WA344

SOURCE TEST REPORT AND RELATIVE ACCURACY AUDIT SINGLE NATURAL GAS FIRED TURBINE COALINGA COGENERATION COMPANY, COALINGA, CALIFORNIA

Prepared for:

Coalinga Cogeneration Company
P.O. Box 81078
Bakersfield, California 93380

For Submittal to:

San Joaquin Valley Unified Air Pollution Control District
1999 Tuolumne St., Suite 200
Fresno, California 93721

Test Dates:

March 4, 1993

Publication Date:

April 1, 1993

Prepared by:

Engineering-Science, Inc.
2520 Pegasus Drive
Bakersfield, California 93308
(805)393-0272

ES ENGINEERING-SCIENCE

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San Joaquin Valley Unified
Air Pollution Control District

Coalinga Cogeneration Company | P.O. Box 81078, Bakersfield, CA 93380 • (805) 392-2630

Gordon M. Thomson, Executive Director

May 17, 1993

CC-1349

Mr. Gary Martin
Source Test Supervisor
San Joaquin Valley Unified APCD
Central Region Office
1999 Tuolumne Street, Suite 200
Fresno, CA 93721

Re: **Non-Methane Hydrocarbon Source Test Results**

Dear Mr. Martin:

Pursuant to your conversation with Mervyn Soares on May 12, 1993, this letter is an addendum to the retest report for non-methane hydrocarbons ("NMHC") submitted April 16, 1993 (CC-1322). Coalinga Cogeneration Company's ("CCC") turbine fires on utility grade natural gas of which methane is the major component. Initial performance test results for NMHC emissions conducted in December 1991 on CCC's turbine were found to be non-detectable (see Attachment A). This is consistent with NMHC emissions test data for substantially identical gas turbines fired on utility grade natural gas.

Mid-Set Cogeneration Company ("Mid-Set") located within the jurisdiction of the San Joaquin Valley Unified APCD ("SJVUAPCD") operates a GE Frame 6 turbine in Fellows, California. The Mid-Set turbine is substantially identical to the turbine operating at CCC and equipped with ammonia and SCR for NOx reduction. Source tests conducted at Mid-Set confirm that NMHC emissions from a Frame 6 turbines are at non-detectable levels (see Attachment B).

Based on source test results from CCC and Mid-Set, it is extremely unlikely that NMHC emissions are present in detectable quantities in the turbine exhaust gas. Existing test data for GE Frame 6 turbines substantiates that the March 4, 1993, NMHC emissions data of 2.58 #/hour is improbable. Based on these observations and the April 5, 1993 data from the retest, we infer that CCC is in compliance with the NMHC permitted emission limit.

If you have any questions, please contact Mervyn Soares at (805) 392-2643.

Sincerely,

G. M. THOMSON
Executive Director

MAS:plc

cc: D. S. King - MOMI (w/attachment)
R. L. LaRue (w/attachment)
F. A. Maggio (w/attachment)
A. Wu - Texaco, UCP (w/attachment)

Attachment A

Initial Performance NMHC Emission Data

EMISSION DATA SUMMARY
GAS COMPONENTS

COALINGA COGENERATION
STACK OUTLET

12-Dec-91

NITROGEN DIOXIDE

Run #	% O2	Corrected ppm (dry)	Corrected ppm (dry) @ 15% O2	lb/hr	lb/MMBtu
1	14.79	3.60	3.48	6.04	0.0127
2	14.53	3.55	3.29	5.91	0.0120
3	14.52	3.34	3.09	5.59	0.0113
4					
5					
6					
Average	14.61	3.50	3.28	5.85	0.0120

CARBON MONOXIDE

Run #	Corrected ppm (dry)	Corrected ppm (dry) @ 15% O2	lb/hr	lb/MMBtu
1	4.00	3.86	4.09	0.0086
2	3.06	2.83	3.10	0.0063
3	3.03	2.80	3.09	0.0062
4				
5				
6				
Average	3.36	3.17	3.42	0.0070

SULFUR DIOXIDE

Run #	Corrected ppm (dry)	Corrected ppm (dry) @ 15% O2	lb/hr	lb/MMBtu
1	0.19	0.18	0.44	0.0009
2	0.09	0.08	0.21	0.0004
3	0.12	0.11	0.28	0.0006
4				
5				
6				
Average	0.13	0.13	0.31	0.0006

HYDROCARBON (NON-METHANE)

Run #	Corrected ppm (dry)	Corrected ppm (dry) @ 15% O2	lb/hr	lb/MMBtu
1	0.00	0.00	0.00	0.0000
2	0.00	0.00	0.00	0.0000
3	0.00	0.00	0.00	0.0000
4				
5				
6				
Average	0.00	0.00	0.00	0.0000

Attachment B

Mid-Set Cogeneration Company

NMHC Emission Data

SUMMARY OF SOURCE TEST RESULTS FOR KCAPCD

Company: Mid-Set Cogeneration Company
Test Date: April 27, 1989

APCD # 4003597D
Unit: Gas Turbine (Natural Gas)

EMISSIONS

	gr/SCF	ppm(v/v)	ppm(v/v) @15%O2	lb/hr	lb/MMBTU	Other
Particulate	0.0012			2.37		
	0.0012			2.33		
	0.0013			2.59		
Mean	0.0012			2.43		
Sulfate	<0.00003			<0.058		
	<0.00003			<0.063		
	<0.00003			<0.059		
Mean	<0.00003			<0.060		
SO2 (wet)		<0.04	<0.04	<0.10		
		<0.05	<0.04	<0.12		
		<0.04	<0.04	<0.11		
Mean		<0.04	<0.04	<0.11		
NOX as NO2 (dry)		9.2	8.4	15.25	0.029	
		8.9	7.9	14.40	0.029	
		9.1	8.1	14.70	0.029	
Mean		9.1	8.1	14.78	0.029	
HC		<1.0	<1.0	<0.57	<0.001	
		<1.0	<1.0	<0.57	<0.001	
		<1.0	<1.0	<0.57	<0.001	
Mean:		<1.0	<1.0	<0.57	<0.001	
CO		6.7	6.1	6.76	0.013	
		6.8	6.1	6.70	0.013	
		6.5	5.8	6.39	0.013	
Mean:		6.7	6.0	6.62	0.013	
NH3 Slip from SCR:		1.1	<1.0			
		2.1	1.9			
		1.6	1.5			
Mean:		1.6	1.5			

For Kern County Use Only:

Standard Conditions: 29.92 inches Hg & 60 deg F

Coalinga Cogeneration Company | P.O. Box 81078, Bakersfield, CA 93380 • (805) 392-2630

Gordon M. Thomson, Executive Director

RECEIVED
APR 21 1993
San Joaquin Valley Unified
Air Pollution Control District

April 16, 1993

CC-1322

Mr. Gary Martin
Source Test Supervisor
San Joaquin Valley Unified APCD
Central Region Office
1999 Tuolumne Street, Suite 200
Fresno, CA 93721

Re: **Non-Methane Hydrocarbon Source Test Results**

Dear Mr. Martin:

Attached is an addendum to the 1993 source test report submitted by Coalinga Cogeneration Company ("CCC") dated April 1, 1993 (CC-1313). Pursuant to your request a retest for non-methane hydrocarbons ("NMHC") was conducted at CCC on April 5, 1993. The test results verified NMHC emissions from the gas turbine at CCC to be non-detectable. The test was performed by Engineering-Science, Inc., Bakersfield.

If you have any questions, please contact Mervyn Soares at (805) 392-2643.

Sincerely,

G. M. THOMSON
Executive Director

MAS:plc

cc: D. S. King - MOMI (w/attachment)
R. L. LaRue (w/attachment)

ES
ENGINEERING-SCIENCE, INC.

2520 PEGASUS DRIVE
BAKERSFIELD, CA 93308
Tel: (805) 393-0272
Fax: (805) 393-8306

April 15, 1993

Coalinga Cogeneration Company
P.O. Box 81078
Bakersfield, CA 93380

Attention: Mervyn Soares

Subject: Retest results for Hydrocarbons at Coalinga Cogeneration Company.

Enclosed are the results from the retesting Engineering-Science, Inc. performed at Coalinga Cogeneration Company (District Permit # 3040170101R3) for hydrocarbon emissions. These results are an Addendum to the Source Test Report and Relative Accuracy Audit for the testing performed on March 4, 1993 and reported on April 1, 1993. We have included with Table 1 all calculations and supporting raw data.

Please feel free to call if you have any questions or need further assistance.

Sincerely,

Gary W. McRae

Gary W. McRae
Environmental Scientist

GWM/lkm
Enclosure

TABLE 1
HYDROCARBON DATA SUMMARY
HRSG STACK OUTLET, DISTRICT PERMIT # 3040170101R3
COALINGA COGENERATION COMPANY
COALINGA, CALIFORNIA
APRIL 5, 1993

RUN	O_2	NON-METHANE HYDROCARBONS (NMHC) AS METHANE			
#	%	ppm(v)	ppm(v) @ 15% O_2	lb/hr	lb/MMBtu
1	14.48	ND	ND	ND	ND
2	14.47	ND	ND	ND	ND
3	14.46	ND	ND	ND	ND
AVG	14.47	ND	ND	ND	ND

Note: "ND" samples were non-detectable for all hydrocarbon compounds (C_2-C_6) with a detection limit of no greater than 0.50 ppm for each compound.

EMISSION CALCULATIONS
HYDROCARBON COMPOUNDS

COALINGA COGENERATION
OUTLET STACK
APRIL 5, 1993

Hydrocarbon Compound		Molecular Weight	Molecular Formula	Laboratory Analysis, ppm as HC compound *			ppm HC as methane *		
				Run 1	Run 2	Run 3	Run 1	Run2	Run 3
C_1	Methane	16.04	CH_4						
C_2	Ethane	30.07	C_2H_6						
C_3	Propane	44.09	C_3H_8						
C_4	Butane	58.12	C_4H_{10}						
C_5	Pentane	72.15	C_5H_{12}						
C_6	Hexane	86.17	C_6H_{14}						
C_6+	as Hexane	86.17	C_6H_{14}						

	Run 1	Run 2	Run 3	Average	
Stack Parameters					
Stack Gas Oxygen, %	14.48	14.47	14.46	14.47	
Stack Gas Flowrate, dscfm	220,976	224,684	224,336	223,332	
F–Factor, dscf/MMBtu	8,517.09	8,517.09	8,517.09	8,517.09	
Total Hydrocarbons, THC as methane					
ppm	0.00	0.00	0.00	0.00	C_1–C_6+ HC
ppm @ Oxygen Correction	0.00	0.00	0.00	0.00	
lb/hr	0.00	0.00	0.00	0.00	
lb/MMBtu	0.0000	0.0000	0.0000	0.0000	
Reactive Organic Compounds, ROC as methane					
ppm	0.00	0.00	0.00	0.00	C_2–C_6+ HC
ppm @ Oxygen Correction	0.00	0.00	0.00	0.00	
lb/hr	0.00	0.00	0.00	0.00	
lb/MMBtu	0.0000	0.0000	0.0000	0.0000	

Oxygen Correction : 15.0 %
Standard Temperature = 60 °F

Equations

HC corrected to methane, ppm = (MW of HC Compound / MW of Methane) x ppm value

ppm @ Oxygen Correction = ppm measured x [(20.9 – Oxygen Correction) / (20.9 – %Oxygen Measured)]

lb/hr = (0.00000137 lb–mole dR / ft3) x 60 min/hr x Qs(std) x (MW of Methane) x ppm / [T(std) + 460)]

lb/MMBtu = F–Factor x (MW of Methane) x [(1.3711E–06 lb–mole dR/ft3) / [T(std) + 460)] x [20.9 / 20.9 – O2%)] x ppm

Performance Analytical Inc.
Environmental Testing and Consulting

PERFORMANCE ANALYTICAL INC.

RESULTS OF ANALYSIS

Client: Engineering Science, Inc.

