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INTRODUCTION

One Dresser Rand 10TCV engine was tested to determine the quantity of emissions released into the atmosphere. The tests were conducted on March 17, 1992 at Compressor Station No. 12 located near Munson, in Santa Rosa 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 57-188869.

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

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

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

Florida Gas Transmission Co.

Cubix Corporation

Table 1
Background Data

Source Owner/Operator:	**Florida Gas Transmission Co.** 601 South Lake Destiny Drive Maitland, Florida 32751 (407) 875-5816 TEL (407) 875-5896 FAX Attn: Allan Weatherford
Testing Organization	**Cubix Corporation** 9225 Lockhart Hwy Austin, Texas 78747 (512) 243-0202 TEL (512) 243-0222 FAX Attn: Lowell Faulkner
Test Participants:	**Florida Gas Transmission Co.** Allan Weatherford Jerry Thomas Bill Rogers Fred Griffin **Dresser Rand** Bill Hutchins **Cubix Corporation** Lowell Faulkner Norman Franco Tony Sacre
Test Date:	March 17, 1992
Location:	near Munson, in Santa Rosa County, Florida
Process Description:	Dresser Rand 10TCV compressor engine
Sampling Points:	Exhaust stack of compressor engine (See Appendix A)

Regulatory Application:

Florida Department of Environmental Regulation Permit No. AC 188869

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 Dresser Rand 10TCV compressor engine was tested to determine the quantity of emissions vented to the atmosphere. The emission measurements reported herein result from tests conducted on March 17, 1992 at Compressor Station No. 12 located near Munson, in Santa Rosa County, Florida. The purpose of these tests was to determine the compliance status of this engine with regard to the FDER permit.

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

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

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

The average emissions over the three test runs for NOx were found to be 9.27 lbs/hr, 40.7 tons/yr, and 1.01 g/hp-hr. By comparison, permit limits are 17.6 lbs/hr, 77.2 tons/yr, and 2.0 g/hp-hr. CO emissions averaged 20.6 lbs/hr, 90.4 tons/yr, and 2.25 g/hp-hr and are limited by the permit to 22.1 lbs/hr, 96.6 tons/yr, and 2.5 g/hp-hr. The tons/yr emission rates are based on 8760 hrs/year operation of the engine.

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

10 grains/100 DSCF. The mass emission rate of SO_2 presented in Table 2 was calculated from the estimated fuel flow to the engine assuming that all sulfur in the fuel was oxidized to SO_2. The SO_2 emission rate based on this calculation averaged <0.0026 lbs/hr or <0.012 tons/yr. The permit limits for SO_2 mass emissions are 0.8 lbs/hr and 3.5 tons/yr.

Nonmethane hydrocarbon (i.e. VOC) concentrations were measured as required by the permit using EPA Method 25. Table 2 contains the results of those measurements. The average VOC emissions using Method 25 were 15.3 lbs/hr, 67.0 tons/yr, and 1.66 g/hp-hr. The permit limits nonmethane hydrocarbon emissions to 8.8 lbs/hr, 38.6 tons/yr, and 1.0 g/hp-hr.

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

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

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

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

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

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

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

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

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

(2) It is hoped that the data included in Appendix I can be used to

allow for alternate test methods to be used on future emission tests on similar sources.

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

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

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

TABLE 2
SUMMARY OF RESULTS

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

Test Run No.	**C-1**	**C-2**	**C-3**
Date	3/17/92	3/17/92	3/17/92
Start Time	14:15	15:35	16:52
Stop Time	15:15	16:35	17:52
Engine/Compressor Operation			
Engine Speed (rpm)	330	330	330
Ignition Timing (°BTDC)	8	8	8
Air Manifold Pressure (psig)	16	16	16
Air Manifold Temperature (°F)	124	124	124
Estimated Fuel Flow AT 7600 BTU/hp-hr (SCFH)	31386	31386	31386
Fuel Temperature (°F)	48	47	46
Fuel Manifold Pressure (psig)	35	35.5	35
Loading Step (pockets open out of 10 total)	9	9	9
Suction Pressure (psig)	681	680	679
Suction Temperature (°F)	63	63	62
Discharge Pressure (psig)	919	920	918
Discharge Temperature (°F)	105	105	105
Engine Load (BHP)	4171	4171	4171
Torque (%)	97	96	96
Ambient Conditions			
Atmospheric Pressure (in. Hg)	29.95	29.92	29.92
Temperature (°F) : Dry bulb	78	78	71
(°F) Wet bulb	73	76	66
Humidity (lb/lb air)	0.0159	0.0184	0.0123
Measured Emissions			
NOx (ppmv)	68.0	66.0	62.0
CO (ppmv)	240	236	240
O2 via EPA Method 3 (vol %)	15.00	15.50	15.50
CO2 via EPA Method 3 (vol %)	3.00	3.00	3.00
VOC via EPA Method 25 (ppmv)	318.0	331.6	277.7
SO2 in fuel (grains/100 SCF)	<0.059	<0.059	<0.059
Stack Volumetric Flow Rates			
via Pitot Tube (SCFH, dry)	1.21E+06	1.20E+06	1.16E+06
Calculated Emission Rates (via pitot tube)			
NOx (lbs/hr)	9.83	9.43	8.60
CO (lbs/hr)	21.1	20.5	20.3
VOC (lbs/hr)	16.0	16.5	13.4
SO2 (lbs/hr)	<0.0026	<0.0026	<0.0026
NOx (tons/yr)	43.1	41.3	37.7
CO (tons/yr)	92.5	89.9	88.8
VOC (tons/yr)	70.0	72.2	58.7
SO2 (tons/yr)	<0.012	<0.012	<0.012
NOx (g/hp-hr)	1.07	1.03	0.94
CO (g/hp/hr)	2.30	2.23	2.21
VOC (g/hp-hr)	1.74	1.79	1.46

ppm
12780
34820

33,700

PROCESS DESCRIPTION

Florida Gas Transmission Co. owns and operates the Munson Compressor Station No. 12 located near Munson, 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 Dresser Rand 10TCV compressor engine bearing the serial number 10TCV112AP. The engine is rated at 4,000 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. However, these sample ports were also located upstream of the turbocharger. It was determined by Florida Gas personnel and the Dresser Rand representative that use of these ports would affect the operation of the turbocharger. Consequently, two additional sample ports were installed in a vertical section of the pipe at the silencer. The stack inside diameter at that location is 35-1/5 inches. These ports were used during the testing. 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 the sample port locations.

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 (i.e. measured pitch and yaw flow angles) 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 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. 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. As required by the permit, *Summary of Results* uses the flow rate results obtained from the pitot tube traverses in all calculations. In this case, since the pitot tube values consistently provided the highest flow rate rates, this resulted in a worst case scenario. However, the alternate methods provided for a check of the pitot tube traverse results.

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

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

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

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

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

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

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

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

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

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

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

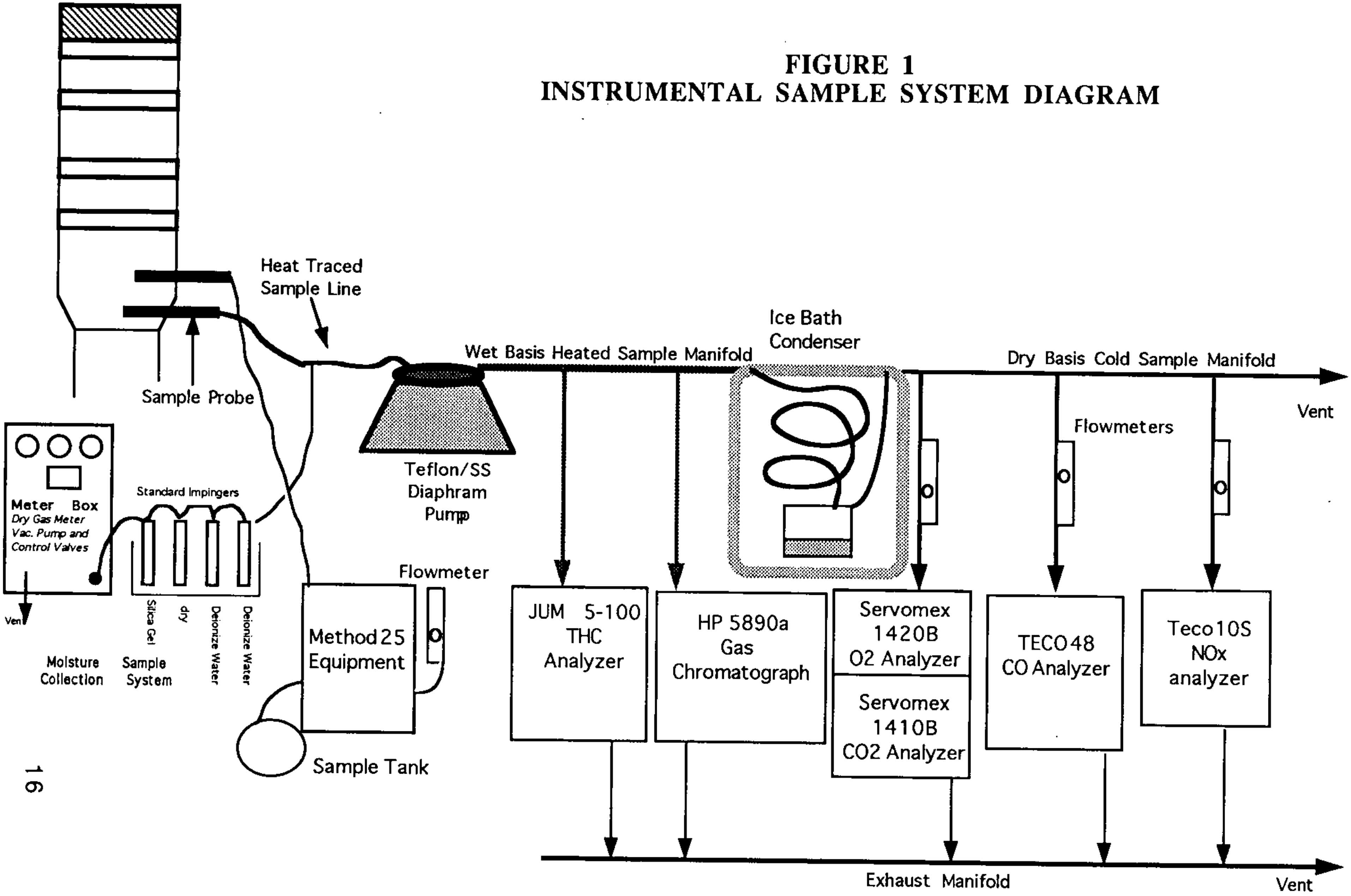
During the tests, the engine and compressor operational data was collected by Florida Gas personnel and is presented in Appendix A. Key operational data collected include compressor discharge pressures, compressor suction pressures, engine manifold pressure, engine speed, timing, and horsepower. Florida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

TABLE 3
ANALYTICAL INSTRUMENTATION

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

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

FIGURE 1
INSTRUMENTAL SAMPLE SYSTEM DIAGRAM



QUALITY ASSURANCE ACTIVITIES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

APPENDIX A:
FIELD DATA SHEETS AND OPERATIONAL DATA

SIGN IN SHEET

JOB NAME: FLORIDA GAS

DATE: 3 / 17 / 92

LOCATION: MUNSON FLORIDA

PERMIT #: AC57-188869
#CD-FL-156

SOURCE(S): Dresser Rand Engine

PARTICIPANTS: Cubix Corporation
FLORIDA GAS
ENRON
Dresser-Rand

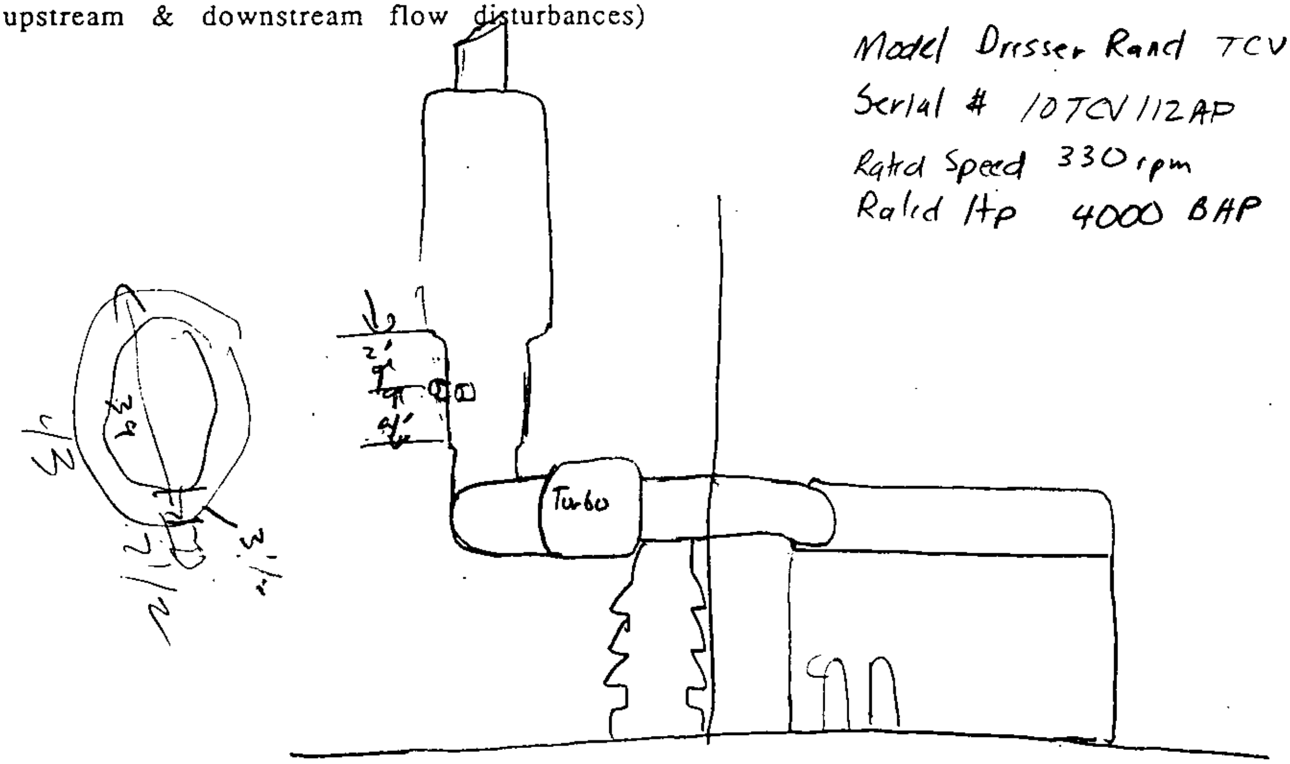
NAME:	AFFILIATION:	PHONE NUMBER:
PLEASE PRINT		
Lowell Faulkner	Cubix	512 243 0202
Tony Sacar	"	"
Norman Franco	"	"
Jerry Thomas	Enron	713-853-7331
Bill Hutchins	D-R	607-937-2120
Allen Weatherford	Florida Gas	407 875-5816

Circular Stack Sampling Traverse Point Layout
(EPA Method 1)

Date: 3/17/92
Plant: FGT MUNSON
Source: Compressor Engine
Technician(s) LF, NF, TS

Port + Stack ID: 43 in.
Port Extension 7.5 in.
Stack ID: 35.5 in.
Stack Area 6.87 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)



Model Dresser Rand TCV10
Serial # 10TCV112AP
Rated Speed 330 rpm
Rated Hp 4000 BHP

Traverse Point Number	Length Factor (% of diameter) Number of traverse pts./diameter				Distance from Reference Point (inches)
	4	6	8	12	
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	6.9
4	93.3	70.4	32.3	17.7	11.5
5		85.4	67.7	25.0	24.0
6		95.6	80.6	35.6	28.6
7			89.5	64.4	31.8
8			96.8	75.0	34.4
9				82.3	
10				88.2	
11				93.3	
12				97.9	

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3/17/92

Plant/Operator: F6T Munson

Source: Dresser Rand

Technicians: LF, NF, TS

Atm. Pres. 29.95 in.Hg(Pb)

Test Run # C-1

Dry Gas Meter ID: Anderson

Dry Gas Meter Factor: 0.9904 (Kd)

Pitot Tube #/Type: #107 S-Type

Pitot Tube Factor: 0.84 (Kp)

Static Pres. - 0.18 in.H2O(Pg)

Average Stack Temp. 539 °F(Ts)

Pre-test Leak check 0.0 OK	0 ft.3/min at in. Hg Vacuum 12"Hg
Post-test Leak check OK	0.000 ft.3/min at in. Hg Vacuum 22.0

Impinger #	Contents	Initial Weight	Final Weight
1	dH2O	629.4	650.8
2	dH2O	660.9	664.0
3	MT	473.7	475.1
4	SiGel	778.9	786.5
5			
6			
Totals		2542.9	2576.4

Moisture Train

	Initial	Final
Time:	1422	1528
Meter Reading (ft3 or L)	388.525	413.270
Meter Temp. (°F)	122	140
Sample Box #	Tr 7 Box	

ORSAT

O2 %	15.0
CO2 %	3.0

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	ΔP (" H2O)	°F	ß	ΔP (" H2O)	°F	ß
1	0.82			2.20		
2	0.94			2.30		
3	1.50			2.40		
4	1.50			2.0		
5	1.8			1.20		
6	2.80			0.81		
7	2.90			0.65		
8	3.10			0.62		
9						
10						
11						
12						

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3/17/92
Plant/Operator: FGT Munson, FL GAS
Source: D-R Engine
Technicians: LF, NF, TS
Atm. Pres. 29.92 in.Hg(Pb)
Test Run # C-2

Dry Gas Meter ID: Anderson
Dry Gas Meter Factor: 0.9904 (Kd)
Pitot Tube #/Type: F107 S-type
Pitot Tube Factor: 0.84 (Kp)
Static Pres. -0.10 in.H2O(Pg)
Average Stack Temp. 543 °F(Ts)

Pre-test Leak check OK	0.000 ft.3/min at 20.0 in. Hg Vacuum
Post-test Leak check OK	0.0 ft.3/min at 20 in. Hg Vacuum

Impinger #	Contents	Initial Weight	Final Weight
1	H_2O	663.8	770.9
2	H_2O	664.6	592.0
3	MT	476.7	475.1
4	S. Gel	786.8	791.7
5			
6			
Totals		2591.9	2622.7

Moisture Train

	Initial	Final
Time:	1535	1045
Meter Reading (ft3 or L)	413.528	435.160
Meter Temp. (°F)	128	130
Sample Box #	TK7 Box	

ORSAT

O2 %	15.5
CO2 %	3.0

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	ΔP (" H2O)	°F	ß	ΔP (" H2O)	°F	ß
1	2.5			1.1		
2	2.6			1.4		
3	2.1			1.4		
4	1.9			1.5		
5	0.85			2.1		
6	0.05			2.1		
7	0.01			2.5		
8	0.74			2.5		
9						
10						
11						
12						

MOISTURE AND VELOCITY FIELD DATA SHEETS

Date: 3/17/92
Plant/Operator: FGT Munson
Source: D-R Engine
Technicians: LF, NF, TS
Atm. Pres. 29.86 in.Hg(Pb)
Test Run # C-3

Dry Gas Meter ID: Anderson
Dry Gas Meter Factor: 0.9904 (Kd)
Pitot Tube #/Type: A107 S-type
Pitot Tube Factor: .84 (Kp)
Static Pres. -.05 in.H2O(Pg)
Average Stack Temp. 542 °F(Ts)

Pre-test Leak check ok	0 ft.3/min at 12 in. Hg Vacuum	Impinger #	Contents	Initial Weight	Final Weight
		1	H2O	770.9	816.6
Post-test Leak check OK	0 ft.3/min at 16" in. Hg Vacuum	2	H2O	582.0	557.9
		3	MT	478.1	484.3
		4	Si Gel	791.7	790.3
		5			
		6			
		Totals		2622.7	2649.1

Moisture Train

	Initial	Final
Time:	17:00	1806
Meter Reading (ft3 or L)	435.240	457.398
Meter Temp. (°F)	124	130
Sample Box #	JK 7 BOX	

ORSAT

O2 %	15.5
CO2 %	3.0

Pitot Tube Traverse/Stack Temp./Angle

Traverse Pt.	ΔP (" H2O)	°F	ß	ΔP (" H2O)	°F	ß
1	1.6			2.2		
2	1.42			2.5		
3	1.3			2.3		
4	1.4 1.6			1.8		
5	1.5			1.1		
6	1.58			.68		
7	2.0			.65		
8	2.1			.74		
9						
10						
11						
12						

Munson Compressor Station: Moisture, Molecular Weight, Stack Flow Rate

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

Test Run No.	C-1	C-2	C-3
Stack Moisture & Molecular Wt. via EPA Method 4			
CO2 (%)	3.00	3.00	3.00
O2 (%)	15.00	15.50	15.50
Beginning Meter Reading (ft3)	388.525	413.528	435.260
Ending Meter Reading (ft3)	413.270	435.160	457.398
Beginning Impinger Wt (g)	2542.9	2591.9	2622.7
Ending Impinger Wt. (g)	2576.4	2619.7	2649.1
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	122	128	124
Dry Gas Meter Temperature (°F end)	140	130	130
Atmospheric Pressure (in Hg, abs.)	29.95	29.95	29.92
Stack Gas Moisture (% volume)	6.73	6.39	5.94
Dry Gas Fraction	0.933	0.936	0.941
Stack Gas Molecular Wt. (lbs/lb-mole)	28.33	28.39	28.44
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	0.82	2.50	1.10
ΔP #2	0.94	2.60	1.40
ΔP #3	1.50	2.10	1.30
ΔP #4	1.50	1.90	1.40
ΔP #5	1.80	0.85	1.50
ΔP #6	2.80	0.65	1.80
ΔP #7	2.90	0.61	2.00
ΔP #8	3.10	0.74	2.10
ΔP #9	2.20	1.10	2.20
ΔP #10	2.30	1.40	2.50
ΔP #11	2.40	1.40	2.30
ΔP #12	2.00	1.50	1.80
ΔP #13	1.20	2.10	1.10
ΔP #14	0.81	2.10	0.68
ΔP #15	0.65	2.50	0.65
ΔP #16	0.62	2.50	0.74
Sum of Square Root of ΔP's	20.4	20.1	19.4
Number of Traverse Points	16	16	16
Average Square Root of ΔP's	1.27	1.26	1.22
Average Temperature (°F)	539	541	542
Static Pressure (in. H2O)	-0.18	-0.1	-0.05
Stack Diameter (in.)	35.5	35.5	35.5
Stack Area (ft2)	6.87	6.87	6.87
Stack Velocity (ft/min)	5948	5870	5683
Stack Flow,wet (ACFM)	40885	40350	39060
Stack Flow,dry (SCFH)	1.21E+06	1.20E+06	1.16E+06

