ENTERPRISE PRODUCTS COMPANY
P.O. BOX 573
MT. BELVIEU, TEXAS 77580
713/383-3546

ENTERPRISE®

R7-37PJ

April 23, 1991

Ms. Jodena Henneke, Director
Texas Air Control Board, Region VII
5555 West Loop South, Suite 300
Bellaire, Texas 77401

RECEIVED
APR 23 1991
REGION 7
TEXAS AIR CONTROL BOARD

SUBJECT: STACK TEST RESULTS FOR WATER-INJECTED IR-ALLISON TURBINES, TACB PERMIT R-8418, DEISOBUTANIZER UNITS I & II, ENTERPRISE PRODUCTS COMPANY, MONT BELVIEU, TEXAS

Dear Ms. Henneke:

Pursuant to 40 CFR 60.8 and to Special Provision No. 6 of the above referenced permit, attached are the results of the stack tests conducted on the water-injected IR-Allison 501-KCM turbines. in the Deisobutanizer Units I and II, along with a copy of the permit. Stack testing was carried out January 17 - 24, 1991.

The stack test results show that the maximum allowable emission rates and stack gas concentrations of nitrogen oxides (NO_x) and carbon monoxide (CO) were met, with fuel comprising both 100% natural gas and various natural gas/ethane blends. In compliance with Special Provision No. 6F, the turbines will be operated only with the fuel blends and at other operating conditions which have been established by the testing to result in emission rates and concentrations of NO_x and CO which are within permitted limits.

If you have any questions, please contact me at the above address or by telephone at area code (713) 383-3546, extension 317.

Yours truly,

for MFB

Mary F. Barron
Environmental Manager

Attachment

cc: Steve Spaw, Executive Director, Texas Air Control Board, Austin, TX

cc: ENV FILE 10617.0

cc (w/Results Tables Only): RMP, JES, CEC, TLH, CMB, WEM, JRD, BBB, ENV FILE 10120.0

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RECEIVED April 22, 1991

APR 23 1991

REGION 7
TEXAS AIR CONTROL BOARD

Ms. Mary Barron
Environmental Manager
Enterprise Products Company
P.O. Box 573
Mont Belvieu, Texas 77580

SUBJECT: TRANSMITTAL OF THE REVISED TENERX REPORT ENTITLED "ENTERPRISE PRODUCTS ISOM-DIB UNIT'S NO. 7 & 8 ALLISON GAS TURBINES NSPS EMISSIONS COMPLIANCE TEST (TACB OPERATING PERMIT R-8418)".

Tenerx Corporation conducted the emissions compliance test program on Enterprise Products, Isomerization Deisobutanizer Unit's No. 7 and 8 Allison Gas Turbines in January 1991. The program was performed under Enterprise Products P.O. No. MB314-179. The initial report was transmitted in February 1991. The report was returned to Tenerx for changes and corrections in April 1991 after Enterprise Products personnel reviewed and commented on the report.

Three copies of the revised Tenerx final report which documents the findings and results of this program are enclosed. If you have any questions concerning the findings of this program, please contact us at our Friendswood office.

Sincerely,

Billy T. Y. Lee

Billy T. Y. Lee
Principal Engineer
Tenerx Corporation

Texas Air Control Board

AUSTIN **MEMORANDUM** TEXAS

TO: Compliance Division

FROM: _____, Reviewer

DATE:

SUBJECT: CEMS Certification Report

If more than one source or one system per report, attach additional forms.

1) TACB Permit No.: _____ PSD-TX- _____
2) Company: _____ Account No.: _____
3) City: _____ County: _____ Region: _____
4) Source Monitored (Monitor Location): _____
5) Pollutant Monitored: _____ Instrument Manufacturer: _____
5a) Model No.: _____ Serial No.: _____
6) Diluent Monitored: _____ Instrument Manufacturer: _____
6a) Model No.: _____ Serial No.: _____
7) Certification Required By: TACB Permit NSPS PSD Permit
8) Date(s) of Certification: Factory (opacity): _____
Relative Accuracy: _____
Calibration Drift: _____
9) Date Report Received by Reviewer: _____
10) Name of Testing Organization: _____
11) Recertification Required? YES _____ NO _____
12) Reported Results and Discussion (use additional pages as necessary)

cc: Regional Director, Region _____
TACB Permit File _____
Permit File PSD-TX- _____

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ENTERPRISE PRODUCTS COMPANY
ISOMERIZATION DEISOBUTANIZER UNIT
NO. 7 & 8 ALLISON GAS TURBINES
NEW SOURCE PERFORMANCE STANDARD
EMISSIONS COMPLIANCE TEST
(TACB OPERATING PERMIT R-8418)

(TENERX REPORT NO. TR91-02-09R1)

PREPARED BY

TENERX CORPORATION

APRIL 1991

PREPARED FOR

ENTERPRISE PRODUCTS COMPANY
MONT BELVIEU, TEXAS 77580

SAMPLING LOCATION

ENTERPRISE PRODUCTS COMPANY
MONT BELVIEU, CHAMBERS COUNTY, TEXAS

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SECTION 1.0 - SUMMARY

Tenerx Corporation performed an emissions compliance test program on Enterprise Products Company, Isomerization Deisobutanizer (ISOM-DIB) Unit's No. 7 and 8 IR-Allison Gas Turbines between January 17 and 24, 1991. The objective of the test program is to certify compliance of the ISOM-DIB turbines for NOx and CO emissions per the Special Provision of the Texas Air Control Board (TACB) Operating Permit No. R-8418. The test program was coordinated by Ms. Mary Barron, Environmental Manager of Enterprise Products Company. The Texas Air Control Board observer during the test was Mr. Michael Vance from the TACB Houston (Region VII) regional office.

The emissions compliance test was conducted per EPA 40 CFR, Part 60, Subparts A and GG. The emission concentrations in the flue gas were measured according to procedures described in 40 CFR, Part 60, Appendix A. Reference Methods 20, 10, and 3A were used to measure the concentrations of NOx, CO, and O2, respectively. In order to determine the NOx and CO mass emission rates in pounds per hour, flue gas volumetric flow rates and moisture contents were also measured at the turbine exhaust stack.

The ISOM-DIB Allison turbines were permitted to fire natural gas and deethanizer overhead. The deethanizer overhead are comprised of 98% by volume ethane and will herein after be referred to as ethane. The purpose of the blended-fuel test was to determine the maximum volume percent of ethane in fuel fired to the turbines with which permitted turbine emissions could be achieved. Therefore, the two fuels tested were natural gas and a blend of natural gas with ethane. The initial intent was to test the gas turbines with a fuel blend of up to 50% ethane (Note: all fuel blend ratios are in volume percentages; e.g., 70% ethane means a blend fuel comprised of 70% by volume of ethane and 30% by volume of natural gas). During the preliminary test, it was found that turbine No. 8 could meet the compliance requirements with a blend fuel of up to 70% ethane. No.7 turbine, on the other hand, had problems meeting the compliance requirements at the same fuel blend due to combustor and fuel nozzle problems. Since the preliminary test, turbine No. 7 had undergone modifications to correct these problems. However, during the compliance test, the No. 7 turbine still could not meet the emissions limitations when firing 50% ethane blend fuel. The ethane ratio was then reduced to where the turbines could meet the emission limitations. The final compliance tests for the blend fuel on both turbines were conducted with a 30% ethane and 70% natural gas blend.

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The emission limits with which the turbines were permitted were supplied by General Turbine Systems, Inc. (GTS), who also provided the mechanical configuration elements for both turbines, including the combustor and water injection nozzles. These emission limits are detailed in a letter dated March 31, 1989 from Sajjad A. Chaudhry of General Turbine Systems, Inc. to Bob Soehl, Enterprise Products Company. This document is included in this report as pages 2A and 2B. Per the GTS's document, the emission limits are conditional upon various factors, including "Maximum Continuous Power Rating". Testing determined that with the turbine configuration supplied by GTS, maximum continuous power rating for the No. 7 turbine was necessarily defined at maximum power turbine inlet temperature of 1400 °F and for the No. 8 turbine at maximum power turbine inlet temperature of 1420 °F.

The compliance test was conducted during the cold winter month where the NOx emissions are high due to the lower ambient moisture content and the turbine exhaust flow was also high due to the higher air density. The combination of the two resulted in substantially higher NOx mass emissions, even though the corrected ISO PPM NOx concentrations were below the regulation limit.

The compliance test consists of measuring all emissions parameters in the flue gas at the maximum unit production rate without exceeding the allowable emissions limits. Three runs were conducted on each operating condition for a total of twelve runs or six runs for each turbine to meet the compliance requirements. The emission concentrations are determine by averaging the results of the three runs. A summary of the compliance test results with water injection rates for both turbines firing two blends of fuels is summarized in Table 1.

All emissions parameters met the compliance guidelines and were below the permit's maximum allowable emission rate limits.

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GENERAL TURBINE SYSTEMS, INC.

FAX TRANSMITTAL FORM

DATE: March 31, 1989 TIME: 12:15 p.m.

FAX NO.: 713-383-3546

No. of pages (incld. this page) 2

TO: ENTERPRISE PRODUCTS

ATTENTION: Bob Soehl

FROM: Sajjad A. Chaudhry, GENERAL TURBINE SYSTEMS, INC.

REFERENCE: Allison 501-KCM Emissions Test

COMMENTS:

The following are the test results for the Allison 501-KB5 operating at 1895 degrees F. T.I.T. (Allison 501-KCM operates at 1840 degrees F. T.I.T.).

All data recorded was obtained per ARP1256A, Society of Automotive Engineers, October 1980.

A. Water injection ratio 0.8 #H20/Fuel:

Engine T.I.T. = 1,840 degrees F.
Engine RPM = 13,800 RPM

	Average Results	Variation Range
CO	1.36 lb/hr	0.75-2.22
HC	0.27 lb/hr	0.17-0.40
NOX	5.18 lb/hr	4.65-5.79

B. With no water injection

	Average Results	Variation Range
CO	0.83	0- 2.03
HC	0.21	0.06- 0.39
NOX	18.03	16.27-19.20

PLEASE NOTE: If you are not receiving our transmission or need assistance, please telephone. THANK YOU.

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ENV 10617.0 02

FAX TRANSMITTAL FORM
PAGE 2

USE FOR COMPARISON PURPOSES & PERMITTING

COMMENTS CONTINUED

C. The EPA authorities should be guaranteed the following levels for the GTS supplied Allison 501-KCM:

Nitrogen oxide (NOX)	7 lb/engine hr.
Carbon monoxide (CO)	4.5 lb/engine hr.
Total hydrocarbon (THC)	0.8 lb/engine hr.

The above is based on natural gas, water fuel ratio of 0.8 #H20/fuel, 14,400 RPM and max continous power rating.

Proposed Solution:

A. GTS can provide a skid mounted ratio control system to guarantee the NOX emissions. The system is similar to the one utilized by Texaco in California. The new skids 400 DIB and 300 DIB can be designed to incorporate the controls within the Allen Bradley PLC system. The NOX emissions will be certified by GTS.

B. Retrofit existing skid:

GTS can provide Enterprise with the design and incorporate the hardware to retrofit the existing IR skid to #H20/fuel ratio control.

The GTS system will interface with the Bendix CCC fuel control and provide the desired #H20/fuel ratio for optimum emissions control.

Please advise.

Regards,

Saj Chaudhry

mr

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TABLE 1 ENTERPRISE PRODUCTS CO. ISOM-DIB NO. 7 & 8 IR-ALLISON GAS TURBINES EMISSION COMPLIANCE TEST SUMMARY

*** NATURAL GAS & ETHANE NATURAL GAS BLEND ***

	NOx (ppm,ISO* condition)	CO (ppm,corr. 15% O2)	NOx (---Lb/Hr---)	CO (---Lb/Hr---)
TACB Operating Permit R-8418 Maximum Allowable Emission Rate ----------	50	50	7.00	4.50

Test ID	Test Condition	H20 Inj. Rate (Lb H20/ Lb Fuel)	Vel. (ft/s)	Volum. (DSCFM)	Moist. (%)	NOx (ppm,ISO* condition)	CO (ppm,corr. 15% O2)	NOx (----Lb/Hr----)	CO (----Lb/Hr----)	O2 (%)	CO2 (%)
						ISOM TURBINE # 7					
C # 2-1	30%Ethane+70%NG	0.920	29.97	28371	8.36	35.3	32.9	6.02	3.97	15.13	3.60
C # 2-2	(1420 oF)	0.913	30.13	28657	8.09	36.0	30.6	6.25	3.72	15.15	3.60
C # 2-3		0.910	30.51	28133	10.24	35.5	27.2	6.09	3.27	15.10	3.80
Average		0.914	30.20	28387	8.90	35.6 (PASSED)	30.2 (PASSED)	6.12 (PASSED)	3.65 (PASSED)	15.33	3.67
C # 4-1	100% Nat. Gas	0.602	28.10	26485	8.00	44.6	34.2	6.90	3.70	15.37	3.20
C # 4-2	(1400 oF)	0.602	28.29	26931	7.81	45.3	33.7	7.09	3.70	15.37	3.30
C # 4-3		0.603	27.37	26085	7.71	45.7	36.5	6.79	3.87	15.39	3.20
Average		0.602	27.92	26500	7.84	45.2 (PASSED)	34.8 (PASSED)	6.93 (PASSED)	3.76 (PASSED)	15.38	3.23
						ISOM TURBINE # 8					
C # 1-1	30%Ethane+70%NG	0.751	27.22	26055	7.62	38.0	33.8	5.76	3.70	15.21	3.80
C # 1-2	(1420 oF)	0.746	27.56	26443	7.31	40.0	25.4	5.74	2.71	15.43	3.40
C # 1-3		0.750	27.67	26266	7.95	39.9	31.0	5.70	3.38	15.29	3.20
Average		0.749	27.48	26255	7.63	39.3 (PASSED)	30.1 (PASSED)	5.73 (PASSED)	3.26 (PASSED)	15.31	3.47
C # 3-1	100% Nat. Gas	0.504	29.10	28063	6.86	43.2	17.7	6.28	1.82	15.95	2.80
C # 3-2	(1420 oF)	0.546	29.01	27678	7.19	38.5	26.3	5.43	2.66	15.95	2.60
C # 3-3		0.547	29.46	27662	9.12	36.9	29.3	5.14	2.93	16.00	2.90
Average		0.532	29.19	27801	7.72	39.6 (PASSED)	24.4 (PASSED)	5.62 (PASSED)	2.47 (PASSED)	16.97	2.77

* ISO condition is applicable to gas turbines only and corrects NOx to 15% O2, 29.92 in. Hg., 15 deg. C, and Relative Humidity of 60% (40 CFR, Part 60, Subpart GG).

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SECTION 2.0 - TEST METHOD AND EQUIPMENT DESCRIPTION

The emissions test equipment, procedures, and analysis methods were those described in the EPA Federal Register Title 40 (Protection of the Environment), Part 60, Appendix A and/or the TACB Sampling Manual. A Tenerx test trailer conforming to the specifications of the Reference Method was set up at the ISOM-DIB Unit's Allison gas turbines. A description of the flue gas sampling location and the Tenerx trailer CEMS configuration is shown in Figure 1. Reference Methods 20, 10, and 3A were selected to measure concentrations of NOx, CO, and O2, respectively.

Tenerx performed the sample traverse location determination, flue gas velocity and volumetric flow rate, and flue gas composition analysis based on EPA Reference Methods 1, 2, and 3. The velocity was measured using a reverse type (S-Type) pitot tube that is calibrated against a standard pitot tube (standard pitot tube coefficient = 0.99). Dry molecular weight of the flue gas was determined by measuring the excess O2 and CO2 content of the flue. Integrated flue gas samples were collected in an evacuated gas cylinder and the O2 and CO2 contents were analyzed using an Orsat Gas Analyzer. The moisture content of the flue gas was measured per the Reference Method 4 "Determination of Moisture Content in Stack Gases" by condensing moisture in a train of four Greenburg-Smith impingers submerged in an ice water bath.

Since the Allison turbine stack sample port locations do not conform to the minimum sampling points requirement described in Reference Method 1, sixteen sampling points were used according to the procedures described in Reference Method 20.

A Tenerx Test Trailer, equipped with a Continuous Emission Monitoring System (CEMS) capable of measuring O2, CO, and NOx concentrations to the specifications of the EPA Reference Methods, was set up at the ISOM-DIB Unit turbines. Flue gas samples were drawn from sixteen points in the stack, conditioned, and analyzed by Tenerx's NOx, CO, and O2 analyzers on a dry basis. The duration of sampling at each point was 4 minutes for a total of 64 minutes. Description of the Tenerx test trailer CEMS is as follows:

Thermo Electron NOx analyzer -

Model No.	:	TECO 10S
Serial No.	:	10S-28897-233
Principal	:	Chemiluminescence
Calibration	:	High Span - 89.03 ppm NOx in N2
		Mid Span - 55.75 ppm NOx in N2
		Low Span - 24.48 ppm NOx in N2
		Zero - N2 zero gas
Full Span	:	0 - 100 ppm NOx

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Horiba CO Analyzer -

Model No.	:	VIA 500
Serial No.	:	56461401
Principal	:	Non-Dispersive Infrared
Calibration	:	High Span - 102.5 ppm CO in N2
		Mid Span - 169.5 ppm CO in N2
		Low Span - N2 zero gas
Full Span	:	0 - 200 ppm CO

Teledyne O2 Analyzer -

Model No.	:	TAI 326RAX
Serial No.	:	115442
Principal	:	Fuel Cell (Polarographic)
Calibration	:	High Span - Ambient Air (20.9% O2)
		Mid Span - 8.45% O2 in N2
		Low Span - N2 zero gas
Full Span	:	0 - 25% O2

Sampling System - Samples are continuously drawn from the sample points via a diaphragm pump through a glass heated probe and a Teflon heated sample line. Flue gases pass through a filter and a condenser to remove all particulate and moisture in the flue sample. Conditioned flue gas samples then pass through control valves and flow meters to the instruments. The emission concentrations are measured on a dry basis and are recorded on a variable speed strip chart recorder.

Instrument Calibration - Calibration gases were first sent directly to the instrument to check linearity of the instrument (Calibration Error Check). The calibration gases were then sent via a sample line to a three way valve located behind the sample probe and back to the instrument to verify system bias (System Bias Check). Procedures used in the system bias check are repeated prior to and after each run to measure the instrument calibration drift. The calibration gases used for the NOx and the CO analyzers are EPA protocol gases (Alternative Number 1) and the calibration gases used for the O2 analyzer were of the regular certified grade verified according to procedures described in Reference Method 3A, Section 6.1 (Alternative Number 2).

An Orsat Gas Analyzer was used to measure the carbon dioxide (CO2) content in the flue gas as well as to verify the accuracy of the O2 readings during each test. The emission concentrations were determined by integrating the areas under the curves using a THS planimeter and the results corrected for the system bias. The NOx results were then corrected to 15% O2 and ISO conditions (standard temperature of 15 deg. C, std. pressure of 29.92 in. Hg., and relative humidity of 60%) per 40 CFR, Part 60, Subpart GG. The CO results were corrected to 15% O2. Both the NOx and CO results were also presented in pounds per hour.

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SECTION 3.0 - TEST RESULTS

Tenerx conducted an emissions compliance test on Enterprise Products, Isomerization Deisobutanizer (ISOM-DIB) Unit's Allison Gas Turbines No. 7 and 8 between January 17 and 24, 1991. The turbines are located at the Enterprise Products Company facility in Mont Belvieu, Chambers County, Texas. The ISOM-DIB turbines are IR-Allison Model 501 KCM Gas Turbines (Serial Nos.: Turbine No. 7 - ASP 837; Turbine No. 8 - ASP 904) with name plate ratings of 4600 Brake Horsepower (BHP). The Maximum Continuous Power Rating of the turbines is 5000 horsepower. The compliance test was conducted with the units firing 100% natural gas and a blend of 30% ethane and 70% natural gas.

A total of twelve runs was conducted during the test program with three runs at each operating condition. Each run consisted of measuring the velocity, moisture content, and the volumetric flow rate of the flue gas along with flue gas concentrations of O2, CO2, NOx, and CO. A summary of selected test parameters and emission rates for each operating condition is presented in the following tables.

*** ISOM TURBINE # 7 30% ETHANE + 70% NATURAL GAS ***
(ENGINE TEMPERATURE - 1420 °F)

Run Test Date	C # 2-1 01-17-91	C # 2-2 01-17-91	C # 2-3 01-17-91
H2O Inj. Rate, Lb H2O/Lb Fuel	0.920	0.913	0.910
Excess O2, %	15.13	15.15	15.10
CO2 , %	3.60	3.60	3.80
Moisture , %	8.36	8.09	10.24
Barometric Press., in.Hg.	30.26	30.26	30.22
Wet/Dry Bulb Temp, F	59/64	56/61	56/61
Ambient Moisture, Lb H2O/Lb DA	0.0096	0.0085	0.0085
Flue Gas Temp , F	411.9	410.6	414.6
Flue Gas Velocity , ft/sec	29.97	30.13	30.51
Flue Gas Flow Rate, DSCFM	28371	28657	28133
NOx (Dry, Uncorrected) , ppm	29.60	30.45	30.22
(Dry, Corr.to 15% O2), ppm	30.28	31.25	30.76
(Corr. to ISO cond.) , ppm	35.32	36.02	35.45
(Mass Emission Rate) , Lb/Hr	6.02	6.25	6.09
CO (Dry, Uncorrected) , ppm	32.14	29.81	26.70
(Dry, Corr.to 15% O2), ppm	32.87	30.60	27.18
(Mass Emission Rate) , Lb/Hr	3.97	3.72	3.27

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*** ISOM TURBINE # 7 100% NATURAL GAS ***
(ENGINE TEMPERATURE - 1400 °F)

Run	C # 4-1	C # 4-2	C # 4-3
Test Date	01-24-91	01-24-91	01-24-91
H2O Inj. Rate, Lb H2O/Lb Fuel	0.602	0.602	0.603
Excess O2, %	15.37	15.37	15.39
CO2 , %	3.20	3.30	3.20
Moisture , %	8.00	7.81	7.71
Barometric Press., in.Hg.	30.22	30.22	30.25
Wet/Dry Bulb Temp, F	53/58	51/55	51/54
Ambient Moisture, Lb H2O/Lb DA	0.0075	0.0071	0.0074
Flue Gas Temp , F	417.0	411.1	411.8
Flue Gas Velocity , ft/sec	28.10	28.29	27.37
Flue Gas Flow Rate, DSCFM	26485	26931	26085
NOx (Dry, Uncorrected) , ppm	36.35	36.72	36.32
(Dry, Corr.to 15% O2), ppm	38.80	39.17	38.91
(Corr. to ISO cond.) , ppm	44.60	45.26	45.70
(Mass Emission Rate) , Lb/Hr	6.90	7.09	6.79
CO (Dry, Uncorrected) , ppm	32.04	31.55	34.07
(Dry, Corr.to 15% O2), ppm	34.20	33.65	36.50
(Mass Emission Rate) , Lb/Hr	3.70	3.70	3.87

*** ISOM TURBINE # 8 30% ETHANE + 70 % NATURAL GAS ***
(ENGINE TEMPERATURE - 1420 °F)

Run	C # 1-1	C # 1-2	C # 1-3
Test Date	01-17-91	01-17-91	01-17-91
H2O Inj. Rate, Lb H2O/Lb Fuel	0.751	0.746	0.750
Excess O2, %	15.21	15.43	15.29
CO2 , %	3.80	3.40	3.20
Moisture , %	7.62	7.31	7.95
Barometric Press., in.Hg.	30.40	30.35	30.24
Wet/Dry Bulb Temp, F	56/68	60/70	59/65
Ambient Moisture, Lb H2O/Lb DA	0.0068	0.0088	0.0092
Flue Gas Temp , F	412.8	412.3	412.9
Flue Gas Velocity , ft/sec	27.22	27.56	27.67
Flue Gas Flow Rate, DSCFM	26055	26443	26266
NOx (Dry, Uncorrected) , ppm	30.87	30.28	30.29
(Dry, Corr.to 15% O2), ppm	32.02	32.69	31.84
(Corr. to ISO cond.) , ppm	37.97	40.04	39.88
(Mass Emission Rate) , Lb/Hr	5.76	5.74	5.70
CO (Dry, Uncorrected) , ppm	32.62	23.54	29.53
(Dry, Corr.to 15% O2), ppm	33.84	25.42	31.04
(Mass Emission Rate) , Lb/Hr	3.70	2.71	3.38

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***** ISOM TURBINE # 8 100% NATURAL GAS *****
(ENGINE TEMPERATURE - 1420 °F)

Run	C # 3-1	C # 3-2	C # 3-3
Test Date	01-21-91	01-21-91	01-21-91
H2O Inj. Rate, Lb H2O/Lb Fuel	0.504	0.546	0.547
Excess O2, %	15.95	15.95	16.00
CO2 , %	2.80	2.60	2.90
Moisture , %	6.86	7.19	9.12
Barometric Press., in.Hg.	30.37	30.37	30.37
Wet/Dry Bulb Temp, F	43/48	44/47	41/44
Ambient Moisture, Lb H2O/Lb DA	0.0048	0.0055	0.0047
Flue Gas Temp , F	412.6	418.7	416.1
Flue Gas Velocity , ft/sec	29.10	29.01	29.46
Flue Gas Flow Rate, DSCFM	28063	27678	27662
NOx (Dry, Uncorrected) , ppm	31.24	27.39	25.93
(Dry, Corr.to 15% O2), ppm	37.24	32.63	31.23
(Corr. to ISO cond.) , ppm	43.23	38.50	36.93
(Mass Emission Rate) , Lb/Hr	6.28	5.43	5.14
CO (Dry, Uncorrected) , ppm	14.85	22.07	24.29
(Dry, Corr.to 15% O2), ppm	17.70	26.29	29.25
(Mass Emission Rate) , Lb/Hr	1.82	2.66	2.93

All other pertinent information concerning the emission compliance test is contained in the Appendices. The field "raw" data is presented in Appendix A. Equipment calibration data is contained in Appendix B. Data calculations, manufacturer's specifications, calibration gas certification, and process data are presented in Appendices C through F. Chain of custody, resumes, and personnel information are presented in Appendices G through I.

TENERX corp
P.O. Box 1444, Friendswood, TX 77546
(713) 482-5801

CLIENT—JOB NO. Enterprise Products
SUBJECT ISOM DIB #7 & 8 Compliance Test

SHEET _____ OF _____
MADE BY RT DATE 2/12/91
CHKD. _____ DATE _____
APPVD. BY _____ DATE _____

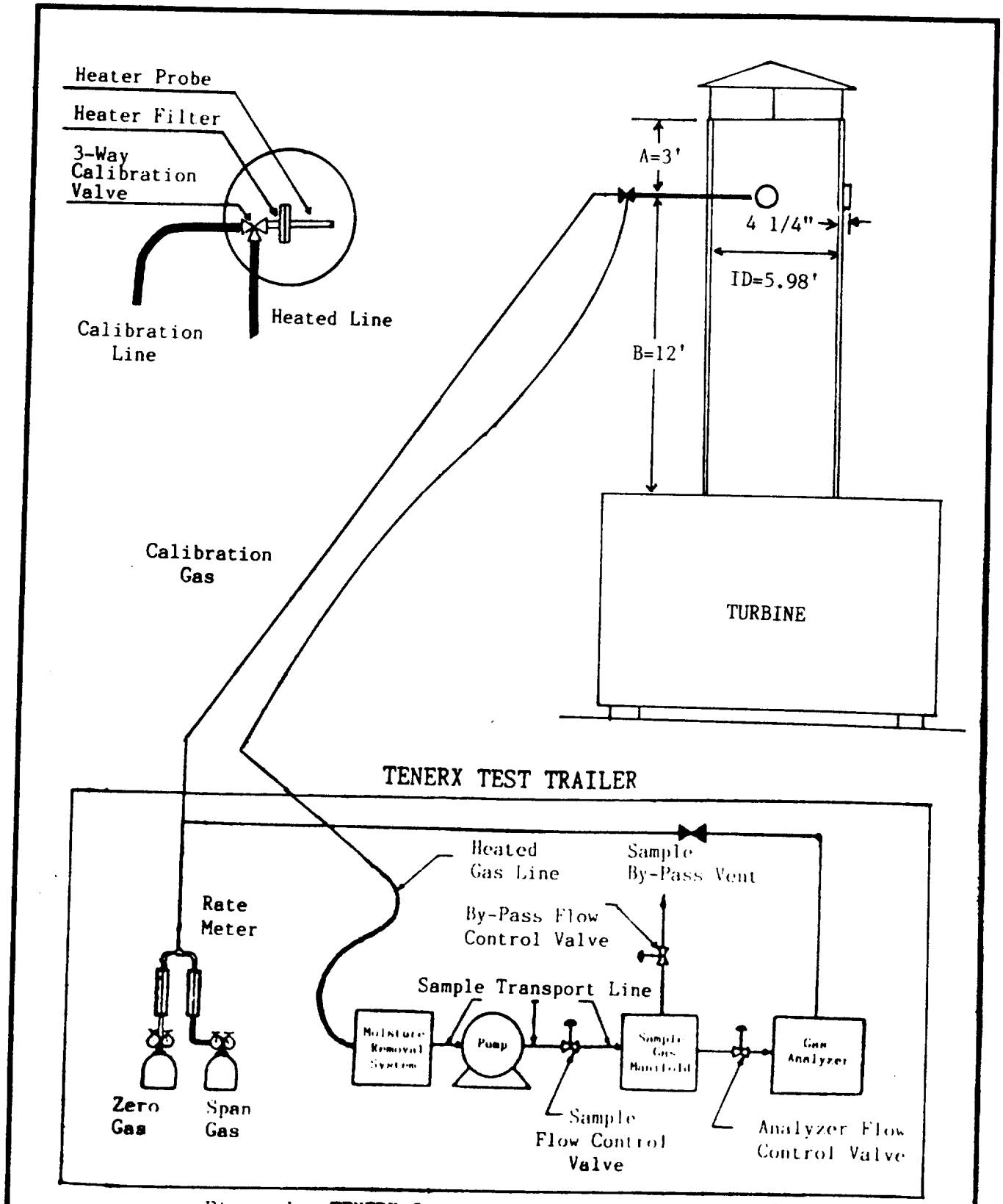

Figure 1: **TENERX** Continuous Emission Monitor (CEM) Test Trailer and Sampling Configuration

TENERX CORP
P.O. Box 1444, Friendswood, TX 77546
(713) 482-5801

APPENDICES

APPENDIX A. FIELD "RAW" DATA
1. ISOM TURBINE # 7
2. ISOM TURBINE # 8

B. EQUIPMENT CALIBRATIONS

C. DATA CALCULATIONS

D. TENERX CEM MANUFACTURER'S SPECIFICATIONS

E. CALIBRATION GAS CERTIFICATIONS

F. PROCESS DATA

G. CHAIN OF CUSTODY

H. RESUMES

I. PERSONNEL INFORMATION

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(713) 482-5801

APPENDIX A

FIELD "RAW" DATA

1. ISOM TURBINE # 7
2. ISOM TURBINE # 8

TENERX CORP
P.O. Box 1444, Friendswood, TX 77546
(713) 482-5801

APPENDIX A

FIELD "RAW" DATA

1. ISOM TURBINE # 7

Enterprise Products
ISOM unit 7 & 8

DETERMINATION OF MINIMUM
NUMBER OF TRAVERSE POINTS

By using the top figure on the following page determine the number of traverse points recommended by both distance A and distance B, which have as units of distance "stack duct diameters". (This figure must be read vertically from either the top down, for distance A, or from the bottom up, for distance B) The greater number of traverse points, as determined by each of the two distances will be the number of traverse points recommended for use. Sketch a drawing of the stack below with both distances A and B and duct diameter shown. Show both elevation and plan view.

How Distances
Are Determined Measured

Distance A (in feet) 3 (in duct diameters) 0.602
Recommended Number of Traverse Points as determined by Distance A 16

Distance B (in feet) 12 (in duct diameters) 2.007
Recommended Number of Traverse Points as determined by Distance B 16

Stack Diameter Port (in feet) 5.98' or 5' 11 3/4"

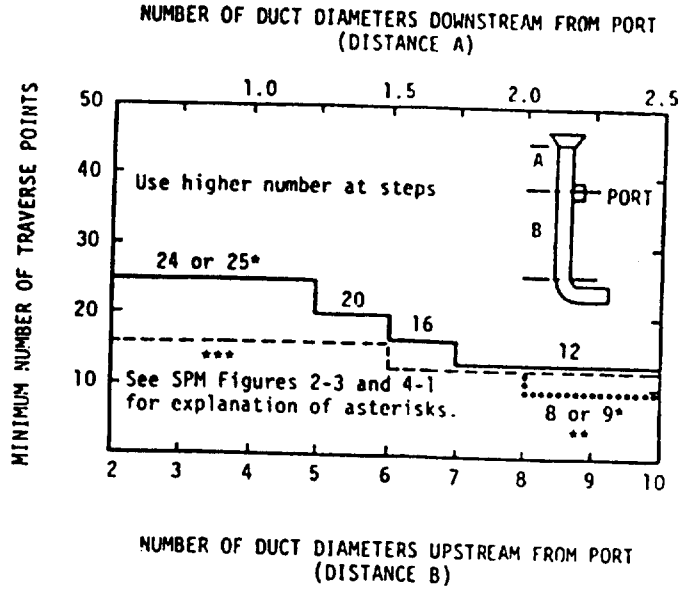
Date 1-14-91

Signature [illegible]

Nov. 1972 Draker

TRAVERSE POINTS LAYOUT FOR CIRCULAR STACKS

Minimum number of traverse points per sample obtained from "Distances to Disturbances", Upstream and Downstream.



For non-circular stacks the hydraulic diameter D_H is used where:

$$D_H = \frac{4\,(\text{Area duct at port})}{(\text{Perimeter duct at port})}$$

Traverse Point Number	LENGTH FACTORS (Fraction of stk. diam. from inside wall to traverse pt.) NUMBER OF TRAVERSE POINTS ON A DIAMETER											
	2	4	6	8	10	12	14	16	18	20	22	24
1	.146	.067	.044	.033	.025	.021	.018	.016	.014	.013	.011	.011
2	.854	.250	.147	.105	.082	.067	.057	.049	.044	.039	.035	.032
3		.750	.295	.194	.146	.118	.099	.085	.075	.067	.060	.055
4		.933	.705	.323	.226	.177	.146	.125	.109	.097	.087	.079
5			.853	.677	.342	.250	.201	.169	.146	.129	.116	.105
6			.956	.806	.658	.355	.269	.220	.188	.165	.146	.132
7				.895	.774	.645	.366	.283	.236	.204	.180	.161
8				.967	.854	.750	.634	.375	.296	.250	.218	.194
9					.918	.823	.731	.625	.382	.306	.261	.230
10					.975	.882	.799	.717	.618	.388	.315	.272
11						.933	.854	.780	.704	.612	.393	.323
12						.979	.901	.831	.764	.694	.607	.398
13							.943	.875	.812	.750	.685	.602
14							.982	.915	.854	.796	.739	.677
15								.951	.891	.835	.782	.728
16								.984	.925	.871	.820	.770
17									.956	.903	.854	.806
18									.986	.933	.884	.839
19										.961	.913	.868
20										.967	.940	.895
21											.965	.921
22											.989	.945
23												.968
24												.989

Enterprise Products
150M Turbine #7 & 8

TRAVERSE POINTS LAYOUT FOR CIRCULAR STACKS - cont'd

Stack I.D. at Port 71 3/4" feet Port Extension 4 1/2" feet

Traverse Point Number	Column A Length Factor from Previous Page, K_L	Column B K_L x (stack ID)
1	0.033	0.033(71.75)+4.25 = 6.62
2	0.105	11.78
3	0.194	18.17
4	0.323	27.43
5	0.677	52.82
6	0.806	62.08
7	0.895	68.47
8	0.967	73.63
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		

The port extension distance is the distance from the nozzle to the reference point.

Column B contains the distances from the reference point to the sample points.

For non-circular stacks the traverse point layout must be recorded and identified on this form.

Measure from the nozzle, a distance equal to the port extension and mark this point as a reference point from which all subsequent distances (from Column B) are measured.

Date 1-14-91

Signature [illegible]

TENERX corp.

STACK SAMPLING FIELD DATA

PLANT NAME Enterprise Products STACK NAME 100M DIB #7

DATE 1/17/91 OPERATOR C.T. SAMPLE NUMBER C#2-1 STACK HEIGHT ~43ft

STACK DIAM. (exit) 5.98' STACK DIAM. (port) 5.98' STACK PRESS. (In. H_2O) -0.08 BARO. PRESS. (In. H_2O) 30.26

PROBE NUMBER 8 PTCF 0.84 DGMCF 0.988 ΔH = 1.53 PUMP NUMBER EN-110

NOZZLE NUMBER — NOZZLE AREA — FILTER NUMBER — OUT WEIGHT GRAMS —

METER NUMBER EN-110 K FACTOR _____ ORIFICE CONSTANTS a _____ b _____

Prelcak check 0.0 @ -26in Hg Post leak Check:

	Point	Clock Time	Dry Gas Meter Reading	ΔP Inches H_2O	ΔH Inches H_2O	Probe Temp.	DRY GAS METER TEMPERATURE Inlet	Outlet	L. VAC. Inches Hg Gauge	Box Temperature °F	Stack Temperature °F
Port #1	1	5:26	204.077	0.22	1.7	262	67	68	16		379
	2	5:30	207.79	0.22	1.7	264	67	68	16		380
	3	5:34	210.52	0.19	1.7	264	67	68	16		382
	4	5:38	213.79	0.18	1.7	263	69	68	16		381
	5	5:42	216.91	0.20	1.7	260	70	68	16		384
	6	5:46	220.46	0.19	1.7	261	70	68	16		382
	7	5:50	223.41	0.14	1.7	261	70	69	16		381
	8	5:54	226.67	0.10	1.7	260	70	69	16		380
		5:58	229.833								
Port #2	1	6:06	229.833	0.20	1.7	260	68	68	16		443
	2	6:10	232.19	0.16	1.7	258	68	68	16		457
	3	6:14	235.51	0.20	1.7	258	70	68	16		472
	4	6:18	238.12	0.19	1.7	258	70	68	16		422
	5	6:22	241.78	0.20	1.7	257	70	69	16		411
	6	6:26	244.99	0.14	1.7	257	70	69	16		445
	7	6:30	248.34	0.14	1.7	258	70	69	16		461
	8	6:34	251.61	0.10	1.7	257	70	69	16		430
		6:38	254.717								
		60min	50.64		1.7		69.1	68.4			411.88

68.75

Sample Time Net Volume

TENERX CORP.

IMPINGER CATCH

Sample Number C#2-1 Stock Name 150M DIB #7 Company Name Enterprise Prod.

Impinger Number	Solution Used	Amount of Solution (milliliters)	Impinger Tip Configuration	Weight (grams)
1	H_2O	200 ml	Modified	Final 364.5 Initial 269.2 Weight gain 95.3
2	H_2O	200 ml	GS	Final 265.1 Initial 263.0 Weight gain 2.1
3	Blank	0 ml	Modified	Final 0 ml Initial 0 ml Weight gain 0 ml
4	Silica Gel	~200 g	Modified	Final 268.2 Initial 268.5 Weight gain 0.7
5				Final Initial Weight gain
6				Final Initial Weight Gain
Flask				Final Initial Weight gain

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 98.1 g

Date 1/17/91

Signature C.T.

Independent Verification of Calculations Shown Above

Explanation: Someone other than the person who performed the original work and associated calculations must verify that these calculations have been performed correctly.

Signature Ray Terrazas

Date 2-11-91

ORSAT ANALYSIS RESULTS

Gas Fractional Part

CO_2 3.6

O_2 15.0

CO

N_2

Date 01-17-91

Time

Signature

Test #C2-1

PRELIMINARY VELOCITY DETERMINATION

If preliminary velocity is not determined by the following procedure please state how preliminary velocity was determined.

Traverse Pt.	Δp (inches H_2O) I	II	III
Date			
Time			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

For Preliminary Velocity Calculation, Isokinetic Sampling:

1. Use calculator to sum the square roots of all Δp's and divide this by N, the number of Δp's.

$$\text{Aver. } \sqrt{\Delta p} = \frac{\Sigma \sqrt{\Delta p}}{N}$$

$$\text{Aver. } \sqrt{\Delta p} = \frac{(6.6138)}{(16)} = \underline{\underline{0.4134}}$$

(units are inches H_2O to the one half power)

2. Obtain the pitot tube calibration factor for the probe used. Probe No. _____ Pitot Tube Calibration Factor 0.84 (Shown in the equation below as PTCF)

3. Calculate Absolute Stack Pressure:
Measured Stk. Press.
(gauge) −0.08 "H_2O
(Measured stack press. may be (+) or (−))
Preliminary Atmo. Press. 30.26 "Hg

Stack pressure in inches of water (gage), times 0.07355, plus the barometric pressure in inches mercury equal to the absolute stack pressure in inches of mercury:

(−0.08) in. H_2O (.07355) + (30.26) in. Hg
= Stack Press. 30.254 in. Hg

4. Calculate average preliminary velocity, V, in feet per second as shown below.

$$V = (85.48)\ (PTCF)\ \sqrt{\frac{(\text{Stack Temp. } °R)}{\left[\text{Mole. Wt.}\right]\left[\text{Stk. Press. inches Hg}\right]}}\ (\text{Average } \sqrt{\Delta p})$$

$$V = (85.48)\ (0.84)\ \sqrt{\frac{(411.88+460)871.88}{(28.246)(30.254)}}\ (0.4134) = \underline{\underline{29.980}} \text{ ft/sec}$$

$$Q_{std} = (60)(0.9168)(29.980)(28.0783)\left(\frac{528}{871.88}\right)\left(\frac{30.254}{29.92}\right)$$
$$= 28,354.8 \text{ DSCFM}$$

Date 01-17-91

Time _____

Signature B.L.

Sample No. F#C2-1 Stack Name ISOM Unit #7 Company Name Ent. Products

FIELD CHECK OF MOLECULAR WEIGHT

(To be used when substantial changes have occurred in the moisture fraction)

	Molecular Weights		Moisture Fraction		Partial Mol. Wt.
H_2O	(18)	. . . . .	[0.0832]	=	1.498

		Orsat Fraction	Dry Gas Fraction		
CO_2	(44)	(0.036)	[0.9168 (see above)]	=	
O_2	(32)	(0.150)		=	
CO	(28)	( )		=	
N_2	(28)	(0.814)		=	26.749
		29.176			

Molecular Weight of Stack Gas 28.246
(Sum of partial molecular weights)

FIELD CHECK ON MOISTURE FRACTION

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 50.286 ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 528.75 °R

Total imp. wt. gain, MWC _____ grams H_2O

Pressure at meter, PM 30.385 inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (499.4)\ \frac{\text{liters °R}}{\text{ft}^3\ \text{in.Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(98.1)\ (1.335)}{\left[(98.1)\ (1.335)\right] + \left[\frac{(50.286)\ (30.385)}{(528.75)}\ (499.4)\right]} = 0.0832$$

Dry Gas Fraction = 1 - (moisture fraction) = 1 - (0.0832) = 0.9168

Date 01-17-91

Signature B. L.

TENERX corp.

STACK SAMPLING FIELD DATA

PLANT NAME Enterprise Products STACK NAME IS [redacted] DIB #7

DATE 1/17/91 OPERATOR CT SAMPLE NUMBER C#2-2 STACK HEIGHT ~43 ft

STACK DIAM. (exit) 5.58' STACK DIAM. (port) 5.58' STACK PRESS. (In. H_2O) -0.08 BARO. PRESS. (In. H_2O) 30.26

PROBE NUMBER 8 PTCF 0.84 DGMCF ΔH@ 2.53 0.988 PUMP NUMBER CM-110

NOZZLE NUMBER — NOZZLE AREA — FILTER NUMBER — OUT WEIGHT GRAMS —

METER NUMBER CM-100 K FACTOR — ORIFICE CONSTANTS a — b —

Leak check: 0.0 @ 25 Hg"

	Point	Clock Time	Dry Gas Meter Reading	ΔP Inches H_2O	ΔH Inches H_2O	Probe Temp.	DRY GAS METER TEMPERATURE Inlet	Outlet	L. VAC. Inches Hg Gauge	Box Temperature °F	Stack Temperature °F
PORT #2	1	7:02	254.752	0.19	2.0	245	69	68	16		457
	2	7:06	258.59	0.20	2.0	256	69	68	16		457
	3	7:10	261.00	0.22	2.0	257	69	68	16		450
	4	7:14	265.62	0.19	2.0	259	69	68	16		420
	5	7:18	268.97	0.18	2.0	259	70	68	16		405
	6	7:22	272.45	0.16	2.0	262	70	68	16		478
	7	7:26	275.82	0.12	2.0	262	70	68	16		460
	8	7:30	278.91	0.10	2.0	260	70	68	16		456
		7:34	282.775								
PORT #1	1	7:44	282.775	0.20	2.0	254	69	69	16		367
	2	7:48	286.34	0.20	2.0	256	69	69	16		375
	3	7:52	289.54	0.18	2.0	254	69	69	16		377
	4	7:56	293.51	0.17	2.0	250	69	69	16		385
	5	8:00	296.99	0.20	2.0	251	70	69	16		381
	6	8:04	300.58	0.21	2.0	252	70	70	16		382
	7	8:08	304.12	0.16	2.0	253	70	70	16		384
	8	8:12	307.77	0.12	2.0	253	70	70	16		380
		8:16	311.162								
		64 min	56.41 cf		2.0		69.5	68.7			410.625

Sample Time — Net Volume

69.1

TENERX CORP.

