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SOURCE TEST REPORT

OXIDES OF NITROGEN and CARBON MONOXIDE EMISSION TEST RESULTS

FOR

INTERNAL COMBUSTION ENGINES

AT

GARDEN CITY COMPRESSOR STATION

Prepared for

LOUISIANA INTRASTATE GAS CORPORATION
1412 Centre Court
P.O. Box 1352
Alexandria, Louisiana 71309-1352

Prepared by

HUNTER/ESE, INC.
Baton Rouge, Louisiana

Hunter/ESE No. 3907022000

September 1989

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HUNTER/ESE, INC.
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CONFIRMATION OF INFORMATION
EMISSION TEST REPORT

FOR

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1412 Centre Court
P.O. Box 1352
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GARDEN CITY COMPRESSOR STATION
INTERNAL COMBUSTION ENGINES

SEPTEMBER 5-6, 1989

I certify that I have personally examined and am familiar with the information contained herein, and based on my inquiries of the individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate, and complete, to the best of my knowledge.

Steven Schwartz 11/1/89
Senior Associate Engineer

Bharat Contractor, P.E.
Regional Manager

TABLE OF CONTENTS

SECTION		PAGE
1.0	INTRODUCTION	1-1
2.0	SUMMARY OF TEST RESULTS	2-1
3.0	TRAVERSE SAMPLING LOCATION	3-1
	3.1 PROCESS DESCRIPTION	3-1
	3.2 SAMPLE PORTS	3-1
4.0	TEST PROCEDURES	4-1
	4.1 CONTINUOUS INSTRUMENTAL ANALYSIS	4-1
	4.2 GAS SAMPLE COLLECTION AND CONDITIONING	4-1
	4.3 METHOD 7E: OXIDES OF NITROGEN ANALYSIS	4-3
	4.4 METHOD 10: CARBON MONOXIDE ANALYSIS	4-3
	4.5 METHOD 3A: CONTINUOUS OXYGEN ANALYSIS	4-6
	4.6 EPA METHODS 1-4: SAMPLING AND ANALYSIS	4-6
	4.7 METHOD 3: ORSAT SAMPLING AND ANALYSIS	4-10
	4.8 SAMPLE RECOVERY	4-10

APPENDICES

A	Complete Field Data and Emission Calculations - Source No. 1-88
B	Complete Field Data and Emission Calculations - Source No. 2-88
C	Complete Field Data and Emission Calculations - Source No. 3-88
D	Operational Data and Fuel Gas Analysis
E	Strip Charts
F	Calibration Gas Certificates
G	LDEQ Air Permit
H	Project Participants

LIST OF TABLES

TABLE		PAGE
2-1	Summary of Oxides of Nitrogen and Carbon Monoxide Concentrations and Emission Results: Garden City Compressor Station, Louisiana Intrastate Gas Corporation, September 5-6, 1989.	2-3
2-2	Summary of Stack Gas Flow Parameters: Garden City Compressor Station, Louisiana Intrastate Gas Corporation, Septermber 5-6, 1989.	2-4
4-1	Technical Specifications of the Thermo Electron Model 10AR NO/NO_x Analyzer.	4-5
4-2	Technical Specifications of the Horiba Model AIA-23 (AS) NDIR Carbon Monoxide Analyzer.	4-7

LIST OF FIGURES

FIGURE		PAGE
3-1	Process Diagram of the Garden City Internal Combustion Engine Compressor Station	3-2
3-2	Traverse Sampling Layout - Source No. 1-88	3-3
3-3	Traverse Sampling Layout - Source No. 2-88	3-4
3-4	Traverse Sampling Layout - Source No. 3-88	3-5
4-1	Instrumentation Sampling System	4-2
4-2	EPA Method 1-4 Sampling Train	4-9

1.0 INTRODUCTION

Hunter/ESE, Inc. was contracted by Louisiana Intrastate Gas Corporation (LIGC), to conduct compliance emission testing for Oxides of Nitrogen (NO_x) and Carbon Monoxide (CO) on three (3) Internal Combustion Engines located at the Garden City Compressor Station, St. Mary Parish, Louisiana. The Garden City compressor station is comprised of three natural gas fired reciprocating internal combustion engines of 930, 180, and 118 horsepower The source I.D. numbers are 1-88, 2-88, and 3-88, respectively.

Oxides of Nitrogen emissions were determined by U.S. EPA Method 7E, Oxygen was determined by U.S. EPA Method 3A, and Carbon Monoxide emissions were found by U.S. EPA Method 10 using continuous emission monitors. Traverse sampling location, stack gas velocity, dry gas molecular weight, and moisture content were determined by U.S. EPA Methods 1-4, respectively. EPA methods are found in, Appendix A, Title 40, Part 60 of the Code of Federal Regulations.

Three, one hour sampling test runs were performed on each I.C. Engine by the testing team of Mike Calamia and Steven Schwartz. Mike Calamia was responsible for the analysis of Carbon Monoxide, Oxides of Nitrogen, and Oxygen Emissions; Steven Schwartz was responsible for the determination of the stack gas flow parameters. Source I.D. 3-88 was tested on September 5, 1989. Sources 1-88 and 2-88 were tested on September 6, 1989.

The operational data of each I.C. Engine Source was taken by Louisiana Intrastate Gas Corporation personnel and provided by Mr. Mike Leger. Mr. Leger also coordinated the testing activities within the Garden City Compressor Station facility.

A pretest meeting with LDEQ was waived as per a telephone conversation with Mr. James Magee, however, the testing was observed by Mr. Robert Freeman of the Acadian regional office, LDEQ.

2.0 SUMMARY OF TEST RESULTS

Table 2-1 contains the Oxides of Nitrogen and Carbon Monoxide emission results for the three Internal Combustion Engines tested at the Garden City Compressor Station.

Source No. 1-88 showed NO_x and CO emission rates to be 12.636 and 2.520 lb/hr, respectively. The engine was tested at maximum load conditions at an engine speed of 1,197 RPM. The permitted NO_x and CO emissions were 10.25 and 3.05 lb/hr, respectively.

The NO_x and CO emission rates for Source No. 2-88 were determined to be 4.411 and 0.755 lb/hr, respectively. The permitted NO_x and CO emissions were 7.13 and 0.63 lb/hr. This engine was operated at maximum load conditions at an engine speed of 1,171 RPM.

Source No. 3-88 gave NO_x and CO emission rates of 1.084 and 0.421 lb/hr, respectively, when tested at the maximum load while running at 1,468 RPM. The permitted limits were 3.17 lb/hr NO_x and 0.28 lb/hr CO.

Table 2-2 gives a summary of the stack gas temperature, moisture content, velocity, and volumetric flow rate. The stack gas volumetric flow rate, corrected to dry, standard conditions; and the actual volumetric flow rates are also tabulated.

Section 3.0 outlines the methodology utilized in the determination of the sampling traverse locations. A process diagram of the Garden City Compressor Station can also be seen in this section.

Section 4.0 gives a complete description of the sampling equipment and sampling procedures. Complete field test data, sample calculations, operational data, fuel gas analysis, calibration gas certificates, and photocopies of the actual NO_x and CO strip charts are located in the appendices. A list of the personnel who participated on this project and a photocopy of the Louisiana Air Permit can also be seen in the appendices.

Table 2-1. Summary of Oxides of Nitrogen and Carbon Monoxide Concentrations and Emission Results: Garden City Compressor Station, Louisiana Intrastate Gas Corporation, September 5-6, 1989.

Run No.	Engine Speed (RPM)	NOx Emissions (ppm)	NOx Emissions (lb/hr)	NOx Emissions (lb/hr)[1]	CO Emissions (ppm)	CO Emissions (lb/hr)	CO Emissions (lb/hr)[2]
SOURCE NO. 1-88 930 HP							
1	1,196	1,194.9	11.914	-----	415.7	2.520	----
2	1,199	1,394.6	13.091	-----	383.5	2.190	----
3	1,198	1,515.9	12.903	-----	371.7	1.925	----
AVG.	**1,197**	**1,368.5**	**12.636**	**10.25**	**390.3**	**2.212**	**3.05**
SOURCE NO. 2-88 180 HP							
1	1,162	1,311.9	3.688	-----	456.3	0.781	----
2	1,174	1,544.6	4.506	-----	414.8	0.737	----
3	1,177	1,777.5	5.038	-----	433.4	0.748	----
AVG.	**1,171**	**1,544.7**	**4.411**	**7.13**	**434.8**	**0.755**	**0.63**
SOURCE NO. 3-88 118 HP							
1	1,467	473.47	1.133	-----	290.7	0.423	----
2	1,446	622.42	1.421	-----	306.6	0.426	----
3	1,490	294.25	0.697	-----	287.0	0.414	----
AVG.	**1,468**	**463.38**	**1.084**	**3.17**	**294.8**	**0.421**	**0.28**

SOURCE: Hunter/ESE, Inc., 1989

[1], [2] State Air Permit Limit

Table 2-2. Summary of Stack Gas Flow Parameters: Garden City Compressor Station, Louisiana Intrastate Gas Corporation, September 5-6, 1989.

Run No.	Stack Temperature (R)	Moisture Content (%)	Stack Gas Velocity (ft/s)	Volumetric Flow Rate[1] (DSCF/MIN)	Actual Flow Rate (CF/MIN)
SOURCE NO. 1-88					
1	1,354.70	17.55	193.448	1,391.94	4,308.47
2	1,361.75	16.88	181.651	1,310.42	4,045.73
3	1,361.92	19.12	169.345	1,188.18	3,771.65
AVG.	**1,359.46**	**17.85**	**181.481**	**1,296.85**	**4,041.95**
SOURCE NO. 2-88					
1	1,139.13	13.58	76.338	392.41	976.06
2	1,104.38	14.47	77.670	407.31	993.09
3	1,162.13	15.81	80.742	395.68	1,032.37
AVG.	**1,135.21**	**14.62**	**78.250**	**398.47**	**1,000.51**
SOURCE NO. 3-88					
1	1,260.00	6.4	153.170	334.11	852.85
2	1,266.55	7.5	147.904	318.75	823.53
3	1,241.00	6.1	148.538	330.57	827.06
AVG.	**1,255.80**	**6.7**	**149.871**	**327.81**	**834.48**

Source: Hunter/ESE, Inc., 1989

[1] Corrected to Dry, Standard Conditions.

3.0 TRAVERSE SAMPLING LOCATION

3.1 PROCESS DESCRIPTION

Louisiana Intrastate Gas Corporation operates three Nautral Gas Fired Internal Combustion Engine Compressor Units at the Garden City Station near Centerville, St. Mary Parish, Louisiana. The three compressors are aligned in series and are capable of operating simultaneously or independently. Figure 3-1 details the location of the engines the at the compressor facility.

3.2 SAMPLE PORTS

Figure 3-2 gives the details of the stack diameter, upstream and downstream duct diameters for the 930 HP I.C. Engine, Source No. 1-88. The stack diameter (D) was measured to be 8.250 inches. One, three inch nipple port was available for the velocity traverse sampling. The port location met the 8D and 2D sampling requirements and six travese points were selected for the velocity determination as outlined in 40 CFR 60..

Figure 3-3 shows the details of the stack dimensions of the 180 HP I.C. Engine, Source I.D. No. 2-88. The diameter (D) was measured and found to be 6.250 inches. One 3 inch nipple, located within the 8D and 2D requirements, was available for the velocity traverse sampling. Four traverse points were selected as outlined in 40 CFR 60.

Figure 3-4 shows the stack measurements for the 118 HP I.C. Engine, Source I.D. No. 3-88. The diameter (D) was found to be 4.125 inches, and the upstream and downstream distance were found to be within the 8D and 2 D requirements. Four traverse points were used for the velocity traverse as stipulated in 40 CFR 60. The stack had one, three inch nipple available for the traverse sampling.

9/6/89

FIGURE 3-1: PROCESS DIAGRAM OF THE GARDEN CITY COMPRESSOR STATION

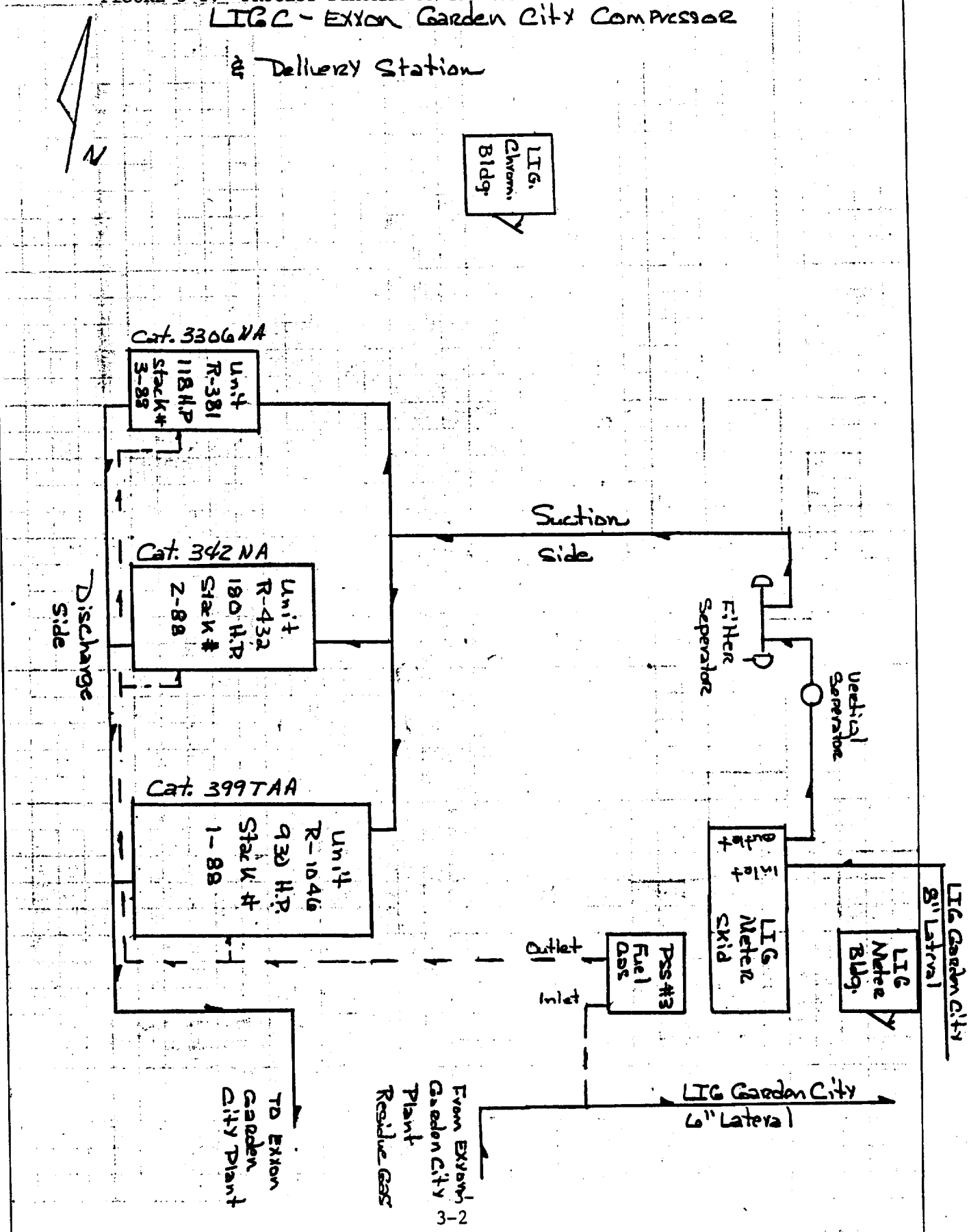


FIGURE 3-2
SAMPLE AND VELOCITY TRAVERSE DETERMINATION
CIRCULAR STACK SOURCES

CLIENT LA INTRASTATE

PROJECT NUMBER 3907022000

SOURCE I.D. #1-88

DATE Sept. 6, 1988

INSIDE DIAMETER 8.250 in

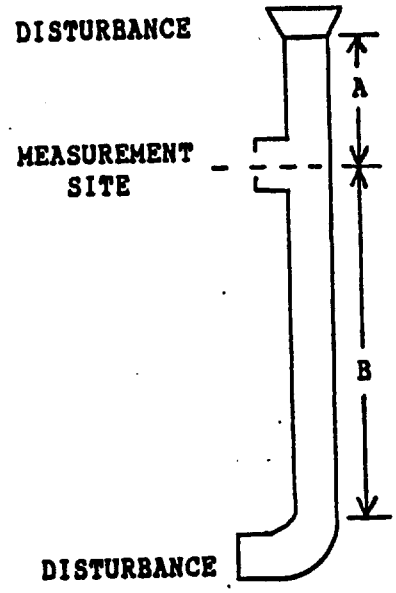
UPSTREAM DISTANCE (A) ~~32~~ 20.5 in

DOWNSTREAM DISTANCE (B) >120 in

✓ UPSTREAM DIAMETERS ~~2.563~~ 2.485

✓ DOWNSTREAM DIAMETERS >8.0 (

COUPLING LENGTH 10.25 in



TRAVERSE POINT	TRAVERSE % DIAMETER		INSIDE DIAMETER		COUPLING LENGTH		TRAVERSE LOCATION
1	0.044	X	8.[redacted]	+	10.25	=	10.602
2	0.146	X		+		=	11.418
3	0.296	X		+		=	12.618
4	0.704	X		+		=	15.882
5	0.854	X		+		=	17.082
6	0.956	X		+		=	17.898
7		X		+		=	
8		X		+		=	
9		X		+		=	
10		X		+		=	
11		X		+		=	
12		X		+		=	

18.25 − 8 = 10.25

PORT FACING EAST

FIGURE 3-3
SAMPLE AND VELOCITY TRAVERSE DETERMINATION
CIRCULAR STACK SOURCES

CLIENT LA INTRASTATE

PROJECT NUMBER 3907022000

SOURCE I.D. #2-88

DATE Sept. 6 1989

INSIDE DIAMETER 6.250 in

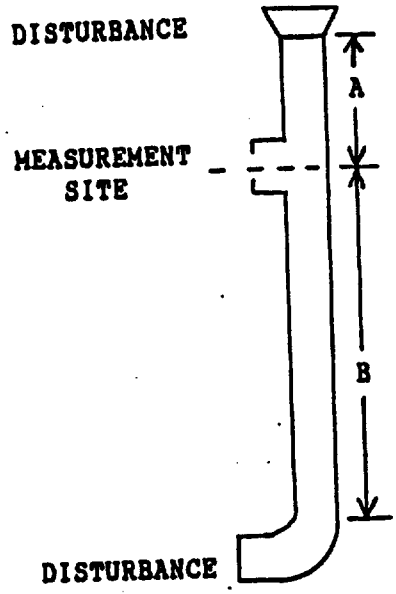
UPSTREAM DISTANCE (A) 15.5 in

DOWNSTREAM DISTANCE (B) 59.5 in

✓ UPSTREAM DIAMETERS ~~2.58~~ 2.48

✓ DOWNSTREAM DIAMETERS ~~9.917~~ 9.52

COUPLING LENGTH 12.50 in



TRAVERSE POINT	TRAVERSE % DIAMETER		INSIDE DIAMETER		COUPLING LENGTH		TRAVERSE LOCATION
1	0.067	X	6"	+	12.50	=	12.902
2	0.250	X		+		=	14.000
3	0.750	X		+		=	17.000
4	0.933	X		+		=	18.098
5		X		+		=	
6		X		+		=	
7		X		+		=	
8		X		+		=	
9		X		+		=	
10		X		+		=	
11		X		+		=	
12		X		+		=	

FIGURE 3-4
SAMPLE AND VELOCITY TRAVERSE DETERMINATION
CIRCULAR STACK SOURCES

CLIENT LA INTRASTATE

PROJECT NUMBER 3907022000

SOURCE I.D. 3-8B

DATE SEPT. 5, 1989

INSIDE DIAMETER ~~4.00~~ 4.125 in

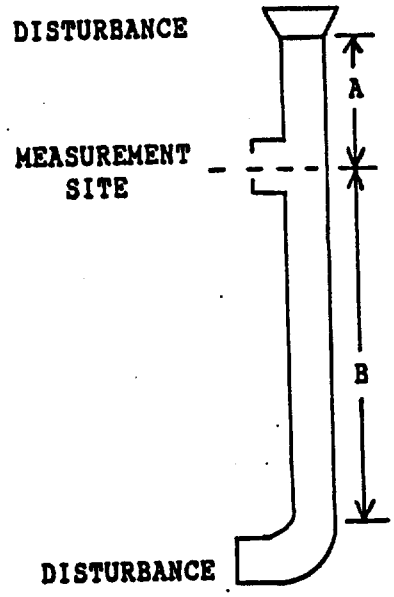
UPSTREAM DISTANCE (A) 11 in

DOWNSTREAM DISTANCE (B) 40 in

✓ UPSTREAM DIAMETERS ~~2.75~~ 2.67

✓ DOWNSTREAM DIAMETERS ~~10.0~~ 9.70

COUPLING LENGTH 4.25 in



TRAVERSE POINT	TRAVERSE % DIAMETER		INSIDE DIAMETER		COUPLING LENGTH		TRAVERSE LOCATION
1	0.067	X	4	+	4.25	=	4.518
2	0.250	X		+		=	5.25
3	0.750	X		+		=	7.25
4	0.933	X		+		=	7.97
5		X		+		=	
6		X		+		=	
7		X		+		=	
8		X		+		=	
9		X		+		=	
10		X		+		=	
11		X		+		=	
12		X		+		=	

11

4.0 TEST PROCEDURES

4.1 CONTINUOUS INSTRUMENTAL ANALYSIS

Stack gas emissions of Oxygen, Oxides of Nitrogen and Carbon Monoxide were measured by continuous emission monitors. These tests were performed in accordance with Methods, 3A, 7E, and 10, as outlined in Title 40, Part 60, Appendix A of the Code of Federal Regulations. All field data collected during the tests are located in Appendix A, B, and C. A photocopy of the actual NO_x and CO strip charts are located in Appendix E.

4.2 GAS SAMPLE COLLECTION AND CONDITIONING

The gas sample was withdrawn from the stack via stainless steel sample probe and traveled down a heated sample line to a glass condenser system. The condenser system was used to remove moisture from the gas sample and consisted of a glass condensor and cyclone. Cold water at 33°F, supplied from a refrigeration system was channeled to the outside jacket of the condensor. The sample gas was sufficiently cooled by water to separate moisture from the gas. The condensed water was collected in a glass cyclone and later disposed. From the cyclone, the dry gas sample traveled via unheated 1/4-inch O.D. teflon tube to a single-headed, teflon-lined, diaphram pump manufactured by Thomas Industries. Flow control valves were utilized to deliver the stack gas at a regulated positive pressure to the Thermox WDG-P, Thermo Electron 10AR and the Horiba AIA-23 (AS) Continuous Emission Monitors. All sample wetted surfaces were stainless steel, teflon, or glass.

A schematic diagram of the sampling system is shown in Figure 4-1.

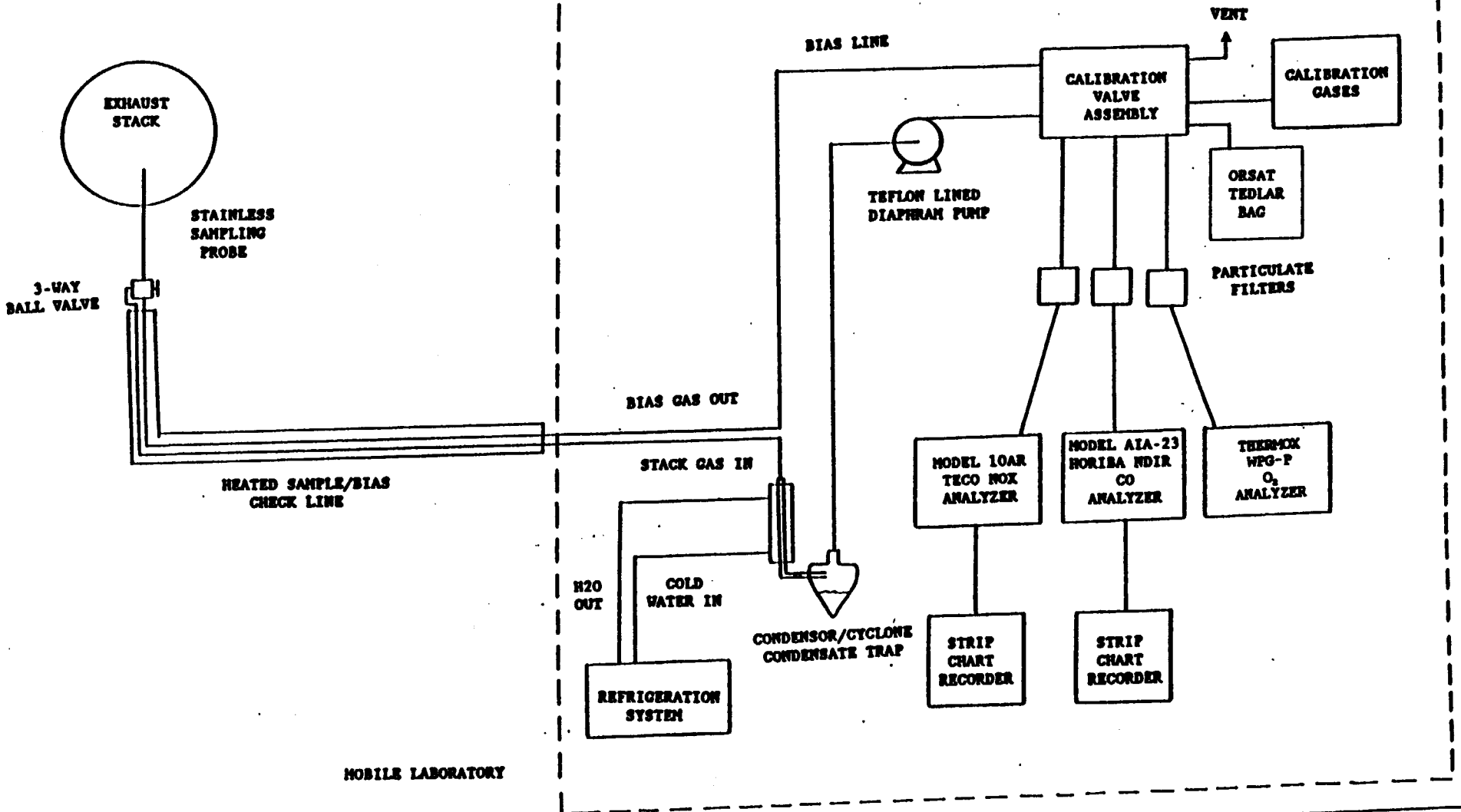


Figure 4-1 INSTRUMENTATION SAMPLING SYSTEM

HUNTER/ESE

4.3 METHOD 7E: OXIDES OF NITROGEN ANALYSIS

A gas sample is continuously withdrawn from the exhaust stream of a stationary gas-fired engine analyzed for Oxides of Nitrogen Emissions with a continuous emission monitor. A Thermo Electron Model 10AR continuous instrument analyzes the sample gas stream for NO_x emissions. Known Protocol 1 NO_x gas standards are utilized for calibrating the instrument at various range settings. The output signal of the analyzer was preset to give a 0-10 volt signal to a strip chart recorder used to record the continuous NO_x readings. The output signal from the instrument is read off a standard volt meter and a linear regression curve is generated between the output signal of the analyzer and known calibration gas standards. The linear regression curve is of the form:

$$\text{ppm} = (\text{Response Volts})(\text{Slope}) + \text{Y Intercept}$$

Hence, linearity is established and an unknown gas sample concentration can be determined from the output response of the instrument.

Instrument integrity is assured by determining any instrument drift between typical one-hour test runs by performing calibrations with known Protocol 1 Gas Standards before and after test runs. A 2% zero drift and 2% upscale drift are acceptable by the standards set in 40 CFR 60.

Table 4-1 shows a detailed technical specification list for the Thermo Electron Model 10AR $NO/NO_2/NO_x$ instrument.

4.4 METHOD 10: CARBON MONOXIDE ANALYSIS

A continuous gas sample was conveyed to a Horiba Model AIA-23 (AS) non-dispersive infrared instrument which analyzes the unknown gas sample for Carbon Monoxide. Protocol 1 CO gas standards are utilized for

calibrating the instrument at various range settings. The available range settings for this instrument are: 0-100, 0-500, 0-1000, and 0-5000 ppm. The output signal of the instrument is preset to give a 0 - 100 millivolt signal. The output signal is read off a standard volt meter and a linear regression curve is generated between the output signal of the analyzer and known Protocol 1 CO calibration gas standards. The linear regression curve is of the form:

$$\text{ppm} = (\text{response millivolts})(\text{slope}) + \text{y intercept}$$

Hence, linearity is established and an unknown sample gas concentration can be determined from the signal output response of the instrument. Instrument drift is assured by calibration the instrument against the known gas standards prior to and immediately following typical test runs. A 2% zero drift and a 2% upscale drift are acceptable by the standards set in 40 CFR 60.

A technical specification list follows for the Horiba Model AIA-23 (AS) in Table 4-2.

Table 4-1. Technical Specifications of the Thermo Electron Model 10AR NO/NO_x Analyzer

Sensitivity	Each instrument is equipped with the following ranges: 0 - 2.5 ppm 0 - 10 ppm 0 - 25 ppm 0 - 100 ppm 0 - 250 ppm 0 - 1,000 ppm 0 - 10,000 ppm
Accuracy	Derived from the NO or NO_2 calibration gas, ±1% of full scale.
Response Time (0-90%) Typical	1.5 seconds - NO mode 1.7 seconds - NO_x mode
Output	0 - 10mV and 0 - 10V
Zero Drift	Negligible after 1/2-hour warm-up.
Linearity	±1% of full scale to 2,500 ppm with air as O_2 supply ±1% of full scale to 10,000 ppm with compressed O_2
Input Power Requirements	115 VAC/60 Hz

Source: Thermo Electron, 1985.

4.5 METHOD 3A: CONTINUOUS OXYGEN ANALYSIS

A gas sample is continuously extracted from a stack source and analyzed for Oxygen with a Thermox WDG-P continuous emission monitor. Known Certified Zero Nitrogen and 20.9% Oxygen gas standards were used to calibrate the instrument before and immediately following each 1-hour test run. Oxygen concentration was directly read off the instrument front panel.

4.6 EPA METHODS 1-4: SAMPLING AND ANALYSIS

The sampling and analytical procedures used follow the procedures as outlined in EPA Methods 1-4, of 40 CFR 60, revised as of July 1, 1987. The sampling equipment consisted of the following:

1. Pitot Tube Assembly
   a. Nozzle--Stainless steel with a sharp, tapered leading edge.
   b. Probe--Stainless steel (S.S.) sheath with a 5/8 inch diameter stainless steel insert wrapped with nichrome wire; electronically controlled and capable of maintaining a minimum temperature of 248 degrees Fahrenheit (°F).
   c. Pitot--Type "S" constructed and attached to probe according to specifications outlined in the Code of Federal Regulations, Chapter I, Title 40, Part 60, Appendix A, Method.
   d. Orsat Probe--Stainless steel 1/4 inch tubing attached to pitot tube in an interference-free arrangement.
   e. Thermocouple--Type "K" attached to the pitot tube such that the tip has no contact with metal and does not interfere with the pitot tube face openings.
2. Impingers--Four impingers connected in series with glass ball/socket joint fittings and placed in an ice bath. The first, third, and fourth impingers are the modified Greenburg-Smith design. The second impinger is the Greenburg-Smith design with a standard tip. Final gas exit temperature is measured to within ±5°F with a type "K" thermocouple immersed in the gas stream.

Table 4-2. Technical Specifications of the Horiba Model AIA-23 (AS) NDIR Carbon Monoxide Analyzer

Sensitivity	Each instrument is equipped with the following ranges: 0 - 100 ppm 0 - 500 ppm 0 - 1,000 ppm 0 - 5,000 ppm
Repeatability	±0.5% of full scale with successive identical gas samples under the same physical conditions
Response Time (0-90%) Typical	0.5 to 15.5 seconds
Output	0 - 10 and 0 - 100 millivolts 0 - 1 and 1 - 5 volts
Zero Drift	< 1.0% of full scale over 24 hours
Span Drift	< 1.0% of full scale over 24 hours
Linearity	±1% of full scale with NOR linearizer
Sample Flow Rate	0.5 to 10 liters per minute at 28.5 psig
Sample Cell Temperature	Regulated at 131°F (55°C)
Noise Level	< 0.5% of full scale on most sensitive lower span range
Ambient Operating Conditions	Temperature - 32°F to 105°F Humidity - 95% relative humidity
Input Power Requirements	115 VAC/60 Hz

Source: Horiba Instruments Inc., 1987

3. Control Box--Module containing vacuum gauge, external leak-free pump, thermocouples capable of measuring temperature to within ±5°F, dry gas meter with a minimum of 2 percent accuracy, valves and related equipment as required to maintain an isokinetic sampling rate, and to determine sample volume. Manufactured by NuTECH Corporation.

A schematic of the sampling train is shown in Figure 4-2.

Upon arrival at the sampling site, the control box was leak-checked from pump to orifice at 5 to 7 inches of water. The sample train was prepared in the following manner: 100 mL of H_2O was added to the first and second impingers. The third impinger was left empty, and approximately 200 g of silica gel (indicating type, 6-16 Mesh) was added to the fourth impinger. Each impinger was then weighed to the nearest 0.1 g and transferred to the cold box and assembled together with glass u-tube connectors. The cold box was then packed full with crushed ice. After assembling the train with the pitot as shown in the schematic, the system was leak-checked by plugging the inlet to the probe nozzle and pulling a vacuum of at least 10 inches of mercury (Hg). A leakage rate not in excess of 0.02 cfm was considered acceptable. The pitot tube system was also leak-checked at 2 to 3 inches of water, and any leaks found were corrected.