Testing By Cubix Corporation, Austin, Texas

10TCV112 AP FIELD TEST FLORIDA GAS STATION 12
MUNSON, FLA.
BHP BY LOADING CURVES 3550

RUN	1A	1B		2A	2B		3A	3B		4		
FUEL TEMP., °F	46.7°	46.9		46.6	46.3		46.0	45.4		44.3		
BHP by panel	3977	+1.1%	=4021									
TIME	2:08	2:45		4:05	4:31		5:05	5:35		6:13		
BLOWER INLET TEMP °F	76	76		74.5	74.0		71.0	70.0		70		
AIR MFLD TEMP. °F MOORE/THERM	124.5/125	124.9/125		124.2/124	124.1/124		124.6/124	124.1/124		103.6/103.5		
ENGINE SPEED, RPM DYNALCO/MOORE	330/332	330/332		331/332	330/332		330/331	330.5/332		331/331		
LOAD STEP	16	16		16	16		16	16		7		
SUCT PRESS PSIG	685	683		681	680		680	678		672		
DISCH PRESS, PSIG	921	921		918	918		918	916		917		
AIR MFLD PRESS, PSIG	16.1	16.2		16.2	16.1		16.2	16.25		18.8		
FUEL MFLD PRESS, PSIG	35.3	35.15		35.1	35.1		35.5	35.2		40.5		
PCC FUEL PRESS, PSIG	37.0	37.0		36.7	36.8		37.2	37.1		40.9		
SPARK, °BTC	8°	8		8	8		8	8		6		
JW PRESS, PSIG, IN/OUT	15.9/29.9	29.3/15.4		29.4/15.3	29.3/15.1		30/15.1	29.6/15.3		30.1/15.3		
M.B. OIL PRESS, PSIG	48.7	48.4		48.4	48.6		48.8	48.6		48.5		
TURBO OIL PRESS, PSIG	20.0	20.2		20.3	20.1		20.1	20.2		20.2		
TURBO SPEED, RPM	11,900	11,900		11,900	11,900		11,850	11,800		12,600		
AFTERC. H2O IN, °F. SETPOINT	123	123		123	123		123	123		95.1		
AFTERC H2O IN, ACTUAL MOORE/THERM	122.9/126	123.4/126		122.9/125.5	122.6/125.5		122.6/126	122.4/125		101.1/103.5		
AFTERCOOLER H2O OUT, °F	131	131.5		131	131		131	130.5		111.5		
JW TEMP, °F, IN/OUT	152/156	152.5/154		152/154	152/154		157/159	151/154		150.5/154		
OIL TEMP, °F, IN/OUT	142/153	142/153		141.5/152.5	142/153		141/152	141/152		142/152		
CYL #1LB °F	614	615		614	616		614	613		651		
2LB	681	682		682	683		679	680		697		
3LB	640	652		649	647		646	644		683		
4LB	638	641		638	638		637	638		665		
5LB	633	635		631	633		633	630		658		
1RB	591	593		592	595		590	588		617		
2RB	610	611		611	610		611	610		614		
3RB	630	631		631	629		627	627		662		
4RB	603	602		602	602		603	601		627		
5RB	616	615		615	613		616	616		637		
TURBINE IN/OUT °F	702/536	701/538		702/539	701/539		701/539	701/539		728/548		
% TORQUE DYNALCO/MOORE	97/97	96.5/96.5		96.5/97	96/97		96/97	96/97		110.5/110.5		
BAROM., IN HG.	29.95	29.95		—	29.95		29.96	29.95				
% O_2	15.25			15.7			15.625			15.6		
% CO_2	3.02			3.00			3.05			2.93		
CO, PPM	240			236			240			191		
CO LBS/HR	21.23			21.23								
CO g/BHP-HR	2.42			2.22								
NO_x, PPM	68			66			62			86		
NO_x LBS/HR	9.89			9.38								
NO_x g/BHP-HR	1.13			1.02								
THC, PPM WAT	1200			1115			1200			1050		
THC LBS/HR	60.7			55.18								
THC, g/BHP-HR	6.92			6.01								

(15 CYCLES) BHP by PFM = 4241.4
SPEED " " 333
AVG BHP = 4131-
~~Woodward speed~~ 3304-334.2 330.6-333.8

10TCV112 AP FIELD TEST

FLORIDA GAS STATION 12
MUNSON, FLA.

BHP BY LOADING CURVES 3550

RUN	1A	1B		2A	2B		3A	3B		4		
FUEL TEMP., °F	46.7°	46.9		46.5	46.3		46.0	45.4		44.3		
BHP by panel	3977	+1.1%	= 4021									
TIME	2:08	2:45		4:05	4 31		5:05	5:35		6:13		
BLOWER INLET TEMP °F	76	76		74.5	74.0		71.0	70.0		70		
AIR MFLD TEMP. °F MOORE / THERM	124.5/125	124.9/125		124.2/124	124.3/124		124.1/124	124.1/124		103.6/102.5		
ENGINE SPEED, RPM DYNALCO / MOORE	330/332	330/332		331/332	330/331		330/331	330.5/332		331/331		
LOAD STEP	16	16		16	16		16	16		7		
SUCT PRESS PSIG	685	683		681	680		680	678		672		
DISCH PRESS, PSIG	921	921		918	918		918	916		917		
AIR MFLD PRESS. PSIG	16.1	16.2		16.2	16.1		16.2	16.25		18.8		
FUEL MFLD PRESS, PSIG	35.3	35.15		35.1	35.1		35.5	35.2		40.5		
PCC FUEL PRESS, PSIG	37.0	37.0		36.7	36.8		37.2	37.1		40.9		
SPARK, °BTDC	8°	8		8	8		8	8		6		
JW PRESS, PSIG, IN/OUT	15.9/29.9	29.3/15.4		24.4/15.3	29.3/15.1		30/15.1	29.6/15.3		30.1/15.3		
M.B. OIL PRESS, PSIG	48.7	48.4		48.4	48.6		48.8	48.6		48.5		
TURBO OIL PRESS, PSIG	20.0	20.2		20.3	20.1		20.1	20.2		20.2		
TURBO SPEED, RPM	11,400	11,900		11,900	11,700		11,850	11,800		12,600		
AFTERC. H_2O IN, °F. SETPOINT	123	123		123	123		123	123		95.1		
AFTERC. H_2O IN, ACTUAL MOORE / THERM	122.9/126	123.4/126		122.9/125.5	122.1/125.5		122.6/126	122.4/125		101.1/103.5		
AFTERCOOLER H_2O OUT, °F	131	131.5		131	131		131	130.5		111.5		
J.W. TEMP, °F, IN/OUT	152/156	152.5/154		152/154	152/154		151/159	151/154		150.5/154		
OIL TEMP, °F., IN/OUT	141/153	142/153		141.5/152.5	142/153		141/152	141/152		140/152		
CYL #1LB °F	614	615		614	616		614	613		651		
2LB	681	682		682	683		679	680		697		
3LB	640	652		649	647		646	644		683		
4LB	630	641		638	638		637	638		665		
5LB	633	635		631	633		633	630		658		
1RB	591	593		592	595		590	588		617		
2RB	610	611		611	610		611	610		614		
3RB	630	631		631	629		627	627		662		
4RB	603	602		602	602		603	601		627		
5RB	616	615		615	613		616	616		637		
TURBINE IN/OUT, °F	701/538	701/538		702/529	701/539		701/539	701/539		728/548		
% TORQUE DYNALCO/MOORE	97/97	96.5/96.5		96.5/97	96/97		96/97	96/97		110.5/110.5		
BAROM., IN HG	29.95	29.95		—	29.95		29.96	29.95				
% O_2	15.25			15.7			15.625			15.6		
% CO_2	3.02			3.00			3.05			2.93		
CO, PPM	240			236			240			191		
CO LBS/HR	21.23			21.23								
CO g/BHP-HR	2.42			2.22								
NO_x, PPM	69			66			62			86		
NO_x LBS/HR	9.89			9.38								
NO_x g/BHP-HR	1.13			1.02								
THC, PPM WET	1200			1115			1200			1050		
THC LBS/HR	60.7			55.18								
THC, g/BHP-HR	6.92			6.01								

(15 CYCLES) BHP by PFM = 4241.4
SPEED " " 333
AVG BHP = 4131
Woodward speed 330.4-334.2 33 330.6-333.8

Volatile Organic Carbon by Method 25

Client: Florida Gas
Plant: Mission Station
Operator: LF NF TS
Run Number: C-1
Tank Number: (4T238
Sampling Train ID#: EX25
Side: Left / Right: #2
Start Time: 1425
Project #:
Sample Location: center of exhaust stack
Date: 3/17/92
Sample ID: C-1
Trap Number: S00B A00C20 N-13
% CO2: 3.02
% H2O: ~~9.2~~ ~~8.8~~ ~~6.12~~ 7%
Stop Time: 1530

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	27.8	27.4	1015 mb	85
Post Test	17.2	17.0	1015	85

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	0

$$\Delta P = .01 \frac{F\ Pb\ \emptyset}{Vt} = \frac{.01 * \cancel{60}\ 55 * 29.95 * \cancel{10}}{100}$$

21.25 - 21 = .24

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 35cc/min (silver ball)	Probe Temp C / [✓ F]	Filter Temp C / [✓ F]	Notes
1425	27.4	35	265	250	
1428	27.0	35	265	250	
1430	26.2	35	265	250	
1432	24.9	35	264	251	
1435	24.5	33	263	254	
1440	24.0	35	262	252	
1445	23.4	33	265	251	
1450	22.9	35	264	250	
1455	21.3	35	262	249	
1500	19.7	35	265	250	
1505	19.0	35	266	251	
1510	185	35	267	254	
1515	17.7	35	264	255	
1520	17.2	35	263	253	

Volatile Organic Carbon by Method 25

Client: Florida Gas
Plant: Munson Station
Operator: LENE, JS
Run Number: C-2
Tank Number: 4T 222
Sampling Train ID#: EX 25
Side: Left / Right: #2
Start Time: 1530

Project #:
Sample Location: Centroid
Date: 3/17/92
Sample ID: C-2
Trap Number: (B53-
% CO2: 3%
% H2O: 7%
Stop Time: 1630

Pressure Readings	Tank Vacuum Manometer mm Hg / in Hg	Tank Vacuum Gauge mm Hg / in Hg	Barometric Pressure mm Hg / in Hg	Ambient Temperature C [✓ F]
Pre Test	27.9	28.4	29.92	77
Post Test	4.2	3.9	~~[illegible]~~ 29.89	80

Leak Rate	Tank * (in Hg) Allowable	Tank * (in Hg) Actual	Trap black ball reading
Pre Test	0.52	0	0
Post Test	.52	14.9 5.60 14.0 end .40	0

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

$$.01 \frac{35\ 21.92\ (5)}{100}$$

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

Clock Time	Gauge Vacuum (in Hg)	Flowmeter Setting (silver ball)	Probe Temp C / F	Filter Temp C / F	Notes
1530	28.4	35	264	250	
1535	26.0	35	263	251	
1540	25.1	35	264	250	
1545	24.0	35	265	252	
1550	22.3	35	264	251	
1555	20.5	35	262	254	
1600	18.0	37	269	255	
1605	17.0	38	265	252	
1610	14.3	40	265	253	
1615	10.9	39	264	252	
1620	7.8	38	266	250	
1625	6.2	39	265	252	
1630	3.9	40	266	253	

Volatile Organic Carbon by Method 25

Client: FLORIDA GAS
Plant: MUNSON STATION
Operator: NF LF TS
Run Number: C-3
Tank Number: 4T 254
Sampling Train ID#: EX 25
Side: Left / Right: #2
Start Time: 1 1643

Project #:
Sample Location: center of engine shop
Date: 3/17/92
Sample ID: C-3
Trap Number: C-13
% CO2: 3%
% H2O: 7%
Stop Time: 1745

Pressure Readings	Tank Vacuum Manometer mm Hg / in Hg	 Gauge mm Hg / in Hg	Barometric Pressure mm Hg / [✓ in Hg]	Ambient Temperature C / [✓ F]
Pre Test	29.4	27.9	29.86	~~3~~ 80
Post Test	7.1	6.1	29.86	73

Leak Rate	Tank* (in Hg) Allowable	 Actual	Trap black ball reading
Pre Test	.152	0	0
Post Test	.152	0	0

$$\Delta P = .01\,\frac{F\,Pb\,\text{ø}}{Vt} = \frac{,01 \times 35 \times 29.86 \times 5}{100}$$

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

Clock Time	Gauge Vacuum (in Hg)	Flowmeter Setting (silver ball)	Probe Temp C / F	Filter Temp C / F	Notes
1643	29.4	40	260	252	
1648	27.1	40	262	252	
1653	25.0	40	264	254	
1658	23.1	40	265	255	
1703	20.7	40	267	255	
1708	18.1	40	267	256	
1713	17.2	39	267	254	
1718	16.8	37	270	253	
1723	15.4	39	265	251	
1728	14.2	38	264	253	
1733	12.2	37	260	255	
1738	9.0	40	260	255	
1743	6.1	37	261	252	

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

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
	4/1/92 1:42	LAB 412 Tom Gro[illegible]			

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:

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

Clean Air Engineering

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

4334

CHAIN OF CUSTODY RECORD

PROJ. NO.

DEPT. NO. 8151

PROJECT NAME Cubix Corp.

SAMPLERS: *(Signature)* Joseph Rudyk

LAB NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CON-TAINERS	COS 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	3/24/92	1130	C1		2.4						Silver Springs - Fla. GAS ✓
	C-1	3/19/92	900	C3		3.5						Quincy - Fla. GAS ✓
	Adit-2	3/26/92		C7		0.8						Melbourne
	C-3	3/29/92	1120	C10		6.6						Perry - Fla. GAS ✓
	C-3	3/17/92	1643	C13		3.6						MUNSON. - Fla. GAS ✓
	C-3			C15		3.6						Brooker
	C-2	3/26/92	955	C37		0.8						Melbourne - Fla. GAS ✓
	G-2	3/18	1300	R002		4.3						Coating with C - Plant
				R004		1.2						
				R008		2.5						
				X1		2.6						
	C-1	3/20/92	830	X10		2.5						Perry - Fla. GAS ✓

LAB 4/12

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
	4/1/92 1:42	Tom Grosch			
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.

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 (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
				Y27		1.8						
				X28		8.0						
	C-3	3/24/92	1100	X32		3.3						Melbourne - Fla. GAS ✓
	C-1	3/24/92	1000	X48		9.0						Silver Springs - Fla. GAS ✓
	C-4	3/27/92		XY		2.3						Melbourne
	C-3	3/19/92	1135	N2		5.6						Quincy - Fla. GAS ✓
	C-3	3/24/92	1310	N4		3.0						Silver Spring - Fla. GAS ✓
				N7		2.1						
	C-6	3/27/92		N8		2.6						Melbourne
	C-1	3/17/92	1425	N15		8.7						Munson - Fla GAS ✓
	~~C-1~~	~~[illegible]~~	~~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)
	4/1/92 1:42				

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

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

REMARKS:

Clean Air Engineering

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

Table of Carbon Concentration for Method 25. Samples collected by Cubix Corp. at Florida Gas & Trans on 3/17/92 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)
MUNSON STATION	C-1	158.8	318.0	269.5	48.5
	C-2	165.6	331.6	285.7	45.9
	C-3	138.6	277.7	235.3	42.4

Compiled By: ____________ On: 5-1-92

Approved By: ____________ On: 5/1/92

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

Plant: Florida Gas & Trans.
Sample Loc. Munson Station
(In/Out) Centroid
Date 3/19/92

Preliminary Data				
Run No.		C-1	C-2	C-3
Tank No.		4T238	4T222	4T254
Trap No.		NO 13	B53	C13
Tank Volume V(cc)		4272	4255	4265
Field Data				
PTI	(mm Hg)	-706	-709	-747
TTI	(F)	85	77	80
PbI	(mm Hg)	760	760	758
PT	(mm Hg)	-437	-107	-180
TT	(F)	85	80	73
Pb	(mm Hg)	760	759	758
Noncondensible Organics				
PT(Lab)	(mm Hg)	-400	-80	-158
TT(Lab)	(F)	77	77	77
Pb(Lab)	(mm Hg)	749	749	749
PTF	(mm Hg)	922	920	920
TTF	(F)	77	77	77
PbF	(mm Hg)	749	749	749
Ba	(ppmv C)	1.6	0.0	0.1
Ctm 1	(ppmv C)	9.1	15.7	14.7
Ctm 2	(ppmv C)	9.5	17.5	14.4
Ctm 3	(ppmv C)	9.3	16.1	14.7
Avg. Ctm	(ppmv C)	9.3	16.4	14.6
RSD Ctm	(%)	2.2	5.8	1.2
Condensible Organics				
ICV Tank No.		4T243	4T249	4T154
ICV Tank, Vv (cc)		4277	4255	3995
PFI	(mm Hg)	-742	-742	-742
TFI	(F)	77	77	77
PbFI	(mm Hg)	749	749	749
PF	(mm Hg)	920	920	920
TF	(F)	78	77	78
PbFf	(mm Hg)	749	749	749
Bt	(ppmv C)	8.7	4.5	3.6
Ccm 1	(ppmv C)	50.2	105.9	87.5
Ccm 2	(ppmv C)	52.1	106.2	90.8
Ccm 3	(ppmv C)	52.4	108.3	90.7
Avg. Ccm	(ppmv C)	51.6	106.8	89.7
RSD Ccm	(%)	2.3	1.2	2.1
Total Gaseous Nonmethane Organics (TGNMO)				
Vs	(cc)	1467	3291	3151
Dil. Factor (Non)		6.298	2.793	2.924
Dil. Factor (Con)		6.286	2.793	2.734
Ct	(ppmv C)	48.5	45.9	42.4
Cc	(ppmv C)	269.5	285.7	235.3
Ct+Cc= C	(ppmv C)	318.0	331.6	277.7
Mc	(mg C/dscm)	158.8	165.6	138.6

APPENDIX B:
EXAMPLE CALCULATIONS

MOISTURE CONTENT

refers to test run C-1 at Munson Station No. 12

V_1 = initial dry gas meter reading = 388.525 ft^3
V_2 = final dry gas meter reading = 413.270 ft^3
V_{net} = total gas sample volume collected (ft^3)
= V_2-V_1
= 413.270 - 388.525 = 24.745 ft^3

M_1 = initial weight of impinger train = 2542.9 g
M_2 = final weight of impinger train = 2576.4 g

MWC = total weight gain of all impingers (g)
= M_2 - M_1 = 2576.4- 2542.9
= 33.5 g

K_d = dry gas meter factor (unitless) = 0.9904

$V_{corrected} = V_{net} \times K_d =$ x
= 24.745 x 0.9904 = 24.507 ft^3

1.335 liters weighs 1 gram at standard conditions
499.4 = Gas constant
P_{bar} = barometric pressure (in Hg) = 29.95
T = temperature of gas DGM (F°) = 131.0

F_w = moisture fraction by volume

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

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

$$= \frac{(33.5 \times 1.335)}{(33.5 \times 1.335) + (((24.507 \times 29.95) / (131.0 + 460)) \times 499.4)}$$

= 0.063 moisture

Moisture Content via Stoichiometry

Refers to test run #1

H = Ambient humidity (via psychrometer) = 0.0159 lb/lb air
O2 = O2 concentration in stack = 15.25%
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
= 18.85 %

Fw = moisture content
= (CM x (20.9 - O2)/20.9) + (H x 64.3)
= (18.85 x (20.9 - 15.25)/20.9) + (.0159 x 64.3)
= 6.12 %

MOLECULAR WEIGHT

refers to test run C-1 at Munson Station No. 12

MW_{H_2O} = molecular wt of H_2O = 18 lb/lb-mole
MW_{CO_2} = molecular wt of CO_2 = 44 lb/lb-mole
MW_{O_2} = molecular wt of O_2 = 32 lb/lb-mole
MW_{N_2} = molecular wt of N_2 = 28 lb/lb-mole
C_{CO_2} = concentration of CO_2 = 3.0(from analyzer)
C_{O_2} = concentration of O_2 = 15.0 (from analyzer)
C_{N_2} = concentration of N_2 = $1-(C_{CO_2}+C_{O_2})$ = 0..82
Fw = moisture fraction = 0.0673
F_d = dry gas fraction = 1 - Fw = 0.9327

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

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

$$= (18 \text{ x } 0.0673) + (0.9327 \text{ x } ((44 \text{ x } 0.03)+(32 \text{ x } 0.15) + (28 \text{ x } 0.82)))$$

$$= 28.33 \text{ lb/lb-mole}$$

STACK GAS VELOCITY AND FLOW RATE

refers to test run C-1 at Munson Station No. 12

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 = 1.27221
T_s = stack temperature = 539 F° = 999 R°
P_b = atmospheric pressure (in Hg) = 29.95
P_g = stack static pressure (in. H_2O) = -0.18
Ps = absolute stack pressure
= P_b + (Pg x .0735 in.Hg / in.H_2O) = 29.93 in. Hg

V = stack velocity (ft/min)

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

$= 5128.8 \times .84 \times 1.27221 \times \sqrt{(999/ (29.93 \times 28.33)}$
= 5949 ft/min

Q_a = stack flow rate (ft^3/min)
= V x A , where A= area of stack = 6.87 ft^2
= 6131 x 6.87 = 40,871 ft^3/min

Qd= stack flow rate on dry basis at standard conditions (SCFH)
= Q_a x 1059 x (Ps / Ts) x Fd
= 40871 x 1059 x (29.93/ 999) x 0.9327
= 1.21×10^6 SCFH

FLOW RATE DETERMINATION BY F-FACTOR (EPA Method 19)

refers to test run C-1 at Munson Station No. 12

Q_f = fuel flow = 30866 SCF/hr
F_{BTU} = heating value of gas = 1027 BTU/SCF
F = O_2 F factor = 8635 SCF/MMBTU
C_{O_2} = concentration of O_2 = 15.25 %(from analyzer)

Q_d = stack flow rate on dry basis at standard conditions (SCFH)
= $Q_f \times F_{BTU} \times 10^{-6} \times F \times 20.9 / (20.9 - C_{O_2})$
= $30{,}866 \times 1027 \times 10^{-6} \times 8636 \times 20.9 / (20.9 - 15.25)$
= 1.01×10^6 SCFH

With CO2 F-factor (i.e. F=1023), same calculation is used except for final term......

