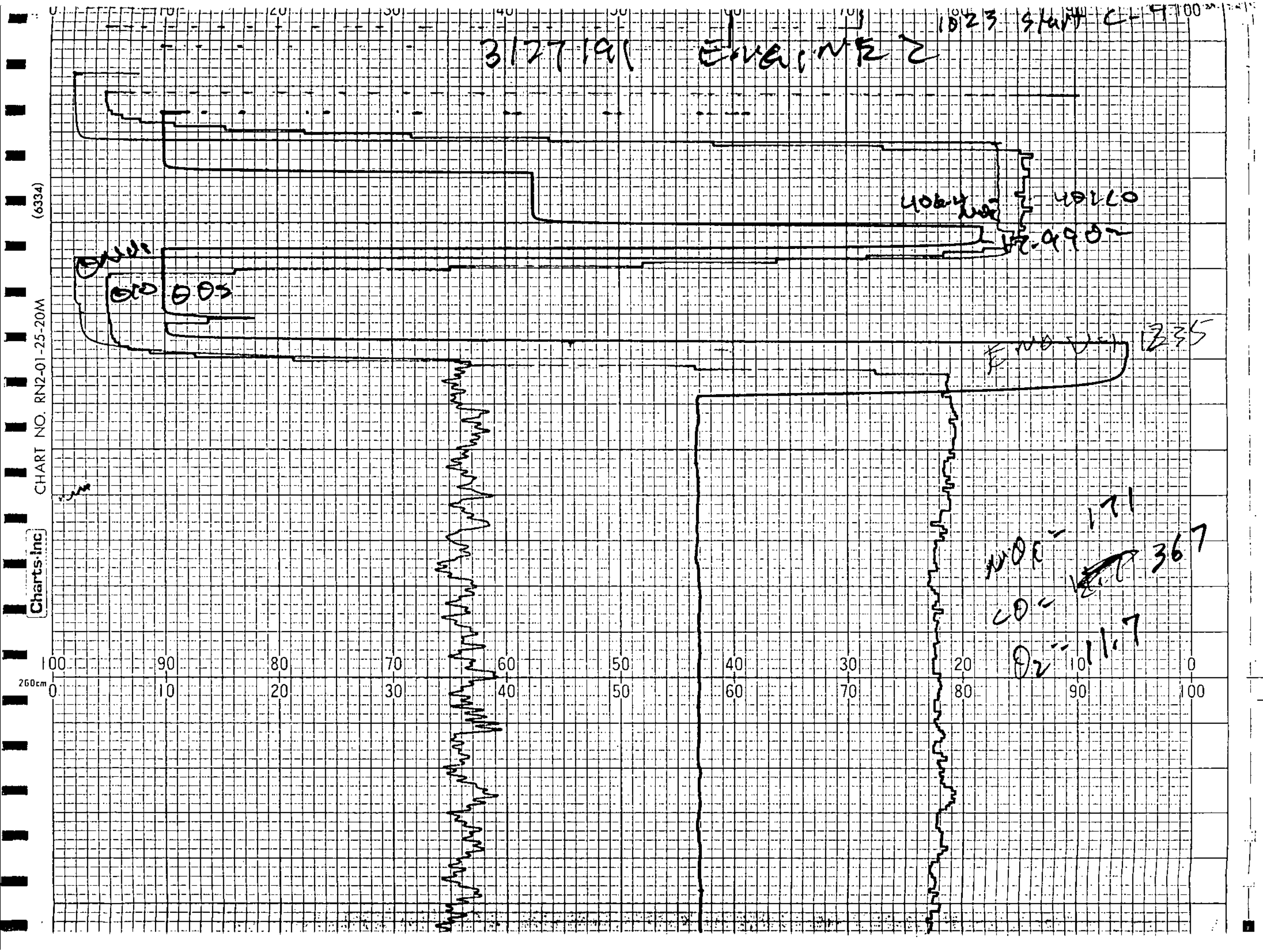

100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
(6334)
340cm
ART NO. RN2-01-25-20M
start c-2
7.98 O2
END c-1 9:36

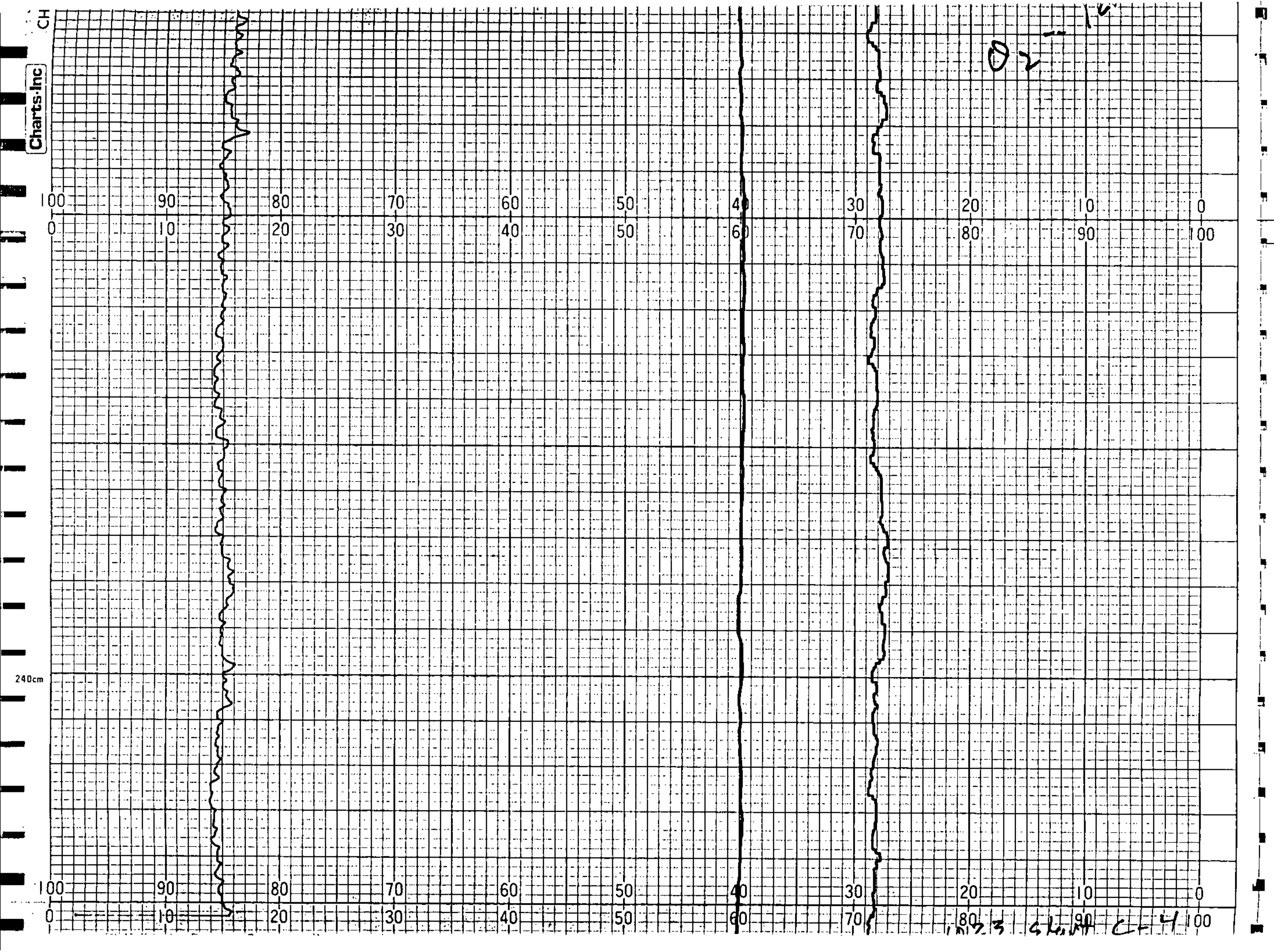

401 CO
406.4 NOx
7.99 O2
END C-2 1045
(6334)
CHART NO. RN2-01-25-20M
Charts-Inc
100 90 80 70 60 50 40 30 20 10 0
320cm
0 10 20 30 40 50 60 70 80 90 100
NOx = 141
CO = 345
O2 = 12.0

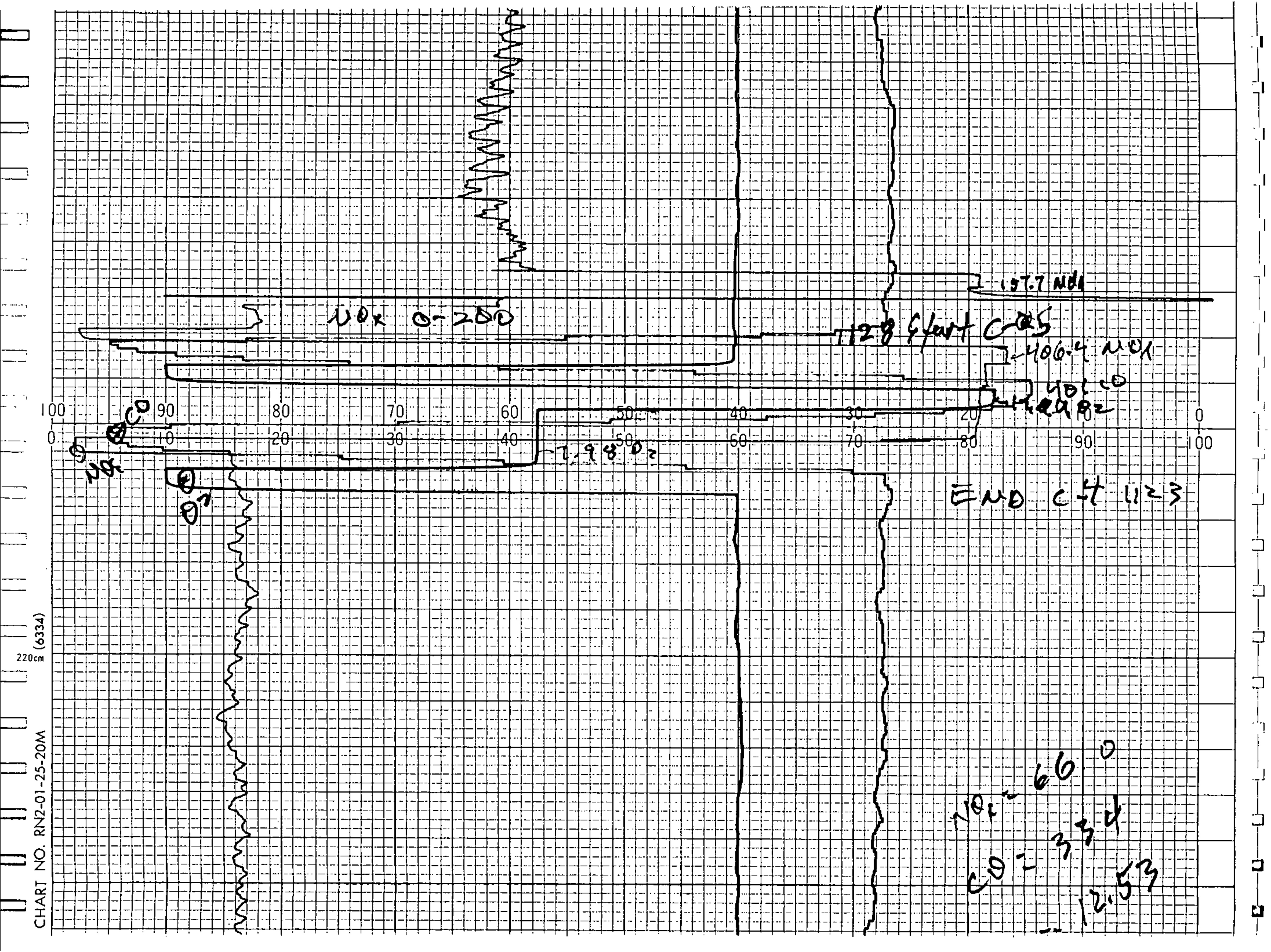


CHA
Charts-Inc
NOx = 147
CO = 355
O2 = 11.9
300cm
10:51 Start C-3


1206 Start U-1
401 CO
406.4 NO
12.44 O2
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
7.98 O2
End C-3 1151
CHART NO. RN2-01-25-20M
(6334)
280cm
24


3/27/91 ENGINE 2
1023 start
1235
NOx 171
CO 367
O2 11.7
CHART NO. RN2-01-25-20M
(6334)
Charts-Inc
260cm


CH
Charts·Inc
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
240cm
C-4



100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
NOx 0-200
197.7 NOx
1128 Start C-5
406.4 NOx
40.0 CO
1.98 O2
CO
NOx
O2
END C-4 1123
NOx ~ 66.0
CO ~ 33.4
12.53
220cm (6334)
CHART NO. RN2-01-25-20M