IMPINGER CATCH

Sample Number C #1-2 Stock Name 150M DIB #7 Company Name Enter Pave Products

Impinger Number	Solution Used	Amount of Solution (milliliters)	Impinger Tip Configuration	Weight (grams)	
1	H_2O	200ml	Mod.	Final	351.8
				Initial	265.7
				Weight gain	86.1
2	H_2O	200ml	GS	Final	275.2
				Initial	269.1
				Weight gain	6.1
3	empty	0ml	Mod	Final	0ml
				Initial	0ml
				Weight gain	0ml
4	silicagel	278.9	Mod	Final	292.2
				Initial	278.9
				Weight gain	13.3
5				Final	
				Initial	
				Weight gain	
6				Final	
				Initial	
				Weight Gain	
Flask				Final	
				Initial	
				Weight gain	

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 105.5g

Date C.T. 1/17/91

Signature C.T.

Independent Verification of Calculations Shown Above

Explanation: Someone other than the person who performed the original work and associated calculations must verify that these calculations have been performed correctly.

Signature Ray Terazas

Date 2-11-91

ORSAT ANALYSIS RESULTS

Gas Fractional Part

CO_2 3.6

O_2 15.0

CO

N_2

Date 01-17-91

Time

Signature

ISOM Unit #7
Test # C2-[illegible]

PRELIMINARY VELOCITY DETERMINATION

If preliminary velocity is not determined by the following procedure please state how preliminary velocity was determined.

Traverse Pt.	Δp (inches H_2O) I	II	III
Date			
Time			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

For Preliminary Velocity Calculation, Isokinetic Sampling:

1. Use calculator to sum the square roots of all Δp's and divide this by N, the number of Δp's.

   Aver. $\sqrt{\Delta p} = \frac{\Sigma\sqrt{\Delta p}}{N}$

   Aver. $\sqrt{\Delta p} = \frac{(6.6678)}{(16)} = 0.4161$

   (units are inches H_2O to the one half power)

2. Obtain the pitot tube calibration factor for the probe used. Probe No. _____ Pitot Tube Calibration Factor 0.84 (Shown in the equation below as PTCF)

3. Calculate Absolute Stack Pressure:
   Measured Stk. Press. (gauge) −0.08 "H_2O
   (Measured stack press. may be (+) or (−))
   Preliminary Atmo. Press. 30.26 "Hg
   Stack pressure in inches of water (gage), times 0.07355, plus the barometric pressure in inches mercury equal to the absolute stack pressure in inches of mercury:

   (−0.08) in.H_2O (.07355) + (30.26) in. Hg = Stack Press. 30.254 in. Hg

4. Calculate average preliminary velocity, V, in feet per second as shown below.

$$V = (85.48)\ (PTCF)\ \sqrt{\frac{(\text{Stack Temp. } °R)}{[\text{Mole. Wt.}]\ [\text{Stk. Press. inches Hg}]}}\ (\text{Average } \sqrt{\Delta p})$$

$$V = (85.48)\ (0.84)\ \sqrt{\frac{410.6+460=870.6}{(28.276)(30.254)}}\ (0.4161) = 30.142 \text{ ft/sec}$$

$$Q_{std} = (60)(0.9194)(30.142)(28.0783)\left(\frac{528}{870.6}\right)\left(\frac{30.254}{29.92}\right)$$
$$= 28{,}630.0 \text{ DSCFM}$$

Date 01-17-90

Time _____

Signature B.L.

Sample No. T#C2-2 Stack Name ISOM Unit #7 Company Name Ent. Products

FIELD CHECK OF MOLECULAR WEIGHT

(To be used when substantial changes have occurred in the moisture fraction)

	Molecular Weights	Orsat Fraction	Moisture Fraction / Dry Gas Fraction		Partial Mol. Wt.
H_2O	(18)	. . . . .	[0.0806]	=	1.450
CO_2	(44)	(0.036)	[0.9194 (see above)]	=	
O_2	(32)	(0.150)		=	
CO	(28)	( )		=	
N_2	(28)	(0.814)		=	26.826
		29.176			

Molecular Weight of Stack Gas 28.276
(Sum of partial molecular weights)

FIELD CHECK ON MOISTURE FRACTION

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 56.015 ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 529.1 °R

Total imp. wt. gain, MWC 105.5 grams H_2O

Pressure at meter, PM _____ inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (499.4)\ \frac{\text{liters °R}}{ft^3\ \text{in.Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(105.5)\ (1.335)}{\left[(105.5)(1.335)\right] + \left[\frac{(56.015)\ (30.407)}{(529.1)}\ (499.4)\right]} = 0.0806$$

Dry Gas Fraction = 1 - (moisture fraction) = 1 - (0.0806) = 0.9194

Date 01-17-99

Signature B.R.

TENERX corp.

STACK SAMPLING FIELD DATA

PLANT NAME Enterprise Products STACK NAME ESOM DIB #7

DATE 1/18/98 OPERATOR CT SAMPLE NUMBER C2-3 STACK HEIGHT ~43 ft

STACK DIAM. (exit) 5.58" STACK DIAM. (port) 5.58 STACK PRESS. (In. H_2O) -0.06 BARO. PRESS. (In. H_2O) 30.22

PROBE NUMBER 8 PTCF 0.84 DGMCF 0.988 ΔH=1.53 PUMP NUMBER EA-110

NOZZLE NUMBER — NOZZLE AREA — FILTER NUMBER — OUT WEIGHT GRAMS —

METER NUMBER EA-110 K FACTOR — ORIFICE CONSTANTS a — b —

Leak Check 0.00 @ 25" Hg

	Point	Clock Time	Dry Gas Meter Reading	ΔP Inches H_2O	ΔH Inches H_2O	Probe Temp.	DRY GAS METER TEMPERATURE Inlet	DRY GAS METER TEMPERATURE Outlet	L. VAC. Inches Hg Gauge	Box Temperature °F	Stack Temperature °F
Port #1	1	8:44	316.285	0.21	1.0	247	69	69	7		367
	2	8:48	313.69	0.18	1.0	248	69	69	7		372
	3	8:52	316.14	0.20	1.0	248	70	69	7		410
	4	8:56	318.61	0.20	1.0	251	70	69	7		416
	5	9:00	321.39	0.20	1.0	254	70	69	7		385
	6	9:04	323.67	0.18	1.0	255	70	69	7		382
	7	9:08	326.21	0.14	1.0	256	70	69	7		382
	8	9:12	328.61	0.11	1.0	255	70	69	7		359
		9:16	331.285								
Port #2	1	9:24	331.295	0.20	1.0	243	69	69	7		450
	2	9:28	333.62	0.21	1.0	245	69	69	7		470
	3	9:32	336.25	0.22	1.0	249	70	69	7		456
	4	9:36	338.59	0.21	1.0	250	70	69	7		430
	5	9:40	339.02	0.21	1.0	251	70	69	7		423
	6	9:44	343.69	0.16	1.0	254	70	69	7		454
	7	9:48	345.91	0.11	1.0	253	70	69	7		452
	8	9:52	348.49	0.10	1.0	253	70	69	7		426
		9:56	350.88								
		64 min	39.595		1.0		69.75	69			414.625

69.4

Sample Time — Net Volume

TENERX corp.

IMPINGER CATCH

Sample Number C2-3 Stock Name 25cm #7 Company Name Catalaxa Products

Impinger Number	Solution Used	Amount of Solution (milliliters)	Impinger Tip Configuration	Weight (grams)	
1	H_2O	200	Mod	Final	350.0
				Initial	279.1
				Weight gain	70.9
2	H_2O	200	CS	Final	274.7
				Initial	265.1
				Weight gain	9.6
3	empty	0	Mod	Final	0
				Initial	0
				Weight gain	0
4	Silica gel	269.2	Mod	Final	284.2
				Initial	269.2
				Weight gain	15.0
5				Final	
				Initial	
				Weight gain	
6				Final	
				Initial	
				Weight Gain	
Flask				Final	
				Initial	
				Weight gain	

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 95.5g

Date 1/17/91

Signature CT

Independent Verification of Calculations Shown Above

Explanation: Someone other than the person who performed the original work and associated calculations must verify that these calculations have been performed correctly.

Signature Ray Terrazas

Date 2-11-91

ORSAT ANALYSIS RESULTS

Gas Fractional Part

CO_2 3.8

O_2 14.7

CO

N_2 81.5

Date 1/17/91

Time

Signature CT

ISOM Unit #1
T#C2-3

PRELIMINARY VELOCITY DETERMINATION

If preliminary velocity is not determined by the following procedure please state how preliminary velocity was determined.

Traverse Pt.	Δp (inches H_2O) I	II	III
Date			
Time			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

For Preliminary Velocity Calculation, Isokinetic Sampling:

1. Use calculator to sum the square roots of all Δp's and divide this by N, the number of Δp's.

$$\text{Aver. } \sqrt{\Delta p} = \frac{\Sigma\sqrt{\Delta p}}{N}$$

$$\text{Aver. } \sqrt{\Delta p} = \frac{(6.693)}{(16)} = 0.41832$$

(units are inches H_2O to the one half power)

2. Obtain the pitot tube calibration factor for the probe used. Probe No. _____ Pitot Tube Calibration Factor 0.84 (Shown in the equation below as PTCF)

3. Calculate Absolute Stack Pressure:
Measured Stk. Press. (gauge) -0.06 "H_2O
(Measured stack press. may be (+) or (-))
Preliminary Atmo. Press. 30.22 "Hg

Stack pressure in inches of water (gage), times 0.07355, plus the barometric pressure in inches mercury equal to the absolute stack pressure in inches of mercury:

(-0.06) in. H_2O (.07355) + (30.22) in. Hg = Stack Press. 30.216 in. Hg

4. Calculate average preliminary velocity, V, in feet per second as shown below.

$$V = (85.48)\ (PTCF)\ \sqrt{\frac{(\text{Stack Temp. } °R)}{\left[\text{Mole. Wt.}\right]\left[\text{Stk. Press. inches Hg}\right]}}\ (\text{Average } \sqrt{\Delta p})$$

$$V = (85.48)\ (0.84)\ \sqrt{\frac{(414.6+460 = 874.6)}{(28.055)(30.216)}}\ (0.41832) = 30.510 \text{ ft/sec}$$

$$Q_{std} = (60)(0.89810)(30.510)(28.0783)\left(\frac{528}{874.6}\right)\left(\frac{30.216}{29.92}\right)$$
$$= 28,144.4 \text{ DSCFM}$$

Date 01-17-91

Time

Signature B. R.

Sample No. T#C2-3 Stack Name ISOM Unit #7 Company Name Ent. Products

FIELD CHECK OF MOLECULAR WEIGHT

(To be used when substantial changes have occurred in the moisture fraction)

	Molecular Weights		Moisture Fraction		Partial Mol. Wt.
H_2O	(18)	. . . . .	[0.10190]	=	1.8342

		Orsat Fraction	Dry Gas Fraction		
CO_2	(44)	(0.038)	[0.89810 (see above)]	=	
O_2	(32)	(0.147)		=	
CO	(28)	( )		=	
N_2	(28)	(0.815)		=	26.221
		29.196			

Molecular Weight of Stack Gas 28.055
(Sum of partial molecular weights)

FIELD CHECK ON MOISTURE FRACTION

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 39.318 ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 529.375 °R

Total imp. wt. gain, MWC 95.5 grams H_2O

Pressure at meter, PM 30.294 inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (499.4)\ \frac{\text{liters °R}}{ft^3\ \text{in.Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(95.5)\ (1.335)}{\left[(95.5)(1.335)\right] + \left[\frac{(39.318)\ (30.294)}{(529.375)}\ (499.4)\right]} = 0.10190$$

Dry Gas Fraction = 1 - (moisture fraction) = 1 - (0.10190) = 0.89810

Date 01-17-91

Signature B.L.

TENERX corp.

STACK SAMPLING FIELD DATA

PLANT NAME Enterprise Products STACK NAME Iron #7

DATE 1-24-91 OPERATOR CS SAMPLE NUMBER C4-1 STACK HEIGHT ~43ft

STACK DIAM. (exit) 5.98' STACK DIAM. (port) 5.98' STACK PRESS. (In. H_2O) 0.06 BARO. PRESS. (In. H_2O) 30.22

PROBE NUMBER 8 PTCF 0.84 DGMCF 0.988 (ΔH = 1.53) PUMP NUMBER EA-110

NOZZLE NUMBER — NOZZLE AREA — FILTER NUMBER — OUT WEIGHT GRAMS —

METER NUMBER EA-110 K FACTOR — ORIFICE CONSTANTS a — b —

Preleak check 0.003 @ -26 in Hg Post leak Check 0.002 @ 25" Hg

	Point	Clock Time	Dry Gas Meter Reading	ΔP Inches H_2O	ΔH Inches H_2O	Probe Temp	DRY GAS METER TEMPERATURE Inlet	Outlet	L. VAC. Inches Hg Gauge	Box Temperature °F	Stack Temperature °F
port #1	1	1:09	507.61	0.18	1	258	68	68	7		381
	2	1:13	510.21	0.18	1	259	68	68	7		392
	3	1:17	512.81	0.17	1	256	68	68	7		389
	4	1:21	515.33	0.16	1	257	68	68	7		392
	5	1:25	518.10	0.14	1	254	68	68	7		386
	6	1:29	520.85	0.15	1	250	68	68	7		383
	7	1:33	522.81	0.12	1	250	69	68	7		383
	8	1:37	525.50	0.10	1	252	69	68	7		371
	22	1:41	528.023								
port #2	1	1:47	528.023	0.16	1	249	69	68	7		464
	2	1:51	530.70	0.20	1	254	69	68	7		456
	3	1:55	533.02	0.21	1	259	69	68	7		454
	4	1:59	535.89	0.15	1	260	69	69	7		420
	5	2:03	538.28	0.14	1	261	69	69	7		437
	6	2:07	540.71	0.14	1	261	69	69	7		465
	7	2:11	543.29	0.11	1	258	69	69	7		460
	8	2:15	545.81	0.10	1	257	69	69	7		439
		2:19	548.32								
		64	40.71	0.38587	1		68.625	68.3125			417

Sample Time Net Volume

68.467

TENERX CORP.

IMPINGER CATCH

Sample Number C9-2 Stack Name 150M DIB #7 Company Name Enterprise Prod.

Impinger Number	Solution Used	Amount of Solution (milliliters)	Impinger Tip Configuration	Weight (grams)
1	H_2O	200	Modified	Final 328.5 Initial 261.7 Weight gain 67.8
2	H_2O	200	# 6S	Final 262.2 Initial 265.8 Weight gain -3.6
3	Blank	0	Modified	Final 0 Initial 0 Weight gain
4	Silica Gel.	~200 g	Modified	Final 276.5 Initial 265.7 Weight gain 10.8
5				Final Initial Weight gain
6				Final Initial Weight Gain
Flask				Final Initial Weight gain

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 75 g

Date 1-24-91

Signature Ray Terrazas.

Independent Verification of Calculations Shown Above

Explanation: Someone other than the person who performed the original work and associated calculations must verify that these calculations have been performed correctly.

Vincent Matter
Signature

2/11/91
Date

ORSAT ANALYSIS RESULTS

Gas Fractional Part

CO_2 3.2

O_2 14.9

CO

N_2 81.9

Date

Time

Signature

PRELIMINARY VELOCITY DETERMINATION

Enterprise Products
T# C4-1
1-24-91

If preliminary velocity is not determined by the following procedure please state how preliminary velocity was determined.

Traverse Pt.	Δp (inches H_2O) I	II	III
Date			
Time			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

For Preliminary Velocity Calculation, Isokinetic Sampling:

1. Use calculator to sum the square roots of all Δp's and divide this by N, the number of Δp's.

   Aver. $\sqrt{\Delta p} = \frac{\Sigma\sqrt{\Delta p}}{N}$

   Aver. $\sqrt{\Delta p} = \frac{(\quad)}{(\quad)} = 0.38587$

   (units are inches H_2O to the one half power)

2. Obtain the pitot tube calibration factor for the probe used. Probe No. _____ Pitot Tube Calibration Factor 0.84 (Shown in the equation below as PTCF)

3. Calculate Absolute Stack Pressure:
   Measured Stk. Press. (gauge) -0.06 "H_2O
   (Measured stack press. may be (+) or (-))
   Preliminary Atmo. Press. 30.22 "Hg

   Stack pressure in inches of water (gage), times 0.07355, plus the barometric pressure in inches mercury equal to the absolute stack pressure in inches of mercury:

   (-0.06) in.H_2O (.07355) + (30.22) in. Hg = Stack Press. 30.2156 in. Hg

4. Calculate average preliminary velocity, V, in feet per second as shown below.

$$V = (85.48)\ (PTCF)\ \sqrt{\frac{(\text{Stack Temp. °R})}{\left[\text{Mole. Wt.}\right]\left[\text{Stk. Press. inches Hg}\right]}}\ (\text{Average}\sqrt{\Delta p})$$

Area = 28.08615

$$V = (85.48)\ (0.84)\ \sqrt{\frac{(877)}{(28.222)(30.2156)}}\ (0.38587) = 27.098 \text{ ft/sec}$$

$Q_{std} = 3600(0.9202)(27.098)(28.08615)\frac{528}{877}\cdot\frac{29.92}{30.2156}$

$Q_{std} = \cancel{1558547.2}\ 1589484.55$

26491.4 DSCFM

Date _____

Time _____

Signature _____

PRELIMINARY MOISTURE DETERMINATION

If preliminary moisture is not determined by the following procedure please state how preliminary moisture was determined:

_____

_____

CONDENSER METHOD

Initial Meter Temp. Inlet _____ Outlet _____

Final Meter Temp. Inlet _____ Outlet _____

Average Tmp. _____ °F TM = Average temp. + 460 = 528.469 °R

FIRST IMPINGER
Final Wt. _____
Initial Wt. _____

SILICA GEL IMPINGER
Final Wt. _____
Initial Wt. _____

Total Gain, MWC _____ grams H_2O

(Add the gains from both impingers to obtain total gain)

Pressure at Meter, PM, _____ inches Hg. (For purposes of this test, PM is equal to atmospheric pressure since ΔH is very small.)

Dry Gas Meter Reading, Final _____
Initial _____
Net Volume 40.71 ft^3

Corrected Volume (V)
Dry Gas Meter Calibration Factor, DGMCF _____

V = (Net Vol) (DGMCF) = (40.71) (.993) = 40.425 ft^3

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.335)\ \frac{liters}{gm\ H_2O}}{\left[(MWC)\ (1.335)\ \frac{liters}{gm\ H_2O}\right] + \left[\frac{(V)\ (PM)}{(TM)}\ (499.4)\ \frac{liters\ °R}{ft^3\ in.\ Hg}\right]}$$

$$\text{Moisture Fraction} = \frac{(75)\ (1.335)}{\left[(75)\ (1.335)\right] + \left[\frac{(40.425)(30.22)}{528.469}\ (499.4)\right]}$$

$$= 0.0798$$

Dry Gas Fraction = 1 - (moisture fraction) = 1 - ( ) = 0.9202

When the moisture determination experiment is repeated, use copies of this page for collecting data and recording results. If this is done, calculate the averages:

Average Moisture Fraction _____
Average Dry Gas Fraction _____

$M_{w\,dry} = 29.108$
$M_{w\,wet} = 28.222$

TENERX corp.

STACK SAMPLING FIELD DATA

PLANT NAME Enterprise Products STACK NAME Dryer #7

DATE 1/24/91 OPERATOR CT SAMPLE NUMBER C-4-2 STACK HEIGHT ~43ft

STACK DIAM. (exit) 5.98" STACK DIAM. (port) 5.98" STACK PRESS. (In. H_2O) ~~0.05~~ ΔH=1.53 -0.05 BARO. PRESS. (In. H_2O) 30.22

PROBE NUMBER P PTCF 0.84 DGMCF 0.988 PUMP NUMBER EA110

NOZZLE NUMBER — NOZZLE AREA — FILTER NUMBER — OUT WEIGHT GRAMS —

METER NUMBER EA-110 K FACTOR — ORIFICE CONSTANTS a — b —

Leak Check 0.00 @ 25" Hg

Point	Clock Time	Dry Gas Meter Reading	ΔP Inches H_2O	ΔH Inches H_2O	Probe Temp.	DRY GAS METER TEMPERATURE Inlet	DRY GAS METER TEMPERATURE Outlet	L. VAC. Inches Hg Gauge	Box Temperature °F	Stack Temperature °F
1	3:12	548.505	0.18	1	240	69	69	7		339
2	3:16	551.01	0.20	1	244	69	69	7		371
3	3:20	553.58	0.20	1	248	69	69	7		382
4	3:24	556.39	0.16	1	251	69	69	7		402
5	3:28	558.73	0.14	1	251	69	69	7		399
6	3:32	561.01	0.14	1	252	69	69	7		390
7	3:36	563.41	0.11	1	250	69	69	7		385
8	3:40	566.05	0.10	1	251	69	69	7		377
	3:44	568.542								
1	3:51	568.542	0.20	1	245	69	69	7		438
2	3:55	571.35	0.18	1	251	69	69	7		448
3	3:59	573.65	0.17	1	250	69	69	7		451
4	4:03	576.09	0.16	1	252	69	69	7		413
5	4:07	578.72	0.16	1	253	69	69	7		439
6	4:11	581.32	0.16	1	253	69	69	7		451
7	4:15	583.72	0.12	1	257	70	70	7		454
8	4:19	586.45	0.09	1	254	70	71	7		438
	4:23	588.84								
	64	40.335	0.397188	1		69.125	69.175			411.0625

69.15625

Sample Time Net Volume

TENERX CORP

IMPINGER CATCH

Sample Number C4-3 Stock Name 150M D113 #7 Company Name Enterprise Prod.

Impinger Number	Solution Used	Amount of Solution (milliliters)	Impinger Tip Configuration	Weight (grams)	
1	H_2O	200	Mod.	Final	331.7
				Initial	267.7
				Weight gain	64
2	H_2O	200	GS	Final	264.7
				Initial	263.5
				Weight gain	1.2
3	Blank		Mod	Final	0
				Initial	0
				Weight gain	
4	Silica Gel	~200g	Mod	Final	277.1
				Initial	270.0
				Weight gain	7.1
5				Final	
				Initial	
				Weight gain	
6				Final	
				Initial	
				Weight Gain	
Flask				Final	
				Initial	
				Weight gain	

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 72.3

Date 1-27-91

Signature RJ

Independent Verification of Calculations Shown Above

Explanation: Someone other than the person who performed the original work and associated calculations must verify that these calculations have been performed correctly.

Vincent Meth
Signature

2/11/91
Date

ORSAT ANALYSIS RESULTS

Gas Fractional Part

CO_2 3.3

O_2 15.3

CO

N_2

Date

Time

Signature

Test #C4-2

PRELIMINARY VELOCITY DETERMINATION

If preliminary velocity is not determined by the following procedure please state how preliminary velocity was determined.

Traverse Pt.	Δp (inches H_2O) I	II	III
Date			
Time			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

For Preliminary Velocity Calculation, Isokinetic Sampling:

1. Use calculator to sum the square roots of all Δp's and divide this by N, the number of Δp's.

   Aver. $\sqrt{\Delta p} = \frac{\Sigma\sqrt{\Delta p}}{N}$

   Aver. $\sqrt{\Delta p} = \frac{(\quad)}{(\quad)} =$ _____

   (units are inches H_2O to the one half power)

2. Obtain the pitot tube calibration factor for the probe used. Probe No. _____ Pitot Tube Calibration Factor _____ (Shown in the equation below as PTCF)

3. Calculate Absolute Stack Pressure:
   Measured Stk. Press. (gauge) _____ "H_2O
   (Measured stack press. may be (+) or (-))
   Preliminary Atmo. Press. _____ "Hg
   Stack pressure in inches of water (gage), times 0.07355, plus the barometric pressure in inches mercury equal to the absolute stack pressure in inches of mercury:

   ( ) in. H_2O (.07355) + ( ) in. Hg
   = Stack Press. _____ in. Hg

4. Calculate average preliminary velocity, V, in feet per second as shown below.

$$V = (85.48)\ (PTCF)\ \sqrt{\frac{(\text{Stack Temp. } ^\circ R)}{[\text{Mole. Wt.}]\ [\text{Stk. Press. inches Hg}]}}\ (\text{Average } \sqrt{\Delta p})$$

$$V = (85.48)\ (0.84)\ \sqrt{\frac{(871.0625)}{(28.2722)(30.2163)}}\ (0.377188)\ \frac{28.7981}{\text{ft/sec}}$$

$$Q_{STD} = 60 \times 28.7981 (28.08615)(0.9221) \frac{528}{871.0625} \frac{30.2163}{29.92}$$

$Q_{STD} = 27393.63$

Date 1-24-91

Time _____

Signature RT

Sample No. C4-2 Stack Name _____ Company Name _____

FIELD CHECK OF MOLECULAR WEIGHT

(To be used when substantial changes have occurred in the moisture fraction)

	Molecular Weights		Moisture Fraction		Partial Mol. Wt.
H_2O	(18)	. . . . .	[0.0779]	=	_____

		Orsat Fraction	Dry Gas Fraction		
CO_2	(44)	(3.3)	[0.9221 (see above)]	=	_____
O_2	(32)	(15.3)		=	_____
CO	(28)	( )		=	_____
N_2	(28)	(81.4)		=	_____
		29.14			

Molecular Weight of Stack Gas 28.2722
(Sum of partial molecular weights)

FIELD CHECK ON MOISTURE FRACTION

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 40.0526 ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 529.156 °R

Total imp. wt. gain, MWC 72.3 grams H_2O

Pressure at meter, PM 30.22 inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (499.4)\ \frac{\text{liters °R}}{\text{ft}^3\ \text{in.Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(72.3)\ (1.335)}{\left[(72.3)(1.335)\right] + \left[\frac{(40.0526)\ (30.22)}{(529.156)}\ (499.4)\right]} = 0.0779$$

Dry Gas Fraction = 1 - (moisture fraction) = 1 - ( ) = 0.9221

Date 1-24-91

Signature RT

TENERX corp.

STACK SAMPLING FIELD DATA

PLANT NAME Enterprise Products STACK NAME ISOM #7

DATE 1/24/91 OPERATOR CT SAMPLE NUMBER C4-3 STACK HEIGHT ~43ft

STACK DIAM. (exit) 5.98' STACK DIAM. (port) 5.98' STACK PRESS. (In. H_2O) -0.06 BARO. PRESS. (In. H_2O) 30.25

PROBE NUMBER 8 PTCF 0.84 DGMCF 0.981 ΔH = 1.53 PUMP NUMBER EA-110

NOZZLE NUMBER — NOZZLE AREA — FILTER NUMBER — OUT WEIGHT GRAMS —

METER NUMBER EA-110 K FACTOR — ORIFICE CONSTANTS a — b —

Leak Check 0.015 @ 25" Hg

Point	Clock Time	Dry Gas Meter Reading	ΔP Inches H_2O	ΔH Inches H_2O	Probe Temp.	DRY GAS METER TEMPERATURE Inlet	DRY GAS METER TEMPERATURE Outlet	L. VAC. Inches Hg Gauge	Box Temperature °F	Stack Temperature °F
1	5:07	589.00	0.17	1	239	70	71	7		362
2	5:11	591.48	0.18	1	244	70	71	7		377
3	5:15	593.99	0.18	1	248	70	70	7		380
4	5:19	596.43	0.16	1	252	70	71	7		394
5	5:23	598.85	0.14	1	252	70	71	7		386
6	5:27	601.43	0.12	1	253	71	71	7		387
7	5:31	604.01	0.10	1	256	72	71	7		386
8	5:35	606.40	0.10	1	255	72	71	7		369
	5:39	608.862								
1	5:45	608.862	0.20	1	245	71	71	7		440
2	5:49	611.13	0.19	1	247	71	71	7		454
3	5:53	613.65	0.20	1	256	71	71	7		449
4	5:57	616.17	0.18	1	251	72	71	7		413
5	6:01	618.72	0.14	1	251	72	71	7		444
6	6:05	621.20	0.10	1	250	73	71	7		461
7	6:09	623.74	0.09	1	251	73	71	7		460
8	6:13	626.22	0.08	1	254	73	71	7		431
	6:17	628.732								
	64	39.732		1		71.3125	70.9375			411.8125

Sample Time — Net Volume

71.125

TENERX corp.

IMPINGER CATCH

Sample Number C4-3 Stock Name ISOM #7 Company Name Enterprise Products

Impinger Number	Solution Used	Amount of Solution (milliliters)	Impinger Tip Configuration	Weight (grams)	
1	H_2O	200	Mod	Final	334.8
				Initial	272.2
				Weight gain	61.6
2	H_2O	200	GS	Final	266.7
				Initial	265.8
				Weight gain	0.9
3	empty	~~200ml~~ 0	Mod	Final	
				Initial	
				Weight gain	
4	Silicagel	287.9	Mod	Final	295.4
				Initial	287.9
				Weight gain	7.5
5				Final	
				Initial	
				Weight gain	
6				Final	
				Initial	
				Weight Gain	
Flask				Final	
				Initial	
				Weight gain	

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 70.0

Date 1-24-91

Signature RJ

Independent Verification of Calculations Shown Above

Explanation: Someone other than the person who performed the original work and associated calculations must verify that these calculations have been performed correctly.

Vincent Mathis
Signature

2/11/91
Date

ORSAT ANALYSIS RESULTS

Gas Fractional Part

CO_2 3.2

O_2 15.1

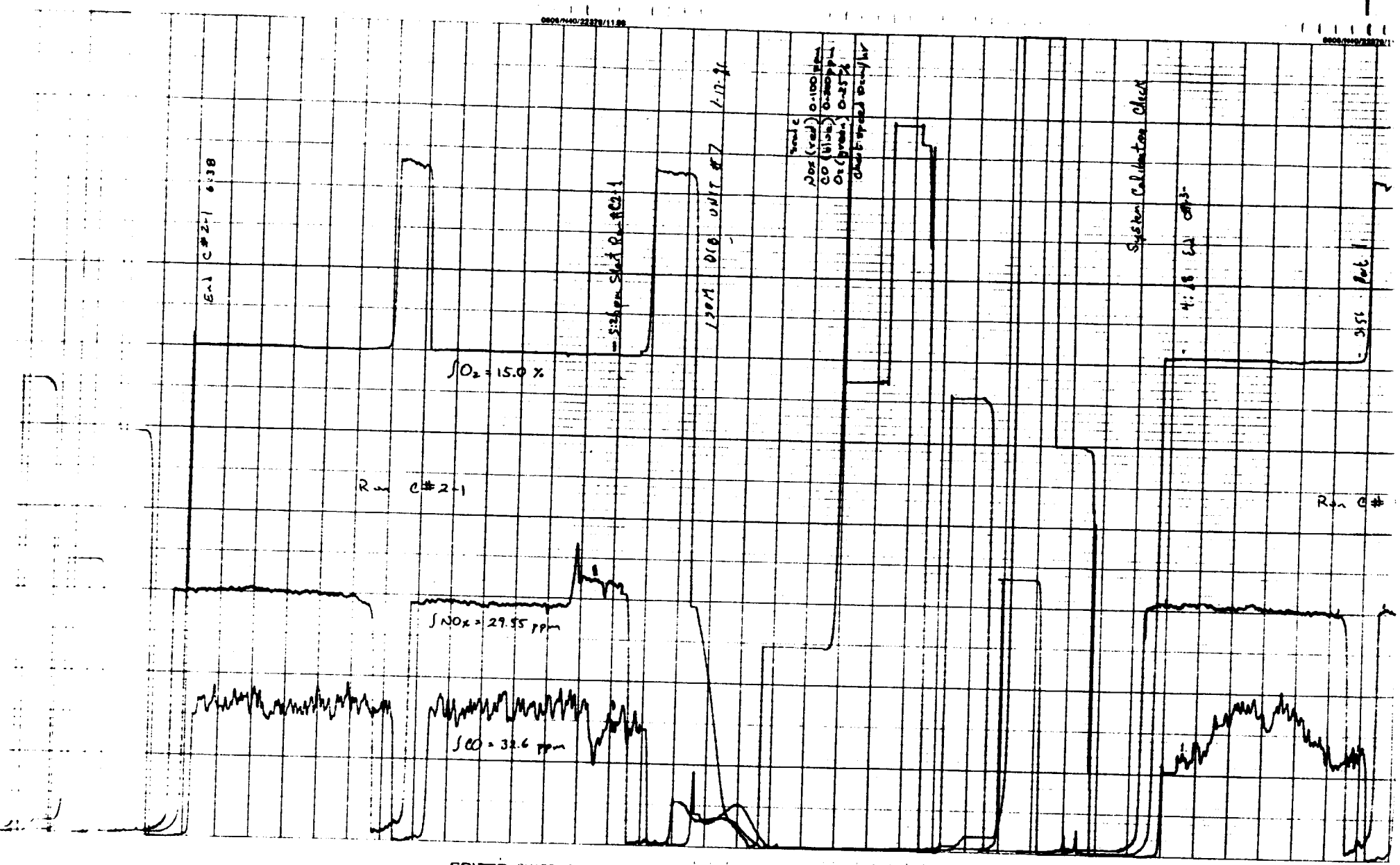
CO

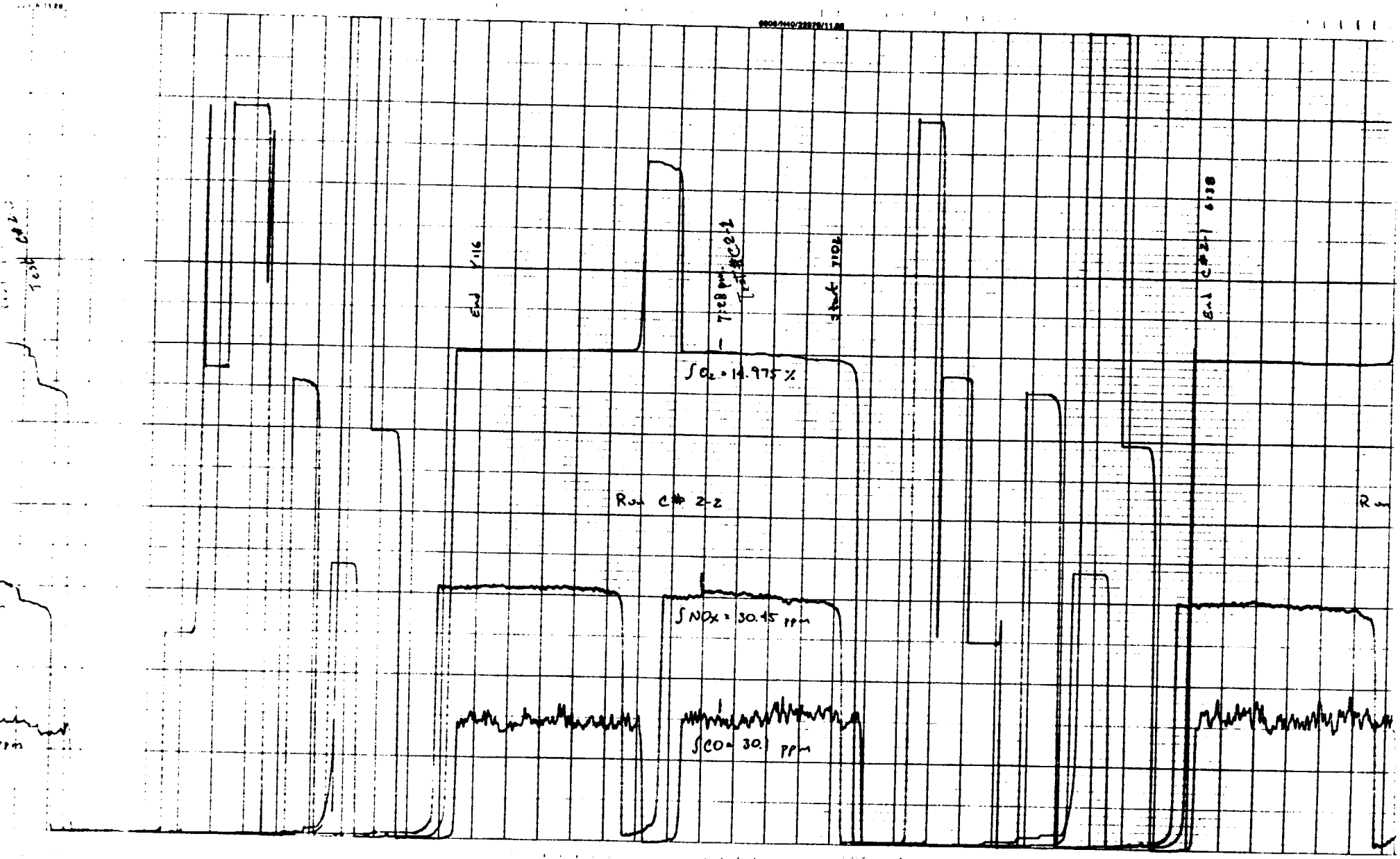
N_2

Date 1-24-91

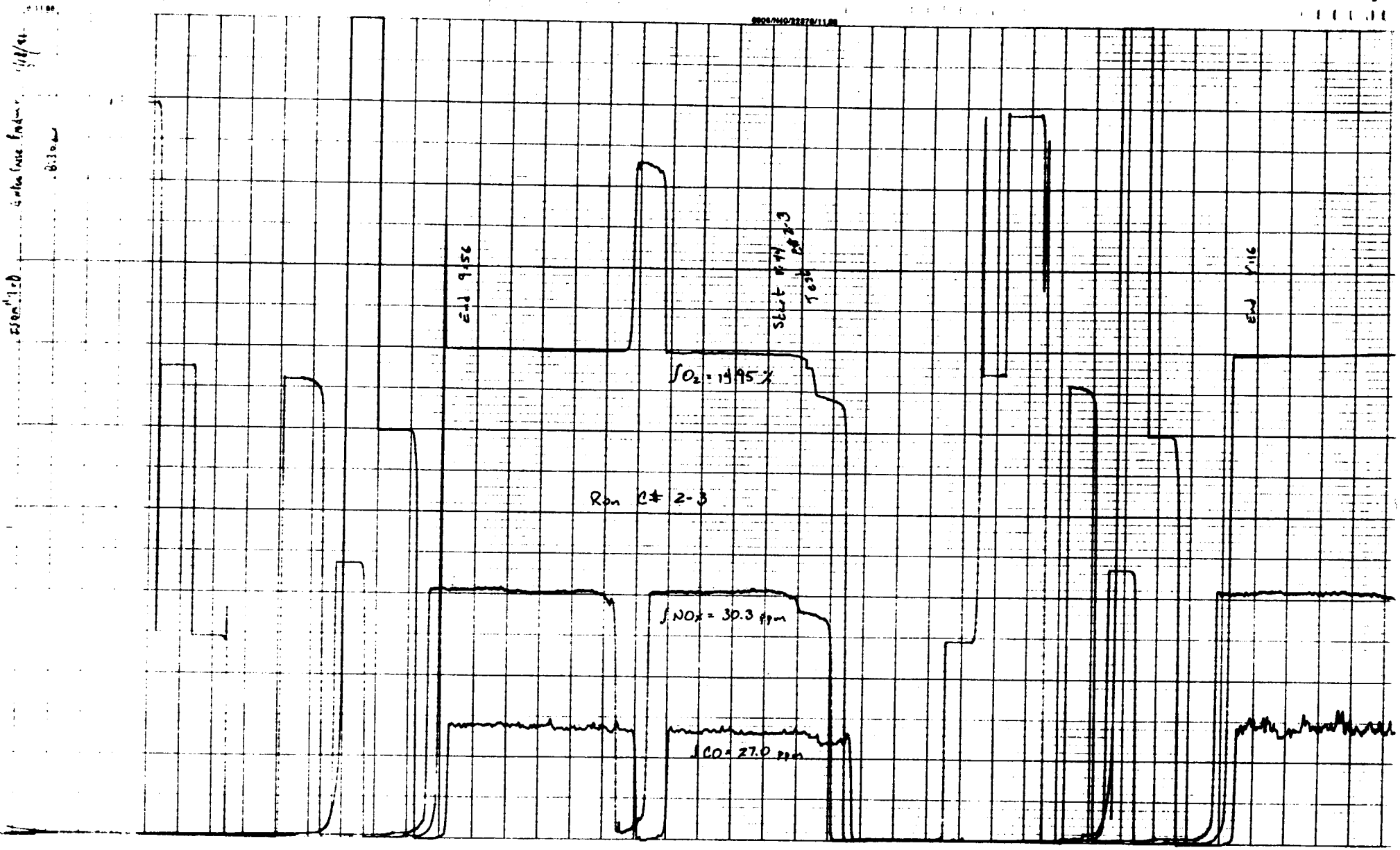
Time

Signature RJ


Run C#2-1 6:38
∫O2 = 15.0 %
Run C#2-1
∫NOx = 29.55 ppm
∫CO = 32.6 ppm
Shut Run #C2-1
1:30 PM DIG UNIT #7
1:12
Scale
NOx (red) 0-100 ppm
CO (blue) 0-500 ppm
O2 (green) 0-25 %
Dig Unit Reset
System Calibration Check
4:18 Cal gas
3:56 Pot
Run C#
SOLTEC CHART NO. RD1-01-25-30M
SOLTEC CHART NO. RD1-

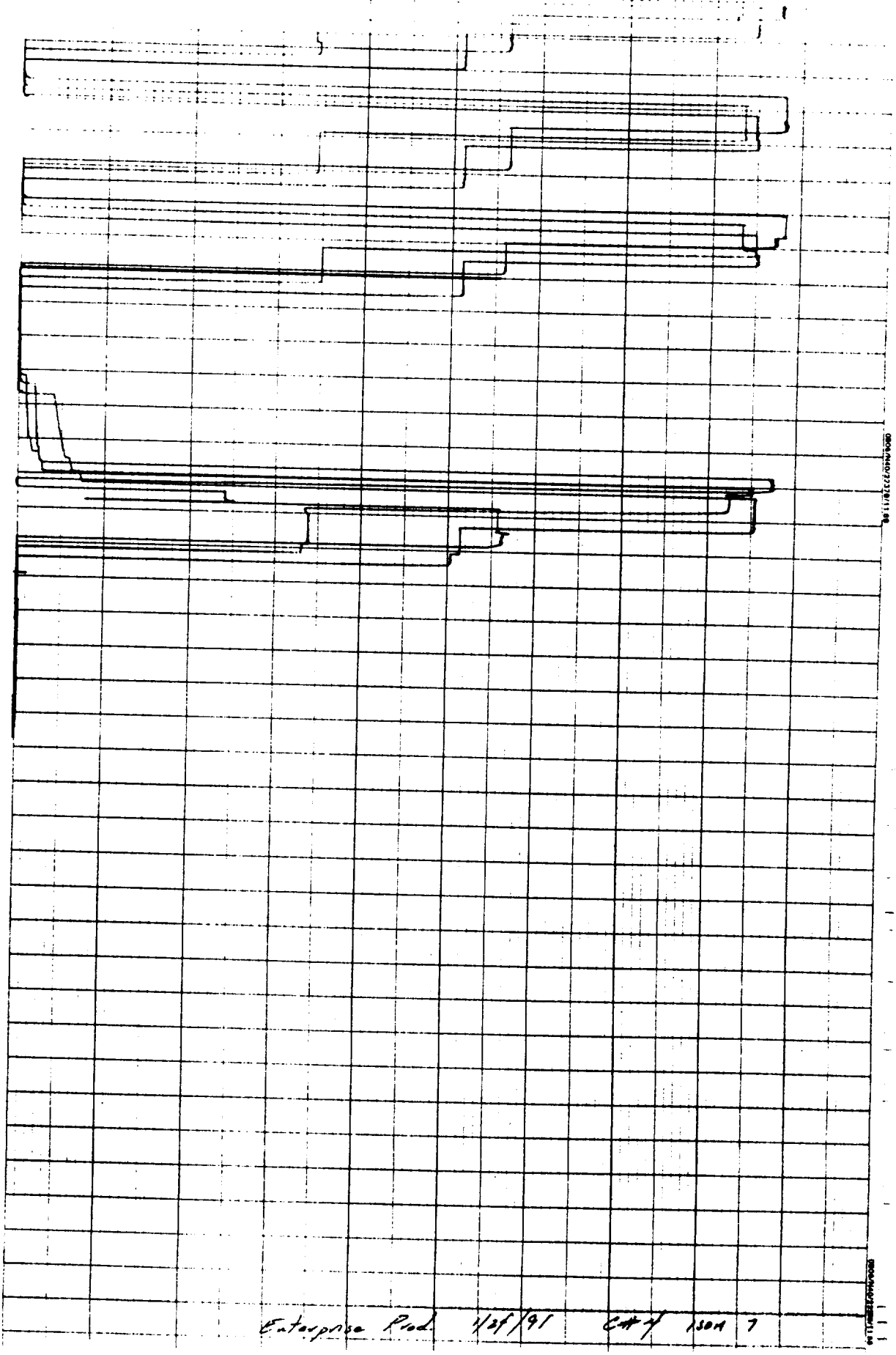


SOLTEC CHART NO RD1-01-25-30M

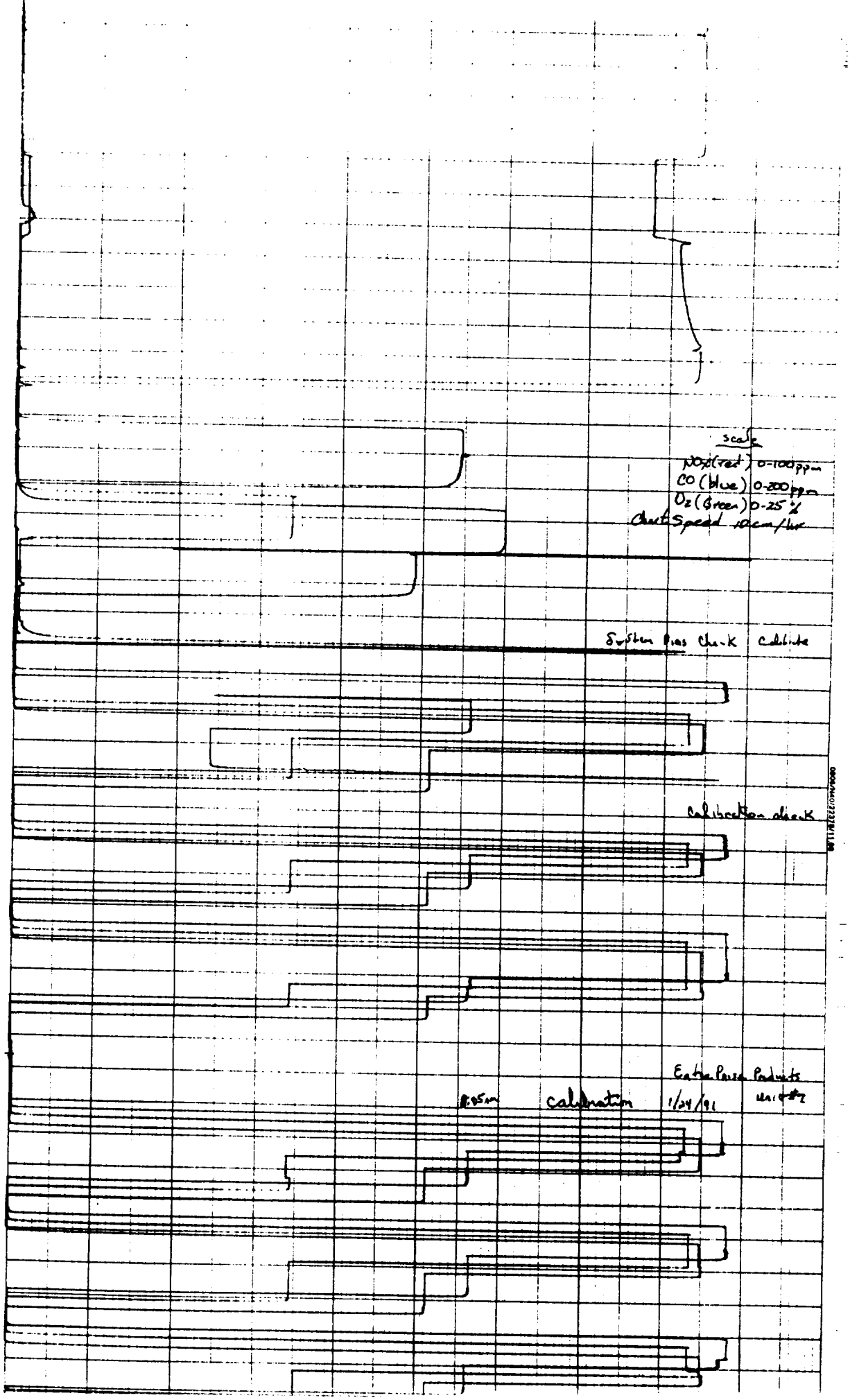

End 9:56
Start #44 Run #2-3
Test
End 9:16
∫O2 = 19.95 %
Run C# 2-3
∫NOx = 30.3 ppm
∫CO = 27.0 ppm