Q_d = $Q_f \times F_{BTU} \times 10^{-6} \times F \times 100/C_{CO_2}$
= $30866 \times 1027 \times 10^{-6} \times 1023 \times 100/3.02$
= 1.07×10^6 SCFH

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

MASS EMISSION RATES

refers to test run C-1 at Munson Station No. 12

NOx = concentration of NOx (uncorrected)= 68 ppmv
CO = observed concentration of CO = 240 ppmv
VOC = observed concentration via EPA Method 25 and 18
= 66 ppmv
1 SCF NOx = 11.94×10^{-8} lbs
1 SCF CO = 7.26×10^{-8} lbs
1 SCF C1(methane) = 4.15×10^{-8} lbs
E_{NOx} = mass emission rate of NOx (lb/hr)
$= NOx \times Qd \times 11.94 \times 10^{-8}$
$E_{NOx} = 68 \times 1.21 \times 10^{6} \times 11.94 \times 10^{-8}$

E_{NOx}= 9.8 lb/hr
E_{CO} = 21.1 lb/hr
E_{VOC}= 3.3 lb/hr

HP = engine horsepower = 4171 hp
454 g = 1.0 lb

E_{NOx} (g/hp-hr)= E_{NOx} x 454 / HP
= 9.8 x 454 / 4171
E_{NOx} (g/hp-hr)= 1.07 g/hp-hr
E_{CO} (g/hp-hr)= 2.3 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

Assume 7600 BTU/hp-hr (standard for engine)
HTG = heating value of fuel = 1026 BTU/SCF (from fuel calcs)
hp = engine load = 4171 BHP
Q_f = fuel flow = 7600 x 4171 / 1026
= 30896 SCF/hr
Cf = carbon content of fuel (from fuel analysis) = 1.026
Ce = exhaust gas carbon content
= CO + THC (as C1) + CO2
= (240 + 1200) / 10000 + 3.02 = 3.16 %

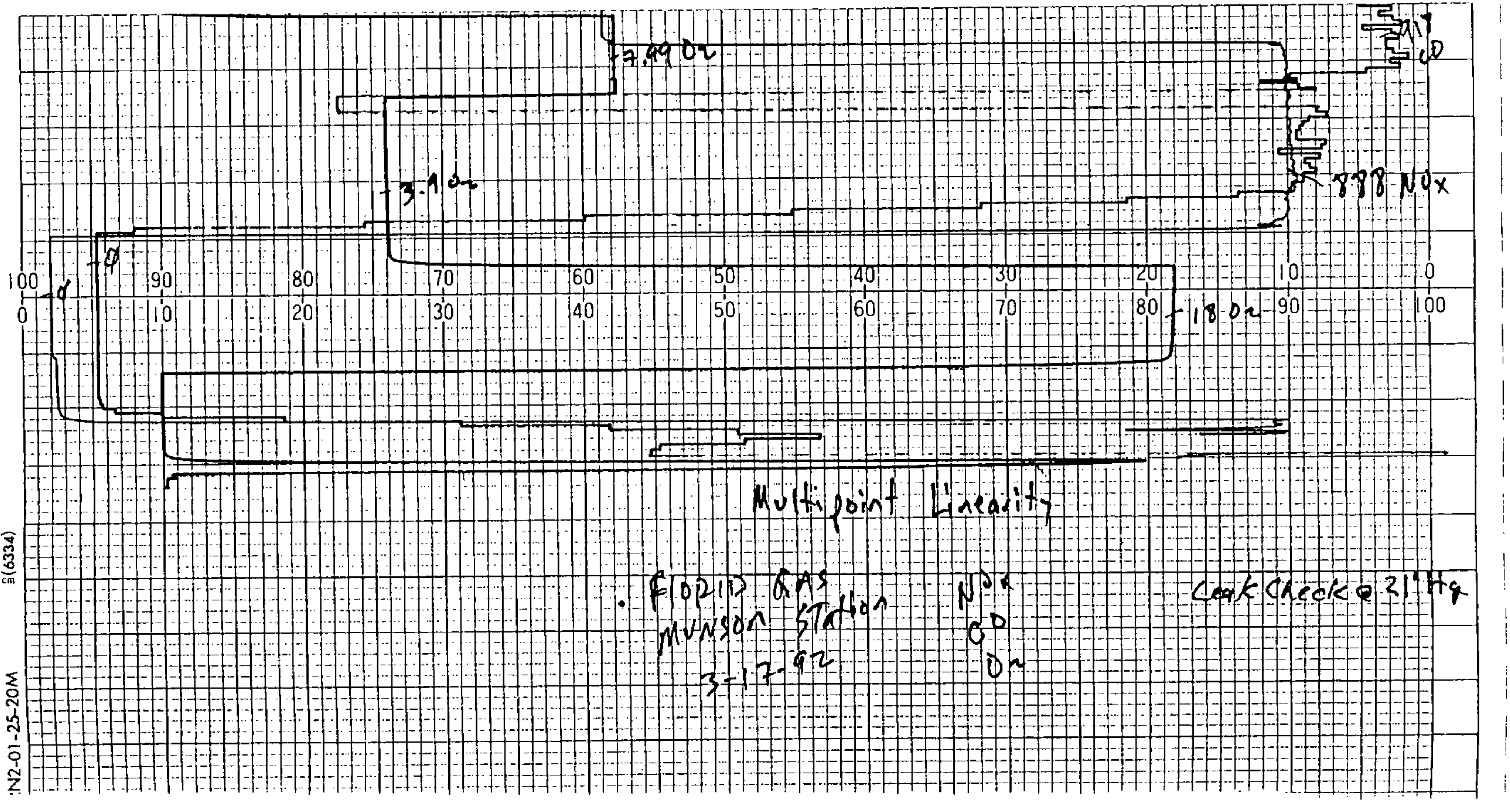
Q = stack flow rate
= Qf x Cf x 100 / Ce
= 30896 x 1.026 x 100 / 3.16
= 1 x 10 SCFH

SO2 Emission Rate from Fuel Analysis

Refers to Test Run #C-1

S = sulfur content of fuel = <0.059 grains/100 DSCF
7000 grains = 1.0 lb
Q_f = 30896 SCF/hr
SO2 = mass emission rate of SO2
= S / 100 / 7000 x Q_f
= <.059 /100 / 7000 x 30896
= <0.0026 lbs/hr

APPENDIX C:
QUALITY ASSURANCE ACTIVITIES



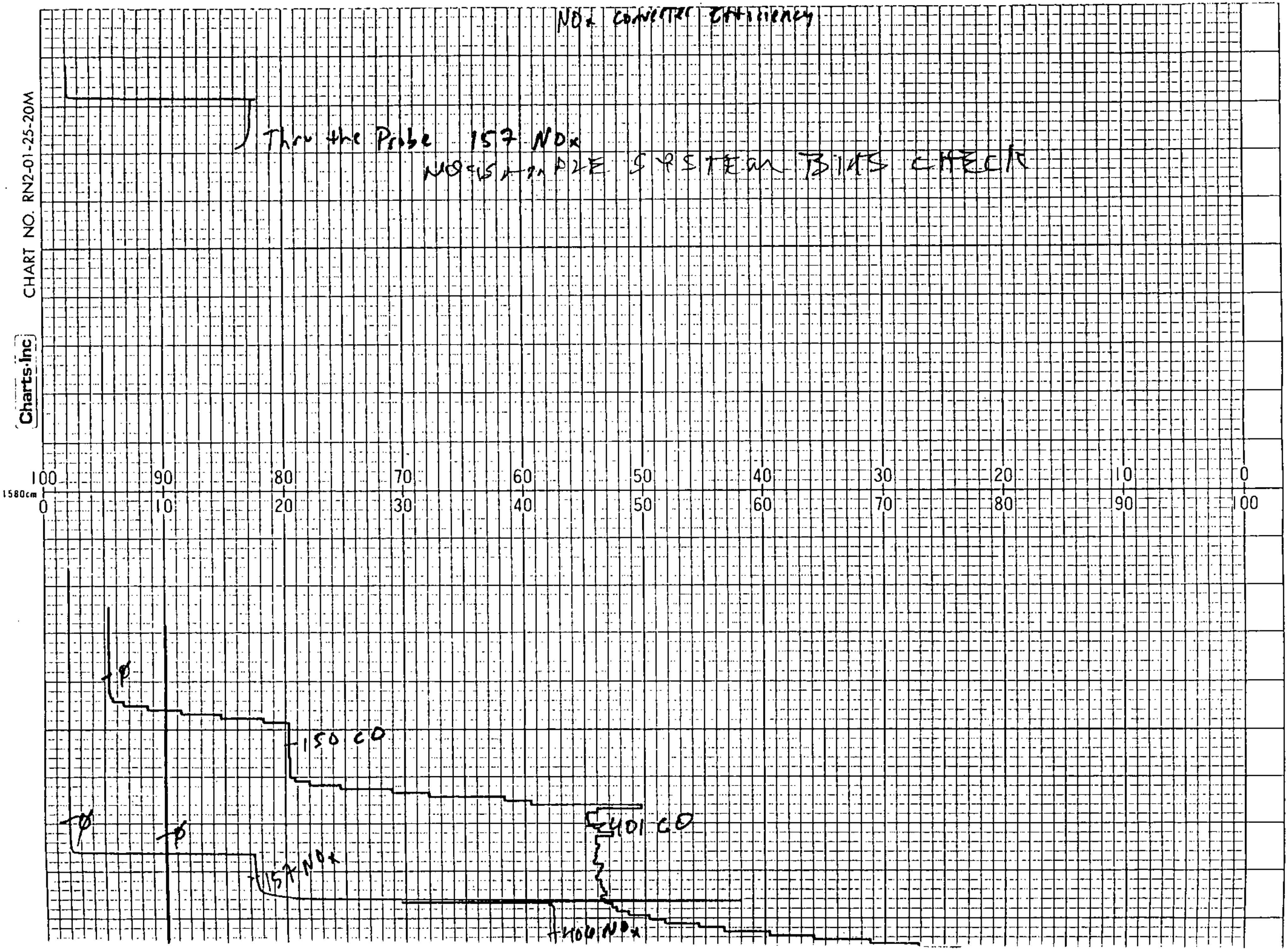
Multipoint Linearity

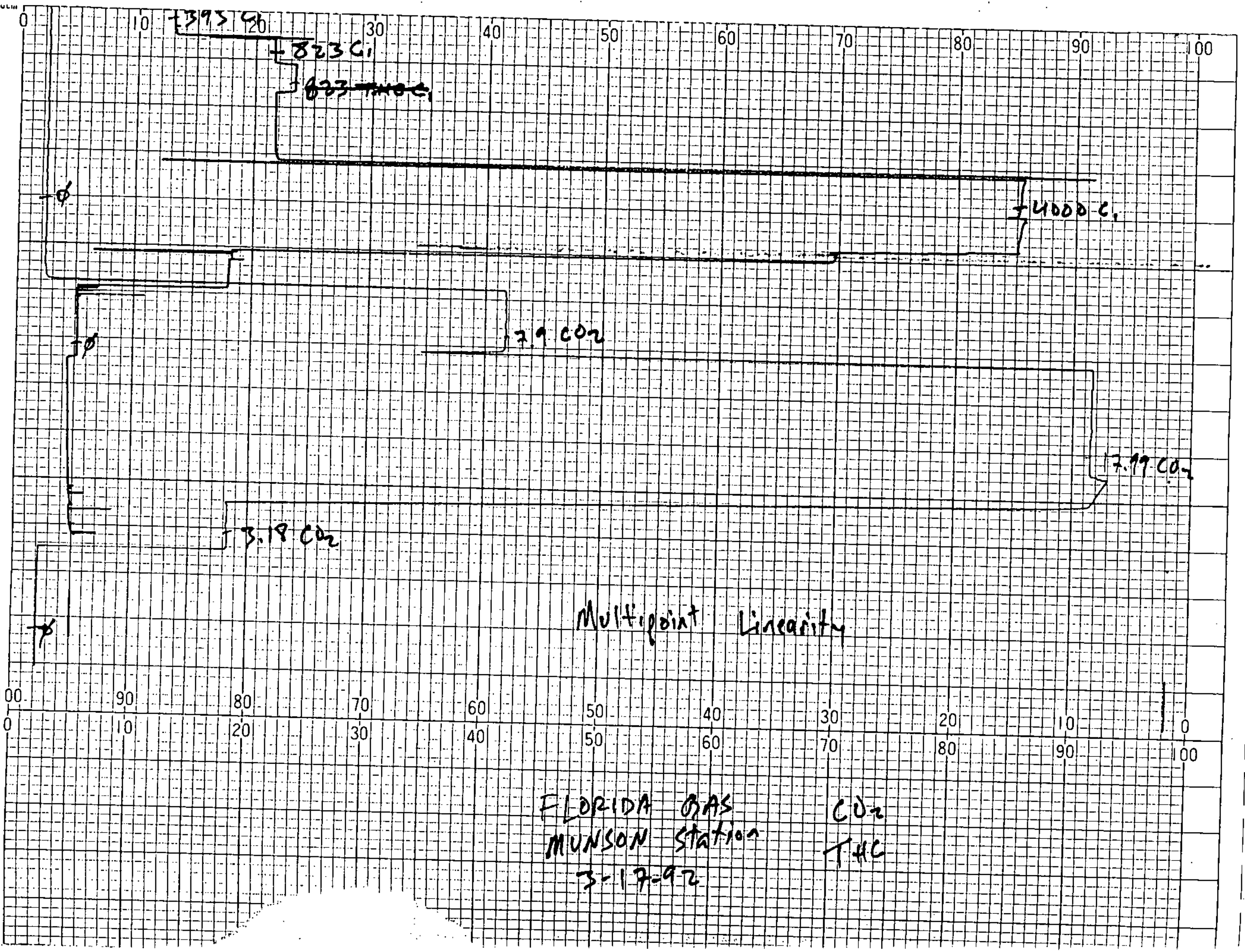
Florida Gas
Munson Station
3-17-92

NOx
CO
O2

Leak Check @ 21" Hg

NOx converter Efficiency

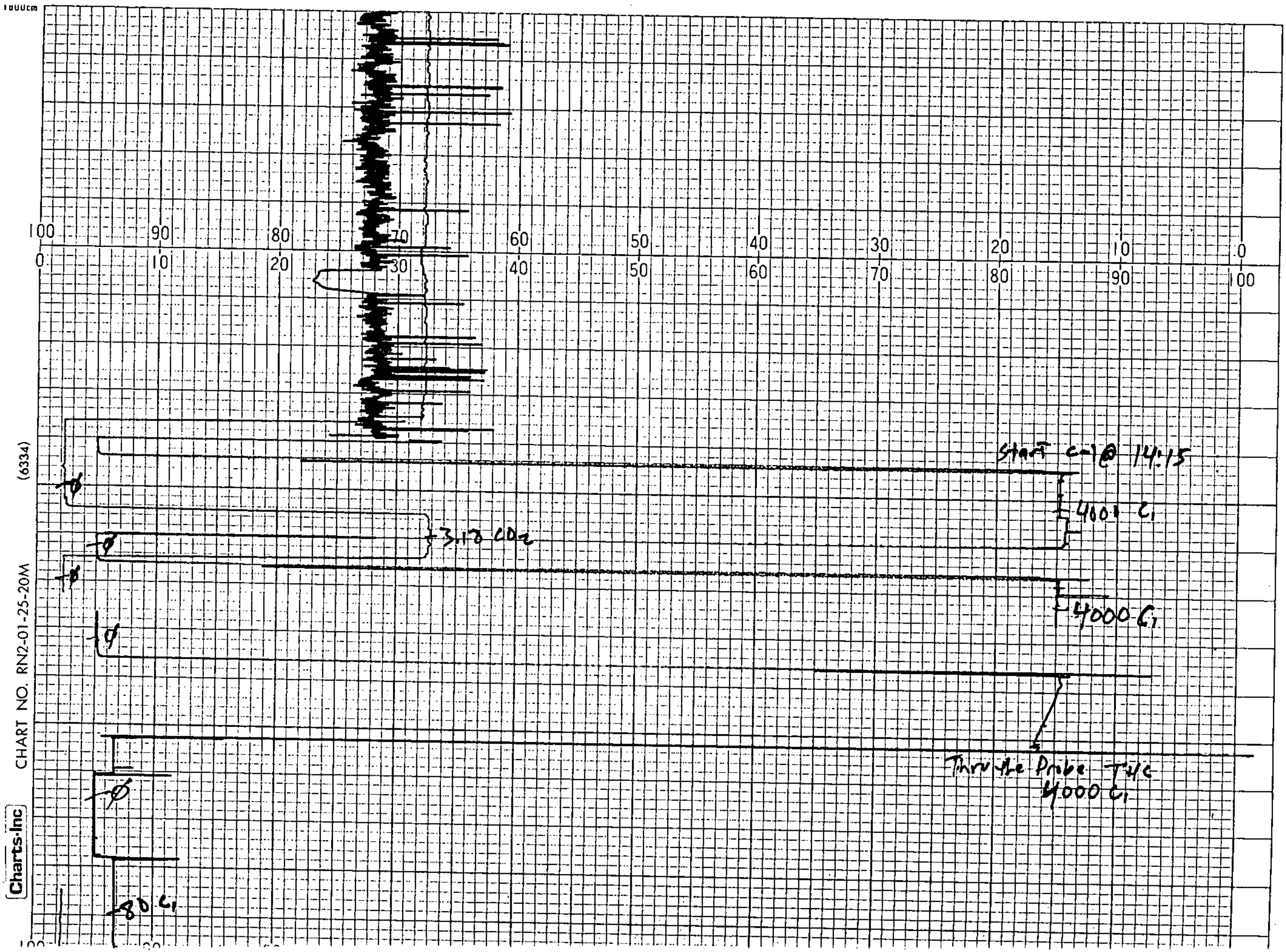


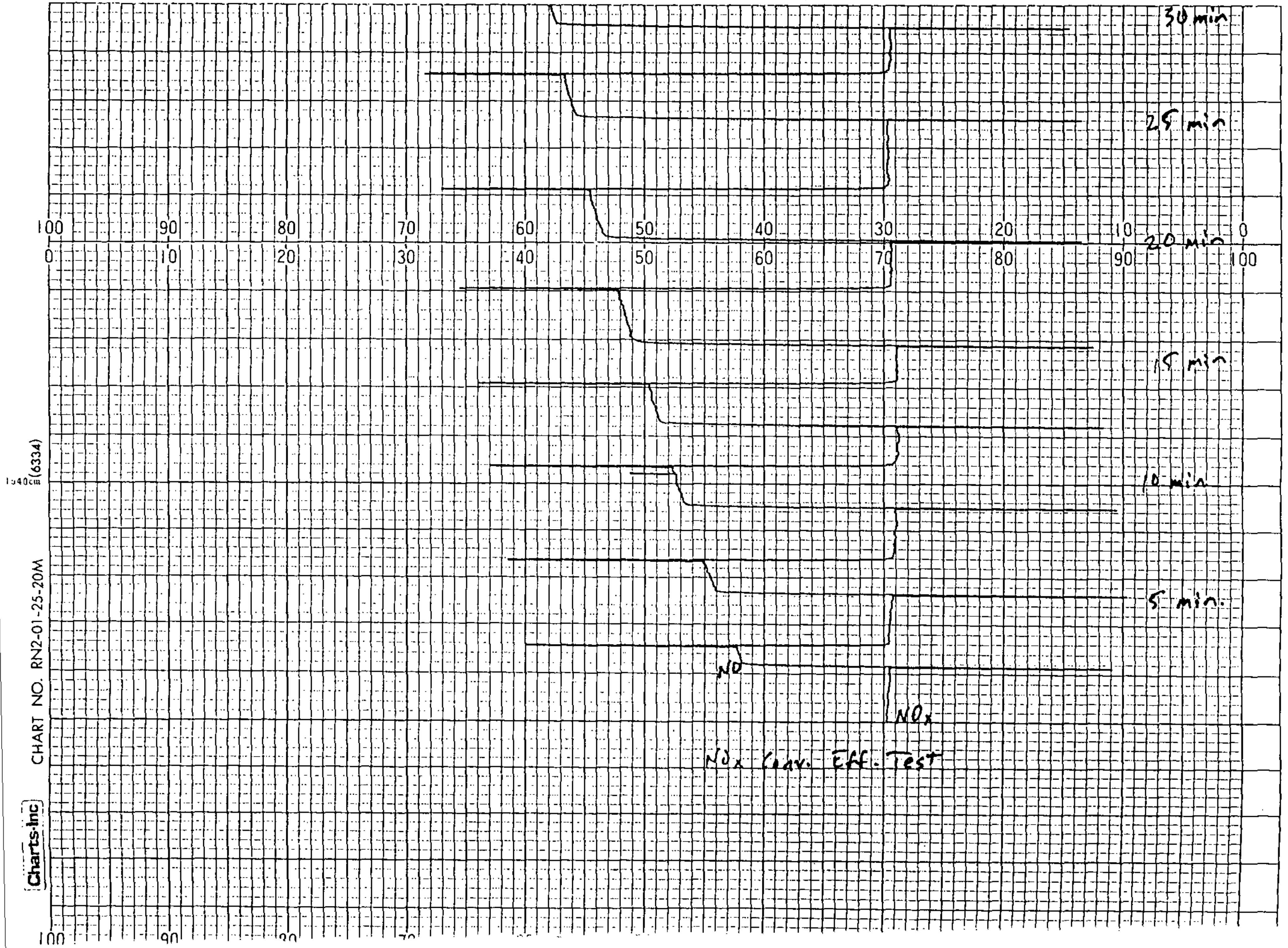


Multipoint Linearity

FLORIDA GAS
MUNSON Station
3-17-92

CO2
THC


1000cm
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
Charts-Inc
Start c-1 @ 14:15
400 C1
3.12 CO2
4000 C1
Thru the Probe T.H.C
4000 C1
80 C1
ϕ
ϕ
ϕ
ϕ
ϕ


30 min
25 min
20 min
15 min
10 min
5 min.
NO
NOx
NOx Conv. Eff. Test
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
1540cm (6334)
CHART NO. RN2-01-25-20M
Charts-Inc

Gaseous Emission QA Worksheet: Munson Compressor Station

GASEOUS EMISSION	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)	C-1	Final (% Chart)	Drift (% Chart)	C-2	Final (% Chart)	Drift (% Chart)	C-3	Final (% Chart)	Drift (% Chart)
NOx					Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	2.0	2.0	0.0	68.0	2.0	0.0	66.0	2.0	0.0	62.0	0.0	0.0
low	157.7	17.8	17.5	-0.3	% Chart			% Chart			% Chart		
mid	406.4	42.6	41.5	-1.1	36.0	81.1	0.6	35.0	0.5	0.0	33.0	80.5	0.0
high	888.1	90.8	90.5	-0.3									
full scale	1000.0				200.0			200			200		
O2					Avg.%			Avg. %			Avg. %		
zero	0.0	10.0	10.0	0.0	15.3	10.0	0.0	15.70	10.0	0.0	15.62	10.0	0.0
low	3.99	26.0	26.0	0.0	% Chart			% Chart			% Chart		
mid	7.98	41.9	42.4	-0.1	71.0	81.5	-0.5	72.8	81.8	-0.2	72.5	81.5	-0.5
high	17.99	82.0	82.0	0.0									
full scale	25.0				25.0			25			25		
CO					Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	5.0	5.0	0.0	240.0	5.0	0.0	236.0	5.0	0.0	240.0	5.0	0.0
low	150.0	20.0	20.2	0.2	% Chart			% Chart			% Chart		
mid	401.0	45.1	46.0	0.9	53.0	84.9	-0.1	52.2	86.0	0.8	53.0	85.5	0.3
high	918.0	96.8	97.0	0.2									
full scale	1000.0				500.0			500			500		
CO2					Avg. %			Avg. %			Avg. %		
zero	0.0	2.0	2.0	0.0	3.02	2.0	0.0	3.00	2.0	0.0	3.05	2.0	0.0
low	3.18	17.9	18.1	0.2	% Chart			% Chart			% Chart		
mid	7.99	42.0	41.9	0.0	32.2			32.0			32.5		
high	17.99	92.0	91.8	-0.1		33.8	0.0		33.5	-0.3		33.8	0.0
full scale	20.0				10.0			10			10		
THC					Avg. ppm			Avg. ppm			Avg. ppm		
zero	0.0	5.0	5.0	0.0	1200.0	10.0	5.0	1115.0	10.0	5.0	1200.0	10.0	5.0
low	19.7 ~~20.0~~	6.6	11.9	5.3	% Chart			% Chart			% Chart		
mid	395.0	12.9	13.0	0.1	29.0			27.3			29.0		
high	823.0	21.5	21.8	0.3		85.0	0.0		85.5	0.5		85.0	0.0
full scale	5000.0				5000.0			5000			5000		