Client Project ID: #WA344

PAI Project ID: #5103

Test code: EPA 18
Analyst: Ku-Jih Chen
Instrument ID: HP5890/FID #4
Verified by: Michael Tuday

Matrix: Tedlar Bags
Date Received: 04/08/93
Date Analyzed: 04/08/93
Volume Analyzed: 1.0 ml

Client Sample ID	PAI Sample ID	C_1 as Methane ppm	C_2 as Ethane ppm	C_3 as Propane ppm
BK9304001 (04/05/93)	9301133	ND < 0.50	ND < 0.50	ND < 0.40
BK9304002 (04/05/93)	9301134	ND < 0.50	ND < 0.50	ND < 0.40
BK9304003 (04/05/93)	9301135	ND < 0.50	ND < 0.50	ND < 0.40
BK9304003 (04/05/93)	Lab Duplicate	ND < 0.50	ND < 0.50	ND < 0.40
N/A (04/08/93)	Method Blank	ND < 0.50	ND < 0.50	ND < 0.40

Client Sample ID	PAI Sample ID	C_4 as Butane ppm	C_5 as Pentane ppm	C_6 as Hexane ppm	C_6+ as Hexane ppm
BK9304001 (04/05/93)	9301133	ND < 0.30	ND < 0.30	ND < 0.20	ND < 0.20
BK9304002 (04/05/93)	9301134	ND < 0.30	ND < 0.30	ND < 0.20	ND < 0.20
BK9304003 (04/05/93)	9301135	ND < 0.30	ND < 0.30	ND < 0.20	ND < 0.20
BK9304003 (04/05/93)	Lab Duplicate	ND < 0.30	ND < 0.30	ND < 0.20	ND < 0.20
N/A (04/08/93)	Method Blank	ND < 0.30	ND < 0.30	ND < 0.20	ND < 0.20

ND = Not Detected - Less Than Indicated Detection Limit

20954 Osborne Street, Canoga Park, CA 91304 • Phone 818 709-1139 • Fax 818 709-2915

ENGINEERING SCIENCE, INC.
2520 Pegasus Drive
Bakersfield, CA 93308
(805) 393-0272

#5103

CHAIN OF CUSTODY RECORD

Project No.	Project Name	Project Manager	Samples Sent To:
WA344	Coalinga Cogen HC	G. McRae	Oilwell Research Performance Analytical By:

Samples Collected By	Regulatory Agency (EPA, CARB, SCAQMD, etc.)
G. McRae	San Joaquin Valley

ES Lab Control No.	Test Date	Field Sample ID (Method-Run#-Sample Source)	Sample Amount	Sample Medium	Comments	Analysis Required: CO-12 +			
BK9304001	4/5/93	EPA Method 18 - Run #1	10 l	Tedlar Bag	Send to Perf. Analytical for	X		930	1133
BK9304002		Run #2	10 l		duplicate analysis	X		930	1134
BK9304003		Run #3	10 l			X		930	1135

Relinquished By: (Sign & Print)	Date/Time	Received By: (Sign & Print)	Comments:
G. McR — Phone: 393-0272	1415 4/5/93	Of:	
Relinquished By: (Sign & Print) Ron Hoff Phone: (805) 392-8811	Date/Time 4-7-93 16:45	Received By: (Sign & Print) Kathleen Aguilera Kathleen Aguilera Of: PAL	Comments:
Relinquished By: (Sign & Print) Phone:	Date/Time	Received By: (Sign & Print) Of:	Comments:

INTEGRATED BAG GAS SAMPLING
FIELD DATA SHEET

Company: Coalinga Cogen

Date: 4/5/93

Test Location: HRSG Outlet

Test Method / Parameter: EPA Method 18 / HC

ENGINEERING–SCIENCE, INC.

Run No.	Laboratory No.	Start Time	Rotameter (liter/min)	End Time	Rotameter (liter/min)	Total Time (min)	Leak Rate (liter/min)	Comments
1	BK9304001	0930	0.33	1000	0.33	30.0	0.0	Run #1, Bag Purged Twice before Sampling Gen
2	BK9304002	1015	0.33	1045	0.33	30.0	0.0	Run #2 " " " " " Gen
3	BK9304003	1100	0.33	1130	0.33	30.0	0.0	Run #3 " " " " " Gen

Note: Using a 10 liter sample bag, set the flowrate as follows: 15 min sample = 0.67 l/min; 30 min sample = 0.33 l/min; 60min sample = 0.17 l/min.

Daily Logs for Mon 05 Apr 1993
***** Coalinga Cogeneration Company *****
Coalinga, Fresno County, CA 93210

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
09:30	14.48	6.04	5.55	.012	5.92	DAS Dn	4.90	4.51	.017	7.88	DAS Dn

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
09:30	596.78	4.93	2.91	DAS Dn	DAS Dn	.915	42.80	738.71

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
09:30	304.00	5.85	3.66	.62	26.47

Fifteen Minute Log Run #1

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
09:45	14.49	6.19	5.70	.013	6.16	DAS Dn	4.37	4.03	.015	7.12	DAS Dn

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
45	601.67	5.09	3.00	DAS Dn	DAS Dn	.930	42.45	738.96

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
09:45	303.91	5.92	3.73	.63	27.01

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
10:00	14.46	6.34	5.81	.013	6.42	6.29	4.18	3.83	.014	6.93	7.03

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
10:00	607.23	5.13	3.07	5.11	3.04	.936	41.94	738.83

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
10:00	308.52	6.06	3.68	.61	26.66

Run #1 O_2 = 14.48 %
Fuel = 5.99 #/sec

One Hour Log

Time hh:mm	Gas mmBTU	O2 Pct	CO ppm	CO ppmC	CO #/mmBTU	CO #/hrC	NOx (Stack) ppm	NOx (Stack) ppmC	NOx (Stack) #/mmBTU	NOx (Stack) #/hrC
10:00	3446.00	14.48	6.21	5.70	.013	6.20	4.43	4.07	.015	7.24

Daily Logs for Mon 05 Apr 1999

***** Coalinga Cogeneration Company *****

Coalinga, Fresno County, CA 93210

	Air #/sec	Gas #/sec	H2O #/sec	NH3 SCFH	-- NH3 Slip -- ppmC	#/hr	Inj. Ratio	H2O gal/hr	NH3/NOx Ratio	---- SCR ----- NOx	Temp
00	305.70	5.96	3.69	602.50	5.06	3.01	.62	26.74	.93	42.35	738.800

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
10:15	14.45	6.67	6.10	.014	6.81	6.46	4.30	3.93	.015	7.19	7.08

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
10:15	604.74	4.96	2.98	5.06	3.02	.930	42.00	739.05

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
10:15	309.01	6.12	3.57	.58	25.86

Fifteen Minute Log Run#

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
10:30	14.47	5.60	5.13	.011	5.71	6.27	4.25	3.90	.014	7.11	7.09

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
10:30	621.61	5.06	3.03	5.06	3.02	.932	43.10	739.33

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
10:30	308.87	6.10	3.48	.57	25.17

Fifteen Minute Log Run #2

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
10:45	14.46	5.65	5.18	.012	5.76	6.17	3.96	3.63	.013	6.61	6.96

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
10:45	619.45	5.07	3.04	5.05	3.03	.938	42.64	739.36

Run #2

O_2 = 14.47%

Fuel = 6.10 #/sec

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
10:45	308.84	6.09	3.52	.58	25.50

Daily Logs for Mon 05 Apr 1993
***** Coalinga Cogeneration Company *****
Coalinga, Fresno County, CA 93210

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
11:00	14.46	5.49	5.03	.011	5.59	5.96	4.03	3.70	.014	6.73	6.91

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
11:00	621.63	4.84	2.90	4.98	2.99	.932	43.07	739.33

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
11:00	309.15	6.09	3.50	.57	25.35

One Hour Log

Time hh:mm	Gas mmBTU	O2 Pct	CO ppm	CO ppmC	CO #/mmBTU	CO #/hrC	NOx (Stack) ppm	NOx (Stack) ppmC	NOx (Stack) #/mmBTU	NOx (Stack) #/hrC
11:00	3476.00	14.46	5.85	5.36	.012	5.96	4.13	3.79	.014	6.91

	Air #/sec	Gas #/sec	H2O #/sec	NH3 SCFH	NH3 Slip ppmC	NH3 Slip #/hr	Inj. Ratio	H2O gal/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
11:00	309.00	6.10	3.52	616.90	4.98	2.99	.58	25.47	.93	42.70	739.300

Fifteen Minute Log Run #3

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
11:15	14.46	5.55	5.09	.012	5.66	5.68	3.87	3.54	.013	6.45	6.72

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
11:15	618.91	4.88	2.93	4.96	2.97	.936	42.70	739.25

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
11:15	308.88	6.10	3.51	.58	25.43

Fifteen Minute Log Run #3

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
11:30	14.46	5.41	4.96	.011	5.52	5.63	3.96	3.63	.013	6.60	6.60

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
11:30	619.15	4.93	2.96	4.93	2.96	.936	42.75	739.25

Run #3
O_2 = 14.46%
Fuel = 6.10 #/sec

Carlino Cogeneration G.

MAINSCREEN: 1005 VER: 100 SUBSCREEN: 11 VER: 102 WINDOW: 0 VER: 0
DATE: 04/05/93 TIME: 09:30:45

05/APR/93 GROUP 5012 TYPE BOTH 09:30:45

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1	FC206		CALC STM FLOW FROM FQI201A1	128700	
2	FC207		CALC STM FLOW FROM FQI202A1	86700	
3	DW		GENERATOR LOAD	39.72	MW
4	FQT		TOTAL FUEL FLOW (GAS)	5.94	LB/SEC
5	WQJ		H2O INJ FLOW (REDUNDANT INPUT)	3.813	LB/SEC
6	FT404C		NH3 TO NH3/AIR MIXER COMPENSTD	27.30	LB/HR
7					
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9					
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COPY IN PROGRESS

Cogeneration Co.

MAINSCREEN: 1006 VER: 100 SUBSCREEN: 11 VER: 102 WINDOW: 0 VER: 0
DATE: 04/05/93 TIME: 10:02:22

05/APR/93 GROUP 5012 TYPE BOTH 10:02:22

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1	FC206		CALC STM FLOW FROM FQI201A1	132000	
2	FC207		CALC STM FLOW FROM FQI202A1	85800	
3	DW		GENERATOR LOAD	40.81	MW
4	FQT		TOTAL FUEL FLOW (GAS)	6.16	LB/SEC
5	WQJ		H2O INJ FLOW (REDUNDANT INPUT)	3.774	LB/SEC
6	FT404C		NH3 TO NH3/AIR MIXER COMPENSID	27.47	LB/HR
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COPY IN PROGRESS

Collins Cogeneration Co.

MAINSCREEN: 1005 VER: 100 SUBSCREEN: 11 VER: 102 WINDOW: 0 VER: 0
DATE: 04/05/93 TIME: 10:29:56

05/APR/93 GROUP 5012 TYPE BOTH 10:29:55

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1	FC206		CALC STM FLOW FROM FQI201A1	130500	
2	FC207		CALC STM FLOW FROM FQI202A1	86700	
3	DW		GENERATOR LOAD	40.16	MW
4	FQT		TOTAL FUEL FLOW (GAS)	6.02	LB/SEC
5	WQJ		H2O INJ FLOW (REDUNDANT INPUT)	3.436	LB/SEC
6	FT404C		NH3 TO NH3/AIR MIXER COMPENSTD	28.63	LB/HR
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COPY IN PROGRESS

Cogeneration Co.

MAINSCREEN: 1005 VER: 100 SUBSCREEN: 11 VER: 102 WINDOW: 0 VER: 0
DATE: 04/05/93 TIME: 11:04:16

05/APR/93 GROUP 5012 TYPE BOTH 11:04:15

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1	FC206		CALC STM FLOW FROM FQI201A1	127800	
2	FC207		CALC STM FLOW FROM FQI202A1	86100	
3	DW		GENERATOR LOAD	40.25	MW
4	FWT		TOTAL FUEL FLOW (GAS)	6.01	LB/SEC
5	WQJ		H2O INJ FLOW (REDUNDANT INPUT)	3.483	LB/SEC
6	FT404C		NH3 TO NH3/AIR MIXER COMPENSTD	28.77	LB/HR
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Cogeneration Co.