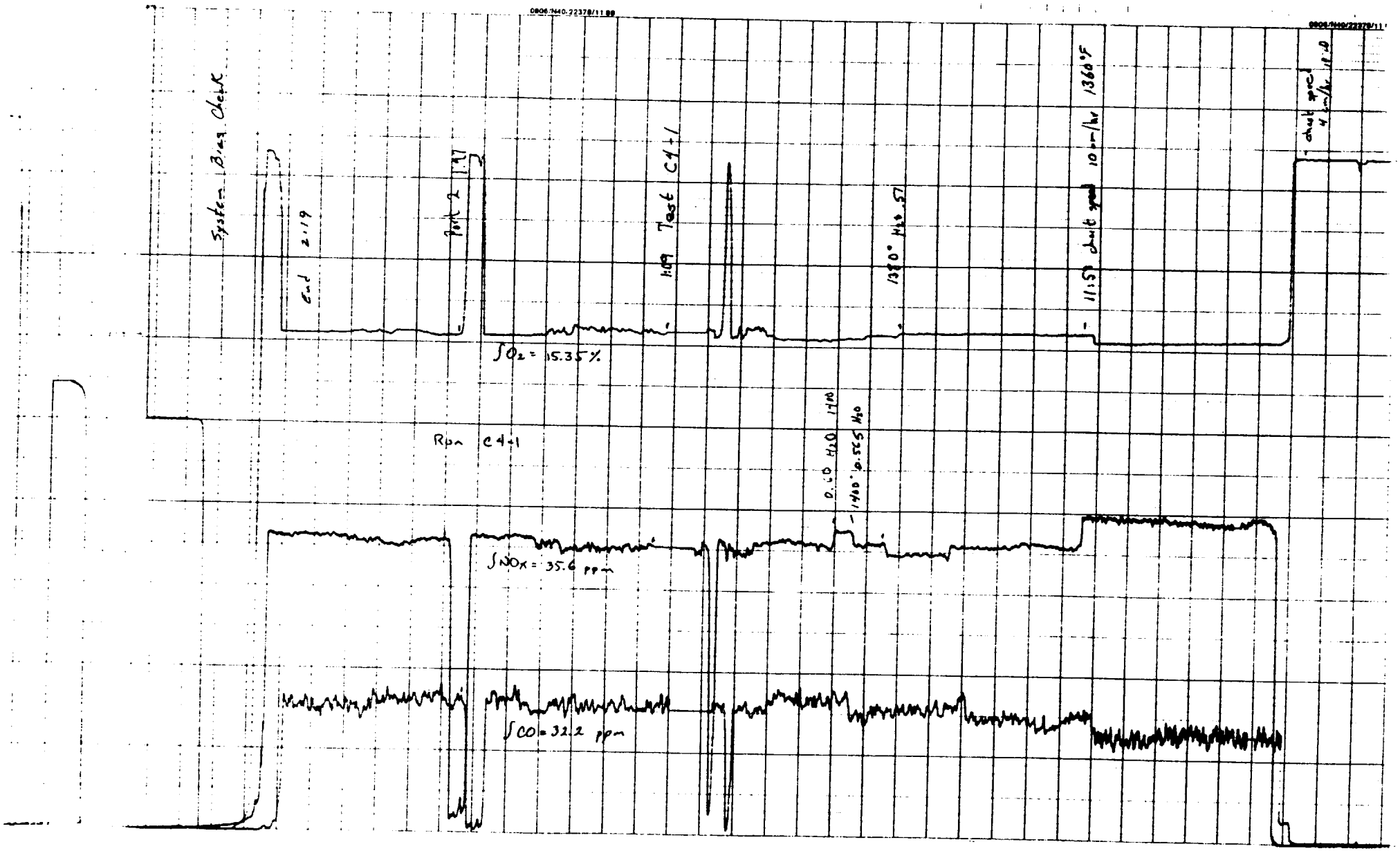
Enterprise Products

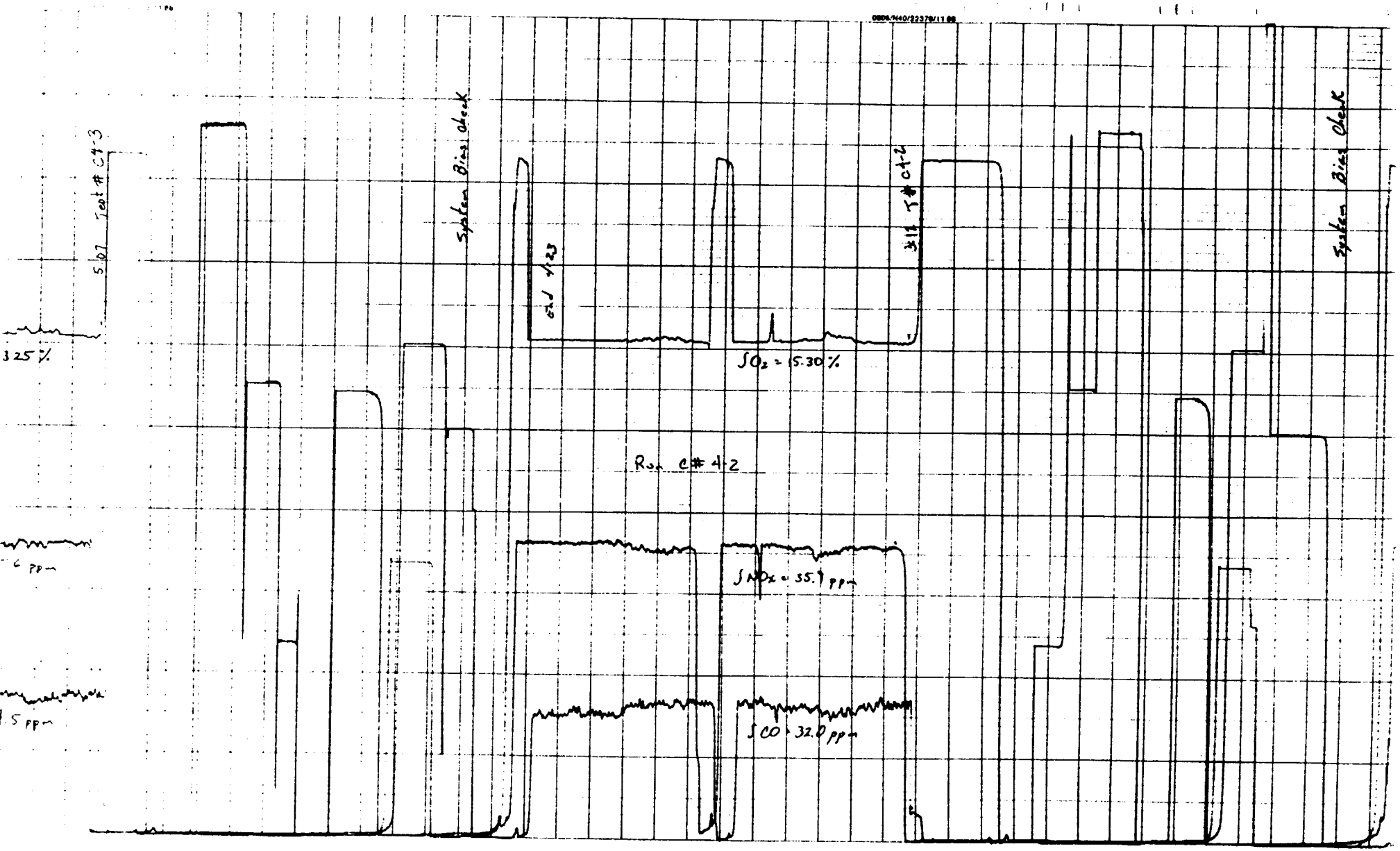
0.05in calibration 1/24/91 u. #7

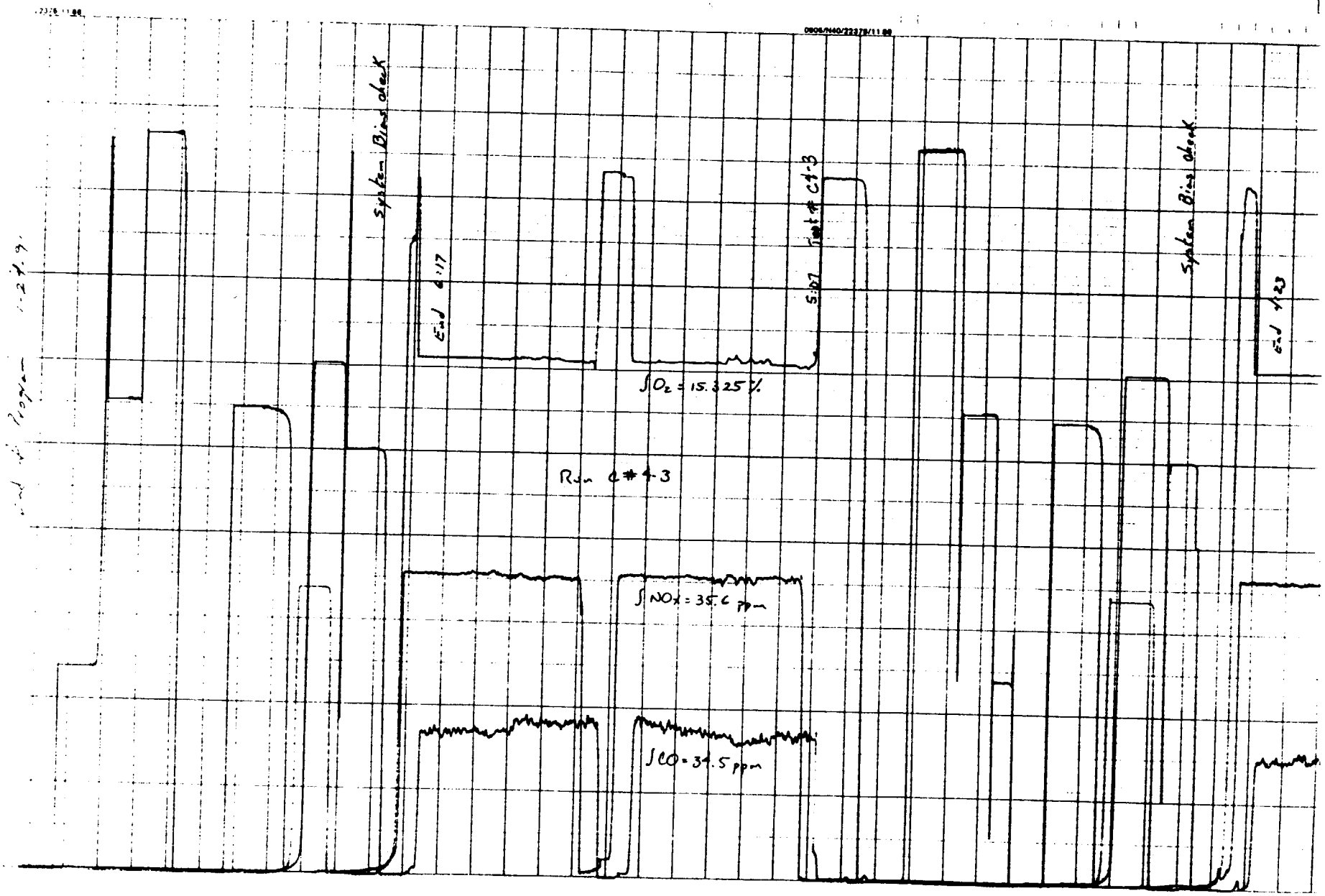


Enterprise Prod. 1/24/91 Cal #7 ASOM 7


scale
NOx (red) 0-100 ppm
CO (blue) 0-200 ppm
O2 (Green) 0-25 %
Chart Speed 10cm/hr
System Bias Check Calibrate
Calibration check
Eastern Power Products
8:05am calibration 1/24/91


System Bias Check
End 2:19
Port 2
1:09 Test C4+1
1360°F
11:59 shut speed 10 m/hr
shut speed 4 m/hr 11:0
∫O2 = 15.35%
Rpm C4+1
∫NOx = 35.6 ppm
∫CO = 32.2 ppm


Test # C4-3
Spikes Bias check
Cal 4/23
Test # C4-2
Spikes Bias Check
SO2 = 15.30 %
Run C# 4-2
SNOx = 35.1 ppm
SCO = 32.0 ppm
325 %
6 ppm
5 ppm


System Bias check
End 4:17
Start # C4-3
5:07
System Bias check
End 4:23
$\int O_2 = 15.325\%$
Run C#4-3
$\int NO_x = 35.6$ ppm
$\int CO = 34.5$ ppm

NOx

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 1SOM #7
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: RUN #
Span: 0-100 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 1SOM #7
Test personnel: RT, BL, CT

Date: 1-17-91
Run number: Run # C2-1
Span: 0-100 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0	0	0	0	0
Upscale gas	56.65	55.6	-1.05	55.7	-0.95	0.1

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (%)	Mid-range [b] (%)	High-range [c] (%)
Sample run.			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 1SOM #7
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0-25%

	Cylinder value (indicate units) (%)	Analyzer calibration response (indicate units) (%)	Absolute difference (indicate units) (%)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 1SOM #7
Test personnel: RT, BL, CT

Date: 1-17-91
Run number: Run # C2-1
Span: 0-25%

	Analyzer calibration response (%)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (%)	System cal. bias (percent of span) (%)	System calibration response (%)	System cal. bias (percent of span) (%)	
Zero gas	0	0	0	0.05	0.5	0.5
Upscale gas	8.5	8.375	-1.25	8.4	-1.0	-0.25

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

CO

TENERX corp

FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 150M #7
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0 – 200 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 150M #7
Test personnel: RT, BL, CT

Date: 1-17-91
Run number: Run # C2-1
Span: 0 – 200 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0.4	0.4	0.4	0.4	0
Upscale gas	102.2	99.8	-2.4	99	-3.2	-0.8

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

NOx

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 150M #7
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: RUN #
Span: 0-100 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 150M #7
Test personnel: RT, BL, CT

Date: 1-17-91
Run number: Run # C 2-2
Span: 0-100 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0	0	0	0	0
Upscale gas	56.65	55.7	-0.95	55.8	-0.85	-0.1

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

O_2

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (%)	Mid-range [b] (%)	High-range [c] (%)
Sample run			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 1SOM #7
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0-25%

	Cylinder value (indicate units) (%)	Analyzer calibration response (indicate units) (%)	Absolute difference (indicate units) (%)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 1SOM #7
Test personnel: RT, BL, CT

Date: 1-17-91
Run number: Run # C2-2
Span: 0-25%

	Analyzer calibration response (%)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (%)	System cal. bias (percent of span) (%)	System calibration response (%)	System cal. bias (percent of span) (%)	
Zero gas	0	0.05	0.5	0	0	0.5
Upscale gas	8.5	8.4	-1.0	8.325	-1.75	-0.75

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 150M #7
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0 – 200 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 150M #7
Test personnel: RT, BL, CT

Date: 1-17-91
Run number: Run # C2-2
Span: 0 – 200 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0.4	0.4	0	0	0.4
Upscale gas	102.2	99	-3.2	99.6	-2.6	0.6

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

NOx

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP ISOM #7
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: RUN #
Span: 0-100 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP ISOM #7
Test personnel: RT, BL, CT

Date: 1-17-91
Run number: Run # C 2-3
Span: 0-100 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0	0	0	0	0
Upscale gas	56.65	55.8	-0.85	56.0	-0.65	0.2

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

O2

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (%)	Mid-range [b] (%)	High-range [c] (%)
Sample run			
1.			
2.			
3.			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 150M #7
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0-25%

	Cylinder value (indicate units) (%)	Analyzer calibration response (indicate units) (%)	Absolute difference (indicate units) (%)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 150M #7
Test personnel: RT, BL, CT

Date: 1-17-91
Run number: Run # C 2-3
Span: 0-25%

	Analyzer calibration response (%)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (%)	System cal. bias (percent of span) (%)	System calibration response (%)	System cal bias (percent of span) (%)	
Zero gas	0	0	0	0.05	0.5	0.5
Upscale gas	8.5	8.325	-1.75	8.425	-0.75	1.0

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 150M #7
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0 – 200 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 150M #7
Test personnel: RT, BL, CT

Date: 1-17-91
Run number: Run # C 2-3
Span: 0 – 200 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0	0	0	0	0
Upscale gas	102.2	99.6	-2.6	99.8	-2.4	-0.2

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

NOx

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used EPA Protocol 1

Date 1-24-91

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average	0	55.75	87.03
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP ISOM #7
Test personnel: RT, BL, CT
Date: 1-24-91

Analyzer calibration data for sampling runs: RUN # C4-1
Span: 0-100 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas	0	0	0	0
Mid-range gas	55.75	56.0	0.25	
High-range gas	87.03	87.3	1.73	1.73

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP ISOM #7
Test personnel: RT, BL, CT

Date: 1-24-91
Run number: Run # C4-1
Span: 0-100 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0	0	0	0	0
Upscale gas	56.0	54.7	-1.3	54.5	-1.5	-0.2

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

O2

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used Orsat

Date 1-24-91

	Gas concentration (indicate units)		
	Zero [a] (%)	Mid-range [b] (%)	High-range [c] (%)
Sample run			
1			
2			
3			
Average	0	8.45	20.9
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP ISOM #7
Test personnel: RT, BL, CT
Date: 1-24-91

Analyzer calibration data for sampling runs: Run # C4-1
Span: 0-25%

	Cylinder value (indicate units) (%)	Analyzer calibration response (indicate units) (%)	Absolute difference (indicate units) (%)	Difference (percent of span) (%)
Zero gas	0	0	0	0
Mid-range gas	8.45	8.525	0.075	0.75
High-range gas	20.9	20.725	0.175	1.75

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP ISOM #7
Test personnel: RT, BL, CT

Date: 1-24-91
Run number: Run # C4-1
Span: 0-25%

	Analyzer calibration response (%)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (%)	System cal. bias (percent of span) (%)	System calibration response (%)	System cal. bias (percent of span) (%)	
Zero gas	0	0	0	0	0	0
Upscale gas	8.525	8.45	-0.75	8.425	-1.0	-0.25

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used EPA Protocol 1

Date 1-24-91

	Gas concentration (indicate units)		
	Zero[a] (ppm)	Mid-range[b] (ppm)	High-range[c] (ppm)
Sample run:			
1			
2			
3			
Average	0	102.5	169.5
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 150M #7
Test personnel: RT, BL, CT
Date: 1-24-91

Analyzer calibration data for sampling runs: Run # C4-1
Span: 0 – 200 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas	0	0	0	0
Mid-range gas	102.5	102	0.5	0.5
High-range gas	169.5	169.5	0	0

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 150M #7
Test personnel: RT, BL, CT

Date: 1-24-91
Run number: Run # C4-1
Span: 0 – 200 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0.4	0.4	0.2	0.2	-0.2
Upscale gas	102	98	-4	100.2	-1.8	-2.2

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

NOx

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP ISOM #7
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: RUN #
Span: 0 - 100 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP ISOM #7
Test personnel: RT, BL, CT

Date: 1-24-91
Run number: Run #C4-2
Span: 0 - 100 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0	0	0	0	0
Upscale gas	56.0	54.5	-1.5	54.5	-1.5	0

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal Response} - \text{Initial System Cal Response}}{\text{Span}} \times 100$$

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (%)	Mid-range [b] (%)	High-range [c] (%)
Sample run			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 1SOM #7
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0-25%

	Cylinder value (indicate units) (%)	Analyzer calibration response (indicate units) (%)	Absolute difference (indicate units) (%)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Date: 1-24-91
Run number: Run # C4-2
Span: 0-25%

Source identification: EP 1SOM #7
Test personnel: RT, BL, CT

	Analyzer calibration response (%)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (%)	System cal. bias (percent of span) (%)	System calibration response (%)	System cal. bias (percent of span) (%)	
Zero gas	0	0	0	0	0	0
Upscale gas	8.525	8.425	-1.0	8.40	-1.25	-0.25

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 150M #7
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0 – 200 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Date: 1-24-91
Run number: Run # C4-2
Span: 0 – 200 ppm

Source identification: EP 150M #7
Test personnel: RT, BL, CT

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0.2	0.2	0.2	0.2	0
Upscale gas	102	100.2	-1.8	100	2.0	-0.2

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

NOx

TENERX corp

FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP ISOM #7
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: RUN #
Span: 0 - 100 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP ISOM #7
Test personnel: RT, BL, CT

Date: 1-24-91
Run number: Run # C4-3
Span: 0 - 100 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0	0	0	0	0
Upscale gas	56.0	54.5	-1.5	54.8	-1.2	0.3

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

O2

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (%)	Mid-range [b] (%)	High-range [c] (%)
Sample run.			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 1SOM #7
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0-25%

	Cylinder value (indicate units) (%)	Analyzer calibration response (indicate units) (%)	Absolute difference (indicate units) (%)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 1SOM #7
Test personnel: RT, BL, CT

Date: 1-24-91
Run number: Run # C#4-3
Span: 0-25%

	Analyzer calibration response (%)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (%)	System cal. bias (percent of span) (%)	System calibration response (%)	System cal. bias (percent of span) (%)	
Zero gas	0	0	0	0	0	0
Upscale gas	8.525	8.4	-1.25	8.425	-1.0	0.25

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 150M #7
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0 – 200 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 150M #7
Test personnel: RT, BL, CT

Date: 1-24-91
Run number: Run # C4-3
Span: 0 – 200 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0.2	0.2	0.2	0.2	0
Upscale gas	102	100	2.0	100.2	-1.8	0.2

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

JOB: Ent. Products

TURBINE ID: ISOM Unit #8 & 7

FUEL: 100% Nat. Gas.

TENERX CORP.

DATE: 01-21-91 (ISOM #8)
01-22-91 (ISOM #7)
01-24-91 (ISOM #7)

	Test No.	Time	Load	O_2, %	CO ppm	Temp WB/DB	Specif Humid	NO_x PPMV	NO_x PPMV (15% O_2)	NO (15% O_2)	NO_x (15% O_2) 250	P_{bar} In.Hg	NO* (LB/HR)	NO_x* (LB/HR)
	ISOM #8													
	T#C3-1				18	43/48		33				30.37	2.2021	6.6354
	T#C3-2				24	44/47		27				30.37	2.8949	5.3528
	T#C3-3				28	41/44		27				30.37	3.2427	5.1392
	ISOM #7													
1/22	T#C4-1				39	40/44		36				30.37	4.9338	7.4624
1/24	T#C4-1				31.4	53/58		36.5				30.22	4.2724	6.9271
	T#C4-2				35	51/55		37.50				30.22	4.1767	7.1718
	T#C4-3					51/54		30.225				30.25		

$$NOx = (NOx_{obs})\left(\frac{P_{ref}}{P_{obs}}\right)^{0.5} e^{19(H_{obs} - 0.00633)}\left(\frac{T_{amb}}{288k}\right)^{1.53}$$

where:

NOx = emissions of NOx at 15% oxygen and ISO standard ambient conditions, ppm%.

NOx_{obs} = measured NOx emissions (dry) at 15% oxygen, ppmv.

P_{ref} = reference combustor inlet absolute pressure at 29.92 In. Hg.

P_{obs} = measured combustor inlet absolute pressure at test ambient pressure.

H_{obs} = specific humidity of ambient air at test. $\frac{lb\ H_2O}{lb\ AIR}$

Tamb = Ambient temp., °K

JOB: ENTERPRISE PRODUCTS

TURBINE ID: ISOM Unit #8

FUEL: 30% Ethane & 70% NG.

TENERX CORP.

DATE: 01-17-91

Test No.	Time	Load	O_2,%	CO ppm	Temp WB/DB	Specif Humid	NO_x PPMV	NO_x PPMV (15%O_2)	NO (15%O_2)	NO_x (15%O_2)	P_{bar} In.Hg	NO (LB/HR)	NO_x (LB/HR)	CO/O_2 ratio
T#C1-1				35	56/68	0.0068	31.5				30.40	3.974	5.8782	
T#C1-2				26	60/70	0.0088	31.0				30.35	2.992	5.8638	
T#C1-3				32	59/65	0.0092	31.0				30.26	3.6777	5.8557	
ISOM UNIT #7														
T#C2-1				34	59/64	0.0096	30.5				30.26	4.202	6.1956	3.6/15.0
T#C2-2				32	56/61	0.0085	31				30.25	3.993	6.3583	3.6/15.0
T#C2-3				30	56/61	0.0085	31				30.24	3.680	6.2504	3.8/14.7

$$NOx = (NOx_{obs})\left(\frac{P_{ref}}{P_{obs}}\right)^{0.5} e^{19(H_{obs} - 0.00633)} \left(\frac{T_{amb}}{288k}\right)^{-1.53}$$

where:

NOx = emissions of NOx at 15% oxygen and ISO standard ambient conditions, ppm%,

NOx_{obs} = measured NOx emissions (dry) at 15% oxygen, ppmv.

P_{ref} = reference combustor inlet absolute pressure at 29.92 In. Hg.

P_{obs} = measured combustor inlet absolute pressure at test ambient pressure.

H_{obs} = specific humidity of ambient air at test. $\frac{lb\ H_2O}{lb\ AIR}$

Tamb = Ambient temp. , °K

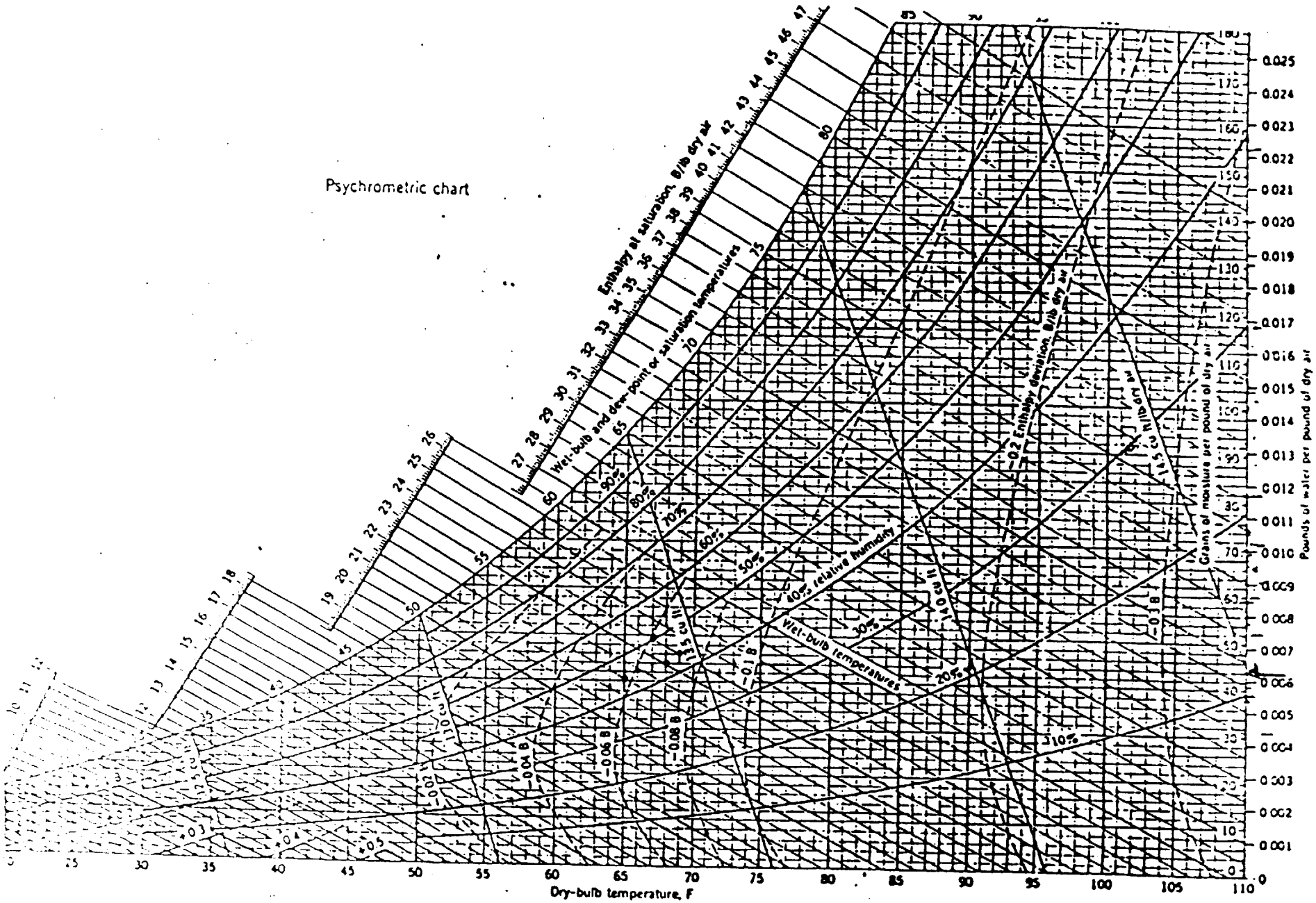

Chart A-6 Psychrometric chart. Adapted by permission from Carrier psychrometric chart, copyright 1946 by Carrier Corporation.

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FIGURE 20-3—ZERO AND CALIBRATION DATA

Turbine type: Allison 501 KCM
Date: 1/17/91
Analyzer type: TECO 10S Chemiluminescent
Identification number: #7 ASP 837
Test number: Run CE 2-1
Identification number: 10S-28997-233

	Cylinder value, ppm or %	Initial analyzer response, ppm or %	Final analyzer responses, ppm or %	Difference: initial-final, ppm or %
Zero gas	0	0	0	0
Low-level gas	24.48	24.7	24.9	-0.2
Mid-level gas	55.75	57.3	57.6	-0.3
High-level gas	89.03	89.0	88.9	-0.1

$$\text{Percent drift} = \frac{\text{Absolute difference}}{\text{Span value}} \times 100$$

FIGURE 20-5—RESPONSE TIME

Date of test: 1/17/91
Analyzer type: TECO 10S Chemiluminescent
S/N: 10S-28997-233
Span gas concentration: 55.75 ppm.
Analyzer span setting: 100 ppm.
Upscale:
1 — 17 seconds.
2 — 17 seconds.
3 — 18 seconds.
Average upscale response 17 seconds.
Downscale:
1 — 10 seconds.
2 — 10 seconds.
3 — 10 seconds.
Average downscale response 10 seconds.
System response time = 45 sec
slower average time = ——— seconds.

FIGURE 20-6—PRELIMINARY DILUENT TRAVERSE

Date ———
Location:
Plant ———
City, State ———

Turbine identification:
Manufacturer ———
Model, serial number ———

Sample point	Diluent concentration, ppm	Sample point	Diluent concentration, ppm
	N/A		

FIGURE 20-7—STATIONARY GAS TURBINE DATA

TURBINE OPERATION RECORD

Test operator: RT Date: 1/17/91
Turbine identification:
Type: Allison 501 KCM
Serial No.: ASP 837
Location:
Plant: Enterprise Products
City: Mont Belvieu, TX

Ambient temperature ———
Ambient humidity ———
Test time start: See Operation Data
Test time finish ———
Fuel flow rate* ———
Water or steam flow rate* ———
Ambient pressure ———
Diluent instrument type: Teledyne TAI 326
Serial No: 115492
NO, instrument type: TECO 10S
Serial No.: 10S-28997-233

Ultimate fuel analysis:
C ———
H ———
O — See Operation Data
N ———
S ———
Ash ———
H_2O ———
Trace metals:
Na ———
Va ———
K ———
etc* ———
Operating load ———

*Describe measurement method, i.e., continuous flow meter, start finish volumes, etc.
*i.e., additional elements added for smoke suppression.

FIGURE 20-8—STATIONARY GAS TURBINE SAMPLE POINT RECORD

Sample point	Time, min	Diluent*, %	NO_x*, ppm	Sample point	Time, min	Diluent*, %	NO_x*, ppm
	See Integrated RM 20(7E) & 3A Results						

*Average steady-state value from recorder or instrument readout.

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FIGURE 20-3—ZERO AND CALIBRATION DATA

Turbine type: Allison 501 KCM
Date: 1/17/91
Analyzer type: TECO 10S Chemiluminescent
Identification number: #7 ASP 837
Test number: Run 2 & 2-2
Identification number: 10S-28997-233

	Cylinder value, ppm or %	Initial analyzer response, ppm or %	Final analyzer responses, ppm or %	Difference: initial-final, ppm or %
Zero gas	0	0	0	0
Low-level gas	24.48	24.9	24.5	0.4
Mid-level gas	55.75	57.6	57.2	0.4
High-level gas	89.03	88.7	89.1	−0.2

$$\text{Percent drift} = \frac{\text{Absolute difference}}{\text{Span value}} \times 100$$

FIGURE 20-6—RESPONSE TIME

Date of test 1/17/91
Analyzer type TECO 10S Chemiluminescent
S/N 10S-28997-233
Span gas concentration: 55.75 ppm.
Analyzer span setting: 100 ppm.
Upscale:
1 ——— seconds.
2 ——— seconds.
3 ——— seconds.
Average upscale response —— seconds.
Downscale:
1 ——— seconds.
2 ——— seconds.
3 ——— seconds.
Average downscale response —— seconds.
System response time = slower average time = ——— seconds.

FIGURE 20-6—PRELIMINARY DILUENT TRAVERSE

Date ———
Location:
Plant ———
City, State ———
Turbine identification:
Manufacturer ———
Model, serial number ———

Sample point	Diluent concentration, ppm	Sample point	Diluent concentration, ppm
	N/A		

FIGURE 20-7—STATIONARY GAS TURBINE DATA

TURBINE OPERATION RECORD

Test operator RT Date 1/17/91
Turbine identification:
Type Allison 501 KCM
Serial No. ASP 837
Location:
Plant Enterprise Products
City Mont Belvieu, TX

Ambient temperature ———
Ambient humidity ———
Test time start See Operation Data
Test time finish ———
Fuel flow rate* ———
Water or steam flow rate* ———
Ambient pressure ———
Diluent instrument type Teledyne TAI 326
Serial No 115442
NO_x instrument type TECO 10S
Serial No. 10S-28997-233

Ultimate fuel analysis:
C ———
H ———
O ———
N See Operation Data
S ———
Ash ———
H_2O ———
Trace metals:
Na ———
Va ———
K ———
etc.† ———
Operating load ———

*Describe measurement method, i.e., continuous flow meter, start finish volumes, etc.
†i.e., additional elements added for smoke suppression.

FIGURE 20-8—STATIONARY GAS TURBINE SAMPLE POINT RECORD

Sample point	Time, min	Diluent*, %	NO_x*, ppm	Sample point	Time, min	Diluent*, %	NO_x*, ppm
	See Integrated RM 20(7E) & 3A Results						

*Average steady-state value from recorder or instrument readout.

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FIGURE 20-3—ZERO AND CALIBRATION DATA

Turbine type: Allison 501 KCO
Date: 1/17/91
Analyzer type: TECO 10S Chemiluminescent
Identification number: #7 ASD 437
Test number: Run 2 & 2-3
Identification number: 10S-28997-233

	Cylinder value, ppm or %	Initial analyzer response, ppm or %	Final analyzer responses, ppm or %	Difference: initial-final, ppm or %
Zero gas	0	0	0	0
Low-level gas	24.48	24.5	24.6	-0.1
Mid-level gas	55.75	57.2	57.4	-0.2
High-level gas	89.03	89.1	89.3	-0.2

$$\text{Percent drift} = \frac{\text{Absolute difference}}{\text{Span value}} \times 100$$

FIGURE 20-5—RESPONSE TIME

Date of test 1/17/91
Analyzer type TECO 10S Chemiluminescent
S/N 10S-28997-233
Span gas concentration: 55.75 ppm.
Analyzer span setting: 100 ppm.
Upscale:
1 ——— seconds.
2 ——— seconds.
3 ——— seconds.
Average upscale response —— seconds.
Downscale:
1 ——— seconds.
2 ——— seconds.
3 ——— seconds.
Average downscale response —— seconds.
System response time = slower average time = ——— seconds.

FIGURE 20-6—PRELIMINARY DILUENT TRAVERSE

Date ———
Location:
Plant ———
City, State ———

Turbine identification:
Manufacturer ———
Model, serial number ———

Sample point	Diluent concentration, ppm	Sample point	Diluent concentration, ppm
	N/A		

FIGURE 20-7—STATIONARY GAS TURBINE DATA

TURBINE OPERATION RECORD

Test operator RT Date 1/17/91
Turbine identification:
Type Allison 501 KCM
Serial No. ASD 437
Location:
Plant Enterprise Products
City Mont Belvieu, TX

Ambient temperature ———
Ambient humidity ———
Test time start See Operation Data
Test time finish ———
Fuel flow rate* ———
Water or steam flow rate* ———
Ambient pressure ———
Diluent instrument type Teledyne TAI 326
Serial No 115492
NO_x instrument type TECO 10S
Serial No. 10S-28997-233

Ultimate fuel analysis:
C ———
H ———
O ———
N See Operation Data
S ———
Ash ———
H_2O ———
Trace metals:
Na ———
Va ———
K ———
etc* ———
Operating load ———

*Describe measurement method, i.e., continuous flow meter, start finish volumes, etc.
*i.e., additional elements added for smoke suppression.

FIGURE 20-8—STATIONARY GAS TURBINE SAMPLE POINT RECORD

Sample point	Time, min	Diluent*, %	NO_x*, ppm	Sample point	Time, min	Diluent*, %	NO_x*, ppm
	See Integrated RM 20(7E) & 3A Results						

*Average steady-state value from recorder or instrument readout

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FIGURE 20-3—ZERO AND CALIBRATION DATA

Turbine type: Allison 501 KCM
Date: 1/24/91
Analyzer type: TECO 10S Chemiluminescent
Identification number: #7 ASI 837
Test number: Run 2 of 4-1
Identification number: 10S-28997-233

	Cylinder value, ppm or %	Initial analyzer response, ppm or %	Final analyzer responses, ppm or %	Difference: initial-final, ppm or %
Zero gas	0	0	0	0
Low-level gas	24.48	24.0	23.9	0.1
Mid-level gas	55.75	56.0	55.4	0.6
High-level gas	89.03	87.3	86.6	0.7

$$\text{Percent drift} = \frac{\text{Absolute difference}}{\text{Span value}} \times 100$$

FIGURE 20-4—RESPONSE TIME

Date of test: 1/24/91
Analyzer type: TECO 10S Chemiluminescent
S/N: 10S-28997-233
Span gas concentration: 55.75 ppm.
Analyzer span setting: 100 ppm.
Upscale:
1 — 17 — seconds.
2 — 18 — seconds.
3 — 17 — seconds.
Average upscale response 17 seconds.
Downscale:
1 — 10 — seconds.
2 — 10 — seconds.
3 — 10 — seconds.
Average downscale response 10 seconds.
System response time = 45 sec.
slower average time = ——— seconds.

FIGURE 20-6—PRELIMINARY DILUENT TRAVERSE

Date ———
Location:
Plant ———
City, State ———

Turbine identification:
Manufacturer ———
Model, serial number ———

Sample point	Diluent concentration, ppm	Sample point	Diluent concentration, ppm
	N/A		

FIGURE 20-7—STATIONARY GAS TURBINE DATA

TURBINE OPERATION RECORD

Test operator: RT — Date ———
Turbine identification:
Type: Allison 501 KCM
Serial No.: ASI 837
Location:
Plant: Enterprise Products
City: Mont Belvieu, TX

Ambient temperature ———
Ambient humidity ———
Test time start: See Operation Data
Test time finish ———
Fuel flow rate* ———
Water or steam flow rate* ———
Ambient pressure ———
Diluent instrument type: Teledyne TAI 326
Serial No: 115492
NO_x instrument type: TECO 10S
Serial No.: 10S-28997-233

Ultimate fuel analysis:
C ———
H ———
O ———
N: See Operation Data
S ———
Ash ———
H_2O ———
Trace metals:
Na ———
Va ———
K ———
etc* ———
Operating load ———

*Describe measurement method, i.e., continuous flow meter, start finish volumes, etc.
*i.e., additional elements added for smoke suppression.

FIGURE 20-8—STATIONARY GAS TURBINE SAMPLE POINT RECORD

Sample point	Time, min	Diluent*, %	NO_x*, ppm	Sample point	Time, min	Diluent*, %	NO_x*, ppm
	See Integrated RM 20(TE) & 3A Results						

*Average steady-state value from recorder or instrument readout

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FIGURE 20-3—ZERO AND CALIBRATION DATA

Turbine type: Allison 501 KCM
Date: 1/24/91
Analyzer type: TECO 10S Chemiluminescent
Identification number: #7 ASP 837
Test number: Run C & 4-2
Identification number: 10S-28997-233

	Cylinder value, ppm or %	Initial analyzer response, ppm or %	Final analyzer responses, ppm or %	Difference: initial-final, ppm or %
Zero gas	0	0	0	0
Low-level gas	24.48	23.7	23.7	0.2
Mid-level gas	55.75	55.4	55.3	0.1
High-level gas	89.03	86.6	86.5	0.1

$$\text{Percent drift} = \frac{\text{Absolute difference}}{\text{Span value}} \times 100$$

FIGURE 20-5—RESPONSE TIME

Date of test: 1/24/91
Analyzer type: TECO 10S Chemiluminescent
S/N: 10S-28997-233
Span gas concentration: 55.75 ppm.
Analyzer span setting: 100 ppm.
Upscale:
1 ——— seconds.
2 ——— seconds.
3 ——— seconds.
Average upscale response —— seconds.
Downscale:
1 ——— seconds.
2 ——— seconds.
3 ——— seconds.
Average downscale response —— seconds.
System response time = slower average time = ——— seconds.

FIGURE 20-6—PRELIMINARY DILUENT TRAVERSE

Date ———
Location:
Plant ———
City, State ———

Turbine identification:
Manufacturer ———
Model, serial number ———

Sample point	Diluent concentration, ppm	Sample point	Diluent concentration, ppm
	N/A		

FIGURE 20-7—STATIONARY GAS TURBINE DATA

TURBINE OPERATION RECORD

Test operator: RT Date: 1/24/91
Turbine identification:
Type: Allison 501 KCM
Serial No.: ASP 837
Location:
Plant: Enterprise Products
City: Mont Belvieu, TX

Ambient temperature ———
Ambient humidity ———
Test time start ———
Test time finish: See Operation Data
Fuel flow rate* ———
Water or steam flow rate* ———
Ambient pressure ———
Diluent instrument type: Teledyne TAI 326
Serial No: 115492
NO, instrument type: TECO 10S
Serial No.: 10S-28997-233

Ultimate fuel analysis:
C ———
H ———
O ———
N: See Operation Data
S ———
Ash ———
H_2O ———
Trace metals:
Na ———
Va ———
K ———
etc* ———
Operating load ———

*Describe measurement method, i.e., continuous flow meter, start finish volumes, etc.
*i.e., additional elements added for smoke suppression.