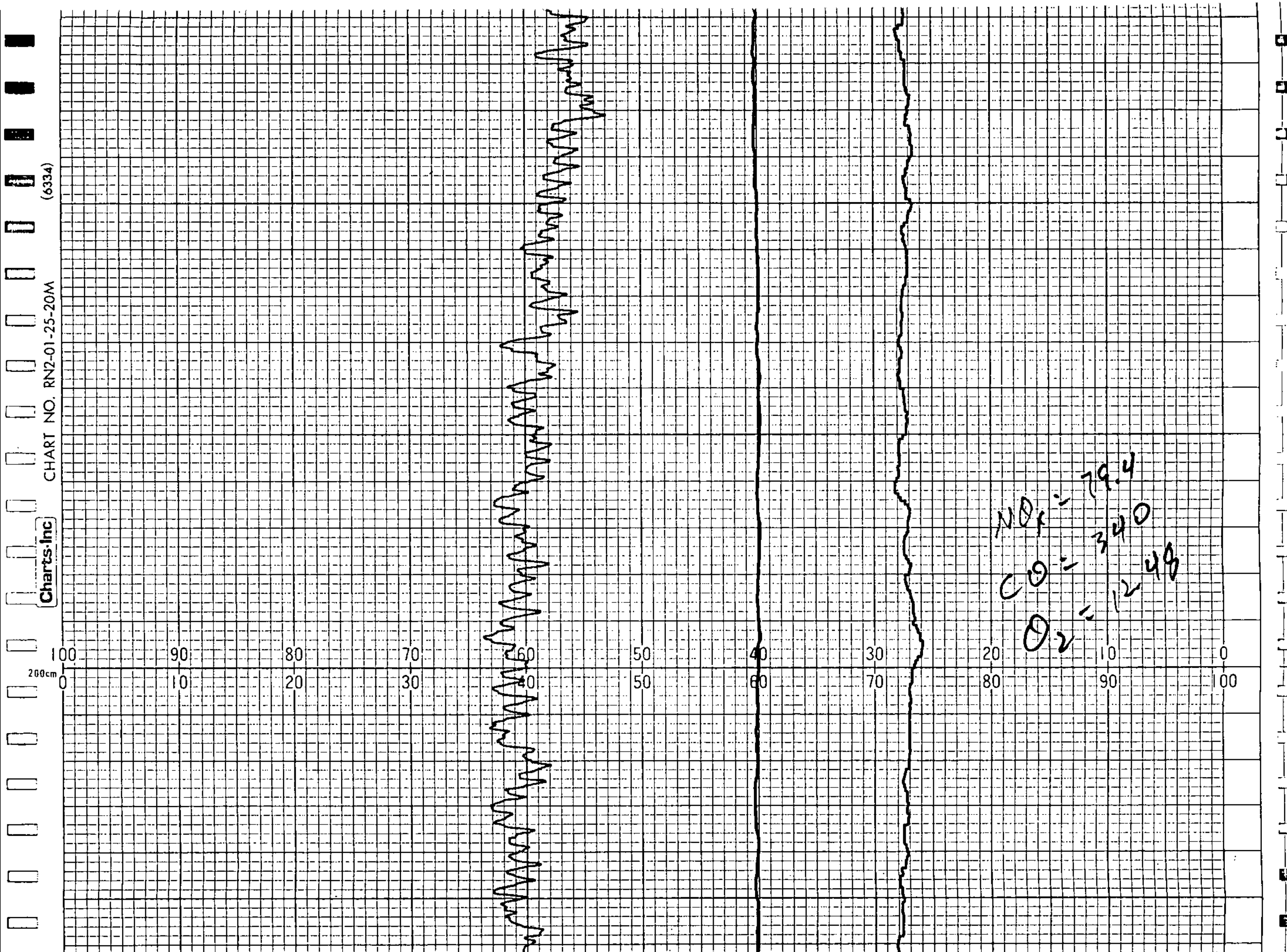
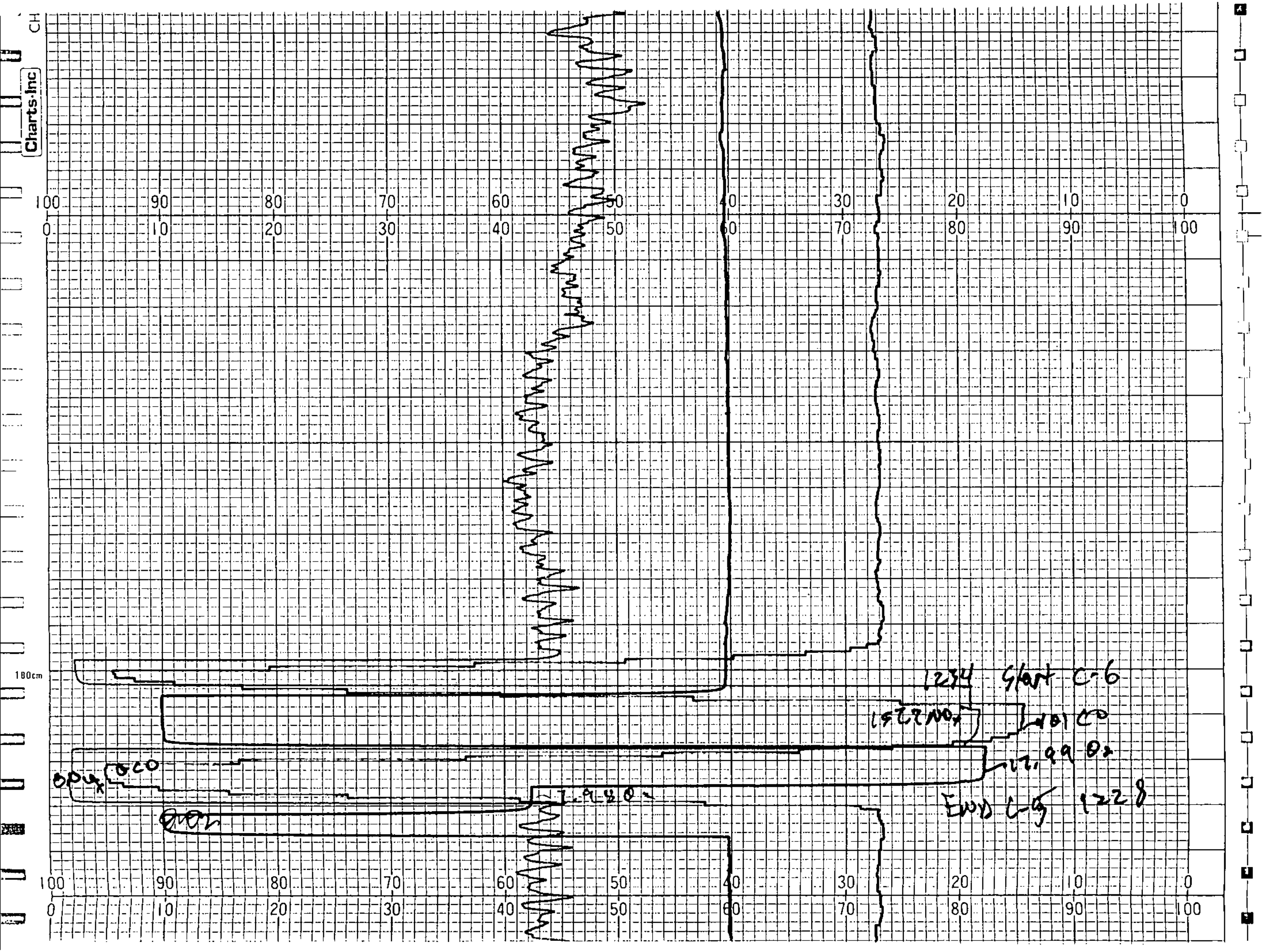
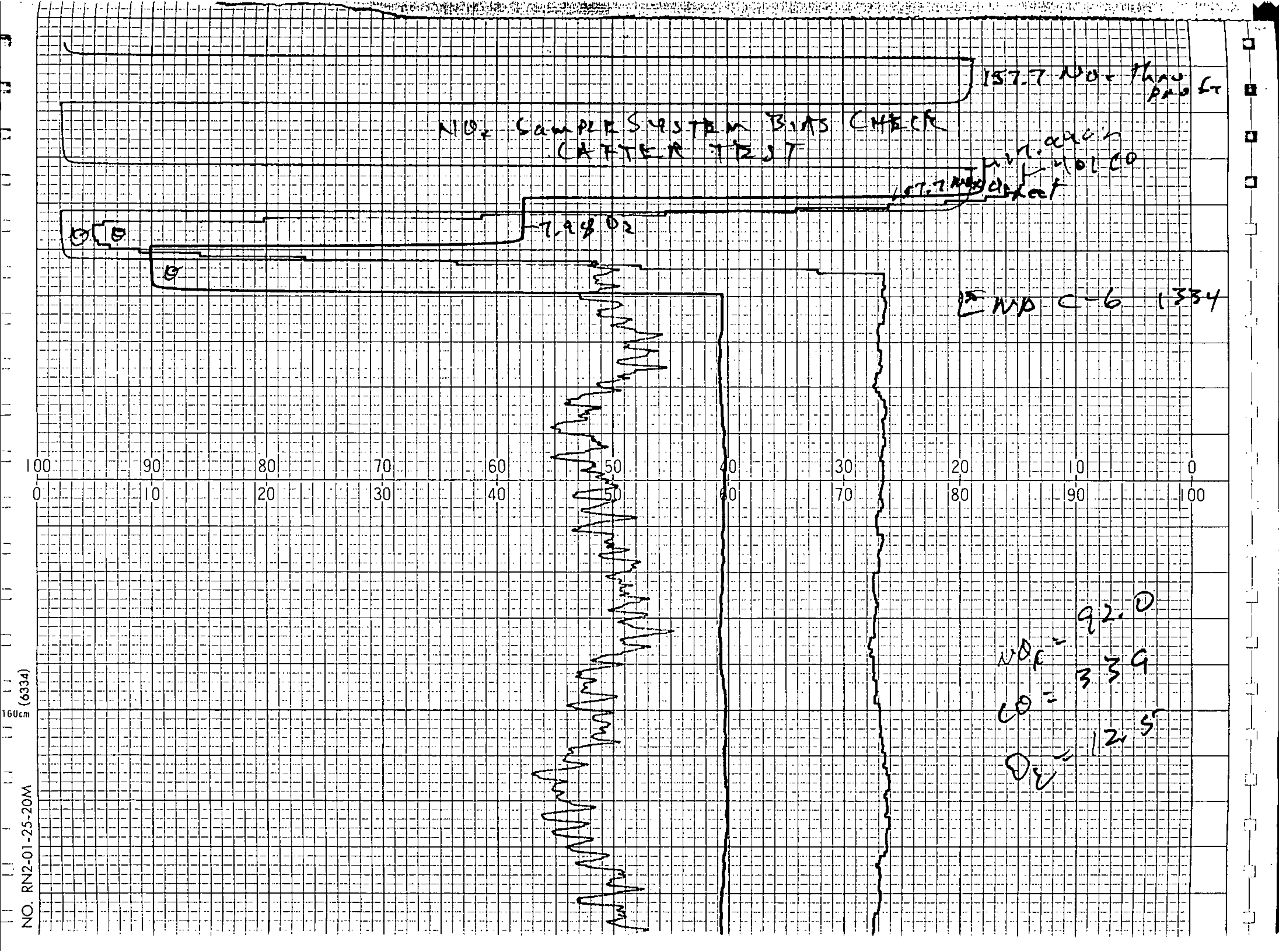


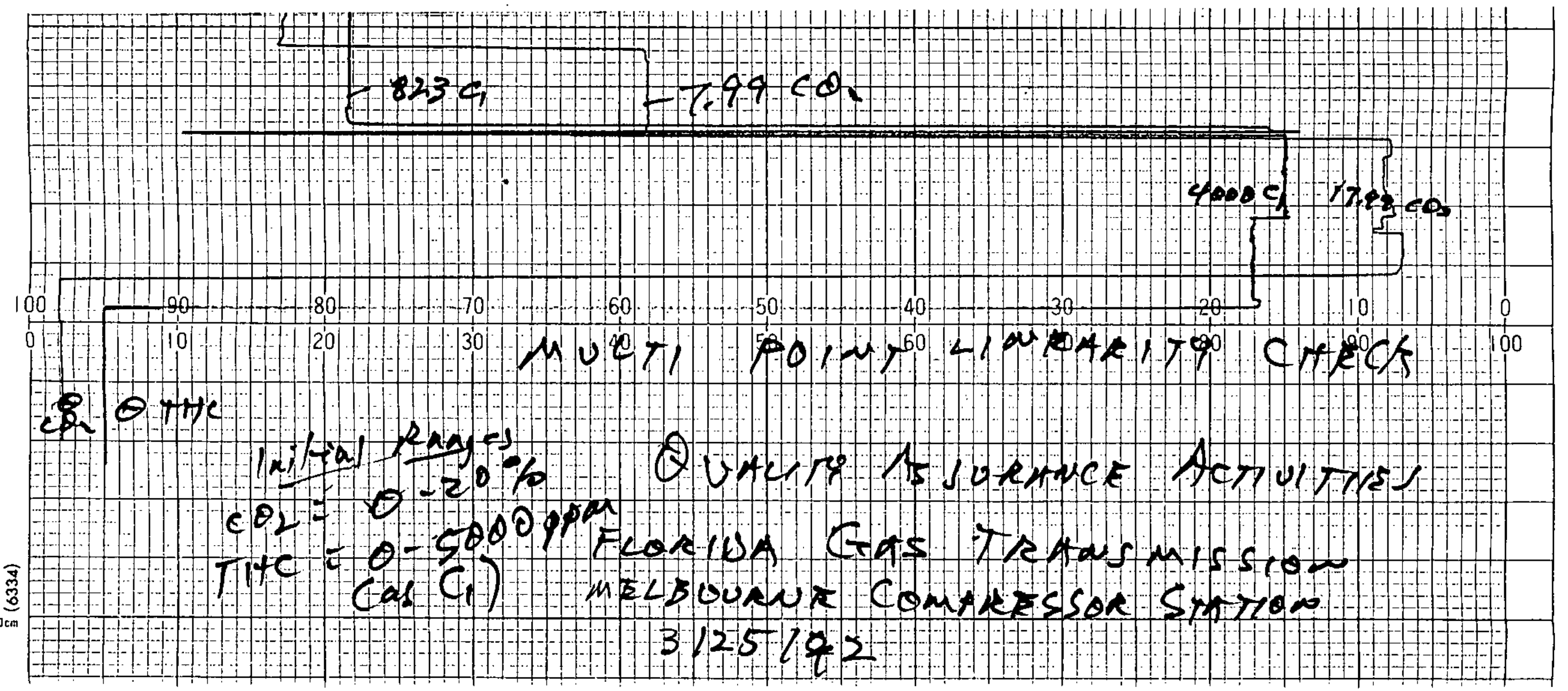
CHART NO. RN2-01-25-20M
(6334)
Charts-Inc
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
200cm
NOx = 79.4
CO = 340
O2 = 12.48



Charts-Inc
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
180cm
1234 Start C-6
1522 NOx
17.99 O2
End C-5 1228


157.7 NOx thru probe
NOx SAMPLE SYSTEM BIAS CHECK
(AFTER TEST)
401 CO
157.7 NOx direct
7.98 O2
END C-6 1334
NOx = 92.0
CO = 33.9
O2 = 12.5
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
NO. RN2-01-25-20M (6334) 160cm

CO_2, THC


823 C_1
7.99 CO_2
4000 C_1
17.99 CO_2
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
MULTI POINT LINEARITY CHECK
CO_2 0 THC
Initial Ranges
CO_2 = 0-20 %
THC = 0-5000 ppm
Cal (C_1)
QUALITY ASSURANCE ACTIVITIES
FLORIDA GAS TRANSMISSION
MELBOURNE COMPRESSOR STATION
3/25/92
(6334)
820cm

