Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

Source category: Portland Cement
Date: 01/22/93
Plant name : Lone Star Cement
Location: Davenport, CA
Test date : 8/27/85
Ref. No.: 31
Process : precalciner
Basis for process rate : feed

Source	Type of control	Pollutant	Run No.	Emission rate, lb/hr	Process rate, ton/hr	Emission factor kg/Mg	Emission factor lb/ton	Volumetric flow rate, DSCFM	Concen ppm
rotary kiln	ESP	BASED ON FEED RATE							
		filt. PM	1	7.51	190	0.0198	0.0395		
		filt. PM	2	4.83	190	0.0127	0.0254		
		filt. PM	3	3.78	190	0.0099	0.0199		
				AVERAGE		0.0141	0.0283	RATING:	B
		con. inorg. PM	1	29.35	190	0.0772	0.154		
		con. inorg. PM	2	32.12	190	0.0845	0.169		
		con. inorg. PM	3	37.66	190	0.0991	0.198		
				AVERAGE		0.0870	0.174	RATING:	B
		SO2	1	65.12	190	0.171	0.343		
		SO2	2	71.78	190	0.189	0.378		
		SO2	3	71.98	190	0.189	0.379		
				AVERAGE		0.183	0.366	RATING:	B
		NOx	1	229.80	190	0.605	1.21		
		NOx	2	245.82	190	0.647	1.29		
		NOx	3	234.14	190	0.616	1.23		
				AVERAGE		0.623	1.25	RATING:	B
		CO	1	235.99	190	0.621	1.24		
		CO	2	260.60	190	0.686	1.37		
		CO	3	264.65	190	0.696	1.39		
				AVERAGE		0.668	1.34	RATING:	B
		CO2	1	181,708	190	478	956	135,757	19.5
		CO2	2	182,774	190	481	962	137,257	19.4
		CO2	3	188,108	190	495	990	137,025	20.0
				AVERAGE		485	969	RATING:	B

QUARTERLY TESTING FOR
LONE STAR CEMENT
DAVENPORT, CALIFORNIA

August 27 and 28, 1985

Pren-

Reference SS:
(1) Unspecified kiln
w/ESP - Probably
Wet
Delete!

Daver

Sep

DRY - PRECALCINER

Prepared by

Pape & Steiner Environmental Services
5801 Norris Road
Bakersfield, California 93308

Report PS-85-539/Project 5509-85

QUARTERLY TESTING FOR
LONE STAR CEMENT
DAVENPORT, CALIFORNIA

August 27 and 28, 1985

Prepared for

Lone Star Cement
Highway 1
Davenport, California 95017

September 1985

Prepared by

Pape & Steiner Environmental Services
5801 Norris Road
Bakersfield, California 93308

Report PS-85-539/Project 5509-85

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SECTION 1

INTRODUCTION

At the request of Lone Star Cement, Pape & Steiner Environmental Services conducted emission tests for particulates, NO_x, SO_2 and CO on the effluent of the main stack from August 27 and 28, 1985.

The purpose of these tests was to determine compliance with Monterey Bay Unified Air Pollution Control District (MBUAPCD) rules and regulations. These compliance tests must be done on a quarterly basis and these tests were the third set for 1985.

Section 2 of the report summarizes the test matrix for the program. The results are presented in Section 3. The sampling and analysis procedures are described in Section 4 and 5. Section 6 summarizes the QA/QC steps taken on this program. Finally, the Appendix contains all the raw data and calculations used to obtain these results.

SECTION 2

TEST MATRIX

Lone Star Cement owns and operates a cement plant at Davenport, California. The plant is currently operating under a variance granted by the MBUAPCD. A condition of this variance requires the plant to conduct quarterly compliance tests on the main stack at the plant.

Table 2-1 summarizes the tests conducted by Pape & Steiner on this third quarterly compliance test program for 1985. Testing for particulates and NO_x, SO_2 and CO was done simultaneously. Particulates (filterable and condensible) were sampled using a modified EPA Method 5/8 train. NO_x, SO_2, and CO were sampled continuously using CARB Method 1-100 procedures.

Triplicate tests were conducted under two operating conditions - roller mill on and roller mill off, as per the variance. Mr. Duc Vu of Lone Star Cement gathered process data and Messers. Ken Kitts and Larry Borelli of MBUAPCD were on hand to observe the process operation and the Pape & Steiner test work.

Section 3 summarizes the results.

TABLE 2-1. SECOND QUARTERLY COMPLIANCE TEST PROGRAM

Date	Parameter	Test No.	Time	Test Condition
08/27/85	Particulates, NO_x, SO_2, CO	1	8:09 am - 9:33 am	Kiln Feed 190 TPH; Roller Mill Feed 0 TPH; Lime Slurry 20 GPM
		2	10:13 am - 11:31 am	
		3	12:16 pm - 1:52 pm	
08/28/85	Particulates, NO_x, SO_2, CO	4	7:55 am - 9:22 am	Kiln Feed 190 TPH; Roller Mill Feed 200 TPH; Lime Slurry 10 GPM
		5	9:40 am - 11:10 am	
		6	11:40 am - 1:11 pm	

SECTION 3

TEST RESULTS

Tables 3-1 and 3-2 summarize the results of the tests performed on August 27 and 28, 1985. All tests were conducted isokinetically and the data is reported at 60°F and 29.92 inches of Mercury.

TABLE 3-1. SUMMARY OF SOURCE EMISSION TESTS

Unit Tested: Kiln Location: Main Stack (ESP Outlet)

Test Number	1	2	3	Average
Date	08/27/85	08/27/85	08/27/85	
Test Condition	Mill Off	Mill Off	Mill Off	
Barometric Pressure (in. Hg)	30.35	30.35	30.35	
Stack Pressure (in. Hg)	30.32	30.32	30.32	
Stack Area (ft^2)	78.54	78.54	78.54	
Elapsed Sampling Time (min)	60	60	60	
Volume Gas Sampled (dscf)	40.0830	41.0906	40.5177	
GAS DATA				
Average Gas Velocity (fps)	46.92	47.46	46.30	46.89
Average Gas Temperature (^oF)	281	279	272	277
Gas Flowrate (dscfm)	135,757.1	137,256.9	137,025.0	136,679.7
Gas Flowrate (acfm)	226,026.4	223,640.4	218,159.7	222,608.8
Gas Analysis (Dry % Basis)				
Carbon Dioxide	19.5	19.4	20.0	19.6
Oxygen	9.8	9.8	9.6	9.7
Carbon Monoxide	---	---	---	---
Water	13.7	13.9	12.8	13.5
EMISSION CONCENTRATION				
Filterable Particulate (gr/dscf)	0.0065	0.0041	0.0032	0.0046
Total Particulate (gr/dscf)	0.0382	0.0355	0.0385	0.0374
SO_2 (ppm)	47.3	51.6	51.8	50.2
NO_x (ppm)	232.7	246.2	234.9	237.9
EMISSION RATE				
Filterable Particulate (lb/hr)	7.51	4.83	3.78	5.37
Wet Catch (lb/hr)	36.88	36.95	41.44	38.42
Total Particulate (lb/hr)	44.39	41.78	45.22	43.80
SO_2 (lb/hr)	65.12	71.78	71.98	69.63
NO_x (lb/hr)	229.80	245.82	234.14	236.59
Lb/Ton - EMISSION FACTOR				
Filterable Particulate	0.04	0.03	0.02	0.03
Wet Catch	0.19	0.19	0.22	0.20
Total Particulate	0.23	0.22	0.24	0.23

TABLE 3-2. SUMMARY OF SOURCE EMISSION TESTS

Unit Tested: Kiln Location: Main Stack (ESP Outlet)

Test Number	4	5	6	Average
Date	08/28/85	08/28/85	08/28/85	
Test Condition	Mill On	Mill On	Mill On	
Barometric Pressure (in. Hg)	30.34	30.34	30.34	
Stack Pressure (in. Hg)	30.30	30.30	30.30	
Stack Area (ft^2)	78.54	78.54	78.54	
Elapsed Sampling Time (min)	60	60	60	
Volume Gas Sampled (dscf)	48.4321	48.5052	48.1525	
GAS DATA				
Average Gas Velocity (fps)	50.42	50.68	50.38	50.49
Average Gas Temperature (^oF)	205	217	213	212
Gas Flowrate (dscfm)	165,090.8	164,637.7	165,800.4	165,176.3
Gas Flowrate (acfm)	237,589.7	238,796.8	237,424.9	237,937.1
Gas Analysis (Dry % Basis)				
Carbon Dioxide	16.7	17.2	17.5	17.1
Oxygen	11.3	11.0	10.8	11.0
Carbon Monoxide	---	---	---	---
Water	12.2	11.4	10.7	11.4
EMISSION CONCENTRATION				
Filterable Particulate (gr/dscf)	0.0056	0.0038	0.0043	0.0046
Total Particulate (gr/dscf)	0.0080	0.0080	0.0092	0.0084
SO_2 (ppm)	44.6	43.4	34.5	40.9
NO_x (ppm)	199.2	135.3	223.0	185.8
EMISSION RATE				
Filterable Particulate (lb/hr)	7.89	5.32	6.12	6.44
Wet Catch (lb/hr)	3.36	5.97	6.95	5.43
Total Particulate (lb/hr)	11.25	11.29	13.07	11.87
SO_2 (lb/hr)	74.69	72.49	57.98	68.39
NO_x (lb/hr)	239.22	162.04	268.95	223.40
Lb/Ton - EMISSION FACTOR				
Filterable Particulate	0.04	0.03	0.03	0.03
Wet Catch	0.02	0.03	0.04	0.03
Total Particulate	0.06	0.06	0.07	0.06

SECTION 4

SAMPLING EQUIPMENT AND PROCEDURES

This section of the report describes the equipment and procedures used to conduct the particulate gaseous tests on this program.

4.1 PRELIMINARY MEASUREMENTS

Before conducting the stack tests a series of preliminary measurements were made to determine:

- The location of the sampling site and the number and location of the sampling points to be used (EPA Method 1)
- The velocity, temperature, and pressure of the gases in the stack (EPA Method 2)
- The composition of the stack gases (EPA Method 3)
- The moisture content of the stack gases (psychrometric chart)

Using the results of these preliminary measurements and the calibration constants for the sampling train, a series of calculations were made to determine the value of K, a constant, and N_d, ideal nozzle diameter, required to run an isokinetic test according to the equation:

$$\Delta H = \left\{ \frac{60^2 \pi^2 K_p^2 C_p^2 (1 - B_{wo})^2 P_s MW_d}{576^2 K_o^2 MW_s P_m} \right\} (N_d^4) \left(\frac{T_m}{T_s} \right) (\Delta P)$$

where

$$K = \left\{ \frac{60^2 \pi^2 K_p^2 C_p^2 (1 - B_{wo})^2 P_s MW_d}{576^2 K_o^2 MW_s P_m} \right\}$$

An actual nozzle, whose diameter was as close as possible to the ideal nozzle diameter, was selected for the test. Isokinetic sampling rates for each sampling point in the stack were computed using the equation:

$$\Delta H = (K)(N_d^4)\left(\frac{T_m}{T_s}\right)(\Delta P)$$

Since K and N_d are known, and remain constant during a test, the only variables are the meter temperature, the stack temperature and the velocity pressure for each sampling point.

4.2 PREPARATION OF THE PARTICULATE SAMPLING TRAIN

All sampling train components were cleaned in the laboratory (soap and water, tap water rinse, distilled water rinse, and IPA rinse) to eliminate previous contamination. The sampling train components were sealed and transported to the sampling site in a mobile lab. Modified EPA Method 5/8 equipment was used to measure particulates (filterable and condensible) consisted of:

- A calibrated 316 stainless steel nozzle for isokinetic sampling
- A heated Pyrex glass sampling probe (6' long) equipped with an S-type pitot tube and a thermocouple to measure stack velocity, pressure and temperature

- A heated Pyrex glass filter holder containing a weighed 100-mm Reeve Angel 934 AH glass fiber filter
- A Pyrex glass impinger train in an icebath (impinger 1 contained 100 ml 80% IPA; impinger 2 contained 100 ml 6% H_2O_2; impinger 3 was dry; bubbler 4 contained a weighed amount of silica gel)
- An umbilical to connect the probe and sample box to the control module
- A control module containing a vacuum pump, a calibrated dry gas meter and a calibrated orifice meter to measure the pressure, temperature and flowrate throughout the train.

The sampling train was charged in the mobile lab using freshly prepared reagents. Each impinger and its contents was weighed to the nearest 0.1 gm on a calibrated electronic balance. Blanks of all filters and reagents were retained for subsequent analysis. The sampling point locations were marked on the probe using a high-temperature marker. The sampling train was completely assembled and lifted to the sampling site.

4.3 SAMPLING PROCEDURES FOR PARTICULATE SAMPLING TRAIN

Prior to a test, the sampling train was heated and leak-checked at 15 inches Mercury to insure leakage was less than 0.02 cfm. The S-type pitot tube was also leak-checked. The sampling train was installed on the unirail and the probe was inserted into the stack at the farthest point. An isokinetic sampling rate was calculated using an HP-41CV calculator for each sampling point on the traverse (3 points per traverse; 4 traverses at 90°). Each point was sampled for an equal period of time (5 minutes)

and all pertinent data was recorded on the data sheet for each point. The probe and sample box were maintained at 250°F throughout the traverse. The gases leaving the impinger train were maintained at <70°F. At the end of a traverse, the probe was withdrawn from the stack and the entire sampling train was transferred (intact) to the next sampling port. Another traverse of the stack was completed and the sampling train was withdrawn for the final leak check. This leak check was performed at 15 inches Mercury or at the highest vacuum achieved during the test. The S-type pitot tube was also checked at this time. The sampling train was then purged with ambient air for 15 minutes using the highest ΔH measured during the test. After the train was purged, the probe, nozzle, filter holder, and impinger train was sealed with tin foil and lowered to the mobile lab for sample recovery.

4.4 SAMPLE RECOVERY PROCEDURES FOR PARTICULATE SAMPLING TRAIN

Sample recovery occurred in the mobile lab. The nozzle and probe were brushed and rinsed three times using ACS reagent grade acetone into a polyethylene sample bottle. The 100-mm filter was removed from the 4-inch filter holder and sealed in its petri dish. The front half of the 4-inch glass filter holder was brushed and rinsed with acetone. Each impinger was removed from the icebath, wiped dry and weighed to the nearest 0.1 gm. The backhalf of the 4-inch filter holder, the connectors and the first impinger were rinsed with 80% IPA. The connector and impinger #2 were rinsed with distilled water. The rinsings were transferred to precleaned polyethylene sample bottles. All sample bottles and petri dishes were marked and labeled. A chain-of-custody log was completed and the field data sheet was

also labeled with the sample ID numbers. The sampling train was then recharged in preparation for the next test.

4.5 SAMPLING PROCEDURES FOR CONTINUOUS MONITORING

The continuous monitors used in the Pape & Steiner Mobile Monitoring Lab are shown in Table 4-1. Figure 4-1 is a schematic of the continuous monitoring system. The procedures used to continuously monitor stack gases for NO_x, SO_2, CO, CO_2, and O_2 strictly follow CARB Method 1-100.

Sample was taken from the stack using a 316 stainless steel probe. A Balston filter holder and fiberglass filter (99.9999 percent efficiency retention of 0.6 micron particles) was connected to the outlet of the probe. Sample gas was transported through heated Teflon sample line (maintained at >250°F) by a Teflon-lined diaphragm pump to a glass knockout. The knockout was connected to a 316 stainless steel refrigeration type conditioner (Hankison Model E-4G-SS) by unheated Teflon line. The sample gas was passed through the conditioner two separate times under vacuum before entering the pump, then two additional times under pressure. The clean, dry sample gas ($\sim$35°F) was then transported to the continuous analyzer system through an unheated Teflon line. A series of flowmeters, valves, and regulators maintain constant flow through the system at a constant pressure.