The inside dimensions of each stack were measured and recorded. The number of sampling points and the location of these points on a traverse were determined by the guidelines set forth in the Code of Federal Regulations, Chapter I, Title 40, Part 60, Appendix A, Method 1. These points were then marked on the probe for easy visibility. The nozzle was placed at the first traverse point with the tip pointing directly into the gas stream. The pump was started and the flow adjusted to a suitable pressure drop over the dry gas meter in order to draw at least 21.0 cubic feet of sample gas. After the required time interval had

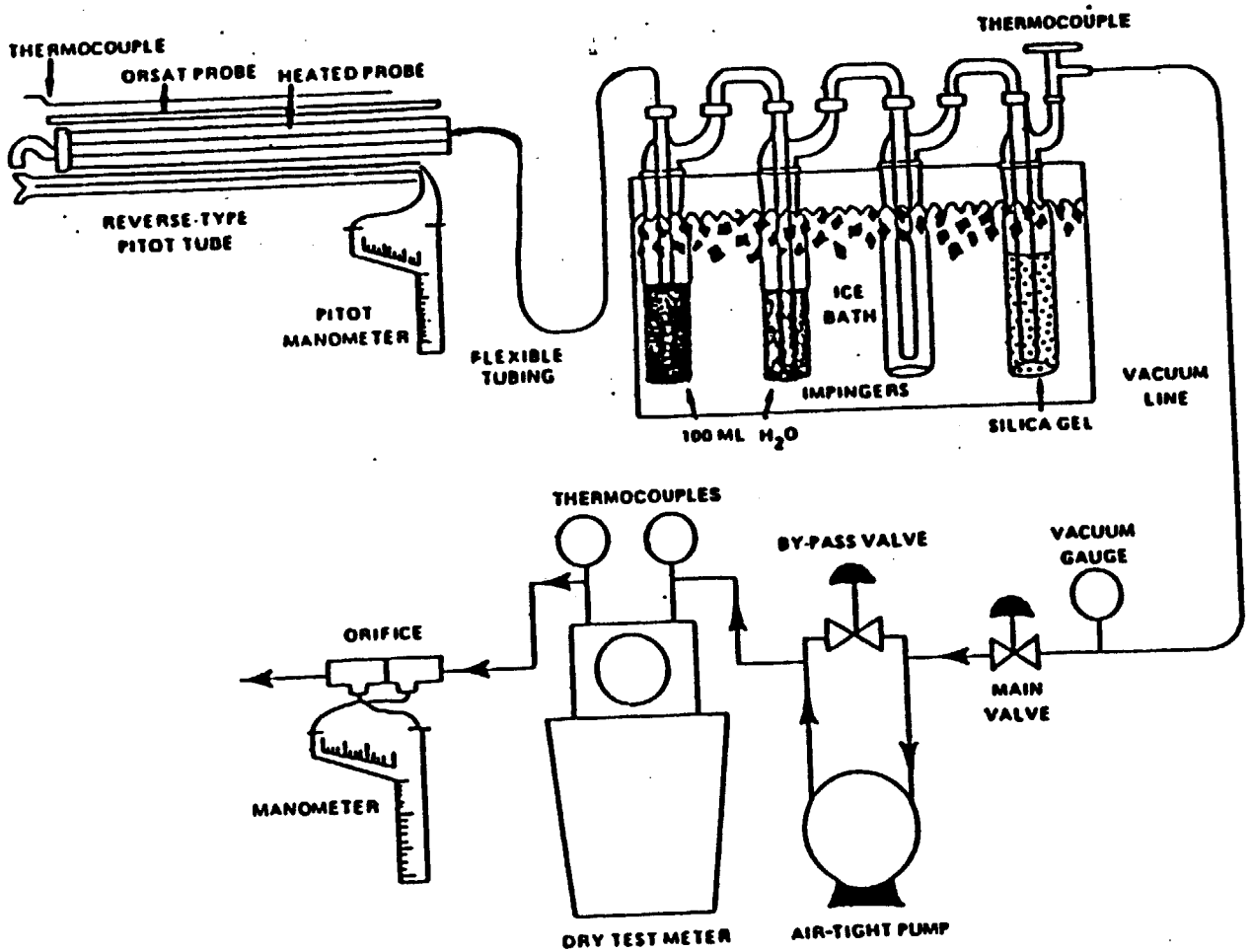


Figure 4-2 EPA METHODS 1-4 SAMPLING TRAIN

HUNTER/ESE

elapsed, the probe was repositioned to the next traverse point. This was done for each point on the traverse until the run was completed. Readings were taken at five minute intervals.

At the conclusion of each run, the pump was turned off and the final readings were recorded. A final leak-check of the system was performed as previously described at the highest vacuum encountered during testing, and a leak-check of the pitot system was performed as previously described.

4.7 METHOD 3: ORSAT SAMPLING AND ANALYSIS

Carbon monoxide, oxygen, and carbon dioxide emissions were determined with a Teledyne 990 analyzer. The Teledyne 990 is capable of auto zero calibration, up scale calibration is achieved with 20.9% oxygen. Sample gas from the stack source was collected in a leak-free Tedlar bag for the same sampling period as a test period. The Teledyne 990 instrument was challenged three times by connecting the Tedlar bag to the inlet of the analyzer. The sampling system was identical to that used for the continuous emission monitors.

4.8 SAMPLE RECOVERY

The impinger moisture train was carefully moved to a convenient sample recovery area in order to minimize the loss of collected water sample. The volume of condensate in all four impingers was measured and recorded on the field data sheet.

APPENDIX A -- COMPLETE FIELD DATA
AND EMISSION CALCULATIONS
SOURCE NO. 1-88

OXIDES OF NITROGEN EMISSION RATE SAMPLE CALCULATIONS

Oxides of nitrogen emission rates were determined using the following equation:

$$\text{lb/hr } NO_x = \frac{(60)(46)(Q_{sd})(ppm)}{(10^6)(385.3)}$$

Where:

Q_{sd}	=	Volumetric Flow Rate of Stack Gas; Dry Standard Cubic feet per minute; DSCF/min
46	=	Molecular Weight of Nitrogen Dioxide; g/gmol
385.3	=	Conversion Factor; g/gmol-lb/ft^3
ppm	=	Concentration of NO_x Stack Emissions
60	=	Conversion Factor; 60 Minutes in One Hour
10^6	=	Conversion Factor; part per million

EXAMPLE CALCULATIONS

Data :	Run 1	NO_x = 1194.9 ppm	Q_{sd} = 1,391.94
	Run 2	NO_x = 1394.6 ppm	Q_{sd} = 1,310.42
	Run 3	NO_x = 1515.9 ppm	Q_{sd} = 1,188.18

Thus: Run 1: lb/Hr NO_x = $\frac{(60)(46)(1194.9)(1,391.94)}{(10^6)(385.3)}$ = 11.914

Run 2: lb/Hr NO_x = $\frac{(60)(46)(1394.6)(1,310.42)}{(10^6)(385.3)}$ = 13.091

Run 3: lb/Hr NO_x = $\frac{(60)(46)(1515.9)(1,188.18)}{(10^6)(385.3)}$ = 12.903

Robert Bowman

METHOD 7E
OXIDES OF NITROGEN

CLIENT LA. INTRA STATE PROJECT NUMBER 3907022000

SOURCE #1-88 LOAD % MAX RUN NUMBER #1

DATE 9-6-89 ANALYST M. CALAMIA

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N_2	0.05	1.68	0.07	6.36	0.2
Low	598.6	2.58	594.05	2.63	605.76	0.5
Mid						
High	937.7	4.06	940.57	4.02	931.2	-0.4

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 234.1376 y intercept -10.03 Span Range 2331.346

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 10:50 End 11:50 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	4.85	11	5.40	21	5.33
2	4.65	12	5.25	22	5.26
3	4.86	13	5.29	23	5.22
4	4.94	14	5.37	24	5.17
5	4.62	15	5.22	25	4.93
6	4.90	16	5.35	26	5.21
7	4.76	17	5.28	27	5.46
8	4.98	18	5.12	28	5.49
9	4.98	19	5.16	29	~~5.50~~ 5.50
10	5.09	20	5.21	30	5.54

Average Volts 5.1463

Average Concentration 1194.917

Robert Freeman

METHOD 7E
OXIDES OF NITROGEN

CLIENT LA. INTRA STATE PROJECT NUMBER 3907022000

SOURCE #1-88 LOAD % MAX RUN NUMBER 2

DATE 9-6-89 ANALYST M. CALAMIA

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N_2	0.07	-2.08	0.08	0.29	0.1
Low	598.6	2.63	604.5	2.62	602.1	-0.1
Mid						
High	937.7	4.02	933.9	3.98	924.4	-0.4

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 236.949 y intercept -18.666 Span Range 2350.826

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 12:10 End 1:10 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	5.90	11	6.12	21	6.03
2	6.31	12	6.09	22	6.23
3	6.14	13	6.28	23	6.27
4	6.13	14	6.36	24	6.24
5	6.15	15	5.99	25	6.20
6	6.29	16	6.03	26	6.11
7	6.37	17	6.12	27	6.14
8	6.12	18	6.00	28	6.17
9	6.17	19	5.91	29	6.05
10	6.28	20	6.00	30	6.04

Average Volts $5.964\overline{3}$

Average Concentration 1394.570

Robert Freeman

METHOD 7E
OXIDES OF NITROGEN

CLIENT LA. INTRASTATE PROJECT NUMBER 3907022000

SOURCE #1-88 LOAD % MAX RUN NUMBER 3

DATE 9-6-89 ANALYST M. CALAMIA

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N_2	0.08	-2.73	0.07	-5.13	-0.1
Low	598.6	2.62	606.4	2.62	606.4	0.0
Mid						
High	937.7	3.98	932.60	3.94	923.01	-0.4

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 239.8283 y intercept -2.92 Span Range 2376.365

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 1:15 End 14:15 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	6.44	11	6.20	21	6.50
2	6.29	12	6.41	22	6.56
3	6.29	13	6.35	23	6.61
4	6.38	14	6.38	24	6.52
5	6.45	15	6.45	25	6.49
6	6.15	16	6.39	26	6.48
7	6.37	17	6.42	27	6.51
8	6.29	18	6.39	28	6.53
9	6.28	19	6.34	29	6.57
10	6.30	20	6.43	30	6.61

Average Volts $6.412\overline{3}$

Average Concentration 1515.933

CARBON MONOXIDE CONCENTRATION CORRECTION FOR DILUTENT CO_2

$C_{co\ stack}$ - Concentration of CO in Stack, Dry Basis; ppm

$C_{co\ ndir}$ - Concentration of CO Measured by NDIR Analyzer, Dry Basis; ppm

F_{co2} - Volume Fraction of CO_2 in Stack Gas Sample, Orsat Analysis; % CO_2 Divided By 100

$$C_{co\ stack} = C_{co\ ndir}\ (1 - F_{co2})$$

EXAMPLE CALCULATIONS

Data:

RUN 1: $C_{co\ ndir} = 470.19$ $F_{co2} = 0.116$

RUN 2: $C_{co\ ndir} = 422.38$ $F_{co2} = 0.092$

RUN 3: $C_{co\ ndir} = 417.58$ $F_{co2} = 0.110$

Thus:

RUN 1: $C_{co\ stack} = (470.19)(1 - 0.116) = 415.65$

RUN 2: $C_{co\ stack} = (422.38)(1 - 0.092) = 383.52$

RUN 3: $C_{co\ stack} = (417.58)(1 - 0.110) = 371.65$

CARBON MONOXIDE EMISSION RATE SAMPLE CALCULATIONS

Carbon monoxide emission rates were determined using the following relation:

$$\text{lb/hr CO} = \frac{(60)(28)(Q_{sd})(\text{ppm})}{(10^6)(385.3)}$$

Where:

Q_{sd}	=	Volumetric Flow Rate of Stack Gas; Dry Standard Cubic feet per minute; DSCF/min
28	=	Molecular Weight of Carbon Monoxide; g/gmol
385.3	=	Conversion Factor; g/gmol-lb/ft^3
ppm	=	Concentration of CO Stack Emissions; Corrected to % Carbon Dioxide; ppm
60	=	Conversion Factor; 60 Minutes in One Hour
10^6	=	Conversion Factor; part per million

EXAMPLE CALCULATIONS

Data :	Run 1	CO = 415.65 ppm	Q_{sd} = 1,391.94
	Run 2	CO = 383.52 ppm	Q_{sd} = 1,310.42
	Run 3	CO = 371.65 ppm	Q_{sd} = 1,188.18

Thus: Run 1: lb/Hr CO = $\frac{(60)(28)(415.65)(1,391.94)}{(10^6)(385.3)}$ = 2.520

Run 2: lb/Hr CO = $\frac{(60)(28)(383.52)(1,310.42)}{(10^6)(385.3)}$ = 2.190

Run 3: lb/Hr CO = $\frac{(60)(28)(371.65)(1,188.18)}{(10^6)(385.3)}$ = 1.925

Robert Freeman

METHOD 10
CARBON MONOXIDE

CLIENT LA INTRASTATE PROJECT NUMBER 390702000

SOURCE #1-88 LOAD % MAX RUN NUMBER R 1

DATE 9-6-89 ANALYST M. CALAMA

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N_2	.009	1.3	.010	1.92	0.1
Low	89.61	.150	87.95	.151	88.56	0.1
Mid						
High	401.0	.660	405.6	.664	403.8	0.4

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 614.5297 y intercept -4.23 Span Range 610.299

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 10:50 End 11:50 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	.755	11	.777	21	.773
2	.767	12	.782	22	.778
3	.766	13	.778	23	.783
4	.767	14	.776	24	.758
5	.768	15	.782	25	.773
6	.768	16	.775	26	.762
7	.771	17	.775	27	.763
8	.785	18	.778	28	.765
9	.780	19	.779	29	.761
10	.784	20	.783	30	.751

Average Volts ~~.772~~ .772

Average Concentration 470.187

Robert Freeman

METHOD 10
CARBON MONOXIDE

CLIENT LA INTRA STATE PROJECT NUMBER 3907022000

SOURCE #1-88 LOAD % MAX RUN NUMBER 2

DATE 9-6-89 ANALYST M. Calomia

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N_2	.000	1.49	.012	2.71	0.2
Low	89.61	.151	87.71	.152	88.32	0.1
Mid						
High	401.0	.664	401.41	.664	401.41	0.0

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 611.498 y intercept −4.63 Span Range 606.873

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 12:10 End 1:10 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	.688	11	.707	21	.693
2	.684	12	.704	22	.689
3	.687	13	.703	23	.700
4	.684	14	.698	24	.694
5	.699	15	.698	25	.706
6	.697	16	.700	26	.709
7	.698	17	.698	27	.705
8	.702	18	.699	28	.703
9	.705	19	.698	29	.707
10	.703	20	.696	30	.708

Average Volts .6983

Average Concentration 422.384

Robert Freeman

METHOD 10
CARBON MONOXIDE

CLIENT LA INTRA STATE PROJECT NUMBER 3907022000

SOURCE #1-88 LOAD % MAX RUN NUMBER 3

DATE 9-6-89 ANALYST M. CALAMIA

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N_2	.012	1.66	.014	2.88	0.2
Low	89.61	.152	87.50	.152	87.50	0.0
Mid						
High	401.0	.664	401.5	.661	399.6	-0.3

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 613.186 y intercept -5.70 Span Range 607.486

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 1:15 End 14:15 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	.699	11	.695	21	.686
2	.701	12	.690	22	.684
3	.692	13	.695	23	.687
4	.693	14	.694	24	.688
5	.691	15	.692	25	.681
6	.699	16	.692	26	.681
7	.689	17	.695	27	.679
8	.692	18	.694	28	.677
9	.691	19	.693	29	.680
10	.692	20	.690	30	.683

Average Volts .6903

Average Concentration 417.580

Robert Freeman

METHOD 3A
OXYGEN

CLIENT LA INTRASTATE PROJECT NUMBER 390702000

SOURCE # 1-88 LOAD % MAX RUN NUMBER ~~2~~ 1

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	%	volts	%	volts	%	
Zero	N2		0.0		0.0	0.0
Mid						
High	AIR		20.9		20.9	20.9

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope _____ y intercept _____ Span Range _____

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 10:50 End 11:50 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	6.0	11	5.3	21	5.3
2	5.6	12	5.3	22	5.3
3	5.6	13	5.3	23	5.3
4	5.6	14	5.3	24	5.7
5	5.6	15	5.3	25	5.4
6	5.6	16	5.3	26	5.5
7	5.4	17	5.3	27	5.4
8	5.4	18	5.3	28	5.5
9	5.3	19	5.3	29	5.5
10	5.3	20	5.3	30	5.5

Average Volts _____

Average Concentration 5.426%

Comments

Robert Freeman

METHOD 3A
OXYGEN

CLIENT LA INTRASTATE PROJECT NUMBER 3907022000

SOURCE #1-PP LOAD % MAX RUN NUMBER 2

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	%	volts	%	volts	%	
Zero	N_2		0.0		0.0	0.0
Mid						
High	AIR		20.9		20.9	0.0

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope _____ y intercept _____ Span Range _____

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 12:10 End 1:10 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	6.5	11	6.3	21	6.4
2	6.5	12	6.3	22	6.4
3	6.5	13	6.3	23	6.3
4	6.5	14	6.3	24	6.3
5	6.5	15	6.4	25	6.3
6	6.3	16	6.4	26	6.3
7	6.3	17	6.3	27	6.3
8	6.3	18	6.4	28	6.3
9	6.4	19	6.4	29	6.3
10	6.4	20	6.5	30	6.4

Average Volts _____

Average Concentration 6.37%

Comments

Robert Fisseman

METHOD 3A
OXYGEN

CLIENT LA INTRA STATE PROJECT NUMBER 3907022000

SOURCE #1-88 LOAD % MAX RUN NUMBER 3

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	%	volts	%	volts	%	
Zero	N_2		0.0		0.0	0.0
Mid						
High	AIR		20.9		20.9	0.0

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope _____ y intercept _____ Span Range _____

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 1:15 End 14:15 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	6.3	11	6.3	21	6.3
2	6.3	12	6.3	22	6.3
3	6.3	13	6.3	23	6.3
4	6.3	14	6.3	24	6.3
5	6.3	15	6.3	25	6.3
6	6.4	16	6.3	26	6.3
7	6.4	17	6.3	27	6.3
8	6.4	18	6.3	28	6.3
9	6.4	19	6.3	29	6.3
10	6.3	20	6.3	30	6.3

Average Volts _____

Average Concentration 6.313 %

Comments

METHODS 1-4 SAMPLE CALCULATIONS

MOISTURE CONTENT DETERMINATION

P_m	-	Absolute Pressure at Meter; in Hg
P_o	-	Average Orfice Meter Pressure; in H_2O
Ps	-	Standard Absolute Pressure; 29.92 in Hg
P_b	-	Barometric Pressure; in Hg
K	-	Constant; 0.04715 ft^3/g
T_m	-	Meter Box Temperature; °R
T_{std}	-	Standard Absolute Temperature; 528 °R
DGMC	-	Dry Gas Meter Calibration Factor
V_{lcg}	-	Volume of Water Condensate Collected in Impingers; g
B_{ws}	-	Moisture Fraction Content
V_m	-	Volume of Gas Sampled; scf
V_{mstd}	-	Volume of Gas Sampled at the Meter; Corrected to Standard Conditions; dscf
V_{wstd}	-	Volume of Water Vapor in the Gas Sample; Standard Conditions; scf
B_{wd}	-	Moisture Content; percent

EXAMPLE CALCULATION: RUN 1

Data:

P_b	=	30.04
V_m	=	20.183
V_{lcg}	=	84.1
T_m	=	571.00
P_o	=	1.50
DGMC	=	0.9904

$$Pm = \frac{Po}{13.6} + Pb = \frac{(1.50)}{13.6} + (30.04) = 30.15$$

$$Vmstd = \frac{(Vm)(DGMC)(Pm)(Tstd)}{(Ps)\ (Tm)} = \frac{(20.183)(0.9904)(30.15)(528)}{(29.92)\ (550.75)} = 18.626$$

$$Vwstd = (K)\ (Vlcg) = (0.04715)\ (84.1) = 3.965$$

$$Bws = \frac{(Vwstd)}{(Vmstd) + (Vwstd)} = \frac{(3.965)}{(18.626) + (3.965)} = 0.1755$$

$$Bwd = (Bws) \times 100 = (0.1755) \times 100 = 17.55$$

DRY GAS MOLECULAR WEIGHT DETERMINATION

M_d	-	Molecular Weight of Stack Gas, Dry Basis; lb/lb-mole
M_s	-	Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
B_{ws}	-	Stack Gas Moisture Fraction
% CO_2	-	Percent CO_2 by Volume; Dry Basis
% CO	-	Percent CO by Volume; Dry Basis
% O_2	-	Percent O_2 by Volume; Dry Basis
0.32	-	Molecular Weight of Oxygen, Divided by 100; 0.32
0.28	-	Molecular Weight of Nitrogen, Divided by 100; 0.28
0.28	-	Molecular Weight of Carbon Monoxide, Divided by 100; 0.28
0.44	-	Molecular Weight of Carbon Dioxide, Divided by 100; 0.44
18.0	-	Molecular Weight of Water; lb/lb-mole

$$M_d = (0.44)(\%CO_2) + (0.32)(\%O_2) + (0.28)(\%N_2 + \%CO)$$

$$M_s = (M_d)(1-B_{ws}) + (18.0)(B_{ws})$$

Air:
$N_2 = 79\%$
$O_2 = 21\%$

EXAMPLE CALCULATION: RUN 1

Data:

B_{ws}	=	0.1755
% CO	=	0.0
% O_2	=	5.4
% N_2	=	83.0
% CO_2	=	11.6

$$M_d = (0.44)(11.6) + (0.32)(5.4) + (0.28)(83.0 + 0.0) = 30.072$$

$$M_s = (30.072)(1 - 0.1755) + (18.0)(0.1755) = 27.953$$

STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

C_p	-	Pitot Tube Coefficient
V_s	-	Stack Gas Velocity, Dry Standard Conditions; ft/s
Q_{sd}	-	Volumetric Flow Rate, Dry Standard Conditions; DSCF/min
B_{ws}	-	Moisture Fraction
D_p	-	Velocity Head of Stack Gas, Avg. Sq. Root; $(\text{in } H_2O)^{0.5}$
P_b	-	Barometric Pressure; in Hg
K_p	-	Pitot Tube Constant; 85.49 $\frac{(\text{ft})(\text{lb/lb-mole})(\text{in Hg})^{0.5}}{(\text{s})(\text{deg R})(\text{in } H_2O)}$
T_s	-	Absolute Stack Gas Temperature; °R
M_s	-	Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
Sp	-	Static Pressure of Stack Gas; in H_2O
528	-	Standard Absolute Temperature; °R
CSA	-	Stack Cross-sectional Area; ft^2
P_s	-	Absolute Stack Gas Pressure; in Hg
60	-	Conversion Factor; sec/min
Pi	-	Constant; 3.14
D	-	Diameter of Stack; in

$$Ps = \frac{Sp}{13.6} + Pb$$

$$Vs = (85.49)\ (Cp)\ (Dp) \left(\frac{Ts}{(Ms)\ (Ps)}\right)^{0.5}$$

$$CSA = \frac{(Pi)\ (D)^2}{(4)(144)}$$

$$Qsd = (60)\ (1 - Bws)\ (CSA)\ (Vs) \left(\frac{528}{(Ts)\ (29.92)}\right)(Ps)$$

EXAMPLE CALCULATION: RUN 1

Data:

M_s	= 27.953	P_b	= 30.04
C_p	= 0.85	D_p	= 2.097
T_s	= 1354.70	S_p	= 0.48
D	= 8.250		

$$Ps = \frac{(0.48)}{13.6} + 30.04 = 30.08$$

$$Vs = (85.49)(0.85)(2.097)\left(\frac{1354.70}{(27.953)\ (30.08)}\right)^{0.5} = 193.448$$

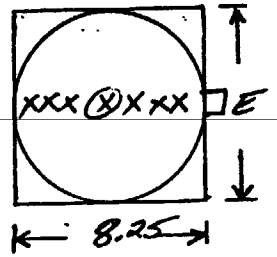
$$CSA = \frac{(3.14)\ (8.250)^2}{(4)\ (144)} = 0.3712$$

$$Qsd = (60)(1-0.1755)(0.3712)(193.448)\left(\frac{(528)\ (30.08)}{(1354.70)(29.92)}\right) = 1,391.94$$

HUNTER/ESE ENVIRONMENTAL SERVICES, INC.

STACK SAMPLING DATA SHEET

METHODS 1-4



STACK SCHEMATIC

CLIENT LZG
LOCATION Garden City
SOURCE I.D. #1-88
PROJECT NO. 3907022000
DATE Sept. 6, 1989
RUN NUMBER 6
OPERATOR [illegible]

HOT BOX NO. Green
COLD BOX NO. Blue
CONSOLE NO. BR 4
PITOT NO. 0.85
PITOT FACTOR P-5-1
METER ΔH@ 1.811
D.G.M.C. FACTOR 0.9904

STACK DIAMETER, in 8.250
NOZZLE DIAMETER, in N/A
FILTER NO. N/A
AMBIENT TEMP. 92
BAROMETRIC PRESSURE 30.04
K FACTOR N/A

Port and Traverse Point No	Clock Time (24-hr)	Gas Meter Reading (ft³)	Velocity Head ("H₂O) ΔP	Velocity Head ("H₂O) √ΔP	Orifice Pressure Differential ("H₂O) Calc.	Orifice Pressure Differential ("H₂O) Actual	Stack Gas Temperature (°F)	Sample Train Temperatures (°F) Sample Box	Sample Train Temperatures (°F) Dry Gas Meter	Sample Train Temperatures (°F) Last Impinger	Vacuum ("Hg)	Total or Static Pressure ("H₂O)
E 1	10:58	795.900	4.750	2.1794		1.5	900		110	60	8	
2	11:03	799.170	4.900	2.2136		1.5	896		110	62	8	
3	11:08	802.560	4.850	3.500	1.8708	1.5	897		112	62	8	
4	11:13	805.870	3.850	1.962		1.5	889		110	63	8	0.480
5	11:18	809.250	4.950	2.2249		1.5	894		111	63	8	
6	11:23	812.610	4.550	2.133		1.5	892		113	65	8	
Off ⊘	11:28	816.083										
	30	20.183		2.0973		1.5	894.70 1354.70		111.00 571.00			0.480

	FINAL WEIGHTS	INITIAL WEIGHTS	WEIGHT GAINED
FIRST IMPINGER	627.8	642.5	63.5
SECOND IMPINGER	706.0	693.9	13.9
THIRD IMPINGER	495.0	492.6	2.4
SILICA GEL	676.7	672.4	4.3
TOTAL CONDENSATE			84.1

FLUE GAS ANALYSIS			
TRIAL	O_2	CO_2	CO
1	5.4	11.6	0.0
2			
3			
AVG	5.4	11.6	0.0

COMMENTS Pretest leak ✓ GOOD AT 0.002 CFM 15" Hg

Post test leak ✓ GOOD AT 0.002 CFM 12" Hg

METHODS 1-4 SAMPLE CALCULATIONS

MOISTURE CONTENT DETERMINATION

P_m	-	Absolute Pressure at Meter; in Hg
P_o	-	Average Orfice Meter Pressure; in H_2O
P_s	-	Standard Absolute Pressure, 29.92 in Hg
P_b	-	Barometric Pressure; in Hg
K	-	Constant; 0.04715 ft^3/g
T_m	-	Meter Box Temperature; °R
T_{std}	-	Standard Absolute Temperature; 528 °R
DGMC	-	Dry Gas Meter Calibration Factor
V_{lcg}	-	Volume of Water Condensate Collected in Impingers; g
B_{ws}	-	Moisture Fraction Content
V_m	-	Volume of Gas Sampled; scf
V_{mstd}	-	Volume of Gas Sampled at the Meter; Corrected to Standard Conditions; dscf
V_{wstd}	-	Volume of Water Vapor in the Gas Sample, Standard Conditions; scf
B_{wd}	-	Moisture Content; percent

EXAMPLE CALCULATION: RUN 2

Data:

P_b	=	30.04
V_m	=	20.316
V_{lcg}	=	80.6
T_m	=	571.83
P_o	=	1.50
DGMC	=	0.9904

$$Pm = \frac{Po}{13.6} + Pb = \frac{(1.50)}{13.6} + (30.04) = 30.15$$

$$Vmstd = \frac{(Vm)(DGMC)(Pm)(Tstd)}{(Ps)\ (Tm)} = \frac{(20.316)(0.9904)(30.15)(528)}{(29.92)\ (571.83)} = 18.718$$

$$Vwstd = (K)\ (Vlcg) = (0.04715)\ (80.6) = 3.800$$

$$Bws = \frac{(Vwstd)}{(Vmstd) + (Vwstd)} = \frac{(3.800)}{(18.718) + (3.800)} = 0.1688$$

$$Bwd = (Bws) \times 100 = (0.1688) \times 100 = 16.88$$

DRY GAS MOLECULAR WEIGHT DETERMINATION

M_d	-	Molecular Weight of Stack Gas, Dry Basis; lb/lb-mole
M_s	-	Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
B_{ws}	-	Stack Gas Moisture Fraction
% CO_2	-	Percent CO_2 by Volume; Dry Basis
% CO	-	Percent CO by Volume; Dry Basis
% O_2	-	Percent O_2 by Volume; Dry Basis
0.32	-	Molecular Weight of Oxygen, Divided by 100; 0.32
0.28	-	Molecular Weight of Nitrogen, Divided by 100; 0.28
0.28	-	Molecular Weight of Carbon Monoxide, Divided by 100; 0.28
0.44	-	Molecular Weight of Carbon Dioxide, Divided by 100; 0.44
18.0	-	Molecular Weight of Water; lb/lb-mole

$$M_d = (0.44)(\%CO_2) + (0.32)(\%O_2) + (0.28)(\%N_2 + \%CO)$$

$$M_s = (M_d)(1-B_{ws}) + (18.0)(B_{ws})$$

EXAMPLE CALCULATION: RUN 2

Data:			
	B_{ws}	=	0.1688
	% CO	=	0.0
	% O_2	=	6.0
	% N_2	=	84.8
	% CO_2	=	9.2

$$M_d = (0.44)(9.2) + (0.32)(6.0) + (0.28)(84.8 + 0.0) = 29.712$$

$$M_s = (29.712)(1 - 0.1688) + (18.0)(0.1688) = 27.735$$

STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

C_p	-	Pitot Tube Coefficient
V_s	-	Stack Gas Velocity, Dry Standard Conditions; ft/s
Q_{sd}	-	Volumetric Flow Rate, Dry Standard Conditions; DSCF/min
B_{ws}	-	Moisture Fraction
D_p	-	Velocity Head of Stack Gas, Avg. Sq. Root; $(\text{in } H_2O)^{0.5}$
P_b	-	Barometric Pressure; in Hg
K_p	-	Pitot Tube Constant; 85.49 $\frac{(\text{ft})(\text{lb/lb-mole})(\text{in Hg})^{0.5}}{(\text{s})(\text{deg R})(\text{in } H_2O)}$
T_s	-	Absolute Stack Gas Temperature; °R
M_s	-	Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
Sp	-	Static Pressure of Stack Gas; in H_2O
528	-	Standard Absolute Temperature; °R
CSA	-	Stack Cross-sectional Area; ft^2
P_s	-	Absolute Stack Gas Pressure; in Hg
60	-	Conversion Factor; sec/min
Pi	-	Constant; 3.14
D	-	Diameter of Stack; in

$$Ps = \frac{Sp}{13.6} + Pb$$

$$Vs = (85.49)\ (Cp)\ (Dp)\ \left(\frac{Ts}{(Ms)\ (Ps)}\right)^{0.5}$$

$$CSA = \frac{(Pi)\ (D)^2}{(4)(144)}$$

$$Qsd = (60)\ (1 - Bws)\ (CSA)\ (Vs)\ \left(\frac{528}{(Ts)}\ \frac{(Ps)}{(29.92)}\right)$$

EXAMPLE CALCULATION: RUN 2

Data:

M_s	= 27.735	P_b	= 30.04
C_p	= 0.85	D_p	= 1.9563
T_s	= 1361.75	S_p	= 0.40
D	= 8.250		

$$Ps = \frac{(0.40)}{13.6} + 30.04 = 30.07$$

$$Vs = (85.49)(0.85)(1.9563)\left(\frac{1361.75}{(27.735)\ (30.07)}\right)^{0.5} = 181.651$$

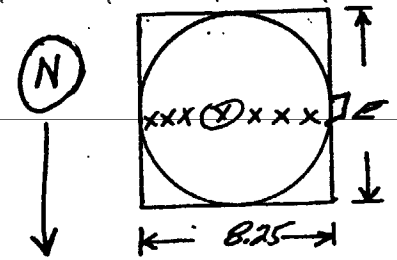
$$CSA = \frac{(3.14)\ (8.250)^2}{(4)\ (144)} = 0.3712$$

$$Qsd = (60)(1-0.1688)(0.3712)(181.651)\left(\frac{(528)\ (30.07)}{(1361.75)(29.92)}\right) = 1{,}310.42$$

HUNTER/ESE ENVIRONMENTAL SERVICES, INC.