MAINSCREEN: 1005 VER: 100 SUBSCREEN: 11 VER: 102 WINDOW: 0 VER: 0
DATE: 04/05/93 TIME: 11:30:08

05/APR/93 GROUP 5012 TYPE BOTH 11:30:08

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1	FC206		CALC STM FLOW FROM FQI201A1	133800	
2	FC207		CALC STM FLOW FROM FQI202A1	87000	
3	DW		GENERATOR LOAD	40.41	MW
4	FQT		TOTAL FUEL FLOW (GAS)	6.24	LB/SEC
5	WQJ		H2O INJ FLOW (REDUNDANT INPUT)	3.578	LB/SEC
6	FT404C		NH3 TO NH3/AIR MIXER COMPENSTD	27.09	LB/HR
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Coalinga Cogeneration Company | P.O. Box 81078, Bakersfield, CA 93380 • (805) 392-2630

Gordon M. Thomson, Executive Director

VIA FEDERAL EXPRESS

April 8, 1993

CC-1313

Mr. Gary Martin
San Joaquin Valley Unified APCD - Central Region
1999 Tuolumne Street, Suite 200
Fresno, CA 93721

Re: **Annual Compliance Source Test Report**
Relative Accuracy Audit - CEM System

Dear Mr. Martin:

Pursuant to Permit to Operate (PTO) number 3040170101R3, attached is the 1993 annual compliance source test report and a relative accuracy audit (RA) of the continuous emission monitoring (CEM) system for Coalinga Cogeneration Company (CCC). The source testing and audit were conducted at the CCC facility on March 4, 1993.

In accordance with CCC's PTO, the gas turbine was tested under normal operating conditions fired on natural gas. Testing was performed by Engineering Science, Inc., Bakersfield, California.

As verified by the emission data, CO emissions from gas turbines are extremely low. As a result of such low stack gas concentration for CO you had agreed during the initial certification of the CEM system that the calculation method for the determination of relative accuracy as specified in Performance Specification No. 4 does not apply. Since the absolute difference between the reference method CO concentrations and those of the plant CEM differ by approximately 1 ppm the plant instrument is considered sufficiently accurate.

As per your verbal approval on April 2, 1993, a retest for non-methane hydrocarbons has been scheduled for April 5, 1993.

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Air Pollution Control District

If you have any questions, please contact Karen White-Fallon at (805) 392-2720 or Mervyn Soares at (805) 392-2643.

Sincerely,

G. M. THOMSON
Executive Director

KWF:plc

Attachment

WA344

SOURCE TEST REPORT AND RELATIVE ACCURACY AUDIT SINGLE NATURAL GAS FIRED TURBINE COALINGA COGENERATION COMPANY, COALINGA, CALIFORNIA

Prepared for:

Coalinga Cogeneration Company
P.O. Box 81078
Bakersfield, California 93380

For Submittal to:

San Joaquin Valley Unified Air Pollution Control District
1999 Tuolumne St., Suite 200
Fresno, California 93721

Test Dates:

March 4, 1993

Publication Date:

April 1, 1993

Prepared by:

Engineering-Science, Inc.
2520 Pegasus Drive
Bakersfield, California 93308
(805)393-0272

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San Joaquin Valley Unified
Air Pollution Control District

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SECTION 1

INTRODUCTION

SOURCE TEST REPORT AND RELATIVE ACCURACY AUDIT
SINGLE NATURAL GAS FIRED TURBINE
COALINGA COGENERATION COMPANY,
COALINGA, CALIFORNIA

SECTION 1

INTRODUCTION

Engineering-Science, Inc. (ES), Bakersfield, California conducted source testing of a single natural gas fired General Electric Frame 6, 42.7 MW (Gross) combustion gas turbine operated by Coalinga Cogeneration Company (CCC), Coalinga, California. NO_X emissions are controlled by ammonia injection and Selective Catalytic Reduction (SCR). A Relative Accuracy Audit of the CCC Continuous Emission Monitoring (CEM) system was conducted simultaneously with the source test. Testing was conducted to demonstrate compliance with annual testing requirements in Permit to Operate number 3040170101R3 issued by the San Joaquin Valley Unified Air Pollution Control District (District).

Testing consisted of Continuous Emission Monitoring (CEM) for Nitrogen Oxides (NO_X), Carbon Monoxide (CO), and Oxygen (O_2); non-methane hydrocarbons (NMHC); and ammonia slip (NH_3 slip). Testing procedures for NO_X, CO, and O_2 were conducted in accordance with EPA Methods published in 40 CFR, Part 60, Appendix A and Appendix B, dated July 1990 and CARB Method 100. NH_3 slip testing was conducted in accordance with BAAQMD Method ST-1b as published in the Bay Area Air Quality Management District Manual of Procedures. NMHC testing was conducted in accordance with EPA Method 18. The turbine was operated at 100% load condition and fired on natural gas. The test program is summarized in Table 1-1. Relative accuracy calculations are in accordance with 40 CFR, Part 60, Appendix B, Performance Specifications 2 (NO_X), 3 (O_2), and 4 (CO).

Testing was performed March 4, 1993. Ten CEM test runs of 30 minute duration were performed. These 10 runs were used for compliance determination and

TABLE 1-1
SUMMARY OF SOURCE TESTING
COMPLIANCE AND RELATIVE ACCURACY TESTING
HRSG STACK OUTLET, DISTRICT PERMIT # 3040170101R3
COALINGA COGENERATION COMPANY
COALINGA, CALIFORNIA
MARCH 4, 1993

Source Test Parameters and Methodology					
Natural Gas					
Nitrogen Oxides NO_x	Carbon Monoxide CO	Oxygen O_2	Non-methane Hydrocarbons NMHC	Ammonia Slip NH_3	Exhaust Gas Flow Rate
10 30-minute* runs for compliance and Relative Accuracy determination CARB Method 100	10 30-minute* runs for compliance and Relative Accuracy determination CARB Method 100	10 30-minute* runs for Relative Accuracy determination and O_2 correction CARB Method 100	Triplicate 30 minute runs for compliance determination EPA Method 18	Triplicate 30 minute runs for compliance determination BAAQMD Method ST-1b	Single fuel Sample Analyzed by ASTM Method D-3588 F-Factor calculations in accordance with 40 CFR, Part 60, Appendix A

* Note: The ten Relative Accuracy Test runs are averaged for compliance determination.
Relative Accuracy calculations are accordance with Title 40 CFR, Part 60, Appendix B, Performance Specifications 2 (NO_x), 3 (O_2), and 4 (CO).

to calculate the Relative Accuracy of the CCC NO_x, CO, and O_2 analyzers. The CCC CEM system was operated in its normal mode. Triplicate 30 minute duration ammonia slip test runs (BAAQMD Method ST-1b) and triplicate 30-minute hydrocarbon test runs (EPA Method 18) were also performed for compliance determination.

In addition to the compliance and RA testing, a sample of natural gas was collected and analyzed for Carbon (C), Hydrogen (H), Oxygen (O), Nitrogen (N), Sulfur (S), and heating value (Btu). Fuel consumption data was supplied by CCC plant personnel. This data was used to determine exhaust gas pollutant mass emission rates (lb/hr) in accordance with F-Factor calculation methods specified in 40 CFR, Part 60, Appendix A.

Ms. Karen White-Fallon of CCC coordinated plant activities and was responsible for supplying ES with plant operating data. The ES testing team was comprised of Mssrs. Gary McRae, Troy Delfino, and Cesario Mangaoang.

SECTION 2

SUMMARY OF RESULTS

SECTION 2

SUMMARY OF RESULTS

The following Tables present the parameters and emission data measured by Engineering-Science, Inc. at Coalinga Cogeneration Company on March 4, 1993. Emission measurements were made of the exhaust gases of the single 42.7 MW natural gas fired turbine, District Permit No. 3040170101R3.

Table 2-1 summarizes the NO_x and CO emissions in parts per million (ppm), ppm @ 15% O_2, pounds per hour (lb/hr), and pounds per million British Thermal units (lb/MMBtu). Table 2-2 summarizes the NMHC emissions in ppm, lb/hr, and lb/MMBtu. Ammonia slip in ppm and lb/hr is also presented in Table 2-2. Relative Accuracy of the CCC NO_x, CO, and O_2 monitors are presented in Tables 2-3 through 2-5, respectively.

TABLE 2-1
NITROGEN OXIDE AND CARBON MONOXIDE DATA SUMMARY
HRSG STACK OUTLET, DISTRICT PERMIT # 3040170101R3
COALINGA COGENERATION COMPANY
COALINGA, CALIFORNIA
MARCH 4, 1993

RUN	O_2	NITROGEN OXIDE (NOx)				CARBON MONOXIDE (CO)			
#	%	ppm(v)	ppm(v) @ 15% O_2	lb/hr	lb/MMBtu	ppm(v)	ppm(v) @ 15% O_2	lb/hr	lb/MMBtu
1	14.48	2.21	2.03	3.50	0.0074	10.66	9.79	10.28	0.0218
2	14.54	3.58	3.32	5.69	0.0122	9.17	8.50	8.88	0.0189
3	14.53	3.62	3.35	5.73	0.0123	8.85	8.19	8.52	0.0183
4	14.52	3.66	3.39	5.77	0.0124	8.18	7.57	7.85	0.0169
5	14.59	3.95	3.69	6.27	0.0135	7.97	7.45	7.70	0.0166
6	14.53	3.78	3.50	5.92	0.0128	7.99	7.40	7.63	0.0165
7	14.57	4.10	3.82	6.43	0.0140	7.37	6.87	7.04	0.0153
8	14.56	4.33	4.03	6.72	0.0148	7.44	6.93	7.02	0.0154
9	14.56	4.30	4.00	6.65	0.0146	7.67	7.13	7.22	0.0159
10	14.61	4.12	3.86	6.46	0.0141	7.77	7.28	7.42	0.0162
AVG	14.55	3.77	3.50	5.91	0.0128	8.31	7.71	7.96	0.0172

TABLE 2–2
HYDROCARBON DATA SUMMARY
HRSG STACK OUTLET, DISTRICT PERMIT # 3040170101R3
COALINGA COGENERATION COMPANY
COALINGA, CALIFORNIA
MARCH 4, 1993

RUN	O_2	NON–METHANE HYDROCARBONS (NMHC) AS METHANE				AMMONIA SLIP		
#	%	ppm(v)	ppm(v) @ 15% O_2	lb/hr	lb/MMBtu	ppm(v)	ppm(v) @ 15% O_2	lb/hr
1	14.48	5.37	4.94	2.96	0.0063	1.71	1.57	1.00
2	14.54	8.60	7.97	4.76	0.0102	0.67	0.62	0.39
3	14.53	ND	ND	ND	ND	0.91	0.84	0.53
AVG	14.52	4.66	4.30	2.58	0.0055	1.10	1.01	0.64

Note: "ND" samples were non–detectable for all hydrocarbon compounds (C_2–C_6) with a detection limit of 1 ppm for each compound.