Calibrations of the continuous analyzers were performed using EPA Protocol 1 calibration gases ($\pm$ 1 percent) for criteria pollutant analysis (NO_x/SO_2) and certified calibration gases ($\pm$ 1 percent) for fixed gas analysis. Copies of the gas certifications are included in the Appendix of

TABLE 4-1. CONTINUOUS MONITORING LAB

NO_x CHEMILUMINESCENT ANALYZER -- THERMO ELECTRON MODEL 10

Response Time (0-90%)	1.5 sec -- NO mode 1.7 sec -- NO_x mode
Zero Drift	Negligible after 1/2 hour warmup
Linearity	±1% of full scale
Accuracy	Derived from the NO or NO_2 calibration gas, ±1% of full scale
Output	0.100 mV, 0-10 mV, 0-5 V, 0-10 V

O_2 ANALYZER, FUEL TYPE -- TELEDYNE MODEL 326

Response Time (0-90%)	60 seconds
Accuracy	±1% of scale at constant temperatures; ±1% of scale of ±5% of reading, whichever is greater, over the operating temperature range
Output	0-1 V

CO_2/CO INFRARED ANALYZER -- ANARAD MODEL AR-600

Response Time (0-90%)	5 seconds
Zero Drift	±1%
Span Drift	±1%
Linearity	±1%
Resolution	Less than 1% of full scale
Output	0-1 V

SO_2 UV ANALYZER -- DUPONT MODEL 400

Response Time (0-90%)	Less than 1 second
Zero Drift	Less than 1% full scale in 24 hours
Linearity	±1% full scale
Accuracy	±2% full scale
Output	0-10 mV
Operating Ranges	0-100 ppm, 0-1000 ppm

STRIP CHART RECORDERS (3) -- LINEAR MODEL 486

Pen Response	20 inches/second
Span -- full scale	1 mV through 10 V
Zero Set	Electronically adjustable full scale with 1 full scale of zero supression
Accuracy Dead Band Linearity Repeatability	Total limit of error ±0.5%

SCOTSMAN TRAILER

Fully Insulated
Air conditioned
8-ft x 14-ft x 11-ft

1. Filter 0.6 μ, 99.9999 percent efficient
2. Duct
3. 316 stainless steel probe
4. 3/8-inch, heated (250°F) Teflon
5. Four-pass conditioner-dryer, 316 stainless steel internals
6. 3/8-inch, unheated Teflon
7. Teflon-lined sample pump
8. 3/8-inch unheated Teflon
9. Rotameter
10. 1/4-inch Teflon tubing
11. Calibration gas manifold
12. Calibration gas selector valve
13. Calibration gas cylinders
14. Backpressure regulator
15. Auxiliary analysis port

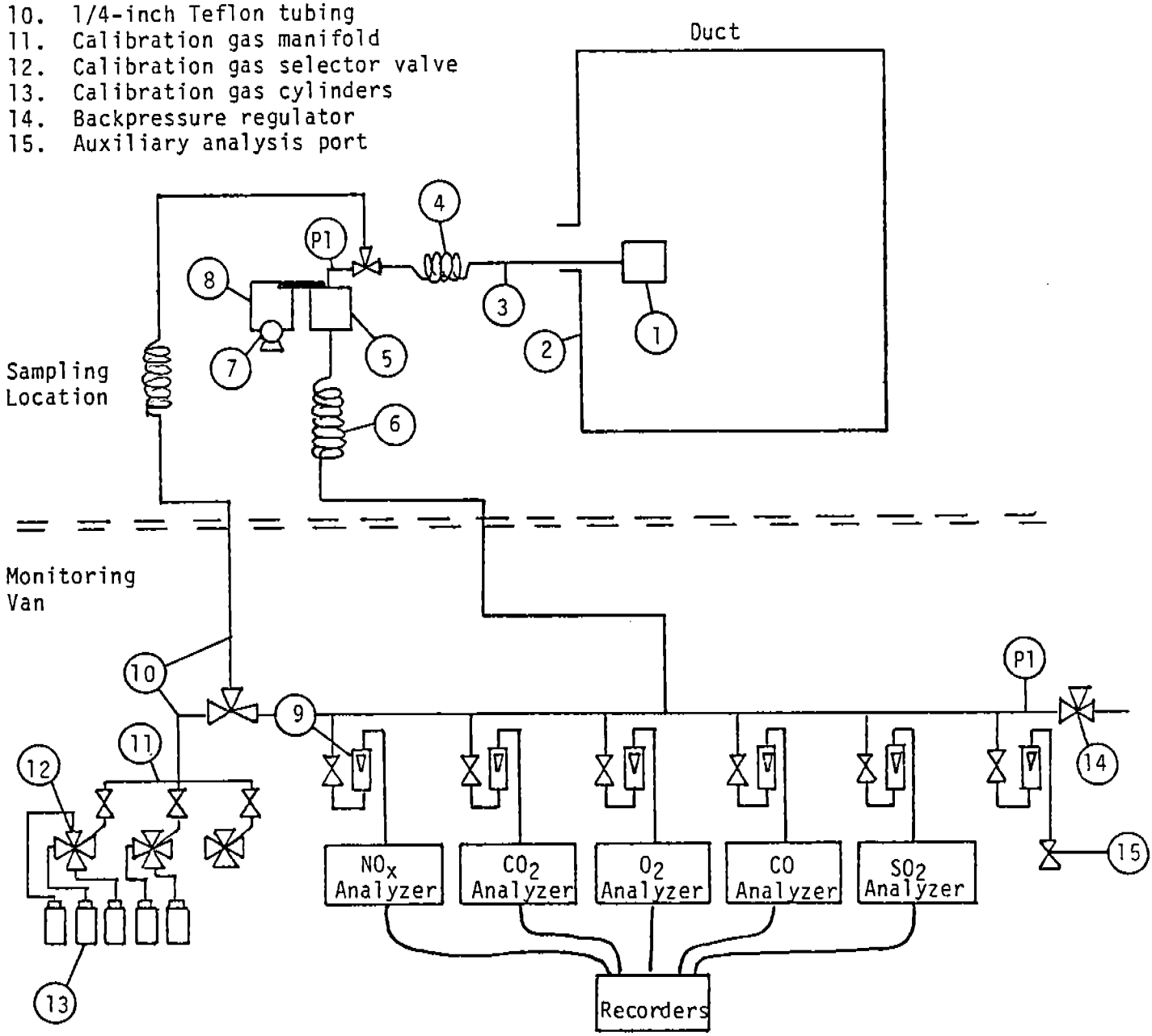

Figure 4-1. Schematic of Continuous Monitoring System.

this report. All pertinent data (date, time, test locations, analyzer range, cal gas value) were recorded on both the field data sheets and continuous analyzer strip charts in the field.

At the start of the test, a leak-check was performed. The sample probe was removed from the stack and the end was sealed with a Swagelok cap. A leak-check is successful only if pressure at the analyzer system and flow through the rotameters to the individual analyzers all drop to zero. A mandatory leak-check was performed at the completion of each test.

An initial calibration was performed at the start of the test period by introducing zero and span gases for each analyzer and making the necessary adjustments. Calibration gas values were recorded on the continuous monitor strip charts and field data sheets. A calibration check was completed at the end of the test and adjustments (if necessary) to the analyzers were made in preparation for another test.

Test data was collected by continuously recording data onto strip charts for each test.

SECTION 5

ANALYSIS PROCEDURES

This section of the report describes the procedures used to analyze the samples collected during the test program. All analyses were performed in the Pape & Steiner climate-controlled laboratory in Bakersfield.

5.1 ANALYSIS OF PARTICULATE SAMPLES

5.1.1 Nozzle, Probe, Filter Holder Wash

The volume of the acetone washings were measured and the washings were transferred to clean, tared, aluminum weighing dishes. The dishes were placed on a hot plate in a fume hood and gently heated to dryness. The dishes with the dry residue were desiccated and weighed repeatedly at 6-hour intervals until a constant weight was achieved (to the nearest 0.01 mg with a tolerance of <0.1 mg between weighings). The ACS reagent grade acetone blank was treated in the same manner.

5.1.2 Filter

The 100 mm filter was removed from its petri dish and transferred to an oven where it was heated for 2 hours at 105°C. The filter was then desiccated and weighed repeatedly at 6-hour intervals until a constant weight was achieved (to nearest 0.01 mg with a tolerance of <0.1 mg between weighings). An unused, tared blank filter was treated in the same manner.

5.1.3 Condensible Particulate

A 100 ml aliquot of the thoroughly shaken 80% IPA was transferred to a clean, tared glass dish. This dish was gently heated on a hot plate. The dishes with the dry residue were desiccated and weighed repeatedly at 6-hour intervals until a constant weight was achieved (to the nearest 0.01 mg with a tolerance of <0.1 mg between weighings). The ACS reagent grade 80% IPA blank was treated in the same manner. A 10 ml aliquot of each 80% IPA sample was treated with KI and analyzed spectrophotometrically to determine the presence or absence of H_2O_2 contamination.

SECTION 6

QUALITY ASSURANCE

6.1 PARTICULATE SAMPLING EQUIPMENT

A detailed record of repair and maintenance to each sampling train is kept. Preventative maintenance to each system is performed periodically to avoid complete component breakdown during a field test.

A detailed record of sampling system calibrations is also kept. Calibration data for the sampling nozzles, pitot tubes, dry gas meters and orifice meters are available for review. Results of the EPA Quality Assurance Branch biannual audits of the dry gas meter and orifice meter combinations are also logged and verify our in-house calibration data. The calibration data for the equipment used on this program can be found in the Appendix.

6.2 LAB ANALYSIS

All field samples are assigned a label and an ID number. This ID is also affixed to a chain-of-custody log and to the field data sheet to eliminate any chance of sample mixup.

Prior to analysis, all glassware is thoroughly cleaned (soap and water, tap water rinse, distilled water rinse, IPA rinse) to eliminate any contamination. The evaporating dishes used to evaporate the washings are

treated the same as a sample (dried in an oven, desiccated and weighed repeatedly at 6-hour intervals until a constant weight is achieved). The glassware used to measure volumes and make transfers and dilutions are all NBS Class A to insure accurate measurements. All weighings are carried out on a Mettler Model H54AR analytical balance supported by a marble table in a separate room from the main analytical laboratory. The balance is calibrated regularly against an NBS Class S-1 weight.

All reagents used in the field and in the laboratory are ACS reagent grade and blanks of these reagents are evaluated for every set of tests. Blanks are taken in the field from the squeeze bottles and not the original container. Records are kept on these blanks to insure consistent quality of the reagents. Prior to use, the IPA is also analyzed to insure no peroxides are present which could lead to high SO_3 and low SO_2 values.

A quality control program consisting of duplicate analyses (to measure precision), spikes (to measure recovery efficiency) or analysis of blind standards supplied by EPA's Quality Assurance Branch (to measure accuracy) is implemented for each test program. Table 6-1 summarizes the results of the QC checks on this program.

6.3 CONTINUOUS MONITORS

Prior to the test program, an internal and external calibration of the sampling system was performed using the calibration gases. There was excellent agreement between the internal and external calibrations (indicating no sample loss in the system) over the test period. The calibration gas certificates for the gases used on this test program appear in the Appendix.

As an additional check on the quality of the SO_2 data, a sample of the 6-percent H_2O_2 from the modified EPA Method 5/8 train for Test #3 on August 27, 1985 was analyzed for SO_2. This comparison data is presented in Table 6-2.

TABLE 6-1. QA/QC RESULTS

Date	Test	Sample	Duplicate (%)	Spike (%)
08/27/85	3	Condensible Particulate	101.2	
08/28/85	6	Condensible Particulate	106.3	
08/27/85	3	SO_2		102.5

TABLE 6-2. SO_2 COMPARISON DATA

Test	Continuous Monitor ppm SO_2	Wet Chemical ppm SO_2
3	51.8	52.2

APPENDIX

- Sampling Point Locations
- Velocity Traverse Sheet
- Particulate Field Data Sheets
- Continuous Monitor Data Sheets
- Continuous Monitor Strip Charts
- Sample Handling Log
- Analytical Reports
- Isokinetic Calculations
- Emission Rate Calculations
- Equipment Calibrations
- Calibration Gas Certificates

Pape & Steiner Environmental Services

SAMPLING POINT LOCATION DATA SHEET

Plant Lone Star Cement

Date 8-27-85

Test Location Kiln Stack

Upstream Dist./Dia. 21'/2.1

Downstream Dist./Dia. 80'/10

No. of Sampling Points 12

Stack Dimension 120

Coupling Length 8.5

Sample Point	Dist	Sample Point	Dist	Sample Point	Dist	Sample Point	Dist
1	13.7						
2	26.1						
3	44.0						

SAMPLING POINT RELOCATION:

Pape & Steiner Environmental Services

K FACTOR/NOZZLE CALCULATION

$$K = \frac{782.687(Cp)^2(1 - B_{wo})^2 P_s MW_d}{K_o^2 MW_s P_m}$$

29.84

XEQ KC

CP	.840	O_2	16.2	MWd =	31.368
Bwo	0.15	CO_2	18.5	K(R10) =	~~897.398~~
Ps H_2O"	Ø	Ko	.6856		902.892
Pb	30.25				

$$N_d = \left(\frac{\Delta H\ T_s}{K\ T_m \Delta P}\right)^{.25}$$

XEQ ND

ΔP		Ideal Nozzle @ 1.1 ΔH =	0.223
Ts		Ideal Nozzle @ 1.8 ΔH =	4
Tm			

$$\Delta H = K(N_d)^4\left(\frac{T_m}{T_s}\right)(\Delta P)$$

XEQ KND

SN 1428

(1) Actual Nozzle I.D. .2680 (2) Actual Nozzle I.D. _____

$K(Nd)^4$ (R09) = 4.658 $K(Nd)^4$ (R09) = _____

XEQ DH

	Nozzle 1		Nozzle 2	
	High	Low	High	Low
Tm in	90			
Tm out	90			
Ts	280			
ΔP	.79	.48		
ΔH	2.73	1.66		

CLΣ

Pape & Steiner Environmental Services

PLANT Lonestar TEST TYPE Method 5/8 FIELD TEST DATA SHEET (Page 1 of 1)

Date 8-27-1985
Test Location Stack
Run Number 1 mill DFF
Stack Diameter 120"
Operator JCO
Filter No. 671

Barometric Pressure 30.35
Static in. wg. -.43
Probe Type/Length Glass 6'
Pitot Coefficient .840
Meter Box No./γ 644/.9756
Nozzle No./Size 1428/.2680

Impinger Volumes/Weights			
Contents	Final	Initial	Net
80% IPA	584.5	534.1	50.4
8% H_2O_2	624.3	572.9	51.4
—	450.4	446.3	4.1
S.G.	1058.1	627.1	31.0
		Total	136.9

Gas Composition			
Time	CO_2	O_2	CO
8:10 – 9:35	19.49	9.835	392.6

Leak Rate	cfm	"Hg
Initial	NOZZLE .014	.15
Final	.006	7

Sample Point	Time	ΔP in wg	ΔH in wg	Gas Meter Volume Ft^3	Temperature °F Stack	Probe	Oven	Imp.	Gas Meter In	Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
A 1	0809 0	.47	1.55	778.349	283	246	254	60	64	66	5.0	0.686	Pitot - OK
2	5	.53	1.71	781.73	284	265	256	58	64	65	5.0	0.721	
3	10	.45	1.48	785.02	283	236	258	53	66	62	4.5	0.671	
B 1	0831 15	.49	1.61	788.122	283	243	256	57	65	65	4.5	0.700	
2	20	.49	1.63	791.051	280	235	252	40	70	67	5.0	0.700	
3	25	.42	1.41	794.74	277	248	247	39	72	68	4.0	0.648	
C 1	38	.59	1.97	797.900	282	264	240	44	71	71	5.0	0.768	
2	35	.59	1.98	801.50	283	239	229	40	78	75	5.5	0.768	
3	40	.47	1.59	805.42	280	247	230	43	79	76	4.5	0.686	
D 1	0910 45	.59	2.00	808.503	278	267	250	48	76	78	5.0	0.768	
2	50	.59	2.00	812.21	283	252	254	48	82	79	5.0	0.768	
3	55	.57	1.96	816.05	275	249	250	49	74	82	5.0	0.755	Pitot - OK
	60			819.604									purge 15 min
			1.74	41.255	280.92				71.88			0.7129	

B 10749 | B 10750 | B 10751 | B 10752 | 10753 | 10754 | 10755 | 10756

Pape & Steiner Environmental Services

PLANT Lone Star Ind TEST TYPE M5/8 FIELD TEST DATA SHEET (Page 1 of 1)

Date 8-27-85
Test Location ESP Stack
Run Number 2-mill off
Stack Diameter 120
Operator GEO
Filter No. 672