STACK SAMPLING DATA SHEET

METHODS 1-4



STACK SCHEMATIC

CLIENT LGI
LOCATION GREEN CITY
SOURCE I.D. #1-88
PROJECT NO. 3907022000
DATE Sept 6, 1988
RUN NUMBER 2
OPERATOR Schmitz

HOT BOX NO. Blue
COLD BOX NO. GREEN
CONSOLE NO. BR 4
PITOT NO. P-5-1
PITOT FACTOR 0.85
METER ΔH@ 1.811
D.G.M.C. FACTOR 0.9904

STACK DIAMETER, in 8.250
NOZZLE DIAMETER, in N/A
FILTER NO. N/A
AMBIENT TEMP. 88
BAROMETRIC PRESSURE 30.04
K FACTOR N/A

Port and Traverse Point No	Clock Time (24-hr)	Gas Meter Reading (ft^3)	Velocity Head ("H_2O) ΔP	Velocity Head ("H_2O) $\sqrt{\Delta P}$	Orifice Pressure Differential ("H_2O) Calc.	Orifice Pressure Differential ("H_2O) Actual	Stack Gas Temperature (°F)	Sample Train Temperatures (°F) Sample Box	Sample Train Temperatures (°F) Dry Gas Meter	Sample Train Temperatures (°F) Last Impinger	Vacuum ("Hg)	Total or Static Pressure ("H_2O)
E 1	12:16	816.694	3.20	1.789		1.5	904		113	61	5	
2	12:18.5	818.400	3.45	1.857		1.5	904		112	61	5	
3	12:21	820.100	3.50	1.871		1.5	904		112	61	5	
4	12:23.5	822.200	3.40	1.843		1.5	901		108	62	5	0.385
5	12:26	823.590	3.25	1.803		1.5	900		111	62	5	
6	12:28.5	825.100	3.45	1.857		1.5	898		109	62	5	
	—	—	—	—		—	—		—	—	—	
E 1	12:31	826.920	3.90	1.975		1.5	904		111	62	5	
2	12:33.5	828.640	4.50	2.121		1.5	902		109	63	5	
3	12:36	830.250	4.60	2.145		1.5	904		115	63	5	
4	12:38.5	832.000	4.45	2.110		1.5	901		114	63	5	0.415
5	12:41	833.720	4.70	2.168		1.5	899		113	65	5	
6	12:43.5	835.410	3.75	1.936		1.5	898		115	65	5	
	—	—	—	—		—	—		—	—	—	
~~66~~	12:46	837.010										
							901.75					
	30	20.316		1.9563		1.5	~~904.50~~		111.83			0.400
							~~+361.50~~		571.83			
							1361.75					

COMMENTS Pre test Leak ✓ 6000 @ 0.001 CFM 1.5" Hg
Post test Leak ✓ 6000 @ 0.001 CFM 16" Hg

	FINAL WEIGHTS	INITIAL WEIGHTS	WEIGHT GAINED
FIRST IMPINGER	614.3	548.1	66.2
SECOND IMPINGER	638.0	627.8	10.2
THIRD IMPINGER	495.2	495.0	0.2
SILICA GEL	681.1	677.1	4.0
TOTAL CONDENSATE			80.6

FLUE GAS ANALYSIS

TRIAL	O_2	CO_2	CO
1	6.0	9.2	0.0
2			
3			
AVG	6.0	9.2	0.0

METHODS 1-4 SAMPLE CALCULATIONS

MOISTURE CONTENT DETERMINATION

P_m	-	Absolute Pressure at Meter; in Hg
P_o	-	Average Orfice Meter Pressure; in H_2O
P_s	-	Standard Absolute Pressure; 29.92 in Hg
P_b	-	Barometric Pressure; in Hg
K	-	Constant; 0.04715 ft^3/g
T_m	-	Meter Box Temperature; °R
T_{std}	-	Standard Absolute Temperature; 528 °R
DGMC	-	Dry Gas Meter Calibration Factor
V_{lcg}	-	Volume of Water Condensate Collected in Impingers; g
B_{ws}	-	Moisture Fraction Content
V_m	-	Volume of Gas Sampled; scf
V_{mstd}	-	Volume of Gas Sampled at the Meter; Corrected to Standard Conditions; dscf
V_{wstd}	-	Volume of Water Vapor in the Gas Sample, Standard Conditions; scf
B_{wd}	-	Moisture Content; percent

EXAMPLE CALCULATION: RUN 3

Data:

P_b	=	30.02
V_m	=	20.572
V_{lcg}	=	94.6
T_m	=	574.33
P_o	=	1.50
DGMC	=	0.9904

$$Pm = \frac{Po}{13.6} + Pb = \frac{(1.50)}{13.6} + (30.02) = 30.13$$

$$Vmstd = \frac{(Vm)(DGMC)(Pm)(Tstd)}{(Ps)\ (Tm)} = \frac{(20.572)(0.9904)(30.13)(528)}{(29.92)\ (574.33)} = 18.862$$

$$Vwstd = (K)\ (Vlcg) = (0.04715)\ (94.6) = 4.460$$

$$Bws = \frac{(Vwstd)}{(Vmstd) + (Vwstd)} = \frac{(4.460)}{(18.862) + (4.460)} = 0.1912$$

$$Bwd = (Bws) \times 100 = (0.1912) \times 100 = 19.12$$

DRY GAS MOLECULAR WEIGHT DETERMINATION

M_d	-	Molecular Weight of Stack Gas, Dry Basis; lb/lb-mole
M_s	-	Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
B_{ws}	-	Stack Gas Moisture Fraction
% CO_2	-	Percent CO_2 by Volume; Dry Basis
% CO	-	Percent CO by Volume; Dry Basis
% O_2	-	Percent O_2 by Volume; Dry Basis
0.32	-	Molecular Weight of Oxygen, Divided by 100; 0.32
0.28	-	Molecular Weight of Nitrogen, Divided by 100; 0.28
0.28	-	Molecular Weight of Carbon Monoxide, Divided by 100; 0.28
0.44	-	Molecular Weight of Carbon Dioxide, Divided by 100; 0.44
18.0	-	Molecular Weight of Water; lb/lb-mole

$$M_d = (0.44)(\%CO_2) + (0.32)(\%O_2) + (0.28)(\%N_2 + \%CO)$$

$$M_s = (M_d)(1-B_{ws}) + (18.0)(B_{ws})$$

EXAMPLE CALCULATION: RUN 3

Data:	B_{ws}	=	0.1912
	% CO	=	0.0
	% O_2	=	6.2
	% N_2	=	82.8
	% CO_2	=	11.0

$$M_d = (0.44)(11.0) + (0.32)(6.2) + (0.28)(82.8 + 0.0) = 30.008$$

$$M_s = (30.008)(1 - 0.1912) + (18.0)(0.1912) = 27.712$$

STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

C_p	-	Pitot Tube Coefficient
V_s	-	Stack Gas Velocity, Dry Standard Conditions; ft/s
Q_{sd}	-	Volumetric Flow Rate, Dry Standard Conditions; DSCF/min
B_{ws}	-	Moisture Fraction
D_p	-	Velocity Head of Stack Gas, Avg. Sq. Root; $(\text{in } H_2O)^{0.5}$
P_b	-	Barometric Pressure; in Hg
K_p	-	Pitot Tube Constant; 85.49 $\frac{(ft)(lb/lb\text{-}mole)(in\ Hg)^{0.5}}{(s)(deg\ R)(in\ H_2O)}$
T_s	-	Absolute Stack Gas Temperature; °R
M_s	-	Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
Sp	-	Static Pressure of Stack Gas; in H_2O
528	-	Standard Absolute Temperature; °R
CSA	-	Stack Cross-sectional Area; ft^2
P_s	-	Absolute Stack Gas Pressure; in Hg
60	-	Conversion Factor; sec/min
Pi	-	Constant; 3.14
D	-	Diameter of Stack; in

$$Ps = \frac{Sp}{13.6} + Pb$$

$$Vs = (85.49)\ (Cp)\ (Dp) \left(\frac{Ts}{(Ms)\ (Ps)}\right)^{0.5}$$

$$CSA = \frac{(Pi)\ (D)^2}{(4)(144)}$$

$$Qsd = (60)\ (1 - Bws)\ (CSA)\ (Vs) \left(\frac{(528)\ (Ps)}{(Ts)\ (29.92)}\right)$$

SAMPLE CALCULATION: RUN 3

Data:

M_s	= 27.712	P_b	= 30.02
C_p	= 0.85	D_p	= 1.823
T_s	= 1361.92	S_p	= 0.495
D	= 8.250		

$$Ps = \frac{(0.495)}{13.6} + 30.02 = 30.06$$

$$Vs = (85.49)(0.85)(1.823)\left(\frac{1361.92}{(27.712)\ (30.06)}\right)^{0.5} = 169.345$$

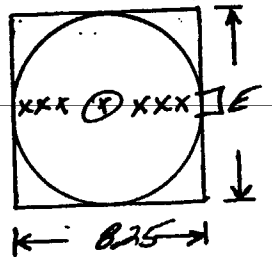
$$CSA = \frac{(3.14)\ (8.250)^2}{(4)\ (144)} = 0.3712$$

$$Qsd = (60)(1-0.1912)(0.3712)(169.345)\left(\frac{((528)\ (30.06))}{(1361.92)(29.92)}\right) = 1{,}188.18$$

HUNTER/ESE ENVIRONMENTAL SERVICES, INC.

STACK SAMPLING DATA SHEET

METHODS 1-4
R-1046
CAT 6399



STACK SCHEMATIC

CLIENT LGE
LOCATION Green City
SOURCE I.D. #1-88
PROJECT NO. 3907022000
DATE Sept 6, 1989
RUN NUMBER 3
OPERATOR [illegible]

HOT BOX NO. GREEN
COLD BOX NO. BLUE
CONSOLE NO. BR 4
PITOT NO. P-5-1
PITOT FACTOR 0.85
METER ΔH@ 1.811
DRY G.M.C. FACTOR 0.9904

STACK DIAMETER, in 8.25
NOZZLE DIAMETER, in N/A
FILTER NO. N/A
AMBIENT TEMP. 91
BAROMETRIC PRESSURE 30.02
K FACTOR N/A

Port and Traverse Point No	Clock Time (24-hr)	Gas Meter Reading (ft^3)	Velocity Head ("H_2O) ΔP	Velocity Head ("H_2O) $\sqrt{\Delta P}$	Orifice Pressure Differential ("H_2O) Calc.	Orifice Pressure Differential ("H_2O) Actual	Stack Gas Temperature (°F)	Sample Train Temperatures (°F) Sample Box	Sample Train Temperatures (°F) Dry Gas Meter	Sample Train Temperatures (°F) Last Impinger	Vacuum ("Hg)	Total or Static Pressure ("H_2O)
E 1	1322	837.612	2.45	1.565		1.5	904		114	62	6	
2	13:24.5	839.340	3.25	1.803		1.5	902		113	62	6	
3	13:27	841.170	3.35	1.830		1.5	901		114	64	6	0.480
4	13:29.5	842.830	3.70	1.924		1.5	900		113	64	6	
5	13:32	844.540	3.60	1.897		1.5	903		115	65	6	
6	13:34.5	846.250	3.60	1.897		1.5	902		114	66	6	
—	—	—	—	—		—	—		—	—	—	
E 1	13:37	848.000	3.45	1.565		1.5	902		115	66	6	*
2	13:39.5	849.720	3.50	1.871		1.5	902		114	66	* 6	
3	13:42	851.350	3.35	1.830		1.5	904		115	67	6	0.510
4	13:44.5	853.100	3.55	1.910		1.5	903		114	68	6	
5	13:47	854.750	3.80	1.949		1.5	902		116	68	6	
6	13:49.5	856.570	3.35	1.830		1.5	898		115	68	6	
							~~898~~			~~68~~	~~6~~	
~~E~~	13:52	858.184										
	30	20.572		1.8226		1.5	901.92 1361.92		114.33 574.33			0.495

COMMENTS Pretest Leak ✓ good @ 0.001 CFM - 13" Hg
Post test Leak ✓ good @ 0.000 CFM - 11" Hg

	FINAL WEIGHTS	INITIAL WEIGHTS	WEIGHT GAINED
FIRST IMPINGER	688.8	614.3	74.5
SECOND IMPINGER	650.4	638.0	12.4
THIRD IMPINGER	496.8	495.2	1.6
SILICA GEL	637.7	631.6	6.1
TOTAL CONDENSATE			94.6

FLUE GAS ANALYSIS

TRIAL	O_2	CO_2	CO
1	6.2	11.0	0.0
2			
3			
AVG	6.2	11.0	0.0

* ADDED ICE

APPENDIX B -- COMPLETE FIELD DATA
AND EMISSION CALCULATIONS
SOURCE NO. 2-88

OXIDES OF NITROGEN EMISSION RATE SAMPLE CALCULATIONS

Oxides of nitrogen emission rates were determined using the following equation:

$$\text{lb/hr } NO_x = \frac{(60)(46)(Q_{sd})(ppm)}{(10^6)(385.3)}$$

Where:

Q_{sd}	=	Volumetric Flow Rate of Stack Gas; Dry Standard Cubic feet per minute; DSCF/min
46	=	Molecular Weight of Nitrogen Dioxide; g/gmol
385.3	=	Conversion Factor; g/gmol-lb/ft^3
ppm	=	Concentration of NO_x Stack Emissions
60	=	Conversion Factor; 60 Minutes in One Hour
10^6	=	Conversion Factor; part per million

EXAMPLE CALCULATIONS

Data :	Run 1	NO_x = 1311.91 ppm	Q_{sd} = 392.413
	Run 2	NO_x = 1544.64 ppm	Q_{sd} = 407.311
	Run 3	NO_x = 1777.54 ppm	Q_{sd} = 395.684

Thus:

Run 1: lb/Hr $NO_x = \frac{(60)(46)(1311.91)(392.413)}{(10^6)(385.3)} = 3.688$

Run 2: lb/Hr $NO_x = \frac{(60)(46)(1544.64)(407.311)}{(10^6)(385.3)} = 4.506$

Run 3: lb/Hr $NO_x = \frac{(60)(46)(1777.54)(395.684)}{(10^6)(385.3)} = 5.038$

Robert Freeman

METHOD 7E
OXIDES OF NITROGEN

CLIENT LA. INTRASTATE PROJECT NUMBER 3907022000

SOURCE #2-88 LOAD % MAX RUN NUMBER 1

DATE 9-6-89 ANALYST M. CALAMIA

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N_2	0.08	0.0	0.10	3.47	0.2
Low	598.6					
Mid						
High	937.7	5.49	937.7	5.48	935.97	-0.1

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 173.327 y intercept -13.87 Span Range 1719.4

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 4:05 End 5:05 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	7.47	11	7.50	21	7.43
2	7.62	12	7.40	22	7.63
3	7.54	13	7.36	23	8.02
4	7.39	14	7.23	24	8.09
5	7.18	15	7.35	25	8.10
6	7.42	16	7.37	26	8.11
7	7.58	17	7.54	27	7.74
8	7.45	18	7.62	28	8.11
9	7.50	19	7.41	29	8.32
10	7.67	20	7.56	30	8.78

Average Volts ~~4.634~~ 7.649

Average Concentration 1311.91

Robert Bowman

METHOD 7E
OXIDES OF NITROGEN

CLIENT LA. INTRASTATE PROJECT NUMBER 3907022000

SOURCE #2-88 LOAD % MAX RUN NUMBER 2

DATE 9-6-89 ANALYST M. CALAMIA

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N_2	0.10	0.0	0.10	0.0	0.0
Low	598.6					
Mid						
High	937.7	5.48	937.7	5.48	937.7	0.0

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 174.294 y intercept -17.43 Span Range 1725.51

$$\% \text{ Drift} = \frac{\text{Final Responce} - \text{Initial Responce}}{\text{Span}} \times 100$$

TEST DATA

Time: Start 5:10 End 6:10 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	7.44	11	9.44	21	9.33
2	7.71	12	9.88	22	9.13
3	7.84	13	9.99	23	9.30
4	8.43	14	10.01	24	9.07
5	7.74	15	9.37	25	9.11
6	7.19	16	9.83	26	9.21
7	7.95	17	9.78	27	9.25
8	8.03	18	9.67	28	9.30
9	8.71	19	9.78	29	9.31
10	9.06	20	9.76	30	9.20

Average Volts 8.9623

Average Concentration 1544.64

Robert Bressman

METHOD 7E
OXIDES OF NITROGEN

CLIENT LA. INTRASTATE PROJECT NUMBER 3907022000

SOURCE #2-88 LOAD % MAX RUN NUMBER 3

DATE 9-6-89 ANALYST M. CALAMIA

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N2	0.10	0.0	0.01	0.0	0.0
Low	598.6					
Mid						
High	937.7	4.15	937.7	4.16	939.7	0.1

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 201.6559 y intercept -20.07 Span Range 199639

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 6:15 End 7:15 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	8.98	11	8.64	21	9.01
2	9.03	12	9.02	22	9.44
3	8.76	13	8.72	23	8.92
4	8.91	14	8.84	24	9.02
5	9.27	15	8.41	25	9.46
6	9.28	16	8.47	26	8.43
7	9.13	17	8.80	27	9.23
8	8.95	18	8.50	28	9.52
9	8.92	19	8.84	29	9.31
10	8.90	20	8.38	30	9.45

Average Volts ~~8.86~~ 8.9147

Average Concentration 1777.536

Changed UPSCALE SPAN

CARBON MONOXIDE CONCENTRATION CORRECTION FOR DILUTENT CO_2

$C_{co\ stack}$ - Concentration of CO in Stack, Dry Basis; ppm

$C_{co\ ndir}$ - Concentration of CO Measured by NDIR Analyzer, Dry Basis; ppm

F_{co2} - Volume Fraction of CO_2 in Stack Gas Sample, Orsat Analysis; % CO_2 Divided By 100

$$C_{co\ stack} = C_{co\ ndir}\ (1 - F_{co2})$$

EXAMPLE CALCULATIONS

Data:

RUN 1: $C_{co\ ndir} = 504.23$ $F_{co2} = 0.095$

RUN 2: $C_{co\ ndir} = 420.95$ $F_{co2} = 0.091$

RUN 3: $C_{co\ ndir} = 477.78$ $F_{co2} = 0.093$

Thus:

RUN 1: $C_{co\ stack} = (504.23)(1 - 0.095) = 456.33$

RUN 2: $C_{co\ stack} = (420.95)(1 - 0.091) = 414.80$

RUN 3: $C_{co\ stack} = (477.78)(1 - 0.093) = 433.35$

CARBON MONOXIDE EMISSION RATE SAMPLE CALCULATIONS

Carbon monoxide emission rates were determined using the following relation:

$$\text{lb/hr CO} = \frac{(60)(28)(Q_{sd})(\text{ppm})}{(10^6)(385.3)}$$

Where:

Q_{sd}	=	Volumetric Flow Rate of Stack Gas; Dry Standard Cubic feet per minute; DSCF/min
28	=	Molecular Weight of Carbon Monoxide; g/gmol
385.3	=	Conversion Factor; g/gmol-lb/ft^3
ppm	=	Concentration of CO Stack Emissions; Corrected to % Carbon Dioxide; ppm
60	=	Conversion Factor; 60 Minutes in One Hour
10^6	=	Conversion Factor; part per million

EXAMPLE CALCULATIONS

Data :			
	Run 1	CO = 456.33 ppm	Q_{sd} = 392.413
	Run 2	CO = 414.80 ppm	Q_{sd} = 407.311
	Run 3	CO = 433.35 ppm	Q_{sd} = 395.684

Thus:

Run 1: lb/Hr CO = $\frac{(60)(28)(456.33)(392.413)}{(10^6)(385.3)}$ = 0.781

Run 2: lb/Hr CO = $\frac{(60)(28)(414.80)(407.311)}{(10^6)(385.3)}$ = 0.737

Run 3: lb/Hr CO = $\frac{(60)(28)(433.35)(395.684)}{(10^6)(385.3)}$ = 0.748

Robert Freeman

METHOD 10
CARBON MONOXIDE

CLIENT ~~A~~ INTRASTATE PROJECT NUMBER 3907022000

SOURCE #2-88 LOAD % MAX RUN NUMBER X1

DATE 9-6-89 ANALYST M. CALANIA

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N_2	.019	2.98	-0.14	-0.14	-0.5
Low	89.61	.152	85.85	.150	85.23	-0.1
Mid						
High	401.0	.659	401.8	.659	401.8	0.0

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 0.623132 y intercept -8.86 Span Range 614.269

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 4:05 End 5:05 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	.792	11	.827	21	.812
2	.824	12	.832	22	.831
3	.804	13	.803	23	.852
4	.790	14	.831	24	.838
5	.767	15	.828	25	.854
6	.806	16	.823	26	.832
7	.816	17	.815	27	.839
8	.823	18	.822	28	.860
9	.819	19	.832	29	.838
10	.806	20	.839	30	.842

Average Volts ~~.78803~~ .8234

Average Concentration 504.227

Robert Freeman

METHOD 10
CARBON MONOXIDE

CLIENT LA. ~~INT~~ RASTATE PROJECT NUMBER 3907022000

SOURCE #2-88 LOAD % MAX RUN NUMBER 2

DATE 9-6-89 ANALYST M. CALAMIA

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N_2	.014	2.09	.012	0.86	-0.2
Low	89.61	.151	86.95	.151	86.95	0.0
Mid						
High	401.0	.659	401.6	.660	402.2	0.1

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 619.3299 y intercept -6.573 Span Range 612.757

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 5:10 End 6:10 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	.767	11	.664	21	.675
2	.799	12	.674	22	.644
3	.753	13	.678	23	.659
4	.734	14	.674	24	.674
5	.738	15	.654	25	.668
6	.743	16	.664	26	.666
7	.704	17	.667	27	.665
8	.686	18	.658	28	.683
9	.727	19	.672	29	.679
10	.672	20	.673	30	.689

Average Volts 0.6903

Average Concentration 420.951

Robert Freeman

METHOD 10
CARBON MONOXIDE

CLIENT LA INTRASTATE PROJECT NUMBER 3907022000

SOURCE #2-88 LOAD % MAX RUN NUMBER 3

DATE 9-6-89 ANALYST M. CALAMIA

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N2	.012	1.7	.002	1.7	0.0
Low	89.61	.151	87.45	.151	87.45	0.0
Mid						
High	401.0	.660	401.5	.658	400.2	-0.2

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 616.923 y intercept -5.71 Span Range 611.213

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 6:15 End 7:15 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	.752	11	.769	21	.798
2	.740	12	.771	22	.815
3	.777	13	.776	23	.812
4	.739	14	.746	24	.825
5	.765	15	.789	25	.811
6	.759	16	.802	26	.805
7	.754	17	.784	27	.814
8	.743	18	.776	28	.820
9	.775	19	.785	29	.846
10	.776	20	.773	30	.814

Average Volts .7831

Average Concentration 477.777

Robert Freeman

METHOD 3A
OXYGEN

CLIENT LA INTRASTATE PROJECT NUMBER 3907022000

SOURCE #2-98 LOAD % MAX RUN NUMBER #1

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	%	volts	%	volts	%	
Zero	N_2		0.0		0.0	0.0
Mid						
High	AIR		20.9		20.9	0.0

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope _____ y intercept _____ Span Range _____

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 4:05 End 5:05 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	8.1	11	8.0	21	8.1
2	8.1	12	8.0	22	7.5
3	8.1	13	8.0	23	7.5
4	8.0	14	8.0	24	7.5
5	8.0	15	8.0	25	7.5
6	8.1	16	8.0	26	7.4
7	8.1	17	8.0	27	7.5
8	8.0	18	8.0	28	7.5
9	8.0	19	8.0	29	7.3
10	8.0	20	8.0	30	7.4

Average Volts _____

Average Concentration 7.91 %

Comments

Robert Freeman

METHOD 3A
OXYGEN

CLIENT LA · INTRASTATE PROJECT NUMBER 3707022000

SOURCE #2-88 LOAD % MAX RUN NUMBER 2

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	%	volts	%	volts	%	
Zero	N_2		0.0		0.0	0.0
Mid						
High	AIR		20.9		20.9	0.0

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope _____ y intercept _____ Span Range _____

$$\% \text{ Drift} = \frac{\text{Final Responce} - \text{Initial Responce}}{\text{Span}} \times 100$$

TEST DATA

Time: Start 5:10 End 6:10 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	8.8	11	8.9	21	9.2
2	8.6	12	9.0	22	9.4
3	8.6	13	9.6	23	8.9
4	8.8	14	8.6	24	9.0
5	9.0	15	9.0	25	9.0
6	8.9	16	9.0	26	9.0
7	9.0	17	8.8	27	8.8
8	9.0	18	9.0	28	8.8
9	8.6	19	9.0	29	8.8
10	8.9	20	9.0	30	9.0

Average Volts _____

Average Concentration 8.9%

Comments

Robert Freeman

METHOD 3A
OXYGEN

CLIENT LA INTRASTATE PROJECT NUMBER 3707022000

SOURCE #2-88 LOAD % MAX RUN NUMBER 3

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	%	volts	%	volts	%	
Zero	N2		0.0		0.0	0
Mid						
High	AIR		20.9		20.9	0

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope _____ y intercept _____ Span Range _____

$$\% \text{ Drift} = \frac{\text{Final Responce} - \text{Initial Responce}}{\text{Span}} \times 100$$

TEST DATA

Time: Start 6:15 End 7:15 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	7.5	11	7.5	21	7.5
2	7.5	12	7.5	22	7.5
3	7.4	13	7.5	23	7.5
4	7.5	14	7.5	24	7.5
5	7.5	15	7.5	25	7.6
6	7.5	16	7.5	26	7.5
7	7.5	17	7.5	27	7.5
8	7.6	18	7.5	28	7.4
9	7.6	19	7.5	29	7.5
10	7.4	20	7.5	30	

Average Volts _____

Average Concentration 7.5%

Comments

METHODS 1-4 SAMPLE CALCULATIONS

MOISTURE CONTENT DETERMINATION

P_m	-	Absolute Pressure at Meter; in Hg
P_o	-	Average Orfice Meter Pressure; in H_2O
Ps	-	Standard Absolute Pressure; 29.92 in Hg
P_b	-	Barometric Pressure; in Hg
K	-	Constant; 0.04715 ft^3/g
T_m	-	Meter Box Temperature; °R
T_{std}	-	Standard Absolute Temperature; 528 °R
DGMC	-	Dry Gas Meter Calibration Factor
V_{lcg}	-	Volume of Water Condensate Collected in Impingers; g
B_{ws}	-	Moisture Fraction Content
V_m	-	Volume of Gas Sampled; scf
V_{mstd}	-	Volume of Gas Sampled at the Meter; Corrected to Standard Conditions; dscf
V_{wstd}	-	Volume of Water Vapor in the Gas Sample; Standard Conditions; scf
B_{wd}	-	Moisture Content; percent

EXAMPLE CALCULATION: RUN 1

Data:

P_b	=	30.00
V_m	=	21.754
V_{lcg}	=	66.5
T_m	=	574.00
P_o	=	1.50
DGMC	=	0.9904

$$Pm = \frac{Po}{13.6} + Pb = \frac{(1.50)}{13.6} + (30.00) = 30.11$$

$$Vmstd = \frac{(Vm)(DGMC)(Pm)(Tstd)}{(Ps)\ (Tm)} = \frac{(21.754)(0.9904)(30.11)(528)}{(29.92)\ (574.00)} = 19.944$$

$$Vwstd = (K)\ (Vlcg) = (0.04715)\ (66.5) = 3.135$$

$$Bws = \frac{(Vwstd)}{(Vmstd) + (Vwstd)} = \frac{(3.135)}{(19.944) + (3.135)} = 0.1358$$

$$Bwd = (Bws) \times 100 = (0.1358) \times 100 = 13.58$$

DRY GAS MOLECULAR WEIGHT DETERMINATION

M_d	-	Molecular Weight of Stack Gas, Dry Basis; lb/lb-mole
M_s	-	Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
B_{ws}	-	Stack Gas Moisture Fraction
% CO_2	-	Percent CO_2 by Volume; Dry Basis
% CO	-	Percent CO by Volume; Dry Basis
% O_2	-	Percent O_2 by Volume; Dry Basis
0.32	-	Molecular Weight of Oxygen, Divided by 100; 0.32
0.28	-	Molecular Weight of Nitrogen, Divided by 100; 0.28
0.28	-	Molecular Weight of Carbon Monoxide, Divided by 100; 0.28
0.44	-	Molecular Weight of Carbon Dioxide, Divided by 100; 0.44
18.0	-	Molecular Weight of Water; lb/lb-mole

$$M_d = (0.44)(\%CO_2) + (0.32)(\%O_2) + (0.28)(\%N_2 + \%CO)$$

$$M_s = (M_d)(1-B_{ws}) + (18.0)(B_{ws})$$

EXAMPLE CALCULATION: RUN 1

Data:	B_{ws}	=	0.1358
	% CO	=	0.0
	% O_2	=	8.2
	% N_2	=	82.3
	% CO_2	=	9.5

$$M_d = (0.44)(9.5) + (0.32)(8.2) + (0.28)(82.3 + 0.0) = 29.848$$

$$M_s = (29.848)(1 - 0.1358) + (18.0)(0.1358) = 28.239$$

STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

C_p	-	Pitot Tube Coefficient
V_s	-	Stack Gas Velocity, Dry Standard Conditions; ft/s
Q_{sd}	-	Volumetric Flow Rate, Dry Standard Conditions; DSCF/min
B_{ws}	-	Moisture Fraction
D_p	-	Velocity Head of Stack Gas, Avg. Sq. Root; $(\text{in } H_2O)^{0.5}$
P_b	-	Barometric Pressure; in Hg
K_p	-	Pitot Tube Constant; 85.49 $\frac{(\text{ft})(\text{lb/lb-mole})(\text{in Hg})^{0.5}}{(\text{s})(\text{deg R})(\text{in } H_2O)}$
T_s	-	Absolute Stack Gas Temperature; °R
M_s	-	Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
Sp	-	Static Pressure of Stack Gas; in H_2O
528	-	Standard Absolute Temperature; °R
CSA	-	Stack Cross-sectional Area; ft^2
P_s	-	Absolute Stack Gas Pressure; in Hg
60	-	Conversion Factor; sec/min
Pi	-	Constant; 3.14
D	-	Diameter of Stack; in

$$Ps = \frac{Sp}{13.6} + Pb$$

$$Vs = (85.49)\ (Cp)\ (Dp) \left(\frac{Ts}{(Ms)\ (Ps)}\right)^{0.5}$$

$$CSA = \frac{(Pi)\ (D)^2}{(4)(144)}$$

$$Qsd = (60)\ (1 - Bws)\ (CSA)\ (Vs) \left(\frac{(528)\ \ (Ps)}{(Ts)\ (29.92)}\right)$$

EXAMPLE CALCULATION: RUN 1

Data:

M_s	= 28.239	P_b	= 30.00
C_p	= 0.85	D_p	= 0.9064
T_s	= 1139.13	S_p	= 0.385
D	= 6.250		

$$Ps = \frac{(0.385)}{13.6} + 30.00 = 30.03$$

$$Vs = (85.49)(0.85)(0.9064)\left(\frac{1139.13}{(28.239)\ (30.03)}\right)^{0.5} = 76.338$$

$$CSA = \frac{(3.14)\ (6.250)^2}{(4)\ (144)} = 0.2131$$

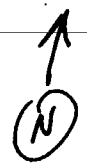
$$Qsd = (60)(1-0.1358)(0.2131)(76.338)\left(\frac{((528)\ \ (30.03))}{(1139.13)(29.92)}\right) = 392.413$$

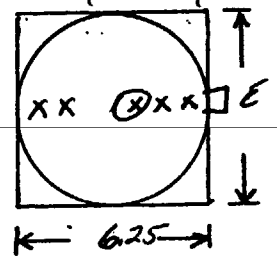
HUNTER/ESE ENVIRONMENTAL SERVICES, INC.

STACK SAMPLING DATA SHEET

METHODS 1-4

CAT 6342





STACK SCHEMATIC

CLIENT LLG
LOCATION Garden City
SOURCE I.D. #2-88
PROJECT NO. 3907022000
DATE Sept 6, 1989
RUN NUMBER 1
OPERATOR [signature]

HOT BOX NO. GREEN
COLD BOX NO. BLUE
CONSOLE NO. BR 4
PITOT NO. P-5-1
PITOT FACTOR 0.85
METER ΔH@ 1.811
D.G.M.C. FACTOR 0.9904

STACK DIAMETER, in 6.25"
NOZZLE DIAMETER, in N/A
FILTER NO. N/A
AMBIENT TEMP. 89
BAROMETRIC PRESSURE 30.00
K FACTOR N/A

Port and Traverse Point No	Clock Time (24-hr)	Gas Meter Reading (ft³)	Velocity Head ("H₂O) ΔP	Velocity Head ("H₂O) √ΔP	Orifice Pressure Differential ("H₂O) Calc.	Orifice Pressure Differential ("H₂O) Actual	Stack Gas Temperature (°F)	Sample Train Temperatures (°F) Sample Box	Sample Train Temperatures (°F) Dry Gas Meter	Sample Train Temperatures (°F) Last Impinger	Vacuum ("Hg)	Total or Static Pressure ("H₂O)
E1	16:08	871.358	0.819	0.9050		1.5	663		109	62	4	
2	16:12	874.110	0.822	0.9066		1.5	672		109	62	4	
3	16:16	876.850	0.810	0.9000		1.5	686		112	63	4	0.380
4	16:20	879.550	0.815	0.9028		1.5	682		116	64	4	
	—	—	—	—	—	—	—		—	—	—	
E1	16:24	882.290	0.818	0.9044		1.5	685		116	64	4	
2	16:28	884.990	0.824	0.9077		1.5	677		117	65	4	0.390
3	16:32	887.730	0.830	0.9110		1.5	682		116	65	4	
4	16:36	890.440	0.835	0.9138		1.5	686		117	65	4	
~~88~~ (4)	16:40	893.112										
	32 8	21.754	~~0.0~~	0.90641		1.5	679.13 1139.13		114.00 57400			0.385

	FINAL WEIGHTS	INITIAL WEIGHTS	WEIGHT GAINED
FIRST IMPINGER	621.8	567.2	54.6
SECOND IMPINGER	580.0	572.2	7.8
THIRD IMPINGER	497.8	497.5	0.3
SILICA GEL	602.6	598.8	3.8
	TOTAL CONDENSATE		66.5

FLUE GAS ANALYSIS			
TRIAL	O_2	CO_2	CO
1	8.2	9.5	0.0
2			
3			
AVG	8.2	9.5	0.0

COMMENTS Pretest Leak ✓ 4000 @ 12" Hg 0.000 CFM
Post-test Leak ✓ 4000 @ 13" Hg 0.000 CFM

METHODS 1-4 SAMPLE CALCULATIONS

MOISTURE CONTENT DETERMINATION

P_m	-	Absolute Pressure at Meter; in Hg
P_o	-	Average Orfice Meter Pressure; in H_2O
P_s	-	Standard Absolute Pressure, 29.92 in Hg
P_b	-	Barometric Pressure; in Hg
K	-	Constant; 0.04715 ft^3/g
T_m	-	Meter Box Temperature; °R
T_{std}	-	Standard Absolute Temperature; 528 °R
DGMC	-	Dry Gas Meter Calibration Factor
V_{lcg}	-	Volume of Water Condensate Collected in Impingers; g
B_{ws}	-	Moisture Fraction Content
V_m	-	Volume of Gas Sampled; scf
V_{mstd}	-	Volume of Gas Sampled at the Meter; Corrected to Standard Conditions; dscf
V_{wstd}	-	Volume of Water Vapor in the Gas Sample, Standard Conditions; scf
B_{wd}	-	Moisture Content; percent

EXAMPLE CALCULATION: RUN 2

Data:

P_b	=	29.98
V_m	=	21.179
V_{lcg}	=	71.0
T_m	=	562.75
P_o	=	1.50
DGMC	=	0.9904

$$Pm = \frac{Po}{13.6} + Pb = \frac{(1.50)}{13.6} + (29.98) = 30.09$$

$$Vmstd = \frac{(Vm)(DGMC)(Pm)(Tstd)}{(Ps)\ (Tm)} = \frac{(21.179)(0.9904)(30.09)(528)}{(29.92)\ (562.75)} = 19.792$$

$$Vwstd = (K)\ (Vlcg) = (0.04715)\ (71.0) = 3.348$$

$$Bws = \frac{(Vwstd)}{(Vmstd) + (Vwstd)} = \frac{(3.348)}{(19.792) + (3.348)} = 0.1447$$

$$Bwd = (Bws) \times 100 = (0.1447) \times 100 = 14.47$$

DRY GAS MOLECULAR WEIGHT DETERMINATION

M_d	-	Molecular Weight of Stack Gas, Dry Basis; lb/lb-mole
M_s	-	Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
B_{ws}	-	Stack Gas Moisture Fraction
% CO_2	-	Percent CO_2 by Volume; Dry Basis
% CO	-	Percent CO by Volume; Dry Basis
% O_2	-	Percent O_2 by Volume; Dry Basis
0.32	-	Molecular Weight of Oxygen, Divided by 100; 0.32
0.28	-	Molecular Weight of Nitrogen, Divided by 100; 0.28
0.28	-	Molecular Weight of Carbon Monoxide, Divided by 100; 0.28
0.44	-	Molecular Weight of Carbon Dioxide, Divided by 100; 0.44
18.0	-	Molecular Weight of Water; lb/lb-mole

$$M_d = (0.44)(\%CO_2) + (0.32)(\%O_2) + (0.28)(\%N_2 + \%CO)$$

$$M_s = (M_d)(1-B_{ws}) + (18.0)(B_{ws})$$

EXAMPLE CALCULATION: RUN 2

Data:

B_{ws}	=	0.1447
% CO	=	0.0
% O_2	=	8.8
% N_2	=	82.1
% CO_2	=	9.1

$$M_d = (0.44)(9.1) + (0.32)(8.8) + (0.28)(82.1 + 0.0) = 29.808$$

$$M_s = (29.808)(1 - 0.1447) + (18.0)(0.1447) = 28.099$$

STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

C_p	-	Pitot Tube Coefficient
V_s	-	Stack Gas Velocity, Dry Standard Conditions; ft/s
Q_{sd}	-	Volumetric Flow Rate, Dry Standard Conditions; DSCF/min
B_{ws}	-	Moisture Fraction
D_p	-	Velocity Head of Stack Gas, Avg. Sq. Root; $(\text{in } H_2O)^{0.5}$
P_b	-	Barometric Pressure; in Hg
K_p	-	Pitot Tube Constant; 85.49 $\frac{(\text{ft})(\text{lb/lb-mole})(\text{in Hg})^{0.5}}{(\text{s})(\text{deg R})(\text{in } H_2O)}$
T_s	-	Absolute Stack Gas Temperature; °R
M_s	-	Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
Sp	-	Static Pressure of Stack Gas; in H_2O
528	-	Standard Absolute Temperature; °R
CSA	-	Stack Cross-sectional Area; ft^2
P_s	-	Absolute Stack Gas Pressure; in Hg
60	-	Conversion Factor; sec/min
Pi	-	Constant; 3.14
D	-	Diameter of Stack; in

$$Ps = \frac{Sp}{13.6} + Pb$$

$$Vs = (85.49)\ (Cp)\ (Dp) \left(\frac{Ts}{(Ms)\ (Ps)}\right)^{0.5}$$

$$CSA = \frac{(Pi)\ (D)^2}{(4)(144)}$$

$$Qsd = (60)\ (1 - Bws)\ (CSA)\ (Vs) \left(\frac{528}{Ts}\right) \left(\frac{Ps}{29.92}\right)$$

EXAMPLE CALCULATION: RUN 2

Data:

M_s	= 28.099	P_b	= 29.98
C_p	= 0.85	D_p	= 0.93398
T_s	= 1104.38	S_p	= 0.375
D	= 6.250		

$$Ps = \frac{(0.375)}{13.6} + 29.98 = 30.01$$

$$Vs = (85.49)(0.85)(0.93398)\left(\frac{1104.38}{(28.099)\ (30.01)}\right)^{0.5} = 77.670$$

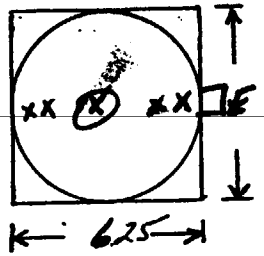
$$CSA = \frac{(3.14)\ (6.250)^2}{(4)\ (144)} = 0.2131$$

$$Qsd = (60)(1-0.1447)(0.2131)(77.670)\left(\frac{(528)}{(1104.38)}\right)\left(\frac{(30.01)}{(29.92)}\right) = 407.311$$

HUNTER/ESE ENVIRONMENTAL SERVICES, INC.