TABLE 2-3
NO_x RELATIVE ACCURACY DATA SUMMARY
DISTRICT PERMIT # 3040170101R3
COALINGA COGENERATION COMPANY
COALINGA, CALIFORNIA
MARCH 4, 1993

Run #	Reference Method (ES) Values ppm	Plant CEM Values ppm	Difference
1	2.21	2.35	0.14
2	3.58	3.62	0.04
3	3.62	3.68	0.06
4	3.66	3.75	0.09
5	3.95	3.99	0.04
6	3.78	3.86	0.08
7	4.10	4.24	0.14
8	4.33	4.05	−0.28
9	4.30	4.18	−0.12
10	4.12	4.02	−0.10

RELATIVE ACCURACY PERCENT = 2.79

TABLE 2-4
CO RELATIVE ACCURACY DATA SUMMARY
DISTRICT PERMIT # 3040170101R3
COALINGA COGENERATION COMPANY
COALINGA, CALIFORNIA
MARCH 4, 1993

Run #	Reference Method (ES) Values ppm	Plant CEM Values ppm	Difference
1	10.66	9.37	−1.29
2	9.17	7.92	−1.25
3	8.85	7.49	−1.36
4	8.18	6.91	−1.27
5	7.97	6.60	−1.37
6	7.99	6.76	−1.23
7	7.37	6.06	−1.31
8	7.44	6.37	−1.07
9	7.67	6.25	−1.42
10	7.77	6.59	−1.18

RELATIVE ACCURACY PERCENT = 16.22

TABLE 2–5
O_2 RELATIVE ACCURACY DATA SUMMARY
DISTRICT PERMIT # 3040170101R3
COALINGA COGENERATION COMPANY
COALINGA, CALIFORNIA
MARCH 4, 1993

Run #	Reference Method (ES) Values %	Plant CEM Values %	Difference
1	14.48	14.51	0.03
2	14.54	14.54	0.00
3	14.53	14.56	0.03
4	14.52	14.56	0.04
5	14.59	14.56	−0.03
6	14.53	14.55	0.02
7	14.57	14.58	0.01
8	14.56	14.59	0.03
9	14.56	14.57	0.01
10	14.61	14.57	−0.04

RELATIVE ACCURACY PERCENT = 0.20

SECTION 3

SAMPLING AND ANALYSIS PROCEDURES

SECTION 3

SAMPLING AND ANALYSIS PROCEDURES

Continuous Emissions Monitoring

Sample Extraction and Conditioning

Sampling is performed using a system which delivers a conditioned, continuous gas sample to the gas analyzers. The gas sample is extracted through a stainless steel probe, then passes through a heated (250°F) Teflon sample line, a sample condenser (for moisture removal), an in-line filter (for particulate removal), and a stainless steel pump. The clean, dry sample is then transported via unheated Teflon line to the analyzer manifold (located within the mobile van) for sample distribution to the continuous emissions monitors.

Continuous Emissions Monitors (CEMS)

Table 3-1 describes the CEMS used in the mobile van to analyze the exhaust gases. Calibrations of the CEMS are performed using EPA Protocol 1 or NIST certified calibration gases. Copies of gas certifications are included in the Report appendix.

Prior to performing the emissions testing, a leak check of the sample system is performed. A check of sampling system bias is performed by injecting calibration gas (for each parameter) at the sample probe and then observing instrument response. A response within $\pm$ 5 percent of instrument range is considered acceptable. The leak check is repeated at the conclusion of the test day to verify the validity of the tests.

Before each test run, an initial calibration of the analyzers is performed by introducing zero and span gases and making appropriate adjustments. During each test run, analyzer response data is recorded for each instrument. At the conclusion of the test run, a calibration check is performed to verify acceptable zero and span drift limits.

TABLE 3–1
CEM INSTRUMENT SPECIFICATIONS
CEM VAN # 3

PARAMETER	MANUFACTURER	MODEL NO.	ANALYZER PRINCIPLE	SENSITIVITY / ACCURACY	LINEARITY	SPECIAL NOTES	RESPONSE TIME	NOISE	PRECISION
O_2	MSA Instruments	4000	Electroconductivity Detection	+– 0.01%	< 2%	Galvanic Fuel Cell	90% Full Scale in 20 sec.	+– 1%	
CO_2	Infrared Industries	732	Non–Dispersive Infrared		< 2%		90% Full Scale in 20 sec.		
NO_x	Thermo Environmental Instruments Inc.	10	Chemiluminescent	0.05 ppm	+– 1% from 0.05 to 10,000	High range has 0_2 feed.	Approx. 1.5 sec NO mode Approx. 1.7 sec NO_x mode	< 1% of Full Scale	
CO	Thermo Environmental Instruments Inc.	48	Gas Filter Correlation	0.1 ppm	< +– 1%		95% Full Scale in < 60 sec.	< 0.05 ppm	> +– 0.1ppm
Gas Dilution System	Environics, Inc.	Series 2000	Computerized Mass Flow Controllers	+–0.05% Full Scale	NA	Operated between 10% and 90% of flow controller full scale operating range.	+–2.0% of target flow in 30 seconds	NA	+–0.2% Full Scale
CO_2 / High CO	Fuji – Milton Roy	ZRH	Non–Dispersive Infrared	2% of Full Scale / week	1% of Full Scale	CO_2 Range : 0–20 % CO Range : 0–1 %	90% Full Scale in 3 sec.	< 0.5% of Full Scale	CO_2: .5% Full Scale CO: 1% Full Scale

Ammonia (BAAQMD Method ST-1B)

General

Testing is conducted in accordance with BAAQMD Method ST-1b. Sample gas is collected in a solution of 0.1 Normal hydrochloric acid which absorbs the ammonia.

Sampling Train

The impinger train is kept in an icebath during the test run. Impingers 1 and 2 contain 100 milliliters of 0.1 N HCl, impinger 3 is empty, and impinger 4 contains a tared amount of silica gel. The impingers are weighed before and after sampling to allow calculation of percent moisture in the gas stream. The probe and sample box are connected to the control module using an umbilical line. The control module consists of a vacuum pump, a calibrated dry gas meter, and a calibrated orifice meter. The control module components measure pressure, temperature, and flowrate throughout the train.

Sampling Procedure

A leak check is performed before sampling begins by bringing the sample train to 15-inches of mercury vacuum. Leakage has to be less than 0.02 cfm or 4% of the average sampling rate prior to beginning a test. After sampling is complete, a final leak check is performed on the sampling train. This leak check is performed at 15-inches of mercury vacuum or at the highest vacuum achieved during the test. All pertinent data is recorded on field data sheets.

Sample Recovery

Each impinger is removed from the icebath, wiped dry, and weighed to allow calculation of percent moisture in the gas stream. A polyethylene bottle labeled as NH_3 is used to collect the contents of the impingers and the distilled water rinses of the impingers

and their connectors . A chain-of-custody form is filled out with sample numbers for tracking purposes.

Sample Analysis for Ammonia

The volume of the NH_3 sample bottle is measured and an aliquot is transferred to a 250 milliliter beaker using a 100 milliliter NBS class A pipet. A Teflon stir bar is carefully placed in the beaker and NH_3 ionic strength adjuster (ISA) solution is added until a blue color persists. The ammonia content is determined using a specific ion electrode. The electrode is rinsed with distilled water, immersed in the liquid, and allowed to reach a stable ppm (and millivolt) reading. The ion selective electrode (ISE) meter is calibrated with 1 ppm, 10 ppm and 100 ppm standards (3-point calibration) prior to sample analysis. Quality Control, duplicate, spike, and blank (0.1 N HCl impinger solution) samples are also analyzed.

Non-methane Hydrocarbons (EPA Method 18)

Integrated samples are collected through a 316 stainless steel probe and teflon line directly into a new Tedlar bag by utilizing an evacuated chamber to draw the exhaust gas into the bag. The Tedlar bags are purged twice with the exhaust gas before collecting each sample. At the conclusion of sampling, the Tedlar bag is closed off, labeled, and delivered to the laboratory along with a chain-of-custody form. Non-methane Hydrocarbon (NMHC) analysis is performed by Gas Chromatograpy equipped with Flame Ionization Detection (GC/FID).

Fuel Gas

A fuel gas sample is collected in a stainless steel gas sample cylinder, properly labeled, and delivered to the laboratory with an accompanying chain-of-custody form.

Samples are analyzed by gas chromotography for CHONS (carbon, hydrogen, oxygen, nitrogen, and sulfur) and heating value in accordance with ASTM Method D-3588.

SECTION 4

CALCULATIONS

NOMENCLATURE

A_s	= Cross-sectional area of stack (ft^2)
A_n	= Cross-sectional area of nozzle (ft^2)
B_{ws}	= Water vapor in the gas stream, proportion by volume (dimensionless)
C_p	= Pitot tube coefficient (dimensionless)
dH	= Average pressure differential across the orifice meter (inches of water)
Md	= Dry molecular weight of stack gas (lb/lb-mole)
Ms	= Wet molecular weight of stack gas (lb/lb-mole)
N	= Normality of titrant (milliequivalents/ml)
dP	= Velocity pressure of stack gas (inches of water)
Pb	= Barometric pressure at sampling site (in. Hg)
Ps	= Absolute stack gas pressure (in. Hg)
Pstd	= Standard absolute pressure (29.92 in. Hg)
Qs(std)	= Dry volumetric stack gas flow rate, standard conditions (dscfm)
Ts	= Stack temperature (^oF)
Vm	= Dry gas volume as measured by dry gas meter (dcf)
Vm(std)	= Dry gas volume as measured by dry gas meter, corrected to standard conditions (dscf)
Vw(std)	= Volume of water vapor in the gas stream, corrected to standard conditions (scf)
Vlc	= Volume of water vapor condensed in impingers and silica gel (ml)
T(std)	= Standard temperature (^oF)
Tm	= Meter temperature (^oF)
SQ.RT.dP	= Square root of velocity pressure (dimensionless)
y	= Dry gas meter calibration factor (dimensionless)
Pstatic	= Static pressure of stack (in. H_2O)
Pstack	= Static pressure of stack (in. Hg)
I	= Isokinetic sample rate (percent)
vs	= Average velocity of the stack gas (ft/sec)
Qs	= Actual stack gas flow rate at stack conditions (ft^3/min)
Θ	= Total sampling time (min)
% O_2	= Percent oxygen by volume (dry basis)
% CO_2	= Percent carbon dioxide by volume (dry basis)
% CO	= Percent carbon monoxide by volume (dry basis)
% N_2	= Percent nitrogen by volume (dry basis)
Zcf	= Zero drift correction factor
Scf	= Span drift correction factor
Cz	= Zero correction concentration
MW	= Molecular weight (lb/lb-mole)
ppm	= Parts per million by volume

lb/MMBtu	= Emission concentration, pounds per million British thermal units
dscf/MMBtu	= Fuel factor, dry standard cubic feet per million British thermal units
gr/scf	= Emission concentration, grains per standard cubic foot
lb/hr	= Emission rate, pounds per hour
FHW	= Front Half Wash of sampling train
MF	= Mass Filter of sampling train
BHW	= Back Half Wash of Sampling train
gr/dscf	= Emission concentration, grains per dry standard cubic foot
ng	= Mass unit, nanograms
mg	= Mass unit, milligrams
g	= Mass unit, grams
ml	= Unit of volume, milliliters
L	= Unit of volume, liters
ul	= Unit of volume, microliters
H_2SO_4	= Chemical formula, sulfuric acid
$BaCl_2$	= Chemical formula, barium chloride
NaOH	= Chemical formula, sodium hydroxide
H_2S	= Chemical formula, hydrogen sulfide
FHS	= Front Half Sulfate of sampling train
BHS	= Back Half Sulfate of sampling train
F-Factor	= Fuel factor, volume of generated gases per unit of heat content (dscf/MMBtu)
^oF	= Degrees Fahrenheit
^oR	= Degrees Rankine
^oC	= Degrees Celsius
98.076	= Molecular weight of sulfuric acid
64.062	= Molecular weight of sulfur dioxide
46.006	= Molecular weight of nitrogen dioxide
28.010	= Molecular weight of carbon monoxide
60	= Conversion factor, minutes per hour
460	= Conversion factor, ^oF to ^oR
15.432	= Conversion factor, grains per gram
0.000143	= Converson factor, pounds per grain
32/98.076	= Conversion factor, equivalent weight of SO_2 to MW of H_2SO_4
1.60982	= Ideal Gas Law (lb-mole x dscf/ dscf/ ^oR x mg)
0.00000137	= Ideal Gas Law (lb-mole x $^oR/ft^3$)
0.280	= Molecular weight of N_2 or CO, divided by 100
0.320	= Molecular weight of O_2, divided by 100
0.440	= Molecular weight of CO_2, divided by 100
18.0	= Molecular weight of H_2O
32.064	= Equivalent weight of SO_2
85.49	= Pitot tube constant, ft/sec x $[(lb/lb\text{-}mole) \times (in.Hg)/((^oR) \times (in.H_2O))]^{0.5}$
8.223E-05	= Ideal gas constant (1.37E-06 lb-mole $^oR/ft^3$) x (60 min/hr)

RELATIVE ACCURACY CALCULATIONS – NOx (ppm)