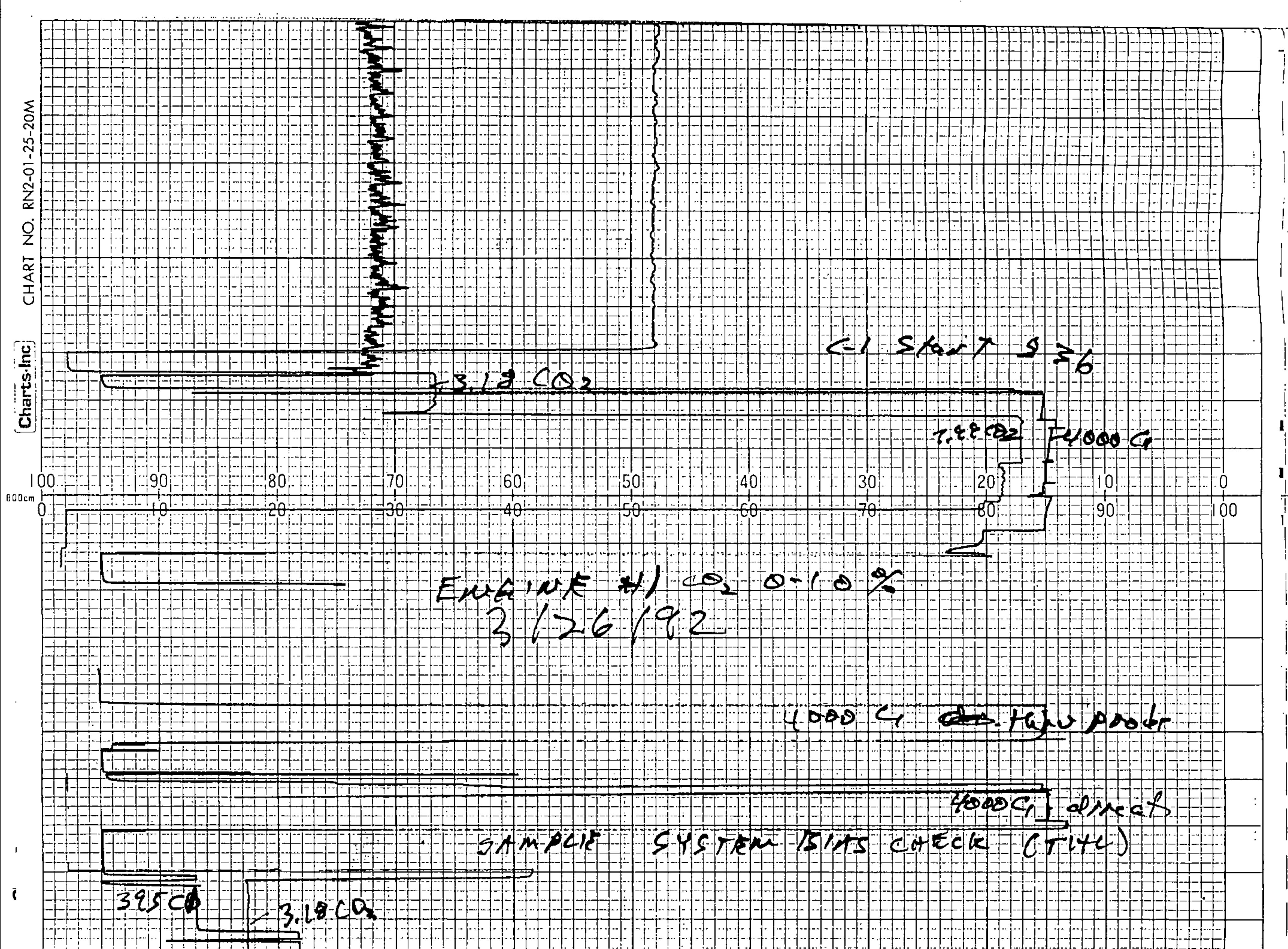
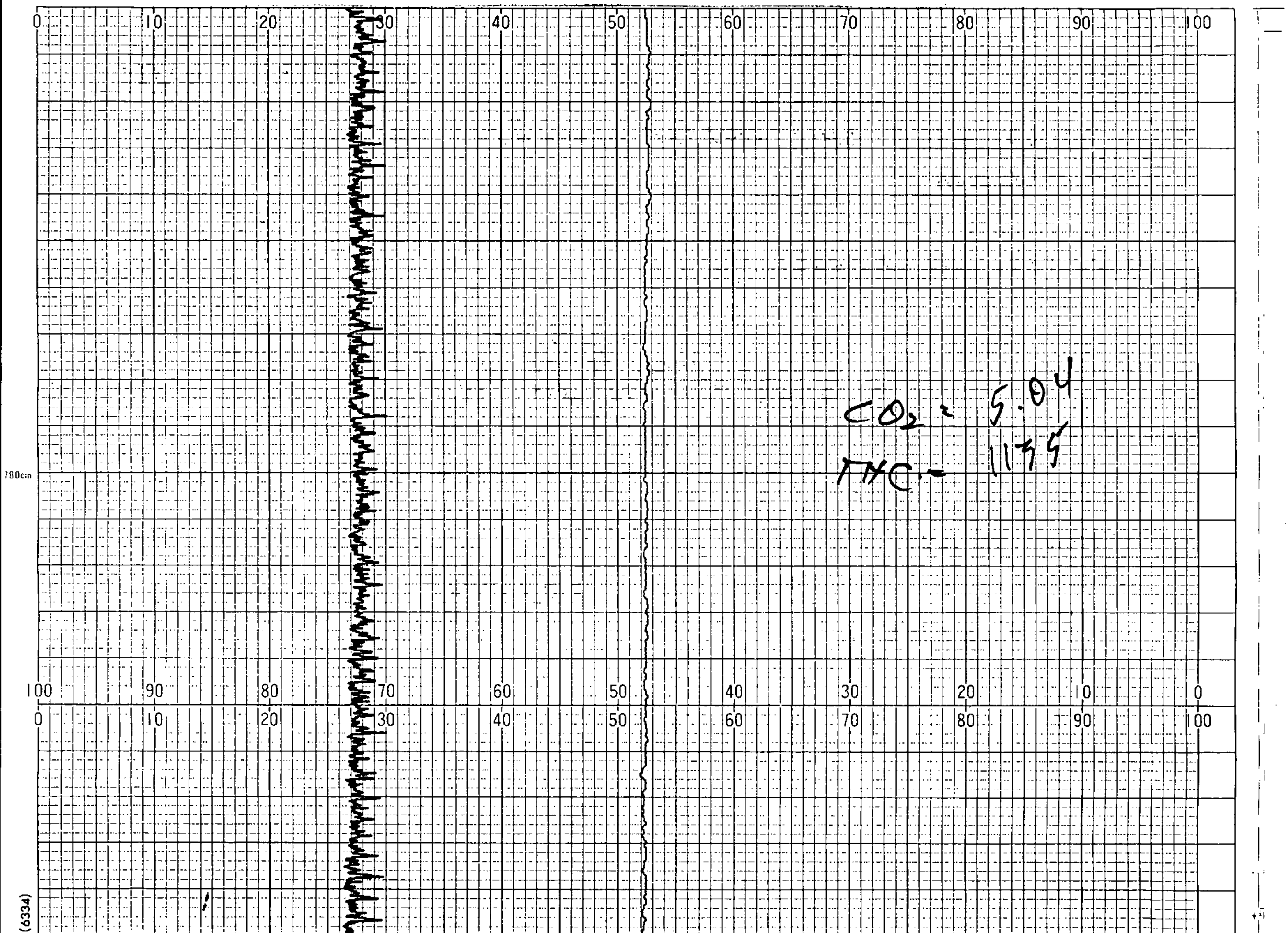
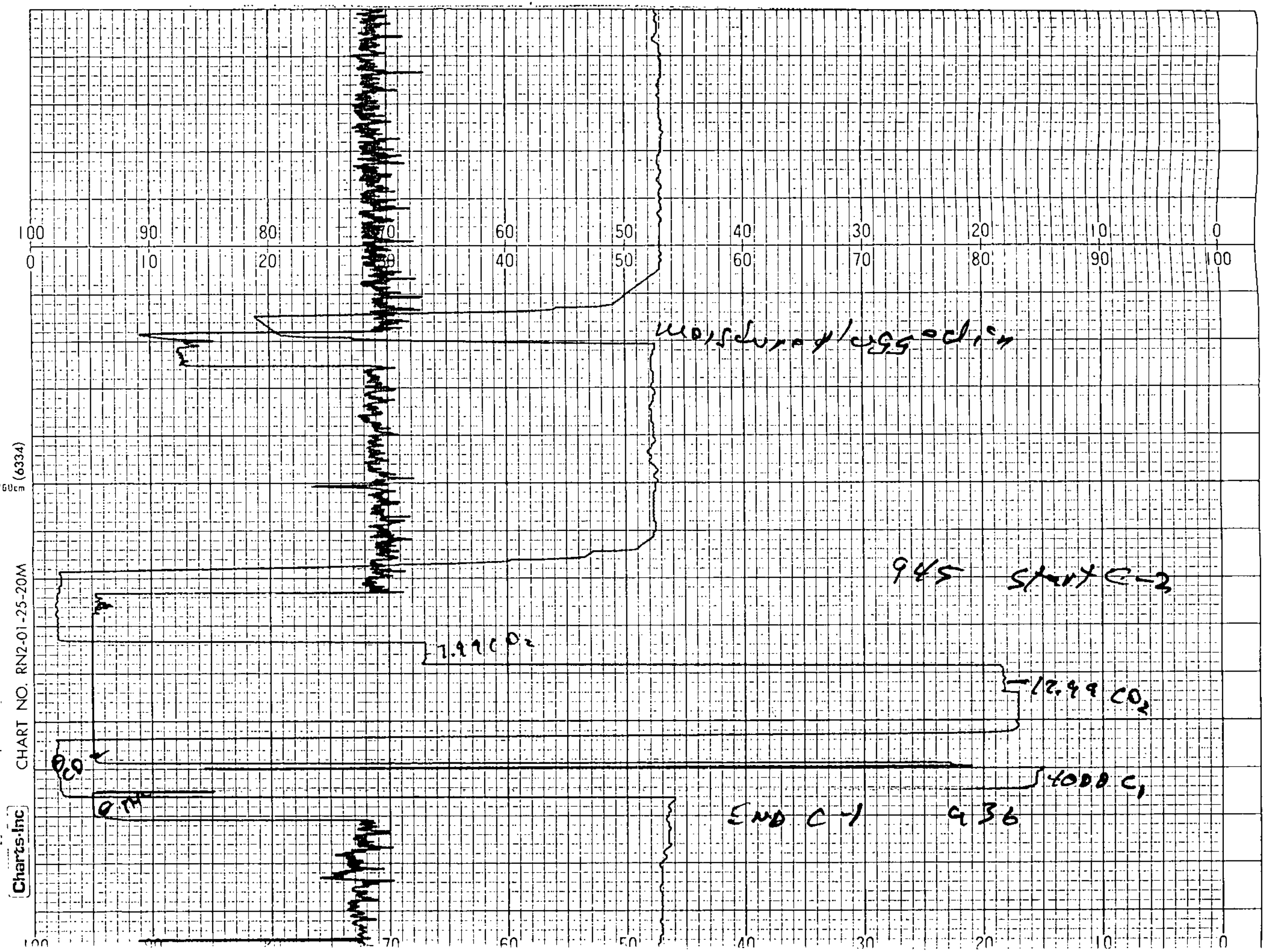


CHART NO. RN2-01-25-20M
Charts-Inc
C-1 Start 9:36
3.18 CO2
7.88 CO2
4000 C1
100 90 80 70 60 50 40 30 20 10 0
800cm
0 10 20 30 40 50 60 70 80 90 100
ENGINE #1 CO2 0-10%
3/26/92
4000 C1 thru probe
4000 C1 direct
SAMPLE SYSTEM BIAS CHECK (THC)
3.95 CO2
3.18 CO2



0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0
780cm
(6334)
CO_2 = 5.04
THC = 1135



100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
945 start C-2
7.99 CO_2
12.99 CO_2
0 CO
4000 C_1
END C-1 936
CHART NO. RN2-01-25-20M
(6334)
760cm
Charts-Inc

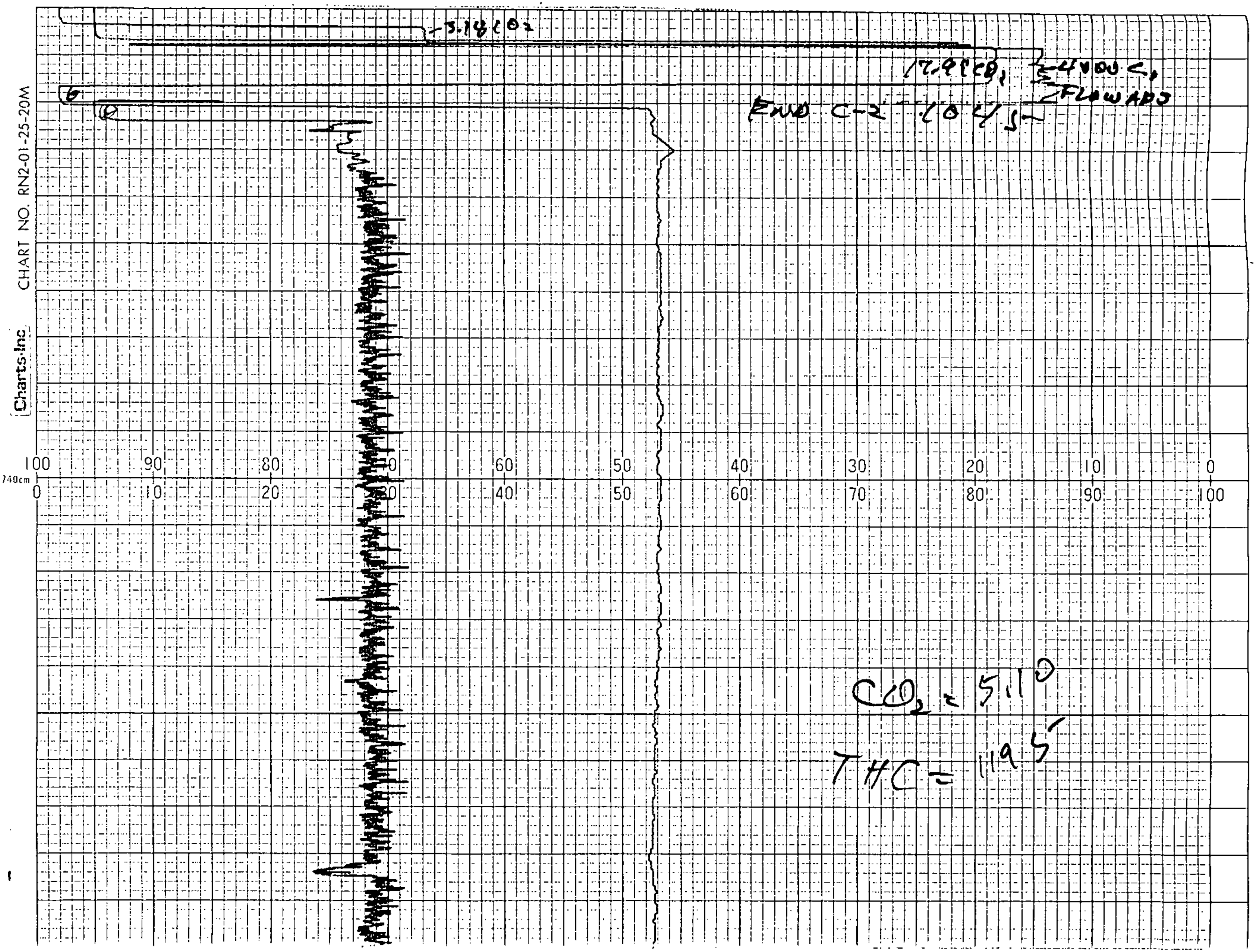
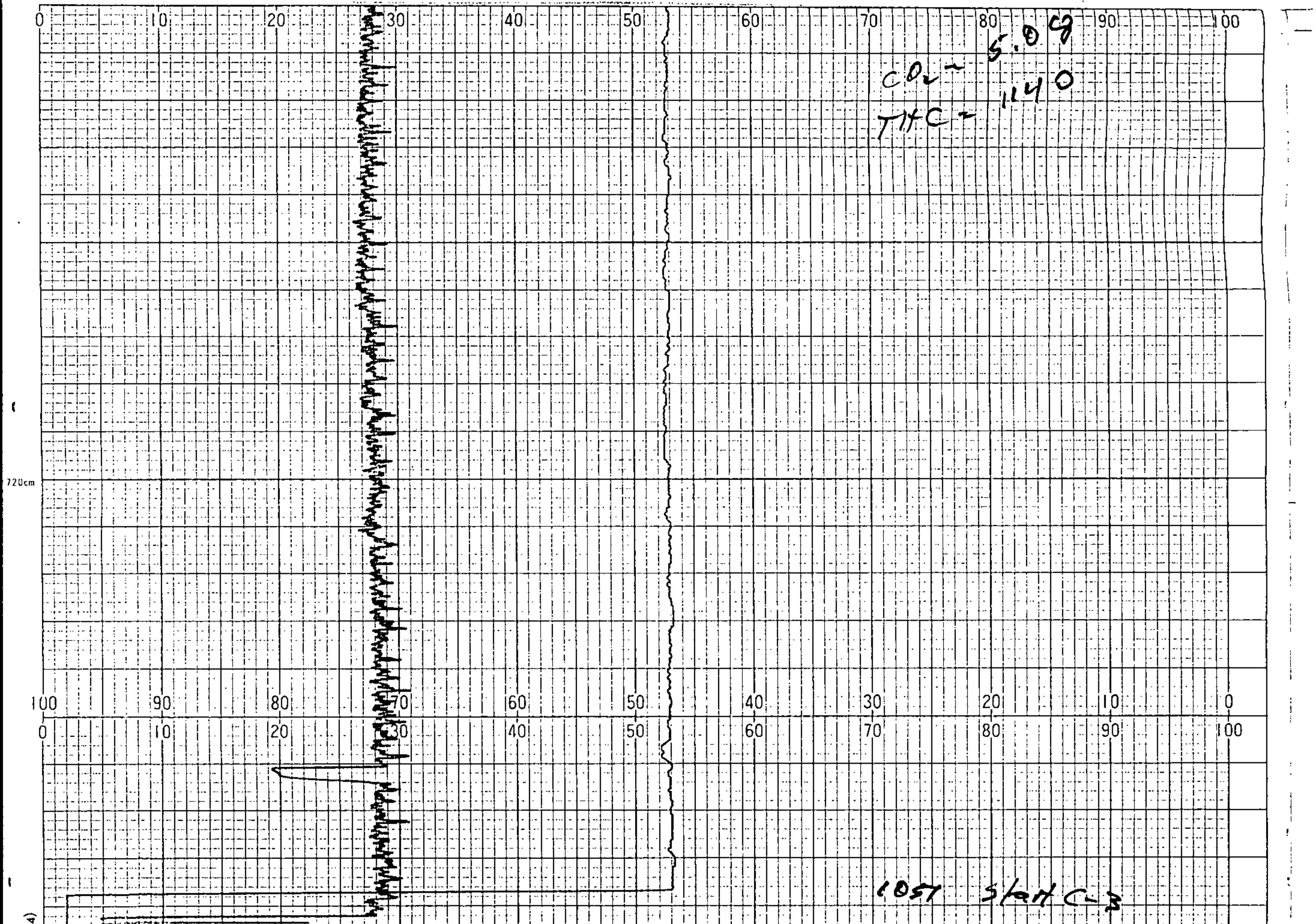
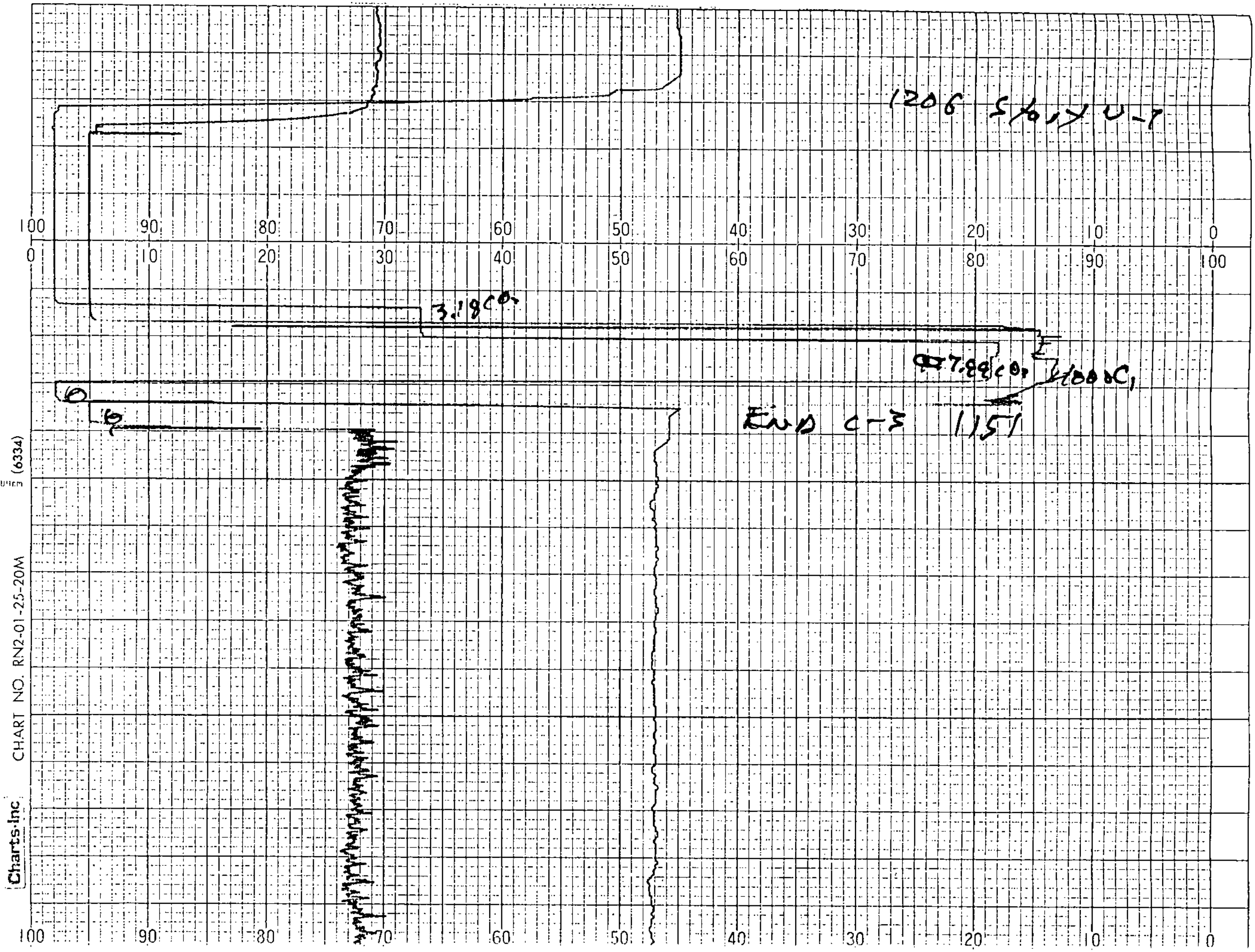