FIGURE 20-8—STATIONARY GAS TURBINE SAMPLE POINT RECORD

Sample point	Time, min	Diluent*, %	NO_x*, ppm	Sample point	Time, min	Diluent*, %	NO_x*, ppm
	See Integrated RM 20(7E) & 3A Results						

*Average steady-state value from recorder or instrument readout

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(713) 482-5801

FIGURE 20-3—ZERO AND CALIBRATION DATA

Turbine type: Allison 501 KCM
Date: 1/24/91
Analyzer type: TECO 105 Chemiluminescent
Identification number: #7 ASP #37
Test number: Run 2 & 4-3
Identification number: 105-28997-233

	Cylinder value, ppm or %	Initial analyzer response, ppm or %	Final analyzer responses, ppm or %	Difference: initial-final, ppm or %
Zero gas	0	0	0	0
Low-level gas	24.48	23.7	23.8	-0.1
Mid-level gas	55.75	55.3	55.5	-0.2
High-level gas	89.03	86.5	86.8	-0.3

$$\text{Percent drift} = \frac{\text{Absolute difference}}{\text{Span value}} \times 100$$

FIGURE 20-5—RESPONSE TIME

Date of test: 1/24/91
Analyzer type: TECO 105 Chemiluminescent
S/N: 105-28997-233
Span gas concentration: 55.75 ppm.
Analyzer span setting: 100 ppm.
Upscale:
1 ——— seconds.
2 ——— seconds.
3 ——— seconds.
Average upscale response —— seconds.
Downscale:
1 ——— seconds.
2 ——— seconds.
3 ——— seconds.
Average downscale response —— seconds.
System response time = slower average time = ——— seconds.

FIGURE 20-6—PRELIMINARY DILUENT TRAVERSE

Date ———
Location:
Plant ———
City, State ———
Turbine identification:
Manufacturer ———
Model, serial number ———

Sample point	Diluent concentration, ppm	Sample point	Diluent concentration, ppm
	N/A		

FIGURE 20-7—STATIONARY GAS TURBINE DATA

TURBINE OPERATION RECORD

Test operator: RT Date: 1/24/91
Turbine identification:
Type: Allison 501 KCM
Serial No.: ASP 837
Location:
Plant: Enterprise Products
City: Mont Belvieu, TX

Ambient temperature ———
Ambient humidity ———
Test time start ———
Test time finish: See Operation Data
Fuel flow rate* ———
Water or steam flow rate* ———
Ambient pressure ———
Diluent instrument type: Teledyne TAI 326
Serial No: 115492
NO_x instrument type: TECO 105
Serial No.: 105-28997-233

Ultimate fuel analysis:
C ———
H ———
O ———
N: See Operation Data
S ———
Ash ———
H_2O ———
Trace metals:
Na ———
Va ———
K ———
etc* ———
Operating load ———

*Describe measurement method, i.e., continuous flow meter, start finish volumes, etc.
*i.e., additional elements added for smoke suppression.

FIGURE 20-8—STATIONARY GAS TURBINE SAMPLE POINT RECORD

Sample point	Time, min	Diluent*, %	NO_x*, ppm	Sample point	Time, min	Diluent*, %	NO_x*, ppm
	See Integrated RM 20(7E) & 3A Results						

*Average steady-state value from recorder or instrument readout.

TENERX corp
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(713) 482-5801

APPENDIX A

FIELD "RAW" DATA

2. ISOM TURBINE # 8

TENERX corp.

STACK SAMPLING FIELD DATA

PLANT NAME Enterprise Products STACK NAME 150M DIB #8

DATE 1-17-91 OPERATOR RT SAMPLE NUMBER C# 1-1 STACK HEIGHT ~43ft

STACK DIAM. (exit) 5.98' STACK DIAM. (port) 5.98' STACK PRESS. (In. H_2O) -0.08 BARO. PRESS. (In. Hg) 30.40

ΔH = 1.58

PROBE NUMBER X8 PTCF 0.84 DGMCF 0.988 PUMP NUMBER EN 110

NOZZLE NUMBER — NOZZLE AREA — FILTER NUMBER — OUT WEIGHT GRAMS —

METER NUMBER EN 110 K FACTOR — ORIFICE CONSTANTS a — b —

Preleak check 0.002 @ -26in Hg Post leak 0.002 @ -26 in Hg

Point	Clock Time	Dry Gas Meter Reading	ΔP Inches H_2O	ΔH Inches H_2O	Probe Temp	DRY GAS METER TEMPERATURE Inlet	Outlet	L. VAC. Inches Hg Gauge	Box Temperature °F	Stack Temperature °F
	11:10	103.382								
1	11:15	105.51	0.16	0.8	245	66	65	6		386
2	11:19	107.55	0.15	0.8	247	66	65	6		394
3	11:23	109.745	0.16	0.8	249	67	65	6		400
4	11:27	111.95	0.15	0.8	250	67	65	6		414
5	11:31	114.15	0.18	0.8	247	68	65	6		358
6	11:35	116.40	0.18	0.8	252	68	66	6		397
7	11:39		0.15	0.8	252	68	66	6		401
8	11:43	120.901	0.11	0.8	253	69	68	6		397
	11:53	120.901								
1	11:57	123.03	0.17	0.8	266	69	67	6		422
2	12:01	125.29	0.17	0.8	248	70	68	6		431
3	12:05	127.57	0.16	0.8	254	71	68	6		406
4	12:09	129.84	0.15	0.8	252	72	69	6		438
5	12:13	132.00	0.13	0.8	263	73	69	6		448
6	12:17	134.42	0.11	0.8	261	74	70	6		446
7	12:21	136.75	0.08	0.8	259	74	70	6		428
8	12:25	138.97	0.09	0.8	255	74	70	6		408
			$\sqrt{\Delta P}$ =							
	64min	35.588	0.37682	0.8		69.75	67.25			412.75

68.5

Sample Time Net Volume

TENERX corp

IMPINGER CATCH

Sample Number C# 1-1 Stock Name 150M DIB # 8 Company Name Enterprise Products

Impinger Number	Solution Used	Amount of Solution (milliliters)	Impinger Tip Configuration	Weight (grams)	
1	H_2O			Final	314.8
				Initial	261.2
				Weight gain	53.6
2	H_2O			Final	267.4
				Initial	265.8
				Weight gain	1.6
3	Empty			Final	—
				Initial	—
				Weight gain	—
4	Silica Gel			Final	213.0
				Initial	205.7
				Weight gain	7.3
5				Final	
				Initial	
				Weight gain	
6				Final	
				Initial	
				Weight Gain	
Flask				Final	
				Initial	
				Weight gain	

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 62.5g

Date 1-17-91

Signature BL

Independent Verification of Calculations Shown Above

Explanation: Someone other than the person who performed the original work and associated calculations must verify that these calculations have been performed correctly.

Signature Ray Tenazas

Date 2-11-91

ORSAT ANALYSIS RESULTS

Gas Fractional Part

CO_2 3.8

O_2 15.2

CO

N_2 81.0

Date 1-17-1991

Time 12:15

Signature RT

T#C1-1
ISOM #8

PRELIMINARY VELOCITY DETERMINATION

If preliminary velocity is not determined by the following procedure please state how preliminary velocity was determined.

Traverse Pt.	Δp (inches H_2O) I	II	III
Date			
Time			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

For Preliminary Velocity Calculation, Isokinetic Sampling:

1. Use calculator to sum the square roots of all Δp's and divide this by N, the number of Δp's.

   Aver. $\sqrt{\Delta p} = \frac{\Sigma\sqrt{\Delta p}}{N}$

   Aver. $\sqrt{\Delta p} = \frac{(\quad)}{(\quad)} = \underline{\underline{0.37682}}$

   (units are inches H_2O to the one half power)

2. Obtain the pitot tube calibration factor for the probe used. Probe No. _____ Pitot Tube Calibration Factor 0.84 (Shown in the equation below as PTCF)

3. Calculate Absolute Stack Pressure:
   Measured Stk. Press. (gauge) -0.08 "H_2O
   (Measured stack press. may be (+) or (-))
   Preliminary Atmo. Press. 30.40 "Hg
   Stack pressure in inches of water (gage), times 0.07355, plus the barometric pressure in inches mercury equal to the absolute stack pressure in inches of mercury:

   (-0.08) in. H_2O (.07355) + (30.40) in. Hg
   = Stack Pressure 30.394 in. Hg

4. Calculate average preliminary velocity, V, in feet per second as shown below.

$$V = (85.48)\ (PTCF)\ \sqrt{\frac{(\text{Stack Temp. } °R)}{\left[\text{Mole. Wt.}\right]\left[\text{Stk. Press. inches Hg}\right]}}\ (\text{Average } \sqrt{\Delta p})$$

$$V = (85.48)\ (0.84)\ \sqrt{\frac{(412.75+460=872.75)}{(28.366)(30.394)}}\ (0.37682)\ \underline{27.222}\ \text{ft/sec}$$

$$Q_{std} = (60)(1-0.07581)(27.222)(28.0783)\left(\frac{528}{872.75}\right)\left(\frac{30.394}{29.92}\right)$$
$$= 26{,}048.2\ \text{DSCFM}$$

Date 01-17-91

Time

Signature B. P.

T#C1-1

PRELIMINARY
ORSAT ANALYSIS RESULTS

Date 01-17-90

Time _____

Signature _____

Gas Fractional Part

CO_2 0.038

O_2 0.152

CO _____

N_2 0.81

Orsat fractional parts must sum to 1.00.

At least one preliminary Orsat analysis must be taken unless reliable preliminary information is available from other sources. If a preliminary Orsat is not taken, state how this preliminary information was obtained: _____

_____.

PRELIMINARY
MOLECULAR WEIGHT CALCULATIONS

This calculation of molecular weight is not required for gaseous sampling.

	Molecular Weights	Orsat Fraction	Moisture Fraction / Dry Gas Fraction	Partial Mol. Wt.
H_2O	(18)		[_____]	_____
CO_2	(44)	(_____)	[_____] =	_____
O_2	(32)	(_____)		_____
CO	(28)	(_____)		_____
N_2	(28)	(_____)		_____

Molecular Weight of Stack Gas . . . . . _____
(Sum of partial molecular weights)

Date _____

Signature _____

Sample No. C#1-1 Stack Name Isom Unit #8 Company Name Ent. Products

FIELD CHECK OF MOLECULAR WEIGHT

(To be used when substantial changes have occurred in the moisture fraction)

	Molecular Weights		Moisture Fraction		Partial Mol. Wt.
H_2O	(18)	. . . . .	[0.07581]	=	1.3646

		Orsat Fraction	Dry Gas Fraction		
CO_2	(44)	(0.038)	[0.924186 (see above)]	=	
O_2	(32)	(0.152)		=	
CO	(28)	( )		=	
N_2	(28)	(0.810)		=	27.0010
		29.216			

Molecular Weight of Stack Gas 28.366
(Sum of partial molecular weights)

FIELD CHECK ON MOISTURE FRACTION

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 35.339 ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 528.5 °R

Total imp. wt. gain, MWC 62.5 grams H_2O

Pressure at meter, PM 30.46 inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (499.4)\ \frac{\text{liters } °R}{ft^3 \text{ in.Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(62.5)\ (1.335)}{\left[(62.5)(1.335)\right] + \left[\frac{(35.339)\ (30.46)}{(528.5)}\ (499.4)\right]} = 0.07581$$

Dry Gas Fraction = 1 - (moisture fraction) = 1 - (0.07581) = 0.924186

Date 01-17-98

Signature Billy Lee

TENERX corp.

STACK SAMPLING FIELD DATA

PLANT NAME Enterprise Products STACK NAME ~~Enterprise Prod.~~ ISOM DIB #8

DATE 1-17-91 OPERATOR RT SAMPLE NUMBER C# 1-2 STACK HEIGHT ~43ft

STACK DIAM. (exit) 5.98' STACK DIAM. (port) 5.98' STACK PRESS. (In. H_2O) -0.08 BARO. PRESS. (In. Hg) 30.35

PROBE NUMBER 78 PTCF 0.84 DGMCF 0.988 ΔH = 1.58 PUMP NUMBER EN 110

NOZZLE NUMBER — NOZZLE AREA — FILTER NUMBER — OUT WEIGHT GRAMS —

METER NUMBER EN 110 K FACTOR — ORIFICE CONSTANTS a — b —

Preleak 0.001 @ -25 in Hg Post leak check 0.003 @ -26 in Hg

Point	Clock Time	Dry Gas Meter Reading	ΔP Inches H_2O	ΔH Inches H_2O	Probe Temp	DRY GAS METER TEMPERATURE Inlet	Outlet	L. VAC. Inches Hg Gauge	Box Temperature °F	Stack Temperature °F
	1:10	139.308								
1	1:14	141.50	0.18	0.6	268	70	71	7		386
2	1:18	143.60	0.19	0.6	247	71	71	7		354
3	1:22	145.47	0.17	0.6	246	71	71	7		406
4	1:26	147.37	0.17	0.6	250	71	71	7		404
5	1:30	149.44	0.16	0.6	255	71	71	7		353
6	1:34	151.37	0.14	0.6	254	71	71	7		353
7	1:38	153.48	0.10	0.6	249	72	71	7		402
8	1:42	155.363	0.10	0.6	247	72	71	7		404
	2:17	155.363	0							
1	2:21	157.32	0.18	0.6	257	69	70	7		425
2	2:25	159.24	0.17	0.6	255	69	70	7		422
3	2:29	161.23	0.16	0.6	260	68	70	7		415
4	2:33	163.23	0.14	0.6	259	69	70	7		404
5	2:37	165.20	0.13	0.6	254	69	69	7		441
6	2:41	167.19	0.13	0.6	253	69	69	7		444
7	2:45	169.19	0.13	0.6	250	69	69	7		444
8	2:49	171.178	0.1	0.6	247	68	69	7		419
	~~Avg~~	31.870		0.6		69.9	70.25			412.25

70.1

Sample Time Net Volume

TENERX CORP.

IMPINGER CATCH

Sample Number C# 1-2 Stack Name 150M DID #8 Company Name Enterprise Prod.

Impinger Number	Solution Used	Amount of Solution (milliliters)	Impinger Tip Configuration	Weight (grams)	
1	H_2O	200		Final	306.6
				Initial	261.0
				Weight gain	45.6
2	H_2O	200		Final	~~267.4~~ 263.0
				Initial	261.7
				Weight gain	1.3
3	Blank	0		Final	
				Initial	
				Weight gain	
4	Silicagel	200g		Final	268.5
				Initial	262.1
				Weight gain	6.4
5				Final	
				Initial	
				Weight gain	
6				Final	
				Initial	
				Weight Gain	
Flask				Final	
				Initial	
				Weight gain	

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 53.8g

Date 01-7-90

Signature BL

Independent Verification of Calculations Shown Above

Explanation: Someone other than the person who performed the original work and associated calculations must verify that these calculations have been performed correctly.

Signature Ray Terrazas

Date 2-11-91

ORSAT ANALYSIS RESULTS

Gas Fractional Part

CO_2 3.4

O_2 15.2

CO

N_2 81.4

Date 1-17-91

Time 2:35p

Signature BL

Sample No. C#1-2 Stack Name ISOM Unit #8 Company Name Ent. Products.

FIELD CHECK OF MOLECULAR WEIGHT

(To be used when substantial changes have occurred in the moisture fraction)

	Molecular Weights		Moisture Fraction		Partial Mol. Wt.
H_2O	(18)	. . . . .	[0.07306]	=	1.31508

		Orsat Fraction	Dry Gas Fraction			
CO_2	(44)	(0.034)	[0.92694 (see above)]	=	1.3069	27.0837
O_2	(32)	(0.152)		=	4.5568	
CO	(28)	( )		=		
N_2	(28)	(0.814)		=	21.1884	

Molecular Weight of Stack Gas 28.399
(Sum of partial molecular weights)

FIELD CHECK ON MOISTURE FRACTION

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 31.647 ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 530.1 °R

Total imp. wt. gain, MWC 53.5 grams H_2O

Pressure at meter, PM 30.39 inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (499.4)\ \frac{\text{liters °R}}{ft^3\ \text{in.Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(53.5)\ (1.335)}{\left[(53.5)(1.335)\right] + \left[\frac{(31.647)\ (30.39)}{(530.1)}\ (499.4)\right]} = 0.07306$$

Dry Gas Fraction = 1 - (moisture fraction) = 1 - (0.07306) = 0.92694

Date 01-17-91

Signature B. L.

TENERX corp.

STACK SAMPLING FIELD DATA

PLANT NAME Enterprise Products STACK NAME 150M DIB #8

DATE 1-17-91 OPERATOR RJ SAMPLE NUMBER C# 1-3 STACK HEIGHT ~43ft

STACK DIAM. (exit) 5.98' STACK DIAM. (port) 5.98' STACK PRESS. (In. H_2O) -0.06 BARO. PRESS. (In. H_2O) 30.24

PROBE NUMBER #8 PTCF 0.84 DGMCF 0.993 ΔH = 1.54 PUMP NUMBER EN 110

NOZZLE NUMBER — NOZZLE AREA — FILTER NUMBER — OUT WEIGHT GRAMS —

METER NUMBER EN 110 K FACTOR — ORIFICE CONSTANTS a — b —

Preleak check 0.003 @ -26 in Hg Post leak check 0.005 @ -28 in Hg

	Point	Clock Time	Dry Gas Meter Reading	ΔP Inches H_2O	ΔH Inches H_2O	Probe Temp	DRY GAS METER TEMPERATURE Inlet	DRY GAS METER TEMPERATURE Outlet	L. VAC. Inches Hg Gauge	Box Temperature °F	Stack Temperature °F
		3:16	171.735								
Port 2	1	3:20	173.54	0.18	0.6	264	67	68	5		423
	2	3:24	175.57	0.17	0.6	265	68	68	5		419
	3	3:28	177.62	0.16	0.6	255	68	69	5		400
	4	3:32	179.63	0.14	0.6	259	68	68	5		436
	5	3:36	181.55	0.12	0.6	258	69	68	5		443
	6	3:40	183.57	0.12	0.6	259	68	68	5		449
	7	3:44	185.60	0.10	0.6	263	69	69	5		441
	8	3:48	187.631	0.09	0.6	260	68	68	5		404
		3:56	187.631								
	1	4:00	189.51	0.22	0.6	251	67	68	5.5		385
	2	4:04	191.61	0.22	0.6	252	67	68	5		358
	3	4:08	193.53	0.18	0.6	258	68	69	5		401
	4	4:12	195.51	0.17	0.6	254	68	69	5		409
	5	4:16	197.57	0.16	0.6	252	68	68	5		403
	6	4:20	199.60	0.13	0.6	250	68	69	5		399
	7	4:24	201.63	0.12	0.6	250	68	68	5		398
	8	4:28	203.699	0.09	0.6	253	69	68	5		398
				$\sqrt{\Delta P}$							
		64 min	31.964	0.38134	0.6		68.0	68.3			412.88

68.2

Sample Time Net Volume

TENERX CORP.

IMPINGER CATCH

Sample Number C# 1-3 Stock Name 150M D10 #8 Company Name Enterprise Prod

Impinger Number	Solution Used	Amount of Solution (milliliters)	Impinger Tip Configuration	Weight (grams)	
1	H_2O	200		Final	316.2
				Initial	265.2
				Weight gain	51.0
2	H_2O	200		Final	269.0
				Initial	267.4
				Weight gain	1.6
3	Empty			Final	
				Initial	
				Weight gain	
4	Silica Gel	~200g		Final	278.7
				Initial	272.8
				Weight gain	5.9
5				Final	
				Initial	
				Weight gain	
6				Final	
				Initial	
				Weight Gain	
Flask				Final	
				Initial	
				Weight gain	

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 58.5g

Date 1-17-91

Signature R. T

Independent Verification of Calculations Shown Above

Explanation: Someone other than the person who performed the original work and associated calculations must verify that these calculations have been performed correctly.

Signature Ray Terazao

Date 2-11-91

ORSAT ANALYSIS RESULTS

Gas Fractional Part

CO_2 3.2

O_2 15.2

CO

N_2 81.6

Date 1-17-91

Time 4:15

Signature RL

Test #C1-3
ISOM #8

PRELIMINARY VELOCITY DETERMINATION

If preliminary velocity is not determined by the following procedure please state how preliminary velocity was determined.

Traverse Pt.	Δp (inches H_2O) I	II	III
Date			
Time			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

For Preliminary Velocity Calculation, Isokinetic Sampling:

1. Use calculator to sum the square roots of all Δp's and divide this by N, the number of Δp's.

   Aver. $\sqrt{\Delta p} = \frac{\Sigma\sqrt{\Delta p}}{N}$

   Aver. $\sqrt{\Delta p} = \frac{(6.104)}{(16)} = 0.38134$

   (units are inches H_2O to the one half power)

2. Obtain the pitot tube calibration factor for the probe used. Probe No. _____ Pitot Tube Calibration Factor 0.84 (Shown in the equation below as PTCF)

3. Calculate Absolute Stack Pressure:
   Measured Stk. Press. (gauge) −0.06 "H_2O
   (Measured stack press. may be (+) or (−))

   Preliminary Atmo. Press. 30.24 "Hg

   Stack pressure in inches of water (gage), times 0.07355, plus the barometric pressure in inches mercury equal to the absolute stack pressure in inches of mercury:

   (−0.06) in. H_2O (.07355) + (30.24) in. Hg = Stack Press. 30.236 in. Hg

4. Calculate average preliminary velocity, V, in feet per second as shown below.

$$V = (85.48)\ (PTCF)\ \sqrt{\frac{(\text{Stack Temp. °R})}{[\text{Mole. wt.}]\ [\text{Stk. Press. inches Hg}]}}\ (\text{Average}\ \sqrt{\Delta p})$$

$$V = (85.48)\ (0.84)\ \sqrt{\frac{(412.80+460) = 872.88}{(28.2401)(30.236)}}\ (0.38134) = 27.6846\ \text{ft/sec}$$

$$Q_{std} = (60)(0.92087)(27.6846)(28.0783)\left(\frac{528}{872.88}\right)\left(\frac{30.344}{29.92}\right)$$
$$= 26{,}367.1$$

Date 01-17-91

Time _____

Signature B. K.

Sample No. T#C1-3 Stack Name ISOM Unit #8 Company Name Ent. Products

FIELD CHECK OF MOLECULAR WEIGHT

(To be used when substantial changes have occurred in the moisture fraction)

	Molecular Weights		Moisture Fraction		Partial Mol. Wt.
H_2O	(18)	. . . . .	[0.07913]	=	1.4243

		Orsat Fraction	Dry Gas Fraction		
CO_2	(44)	(0.032)	[0.92087 (see above)]	=	
O_2	(32)	(0.152)		=	
CO	(28)	( )		=	
N_2	(28)	(0.816)		=	26.8158
		29.12			

Molecular Weight of Stack Gas 28.2401
(Sum of partial molecular weights)

FIELD CHECK ON MOISTURE FRACTION

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 31.740 ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 528.2 °R

Total imp. wt. gain, MWC 58.5 grams H_2O

Pressure at meter, PM 30.284 inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (499.4)\ \frac{\text{liters °R}}{ft^3\ \text{in.Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(58.5)\ (1.335)}{\left[(58.5)(1.335)\right] + \left[\frac{(31.740)\ (30.284)}{(528.2)}\ (499.4)\right]} = 0.07913$$

Dry Gas Fraction = 1 - (moisture fraction) = 1 - (0.07913) = 0.92087

Date 01-17-91

Signature B. L.

TENERX corp.

STACK SAMPLING FIELD DATA

PLANT NAME Enterprise Products STACK NAME 150m DIB #8

DATE 1/21/91 OPERATOR CT SAMPLE NUMBER C#3-1 STACK HEIGHT ~43ft

STACK DIAM. (exit) 5.98' STACK DIAM. (port) 5.98 STACK PRESS. (In. H_2O) 0.988 (ΔH = 1.58) BARO. PRESS. (In. H_2O) 30.37

PROBE NUMBER 8 PTCF 0.84 (DGMCF) -0.02 PUMP NUMBER EN-110

NOZZLE NUMBER — NOZZLE AREA — FILTER NUMBER — OUT WEIGHT GRAMS —

METER NUMBER EN-110 K FACTOR — ORIFICE CONSTANTS a — b

Leak Check:

Point	Clock Time	Dry Gas Meter Reading	ΔP Inches H_2O	ΔH Inches H_2O	Probe Temp.	DRY GAS METER TEMPERATURE Inlet	DRY GAS METER TEMPERATURE Outlet	L. VAC. Inches Hg Gauge	Box Temperature °F	Stack Temperature °F
1	2:54	351.288	0.22	1	260	68	68	7		396
2	2:59	354.35	0.22	1	261	68	68	7		400
3	3:03	356.86	0.20	1	258	68	68	7		406
4	3:07	359.40	0.20	1	257	68	68	7		403
5	3:11	361.90	0.18	1	260	69	69	7		402
6	3:15	364.38	0.16	1	262	69	69	7		403
7	3:19	366.91	0.11	1	264	70	69	7		395
8	3:23	369.47	0.10	1	263	70	69	7		387
	3:27	371.956								
1	3:36	371.956	0.19	1	245	69	69	7		416
2	3:40	374.41	0.20	1	250	69	69	7		425
3	3:44	376.99	0.18	1	251	69	69	7		418
4	3:49	380.29	0.18	1	254	69	69	7		403
5	3:53	382.85	0.17	1	255	70	69	7		432
6	3:57	385.65	0.14	1	254	70	69	7		448
7	4:01	387.91	0.10	1	254	70	69	7		451
8	4:05	390.58	0.09	1	253	70	69	7		417
	4:09	393.106								
			$\sqrt{\Delta P}$							
	66 min	41.818	0.00244	1.0		69.1	68.75			412.6

68.9

Sample Time — Net Volume

TENERX corp.

IMPINGER CATCH

Sample Number C# 2-1 Stock Name 150M DIB #8 Company Name Enterprise Prod.

Impinger Number	Solution Used	Amount of Solution (milliliters)	Impinger Tip Configuration	Weight (grams)	
1	H_2O	200	Modified	Final	318.8
				Initial	262.2
				Weight gain	55.8 g
2	H_2O	200	~~Std~~ GS	Final	264.9
				Initial	264.7
				Weight gain	0.2
3	Blank		Modified	Final	0
				Initial	0
				Weight gain	
4	Silica Gel	~200 g	Modified	Final	273.1
				Initial	264.1
				Weight gain	9.0
5				Final	
				Initial	
				Weight gain	
6				Final	
				Initial	
				Weight Gain	
Flask				Final	
				Initial	
				Weight gain	

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 65.5 g

Date Jan 21, 1991

Signature BL

Independent Verification of Calculations Shown Above

Explanation: Someone other than the person who performed the original work and associated calculations must verify that these calculations have been performed correctly.

Signature Ray Terrazas

Date 2-11-91

ORSAT ANALYSIS RESULTS

Gas Fractional Part

CO_2 2.8

O_2 16.0

CO

N_2

Date 01-21-90

Time

Signature

Isom Unit #D
Test #C3-1

PRELIMINARY VELOCITY DETERMINATION

If preliminary velocity is not determined by the following procedure please state how preliminary velocity was determined.

Traverse Pt.	Δp (inches H_2O) I	II	III
Date			
Time			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

For Preliminary Velocity Calculation, Isokinetic Sampling:

1. Use calculator to sum the square roots of all Δp's and divide this by N, the number of Δp's.

   Aver. $\sqrt{\Delta p} = \dfrac{\Sigma\sqrt{\Delta p}}{N}$

   Aver. $\sqrt{\Delta p} = \dfrac{(6.439)}{(16)} = 0.40244$

   (units are inches H_2O to the one half power)

2. Obtain the pitot tube calibration factor for the probe used. Probe No. _____ Pitot Tube Calibration Factor 0.84 (Shown in the equation below as PTCF)

3. Calculate Absolute Stack Pressure:
   Measured Stk. Press. (gauge) -0.02 "H_2O
   (Measured stack press. may be (+) or (-))
   Preliminary Atmo. Press. 30.37 "Hg
   Stack pressure in inches of water (gage), times 0.07355, plus the barometric pressure in inches mercury equal to the absolute stack pressure in inches of mercury:

   (-0.02) in. H_2O (.07355) + (30.37) in. Hg = Stack Press. 30.369 in. Hg

4. Calculate average preliminary velocity, V, in feet per second as shown below.

$$V = (85.48)\ (PTCF)\ \sqrt{\frac{(\text{Stack Temp. °R})}{\left[\text{Mole. Wt.}\right]\left[\text{Stk. Press. inches Hg}\right]}}\ (\text{Average}\sqrt{\Delta p})$$

$$V = (85.48)\ (0.84)\ \sqrt{\frac{(412.6+460) = 872.6}{(28.337)(30.369)}}\ (0.40244)\ 29.0981\ \text{ft/sec}$$

$$Q_{std} = (60)(0.93223)(29.0981)(28.0783)\left(\frac{528}{872.6}\right)\left(\frac{30.369}{29.92}\right)$$
$$= 28{,}067.04\ \text{DSCFM}$$

Date 01-21-91

Time _____

Signature _____

Sample No. T#C3-1 Stack Name ISOM Unit #8 Company Name Enterprise Products

FIELD CHECK OF MOLECULAR WEIGHT

(To be used when substantial changes have occurred in the moisture fraction)

	Molecular Weights		Moisture Fraction		Partial Mol. Wt.
H_2O	(18)	. . . . .	[0.06777]	=	1.2199

		Orsat Fraction	Dry Gas Fraction		
CO_2	(44)	(0.028)	[0.93223 (see above)]	=	
O_2	(32)	(0.160)		=	
CO	(28)	( )		=	
N_2	(28)	(0.812)		=	27.117
		29.088			

Molecular Weight of Stack Gas 28.338
(Sum of partial molecular weights)

FIELD CHECK ON MOISTURE FRACTION

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 41.525 ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 528.9 °R

Total imp. wt. gain, MWC 65.0 grams H_2O

Pressure at meter, PM 30.444 inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (499.4)\ \frac{\text{liters °R}}{\text{ft}^3\ \text{in.Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(65.0)\ (1.335)}{\left[(65.0)(1.335)\right] + \left[\frac{(41.525)\ (30.444)}{(528.9)}\ (499.4)\right]} = 0.06777$$

Dry Gas Fraction = 1 - (moisture fraction) = 1 - (0.06777) = 0.93223

Date 01-21-94

Signature _____

TENERX corp.

STACK SAMPLING FIELD DATA

PLANT NAME Enterprise Products STACK NAME 150M DIB # 8

DATE 1-21-91 OPERATOR RT SAMPLE NUMBER C# 3-2 STACK HEIGHT ~43ft

STACK DIAM. (exit) 5.58' STACK DIAM. (port) 5.58' STACK PRESS. (In. H_2O) ~~-0.01~~ -0.06 BARO. PRESS. (In. ~~H_2O~~ Hg) 30.37

ΔH = 1.53

PROBE NUMBER #B PTCF 0.84 DGMCF 0.988 PUMP NUMBER EN 110

NOZZLE NUMBER — NOZZLE AREA — FILTER NUMBER — OUT WEIGHT GRAMS —

METER NUMBER EN 110 K FACTOR — ORIFICE CONSTANTS a — b —

Preleak check 0.002 @ -26 in Hg Postleak check 0.005 @ -25 in Hg

Point	Clock Time	Dry Gas Meter Reading	ΔP Inches H_2O	ΔH Inches H_2O	Probe Temp	DRY GAS METER TEMPERATURE Inlet	Outlet	L. VAC. Inches Hg Gauge	Box Temperature °F	Stack Temperature °F
	4:45	393.24								
1	4:49	395.72	0.25	0.8	259	72	71	6		398
2	4:53	397.68	0.22	0.8	257	72	71	6		399
3	4:57	399.71	0.20	0.8	253	72	71	6		399
4	5:01	401.58	0.19	0.8	254	72	71	6		424
5	5:05	404.24	0.18	0.8	262	73	71	6		401
6	5:09	406.71	0.15	0.8	263	73	71	6		391
7	5:13	408.13	0.11	0.8	259	73	72	6		401
8	5:17	410.865	0.10	0.8	259	73	72	6		402
	5:24	410.865								~~454~~
1	5:28	413.00	0.21	0.8	258	72	72	6		454
2	5:32	414.85	0.20	0.8	261	72	72	6		442
3	5:36	417.02	0.18	0.8	263	72	72	6		417
4	5:40	419.95	0.16	0.8	260	72	72	6		409
5	5:44	422.22	0.15	0.8	259	73	72	6		445
6	5:48	424.48	0.13	0.8	255	72	72	6		456
7	5:52	426.71	0.10	0.8	256	73	72	6		442
8	5:56	428.957	0.080	0.8	258	73	72	6		419
			$\sqrt{\Delta P}$							
	64min	35.717	0.3993	0.8		72.44	71.63			418.69

72.03

Sample Time Net Volume

TENERX corp.

IMPINGER CATCH

Sample Number C#3-2 Stack Name 150M DIB #8 Company Name Enterprise Prod.

Impinger Number	Solution Used	Amount of Solution (milliliters)	Impinger Tip Configuration	Weight (grams)	
1	H_2O	200	Modified	Final	310.9
				Initial	260.7
				Weight gain	50.2
2	H_2O	200	GS	Final	263.0
				Initial	261.7
				Weight gain	1.3
3	Blank	0m	Modified	Final	0
				Initial	0
				Weight gain	
4	Silica Gel	~200g	Modified	Final	272.0
				Initial	265.0
				Weight gain	7.0
5				Final	
				Initial	
				Weight gain	
6				Final	
				Initial	
				Weight Gain	
Flask				Final	
				Initial	
				Weight gain	

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 58.5g

Date 01-21-91

Signature BL

Independent Verification of Calculations Shown Above

Explanation: Someone other than the person who performed the original work and associated calculations must verify that these calculations have been performed correctly.

Signature Ray Tarlagos

Date 2-11-91

ORSAT ANALYSIS RESULTS

Gas Fractional Part

CO_2 2.6

O_2 15.8

CO

N_2

Date 1-21-91

Time 5:35

Signature RJ

Test #C3-2

PRELIMINARY VELOCITY DETERMINATION

If preliminary velocity is not determined by the following procedure please state how preliminary velocity was determined.

Traverse Pt.	Δp (inches H_2O) I	II	III
Date			
Time			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

For Preliminary Velocity Calculation, Isokinetic Sampling:

1. Use calculator to sum the square roots of all Δp's and divide this by N, the number of Δp's.

$$\text{Aver. } \sqrt{\Delta p} = \frac{\Sigma \sqrt{\Delta p}}{N}$$

$$\text{Aver. } \sqrt{\Delta p} = \frac{(6.3893)}{(16)} = 0.3993$$

(units are inches H_2O to the one half power)

2. Obtain the pitot tube calibration factor for the probe used. Probe No. _____ Pitot Tube Calibration Factor 0.84 (Shown in the equation below as PTCF)

3. Calculate Absolute Stack Pressure:
Measured Stk. Press. (gauge) -0.06 "H_2O
(Measured stack press. may be (+) or (-))
Preliminary Atmo. Press. ~~[illegible]~~ 30.37 "Hg

Stack pressure in inches of water (gage), times 0.07355, plus the barometric pressure in inches mercury equal to the absolute stack pressure in inches of mercury:

(-0.06) in. H_2O (.07355) + (30.37) in. Hg
= Stack Press. 30.366 in. Hg

4. Calculate average preliminary velocity, V, in feet per second as shown below.

$$V = (85.48)\ (PTCF) \sqrt{\frac{(\text{Stack Temp. } °R)}{\begin{bmatrix}\text{Mole.}\\ \text{Wt.}\end{bmatrix}\begin{bmatrix}\text{Stk. Press.}\\ \text{inches Hg}\end{bmatrix}}}\ (\text{Average } \sqrt{\Delta p})$$

$$V = (85.48)\ (0.84) \sqrt{\frac{418.7+460 = 878.7}{(28.257)(30.366)}}\ (0.3993) = 29.0114 \text{ ft/sec}$$

$$Q_{std} = (60)(0.92842)(29.0114)(28.0783)\left(\frac{528}{878.7}\right)\left(\frac{30.366}{29.92}\right)$$
$= 27673.25$ DSCFM

Date 01-21-91

Time _____

Signature _____

T#C1-2
ISOM#8

PRELIMINARY VELOCITY DETERMINATION

If preliminary velocity is not determined by the following procedure please state how preliminary velocity was determined.

Traverse Pt.	Δp (inches H_2O) I	II	III
Date			
Time			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

For Preliminary Velocity Calculation, Isokinetic Sampling:

1. Use calculator to sum the square roots of all Δp's and divide this by N, the number of Δp's.

   Aver. $\sqrt{\Delta p} = \frac{\Sigma\sqrt{\Delta p}}{N}$

   Aver. $\sqrt{\Delta p} = \frac{(\quad)}{(\quad)} = 0.38125$

   (units are inches H_2O to the one half power)

2. Obtain the pitot tube calibration factor for the probe used. Probe No. _____ Pitot Tube Calibration Factor 0.84 (Shown in the equation below as PTCF)

3. Calculate Absolute Stack Pressure:
   Measured Stk. Press. (gauge) -0.08 "H_2O
   (Measured stack press. may be (+) or (-))
   Preliminary Atmo. Press. 30.35 "Hg

   Stack pressure in inches of water (gage), times 0.07355, plus the barometric pressure in inches mercury equal to the absolute stack pressure in inches of mercury:

   (-0.08) in. H_2O (.07355) + (30.35) in. Hg
   = Stack Press. 30.344 in. Hg

4. Calculate average preliminary velocity, V, in feet per second as shown below.

$$V = (85.48)\ (PTCF)\ \sqrt{\frac{(\text{Stack Temp. °R})}{\left[\text{Mole. Wt.}\right]\left[\text{Stk. Press. inches Hg}\right]}}\ (\text{Average}\sqrt{\Delta p})$$

$$V = (85.48)\ (0.84)\ \sqrt{\frac{(872.25)}{(28.399)(30.344)}}\ (0.38125) = 27.5414 \text{ ft/sec}$$

$$Q_{std} = (60)(0.92694)(27.5414)(28.0783)\left(\frac{528}{872.25}\right)\left(\frac{30.344}{29.92}\right)$$
$$= 26{,}403.6 \text{ DSCFM}$$

Date 01-17-94

Time

Signature B. L.

Sample No. T#C3-2 Stack Name ISOM Unit #8 Company Name Ent. Products

FIELD CHECK OF MOLECULAR WEIGHT

(To be used when substantial changes have occurred in the moisture fraction)

	Molecular Weights	Orsat Fraction	Moisture Fraction / Dry Gas Fraction		Partial Mol. Wt.
H_2O	(18)		[0.07158]	=	1.2884
CO_2	(44)	(0.026)	[0.92842 (see above)]	=	
O_2	(32)	(0.158)		=	
CO	(28)	( )		=	
N_2	(28)	(0.816)		=	
		29.048			26.9687

Molecular Weight of Stack Gas 28.2572
(Sum of partial molecular weights)

FIELD CHECK ON MOISTURE FRACTION

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 35.467 ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 532.03 °R

Total imp. wt. gain, MWC 58.5 grams H_2O

Pressure at meter, PM 30.429 inches Hg

$$\text{Moisture Fraction} = \frac{(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (499.4)\ \frac{\text{liters °R}}{ft^3\ \text{in.Hg}}\right]}$$

$$\text{Moisture Fraction} = \frac{(58.5)\ (1.335)}{\left[(58.5)(1.335)\right] + \left[\frac{(35.467)\ (30.429)}{(532.03)}\ (499.4)\right]} = 0.07158$$

Dry Gas Fraction = 1 - (moisture fraction) = 1 - (0.07158) = 0.92842

Date 01-21-91

Signature _____

TENERX corp.

STACK SAMPLING FIELD DATA

PLANT NAME Enterprise Products STACK NAME Tom DEB #8

DATE 1/21/91 OPERATOR CT SAMPLE NUMBER C#3-3 STACK HEIGHT ~43 ft

STACK DIAM. (exit) 5.98' STACK DIAM. (port) 5.98 STACK PRESS. (In. H_2O) -0.04 BARO. PRESS. (In. H_2O) 30.37

PROBE NUMBER 8 PTCF 0.84 DGMCF 0.988 ΔH@ 1.58 PUMP NUMBER EA-110

NOZZLE NUMBER — NOZZLE AREA — FILTER NUMBER — OUT WEIGHT GRAMS —

METER NUMBER EM110 K FACTOR — ORIFICE CONSTANTS a — b —

Leak Check 0.00 @ 25" Hg

Point	Clock Time	Dry Gas Meter Reading	ΔP Inches H_2O	ΔH Inches H_2O	Probe Temp.	DRY GAS METER TEMPERATURE Inlet	DRY GAS METER TEMPERATURE Outlet	L. VAC. Inches Hg Gauge	Box Temperature °F	Stack Temperature °F
1	6:24	429.285	0.21	1	240	71	71	7		380
2	6:29	432.45	0.22	1	246	71	71	7		391
3	6:33	435.00	0.20	1	247	71	71	7		400
4	6:37	437.48	0.19	1	250	71	71	7		402
5	6:41	439.99	0.18	1	248	71	71	7		406
6	6:45	442.02	0.20	1	249	71	71	7		403
7	6:49	444.98	0.17	1	253	71	71	7		398
8	6:53	447.62	0.12	1	254	71	71	7		391
	6:57	450.145								
1	7:04	450.145	0.18	1	251	71	71	7		426
2	7:09	453.32	0.18	1	255	71	71	7		431
3	7:13	456.10	0.17	1	254	71	71	7		423
4	7:17	458.32	0.16	1	252	72	70	7		404
5	7:21	460.86	0.14	1	256	72	70	7		434
6	7:25	462.98	0.12	1	258	72	70	7		453
7	7:29	465.98	0.12	1	258	72	71	7		457
8	7:33	468.32	0.10	1	256	72	71	7		458
	7:37	470.791								
			$\sqrt{\Delta P}$							
	66 min	41.506	0.3897	1.0		71.31	70.81			416.1
	Sample Time	Net Volume				71.1				

TENERX corp.

IMPINGER CATCH

Sample Number C#3-3 Stack Name 150M DIB #8 Company Name Enterprise Prod.

Impinger Number	Solution Used	Amount of Solution (milliliters)	Impinger Tip Configuration	Weight (grams)
1	H_2O	200	Modified	Final 346.5 Initial 265.7 Weight gain 80.8
2	H_2O	200	GS	Final 265.8 Initial 265.2 Weight gain 0.6
3	Blank		Modified	Final 0 Initial 0 Weight gain 0
4	Silica Gel	~200g	Modified	Final 279.7 Initial 272.8 Weight gain 6.9
5				Final Initial Weight gain
6				Final Initial Weight Gain
Flask				Final Initial Weight gain

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 88.3g

Date 1/21/91

Signature CT

Independent Verification of Calculations Shown Above

Explanation: Someone other than the person who performed the original work and associated calculations must verify that these calculations have been performed correctly.

Signature Ray Terrazas

Date 2-11-91

ORSAT ANALYSIS RESULTS

Gas Fractional Part

CO_2 2.9

O_2 15.9

CO

N_2

Date 01-21-91

Time

Signature

Test # C3-3

PRELIMINARY VELOCITY DETERMINATION

If preliminary velocity is not determined by the following procedure please state how preliminary velocity was determined.