COALINGA COGENERATION COMPANY
OUTLET STACK

04–Mar–93

Run No.	RM Test Values		Plant CEM Values		Difference d
	Runs not Used for RA	Runs Used for RA	Runs not Used for RA	Runs Used for RA	
1		2.21		2.35	0.14
2		3.58		3.62	0.04
3		3.62		3.68	0.06
4		3.66		3.75	0.09
5		3.95		3.99	0.04
6		3.78		3.86	0.08
7		4.10		4.24	0.14
8		4.33		4.05	–0.28
9		4.30		4.18	–0.12
10		4.12		4.02	–0.10
11					
12					

$\overline{RM}$: 3.77

$\overline{d}$: 0.01

Standard Deviation (Std.Dev.) : 0.13

t–VALUES TABLE

n	t0.975	n	t0.975
2	12.706	10	2.262
3	4.303	11	2.228
4	3.182	12	2.201
5	2.776	13	2.179
6	2.571	14	2.160
7	2.447	15	2.145
8	2.365	16	2.131
9	2.306		

CONFIDENCE COEFFICIENT

CC = t0.975 x [Std.Dev. / (Sq.Rt. n)]= 0.10

Where : CC = 2.5 percent error Confidence Coefficient.

n , number of valid test runs = 10

t0.975, t–Value from table = 2.262

RELATIVE ACCURACY

$RA (\%) = (|\overline{d}| + |CC|) / \overline{RM} \times 100 =$ **2.79**

RELATIVE ACCURACY CALCULATIONS – CO (ppm)

COALINGA COGENERATION COMPANY
OUTLET STACK

04–Mar–93

Run No.	RM Test Values		Plant CEM Values		Difference d
	Runs not Used for RA	Runs Used for RA	Runs not Used for RA	Runs Used for RA	
1		10.66		9.37	–1.29
2		9.17		7.92	–1.25
3		8.85		7.49	–1.36
4		8.18		6.91	–1.27
5		7.97		6.60	–1.37
6		7.99		6.76	–1.23
7		7.37		6.06	–1.31
8		7.44		6.37	–1.07
9		7.67		6.25	–1.42
10		7.77		6.59	–1.18
11					
12					

$\overline{RM}$: 8.31

$\overline{d}$: –1.28

Standard Deviation (Std.Dev.) : 0.10

t–VALUES TABLE

n	t0.975	n	t0.975
2	12.706	10	2.262
3	4.303	11	2.228
4	3.182	12	2.201
5	2.776	13	2.179
6	2.571	14	2.160
7	2.447	15	2.145
8	2.365	16	2.131
9	2.306		

CONFIDENCE COEFFICIENT

CC = t0.975 x [Std.Dev. / (Sq.Rt. n)]= 0.07

Where : CC = 2.5 percent error Confidence Coefficient.

n , number of valid test runs = 10

t0.975, t–Value from table = 2.262

RELATIVE ACCURACY

$RA (\%) = (|\overline{d}| + |CC|) / \overline{RM} \times 100 =$ **16.22**

RELATIVE ACCURACY CALCULATIONS – O2 (%)

COALINGA COGENERATION COMPANY
OUTLET STACK

04–Mar–93

Run No.	RM Test Values		Plant CEM Values		Difference d
	Runs not Used for RA	Runs Used for RA	Runs not Used for RA	Runs Used for RA	
1		14.48		14.51	0.03
2		14.54		14.54	0.00
3		14.53		14.56	0.03
4		14.52		14.56	0.04
5		14.59		14.56	–0.03
6		14.53		14.55	0.02
7		14.57		14.58	0.01
8		14.56		14.59	0.03
9		14.56		14.57	0.01
10		14.61		14.57	–0.04
11					
12					

$\overline{RM}$: 14.55

$\overline{d}$: 0.01

Standard Deviation (Std.Dev.) : 0.03

t–VALUES TABLE

n	t0.975	n	t0.975
2	12.706	10	2.262
3	4.303	11	2.228
4	3.182	12	2.201
5	2.776	13	2.179
6	2.571	14	2.160
7	2.447	15	2.145
8	2.365	16	2.131
9	2.306		

CONFIDENCE COEFFICIENT

CC = t0.975 x [Std.Dev. / (Sq.Rt. n)]= 0.02

Where : CC = 2.5 percent error Confidence Coefficient.

n , number of valid test runs = 10

t0.975, t–Value from table = 2.262

RELATIVE ACCURACY

RA (%) = ($|\overline{d}|$ + |CC|) / $\overline{RM}$ x 100 = **0.20**

EMISSION CALCULATIONS
GAS COMPONENTS

COALINGA COGENERATION COMPANY
OUTLET STACK

DATA :

	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6
Date	04-Mar-93	04-Mar-93	04-Mar-93	04-Mar-93	04-Mar-93	04-Mar-93
Oxygen (%)	14.48	14.54	14.53	14.52	14.59	14.53
Qs(std), dscfm	217,656	218,592	217,320	216,608	218,073	215,647
F-Factor, dscf/MMBtu	8,517.09	8,517.09	8,517.09	8,517.09	8,517.09	8,517.09
NOx, ppm	2.21	3.58	3.62	3.66	3.95	3.78
CO, ppm	10.66	9.17	8.85	8.18	7.97	7.99

CALCULATIONS :

NOx, lb/hr	3.50	5.69	5.73	5.77	6.27	5.92
NOx, ppm @ 15 %O2	2.03	3.32	3.35	3.39	3.69	3.50
NOx, lb/MMBtu	0.0074	0.0122	0.0123	0.0124	0.0135	0.0128
CO, lb/hr	10.28	8.88	8.52	7.85	7.70	7.63
CO, ppm @ 15 %O2	9.79	8.50	8.19	7.57	7.45	7.40
CO, lb/MMBtu	0.0218	0.0189	0.0183	0.0169	0.0166	0.0165
SO2, lb/hr						
SO2, ppm @ 15 %O2						
SO2, lb/MMBtu						
HC, lb/hr						
HC, ppm @ 15 %O2						
HC, lb/MMBtu						

EQUATIONS :

lb/hr = (0.00000137 Lb-Mole °R / ft3) x 60 min/hr x Qs(std) x MW x ppm / [T(std) + 460]

ppm @ 15 %O2 = ppm measured x [(20.9 - 15 %O2) / (20.9 - %O2 measured)]

lb/MMBtu = F-Factor x MW x [(1.3711E-6 Lb-Mole °R / ft3) / (T(std) + 460)] x [20.9 / (20.9 - O2%)] x ppm

CONSTANTS :

Standard Temp. T(std): 60 °F
Oxygen Correction : 15 % O2

NOx, MW = 46.005 lb/lb-mole
CO, MW = 28.010 lb/lb-mole
SO2, MW = 64.058 lb/lb-mole
HC, MW = 16.043 lb/lb-mole

EMISSION CALCULATIONS
GAS COMPONENTS

COALINGA COGENERATION COMPANY
OUTLET STACK

DATA :

	Run 7	Run 8	Run 9	Run 10
Date	04-Mar-93	04-Mar-93	04-Mar-93	04-Mar-93
Oxygen (%)	14.57	14.56	14.56	14.61
Qs(std), dscfm	215,700	213,118	212,745	215,754
F-Factor, dscf/MMBtu	8,517.09	8,517.09	8,517.09	8,517.09
NOx, ppm	4.10	4.33	4.30	4.12
CO, ppm	7.37	7.44	7.67	7.77
SO2, ppm				
HC (non-methane), ppm				

CALCULATIONS :

NOx, lb/hr	6.43	6.72	6.65	6.46
NOx, ppm @ 15 %O2	3.82	4.03	4.00	3.86
NOx, lb/MMBtu	0.0140	0.0148	0.0146	0.0141
CO, lb/hr	7.04	7.02	7.22	7.42
CO, ppm @ 15 %O2	6.87	6.93	7.13	7.28
CO, lb/MMBtu	0.0153	0.0154	0.0159	0.0162
SO2, lb/hr				
SO2, ppm @ 15 %O2				
SO2, lb/MMBtu				
HC, lb/hr				
HC, ppm @ 15 %O2				
HC, lb/MMBtu				

EQUATIONS :

lb/hr = (0.00000137 Lb-Mole °R / ft3) x 60 min/hr x Qs(std) x MW x ppm / [T(std) + 460]

ppm @ 15 %O2 = ppm measured x [(20.9 - 15 %O2) / (20.9 - %O2 measured)]

lb/MMBtu = F-Factor x MW x [(1.3711E-6 Lb-Mole °R / ft3) / (T(std) + 460)] x [20.9 / (20.9 - O2%)] x ppm

CONSTANTS :

Standard Temp. T(std): 60 °F
Oxygen Correction : 15 % O2

NOx, MW = 46.005 lb/lb-mole
CO, MW = 28.010 lb/lb-mole
SO2, MW = 64.058 lb/lb-mole
HC, MW = 16.043 lb/lb-mole

GAS ANALYZER DATA

COALINGA COGENERATION COMPANY
OUTLET STACK

Date : 04-Mar-93
Run No. : 1

	O2, %		CO2, %		NOx, ppm		CO, ppm		SO2, ppm	
	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading
Point #										
1	14.50	14.50			2.20	2.20	10.40	10.40		
2	14.50	14.50			2.40	2.40	10.40	10.39		
3	14.48	14.48			2.23	2.23	11.00	10.99		
4	14.47	14.47			2.15	2.15	11.00	10.99		
5	14.46	14.46			2.14	2.14	10.60	10.58		
6	14.45	14.45			2.15	2.15	10.65	10.62		
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MEAN :		14.48				2.21		10.66		
Zero Check		0.00				0.00		0.20		
Span Check		15.14				8.46		12.54		
Initial Span Value		15.14				8.46		12.54		
Drift, Percent		0.0				0.0		-1.6		
Zero Drift, Zcf		0.00000				0.00000		0.03333		
Span Drift, Scf		0.00000				0.00000		-0.00266		

Drift, Percent = [(Span Check – Zero Check) – Calib. Gas] / Calib. Gas x 100

Zero Drift Correction Factor, Zcf = Zero Check / # of Readings

Span Drift Correction Factor, Scf = (% Drift / 100) / # of Readings

Cz, Zero Corr. Concentration = measured value – [Zcf x (Point # – 0.5)]

Drift Corrected Reading = Cz / [1 + (Scf x (Point # – 0.5))]

GAS ANALYZER DATA

COALINGA COGENERATION COMPANY
OUTLET STACK

Date : 04-Mar-93
Run No. : 2

	O2, %		CO2, %		NOx, ppm		CO, ppm		SO2, ppm	
	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading
Point #										
1	14.54	14.54			3.30	3.30	9.70	9.70		
2	14.54	14.54			3.60	3.60	9.50	9.50		
3	14.54	14.54			3.70	3.70	9.10	9.10		
4	14.54	14.54			3.65	3.65	8.90	8.90		
5	14.54	14.54			3.63	3.63	8.90	8.90		
6	14.54	14.54			3.60	3.60	8.90	8.90		
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MEAN :		14.54				3.58		9.17		
Zero Check		0.00				0.00		0.00		
Span Check		15.14				8.46		12.54		
Initial Span Value		15.14				8.46		12.54		
Drift, Percent		0.0				0.0		0.0		
Zero Drift, Zcf		0.00000				0.00000		0.00000		
Span Drift, Scf		0.00000				0.00000		0.00000		

Drift, Percent = [(Span Check – Zero Check) – Calib. Gas] / Calib. Gas x 100

Zero Drift Correction Factor, Zcf = Zero Check / # of Readings

Span Drift Correction Factor, Scf = (% Drift / 100) / # of Readings

Cz, Zero Corr. Concentration = measured value – [Zcf x (Point # – 0.5)]

Drift Corrected Reading = Cz / [1 + (Scf x (Point # – 0.5))]

GAS ANALYZER DATA

COALINGA COGENERATION COMPANY
OUTLET STACK

Date : 04-Mar-93
Run No. : 3

	O2, %		CO2, %		NOx, ppm		CO, ppm		SO2, ppm	
Point #	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading
1	14.53	14.53			3.80	3.79	9.00	9.00		
2	14.53	14.53			3.80	3.78	8.30	8.31		
3	14.53	14.53			3.40	3.37	9.20	9.21		
4	14.53	14.53			3.55	3.50	9.00	9.02		
5	14.53	14.53			3.75	3.68	8.90	8.92		
6	14.53	14.53			3.70	3.62	8.60	8.63		
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MEAN :		14.53				3.62		8.85		
Zero Check		0.00				0.00		0.00		
Span Check		15.14				8.67		12.50		
Initial Span Value		15.14				8.46		12.54		
Drift, Percent		0.0				2.5		-0.3		
Zero Drift, Zcf		0.00000				0.00000		0.00000		
Span Drift, Scf		0.00000				0.00414		-0.00053		