CHART NO. RN2-01-25-20M
Charts Inc
3.18% O2
17.9% CO2
4400 C1
FLOW ADJ
END C-2 10:45
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
CO2 = 5.10
THC = 1195



0 10 20 30 40 50 60 70 80 90 100
CO2 ~ 5.0 %
THC ~ 1140
720cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
1057 Start C-3


1206 Stop U-1
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
3.18 CO2
7.88 CO2
1.80 C1
END C-3 1151
(6334)
CHART NO. RN2-01-25-20M
Charts-Inc
100 90 80 70 60 50 40 30 20 10 0

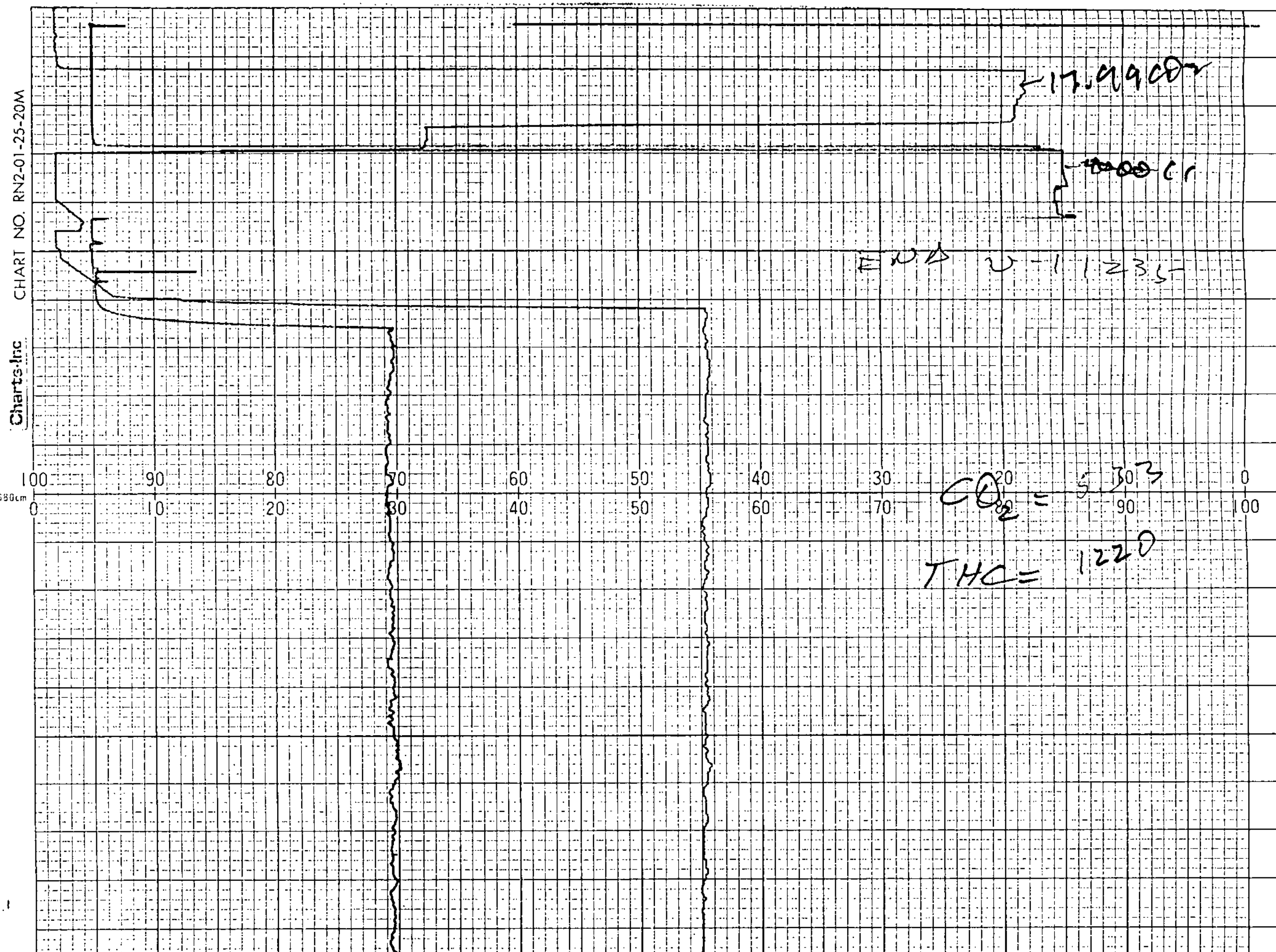
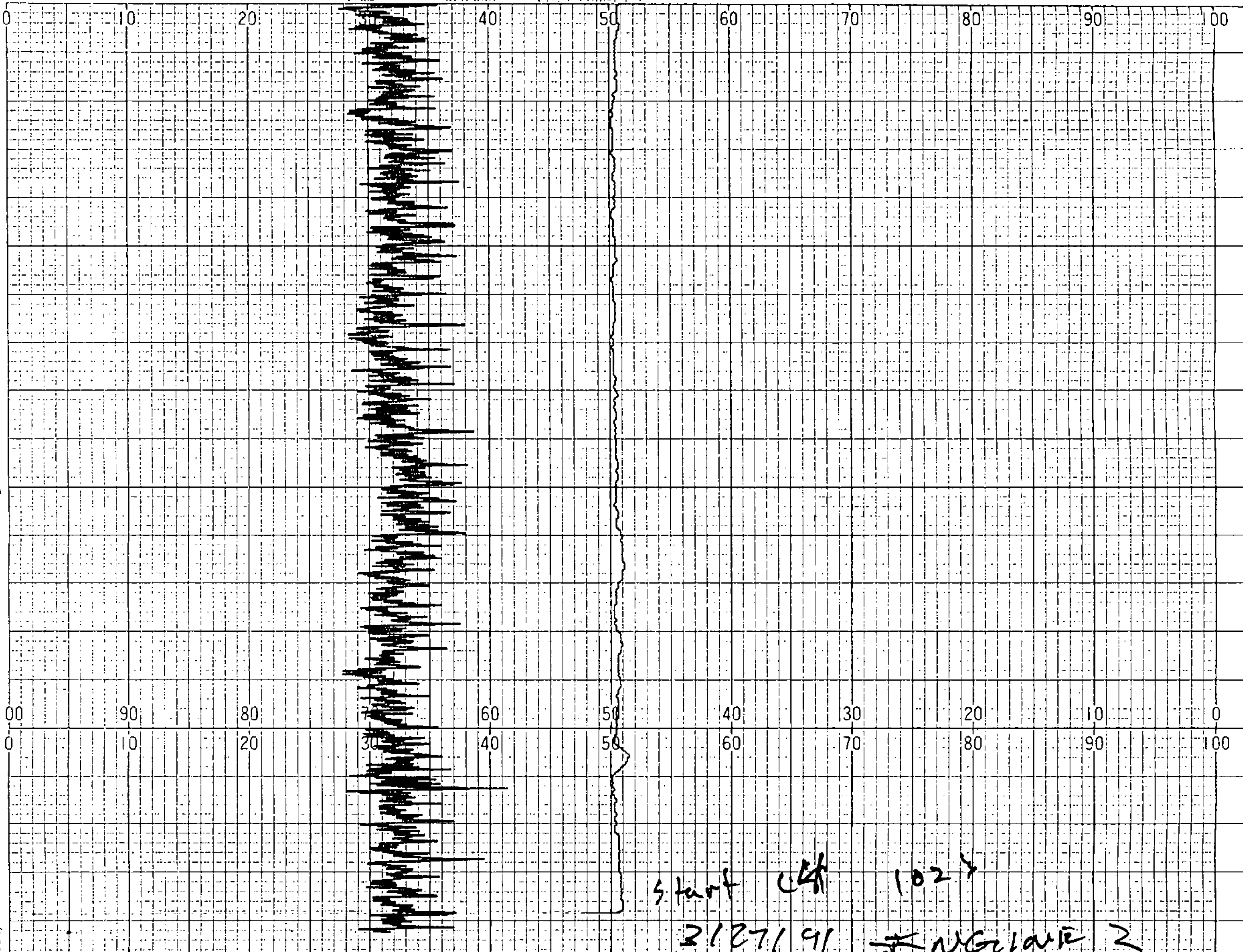
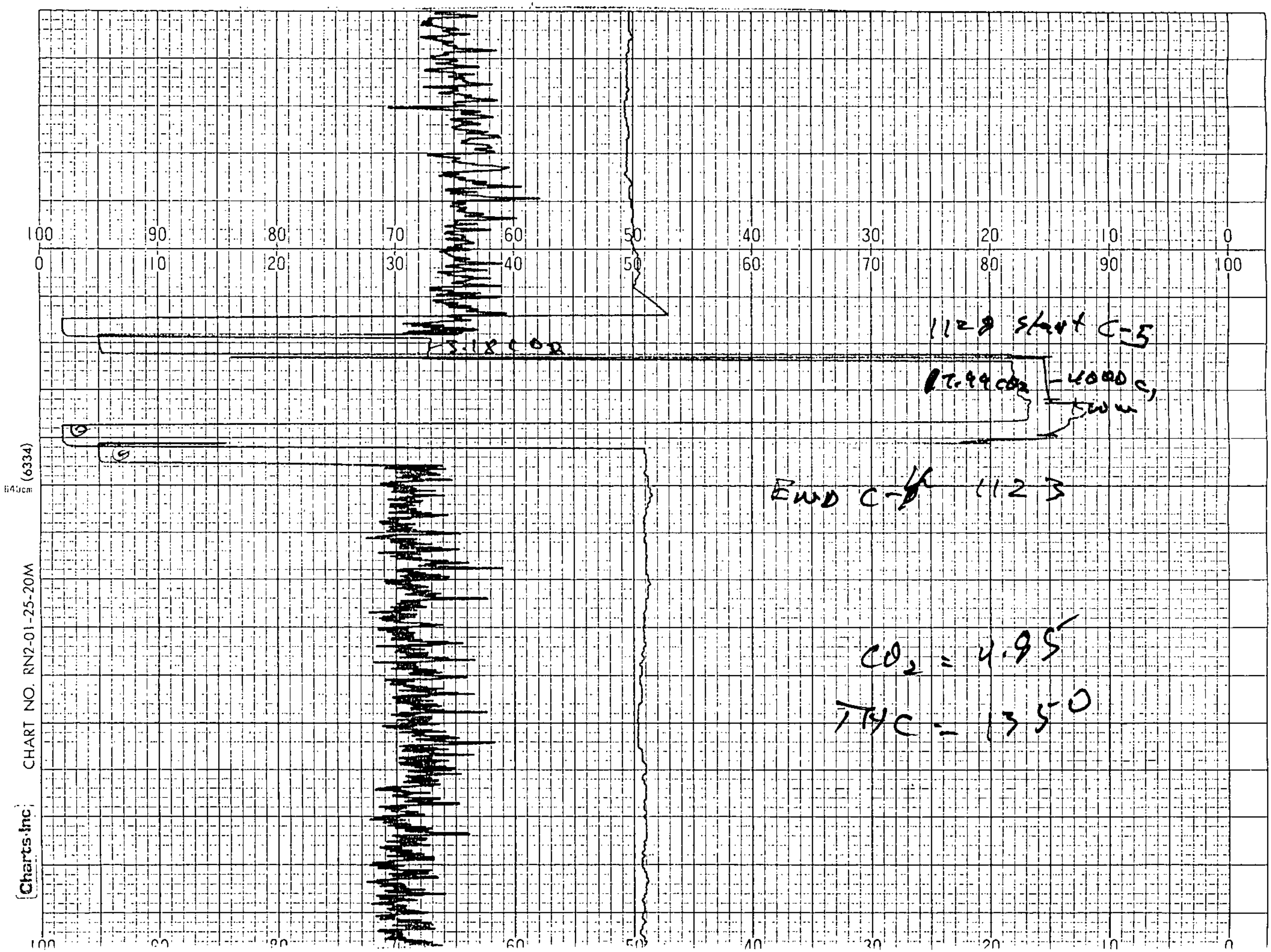


CHART NO. RN2-01-25-20M
Charts Inc
17.99 CO2
END U-1 1235
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
CO2 = 5.3
THC = 1220



0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
start CH 1024
3/27/91 ENGINE 2