Barometric Pressure 30.35
Static in. wg. -.45
Probe Type/Length Glass 6'
Pitot Coefficient .840
Meter Box No./γ 644/.9756
Nozzle No./Size 1428/.2680

Impinger Volumes/Weights			
Contents	Final	Initial	Net
80% IPA	583.4	528.5	54.9
6% H_2O_2	592.8	540.5	52.3
—	441.2	437.8	3.4
S.G.	669.0	636.7	32.3
		Total	142.9

Gas Composition			
Time	CO_2	O_2	CO
1010 –	19.44	9.824	428.8
1135			

Leak Rate	cfm	"Hg
Initial	NOZZLE .013	15
Final	.005	8

Sample Point	Time	ΔP in wg	ΔH in wg	Gas Meter Volume Ft^3	Temperature °F Stack	Probe	Oven	Imp.	Gas Meter In	Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
0 1	1013 0	.61	2.07	831.195	280	272	239	51	77	79	7.0	0.781	Pitot OK
2	5	.60	2.03	835.34	280	250	239	47	78	79	7.0	0.775	
3	10	.46	1.56	838.96	279	244	248	49	79	79	5.0	0.678	
C 1	15	.60	2.03	842.118	279	258	242	54	75	77	6.0	0.775	
2	20	.61	2.07	845.86	282	245	243	46	80	78	7.0	0.781	
3	25	.52	1.77	849.58	278	240	241	50	81	79	6.0	0.721	
B 1	1054 30	.54	1.83	853.191	280	248	245	51	79	79	5.5	0.735	
2	35	.52	1.76	857.25	282	250	243	47	80	80	6.0	0.721	
3	40	.42	1.43	860.68	278	244	251	52	81	80	5.0	0.648	
A 1	1114 45	.51	1.74	863.845	278	258	237	55	79	80	5.5	0.714	
2	50	.54	1.84	867.45	280	270	240	53	83	81	6.0	0.735	
3	55	.46	1.58	870.90	277	270	239	54	84	82	5.0	0.678	Pitot - OK
	60			874.092									purge 15 min
			1.81	42.897	279.42				79.58			0.7285	

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Pape & Steiner Environmental Services

PLANT Lincoln Inl TEST TYPE M5/8 FIELD TEST DATA SHEET (Page 1 of 1)

Date 8-27-1955
Test Location ESP Stack
Run Number 3-mill-off
Stack Diameter 120
Operator geo
Filter No. 673

Barometric Pressure 30.35
Static in. wg. -.44
Probe Type/Length Glass 6'
Pitot Coefficient .840
Meter Box No./γ 644/.9756
Nozzle No./Size 1418/.2680

Impinger Volumes/Weights			
Contents	Final	Initial	Net
80% IPA	596.0	545.3	50.7
3% H_2O_2	590.1	547.9	42.2
—	448.1	445.6	2.5
S.G.	668.8	636.5	32.3
		Total	127.7

Gas Composition			
Time	CO_2	O_2	CO
1215 -	20.02	9.576	436.2
1340			

Leak Rate	cfm	"Hg
Initial	.017	15
Final	.013	8

Sample Point	Time	ΔP in wg	ΔH in wg	Gas Meter Volume Ft^3	Temperature °F Stack	Probe	Oven	Imp.	Gas Meter In	Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
D 1	1216 0	.58	1.96	883.711	277	252	230	50	73	74	8.5	0.762	
2	5	.60	2.03	887.63	275	240	228	48	76	74	8.0	0.775	
3	10	.43	1.46	891.40	274	240	226	49	76	74	6.0	0.656	
C 1	1226 15	.60	2.03	894.847	274	248	228	55	73	74	7.0	0.775	
2	20	.60	2.03	898.29	275	247	231	51	76	74	8.0	0.775	
3	25	.49	1.68	902.00	268	259	233	53	77	75	8.0	0.700	
B 1	1302 30	.49	1.67	905.552	271	235	228	51	74	74	6.5	0.700	
2	35	.50	1.70	908.88	271	245	232	48	75	73	6.5	0.707	
3	40	.41	1.41	912.28	268	267	228	48	78	74	6.0	0.640	
A 1	1333 45	.50	1.72	915.543	264	254	230	50	74	75	6.0	0.707	
2	50	.52	1.77	918.88	274	262	236	51	77	75	7.0	0.721	
3	55	.47	1.61	922.38	273	262	228	51	79	76	6.5	0.686	
	1370			925.656									
			1.76	41.945	272.00				25.00			0.7169	

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Pape & Steiner Environmental Services

PLANT Lonestar TEST TYPE M5/8 FIELD TEST DATA SHEET (Page 1 of 1)

Date 8/28/1985
Test Location Stack
Run Number 4 (million)
Stack Diameter 120
Operator geo
Filter No. 675

Barometric Pressure 30.34
Static in. wg. − .055
Probe Type/Length glass 6'
Pitot Coefficient .840
Meter Box No./γ 644/.9756
Nozzle No./Size 1428/.2680

Impinger Volumes/Weights				Gas Composition			
Contents	Final	Initial	Net	Time	CO_2	O_2	CO
80% IPA	580.3	519.8	60.5	755 −	16.71	11.28	362.7
6% H_2O_2	601.8	559.1	42.7	910			
—	450.4	446.3	4.1				
				Leak Rate		cfm	"Hg
				Initial		NOZZLE .019	.16
S.G.	739.9	701.8	38.1				
		Total	145.4	Final		.005	9

Sample Point	Time	ΔP in wg	ΔH in wg	Gas Meter Volume Ft^3	Temperature °F Stack	Probe	Oven	Imp.	Gas Meter In	Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
D 1	0755 0	.72	2.67	936.876	203	225	250	43	68	68	7.0	0.849	PITOT - OK
2	5	.78	2.90	940.25	204	230	243	41	70	69	7.5	0.883	
3	10	.64	2.38	945.12	204	244	248	41	71	69	6.5	0.800	
C 1	15	.74	2.75	949.187	202	262	257	44	69	69	7.0	0.860	
2	20	.81	3.00	953.48	208	246	259	39	72	69	8.0	0.900	
3	25	.76	2.81	958.08	210	232	246	43	73	71	7.0	0.872	
B 1	0833 30	.59	2.21	962.425	203	264	254	38	72	72	5.5	0.768	
2	35	.60	2.23	966.57	208	251	245	40	74	72	6.0	0.775	
3	40	.51	1.90	970.42	206	234	230	44	75	73	5.0	0.714	
A 1	0852 45	.60	2.25	974.014	204	259	235	49	74	73	5.5	0.775	
2	50	.64	2.39	978.17	208	254	241	48	78	75	6.0	0.800	
3	55	.60	2.27	982.12	203	220	260	47	78	77	6.0	0.775	PITOT - OK
	0907 60			986.175									Purge 15 min
			2.48	49.799	205.25				72.13			0.8141	

10765 | 10766 | 10767 | 10768

Pape & Steiner Environmental Services

PLANT Lonestar TEST TYPE MS/8 FIELD TEST DATA SHEET (Page 1 of 1)

Date 8/28/1985
Test Location Stack
Run Number 5 (mill on)
Stack Diameter 120
Operator GEO
Filter No. 676

Barometric Pressure 30.34
Static in. wg. -0.55
Probe Type/Length Glass 6'
Pitot Coefficient .840
Meter Box No./γ 644/.9256
Nozzle No./Size 1428/.3620

Impinger Volumes/Weights				Gas Composition			
Contents	Final	Initial	Net	Time	CO_2	O_2	CO
80% IPA	573.5	516.7	56.8	940 -	17.19	10.96	321.7
6% H_2O_2	570.8	536.4	34.4	1110			
—	442.9	439.4	3.5				
				Leak Rate		cfm	"Hg
				Initial		NOZZLE .018	15
S.G.	719.1	678.9	40.2				
		Total	134.9	Final		.010	10

Sample Point	Time	ΔP in wg	ΔH in wg	Gas Meter Volume Ft^3	Temperature °F Stack	Probe	Oven	Imp.	Gas Meter In	Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
D1	0940 0	.74	2.25	995.214	208	270	236	46	73	73	9.0	0.860	
2	5	.83	3.09	999.61	209	228	270	53	75	74	10.0	0.911	0945 pump stopped 1005 start
3	10	.67	2.48	4.98	213	254	236	45	75	75	9.0	0.819	
C1	1012 15	.74	2.23	9.12	218	250	240	53	76	77	9.0	0.860	
2	20	.84	3.09	13.48	220	255	245	47	79	76	10.0	0.917	
3	25	.78	2.87	18.10	221	236	248	50	79	77	9.5	0.883	
B1	1036 30	.56	2.07	22.609	218	240	240	50	80	78	6.0	0.748	
2	35	.62	2.28	26.49	220	246	242	46	79	77	7.0	0.787	
3	40	.52	1.92	30.37	219	244	246	45	79	77	6.0	0.721	
A1	1055 45	.57	2.09	34.092	218	255	234	46	75	75	6.5	0.755	
2	50	.62	2.28	37.86	220	270	236	46	78	76	7.0	0.787	
3	55	.57	1.89	41.84	215	249	235	47	78	76	6.0	0.714	
	60			1045.504									
			2.46	50.290	216.58				76.54			0.8136	

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Pape & Steiner Environmental Services

PLANT Lonestar TEST TYPE M5/8 FIELD TEST DATA SHEET (Page 1 of 1)

Date 8-28-1985
Test Location Stack
Run Number 6 (million)
Stack Diameter 120"
Operator geo
Filter No. 677

Barometric Pressure 30.34
Static in. wg. -0.55
Probe Type/Length Glass 6'
Pitot Coefficient .840
Meter Box No./γ 644/1.92556
Nozzle No./Size 1488/.2180

Impinger Volumes/Weights				Gas Composition			
Contents	Final	Initial	Net	Time	CO_2	O_2	CO
80% IPA	582.2	533.8	48.4	1140-	17.45	10.83	344.7
6% H_2O_2	533.8	526.6	7.2	1300			
—	489.0	449.2	39.8				
				Leak Rate		cfm	"Hg
				Initial		NOZZLE .0013	15
S.G.	671.8	642.6	29.2				
		Total	124.6	Final		.0014	15

Sample Point	Time	ΔP in wg	ΔH in wg	Gas Meter Volume Ft^3	Temperature °F Stack	Probe	Oven	Imp.	Gas Meter In	Out	Pump Vacuum in. Hg	$\sqrt{\Delta P}$	Comments
D1	1140 0	.77	2.83	56.223	216	253	228	46	72	73	11.0	0.877	Pitot - OK
2	5	.86	3.17	60.65	217	243	238	46	76	75	12.0	0.927	
3	10	.70	2.58	65.44	218	234	248	52	76	75	11.0	0.837	
C1	1159 15	.76	2.23	69.604	210	222	236	51	73	74	9.0	0.775	
2	20	.86	3.16	73.62	217	262	225	51	75	74	13.0	0.927	
3	25	.80	2.95	78.60	214	236	228	50	75	74	13.0	0.894	
B1	1220 30	.61	2.26	82.89	208	260	225	49	72	73	9.0	0.781	
2	35	.61	2.25	87.25	214	258	230	51	75	73	9.0	0.781	
3	40	.51	1.89	90.98	213	250	228	50	76	74	7.5	0.714	
A1	45	.59	2.19	94.680	210	257	229	47	75	74	8.0	0.768	
2	50	.58	2.15	98.73	212	270	243	50	77	74	8.0	0.762	
3	55	.50	1.86	102.32	211	246	253	52	77	74		0.707	Pitot - OK
	1256 60			105.950									Purge 15 min
			2.46	49.727	213.33				74.42			0.8126	

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Pape & Stein Environmental Services

CONTINUOUS MONITOR DATA SHEET

Plant: Lonestar Ind, Davenport CA
Date: 8-27-1985
Test Location: Kiln ESP Stack
Run Number: 1 - mill off-line
Operator: C. Werden

Ambient Temperature:
Barometric Pressure: 30.35
Static Pressure Duct:
Fuel:
Trailer Number: 2

Begin Time	Sample Point	Fuel Flow	Dry Uncorrected O_2 %	Dry Uncorrected CO_2 %	Dry Uncorrected CO ppm	Dry Uncorrected SO_2 ppm	Dry Uncorrected NO ppm	Dry Uncorrected NO_x ppm	3% O_2 Dry ppm	3% O_2 Dry NO_x ppm	Hydrocarbons THC	Hydrocarbons CH_4	Hydrocarbons Non CH_4				Comments
8:00	INITIAL		8.04	17.07	400	79.8		208.3									AAL-O_2/CO_2/CO -
			1.1	0	0	76.0		2									AAL-NO_x - 14803
																	AAL-SO_2 - 13830
8:10			9.5	20.0	405	32		235									Span Gas Value
8:15			9.8	19.2	430	29		223									External Cal
8:20			9.9	19.2	425	33		227									Initial Leak Check OK
8:25			9.9	19.1	400	37		235									-10 to 100% recorder
8:30			10.0	19.1	370	41		240									10 cm/hr speed
8:35			9.9	19.2	385	45		238									0-25% O_2
8:40			9.8	19.3	365	49.5		238									0-250 ppm NOx
8:45			9.8	19.4	370	51		235									0-500 ppm CO
8:50			9.9	19.4	363	50		233									0-40% CO_2
8:55			9.8	19.6	400	54		215									0-100 ppm SO_2
9:00			9.8	19.6	430	58		212									
9:05			9.8	19.6	415	57		230									
9:10			9.8	19.6	435	53		235									
9:15			9.9	19.7	370	55		248									
9:20			9.9	19.8	370	53		243									
9:25																	

Pape & Steir Environmental Services

CONTINUOUS MONITOR DATA SHEET

Plant: Cemestar Ind. Davenport CA

Date: 8-27-1985

Test Location: Kiln ESP Stack

Run Number: 2- mill off-line

Operator: C. Werder

Ambient Temperature:

Barometric Pressure: 30.35

Static Pressure Duct:

Fuel:

Trailer Number:

Begin Time	Sample Point	Fuel Flow	Dry Uncorrected O_2 %	Dry Uncorrected CO_2 %	Dry Uncorrected CO ppm	Dry Uncorrected SO_2 ppm	Dry Uncorrected NO ppm	Dry Uncorrected NO_x ppm	3% O_2 Dry ppm	3% O_2 Dry NO_x ppm	Hydrocarbons THC	Hydrocarbons CH_4	Hydrocarbons Non CH_4				Comments
1000	INITIAL		8.04	17.07	400	79.8		208.3									Span Gas Values
1010			9.8	19.7	410	50		215									
1015			9.8	19.6	450	52		212									
1020			9.8	19.5	435	49		208									
1025			9.7	19.6	450	51		210									
1030			9.7	19.7	7500	59		202									0-25 % O_2
1035			9.6	19.7	7500	62		210									0-1000 NO_x
1040			9.6	19.7	7500	59		218									0-500 CO
1045			9.6	19.6	500	60		229									0-40 CO_2
1050			9.7	19.5	430	54		255									0-100 SO_2
1055			9.7	19.4	380	52		290									
1100			9.8	19.3	370	52		302									
1105			9.9	19.2	370	52		295									
1110			10.0	19.3	400	52		284									
1115			10.0	19.3	385	46		275									
1120			10.1	19.1	385	38		265									
1125			10.1	19.1	400	36		260									
1130			10.1	19.1	425	43		255									
	CHECK		.25	0	0	1.4		1									Zero
			8.1	16.85	404	82.5		207									Span

Pape & Steir nvironmental Services

CONTINUOUS MONITOR DATA SHEET

Plant: Lonestar Ind. Davenport CA

Date: 8-27-1985

Test Location: Kiln ESP Stack

Run Number: 3- mill off-line

Operator: C. Werden

Ambient Temperature:

Barometric Pressure: 30.37

Static Pressure Duct:

Fuel:

Trailer Number:

Begin Time	Sample Point	Fuel Flow	Dry Uncorrected O_2 %	Dry Uncorrected CO_2 %	Dry Uncorrected CO ppm	Dry Uncorrected SO_2 ppm	Dry Uncorrected NO ppm	Dry Uncorrected NO_x ppm	3% O_2 Dry ppm	3% O_2 Dry NO_x ppm	Hydrocarbons THC	Hydrocarbons CH_4	Hydrocarbons Non CH_4				Comments
12:00	INITIAL		8.04	17.07	400	79.8		205.3									0-25% O_2
																	0-1000 ppm NO_x
12:15			9.8	19.8	370	47		248									0-500 ppm CO
12:20			9.8	19.9	400	48		242									0-40% CO_2
12:25			9.7	20.0	445	50		230									0-100 ppm SO_2
12:30			9.7	20.0	435	51		230									
12:35			9.7	19.9	415	50		232									
12:40			9.7	19.9	430	50		232									
12:45			9.7	19.9	430	50		234									
12:50			9.7	20.0	435	52		228									
12:55			9.7	20.1	460	53		218									
13:00			9.5	20.2	>500	57		215									
13:05			9.4	20.1	480	58		226									
13:10			9.4	20.1	465	58		232									
13:25 15			9.4	20.0	425	57		240									
13:30 20			9.4	20.1	430	57		243									
13:35 25			9.4	20.1	425	53		248									
13:40 30			9.4	20.1	450	50		248									
13:35			9.4	20.1	420	40		248									
13:40																	
	CHECK		0	-.05	-5	0		0									Zero
			7.95	17.0	403	80.6		208									Span
																	Leak Check OK

Pape & Stein Environmental Services

CONTINUOUS MONITOR DATA SHEET

Plant: Lonestar Ind Davenport CA
Date: 8-28-1985
Test Location: Kiln Stack
Run Number: 4 (mill on)
Operator: C. Werden

Ambient Temperature:
Barometric Pressure: 30.34
Static Pressure Duct:
Fuel:
Trailer Number: 2

Time	Sample Point	Fuel Flow	Dry Uncorrected O_2 %	Dry Uncorrected CO_2 %	Dry Uncorrected CO ppm	Dry Uncorrected SO_2 ppm	Dry Uncorrected NO ppm	Dry Uncorrected NO_x ppm	3% O_2 Dry ppm	3% O_2 Dry NO_x ppm	Hydrocarbons THC	Hydrocarbons CH_4	Hydrocarbons Non CH_4				Comments
730	INITIAL		8.04	17.07	400	79.8		208.3									Span Gas Values
755			11.3	16.8	385	38		255									
800			11.3	16.9	385	46		260									
805			11.3	16.8	375	45		243									
810			11.3	16.8	380	43		240									
815			11.3	16.8	372	46		240									
820			11.3	16.7	330	39		230									
825			11.4	16.4	335	38		225									
830			11.4	16.5	340	44		200									
835			11.3	16.8	370	47		160									
840			11.2	16.8	435	49		160									
845			11.3	16.6	343	50		180									
850			11.2	16.8	350	45.5		160									
855			11.2	16.6	355	45		150									
900			11.2	16.7	345	46		145									
905			11.2	16.7	340	48		140									
	CHECK		0	0	-3	-0.7		0									Zero
			7.9	16.8	398	78.8		200									Span

Pape & Steir Environmental Services

CONTINUOUS MONITOR DATA SHEET

Plant: Lonestar Ind Davenport CA

Date: 8-28-1985

Test Location: Kiln Stack

Run Number: 5 (mill on)

Operator: C. Werden

Ambient Temperature:

Barometric Pressure: 30.34 in. Hg

Static Pressure Duct:

Fuel:

Trailer Number: 2

Time	Sample Point	Fuel Flow	Dry Uncorrected O_2 %	Dry Uncorrected CO_2 %	Dry Uncorrected CO ppm	Dry Uncorrected SO_2 ppm	Dry Uncorrected NO ppm	Dry Uncorrected NO_x ppm	3% O_2 Dry ppm	3% O_2 Dry NO_x ppm	Hydrocarbons THC	Hydrocarbons CH_4	Hydrocarbons Non CH_4				Comments
930	INITIAL		8.04	17.07	400	79.8		208.3									Span Gas Values
940			11.2	17.1	335	40		126									
945			11.2	17.1	335	41		125									
950			11.2	17.0	328	42		134									
955			11.1	17.1	335	42		128									
1000			11.1	17.2	330	44		129									
1005			11.0	17.2	320	44		130									
1010			11.0	17.2	325	45		124									
1015			10.9	17.3	333	44		120									
1020			10.8	17.2	317	41.5		126									
1025			10.8	17.2	315	41.5		122									
1030			10.8	17.2	312	41		125									
1035			10.8	17.1	320	42		134									
1040			10.9	17.3	312	50		138									
1045			10.9	17.3	312	52		146									
1050			10.9	17.2	304	43		164									
1055			10.9	17.3	309	41		164									
1100			11.0	17.2	313	42		154									
1105			10.8	17.3	335	46		147									
	CHECK		0	0	3	0		-1									Zero
			7.8	17.1	390	79.2		204									Span

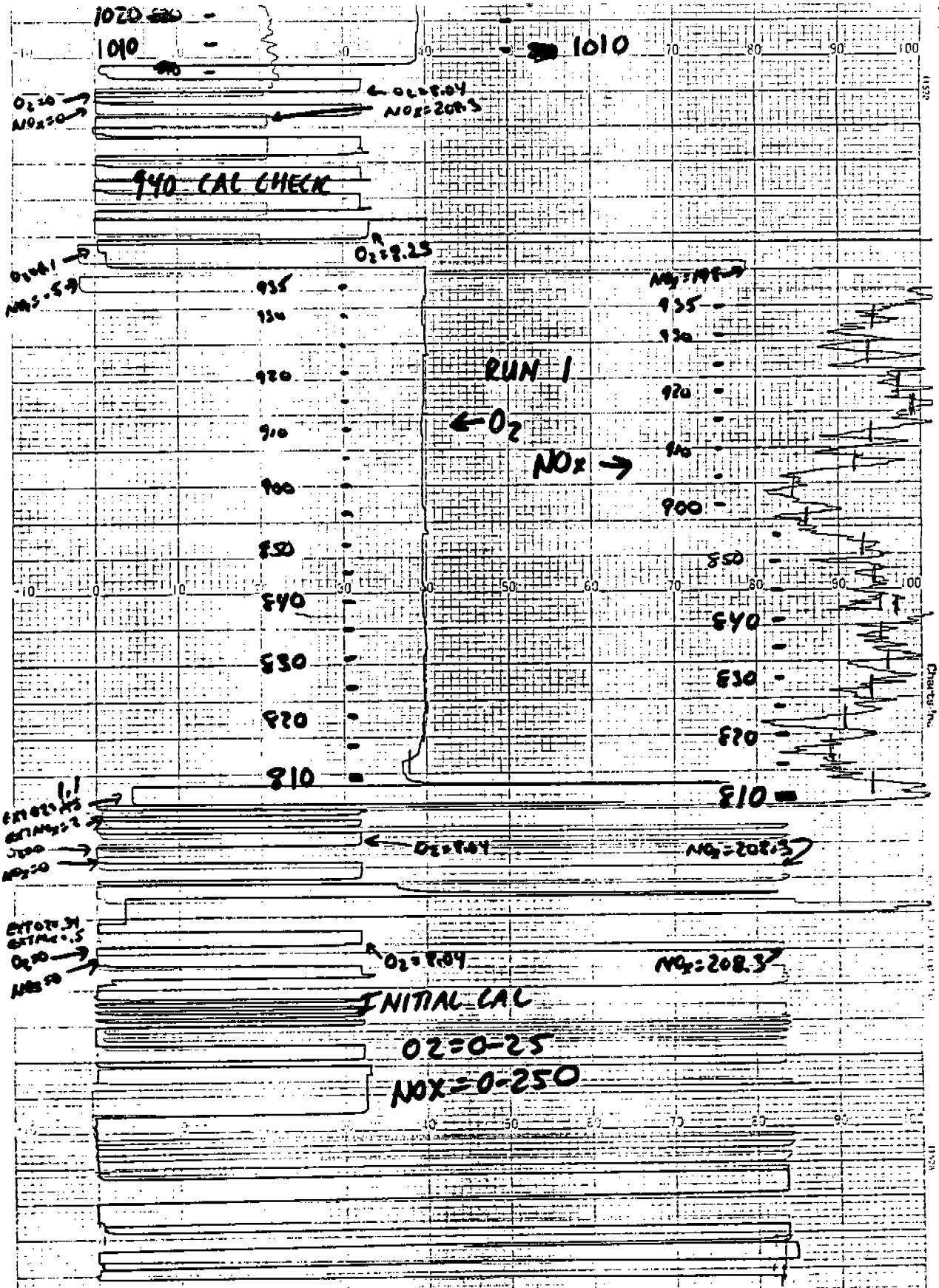
Pape & Stein Environmental Services

CONTINUOUS MONITOR DATA SHEET

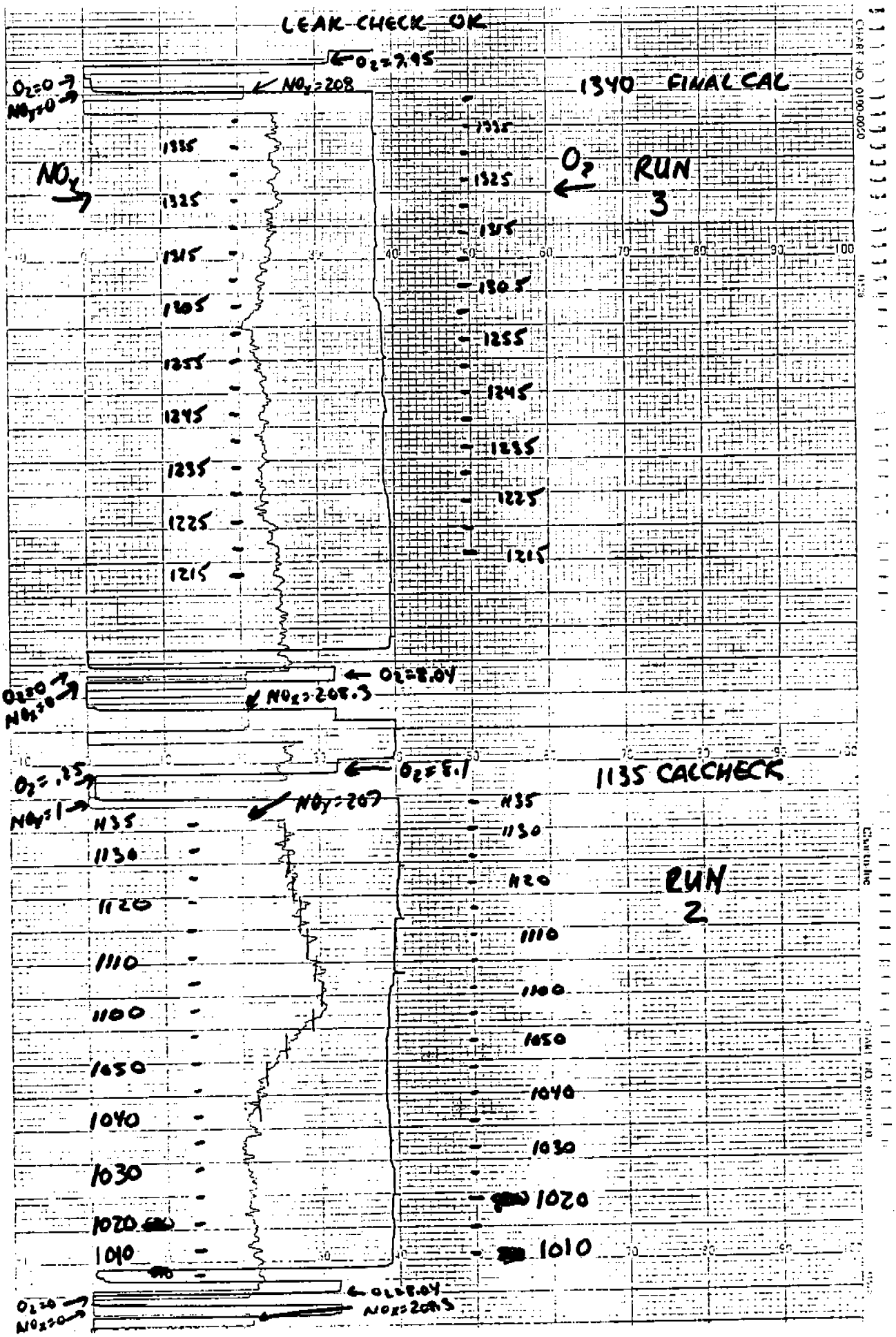
Plant: Lonestar Ind. Davenport CA
Date: 8-28-1985
Test Location: Kiln Stack
Run Number: 6 (mill on)
Operator: C. Werden

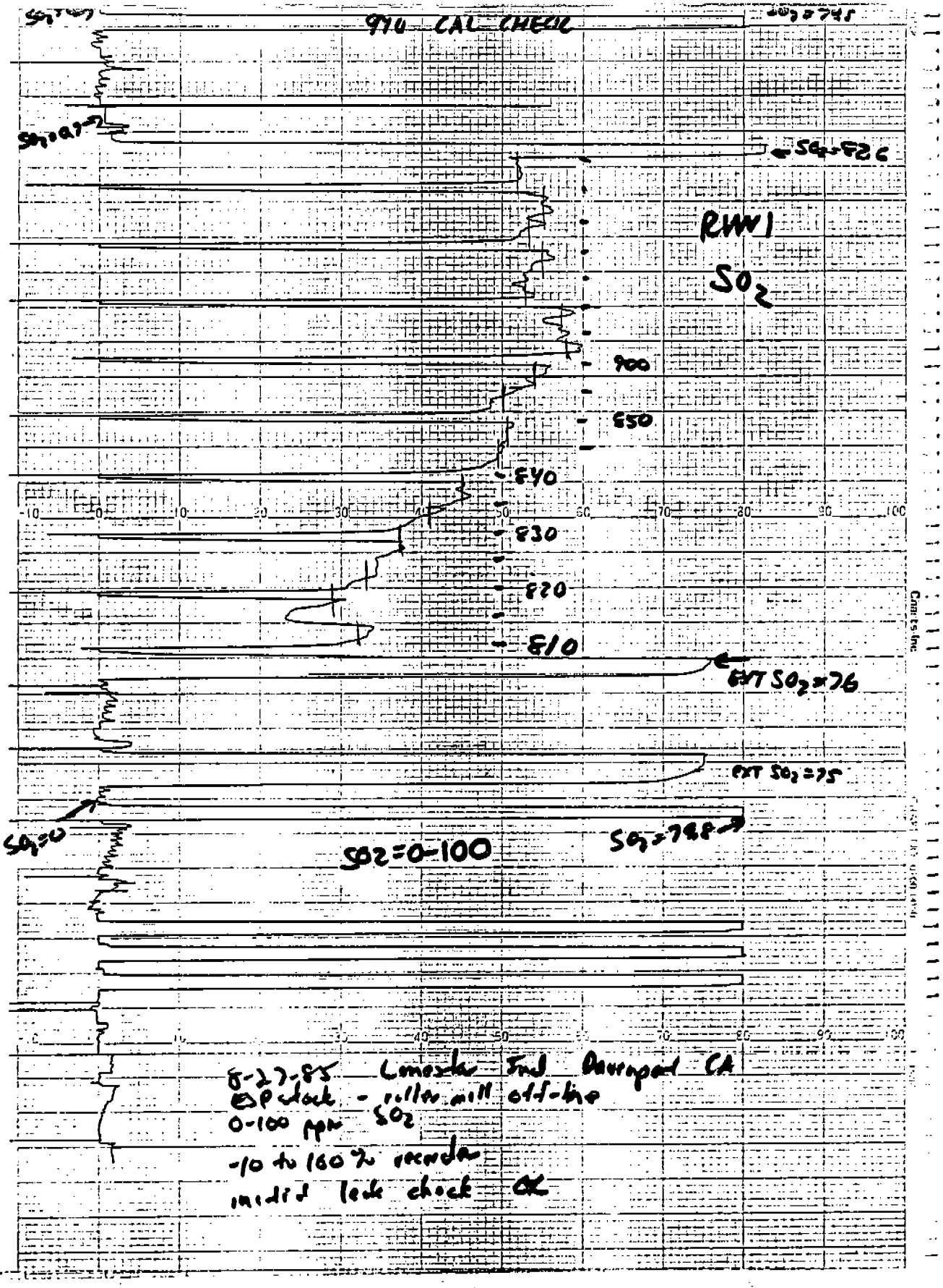
Ambient Temperature:
Barometric Pressure: 30.33
Static Pressure Duct:
Fuel:
Trailer Number: 2