STACK SAMPLING DATA SHEET

METHODS 4



STACK SCHEMATIC

CLIENT LTG
LOCATION Gaston City
SOURCE I.D. #2-88
PROJECT NO. 3907022000
DATE Sept 6, 1988
RUN NUMBER 2
OPERATOR [redacted]

HOT BOX NO. 4 Green
COLD BOX NO. Blue
CONSOLE NO. BR4
PITOT NO. A 5-1
PITOT FACTOR 0.85
METER ΔH@ 1.811
D.G.M.C.FACTOR 0.99[redacted]

STACK DIAMETER, in 6.250"
NOZZLE DIAMETER, in N/A
FILTER NO. N/A
AMBIENT TEMP. 87
BAROMETRIC PRESSURE 29.78
K FACTOR N/A

Port and Traverse Point No	Clock Time (24-hr)	Gas Meter Reading (ft³)	Velocity Head (" H_2O) ΔP	Velocity Head (" H_2O) √ΔP	Orifice Pressure Differential (" H_2O) Calc.	Orifice Pressure Differential (" H_2O) Actual	Stack Gas Temperature (°F)	Sample Train Temperatures (°F) Sample Box	Sample Train Temperatures (°F) Dry Gas Meter	Sample Train Temperatures (°F) Last Impinger	Vacuum (" Hg)	Total or Static Pressure (" H_2O)
E1	17:14	893.398	[redacted]	0.9110		1.[redacted]	678		110	62	[redacted]	
E2	17:18	894.940	[redacted]	0.9192		1.[redacted]	679		106	64	[redacted]	
3	17:22	896.150	[redacted]	0.9301		1.[redacted]	668		103	64	[redacted]	0.37
4	17:26	898.010	[redacted]	0.9327		[redacted]	651		103	64	[redacted]	
E1	17:30	901.320	[redacted]	0.9434		1.50	644		101	65	5	
2	17:34	904.080	[redacted]	0.9434		1.50	624		100	65	5	
3	17:38	909.680	[redacted]	0.9407		1.50	613		99	65	5	0.38
4	17:42	912.370	0.905	0.9513		1.50	598		100	66	5	
~~Pb~~ (P)	17:46	919.477										
		914.477										
		555										
	32	21.179		0.93398		1.5125	644.38 / 1104.38		102.75 / 562.75			0.375

	FINAL WEIGHTS	INITIAL WEIGHTS	WEIGHT GAINED
FIRST IMPINGER	678.1	621.8	56.3
SECOND IMPINGER	582.7	580.0	2.7
THIRD IMPINGER	500.0	497.8	2.2
SILICA GEL	675.4	665.6	9.8
TOTAL CONDENSATE			71.0

FLUE GAS ANALYSIS			
TRIAL	O_2	CO_2	CO
1			
2			
3			
AVG	8.8	9.1	0.0

COMMENTS Pretest Leak ✓ okay @ 0.000 CFM at 12" Hg
Post Test Leak ✓ good @ 0.001 CFM at 12" Hg

Rain From 17:18 - 17:34

METHODS 1-4 SAMPLE CALCULATIONS

MOISTURE CONTENT DETERMINATION

P_m	-	Absolute Pressure at Meter; in Hg
P_o	-	Average Orfice Meter Pressure; in H_2O
P_s	-	Standard Absolute Pressure; 29.92 in Hg
P_b	-	Barometric Pressure; in Hg
K	-	Constant; 0.04715 ft^3/g
T_m	-	Meter Box Temperature; °R
T_{std}	-	Standard Absolute Temperature; 528 °R
DGMC	-	Dry Gas Meter Calibration Factor
V_{lcg}	-	Volume of Water Condensate Collected in Impingers; g
B_{ws}	-	Moisture Fraction Content
V_m	-	Volume of Gas Sampled; scf
V_{mstd}	-	Volume of Gas Sampled at the Meter; Corrected to Standard Conditions; dscf
V_{wstd}	-	Volume of Water Vapor in the Gas Sample, Standard Conditions; scf
B_{wd}	-	Moisture Content; percent

EXAMPLE CALCULATION: RUN 3

Data:

P_b	=	29.94
V_m	=	21.017
V_{lcg}	=	78.7
T_m	=	558.50
P_o	=	1.50
DGMC	=	0.9904

$$Pm = \frac{Po}{13.6} + Pb = \frac{(1.50)}{13.6} + (29.94) = 30.05$$

$$Vmstd = \frac{(Vm)(DGMC)(Pm)(Tstd)}{(Ps)\ (Tm)} = \frac{(21.017)(0.9904)(30.05)(528)}{(29.92)\ (558.50)} = 19.764$$

$$Vwstd = (K)\ (Vlcg) = (0.04715)\ (78.7) = 3.711$$

$$Bws = \frac{(Vwstd)}{(Vmstd) + (Vwstd)} = \frac{(3.711)}{(19.764) + (3.711)} = 0.1581$$

$$Bwd = (Bws) \times 100 = (0.1581) \times 100 = 15.81$$

DRY GAS MOLECULAR WEIGHT DETERMINATION

M_d	-	Molecular Weight of Stack Gas, Dry Basis; lb/lb-mole
M_s	-	Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
B_{ws}	-	Stack Gas Moisture Fraction
% CO_2	-	Percent CO_2 by Volume; Dry Basis
% CO	-	Percent CO by Volume; Dry Basis
% O_2	-	Percent O_2 by Volume; Dry Basis
0.32	-	Molecular Weight of Oxygen, Divided by 100; 0.32
0.28	-	Molecular Weight of Nitrogen, Divided by 100; 0.28
0.28	-	Molecular Weight of Carbon Monoxide, Divided by 100; 0.28
0.44	-	Molecular Weight of Carbon Dioxide, Divided by 100; 0.44
18.0	-	Molecular Weight of Water; lb/lb-mole

$$M_d = (0.44)(\%CO_2) + (0.32)(\%O_2) + (0.28)(\%N_2 + \%CO)$$

$$M_s = (M_d)(1-B_{ws}) + (18.0)(B_{ws})$$

EXAMPLE CALCULATION: RUN 3

Data:

B_{ws}	=	0.1581
% CO	=	0.0
% O_2	=	8.6
% N_2	=	82.1
% CO_2	=	9.3

$$M_d = (0.44)(9.3) + (0.32)(8.6) + (0.28)(82.1 + 0.0) = 29.832$$

$$M_s = (29.832)(1 - 0.1581) + (18.0)(0.1581) = 27.961$$

STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

C_p	-	Pitot Tube Coefficient
V_s	-	Stack Gas Velocity, Dry Standard Conditions; ft/s
Q_{sd}	-	Volumetric Flow Rate, Dry Standard Conditions; DSCF/min
B_{ws}	-	Moisture Fraction
D_p	-	Velocity Head of Stack Gas, Avg. Sq. Root; $(\text{in } H_2O)^{0.5}$
P_b	-	Barometric Pressure; in Hg
K_p	-	Pitot Tube Constant; 85.49 $\frac{(ft)(lb/lb\text{-}mole)(in\ Hg)^{0.5}}{(s)(deg\ R)(in\ H_2O)}$
T_s	-	Absolute Stack Gas Temperature; °R
M_s	-	Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
Sp	-	Static Pressure of Stack Gas; in H_2O
528	-	Standard Absolute Temperature; °R
CSA	-	Stack Cross-sectional Area; ft^2
P_s	-	Absolute Stack Gas Pressure; in Hg
60	-	Conversion Factor; sec/min
Pi	-	Constant; 3.14
D	-	Diameter of Stack; in

$$Ps = \frac{Sp}{13.6} + Pb$$

$$Vs = (85.49)\ (Cp)\ (Dp)\ \left(\frac{Ts}{(Ms)\ (Ps)}\right)^{0.5}$$

$$CSA = \frac{(Pi)\ (D)^2}{(4)(144)}$$

$$Qsd = (60)\ (1 - Bws)\ (CSA)\ (Vs)\ \left(\frac{528}{(Ts)}\ \frac{(Ps)}{(29.92)}\right)$$

SAMPLE CALCULATION: RUN 3

Data:

M_s	= 27.961	P_b	= 29.94
C_p	= 0.85	D_p	= 0.9437
T_s	= 1162.13	S_p	= 0.480
D	= 6.250		

$$Ps = \frac{(0.480)}{13.6} + 29.94 = 29.98$$

$$Vs = (85.49)(0.85)(0.9437)\left(\frac{1162.13}{(27.961)\ (29.98)}\right)^{0.5} = 80.742$$

$$CSA = \frac{(3.14)\ (6.250)^2}{(4)\ (144)} = 0.2131$$

$$Qsd = (60)(1-0.1581)(0.2131)(80.742)\left(\frac{(528)\ (29.98)}{(1162.13)(29.92)}\right) = 395.684$$

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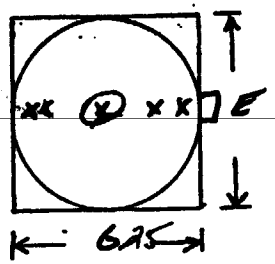
ENVIRONMENTAL SERVICES, INC.

STACK SAMPLING DATA SHEET

METHODS 1-4



STACK SCHEMATIC

CLIENT LIG
LOCATION Green City
SOURCE I.D. #2-88
PROJECT NO. 3907022000
DATE 9-6-89
RUN NUMBER 3
OPERATOR [illegible]

HOT BOX NO. Green
COLD BOX NO. Blue
CONSOLE NO. BR4
PITOT NO. P-5-1
PITOT FACTOR 0.85
METER ΔH@ 1.811
D.G.M. FACTOR 0.9904

STACK DIAMETER, in 6.250"
NOZZLE DIAMETER, in N/A
FILTER NO. N/A
AMBIENT TEMP. 85
BAROMETRIC PRESSURE 29.94
K FACTOR N/A

Port and Traverse Point No	Clock Time (24-hr)	Gas Meter Reading (ft^3)	Velocity Head ($"H_2O$) ΔP	Velocity Head ($"H_2O$) $\sqrt{\Delta P}$	Orifice Pressure Differential ($"H_2O$) Calc.	Orifice Pressure Differential ($"H_2O$) Actual	Stack Gas Temperature (°F)	Sample Train Temperatures (°F) Sample Box	Sample Train Temperatures (°F) Dry Gas Meter	Sample Train Temperatures (°F) Last Impinger	Vacuum ("Hg)	Total or Static Pressure ($"H_2O$)
E 1	18:17	914.835	0.860	0.9274		1.5	732		98	62	2	
2	18:21	917.320	0.880	0.9381		1.5	719		97	62	3	
3	18:25	919.870	0.895	0.9460		1.5	710		98	63	3	0.480
4	18:29	922.560	0.890	0.9434		1.5	703		98	64	3	
										6	3	
1	18:33	925.230	0.895	0.9460		1.5	700		99	65	3	
2	18:37	927.880	0.910	0.9539		1.5	693		99	66	3	
3	18:41	930.540	0.895	0.9460		1.5	682		100	66	3	0.480
4	18:45	932.980	0.900	0.9487		1.5	678		99	68	3	
Off	18:49	935.852										
	32	21,017		0.94369		1.5	70213 1162.13		98.50 558.50			0.480

	FINAL WEIGHTS	INITIAL WEIGHTS	WEIGHT GAINED
FIRST IMPINGER	742.5	678.1	64.4
SECOND IMPINGER	591.0	582.7	8.3
THIRD IMPINGER	500.1	500.0	0.1
SILICA GEL	586.6	580.7	5.9
TOTAL CONDENSATE			78.7

FLUE GAS ANALYSIS

TRIAL	O_2	CO_2	CO
1			
2			
3			
AVG	8.6	9.3	0.0

COMMENTS Pre Test Leak ✓ Good @ 0.001 CFM
Post Test Leak ✓ Good @ 0.000 CFM

APPENDIX C -- COMPLETE FIELD DATA
AND EMISSION CALCULATIONS
SOURCE NO. 3-88

OXIDES OF NITROGEN EMISSION RATE SAMPLE CALCULATIONS

Oxides of nitrogen emission rates were determined using the following equation:

$$\text{lb/hr } NO_x = \frac{(60)(46)(Q_{sd})(ppm)}{(10^6)(385.3)}$$

Where:

Q_{sd}	=	Volumetric Flow Rate of Stack Gas; Dry Standard Cubic feet per minute; DSCF/min
46	=	Molecular Weight of Nitrogen Dioxide; g/gmol
385.3	=	Conversion Factor; g/gmol-lb/ft^3
ppm	=	Concentration of NO_x Stack Emissions
60	=	Conversion Factor; 60 Minutes in One Hour
10^6	=	Conversion Factor; part per million

EXAMPLE CALCULATIONS

Data :			
	Run 1	NO_x = 473.47 ppm	Q_{sd} = 334.112
	Run 2	NO_x = 622.42 ppm	Q_{sd} = 318.745
	Run 3	NO_x = 294.25 ppm	Q_{sd} = 330.569

Thus:

Run 1: lb/Hr NO_x = $\frac{(60)(46)(473.47)(334.112)}{(10^6)(385.3)}$ = 1.133

Run 2: lb/Hr NO_x = $\frac{(60)(46)(622.42)(318.745)}{(10^6)(385.3)}$ = 1.421

Run 3: lb/Hr NO_x = $\frac{(60)(46)(294.25)(330.569)}{(10^6)(385.3)}$ = 0.697

METHOD 7E
OXIDES OF NITROGEN

CLIENT LIG PROJECT NUMBER 3907022000

SOURCE #3-88 LOAD % MAX RUN NUMBER 1

DATE Sept. 5, 1989 ANALYST [signature]

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N2	0.00	0.03	0.03	3.1	0.3
Low	598.6	5.85				
Mid	598.6	5.84	598.5	5.75	589.3	-0.9
High	937.7	9.15	937.7	9.03	925.4	-1.2

Bias

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 102.48307 y intercept 0.026 Span Range 1024.8567

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 12:55 End 1:55 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	3.36	11	3.74	21	5.05
2	3.41	12	3.44	22	6.74
3	3.38	13	3.24	23	6.13
4	3.25	14	3.84	24	8.09
5	3.27	15	3.10	25	8.16
6	3.19	16	2.92	26	7.74
7	2.97	17	3.04	27	5.20
8	3.18	18	3.02	28	8.90
9	3.36	19	3.41	29	8.61
10	3.06	20	4.57	30	8.12

Average Volts 4.6197

Average Concentration 473.467 ppm

[signature]

METHOD 7E
OXIDES OF NITROGEN

CLIENT LA INTRASTATE PROJECT NUMBER 3907022000

SOURCE #3-88 LOAD % MAX RUN NUMBER 2

DATE 9-5-89 ANALYST M. CALAMIA

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N_2	0.03	0.63	0.01	4.80	0.4
Low	598.6					
Mid	598.6	5.75	596.9	5.66	587.5	-0.9
High	937.7	9.03	938.8	8.88	923.2	-1.5

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 104.241 y intercept -2.50 Span Range 1039.91

$$\% \text{ Drift} = \frac{\text{Final Responce} - \text{Initial Responce}}{\text{Span}} \times 100$$

TEST DATA

Time: Start 2:40 End 3:40 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	7.03	11	8.44	21	5.95
2	9.30	12	7.74	22	4.74
3	8.56	13	7.00	23	4.03
4	7.80	14	6.89	24	3.38
5	7.93	15	5.82	25	2.99
6	7.74	16	5.59	26	3.38
7	8.72	17	5.28	27	3.36
8	6.54	18	5.22	28	3.42
9	7.60	19	5.63	29	3.53
10	7.99	20	5.69	30	3.57

Average Volts 5.995

Average Concentration 622.421 ppm

Robert Pearson

METHOD 7E
OXIDES OF NITROGEN

CLIENT LA. INTRASTATE PROJECT NUMBER 3907022000

SOURCE ~~#3~~ - 88 LOAD % MAX. RUN NUMBER 3

DATE 9-5-89 ANALYST M. CALAMIA

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N_2	0.01	0.86	0.05	-1.27	-0.2
Low	598.6					
Mid	598.6	5.66	596.2	5.71	601.6	0.5
High	937.7	8.88	939.2	8.96	947.7	0.8

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 106.508 y intercept -6.59 Span Range 1058.49

$$\% \text{ Drift} = \frac{\text{Final Responce} - \text{Initial Responce}}{\text{Span}} \times 100$$

TEST DATA

Time: Start 3:48 End 4:48 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	2.90	11	3.10	21	2.62
2	3.05	12	2.98	22	2.52
3	2.95	13	2.92	23	2.75
4	2.99	14	2.69	24	2.69
5	2.87	15	2.60	25	2.70
6	3.06	16	2.72	26	2.73
7	2.91	17	2.46	27	2.74
8	2.96	18	2.86	28	2.73
9	3.22	19	2.69	29	2.79
10	3.06	20	2.63	30	2.85

Average Volts 2.8246

Average Concentration 294.249 ppm

Robert Freeman

CARBON MONOXIDE CONCENTRATION CORRECTION FOR DILUTENT CO_2

$C_{co\ stack}$ - Concentration of CO in Stack, Dry Basis; ppm

$C_{co\ ndir}$ - Concentration of CO Measured by NDIR Analyzer, Dry Basis; ppm

F_{co2} - Volume Fraction of CO_2 in Stack Gas Sample, Orsat Analysis; % CO_2 Divided By 100

$$C_{co\ stack} = C_{co\ ndir}\ (1 - F_{co2})$$

EXAMPLE CALCULATIONS

Data:

RUN 1: $C_{co\ ndir} = 321.91$ $F_{co2} = 0.097$

RUN 2: $C_{co\ ndir} = 336.92$ $F_{co2} = 0.090$

RUN 3: $C_{co\ ndir} = 318.56$ $F_{co2} = 0.099$

Thus:

RUN 1: $C_{co\ stack} = (321.91)(1 - 0.097) = 290.68$

RUN 2: $C_{co\ stack} = (336.92)(1 - 0.090) = 306.60$

RUN 3: $C_{co\ stack} = (318.56)(1 - 0.099) = 287.02$

CARBON MONOXIDE EMISSION RATE SAMPLE CALCULATIONS

Carbon monoxide emission rates were determined using the following relation:

$$\text{lb/hr CO} = \frac{(60)(28)(Q_{sd})(\text{ppm})}{(10^6)(385.3)}$$

Where:

Q_{sd}	=	Volumetric Flow Rate of Stack Gas; Dry Standard Cubic feet per minute; DSCF/min
28	=	Molecular Weight of Carbon Monoxide; g/gmol
385.3	=	Conversion Factor; g/gmol-lb/ft^3
ppm	=	Concentration of CO Stack Emissions; Corrected to % Carbon Dioxide; ppm
60	=	Conversion Factor; 60 Minutes in One Hour
10^6	=	Conversion Factor; part per million

EXAMPLE CALCULATIONS

Data :	Run 1	CO = 290.68 ppm	Q_{sd} = 334.112
	Run 2	CO = 306.60 ppm	Q_{sd} = 318.745
	Run 3	CO = 287.02 ppm	Q_{sd} = 330.569

Thus:

Run 1: lb/Hr CO = $\frac{(60)(28)(290.68)(334.112)}{(10^6)(385.3)}$ = 0.423

Run 2: lb/Hr CO = $\frac{(60)(28)(306.60)(318.745)}{(10^6)(385.3)}$ = 0.426

Run 3: lb/Hr CO = $\frac{(60)(28)(287.02)(330.569)}{(10^6)(385.3)}$ = 0.414

METHOD 10
CARBON MONOXIDE

CLIENT LA INTRA STATE PROJECT NUMBER 3907022000

SOURCE #3-88 LOAD % MAX RUN NUMBER 1

DATE Sept. 5, 1989 ANALYST [signature]

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N2	.026	0.36	0.0.25	-0.24	-0.1
Low	89.61	.174	89.15	.170	86.75	-0.4
Mid	Bias	0.0		0.0		0.0
High	401.0	.694	401.1	.686	396.3	-0.8

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 599.9137 y intercept -15.238 Span Range 584.676

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 12:55 End 1:55 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	.536	11	.552	21	.578
2	.544	12	.547	22	.592
3	.532	13	.536	23	.603
4	.544	14	.535	24	.605
5	.538	15	.534	25	.607
6	.532	16	.525	26	.614
7	.543	17	.535	27	.578
8	.536	18	.538	28	.648
9	.537	19	.538	29	.639
10	.534	20	.551	30	.615

Average Volts .562

Average Concentration ~~.5~~ 321.914 ppm

[signature]

METHOD 10
CARBON MONOXIDE

CLIENT LA INTRASTATE PROJECT NUMBER 39090 22000

SOURCE #3-88 LOAD % MAX RUN NUMBER 2

DATE 9-5-89 ANALYST M CALAMIA

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N_2	.025	0.78	.022	-1.04	-0.3
Low	89.61	.170	88.62	.160	82.56	-1.0
Mid						
High	401.0	.696	401.22	.670	391.52	-1.6

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 605.814 y intercept -14.37 Span Range 591.444

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 2:40 End 3:40 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	.612	11	.611	21	.569
2	.632	12	.614	22	.564
3	.602	13	.599	23	.559
4	.610	14	.588	24	.544
5	.596	15	.566	25	~~[illegible]~~ 541
6	.618	16	.567	26	~~[illegible]~~ 535
7	.613	17	.566	27	.548
8	.614	18	.573	28	.540
9	.611	19	.569	29	.533
10	.611	20	.558	30	.533

Average Volts .57998

Average Concentration 336.923

Robert Freeman

METHOD 10
CARBON MONOXIDE

CLIENT LA. INTRA STATE PROJECT NUMBER 3907022000

SOURCE #3-88 LOAD % MAX. RUN NUMBER 3

DATE 9-5-89 ANALYST M. CALAMIA

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	ppm	volts	ppm	volts	ppm	
Zero	N_2	.022	1.99	.017	-1.09	-0.5
Low	89.61	.160	87.08	.155	83.99	-0.5
Mid						
High	401.0	.670	401.5	.666	399.1	-0.4

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope 616.59 y intercept -11.57 Span Range 605.01

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 3:48 End 4:48 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	.538	11	.538	21	.537
2	.539	12	.542	22	.523
3	.532	13	.533	23	.542
4	.528	14	.535	24	.537
5	.540	15	.539	25	.533
6	.543	16	.538	26	.547
7	.534	17	.530	27	.536
8	.539	18	.528	28	.539
9	.531	19	.532	29	.525
10	.538	20	.538	30	.548

Average Volts .5359

Average Concentration 318.855 ppm

Robert Freeman

METHOD 3A
OXYGEN

CLIENT LA INTRASTATE PROJECT NUMBER 3907022000

SOURCE #3-88 LOAD % MAX RUN NUMBER 1

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	%	volts	%	volts	%	
Zero	N_2		0.0		0.0	0.0
Mid						
High	AIR		20.9		20.9	0.0

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope _____ y intercept _____ Span Range _____

% Drift = $\frac{\text{Final Responce - Initial Responce}}{\text{Span}}$ X 100

TEST DATA

Time: Start 12:55 End 1:55 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	7.6	11	7.6	21	7.6
2	7.6	12	7.6	22	7.6
3	7.6	13	7.6	23	7.6
4	7.6	14	7.6	24	7.6
5	7.6	15	7.6	25	7.6
6	7.6	16	7.6	26	7.6
7	7.6	17	7.6	27	7.6
8	7.6	18	7.6	28	7.5
9	7.6	19	7.6	29	7.5
10	7.6	20	7.6	30	7.5

Average Volts _____

Average Concentration 7.59 %

Comments

METHOD 3A
OXYGEN

CLIENT LA. INTRASTATE PROJECT NUMBER 3907022000

SOURCE #3-88 LOAD % MAX RUN NUMBER 2

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	%	volts	%	volts	%	
Zero	N_2		0.0		0.0	0.0
Mid						
High	AIR		20.9		20.9	0.0

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope _____ y intercept _____ Span Range _____

$$\% \text{ Drift} = \frac{\text{Final Responce} - \text{Initial Responce}}{\text{Span}} \times 100$$

TEST DATA

Time: Start 2:40 End 3:40 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	7.9	11	7.5	21	7.5
2	7.9	12	7.5	22	7.6
3	7.5	13	7.5	23	7.6
4	7.5	14	7.5	24	7.7
5	7.5	15	7.5	25	7.7
6	7.5	16	7.5	26	7.6
7	7.5	17	7.6	27	7.7
8	7.7	18	7.5	28	7.7
9	7.5	19	7.5	29	7.7
10	7.5	20	7.5	30	7.7

Average Volts _____

Average Concentration 7.59

Comments

Robert Pierson

METHOD 3A
OXYGEN

CLIENT LA. INTRASTATE PROJECT NUMBER 3907022000

SOURCE #3-88 LOAD % MAX. RUN NUMBER 3

INSTRUMENT CALIBRATION STATISTICS

	Cylindar Value	Initial Analyzer Responce		Final Analyzer Responce		% Drift
	%	volts	%	volts	%	
Zero	N_2		0.0		0.0	0.0
Mid						
High	AIR		20.9		20.9	0.0

Linear Regression Curve: ppm = (responce volts)(slope) + y intercept

Slope _____ y intercept _____ Span Range _____

$$\% \text{ Drift} = \frac{\text{Final Responce} - \text{Initial Responce}}{\text{Span}} \times 100$$

TEST DATA

Time: Start 3:48 End 4:48 Minutes per Point 2

Test Point	Volts	Test Point	Volts	Test Point	Volts
1	7.4	11	7.5	21	7.5
2	7.5	12	7.5	22	7.5
3	7.5	13	7.5	23	7.5
4	7.5	14	7.5	24	7.5
5	7.5	15	7.5	25	7.5
6	7.5	16	7.5	26	7.5
7	7.5	17	7.5	27	7.5
8	7.5	18	7.5	28	7.5
9	7.5	19	7.5	29	7.5
10	7.5	20	7.5	30	7.5

Average Volts _____

Average Concentration 7.4966 %

Comments

Robert Pressman

METHODS 1-4 SAMPLE CALCULATIONS

MOISTURE CONTENT DETERMINATION

P_m	-	Absolute Pressure at Meter; in Hg
P_o	-	Average Orfice Meter Pressure; in H_2O
Ps	-	Standard Absolute Pressure; 29.92 in Hg
P_b	-	Barometric Pressure; in Hg
K	-	Constant; 0.04715 ft^3/g
T_m	-	Meter Box Temperature; °R
T_{std}	-	Standard Absolute Temperature; 528 °R
DGMC	-	Dry Gas Meter Calibration Factor
V_{lcg}	-	Volume of Water Condensate Collected in Impingers; g
B_{ws}	-	Moisture Fraction Content
V_m	-	Volume of Gas Sampled; scf
V_{mstd}	-	Volume of Gas Sampled at the Meter; Corrected to Standard Conditions; dscf
V_{wstd}	-	Volume of Water Vapor in the Gas Sample; Standard Conditions; scf
B_{wd}	-	Moisture Content; percent

EXAMPLE CALCULATION: RUN 1

Data:

P_b	=	30.01
V_m	=	22.076
V_{lcg}	=	29.4
T_m	=	574.50
P_o	=	1.50
DGMC	=	0.9904

$$Pm = \frac{Po}{13.6} + Pb = \frac{(1.50)}{13.6} + (30.01) = 30.12$$

$$Vmstd = \frac{(Vm)(DGMC)(Pm)(Tstd)}{(Ps)\ (Tm)} = \frac{(22.076)(0.9904)(30.12)(528)}{(29.92)\ (574.50)} = 20.229$$

$$Vwstd = (K)\ (Vlcg) = (0.04715)\ (29.4) = 1.386$$

$$Bws = \frac{(Vwstd)}{(Vmstd) + (Vwstd)} = \frac{(1.386)}{(20.229) + (1.386)} = 0.0640$$

$$Bwd = (Bws) \times 100 = (0.0640) \times 100 = 6.40$$

DRY GAS MOLECULAR WEIGHT DETERMINATION

M_d	-	Molecular Weight of Stack Gas, Dry Basis; lb/lb-mole
M_s	-	Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
B_{ws}	-	Stack Gas Moisture Fraction
% CO_2	-	Percent CO_2 by Volume; Dry Basis
% CO	-	Percent CO by Volume; Dry Basis
% O_2	-	Percent O_2 by Volume; Dry Basis
0.32	-	Molecular Weight of Oxygen, Divided by 100; 0.32
0.28	-	Molecular Weight of Nitrogen, Divided by 100; 0.28
0.28	-	Molecular Weight of Carbon Monoxide, Divided by 100; 0.28
0.44	-	Molecular Weight of Carbon Dioxide, Divided by 100; 0.44
18.0	-	Molecular Weight of Water; lb/lb-mole

$$M_d = (0.44)(\%CO_2) + (0.32)(\%O_2) + (0.28)(\%N_2 + \%CO)$$

$$M_s = (M_d)(1-B_{ws}) + (18.0)(B_{ws})$$

EXAMPLE CALCULATION: RUN 1

Data:			
	B_{ws}	=	0.0640
	% CO	=	0.0
	% O_2	=	8.0
	% N_2	=	82.3
	% CO_2	=	9.7

$$M_d = (0.44)(9.7) + (0.32)(8.0) + (0.28)(82.3 + 0.0) = 29.872$$

$$M_s = (29.872)(1 - 0.0640) + (18.0)(0.0640) = 29.112$$

STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

C_p - Pitot Tube Coefficient
V_s - Stack Gas Velocity, Dry Standard Conditions; ft/s
Q_{sd} - Volumetric Flow Rate, Dry Standard Conditions; DSCF/min
B_{ws} - Moisture Fraction
D_p - Velocity Head of Stack Gas, Avg. Sq. Root; $(\text{in } H_2O)^{0.5}$
P_b - Barometric Pressure; in Hg
K_p - Pitot Tube Constant; 85.49 $\frac{(\text{ft})(\text{lb/lb-mole})(\text{in Hg})^{0.5}}{(\text{s})(\text{deg R})(\text{in } H_2O)}$

T_s - Absolute Stack Gas Temperature; °R
M_s - Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
Sp - Static Pressure of Stack Gas; in H_2O
528 - Standard Absolute Temperature; °R
CSA - Stack Cross-sectional Area; ft^2
P_s - Absolute Stack Gas Pressure; in Hg
60 - Conversion Factor; sec/min
Pi - Constant; 3.14
D - Diameter of Stack; in

$$Ps = \frac{Sp}{13.6} + Pb$$

$$Vs = (85.49)\ (Cp)\ (Dp)\ \left(\frac{Ts}{(Ms)\ (Ps)}\right)^{0.5}$$

$$CSA = \frac{(Pi)\ (D)^2}{(4)(144)}$$

$$Qsd = (60)\ (1 - Bws)\ (CSA)\ (Vs)\ \left(\frac{528}{Ts}\ \frac{Ps}{29.92}\right)$$

EXAMPLE CALCULATION: RUN 1

Data:

M_s	= 29.112	P_b	= 30.01
C_p	= 0.85	D_p	= 1.7515
T_s	= 1267.00	S_p	= 0.575
D	= 4.125		

$$Ps = \frac{(0.575)}{13.6} + 30.01 = 30.05$$

$$Vs = (85.49)(0.85)(1.7515)\left(\frac{1267.00}{(29.112)\ (30.05)}\right)^{0.5} = 153.170$$

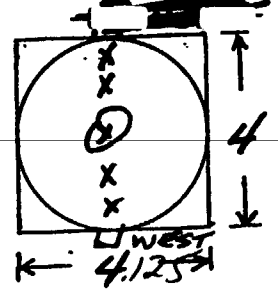
$$CSA = \frac{(3.14)\ (4.125)^2}{(4)\ (144)} = 0.0928$$

$$Qsd = (60)(1-0.0640)(0.0928)(153.170)\left(\frac{(528)\ (30.05)}{(1267.00)(29.92)}\right) = 334.112$$

HUNTER/ESE ENVIRONMENTAL SERVICES, INC.