100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
1128 start C-5
3.18 CO2
7.94 CO2
4000 C1
CO2 = 4.95
THC = 1350
CHART NO. RN2-01-25-20M
Charts-Inc
(6334)

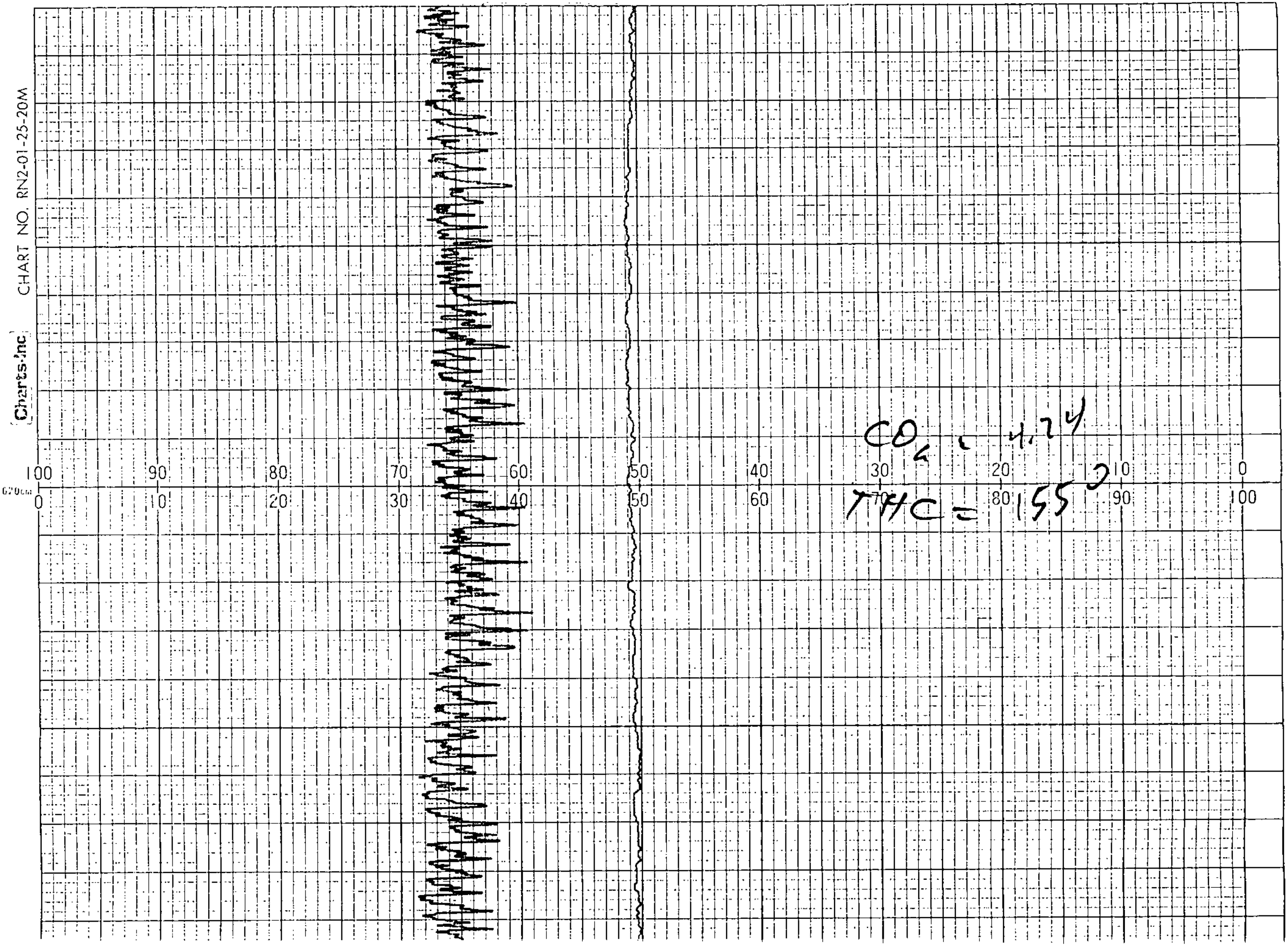
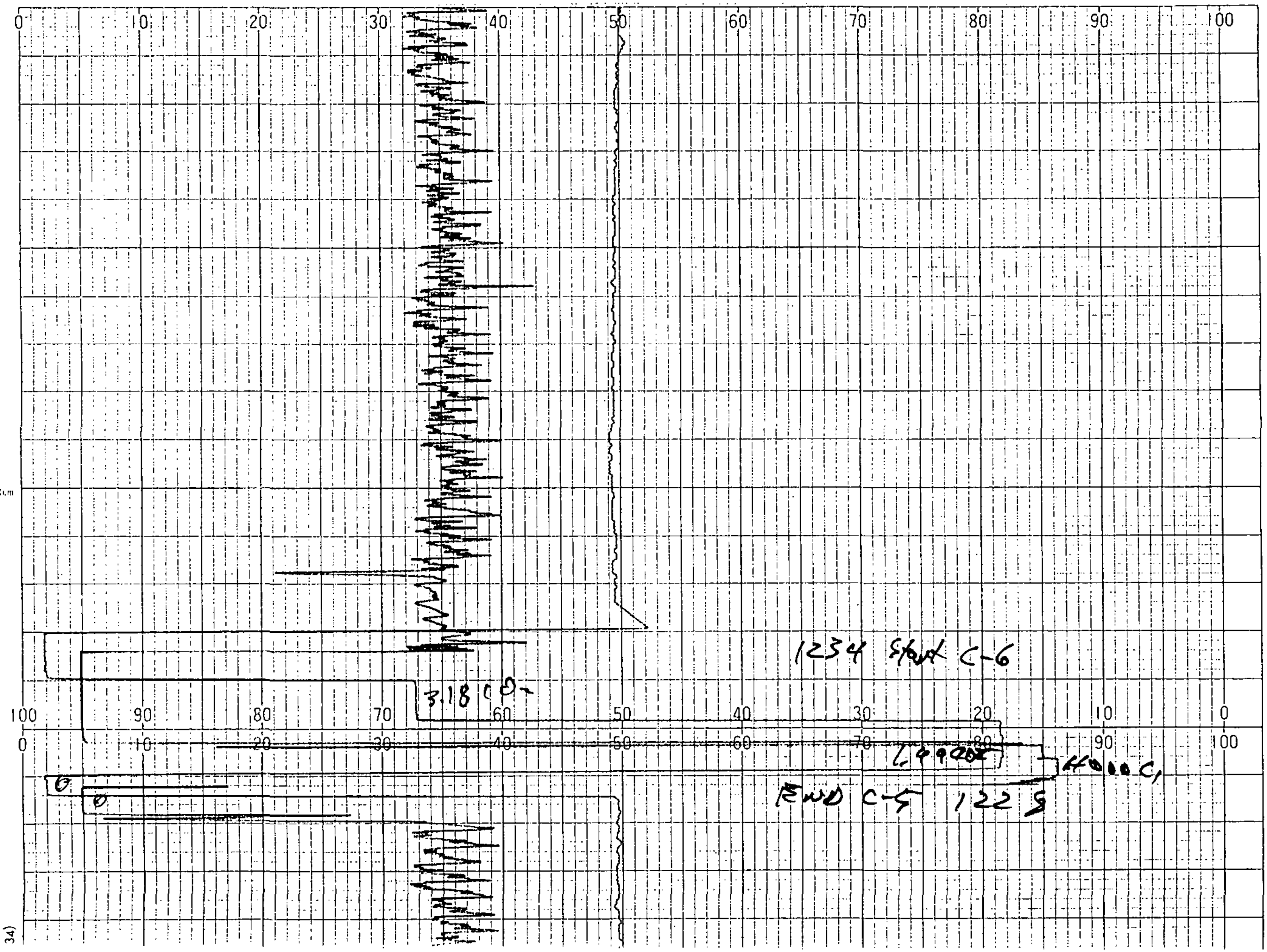
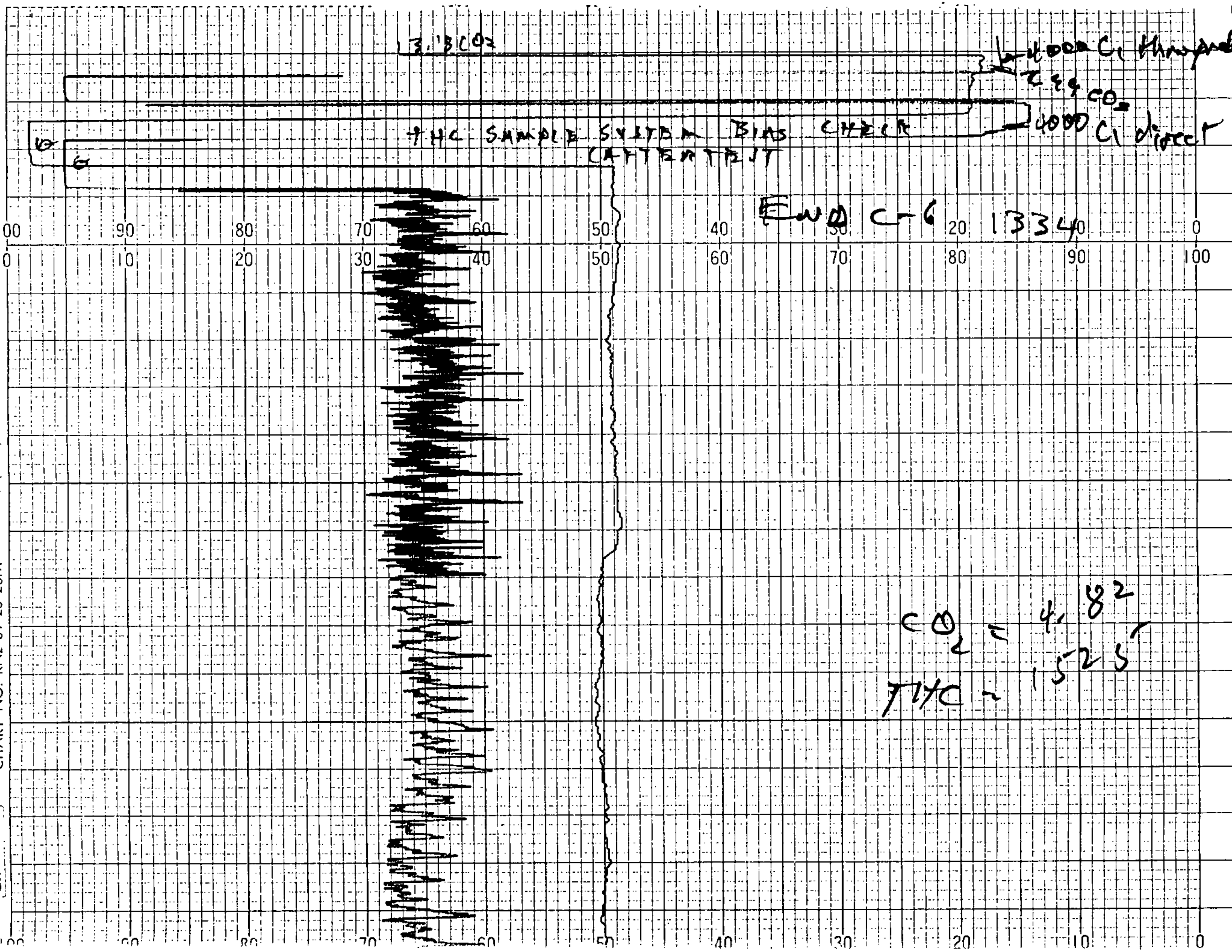


CHART NO. RN2-01-25-20M
Charts-Inc
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
CO2 = 4.74
THC = 155



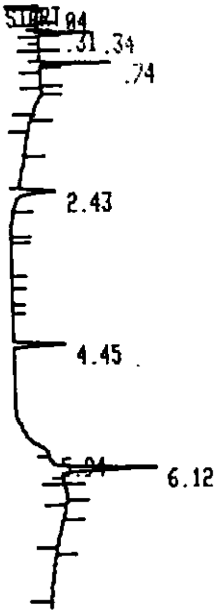
34)



4000 C1 thru probe
4000 C1 direct
THC SAMPLE SYSTEM BIAS CHECK
(AFTER TEST)
END C-6 1334
CO2 = 4.82
THC = 1525
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 (6334)
Charts-Inc

APPENDIX F
CHROMATOGRAMS

C1 - C6



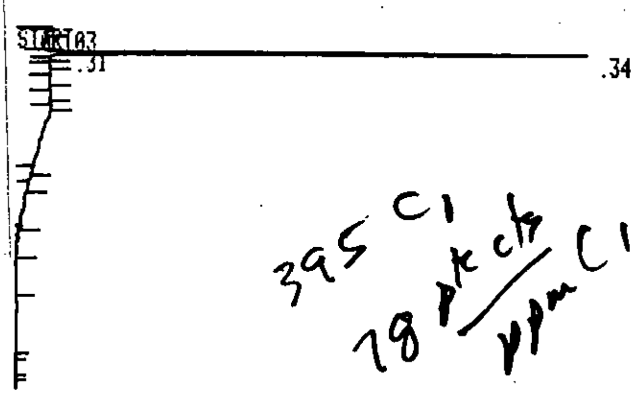
~~29 pk count / ppm C1~~

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

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.04	1319	PB	0.069	9.666
0.31	238	D PY	0.016	1.744
0.34	762	D VB	0.016	5.584 — C1
0.74	1345	D PB	0.021	9.856 — C2
2.43	2027	BB	0.061	14.854 — C3
4.45	2613	PY	0.051	19.148 — C4
5.94	59	PY	0.012	0.432
6.12	5283	VV	0.057	38.[illegible]

TOTAL AREA= 13646
MUL FACTOR= 1.0000E+00



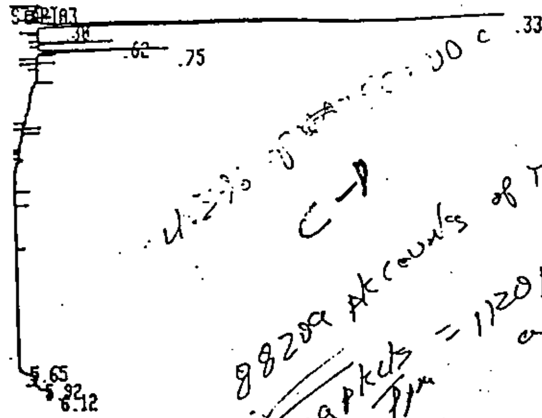
395 C1
78 pk cts / ppm C1

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

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.03	659	PB	0.038	2.091
0.31	212	PY	0.015	0.673
0.34	30649	D VB	0.015	97.237

TOTAL AREA= 31520
MUL FACTOR= 1.0000E+00



[illegible] UOC

C-1

88209 pk counts of THC / 79 pk cts/ppm = 1120 ppm THC as C1

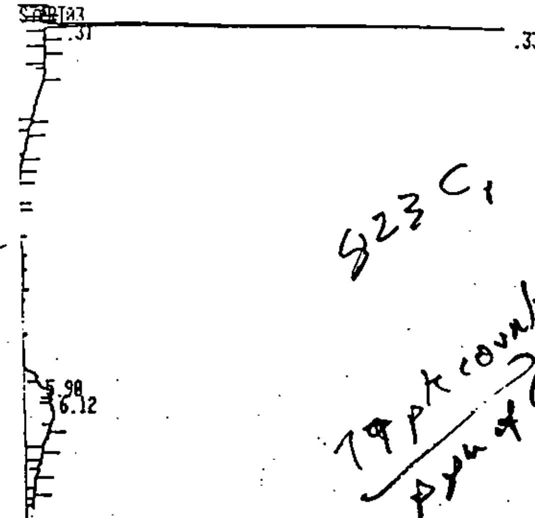
RUN # 91 MAR/26/92 09:14:09
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
~~0.03~~	~~682~~	~~PV~~	~~0.038~~	~~0.649~~
~~0.30~~	~~233~~	~~D PV~~	~~0.015~~	~~0.222~~
0.33	83683	D VB	0.015	79.626 C1
0.62	1499	D PP	0.019	1.426 C2
0.75	3027	D PB	0.022	2.880 C2
5.65	2184	VV	0.213	2.078
~~5.92~~	~~5796~~	~~VV~~	~~0.194~~	~~5.515~~ ghost pks
~~6.12~~	~~7991~~	~~I VH~~	~~0.176~~	~~7.604~~