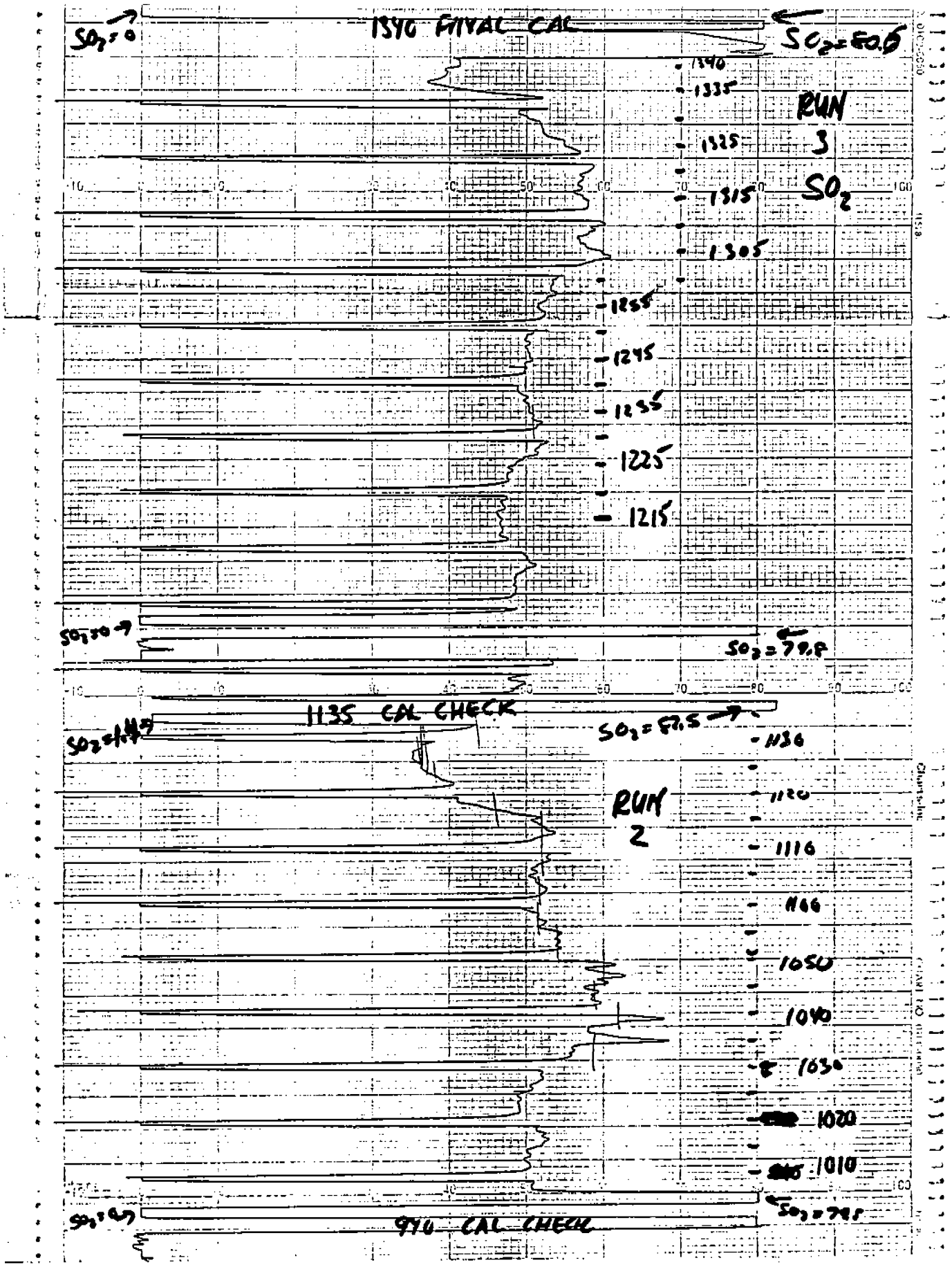
Time	Sample Point	Fuel Flow	Dry Uncorrected O_2 %	Dry Uncorrected CO_2 %	Dry Uncorrected CO ppm	Dry Uncorrected SO_2 ppm	Dry Uncorrected NO ppm	Dry Uncorrected NO_x ppm	3% O_2 Dry ppm	3% O_2 Dry NO_x ppm	Hydrocarbons THC	Hydrocarbons CH_4	Hydrocarbons Non CH_4				Comments
1130	INITIAL		8.04	17.07	400	79.8		208.3									Span Gas Values
1140			10.9	17.5	360	38		180									
1145			10.9	17.5	365	37		186									
1150			10.9	17.5	370	35		208									
1155			10.9	17.6	370	32		212									
1200			10.8	17.6	380	32		200									
1205			10.8	17.6	345	29		228									
1210			10.8	17.5	340	28		228									
1215			n/a	n/a	n/a	n/a		n/a									Drain Condenser
1220			10.8	17.4	317	32.5		236									
1225			10.9	17.4	318	34		250									
1230			10.8	17.3	322	32.5		262									
1235			10.8	17.3	327	35		244									
1240			10.8	17.4	330	35		230									
1245			10.8	17.4	342	37		230									
1250			10.8	17.4	330	38.5		229									
1255			10.8	17.4	355	42		222									
1300			0.1	0	8	-0.7		4									Zero
			7.8	17	412	78.8		214									Span
			0.8	0	10	76		4									Final (SO_2 = 79.8)
																	Final Leak Check OK

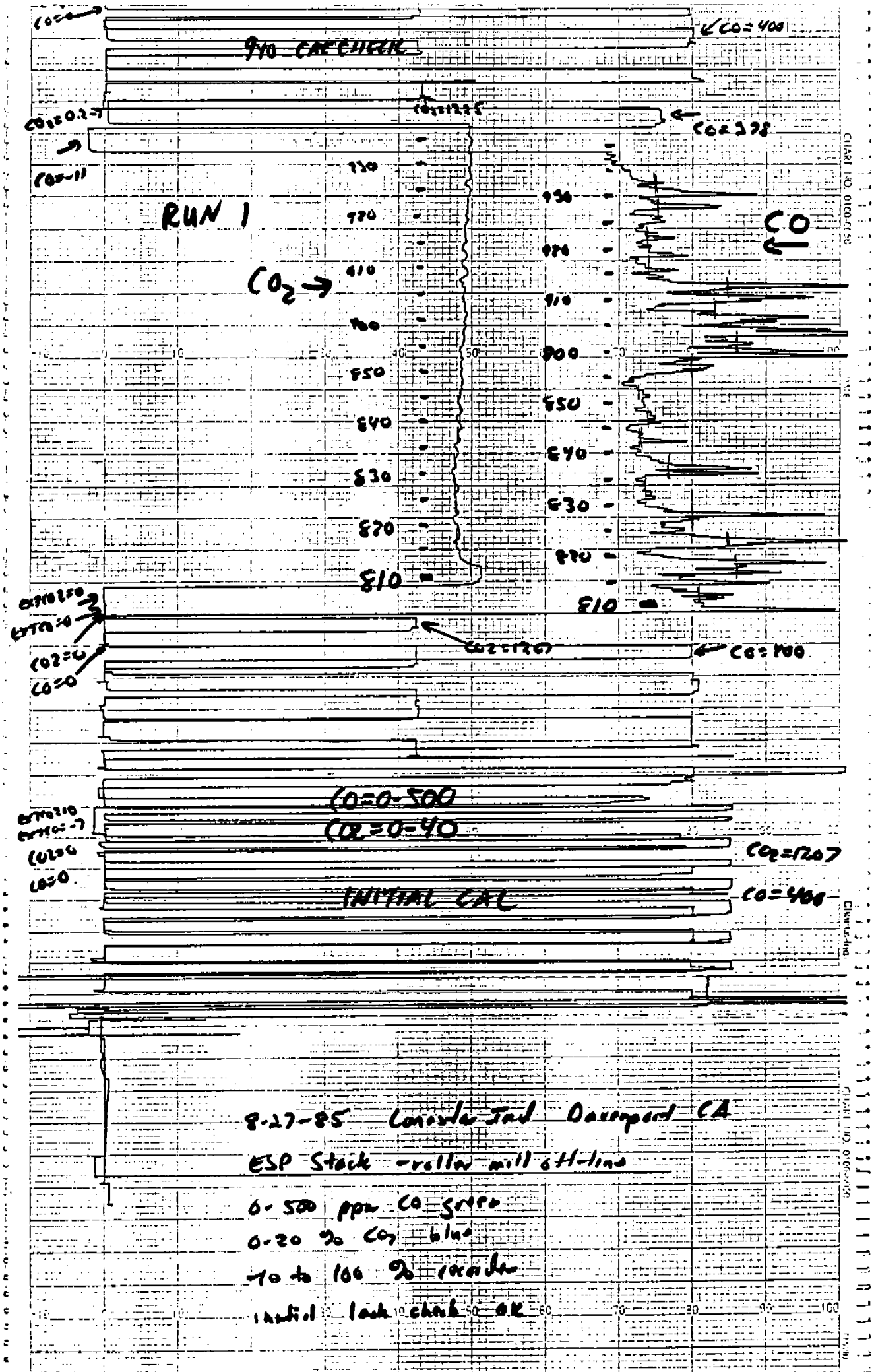


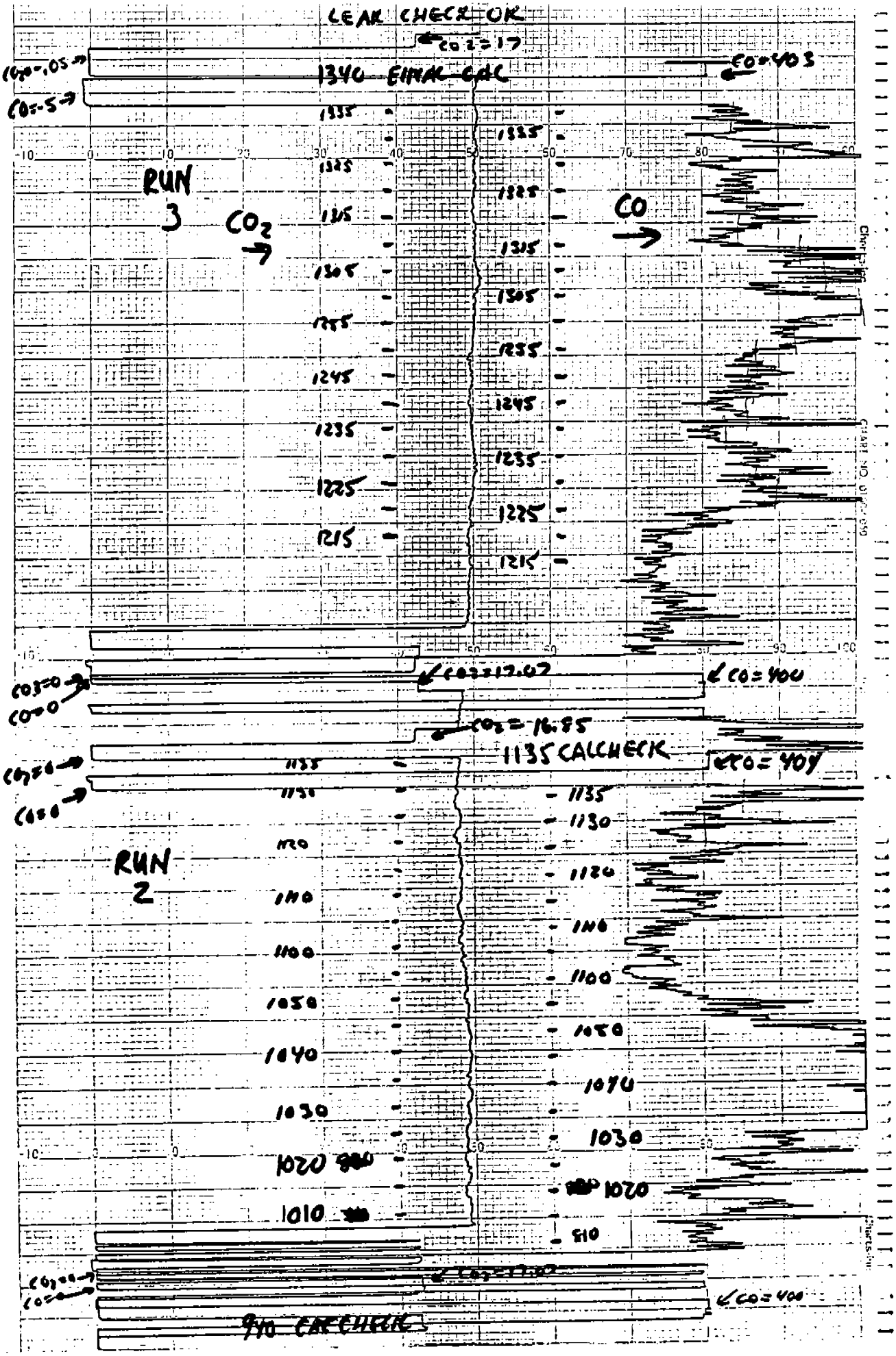
8-27-85 Lonestar Ind Davenport CA
ESP stack - roller mill off-line
0-250 ppm NO_x red
0-25 % O_2 black
10 to 100 % recorder
initial leak check OK

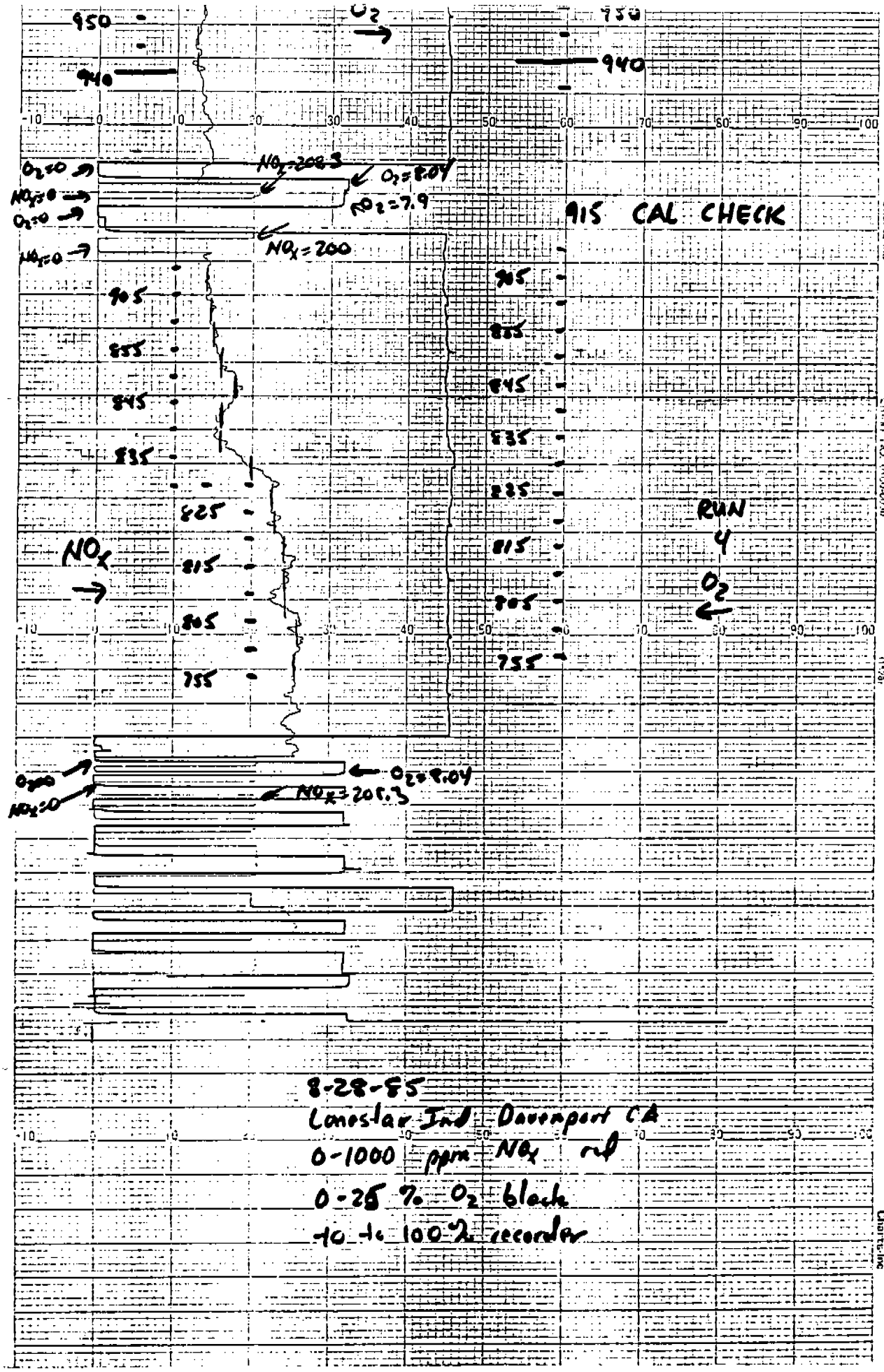

LEAK CHECK OK
O2=20.95
NOx=208
O2=0
NOx=0
1340 FINAL CAL
NOx
O2
RUN 3
1335
1325
1315
1305
1295
1285
1275
1265
1255
1245
1235
1225
1215
O2=8.04
NOx=208.3
O2=.25
NOx=1
O2=8.1
1135 CALCHECK
NOx=207
RUN 2
1135
1130
1120
1110
1100
1050
1040
1030
1020
1010
O2=8.04
NOx=208.3