STACK SAMPLING DATA SHEET

METHODS 1-4 N



STACK SCHEMATIC

CLIENT LZ G
LOCATION GARDEN CITY
SOURCE I.D. #3-88
PROJECT NO. 3907022000
DATE SEPT 5, 1989
RUN NUMBER 1
OPERATOR Schwartz

HOT BOX NO. Blue
COLD BOX NO. Green
CONSOLE NO. BR 4
PITOT NO. P-5-1
PITOT FACTOR 0.85
METER ΔH@ 1.811
D.G.M.C. FACTOR 0.9904

STACK DIAMETER, in 4.125
NOZZLE DIAMETER, in N/A
FILTER NO. N/A
AMBIENT TEMP. 94
BAROMETRIC PRESSURE 30.01
K FACTOR N/A

Port and Traverse Point No	Clock Time (24-hr)	Gas Meter Reading (ft³)	Velocity Head (" H_2O) ΔP	Velocity Head (" H_2O) √ΔP	Orifice Pressure Differential (" H_2O) Calc.	Orifice Pressure Differential (" H_2O) Actual	Stack Gas Temperature (°F)	Sample Train Temperatures (°F) Sample Box	Sample Train Temperatures (°F) Dry Gas Meter	Sample Train Temperatures (°F) Last Impinger	Vacuum (" Hg)	Total or Static Pressure (" H_2O)
1	[illegible]	707.223	2.85	1.688		1.5	818		114	61	4	
2	[illegible]	712.743	2.95	1.716		1.5	768		113	62	4	0.55
3	13:16	717.942	2.90	1.703		1.5	847		115	62	4 *	0.60
4	13:24	729.299	3.60	1.897		1.5	795		116	[illegible]	4	
[illegible]	13:32	↓										
	32	22.076		1.7515		1.5	807.0 / 604.0		114.5 / 574.5			0.575

	FINAL WEIGHTS	INITIAL WEIGHTS	WEIGHT GAINED
FIRST IMPINGER	624.5	603.2	21.3
SECOND IMPINGER	595.4	592.5	2.9
THIRD IMPINGER	488.7	488.0	0.7
SILICA GEL	656.0	651.5	4.5
TOTAL CONDENSATE			29.4

FLUE GAS ANALYSIS

TRIAL	O_2	CO_2	CO
1	8.0	9.7	0.0
2			
3			
AVG	8.0	9.7	0.0

COMMENTS Pretest Leak check @ 8" Hg w/ 0.001 CFM

Post Test Leak check @ 9" Hg 0.0015 CFM

* ADDED ICE

METHODS 1-4 SAMPLE CALCULATIONS

MOISTURE CONTENT DETERMINATION

P_m	-	Absolute Pressure at Meter; in Hg
P_o	-	Average Orfice Meter Pressure; in H_2O
P_s	-	Standard Absolute Pressure, 29.92 in Hg
P_b	-	Barometric Pressure; in Hg
K	-	Constant; 0.04715 ft^3/g
T_m	-	Meter Box Temperature; °R
T_{std}	-	Standard Absolute Temperature; 528 °R
DGMC	-	Dry Gas Meter Calibration Factor
V_{lcg}	-	Volume of Water Condensate Collected in Impingers; g
B_{ws}	-	Moisture Fraction Content
V_m	-	Volume of Gas Sampled; scf
V_{mstd}	-	Volume of Gas Sampled at the Meter; Corrected to Standard Conditions; dscf
V_{wstd}	-	Volume of Water Vapor in the Gas Sample, Standard Conditions; scf
B_{wd}	-	Moisture Content; percent

EXAMPLE CALCULATION: RUN 2

Data:

P_b	=	29.99
V_m	=	22.185
V_{lcg}	=	34.3
T_m	=	587.00
P_o	=	1.50
DGMC	=	0.9904

$$Pm = \frac{Po}{13.6} + Pb = \frac{(1.50)}{13.6} + (29.99) = 30.10$$

$$Vmstd = \frac{(Vm)(DGMC)(Pm)(Tstd)}{(Ps)\ (Tm)} = \frac{(22.185)(0.9904)(30.10)(528)}{(29.92)\ (587.00)} = 19.882$$

$$Vwstd = (K)\ (Vlcg) = (0.04715)\ (34.3) = 1.617$$

$$Bws = \frac{(Vwstd)}{(Vmstd) + (Vwstd)} = \frac{(1.617)}{(19.882) + (1.617)} = 0.0750$$

$$Bwd = (Bws) \times 100 = (0.0750) \times 100 = 7.50$$

DRY GAS MOLECULAR WEIGHT DETERMINATION

M_d	-	Molecular Weight of Stack Gas, Dry Basis; lb/lb-mole
M_s	-	Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
B_{ws}	-	Stack Gas Moisture Fraction
% CO_2	-	Percent CO_2 by Volume; Dry Basis
% CO	-	Percent CO by Volume; Dry Basis
% O_2	-	Percent O_2 by Volume; Dry Basis
0.32	-	Molecular Weight of Oxygen, Divided by 100; 0.32
0.28	-	Molecular Weight of Nitrogen, Divided by 100; 0.28
0.28	-	Molecular Weight of Carbon Monoxide, Divided by 100; 0.28
0.44	-	Molecular Weight of Carbon Dioxide, Divided by 100; 0.44
18.0	-	Molecular Weight of Water; lb/lb-mole

$$M_d = (0.44)(\%CO_2) + (0.32)(\%O_2) + (0.28)(\%N_2 + \%CO)$$

$$M_s = (M_d)(1-B_{ws}) + (18.0)(B_{ws})$$

EXAMPLE CALCULATION: RUN 2

Data:

B_{ws}	=	0.0750
% CO	=	0.0
% O_2	=	8.9
% N_2	=	82.1
% CO_2	=	9.0

$$M_d = (0.44)(9.0) + (0.32)(8.9) + (0.28)(82.1 + 0.0) = 29.796$$

$$M_s = (29.796)(1 - 0.0750) + (18.0)(0.0750) = 28.911$$

STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

C_p	-	Pitot Tube Coefficient
V_s	-	Stack Gas Velocity, Dry Standard Conditions; ft/s
Q_{sd}	-	Volumetric Flow Rate, Dry Standard Conditions; DSCF/min
B_{ws}	-	Moisture Fraction
D_p	-	Velocity Head of Stack Gas, Avg. Sq. Root; $(\text{in } H_2O)^{0.5}$
P_b	-	Barometric Pressure; in Hg
K_p	-	Pitot Tube Constant; 85.49 $\frac{(ft)(lb/lb\text{-}mole)(in\ Hg)^{0.5}}{(s)(deg\ R)(in\ H_2O)}$
T_s	-	Absolute Stack Gas Temperature; °R
M_s	-	Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
Sp	-	Static Pressure of Stack Gas; in H_2O
528	-	Standard Absolute Temperature; °R
CSA	-	Stack Cross-sectional Area; ft^2
P_s	-	Absolute Stack Gas Pressure; in Hg
60	-	Conversion Factor; sec/min
Pi	-	Constant; 3.14
D	-	Diameter of Stack; in

$$Ps = \frac{Sp}{13.6} + Pb$$

$$Vs = (85.49)\ (Cp)\ (Dp)\ \left(\frac{Ts}{(Ms)\ (Ps)}\right)^{0.5}$$

$$CSA = \frac{(Pi)\ (D)^2}{(4)(144)}$$

$$Qsd = (60)\ (1 - Bws)\ (CSA)\ (Vs)\ \left(\frac{528}{(Ts)}\ \frac{(Ps)}{(29.92)}\right)$$

EXAMPLE CALCULATION: RUN 2

Data:

M_s	= 28.911	P_b	= 29.99
C_p	= 0.85	D_p	= 1.6852
T_s	= 1266.50	S_p	= 0.608
D	= 4.125		

$$Ps = \frac{(0.608)}{13.6} + 29.99 = 30.03$$

$$Vs = (85.49)(0.85)(1.6852)\left(\frac{1266.50}{(28.911)\ (30.03)}\right)^{0.5} = 147.904$$

$$CSA = \frac{(3.14)\ (4.125)^2}{(4)\ (144)} = 0.0928$$

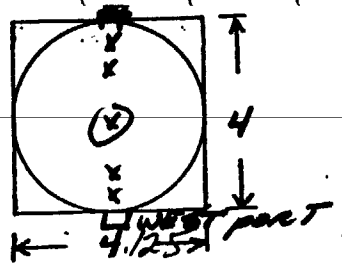
$$Qsd = (60)(1-0.0750)(0.0928)(147.904)\left(\frac{(528)\ (30.03)}{(1266.50)(29.92)}\right) = 318.745$$

HUNTER/ESE
ENVIRONMENTAL SERVICES, INC.

STACK SAMPLING DATA SHEET

METHODS 1-4

← N



STACK SCHEMATIC

CLIENT LIG
LOCATION Garden City
SOURCE I.D. #3-88
PROJECT NO. 3907022000
DATE Sept 5, 1989
RUN NUMBER 2
OPERATOR [illegible]

HOT BOX NO. Blue
COLD BOX NO. Green
CONSOLE NO. BR 4
PITOT NO. P5-1
PITOT FACTOR 0.85
METER ΔH@ 1.811
G.M.C. FACTOR 0.9904

STACK DIAMETER, in 4.125
NOZZLE DIAMETER, in N/A
FILTER NO. N/A
AMBIENT TEMP. 96
BAROMETRIC PRESSURE 29.99
K FACTOR N/A

Port and Traverse Point No	Clock Time (24-hr)	Gas Meter Reading (ft³)	Velocity Head ("H₂O) ΔP	Velocity Head ("H₂O) √ΔP	Orifice Pressure Differential ("H₂O) Calc.	Orifice Pressure Differential ("H₂O) Actual	Stack Gas Temperature (°F)	Sample Train Temperatures (°F) Sample Box	Sample Train Temperatures (°F) Dry Gas Meter	Sample Train Temperatures (°F) Last Impinger	Vacuum ("Hg)	Total or Static Pressure ("H₂O)
1	14:56	729.670	2.850	1.6882		1.5	820		129	64	6	
2	15:04	734.904	2.795	1.6718		1.5	843		127	65	6	0.585
3	15:12	740.020	2.815	1.6778		1.5	765		125	65	6	0.630
4	15:20	751.855	2.900	1.7039		1.5	798		127	66	6	
~~8~~ 10	15:28	↓										
	32	22,185		~~1.6852~~ 1.6852		1.5	806.5 / 1266.5		127.0 / 587.0			+ 0.6075

	FINAL WEIGHTS	INITIAL WEIGHTS	WEIGHT GAINED
FIRST IMPINGER	648.8	624.5	24.3
SECOND IMPINGER	601.0	595.4	5.6
THIRD IMPINGER	490.5	490.0	.5
SILICA GEL	654.7	650.8	3.9
TOTAL CONDENSATE			34.3

FLUE GAS ANALYSIS

TRIAL	O_2	CO_2	CO
1	8.9	9.0	0.0
2			
3			
AVG	8.9	9.0	0.0

COMMENTS Pre Test Leak ✓ Good at 0.001 CFM @ 9" Hg

Post Test Leak ✓ Good @ 0.000 CFM 10" Hg

METHODS 1-4 SAMPLE CALCULATIONS

MOISTURE CONTENT DETERMINATION

P_m	-	Absolute Pressure at Meter; in Hg
P_o	-	Average Orfice Meter Pressure; in H_2O
P_s	-	Standard Absolute Pressure; 29.92 in Hg
P_b	-	Barometric Pressure; in Hg
K	-	Constant; 0.04715 ft^3/g
T_m	-	Meter Box Temperature; °R
T_{std}	-	Standard Absolute Temperature; 528 °R
DGMC	-	Dry Gas Meter Calibration Factor
V_{lcg}	-	Volume of Water Condensate Collected in Impingers; g
B_{ws}	-	Moisture Fraction Content
V_m	-	Volume of Gas Sampled; scf
V_{mstd}	-	Volume of Gas Sampled at the Meter; Corrected to Standard Conditions; dscf
V_{wstd}	-	Volume of Water Vapor in the Gas Sample, Standard Conditions; scf
B_{wd}	-	Moisture Content; percent

EXAMPLE CALCULATION: RUN 3

Data:

P_b	=	29.90
V_m	=	21.455
V_{lcg}	=	27.4
T_m	=	567.80
P_o	=	1.50
DGMC	=	0.9904

$$Pm = \frac{Po}{13.6} + Pb = \frac{(1.50)}{13.6} + (29.90) = 30.01$$

$$Vmstd = \frac{(Vm)(DGMC)(Pm)(Tstd)}{(Ps)\ (Tm)} = \frac{(21.455)(0.9904)(30.01)(528)}{(29.92)\ (567.80)} = 19.819$$

$$Vwstd = (K)\ (Vlcg) = (0.04715)\ (27.4) = 1.292$$

$$Bws = \frac{(Vwstd)}{(Vmstd) + (Vwstd)} = \frac{(1.292)}{(19.819) + (1.292)} = 0.0610$$

$$Bwd = (Bws) \times 100 = (0.0610) \times 100 = 6.10$$

DRY GAS MOLECULAR WEIGHT DETERMINATION

M_d	-	Molecular Weight of Stack Gas, Dry Basis; lb/lb-mole
M_s	-	Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
B_{ws}	-	Stack Gas Moisture Fraction
% CO_2	-	Percent CO_2 by Volume; Dry Basis
% CO	-	Percent CO by Volume; Dry Basis
% O_2	-	Percent O_2 by Volume; Dry Basis
0.32	-	Molecular Weight of Oxygen, Divided by 100; 0.32
0.28	-	Molecular Weight of Nitrogen, Divided by 100; 0.28
0.28	-	Molecular Weight of Carbon Monoxide, Divided by 100; 0.28
0.44	-	Molecular Weight of Carbon Dioxide, Divided by 100; 0.44
18.0	-	Molecular Weight of Water; lb/lb-mole

$$M_d = (0.44)(\%CO_2) + (0.32)(\%O_2) + (0.28)(\%N_2 + \%CO)$$

$$M_s = (M_d)(1-B_{ws}) + (18.0)(B_{ws})$$

EXAMPLE CALCULATION: RUN 3

Data:

B_{ws}	=	0.0610
% CO	=	0.0
% O_2	=	7.6
% N_2	=	82.5
% CO_2	=	9.9

$$M_d = (0.44)(9.9) + (0.32)(7.6) + (0.28)(82.5 + 0.0) = 29.888$$

$$M_s = (29.888)(1 - 0.0610) + (18.0)(0.0610) = 29.160$$

STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

C_p	-	Pitot Tube Coefficient
V_s	-	Stack Gas Velocity, Dry Standard Conditions; ft/s
Q_{sd}	-	Volumetric Flow Rate, Dry Standard Conditions; DSCF/min
B_{ws}	-	Moisture Fraction
D_p	-	Velocity Head of Stack Gas, Avg. Sq. Root; $(\text{in } H_2O)^{0.5}$
P_b	-	Barometric Pressure; in Hg
K_p	-	Pitot Tube Constant; 85.49 $\frac{(\text{ft})(\text{lb/lb-mole})(\text{in Hg})^{0.5}}{(\text{s})(\text{deg R})(\text{in } H_2O)}$
T_s	-	Absolute Stack Gas Temperature; °R
M_s	-	Molecular Weight of Stack Gas, Wet Basis; lb/lb-mole
Sp	-	Static Pressure of Stack Gas; in H_2O
528	-	Standard Absolute Temperature; °R
CSA	-	Stack Cross-sectional Area; ft^2
P_s	-	Absolute Stack Gas Pressure; in Hg
60	-	Conversion Factor; sec/min
Pi	-	Constant; 3.14
D	-	Diameter of Stack; in

$$Ps = \frac{Sp}{13.6} + Pb$$

$$Vs = (85.49)\ (Cp)\ (Dp) \left(\frac{Ts}{(Ms)\ (Ps)}\right)^{0.5}$$

$$CSA = \frac{(Pi)\ (D)^2}{(4)(144)}$$

$$Qsd = (60)\ (1 - Bws)\ (CSA)\ (Vs) \left(\frac{528}{(Ts)}\ \frac{Ps}{(29.92)}\right)$$

SAMPLE CALCULATION: RUN 3

Data:

M_s	= 29.160	P_b	= 29.90
C_p	= 0.85	D_p	= 1.7145
T_s	= 1241.00	S_p	= 0.603
D	= 4.125		

$$Ps = \frac{(0.603)}{13.6} + 29.90 = 29.94$$

$$Vs = (85.49)(0.85)(1.7145)\left(\frac{1241.00}{(29.160)\ (29.94)}\right)^{0.5} = 148.538$$

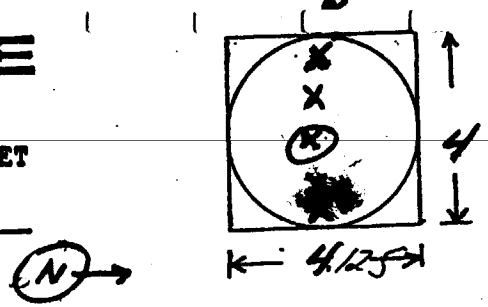
$$CSA = \frac{(3.14)\ (4.125)^2}{(4)\ (144)} = 0.0928$$

$$Qsd = (60)(1-0.0610)(0.0928)(148.538)\left(\frac{(528)\ (29.94)}{(1241.00)(29.92)}\right) = 330.569$$

HUNTER/ESE ENVIRONMENTAL SERVICES, INC.

STACK SAMPLING DATA SHEET

METHODS 1-4



STACK SCHEMATIC

CLIENT Lag
LOCATION Garden City
SOURCE I.D. 33
PROJECT NO. 3907022000
DATE Sept 5, 1987
RUN NUMBER 3
OPERATOR [illegible]

HOT BOX NO. 3
COLD BOX NO. Green
CONSOLE NO. BQ-4
PITOT NO. RS-1
PITOT FACTOR 0.85
METER ΔH@ 1.811
D.G.M.C. FACTOR 0.9904

STACK DIAMETER, in 4.125
NOZZLE DIAMETER, in N/A
FILTER NO. N/A
AMBIENT TEMP. 94°F
BAROMETRIC PRESSURE 29.90
K FACTOR N/A

Port and Traverse Point No	Clock Time (24-hr)	Gas Meter Reading (ft³)	Velocity Head ("H₂O) ΔP	Velocity Head ("H₂O) √ΔP	Orifice Pressure Differential ("H₂O) Calc.	Orifice Pressure Differential ("H₂O) Actual	Stack Gas Temperature (°F)	Sample Train Temperatures (°F) Sample Box	Sample Train Temperatures (°F) Dry Gas Meter	Sample Train Temperatures (°F) Last Impinger	Vacuum ("Hg)	Total or Static Pressure ("H₂O)
1	15:53	752.3[illegible]	2.850	1.6882		1.5	790		108	62	5	–
2	16:01	757.545	3.080	1.7464		1.5	803		109	61	5	0.610
3	16:09	76[illegible]90	2.960	1.7205		1.5	797		107	61	5	0.575
4	16[illegible]	773.8095	2.900	1.7029		1.5	794		107	63	5	–
	16:25											
32		21.455		1.7145		1.5	781.0 1241.0		107.8 567.8			0.603

	FINAL WEIGHTS	INITIAL WEIGHTS	WEIGHT GAINED
FIRST IMPINGER	669.9	648.8	21.1
SECOND IMPINGER	603.7	601.0	2.7
THIRD IMPINGER	491.0	490.5	0.5
SILICA GEL	643.2	640.1	3.1
TOTAL CONDENSATE			27.4

FLUE GAS ANALYSIS			
TRIAL	O_2	CO_2	CO
1			
2			
3			
AVG	7.6	9.9	0.0

COMMENTS Pretest Leak @ 6000 @ 10" Hg 0.001 CFM

Post Test Leak @ 6000 @ 9" Hg 0.000 CFM

APPENDIX D -- OPERATIONAL DATA AND FUEL GAS ANALYSIS

LIGC - Exxon Garden City Compressor Station Date: 9-6-89 Stack Emmissions Testing

Stack # 1-88 Compressor # R-1046

Test Run	Time	Engine RPM	Manifold Pressure PSIA	Manifold Temp. F°	Suction Pressure PSIG	Suction Differential " H_2O	Suction Temp. F°	Flow Rate MMCFD	Discharge Pressure PSIG	Fuel Gas Header PSIG	Fuel Gas Consump. converted volume
	8:10 A.M.	1195	26.0	95	561	57	81	24.483	1005	34	PS#3
	8:25	1194	26.0	95	564	58	81	24.812	1005	34	
Engine Down	8:39	000	—	—	—	—	—	—	—		
	9:05	1197	26.0	96	559	58	81	25.487	1010	34	
	9:20	1199	26.0	97	569	54	81	24.265	1009	34	S342.3 ft
	9:35	1197	26.0	97	567	54	81	23.939	1009	34	

Preliminary Test Run

RECEIVED OCT 23 1989

By LIGC
M. Leger
R. Gillette
R. Bianssard
R. Frederick

Energy Industries
Don Wright

Run #1
Engine Timing 20° BTC
Clearance Pockets Front out 2 1/4"
Back out 1 1/4"

D-1

LIGC - Exxon Garden City Compressor Station Date: 9-6-89 Stack Emmissions Testing

Stack # 1-88 Compressor # R 1046

Test Run	Time	Engine RPM	Manifold Pressure PSIA	Manifold Temp. F°	Suction Pressure PSIG	Suction Differential " H_2O	Suction Temp F°	Flow Rate MMCFD	Discharge Pressure PSIG	Fuel Gas Header PSIG	Fuel Gas Consump. Converted Volume
#1											PSC#3
	10:50 A.M.	1195	25.5	101	570	49	81	22.804	1006	34	
	11:05	1197	25.5	101	570	50	81	23.139	1006	34	
	11:20	1198	25.5	101	570	50	81	23.139	1006	34	
	11:35	1196	25.5	101	570	50	81	23.139	1006	34	
	11:50	1196	25.5	101	570	49	81	22.906	1005	34	42185 A
AVG	1196.4										
	885										

By LIGC
M. Leger
R. Guillotte
R. Broussard
R. Frederick

Energy Industries
Don Wright

Run #2
Engine Timing 20° BTC

Clearance Pockets Front out 3½"
Back out 3½"

% Oxygen Setting on Exhaust 4.8%

LIGC - Exxon Garden City Compressor Station Date: 9-6-89 Stack Emmissions Testing

Stack # 1-88 Compressor # R-1046

Test Run	Time	Engine RPM	Manifold Pressure PSIA	Manifold Temp. F°	Suction Pressure PSIG	Suction Differential " H_2O	Suction Temp F°	Flow Rate MMCFD	Discharge Pressure PSIG	Fuel Gas Header PSIG	Fuel Gas Consump. Converted Volume
											PSC #3
#2	12:10PM	1199	25.5	102	580	53	81	24.364	1005	34	
	12:25	1198	25.5	102	571	50	81	23.455	1005	34	
	12:40	1199	25.5	102	572	50	81	23.349	1005	34	
	12.55	1198	25.5	102	574	50	81	23.349	1005	34	
	1:10	1200	25.5	102	573	50	81	23.349	1005	34	4381.44
AVG.	#	1198.8									
		885									

By: LIGC
M. Leger
R. Guillotte
R. Bronsard

Energy Industries
Dan Wright

Run # 3
Engine Timing 20° BTC

Clearance Pockets Front 3 1/2"
Back 3 1/2"

% Oxygen Setting on Exhaust 4.5%

D-3

LIGC - Exxon Garden City Compressor Station Date: 9-6-89 Stack Emmissions Testing

Stack # 1-88 Compressor # R-1046

Test Run	Time	Engine RPM	Manifold Pressure PSIA	Manifold Temp. F°	Suction Pressure PSIG	Suction Differential " H_2O	Suction Temp. F°	Flow Rate MMCFD	Discharge Pressure PSIG	Fuel Gas Header PSIG	Fuel Gas Consump. Converted Volume
#3											PSC #3
	1:15 PM	1197	25.5	102	570	50	81	23.245	1005	34	
	1:30	1197	25.5	102	570	49	81	23.011	1005	34	
	1:45	1197	25.5	102	570	49	81	23.011	1005	34	
	2:00	1199	25.5	102	575	50	81	23.245	1005	34	
	2:15	1200	25.3	102	575	51	81	23.476	1005	34	4299.944
	AVG:	1198									
		888									

By: LIGC
M. Leger
R. Guillotte
R. Boudreaux

Energy Industries
Don Wright

Run #4
Engine Timing 23° BTC

Clearance Packers Front 3 1/2"
Back 3 1/2"

% Oxygen on Exhaust 4.5%

Fuel Gas LIG-Exxon Gordon City Compressor Sta Stack # 1-88
DSS #3 Unit # R-1046
930 H.P.

ANALYSIS

DATE: 09/06/89 ANALYSIS TIME: 345 STREAM SEQUENCE: 11
TIME: 09:14 CYCLE TIME: 360 STREAM#: 2
ANALYZER#: 1912 MODE: RUN CYCLE START TIME: 09:08

COMP NAME	COMP CODE	GAL/MCF**	B.T.U.*	SP. GR.*
C 6 +	108	0.0174	2.02	0.0013
PROPANE	102	0.0026	0.24	0.0001
I-BUTANE	103	0.0017	0.16	0.0001
N-BUTANE	104	0.0019	0.20	0.0001
IPENTANE	105	0.0027	0.29	0.0002
NPENTANE	106	0.0015	0.16	0.0001
NITROGEN	114	0.0000	0.00	0.0036
METHANE	100	0.0000	963.13	0.5272
C O 2	117	0.0000	0.00	0.0261
ETHANE	101	0.7262	47.24	0.0277
TOTALS		0.7540	1013.44	0.5865

* @ 14.730 PSIA DRY & UNCORRECTED FOR COMPRESSIBILITY

** @ 15.025 & 60 DEG. F

COMPRESSIBILITY FACTOR (1/Z) = 1.0022
DRY B.T.U. @ 15.025 PSIA & 60 DEG. F CORRECTED FOR (1/Z) = 1036.0
SAT B.T.U. @ 15.025 PSIA & 60 DEG. F CORRECTED FOR (1/Z) = 1018.0
REAL SPECIFIC GRAVITY = 0.5875
UNNORMALIZED TOTAL = 99.75

ACTIVE ALARMS

NONE

LIGC - Exxon Garden City Compressor Station Date: 9-6-89 Stack Emmissions Testing

Stack # 2-88 Compressor # R432

Test Run	Time	Engine RPM	Manifold Pressure PSIA	Manifold Temp. F°	Suction Pressure PSIG	Suction Differential "H_2O	Suction Temp. F°	Flow Rate MMCFD	Discharge Pressure PSIG	Fuel Gas Header PSIG	Fuel Gas Consump. Converted Volume
Preliminary Test Run	2:50PM	1160	14.0	N/A	616	72	82	5.393	994	43	PS2#3
	3:05	1172	14.0	Not Available	616	74	82	5.468	994	43	
	3:20	1175	14.0		617	74	82	5.468	994	43	
	3:35	1172	14.0		617	74	82	5.468	994	43	
	3:50	1172	14.0		617	74	82	5.468	994	43	980.3 ft³

By LIGC
M. Leger
R. Guillotte
R. Broussard

Energy Industries
Dan Wright

Engine Timing 20° BTC

LIGC - Exxon Garden City Compressor Station Date: 9-6-89 Stack Emmissions Testing

Stack # 2-88 Compressor # R-432

Test Run	Time	Engine RPM	Manifold Pressure PSIA	Manifold Temp. F°	Suction Pressure PSIG	Suction Differential "H_2O	Suction Temp. F°	Flow Rate MMCFD	Discharge Pressure PSIG	Fuel Gas Header PSIG	Fuel Gas Consump. converted volume
#1											PS2#3
	4:05 PM	1162	14.0	N/A	617	72	82	5.393	994	43	
	4:20	1162	14.0		618	72	82	5.393	994	43	
	4:35	1162	14.0	Not Available	618	72	82	5.393	994	43	
	4:50	1162	14.0		619	74	82	5.468	994	43	
	5:05	1162	14.0		620	75	81	5.519	994	43	976.5 ft
	AVG	1162									
		886									

Engine Timing 20° BTC

By LIGC
M. Leger
R Guillotte
R. Broussard

Energy Industries
Dan Wright

LIGC - Exxon Garden City Compressor Station Date: 9-6-89 Stack Emmissions Testing

Stack # 2-88 Compressor # R-432

Test Run	Time	Engine RPM	Manifold Pressure PSIA	Manifold Temp. F°	Suction Pressure PSIG	Suction Differential " H_2O	Suction Temp. F°	Flow Rate MMCFD	Discharge Pressure PSIG	Fuel Gas Header PSIG	Fuel Gas Consump. Converted Volume
#2											PSC #3
	5:10 P.M.	1165	14.0	N/A	620	74	82	5.393	994	43	
	5:25	1166	14.0		619	76	81	5.565	994	43	
	5:40	1180	14.0	Not Available	619	79	81	5.664	994	43	
	5:55	1180	14.0		619	78	81	5.628	994	43	
	6:10	1180	14.0		619	78	81	5.628	994	43	995.7 ft³
	AVG.	1174									

By LIGC
M. Leger
R. Guillotte
R. Broussard

Energy Industries
Don Wright

Engine Timing 20° BTC

D-8

LIGC - Exxon Garden City Compressor Station Date: 9-6-89 Stack Emmissions Testing

Stack # 2-88 Compressor # R-432

Test Run	Time	Engine RPM	Manifold Pressure PSIA	Manifold Temp. F°	Suction Pressure PSIG	Suction Differential "H_2O	Suction Temp. F°	Flow Rate MMCFD	Discharge Pressure PSIG	Fuel Gas Header PSIG	Fuel Gas Consump. Converted Volume
#3											PSI #3
	6:15 P.M	1180	14.0	N/A	620	78	81	5.628	994	43	
	6:30	1180	14.0		620	79	81	5.664	994	43	
	6:45	1180	14.0	Not Available	620	78	81	5.628	994	43	
	7:00	1175	14.0		620	78	81	5.628	994	43	
	7:15	1172	14.0		620	79	81	5.664	994	43	964.8 ft
	AVG.	1177.4									

By LIGC
M. Leger
R. Guillotte
R. Broussard

Energy Industries
Dan Wright

Engine Timing 20° BTC

Fuel Gas LIGC-Exxon Garden City Compressor Emmission Stacks Testing
DSS #3 Stack #2-88 Unit R-432

ANALYSIS

DATE: 09/06/89
TIME: 16:28
ANALYZER#: 1912

ANALYSIS TIME: 345
CYCLE TIME: 360
MODE: RUN

STREAM SEQUENCE: 11
STREAM#: 2
CYCLE START TIME: 16:22

COMP NAME	COMP CODE	GAL/MCF**	B.T.U.*	SP. GR.*
C 6 +	108	0.0149	1.73	0.0011
PROPANE	102	0.0025	0.23	0.0001
I-BUTANE	103	0.0015	0.15	0.0001
N-BUTANE	104	0.0017	0.17	0.0001
IPENTANE	105	0.0024	0.26	0.0002
NPENTANE	106	0.0013	0.14	0.0001
NITROGEN	114	0.0000	0.00	0.0037
METHANE	100	0.0000	965.47	0.5284
C O 2	117	0.0000	0.00	0.0255
ETHANE	101	0.6750	43.91	0.0257
TOTALS		0.6993	1012.05	0.5850

@ 14.730 PSIA DRY & UNCORRECTED FOR COMPRESSIBILITY

** @ 15.025 & 60 DEG. F

COMPRESSIBILITY FACTOR (1/Z) = 1.0022
DRY B.T.U. @ 15.025 PSIA & 60 DEG. F CORRECTED FOR (1/Z) = 1034.6
SAT B.T.U. @ 15.025 PSIA & 60 DEG. F CORRECTED FOR (1/Z) = 1016.8
REAL SPECIFIC GRAVITY = 0.5860
UNNORMALIZED TOTAL = 99.49

ACTIVE ALARMS

NONE

LIGC - Exxon Garden City Compressor Station Date: 9-5-89 Stack Emmissions Testing

Stack # 3-88 Compressor # R-381

Test Run	Time	Engine RPM	Manifold Pressure PSIA	Manifold Temp. F°	Suction Pressure PSIG	Suction Differential "H_2O	Suction Temp. F°	Flow Rate MMCFD	Discharge Pressure PSIG	Fuel Gas Header PSIG	Fuel Gas Consump. Converted Volume
											PSI # 3
#1	12:55 P.M.	1475	14.0	Not Available	617	62	82	2.771	980	44	
	1:10	1500			619	68	83	2.960	980	44	
	1:25	1490			630	68	83	2.960	980	44	
	1:40	1420			626	61	83	2.540	990	44	
	1:55	1450	888		636	61	83	2.851	985	44	604.644
	AVG:	1467									
# 2	2:40 P.M.	1400			625	56	84	2.671	985	43	
	2:55	1400			622	56	84	2.671	985	43	
	3:10	1450			625	61	84	2.802	985	43	
	3:25	1490			625	57	84	2.695	985	43	
	3:40	1490	888		623	60	82	2.679	980	44	607.84
	AVG:	1446									
# 3	3:43 P.M.	1490			623	60	82	2.679	980	44	
	4:03	1490			622	60	81	2.775	980	44	
	4:18	1490			622	59	81	2.752	980	44	
	4:33	1490			623	59	81	2.752	980	44	
	4:43	1490	888		624	60	81	2.775	980	44	638.443
	AVG:	1490									

LIGC
By: Mike Lesser
Randy Guillot
Ray Bronzeard

Energy Industries
Don Wright

Engine Spark Ignition timing: 30° BTC

D-11

Fuel Gas Stack #3-88 Garden City Compressor Station
PSS#3 118 H.P. ANALYSIS
Unit R-381

DATE: 09/05/89
TIME: 13:51
ANALYZER#: 1912

ANALYSIS TIME: 345
CYCLE TIME: 360
MODE: RUN

STREAM SEQUENCE: 11
STREAM#: 2
CYCLE START TIME: 13:44

COMP NAME	COMP CODE	GAL/MCF**	B.T.U.*	SP. GR.*
C 6 +	108	0.0204	2.37	0.0015
PROPANE	102	0.0035	0.32	0.0002
I-BUTANE	103	0.0026	0.25	0.0002
N-BUTANE	104	0.0029	0.29	0.0002
IPENTANE	105	0.0029	0.31	0.0002
NPENTANE	106	0.0017	0.19	0.0001
NITROGEN	114	0.0000	0.00	0.0037
METHANE	100	0.0000	964.23	0.5278
C O 2	117	0.0000	0.00	0.0262
ETHANE	101	0.6896	44.86	0.0263
TOTALS		0.7236	1012.82	0.5862