Drift, Percent = [(Span Check – Zero Check) – Calib. Gas] / Calib. Gas x 100

Zero Drift Correction Factor, Zcf = Zero Check / # of Readings

Span Drift Correction Factor, Scf = (% Drift / 100) / # of Readings

Cz, Zero Corr. Concentration = measured value – [Zcf x (Point # – 0.5)]

Drift Corrected Reading = Cz / [1 + (Scf x (Point # – 0.5))]

GAS ANALYZER DATA

COALINGA COGENERATION COMPANY
OUTLET STACK

Date : 04-Mar-93
Run No. : 4

	O2, %		CO2, %		NOx, ppm		CO, ppm		SO2, ppm	
	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading
Point #										
1	14.50	14.50			4.05	4.05	7.70	7.70		
2	14.50	14.50			3.40	3.39	8.80	8.80		
3	14.50	14.50			3.70	3.68	8.30	8.30		
4	14.52	14.52			3.80	3.78	7.80	7.80		
5	14.55	14.55			3.25	3.22	8.10	8.10		
6	14.57	14.57			3.90	3.86	8.40	8.40		
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MEAN :		14.52				3.66		8.18		

Zero Check	0.00	0.00	0.00
Span Check	15.14	8.55	12.54
Initial Span Value	15.14	8.46	12.54
Drift, Percent	0.0	1.1	0.0
Zero Drift, Zcf	0.00000	0.00000	0.00000
Span Drift, Scf	0.00000	0.00177	0.00000

Drift, Percent = [(Span Check – Zero Check) – Calib. Gas] / Calib. Gas x 100

Zero Drift Correction Factor, Zcf = Zero Check / # of Readings

Span Drift Correction Factor, Scf = (% Drift / 100) / # of Readings

Cz, Zero Corr. Concentration = measured value – [Zcf x (Point # – 0.5)]

Drift Corrected Reading = Cz / [1 + (Scf x (Point # – 0.5))]

GAS ANALYZER DATA

COALINGA COGENERATION COMPANY
OUTLET STACK

Date : 04-Mar-93
Run No. : 5

	O2, %		CO2, %		NOx, ppm		CO, ppm		SO2, ppm	
	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading
Point #										
1	14.57	14.57			3.62	3.62	7.95	7.95		
2	14.59	14.59			4.05	4.05	8.00	8.00		
3	14.59	14.59			3.90	3.90	8.25	8.25		
4	14.59	14.59			4.30	4.30	7.80	7.80		
5	14.59	14.59			4.10	4.10	8.00	8.00		
6	14.59	14.59			3.75	3.75	7.80	7.80		
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MEAN :		14.59				3.95		7.97		

Zero Check	0.00	0.00	0.00
Span Check	15.14	8.46	12.54
Initial Span Value	15.14	8.46	12.54
Drift, Percent	0.0	0.0	0.0
Zero Drift, Zcf	0.00000	0.00000	0.00000
Span Drift, Scf	0.00000	0.00000	0.00000

Drift, Percent = [(Span Check – Zero Check) – Calib. Gas] / Calib. Gas x 100

Zero Drift Correction Factor, Zcf = Zero Check / # of Readings

Span Drift Correction Factor, Scf = (% Drift / 100) / # of Readings

Cz, Zero Corr. Concentration = measured value – [Zcf x (Point # – 0.5)]

Drift Corrected Reading = Cz / [1 + (Scf x (Point # – 0.5))]

GAS ANALYZER DATA

COALINGA COGENERATION COMPANY
OUTLET STACK

Date : 04-Mar-93
Run No. : 6

	O2, %		CO2, %		NOx, ppm		CO, ppm		SO2, ppm	
	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading
Point #										
1	14.52	14.52			4.00	4.00	7.50	7.50		
2	14.52	14.53			3.60	3.60	8.00	8.00		
3	14.50	14.52			3.80	3.80	8.10	8.10		
4	14.50	14.53			3.70	3.70	8.15	8.15		
5	14.48	14.52			3.55	3.55	8.40	8.40		
6	14.48	14.53			4.00	4.00	7.80	7.80		
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MEAN :		14.53				3.78		7.99		

Zero Check	0.00	0.00	0.00
Span Check	15.08	8.46	12.54
Initial Span Value	15.14	8.46	12.54
Drift, Percent	-0.4	0.0	0.0
Zero Drift, Zcf	0.00000	0.00000	0.00000
Span Drift, Scf	-0.00066	0.00000	0.00000

Drift, Percent = [(Span Check − Zero Check) − Calib. Gas] / Calib. Gas x 100

Zero Drift Correction Factor, Zcf = Zero Check / # of Readings

Span Drift Correction Factor, Scf = (% Drift / 100) / # of Readings

Cz, Zero Corr. Concentration = measured value − [Zcf x (Point # − 0.5)]

Drift Corrected Reading = Cz / [1 + (Scf x (Point # − 0.5))]

GAS ANALYZER DATA

COALINGA COGENERATION COMPANY
OUTLET STACK

Date : 04-Mar-93
Run No. : 7

	O2, %		CO2, %		NOx, ppm		CO, ppm		SO2, ppm	
	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading
Point #										
1	14.55	14.55			4.00	3.99	7.80	7.80		
2	14.55	14.55			4.20	4.18	7.00	7.00		
3	14.58	14.58			4.20	4.17	7.80	7.80		
4	14.58	14.58			3.70	3.66	8.00	8.00		
5	14.58	14.58			4.40	4.35	6.80	6.80		
6	14.58	14.58			4.30	4.24	6.80	6.80		
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30										
MEAN :		14.57				4.10		7.37		

Zero Check	0.00	0.00	0.00
Span Check	15.14	8.60	12.54
Initial Span Value	15.14	8.46	12.54
Drift, Percent	0.0	1.7	0.0
Zero Drift, Zcf	0.00000	0.00000	0.00000
Span Drift, Scf	0.00000	0.00276	0.00000

Drift, Percent = [(Span Check – Zero Check) – Calib. Gas] / Calib. Gas x 100

Zero Drift Correction Factor, Zcf = Zero Check / # of Readings

Span Drift Correction Factor, Scf = (% Drift / 100) / # of Readings

Cz, Zero Corr. Concentration = measured value – [Zcf x (Point # – 0.5)]

Drift Corrected Reading = Cz / [1 + (Scf x (Point # – 0.5))]

GAS ANALYZER DATA

COALINGA COGENERATION COMPANY
OUTLET STACK

Date : 04-Mar-93
Run No. : 8

	O2, %		CO2, %		NOx, ppm		CO, ppm		SO2, ppm	
	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading
Point #										
1	14.55	14.55			4.30	4.31	7.40	7.40		
2	14.55	14.55			4.40	4.42	7.00	7.00		
3	14.55	14.55			4.20	4.23	7.80	7.80		
4	14.55	14.55			4.25	4.29	7.75	7.75		
5	14.58	14.58			4.25	4.30	7.50	7.50		
6	14.60	14.60			4.40	4.46	7.20	7.20		
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
MEAN :		14.56				4.33		7.44		
Zero Check		0.00				0.00		0.00		
Span Check		15.14				8.33		12.54		
Initial Span Value		15.14				8.46		12.54		
Drift, Percent		0.0				-1.5		0.0		
Zero Drift, Zcf		0.00000				0.00000		0.00000		
Span Drift, Scf		0.00000				-0.00256		0.00000		

Drift, Percent = [(Span Check − Zero Check) − Calib. Gas] / Calib. Gas x 100

Zero Drift Correction Factor, Zcf = Zero Check / # of Readings

Span Drift Correction Factor, Scf = (% Drift / 100) / # of Readings

Cz, Zero Corr. Concentration = measured value − [Zcf x (Point # − 0.5)]

Drift Corrected Reading = Cz / [1 + (Scf x (Point # − 0.5))]

GAS ANALYZER DATA

COALINGA COGENERATION COMPANY
OUTLET STACK

Date : 04-Mar-93
Run No. : 9

	O2, %		CO2, %		NOx, ppm		CO, ppm		SO2, ppm	
	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading
Point #										
1	14.55	14.55			4.15	4.16	7.90	7.90		
2	14.55	14.55			4.27	4.29	7.70	7.70		
3	14.55	14.55			4.27	4.30	7.60	7.60		
4	14.55	14.55			4.20	4.24	7.70	7.70		
5	14.55	14.55			4.30	4.35	7.60	7.60		
6	14.58	14.58			4.40	4.46	7.50	7.50		
7										
8										
9										
10										
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27										
28										
29										
30										
MEAN :		14.56				4.30		7.67		

Zero Check	0.00	-0.13	0.00
Span Check	15.14	8.46	12.54
Initial Span Value	15.14	8.46	12.54
Drift, Percent	0.0	1.5	0.0
Zero Drift, Zcf	0.00000	-0.02167	0.00000
Span Drift, Scf	0.00000	0.00256	0.00000

Drift, Percent = [(Span Check – Zero Check) – Calib. Gas] / Calib. Gas x 100

Zero Drift Correction Factor, Zcf = Zero Check / # of Readings

Span Drift Correction Factor, Scf = (% Drift / 100) / # of Readings

Cz, Zero Corr. Concentration = measured value – [Zcf x (Point # – 0.5)]

Drift Corrected Reading = Cz / [1 + (Scf x (Point # – 0.5))]

GAS ANALYZER DATA

COALINGA COGENERATION COMPANY
OUTLET STACK

Date : 04-Mar-93
Run No. : 10

	O2, %		CO2, %		NOx, ppm		CO, ppm		SO2, ppm	
	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading	Instrument Reading	Drift Corrected Reading
Point #										
1	14.60	14.60			4.30	4.30	7.40	7.40		
2	14.60	14.60			3.80	3.79	8.10	8.10		
3	14.60	14.60			4.10	4.09	7.60	7.60		
4	14.61	14.61			4.60	4.58	7.50	7.50		
5	14.61	14.61			3.70	3.68	8.20	8.20		
6	14.62	14.62			4.30	4.27	7.80	7.80		
7										
8										
9										
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25										
26										
27										
28										
29										
30										
MEAN :		14.61				4.12		7.77		

Zero Check	0.00	0.00	0.00
Span Check	15.14	8.53	12.54
Initial Span Value	15.14	8.46	12.54
Drift, Percent	0.0	0.8	0.0
Zero Drift, Zcf	0.00000	0.00000	0.00000
Span Drift, Scf	0.00000	0.00138	0.00000

Drift, Percent = [(Span Check – Zero Check) – Calib. Gas] / Calib. Gas x 100

Zero Drift Correction Factor, Zcf = Zero Check / # of Readings

Span Drift Correction Factor, Scf = (% Drift / 100) / # of Readings

Cz, Zero Corr. Concentration = measured value – [Zcf x (Point # – 0.5)]

Drift Corrected Reading = Cz / [1 + (Scf x (Point # – 0.5))]

AMMONIA CALCULATIONS

Company Name	:	COALINGA COGENERATION	O2 Correction	:	15 %
Source	:	OUTLET STACK	Standard Temp.	:	60 °F
Date	:	MARCH 4, 1993	Standard Press.	:	29.92 "Hg

	Run 1	Run 2	Run 3
Tm, °F	77.17	82.50	79.00
Y, meter correction factor	0.9980	0.9980	0.9980
Vm, ft3	20.013	19.958	19.864
Pb, in.Hg.	29.52	29.52	29.52
dH, in.H2O	1.30	1.30	1.30
O2, percent	14.48	14.54	14.53
Qs(std), dscfm	217656	218592	217320
Vm(std), dscf	19.138	18.898	18.931
mg AMMONIA	0.67	0.26	0.35
ppm AMMONIA	1.71	0.67	0.91
ppm AMMONIA @ 15.0 %O2	1.57	0.62	0.84
lb/hr AMMONIA	1.00	0.39	0.53