Traverse Pt.	Δp (inches H_2O) I	II	III
Date			
Time			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

For Preliminary Velocity Calculation, Isokinetic Sampling:

1. Use calculator to sum the square roots of all Δp's and divide this by N, the number of Δp's.

   Aver. $\sqrt{\Delta p} = \dfrac{\Sigma\sqrt{\Delta p}}{N}$

   Aver. $\sqrt{\Delta p} = \dfrac{(6.2356)}{(16)} = 0.389726$

   (units are inches H_2O to the one half power)

2. Obtain the pitot tube calibration factor for the probe used. Probe No. _____ Pitot Tube Calibration Factor 0.84 (Shown in the equation below as PTCF)

3. Calculate Absolute Stack Pressure:
   Measured Stk. Press. (gauge) -0.04 "H_2O
   (Measured stack press. may be (+) or (-))

   Preliminary Atmo. Press. 30.37 "Hg

   Stack pressure in inches of water (gage), times 0.07355, plus the barometric pressure in inches mercury equal to the absolute stack pressure in inches of mercury:

   (-0.04) in. H_2O (.07355) + (30.37) in. Hg = Stack Press. 30.367 in. Hg

4. Calculate average preliminary velocity, V, in feet per second as shown below.

$$V = (85.48)\ (PTCF)\ \sqrt{\frac{(\text{Stack Temp. }^\circ R)}{\left[\text{Mole. Wt.}\right]\left[\text{Stk. Press. inches Hg}\right]}}\ (\text{Average}\sqrt{\Delta p})$$

$$V = (85.48)\ (0.84)\ \sqrt{\frac{(416.1+460)=876.1}{(28.0921)(30.367)}}\ (0.38973) = 28.3581 \text{ ft/sec}$$

$$Q_{std} = (60)(0.9092)(28.3581)(28.0783)\left(\frac{528}{876.1}\right)\left(\frac{30.367}{29.92}\right)$$
$$= 26{,}569.22 \text{ DSCFM}$$

Date 01-21-91

Time _____

Signature _____

Sample No. T#C3-3 Stack Name ISON Unit #8 Company Name Ent. Products

FIELD CHECK OF MOLECULAR WEIGHT

(To be used when substantial changes have occurred in the moisture fraction)

	Molecular Weights		Moisture Fraction		Partial Mol. Wt.
H_2O	(18)	. . . . .	[0.0908]	=	1.6344
		Orsat Fraction	**Dry Gas Fraction**		
CO_2	(44)	(0.029)	[0.9092 (see above)]	=	
O_2	(32)	(0.159)		=	
CO	(28)	( )		=	
N_2	(28)	(0.812)		=	
		29.100			26.4577

Molecular Weight of Stack Gas 28.0921
(Sum of partial molecular weights)

FIELD CHECK ON MOISTURE FRACTION

Corrected sample Vol. (DGV)

(net vol) x (DGMCF) = 41.2155 ft^3

Avg. meter temp., TM = Avg. meter temp. °F + 460 = 531.1 °R

Total imp. wt. gain, MWC 88.3 grams H_2O

Pressure at meter, PM _____ inches Hg

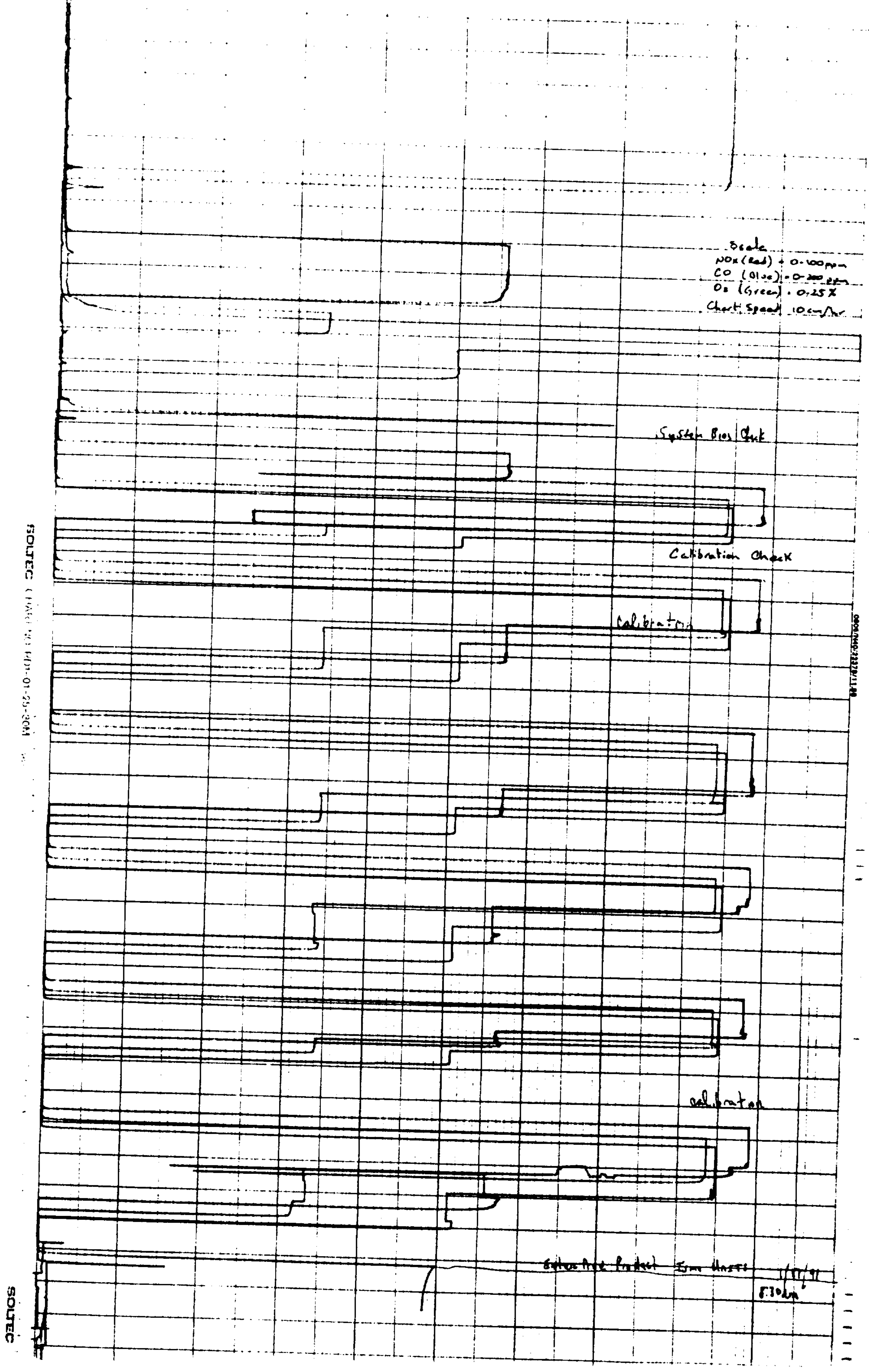
$$\text{Moisture Fraction} = \frac{(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}}{\left[(MWC)\ (1.335)\ \frac{\text{liters}}{\text{gm } H_2O}\right] + \left[\frac{(DGV)\ (PM)}{(TM)}\ (499.4)\ \frac{\text{liters °R}}{ft^3\ \text{in.Hg}}\right]}$$

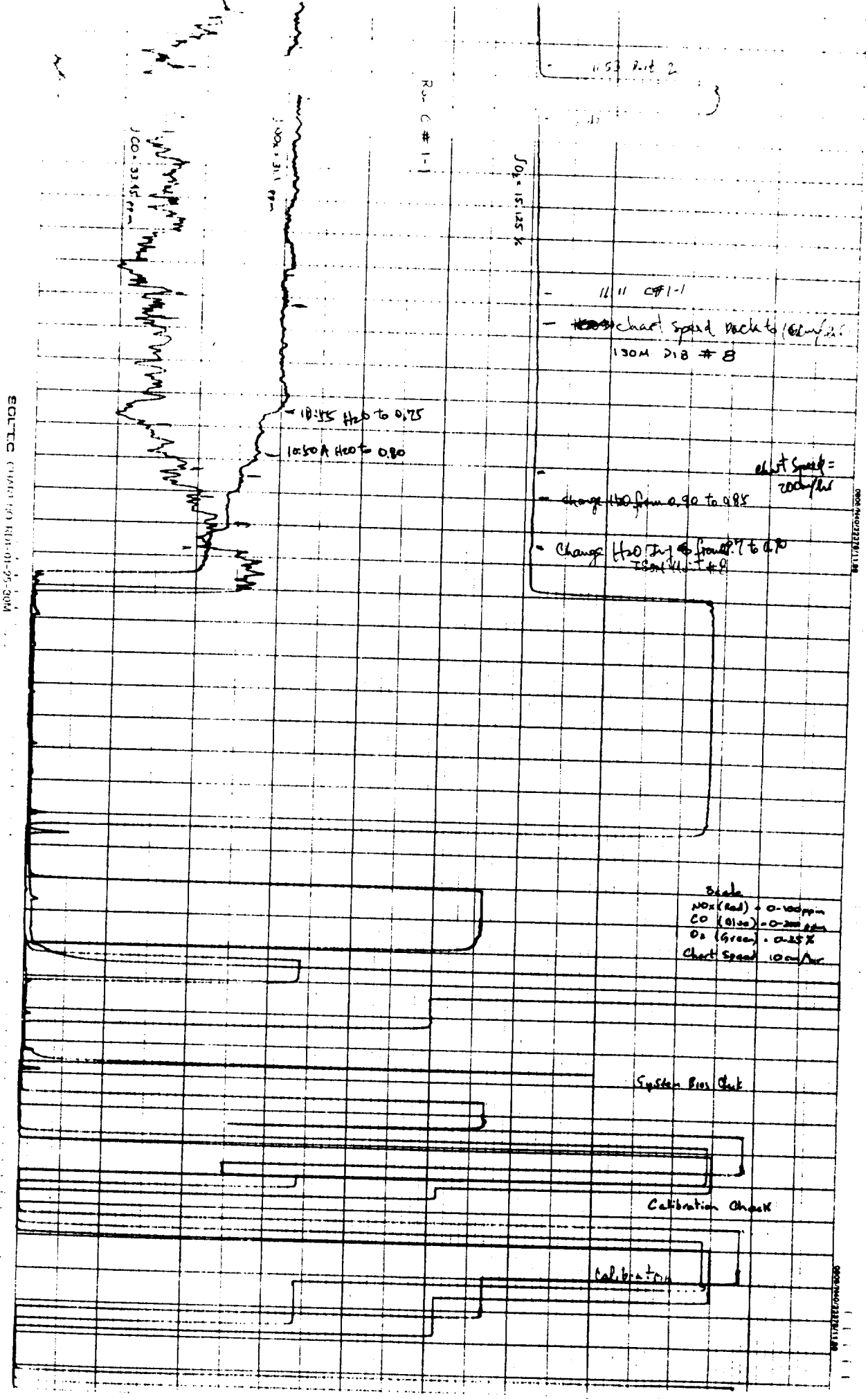
$$\text{Moisture Fraction} = \frac{(88.3)\ (1.335)}{\left[(88.3)(1.335)\right] + \left[\frac{(41.2155)\ (30.44)}{(531.1)}\ (499.4)\right]} = 0.0908$$

Dry Gas Fraction = 1 - (moisture fraction) = 1 - (0.0908) = 0.9092

Date 01-21-81

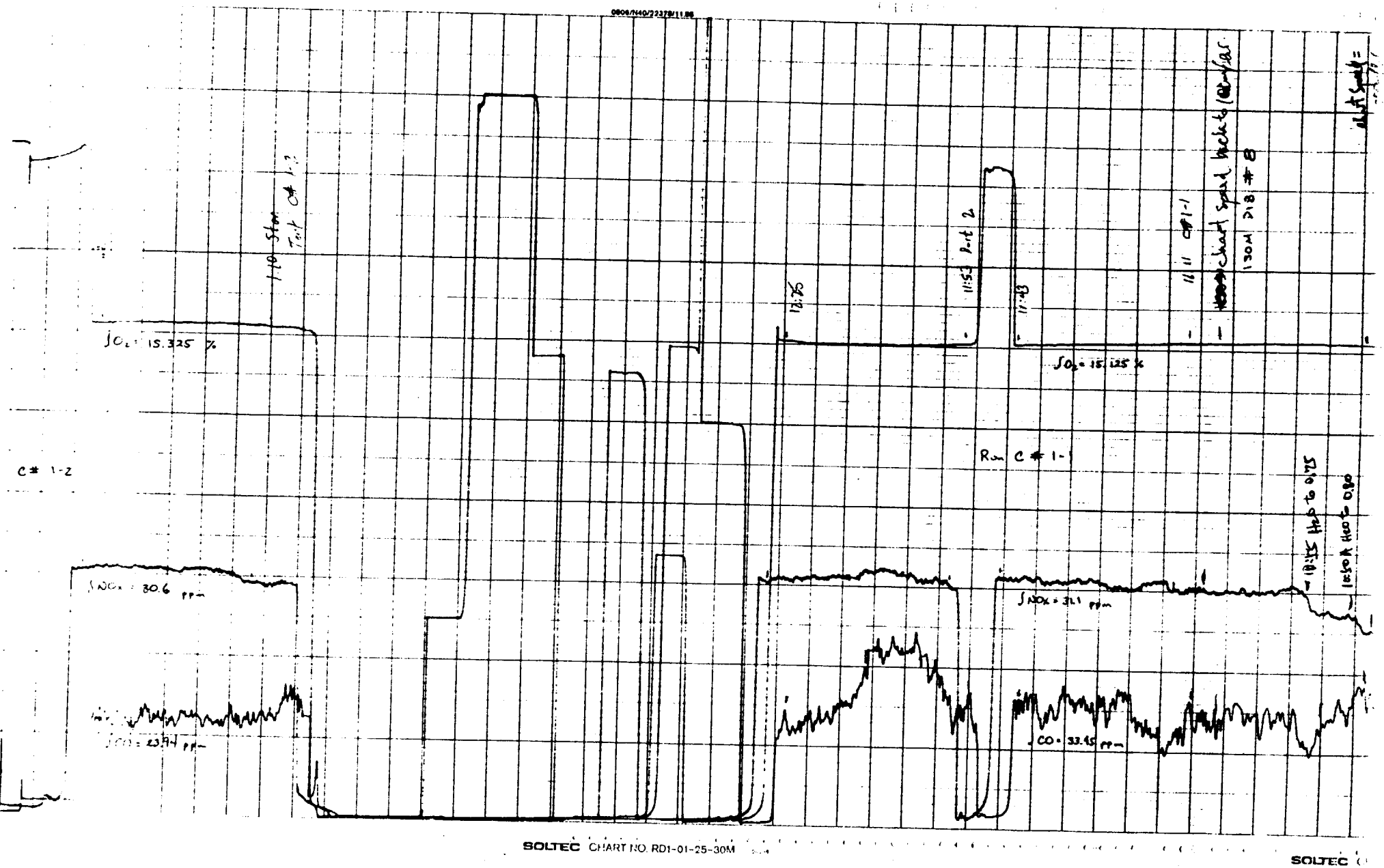
Signature _____

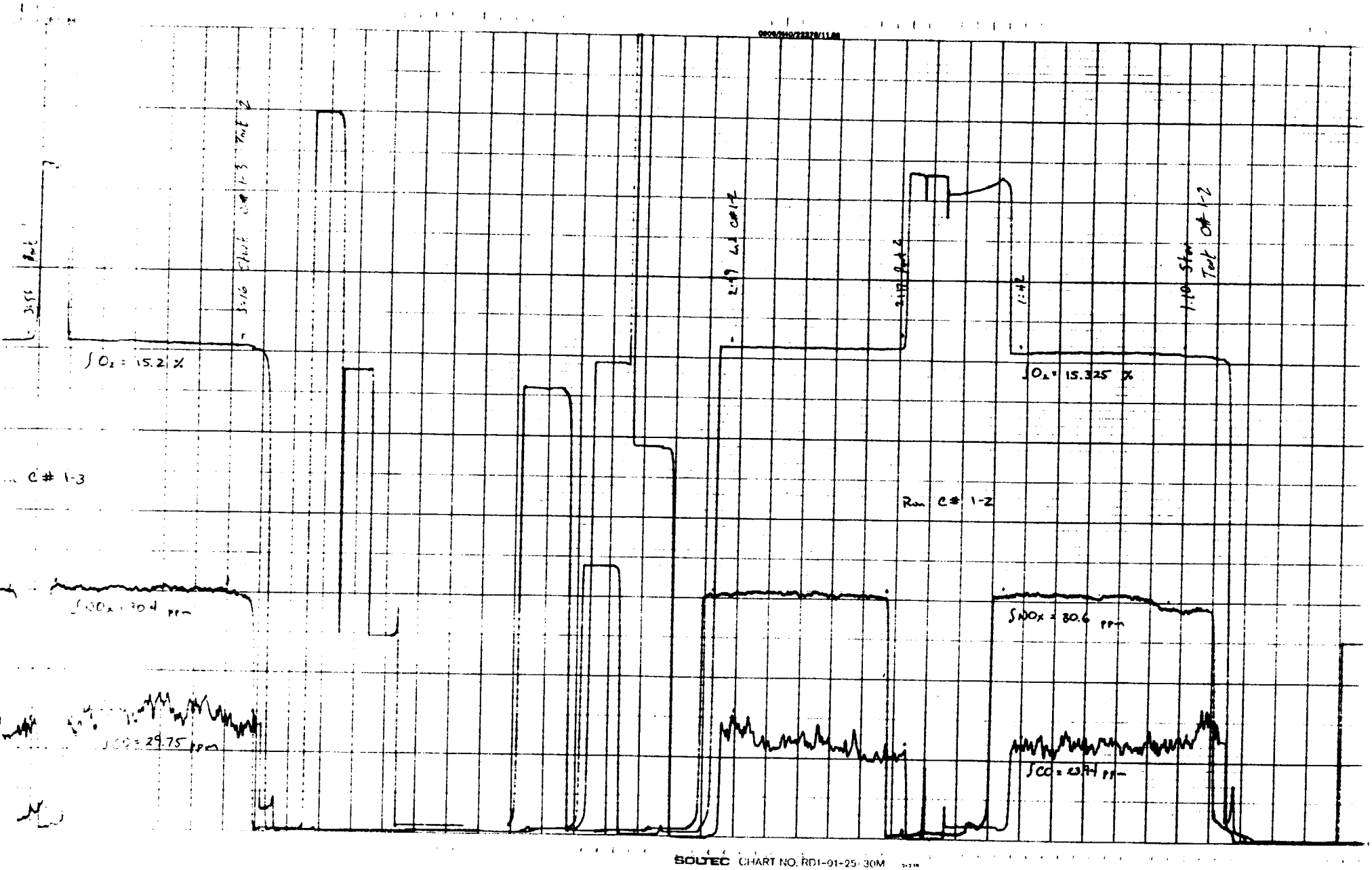

Scale
NOx (Red) : 0-100ppm
CO (Blue) : 0-200 ppm
O2 (Green) : 0-25%
Chart Speed 10cm/hr
System Bias Check
Calibration Check
Calibration
Calibration
SOLTEC



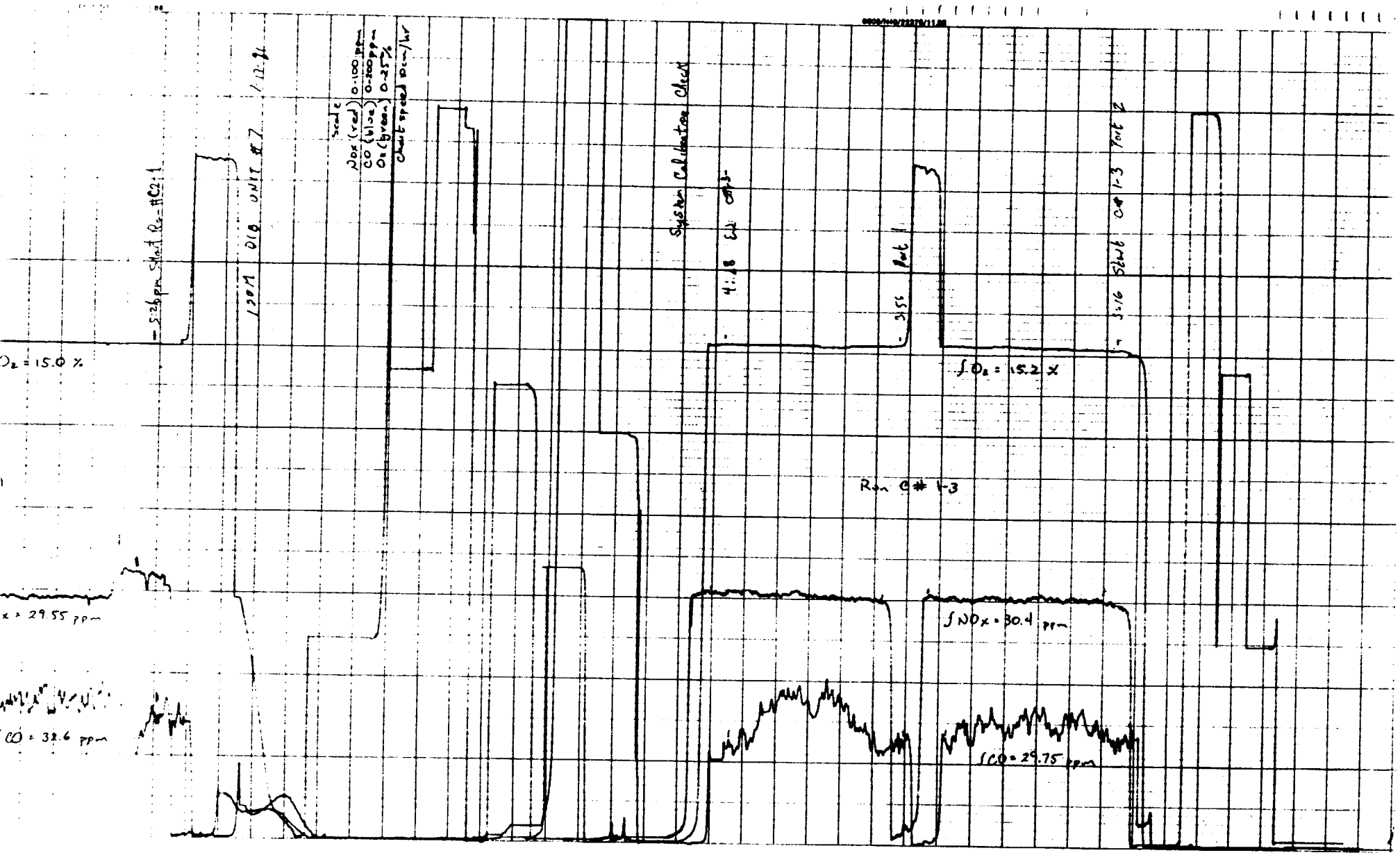
SOLTEC CHART NO MCH-01-25-30M

SOLTEC CHART NO MCH-01-25-30M

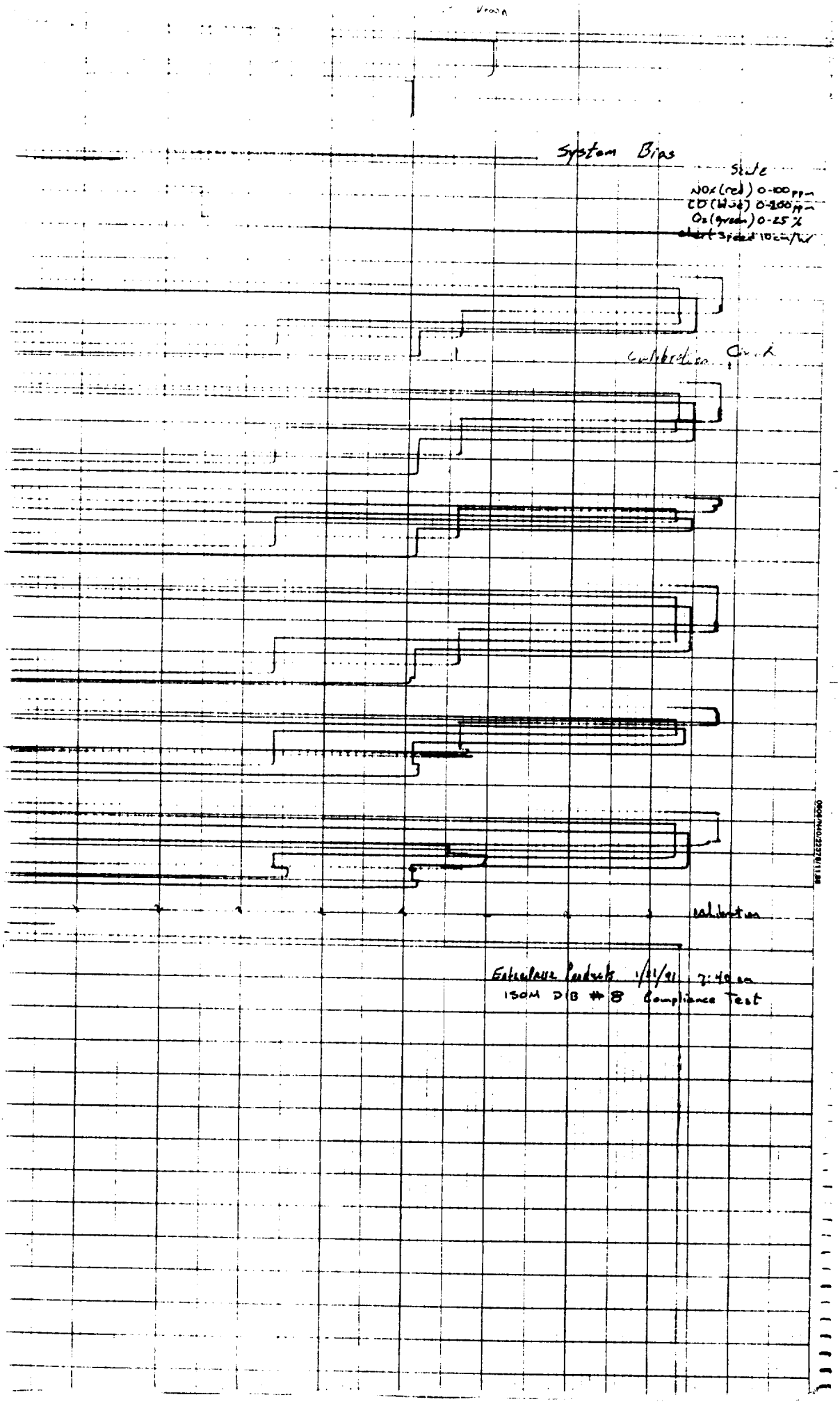

0906/N40/22379/11.88
Run C # 1-
11:53 Port 2
11:43
12:26
11:11 C#1-1
Chart Speed Inches/Min/gas
130M DIB # 8
∫O2 = 15.325 %
∫O2 = 15.125 %
∫NOx = 30.6 ppm
∫NOx = 31.1 ppm
∫CO = 23.94 ppm
∫CO = 33.45 ppm
C# 1-2
SOLTEC CHART NO. RD1-01-25-30M
SOLTEC

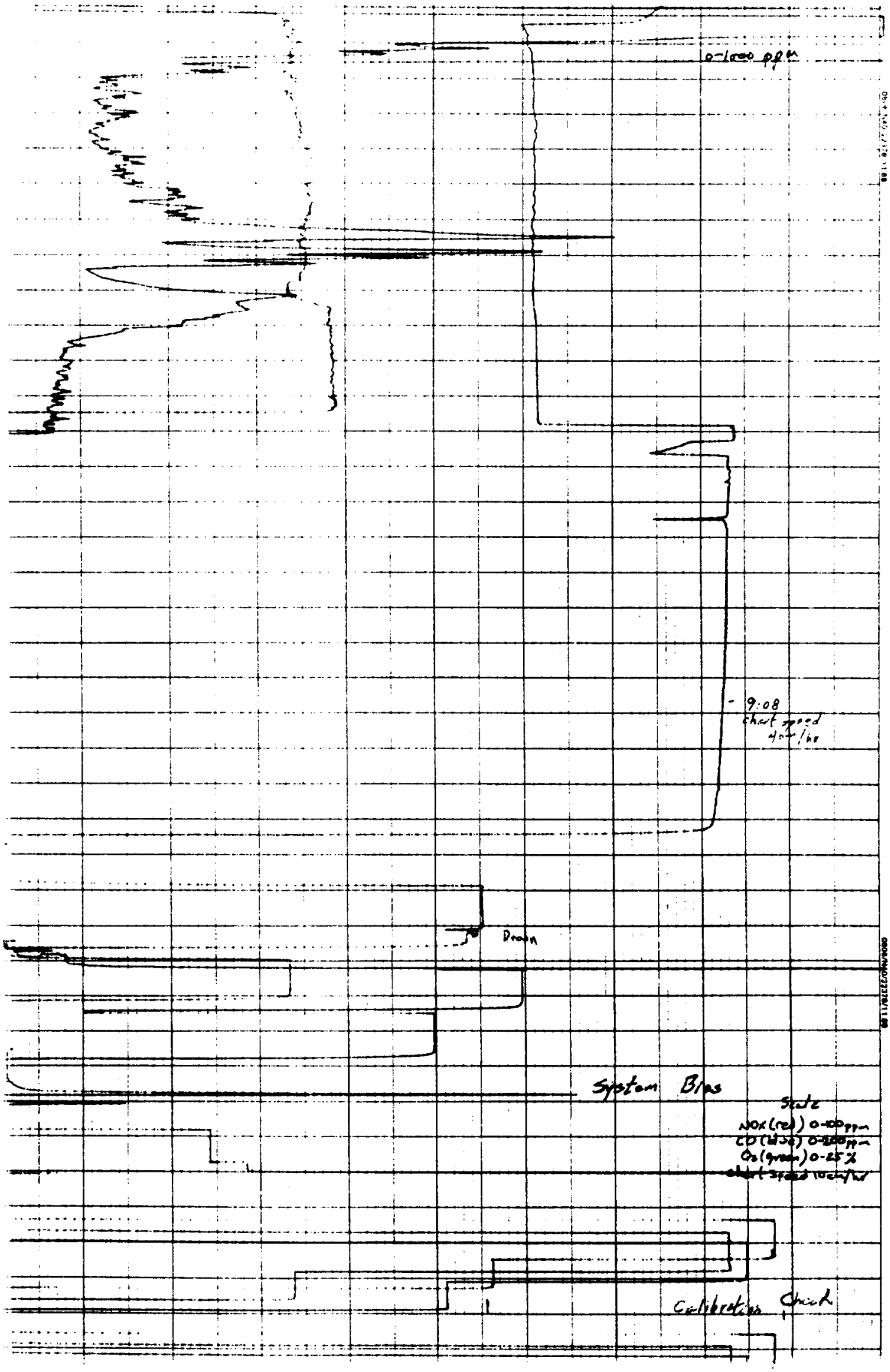


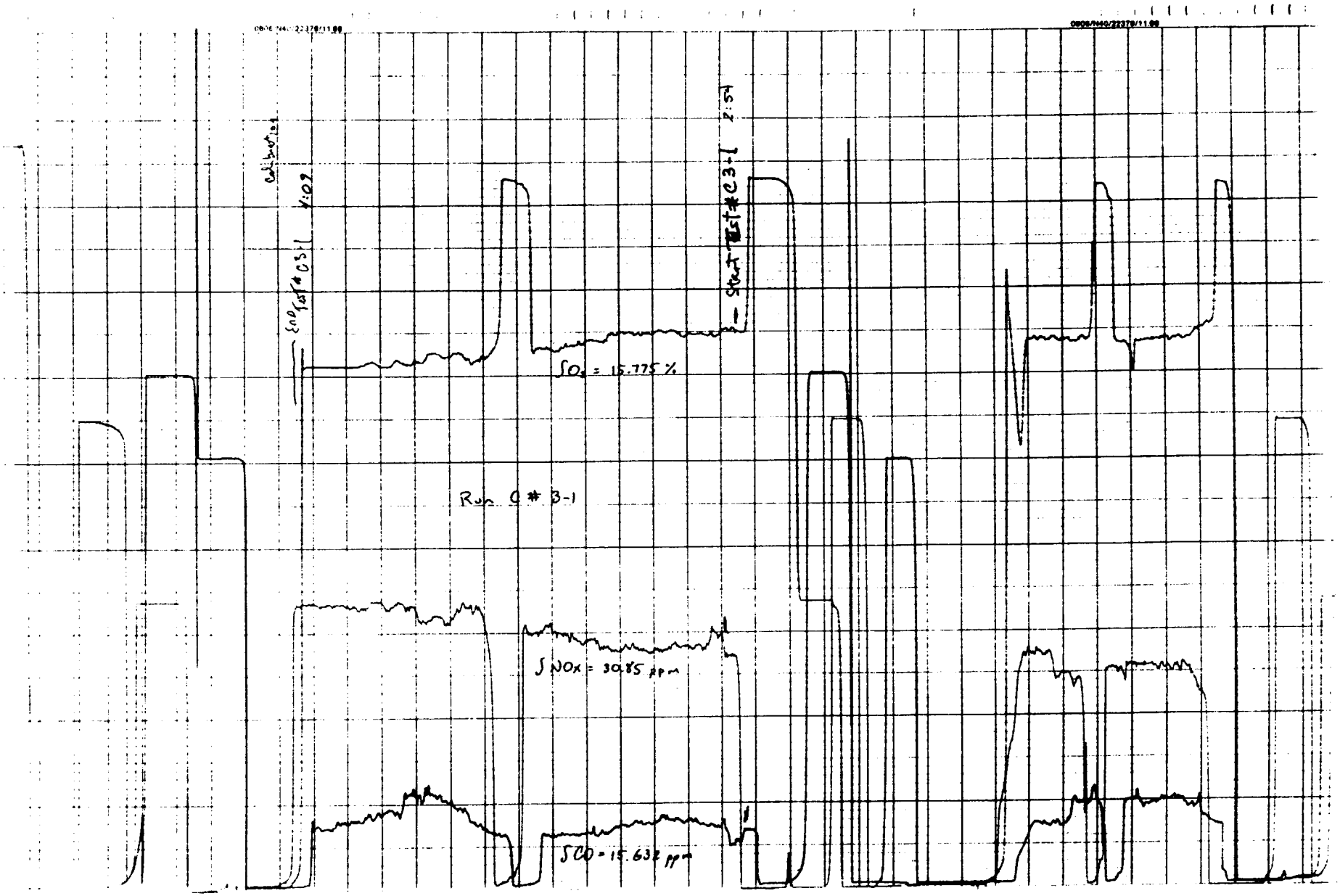
SOLTEC CHART NO. RD1-01-25-30M

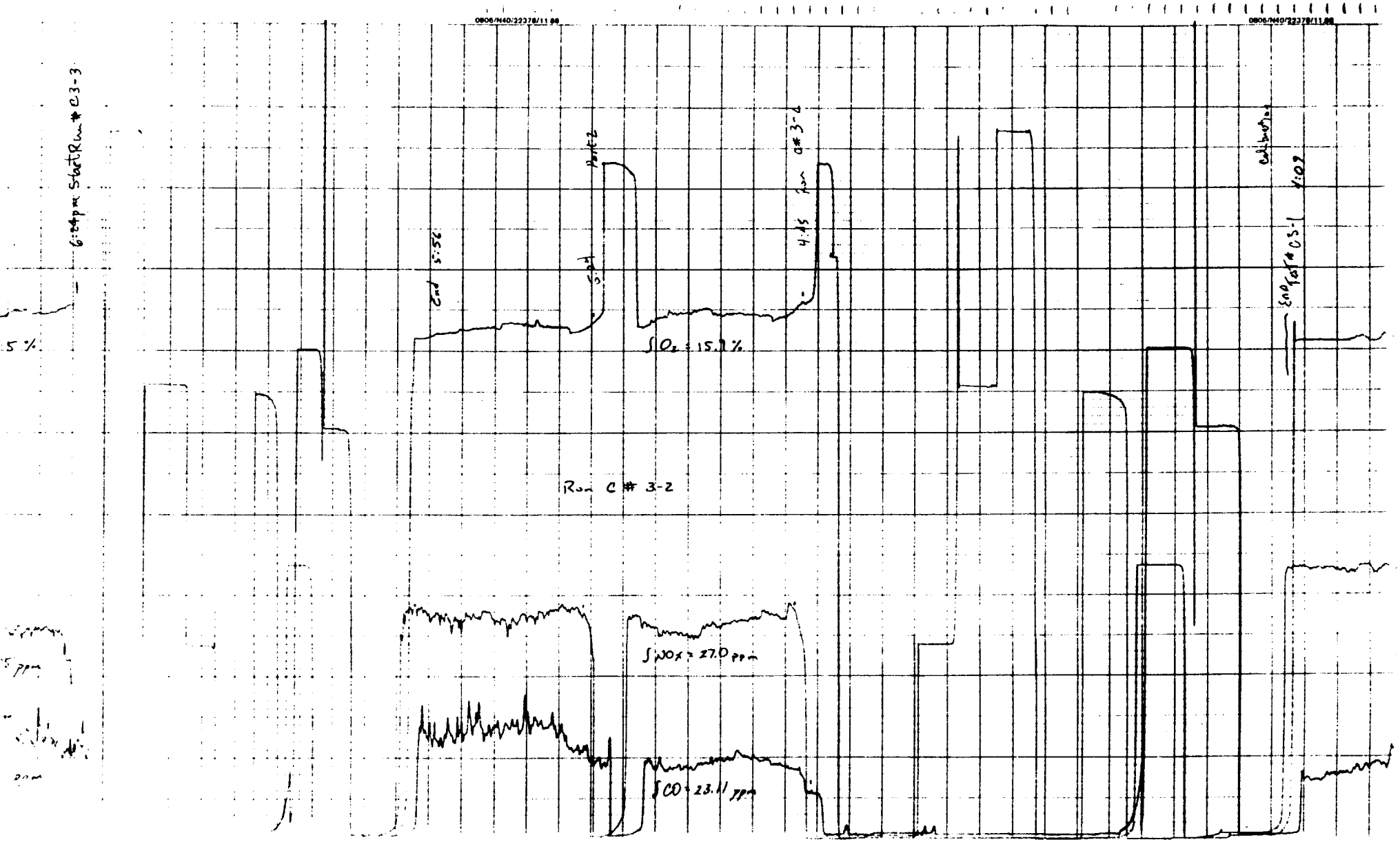


SOLTEC CHART NO. RD1-01-25-30M

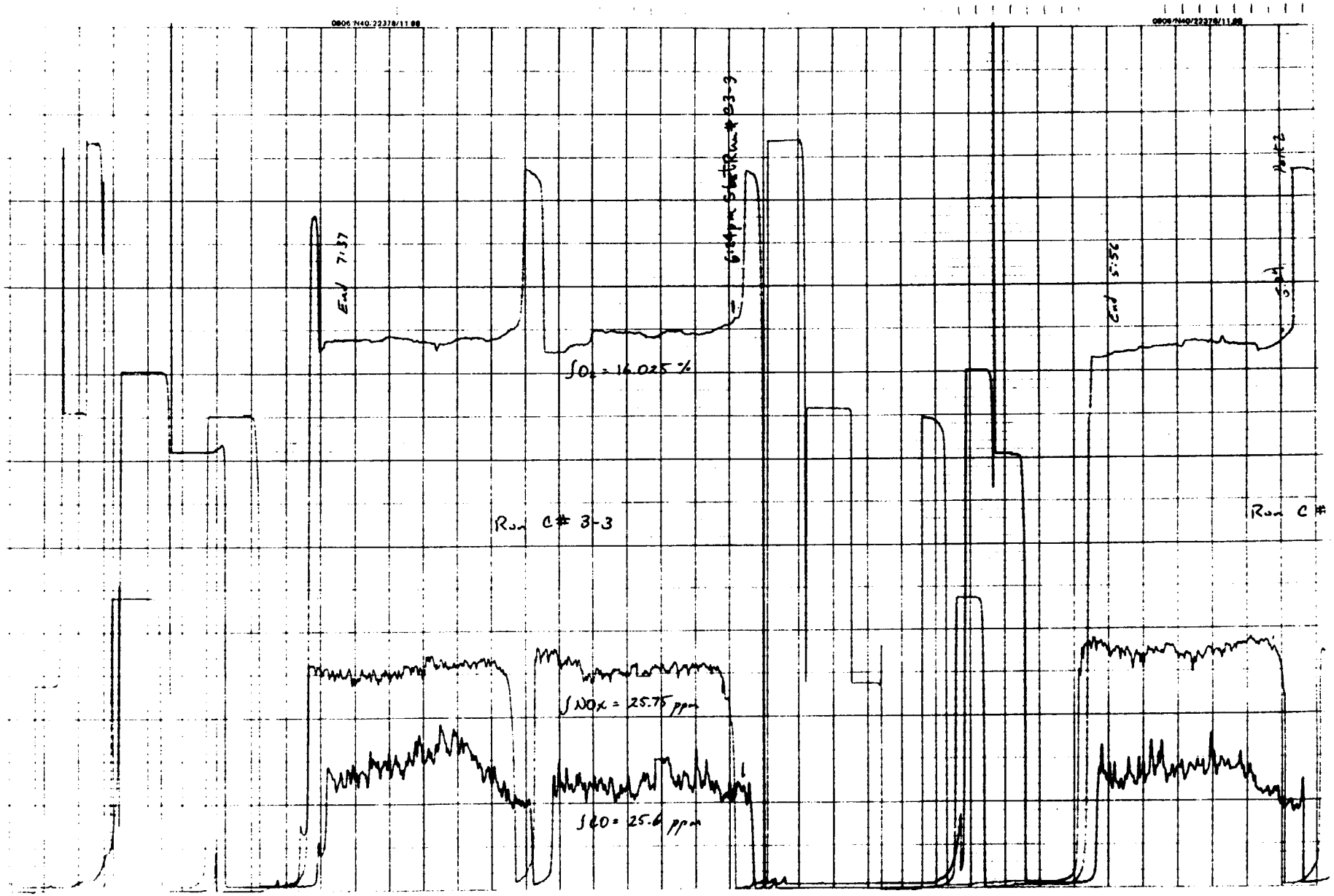

System Bias
Scale
NOx (red) 0-100 ppm
CO (blue) 0-200 ppm
O2 (green) 0-25 %
chart speed 10cm/hr
calibration check
calibration
Exhaust Analysis 1/21/91 7:40 am
ISOM DIB #8 Compliance Test


0-1000 ppm
9:08
chart speed
40 mm/hr
Drain
System Bias
Scale
NOx (red) 0-00 ppm
CO (blue) 0-200 ppm
O2 (green) 0-25 %
Calibration Check


End Test # C3-1
4:02
Start Test # C3-1
2:54
SO_2 = 15.775 %
Run C # 3-1
S NOx = 30.85 ppm
SCO = 15.632 ppm


6:04pm Start Run # C3-3
5 %
5 ppm
ppm
0806/N40/22378/11 88
End 5:56
Start
Port 2
4:45 from C# 3-2
O_2 = 15.7 %
Run C # 3-2
NO_x = 27.0 ppm
CO = 23.11 ppm
Calibration
End Test # C3-1 4:09

Enterprise Prod 1-21-91 Run #8 C 3



NOx

TENERX corp

FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used EPA Protocol 1

Date 1-17-91

	Gas concentration (indicate units)		
	Zero[a] (ppm)	Mid-range[b] (ppm)	High-range[c] (ppm)
Sample run:			
1			
2			
3			
Average	0	55.75	89.03
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP ISOM #8
Test personnel: RT, BL, CT
Date: 1-17-91

Analyzer calibration data for sampling runs: RUN # C 1-1
Span: 0-100 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas	0	0	0	0
Mid-range gas	55.75	56.65	0.9	0.9
High-range gas	89.03	88.7	0.33	0.33

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP ISOM #8
Test personnel: RT, BL, CT

Date: 1-17-91
Run number: Run # C 1-1
Span: 0-100 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0.25	0.25	0.3	0.3	0.05
Upscale gas	56.65	55.8	-0.85	56.1	-0.55	0.3

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

O_2

TENERX corp

FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used: Orsat

Date: 1-17-91

	Gas concentration (indicate units)		
	Zero[a] (%)	Mid-range[b] (%)	High-range[c] (%)
Sample run:			
1			
2			
3			
Average	0	8.45	20.9
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 130M #8
Test personnel: RT, BL, CT
Date: 1-17-91

Analyzer calibration data for sampling runs: Run # C1-1
Span: 0-25%

	Cylinder value (indicate units) (%)	Analyzer calibration response (indicate units) (%)	Absolute difference (indicate units) (%)	Difference (percent of span) (%)
Zero gas	0	0	0	0
Mid-range gas	8.45	8.5	0.05	0.5
High-range gas	20.9	21.05	0.15	1.5

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 130M #8
Test personnel: RT, BL, CT

Date: 1-17-91
Run number: Run # C1-1
Span: 0-25%

	Analyzer calibration response (%)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (%)	System cal. bias (percent of span) (%)	System calibration response (%)	System cal. bias (percent of span) (%)	
Zero gas	0	0	0	0.05	0.5	0.5
Upscale gas	8.5	8.45	-0.5	8.3.75	-1.25	-0.75

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

CO

TENERX corp

FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used EPA Protocol 1

Date 1-17-91

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average	0	102.5	169.5
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 150M #8
Test personnel: RT, BL, CT
Date: 1-17-91

Analyzer calibration data for sampling runs: Run # C1-1
Span: 0 – 200 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas	0	0	0	0
Mid-range gas	102.5	102.2	0.3	0.3
High-range gas	169.5	169.6	0.1	0.1

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 150M #8
Test personnel: RT, BL, CT

Date: 1-17-91
Run number: Run # C1-1
Span: 0 – 200 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0.5	0.5	0.5	0.5	0
Upscale gas	102.2	100	-2.2	100.2	-2.0	0.2

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

NOx

TENERX corp

FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 150M #8
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: RUN #
Span: 0-100 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 150M #8
Test personnel: RT, BL, CT

Date: 1-17-91
Run number: Run # C1-2
Span: 0-100 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0.3	0.3	0.5	0.5	0.2
Upscale gas	56.65	56.1	-0.55	55.9	-0.75	-0.2

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

O2

TENERX CORP

FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (%)	Mid-range [b] (%)	High-range [c] (%)
Sample run			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 1SOM #8
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0-25%

	Cylinder value (indicate units) (%)	Analyzer calibration response (indicate units) (%)	Absolute difference (indicate units) (%)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 1SOM #8
Test personnel: RT, BL, CT

Date: 1-17-91
Run number: Run # C1-2
Span: 0-25%

	Analyzer calibration response (%)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (%)	System cal. bias (percent of span) (%)	System calibration response (%)	System cal. bias (percent of span) (%)	
Zero gas	0	0.05	0.5	0.05	0.5	0
Upscale gas	8.5	8.375	-1.25	8.45	-0.5	0.75

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

CC

TENERX corp

FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 130M #8
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0 – 200 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Date: 1-17-91
Run number: Run # C1-2
Span: 0 – 200 ppm

Source identification: EP 130M #8
Test personnel: RT, BL, CT

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0.5	0.5	0.5	0.5	0
Upscale gas	102.2	100.2	-2.0	98	-4.2	-2.2

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

NOx

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP ISOM #8
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: RUN #
Span: 0-100 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP ISOM #8
Test personnel: RT, BL, CT

Date: 1-17-91
Run number: Run # C1-3
Span: 0-100 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0.5	0.5	0	0	-0.5
Upscale gas	56.65	55.9	-0.75	55.6	-1.05	-0.3

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

O_2

TENERX corp

FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (%)	Mid-range [b] (%)	High-range [c] (%)
Sample run			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 130M #8
Test personnel: RT, BL CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0-25%

	Cylinder value (indicate units) (%)	Analyzer calibration response (indicate units) (%)	Absolute difference (indicate units) (%)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Date: 1-17-91
Run number: Run # C1-3
Span: 0-25%

Source identification: EP 130M #8
Test personnel: RT, BL, CT

	Analyzer calibration response (%)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (%)	System cal. bias (percent of span) (%)	System calibration response (%)	System cal. bias (percent of span) (%)	
Zero gas	0	0.05	0.5	0	0	-0.5
Upscale gas	8.5	8.45	-0.5	8.375	-1.25	-0.75

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

CO

TENERX corp

FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero[a] (ppm)	Mid-range[b] (ppm)	High-range[c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 150M #8
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0 – 00 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 150M #8
Test personnel: RT, BL, CT

Date: 1-17-91
Run number: Run # 1-3
Span: 0 – 00 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0.5	0.5	0.4	0.4	-0.1
Upscale gas	102.2	99.8	-4.2	99.8	-2.4	1.8

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

NOx

TENERX corp

FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used EPA Protocol 1

Date 1-21-91

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average	0	55.75	87.03
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP ISOM #8
Test personnel: RT, BL, CT
Date: 1-21-91

Analyzer calibration data for sampling runs: RUN # C3-1
Span: 0-100 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas	0	0	0	0
Mid-range gas	55.75	56.2	0.45	0.45
High-range gas	87.03	88.0	1.03	1.03

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP ISOM #8
Test personnel: RT, BL, CT

Date: 1-21-91
Run number: Run # C3-1
Span: 0-100 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0	0	0	0	0
Upscale gas	56.2	55.2	1.0	54.9	-1.3	-0.3

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

O_2

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used: Orsat

Date: 1-21-91

	Gas concentration (indicate units)		
	Zero[a] (%)	Mid-range[b] (%)	High-range[c] (%)
Sample run:			
1			
2			
3			
Average	0	8.45	20.9
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 1SOM #8
Test personnel: RT, BL, CT
Date: 1-21-91

Analyzer calibration data for sampling runs: Run # C3-1
Span: 0-25%

	Cylinder value (indicate units) (%)	Analyzer calibration response (indicate units) (%)	Absolute difference (indicate units) (%)	Difference (percent of span) (%)
Zero gas	0	0	0	0
Mid-range gas	8.45	8.425	0.025	0.25
High-range gas	20.9	20.7	0.2	2

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 1SOM #8
Test personnel: RT, BL, CT

Date: 1-21-91
Run number: Run # C3-1
Span: 0-25%

	Analyzer calibration response (%)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (%)	System cal. bias (percent of span) (%)	System calibration response (%)	System cal. bias (percent of span) (%)	
Zero gas	0	0.075	0.75	0	0	-0.75
Upscale gas	8.425	8.325	-1.0	8.425	0	1.0

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used EPA Protocol 1

Date 1-21-91

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average	0	102.5	169.5
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP ISOM #8
Test personnel: RT, BL, CT
Date: 1-21-91

Analyzer calibration data for sampling runs: Run # C3-1
Span: 0 – 200 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas	0	0	0	0
Mid-range gas	102.5	102.2	0.3	0.3
High-range gas	169.5	169.8	0.3	0.3

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP ISOM #8
Test personnel: RT, BL, CT

Date: 1-21-91
Run number: Run #
Span: 0 – 200 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0.6	0.6	1.0	1.0	0.4
Upscale gas	102.2	99.6	-2.6	101	-1.2	1.4

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

NOx

TENERX corp

FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 1SOM #8
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: RUN #
Span: 0-100 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 1SOM #8
Test personnel: RT, BL, CT

Date: 1-21-91
Run number: Run # C3-2
Span: 0-100 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	0	0	+0.3	+0.3	+0.3
Upscale gas	56.2	54.9	-1.3	54.7	-1.5	-0.2

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

O_2

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero[a] (%)	Mid-range[b] (%)	High-range[c] (%)
Sample run			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 130M #8
Test personnel: RT, BL CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0-25%

	Cylinder value (indicate units) (%)	Analyzer calibration response (indicate units) (%)	Absolute difference (indicate units) (%)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 130M #8
Test personnel: RT, BL, CT

Date: 1-21-91
Run number: Run # C 3-2
Span: 0-25%

	Analyzer calibration response (%)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (%)	System cal. bias (percent of span) (%)	System calibration response (%)	System cal. bias (percent of span) (%)	
Zero gas	8.425	0	0	0	0	0
Upscale gas		8.425	0	8.425	0	0

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 150M #8
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0 – 00 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 150M #8
Test personnel: RT, BL, CT

Date: 1-21-91
Run number: Run # C3-2
Span: 0 – 200 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	1.0	1.0	1.0	1.0	0
Upscale gas	102.2	101	-1.2	101	-1.2	0

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

NOx

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 150M #8
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: RUN #
Span: 0-100 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 150M #8
Test personnel: RT, BL, CT

Date: 1-21-91
Run number: Run # C3-3
Span: 0-100 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	+0.3	+0.3	0.5	0.5	0.2
Upscale gas	56.2	54.7	-1.5	55.1	-1.1	0.4

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

O_2

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (%)	Mid-range [b] (%)	High-range [c] (%)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 130M #8
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0-25%

	Cylinder value (indicate units) (%)	Analyzer calibration response (indicate units) (%)	Absolute difference (indicate units) (%)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 130M #8
Test personnel: RT, BL, CT

Date: 1-21-91
Run number: Run # C3-3
Span: 0-25%

	Analyzer calibration response (%)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (%)	System cal. bias (percent of span) (%)	System calibration response (%)	System cal. bias (percent of span) (%)	
Zero gas	0	0	0	0	0	0
Upscale gas	8.425	8.425	0	8.5	0.75	0.75

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

CO

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FIGURE 6C-3—ANALYSIS OF CALIBRATION GASES

Analytic method used _____

Date _____

	Gas concentration (indicate units)		
	Zero [a] (ppm)	Mid-range [b] (ppm)	High-range [c] (ppm)
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

FIGURE 6C-4—ANALYZER CALIBRATION DATA

Source identification: EP 130M #8
Test personnel: RT, BL, CT
Date: _____

Analyzer calibration data for sampling runs: Run #
Span: 0 – 00 ppm

	Cylinder value (indicate units) (ppm)	Analyzer calibration response (indicate units) (ppm)	Absolute difference (indicate units) (ppm)	Difference (percent of span) (%)
Zero gas				
Mid-range gas				
High-range gas				

FIGURE 6C-5—SYSTEM CALIBRATION BIAS AND DRIFT DATA

Source identification: EP 130M #8
Test personnel: RT, BL, CT

Date: 1-21-91
Run number: Run # C3-3
Span: 0 – 00 ppm

	Analyzer calibration response (ppm)	Initial values		Final values		Drift (percent of span) (%)
		System calibration response (ppm)	System cal. bias (percent of span) (%)	System calibration response (ppm)	System cal. bias (percent of span) (%)	
Zero gas	0	1.0	1.0	1.2	1.2	0.2
Upscale gas	102.2	101	-1.2	102	-0.2	1.0

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

JOB: Ent. Products

TURBINE ID: ISOM Unit #8 & 7

FUEL: 100% Nat. Gas.