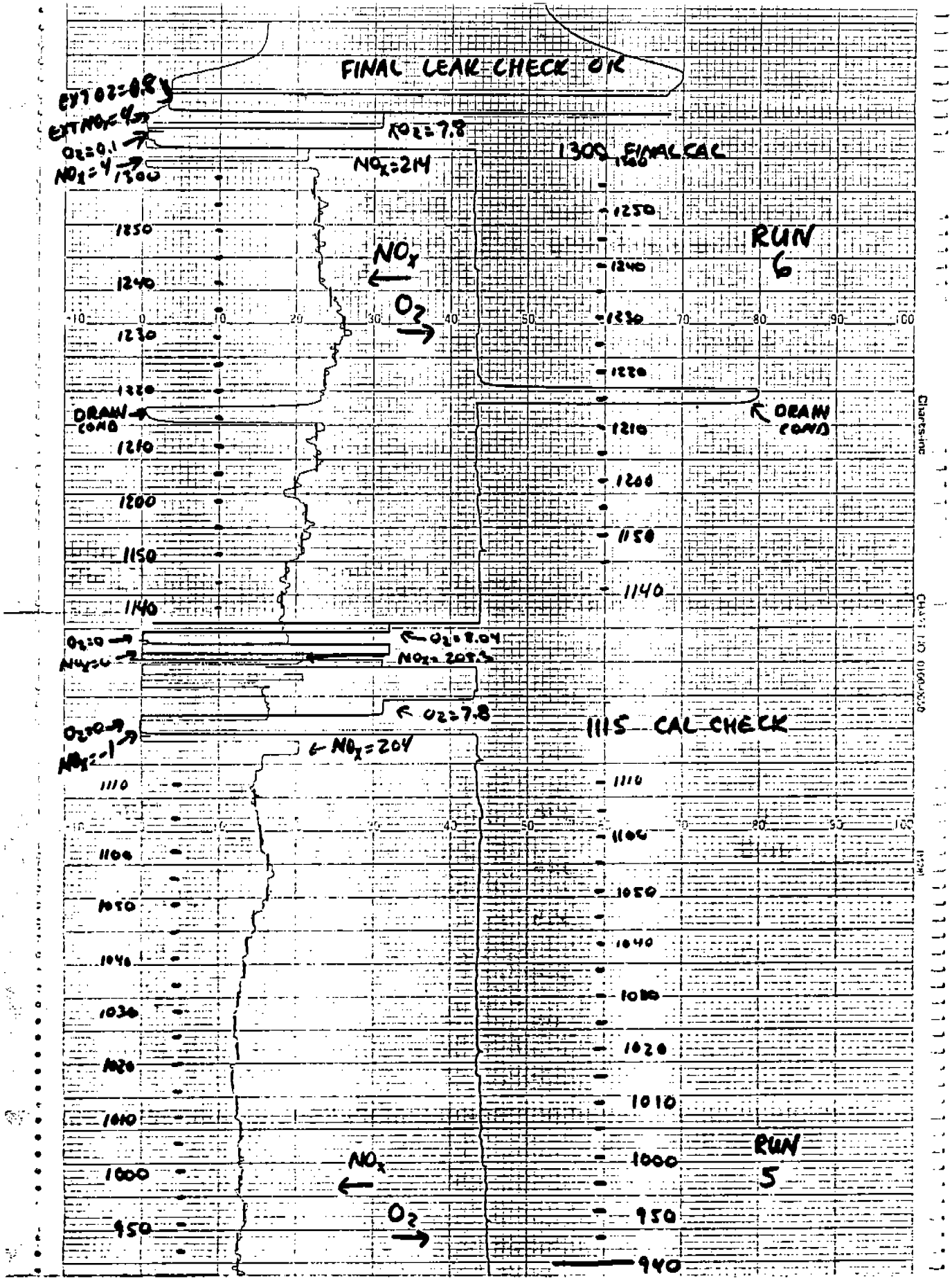

910 CAL CHECK
SO2=0
SO2=826
RW1
SO2
900
850
840
830
820
810
EXT SO2=76
EXT SO2=75
SO2=0
SO2=788
SO2=0-100
-10 0 10 20 30 40 50 60 70 80 90 100
8-27-85 Lonestar Ind Davenport CA
ESP clock - roller mill off-line
0-100 ppm SO2
-10 to 100 % recorder
initial leak check OK

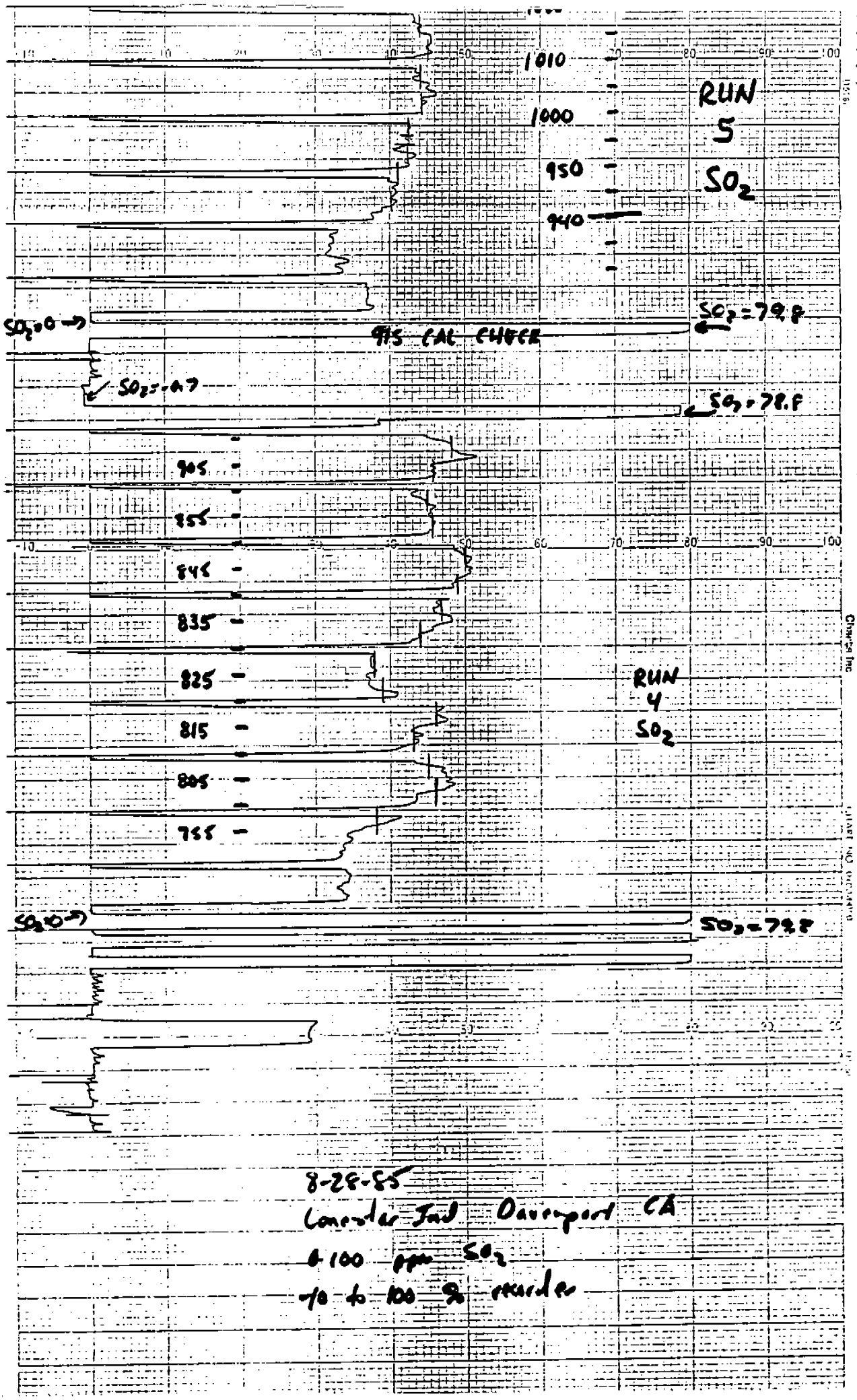

1340 FINAL CAL
SO2 = 0
SO2 = 50.6
1340
1335
RUN
3
1325
1315
SO2
1305
1255
1245
1235
1225
1215
SO2 = 0
SO2 = 79.8
1135 CAL CHECK
SO2 = 57.5
1136
RUN
2
1120
1116
1110
1050
1040
1030
1020
1010
SO2 = 0
SO2 = 79.8
940 CAL CHECK

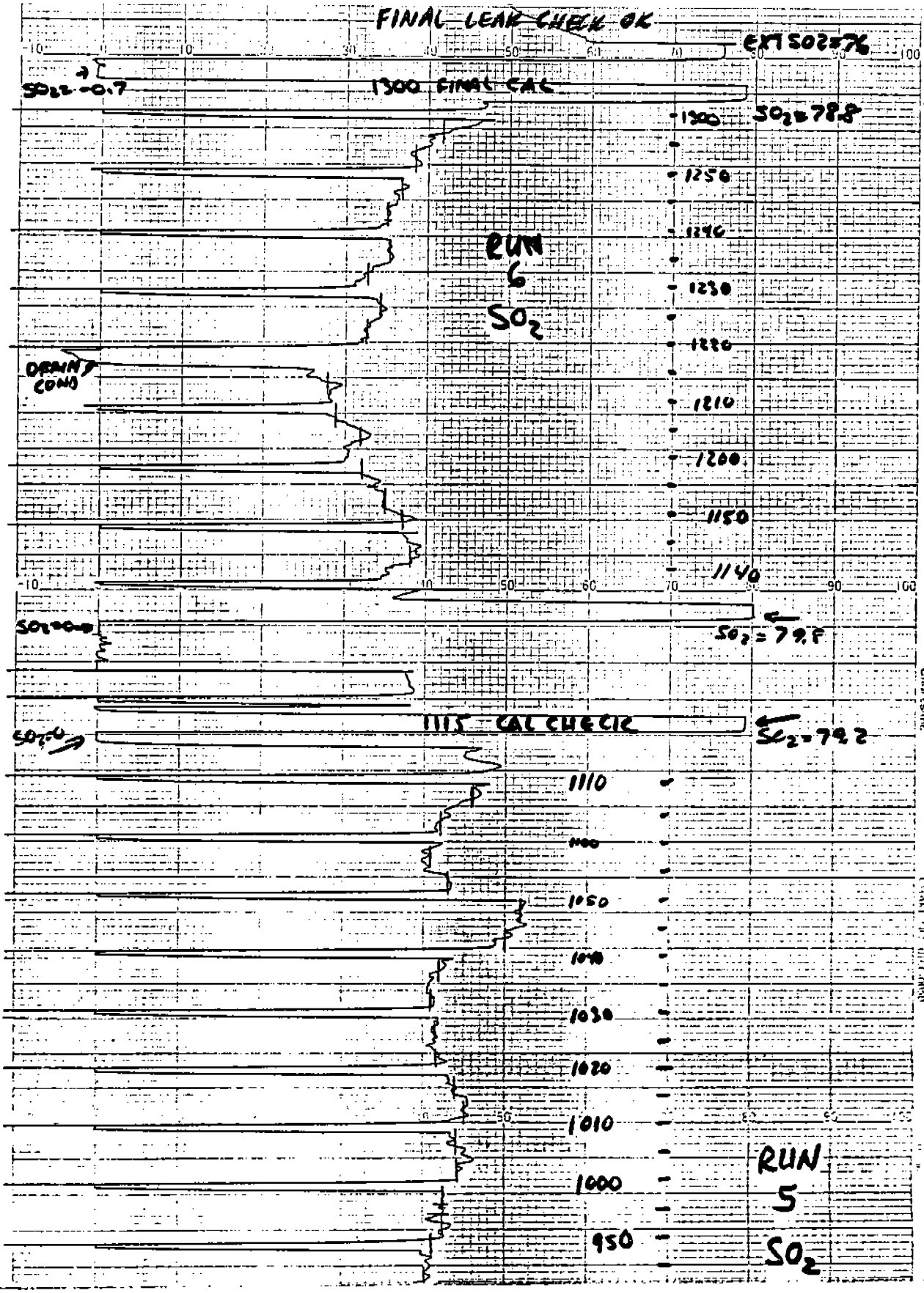

CO=400
9/10 CAL CHECK
CO2=1225
CO=378
CO2=0.2
CO=11
RUN 1
CO2
CO
930
920
910
900
890
880
870
860
850
840
830
820
810
CO2=1207
CO=400
CO2=0
CO=0
CO=0-500
CO2=0-40
INITIAL CAL
CO2=1207
CO=400
8-27-85 Calibrated Developed CA
ESP Stack - roller mill 6th-line
0-500 ppm CO green
0-20 % CO2 blue
10 to 100 % reader
initial leak check OK

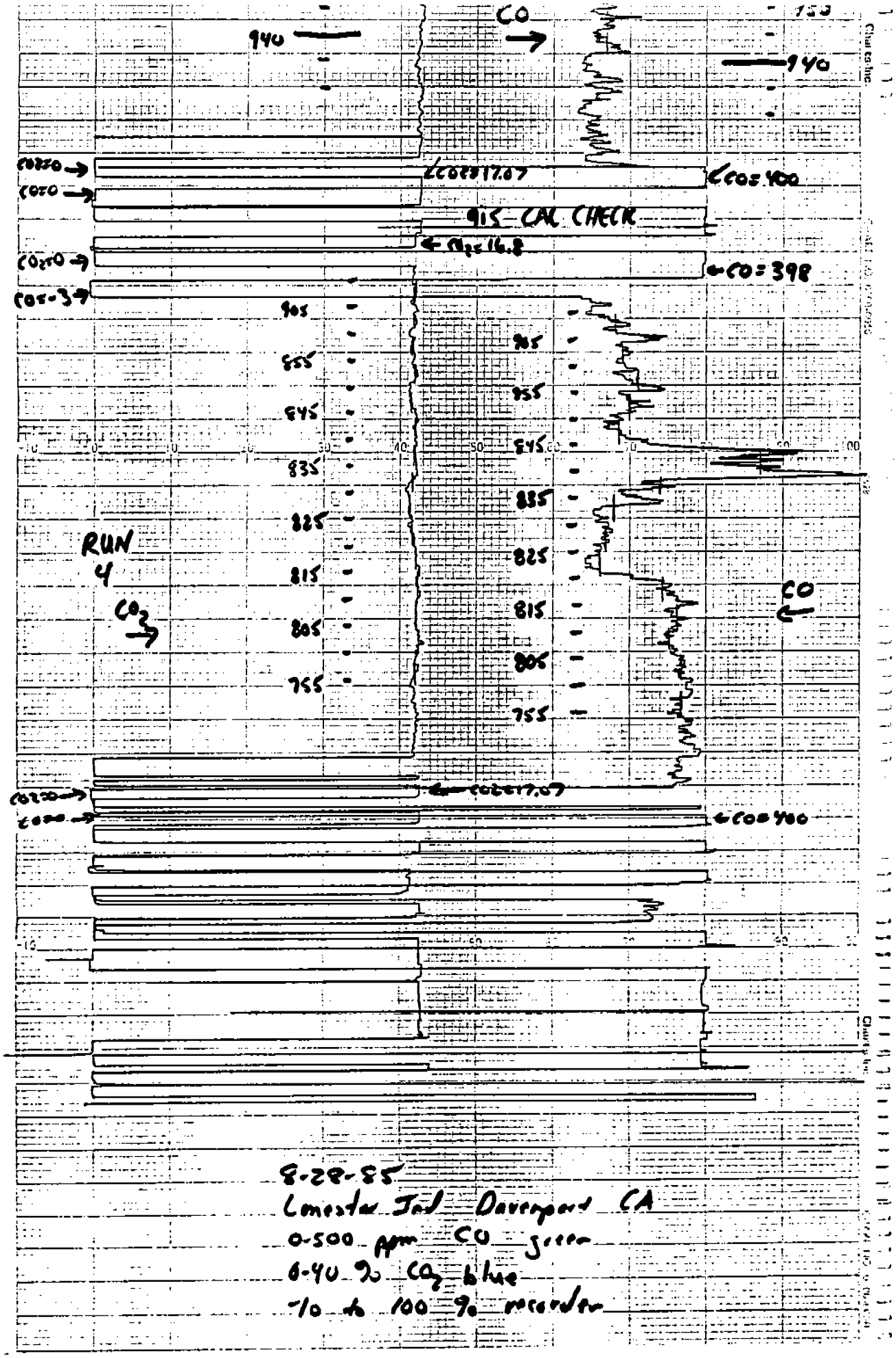

LEAK CHECK OK
CO2=17
CO=403
1340 EMAK CALC
RUN 3
CO2
CO
CO=400
CO2=16.85
1135 CALCHECK
CO=400
RUN 2
CO=400
910 CALCHECK


950
940
O_2
950
940
$O_2=0$
$NO_x=0$
$O_2=0$
$NO_x=0$
$NO_x=208.3$
$O_2=8.04$
$O_2=7.9$
$NO_x=200$
915 CAL CHECK
905
895
885
875
865
855
845
835
825
815
805
755
NO_x
RUN 4
O_2
$O_2=0$
$NO_x=0$
$O_2=8.04$
$NO_x=208.3$
8-28-85
Lonestar Ind Davenport CA
0-1000 ppm NO_x red
0-25 % O_2 black
10 to 100 % recorder