* @ 14.730 PSIA DRY & UNCORRECTED FOR COMPRESSIBILITY

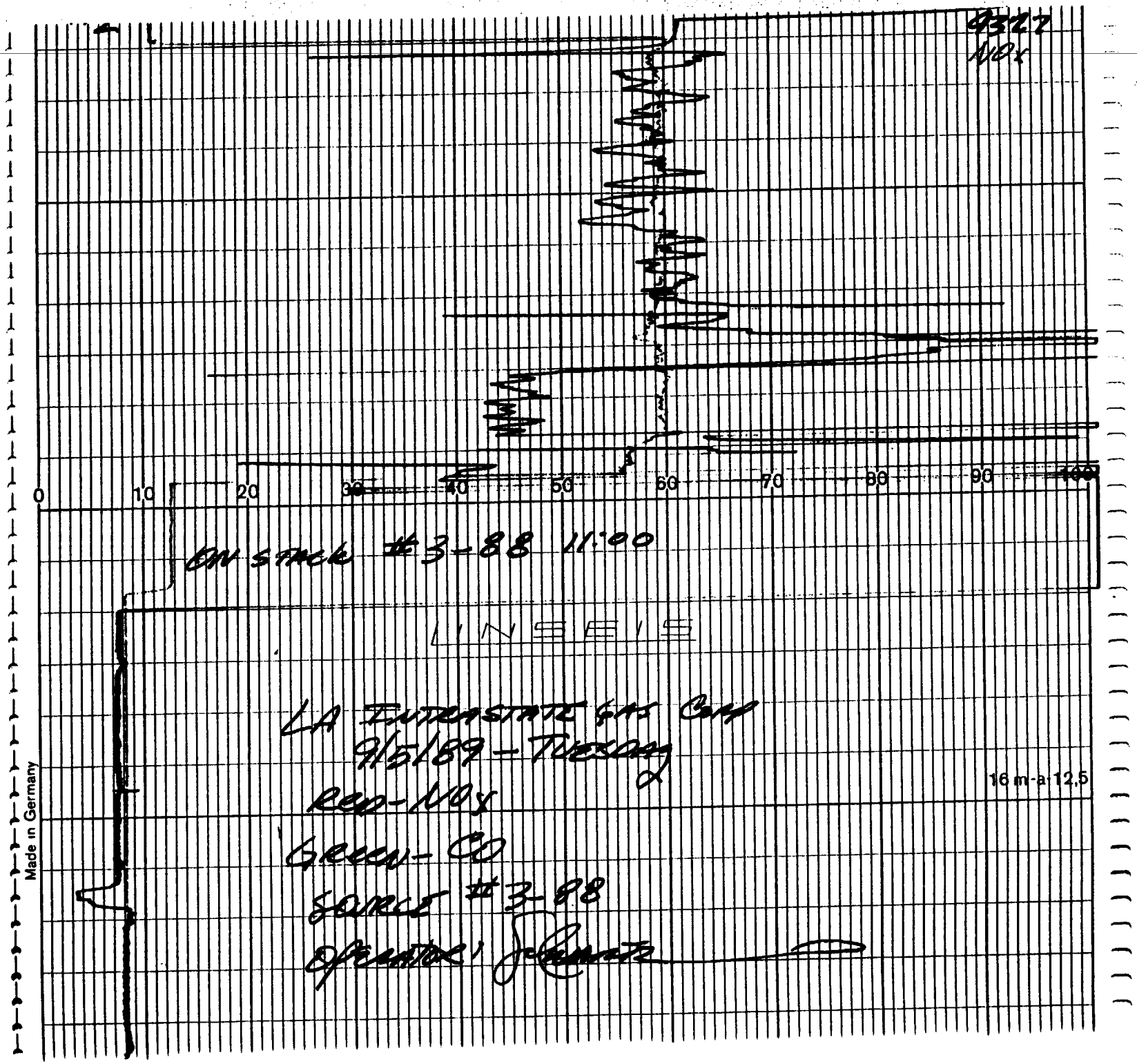
** @ 15.025 & 60 DEG. F

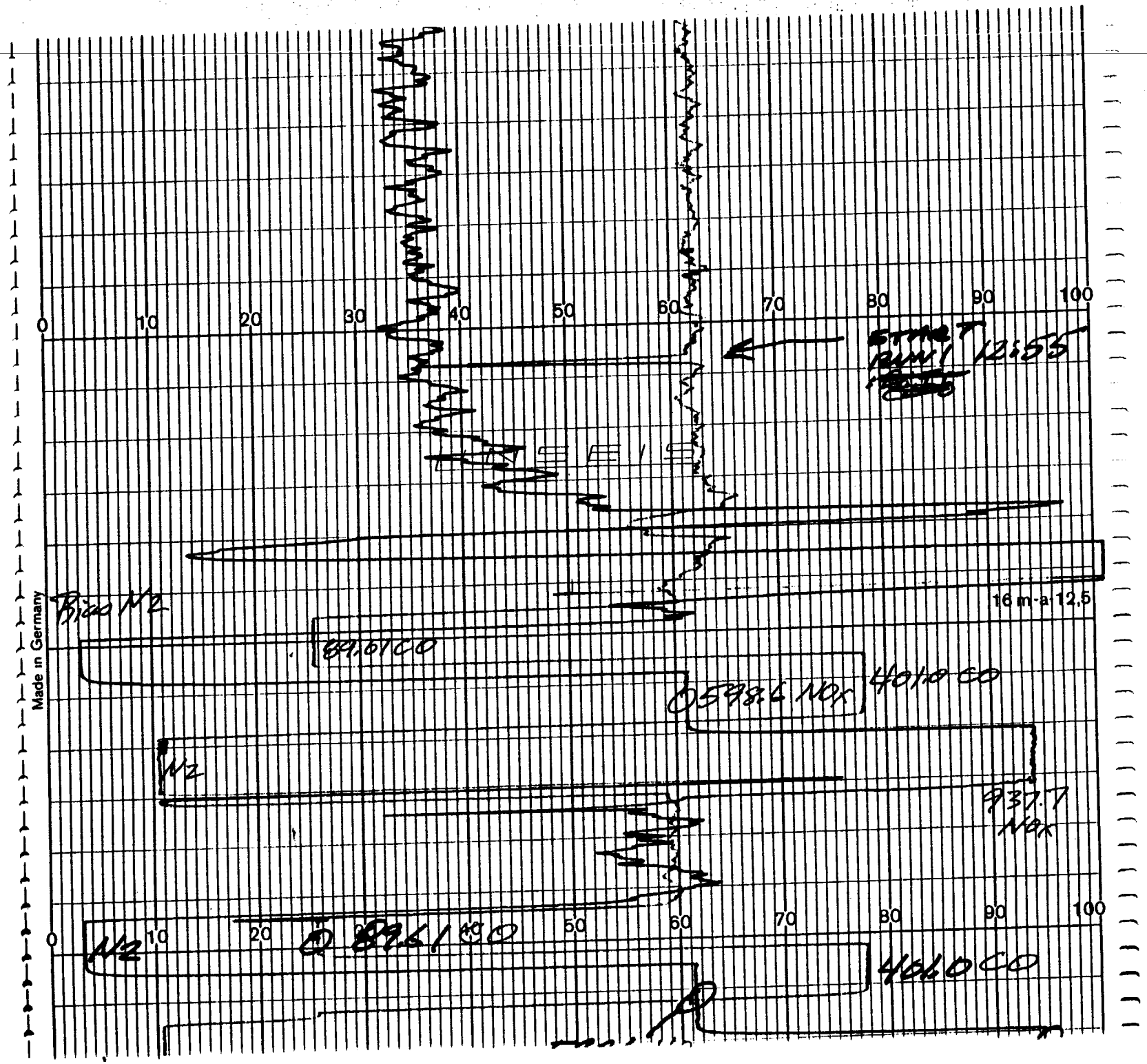
COMPRESSIBILITY FACTOR (1/Z) = 1.0022
DRY B.T.U. @ 15.025 PSIA & 60 DEG. F CORRECTED FOR (1/Z) = 1035.4
SAT B.T.U. @ 15.025 PSIA & 60 DEG. F CORRECTED FOR (1/Z) = 1017.4
REAL SPECIFIC GRAVITY = 0.5872
UNNORMALIZED TOTAL = 99.74

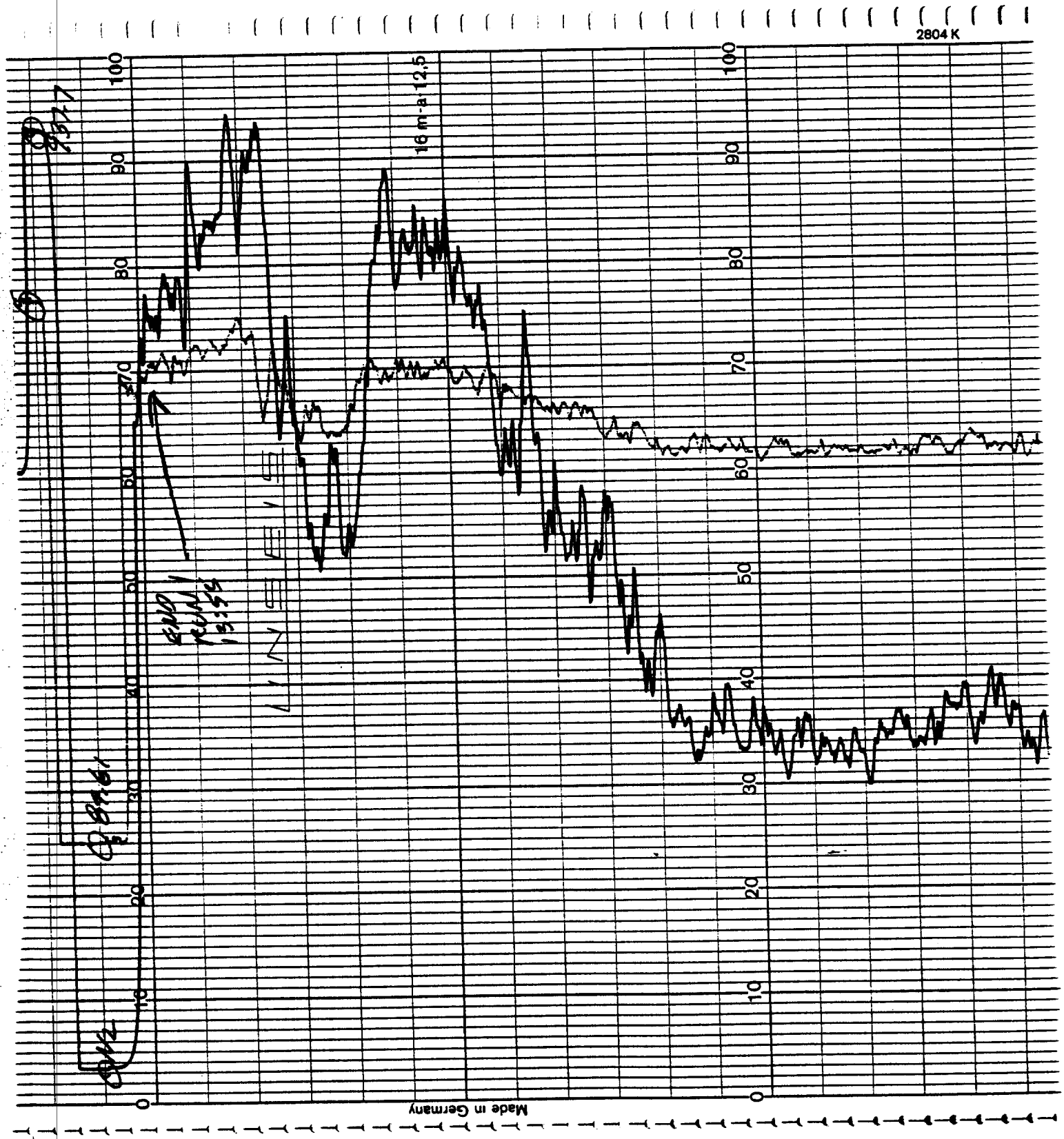
ACTIVE ALARMS

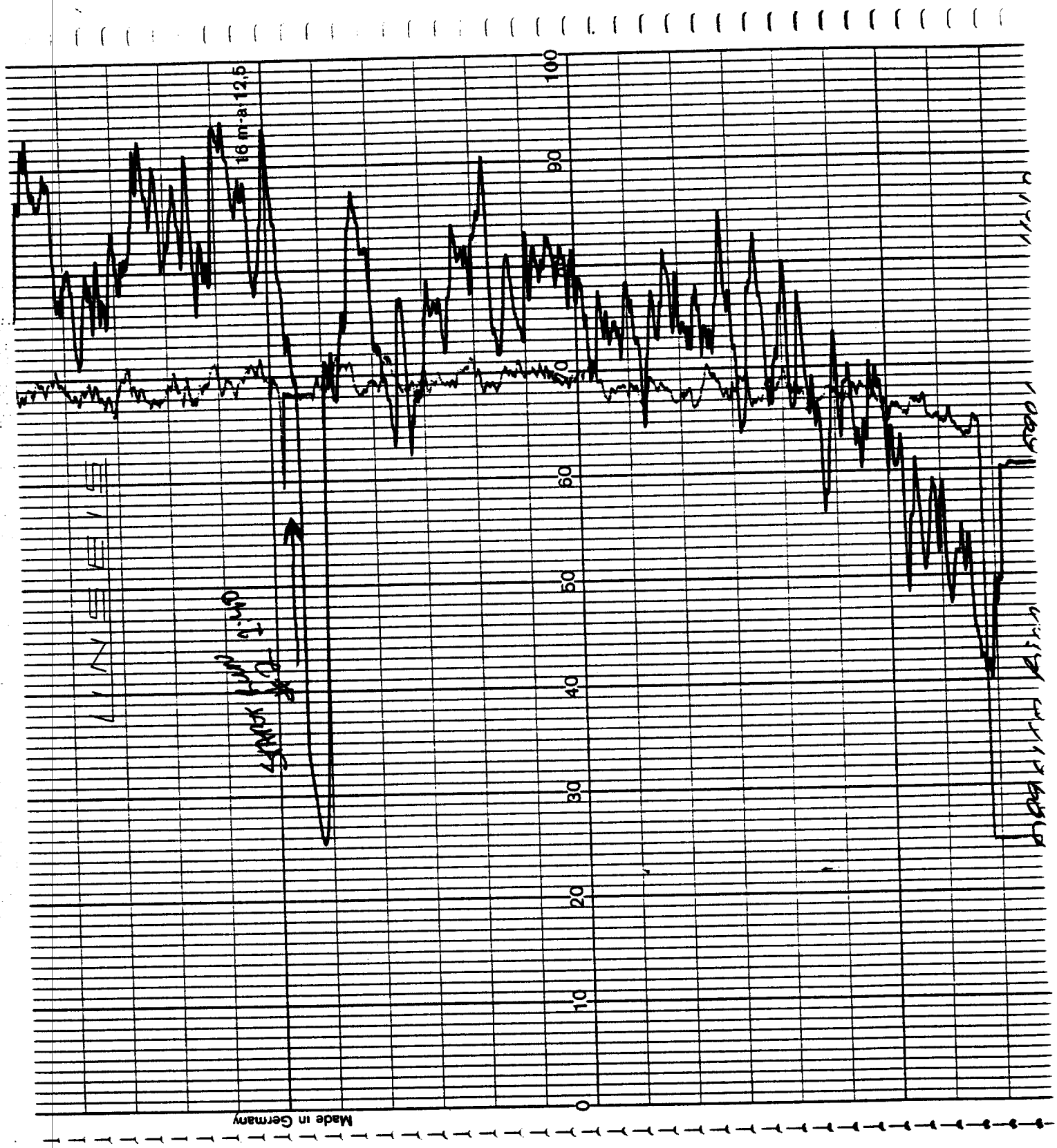
NONE

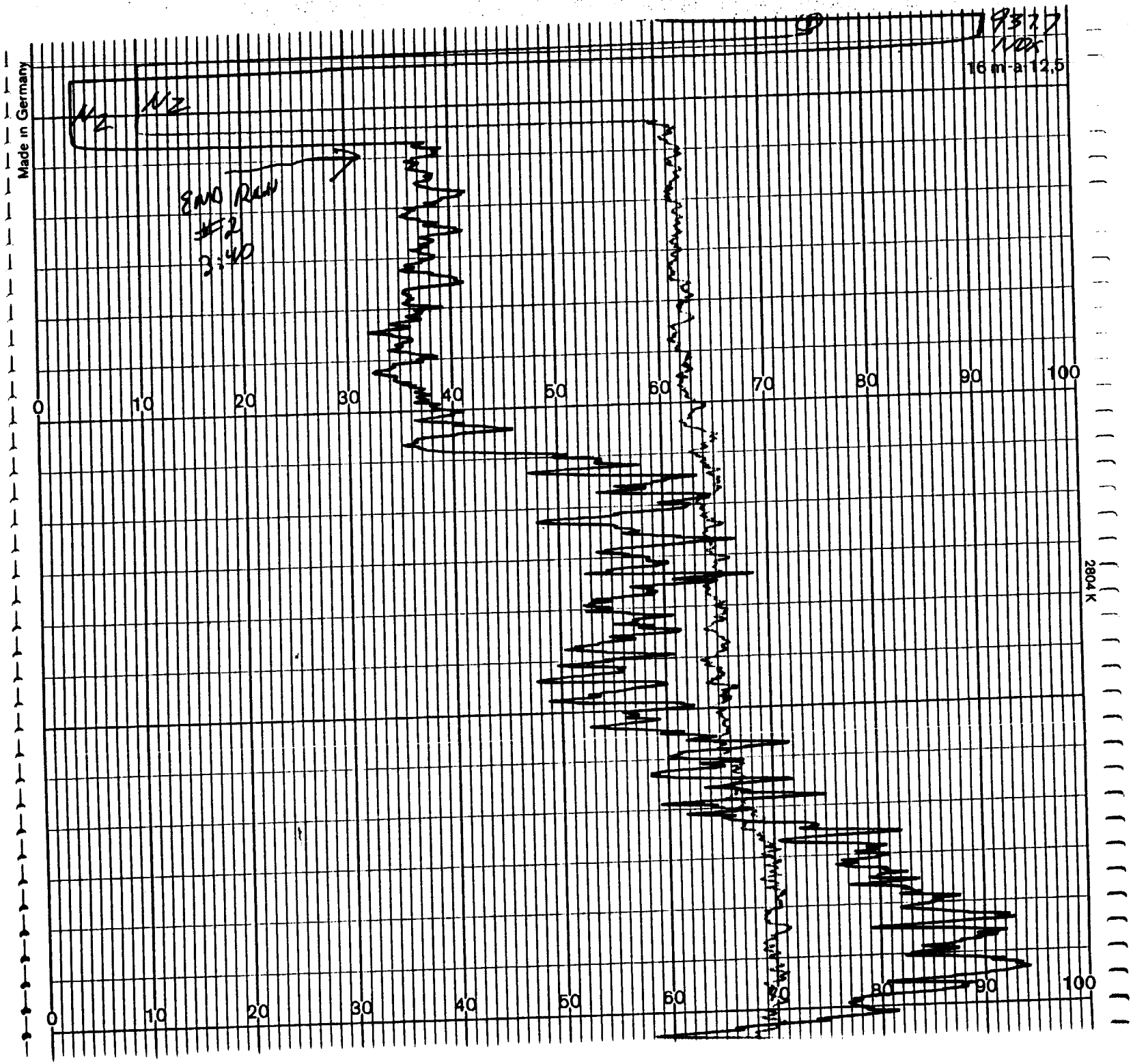
APPENDIX E -- STRIP CHARTS

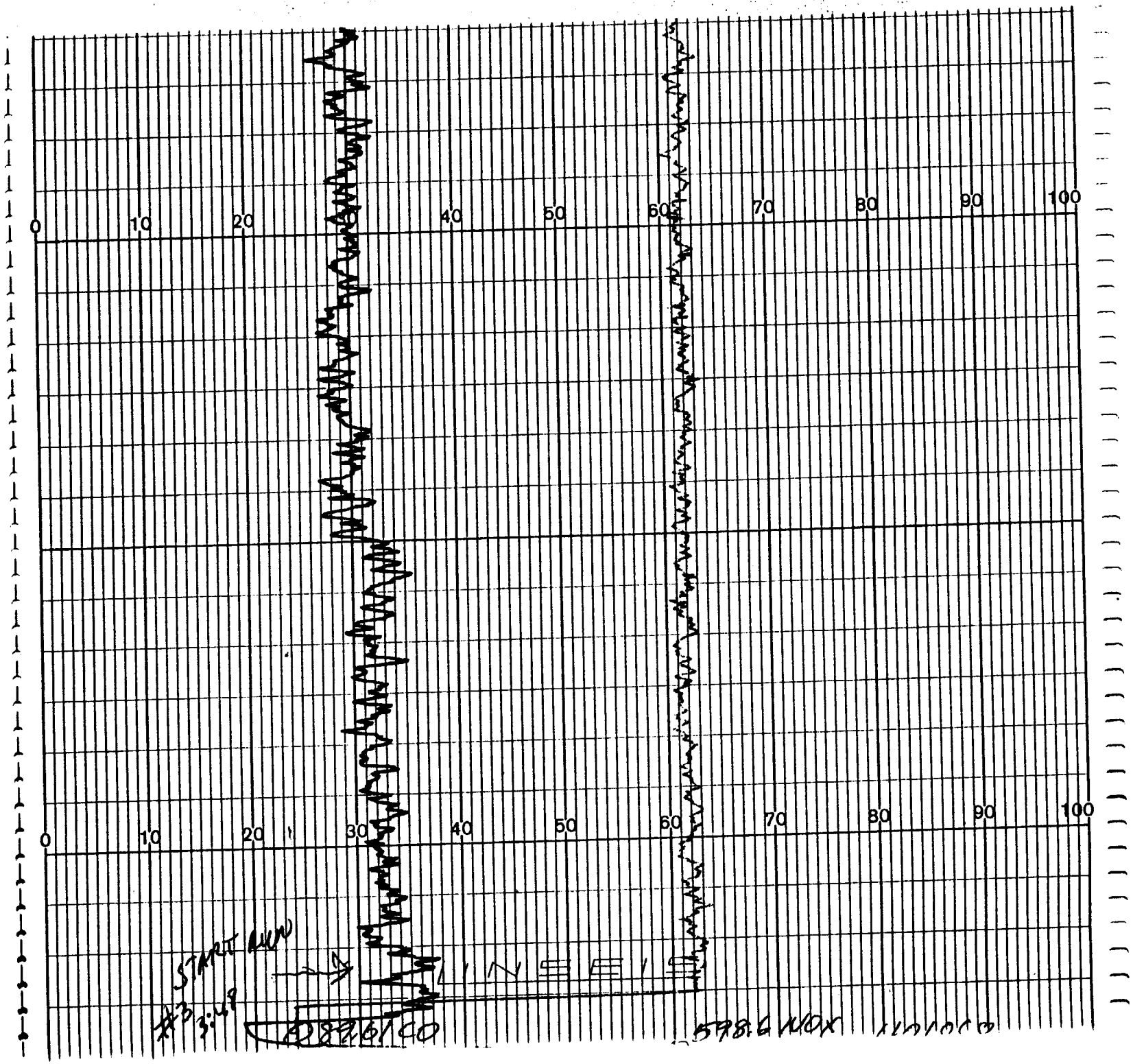

0
10
20
30
40
50
60
70
80
90
100
ON STACK #3-88 11:00
LA Turnpike Gas Co
9/5/89 - Tuesday
Red-NOx
Green-CO
Source #3-88
Operator: J
16 m-a 12,5
Made in Germany

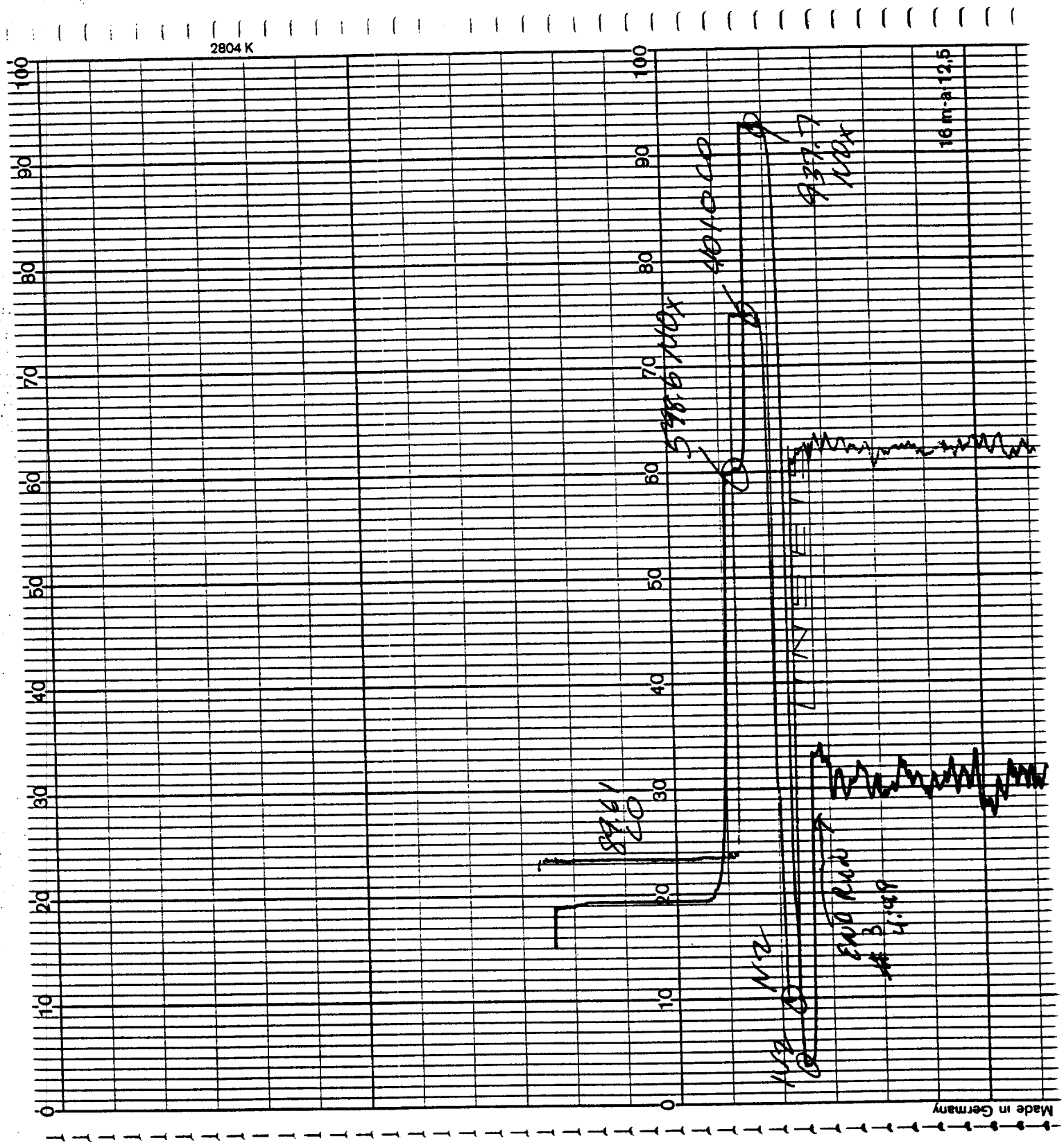

0
10
20
30
40
50
60
70
80
90
100
Made in Germany
16 m-a 12,5
Run 1 12:55
Rico N2
N2
N2
937.7 NOx
4040 CO
4040 CO

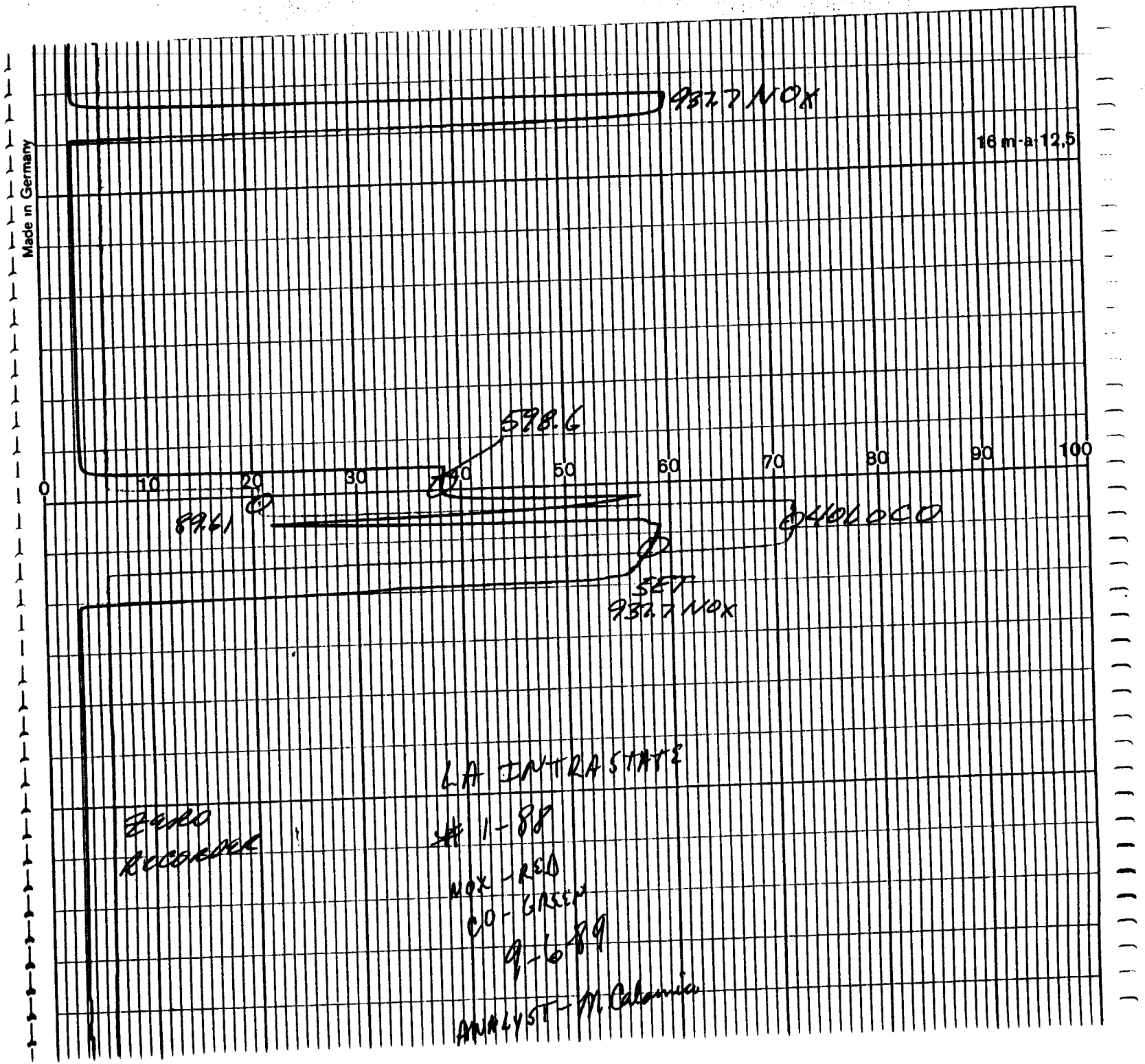

2804 K
16 m-a 12,5
Made in Germany

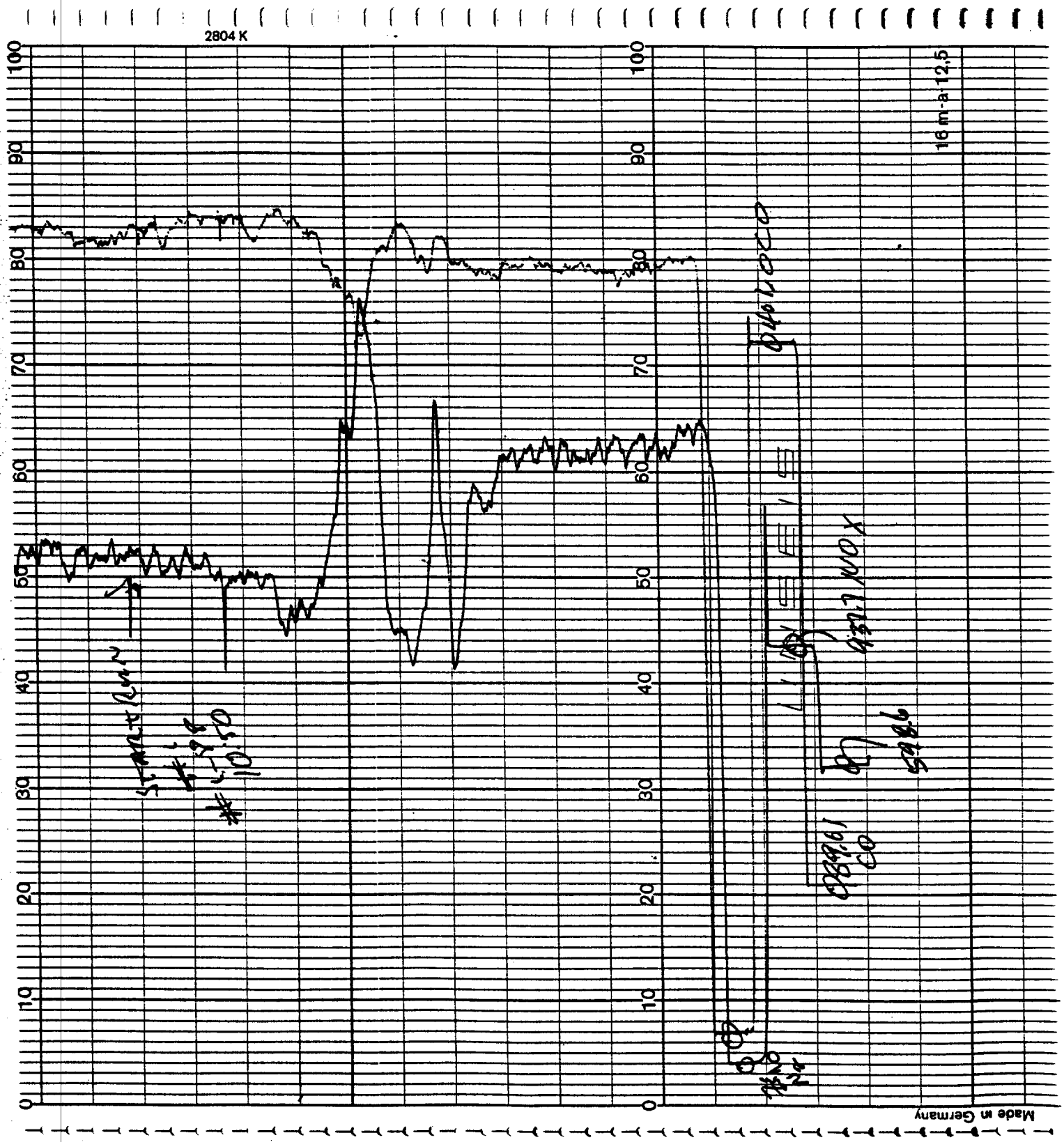

16 m-a 12,5
100
90
0
60
50
40
30
20
10
0
Made in Germany

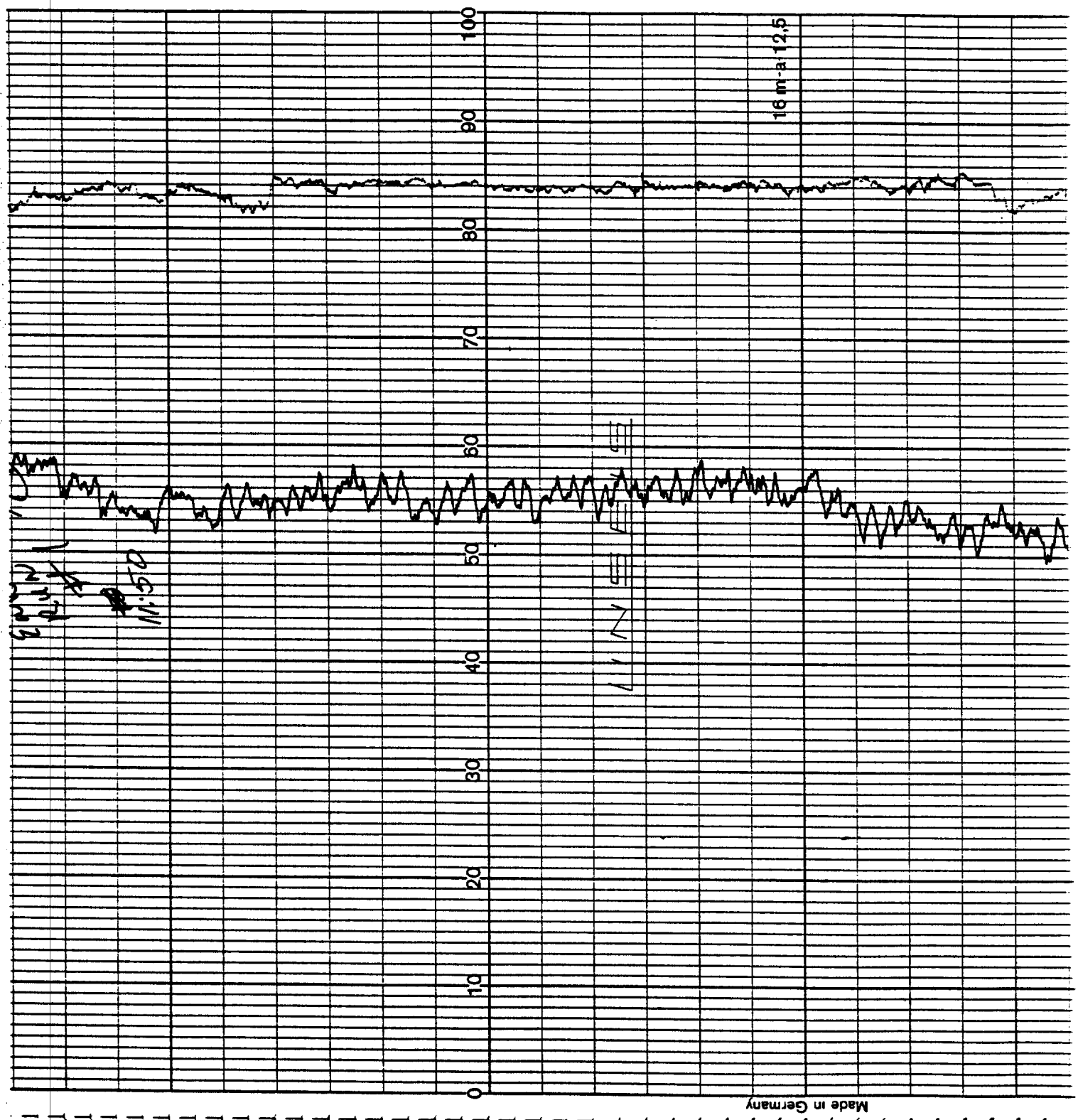

Made in Germany
16 m-a 12,5
2804 K
0
10
20
30
40
50
60
70
80
90
100
Hz
Hz
END Run
#2
2:40