Testing by Cubix Corporation

Thermo Electron CORPORATION

Richard A. Curran
Regional Sales Manager

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

TR 7

INTERFERENCE RESPONSE TEST

DATE OF TEST JAN 20, 1992

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

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

Continous Emission Analyzer
Interference Response Tests

Date: 7/8/88

Technician: KRB / MM

Analyzer Type: Thermo Enviromental

Analyzer Model: Model 48 Gas Filter Correlation Analyzer

Serial Number: 48-23576-210

Analyzer Test Range: 0-20 ppmV

Test Gas		Analyzer Response		Response 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	PPMv/%
CO_2/O_2	21%/3%	-0.3		-0.014 / -0.100	
Air	Dry	0.4		CO Impurity ?	
NOx	176 ppmv	0.4		0.002	
NOx	3030 ppmv	0.4		0.0001	PPMv/PPMv
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 Ratio
Type Gas	Concentration	Concentration	% of Range	
CO	491 ppm	<.05%	<.5	
SO_2	398 ppm	<.05%	<.5	
CO_2	8%	<.05%	<.5	
NO_x	888 ppm	<.05%	<.5	

TA 7 CO_2 ANALYZER

Continous Emission Analyzer Interference Response Tests

Date: 1/16/92
Technician: LT

Analyzer Type: CO_2
Analyzer Model: SERVOMEX 1400
Serial Number: 01410 B619
Analyzer Test Range: 0-2%

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%	<.5	

Response Time Data Sheet

Date: 3/24/89
Plant: — Austin Office
Technician: MM/DC
Sample Manifold Press.: 6 psi
Sample Line Length: 140 ft.
Pump Model No.: 6-3 Dia-pump

Analyzer:	NOx Analyzer	Oxygen Analyzer
Model:	TECO 10AR	Teledyne 320 AX
Range:	0 - 1000 ppm	0 - 25 %
Span Gas:	900 ppm 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 : 3/17/92
Plant: Munson compressor Station
Technician: LF TS NF

NOx Analyzer: NO2 to NO Converter Efficiency Test

	NOx Concentration (ppm)	% Decrease from Initial Concentration	NO Concentration (ppm)
Initial Concentration	685	0	560
10 minute Concentration	685	0	505
20 minute Concentration	685	0	450
30 minute Concentration	685	0	400
Full Scale	1000		

Sample System Bias Check

Parameter	Calibration Gas Concentration (ppm)	Full Scale Span (ppm)	Direct Calibration Response (ppm)	Sample System Response (ppm)	Sample System Bias (% of Span)
NOx	157.7	1000	159	158	-0.1 %
THC	4000	5000	4000	4000	0 %
NOx					
NOx					

Sample System Leak Check

Run #	in. of mercury	in. of mercury
1	Intial 21.0	Final 21.0
3	20.5	20.5

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: ____________ On: 5-1-92

Approved By: ____________ 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

Scott Specialty Gases 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 Procedure # G1
Protocol # 1

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

ANALYST

Approved 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.

Scott Specialty Gases Scott Environmental Technology, Inc.

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

Shipped From : Scott Michigan

Our Project # : 532228

Your P.O. # : 92 0000

ustomer :

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 # PD-2143

Certified Accuracy 1 % NBS Traceable

Expiration Date : 7-21-93

Cylinder Number : AAL5112

Cylinder Pressure 1900 psig

1 of 1 Component(s)

ANALYZED CYLINDER

COMPONENT	CERTIFIED CONC.
TRIC OXIDE	406.4 PPM

ALANCE GAS : NITROGEN

REFERENCE STD

SRM # (CRM #)	CYLINDER NUMBER	CONC.
1687	ALM-014665	965.5 PPM
1685	ALM-006700	250.3 PPM

INSTRUMENTATION

INSTR/MODEL/SERIAL #	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
BECKMAN 951A 270-0828998	1-15-92	CHEMILUMINESCENCE

TROGEN DIOXIDE 0.00 PPM (FROM SECOND ANALYSIS)

FIRST ANALYSIS DATE : 1-15-92

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

CALCULATED RESULTS
406.9
406.9
406.9

AVERAGE : 406.9 PPM

SECOND ANALYSIS DATE : 1-21-92

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

CALCULATED RESULTS
405.9
405.9
405.9 405.9 PPM NOX

AVERAGE : 405.9 PPM

CALIBRATION CURVE 1 ST DEGREE

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

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

GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : F. P. Dore

Approved By : Shapiro

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

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 Procedure # G1
Protocol # 1
File # P08133
Certified Accuracy 1 % NBS Traceable

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

EPA PROTOCOL CERTIFIED

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 : L 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.

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

3714 LAPAS DRIVE, HOUSTON, TEXAS 77023

6/03/91

CUBIX CORPORATION
9225 LOCKHART

AUSTIN TX 78747-0000
KEVUN JANCK

PROJECT #: 04-11057
PO #: 91105

CYLINDER #: ALM006621

ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION		ANALYSIS 1 (MOLES) U/M	
BON MONOXIDE	150.0	PPM	150.	PPM
HANE	80.0	PPM	79.7	PPM
ROGEN	BALANCE		BALANCE	

CERTIFIED

ANALYTICAL METHOD: GRAV.MASTER GAS

DATE OF ANALYSIS: 6/03/91

ANALYST: ______________ APPROVED BY: ______________
ANALYST 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: ANALYST

APPROVED BY: SUPERVISOR

Scott Specialty Gases, Inc.

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

10/22/91

CUBIX CORPORATION
9225 LOCKHART HWY

AUSTIN TX 78747-0000

PROJECT #: 04-13836
PO #: 910505

CYLINDER #: AAL13971

ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION		ANALYSIS 1 (MOLES) U/M	
ARBON MONOXIDE	910.0	PPM	918.	PPM
ETHANE	820.0	PPM	823.	PPM
ITROGEN		BALANCE		BALANCE

NOTES: EXP: 11/92

ANALYTICAL METHOD: ACUBLEND MASTER

DATE OF ANALYSIS: 10/22/91

ANALYST: ______
ANALYST

APPROVED BY: ______ 10/23
SUPERVISOR

CERTIFIED

Matheson
Gas Products
World Leader in Specialty Gases & Equipment

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

RECEIVED JAN 17 1992

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

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

Gentlemen:

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

LABORATORY REPORT ON GAS ANALYSIS

	1R		1R	
	CYL. # MIXTURE REQ. SX-23633	**ANALYSIS**	**CYL. # MIXTURE REQ.** SX-23625	**ANALYSIS**
CARBON DIOXIDE	3.20%	3.18% ± .02	8.00%	7.90% ± .02
OXYGEN	18.00%	17.9% ± .02	8.00%	7.98% ± .02
NITROGEN	BALANCE	BALANCE	BALANCE	BALANCE

	1R			
	CYL. # MIXTURE REQ. SX-23652	**ANALYSIS**	**CYL. # MIXTURE REQ.**	**ANALYSIS**
CARBON DIOXIDE	18.00%	17.99% ± .02		
OXYGEN	4.00%	3.99% ± .02		
NITROGEN	BALANCE	BALANCE		

ACCEPTED BY

WILSON OXYGEN

Analyst John K. Wright
JOHN K. WRIGHT

Pitot Tube Calibration Sheet

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

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

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

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

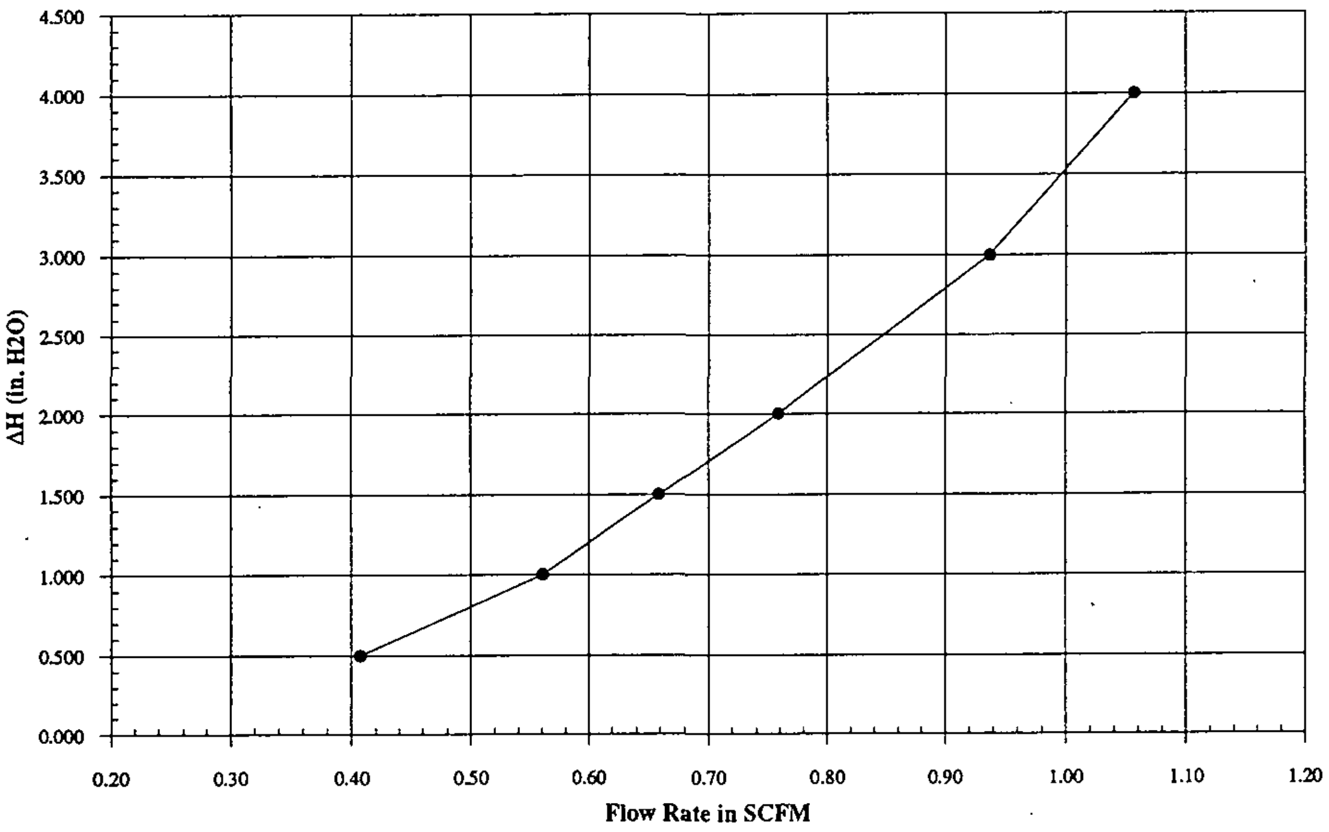
Calibrations Performed by Cubix Corporation, Austin, Texas

METER BOX DRY GAS METER and ORIFICE CALIBRATION

Date:	8/2/91	**Test Meter ID**	P164240
Prev, Calib. Date:	12/27/90	**Make & Model**	American Singer
Location:	1713 Fortview, Austin, Tx	**Calibration Factor**	0.998
Technician:	DH,LI,JB		
Meter No:	1286-3061		
Atm. Pressure:	29.32		

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

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



Testing by Cubix Corporation

Trailer #7 Altimeter

ALTIMETER SCALE ERROR

PART NO. 5934P-1A.83 SERIAL NO. 3H909

ALTIMETER PRESSURE

TEST PT (FT)	INDICATOR READINGS AT + 25 °C	TEST PT (FT)	INDICATOR READINGS AT + 25 °C	TEST PT (FT)	INDICATOR READINGS AT + 25 °C
-1000	0	8,000	-45	30,000	
0 0	-20	10,000	-50	35,000	
500	-15	12,000	-70	40,000	
1000	-10	14,000	-70	45,000	
1500	-15	16,000	-65	50,000	
2000	-15	18,000	-50	55,000	
3000	-25	20,000	-45	60,000	
4000	-25	22,000		70,000	
6000	-30	25,000		80,000	

BFG/C9102

COMPONENT ALTIMETER

PART NO. 5934P-1A.83

SERIAL NO. 3H909

MFG. UNITED WORK ORDER # K0687

☐ Overhaul ☐ Repair ☒ Bench Check & Test

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

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	11		43	47

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

QUANTITY	ITEM NUMBER	DESCRIPTION
4	34100226	BT300R 2.5" Stem 25/125F

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

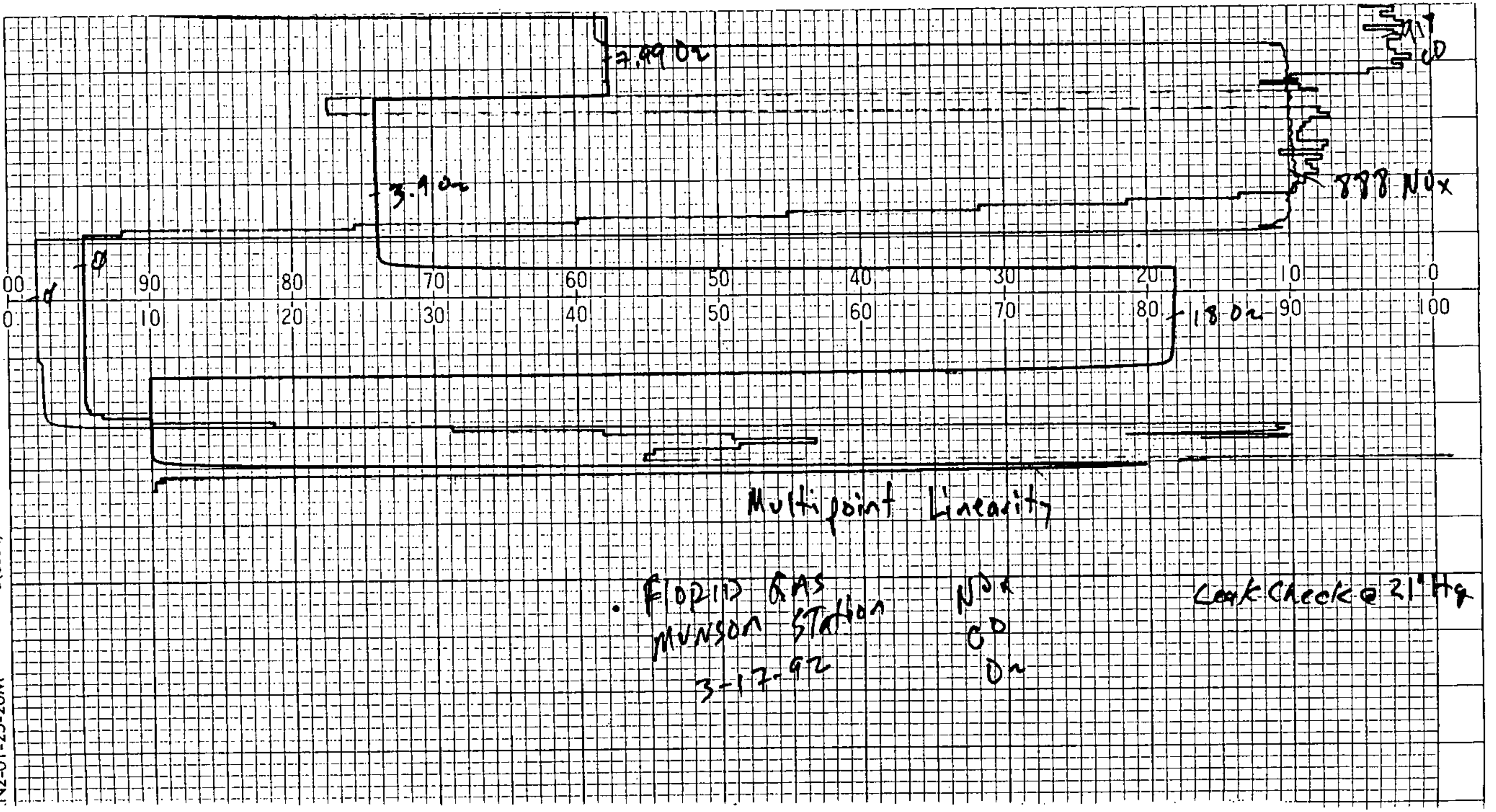
THERMOMETERS CALIBRATED AGAINST MASTER PRECISION THERMOMETERS, DIRECTLY TRACEABLE TO NATIONAL BUREAU OF STANDARDS.

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			505°F	100°F							
2			50°F	100°F							
3			50°F	100°F							
4			50°F	100°F							