TENERX CORP.

DATE: 01-21-91 (ISOM #8)
01-22-91 (ISOM #7)
01-24-91 (ISOM #7

Test No.	Time	Load	O_2,%	CO ppm	Temp WB/DB	Specif Humid	NO_x PPMV	NO_x PPMV (15%O2)	CO (15%O_2)	NO_x (15%O_2)	P_{bar} In.Hg	CO* (LB/HR)	NO_x* (LB/HR)
ISOM #8													
T#C3-1				18	43/48	0.0048	33				30.37	2.2021	6.6354
T#C3-2				24	44/47	0.0055	27				30.37	2.8949	5.3528
T#C3-3				28	41/44	0.0047	27				30.37	3.2427	5.1392
ISOM #7													
T#C4-1				39	40/44		36				30.37	4.9338	7.4624
T#C4-1				34	53/58	0.0075	36.5				30.22	4.2724	6.9271
T#C4-2				35	51/55	0.0071	38.50				30.22	4.1767	7.1718
T#C4-3					51/54	0.0074					30.25		

$$NOx = (NOx_{obs})\left(\frac{P_{ref}}{P_{obs}}\right)^{0.5} e^{19(H_{obs} - 0.00633)}\left(\frac{T_{amb}}{288k}\right)^{1.53}$$

where:

NOx = emissions of NOx at 15% oxygen and ISO standard ambient conditions, ppm%,

NOx_{obs} = measured NOx emissions (dry) at 15% oxygen, ppmv.

P_{ref} = reference combustor inlet absolute pressure at 29.92 In. Hg.

P_{obs} = measured combustor inlet absolute pressure at test ambient pressure.

H_{obs} = specific humidity of ambient air at test. $\frac{lb\ H_2O}{lb\ AIR}$

Tamb = Ambient temp. , °K

JOB: ENTERPRISE PRODUCTS

TURBINE ID: ISOM Unit #8 & 7

FUEL: 30% Ethane & 70% NG.

TENERX CORP.

DATE: 01-17-91

Test No.	Time	Load	O_2,%	CO, ppm	Temp WB/DB	Specif Humid	NO_x PPMV	NO_x PPMV (15%O_2)	NO (15%O_2)	NO_x (15%O_2)	P_{bar} In.Hg	NO* (LB/HR)	NO_x* (LB/HR)	CO_2/O_2 Orsat
ISOM #8														
T#C1-1				35	56/68	0.0068	31.5				30.40	3.974	5.8782	
T#C1-2				26	60/70	0.0088	31.0				30.35	2.992	5.8638	
T#C1-3				32	59/65	0.0092	31.0				30.26	3.6777	5.8557	
ISOM #7														
T#C2-1				34	59/64	0.0096	30.5				30.26	4.202	6.1956	3.6/15.0
T#C2-2				32	56/61	0.0085	31				30.25	3.993	6.3483	3.6/15.0
T#C2-3				30	56/61	0.0085	31				30.24	3.680	6.2504	3.8/14.7

$$NOx = (NOx_{obs})\left(\frac{P_{ref}}{P_{obs}}\right)^{0.5} e^{19(H_{obs} - 0.00633)}\left(\frac{T_{amb}}{288k}\right)^{1.53}$$

where:

NOx = emissions of NOx at 15% oxygen and ISO standard ambient conditions, ppm%,

NOx_{obs} = measured NOx emissions (dry) at 15% oxygen, ppmv.

P_{ref} = reference combustor inlet absolute pressure at 29.92 In. Hg.

P_{obs} = measured combustor inlet absolute pressure at test ambient pressure.

H_{obs} = specific humidity of ambient air at test. $\frac{lb\ H_2O}{lb\ AIR}$

Tamb = Ambient temp. , °K

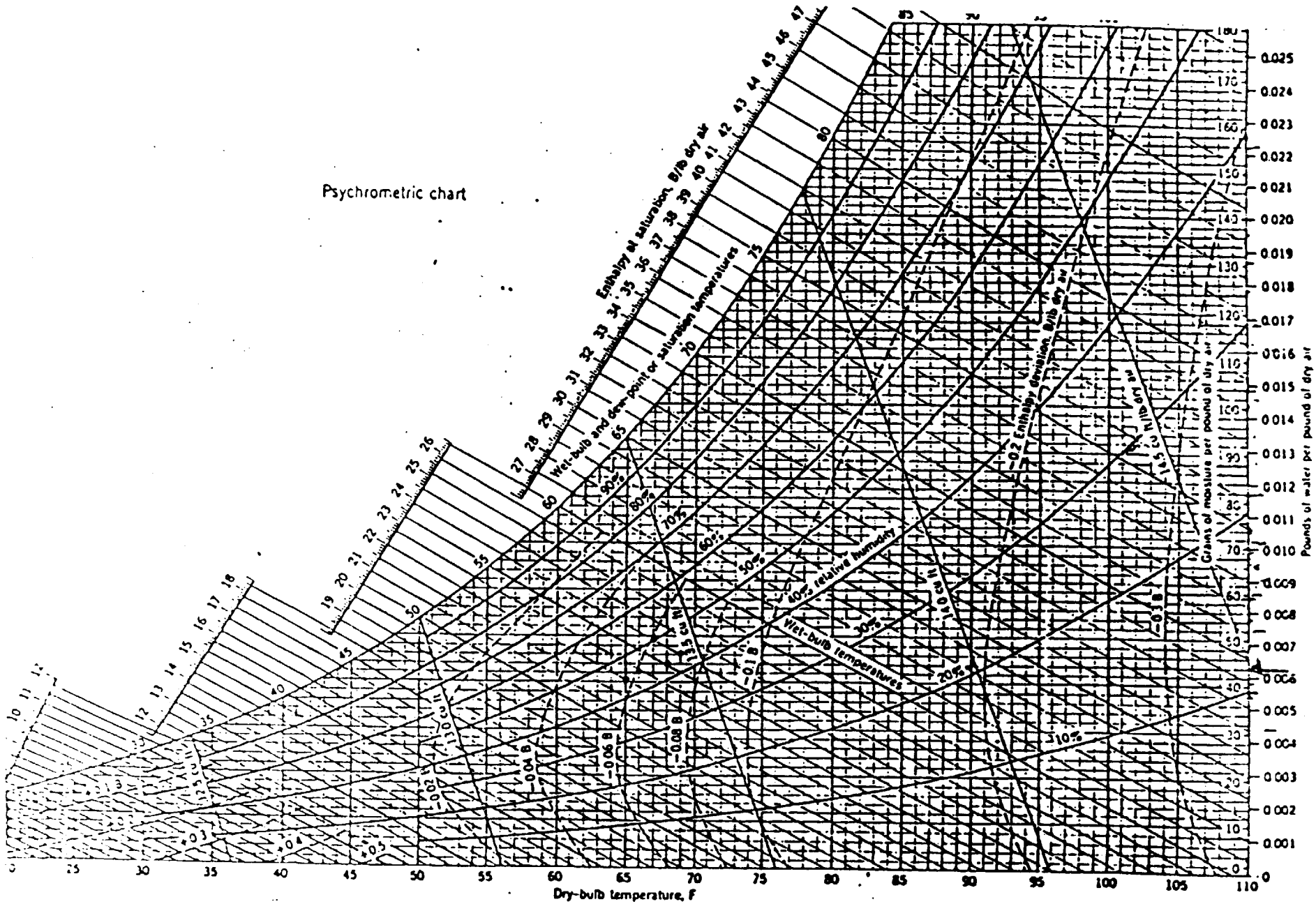

Chart A-6 Psychrometric chart. Adapted by permission from Carrier psychrometric chart, copyright 1946 by Carrier Corporation.

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(713) 482-6801

Figure 20-3—Zero and Calibration Data

Turbine type: Allison 501 KCM
Date: 1/17/91
Analyzer type: TECO 10S Chemiluminescent
Identification number: #8 ASP 904
Test number: Run 2 # 1-1
Identification number: 10S-28997-233

	Cylinder value, ppm or %	Initial analyzer response, ppm or %	Final analyzer responses, ppm or %	Difference: initial-final, ppm or %
Zero gas	0	0	0.25	-0.25
Low-level gas	24.48	24.8	25.1	-0.3
Mid-level gas	55.75	56.65	57.9	-1.25
High-level gas	89.03	88.7	90.2	-1.5

$$\text{Percent drift} = \frac{\text{Absolute difference}}{\text{Span value}} \times 100$$

Figure 20-5—Response Time

Date of test: 1/17/91
Analyzer type: TECO 10S Chemiluminescent
S/N: 10S-28997-233
Span gas concentration: 55.75 ppm.
Analyzer span setting: 100 ppm.
Upscale:
1 — 17 — seconds.
2 — 17 — seconds.
3 — 17 — seconds.
Average upscale response 17 seconds.
Downscale:
1 — 10 — seconds.
2 — 10 — seconds.
3 — 10 — seconds.
Average downscale response 10 seconds.
System response time = 45 sec
slower average time = ——— seconds.

Figure 20-6—Preliminary Diluent Traverse

Date ———
Location:
Plant ———
City, State ———

Turbine identification:
Manufacturer ———
Model, serial number ———

Sample point	Diluent concentration, ppm	Sample point	Diluent concentration, ppm
	N/A		

Figure 20-7—Stationary Gas Turbine Data

TURBINE OPERATION RECORD

Test operator: RT Date: 1/17/91
Turbine identification:
Type: Allison 501 KCM
Serial No.: ASP 904
Location:
Plant: Enterprise Products
City: Mont Belvieu, TX

Ambient temperature ———
Ambient humidity ———
Test time start: See Operation Data
Test time finish
Fuel flow rate* ———
Water or steam flow rate* ———
Ambient pressure ———
Diluent instrument type: Teledyne TAI 326
Serial No: 115442
NO_x instrument type: TECO 10S
Serial No.: 10S-28997-233

Ultimate fuel analysis:
C ———
H ———
O ———
N: See Operation Data
S ———
Ash ———
H_2O ———
Trace metals:
Na ———
Va ———
K ———
etc* ———
Operating load ———

*Describe measurement method, i.e., continuous flow meter, start finish volumes, etc.
*i.e., additional elements added for smoke suppression.

Figure 20-8—Stationary Gas Turbine Sample Point Record

Sample point	Time, min	Diluent*, %	NO_x*, ppm	Sample point	Time, min	Diluent*, %	NO_x*, ppm
	See Integrated RM 20(7E) & 3A Results						

*Average steady-state value from recorder or instrument readout

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FIGURE 20-3—ZERO AND CALIBRATION DATA

Turbine type: Allison 501 KCM
Date: 1/17/91
Analyzer type: TECO 10S Chemiluminescent
Identification number: #8 ASP 904
Test number: Run 2 #1-2
Identification number: 10S-28997-233

	Cylinder value, ppm or %	Initial analyzer response, ppm or %	Final analyzer responses, ppm or %	Difference: initial-final, ppm or %
Zero gas	0	0.25	0.4	-0.15
Low-level gas	24.48	25.1	24.7	0.4
Mid-level gas	55.75	57.9	57.9	0
High-level gas	89.03	90.2	89.8	0.4

$$\text{Percent drift} = \frac{\text{Absolute difference}}{\text{Span value}} \times 100$$

FIGURE 20-5—RESPONSE TIME

Date of test: 1/17/91
Analyzer type: TECO 10S Chemiluminescent
S/N: 10S-28997-233
Span gas concentration: 55.75 ppm.
Analyzer span setting: 100 ppm.
Upscale:
1 ——— seconds.
2 ——— seconds.
3 ——— seconds.
Average upscale response —— seconds.
Downscale:
1 ——— seconds.
2 ——— seconds.
3 ——— seconds.
Average downscale response —— seconds.
System response time = slower average time = ——— seconds.

FIGURE 20-6—PRELIMINARY DILUENT TRAVERSE

Date ———
Location:
Plant ———
City, State ———

Turbine identification:
Manufacturer ———
Model, serial number ———

Sample point	Diluent concentration, ppm	Sample point	Diluent concentration, ppm
	N/A		

FIGURE 20-7—STATIONARY GAS TURBINE DATA

TURBINE OPERATION RECORD

Test operator: RT Date: 1/17/91
Turbine identification:
Type: Allison 501 KCM
Serial No.: ASP 904
Location:
Plant: Enterprise Products
City: Mont Belvieu, TX

Ambient temperature ———
Ambient humidity ———
Test time start ———
Test time finish: See Operation Data
Fuel flow rate* ———
Water or steam flow rate* ———
Ambient pressure ———
Diluent instrument type: Teledyne TAI 326
Serial No: 115442
NO_x instrument type: TECO 10S
Serial No.: 10S-28997-233

Ultimate fuel analysis:
C ———
H ———
O ———
N: See Operation Data
S ———
Ash ———
H_2O ———
Trace metals:
Na ———
Va ———
K ———
etc† ———
Operating load ———

*Describe measurement method, i.e., continuous flow meter, start finish volumes, etc.
†i.e., additional elements added for smoke suppression.

FIGURE 20-8—STATIONARY GAS TURBINE SAMPLE POINT RECORD

Sample point	Time, min	Diluent*, %	NO_x*, ppm	Sample point	Time, min	Diluent*, %	NO_x*, ppm
	See Integrated RM 20(7E) & 3A Results						

*Average steady-state value from recorder or instrument readout.

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FIGURE 20-3—ZERO AND CALIBRATION DATA

Turbine type: Allison 501 KCM
Date: 1/17/91
Analyzer type: TECO 10S Chemiluminescent
Identification number: #8 ASP 304
Test number: Run C #1-3
Identification number: 10S-28997-233

	Cylinder value, ppm or %	Initial analyzer response, ppm or %	Final analyzer responses, ppm or %	Difference: initial-final, ppm or %
Zero gas	0	0.4	0	0.4
Low-level gas	24.48	24.7	24.7	0
Mid-level gas	55.75	57.9	57.3	0.6
High-level gas	89.03	89.8	89.0	0.8

$$\text{Percent drift} = \frac{\text{Absolute difference}}{\text{Span value}} \times 100$$

FIGURE 20-5—RESPONSE TIME

Date of test 1/17/91
Analyzer type TECO 10S Chemiluminescent
S/N 10S-28997-233
Span gas concentration: 55.75 ppm.
Analyzer span setting: 100 ppm.
Upscale:
1 ——— seconds.
2 ——— seconds.
3 ——— seconds.
Average upscale response —— seconds.
Downscale:
1 ——— seconds.
2 ——— seconds.
3 ——— seconds.
Average downscale response —— seconds.
System response time = slower average time = ——— seconds.

FIGURE 20-6—PRELIMINARY DILUENT TRAVERSE

Date ———
Location:
Plant ———
City, State ———

Turbine identification:
Manufacturer ———
Model, serial number ———

Sample point	Diluent concentration, ppm	Sample point	Diluent concentration, ppm
	N/A		

FIGURE 20-7—STATIONARY GAS TURBINE DATA

TURBINE OPERATION RECORD

Test operator RT Date 1/17/91
Turbine identification:
Type Allison 501 KCM
Serial No. ASP 304
Location:
Plant Enterprise Products
City Mont Belvieu, TX

Ambient temperature ———
Ambient humidity ———
Test time start ———
Test time finish See Operation Data
Fuel flow rate* ———
Water or steam flow rate* ———
Ambient pressure ———
Diluent instrument type Teledyne TAI 326
Serial No 115492
NO_x instrument type TECO 10S
Serial No. 10S-28997-233

Ultimate fuel analysis:
C ———
H ———
O ———
N See Operation Data
S ———
Ash ———
H_2O ———
Trace metals:
Na ———
Va ———
K ———
etc* ———
Operating load ———

*Describe measurement method, i.e., continuous flow meter, start finish volumes, etc.
*i.e., additional elements added for smoke suppression.

FIGURE 20-8—STATIONARY GAS TURBINE SAMPLE POINT RECORD

Sample point	Time, min	Diluent*, %	NO_x*, ppm	Sample point	Time, min	Diluent*, %	NO_x*, ppm
	See Integrated RM 20(TE) & 3A Results						

*Average steady-state value from recorder or instrument readout.

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FIGURE 20-3—ZERO AND CALIBRATION DATA

Turbine type: Allison 501 KCM
Date: 1/21/91
Analyzer type: TECO 10S Chemiluminescent
Identification number: #8 ASP 904
Test number: Run C #3-1
Identification number: 10S-28997-233

	Cylinder value, ppm or %	Initial analyzer response, ppm or %	Final analyzer responses, ppm or %	Difference: initial-final, ppm or %
Zero gas	0	0	0	0
Low-level gas	24.48	24.2	24.0	0.2
Mid-level gas	55.75	56.2	55.7	0.5
High-level gas	89.03	88.0	87.1	0.9

$$\text{Percent drift} = \frac{\text{Absolute difference}}{\text{Span value}} \times 100$$

FIGURE 20-5—RESPONSE TIME

Date of test 1/21/91
Analyzer type TECO 10S Chemiluminescent
S/N 10S-28997-233
Span gas concentration: 55.75 ppm.
Analyzer span setting: 100 ppm.
Upscale:
1 — 17 — seconds.
2 — 17 — seconds.
3 — 17 — seconds.
Average upscale response 17 seconds.
Downscale:
1 — 10 — seconds.
2 — 10 — seconds.
3 — 10 — seconds.
Average downscale response 10 seconds.
System response time = 45 sec
slower average time = ——— seconds.

FIGURE 20-6—PRELIMINARY DILUENT TRAVERSE

Date ———
Location:
Plant ———
City, State ———

Turbine identification:
Manufacturer ———
Model, serial number ———

Sample point	Diluent concentration, ppm	Sample point	Diluent concentration, ppm
	N/A		

FIGURE 20-7—STATIONARY GAS TURBINE DATA

TURBINE OPERATION RECORD

Test operator RT Date 1/21/91
Turbine identification:
Type Allison 501 KCM
Serial No. ASP 904
Location:
Plant Enterprise Products
City Mont Belvieu, TX

Ambient temperature ———
Ambient humidity ———
Test time start See Operation Data
Test time finish ———
Fuel flow rate* ———
Water or steam flow rate* ———
Ambient pressure ———
Diluent instrument type Teledyne TAI 326
Serial No 115442
NO_x instrument type TECO 10S
Serial No. 10S-28997-233

Ultimate fuel analysis:
C ———
H ———
O See Operation Data
N ———
S ———
Ash ———
H_2O ———
Trace metals:
Na ———
Va ———
K ———
etc† ———
Operating load ———

*Describe measurement method, i.e., continuous flow meter, start finish volumes, etc.
†i.e., additional elements added for smoke suppression.

FIGURE 20-8—STATIONARY GAS TURBINE SAMPLE POINT RECORD

Sample point	Time, min	Diluent*, %	NO_x*, ppm	Sample point	Time, min	Diluent*, %	NO_x*, ppm
		See Integrated RM 20(TE) & 3A Results					

*Average steady-state value from recorder or instrument readout

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FIGURE 20-3—ZERO AND CALIBRATION DATA

Turbine type: Allison 501 KCM
Date: 1/21/91
Analyzer type: TECO 10S Chemiluminescent
Identification number: #8 ASP 304
Test number: Run C #3-2
Identification number: 10S-28997-233

	Cylinder value, ppm or %	Initial analyzer responses, ppm or %	Final analyzer responses, ppm or %	Difference: initial-final, ppm or %
Zero gas	0	0	-0.2	0.2
Low-level gas	24.48	24.0	23.7	0.3
Mid-level gas	55.75	55.7	55.8	-0.1
High-level gas	89.03	87.1	87.0	0.1

$$\text{Percent drift} = \frac{\text{Absolute difference}}{\text{Span value}} \times 100$$

FIGURE 20-8—RESPONSE TIME

Date of test 1/21/91
Analyzer type TECO 10S Chemiluminescent
S/N 10S-28997-233
Span gas concentration: 55.75 ppm.
Analyzer span setting: 100 ppm.
Upscale:
1 ——— seconds.
2 ——— seconds.
3 ——— seconds.
Average upscale response —— seconds.
Downscale:
1 ——— seconds.
2 ——— seconds.
3 ——— seconds.
Average downscale response —— seconds.
System response time = slower average time = ——— seconds.

FIGURE 20-6—PRELIMINARY DILUENT TRAVERSE

Date ———
Location:
Plant ———
City, State ———

Turbine identification:
Manufacturer ———
Model, serial number ———

Sample point	Diluent concentration, ppm	Sample point	Diluent concentration, ppm
	N/A		

FIGURE 20-7—STATIONARY GAS TURBINE DATA

TURBINE OPERATION RECORD

Test operator RT Date 1/21/91
Turbine identification:
Type Allison 501 KCM
Serial No. ASP 304
Location:
Plant Enterprise Products
City Mont Belvieu, TX

Ambient temperature ———
Ambient humidity ———
Test time start ———
Test time finish See Operation Data
Fuel flow rate* ———
Water or steam flow rate* ———
Ambient pressure ———
Diluent instrument type Teledyne TAI 326
Serial No 115492
NO_x instrument type TECO 10S
Serial No. 10S-28997-233

Ultimate fuel analysis:
C ———
H ———
O ———
N See Operation Data
S ———
Ash ———
H_2O ———
Trace metals:
Na ———
Va ———
K ———
etc[b] ———
Operating load ———

*Describe measurement method, i.e., continuous flow meter, start finish volumes, etc.
[b]i.e., additional elements added for smoke suppression.

FIGURE 20-8—STATIONARY GAS TURBINE SAMPLE POINT RECORD

Sample point	Time, min	Diluent*, %	NO_x*, ppm	Sample point	Time, min	Diluent*, %	NO_x*, ppm
	See Integrated RM 20(7E) & 3A Results						

*Average steady-state value from recorder or instrument readout.

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FIGURE 20-3—ZERO AND CALIBRATION DATA

Turbine type: Allison 501 KCM
Date: 1/21/91
Analyzer type: TECO 10S Chemiluminescent
Identification number: #8 ASP 904
Test number: Run 2 # 3-3
Identification number: 10S-28997-233

	Cylinder value, ppm or %	Initial analyzer response, ppm or %	Final analyzer responses, ppm or %	Difference: initial-final, ppm or %
Zero gas	0	-0.2	-0.3	0.1
Low-level gas	24.48	23.7	23.7	0
Mid-level gas	55.75	55.8	55.5	0.3
High-level gas	89.03	87.0	86.7	0.3

$$\text{Percent drift} = \frac{\text{Absolute difference}}{\text{Span value}} \times 100$$

FIGURE 20-5—RESPONSE TIME

Date of test 1/21/91
Analyzer type TECO 10S Chemiluminescent
S/N 10S-28997-233
Span gas concentration: 55.75 ppm.
Analyzer span setting: 100 ppm.
Upscale:
1 ——— seconds.
2 ——— seconds.
3 ——— seconds.
Average upscale response —— seconds.
Downscale:
1 ——— seconds.
2 ——— seconds.
3 ——— seconds.
Average downscale response —— seconds.
System response time = slower average time = ——— seconds.

FIGURE 20-6—PRELIMINARY DILUENT TRAVERSE

Date ———
Location:
Plant ———
City, State ———
Turbine identification:
Manufacturer ———
Model, serial number ———

Sample point	Diluent concentration, ppm	Sample point	Diluent concentration, ppm
	N/A		

FIGURE 20-7—STATIONARY GAS TURBINE DATA

TURBINE OPERATION RECORD

Test operator RT Date 1/21/91
Turbine identification:
Type Allison 501 KCM
Serial No. ASP 904
Location:
Plant Enterprise Products
City Mont Belvieu, TX

Ambient temperature ———
Ambient humidity ———
Test time start See Operation Data
Test time finish
Fuel flow rate* ———
Water or steam flow rate* ———
Ambient pressure ———
Diluent instrument type Teledyne TAI 326
Serial No 115492
NO_x instrument type TECO 10S
Serial No. 10S-28997-233

Ultimate fuel analysis:
C ———
H ———
O ———
N See Operation Data
S ———
Ash ———
H_2O ———
Trace metals:
Na ———
Va ———
K ———
etc[b] ———
Operating load ———

*Describe measurement method, i.e., continuous flow meter, start finish volumes, etc.
[b]i.e., additional elements added for smoke suppression.

FIGURE 20-8—STATIONARY GAS TURBINE SAMPLE POINT RECORD

Sample point	Time, min	Diluent*, %	NO_x*, ppm	Sample point	Time, min	Diluent*, %	NO_x*, ppm
	See Integrated RM 20(7E) & 3A Results						

*Average steady-state value from recorder or instrument readout.

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APPENDIX B

EQUIPMENT CALIBRATIONS

Probe No. #8

Length 8'

TENERX CORP.

PITOT DATA

Date 01-31-91

Location TENERX Lab

Personnel CT

	"A" (Forward) Calibration			
Run No.	① ΔP_{std} in. H_2O	② $\Delta P_{(s)}$ in. H_2O	④ $C_{P(s)}$	⑥ Dev.
1	0.22	0.305	0.8408	0.00246
2	0.22	0.305	0.8408	0.00246
3	0.22	0.30	0.8478	-0.00494
		⑤a Average	0.84286	σ= 0.00329

	"B" (Reverse) Calibration			
Run No.	① $\Delta P_{std.}$ in. H_2O	② $\Delta P_{(s)}$ in. H_2O	③ $C_{P(s)}$	⑥ Dev.
1	0.22	0.305	0.8408	0
2	0.22	0.305	0.8408	0
3	0.22	0.305	0.8408	0
		⑤b Average	0.8408	σ= 0

C_p Difference = 0.00206

① ΔP_{std} = Velocity head measured by standard pitot tube, in. H_2O.

② $\Delta P_{(s)}$ = Velocity head measured by the type "S" pitot tube, in. H_2O.

③ $C_{P_{std}}$ = Standard pitot tube coefficient = .99.

④ $C_{P(s)}$ = Type "S" pitot tube coefficient where $C_{P(s)} = C_{P(std)}\left(\frac{\Delta P_{std}}{\Delta P_s}\right)^{1/2} = ③\left(\frac{①}{②}\right)^{1/2}$.

⑤a A_{avg} = Average $C_{P(s)} = \overline{C}_{P(s)} = \left(\sum_1^3 C_{P(s)}\right)/3$ for forward calibration.

⑤b B_{avg} = Average $C_{P(s)} = \overline{C}_{P(s)} = \left(\sum_1^3 C_{P(s)}\right)/3$ for reverse calibration.

⑥ Dev. = Deviation from average $C_{P(s)} = C_{P(s)} - \overline{C}_{P(s)}$. Must be ≤ .01

⑦ σ = Average deviation from the mean σ(side A or B) $= \left(\sum_1^3 \left|C_{P(s)} - \overline{C}_{P(A \text{ or } B)}\right|\right)/3$. Must be ≤ .01

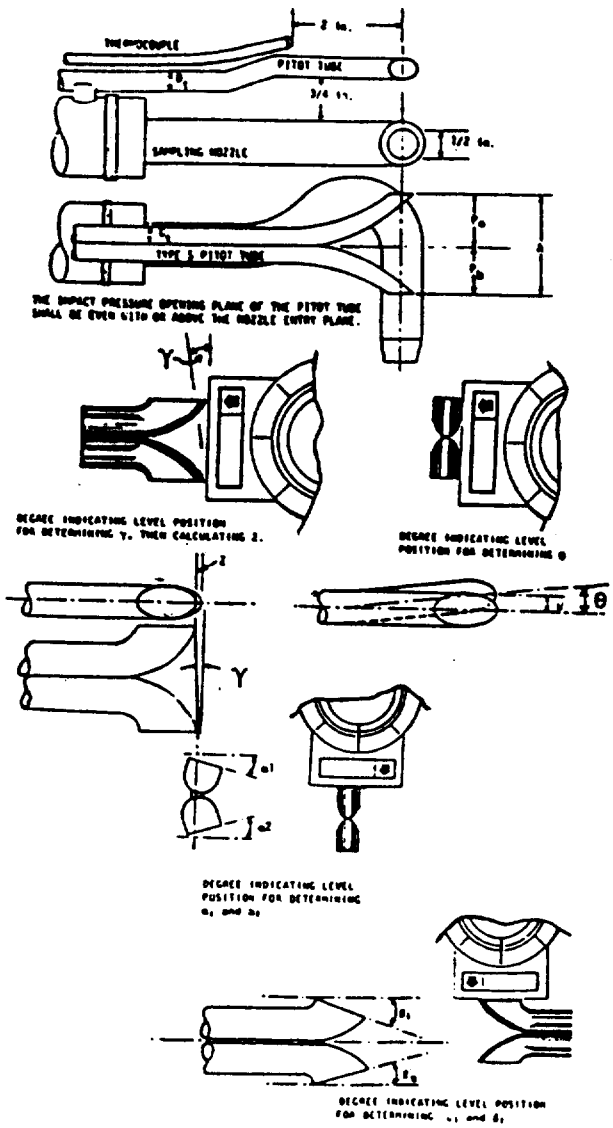
C_p Difference $A_{avg} - B_{avg}$ = 5a - 5b. Must be ≤ .01

PITOT TUBE INSPECTION DATA SHEET

Company Name: *Enterprise Prod. ISOM T.B*

Pre-sample Date *1-7-91*

Post Sample Date *1-31-91*



Yes	level?	Yes
No	obstructions?	No
No	damaged?	No
0	$-10° < \alpha_1 < +10°$	0
0	$-10° < \alpha_2 < +10°$	0
0	$-5° < \beta_1 < +5°$	0
0	$-5° < \beta_2 < +5°$	0
0	γ	0
0	θ	0
0.74	A	0.74
0.37	$1.05\ D_t < P_a < 1.5\ D_t$	0.37
0.37	$1.05\ D_t < P_b < 1.5\ D_t$	0.37
0.25	$3/16" \leq D_t \leq 3/8"$	0.25
0	$A \tan \gamma < 0.125"$	0
0	$A \tan \theta < 0.03125"$	0
0	$P_a = P_b \pm 0.063"$	0

Comments: _____

Pitot tube/probe number *8'* meets or exceeds all specifications criteria and/or applicable design features* and is hereby assigned a pitot tube calibration factor of 0.84.

Signature *Ray Terrazas*

Date *1-31-91*

*See 40 CFR 60, Vol. 42, No. 160, Method 2. Verify the minimum 2 inch setback of the thermocouple and the minimum 3/4 inch separation between the pitot tube and the nozzle as shown at the top of this page.

TENERX CORP.
P.O. BOX 1444
FRIENDSWOOD, TEXAS 77546
(713) 482-5801

CONTROL BOX CALIBRATION RECORD

CONTROL BOX NO. : EN-110
CALIBRATION DATE : 02-05-91
ATM. PRESS. (IN HG) : 30.05

CALIBRATION METER NO. : 68S7005555
CALIBRATION LOCATION : FRIENDSWOOD, TX
CALIBRATION PERSONNEL : JAS

ORIFICE SETTING (IN WC)	STD METER GAS VOL (CF)	TEST METER GAS VOL (CF)	STD METER TEMP (F)	TEST METER TEMP INLET (F)	TEST METER TEMP OUTLET (F)	SAMPLE TIME (MIN)	DGMCF (Y)	DELTA H STD
.5	7.0	6.968	63.33	63.0	63.0	16.667	1.003	1.58
1.0	7.0	7.135	63.33	63.6	63.6	11.42	.979	1.48
1.5	7.0	7.011	63.33	64.4	64.4	9.25	.997	1.45
2.0	7.0	7.136	63.33	64.4	64.4	8.35	.978	1.58
2.5	7.0	7.003	63.33	64.4	64.4	7.367	.996	1.54
3.0	7.0	7.129	63.33	64.6	64.6	6.83	.977	1.58
						AVERAGE :	.988	1.53

Y = RATIO OF ACCURACY OF THE CALIBRATED TEST METER TO THE CONTROL BOX GAS METER. (TOLERANCE = (+/-) 0.02 OF AVERAGE READING).

DELTA H STD = ORIFICE PRESSURE DIFFERENTIAL THAT GIVES 0.75 CFM OF AIR AT 68 DEGREES (F) AT 29.92 IN HG, MEASURED IN INCHES H2O.(TOLERANCE = (+/-) 0.20 OF AVERAGE READING).

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CONTROL BOX CALIBRATION RECORD

CONTROL BOX NO. : EN-110
CALIBRATION DATE : 12-17-90
ATM. PRESS. (IN HG) : 29.80
CALIBRATION METER NO. : 68S7005555
CALIBRATION LOCATION : FRIENDSWOOD, TX
CALIBRATION PERSONNEL : VRM

ORIFICE SETTING (IN WC)	STD METER GAS VOL (CF)	TEST METER GAS VOL (CF)	STD METER TEMP (F)	TEST METER TEMP INLET (F)	TEST METER TEMP OUTLET (F)	SAMPLE TIME (MIN)	DGMCF (Y)	DELTA H STD
.5	6.99	6.913	75	75.5	75.5	15.0167	1.011	1.32
1.0	7.01	7.059	75.25	76.5	76.5	11.133	.993	1.44
1.5	7.0	6.968	75.75	77	77	9.4167	1.003	1.55
2.0	7.0	7.121	76	77	77	8.233	.98	1.58
2.5	7.0	7.02	76.25	77.5	77.5	7.1667	.993	1.5
3.0	7.0	7.137	76.75	78	78	6.7167	.976	1.58
						AVERAGE :	.993	1.5

Y = RATIO OF ACCURACY OF THE CALIBRATED TEST METER TO THE CONTROL BOX GAS METER. (TOLERANCE = (+/-) 0.02 OF AVERAGE READING).

DELTA H STD = ORIFICE PRESSURE DIFFERENTIAL THAT GIVES 0.75 CFM OF AIR AT 68 DEGREES (F) AT 29.92 IN HG, MEASURED IN INCHES H2O.(TOLERANCE = (+/-) 0.20 OF AVERAGE READING).

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Temperature Calibrations

Date: 2-5-91 Personnel CT, JAS, TG

Sample Unit Designation: EN 110

	Ambient Temperature °F	Ice Water Temperature °F	Boiling Water Temperature °F
Mercury Thermometer	72	32.5	210
Stack Thermocouple	71	32	209
Dry Gas Inlet Thermocouple	72	32	209
Dry Gas Outlet Thermocouple	72	32	209

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APPENDIX C

DATA CALCULATIONS

ENERX corp
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(713) 482-5801

CLIENT—JOB NO. Enterprise Products
SUBJECT ISOM #7 & 8 Compliance Test

SHEET 1 OF 3
MADE BY RT DATE 2/13/91
CHKD. DATE
APPVD. BY DATE

Emission Calculations

NOx Emissions Corrected to ISO Conditions (CFR 40, Part 60, Subpart GG

Run C# 2-1

Uncorrected NOx conc. = 29.60 ppm
Excess O_2 diluent conc. = 15.132 %
$P_o = P_{bar} \times 4.91176 \times 10^{-1} + P_{TCPD} = (30.26)(4.91176 \times 10^{-1}) + 118$
P_o = 132.863 psia
Specific Humidity = 0.0096 lb H_2O/lb Dry Air
TA = [(64°F - 32°F)/1.8] + 273.16 = 290.94 °K

$$NOx \text{ corr. to } 15\% O_2 = (\text{ppm } NOx)\left(\frac{5.9\%}{20.9\% - O_2}\right)$$

$$= (29.60 \text{ ppm})\left(\frac{5.9}{20.9 - 15.132}\right)$$

$$= 30.28 \text{ ppm @ } 15\% O_2$$

$$NOx \text{ corr. to ISO Cond.} = (NOx_o)\left(\frac{P_r}{P_o}\right)^{0.5} e^{19(H_o - 0.00633)}\left(\frac{288°K}{TA}\right)^{1.53}$$

$$= (30.28)\left(\frac{150 \text{ psig} + 14.7}{132.863}\right)^{0.5} e^{19(0.0096 - 0.00633)}\left(\frac{288}{290.94}\right)^{1.53}$$

$$= \boxed{35.321 \text{ ppm}}$$

CO Emissions Corrected to 15% O_2

Run C # 2-1

Uncorreted CO conc = 32.138 ppm

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CLIENT—JOB NO. Enterprise Products
SUBJECT ISOM # 7 & 8 Compliance Test

SHEET 2 OF 3
MADE BY RT DATE 2/13/91
CHKD. DATE
APPVD. BY DATE

Excess O_2 conc = 15.132 %

$$CO \text{ Corr to } 15\% \ O_2 = (\text{ppm } CO)\left(\frac{5.9\%}{20.9\% - O_2}\right)$$

$$= 32.138\left(\frac{5.9}{20.9 - 15.132}\right)$$

$$= \boxed{32.873 \text{ ppm}}$$

NOx Emissions Corrected to Lb/hr

Run C# 2-1

NOx conc = 29.60 ppm, dry

NOx correction factor = $1.194 \times 10^{-7} \frac{Lb/scf}{ppm}$ (Reference Method 19)

Stack Volumetric Flow Rate = Q_{STD} = 28371.2 DSCFM

$$NOx \text{ in } Lb/hr = (\text{ppm } NOx)\left(1.194 \times 10^{-7} \frac{Lb/scf}{ppm}\right)(Q_{STD})\left(60 \frac{min}{hr}\right)$$

$$= (29.60)(1.194 \times 10^{-7})(28371.2)(60)$$

$$= \boxed{6.0162 \text{ Lb/hr}}$$

CO Emissions in Lb/hr

Run C# 2-1

CO conc = 32.138 ppm

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(713) 482-5801

CLIENT—JOB NO. Enterprise Products
SUBJECT ISOM # 7 & 8 Compliance Test

SHEET 3 OF 3
MADE BY RT DATE 2/13/91
CHKD. DATE
APPVD. BY DATE

$$\text{CO correction factor} = \left(\frac{28 \text{ Lb CO}}{\text{mole CO}}\right)\left(\frac{1 \text{ mole Co}}{385.43 \text{ ft}^3}\right)\left(\frac{1}{10^6 \text{ ppm}}\right)$$

$$= 0.72646 \times 10^{-7} \frac{\text{Lb/scF}}{\text{ppm}}$$

$$Q_{STD} = 28\,371.2 \text{ DSCFM}$$

$$\text{CO in Lb/hr} = (32.188 \text{ ppm})\left(0.72646 \times 10^{-7} \frac{\text{Lb/scF}}{\text{ppm}}\right)\left(28371.2 \frac{\text{DSCF}}{\text{min}}\right)\left(60 \frac{\text{min}}{\text{hr}}\right)$$

$$= \boxed{3.974 \text{ Lb/hr}}$$

RELATIVE ACCURACY TEST RM (METHOD 7E) RESULTS NOx

TEST ID.	DATE	TIME	C	Co	Cma	Cm	Cgas
C # 2-1	01-17-91	17:26 - 18:38	29.6	0.00	55.75	55.65	29.60
C # 2-2	01-17-91	19:02 - 20:16	30.5	0.00	55.75	55.75	30.45
C # 2-3	01-17-91	20:44 - 21:56	30.3	0.00	55.75	55.90	30.22
C # 4-1	01-24-91	13:09 - 14:19	35.6	0.00	55.75	54.60	36.35
C # 4-2	01-24-91	15:12 - 16:23	35.9	0.00	55.75	54.50	36.72
C # 4-3	01-24-91	17:07 - 16:17	35.6	0.00	55.75	54.65	36.32

$$Cgas = (C-Co)(Cma/(Cm-Co))$$

Where:

Cgas = Effluent gas concentration, dry basis, ppm.
C = Average gas concentration indicated by gas analyzer, dry basis, ppm.
Co = Average of initial and final system calibration bias check responses for the zero gas, ppm.
Cm = Average of initial and final system calibration bias check responses for the upscale calibration gas, ppm.
Cma = Actual concentration of the upscale calibration gas, ppm.