7.42% UOC

TOTAL AREA= 105090
MUL FACTOR= 1.0000E+00



523 C1

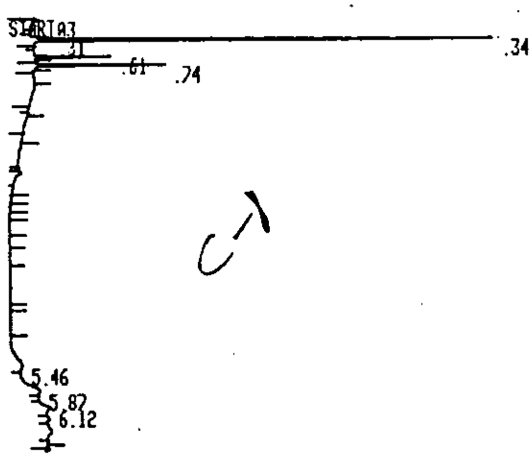
79 pk counts / ppm of C1

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

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.03	791	PV	0.045	1.087
0.31	217	D PV	0.016	0.298
0.33	65083	D VB	0.015	89.405
5.98	2133	PV	0.143	2.930
6.12	4572	VV	0.198	6.281

TOTAL AREA= 72796
MUL FACTOR= 1.0000E+00



C-1

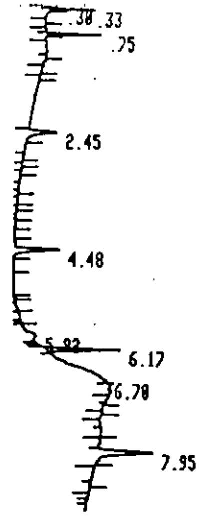
RUN # 93 MAR/26/92 09:32:33
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
~~0.03~~	~~1602~~	~~BV~~	~~0.003~~	~~1.664~~
~~0.31~~	~~131~~	~~PV~~	~~0.010~~	~~0.136~~
0.34	84513	D VB	0.015	87.800 C1
0.61	1585	D PB	0.019	1.647
0.74	3181	D BB	0.022	3.305
5.46	515	PP	0.121	0.535
~~5.87~~	~~1666~~	~~PV~~	~~0.118~~	~~1.731~~
~~6.12~~	~~3063~~	~~VV~~	~~0.163~~	~~3.182~~

5.88% UOC

TOTAL AREA= 96256
MUL FACTOR= 1.0000E+00



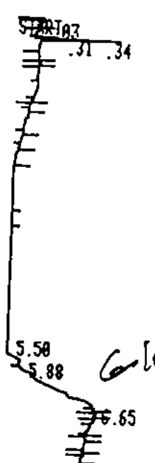
RUN # 97 MAR/26/92 10:23:05
WORKFILE ID: C
WORKFILE NAME:

AREA%

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

TOTAL AREA= 22306
MUL FACTOR= 1.0000E+00

~~Ambient~~ AIR



Ambient Air

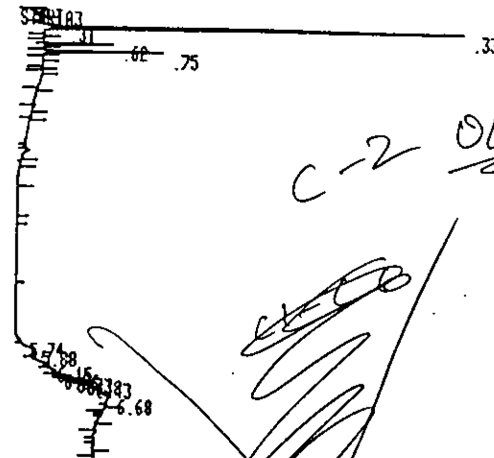
Ghost pKs

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

AREA%

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

TOTAL AREA= 2858
MUL FACTOR= 1.0000E+00



C-2 OK

8.47% VOC

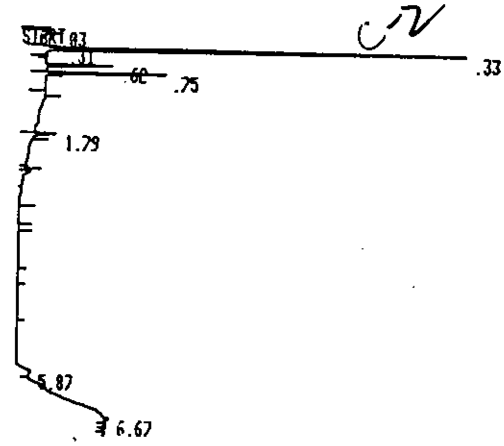
RUN # 96 MAR/26/92 10:10:15
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
~~0.03~~	~~599~~	~~PV~~	~~0.035~~	~~0.595~~
~~0.31~~	~~235~~	~~D PV~~	~~0.014~~	~~0.234~~
0.33	84018	D VB	0.015	83.511
0.62	1479	D PB	0.018	1.470
0.75	3043	D PB	0.022	3.025
~~5.74~~	~~0~~	~~PP~~	~~0.000~~	~~0.000~~
~~5.88~~	~~877~~	~~PP~~	~~0.099~~	~~0.872~~
6.15	470	PV	0.057	0.467
6.26	688	VP	0.088	0.684
6.33	588	PV	0.038	0.585
6.38	492	VV	0.021	0.489
6.43	1016	VV	0.037	1.010
~~6.68~~	~~7102~~	~~VV~~	~~0.274~~	~~7.059~~

TOTAL AREA= 100610
MUL FACTOR= 1.0000E+00

C-2



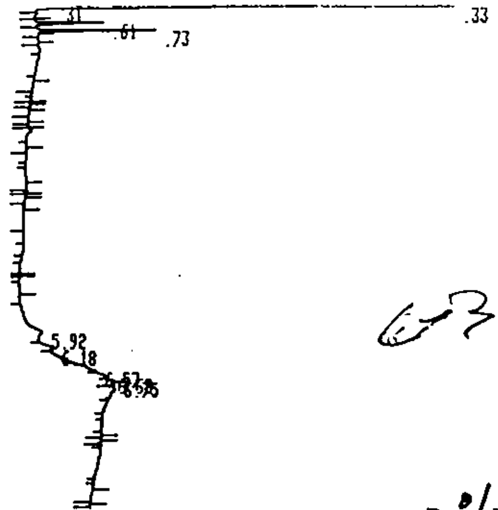
RUN # 95 MAR/26/92 09:58:08
WORKFILE ID: C
WORKFILE NAME:

5.72% VOC

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.03	460	PB	0.030	0.303
0.31	165	D PV	0.011	0.109
0.33	84745	D VB	0.015 C1	55.864
0.62	1431	D PB	0.019	0.943
0.75	2983	D PB	0.022	1.966
1.79	728	D BB	0.028	0.480
~~5.87~~	~~6810~~	~~VV~~	~~0.242~~	~~4.489~~
~~6.67~~	~~54378~~	~~VV~~	~~0.457~~	~~35.846~~

TOTAL AREA= 151700
MUL FACTOR= 1.0000E+00



G-3

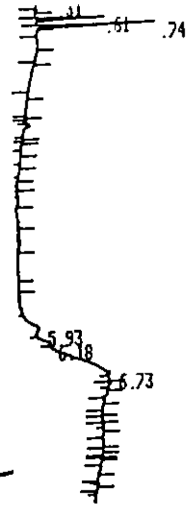
6.2% VOC

RUN # 100 MAR/26/92 11:12:22
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
~~0.03~~	~~921~~	~~PV~~	~~0.056~~	~~1.028~~
~~0.31~~	~~60~~	~~PV~~	~~0.005~~	~~0.067~~
0.33	81941	D VB	0.015	91.471
0.61	1410	D PB	0.018	1.574
0.73	3006	D PB	0.022	3.356
~~5.92~~	~~456~~	~~PP~~	~~0.044~~	~~0.509~~
~~6.18~~	~~645~~	~~PP~~	~~0.077~~	~~0.720~~
6.57	431	PV	0.061	0.481
6.68	569	VV	0.087	0.635
~~6.75~~	~~142~~	~~VB~~	~~0.028~~	~~0.159~~

TOTAL AREA= 89581
MUL FACTOR= 1.0000E+00



G-3

5.02% VOC

RUN # 101 MAR/26/92 11:27:41
WORKFILE ID: C
WORKFILE NAME:

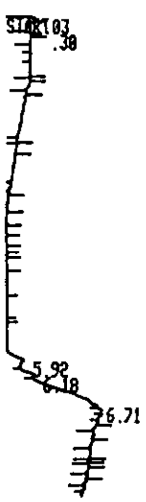
AREA%

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

TOTAL AREA= 95193
MUL FACTOR= 1.0000E+00

N_2

.395 C1

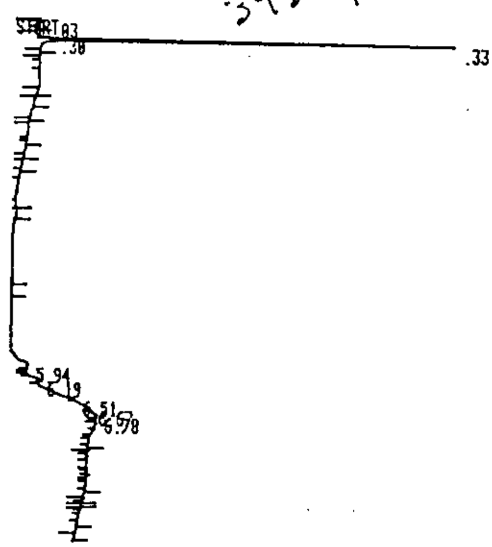


RUN # 98 MAR/26/92 10:39:11
WORKFILE ID: C
WORKFILE NAME:

AREA%

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

TOTAL AREA= 11303
MUL FACTOR= 1.0000E+00

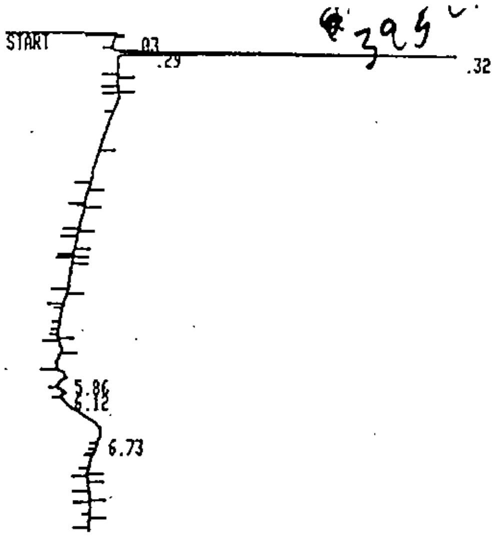


RUN # 99 MAR/26/92 10:54:19
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
0.03	616	PV	0.040	1.284
0.30	0	PP	0.000	0.000
0.33	29539	D PB	0.015	61.565
5.94	1265	PV	0.131	2.637
6.19	732	PV	0.078	1.526
6.51	4249	VV	0.129	8.856
6.67	6036	VV	0.141	12.580
6.78	5543	VV	0.125	11.553

TOTAL AREA= 47980
MUL FACTOR= 1.0000E+00



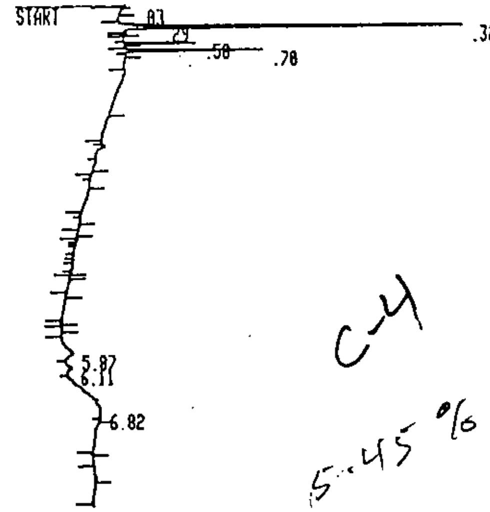
395

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

AREA%

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

TOTAL AREA= 44674
MUL FACTOR= 1.0000E+00



C-4

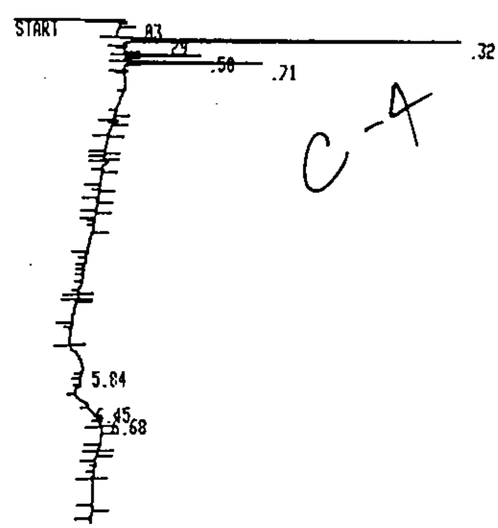
5.45% UOC

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

AREA%

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

TOTAL AREA= 97410
MUL FACTOR= 1.0000E+00



C-4

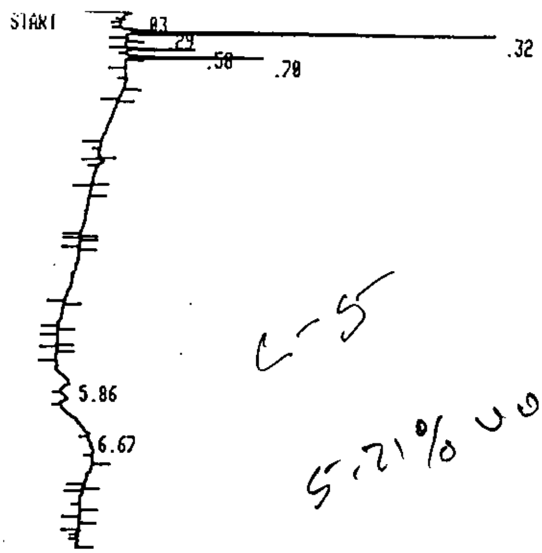
RUN # 127 MAR/27/92 11:22:03
WORKFILE ID: C
WORKFILE NAME:

6.55% UOB

AREA%

RT	AREA	TYPE	AR/HT	AREA%
~~0.03~~	~~1020~~	~~PB~~	~~0.038~~	~~1.054~~
~~0.29~~	~~592~~	~~D PV~~	~~0.016~~	~~0.612~~
0.32	85326	D VB	0.015	88.142
0.58	1569	D BB	0.018	1.621
0.71	3329	D BB	0.021	3.439
~~5.84~~	~~3883~~	~~PV~~	~~0.278~~	~~4.011~~
6.45	299	PV	0.059	0.309
6.68	787	VV	0.085	0.813

TOTAL AREA= 96805
MUL FACTOR= 1.0000E+00



C-5

5.21% UOC

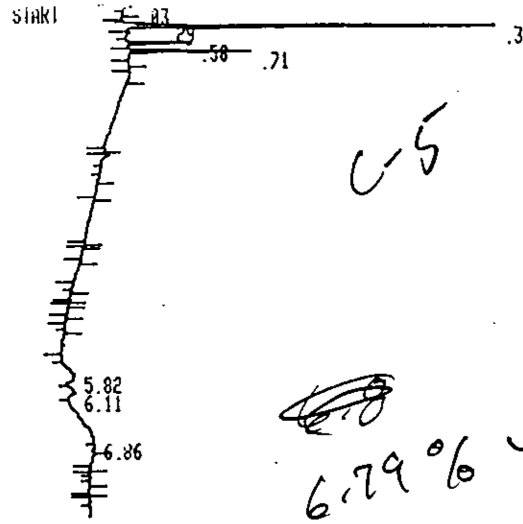
RUN # 129 MAR/27/92 11:55:43
WORKFILE ID: C
WORKFILE NAME:

AREA%

RT	AREA	TYPE	AR/HT	AREA%
~~0.03~~	~~1473~~	~~PY~~	~~0.053~~	~~1.704~~
~~0.29~~	~~437~~	~~D PY~~	~~0.014~~	~~0.506~~
0.32	74771	D VB	0.015	86.519
0.58	1390	D BV	0.019	1.608
0.70	3137	D VB	0.022	3.630
~~5.86~~	~~2282~~	~~BV~~	~~0.194~~	~~2.641~~
~~6.67~~	~~2932~~	~~PY~~	~~0.216~~	~~3.393~~

TOTAL AREA= 86422
MUL FACTOR= 1.0000E+00

395 C1



C-5

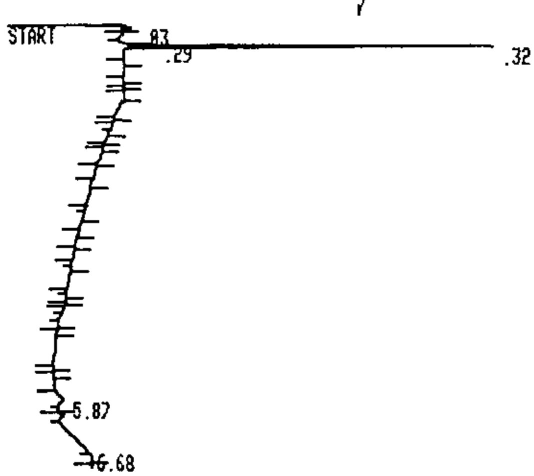
6.79% UOC

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

AREA%

RT	AREA	TYPE	AR/HT	AREA%
~~0.03~~	~~1261~~	~~PY~~	~~0.043~~	~~1.589~~
~~0.29~~	~~470~~	~~D PY~~	~~0.015~~	~~0.592~~
0.32	68018	D VB	0.015	85.690
0.58	1151	D PB	0.017	1.450
0.71	2730	D BB	0.021	3.439
~~5.82~~	~~2064~~	~~PY~~	~~0.172~~	~~2.600~~
6.11	1078	VP	0.119	1.358
~~6.86~~	~~2605~~	~~PY~~	~~0.388~~	~~3.282~~

TOTAL AREA= 79377
MUL FACTOR= 1.0000E+00

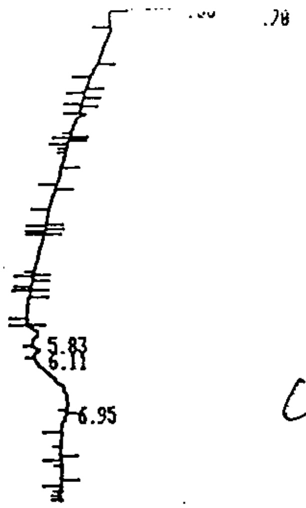


RUN # 128 MAR/27/92 11:36:24
WORKFILE ID: C
WORKFILE NAME:

AREA%

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

TOTAL AREA= 26548
MUL FACTOR= 1.0000E+00



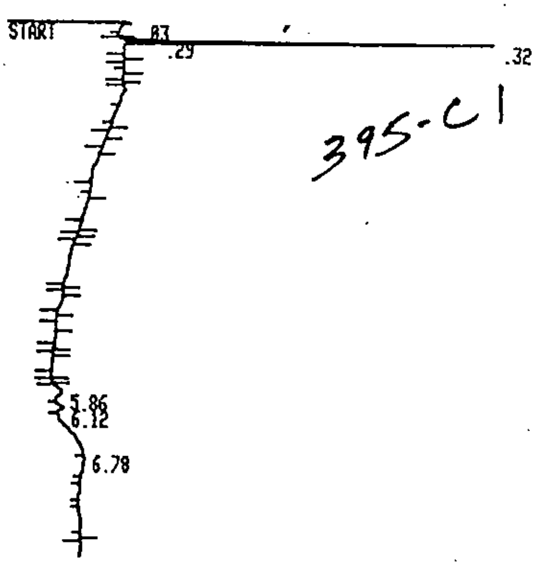
C-6
11.2% VOC

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

AREA%

RT	AREA	TYPE	AR/HT	AREA%
~~0.03~~	~~958~~	~~PB~~	~~0.041~~	~~1.090~~
~~0.29~~	~~449~~	~~D PV~~	~~0.014~~	~~0.511~~
0.32	75106	D VB	0.015	85.462
0.58	1422	D PB	0.019	1.618
0.70	3111	D BB	0.021	3.540
~~5.83~~	~~1322~~	~~PP~~	~~0.139~~	~~1.567~~
~~6.11~~	~~508~~	~~PP~~	~~0.069~~	~~0.578~~
6.95	4951	PV	0.635	5.634

TOTAL AREA= 87882
MUL FACTOR= 1.0000E+00



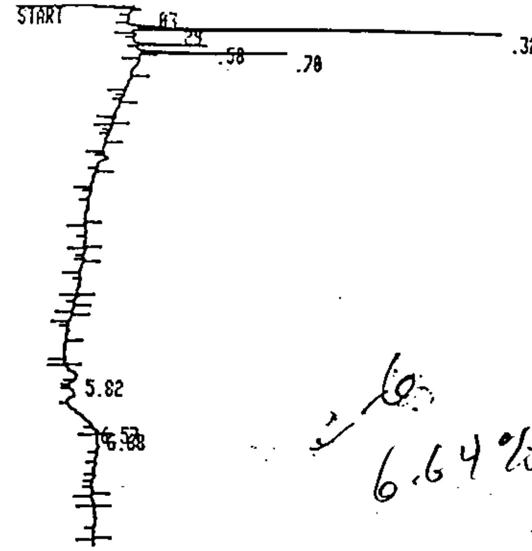
395-C1

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

AREA%

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

TOTAL AREA= 34708
MUL FACTOR= 1.0000E+00



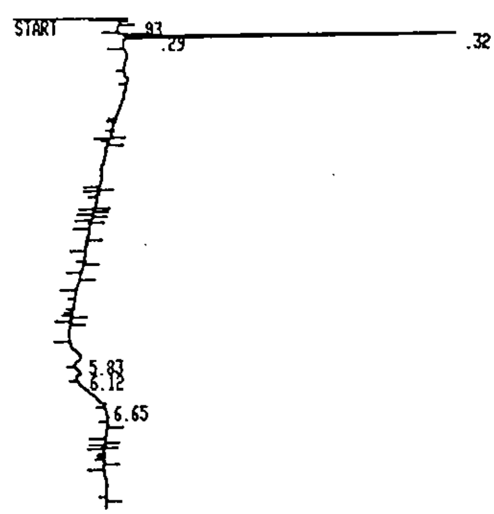
C-6
6.64% VOC

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

AREA%

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

TOTAL AREA= 90408
MUL FACTOR= 1.0000E+00



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

AREA%

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

TOTAL AREA= 29856
MUL FACTOR= 1.0000E+00

APPENDIX G
OPACITY OBSERVATIONS

VISIBLE EMISSIONS EVALUATOR

This is to certify that

Rick J. Krenzke

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

President

232749

Certificate Number

Vice President

Orlando

Location

David B. Savage, Jr.

Program Manager

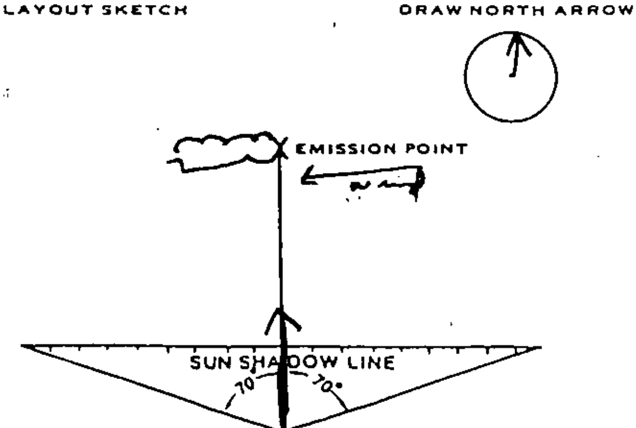
February 26, 1992

Date of Issue

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Florida Gas - Melbourne St. #19	OBSERVATION DATE: 3-27-92
START TIME: 10:15	STOP TIME: 11:15
ADDRESS: 3400 Ranch Road	
CITY: W. Melbourne	STATE: Fl ZIP: 32904-3514
PHONE: 407-723-8998	SOURCE ID NUMBER: Unit #2
PROCESS EQUIPMENT: Dresser 412 KVSR	OPERATING MODE: Full Load
CONTROL EQUIPMENT: NA	OPERATING MODE: NA
DESCRIBE EMISSION POINT: Exhaust Stack of Recip Engine	
HEIGHT ABOVE GROUND LEVEL: 65'	HEIGHT RELATIVE TO OBSERVER: 59'
DISTANCE FROM OBSERVER: 150'	DIRECTION FROM OBSERVER: North
DESCRIBE EMISSIONS: No VE's	
EMISSION COLOR: NO VE'S	PLUME TYPE: CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT: NO ☑ YES ☐	IS WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED: Exit of exhaust Stack	
DESCRIBE BACKGROUND: Sky	
BACKGROUND COLOR: Blue	SKY CONDITIONS: Clear
WIND SPEED: 5-10 mph	WIND DIRECTION: East
AMBIENT TEMP.:	WET BULB TEMP.:
RELATIVE HUMIDITY:	

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



M \ SEC	0	15	30	45	M \ SEC	0	15	30	45
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2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
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5	0	0	0	0	35	0	0	0	0
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
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22	0	0	0	0	52	0	0	0	0
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26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

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

COMMENTS

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SIGNATURE

TITLE	DATE

EPA TH 0101

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Florida Gas - Melbourne St. #A

OBSERVATION DATE: 3-27-92 | START TIME: 1130 | STOP TIME: 1230

ADDRESS: 3400 Ranch Road

CITY: W. Melbourne | STATE: Fl | ZIP: 32904-3514

PHONE: 407-723-8998 | SOURCE ID NUMBER: Unit #2

PROCESS EQUIPMENT: Dresser 412 KVSR | OPERATING MODE: Full Load

CONTROL EQUIPMENT: NA | OPERATING MODE: NA

DESCRIBE EMISSION POINT: Exhaust Stack of Recip. Engine

HEIGHT ABOVE GROUND LEVEL: 65' | HEIGHT RELATIVE TO OBSERVER: 59'

DISTANCE FROM OBSERVER: 150' | DIRECTION FROM OBSERVER: North

DESCRIBE EMISSIONS: No VE's

EMISSION COLOR: No VE's | PLUME TYPE: CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐

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

AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED: Exit of Exhaust Stack

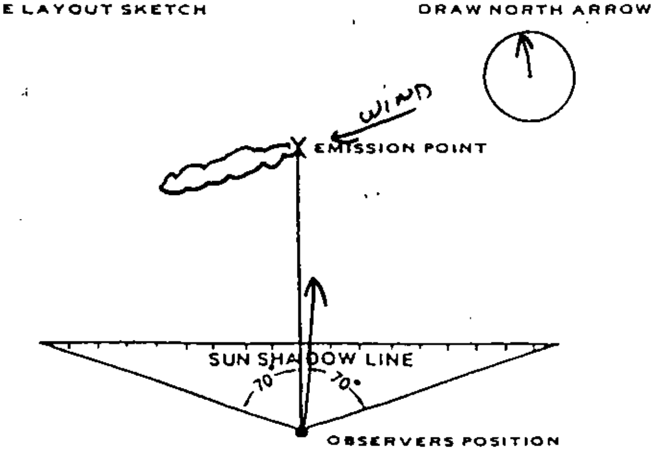
DESCRIBE BACKGROUND: Sky

BACKGROUND COLOR: Blue | SKY CONDITIONS: Clear

WIND SPEED: 5-10 mph | WIND DIRECTION: East

AMBIENT TEMP.: | WET BULB TEMP.: | RELATIVE HUMIDITY:

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



M \ SEC	0	15	30	45	M \ SEC	0	15	30	45
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3	0	0	0	0	33	0	0	0	0
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6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
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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
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27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

AVERAGE OPACITY FOR HIGHEST PERIOD: 0 | NUMBER OF READINGS ABOVE 0 % WERE 0

RANGE OF OPACITY READINGS: 0 MINIMUM 0 MAXIMUM

COMMENTS:

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

OBSERVER'S SIGNATURE: Rick J. Krenzke | DATE: 3-27-92

ORGANIZATION: Curtis Corp.

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE:

TITLE: | DATE:

CERTIFIED BY: State of Fl. by ETA | DATE: 2-27-92

VERIFIED BY: | DATE:

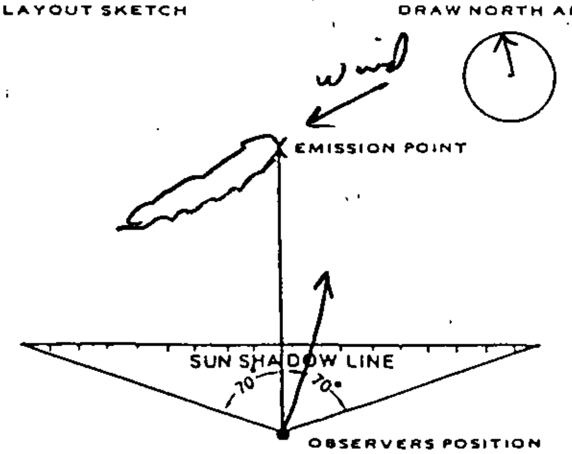
EPA TR 0101

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Florida Gas - Melbourne St. #19
ADDRESS: 3400 Ranch Road

CITY: W. Melbourne
STATE: Fl
ZIP: 32904-3514
PHONE: 407-723-8998
SOURCE ID NUMBER: Unit #2
PROCESS EQUIPMENT: Dresser 412 KVSR
OPERATING MODE: Full Load
CONTROL EQUIPMENT: NA
OPERATING MODE: NA
DESCRIBE EMISSION POINT: Exhaust Stack of Recip. Engine
HEIGHT ABOVE GROUND LEVEL: 65'
HEIGHT RELATIVE TO OBSERVER: 59'
DISTANCE FROM OBSERVER: 150'
DIRECTION FROM OBSERVER: East
DESCRIBE EMISSIONS: No VE's
EMISSION COLOR: NO VE's
PLUME TYPE: CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT: NO ☑ YES ☐
IS WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐
AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED: Exit of Exhaust Stack
DESCRIBE BACKGROUND: Sky
BACKGROUND COLOR: Blue
SKY CONDITIONS: Clear
WIND SPEED: 5-10 MPH
WIND DIRECTION: East
AMBIENT TEMP.:
WET BULB TEMP.:
RELATIVE HUMIDITY:

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



COMMENTS:

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS
SIGNATURE:
TITLE:
DATE:

OBSERVATION DATE: 3-27-92
START TIME: 1245
STOP TIME: 1345

M \ SEC	0	15	30	45	M \ SEC	0	15	30	45
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3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
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7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
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16	0	0	0	0	46	0	0	0	0
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19	0	0	0	0	49	0	0	0	0
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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): RICK J. KRENZKE
OBSERVER'S SIGNATURE: Rick J. Krenzke
DATE: 3-27-92
ORGANIZATION: Cubix CORP.
CERTIFIED BY: State of Fl. by ETA
DATE: 2-27-92
VERIFIED BY:
DATE:

EPA 1R 0101

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Florida GAS - Melbourn Station #19

ADDRESS: 3400 Ranch Road

CITY: West Melbourne **STATE:** Fl **ZIP:** 32904-3518

PHONE: 407-723-9998 **SOURCE ID NUMBER:** Unit #1

PROCESS EQUIPMENT: Dresser Model 412KVSR **OPERATING MODE:** Full Load

CONTROL EQUIPMENT: NA **OPERATING MODE:** NA

DESCRIBE EMISSION POINT: Exhaust of Recip. Engine

HEIGHT ABOVE GROUND LEVEL: 65' **HEIGHT RELATIVE TO OBSERVER:** 59'

DISTANCE FROM OBSERVER: 130' **DIRECTION FROM OBSERVER:** East

DESCRIBE EMISSIONS: No VE's

EMISSION COLOR: No VE's **PLUME TYPE:** CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐

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

AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED: Exit of Exhaust Stack

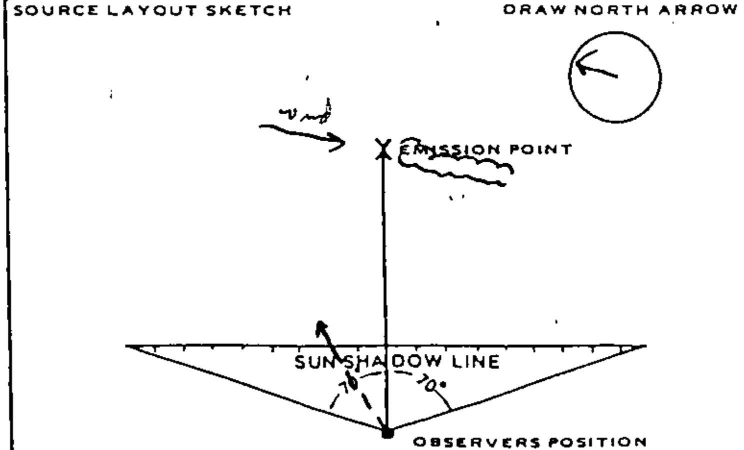
DESCRIBE BACKGROUND: Sky

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

WIND SPEED: 5-10 mph **WIND DIRECTION:** N

AMBIENT TEMP.: **WET BULB TEMP.:** **RELATIVE HUMIDITY:**

SOURCE LAYOUT SKETCH **DRAW NORTH ARROW**



COMMENTS:

OBSERVATION DATE: 3-26-92 **START TIME:** 845 **STOP TIME:** 945

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2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
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): Rick J. Krenzke

OBSERVER'S SIGNATURE: Rick J. Krenzke **DATE:** 3-26-92

ORGANIZATION: Cubix Corp.