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

APPENDIX E:
STRIP CHART RECORDS

NOx, O_2, CO



Multipoint Linearity

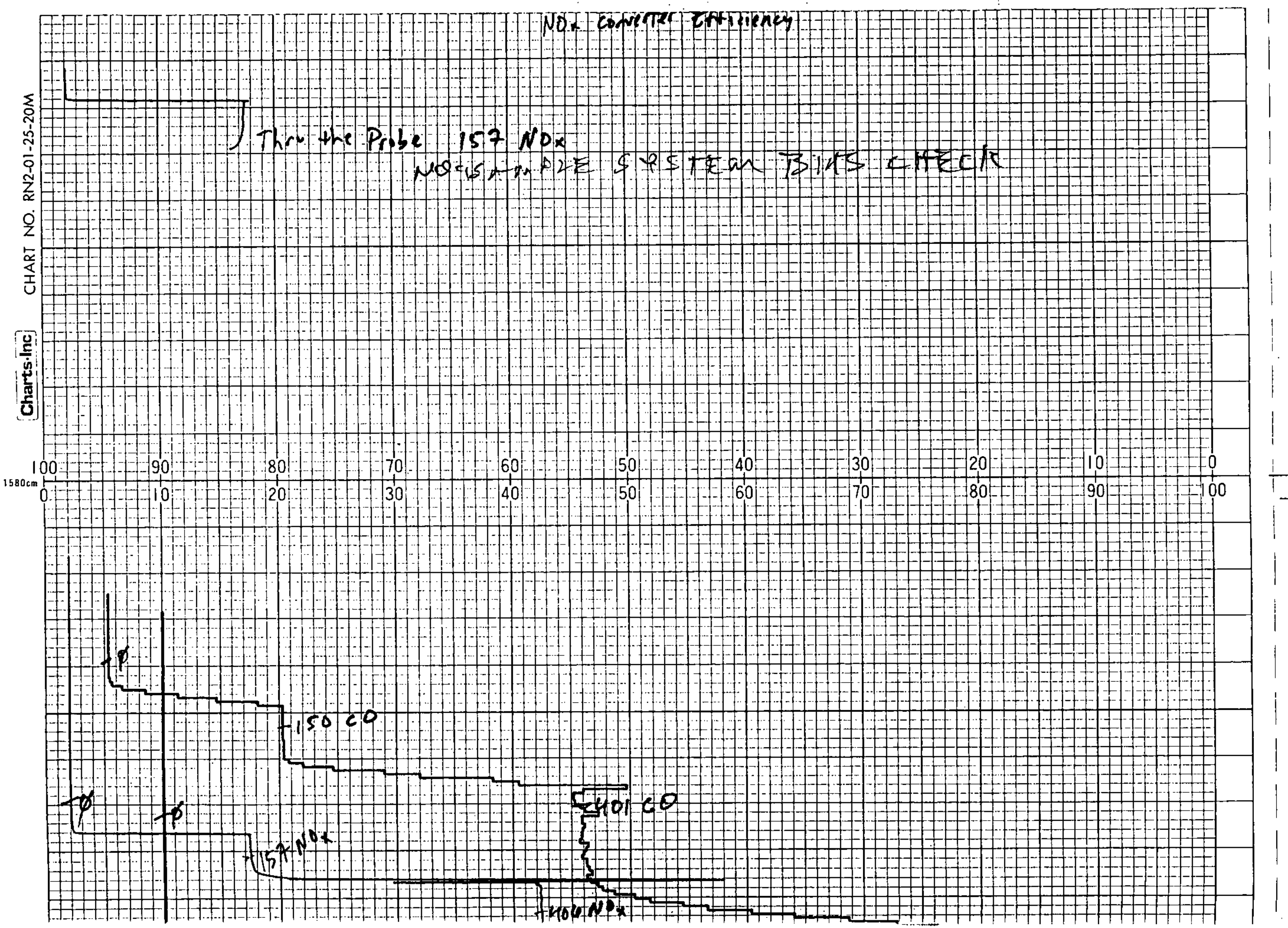
Florida Gas
Munson Station
3-17-92

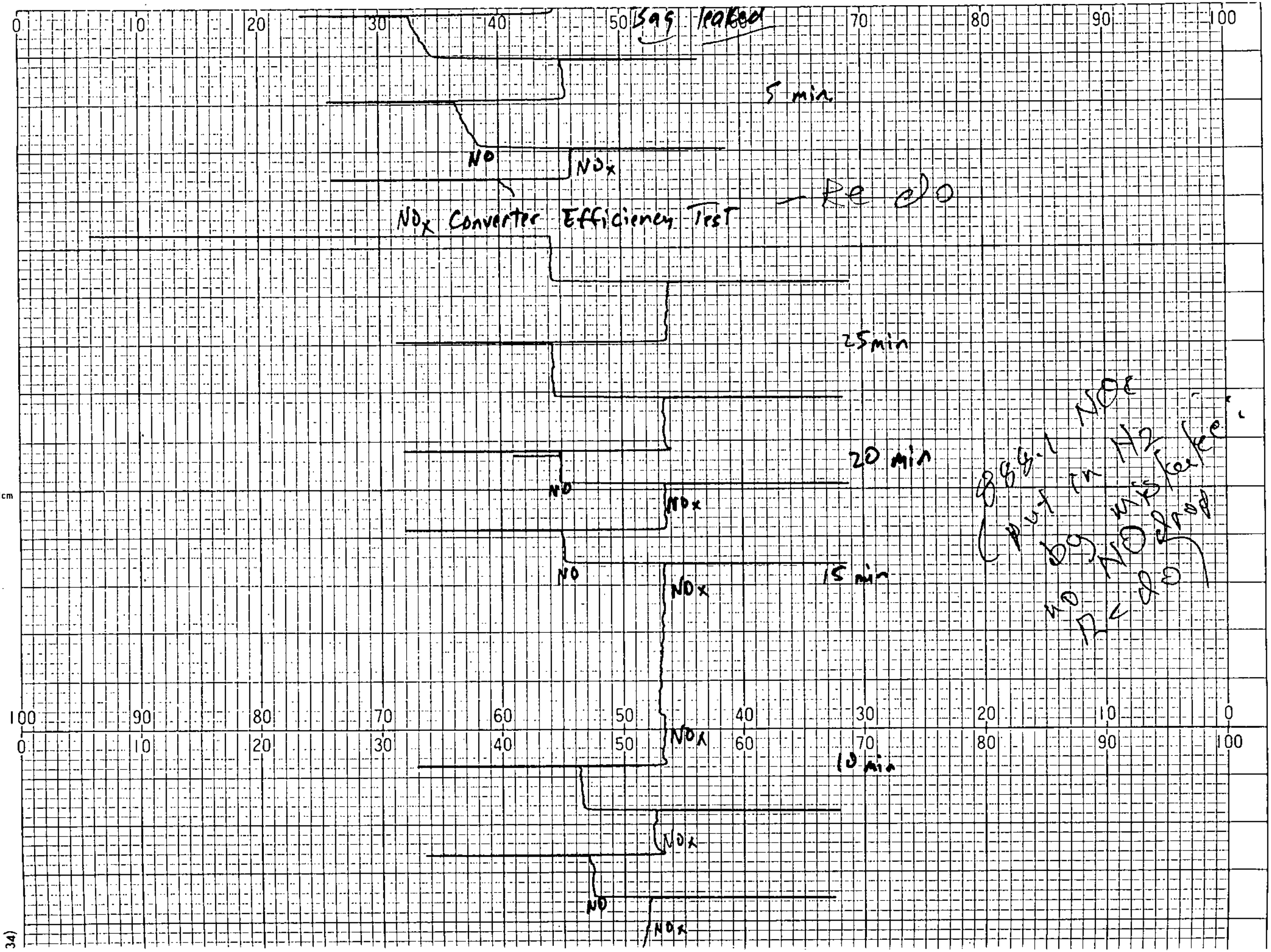
NOx
CO
O2

Leak Check @ 21" Hg

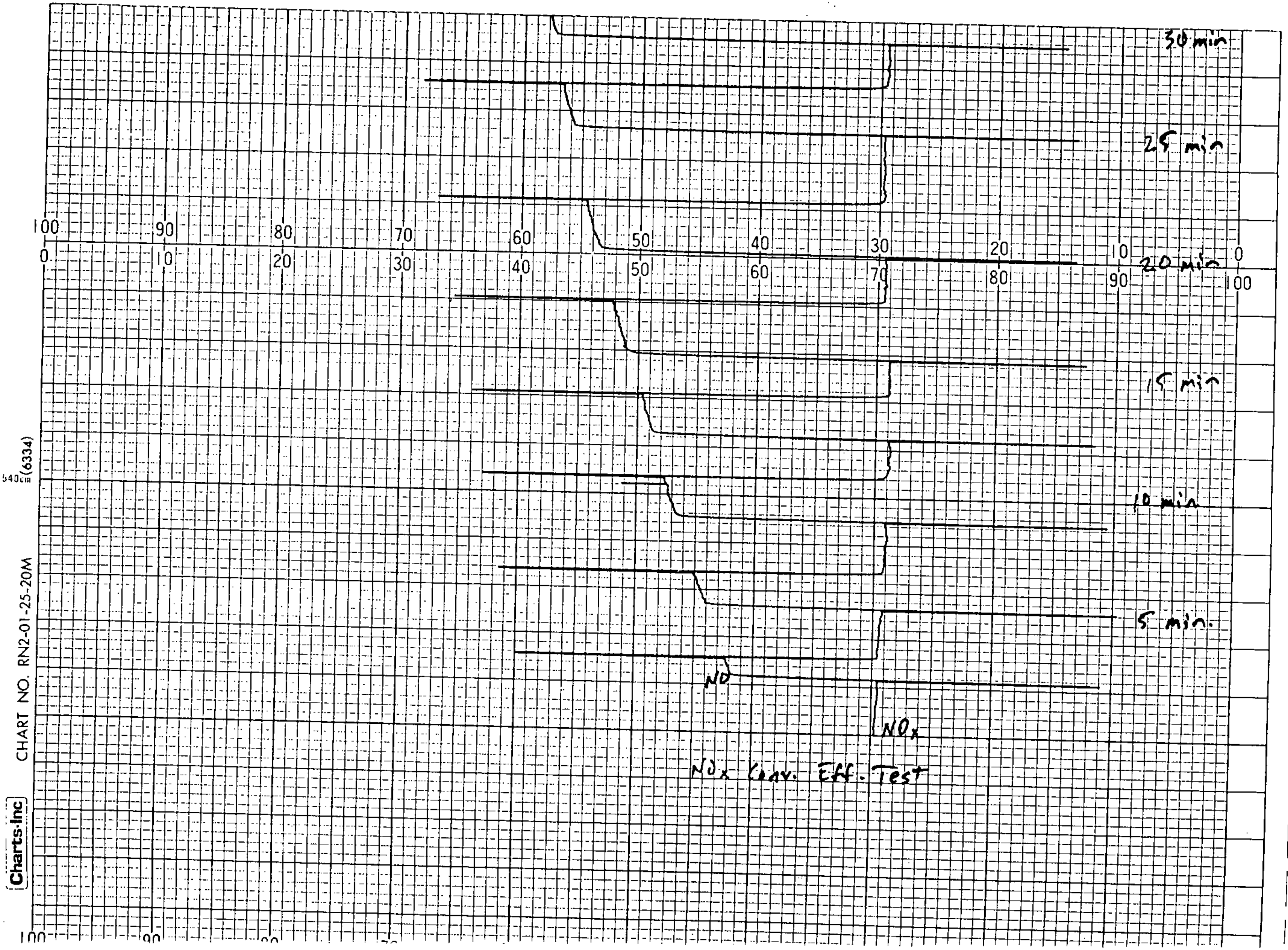
1600cm (6334)

N2-01-25-20M


NOx converter Efficiency
Thru the Probe 157 NOx
NOx SAMPLE SYSTEM BIAS CHECK
CHART NO. RN2-01-25-20M
Charts·Inc
1580cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100
0
150 CO
401 CO
0
0
157 NOx
400 NOx



NOx Converter Efficiency Test



NOx Conv. Eff. Test

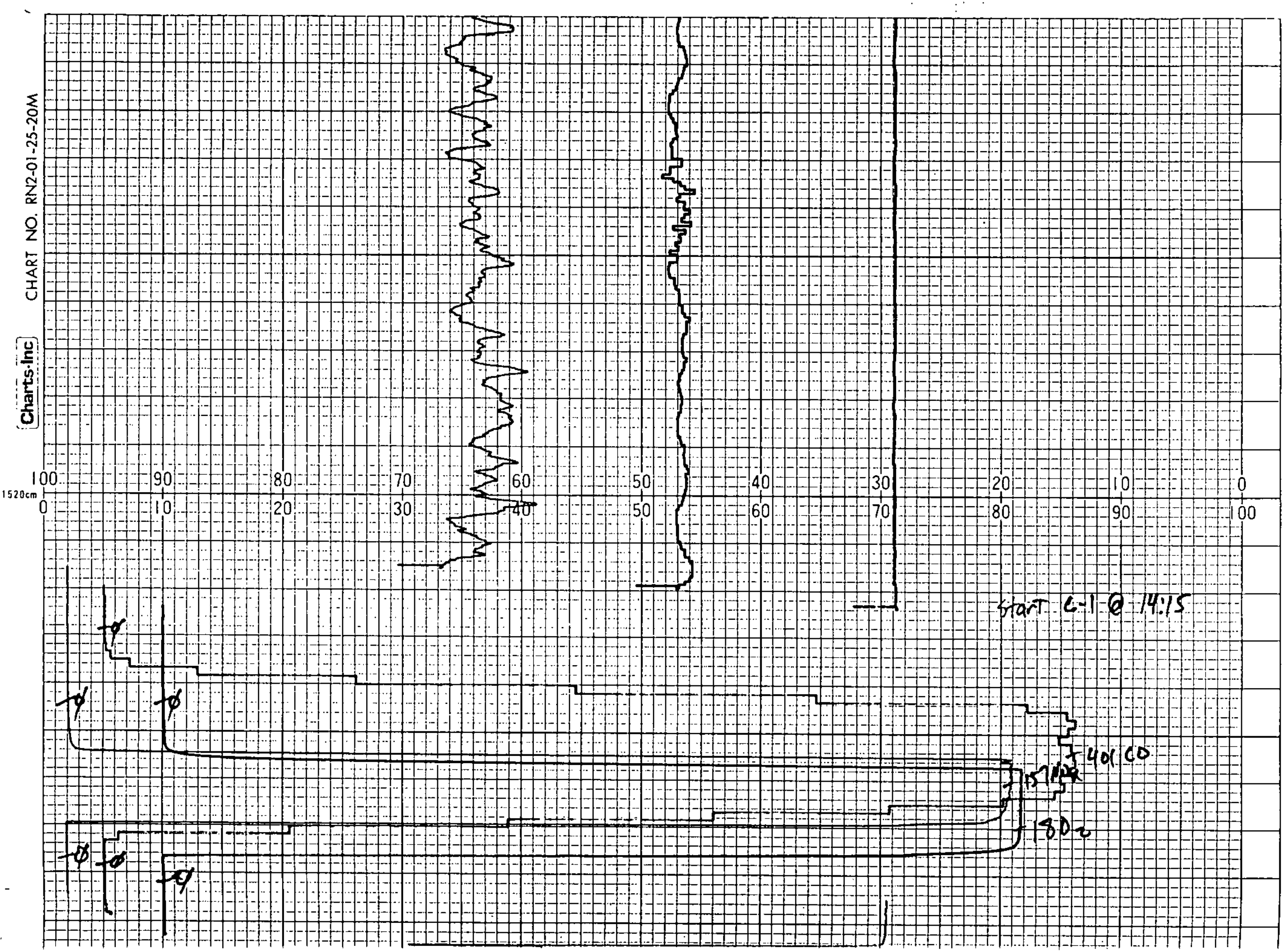
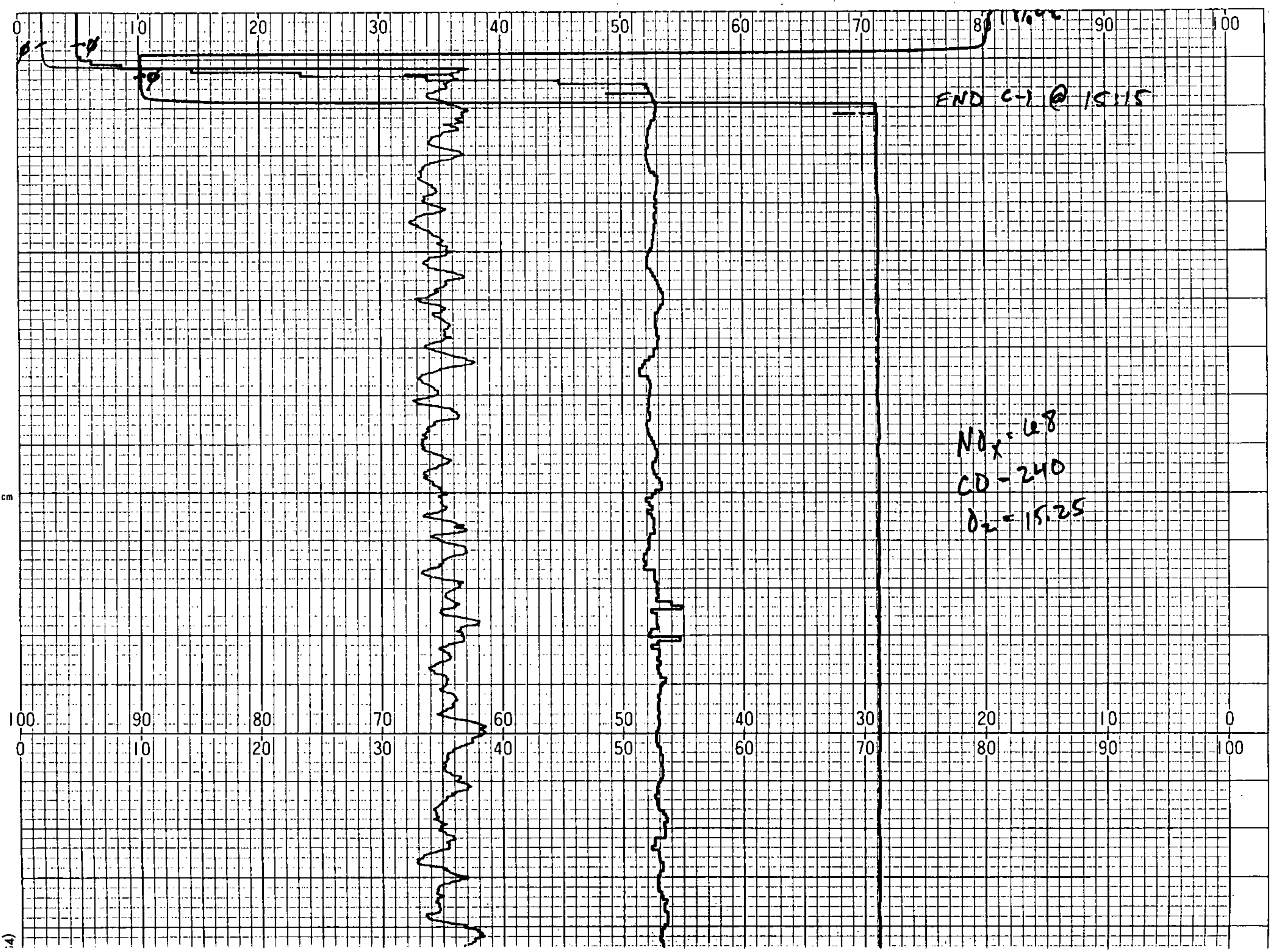
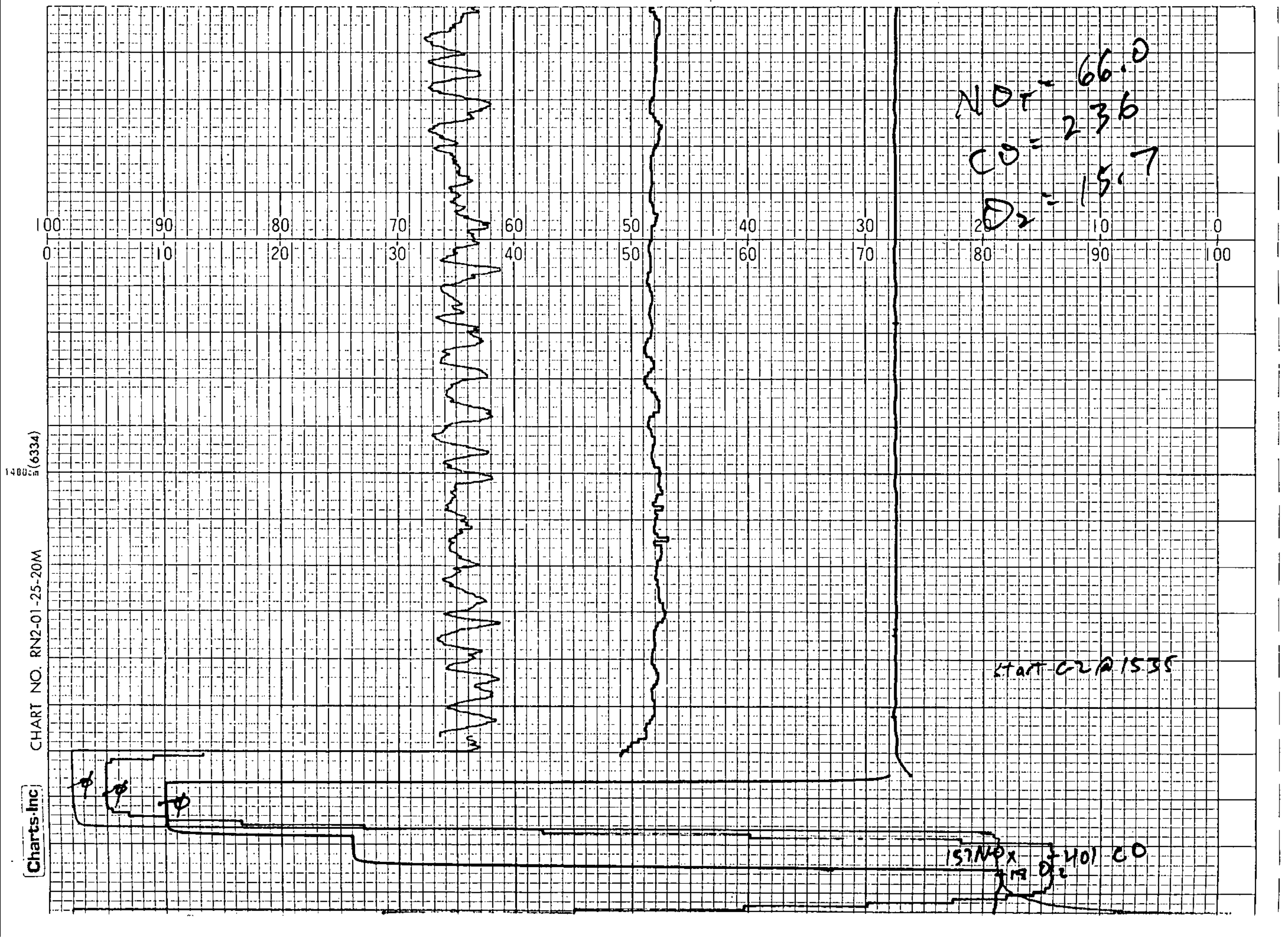


CHART NO. RN2-01-25-20M
Charts-Inc
100 90 80 70 60 50 40 30 20 10 0
1520cm
0 10 20 30 40 50 60 70 80 90 100
Start C-1 @ 14:15
40 | CO
157 NOx
180₂
-0
-0
-0
-0
-0
-0


0 10 20 30 40 50 60 70 80 90 100
ø - -ø
-ø
END C-1 @ 15:15
NO_x = 68
CO = 240
O_2 = 15.25
1500cm
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100