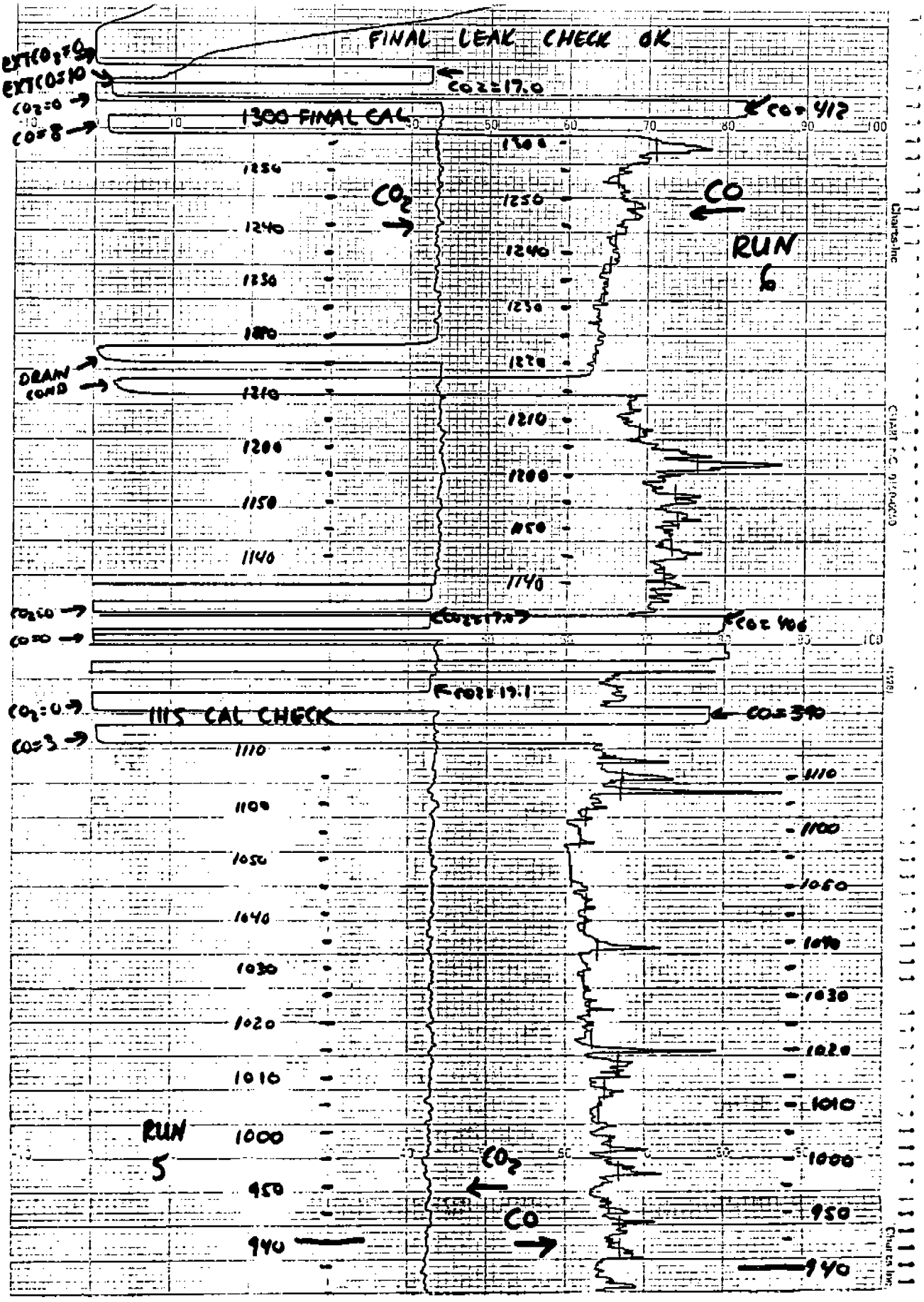

FINAL LEAK CHECK OK
EXT O2=8.8
EXT NOx=4
O2=0.1
NOx=4
O2=7.8
NOx=214
1300 FINAL CAL
RUN 6
NOx
O2
DRAW COND
DRAW COND
O2=0
NOx=0
O2=8.04
NOx=208.3
O2=7.8
1115 CAL CHECK
O2=0
NOx=-1
NOx=204
NOx
O2
RUN 5


1010
1000
950
940
RUN
5
SO_2
SO_2=0
SO_2=79.8
915 CAL CHECK
SO_2=.47
SO_2=78.8
905
855
845
835
825
815
805
755
RUN
4
SO_2
SO_2=0
SO_2=78.8
8-28-85
Converter Inlet Davenport CA
0-100 ppm SO_2
-10 to 100 % recorder


FINAL LEAK CHECK OK
EXT SO2=76
SO2=-0.7
1300 FINAL CAL
SO2=78.8
1300
1250
1240
RUN
6
SO2
1230
1220
DRIFT CORR
1210
1200
1150
1140
SO2=79.8
SO2=0
1115 CAL CHECK
SO2=79.2
1110
1100
1050
1040
1030
1020
1010
1000
950
RUN
5
SO2



8-28-85
Lomeston Jail Davenport CA
0-500 ppm CO green
0-40 % CO_2 blue
-10 to 100 % recorder


FINAL LEAK CHECK OK
EXT CO2=0
EXT CO=10
CO2=0
CO=8
CO2=17.0
CO=412
1300 FINAL CAL
CO2
CO
RUN 6
DRAIN COND
CO2=0
CO=0
CO2=17.0
CO=406
CO2=17.1
CO2=0
1115 CAL CHECK
CO=390
CO=3
RUN 5
CO2
CO

Pape & Steiner Environmental Services

SAMPLE HANDLING/LOG-IN

Date 8/28/1985 Test Location Lonesta

	Sample Type	Volume	Comments
1.	10765 5/8 Meth FHA Sample 4 Test		
2.	10766 5/8 Meth MF Sample 4 Test		~~#675~~ #669
3.	10767 5/8 Meth BHW Sample 4 Test		
4.	10768 5/8 Meth SO_2 Sample 4 Test		
5.	10769 5/8 Meth FHA Sample 5 Test		
6.	10770 5/8 Meth MF Sample 5 Test		#676
7.	10771 5/8 Meth BHW Sample 5 Test		
8.	10772 5/8 Meth SO_2 Sample 5 Test		
9.	10773 5/8 Meth FHA Sample 6 Test		
10.	10774 5/8 Meth MF Sample 6 Test		#677
11.	10775 5/8 Meth BHW Sample 6 Test		
12.	10823 5/8 Meth SO_2 Sample 6 Test		

CHAIN OF CUSTODY

Craig Werlen

Pape & Steiner Environmental Services

SAMPLE HANDLING/LOG-IN

Date 8/27/85 Test Location Lometa

	Sample Type	Volume	Comments
1.	10749 5/8 Meth FHA Sample B Test		
2.	10750 5/8 Meth MF Sample B Test		#674
3.	10751 5/8 Meth SO_2 Sample B Test		
4.	10752 5/8 Meth BHW Sample B Test		
5.	10753 5/8 Meth FHA Sample 1 Test		
6.	10754 5/8 Meth MF Sample 1 Test		#671
7.	10755 5/8 Meth BHW Sample 1 Test		
8.	10756 5/8 Meth SO_2 Sample 1 Test		
9.	10757 5/8 Meth FHA Sample 2 Test		
10.	10758 5/8 Meth MF Sample 2 Test		#672
11.	10759 5/8 Meth BHW Sample 2 Test		
12.	10760 5/8 Meth SO_2 Sample 2 Test		

CHAIN OF CUSTODY

Craig Weble

Pape & Steiner Environmental Services

SAMPLE HANDLING/LOG-IN

Date 8/27/85 Test Location Ignacio

	Sample Type	Volume	Comments
1.	10761 5/8 Meth FHA Sample 3 Test		
2.	10762 5/8 Meth MF Sample 3 Test		#673
3.	10763 5/8 Meth BHW Sample 3 Test		
4.	10764 5/8 Meth SO_2 Sample 3 Test		
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			

CHAIN OF CUSTODY

Craig Weber

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE Front Half Wash DATE 9/12/85

SAMPLE COMPONENT Acetone ANALYST SK

REQUESTED BY Lone Star

ANALYTICAL METHOD Gravimetric

Sample ID No.	Test No.	Sample Volume	Sample Aliquot	Titer mls or (Absorbance)	Analytical Result (total sample) grams	
					Uncorrected	Blank corrected
	1	137	137		0.01551	0.01402
	2	139	139		0.01076	0.00924
	3	148	148		0.00812	0.00651
	4	112	112		0.01604	0.01482
	5	127	127		0.01102	0.00964
	6	110	110		0.01061	0.00941
	Blk.	100	100		0.00109	

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE Filterable Particulate DATE 9/12/85

SAMPLE COMPONENT 100mm filter ANALYST SK

REQUESTED BY Lone Star

ANALYTICAL METHOD Gravimetric

Sample ID No.	Test No.	Sample Volume	Sample Aliquot	Titer mls or (Absorbance)	Analytical Result (total sample) grams	
					Uncorrected	Blank corrected
Filter No. 10-671	1				0.00274	0.00274
10-672	2				0.00169	0.00169
10-673	3				0.00194	0.00194
10-669	4				0.00269	0.00269
10-676	5				0.00222	0.00222
10-677	6				0.00404	0.00404
10-674	Blk				0.00000	

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE Condensible Particulate DATE 9/12/85

SAMPLE COMPONENT 80% IPA ANALYST SK

REQUESTED BY Lone Star

ANALYTICAL METHOD Gravimetric

Sample ID No.	Test No.	Sample Volume	Sample Aliquot	Titer mls or (Absorbance)	Analytical Result (total sample) grams		
					Uncorrected	Blank corrected	
	1	500	100		0.01659	0.08235	
	2	500	100		0.01685	0.08365	
	3	500	100		0.01865	0.09265	101.2% Dup.
	4	500	100		0.00161	0.00745	
	5	500	100		0.00278	0.01330	
	6	500	100		0.00317	0.01525	106.3% Dup.
	Blk,	500	100		0.00012		

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE SO_2 DATE 9/13/85

SAMPLE COMPONENT H_2O_2 ANALYST SK

REQUESTED BY Lone Star

ANALYTICAL METHOD Barium – Thorin

Sample ID No.	Test No.	Sample Volume	Sample Aliquot	Titer mls or (Absorbance)	Analytical Result (total sample) mg H_2SO_4		
					Uncorrected	Blank corrected	
	3	227	10 of a 1:10	2.30		247.765	102.5% spike
	Blk.	100	10	0.05	0.243		
Standardization:							
0.0100 N H_2SO_4			5	5.075	$\frac{(0.01)(5)}{5.075} = 0.0099N$		
$BaCl_2$			5	5.075			

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

Standard temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

Test 1 Date 8/27/85 Location Lonestar

T_m	71.88	V_m	41.255	O_2	9.835	Stack ID "	120
T_s	280.92	γ	0.9756	CO_2	19.49	Stack Area Ft^2	78.54
$\sqrt{\Delta P}$	0.7199	P_b	30.35	Static	-0.43	Test Time	60
ΔH	1.74	V_{1c}	136.9	C_p	0.84	N_d	0.2680

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 40.0830$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 6.3462$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.1367$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.51$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 29.66$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 30.32$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 46.92$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 135,757.11$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 98.74$$

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

Standard temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

Test 2 Date 8/27/85 Location Lonestar

T_m	79.58	V_m	42.897	O_2	9.824	Stack ID "	120
T_s	279.42	γ	0.9756	CO_2	19.44	Stack Area Ft^2	78.54
$\sqrt{\Delta P}$	0.7285	P_b	30.35	Static	-0.45	Test Time	60
ΔH	1.81	V_{1c}	142.9	C_p	0.84	N_d	0.2680

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 41.0906$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 6.6244$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.1388$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.50$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 29.63$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 30.32$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 47.46$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 137,256.88$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 100.11$$

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

Standard temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

Test 3 Date 8/27/85 Location Conestar

T_m	75.00	V_m	41.945	O_2	9.576	Stack ID "	120
T_s	272.00	γ	0.9756	CO_2	20.02	Stack Area Ft^2	78.54
$\sqrt{\Delta P}$	0.7169	P_b	30.35	Static	-0.44	Test Time	60
ΔH	1.76	V_{1c}	127.7	C_p	0.84	N_d	0.2680

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 40.5177$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 5.9198$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.1275$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.59$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 29.85$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 30.32$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 46.30$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 137,024.99$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 98.89$$

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

Standard temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

Test 4 Date 8/28/85 Location Conestar

T_m	72.13	V_m	49.799	O_2	11.28	Stack ID "	120
T_s	205.25	γ	0.9756	CO_2	16.71	Stack Area Ft^2	78.54
$\sqrt{\Delta P}$	0.8141	P_b	30.34	Static	-0.55	Test Time	60
ΔH	2.48	V_{1c}	145.4	C_p	0.84	N_d	0.2680

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 48.4321$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 6.7403$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.1222$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.12$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 29.52$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 30.30$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = \cancel{0.84}\ 50.42$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 165,090.76$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 98.11$$

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

Standard temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

Test 5 Date 8/28/85 Location Conestar

T_m	76.54	V_m	50.290	O_2	10.96	Stack ID "	120
T_s	216.58	γ	0.9756	CO_2	17.19	Stack Area Ft^2	78.54
$\sqrt{\Delta P}$	0.8136	P_b	30.34	Static	-0.55	Test Time	60
ΔH	2.46	V_{1c}	134.9	C_p	0.84	N_d	0.2680

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 48.5052$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 6.2535$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.1142$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.19$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 29.68$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 30.30$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 50.68$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 164,637.74$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 98.53$$

Pape & Steiner Environmental Services

ISOKINETIC CALCULATIONS

Standard temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

Test 6 Date 8/28/85 Location Lonestar

T_m	74.42	V_m	49.727	O_2	10.83	Stack ID "	120
T_s	213.33	γ	0.9756	CO_2	17.45	Stack Area Ft^2	78.54
$\sqrt{\Delta P}$	0.8126	P_b	30.34	Static	-0.55	Test Time	60
ΔH	2.46	V_{1c}	124.6	C_p	0.84	N_d	0.2680