0
10
20
30
40
50
60
70
80
90
100
START RUN
#3 3:48
08/26/00
598.6 MOX


2804 K
16 m-a 12,5
Made in Germany


Made in Germany
16 m-a-12,5
0
10
20
30
40
50
60
70
80
90
100
9327 NOx
598.6
8961
9400000
SET
9327 NOx
LA INTRASTATE
#1-88
NOX - RED
CO - GREEN
9-6-89
ANALYST - M. Calamia


2804 K
16 m-a-12,5
Made in Germany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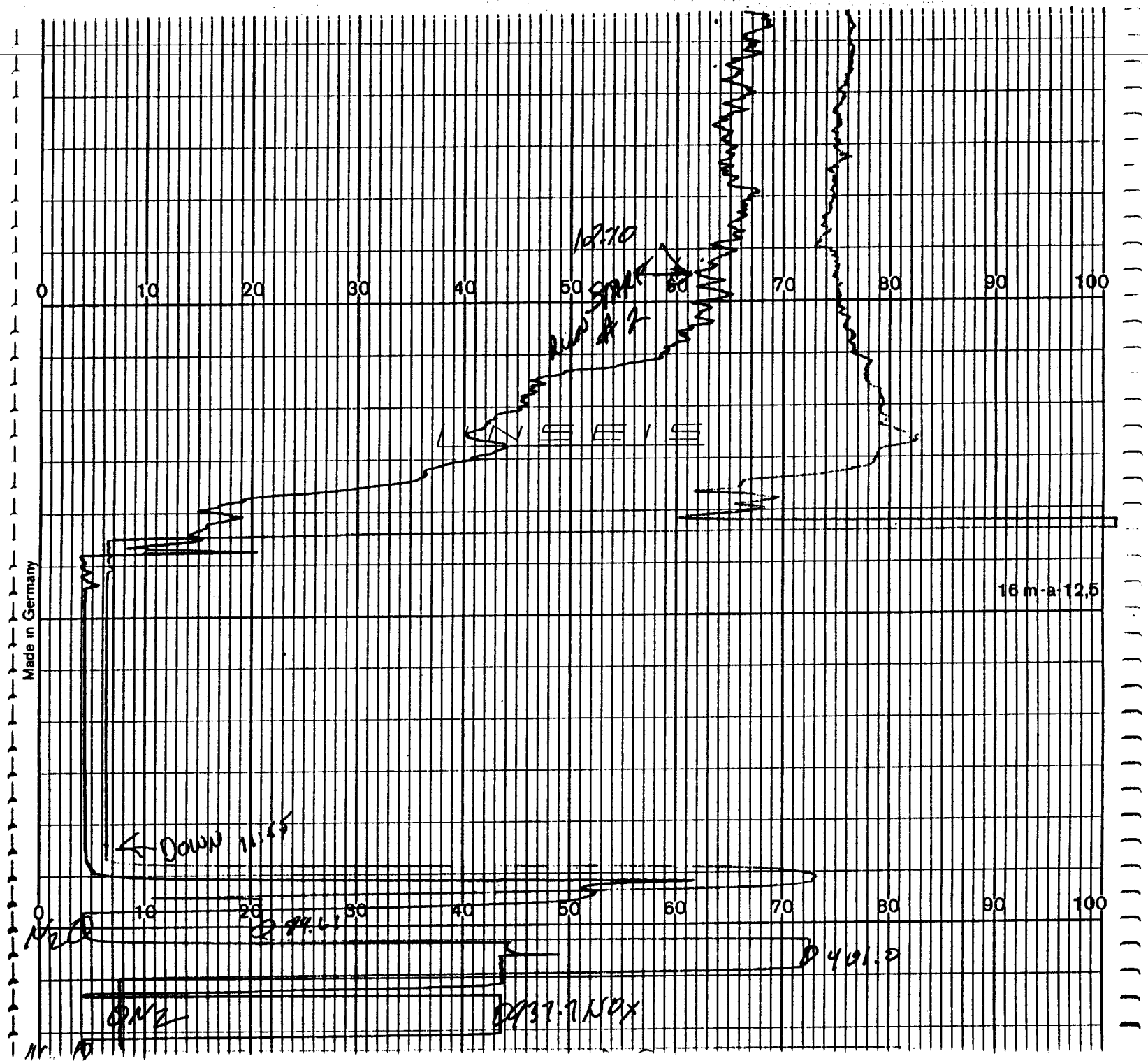
90
80
70
60
50
40
30
20
10
0
16 m-a 12,5
Made in Germany


0
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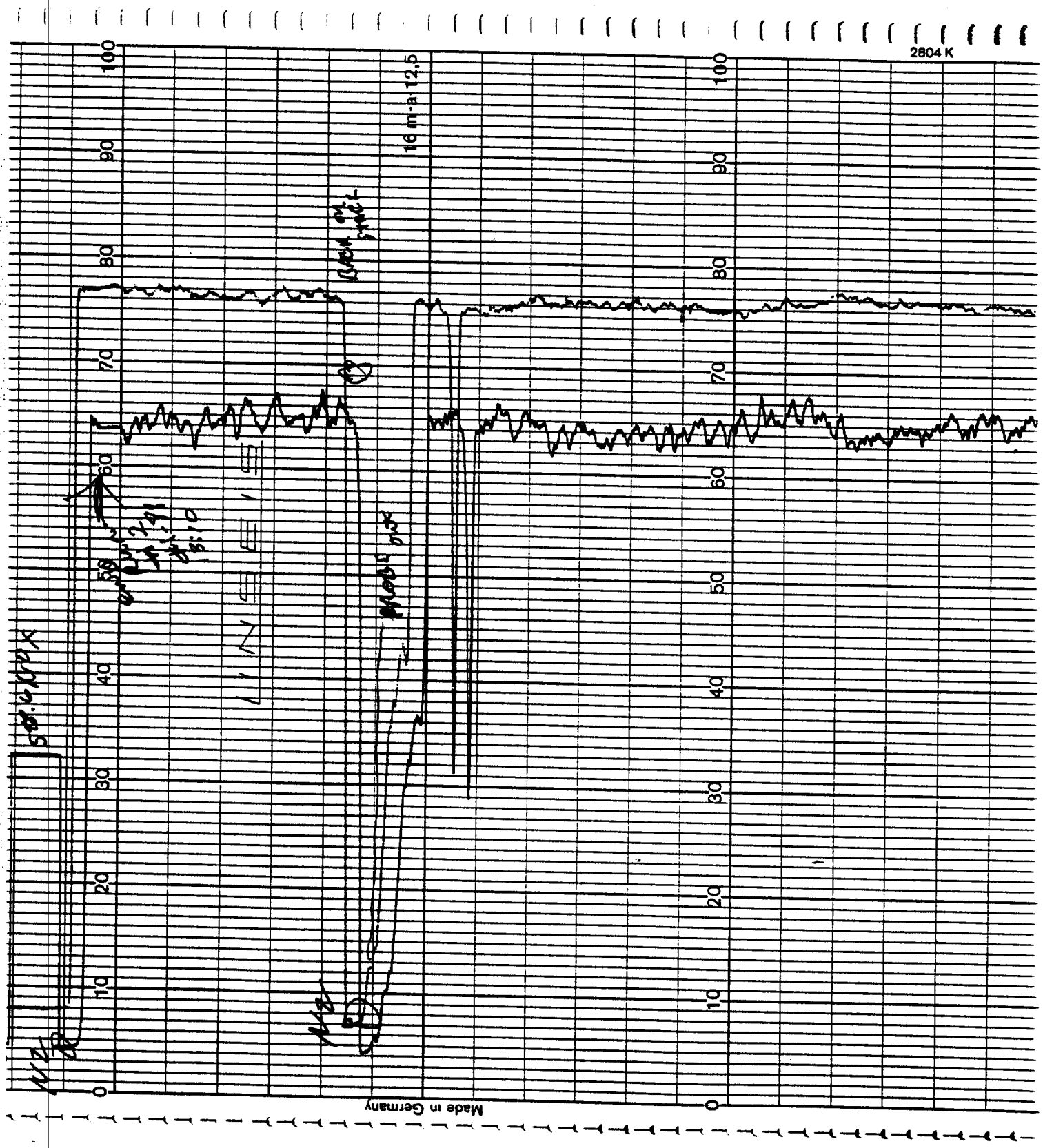
16 m-a 12,5
Made in Germany
10:10
DOWN 11:55
491.0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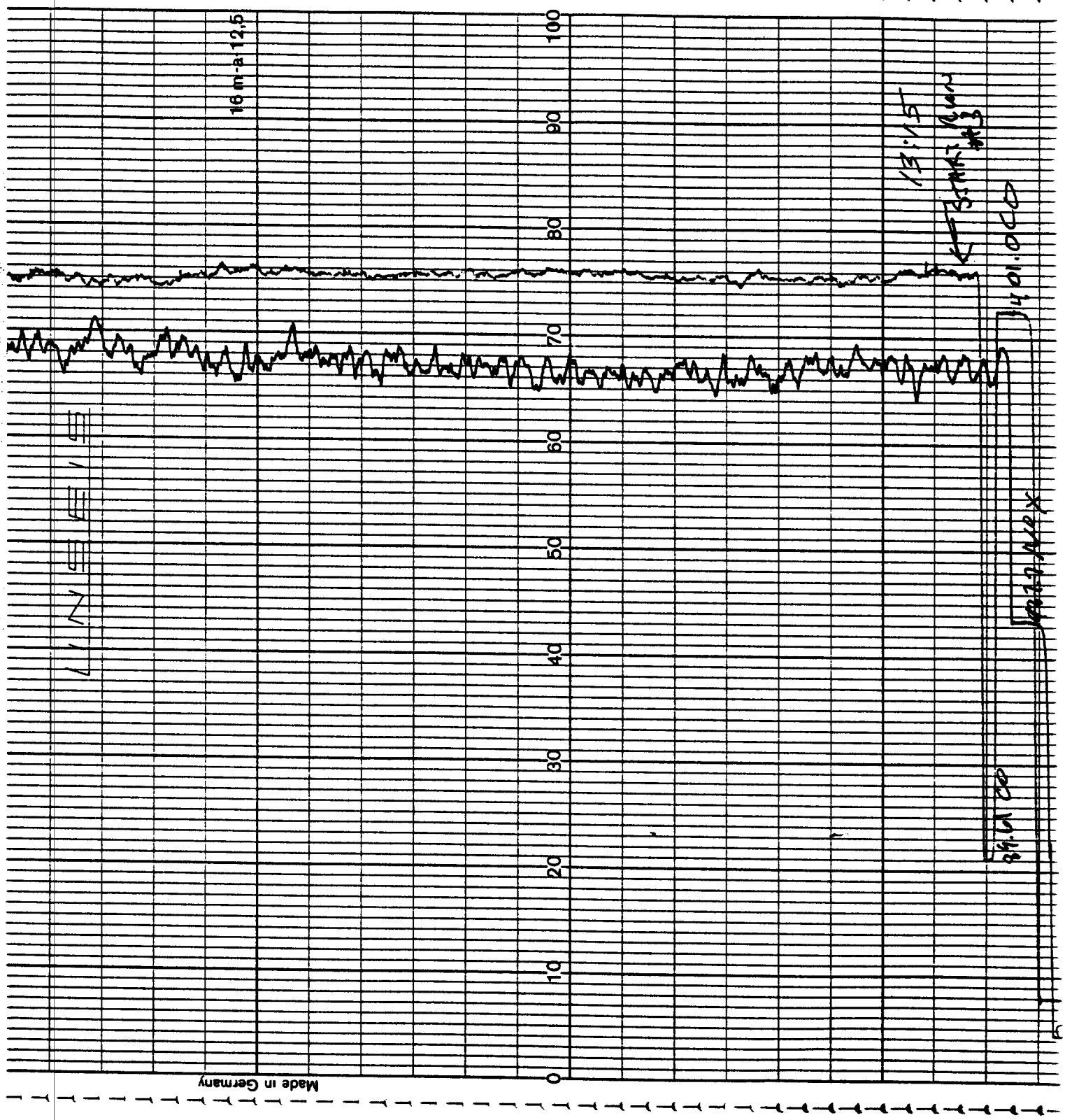
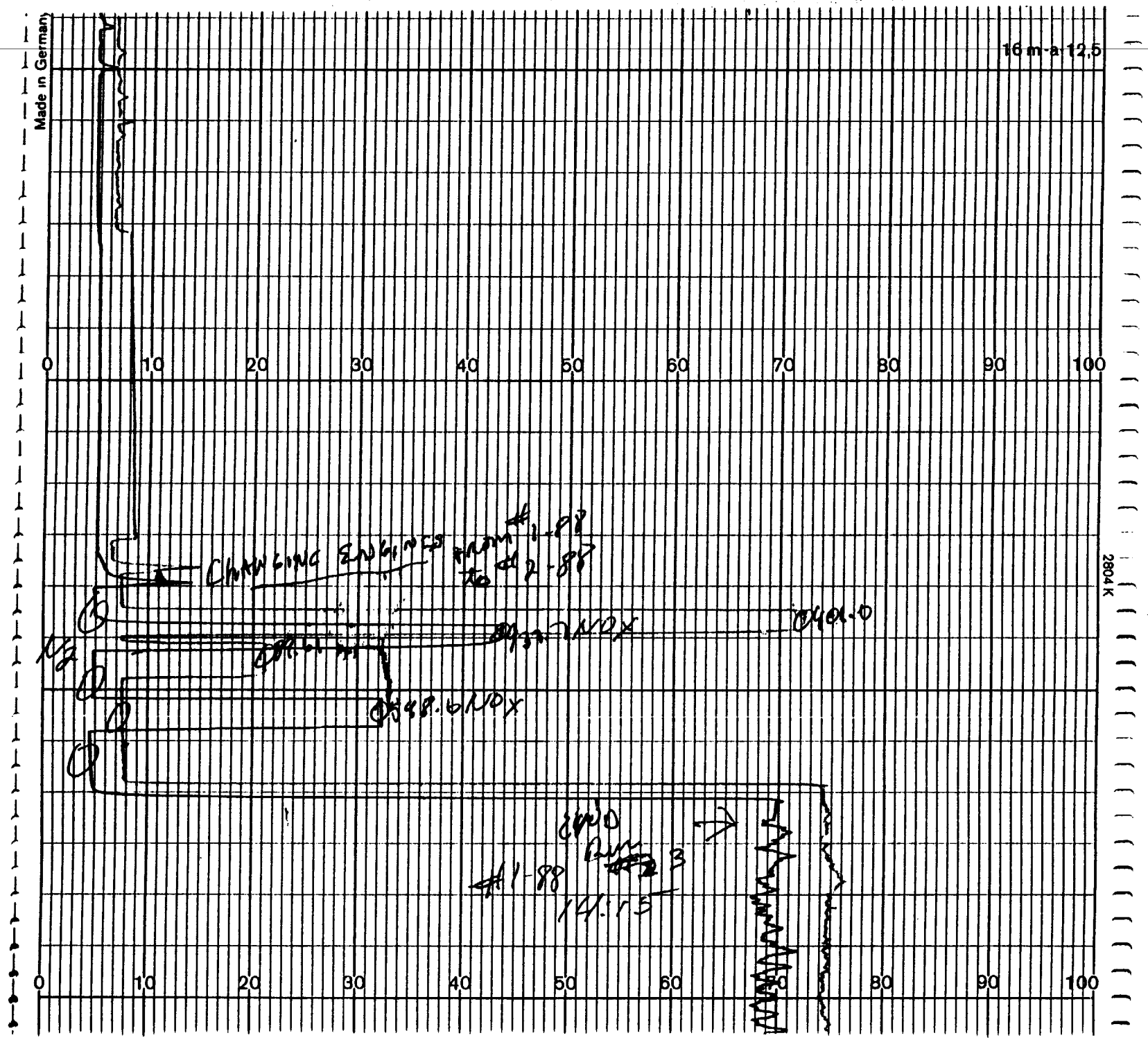
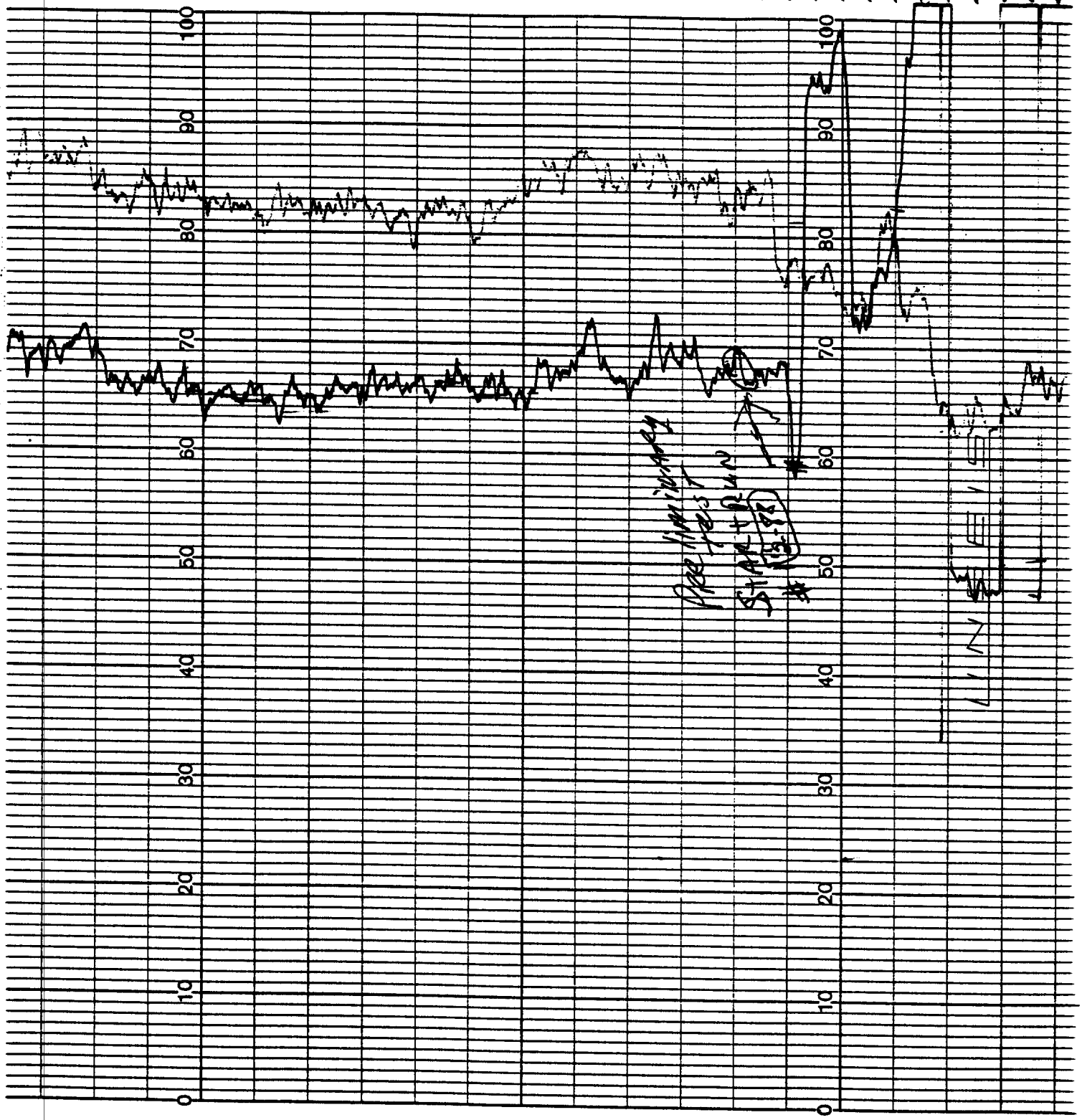
Made in Germany


16 m-a 12,5
100
90
80
70
60
50
40
30
20
10
0
Made in Germany
LIVE


Made in Germany
16 m-a 12,5
0
10
20
30
40
50
60
70
80
90
100
2804 K
CHANGING ENGINES FROM #1-88 TO #2-88
401.0
48.6 NOX
EWO
#1-88
14:15


100
90
80
70
60
50
40
30
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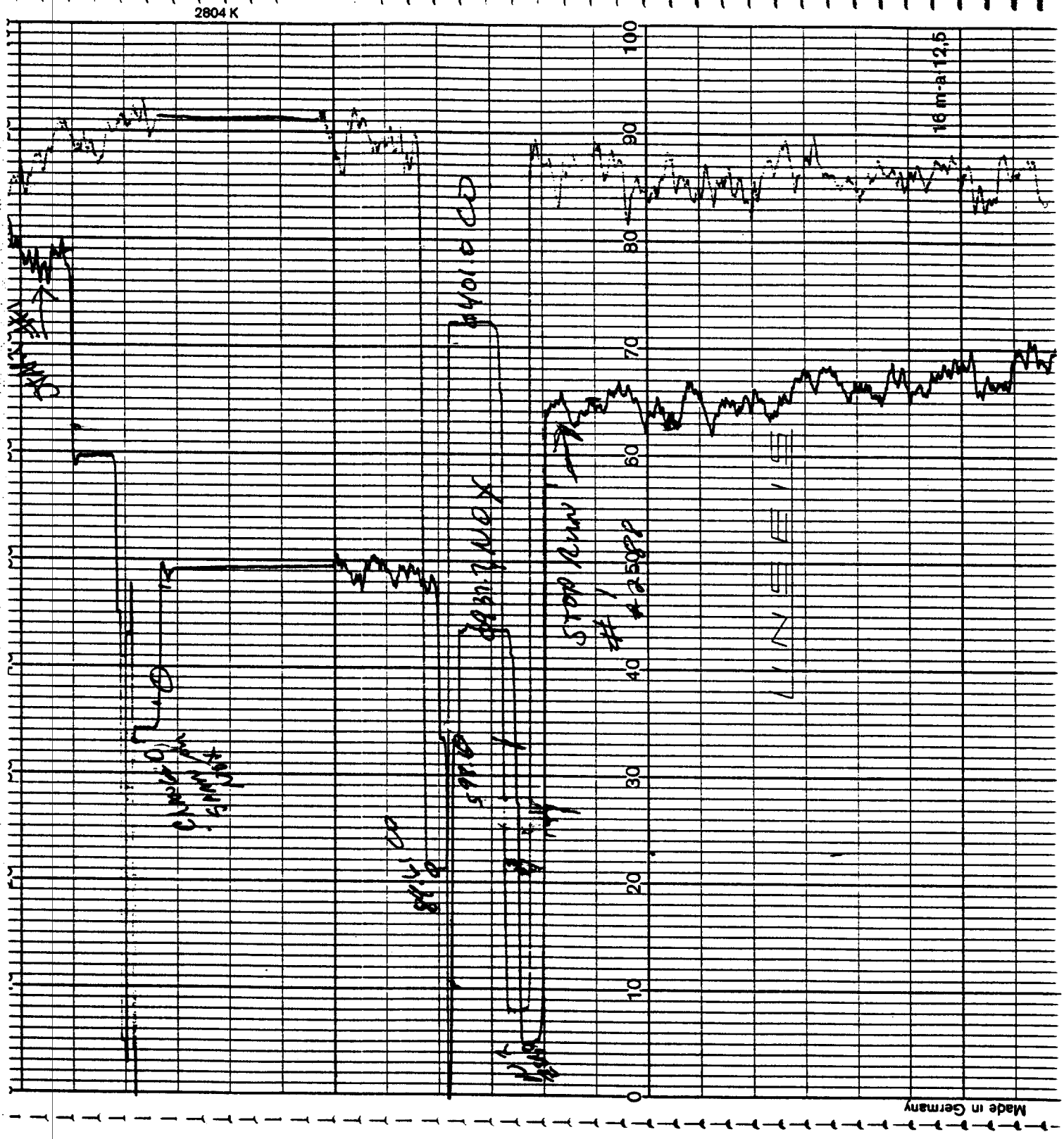
10
0
Pre Hydraulic Start Run
Start Run
Stop