CERTIFIED BY: State of Fl by ETA **DATE:** 2-27-92

VERIFIED BY: 0 **DATE:**

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE:

TITLE: **DATE:**

EPA 1H 0101

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Florida Gas - Melbourne St. #19

ADDRESS: 3400 Ranch Road

CITY: West Melbourne | **STATE:** Fl | **ZIP:** 32904-3518

PHONE: 407-723-8998 | **SOURCE ID NUMBER:** Unit #1

PROCESS EQUIPMENT: Dresser Model 412 KVSR | **OPERATING MODE:** Full Load

CONTROL EQUIPMENT: NA | **OPERATING MODE:** NA

DESCRIBE EMISSION POINT: Exhaust of Recip. Engine

HEIGHT ABOVE GROUND LEVEL: 65' | **HEIGHT RELATIVE TO OBSERVER:** 59'

DISTANCE FROM OBSERVER: 130' | **DIRECTION FROM OBSERVER:** East

DESCRIBE EMISSIONS: No VE's

EMISSION COLOR: No VE's | **PLUME TYPE:** CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐

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

AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED: Exit of Exhaust Stack

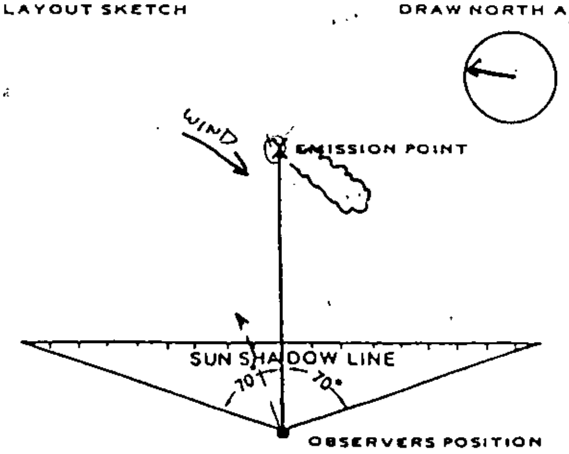
DESCRIBE BACKGROUND: Sky

BACKGROUND COLOR: Blue | **SKY CONDITIONS:** Clear 0-10% clouds

WIND SPEED: 10 mph | **WIND DIRECTION:** N

AMBIENT TEMP.: | **WET BULB TEMP.:** | **RELATIVE HUMIDITY:**

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



COMMENTS:

OBSERVATION DATE: 3-26-92 | **START TIME:** 955 | **STOP TIME:** 1055

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): Rick J. Krenzke

OBSERVER'S SIGNATURE: Rick J. Krenzke | **DATE:** 3-26-92

ORGANIZATION: Cubix Corp.

CERTIFIED BY: State of Fl. by ETA | **DATE:** 2-27-92

VERIFIED BY: | **DATE:**

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE:

TITLE: | **DATE:**

EPA 1H 0101

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Florida Gas - Melbourne St. #19

ADDRESS: 3400 Ranch Road

CITY: W. Melbourne | STATE: Fl | ZIP: 32904-3518

PHONE: 407-723-8998 | SOURCE ID NUMBER: Unit #1

PROCESS EQUIPMENT: Dresser Model 412KVSR | OPERATING MODE: Full

CONTROL EQUIPMENT: NA | OPERATING MODE: NA

DESCRIBE EMISSION POINT: Exhaust stack of Recip Engine

HEIGHT ABOVE GROUND LEVEL: 65' | HEIGHT RELATIVE TO OBSERVER: 59'

DISTANCE FROM OBSERVER: 120 ft | DIRECTION FROM OBSERVER: East

DESCRIBE EMISSIONS: No VE's

EMISSION COLOR: NO VE's | PLUME TYPE: CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐

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

AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED: Exit of exhaust stack

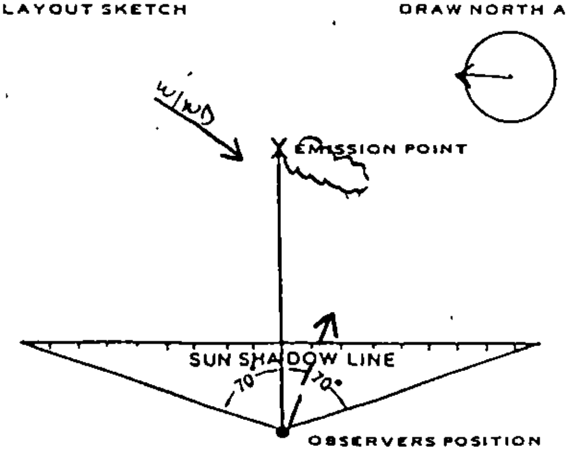
DESCRIBE BACKGROUND: Sky

BACKGROUND COLOR: Blue | SKY CONDITIONS: Clear 10% cloud cover

WIND SPEED: 10 mph | WIND DIRECTION: North

AMBIENT TEMP. | WET BULB TEMP. | RELATIVE HUMIDITY

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



COMMENTS

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE

TITLE | DATE

OBSERVATION DATE: 3-26-92 | START TIME: 1105 | STOP TIME: 1205

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): RICK J. KRENZKE

OBSERVER'S SIGNATURE: Rick J. Krenzke | DATE: 3-26-92

ORGANIZATION: Cubix Corp.

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

VERIFIED BY | DATE

EPA 1H 0101

APPENDIX H: FUEL ANALYSES

Fuel Calculations: Melbourne Station

Client: Florida Gas
Sample ID: Melbourne Engine 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	0.4380	28.016	0.0744	0.00033	0.7402	0	0.00	0	0
CO2	0.6730	44.01	0.117	0.00079	1.7885	0	0.00	0	0
CO		28.01	0.074	0.00000	0.0000	4347	0.00	322	0
Methane	96.6170	16.041	0.0424	0.04097	93.0493	23879	22219.24	1013	978.73
Ethane	2.0120	30.067	0.0803	0.00162	3.6698	22320	819.09	1792	36.055
Ethylene		28.051	0.0746	0.00000	0.0000	21644	0.00	1614	0
Propane	0.2210	44.092	0.1196	0.00026	0.6004	21661	130.05	2590	5.7239
propylene		42.077	0.111	0.00000	0.0000	21041	0.00	2336	0
Isobutane	0.0150	58.118	0.1582	0.00002	0.0539	21308	11.49	3363	0.5045
n-butane	0.0084	58.118	0.1582	0.00001	0.0302	21257	6.42	4016	0.3378
Isobutene		56.102	0.148	0.00000	0.0000	20840	0.00	3068	0
Isopentane	0.0013	72.144	0.1904	0.00000	0.0058	21091	1.22	4008	0.0536
n-pentane		72.144	0.1904	0.00000	0.0000	21052	0.00	3993	0
n-hexane	0.0120	86.169	0.2274	0.00003	0.0620	20940	12.98	4762	0.5714
H2S		34.076	0.0911	0.00000	0.0000	7100	0.00	647	0
total	100.00	Average Density		0.04403	100.0000	Gross Heating Value		Gross Heating Value	
		Specific Gravity		0.57550		Btu/lb	23200	Btu/SCF	1022

CALCULATION OF F FACTORS

Component	Mol. Wt.	C Factor	H Factor	% volume	Fract. Wt.	Weight Percents: Carbon	Hydrogen	Nitrogen	Oxygen	Sulfur
Hydrogen	2.016	0	1	0.00	0.0000	0	0			
Oxygen	32	0	0	0.00	0.0000				0	
Nitrogen	28.016	0	0	0.44	12.2710	0	0	0.737239547		
CO2	44.01	0.272273	0	0.67	29.6187	0.48450626	0		1.2937	
CO	28.01	0.42587	0	0.00	0.0000	0	0		0	
Methane	16.041	0.75	0.25	96.62	1549.8333	69.8352407	23.278414			
Ethane	30.067	0.8	0.2	2.01	60.4948	2.90761195	0.726903			
Ethylene	28.051	0.85714	0.14286	0.00	0.0000	0	0			
Propane	44.092	0.81818	0.18182	0.22	9.7443	0.47899316	0.1064431			
Propene	42.077	0.85714	0.14286	0.00	0.0000	0	0			
Isobutane	58.118	0.82759	0.17247	0.02	0.8718	0.04334565	0.0090332			
n-butane	58.118	0.82759	0.17247	0.01	0.4888	0.02430535	0.0050652			
Isobutene	56.102	0.85714	0.14286	0.00	0.0000	0	0			
Isopentane	72.144	0.83333	0.16667	0.00	0.0965	0.00483168	0.0009664			
n-pentane	72.144	0.83333	0.16667	0.00	0.0000	0	0			
n-hexane	86.169	0.83721	0.16279	0.01	1.0340	0.05201099	0.0101132			
H2S	34.08	0	0	0.00	0.0000	0	0			0
Totals				99.99775	1664.4533	73.8308458	24.14	0.737239547	1.2937	0
										99.999

CALCULATED VALUES		
O2 F Factor (dry)	8635	DSCF of Exhaust/MM Btu of Fuel Burned @ 0% excess air
O2 F Factor (wet)	10643	SCF of Exhaust/MM Btu of Fuel Burned @ 0% excess air
Moisture F Factor	2008	SCF of Water/MM Btu of Fuel Burned @ 0% excess air
Combust. Moisture	18.87	volume % water in flue gas @ 0% excess air
Fo	1.8	fuel factor (dimensionless)
VOC Portion of fuel	2.27	%
CO2 F Factor	1022	DSCF of CO2/MM Btu of Fuel Burned @ 0% excess air

8635
1.22
18.87
2.27
1022

ANALYSIS

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

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

@ 14.730 PSIA DRY & UNCORRECTED FOR COMPRESSIBILITY

@ 14.730 & 60 DEG. F

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

TIVE ALARMS

NE

CERTIFICATE OF ANALYSIS NUMBER 199907

SAMPLE IDENT.: MELBOURNE STATION 1380
FLORIDA GAS TRANS.
ENGINE FUEL GAS
FUEL LINE L.F.
03/26/92 @ 10:30

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

1.8 ppm by wt.

0.107 Grains/100 cu. ft. by vol.

0.190 Grains/100 cu. ft. by wt.

SOUTHERN PETROLEUM LABORATORIES, INC.

JC Winfrey

J. C. WINFREY

APPENDIX I: ALTERNATIVE COMPLIANCE TEST DATA

Melbourne Compressor Station--Engine 1--Unofficial Data

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

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

Testing By Cubix Corporation, Austin, Texas

Melbourne Compressor Station--Engine 1--Unofficial Data

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

Test Run No.	C-1	C-2	C-3
Stack Moisture & Molecular Wt. via EPA Method 4			
CO_2 (%)	5.04	5.10	5.08
O_2 (%)	12.20	12.00	11.90
Beginning Meter Reading (ft3)	913.010	940.350	962.200
Ending Meter Reading (ft3)	938.500	961.880	985.750
Beginning Impinger Wt (g)	2455.1	2502.3	2535.6
Ending Impinger Wt. (g)	2502.3	2546.4	2577.5
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	72	85	118
Dry Gas Meter Temperature (°F end)	134	121	141
Atmospheric Pressure (in Hg, abs.)	29.96	29.99	29.99
Stack Gas Moisture (% volume)	8.59	9.40	8.63
Dry Gas Fraction	0.914	0.906	0.914
Stack Gas Molecular Wt. (lbs/lb-mole)	28.32	28.23	28.32
Stack Moisture & Molecular Wt. via Stoichiometry			
Fuel Moisture Content (vol % @ 0% O_2)	18.87	18.87	18.87
Moisture Content (vol % at stack)	8.54	8.73	8.95
Difference between methods	0%	7%	4%
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	1.10	1.60	1.20
ΔP #2	1.30	1.60	1.50
ΔP #3	1.40	1.60	1.50
ΔP #4	1.30	1.40	1.50
ΔP #5	1.50	1.60	1.40
ΔP #6	1.50	1.70	1.60
ΔP #7	1.50	1.60	1.60
ΔP #8	1.40	1.50	1.50
ΔP #9	1.50	1.30	1.50
ΔP #10	1.50	1.50	1.60
ΔP #11	1.60	1.40	1.70
ΔP #12	1.60	1.40	1.50
ΔP #13	1.50	1.50	1.50
ΔP #14	1.50	1.50	1.60
ΔP #15	1.60	1.50	1.60
ΔP #16	1.60	1.50	1.60
Sum of Square Root of ΔP's	19.3	19.7	19.7
Number of Traverse Points	16	16	16
Average Square Root of ΔP's	1.21	1.23	1.23
Average Temperature (°F)	652	662	669
Static Pressure (in. H_2O)	2	1.8	2
Stack Diameter (in.)	23.5	23.5	23.5
Stack Area (ft2)	3.01	3.01	3.01
Stack Velocity (ft/min)	5943	6082	6115
Stack Flow,wet (ACFM)	17901	18320	18420
Stack Flow,dry (SCFH)	4.69E+05	4.72E+05	4.76E+05
Stack Flow Rate via EPA Method 19			
Fuel Flow to Engine (SCFH)	16730	16730	16730
Fuel Heating Value (BTU/SCF)	1022	1022	1022
Fuel O_2 F-Factor (DSCFH/MMBTU)	8635	8635	8635
Fuel CO_2 F-Factor (DSCFH/MMBTU)	1022	1022	1022
Stack Flow, dry via O_2 F-factor (SCFH)	3.55E+05	3.47E+05	3.43E+05
Stack Flow, dry via CO_2 F-factor (SCFH)	3.47E+05	3.43E+05	3.44E+05
Difference between O_2 F-factor and pitot tube	24%	27%	28%
Difference between CO_2 F-factor and pitot tube	26%	27%	28%
Stack Flow Rate via Carbon Balance			
Fuel Carbon Content	1.021	1.021	1.021
Exhaust Carbon Content	5.19	5.25	5.23
Stack Flow, dry via carbon balance (SCFH)	3.29E+05	3.25E+05	3.27E+05
Difference between carbon balance and pitot tube (%)	30%	31%	31%

Testing By Cubix Corporation, Austin, Texas

Melbourne Compressor Station--Engine 2--Unofficial Data

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

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

Melbourne Compressor Station--Engine 2--Unofficial Data

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

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

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