NOx = 66.0

CO = 236

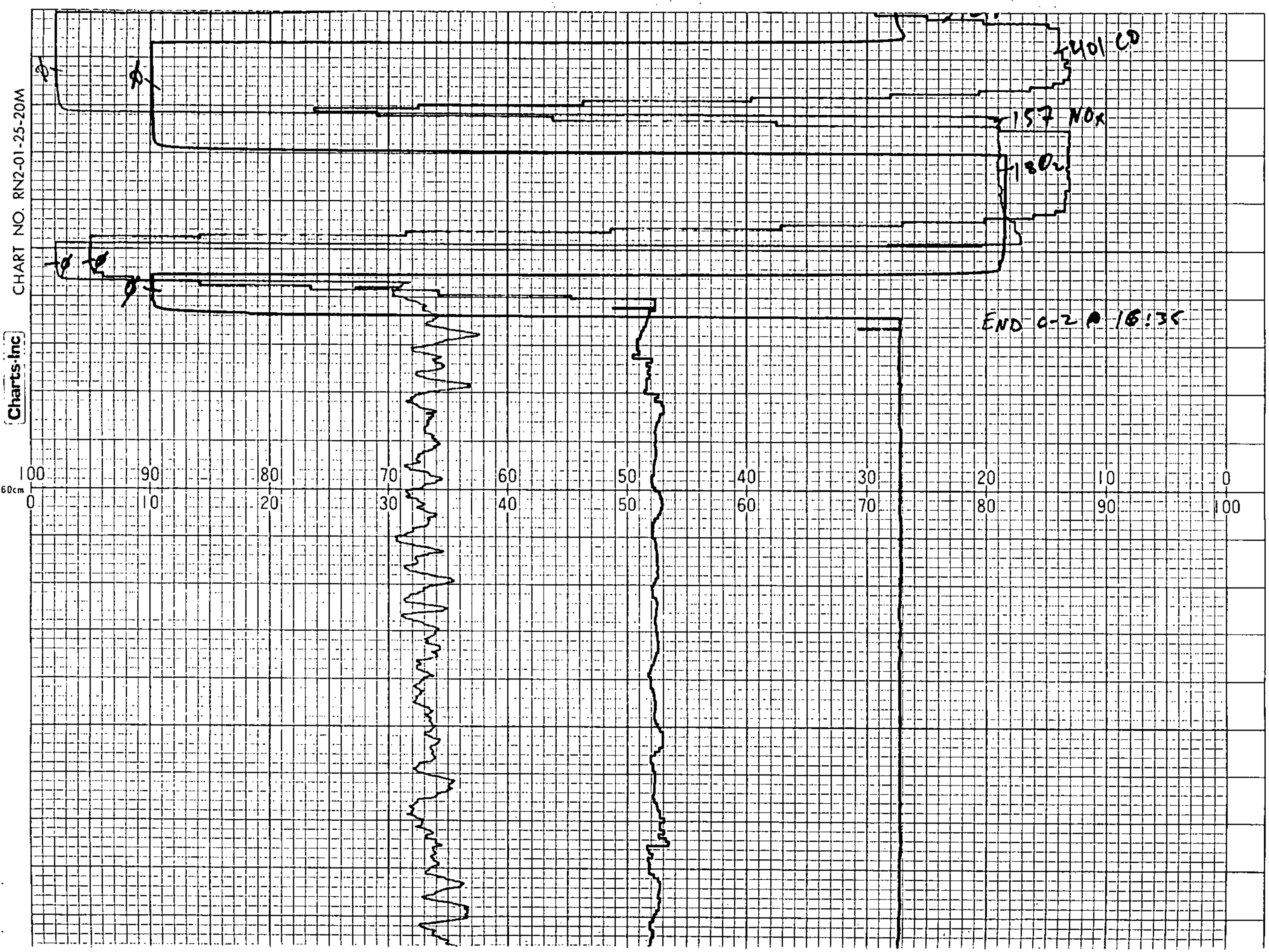
O2 = 15.7

Start C2 @ 1535

157 NOx

17 O2

401 CO

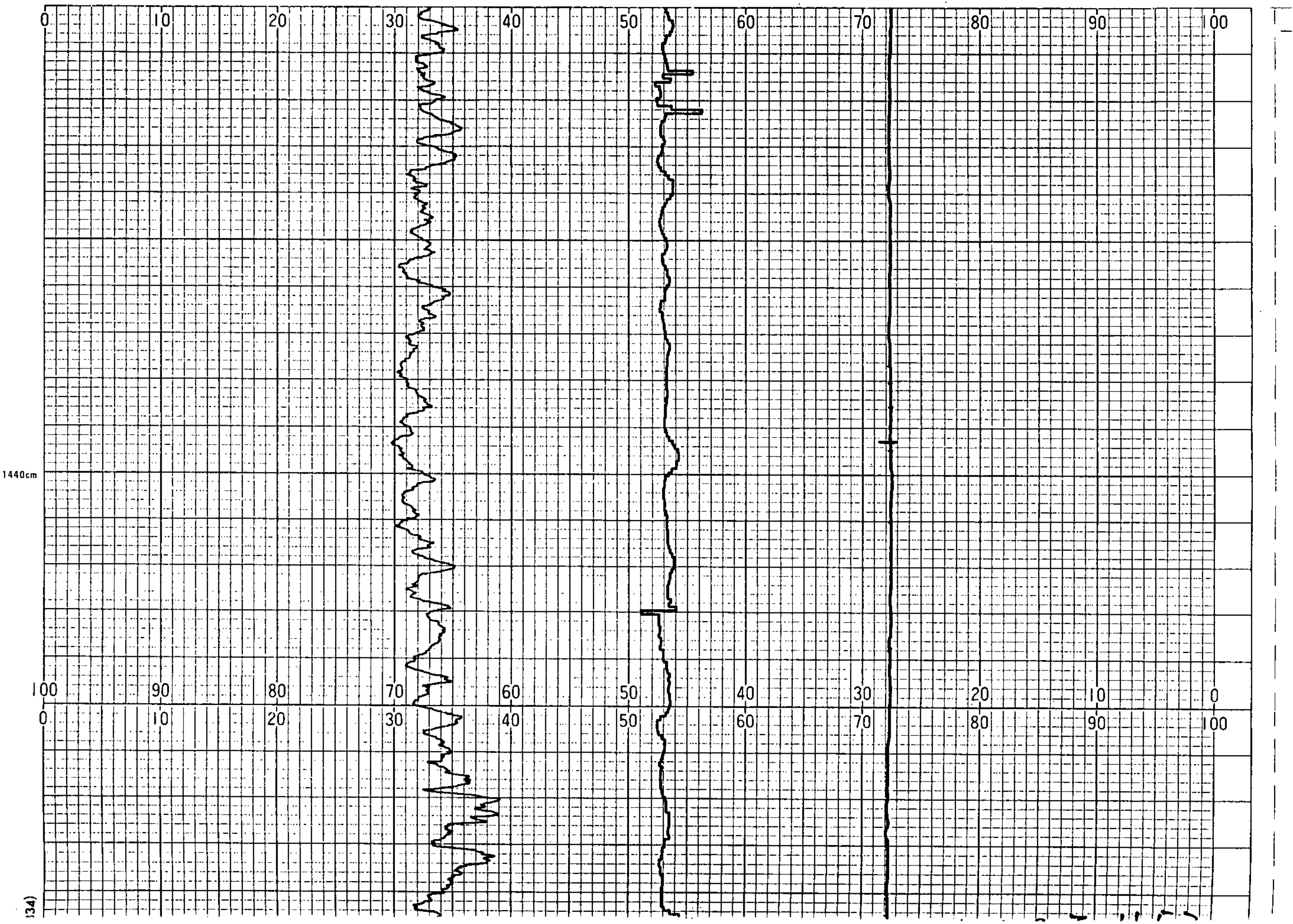


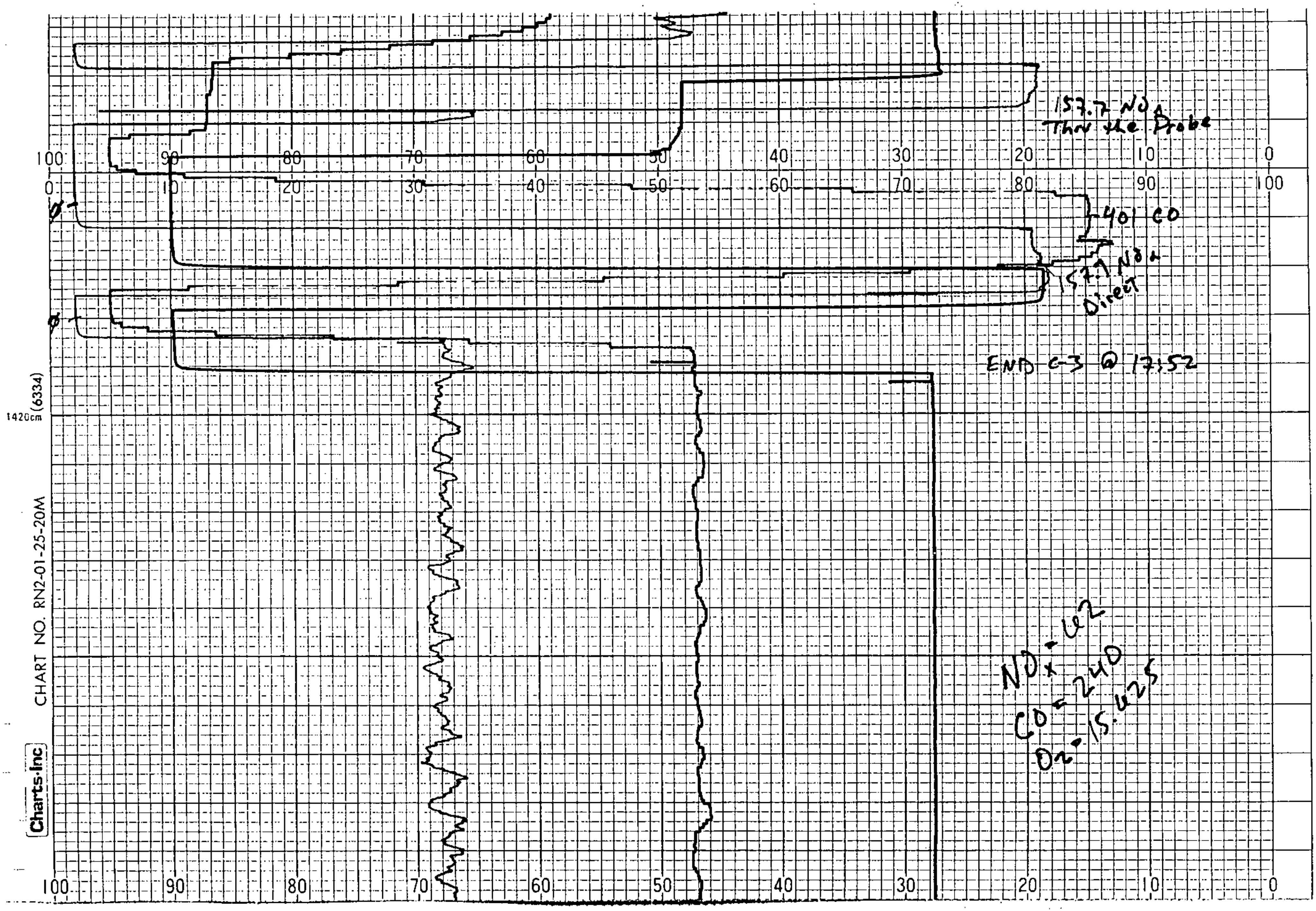
401 CO

157 NOx

18 O2

END 0-2 @ 16:35


0
10
20
30
40
50
60
70
80
90
100
1440cm
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
100
34)