2804 K
16 m-a 12,5
100
90
80
70
60
40
30
20
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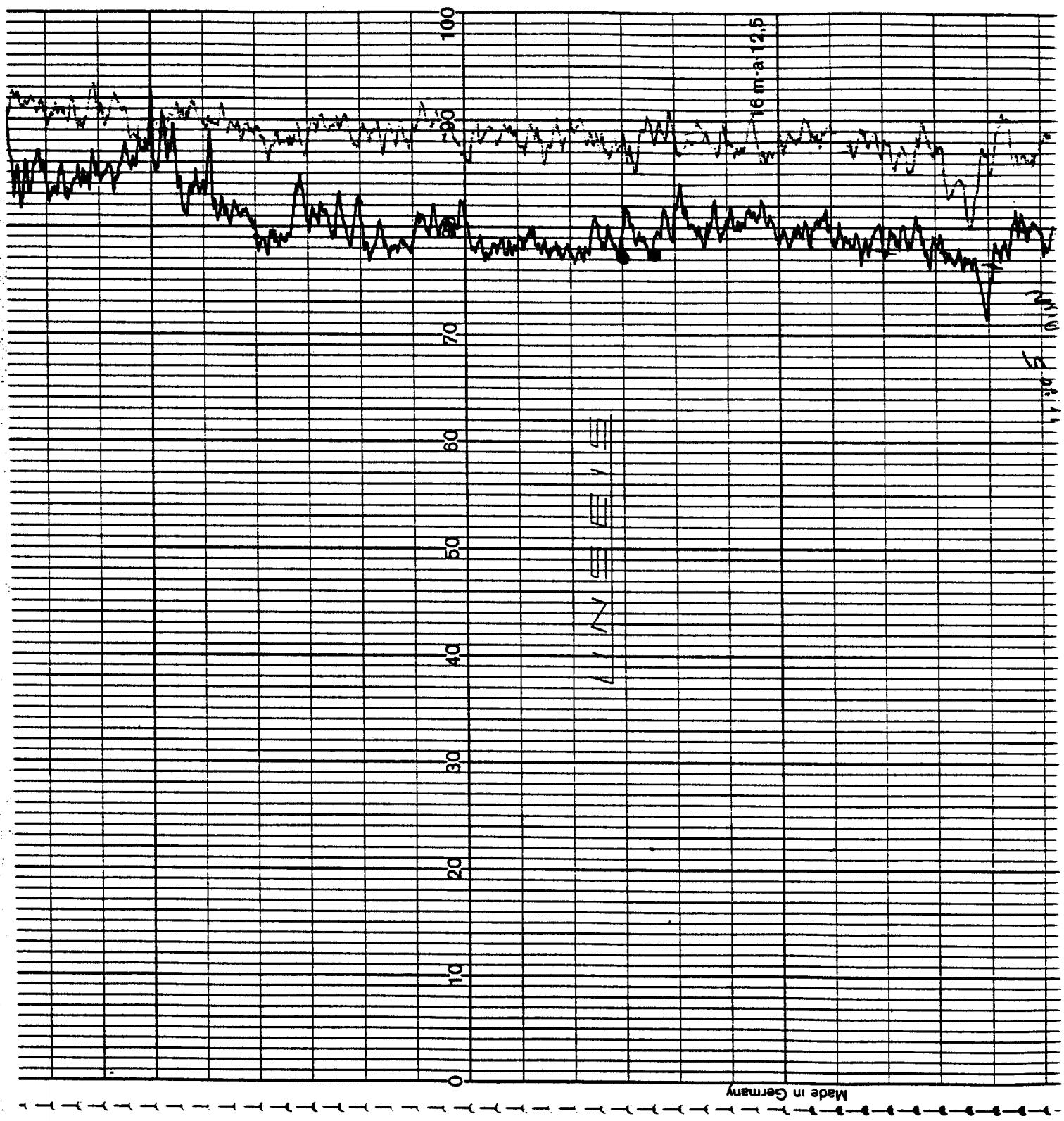
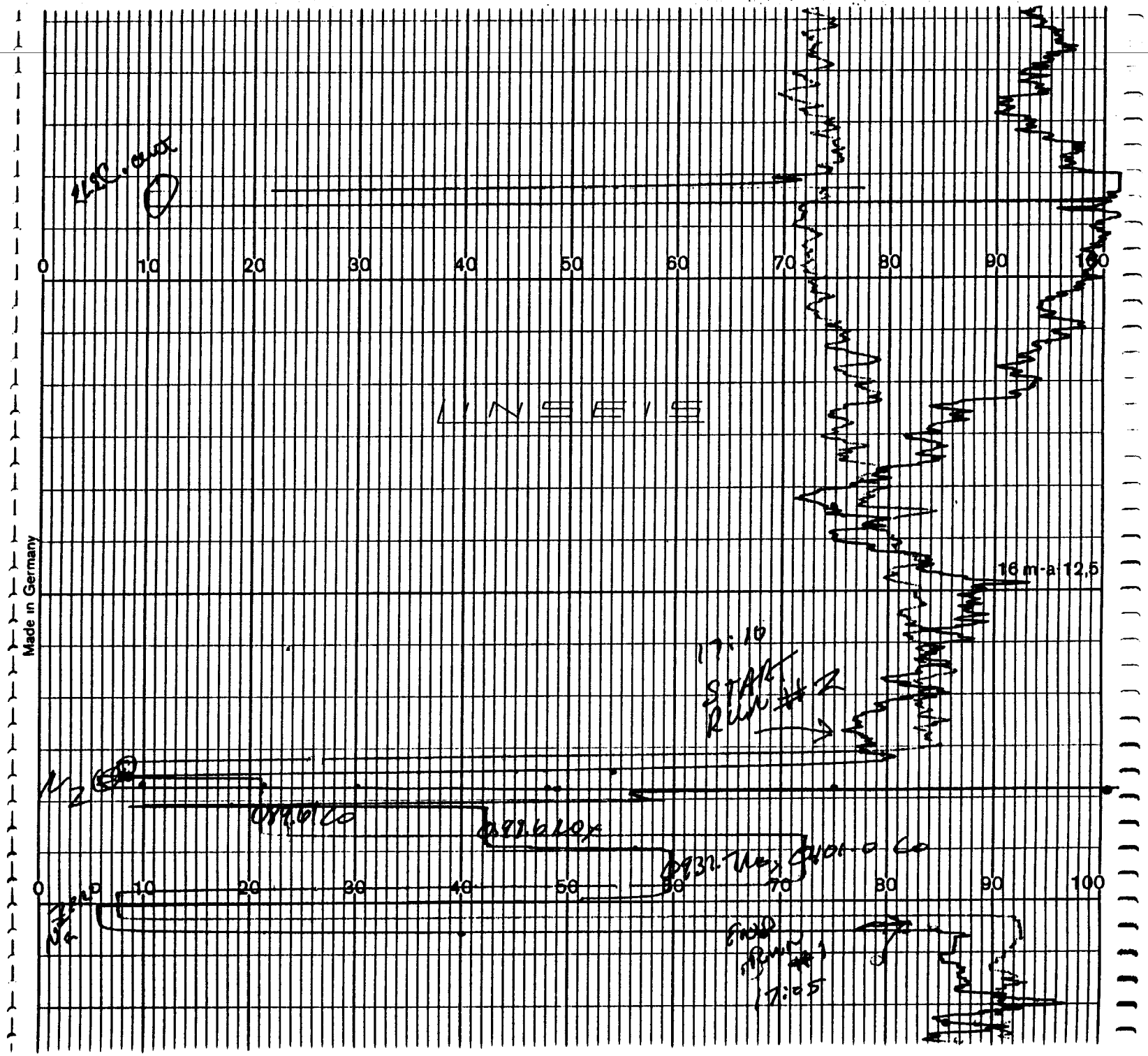
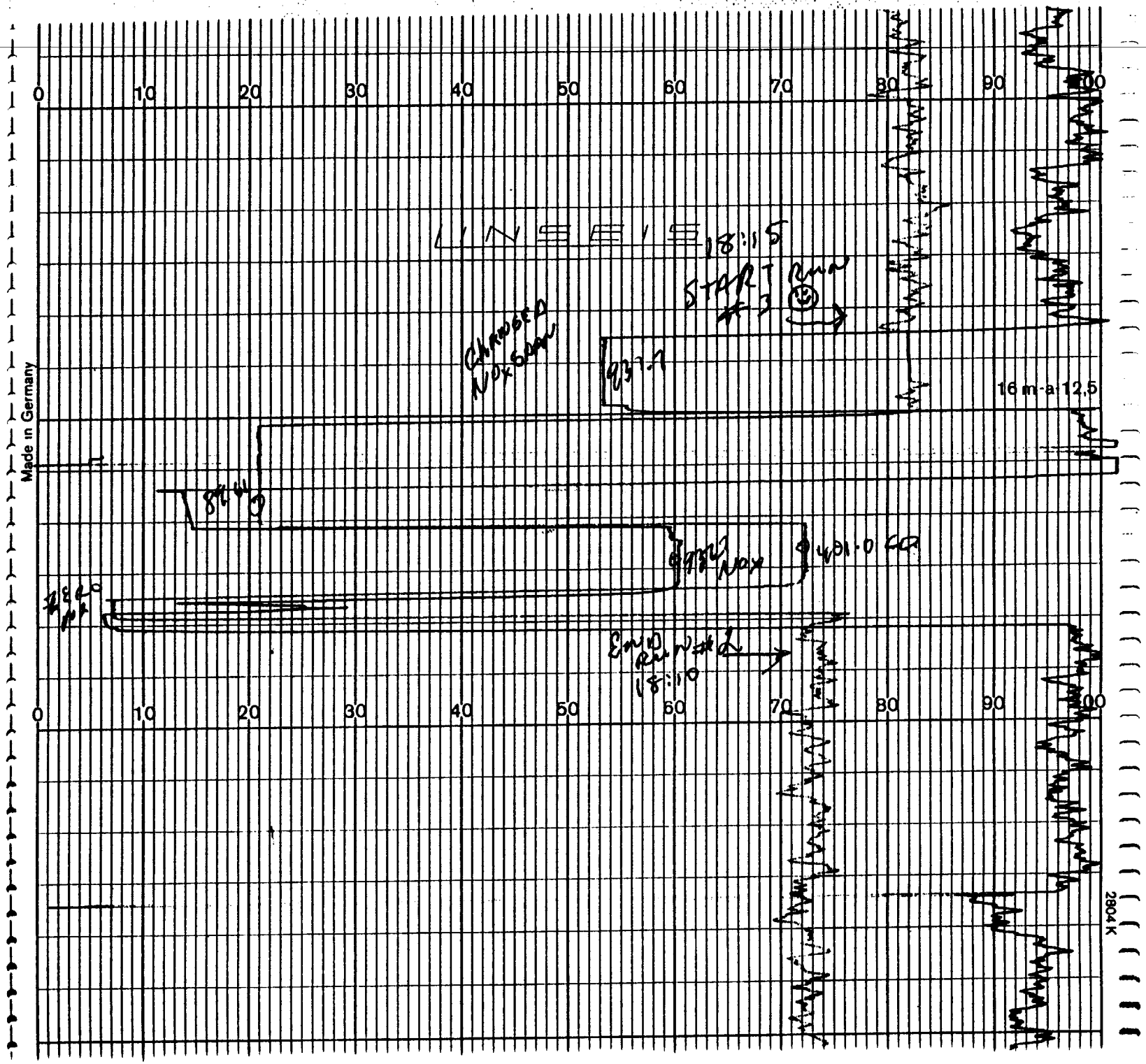
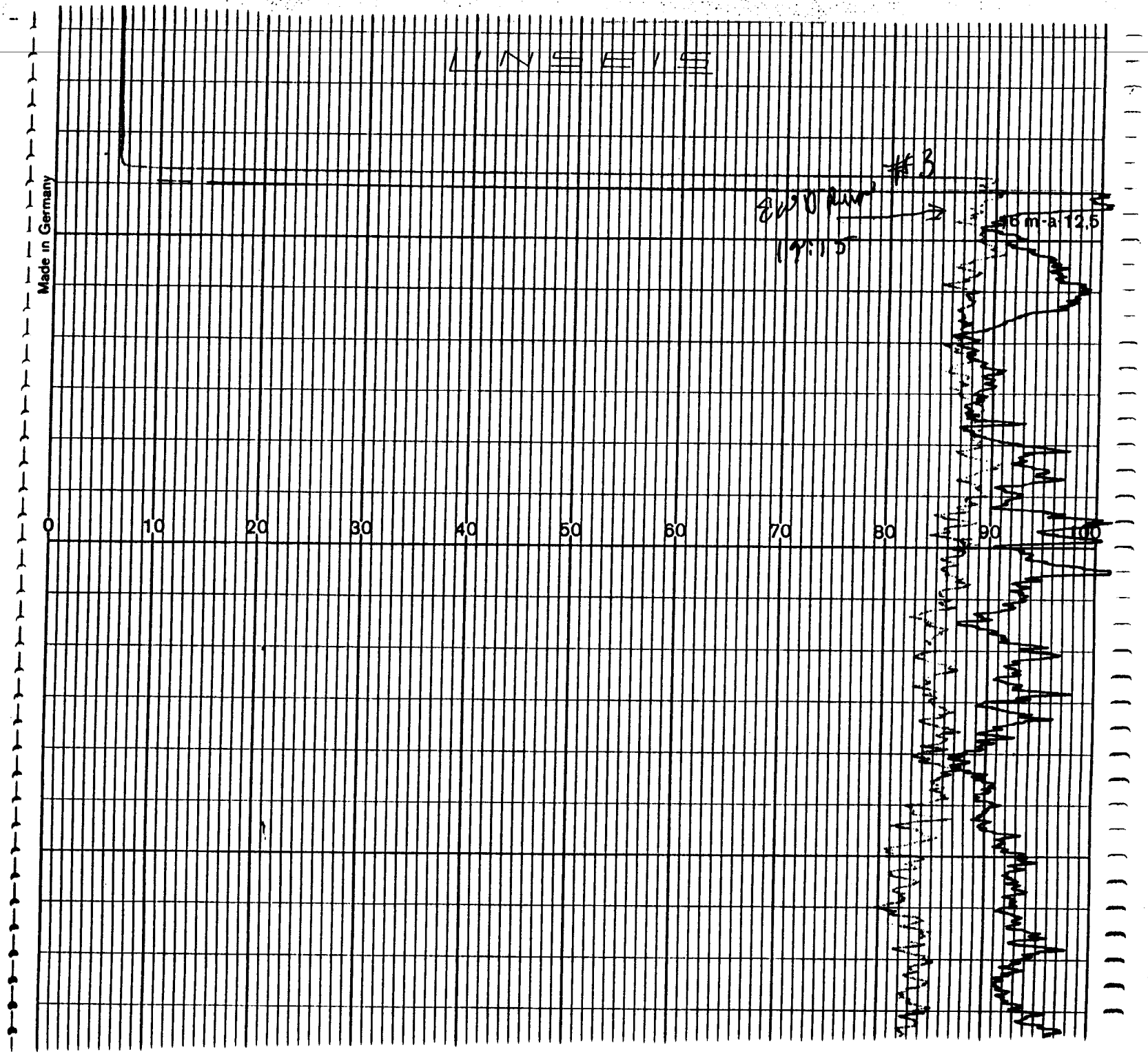
Made in Germany


100
90
70
60
50
40
30
20
10
0
16 m·a 12,5
Made in Germany


0
10
20
30
40
50
60
70
80
90
100
LINEIS
16 m-a 12,5
17:10
START
RUN #2
17:05
Made in Germany


0
10
20
30
40
50
60
70
80
90
100
18:15
START Run #3
CHANGED NOx SCALE
937.7
16 m-a 12.5
87.4
401.0 FG
END Run #2
18:10
Made in Germany
2804 K


#3
16 m-a 12,5
0
10
20
30
40
50
60
70
80
90
100
Made in Germany

APPENDIX F -- CALIBRATION GAS CERTIFICATES

LINCOLN BIG THREE, INC.
P.O. BOX 3274
BATON ROUGE, LOUISIANA 70821

MATERIAL SAFETY DATA SHEET

I — GENERAL INFORMATION

PRODUCT NAME	NITROGEN (Gas)
EMERGENCY TELEPHONE NO.	(504) 357-4331
MANUFACTURERS NAME	Big Three Industries, Inc.
TRADE NAME AND SYNONYMS	Nitrogen
CHEMICAL NAME AND SYNONYMS	Nitrogen

ISSUE DATE	PRODUCT ID. NO.	FORMULA	CHEMICAL FAMILY	GAS NUMBER
APRIL 1, 1984	UN-1066	N_2	Inert Gas	007 727 379

II — HAZARDOUS INGREDIENTS

HAZARDOUS MIXTURES OF LIQUIDS AND GASES	%	TLV
None		

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JUL 13 1989

III — PHYSICAL DATA

BOILING POINT −320.4°F (−195.8°C) @ 1 ATM	SPECIFIC GRAVITY (Air = 1) 0.967 at 70°F (21.1°C) and 1 ATM
VAPOR PRESSURE N/A	PERCENT, VOLATILE BY VOLUME (%) N/A
DENSITY at 70°F (21.1°C) and 1 ATM 0.07245 lb/cu ft	EVAPORATION RATE N/A
SOLUBILITY IN WATER 2.33 SCC/100CC H_2O at 32°F (0°C)	MATERIAL AT NORMAL CONDITION [ ] LIQUID [ ] SOLID [XXX] GAS
EXPANSION RATIO (LIQUID TO GAS) N/A Gas	
APPEARANCE AND ODOR Colorless, Odorless, Tasteless Gas	

IV — FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) N/A [ ] CLOSED CUP [ ] OPEN CUP	FLAMMABILITY LIMITS IN AIR (% OF VOL.) LOWER N/A UPPER N/A

EXTINGUISHING MEDIA

None. Nitrogen neither burns or supports combustion. Use media appropriate for surrounding fire.

SPECIAL FIRE FIGHTING PROCEDURES

Nitrogen will act as a simple asphyxiant if it displaces oxygen. Self-contained breathing apparatus may be required, for rescue workers.

UNUSUAL FIRE AND EXPLOSION HAZARD

None

TELEX: 510-100-8831 (ScotGas)
FAX: 714-887-0549
PHONE: 714-887-2571

Scott Specialty Gases a division of

Scott Environmental Technology Inc. 2600 CAJON BLVD., SAN BERNARDINO, CA 92405

Shipped From: Scott SAN BERNARDINO
Date Shipped 3-14-89
Our Project No: 416668
Your P.O. No: 24795
Page 1 of 1
Expiration Date: 9-14-90

HUNTER ESE -
ATTN: LINDA SMITH

CERTIFICATE OF ANALYSIS—EPA PROTOCOL GASES*

Certified Per Traceability Protocol No. 1 Procedure No. G1 Cylinder No. AAL-13682 Cylinder Pressure 1900 psig Certified Accuracy ±1 % NBS Traceable

REFERENCE STD					GAS ANALYZER		
COMPONENTS	CERTIFIED CONC	SRM/CRM NO.	CYL. NO.	CONC.	MAKE/MODEL/SERIAL NO.	LAST CAL. DATE	ANALYTICAL PRINCIPLE
Nitric Oxide	932.6 PPM	CRM 1687 B	AAL-19314	966 PPM	Thermo-Electron	2-2-89	Chemi-Luminenscent
					10 AR S/N 14853-150		
NOX	937.7 PPM						

BALANCE GAS Nitrogen

ANALYZER READINGS: Z = Zero Gas T = Test Gas R = Reference Gas

Component Nitric Oxide
First Analysis Date 3-4-89 Units PPM

Z 0.01	R 94.78	T 91.36
R 94.80	Z 0.02	T 91.42
Z 0.01	T 91.48	R 94.78

Mean Test Assay 931.7 PPM

Second Analysis Date 3-11-89 Units PPM

Z 0.00	R 94.81	T 91.38
R 94.81	Z 0.00	T 91.70
Z 0.00	T 91.80	R 95.09

Mean Test Assay 932.6

Component _____ Date _____ Units _____

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay _____

Date _____ Units _____

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay _____

Component _____ Date _____ Units _____

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay _____

Date _____ Units _____

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay _____

Chronology: Date _____
Assay _____

Analyst DOUG HAGBERG

Approved By: [signature]

TELEX: 510-100-8831 (ScotGas)
FAX: 714-887-0549
PHONE: 714-887-2571

Scott Specialty Gases a division of

Scott Environmental Technology Inc. 2600 CAJON BLVD., SAN BERNARDINO, CA 92405

Shipped From: Scott SAN BERNARDINO
Date Shipped 3-14-89
Our Project No: 416668
Your P.O. No: 24795
Page 1 of 1
Expiration Date: 9-14-90

HUNTER ESE
ATTN: LINDA SMITH

CERTIFICATE OF ANALYSIS—EPA PROTOCOL GASES*

Certified Per Traceability Protocol No. 1 Procedure No. G1 Cylinder No. AAL-7155 Cylinder Pressure 1900 psig Certified Accuracy ±1 % NBS Traceable

REFERENCE STD					GAS ANALYZER		
COMPONENTS	CERTIFIED CONC	SRM/CRM NO.	CYL. NO.	CONC.	MAKE/MODEL/SERIAL NO.	LAST CAL. DATE	ANALYTICAL PRINCIPLE
Nitric Oxide	594.6 PPM	CRM 1687 B	AAL-19314	966 PPM	Thermo-Electron	2-2-89	Chemi-Luminenscent
					10 AR S/N 14853-150		
NOX	598.6 PPM						

BALANCE GAS Nitrogen

ANALYZER READINGS: Z = Zero Gas T = Test Gas R = Reference Gas

Component Nitric Oxide
First Analysis Date 3-4-89 Units PPM

Z 0.00	R 95.10	T 58.48
R 94.98	Z 0.00	T 58.50
Z 0.00	T 58.54	R 94.98

Mean Test Assay 594.8

Second Analysis Date 3-11-89 Units PPM

Z 0.00	R 94.90	T 58.38
R 94.82	Z 0.01	T 58.36
Z 0.00	T 58.40	R 94.79

Mean Test Assay 598.6

Component ____ Date ____ Units ____

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay ____

Date ____ Units ____

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay ____

Component ____ Date ____ Units ____

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay ____

Date ____ Units ____

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay ____

Chronology: Date ____
Assay ____

Analyst Doug Hagberg

Approved By: [signature]

RECEIVED
JUN 19 1989

TELEX: 510-100-8831 (ScotGas)
FAX: 714-887-0549
PHONE: 714-887-2571

Scott Specialty Gases a division of

Scott Environmental Technology Inc. 2600 CAJON BLVD., SAN BERNARDINO, CA 92405

Shipped From: Scott SAN BERNARDINO
Date Shipped 6-14-89
Our Project No: 00847
Your P.O. No: SS050489
Page 1 of 1
Expiration Date: 12-14-90

HUNTER ESE
ATTN: STEVE SCHWARTZ

CERTIFICATE OF ANALYSIS—EPA PROTOCOL GASES*

Certified Per Traceability Protocol No. 1 Procedure No. G1 Cylinder No. AAL-19068 Cylinder Pressure 1900 psig Certified Accuracy ±1 % NBS Traceable

REFERENCE STD

COMPONENTS	CERTIFIED CONC	SRM/CRM NO.	CYL. NO.	CONC.
Carbon Monoxide	89.61 PPM	CRM 2636	CAL-6965	204.0 PPM

GAS ANALYZER

MAKE/MODEL/SERIAL NO.	LAST CAL. DATE	ANALYTICAL PRINCIPLE
Horiba AIA 24	3-17-89	Infra-red
S/N 4564403		

BALANCE GAS Nitrogen

ANALYZER READINGS: Z = Zero Gas T = Test Gas R = Reference Gas

Component Carbon Monoxide
First Analysis Date 6-6-89 Units PPM

Z	00.0	R	92.6	T	37.2
R	92.6	Z	00.1	T	37.1
Z	00.0	T	37.1	R	92.6

Mean Test Assay 89.61

Second Analysis Date 6-13-89 Units PPM

Z	00.0	R	92.6	T	37.2
R	92.0	Z	00.1	T	37.1
Z	00.0	T	37.1	R	92.6

Mean Test Assay 89.61

Component _____
Date _____ Units _____

Z		R		T	
R		Z		T	
Z		T		R	

Mean Test Assay _____

Date _____ Units _____

Z		R		T	
R		Z		T	
Z		T		R	

Mean Test Assay _____

Component _____
Date _____ Units _____

Z		R		T	
R		Z		T	
Z		T		R	

Mean Test Assay _____

Date _____ Units _____

Z		R		T	
R		Z		T	
Z		T		R	

Mean Test Assay _____

Chronology: Date _____
Assay _____

Analyst Maynard Johnson

Approved By: [signature]

F-4

RECEIVED JUL 28 1989

TELEX: 510-100-8831 (ScotGas)
FAX: 714-887-0549
PHONE: 714-887-2571

Scott Specialty Gases a division of

Scott Environmental Technology Inc. 2600 CAJON BLVD., SAN BERNARDINO, CA 92405

Shipped From: Scott SAN BERNARDINO
Date Shipped 7-25-89
Our Project No: 01588
Your P.O. No: SS070789
Page 1 of 1
Expiration Date: 1-25-91

HUNTER ESE
ATTN: STEVE SCHWARTZ

CERTIFICATE OF ANALYSIS—EPA PROTOCOL GASES*

Certified Per Traceability Protocol No. 1 Procedure No. G1 Cylinder No. ALM-776 Cylinder Pressure 1900 psig Certified Accuracy ±1 % NBS Traceable

REFERENCE STD

COMPONENTS	CERTIFIED CONC	SRM/CRM NO.	CYL. NO.	CONC.
Carbon Monoxide	401.0 PPM	SRM 1680 B	FF-19740	470 PPM

GAS ANALYZER

MAKE/MODEL/SERIAL NO.	LAST CAL. DATE	ANALYTICAL PRINCIPLE
Horiba AIA 24	6-23-89	Infra-red
S/N 4564403		

BALANCE GAS Nitrogen

ANALYZER READINGS: Z = Zero Gas T = Test Gas R = Reference Gas

Component Carbon Monoxide
First Analysis Date 7-17-89 Units PPM

Z 00.0	R 91.0	T 79.9
R 91.0	Z 00.1	T 79.9
Z 00.0	T 79.9	R 91.0

Mean Test Assay 401.0 PPM

Second Analysis Date 7-24-89 Units PPM

Z 00.0	R 91.0	T 79.9
R 91.0	Z 00.0	T 79.9
Z 00.0	T 79.9	R 91.0

Mean Test Assay 401.0 PPM

Component ____ Date ____ Units ____

Z ____	R ____	T ____
R ____	Z ____	T ____
Z ____	T ____	R ____

Mean Test Assay ____

Date ____ Units ____

Z ____	R ____	T ____
R ____	Z ____	T ____
Z ____	T ____	R ____

Mean Test Assay ____

Component ____ Date ____ Units ____

Z ____	R ____	T ____
R ____	Z ____	T ____
Z ____	T ____	R ____

Mean Test Assay ____

Date ____ Units ____

Z ____	R ____	T ____
R ____	Z ____	T ____
Z ____	T ____	R ____

Mean Test Assay ____

Chronology: Date ____
Assay ____

Analyst Maynard Johnson

Approved By: R. Sheely

ESE ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 6-10-87 Meter box number NU-4

Barometric pressure, P_b = 30.22 in. Hg Calibrated by LKB

Orifice manometer setting (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperatures: Wet test meter (t_w), °F	Temperatures: Dry gas meter: Inlet (t_{d_i}), °F	Temperatures: Dry gas meter: Outlet (t_{d_o}), °F	Temperatures: Dry gas meter: Avg[a] (t_d), °F	Time (θ), min	Y_i	$\Delta H@_i$ in. H_2O
0.5	5.00	5.002	69			73	12.5	1.0055	1.720
1.0	5.00	5.018	69.5			73	9.1	1.0007	1.815
1.5	10.00	10.078	69.5			74	15.0	.9971	1.830
2.0	10.00	10.192	69.5			74	13.12	.9846	1.825
3.0	10.00	10.240	69.5			75	10.95	.9796	1.886
4.0	10.00	10.288	69.5			77	9.3	.9764	1.790
							Avg	.9904	1.811

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$	$\Delta H@_i = \frac{0.0317 \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\theta}{V_w}\right]^2$

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d.

(front side)

FORM A

APPENDIX G -- LDEQ AIR PERMIT

State of Louisiana

Department of Environmental Quality

BUDDY ROEMER
Governor

PAUL TEMPLET
Secretary

January 11, 1989

Mr. Mike Tate
Manager, Engineering
Louisiana Intrastate Gas Corporation
1412 Centre Court
Post Office Box 1352
Alexandria, Louisiana 71309-1352

Dear Mr. Tate:

RE: New permit for Garden City Compressor Station, Louisiana Intrastate Gas Corporation, Centerville, St. Mary Parish, Louisiana

This is to inform you that the permit request for the above referenced project has been approved under LAC 33:III.505. The submittal was approved on the basis of the emissions reported and the approval in no way guarantees the design scheme presented will be capable of controlling the emissions to the types and quantities stated. A new application must be submitted if the reported emissions are exceeded after operation begins. The synopsis, data sheets and conditions are attached herewith.

It will be considered a violation of the permit if all proposed control measures and/or equipment are not installed and properly operated and maintained as specified in the application.

The permit number cited below should be referenced in future correspondence regarding this facility.

Done this 28 day of January, 1988.

Permit No.: 2660-00087-00

Very truly yours,

Mike D. McDaniel

Mike D. McDaniel, Ph.D.
Assistant Secretary

MMcD/PH/jsb

cc: Acadian Regional Office

C-K Associates, Inc.
11200 Industriplex Blvd., Suite 150
Baton Rouge, Louisiana 70809

DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION
BRIEFING SHEET

LOUISIANA INTRASTATE GAS CORPORATION
CENTERVILLE, ST. MARY PARISH, LOUISIANA

I. BACKGROUND:

Louisiana Intrastate Gas Corporation has requested a permit to install a new natural gas compressor station near Centerville in St. Mary Parish, Louisiana. The site location is one mile southwest of Centerville and two and a half miles southeast of Garden City on coordinates Section 45, Township 15S, and Range 10E. In addition, the corporation requested a variance to start construction in order to maintain their project schedule.

II. ORIGIN:

An Application for Approval of Emissions and Emissions Inventory Questionnaire were submitted on July 8, 1988. The variance for construction was granted on July 18, 1988. Additional information was received on December 2, 1988.

III. DESCRIPTION:

The proposed facility consists of three natural gas fired reciprocating engine-driven gas compressors of 930, 180, and 118 BHP. No other emission sources are planned. The compressors will be used to compress and transport sales grade natural gas along the Louisiana Intrastate Gas Corporation pipeline system at a rate of 30 MMcfpd. Total emissions from the compressor station are as follows:

Pollutant	Emissions (TPY)
TSP	0.266
SO_2	0.02
NO_x	89.98
HC	12.42
CO	17.38

IV. TYPE OF REVIEW:

This permit was reviewed as a new permit for a minor source in a nonattainment area for ozone. PSD, NSPS and LESHAP regulations do not apply.

V. PUBLIC NOTICE:

Public notice is not required for this minor source, since it is not over 100 TPY NO_x.

SPECIFIC CONDITIONS

LOUISIANA INTRASTATE GAS CORPORATION
CENTERVILLE, ST. MARY PARISH, LOUISIANA

1. The permittee shall conduct a performance test for each source at maximum rate, according to NSPS 40 CFR Part 60, Appendix A, recording operating conditions, and emissions of CO, NO_x, and Oxygen using Method 10, 7E, and 3a, respectively, and a report to this department shall be submitted.

2. The permittee shall have Energy Industries/Cormar, from whom the compressors are leased, do quarterly sampling of NO_x and CO emissions with a portable monitor calibrated according to NSPS, 40 CFR 60, Appendix F, Quality Assurance Procedures. Energy Industries/Cormar shall keep the compressors tuned so as to maintain compliance with permitted emissions. The permittee shall be responsible for any exceedances incurred.

3. The permittee shall maintain for two years a record, available for inspection, of actions taken to comply with Specific Condition 2. A synopsis of these actions shall be included in the annual report to the Air Quality Division.

LOUISIANA AIR EMISSION PERMIT
GENERAL CONDITIONS

I. This permit is issued on the basis of the emissions reported in the application for approval of emissions and in no way guarantees that the design scheme presented will be capable of controlling the emissions to the type and quantities stated. Failure to install, properly operate and/or maintain all proposed control measures and/or equipment as specified in the application and supplemental information shall be considered a violation of the permit and LAC 33:III.505. If the emissions are determined to be greater than those allowed by the permit or if proposed control measures and/or equipment are not installed or do not perform according to design efficiency, an application to modify the permit must be submitted.

II. The permittee is subject to all applicable provisions of the Louisiana Air Quality Regulations. Violation of the terms and conditions of the permit constitutes a violation of these regulations.

III. The permit application and the attached data sheets establish the emission and operating limitations and are a part of the permit. The synopsis and data sheets are based on the application and emissions inventory questionnaire dated July 12, 1988. Additional information was received on December 2, 1988.

IV. This permit shall become invalid, for the sources not constructed, if:

(a) construction is not commenced, or binding agreements or contractural obligations to undertake a program of construction of the project are not entered into, within two (2) years (18 months for PSD permits) after issuance of this permit, or;

(b) if construction is discontinued for a period of two (2) years (18 months for PSD permits) or more.

The administrative authority may extend this time period upon a satisfactory showing that an extension is justified.

This provision does not apply to the time period between construction of the approved phases of a phased construction project. However, each phase must commence construction within two (2) years (18 months for PSD permits) of its projected and approved commencement date.

V. The permittee shall submit semi-annual reports of progress outlining the status of construction, noting any design changes, modifications or alterations in the construction schedule which have or may have an effect on the emission rates or ambient air quality levels. These reports shall continue to be submitted until such time as construction is certified as being complete. Furthermore, for any significant change in the design, prior approval shall be obtained from the Louisiana Air Quality Division.

LOUISIANA AIR EMISSION PERMIT
GENERAL CONDITIONS

VI. The permittee shall notify the Department of Environmental Quality, Air Quality Division within ten (10) calendar days from the date that construction is certified as complete and the estimated date of start-up of operation. The appropriate Regional Office shall also be so notified within the same time frame.

VII. Any emissions testing performed for purposes of demonstrating compliance with the limitations set forth in paragraph III shall be conducted in accordance with the methods described in the Division's test manual or any other methods approved by the U.S. EPA. Any deviation from or modification of the methods used for testing shall have prior approval from the Louisiana Air Quality Division.

VIII. The emission testing described in paragraph VII above, or established in the specific conditions of this permit, shall be conducted within sixty (60) days after achieving normal production rate, but in no event later than 180 days after initial start-up (or restart-up after modification). The Air Quality Division Surveillance Section shall be notified at least thirty (30) days prior to testing and shall be given the opportunity to conduct a pretest meeting and observe the emission testing. The test results shall be submitted to the Air Quality Division within forty-five (45) days after the complete testing. As required by LAC 33:III.913, the permittee shall provide necessary sampling ports in stacks or ducts and such other safe and proper sampling and testing facilities for proper determination of the emission limits.

IX. The permittee shall, within 180 days after start-up of each project or unit, report to the Louisiana Air Quality Division any significant difference in operating emission rates as compared to those limitations specified in paragraph III. This report shall also include, but not be limited to, malfunctions and upsets.

X. The permittee shall retain records of all information resulting from monitoring activities and information indicating operating parameters as specified in the specific conditions of this permit for a minimum of at least two (2) years.

XI. If for any reason the permittee does not comply with, or will not be able to comply with, the emission limitations specified in this permit, the permittee shall provide the Air Quality Division with the following information in writing within five (5) days of such conditions:

a. Description of noncomplying emission(s);
b. Cause of noncompliance;
c. Anticipated time the noncompliance is expected to continue, or, if corrected, the duration of the period of noncompliance;
d. Steps taken by the permittee to reduce and eliminate the noncomplying emissions; and
e. Steps taken by the permittee to prevent recurrences of the noncomplying emissions.

LOUISIANA AIR EMISSION PERMIT
GENERAL CONDITIONS

XII. Permittee shall allow the authorized officers and employees of the Department of Environmental Quality, at all reasonable times and upon presentation of identification, to:

1) Enter upon the permittee's premises where regulated facilities are located, regulated activities are conducted or where records required under this permit are kept;

2) Have access to and copy any records that are required to be kept under the terms and conditions of this permit, the Louisiana Air Quality Regulations, or the Act;

3) Inspect any facilities, equipment (including monitoring methods and an operation and maintenance inspection), or operations regulated under this permit; and,

4) Sample or monitor, for the purpose of assuring compliance with this permit or as otherwise authorized by the Act or regulations adopted thereunder, any substances or parameters at any location.

XIII. If samples are taken under Section XII. 4) above, the officer or employee obtaining such samples shall give the owner, operator or agent in charge a receipt describing the sample obtained. If requested prior to leaving the premises, a portion of each sample equal in volume or weight to the portion retained shall be given to the owner, operator or agent in charge. If an analysis is made of such samples, a copy of the analysis shall be furnished promptly to the owner, operator or agent in charge.

XIV. The permittee shall allow authorized officers and employees of the Department of Environmental Quality, upon presentation of identification, to enter upon the permittee's premises to investigate potential or alleged violations of the Act or the rules and regulations adopted thereunder. In such investigations, the permittee shall be notified at the time entrance is requested of the nature of the suspected violation. Inspections under this subsection shall be limited to the aspects of alleged violations. However, this shall not in any way preclude prosecution of all violations found.

XV. The permittee shall comply with the reporting requirements specified under LAC 33:III.918 as well as notification requirements specified under LAC 33:III.927.

XVI. In the event of any change in ownership of the source described in this permit, the permittee and the succeeding owner shall notify the Louisiana Air Quality Division, within ninety (90) days after the event, to amend this permit.

AIR QUALITY DATA SHEET
PAGE 1

LOUISIANA INTRASTATE GAS CORPORATION
CENTERVILLE, ST. MARY PARISH, LOUISIANA

Location of plant: 15 UTM: 650.4 Km E 3289.7 Km N

Description of location: One mile SW of Centerville and 2 1/2 miles SE of Garden City

Estimated starting date of construction: July 15, 1988

Estimated date operation will begin: August 15, 1988

Type of Dispersion Calculations Used: _____

EFFECTS ON AMBIENT AIR

Pollutant	Time Period	Calculated Maximum Ground Level Concentration	Louisiana Air Quality Standard

NEW X OR MODIFIED ____ EMISSION SOURCES Natural Gas Compressor Station (Type of Source)

Stack I.D.#	Description	Operating Rate (Maximum)	Operating Schedule Hrs/Day	Days/Wk	Wks/Yr
1-88	930 BHP Reciprocating Compressor	9.24 MCFH Natural Gas	24	7	52
2-88	180 BHP Reciprocating Compressor	1.76 MCFH Natural Gas	24	7	52
3-88	118 BHP Reciprocating Compressor	120 MCFH Natural Gas	24	7	52

AIR QUALITY DATA SHEET - PAGE 2

LOUISIANA INTRASTATE GAS CORPORATION
CENTERVILLE, ST. MARY PARISH, LOUISIANA

MAXIMUM/AVERAGE EMISSIONS ARE LISTED USING THE UNITS LBS/HR

STACK	PERMITTED EMISSIONS						FEET	°F	CFM
ID	TSP	SO_2	NO_X	HC	CO	OTHER	HEIGHT	TEMP.	FLOW RATE
1-88	0.046	0.0037	10.25	2.24	3.05	-	3.9	910	5,460
2-88	0.009	Neg.	7.13	0.31	0.63	-	2.6	2005	855
3-88	0.006	Neg.	3.17	0.28	0.28	-	2.2	1080	650.0

AIR QUALITY DATA SHEET
PAGE 3

LOUISIANA INTRASTATE GAS CORPORATION
CENTERVILLE, ST. MARY PARISH, LOUISIANA

	TONS PER YEAR					
STACK I.D.	TSP	SO_2	NO_x	HC	CO	OTHER
1-88	0.202	0.016	44.88	9.8	13.37	-
2-88	0.038	Neg.	31.22	1.38	2.76	-
3-88	0.026	Neg.	13.88	1.24	1.25	-
Total	0.266	0.02	89.98	12.42	17.38	-

Steve

Louisiana Intrastate Gas Corporation
311 PATTERSON ST. LAFAYETTE LA 70501 (318) 233-8945

August 22, 1989

RECEIVED AUG 24 1989

Mr. James Magee
State of Louisiana
Department of Environmental Quality
Air Quality Division Surveillance Section
P. O.Box 44096
Baton Rouge, La. 70804

Re: Louisiana Intrastate Gas Corp. (LIGC) - Garden City Compressor Station
DEQ Permit No. 2660-00087-00

Dear Mr. Magee:

Due to a conflict in testing schedules between Louisiana Intrastate Gas Corp., (LIGC), Louisiana Resources Company (LRC), Hunter/ESE and DEQ Air Quality Surveillance Section, the stack emissions testing of the LIGC Garden City Compressor Station has been changed from August 28 - 30, 1989 to September 5 & 6, 1989. The above testing schedule is being changed as per telephone conversations between Bharat Contractor of Hunter/ESE, Mr. James Magee of DEQ and myself.

As per a previous telephone conversation between Bharat Contractor of Hunter/ESE and James Magee of DEQ, the option to conduct a pretest meeting has been waived by DEQ.

If you have any questions, please call.

Sincerely,

Mike Leger

Mike Leger
Staff Eng. Tech.

ML:rb

c: Mr. M. K. Tate
Mr. R. P. Mathews
Mr. Jim Davis
Mr. Al Briggs
Mr. Frank Landry
Mr. Tommy Tucker
Mr. Ben Potier/DEQ
Ms. Jodie Miller/DEQ
Mr. Bharat Contractor/Hunter ESE
CO Pending
Memo File

APPENDIX H -- PROJECT PARTICIPANTS

HUNTER/ESE, INC.

PERSONNEL

Bharat Contractor	Project Director
Steven Schwartz	Senior Associate Engineer
Mike Calamia	Lead Technician

LOUISIANA INTRASTATE GAS CORPORATION

PERSONNEL

Mike Leger	Test Coordinator

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY

PERSONNEL

Robert Freeman	Test Observer