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 48.1525$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 5.7761$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.1071$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.23$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 29.81$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 30.30$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 50.38$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 165,800.37$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 97.12$$

Pape & Steiner Environmental Services

TEST 1-3

LOCATION Conestar

CM SO_2, NO_x, HC, CO EMISSION RATE DATA

Standard Temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

ENTER			Test 1	Test 2	Test 3	Average
R-22	O_2	%	9.835	9.824	9.576	9.745
R-26	Q_s		135,757.11	137,256.88	137,024.99	136,679.66
R-15	NO_x	ppm	232.7	246.2	234.9	237.9
R-15	SO_2	ppm	47.32	51.59	51.82	50.24
R-15	CO	ppm	392.6	428.8	436.2	419.2
R-15	HC	ppm				

XEQ FF

XEQ SO_2 F-FACTOR

RESULTS:

MW = 46					
NO_x	lb/hr	229.80	245.82	234.14	236.59
NO_x	ppm @ 3% O_2	376.44	397.89	371.31	381.88
NO_x	lb/MMBtu				
NO_x	lb/Bbl				
MW = 64.1					
SO_2	lb/hr	65.12	71.78	71.98	69.63
SO_2	ppm @ 3% O_2	76.55	83.37	81.91	80.61
SO_2	lb/MMBtu				
SO_2	lb/Bbl				
MW = 28					
CO	lb/hr	235.99	260.60	264.65	253.75
CO	ppm @ 3% O_2	635.11	692.99	689.51	672.54
CO	lb/MMBtu				
CO	lb/Bbl				
MW = 16					
HC	lb/hr				
HC	ppm @ 3% O_2				
HC	lb/MMBtu				
HC	lb/Bbl				

Pape & Steiner Environmental Services

TEST 4-6

LOCATION Conestar

CM SO_2, NO_x, HC, CO EMISSION RATE DATA

Standard Temperature, S_t 60 (XEQ 60 or 68); 29.92 inches Hg

ENTER			Test 1	Test 2	Test 3	Average
R-22	O_2	%	11.28	10.96	10.83	11.02
R-26	Q_s		165,090.76	164,637.74	165,800.37	165,176.29
R-15	NO_x	ppm	199.2	135.3	223.0	185.8
R-15	SO_2	ppm	44.63	43.44	34.50	40.86
R-15	CO	ppm	362.7	321.7	344.7	343.0
R-15	HC	ppm				

XEQ FF

XEQ SO_2 F-FACTOR

RESULTS:

MW = 46					
NO_x	lb/hr	239.22	162.04	268.95	223.40
NO_x	ppm @ 3% O_2	370.65	243.65	396.40	336.90
NO_x	lb/MMBtu				
NO_x	lb/Bbl				
MW = 64.1					
SO_2	lb/hr	74.69	72.49	57.98	68.39
SO_2	ppm @ 3% O_2	83.04	78.23	61.33	74.20
SO_2	lb/MMBtu				
SO_2	lb/Bbl				
MW = 28					
CO	lb/hr	265.13	234.51	253.06	250.90
CO	ppm @ 3% O_2	674.88	579.32	612.72	622.31
CO	lb/MMBtu				
CO	lb/Bbl				
MW = 16					
HC	lb/hr				
HC	ppm @ 3% O_2				
HC	lb/MMBtu				
HC	lb/Bbl				

Pape & Steiner Environmental Services

TEST 1-3

LOCATION Loretta 3rd Quarter

EMISSION RATE DATA -- ~~50~~ 60°F

Standard Temperature, S_t = 68°F; 29.92 inches Hg

XEQ FF

XEQ RAT

		Test 1	Test 2	Test 3	Average
ENTER:	R-17 $V_{m,std}$	40.0830	41.0906	40.5177	
	R-26 Q_s	135757.11	137,256.28	137,024.97	136,679.66
	R-22 O_2%				

LAB DATA

Front Half Wash	(g)	.01402	.00924	.00651	
Mass Filter	(g)	.00274	.00169	.00194	
Back Half Catch	(g)	.08235	.08365	.09765	
Front Half Sulfate	(mg H_2SO_4)				
Back Half Sulfate	(mg H_2SO_4)				
H_2O_2 Catch	(mg H_2SO_4)			247.765	

RESULTS

F-Factor		1				
Filt. Particulate	gr/dscf	6	.0065	.0041	.0032	.0046
Filt. Particulate	lb/hr	7	7.51	4.83	3.78	5.37
Total Particulate	gr/dscf	8	.0382	.0355	.0385	.0374
Total Particulate	lb/hr	10	44.39	41.78	45.22	43.80
Total Sulfate	gr/dscf	11				
Total Sulfate	lb/hr	13				
SO_3	ppm	14				
SO_3	lb/hr	15				
SO_2	ppm	16			52.2	
SO_2	lb/hr	17			72.44	
SO_2	@3% O_2	18				
SO_2	lb/MMBtu					
S	lb/MMBtu					
Filt. Particulate	lb/MMBtu					

Pape & Steiner Environmental Services

TEST 4-6

LOCATION Lonestar 3rd Quarter

EMISSION RATE DATA -- 60°F

Standard Temperature, S_t = 68°F; 29.92 inches Hg

XEQ FF

XEQ RAT

		Test ~~1~~ 4	Test ~~2~~ 5	Test ~~3~~ 6	Average
ENTER:	R-17 $V_{m,std}$	48.4321	48.5052	48.1525	
	R-26 Q_s	165,090.76	164,637.74	165,800.37	165176.29
	R-22 O_2%				

LAB DATA

Front Half Wash	(g)	.01482	.00964	.00941	
Mass Filter	(g)	.00269	.00222	.00404	
Back Half Catch	(g)	.00745	.01330	.01525	
Front Half Sulfate	(mg H_2SO_4)				
Back Half Sulfate	(mg H_2SO_4)				
H_2O_2 Catch	(mg H_2SO_4)				

RESULTS

F-Factor	1				
Filt. Particulate gr/dscf	6	.0056	.0038	.0043	.0046
Filt. Particulate lb/hr	7	7.89	5.32	6.12	6.44
Total Particulate gr/dscf	8	.0080	.0090	.0092	.0084
Total Particulate lb/hr	10	11.25	11.29	13.07	11.87
Total Sulfate gr/dscf	11				
Total Sulfate lb/hr	13				
SO_3 ppm	14				
SO_3 lb/hr	15				
SO_2 ppm	16				
SO_2 lb/hr	17				
SO_2 @3% O_2	18				
SO_2 lb/MMBtu					
S lb/MMBtu					
Filt. Particulate lb/MMBtu					

Pape & Steiner Environmental Services

DRY GAS METER/ORIFICE METER CALIBRATION DATA

Date 6/30/95 Dry Gas Meter No. 1008455

Barometric Pressure, in. Hg 29.59 Standard Test Meter No. 69279

Meter Box No. 444 Operator JS

Standard Test Meter			Meter Box				Time	γ	K_o
Pres. ΔH_s ("Wg)	Temp. T_s (°F)	Volume V_s (Ft^3)	Pres. ΔH ("Wg)	Temp. T_{d_i} (°F)	Temp. T_{d_o} (°F)	Volume V_d (Ft^3)	(min)		
	62	880.316		93	91	895.130			
-1.1	60	864.629	0.5	77	72	878.332	41.0	0.9693	0.7051
	61	15.687		83.25		16.808			
	65	904.427		102	99	921.199			
-1.7	64	882.672	1.0	95	91	897.668	41.0	0.9748	0.6863
	64.5	21.755		96.75		23.531			
	67	929.087		104	102	947.883			
-2.3	67	906.859	1.5	102	98	923.831	35.0	0.9754	0.6765
	67	22.228		101.50		24.052			
	68	956.487		106	103	977.455			
-2.9	68	934.354	2.0	104	101	953.568	30.0	0.9769	0.6790
	68	22.133		103.50		23.887			
	69	982.547		109	105	1005.375			
-4.0	69	960.696	3.0	107	102	981.974	24.0	0.9814	0.6811
	69	21.851		105.75		23.401			
			4.0						

Average 0.9756 0.6856

Std.Dev. 0.0044 (0.5%) 0.0115 (1.7%)

$$\gamma = \frac{V_s\left(P_{bar} + \frac{\Delta H_s}{13.6}\right)\left(\frac{T_{d_i} + T_{d_o}}{2} + 460\right)}{V_d\left(P_{bar} + \frac{\Delta H}{13.6}\right)\left(T_s + 460\right)}$$

$$K_o = \frac{\left(\frac{V_s}{t}\right)\left(\frac{T_{d_o}}{T_s}\right)\left(\frac{P_{bar} + \frac{\Delta H_s}{13.6}}{P_{bar} + \frac{\Delta H}{13.6}}\right)}{\left(\frac{T_{d_o}\,\Delta H}{\left(P_{bar} + \frac{\Delta H}{13.6}\right)\left(M_m\right)}\right)^{0.5}}$$

where

ΔH_s = Standard meter pressure drop

T_s = Standard meter temperature

V_s = Standard test meter dry gas volume

ΔH = Meter box orifice meter pressure drop

T_{d_i} = Meter box inlet temperature

T_{d_o} = Meter box outlet temperature

V_d = Meter box dry gas volume

γ = Meter box correction factor

K_o = Orifice meter calibration constant

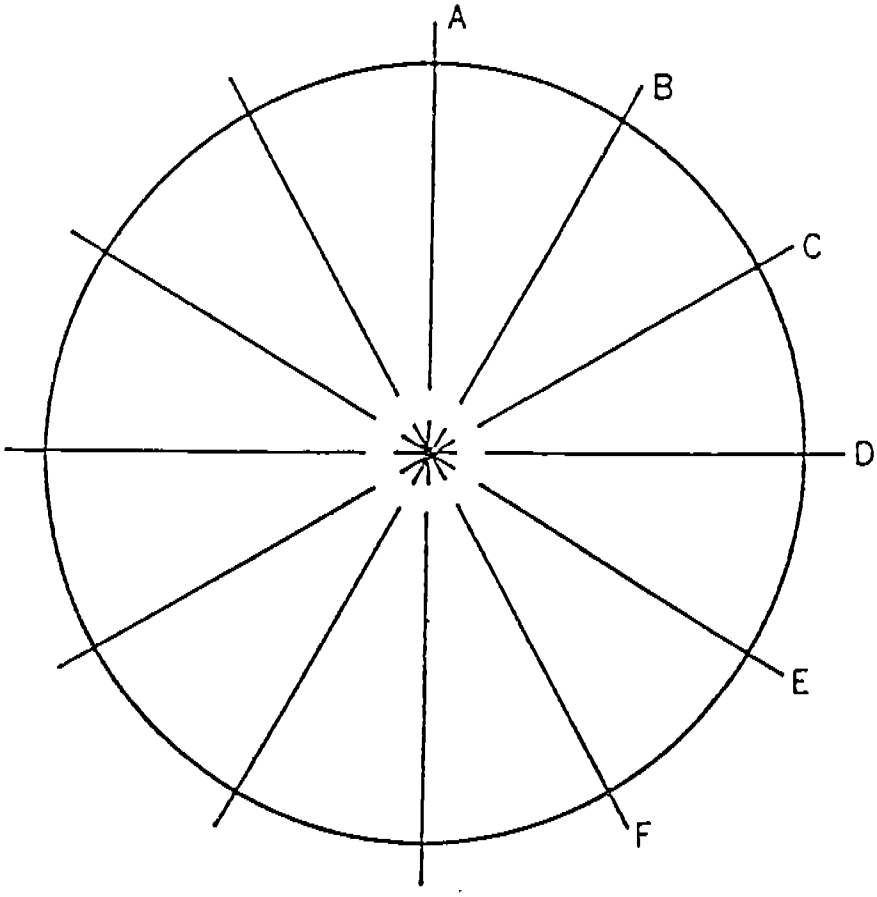
t = Calibration time in minutes

M_m = Molecular weight of air (28.96 lb/lb-mole)

P_{bar} = Barometric pressure

Pape & Steiner Environmental Services

NOZZLE CALIBRATION DATA



DIAMETER (in.)

A 0.2685

B 0.2689

C 0.2675

D 0.2670

E

F

AVG. 0.2680

DATE 01-02-85

NOZZLE NO. 1428

OPERATOR RKC

Scott Specialty Gases

a division of Scott Environmental Technology, Inc.

2600 CAJON BLVD. SAN BERNARDINO, CA 92411 PHONE (714) 887-2571

Date Shipped MAY 10, 1985

Our Project No: 48160

Your P.O. No: SP 0865

Page 1 of 2

PAPE & STEINER
5801 NORRIS ROAD
BAKERSFIELD, CA 93308
ATTN: SUE POWER

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES*

(Concentrations are in mole % or ppm)

Cylinder Number AAL13830 Certified Accuracy ±1% NBS Traceable Analysis Dates: First 4-29-85 Last 5-6-85

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	SECOND
SULFUR DIOXIDE	79.8PPM	11-6-85	ULTRAVIOLET	SRM1694	79.8PPM	79.8PPM
NITROGEN	BALANCE					

Cylinder Number _____ Certified Accuracy _____% NBS Traceable Analysis Dates: First _____ Last _____

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	SECOND

*We hereby certify the cylinder gas has been analyzed according to EPA Protocol No: I

Analyst _____ Approved By Jamer Ross

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.

CERTIFIED REFERENCE MATERIALS ■ EPA PROTOCOL GASES ■ ACUBLEND® ■ CALIBRATION & SPECIALTY GAS MIXTURES
PURE GASES ■ ACCESSORY PRODUCTS ■ CUSTOM ANALYTICAL SERVICES

TROY, MICHIGAN / PLUMSTEADVILLE, PENNSYLVANIA

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

2600 CAJON BLVD. SAN BERNARDINO, CA 92411 PHONE (714) 887-2571

Date Shipped 7-1-85

Our Project No: 48677

Your P.O. No: SP 0890

Page 3 of 6

PAPE & STEINER(CONTINUED)

CERTIFICATE OF ANALYSIS -- EPA PROTOCOL GASES*

(Concentrations are in mole % or ppm)

Cylinder Number AAL14803 Certified Accuracy ±1 % NBS Traceable Analysis Dates: First 6-10-85 Last 6-18-85

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	SECOND
NITRIC OXIDE	207.8PPM	12-18-85	CHEMI.	SRM1685B	208.1PPM	207.4PPM
NOX	208.3PPM				208.4PPM	208.1PPM
NITROGEN	BALANCE					

Cylinder Number _____ Certified Accuracy _____ % NBS Traceable Analysis Dates: First _____ Last _____

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	SECOND

*We hereby certify the cylinder gas has been analyzed according to EPA Protocol No: I

Analyst _____ Approved By [signature]

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

CERTIFIED REFERENCE MATERIALS ■ EPA PROTOCOL GASES ■ ACURLEND® ■ CALIBRATION & SPECIALTY GAS MIXTURES
PURE GASES ■ ACCESSORY PRODUCTS ■ CUSTOM ANALYTICAL SERVICES

TROY, MICHIGAN / PLUMSTEADVILLE, PENNSYLVANIA

Scott Specialty Gases a division of Scott Environmental Technology, Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: (215) 766-8861 TWX: 510-665-9344

Date: JUNE 26, 1985
Our Project No.: 48789
Your P.O. No.: SP 7751

PAPE & STEINER
5801 NORRIS ROAD
BAKERSFIELD, CA 93308
ATTN: SUE POWERS

Gentlemen:

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

ANALYTICAL REPORT

Cyl. No. AAL12619 Analytical Accuracy ±1%

Component	Concentration
CARBON MONOXIDE	400 PPM
CARBON DIOXIDE	17.07%
OXYGEN	8.04%
(CARBON MONOXIDE NBS TRACEABLE TO SRM1680B)	
NITROGEN	BALANCE

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

Cyl. No. _____ Analytical Accuracy _____

Component	Concentration

Analyst _____

Approved By _____

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.

CERTIFIED REFERENCE MATERIALS EPA PROTOCOL GASES
ACUBLEND® CALIBRATION & SPECIALTY GAS MIXTURES PURE GASES
ACCESSORY PRODUCTS CUSTOM ANALYTICAL SERVICES
TROY, MICHIGAN / SAN BERNARDINO, CALIFORNIA / HOUSTON, TEXAS