EQUATIONS :

Vm(std), dscf = [T(std) + 460 / 29.92] x Vm x Y x (Pb + (dH / 13.6)) / (Tm +460)

ppm AMMONIA = 1.60982 x (Temp.Std. + 460) x (mg AMMONIA) / (MW x Vm,std)
Where : 1.60982 = Ideal Gas Law Factor
Where MW of AMMONIA = 17.08 Lb/Lb–Mole

ppm AMMONIA @ corrected O2% = ppm AMMONIA x [20.9 – O2 correction / (20.9 – %O2 measured)

lb/hr = (0.00000137 Lb–Mole °R / ft3) x 60 min/hr x Qs(std) x MW x ppm / [T(std) + 460]

EMISSION CALCULATIONS
HYDROCARBON COMPOUNDS

SALINAS RIVER COGENERATION
OUTLET STACK
MARCH 3, 1993

Hydrocarbon Compound		Molecular Weight	Molecular Formula	Laboratory Analysis, ppm as HC compound *			ppm HC as methane *		
				Run 1	Run 2	Run 3	Run 1	Run2	Run 3
C_1	Methane	16.04	CH_4						
C_2	Ethane	30.07	C_2H_6						
C_3	Propane	44.09	C_3H_8						
C_4	Butane	58.12	C_4H_{10}						
C_5	Pentane	72.15	C_5H_{12}						
C_6	Hexane	86.17	C_6H_{14}	1	1.6		5.37	8.60	
C_6+	as Hexane	86.17	C_6H_{14}						

	Run 1	Run 2	Run 3	Average	
Stack Parameters					
Stack Gas Oxygen, %	14.48	14.54	14.53	14.52	
Stack Gas Flowrate, dscfm	217,656	218,592	217,320	217,856	
F–Factor, dscf/MMBtu	8,517.09	8,517.09	8,517.09	8,517.09	
Total Hydrocarbons, THC as methane					
ppm	5.37	8.60	0.00	4.66	C_1–C_6+ HC
ppm @ Oxygen Correction	4.94	7.97	0.00	4.30	
lb/hr	2.96	4.76	0.00	2.58	
lb/MMBtu	0.0063	0.0102	0.0000	0.0055	
Reactive Organic Compounds, ROC as methane					
ppm	5.37	8.60	0.00	4.66	C_2–C_6+ HC
ppm @ Oxygen Correction	4.94	7.97	0.00	4.30	
lb/hr	2.96	4.76	0.00	2.58	
lb/MMBtu	0.0063	0.0102	0.0000	0.0055	

Oxygen Correction : 15.0 %
Standard Temperature = 60 °F

Equations

HC corrected to methane, ppm = (MW of HC Compound / MW of Methane) x ppm value

ppm @ Oxygen Correction = ppm measured x [(20.9 – Oxygen Correction) / (20.9 – %Oxygen Measured)]

lb/hr = (0.00000137 lb–mole dR / ft3) x 60 min/hr x Qs(std) x (MW of Methane) x ppm / [T(std) + 460)]

lb/MMBtu = F–Factor x (MW of Methane) x [(1.3711E–06 lb–mole dR/ft3) / [T(std) + 460)] x [20.9 / 20.9 – O2%)] x ppm

FUEL BASED CALCULATIONS

COALINGA COGENERATION COMPANY
OUTLET STACK

04-Mar-93

FUEL ANALYSIS DATA

Run #	Fuel Value (%), Moisture & Ash Free: Carbon	Hydrogen	Nitrogen	Oxygen	Sulfur	GCV BTU/lb,dry	ft3/lb	lb/gal
1	72.37	22.72	1.00	3.90	0.00	22,175	20.920	
2	72.37	22.72	1.00	3.90	0.00	22,175	20.920	
3	72.37	22.72	1.00	3.90	0.00	22,175	20.920	
4	72.37	22.72	1.00	3.90	0.00	22,175	20.920	
5	72.37	22.72	1.00	3.90	0.00	22,175	20.920	
6	72.37	22.72	1.00	3.90	0.00	22,175	20.920	

CALCULATIONS

Run #	Stack Gas Oxygen %	Fuel Gas Flowrate lb/hr	Fuel Gas Flowrate ft3/hr	Fuel Oil Flowrate lb/hr	Fuel Oil Flowrate gal/hr	Solid Fuel lb/hr	Heat Input MMBTU/hr	F-Factor dscf/MMBTU	Qs(std) dscfm
1	14.48	21,240					470.999	8,517.09	217,656
2	14.54	21,132					468.604	8,517.09	218,592
3	14.53	21,042					466.608	8,517.09	217,320
4	14.52	21,006					465.810	8,517.09	216,608
5	14.59	20,916					463.814	8,517.09	218,073
6	14.53	20,880					463.016	8,517.09	215,647

Heat Input, MMBTU/hr = (lb/hr fuel gas) x BTU/lb x MM/1E+06

= (ft3/hr fuel gas) x BTU/lb / (ft3/lb fuel gas) x MM/1E+06

= (lb/hr fuel oil) x BTU/lb x MM/1E+06

= (gal/hr fuel oil) x lb/gal x BTU/lb x MM/1E+06

= (lb/hr solid fuel) x BTU/lb x MM/1E+06

F-Factor, dscf/MMBTU = 1E+06 [(3.64 scf/lb)/% x (% H) + (1.53 scf/lb)/% x (% C) + (0.57 scf/lb)/% x (% S) + (0.14 scf/lb)/% x (% N) − (0.46 scf/lb)/% x (% O2)] / (BTU/lb) x [(Tstd + 460) / 528]

Qs(std), dscfm = MMBTU/hr x [F-Factor x (20.9 / (20.9 − %O2)) x (hr / 60 min)]

GCV = Gross Calorific Value of fuel, Btu/lb, dry

Standard Temperature = 60 °F

FUEL BASED CALCULATIONS

COALINGA COGENERATION COMPANY
OUTLET STACK

04-Mar-93

FUEL ANALYSIS DATA

Run #	Fuel Value (%), Moisture & Ash Free: Carbon	Hydrogen	Nitrogen	Oxygen	Sulfur	GCV BTU/lb,dry	ft3/lb	lb/gal
7	72.37	22.72	1.00	3.90	0.00	22,175	20.920	
8	72.37	22.72	1.00	3.90	0.00	22,175	20.920	
9	72.37	22.72	1.00	3.90	0.00	22,175	20.920	
10	72.37	22.72	1.00	3.90	0.00	22,175	20.920	

CALCULATIONS

Run #	Stack Gas Oxygen %	Fuel Gas Flowrate lb/hr	Fuel Gas Flowrate ft3/hr	Fuel Oil Flowrate lb/hr	Fuel Oil Flowrate gal/hr	Solid Fuel lb/hr	Heat Input MMBTU/hr	F-Factor dscf/MMBTU	Qs(std) dscfm
7	14.57	20,754					460.222	8,517.09	215,700
8	14.56	20,538					455.432	8,517.09	213,118
9	14.56	20,502					454.634	8,517.09	212,745
10	14.61	20,628					457.428	8,517.09	215,754

Heat Input, MMBTU/hr = (lb/hr fuel gas) x BTU/lb x MM/1E+06

= (ft3/hr fuel gas) x BTU/lb / (ft3/lb fuel gas) x MM/1E+06

= (lb/hr fuel oil) x BTU/lb x MM/1E+06

= (gal/hr fuel oil) x lb/gal x BTU/lb x MM/1E+06

= (lb/hr solid fuel) x BTU/lb x MM/1E+06

F-Factor, dscf/MMBTU = 1E+06 [(3.64 scf/lb)/% x (% H) + (1.53 scf/lb)/% x (% C) + (0.57 scf/lb)/% x (% S) + (0.14 scf/lb)/% x (% N) − (0.46 scf/lb)/% x (% O2)] / (BTU/lb) x [(Tstd + 460) / 528]

Qs(std), dscfm = MMBTU/hr x [F-Factor x (20.9 / (20.9 − %O2)) x (hr / 60 min)]

GCV = Gross Calorific Value of fuel, Btu/lb, dry

Standard Temperature = 60 °F

SECTION 5

QUALITY ASSURANCE

SECTION 5

QUALITY ASSURANCE

The report is reviewed for technical and editorial quality and for compliance with project requirements. Calculations are performed by computer programs designed for source testing. At least one set of calculations are performed manually to check results.

All equipment used in testing has been checked for proper maintenance and calibrated prior to testing. Test equipment calibrations are included in the Report appendix. The dry gas meter accuracy is expressed as gamma and is determined as the difference between the meter box dry gas meter and the wet test meter used for calibration. The results of the orifice calibration are expressed as the delta H@ (dH@) at various pressure drops (inches of water), as specified in EPA publication APTD-0576. EPA Quality Assurance Branch annual audits are performed with an orifice check of each of the dry gas meters used for volumetric sampling.

The analyzers employed for continuous monitoring of NO_x, CO, SO_2, CO_2, O_2, and HC are California Air Resources Board (CARB) approved instruments. Sampling system bias checks of the continuous monitor sampling system are performed using either EPA protocol 1 or NIST certified calibration gases. Calibration certificates are included in the report. All other required checks of the continuous monitor system are also performed.

All field samples are labeled and logged in on a chain-of-custody sheet. Chain-of-custody sheets remain with samples and document sample movement.

SAMPLE SYSTEM BIAS CHECK

COMPANY COALINGA COGEN. DATE 3/4/93

TEST LOCATION HRSG OUTLET STACK OPERATOR T. DELFINO

COMMENTS: POST-TEST Check

Parameter	Instrument Full Scale	Span Gas Value	Scale	Internal Response	System Response	Percent Difference
O2	0-25%	0.00	Zero	0.00		
(%)		15.14	Upscale	15.14	15.05	-0.36
CO2		0.00	Zero			
(%)			Upscale			
NOx	0-10	0.00	Zero	0.00		
(ppm)		8.46	Upscale	8.53	8.38	-1.50
CO	0-20	0.00	Zero	0.00		
(ppm)		12.54	Upscale	12.54	12.50	-0.20
SO2		0.00	Zero			
(ppm)			Upscale			
HC		0.00	Zero			
(ppm)			Upscale			
		0.00	Zero			
			Upscale			

Percent Difference = [(System Response – Internal Response) / Instrument Full Scale] x 100

Scott Specialty Gases, Inc.

2800 CAJON BOULEVARD, SAN BERNARDINO, CA 92411 (909) 887-2571 FAX: (909) 887-0549

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
ENGINEERING SCIENCE
P.O. BOX 2007
IRWINDALE, CA 91706

Assay Laboratory
Scott Specialty Gases
2600 Cajon Boulevard
San Bernardino, CA 92411

Purchase Order BK042
Scott Project # 0223658

ANALYTICAL INFORMATION

Certified to exceed the minimum specifications of EPA Protocol 1 Procedure #G1, Section Number 3.0.4

Cylinder Number ALM011324 **Certification Date** 2/2/93 **Expiration Date** 8/2/93
Cylinder Pressure 1900 psig **Previous Certification Dates**

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
Nitric Oxide	12.50 ppm	± 1 % NIST Traceable
Carbon Monoxide	12.54 ppm	
Balance Gas: Nitrogen		
NOX	12.7 ppm	

*Analytical uncertainty is inclusive of usual known error sources which at least includes reference standard error & precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
GMIS	3/93	ALM006975	22.52 ppm Nitric Oxide
GMIS	3/93	ALM026614	96.23 ppm Carbon Monoxide

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
TECO / 10AR / 38644-258	11/12/92	Chemi-Luminescent
Horiba / OPE-135D / 56565502	11/20/92	NDIR

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components: Nitric Oxide

First Triad Analysis — Date: 1/22/93 Response Units: mv

Z1=	0.05	R1=	89.87	T1=	49.98
R2=	90.06	Z2=	0.18	T2=	50.02
Z3=	0.20	T3=	50.02	R3=	90.05

Avg. Conc. of Cust Cyl. 12.50 ppm

Second Triad Analysis — Date: 2/2/93 Response Units: mv

Z1=	0.00	R1=	89.99	T1=	50.08
R2=	90.23	Z2=	0.06	T2=	50.14
Z3=	0.10	T3=	50.12	R3=	90.61

Avg. Conc. of Cust Cyl. 12.50 ppm

Calibration Curve — Concentration= Ax^2+Bx+C
A = -0.000050429
B = 1.04899
C = -0.29251

Components: Carbon Monoxide

First Triad Analysis — Date: 1/26/93 Response Units: mv

Z1=	0.00	R1=	97.0	T1=	13.2
R2=	97.0	Z2=	0.00	T2=	13.2
Z3=	0.00	T3=	13.2	R3=	97.0

Avg. Conc. of Cust Cyl. 12.52 ppm

Second Triad Analysis — Date: 2/2/93 Response Units: mv

Z1=	0.00	R1=	97.0	T1=	13.3
R2=	97.0	Z2=	0.00	T2=	13.2
Z3=	0.00	T3=	13.2	R3=	97.0

Avg. Conc. of Cust Cyl. 12.55 ppm

Calibration Curve — Concentration= $Ax^4+Bx^3+Cx^2+DX+E$
A = -0.00000000689
B = -0.000002084
C = -0.0006717
D = 0.93937
E = -0.004755

Date:		Response Units:			
Z1=		R1=		T1=	
R2=		Z2=		T2=	
Z3=		T3=		R3=	

Avg. Conc. of Cust Cyl.