157.7 NO_2 Thru the Probe

401 CO

157.7 NO_2 Direct

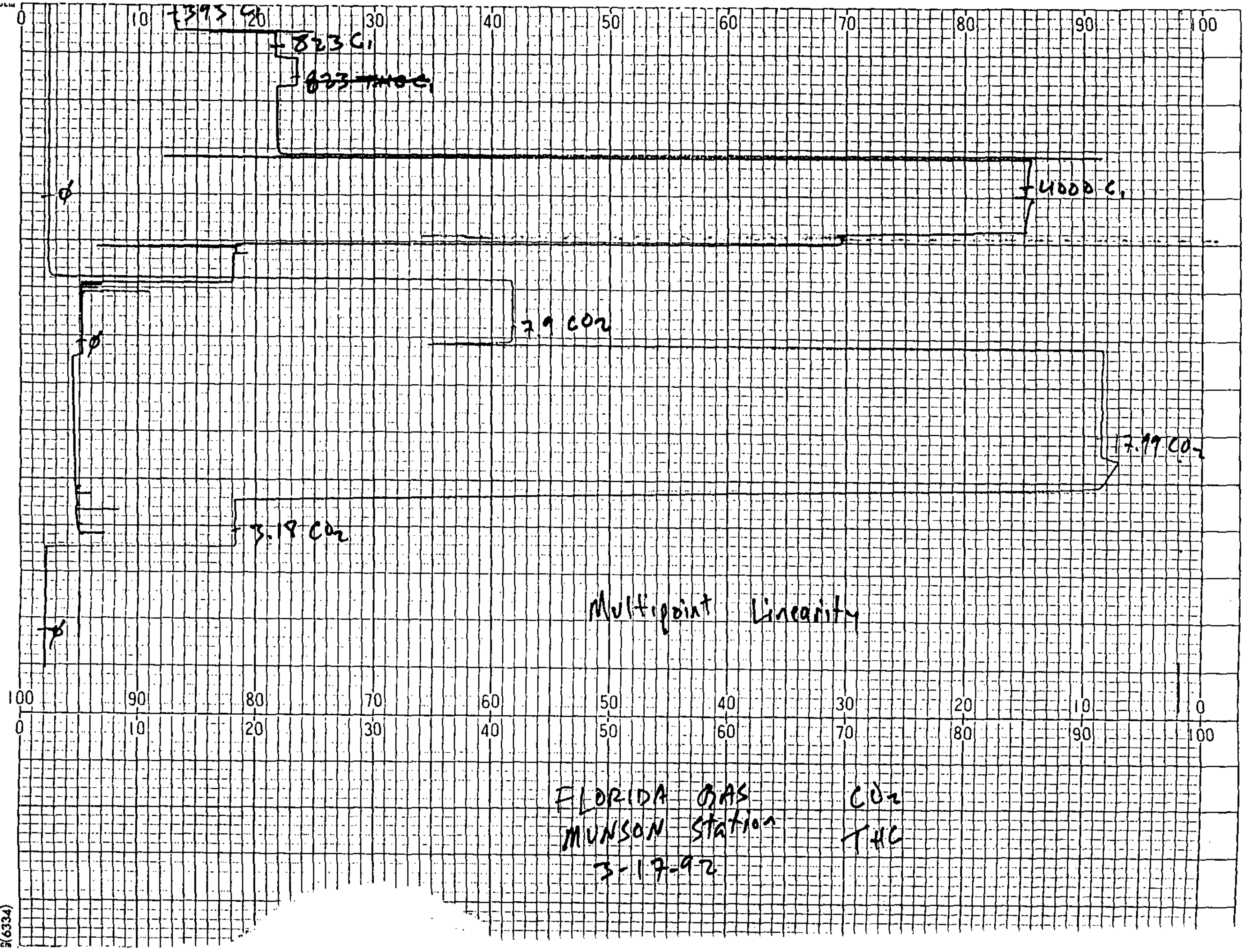
END C-3 @ 17:52

NO_x = 42

CO = 240

O_2 = 15.425

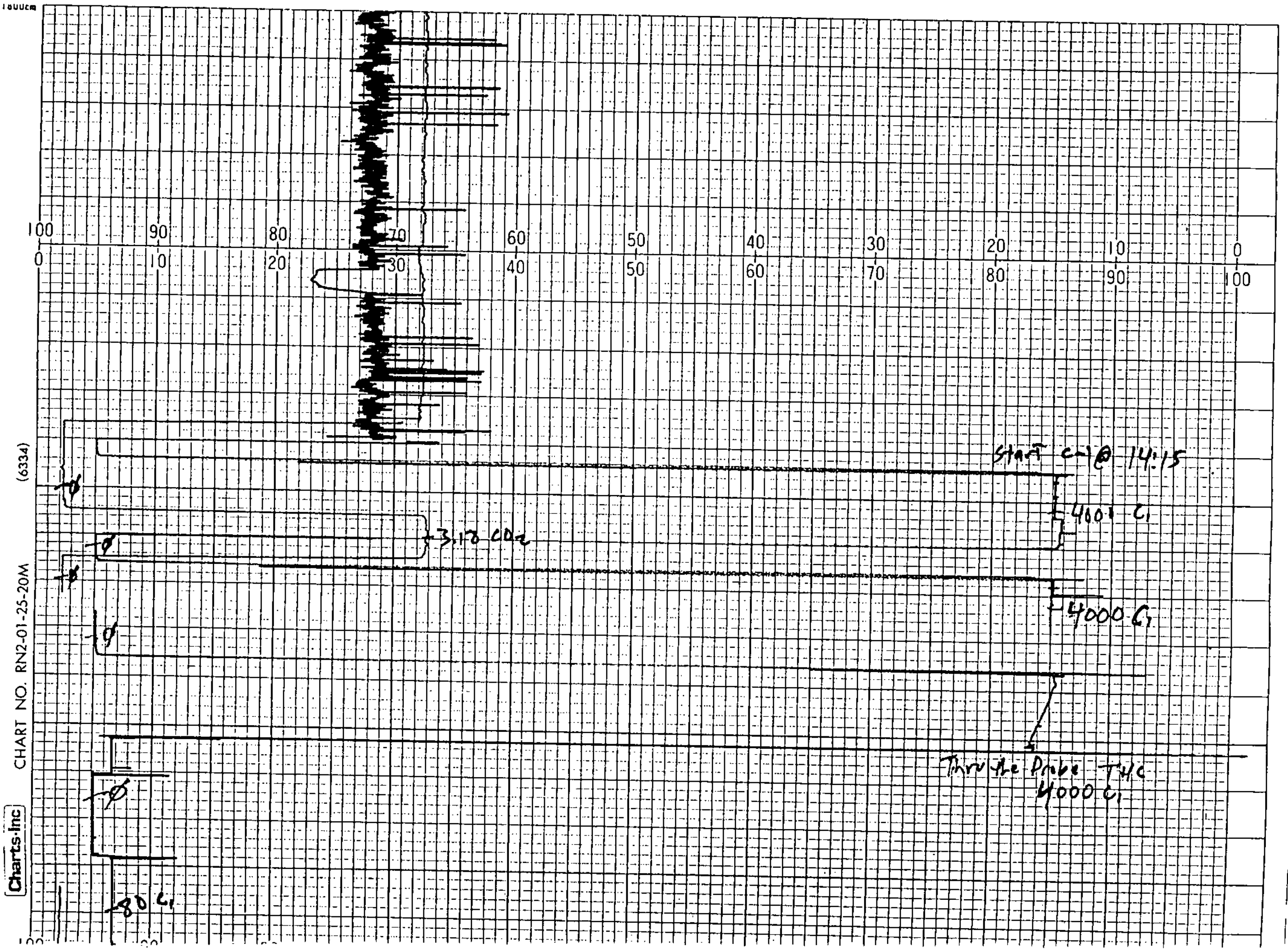
CO_2, THC



Multipoint Linearity

FLORIDA GAS
MUNSON Station
3-17-92

CO_2
THC



Start cal @ 14:15

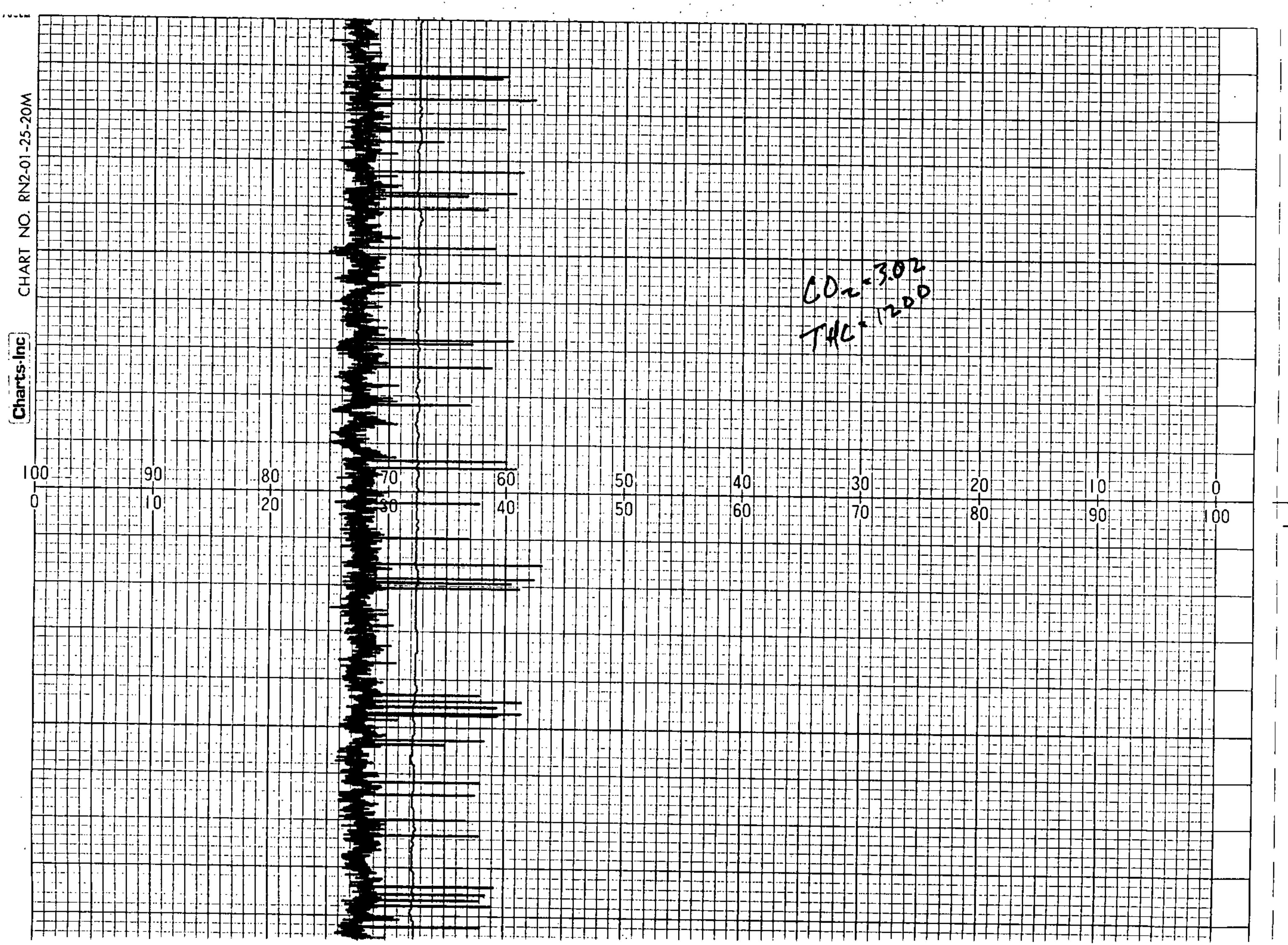
4000 C1

3.18 CO2

4000 C1

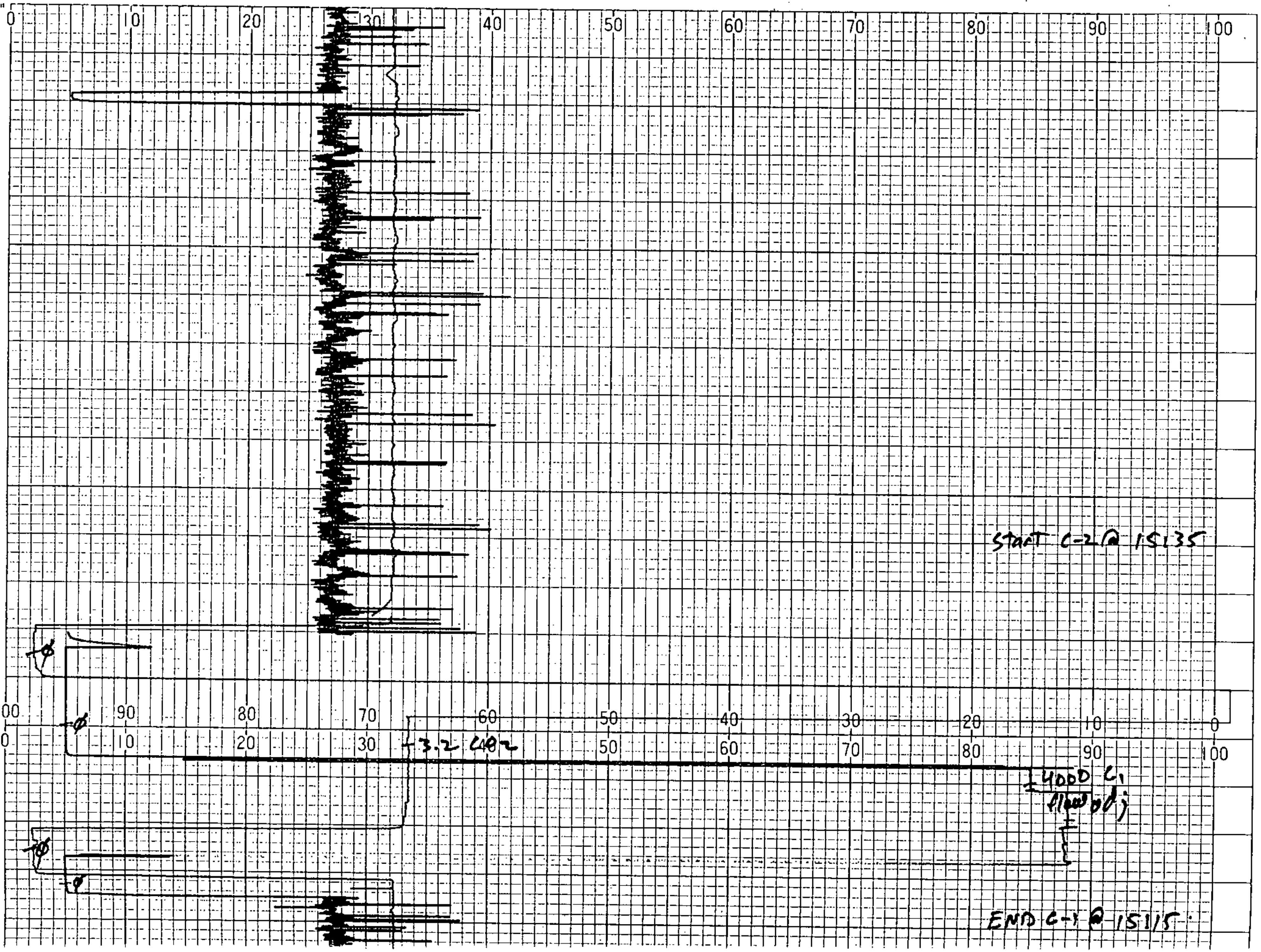
Thru the Probe THC
4000 C1

80 C1



$CO_2 = 3.02$

THC = 1200

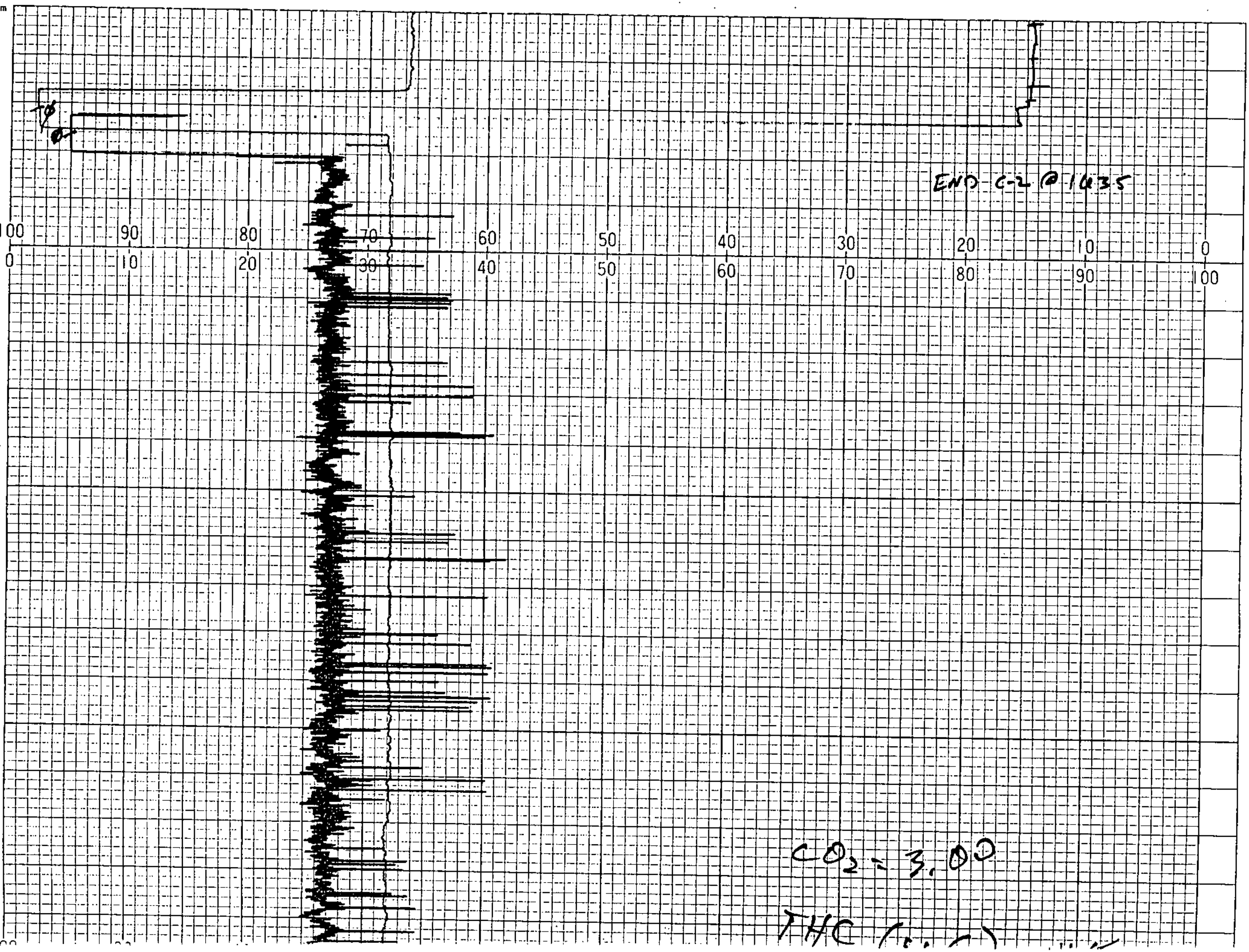


START C-2 @ 15:35

3.2 ClO2

±4000 C1 flow adj

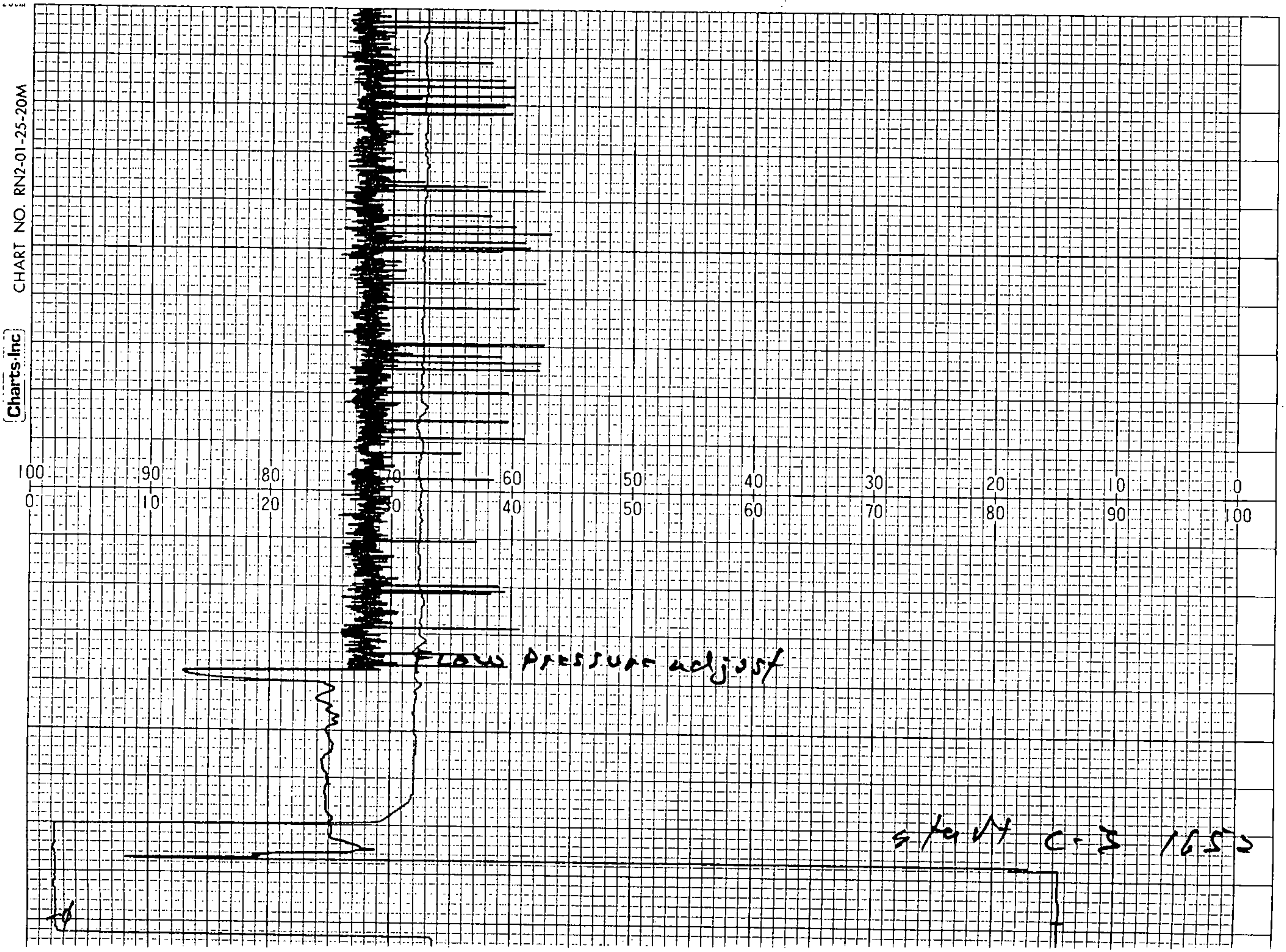
END C-1 @ 15:15



END C-2 @ 1635

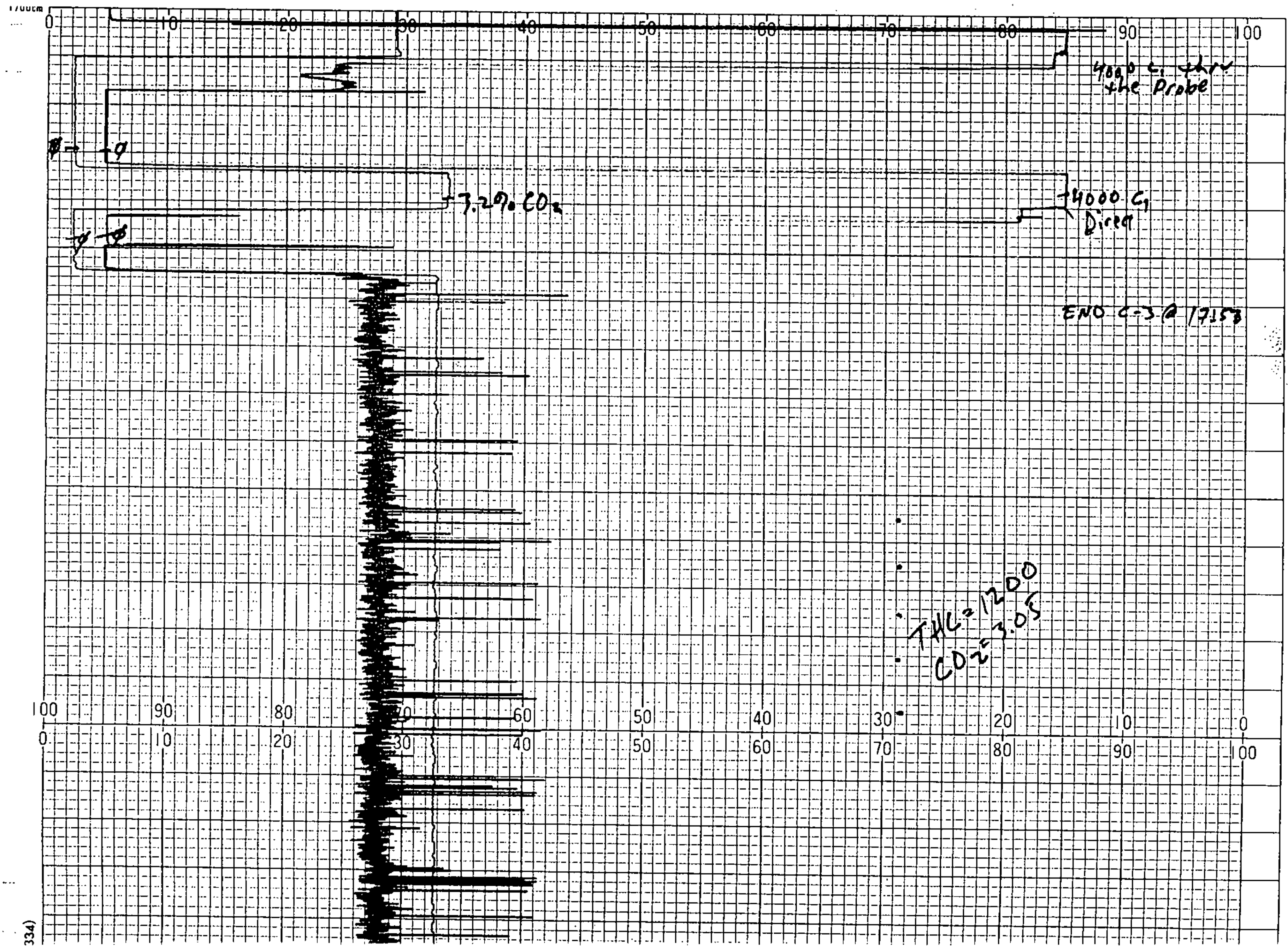
CO_2 = 3.00

THC ([illegible])

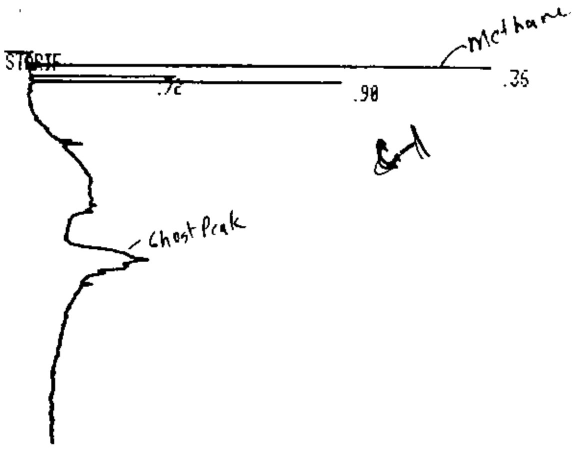


Flow pressure adjust

start C-3 1650


0
10
20
30
40
50
60
70
80
90
100
4000 C1 thru the Probe
ø→
ø
7.2% CO2
4000 C1 Direct
ø
ø
END C-3 @ 17:58
THC = 1200
CO2 = 3.05
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
100
334)

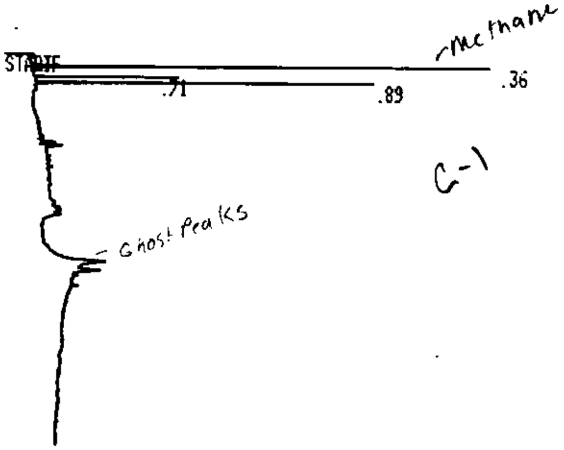
APPENDIX F
CHROMATOGRAMS



S-1

```
RUN #   98                MAR/17/92  14:25:38
WORKFILE ID: C
WORKFILE NAME:

AREA%
  RT           AREA TYPE   AR/HT       AREA%
  0.36       198750 D PB   0.015      94.856
  0.72         3103 D PB   0.020       1.481
  0.90         7675 D PB   0.023       3.663

TOTAL AREA=     209520
MUL FACTOR= 1.0000E+00
```

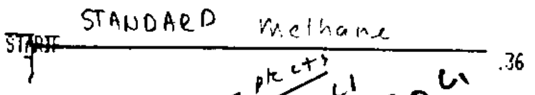
VOC C1



C-1

```
RUN #   99                MAR/17/92  14:47:46
WORKFILE ID: C
WORKFILE NAME:

AREA%
  RT           AREA TYPE   AR/HT       AREA%
  0.36       206370 D PB   0.015      94.770
  0.71         3032 D PB   0.020       1.392
  0.89         8357 D PB   0.023       3.838

TOTAL AREA=     217760
MUL FACTOR= 1.0000E+00
```

VOC

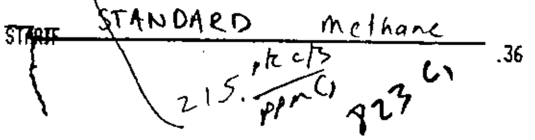


227 pk cts / ppm C1

80 C1

average = 221 pk cts / ppm C1

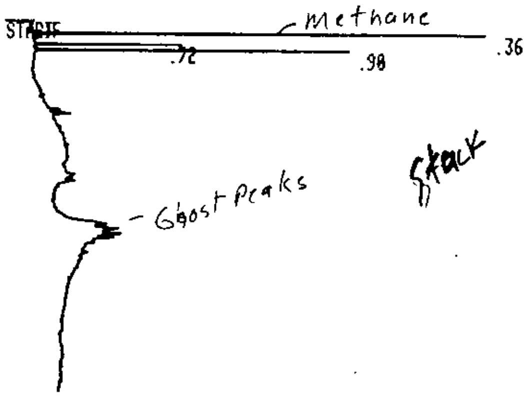
```
RUN #   95                MAR/17/92  13:07:44
WORKFILE ID: C
WORKFILE NAME:

AREA%
  RT           AREA TYPE   AR/HT       AREA%
  0.36        18132 D BB   0.016     100.000

TOTAL AREA=      18132
MUL FACTOR= 1.0000E+00
```



215. pk cts / ppm C1

823 C1

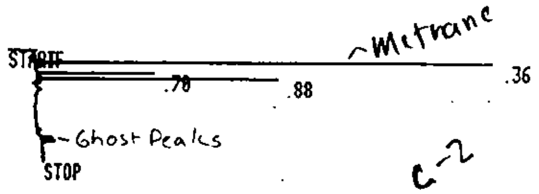
```
RUN #   96                MAR/17/92  13:16:31
WORKFILE ID: C
WORKFILE NAME:

AREA%
  RT           AREA TYPE   AR/HT       AREA%
  0.36       176980 D PB   0.015     100.000

TOTAL AREA=     176980
MUL FACTOR= 1.0000E+00
```



Stack

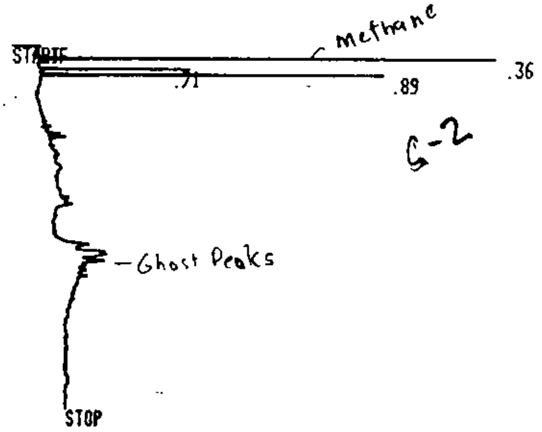
```
RUN #   97                MAR/17/92  13:26:28
WORKFILE ID: C
WORKFILE NAME:

AREA%
  RT           AREA TYPE   AR/HT       AREA%
  0.36       233330 D PB   0.015      95.393
  0.72         3353 D BB   0.021       1.371
  0.90         7916 D PB   0.023       3.236

TOTAL AREA=     244600
MUL FACTOR= 1.0000E+00
```

VOC



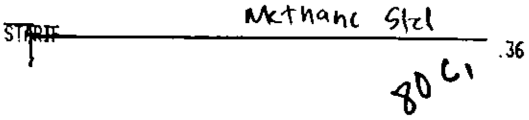
VOC
C1

```
RUN # 103              MAR/17/92  16:03:25
WORKFILE ID: C
WORKFILE NAME:

AREA%
  RT            AREA TYPE   AR/HT      AREA%
 0.36         172490 D BB   0.015     95.288
 0.70           2521 D PB   0.020      1.393
 0.88           6008 D PB   0.024      3.319

TOTAL AREA=     181020
MUL FACTOR= 1.0000E+00
```

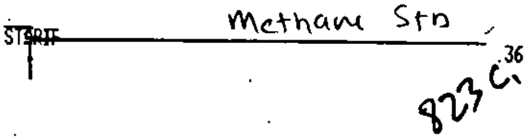


VOC

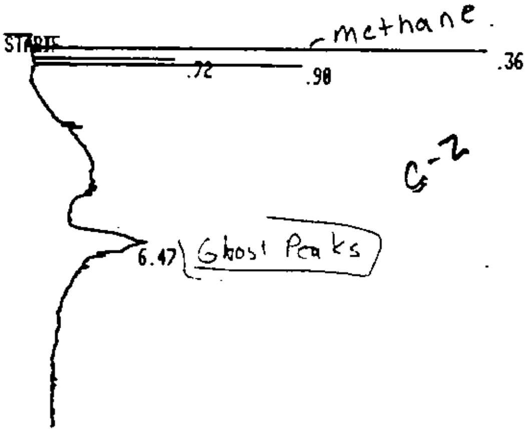
```
RUN # 104              MAR/17/92  16:11:37
WORKFILE ID: C
WORKFILE NAME:

AREA%
  RT            AREA TYPE   AR/HT      AREA%
 0.36         199110 D PB   0.015     94.440
 0.71           3143 D PB   0.020      1.491
 0.89           8579 D BB   0.024      4.069

TOTAL AREA=     210830
MUL FACTOR= 1.0000E+00
```



```
RUN # 100              MAR/17/92  15:11:54
WORKFILE ID: C
WORKFILE NAME:

AREA%
  RT            AREA TYPE   AR/HT      AREA%
 0.36          18008 D PB   0.016    100.000

TOTAL AREA=      18008
MUL FACTOR= 1.0000E+00
```



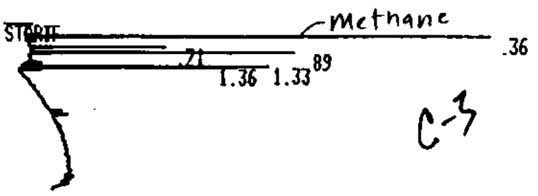
```
RUN # 101              MAR/17/92  15:20:43
WORKFILE ID: C
WORKFILE NAME:

AREA%
  RT            AREA TYPE   AR/HT      AREA%
 0.36         176980 D PB   0.015    100.000

TOTAL AREA=     176980
MUL FACTOR= 1.0000E+00
```



4.84% VOC

VOC

```
RUN # 102              MAR/17/92  15:44:29
WORKFILE ID: C
WORKFILE NAME:

AREA%
  RT            AREA TYPE   AR/HT      AREA%
 0.36         193700 D PB   0.015     83.496
 0.72           3101 D BB   0.021      1.337
 0.90           6761 D BB   0.024      2.914
 6.47          28425   PB   0.458     12.253

TOTAL AREA=     231990
```

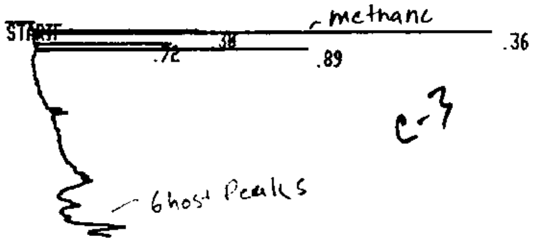


```
RUN #  106                 MAR/17/92  17:00:48
WORKFILE ID: C
WORKFILE NAME:
```

9.01% VOC

VOC

```
AREA%
  RT             AREA TYPE    AR/HT        AREA%
  0.36         184580 D PB    0.015       90.990
  0.71           2832 D PB    0.020        1.396
  0.89           6577 D PB    0.024        3.242
  1.33           3934 D BP    0.015        1.939
  1.36           4935 D PB    0.022        2.433

 TOTAL AREA=     202850
 MUL FACTOR= 1.0000E+00
```

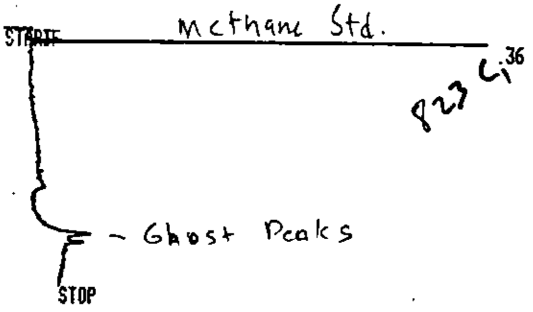


```
RUN #  107                 MAR/17/92  17:22:06
WORKFILE ID: C
WORKFILE NAME:
```