RELATIVE ACCURACY TEST RM (METHOD 10) RESULTS CO

TEST ID.	DATE	TIME	C	Co	Cma	Cm	Cgas
C # 2-1	01-17-91	17:26 - 18:38	32.6	0.4	102.5	99.4	33.3
C # 2-2	01-17-91	19:02 - 20:16	30.1	0.2	102.5	99.3	30.9
C # 2-3	01-17-91	20:44 - 21:56	27.0	0.0	102.5	99.7	27.8
C # 4-1	01-24-91	13:09 - 14:19	32.2	0.3	102.5	99.1	33.1
C # 4-2	01-24-91	15:12 - 16:23	32.0	0.2	102.5	100.1	32.6
C # 4-3	01-24-91	17:07 - 16:17	34.5	0.2	102.5	100.1	35.2

$$Cgas = (C-Co)(Cma/(Cm-Co))$$

Where:

Cgas = Effluent gas concentration, dry basis, ppm.
C = Average gas concentration indicated by gas analyzer, dry basis, ppm.
Co = Average of initial and final system calibration bias check responses for the zero gas, ppm.
Cm = Average of initial and final system calibration bias check responses for the mid-scale calibration gas, p
Cma = Actual concentration of the mid-scale calibration ga ppm.

REFERENCE METHOD 10 FLUE GAS CO2 CORRECTIONS

RUN NO.	DATE	TIME	Cndir	Fco2	Cco stack
C # 2-1	01-17-91	17:26 - 18:38	33.3	0.036	32.138
C # 2-2	01-17-91	19:02 - 20:16	30.9	0.036	29.813
C # 2-3	01-17-91	20:44 - 21:56	27.8	0.038	26.703
C # 4-1	01-24-91	13:09 - 14:19	33.1	0.032	32.036
C # 4-2	01-24-91	15:12 - 16:23	32.6	0.033	31.551
C # 4-3	01-24-91	17:07 - 16:17	35.2	0.032	34.067

Where: Cco stack = Cndir(1-Fco2)

Cco stack = Concentration of CO in stack, dry basis, ppm.
Cndir = Concentration of CO measure by NDIR analyzer, dry basis, ppm. (Cndir = Cgas from Relative Accuracy Test Results).
Fco2 = Volume fraction of CO2 in sample, percent CO2 from Orsat analysis divided by 100.

RELATIVE ACCURACY TEST RM (METHOD 3A) RESULTS 02

TEST ID.	DATE	TIME	C	Co	Cma	Cm	Cgas
C # 2-1	01-17-91	17:26 - 18:38	15.00	0.025	8.45	8.388	15.132
C # 2-2	01-17-91	19:02 - 20:16	14.98	0.025	8.45	8.363	15.152
C # 2-3	01-17-91	20:44 - 21:56	14.95	0.025	8.45	8.375	15.104
C # 4-1	01-24-91	13:09 - 14:19	15.35	0.000	8.45	8.438	15.373
C # 4-2	01-24-91	15:12 - 16:23	15.30	0.000	8.45	8.413	15.368
C # 4-3	01-24-91	17:07 - 16:17	15.33	0.000	8.45	8.413	15.393

$$Cgas = (C-Co)(Cma/(Cm-Co))$$

Where:
- Cgas = Effluent gas concentration, dry basis, ppm.
- C = Average gas concentration indicated by gas analyzer, dry basis, ppm.
- Co = Average of initial and final system calibration bias check responses for the zero gas, ppm.
- Cm = Average of initial and final system calibration bias check responses for the mid-scale calibration gas, ppm.
- Cma = Actual concentration of the mid-scale calibration gas, ppm.

RELATIVE ACCURACY TEST RM (METHOD 7E) RESULTS NOx

TEST ID.	DATE	TIME	C	Co	Cma	Cm	Cgas
C # 1-1	01-17-91	11:11 - 12:25	31.1	0.28	55.75	55.95	30.87
C # 1-2	01-17-91	13:10 - 14:49	30.6	0.40	55.75	56.00	30.28
C # 1-3	01-17-91	15:16 - 16:24	30.4	0.25	55.75	55.75	30.29
C # 3-1	01-21-91	14:54 - 16:09	30.9	0.00	55.75	55.05	31.24
C # 3-2	01-21-91	16:45 - 17:56	27.0	0.15	55.75	54.80	27.39
C # 3-3	01-21-91	18:24 - 19:37	25.8	0.40	55.75	54.90	25.93

$$Cgas = (C-Co)(Cma/(Cm-Co))$$

Where:

Cgas = Effluent gas concentration, dry basis, ppm.
C = Average gas concentration indicated by gas analyzer, dry basis, ppm.
Co = Average of initial and final system calibration bias check responses for the zero gas, ppm.
Cm = Average of initial and final system calibration bias check responses for the upscale calibration gas, ppm.
Cma = Actual concentration of the upscale calibration gas, ppm.

RELATIVE ACCURACY TEST RM (METHOD 10) RESULTS CO

TEST ID.	DATE	TIME	C	Co	Cma	Cm	Cgas
C # 1-1	01-17-91	11:11 - 12:25	33.5	0.5	102.5	100.1	33.9
C # 1-2	01-17-91	13:10 - 14:49	23.9	0.5	102.5	99.1	24.4
C # 1-3	01-17-91	15:16 - 16:24	29.8	0.5	102.5	98.9	30.5
C # 3-1	01-21-91	14:54 - 16:09	15.6	0.8	102.5	100.3	15.3
C # 3-2	01-21-91	16:45 - 17:56	23.1	1.0	102.5	101.0	22.7
C # 3-3	01-21-91	18:24 - 19:37	25.6	1.1	102.5	101.5	25.0

$$Cgas = (C-Co)(Cma/(Cm-Co))$$

Where:

Cgas = Effluent gas concentration, dry basis, ppm.
C = Average gas concentration indicated by gas analyzer, dry basis, ppm.
Co = Average of initial and final system calibration bias check responses for the zero gas, ppm.
Cm = Average of initial and final system calibration bias check responses for the mid-scale calibration gas, p
Cma = Actual concentration of the mid-scale calibration ga ppm.

REFERENCE METHOD 10 FLUE GAS CO2 CORRECTIONS

RUN NO.	DATE	TIME	Cndir	Fco2	Cco stack
C # 1-1	01-17-91	11:11 - 12:25	33.9	0.038	32.621
C # 1-2	01-17-91	13:10 - 14:49	24.4	0.034	23.543
C # 1-3	01-17-91	15:16 - 16:24	30.5	0.032	29.529
C # 3-1	01-21-91	14:54 - 16:09	15.3	0.028	14.851
C # 3-2	01-21-91	16:45 - 17:56	22.7	0.026	22.074
C # 3-3	01-21-91	18:24 - 19:37	25.0	0.029	24.287

Where: Cco stack = Cndir(1-Fco2)

Cco stack = Concentration of CO in stack, dry basis, ppm.
Cndir = Concentration of CO measure by NDIR analyzer, dry basis, ppm. (Cndir = Cgas from Relative Accuracy Test Results).
Fco2 = Volume fraction of CO2 in sample, percent CO2 from Orsat analysis divided by 100.

RELATIVE ACCURACY TEST RM (METHOD 3A) RESULTS 02

TEST ID.	DATE	TIME	C	Co	Cma	Cm	Cgas
C # 1-1	01-17-91	11:11 - 12:25	15.13	0.025	8.45	8.413	15.213
C # 1-2	01-17-91	13:10 - 14:49	15.33	0.050	8.45	8.413	15.435
C # 1-3	01-17-91	15:16 - 16:24	15.20	0.025	8.45	8.413	15.288
C # 3-1	01-21-91	14:54 - 16:09	15.78	0.038	8.45	8.375	15.950
C # 3-2	01-21-91	16:45 - 17:56	15.90	0.000	8.45	8.425	15.947
C # 3-3	01-21-91	18:24 - 19:37	16.03	0.000	8.45	8.463	16.001

$$Cgas = (C-Co)(Cma/(Cm-Co))$$

Where:
- Cgas = Effluent gas concentration, dry basis, ppm.
- C = Average gas concentration indicated by gas analyzer, dry basis, ppm.
- Co = Average of initial and final system calibration bias check responses for the zero gas, ppm.
- Cm = Average of initial and final system calibration bias check responses for the mid-scale calibration gas, ppm.
- Cma = Actual concentration of the mid-scale calibration gas, ppm.

VELOCITY TRAVERSE DATA

CLIENT:ENTERPRISE PRODUCTS
UNIT NO.:ISOM DIB # 7
TEST DATE:1-17-91

TEST I.D.:C # 2-1
SAMPLING LOCATION:STACK
OPERATIONAL STATUS:1420 DEG F

********** TEST CONDITIONS **********

UNIT LOAD (MW)	=	82.85
DUCT DIAMETER (FT)	=	5.9792
BAROMETRIC PRESSURE (IN. HG)	=	30.26
PERCENT MOISTURE IN FLUE GAS	=	8.36
PERCENT CO2 IN FLUE GAS	=	3.6
TENERX PROBE NUMBER	=	8
PITOT TUBE COEFFICIENT	=	.84

********** PORT 1 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.22	379	15.132	33.37	32784.09 / 56219
2	.22	380	15.132	33.39	32764.68 / 56252.7
3	.19	382	15.132	31.07	30415.71 / 52344.15
4	.18	381	15.132	30.22	29618.79 / 50912.14
5	.2	384	15.132	31.92	31173.77 / 53776.16
6	.19	382	15.132	31.07	30415.71 / 52344.15
7	.14	381	15.132	26.66	26129.61 / 44914.55
8	.1	380	15.132	22.51	22088.44 / 37922.98

STATIC PRESS. (IN. H2O) = -.08
AVG. VEL. (FT/SEC) = 30.02625

********** PORT 2 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.2	443	15.132	33.01	30131.91 / 55612.5
2	.16	457	15.132	29.76	26750.53 / 50137.17
3	.2	472	15.132	33.54	29663.06 / 56505.4
4	.19	422	15.132	31.8	29718.53 / 53574
5	.2	411	15.132	32.42	30680.59 / 54618.52
6	.14	445	15.132	27.65	25183.46 / 46582.42
7	.14	461	15.132	27.89	24960.75 / 46986.75
8	.1	430	15.132	23.17	21458.77 / 39034.89

STATIC PRESS. (IN. H2O) = -.08
AVG. VEL. (FT/SEC) = 29.905

********** VELOCITY TRAVERSE SUMMARY **********

AVG. SQ.ROOT OF DP (IN.H2O) = .413364002
AVG. FLUE GAS TEMP. (F) = 411.875
AVG. PERCENT O2 IN FLUE GAS = 15.132
AVG. GAS VELOCITY (FT/SEC) = 29.965625
AVG. FLOW RATE (DSCFM) = 28371.15
(ACFM) = 50483.5925

VELOCITY TRAVERSE DATA

CLIENT:ENTERPRISE PRODUCTS
UNIT NO.:ISOM DIB # 7
TEST DATE:1-17-91

TEST I.D.:C # 2-2
SAMPLING LOCATION:STACK
OPERATIONAL STATUS:1421 DEG F

********** TEST CONDITIONS **********

UNIT LOAD (MW)	=	83.42
DUCT DIAMETER (FT)	=	5.9792
BAROMETRIC PRESSURE (IN. HG)	=	30.26
PERCENT MOISTURE IN FLUE GAS	=	8.09
PERCENT CO2 IN FLUE GAS	=	3.6
TENERX PROBE NUMBER	=	8
PITOT TUBE COEFFICIENT	=	.84

********** PORT 1 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.2	367	15.152	31.58	31568.44 / 53203.36
2	.2	375	15.152	31.73	31414.5 / 53456.07
3	.18	377	15.152	30.14	29769 / 50777.37
4	.17	385	15.152	29.43	28792.55 / 49581.22
5	.2	381	15.152	31.84	31298.5 / 53641.39
6	.21	382	15.152	32.65	32056.61 / 55006.01
7	.16	384	15.152	28.53	27945.11 / 48064.97
8	.12	380	15.152	24.65	24259.63 / 41528.27

STATIC PRESS. (IN. H2O) = [illegible].08
AVG. VEL. (FT/SEC) = [illegible]0.06875

********** PORT 2 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.19	453	15.152	32.34	29283.01 / 54483.74
2	.2	457	15.152	33.25	29975.67 / 56016.84
3	.22	450	15.152	34.74	31559.85 / 58527.06
4	.19	420	15.152	31.75	29826.86 / 53489.76
5	.18	405	15.152	30.64	29283.24 / 51619.73
6	.16	438	15.152	29.43	27093.21 / 49581.22
7	.12	460	15.152	25.8	23183.47 / 43465.7
8	.1	456	15.152	23.5	21208.94 / 39590.85

STATIC PRESS. (IN. H2O) = -.08
AVG. VEL. (FT/SEC) = 30.18125

********** VELOCITY TRAVERSE SUMMARY **********

AVG. SQ.ROOT OF DP (IN.H2O) = .416113757
AVG. FLUE GAS TEMP. (F) = 410.625
AVG. PERCENT O2 IN FLUE GAS = 15.152
AVG. GAS VELOCITY (FT/SEC) = 30.125
AVG. FLOW RATE (DSCFM) = 28657.4119
(ACFM) = 50752.0975

VELOCITY TRAVERSE DATA

CLIENT:ENTERPRISE PRODUCTS
UNIT NO.:ISOM DIB # 7
TEST DATE:1-17-91

TEST I.D.:C # 2-3
SAMPLING LOCATION:STACK
OPERATIONAL STATUS:1420 DEG F

********** TEST CONDITIONS **********

UNIT LOAD (MW)	=	83.2
DUCT DIAMETER (FT)	=	5.9792
BAROMETRIC PRESSURE (IN. HG)	=	30.22
PERCENT MOISTURE IN FLUE GAS	=	10.24
PERCENT CO2 IN FLUE GAS	=	3.8
TENERX PROBE NUMBER	=	8
PITOT TUBE COEFFICIENT	=	.84

********** PORT 1 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.21	367	15.104	32.5	31687.72 / 54753.3
2	.18	372	15.104	30.18	29248.87 / 50844.76
3	.2	410	15.104	32.53	30149.35 / 54803.84
4	.2	416	15.104	32.64	30044.1 / 54989.16
5	.2	385	15.104	32.06	30592.85 / 54012.02
6	.18	382	15.104	30.36	29073.87 / 51148
7	.14	382	15.104	26.77	25635.95 / 45099.87
8	.11	359	15.104	23.41	23047.86 / 39439.22

STATIC PRESS. (IN. H2O) = -.06
AVG. VEL. (FT/SEC) = 30.05625

********** PORT 2 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.2	450	15.104	33.27	29479.8 / 56050.53
2	.21	470	15.104	34.46	29877.58 / 58055.34
3	.22	456	15.104	35.01	30818.38 / 58981.94
4	.21	430	15.104	33.71	30540.91 / 56791.81
5	.21	423	15.104	33.58	30664.31 / 56572.79
6	.16	454	15.104	29.82	26307.2 / 50238.26
7	.11	452	15.104	24.7	21838.12 / 41612.51
8	.1	426	15.104	23.21	21122.95 / 39102.28

STATIC PRESS. (IN. H2O) = -.06
AVG. VEL. (FT/SEC) = 30.97

********** VELOCITY TRAVERSE SUMMARY **********

AVG. SQ.ROOT OF DP (IN.H2O) = .418323302
AVG. FLUE GAS TEMP. (F) = 414.625
AVG. PERCENT O2 IN FLUE GAS = 15.104
AVG. GAS VELOCITY (FT/SEC) = 30.513125
AVG. FLOW RATE (DSCFM) = 28133.1138
(ACFM) = 51405.9769

VELOCITY TRAVERSE DATA

CLIENT:ENTERPRISE PRODUCTS
UNIT NO.:ISOM DIB # 7
TEST DATE:1-24-91

TEST I.D.:C # 4-1
SAMPLING LOCATION:STACK
OPERATIONAL STATUS:1403 DEG F

********** TEST CONDITIONS **********

UNIT LOAD (MW)	=	81.39
DUCT DIAMETER (FT)	=	5.9792
BAROMETRIC PRESSURE (IN. HG)	=	30.22
PERCENT MOISTURE IN FLUE GAS	=	8
PERCENT CO2 IN FLUE GAS	=	3.2
TENERX PROBE NUMBER	=	8
PITOT TUBE COEFFICIENT	=	.84

********** PORT 1 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.18	381	15.373	30.25	29726.76 / 50962.69
2	.18	392	15.373	30.45	29536.96 / 51299.63
3	.17	389	15.373	29.54	28755.5 / 49766.54
4	.16	392	15.373	28.7	27839.44 / 48351.37
5	.14	386	15.373	26.76	26141.7 / 45083.02
6	.15	383	15.373	27.65	27107.27 / 46582.42
7	.12	383	15.373	24.73	24244.58 / 41663.05
8	.1	371	15.373	22.41	22287.38 / 37754.51

STATIC PRESS. (IN. H2O) = -.06
AVG. VEL. (FT/SEC) = 27.56125

********** PORT 2 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.16	464	15.373	29.89	26734.5 / 50356.19
2	.2	456	15.373	33.28	30026.59 / 56067.38
3	.21	454	15.373	34.06	30797.58 / 57381.46
4	.15	420	15.373	28.25	26531.02 / 47593.25
5	.14	437	15.373	27.55	25383.25 / 46413.95
6	.14	465	15.373	27.98	24999.09 / 47138.38
7	.11	460	15.373	24.73	22215.41 / 41663.05
8	.1	439	15.373	23.31	21428.94 / 39270.75

STATIC PRESS. (IN. H2O) = -.06
AVG. VEL. (FT/SEC) = 28.63125

********** VELOCITY TRAVERSE SUMMARY **********

AVG. SQ.ROOT OF DP (IN.H2O) = .385870745
AVG. FLUE GAS TEMP. (F) = 417
AVG. PERCENT O2 IN FLUE GAS = 15.373
AVG. GAS VELOCITY (FT/SEC) = 28.09625
AVG. FLOW RATE (DSCFM) = 26484.7481
(ACFM) = 47334.2275

VELOCITY TRAVERSE DATA

CLIENT:ENTERPRISE PRODUCTS
UNIT NO.:ISOM DIB # 7
TEST DATE:1-24-91

TEST I.D.:C # 4-2
SAMPLING LOCATION:STACK
OPERATIONAL STATUS:1401 DEG F

********** TEST CONDITIONS **********

UNIT LOAD (MW)	=	81.9
DUCT DIAMETER (FT)	=	5.9792
BAROMETRIC PRESSURE (IN. HG)	=	30.22
PERCENT MOISTURE IN FLUE GAS	=	7.81
PERCENT CO2 IN FLUE GAS	=	3.3
TENERX PROBE NUMBER	=	8
PITOT TUBE COEFFICIENT	=	.84

********** PORT 1 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.18	339	15.368	29.46	30535.9 / 49631.76
2	.2	371	15.368	31.67	31562.52 / 53354.98
3	.2	382	15.368	31.88	31356.74 / 53708.77
4	.16	402	15.368	28.85	27718.09 / 48604.08
5	.14	399	15.368	26.94	25973.42 / 45386.27
6	.14	390	15.368	26.8	26112.03 / 45150.41
7	.11	385	15.368	23.69	23218.44 / 39910.94
8	.1	377	15.368	22.48	22243.11 / 37872.44

STATIC PRESS. (IN. H2O) = -.05
AVG. VEL. (FT/SEC) = 27.72125

********** PORT 2 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.2	438	15.368	32.93	30369.67 / 55477.73
2	.18	448	15.368	31.41	28648.82 / 52916.96
3	.17	451	15.368	30.58	27799.94 / 51518.64
4	.16	413	15.368	29.04	27549.08 / 48924.18
5	.16	438	15.368	29.45	27160.24 / 49614.91
6	.16	451	15.368	29.66	26963.57 / 49968.7
7	.12	454	15.368	25.73	23314.08 / 43347.77
8	.09	438	15.368	22.09	20372.49 / 37215.4

STATIC PRESS. (IN. H2O) = -.05
AVG. VEL. (FT/SEC) = 28.86125

********** VELOCITY TRAVERSE SUMMARY **********

AVG. SQ.ROOT OF DP (IN.H2O) = .390319461
AVG. FLUE GAS TEMP. (F) = 411
AVG. PERCENT O2 IN FLUE GAS = 15.368
AVG. GAS VELOCITY (FT/SEC) = 28.29125
AVG. FLOW RATE (DSCFM) = 26931.1338
(ACFM) = 47662.7463

VELOCITY TRAVERSE DATA

CLIENT:ENTERPRISE PRODUCTS
UNIT NO.:ISOM DIB # 7
TEST DATE:1-24-91

TEST I.D.:C # 4-3
SAMPLING LOCATION:STACK
OPERATIONAL STATUS:1398 DEG F

********** TEST CONDITIONS **********

UNIT LOAD (MW)	=	82.17
DUCT DIAMETER (FT)	=	5.9792
BAROMETRIC PRESSURE (IN. HG)	=	30.25
PERCENT MOISTURE IN FLUE GAS	=	7.71
PERCENT CO2 IN FLUE GAS	=	3.2
TENERX PROBE NUMBER	=	8
PITOT TUBE COEFFICIENT	=	.84

********** PORT 1 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.17	362	15.393	29.03	29308.34 / 48907.33
2	.18	373	15.393	30.07	29957.42 / 50659.44
3	.18	380	15.393	30.2	29836.21 / 50878.45
4	.16	394	15.393	28.71	27899.17 / 48368.22
5	.14	386	15.393	26.73	26220.72 / 45032.48
6	.12	387	15.393	24.76	24259.57 / 41713.59
7	.1	386	15.393	22.59	22159.59 / 38057.75
8	.1	369	15.393	22.36	22383.77 / 37670.27

STATIC PRESS. (IN. H2O) = -.06
AVG. VEL. (FT/SEC) = 26.80625

********** PORT 2 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.2	440	15.393	32.95	30382.87 / 55511.42
2	.19	454	15.393	32.36	29381.79 / 54517.44
3	.2	449	15.393	33.11	30228.13 / 55780.98
4	.18	413	15.393	30.79	29269.24 / 51872.43
5	.14	444	15.393	27.63	25364.62 / 46548.73
6	.1	461	15.393	23.57	21238.11 / 39708.78
7	.09	460	15.393	22.35	20160.7 / 37653.42
8	.08	431	15.393	20.73	19308.01 / 34924.18

STATIC PRESS. (IN. H2O) = -.06
AVG. VEL. (FT/SEC) = 27.93625

********** VELOCITY TRAVERSE SUMMARY **********

AVG. SQ.ROOT OF DP (IN.H2O) = .377605469
AVG. FLUE GAS TEMP. (F) = 411.8125
AVG. PERCENT O2 IN FLUE GAS = 15.393
AVG. GAS VELOCITY (FT/SEC) = 27.37125
AVG. FLOW RATE (DSCFM) = 26084.8913
(ACFM) = 46112.8069

********** EPA METHOD 4 **********
********** FLUE MOISTURE DETERMINATION **********

COMPANY	-	ENTERPRISE PRODUCTS
LOCATION	-	MONT BELVIEU; TX
UNIT TESTED	-	ISOM DIB # 7

********** TEST CONDITIONS **********

TEST NUMBER	-	C # 2-1
TEST DATE	-	1-17-91
TEST SITE	-	STACK
UNIT LOAD	-	82.85%
BAROMETRIC PRESSURE (IN HG)	-	30.26
DUCT AREA AT SAMPLING PLANE (SQ. FT.)	-	28.0783

********** FUEL PARAMETERS **********

TYPE OF FUEL USED		30% ETH/70% NG

********** SAMPLING RESULTS **********

CONTROL BOX DELTA H STD	-	1.53
DRY GAS METER CORRECTION FACTOR	-	0.988
AVG. DELTA H (INCHES H2O)	-	1.7
AVG. METER TEMPERATURE (F)	-	68.75
ELAPSED SAMPLING TIME (MINUTES)	-	64
METER VOLUME (CF,UNCORR./CORR.)	-	50.64 / 50.03
METER VOLUME @ STD COND. (DSCF)	-	50.72
MOISTURE MEASURED BY VOL. (ML/SCF)	-	/ 0
MOISTURE MEASURED BY WT. (GRAM/SCF)	-	98.1 / 4.63
TOTAL MOIST. CATCH (ML/GRAM)	-	98.28 / 98.1

********** FLUE GAS PARAMETERS **********

EXCESS OXYGEN (PERCENT, DRY)	-	15.132
CARBON DIOXIDE (PERCENT,ACTUAL)	-	3.6
FLUE GAS TEMPERATURE (F)	-	411.88
MOLECULAR WEIGHT (DRY/WET)	-	29.18 / 28.25
FLUE GAS MOISTURE CONTENT (%)	-	8.36

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********** EPA METHOD 4 **********
********** FLUE MOISTURE DETERMINATION **********

COMPANY	-	ENTERPRISE PRODUCTS
LOCATION	-	MONT BELVIEU; TX
UNIT TESTED	-	ISOM DIB # 7

********** TEST CONDITIONS **********

TEST NUMBER	-	C # 2-2
TEST DATE	-	1-17-91
TEST SITE	-	STACK
UNIT LOAD	-	83.42%
BAROMETRIC PRESSURE (IN HG)	-	30.26
DUCT AREA AT SAMPLING PLANE (SQ. FT.)	-	28.0783

********** FUEL PARAMETERS **********

TYPE OF FUEL USED		30% ETH/70% NG

********** SAMPLING RESULTS **********

CONTROL BOX DELTA H STD	-	1.53
DRY GAS METER CORRECTION FACTOR	-	0.988
AVG. DELTA H (INCHES H2O)	-	2.0
AVG. METER TEMPERATURE (F)	-	69.1
ELAPSED SAMPLING TIME (MINUTES)	-	64
METER VOLUME (CF,UNCORR./CORR.)	-	56.41 / 55.73
METER VOLUME @ STD COND. (DSCF)	-	56.5
MOISTURE MEASURED BY VOL. (ML/SCF)	-	/ 0
MOISTURE MEASURED BY WT. (GRAM/SCF)	-	105.5 / 4.97
TOTAL MOIST. CATCH (ML/GRAM)	-	105.69 / 105.5

********** FLUE GAS PARAMETERS **********

EXCESS OXYGEN (PERCENT, DRY)	-	15.152
CARBON DIOXIDE (PERCENT,ACTUAL)	-	3.6
FLUE GAS TEMPERATURE (F)	-	410.625
MOLECULAR WEIGHT (DRY/WET)	-	29.18 / 28.28
FLUE GAS MOISTURE CONTENT (%)	-	8.09

****

********** EPA METHOD 4 **********
********** FLUE MOISTURE DETERMINATION **********

COMPANY	-	ENTERPRISE PRODUCTS
LOCATION	-	MONT BELVIEU; TX
UNIT TESTED	-	ISOM DIB # 7

********** TEST CONDITIONS **********

TEST NUMBER	-	C # 2-3
TEST DATE	-	1-17-91
TEST SITE	-	STACK
UNIT LOAD	-	83.20%
BAROMETRIC PRESSURE (IN HG)	-	30.22
DUCT AREA AT SAMPLING PLANE (SQ. FT.)	-	28.0783

********** FUEL PARAMETERS **********

TYPE OF FUEL USED		30% ETH/70% NG

********** SAMPLING RESULTS **********

CONTROL BOX DELTA H STD	-	1.53
DRY GAS METER CORRECTION FACTOR	-	0.988
AVG. DELTA H (INCHES H2O)	-	1
AVG. METER TEMPERATURE (F)	-	69.4
ELAPSED SAMPLING TIME (MINUTES)	-	64
METER VOLUME (CF,UNCORR./CORR.)	-	39.595 / 39.12
METER VOLUME @ STD COND. (DSCF)	-	39.49
MOISTURE MEASURED BY VOL. (ML/SCF)	-	/ 0
MOISTURE MEASURED BY WT. (GRAM/SCF)	-	95.5 / 4.5
TOTAL MOIST. CATCH (ML/GRAM)	-	95.67 / 95.5

********** FLUE GAS PARAMETERS **********

EXCESS OXYGEN (PERCENT, DRY)	-	15.104
CARBON DIOXIDE (PERCENT,ACTUAL)	-	3.8
FLUE GAS TEMPERATURE (F)	-	414.625
MOLECULAR WEIGHT (DRY/WET)	-	29.21 / 28.06
FLUE GAS MOISTURE CONTENT (%)	-	10.24

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********** EPA METHOD 4 **********
********** FLUE MOISTURE DETERMINATION **********

COMPANY	-	ENTERPRISE PRODUCTS
LOCATION	-	MONT BELVIEU; TX
UNIT TESTED	-	ISOM DIB # 7

********** TEST CONDITIONS **********

TEST NUMBER	-	C # 4-1
TEST DATE	-	1-24-91
TEST SITE	-	STACK
UNIT LOAD	-	81.39
BAROMETRIC PRESSURE (IN HG)	-	30.22
DUCT AREA AT SAMPLING PLANE (SQ. FT.)	-	28.0783

********** FUEL PARAMETERS **********

TYPE OF FUEL USED		100% NG

********** SAMPLING RESULTS **********

CONTROL BOX DELTA H STD	-	1.53
DRY GAS METER CORRECTION FACTOR	-	0.988
AVG. DELTA H (INCHES H2O)	-	1
AVG. METER TEMPERATURE (F)	-	68.47
ELAPSED SAMPLING TIME (MINUTES)	-	64
METER VOLUME (CF,UNCORR./CORR.)	-	40.71 / 40.22
METER VOLUME @ STD COND. (DSCF)	-	40.67
MOISTURE MEASURED BY VOL. (ML/SCF)	-	/ 0
MOISTURE MEASURED BY WT. (GRAM/SCF)	-	75 / 3.54
TOTAL MOIST. CATCH (ML/GRAM)	-	75.14 / 75

********** FLUE GAS PARAMETERS **********

EXCESS OXYGEN (PERCENT, DRY)	-	15.373
CARBON DIOXIDE (PERCENT,ACTUAL)	-	3.2
FLUE GAS TEMPERATURE (F)	-	417
MOLECULAR WEIGHT (DRY/WET)	-	29.13 / 28.24
FLUE GAS MOISTURE CONTENT (%)	-	8

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********** EPA METHOD 4 **********
********** FLUE MOISTURE DETERMINATION **********

COMPANY	-	ENTERPRISE PRODUCTS
LOCATION	-	MONT BELVIEU; TX
UNIT TESTED	-	ISOM DIB # 7

********** TEST CONDITIONS **********

TEST NUMBER	-	C # 4-2
TEST DATE	-	1-24-91
TEST SITE	-	STACK
UNIT LOAD	-	81.90%
BAROMETRIC PRESSURE (IN HG)	-	30.22
DUCT AREA AT SAMPLING PLANE (SQ. FT.)	-	28.0783

********** FUEL PARAMETERS **********

TYPE OF FUEL USED		100% NG

********** SAMPLING RESULTS **********

CONTROL BOX DELTA H STD	-	1.53
DRY GAS METER CORRECTION FACTOR	-	0.988
AVG. DELTA H (INCHES H2O)	-	1
AVG. METER TEMPERATURE (F)	-	69.16
ELAPSED SAMPLING TIME (MINUTES)	-	64
METER VOLUME (CF,UNCORR./CORR.)	-	40.335 / 39.85
METER VOLUME @ STD COND. (DSCF)	-	40.24
MOISTURE MEASURED BY VOL. (ML/SCF)	-	/ 0
MOISTURE MEASURED BY WT. (GRAM/SCF)	-	72.3 / 3.41
TOTAL MOIST. CATCH (ML/GRAM)	-	72.43 / 72.3

********** FLUE GAS PARAMETERS **********

EXCESS OXYGEN (PERCENT, DRY)	-	15.368
CARBON DIOXIDE (PERCENT,ACTUAL)	-	3.3
FLUE GAS TEMPERATURE (F)	-	411.063
MOLECULAR WEIGHT (DRY/WET)	-	29.14 / 28.27
FLUE GAS MOISTURE CONTENT (%)	-	7.81

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********** EPA METHOD 4 **********
********** FLUE MOISTURE DETERMINATION **********

COMPANY	-	ENTERPRISE PRODUCTS
LOCATION	-	MONT BELVIEU; TX
UNIT TESTED	-	ISOM DIB # 7

********** TEST CONDITIONS **********

TEST NUMBER	-	C # 4-3
TEST DATE	-	1-24-91
TEST SITE	-	STACK
UNIT LOAD	-	82.17%
BAROMETRIC PRESSURE (IN HG)	-	30.25
DUCT AREA AT SAMPLING PLANE (SQ. FT.)	-	28.0783

********** FUEL PARAMETERS **********

TYPE OF FUEL USED		100% NG

********** SAMPLING RESULTS **********

CONTROL BOX DELTA H STD	-	1.53
DRY GAS METER CORRECTION FACTOR	-	0.988
AVG. DELTA H (INCHES H2O)	-	1
AVG. METER TEMPERATURE (F)	-	71.125
ELAPSED SAMPLING TIME (MINUTES)	-	64
METER VOLUME (CF,UNCORR./CORR.)	-	39.732 / 39.26
METER VOLUME @ STD COND. (DSCF)	-	39.53
MOISTURE MEASURED BY VOL. (ML/SCF)	-	/ 0
MOISTURE MEASURED BY WT. (GRAM/SCF)	-	70 / 3.3
TOTAL MOIST. CATCH (ML/GRAM)	-	70.13 / 70

********** FLUE GAS PARAMETERS **********

EXCESS OXYGEN (PERCENT, DRY)	-	15.393
CARBON DIOXIDE (PERCENT,ACTUAL)	-	3.2
FLUE GAS TEMPERATURE (F)	-	411.813
MOLECULAR WEIGHT (DRY/WET)	-	29.13 / 28.27
FLUE GAS MOISTURE CONTENT (%)	-	7.71

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VELOCITY TRAVERSE DATA

CLIENT:ENTERPRISE PRODUCTS
UNIT NO.:ISOM DIB # 8
TEST DATE:1-17-91

TEST I.D.:C # 1-1
SAMPLING LOCATION:STACK
OPERATIONAL STATUS:1418 DEG F

********** TEST CONDITIONS **********

UNIT LOAD (MW)	=	88.4
DUCT DIAMETER (FT)	=	5.9792
BAROMETRIC PRESSURE (IN. HG)	=	30.4
PERCENT MOISTURE IN FLUE GAS	=	7.62
PERCENT CO2 IN FLUE GAS	=	3.8
TENERX PROBE NUMBER	=	8
PITOT TUBE COEFFICIENT	=	.84

********** PORT 1 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.16	386	15.213	28.46	28082.21 / 47947.04
2	.15	394	15.213	27.68	27056.71 / 46632.96
3	.16	400	15.213	28.69	27848.31 / 48334.53
4	.15	414	15.213	28	26743.2 / 47172.07
5	.18	398	15.213	30.4	29576.93 / 51215.39
6	.18	397	15.213	30.38	29591.96 / 51181.7
7	.15	401	15.213	27.8	26953.08 / 46835.13
8	.11	397	15.213	23.75	23133.94 / 40012.03

STATIC PRESS. (IN. H2O) = -.08
AVG. VEL. (FT/SEC) = 29.145

********** PORT 2 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.17	422	15.213	29.95	28346.21 / 50457.27
2	.17	431	15.213	30.1	28200.42 / 50709.98
3	.16	406	15.213	28.79	27751.76 / 48503
4	.15	438	15.213	28.39	26391 / 47829.11
5	.13	448	15.213	26.57	24427.13 / 44762.93
6	.11	446	15.213	24.42	22500.09 / 41140.79
7	.08	418	15.213	20.5	19490.64 / 34536.7
8	.09	408	15.213	21.62	20792.31 / 36423.58

STATIC PRESS. (IN. H2O) = -.08
AVG. VEL. (FT/SEC) = 26.2925

********** VELOCITY TRAVERSE SUMMARY **********

AVG. SQ.ROOT OF DP (IN.H2O) = .376816588
AVG. FLUE GAS TEMP. (F) = 412.75
AVG. PERCENT O2 IN FLUE GAS = 15.213
AVG. GAS VELOCITY (FT/SEC) = 27.21875
AVG. FLOW RATE (DSCFM) = 26055.3688
(ACFM) = 45855.8881

VELOCITY TRAVERSE DATA

CLIENT:ENTERPRISE PRODUCTS
UNIT NO.:ISOM DIB # 8
TEST DATE:1-17-91

TEST I.D.:C # 1-2
SAMPLING LOCATION:STACK
OPERATIONAL STATUS:1418 DEG F

********** TEST CONDITIONS **********

UNIT LOAD (MW)	=	88.75
DUCT DIAMETER (FT)	=	5.9792
BAROMETRIC PRESSURE (IN. HG)	=	30.35
PERCENT MOISTURE IN FLUE GAS	=	7.31
PERCENT CO2 IN FLUE GAS	=	3.4
TENERX PROBE NUMBER	=	8
PITOT TUBE COEFFICIENT	=	.84

********** PORT 1 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.18	386	15.435	30.22	29869.69 / 50912.14
2	.19	394	15.435	31.19	30539.66 / 52546.32
3	.17	406	15.435	29.71	28687.41 / 50052.94
4	.17	404	15.435	29.68	28724.79 / 50002.4
5	.16	393	15.435	28.61	28046.29 / 48199.75
6	.14	393	15.435	26.76	26232.74 / 45083.02
7	.1	402	15.435	22.73	22049.5 / 38293.61
8	.1	404	15.435	22.76	22027.5 / 38344.16

STATIC PRESS. (IN. H2O) = -.08
AVG. VEL. (FT/SEC) = 27.7075

********** PORT 2 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.18	425	15.435	30.9	29195.9 / 52057.75
2	.17	422	15.435	29.98	28422.99 / 50507.81
3	.16	415	15.435	28.97	27685.16 / 48806.25
4	.14	404	15.435	26.93	26063.29 / 45369.43
5	.13	441	15.435	26.5	24593.92 / 44645
6	.13	444	15.435	26.54	24549.3 / 44712.39
7	.13	444	15.435	26.54	24549.3 / 44712.39
8	.1	419	15.435	22.96	21841.86 / 38681.1

STATIC PRESS. (IN. H2O) = -.08
AVG. VEL. (FT/SEC) = 27.415

********** VELOCITY TRAVERSE SUMMARY **********

AVG. SQ.ROOT OF DP (IN.H2O) = .381251867
AVG. FLUE GAS TEMP. (F) = 412.25
AVG. PERCENT O2 IN FLUE GAS = 15.435
AVG. GAS VELOCITY (FT/SEC) = 27.56125
AVG. FLOW RATE (DSCFM) = 26442.4563
(ACFM) = 46432.9038

VELOCITY TRAVERSE DATA

CLIENT:ENTERPRISE PRODUCTS
UNIT NO.:ISOM DIB # 8
TEST DATE:1-17-91

TEST I.D.:C # 1-3
SAMPLING LOCATION:STACK
OPERATIONAL STATUS:1417 DEG F

********** TEST CONDITIONS **********

UNIT LOAD (MW)	=	89.1
DUCT DIAMETER (FT)	=	5.9792
BAROMETRIC PRESSURE (IN. HG)	=	30.24
PERCENT MOISTURE IN FLUE GAS	=	7.95
PERCENT CO2 IN FLUE GAS	=	3.2
TENERX PROBE NUMBER	=	8
PITOT TUBE COEFFICIENT	=	.84

********** PORT 1 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.22	385	15.288	33.51	32814 / 56454.86
2	.22	398	15.288	33.76	32557.92 / 56876.04
3	.18	401	15.288	30.59	29398 / 51535.49
4	.17	409	15.288	29.87	28441.79 / 50322.49
5	.16	403	15.288	28.88	27690.31 / 48654.62
6	.13	399	15.288	25.97	25016.14 / 43752.1
7	.12	398	15.288	24.94	24051.97 / 42016.84
8	.09	398	15.288	21.6	20830.9 / 36389.88

STATIC PRESS. (IN. H2O) = -.06
AVG. VEL. (FT/SEC) = 28.64

********** PORT 2 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.18	423	15.288	30.98	29031.01 / 52192.53
2	.17	419	15.288	30.04	28278.25 / 50608.89
3	.16	400	15.288	28.83	27738.8 / 48570.39
4	.14	436	15.288	27.52	25414.52 / 46363.41
5	.12	443	15.288	25.58	23439.82 / 43095.06
6	.12	449	15.288	25.67	23367.03 / 43246.68
7	.1	441	15.288	23.33	21425.52 / 39304.44
8	.09	404	15.288	21.67	20753.28 / 36507.81

STATIC PRESS. (IN. H2O) = -.06
AVG. VEL. (FT/SEC) = 26.7025

********** VELOCITY TRAVERSE SUMMARY **********

AVG. SQ.ROOT OF DP (IN.H2O) = .381338221
AVG. FLUE GAS TEMP. (F) = 412.875
AVG. PERCENT O2 IN FLUE GAS = 15.288
AVG. GAS VELOCITY (FT/SEC) = 27.67125
AVG. FLOW RATE (DSCFM) = 26265.5788
(ACFM) = 46618.2206

VELOCITY TRAVERSE DATA

CLIENT:ENTERPRISE PRODUCTS
UNIT NO.:ISOM DIB # 8
TEST DATE:1-21-91

TEST I.D.:C # 3-1
SAMPLING LOCATION:STACK
OPERATIONAL STATUS:1420 DEG F

********** TEST CONDITIONS **********

UNIT LOAD (MW)	=	98.2
DUCT DIAMETER (FT)	=	5.9792
BAROMETRIC PRESSURE (IN. HG)	=	30.37
PERCENT MOISTURE IN FLUE GAS	=	6.86
PERCENT CO2 IN FLUE GAS	=	2.8
TENERX PROBE NUMBER	=	8
PITOT TUBE COEFFICIENT	=	.84

********** PORT 1 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.22	396	15.95	33.6	33008.42 / 56606.49
2	.22	400	15.95	33.68	32933.12 / 56741.26
3	.2	406	15.95	32.22	31287.21 / 54281.58
4	.2	403	15.95	32.17	31347.26 / 54197.34
5	.18	402	15.95	30.5	29754.44 / 51383.86
6	.16	403	15.95	28.77	28034.21 / 48469.3
7	.11	395	15.95	23.75	23359.13 / 40012.03
8	.1	387	15.95	22.53	22368.51 / 37956.67

STATIC PRESS. (IN. H2O) = -.02
AVG. VEL. (FT/SEC) = 29.6525

********** PORT 2 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.19	416	15.95	31.59	30325.28 / 53220.21
2	.2	425	15.95	32.57	30948.08 / 54871.23
3	.18	418	15.95	30.78	29480.4 / 51855.59
4	.18	403	15.95	30.52	29739.45 / 51417.56
5	.17	432	15.95	30.15	28423.77 / 50794.21
6	.14	448	15.95	27.61	25570.53 / 46515.03
7	.1	451	15.95	23.37	21572.46 / 39371.83
8	.09	417	15.95	21.75	20855.42 / 36642.59

STATIC PRESS. (IN. H2O) = -.02
AVG. VEL. (FT/SEC) = 28.5425

********** VELOCITY TRAVERSE SUMMARY **********

AVG. SQ.ROOT OF DP (IN.H2O) = .402437522
AVG. FLUE GAS TEMP. (F) = 412.625
AVG. PERCENT O2 IN FLUE GAS = 15.95
AVG. GAS VELOCITY (FT/SEC) = 29.0975
AVG. FLOW RATE (DSCFM) = 28062.9806
(ACFM) = 49021.0488

VELOCITY TRAVERSE DATA

CLIENT:ENTERPRISE PRODUCTS
UNIT NO.:ISOM DIB # 8
TEST DATE:1-21-91

TEST I.D.:C # 3-2
SAMPLING LOCATION:STACK
OPERATIONAL STATUS:1421 DEG F

********** TEST CONDITIONS **********

UNIT LOAD (MW)	=	98.84
DUCT DIAMETER (FT)	=	5.9792
BAROMETRIC PRESSURE (IN. HG)	=	30.37
PERCENT MOISTURE IN FLUE GAS	=	7.19
PERCENT CO2 IN FLUE GAS	=	2.6
TENERX PROBE NUMBER	=	8
PITOT TUBE COEFFICIENT	=	.84

********** PORT 1 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.25	398	15.947	35.9	35057.66 / 60481.34
2	.22	399	15.947	33.7	32870.97 / 56774.96
3	.2	399	15.947	32.13	31339.59 / 54129.95
4	.19	424	15.947	31.77	30112.07 / 53523.46
5	.18	401	15.947	30.52	29700.05 / 51417.56
6	.15	391	15.947	27.7	27272.56 / 46666.66
7	.11	401	15.947	23.86	23218.97 / 40197.34
8	.1	402	15.947	22.76	22122.83 / 38344.16

STATIC PRESS. (IN. H2O) = -.06
AVG. VEL. (FT/SEC) = 29.7925

********** PORT 2 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.21	454	15.947	33.96	31131.3 / 57212.99
2	.2	442	15.947	32.93	30588.69 / 55477.73
3	.18	417	15.947	30.8	29425.7 / 51889.28
4	.16	409	15.947	28.91	27874.3 / 48705.16
5	.15	445	15.947	28.56	26441.46 / 48115.51
6	.13	456	15.947	26.75	24468.31 / 45066.18
7	.1	442	15.947	23.28	21624.8 / 39220.21
8	.08	419	15.947	20.56	19597.92 / 34637.78

STATIC PRESS. (IN. H2O) = -.06
AVG. VEL. (FT/SEC) = 28.21875

********** VELOCITY TRAVERSE SUMMARY **********

AVG. SQ.ROOT OF DP (IN.H2O) = .399266056
AVG. FLUE GAS TEMP. (F) = 418.6875
AVG. PERCENT O2 IN FLUE GAS = 15.947
AVG. GAS VELOCITY (FT/SEC) = 29.005625
AVG. FLOW RATE (DSCFM) = 27677.9488
(ACFM) = 48866.2669