4.56% VOC

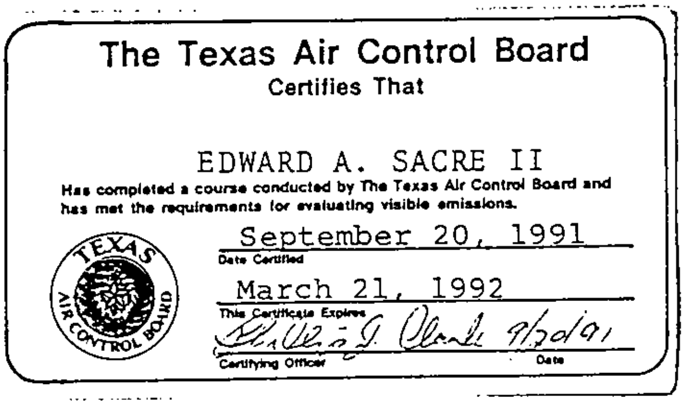
VOC

```
AREA%
  RT             AREA TYPE    AR/HT        AREA%
  0.30           2883 D PP    0.017        1.367
  0.36         198370 D PB    0.015       94.074
  0.72           2869 D PB    0.020        1.361
  0.89           6743 D PB    0.024        3.198

 TOTAL AREA=     210870
 MUL FACTOR= 1.0000E+00
```



```
RUN #  105                 MAR/17/92  16:30:49
WORKFILE ID: C
WORKFILE NAME:

AREA%
  RT             AREA TYPE    AR/HT        AREA%
  0.36         176800 D PB    0.015      100.000

 TOTAL AREA=     176800
 MUL FACTOR= 1.0000E+00
```

APPENDIX G
OPACITY DATA SHEETS



The Texas Air Control Board

Certifies That

EDWARD A. SACRE II

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

September 20, 1991
Date Certified

March 21, 1992
This Certificate Expires

9/20/91
Certifying Officer Date

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Dresser Rand Compressor/Engine 10TCV112AP

OBSERVATION DATE: 3-17-92

START TIME: 1535

STOP TIME: 1635

ADDRESS: Rt. 1 Box 144
Milton, FL

CITY: Milton, FL

STATE: FL

ZIP: 32570

PHONE: (904)957-4221

SOURCE ID NUMBER: 10TCV112AP

PROCESS EQUIPMENT: Turbo Charger

OPERATING MODE: normal maximum

CONTROL EQUIPMENT:

OPERATING MODE:

DESCRIBE EMISSION POINT: Circular stack

HEIGHT ABOVE GROUND LEVEL: ~75'

HEIGHT RELATIVE TO OBSERVER: ~75'

DISTANCE FROM OBSERVER: ~200'

DIRECTION FROM OBSERVER: E

DESCRIBE EMISSIONS: None

EMISSION COLOR:

PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT: NO ☑ YES ☐

IS WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐

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

DESCRIBE BACKGROUND: SKY

BACKGROUND COLOR: Blue/white

SKY CONDITIONS: Partly Cloudy

WIND SPEED: 5-10 mph

WIND DIRECTION: S-SW

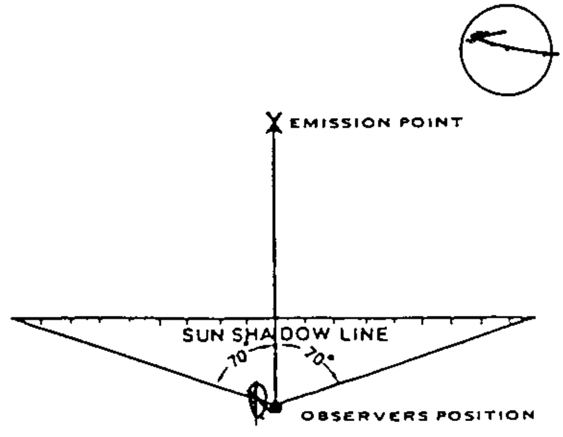
AMBIENT TEMP.: 78

WET BULB TEMP.: 74

RELATIVE HUMIDITY: 91%

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:

NUMBER OF READINGS ABOVE % WERE

RANGE OF OPACITY READINGS: MINIMUM MAXIMUM

COMMENTS:

OBSERVER'S NAME (PRINT): Tony Sacre

OBSERVER'S SIGNATURE: Tony Sacre

DATE: 3-17-92

ORGANIZATION: CUBIX

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE:

TITLE:

DATE:

CERTIFIED BY: TACB

DATE: 9-20-91 ~~9-15-90~~

VERIFIED BY:

DATE:

EPA TH 0101

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME 10 TCV112AP
Dresser Rand Compressor/Engine

ADDRESS
Rt.1 Box 146
Milton, FL

CITY ~~Munson~~ Milton
STATE FL
ZIP 32570

PHONE (904)957-4221
SOURCE ID NUMBER 10TCV112AP

PROCESS EQUIPMENT Turbo charger
OPERATING MODE normal maximum

CONTROL EQUIPMENT None
OPERATING MODE

DESCRIBE EMISSION POINT Circular stack

HEIGHT ABOVE GROUND LEVEL ~75'
HEIGHT RELATIVE TO OBSERVER ~75'

DISTANCE FROM OBSERVER ~200'
DIRECTION FROM OBSERVER East

DESCRIBE EMISSIONS None

EMISSION COLOR
PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐

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

AT WHAT POINT IN THE PLUME WAS OPACITY DETERMINED
2 Duct diameters downstream from stack

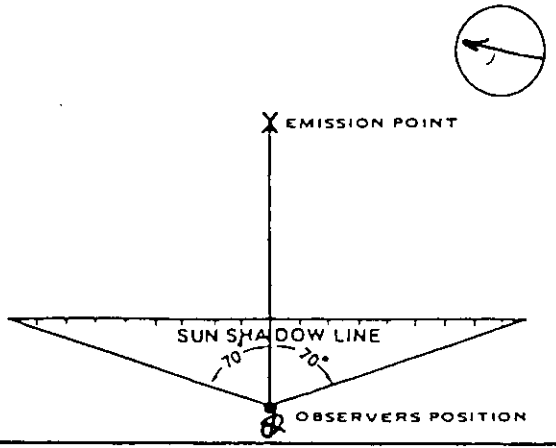
DESCRIBE BACKGROUND ~~Blue/white~~ sky

BACKGROUND COLOR Blue/white
SKY CONDITIONS Partly cloudy

WIND SPEED 5-10 m.p.h.
WIND DIRECTION S-SW

AMBIENT TEMP. 77
WET BULB TEMP. 73
RELATIVE HUMIDITY 79%

SOURCE LAYOUT SKETCH
DRAW NORTH ARROW



OBSERVATION DATE 3-17-92
START TIME 14:15
STOP TIME 15:15

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 % WERE

RANGE OF OPACITY READINGS
0 MINIMUM MAXIMUM 0

OBSERVER'S NAME (PRINT) Tony Sasse

OBSERVER'S SIGNATURE Tony Sasse
DATE 3-17-92

ORGANIZATION Cubix

CERTIFIED BY TACB
DATE ~~9-15-90~~ 9-20-91

VERIFIED BY
DATE

COMMENTS

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

EPA TR 0101

VISIBLE EMISSION OBSERVATION FORM

SOURCE NAME: Dresser Rand Compressor Engine

ADDRESS: Rt.1 Box 146

Milton FL

CITY: Milton

STATE: Fl

ZIP: 32570

PHONE: (904)957-4221

SOURCE ID NUMBER: 10TCV112AP

PROCESS EQUIPMENT: Turbo charger

OPERATING MODE: normal maximum

CONTROL EQUIPMENT:

OPERATING MODE:

DESCRIBE EMISSION POINT:

HEIGHT ABOVE GROUND LEVEL: ~75'

HEIGHT RELATIVE TO OBSERVER: ~75'

DISTANCE FROM OBSERVER: ~200'

DIRECTION FROM OBSERVER: East

DESCRIBE EMISSIONS: None

EMISSION COLOR:

PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT: NO ☑ YES ☐

IS WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐

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

DESCRIBE BACKGROUND: Sky

BACKGROUND COLOR: Blue/white

SKY CONDITIONS: Partly Cloudy

WIND SPEED: 10-15 mph

WIND DIRECTION: S-SW

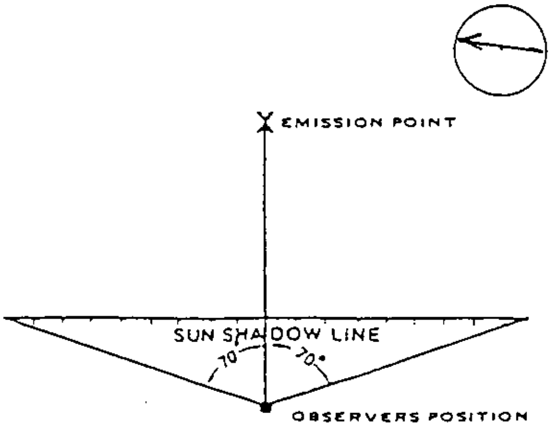
AMBIENT TEMP.: 71

WET BULB TEMP.: 66

RELATIVE HUMIDITY: 76%

SOURCE LAYOUT SKETCH

DRAW NORTH ARROW



COMMENTS:

OBSERVATION DATE: 3-17-92

START TIME: 16:50

STOP TIME: 17:50

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 % WERE

RANGE OF OPACITY READINGS MINIMUM MAXIMUM

OBSERVER'S NAME (PRINT): Tony Sacre

OBSERVER'S SIGNATURE: Tony Sacre

DATE: 3-17-92

ORGANIZATION: CUBIX

CERTIFIED BY: TACB

DATE: ~~4-15-90~~ 9-20-90

VERIFIED BY:

DATE:

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE

TITLE

DATE

EPA TR 0101

APPENDIX H
FUEL ANALYSIS

SPL

CERTIFICATE OF ANALYSIS NUMBER 199904

SAMPLE IDENT.: MUNSON STATION 810
FLORIDA GAS TRANS.
INLET GAS (NATURAL) FGT
03/17/92 @ 10:00

DATE: APRIL 08, 1992

P. O. NO.: 92143

FOR: CUBIX CORPORATION
9225 LOCKHART HIGHWAY
AUSTIN, TEXAS 78747

ATTN: MR. JOE RUDYK

ASTM D-3246
TOTAL SULFUR ANALYSIS

< 1 ppm by wt.

< 0.059 Grains/100 cu. ft. by vol.

< 0.105 Grains/100 cu. ft. by wt.

SOUTHERN PETROLEUM LABORATORIES, INC.

JC Winfrey

J. C. WINFREY

Fuel Calculations: From Carryville Compressor Station

Client: Florida Gas
Sample ID: Carryville Station Fuel Gas

CALCULATION OF DENSITY AND HEATING VALUE

Component	% Volume	Molecular Wt.	Density (lb/ft3)	% volume x Density	weight %	Component Gross Btu/lb	Weight Fract. Btu	Gross Heating Value (Btu/SCF)	Volume Fract. Btu
Hydrogen		2.016	0.0053	0.00000	0.0000	61100	0.00	325	0
Oxygen		32.000	0.0846	0.00000	0.0000	0	0.00	0	
Nitrogen	0.3550	28.016	0.0744	0.00026	0.5982	0	0.00	0	0
CO2	0.6890	44.01	0.117	0.00081	1.8257	0	0.00	0	0
CO		28.01	0.074	0.00000	0.0000	4347	0.00	322	0
Methane	96.7700	16.041	0.0424	0.04103	92.9239	23879	22189.31	1013	980.28
Ethane	[illegible]30	30.067	0.0803	0.00141	3.1880	22320	711.56	1792	31.414
Ethylene		28.051	0.0746	0.00000	0.0000	21644	0.00	1614	0
Propane	0.2240	44.092	0.1196	0.00027	0.6067	21661	131.43	2590	5.8016
propylene		42.077	0.111	0.00000	0.0000	21041	0.00	2336	0
Isobutane	0.0630	58.118	0.1582	0.00010	0.2257	21308	48.10	3363	2.1187
n-butane	0.0520	58.118	0.1582	0.00008	0.1863	21257	39.60	4016	2.0883
Isobutene		56.102	0.148	0.00000	0.0000	20840	0.00	3068	0
Isopentane	0.0240	72.144	0.1904	0.00005	0.1035	21091	21.83	4008	0.9619
n-pentane	0.0160	72.144	0.1904	0.00003	0.0690	21052	14.52	3993	0.6389
n-hexane	0.0530	86.169	0.2274	0.00012	0.2730	20940	57.16	4762	2.5239
H2S		34.076	0.0911	0.00000	0.0000	7100	0.00	647	0
total	100.00	Average Density		0.04415	100.0000	Gross Heating Value		Gross Heating Value	
		Specific Gravity		0.57719		Btu/lb	23214	Btu/SCF	1026

CALCULATION OF F FACTORS

Component	Mol. Wt.	C Factor	H Factor	% volume	Fract. Wt.	Weight Percents Carbon	Hydrogen	Nitrogen	Oxygen	Sulfur
Hydrogen	2.016	0	1	0.00	0.0000	0	0			
Oxygen	32	0	0	0.00	0.0000				0	
Nitrogen	28.016	0	0	0.36	9.9457	0	0	0.59580783		
CO2	44.01	0.272273	0	0.69	30.3229	0.49459178	0		1.3206	
CO	28.01	0.42587	0	0.00	0.0000	0	0		0	
Methane	16.041	0.75	0.25	96.77	1552.2876	69.7437295	23.24791			
Ethane	30.067	0.8	0.2	1.75	52.7075	2.5260022	0.6315006			
Ethylene	28.051	0.85714	0.14286	0.00	0.0000	0	0			
Propane	44.092	0.81818	0.18182	0.22	9.8766	0.48409255	0.1075763			
Propene	42.077	0.85714	0.14286	0.00	0.0000	0	0			
Isobutane	58.118	0.82759	0.17247	0.06	3.6614	0.18152572	0.03783			
n-butane	58.118	0.82759	0.17247	0.05	3.0221	0.14983075	0.0312248			
Isobutene	56.102	0.85714	0.14286	0.00	0.0000	0	0			
Isopentane	72.144	0.83333	0.16667	0.02	1.7315	0.0864371	0.0172878			
n-pentane	72.144	0.83333	0.16667	0.02	1.1543	0.05762474	0.0115252			
n-hexane	86.169	0.83721	0.16279	0.05	4.5670	0.22905145	0.0445376			
H2S	34.08	0	0	0.00	0.0000	0	0			0
Totals				99.99900	1669.2765	73.9528858	24.13	0.59580783	1.3206	0
										99.999

CALCULATED VALUES		
O2 F Factor (dry)	8635	DSCF of Exhaust/MM Btu of Fuel Burned @ 0% excess air
O2 F Factor (wet)	10641	SCF of Exhaust/MM Btu of Fuel Burned @ 0% excess air
Moisture F Factor	2006	SCF of Water/MM Btu of Fuel Burned @ 0% excess air
Combust. Moisture	18.85	volume % water in flue gas @ 0% excess air
Fo	1.8	fuel factor (dimensionless)
VOC Portion of fuel	2.21	%
CO2 F Factor	1023	DSCF of CO2/MM Btu of Fuel Burned @ 0% excess air

APPENDIX I:
UNOFFICIAL COMPLIANCE TEST DATA

Munson Compressor Station--Unofficial Data

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

Test Run No.	C-1	C-2	C-3
Date	3/17/92	3/17/92	3/17/92
Start Time	14:15	15:35	16:52
Stop Time	15:15	16:35	17:52
Engine/Compressor Operation			
Engine Speed (rpm)	330	330	330
Ignition Timing (°BTDC)	8	8	8
Air Manifold Pressure (psig)	16	16	16
Air Manifold Temperature (°F)	124	124	124
Estimated Fuel Flow AT 7600 BTU/hp-hr (SCFH)	30896	30896	30896
Fuel Temperature (°F)	48	47	46
Fuel Manifold Pressure (psig)	35	35.5	35
Loading Step (pockets open out of 10 total)	9	9	9
Suction Pressure (psig)	681	680	679
Suction Temperature (°F)	63	63	62
Discharge Pressure (psig)	919	920	918
Discharge Temperature (°F)	105	105	105
Engine Load (BHP)	4171	4171	4171
Torque (%)	97	96	96
Ambient Conditions			
Atmospheric Pressure (in. Hg)	29.95	29.92	29.92
Temperature (°F) : Dry bulb	78	78	71
(°F) Wet bulb	73	76	66
Humidity (lb/lb air)	0.0159	0.0184	0.0123
Measured Emissions			
NOx (ppmv)	68.0	66.0	62.0
CO (ppmv)	240	236	240
O2 via Method 3a (%)	15.3	15.7	15.6
CO2 via Method 3a (%)	3.02	3.00	3.05
THC via EPA Method 25a (ppmv, wet)	1200	1115	1200
VOC via EPA Method 18 (% of THC)	5.19%	5.04%	6.79%
VOC i.e. non methane via EPA 18 (ppmv, wet)	62.2	56.2	81.4
VOC via Methods 25a and 18 (ppmv, dry)	66.7	60.0	86.6
SO2 in fuel (grains/100 DSCF)	<0.059	<0.059	<0.059
Stack Volumetric Flow Rates			
via Pitot Tube (SCFH, dry)	1.21E+06	1.20E+06	1.16E+06
Calculated Emission Rates (via pitot tube)			
NOx (lbs/hr)	9.83	9.43	8.60
CO (lbs/hr)	21.1	20.5	20.3
VOC (lbs/hr)	3.35	2.98	4.18
SO2 (lbs/hr)	<0.0026	<0.0026	<0.0026
NOx (tons/yr)	43.0	41.3	37.7
CO (tons/yr)	92.4	89.9	88.7
VOC (tons/yr)	14.7	13.1	18.3
SO2 (tons/yr)	0.0	0.0	0.0
NOx (g/hp-hr)	1.07	1.03	0.94
CO (g/hp/hr)	2.30	2.23	2.21
VOC (g/hp-hr)	0.37	0.32	0.45

Testing By Cubix Corporation, Austin, Texas

Munson Compressor Station--Unofficial Data

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

Test Run No.	C-1	C-2	C-3
Stack Moisture & Molecular Wt. via EPA Method 4			
CO2 (%)	3.02	3.00	3.05
O2 (%)	15.25	15.70	15.63
Beginning Meter Reading (ft3)	388.525	413.528	435.260
Ending Meter Reading (ft3)	413.270	435.160	457.398
Beginning Impinger Wt (g)	2542.9	2591.9	2622.7
Ending Impinger Wt. (g)	2576.4	2619.7	2649.1
Dry Gas Meter Factor (Kd)	0.9904	0.9904	0.9904
Dry Gas Meter Temperature (°F begin)	122	128	124
Dry Gas Meter Temperature (°F end)	140	130	130
Atmospheric Pressure (in Hg, abs.)	29.95	29.95	29.92
Stack Gas Moisture (% volume)	6.73	6.39	5.94
Dry Gas Fraction	0.933	0.936	0.941
Stack Gas Molecular Wt. (lbs/lb-mole)	28.35	28.40	28.45
Stack Moisture via Stoichiometry			
Fuel Moisture Content (vol % @ 0% O2)	18.85	18.85	18.85
Moisture Content (vol % at stack)	6.12	5.87	5.55
Difference between methods	9%	8%	7%
Stack Flow Rate via Pitot Tube			
Pitot Tube Factor	0.84	0.84	0.84
ΔP #1	0.82	2.50	1.10
ΔP #2	0.94	2.60	1.40
ΔP #3	1.50	2.10	1.30
ΔP #4	1.50	1.90	1.40
ΔP #5	1.80	0.85	1.50
ΔP #6	2.80	0.65	1.80
ΔP #7	2.90	0.61	2.00
ΔP #8	3.10	0.74	2.10
ΔP #9	2.20	1.10	2.20
ΔP #10	2.30	1.40	2.50
ΔP #11	2.40	1.40	2.30
ΔP #12	2.00	1.50	1.80
ΔP #13	1.20	2.10	1.10
ΔP #14	0.81	2.10	0.68
ΔP #15	0.65	2.50	0.65
ΔP #16	0.62	2.50	0.74
Sum of Square Root of ΔP's	20.4	20.1	19.4
Number of Traverse Points	16	16	16
Average Square Root of ΔP's	1.27	1.26	1.22
Average Temperature (°F)	539	541	542
Static Pressure (in. H2O)	-0.18	-0.1	-0.05
Stack Diameter (in.)	35.5	35.5	35.5
Stack Area (ft2)	6.87	6.87	6.87
Stack Velocity (ft/min)	5947	5870	5681
Stack Flow,wet (ACFM)	40876	40345	39052
Stack Flow,dry (SCFH)	1.21E+06	1.20E+06	1.16E+06
Stack Flow Rate via EPA Method 19			
Fuel Flow to Engine (SCFH)	30896	30896	30896
Fuel Heating Value (BTU/SCF)	1026	1026	1026
Fuel O2 F-Factor (DSCFH/MMBTU)	8635	8635	8635
Fuel CO2 F-Factor (DSCFH/MMBTU)	1023	1023	1023
Stack Flow Rate, dry via O2 F-factor (SCFH)	1.01E+06	1.10E+06	1.08E+06
Stack Flow Rate, dry via CO2 F-factor (SCFH)	1.07E+06	1.08E+06	1.06E+06
Difference between O2 F-factor and pitot tube	16%	8%	7%
Difference between CO2 F-factor and pitot tube	11%	10%	8%
Stack Flow Rate via Carbon Balance			
Fuel Carbon Content	1.026	1.026	1.026
Exhaust Carbon Content	3.16	3.14	3.19
Stack Flow Rate, dry via Carbon Balance (SCFH)	1.00E+06	1.01E+06	9.93E+05
Difference between Carbon Balance and pitot tube	17%	15%	15%

Testing By Cubix Corporation, Austin, Texas

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

March 9, 1992

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

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

Dear Mr. Weatherford:

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

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

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

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

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

Sincerely,

Syed Arif

Syed Arif
Compliance Engineer

SA:cjh

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

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

4APT-AEB

MAY 31 1991

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

RECEIVED
JUN 03 1991
Division of Air
Resources Management

RE: Florida Gas Transmission Company Compressor Stations

PSD-FL-156	Santa Rosa County
PSD-FL-158	Washington County
PSD-FL-159	Gadsden County
PSD-FL-160	Taylor County
PSD-FL-161	Bradford County
PSD-FL-162	Marion County
PSD-FL-163	Orange County
PSD-FL-164	St. Lucie County

Dear Mr. Fancy:

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

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

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

Sincerely yours,

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

J. Pieron
CHF/ST

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