VELOCITY TRAVERSE DATA

CLIENT:ENTERPRISE PRODUCTS
UNIT NO.:ISOM DIB # 8
TEST DATE:1-21-91

TEST I.D.:C # 3-3
SAMPLING LOCATION:STACK
OPERATIONAL STATUS:1420 DEG F

********** TEST CONDITIONS **********

UNIT LOAD (MW)	=	99.1
DUCT DIAMETER (FT)	=	5.9792
BAROMETRIC PRESSURE (IN. HG)	=	30.37
PERCENT MOISTURE IN FLUE GAS	=	9.12
PERCENT CO2 IN FLUE GAS	=	2.9
TENERX PROBE NUMBER	=	8
PITOT TUBE COEFFICIENT	=	.84

********** PORT 1 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.21	380	16.001	32.66	31901.21 / 55022.85
2	.22	391	16.001	33.64	32433.72 / 56673.88
3	.2	400	16.001	32.25	30768.16 / 54332.12
4	.19	402	16.001	31.47	29954.34 / 53018.04
5	.18	406	16.001	30.7	29086.45 / 51720.81
6	.2	403	16.001	32.3	30708.74 / 54416.36
7	.17	398	16.001	29.69	28391.82 / 50019.24
8	.12	391	16.001	24.85	23958.91 / 41865.21

STATIC PRESS. (IN. H2O) = -.04
AVG. VEL. (FT/SEC) = 30.945

********** PORT 2 **********

POINT NO.	DELTA P (IN. H2O)	TEMP. (F)	%O2 (DRY)	VEL. (FT/SEC)	FLOW RATE (DSCFM/ACFM)
1	.18	426	16.001	31.05	28753.99 / 52310.46
2	.18	431	16.001	31.14	28675.51 / 52462.08
3	.17	423	16.001	30.12	27987.53 / 50743.67
4	.16	404	16.001	28.91	27453.94 / 48705.16
5	.14	434	16.001	27.51	25247.79 / 46346.56
6	.12	453	16.001	25.74	23131.73 / 43364.61
7	.12	457	16.001	25.79	23075.56 / 43448.85
8	.1	458	16.001	23.56	21057.31 / 39691.93

STATIC PRESS. (IN. H2O) = -.04
AVG. VEL. (FT/SEC) = 27.9775

********** VELOCITY TRAVERSE SUMMARY **********

AVG. SQ.ROOT OF DP (IN.H2O) = .405290847
AVG. FLUE GAS TEMP. (F) = 416.0625
AVG. PERCENT O2 IN FLUE GAS = 16.001
AVG. GAS VELOCITY (FT/SEC) = 29.46125
AVG. FLOW RATE (DSCFM) = 27661.6694
(ACFM) = 49633.8644

********** EPA METHOD 4 **********
********** FLUE MOISTURE DETERMINATION **********

COMPANY	-	ENTERPRISE PRODUCTS
LOCATION	-	MONT BELVIEU; TX
UNIT TESTED	-	ISOM DIB # 8

********** TEST CONDITIONS **********

TEST NUMBER	-	C # 1-1
TEST DATE	-	1-17-91
TEST SITE	-	STACK
UNIT LOAD	-	88.4%
BAROMETRIC PRESSURE (IN HG)	-	30.40
DUCT AREA AT SAMPLING PLANE (SQ. FT.)	-	28.0783

********** FUEL PARAMETERS **********

TYPE OF FUEL USED		30% ETH/70% NG

********** SAMPLING RESULTS **********

CONTROL BOX DELTA H STD	-	1.53
DRY GAS METER CORRECTION FACTOR	-	0.988
AVG. DELTA H (INCHES H2O)	-	0.8
AVG. METER TEMPERATURE (F)	-	68.5
ELAPSED SAMPLING TIME (MINUTES)	-	64
METER VOLUME (CF,UNCORR./CORR.)	-	35.588 / 35.16
METER VOLUME @ STD COND. (DSCF)	-	35.75
MOISTURE MEASURED BY VOL. (ML/SCF)	-	/ 0
MOISTURE MEASURED BY WT. (GRAM/SCF)	-	62.5 / 2.95
TOTAL MOIST. CATCH (ML/GRAM)	-	62.61 / 62.5

********** FLUE GAS PARAMETERS **********

EXCESS OXYGEN (PERCENT, DRY)	-	15.213
CARBON DIOXIDE (PERCENT,ACTUAL)	-	3.8
FLUE GAS TEMPERATURE (F)	-	412.75
MOLECULAR WEIGHT (DRY/WET)	-	29.22 / 28.36
FLUE GAS MOISTURE CONTENT (%)	-	7.62

****

********** EPA METHOD 4 **********
********** FLUE MOISTURE DETERMINATION **********

COMPANY -	ENTERPRISE PRODUCTS
LOCATION -	MONT BELVIEU; TX
UNIT TESTED -	ISOM DIB # 8

********** TEST CONDITIONS **********

TEST NUMBER -	C # 1-2
TEST DATE -	1-17-91
TEST SITE -	STACK
UNIT LOAD -	88.75%
BAROMETRIC PRESSURE (IN HG) -	30.35
DUCT AREA AT SAMPLING PLANE (SQ. FT.) -	28.0783

********** FUEL PARAMETERS **********

TYPE OF FUEL USED	30% ETH/70% NG

********** SAMPLING RESULTS **********

CONTROL BOX DELTA H STD -	1.53
DRY GAS METER CORRECTION FACTOR -	0.988
AVG. DELTA H (INCHES H2O) -	.6
AVG. METER TEMPERATURE (F) -	70.1
ELAPSED SAMPLING TIME (MINUTES) -	64
METER VOLUME (CF,UNCORR./CORR.) -	31.870 / 31.49
METER VOLUME @ STD COND. (DSCF) -	31.85
MOISTURE MEASURED BY VOL. (ML/SCF) -	/ 0
MOISTURE MEASURED BY WT. (GRAM/SCF) -	53.3 / 2.51
TOTAL MOIST. CATCH (ML/GRAM) -	53.4 / 53.3

********** FLUE GAS PARAMETERS **********

EXCESS OXYGEN (PERCENT, DRY) -	15.435
CARBON DIOXIDE (PERCENT,ACTUAL) -	3.4
FLUE GAS TEMPERATURE (F) -	412.25
MOLECULAR WEIGHT (DRY/WET) -	29.16 / 28.35
FLUE GAS MOISTURE CONTENT (%) -	7.31

****

********** EPA METHOD 4 **********
********** FLUE MOISTURE DETERMINATION **********

COMPANY	-	ENTERPRISE PRODUCTS
LOCATION	-	MONT BELVIEU; TX
UNIT TESTED	-	ISOM DIB # 8

********** TEST CONDITIONS **********

TEST NUMBER	-	C # 1-3
TEST DATE	-	1-17-91
TEST SITE	-	STACK
UNIT LOAD	-	89.10%
BAROMETRIC PRESSURE (IN HG)	-	30.24
DUCT AREA AT SAMPLING PLANE (SQ. FT.)	-	28.0783

********** FUEL PARAMETERS **********

TYPE OF FUEL USED		30% ETH/70% NG

********** SAMPLING RESULTS **********

CONTROL BOX DELTA H STD	-	1.53
DRY GAS METER CORRECTION FACTOR	-	0.988
AVG. DELTA H (INCHES H2O)	-	.6
AVG. METER TEMPERATURE (F)	-	68.2
ELAPSED SAMPLING TIME (MINUTES)	-	64
METER VOLUME (CF,UNCORR./CORR.)	-	31.964 / 31.58
METER VOLUME @ STD COND. (DSCF)	-	31.94
MOISTURE MEASURED BY VOL. (ML/SCF)	-	/ 0
MOISTURE MEASURED BY WT. (GRAM/SCF)	-	58.5 / 2.76
TOTAL MOIST. CATCH (ML/GRAM)	-	58.61 / 58.5

********** FLUE GAS PARAMETERS **********

EXCESS OXYGEN (PERCENT, DRY)	-	15.288
CARBON DIOXIDE (PERCENT,ACTUAL)	-	3.2
FLUE GAS TEMPERATURE (F)	-	412.88
MOLECULAR WEIGHT (DRY/WET)	-	29.12 / 28.24
FLUE GAS MOISTURE CONTENT (%)	-	7.95

****

********** EPA METHOD 4 **********
********** FLUE MOISTURE DETERMINATION **********

COMPANY	-	ENTERPRISE PRODUCTS
LOCATION	-	MONT BELVIEU; TX
UNIT TESTED	-	ISOM DIB # 8

********** TEST CONDITIONS **********

TEST NUMBER	-	C # 3-1
TEST DATE	-	1-21-91
TEST SITE	-	STACK
UNIT LOAD	-	98.20%
BAROMETRIC PRESSURE (IN HG)	-	30.37
DUCT AREA AT SAMPLING PLANE (SQ. FT.)	-	28.0783

********** FUEL PARAMETERS **********

TYPE OF FUEL USED		100% NG

********** SAMPLING RESULTS **********

CONTROL BOX DELTA H STD	-	1.53
DRY GAS METER CORRECTION FACTOR	-	0.988
AVG. DELTA H (INCHES H2O)	-	1.0
AVG. METER TEMPERATURE (F)	-	68.9
ELAPSED SAMPLING TIME (MINUTES)	-	66
METER VOLUME (CF,UNCORR./CORR.)	-	41.818 / 41.32
METER VOLUME @ STD COND. (DSCF)	-	41.95
MOISTURE MEASURED BY VOL. (ML/SCF)	-	/ 0
MOISTURE MEASURED BY WT. (GRAM/SCF)	-	65.5 / 3.09
TOTAL MOIST. CATCH (ML/GRAM)	-	65.62 / 65.5

********** FLUE GAS PARAMETERS **********

EXCESS OXYGEN (PERCENT, DRY)	-	15.950
CARBON DIOXIDE (PERCENT,ACTUAL)	-	2.8
FLUE GAS TEMPERATURE (F)	-	412.6
MOLECULAR WEIGHT (DRY/WET)	-	29.09 / 28.33
FLUE GAS MOISTURE CONTENT (%)	-	6.86

****

********** EPA METHOD 4 **********
********** FLUE MOISTURE DETERMINATION **********

COMPANY	-	ENTERPRISE PRODUCTS
LOCATION	-	MONT BELVIEU; TX
UNIT TESTED	-	ISOM DIB # 8

********** TEST CONDITIONS **********

TEST NUMBER	-	C # 3-2
TEST DATE	-	1-21-91
TEST SITE	-	STACK
UNIT LOAD	-	98.84%
BAROMETRIC PRESSURE (IN HG)	-	30.37
DUCT AREA AT SAMPLING PLANE (SQ. FT.)	-	28.0783

********** FUEL PARAMETERS **********

TYPE OF FUEL USED		100% NG

********** SAMPLING RESULTS **********

CONTROL BOX DELTA H STD	-	1.53
DRY GAS METER CORRECTION FACTOR	-	0.988
AVG. DELTA H (INCHES H2O)	-	0.8
AVG. METER TEMPERATURE (F)	-	72.03
ELAPSED SAMPLING TIME (MINUTES)	-	64
METER VOLUME (CF,UNCORR./CORR.)	-	35.717 / 35.29
METER VOLUME @ STD COND. (DSCF)	-	35.6
MOISTURE MEASURED BY VOL. (ML/SCF)	-	/ 0
MOISTURE MEASURED BY WT. (GRAM/SCF)	-	58.5 / 2.76
TOTAL MOIST. CATCH (ML/GRAM)	-	58.61 / 58.5

********** FLUE GAS PARAMETERS **********

EXCESS OXYGEN (PERCENT, DRY)	-	15.947
CARBON DIOXIDE (PERCENT,ACTUAL)	-	2.6
FLUE GAS TEMPERATURE (F)	-	418.69
MOLECULAR WEIGHT (DRY/WET)	-	29.05 / 28.26
FLUE GAS MOISTURE CONTENT (%)	-	7.19

****

********** EPA METHOD 4 **********
********** FLUE MOISTURE DETERMINATION **********

COMPANY	-	ENTERPRISE PRODUCTS
LOCATION	-	MONT BELVIEU; TX
UNIT TESTED	-	ISOM DIB # 8

********** TEST CONDITIONS **********

TEST NUMBER	-	C # 3-3
TEST DATE	-	1-21-91
TEST SITE	-	STACK
UNIT LOAD	-	99.1%
BAROMETRIC PRESSURE (IN HG)	-	30.37
DUCT AREA AT SAMPLING PLANE (SQ. FT.)	-	28.0783

********** FUEL PARAMETERS **********

TYPE OF FUEL USED		100% NG

********** SAMPLING RESULTS **********

CONTROL BOX DELTA H STD	-	1.53
DRY GAS METER CORRECTION FACTOR	-	0.988
AVG. DELTA H (INCHES H2O)	-	1
AVG. METER TEMPERATURE (F)	-	71.1
ELAPSED SAMPLING TIME (MINUTES)	-	66
METER VOLUME (CF,UNCORR./CORR.)	-	41.506 / 41.01
METER VOLUME @ STD COND. (DSCF)	-	41.47
MOISTURE MEASURED BY VOL. (ML/SCF)	-	/ 0
MOISTURE MEASURED BY WT. (GRAM/SCF)	-	88.3 / 4.16
TOTAL MOIST. CATCH (ML/GRAM)	-	88.46 / 88.3

********** FLUE GAS PARAMETERS **********

EXCESS OXYGEN (PERCENT, DRY)	-	16.001
CARBON DIOXIDE (PERCENT,ACTUAL)	-	2.9
FLUE GAS TEMPERATURE (F)	-	416.1
MOLECULAR WEIGHT (DRY/WET)	-	29.1 / 28.09
FLUE GAS MOISTURE CONTENT (%)	-	9.12

****

• **PARTICULATE CALCULATIONS - EPA METHOD 5**

First, correct the sample volume measured by the dry gas meter to standard conditions:

$$V_{m_{std}} = V_m \left(\frac{T_{std}}{T_m}\right) \left(\frac{P_{bar} + \frac{\Delta H}{13.6}}{P_{std}}\right)$$

$$= (17.64 \frac{°R}{in\ Hg}) \ V_m \left(\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right)$$

where:

$V_{m_{std}}$ = Volume of gas sample through the dry gas meter (standard conditions), cu. ft.

V_m = Volume of gas sample through the dry gas meter (meter conditions), cu. ft.

T_{std} = Absolute temperature at standard conditions, 528°R.

T_m = Average dry gas meter temperature, °R.

P_{bar} = Barometric pressure at the orifice meter, in. Hg.

ΔH = Average pressure drop across the orifice meter, in. H_2O.

13.6 = Specific gravity of mercury.

P_{std} = Absolute pressure at standard conditions, 29.92 in. Hg.

Next, calculate volume of water vapor:

$$V_{w_{std}} = V_{l_c} \left(\frac{\rho H_2O}{M_{H_2O}}\right) \left(\frac{R\ T_{std}}{P_{std}}\right)$$

$$= (.04707 \ \frac{cu.ft.}{ml.}) \ V_{l_c}$$

where:

$V_{w_{std}}$ = Volume of water vapor in the gas sample (standard conditions), cu.ft.

V_{l_c} = Total volume of liquid collected in impingers and silica gel, ml.

ρH_2O = Density of water, 1 g/ml.

M_{H_2O} = Molecular weight of water, 18 lb/lb-mole.

R = Ideal gas constant, 21.85 in. Hg - cu.ft/lb-mole -°R.

T_{std} = Absolute temperature at standard conditions, 528°R.

P_{std} = Absolute pressure at standard conditions, 29.92 in. Hg.

Next, calculate moisture content:

$$B_{wo} = \frac{V_{w_{std}}}{V_{m_{std}} + V_{w_{std}}}$$

where:

B_{wo} = Proportion by volume of water vapor in the gas stream, dimensionless.

$V_{w_{std}}$ = Volume of water in the gas sample (standard conditions), cu.ft.

$V_{m_{std}}$ = Volume of gas sample through the dry gas meter (standard conditions), cu.ft.

Next, calculate stack gas molecular weight:

$$M_d = 0.44(\%CO_2) + [illegible] + [illegible] + [illegible]$$

where:

M_d = Dry molecular weight, lb/lb-mole.

$\%CO_2$ = Percent carbon dioxide by volume, dry basis.

$\%O_2$ = Percent oxygen by volume, dry basis.

$\%N_2$ = Percent nitrogen by volume, dry basis.

0.44 = Molecular weight of carbon dioxide divided by 100.

0.32 = Molecular weight of oxygen divided by 100.

0.28 = Molecular weight of nitrogen and CO divided by 100.

$$M_s = M_d (1 - B_{wo}) + 18 B_{wo}$$

where:

M_s = Molecular weight of stack gas (wet basis), lb/lb-mole.

Next, calculate stack gas velocity:

$$(V_s)_{avg} = K_p C_p (\sqrt{\Delta p})_{avg} \left(\frac{(T_s)_{avg}}{P_s M_s}\right)^{1/2}$$

where:

$(V_s)_{avg}$ = Stack gas velocity, feet per second (fps).

$K_p = 85.49 \frac{ft}{sec} \left(\frac{lb}{lb\ mole\text{-}°R}\right)^{1/2}$ when these units are used.

C_p = Pitot tube coefficient, dimensions.

$(T_s)_{avg}$ = Average absolute stack gas temperature, °R.

$(\sqrt{\Delta p})_{avg}$ = Average velocity head of stack gas, in. H_2O.

Next, calculate percent of isokinetic sampling:

$$I = \frac{T_s \left[\frac{V_{l_c} (\rho H_2O) R}{M_{H_2O}} + \frac{V_m}{T_m} \left(P_{bar} + \frac{\Delta H}{13.6}\right)\right]}{\theta V_s P_s A_n} \times 100$$

$$= \frac{(100) \left[(0.002669 \frac{in.\ Hg\text{-}cu.ft.}{ml\text{-}°R}) V_{l_s} + \frac{V_m}{T_m} (P_{bar} + \frac{\Delta H}{13.6})\right]}{(60 \frac{sec}{min}) \theta V_s P_s A_n}$$

where:

I = Percent of isokinetic sampling.

V_{l_s} = Total volume of liquid collected in impingers and silica gel, ml.

ρH_2O = Density of water, 1 g/ml.

R = Ideal gas constant, 21.85 in. Hg-cu.ft/lb mole-°R.

M_{H_2O} = Molecular weight of water, 18 lb/lb-mole.

V_m = Volume of gas sample through the dry gas meter (meter conditions), cu.ft.

T_m = Absolute average dry gas meter temperature, °R.

P_{bar} = Barometric pressure at sampling site, in. Hg.

ΔH = Average pressure drop across the orifice, in. H_2O.

T_s = Absolute average stack gas temperature, °R.

Θ = Total sampling time, minutes.

V_s = Stack gas velocity calculated by Method 2, ft/sec.

P_s = Absolute stack gas pressure, in. Hg.

A_n = Cross sectional area of nozzle, sq. ft.

Next, calculate concentration in lb/cu.ft.:

$$C_s = \frac{\left(\frac{1}{453{,}600}\ \frac{lb}{mg}\right) M_n}{V_{m_{std}}} = 2.205 \times 10^{-6} \frac{M_n}{V_{m_{std}}}$$

where:

C_s = Concentration of particulate matter in stack gas, lb/scf, dry basis.

453,600 = Mg/lb.

M_n = Total amount of particulate matter collected, mg.

$V_{m_{std}}$ = Volume of gas sample through dry gas meter (standard conditions), cu.ft.

Lastly, calculate concentration in lb/hr :

$$C_p = C_s \, Q_{std} \, (60 \text{ min}/1 \text{ hr})$$

where:

C_p = Concentration of particulate matter in stack gas, lb/hr, dry basis.

Q_{std} = Average stack gas dry volumetric flow rate, dscfm.

$$= 60 \, (1-B_{wo}) \, V_s \, A \, \frac{T_{std}}{T_s} \, \frac{P_s}{P_{std}}$$

where:

A = Cross-sectional area of stack, ft^2

TENERX CORP
P O Box 1444, Friendswood, TX 77546
(713) 482-5801

APPENDIX D

TENERX CEM MANUFACTURER'S SPECIFICATIONS

VI. SPECIFICATIONS

Sensitivity	Each instrument is equipped with the folling ranges: 0 - 2.5 ppm 0 - 10 ppm 0 - 25 ppm 0 - 100 ppm 0 - 250 ppm 0 - 1000 ppm 0 - 2500 ppm 0 - 10000 ppm
Accuracy	Derived from the NO or NO_2 calibration gas, ±1% of fullscale.
Response time (0-90%) Typical	1.5 seconds - NO Mode 1.7 seconds - NO_x Mode
Output	0 - 10mV and 0 - 10V standard. Other outputs available upon request.
Zero Drift	Negligible after 1/2-hour warm-up.
Linearity	±1% of full scale.
Input Power Requirements	Standard: 115v/50Hz; 115v/60 Hz Optional: 220v/50Hz; 220v/60 Hz

Thermo Environmental Instruments Inc.
8 West Forge Parkway
Franklin, MA 02038
(617)520-0430
Telex: 200205 THEMO UR

INTERFERENCE RESPONSE TEST

DATE OF TEST JANUARY 18, 1980

ANALYZER TYPE 10A/R Range 0 - 2.5 PPM

SERIAL NO. SN 10S-28997-233

TEST GAS TYPE	CONCENTRATION PPM	ANALYZER OUTPUT RESPONSE	% OF SPAN
CO	500	< .1 PPM	< .1 %
SO_2	201	< .1 PPM	< .1 %
CO_2	10%	< .1 PPM	< .1 %
O_2	20.9 %	< .1 PPM	< .1 %

Teledyne O_2 Analyzer

7.0 APPLICATION DATA

7.1 TAI SALES ORDER NUMBER: 141175

7.2 INSTRUMENT MODEL NUMBER: 326RA

7.3 INSTRUMENT SERIAL NUMBER: 115442

7.4 MICRO-FUEL CELL CLASS: B-1

7.5 ACCURACY: ±1% of scale at constant temperature; ±1% of scale or ±5% of reading, whichever is greater, over the operating temperature range.

7.6 RESPONSE AND RECOVERY: At the specified flowrate (2.0 scfh), 90% in 7 seconds.

7.7 OPERATING TEMPERATURE RANGE: 0-125°F

7.8 RANGES OF ANALYSIS: 0-5, 0-10, 0-25% OXYGEN

7.9 OUTPUT SIGNAL VOLTAGE: 0-10mV

7.10 OUTPUT SIGNAL CURRENT: NONE

7.11 ALARM SET POINT #1: NONE

7.12 ALARM SET POINT #2: NONE

8.0 SPECIAL FEATURES

TENERX
P.O. Box 1444, Friendswood, TX 77546
(713) 482-5801

NDIR PERFORMANCE

TENERX HORIBA NDIR ANALYZER
MODEL VIA 500, SN 56461401

	EPA METHOD 10 SPECIFICATIONS	HORIBA PERFORMANCE
Range (minimum)	0-1000 ppm.	0-1000 ppm
Output (minimum)	0-10mV.	0-100mV
Minimum detectable sensitivity.	20 ppm.	5 ppm
Rise time, 90 percent (maximum).	30 seconds.	2 seconds
Fall time, 90 percent (maximum).	30 seconds.	2.5 seconds
Zero drift (maximum)	10% in 8 hours.	0.5% in 8 hours
Span drift (maximum)	10% in 8 hours.	0.5% in 8 hours
Precision (minimum)	±2% of full scale.	±1% of full scale
Noise (maximum)	±1% of full scale.	±0.5% of full scale
Linearity (maximum deviation)	2% of full scale.	0.4% of full scale
Interference rejection ratio	CO_2—1000 to 1, H_2O—500 to 1.	CO_2- 6000 to 1

TABLE OF NDIR INTERFERENCE RATIOS (IR)

ANALYSER / INTERFERENT GAS	CO				CO_2		NO			SO_2				CH_4			C_2H_2		C_2H_4				C_3H_6		C_3H_8		NH_3		
																			C_2H_4 ~ A (5 kg)		C_2H_4 ~ B (10 kg)								
	CO-S	CO-L	CO-AS a	CO-AS b	CO_2-S	CO_2-L	NO-S	NO-L	NO-AS	SO_2-S	SO_2-L	SO_2-AS	SO_2-AS	CH_4-S	CH_4-L	CH_4-AS	C_2H_2-S	C_2H_2-L	S	L	S	L	C_3H_6-S	C_3H_6-L	C_3H_8-S	C_3H_8-L	NH_3-S	NH_3-L	NH_3-AS
CO (Low Conc.)	1	1	1	1	15,000	200,000		5,000	50,000		15,000	50,000	50,000	7,000	15,000	50,000	1,000	3,000											
CO (High Conc.)	1	1	1	1	500	300,000					5,000				4,000	30,000	800								5,000		3,000	5,000	50,000
CO_2	1,500	6,000	50,000	20,000	1	1		10,000	50,000	2,000	30,000	100,000	50,000	2,000	8,000	50,000	500	2,500	50		>1,000		400		2,000		1,000	3,000	7,000
CO_2	1,000	2,000	50,000	10,000	1	1								200	500		200												
H_2O	1,500	2,500	20,000	10,000		10,000		60	5,000	150	200	1,500	1,500	300	1,000	4,000	20		1		> 150		3				300	500	5,000
H_2O	1,000	1,500	Adj.	10,000		8,000		50	Adj.	150	150	Adj.	1,500		700	3,000	10	100	3				3		500			100	Adj
NO							1	1	1																				
NO			50,000	50,000			1	1	1		150	2,000	300																
NO_2										1	1	1	1																
SO_2		600	10,000	10,000				400	5,000	1	1	1	1																
CH_4		30,000	140,000	200,000	20,000	50,000								1	1	1	1,000		300										
CH_4		4,000	20,000	30,000		30,000					30	40	Adj.	1	1	1	800	200										2,500	5,300
C_2H_2																	1	1											
C_2H_2															200	600	1	1											
C_2H_4		500	3,000	Adj	5,000	10,000					800						200		1	1	1	1							
C_2H_4		750	3,000	5,000											10	50	200	100	1	1	1	1						2	7
C_2H_4		1,000	3,000	5,000	1,000	1,500					300						80		50		100								
C_2H_4				8,000											1.5	Adj	80		60										
C_2H_4		600	4,000	10,000	1,000	2,000											150						1	1					
C_2H_4					500										3.5	100	150						1	1					
C_2H_6		600	3,000	7,000	1,000	2,000											70								1	1			
C_2H_6	500	600	4,000	10,000				150	1,500		30	80	150		1.5	80	70								1	1	60	60	100
C_4H_{10}																													
C_4H_{10}															1	3.5													
C_2H_5Cl																												30	150
C_2H_5Cl																													
N_2		7,000	10,000	15,000	10,000	15,000					500			500															
N_2								50	500		60	500	100	300													1	1	1
H_2O								500	1,000																		1	1	1
H_2O								500	3,000																				
C_2H_5OH		150	800	2,000	150	600																							
C_2H_5OH		150	800	2,000	150	600																							

TENERX CORP
P.O. Box 1444, Friendswood, TX 77546
(713) 482-5801

APPENDIX E

CALIBRATION GAS CERTIFICATIONS

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

TENSPEX CORP

Shipped From: Scott SAN BERNARDINO, CA
Date Shipped 1/17/90
Our Project No: 4351
Your P.O. No: VERBAL BILL LEE
Page 1 of 1
Expiration Date: 7/91

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES*

Certified Per Traceability Protocol No. 1 Procedure No. G1 Cylinder No. ALM-6082 Cylinder Pressure 1900 psig Certified Accuracy ±1% % NBS Traceable

COMPONENTS	CERTIFIED CONC	REFERENCE STD SRM/CRM NO.	CYL. NO.	CONC.	GAS ANALYZER MAKE/MODEL/SERIAL NO.	LAST CAL. DATE	ANALYTICAL PRINCIPLE
NITRIC OXIDE	24.40 ppm	GMIS	AAL-7160	22.93 ppm	THERMO-ELECTRON	11/10/89	CHEMI LUMINENSCEI
NOX	24.48 ppm	TRACEABLE TO SRM 2629A			10 AR 14853-150		

BALANCE GAS NITROGEN

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

Component NITRIC OXIDE
First Analysis Date 1/8/90 Units ppm

Z 0.00	R 91.77	T 98.06
R [illegible]	Z 0.07	T 98.37
Z [illegible]	T 98.60	R 92.62

Mean Test Assay 24.47 ppm

Second Analysis Date 1/15/90 Units ppm

Z [illegible]	R 91.78	T 97.63
R [illegible]	Z 0.23	T 97.75
Z [illegible]	T 97.74	R 91.92

Mean Test Assay 24.40 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 LEE OLDHAM

Approved By: [signature]

Scott Specialty Gases

a division of
Scott Environmental Technology, Inc.

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

Our Project # : 517048

Your P.O. # : 10-15-90-RT

Expiration Date : 5-14-92

Cylinder Number ALM-004931

Cylinder Pressure 1900 psig

Customer :
TENEREX CORP.
303 LAUREL
FRIENDSWOOD, TX. 77546

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

Certified Per Traceability Protocol # 1 — Procedure # G1

File # P06893

Certified Accuracy 1 % NBS Traceable

COMPONENT	CERTIFIED CONC.	REFERENCE STD: SRM # (CRM #)	REFERENCE STD: CYLINDER NUMBER	REFERENCE STD: CONC.	GAS ANALYZER: MAKE/MODEL	GAS ANALYZER: LAST CALIBRATION DATE	GAS ANALYZER: ANALYTICAL PRINCIPLE
NITRIC OXIDE	55.75 PPM	1684	ALM-003623	97.28 PPM	HORIBA	7-19-90	CHEMILUMINESCENCE
		GMIS*	AAL-14455	45.70 PPM	OPE-235		
					560543082		

BALANCE GAS : NITROGEN

NITROGEN DIOXIDE 0.50 PPM

FIRST ANALYSIS — DATE : 11-5-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	56.20	55.75	97.28 PPM	98.00	97.28
0.00	56.20	55.75		98.00	97.28
0.00	56.20	55.75		98.00	97.28

CALCULATED RESULTS 55.75, 55.75, 55.75

AVERAGE : 55.75 PPM

SECOND ANALYSIS — DATE : 11-14-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	56.20	55.75	97.28 PPM	98.00	97.28
0.00	56.20	55.75		98.00	97.28
0.00	56.20	55.75		98.00	97.28
0.00	56.70 NOX	56.25			

CALCULATED RESULTS 55.75, 55.75, 55.75 — 56.25 PPM NOX

AVERAGE : 55.75 PPM

CALIBRATION CURVE — 2 nd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
1684B	97.28	100	98.00	97.28	0.00
	48.00	49	48.40	48.00	0.00
	45.70	47	46.20	45.82	0.25
	22.40	23	22.70	22.47	0.31
	0.0000	0	0.00	0.0000	0.00
		0		0.00	0.00
		0		0.00	0.00
1683B	22.40	LOW	22.70	22.47	0.31
1684	97.28	HIGH	98.00	97.28	0.00

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : GHalt

Approved By : J Shapiro

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

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, CA
Date Shipped 1/17/90
Our Project No: 4351
Your P.O. No: VERBAL BILL LEE
Page 1 of 1
Expiration Date: 7/91

TENEREX CORP.

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES*

Certified Per Traceability Protocol No. 1 Procedure No. G1 Cylinder No. ALM-11638 Cylinder Pressure 1900 psig Certified Accuracy ±1% % NBS Traceable

REFERENCE STD

COMPONENTS	CERTIFIED CONC	SRM/CRM NO.	CYL. NO.	CONC.
NITRIC OXIDE	88.89 ppm	SRM 1684B	ALM-3640	97.28 ppm
NOX	89.03 ppm			

GAS ANALYZER

MAKE/MODEL/SERIAL NO.	LAST CAL. DATE	ANALYTICAL PRINCIPLE
THERMO ELECTRON 10 AR 14853-150	11/10/89	CHEMI LUMINENSCENT

BALANCE GAS NITROGEN

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

Component NITRIC OXIDE
First Analysis Date 1/8/90 Units ppm

Z 0.00	R 97.29	T 88.88
R 97.20	Z 0.06	T 88.89
Z 0.04	T 88.88	R 97.20

Mean Test Assay 88.93 ppm

Second Analysis Date 1/15/90 Units ppm

Z 0.00	R 97.30	T 88.90
R 97.30	Z 0.07	T 88.89
Z 0.05	T 88.97	R 97.34

Mean Test Assay 88.89 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 LEE OLDHAM

Approved By: [signature]

Scott Specialty Gases

a division of Scott Environmental Technology, Inc.

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

Our Project # : 517048

Your P.O. # : 10-15-90-RT

Customer :
TENEREX CORP.
303 LAUREL
FRIENDSWOOD, TX. 77546]

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

Certified Per Traceability Protocol # 1 — Procedure # G1

File # P06897

Certified Accuracy 1 % NBS Traceable

Expiration Date : 5-13-92

Cylinder Number ALM-010445

Cylinder Pressure 1900 psig

COMPONENT	CERTIFIED CONC.	REFERENCE STD: SRM # (CRM #)	REFERENCE STD: CYLINDER NUMBER	REFERENCE STD: CONC.	GAS ANALYZER: MAKE/MODEL/SERIAL #	GAS ANALYZER: LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
CARBON MONOXIDE	102.5 PPM	1681	CAL-7913	970.0 PPM	HORIBA/OPE-144E/560172153	7-25-90	NON-DISPERSIVE INFRARED
		GMIS*	XA-9163	1001 PPM			

BALANCE GAS : NITROGEN

FIRST ANALYSIS — DATE : 11-6-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	10.90	102.7	243.3 PPM	25.60	243.9
0.00	10.90	102.7		25.60	243.9
0.00	10.90	102.7		25.60	243.9

CALCULATED RESULTS: 102.5, 102.5, 102.5

AVERAGE : 102.5 PPM

SECOND ANALYSIS — DATE : 11-13-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE STANDARD CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	10.90	102.7	243.3 PPM	25.60	243.9
0.00	10.90	102.7		25.60	243.9
0.00	10.90	102.7		25.60	243.9

CALCULATED RESULTS: 102.5, 102.5, 102.5

AVERAGE : 102.5 PPM

CALIBRATION CURVE — 2 nd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
	1001	100	100.00	1001	0.00
1681	970.0	97	97.20	971.2	0.13
	243.3	24	25.60	243.9	0.24
	100.4	10	10.70	100.8	0.42
	0.0000	0	0.00	0.0000	0.00
		0		0.00	0.00
		0		0.00	0.00
GMIS	100.4	LOW	10.70	100.8	0.42
1681	970.0	HIGH	97.20	971.2	0.13

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : _____

Approved By : J Shapiro

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

Scott Specialty Gases

a division of
Scott Environmental Technology, Inc.

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

Our Project # : 51704B

Your P.O. # : 10-15-90-RT

Expiration Date : 5-13-92

Cylinder Number ALM-013252

Cylinder Pressure 1900 psig

Customer :
TENEREX CORP.
303 LAUREL
FRIENDSWOOD, TX. 77546

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

Certified Per Traceability Procedure # G1
Protocol # 1

File # P06903

Certified Accuracy 1 % NBS Traceable

COMPONENT	CERTIFIED CONC.	REFERENCE STD: SRM # (CRM #)	REFERENCE STD: CYLINDER NUMBER	REFERENCE STD: CONC.	GAS ANALYZER: MAKE/MODEL/SERIAL #	GAS ANALYZER: LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
CARBON MONOXIDE	169.5 PPM	1681	CAL-7913	970.0 PPM	HORIBA/OPE-144E/560172153	7-25-90	NON-DISPERSIVE INFRARED
		GMIS*	XA-9163	1001 PPM			

BALANCE GAS : NITROGEN

FIRST ANALYSIS DATE : 11-6-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	17.90	169.6	243.3 PPM	25.60	243.9
0.00	17.90	169.6		25.60	243.9
0.00	17.90	169.6		25.60	243.9

CALCULATED RESULTS 169.2, 169.2, 169.2

AVERAGE : 169.2 PPM

SECOND ANALYSIS DATE : 11-13-90

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE STANDARD CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	17.90	169.6	243.3 PPM	25.60	243.9
0.00	18.00	170.5		25.60	243.9
0.00	18.00	170.5		25.60	243.9

CALCULATED RESULTS 169.2, 170.1, 170.1

AVERAGE : 169.8 PPM

CALIBRATION CURVE 2 nd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT PT (%)	DVM (mV)	FITTED VALUE	PERCENT ERROR
	1001	100	100.00	1001	0.00
1681	970.0	97	97.20	971.2	0.13
	243.3	24	25.60	243.9	0.24
	100.4	10	10.70	100.8	0.42
	0.0000	0	0.00	0.0000	0.00
		0		0.00	0.00
		0		0.00	0.00
GMIS	100.4	LOW	10.70	100.8	0.42
1681	970.0	HIGH	97.20	971.2	0.13

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : AGates

Approved By : J Shapiro

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

AIR PRODUCTS AND CHEMICALS, INC.
SPECIALTY GAS DEPARTMENT
10202 STRANG ROAD
LA PORTE, TX 77571
TELEPHONE (713) 478-3100
FAX (713) 478-3112

DATE: 12/18/90
TIME: 07:50
PAGE: 1

****
* CERTIFICATE OF ANALYSIS *
****

TENERX CORP
303 LAUREL
FRIENDSWOOD TX 77546

CUSTOMER ACCOUNT : C5161
CUSTOMER ORDER NO : VERBAL RAY
ORDER NO : 865-026532
ORDER DETAIL SEQ : 1
SHIPPER NUMBER : 865-S-79255

REMARKS : GAS MIXTURE(S) LISTED BELOW ARE TRACEABLE TO NIST CLASS S WEIGHTS AND/OR NIST GAS MIXTURE STANDARD REFERENCE MATERIALS (SRM's) - REFERENCE APCI SGD FIELD DIRECTIVE BOOK I PART A-3.

** ANALYSIS **

CERTIFIED GAS MIXTURE: 3 COMPONENTS IN NITROGEN

	CYL NO	COMPONENT REQUESTED	CONCENTRATION REQUESTED	ANALYTICAL RESULT	UNIT OF MEASURE
BATCH NO: 00701	SG9141A	OXYGEN	8.5	8.45	MOLAR %
ANAL DATE: 12/12/90		CARBON DIOXIDE	8.5	8.23	MOLAR %
		CARBON MONOXIDE	600	622.0	MOLAR PPM
		NITROGEN		BALANCE	

CERTIFICATION

THIS ANALYSIS HAS BEEN PERFORMED UTILIZING APPROVED ANALYTICAL METHOD(S) AND IS CORRECT TO WITHIN THE ANALYTICAL ACCURACIES OF THIS (THESE) METHOD(S).

AUTHORIZED SIGNATURE

TENERX CORP
P.O. Box 1444, Friendswood, TX 77546
(713) 482-5801

APPENDIX F

PROCESS DATA

Date	01-17-90		
Turbine	ISOM #7		
Test Number	C #2-1	C #2-2	C #2-3
Start Time	17:26	19:02	20:44
Stop Time	18:38	20:16	21:56
Turbine Operation	30% Eth & 70% NG (PCT by Volume) — 1420°F Engine Temp.		
Power Turbine Speed (%)	82.85	83.42	83.20
Engine Temp. (°F)	1420	1421	1420
Turbine Compressor Discharge (psig)	118	118	118
Reference CPD (psia)	164.65	164.65	164.65
Gas Producer Speed (%)	103.2	103.22	103.22
Gas Producer Speed Set. (%)	—	—	—
Gas Comp. Suction Press. (psig)	50.9	49.9	51.4
Gas Comp. Discharge Press. (psig)	116.2	114.5	116.5
Fuel Inlet Pressure (psig)	222	222	222
Fuel Heating Value (Btu/SCF)			
Fuel Flow [redacted] (LB/SEC)	0.497	0.500	0.502
Ambient Conditions			
Barometer (in. Hg.)	30.26	30.26	30.22
Temperature (°F dry)	64	61	61
Temperature (°F wet)	59	56	56
Humidity (lbs/lb of air)	0.0096	0.0085	0.0085
H_2O Injection Rate (LB/sec)	0.452	0.452	0.453
LB H_2O / LB FUEL	0.920	0.913	0.910
Stack Temp (°F)	377	376	376

Fuel Analysis (in Mol.%) Time 18:00

C_1	70.59%
C_2	28.15%
C_3	0.80%
IC_4	0.18%
NC_4	0.19%
IC_5	0.10%
H_2S	0.00%

Date	1-24-91		
Turbine	150M Unit #7		
Test Number	C4-1	C4-2	C4-3
Start Time	13:09	15:12	17:07
Stop Time	14:19	16:23	18:17
Turbine Operation 100% NG - 1400°F Engine Temp.			
Power Turbine Speed (%)	81.39	81.90	82.17
Engine Temp. (°F)	1403	1401	1398
Turbine Compressor Discharge (psig)	116.0	115.0	113.0
Reference CPD (psia)	164.65	164.65	164.65
Gas Producer Speed (%)	101.86	101.83	101.81
Gas Producer Speed Set. (%)	—	—	—
Gas Comp. Suction Press. (psig)	52.0	51.5	50.0
Gas Comp. Discharge Press. (psig)	117.5	117.4	116.2
Fuel Inlet Pressure (psig)	224	224	224
Fuel Heating Value (Btu/SCF)			
Fuel Flow ([redacted]) (LB/SEC)	0.507	0.510	0.510
Ambient Conditions			
Barometer (in. Hg.)	30.22	30.22	30.25
Temperature (°F dry)	58	55	54
Temperature (°F wet)	53	51	51
Humidity (lbs/lb of air)	0.0075	0.0071	0.0074
H_2O Inj. Rate (LB/SEC)	0.300	0.302	0.302
Lb H_2O / Lb Fuel	0.602	.602	0.603
Stack Temp (°F)	376	378	378

Fuel Gas (in Mol. %) Time 5:30p

C6 = 0.07%
N2 = 0.07%
C1 = 97.35%
CO_2 = 0.47%
C2 = 1.48%
C3 = 0.32%
IC4 = 0.08%
NC4 = 0.08%
IC5 = 0.04%
NC5 = 0.03%

Date	01-17-90		
Turbine	ISOM #8		
Test Number	C#1-1	C#1-2	C#1-3
Start Time	11:11	13:10	15:16
Stop Time	12:25	14:49	16:28
Turbine Operation	30% Eth + 70% NG (Pct. by Volume) - 1420°F Engine Temp.		
Power Turbine Speed (%)	88.4	88.75	89.10
Engine Temp. (°F)	1418	1418	1417
Turbine Compressor Discharge (psig)	98	98	98
Reference CPD (psia)	164.65	164.65	164.65
Gas Producer Speed (%)	97.3	97.34	97.45
Gas Producer Speed Set. (%)	—	—	—
Gas Comp. Suction Press. (psig)	50	50	50
Gas Comp. Discharge Press. (psig)	—	—	—
Fuel Inlet Pressure (psig)	196	196	196
Fuel Heating Value (Btu/SCF)			
Fuel Flow [redacted] (LB/SEC)	0.459	0.454	0.459
Ambient Conditions			
Barometer (in. Hg.)	30.40	30.35	30.26
Temperature (°F dry)	68	70	65
Temperature (°F wet)	56	60	59
Humidity (lbs/lb of air)	0.0068	0.0088	0.0092
H_2O Injection Rate (LB/sec)	0.344	0.340	0.344
LB H_2O/LB Fuel	0.751	0.746	0.750
Stack Temp (°F)	375°F	374	375

Fuel Analysis (in Mol. %) Time 11:45 AM

C1 71.02 %
C2 27.48 %
C3 1.04 %
IC4 0.18 %
NC4 0.19 %
IC5 0.10 %

Date	01-21-91		
Turbine	ISOM #8		
Test Number	T#C3-1	T#C3-2	T#C3-3
Start Time	14:54	16:45	18:24
Stop Time	16:09	17:56	19:37
Turbine Operation	100% Nat. Gas @ - 1420°F Engine Temp.		
Power Turbine Speed (%)	98.2	98.84	99.10
Engine Temp. (°F)	1420	1421	1420
Turbine Compressor Discharge (psig)	108	108	106
Reference CPD (psia)	164.65	164.65	164.65
Gas Producer Speed (%)	97.77	97.89	97.92
Gas Producer Speed Set. (%)	—	—	—
Gas Comp. Suction Press. (psig)	49	49	49
Gas Comp. Discharge Press. (psig)	—	—	
Fuel Inlet Pressure (psig)	201	201	201
Fuel Heating Value (Btu/SCF)			
Fuel Flow [redacted] (LB/SEC)	0.511	0.514	0.516
Ambient Conditions			
Barometer (in. Hg.)	30.37	30.37	30.37
Temperature (°F dry)	48	47	44
Temperature (°F wet)	43	44	41
Humidity (lbs/lb of air)	0.0048	0.0055	0.0047
H_2O Inj. Rate (LB/SEC)	0.257	0.282	0.283
Stack Temp. (°F)	367	367	369
LB H_2O/LB FUEL	0.504	0.546	0.547

(in Mol.%) Fuel Gas	Time 4:00pm	5:30pm
N_2	0.24%	0.06 %
C1	97.05 %	98.42 %
CO_2	0.39 %	0.56 %
C2	1.63 %	0.90 %
C3	0.37 %	0.02 %
IC4	0.09 %	0.004 %
NC4	0.09 %	0.01 %
IC5	0.04 %	0.01 %
NC5	0.04 %	0.01 %
C6+	0.05 %	0 %

TENERX CORP
P.O. Box 1444, Friendswood, TX 77546
(713) 482-5801

APPENDIX G

CHAIN OF CUSTODY