Date:		Response Units:			
Z1=		R1=		T1=	
R2=		Z2=		T2=	
Z3=		T3=		R3=	

Avg. Conc. of Cust Cyl.

Concentration=

Special Notes

Analyst Joseph De La Torre

Scott Specialty Gases, Inc.

FAX 714-887-0549
PHONE: 714-887-2571

2600 CAJON BLVD., SAN BERNARDINO, CA 92411

Shipped From: Scott SAN BERNARDINO, CA
Date Shipped 10/14/92
Our Project No: 22021
Your P.O. No: BK033
Page 1 of 1
Expiration Date: 4/94

ENGINEERING SCIENCE
ATTN: GARY MCRAE
2520 PEGASUS
BAKERSFIELD CA 93308

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES

Certified Per Traceability Protocol No. 1 Procedure No. G1 Cylinder No. ALM011705 Cylinder Pressure 2000 PSIG Certified Accuracy ±1% % NIST Traceable

COMPONENTS	CERTIFIED CONC	REFERENCE STD SRM/CRM NO.	REFERENCE STD CYL. NO.	REFERENCE STD CONC.	GAS ANALYZER MAKE/MODEL/SERIAL NO.	GAS ANALYZER LAST CAL. DATE	GAS ANALYZER ANALYTICAL PRINCIPLE
CARBON DIOXIDE	8.002%	CRM1675	ALM001136	14.08%	OPE-135C	9/17/92	INFRA-RED
OXYGEN	15.14%	CRM2659	ALM017573	20.63%	OPE335	8/27/92	PARAMAGNETIC

BALANCE GAS NITROGEN

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

Component CARBON DIOXIDE
First Analysis Date 10/6/92 Units mv

Z 0.00	R 95.5	T 67.3
R 95.5	Z 0.00	T 67.2
Z 0.00	T 67.3	R 95.5

Mean Test Assay 8.002%

Second Analysis Date ____ Units mv

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay ____

Component OXYGEN
Date 10/6/92 Units mv

Z 0.00	R 83.7	T 61.3
R 83.7	Z 0.00	T 61.3
Z 0.01	T 61.2	R 83.7

Mean Test Assay 15.14%

Date ____ Units mv

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay ____

Component ____
Date ____ Units mv

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay ____

Date ____ Units mv

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay ____

Chronology: Date ____
Assay ____

Analyst J. DE LA TORRE

Approved By: [signature]
A.F. LANGE, Ph.D., MANAGER, QA

Scott Specialty Gases, Inc.

FAX 714-887-0549
PHONE: 714-887-2571

2600 CAJON BLVD., SAN BERNARDINO, CA 92411

ENGINEERING SCIENCE
2520 PEGASUS
BAKERSFIELD, CA 93308-5003

Shipped From: Scott SAN BER. DINO, CA
Date Shipped 10/5/92
Our Project No: 0221822
Your P.O. No: BKG0001
Page 1 of 1
Expiration Date: 4/94

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES

Certified Per Traceability Protocol No. 1 Procedure No. G1 Cylinder No. ALM027375 Cylinder Pressure 1800 PSIG Certified Accuracy ±1% % NIST Traceable

COMPONENTS	CERTIFIED CONC	REFERENCE STD SRM/CRM NO.	CYL. NO.	CONC.	GAS ANALYZER MAKE/MODEL/SERIAL NO.	LAST CAL. DATE	ANALYTICAL PRINCIPLE
CARBON DIOXIDE	3.994 %	SRM2626A	CAL-7539	3.9198%	HORIBA PRI2000 406004	6/3/92	INFRA RED
OXYGEN	4.002 %	CRM2657	AAL-20176	2.002 %	BECKMAN 755 100410	6/3/92	PARAMAGNETIC

BALANCE GAS NITROGEN

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

Component CARBON DIOXIDE
First Analysis Date 10/5/92 Units mv
Z 00.0 R 78.2 T 79.4
R 78.2 Z 00.0 T 79.4
Z 00.0 T 79.4 R 78.2
Mean Test Assay 3.994%
Second Analysis Date ____ Units mv
Z ____ R ____ T ____
R ____ Z ____ T ____
Z ____ T ____ R ____
Mean Test Assay ____

Component OXYGEN
Date 10/5/92 Units mv
Z 00.0 R 40.0 T 80.0
R 40.0 Z 00.0 T 80.0
Z 00.0 T 80.0 R 40.0
Mean Test Assay 4.002 %
Date ____ Units mv
Z ____ R ____ T ____
R ____ Z ____ T ____
Z ____ T ____ R ____
Mean Test Assay ____

Component ____
Date ____ Units mv
Z ____ R ____ T ____
R ____ Z ____ T ____
Z ____ T ____ R ____
Mean Test Assay ____
Date ____ Units mv
Z ____ R ____ T ____
R ____ Z ____ T ____
Z ____ T ____ R ____
Mean Test Assay ____

Chronology: Date ____
Assay ____

Analyst F. VILLAMAS

Approved By: [signature]
A.F. LANGE, Ph.D., MANAGER, QA

Scott Specialty Gases, Inc.

2600 CAJON BOULEVARD, SAN BERNARDINO, CA 92411 (909) 887-2571 FAX: (909) 887-0549

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
ENGINEERING SCIENCE
2520 PEGASUS
BAKERSFIELD, CA 93308-2200

Assay Laboratory
Scott Specialty Gases
2600 Cajon Boulevard
San Bernardino, CA 92411

Purchase Order BK034
Scott Project # 23659.003

ANALYTICAL INFORMATION

Certified to exceed the minimum specifications of EPA Protocol 1 Procedure #G1, Section Number 3.0.4

Cylinder Number ALM022850 **Certification Date** 02-03-93 **Expiration Date** 08-93
Cylinder Pressure 1900psig **Previous Certification Dates** NONE

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
Carbon Monoxide	8.352 ppm	± 1 % NIST Traceable
Nitric Oxide	8.338 ppm	± 2 % NIST Traceable
Balance Gas: Nitrogen		
NOX	8.46 ppm	

*Analytical uncertainty is inclusive of usual known error sources which at least include reference standard error & precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
SRM1677	10-93	CAL5078	9.900 ppm
GMIS	03-93	ALM6975	22.52 ppm

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
Horiba / OPE-135D / 56565502	06-03-92	NDIR
TECO / 10AR / 14853-150	10-29-92	Chemi-Luminescent

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components | **First Triad Analysis** | **Second Triad Analysis** | **Calibration Curve**

Carbon Monoxide

First Triad: Date:01-27-93 Response Units:MV
Z1= 0.00 R1= 19.5 T1= 16.5
R2= 19.5 Z2= 0.04 T2= 16.5
Z3= 00.7 T3= 16.5 R3= 19.5
Avg. Conc. of Cust Cyl. 8.352 ppm

Second Triad: Date:02-03-93 Response Units:MV
Z1= 0.00 R1= 19.5 T1= 16.5
R2= 19.5 Z2= 0.00 T2= 16.5
Z3= 0.00 T3= 16.5 R3= 19.5
Avg. Conc. of Cust Cyl. 8.352 ppm

Calibration Curve: Concentration= Ax^2+Bx+C
A =0.00005011
B =0.5059
C =-0.01002

Nitric Oxide

First Triad: Date:01-22-93 Response Units:MV
Z1= 0.02 R1= 89.87 T1= 33.46
R2= 90.41 Z2= 0.18 T2= 33.57
Z3= 0.20 T3= 33.57 R3= 90.45
Avg. Conc. of Cust Cyl. 8.347 ppm

Second Triad: Date:02-02-93 Response Units:MV
Z1= 0.00 R1= 90.40 T1= 33.49
R2= 90.42 Z2= 0.00 T2= 33.42
Z3= 0.00 T3= 33.39 R3= 90.40
Avg. Conc. of Cust Cyl. 8.328 ppm

Calibration Curve: Concentration= Ax^2+Bx+C
A =-0.000504296
B =1.0489880
C =-0.292506

First Triad: Date: Response Units:
Z1= R1= T1=
R2= Z2= T2=
Z3= T3= R3=
Avg. Conc. of Cust Cyl.

Second Triad: Date: Response Units:
Z1= R1= T1=
R2= Z2= T2=
Z3= T3= R3=
Avg. Conc. of Cust Cyl.

Calibration Curve: Concentration=

Special Notes

Analyst Joseph De La Torre

Scott Specialty Gases, Inc.

2600 CAJON BOULEVARD, SAN BERNARDINO, CA 92411 (909) 887-2571 FAX: (909) 887-0549

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
ENGINEERING SCIENCE
P.O. BOX 2007
IRWINDALE, CA 91706

Assay Laboratory
Scott Specialty Gases
2600 Cajon Boulevard
San Bernardino, CA 92411

Purchase Order BK042
Scott Project # 0223658

ANALYTICAL INFORMATION

Certified to exceed the minimum specifications of EPA Protocol 1 Procedure #G1, Section Number 3.0.4

Cylinder Number AAL 2534 **Certification Date** 2/2/93 **Expiration Date** 8/2/93
Cylinder Pressure 1900 psig **Previous Certification Dates**

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
Carbon Monoxide	18.56 ppm	± 1 % NIST Traceable
Nitric Oxide	22.75 ppm	
Balance Gas: Nitrogen		
NOX	23.2 ppm	

*Analytical uncertainty is inclusive of usual known error sources which at least includes reference standard error & precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
CRM-1678	2/94	AAL-5970	47.20 ppm Carbon Monoxide
GMIS	3/93	ALM 006975	22.52 ppm Nitric Oxide

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
Horiba / OPE-135D / 56565502	12/17/92	NDIR
TECO / 10AR / 14853-150	1/20/93	Chemi-Luminescent

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components — **First Triad Analysis** — **Second Triad Analysis** — **Calibration Curve**

Date: 1/26/93 Response Units: mv

Z1= 0.02	R1= 89.55	T1= 90.54
R2= 90.03	Z2= 0.13	T2= 90.60
Z3= 0.12	T3= 90.63	R3= 90.12

Avg. Conc. of Cont Cyl. 22.69 ppm

Date: 2/1/93 Response Units: mv

Z1= 0.00	R1= 89.26	T1= 90.78
R2= 89.16	Z2= -0.23	T2= 90.14
Z3= -0.20	T3= 90.12	R3= 89.25

Avg. Conc. of Cont Cyl. 22.80 ppm

Concentration= Ax^2+Bx+C
A =-0.00008618
B =0.25997
C =-0.019484

Carbon Monoxide

Date: 1/26/93 Response Units: mv

Z1= 0.00	R1= 20.9	T1= 8.40
R2= 20.9	Z2= 0.00	T2= 8.30
Z3= 0.00	T3= 8.33	R3= 20.9

Avg. Conc. of Cont Cyl. 18.52 ppm

Date: 2/2/93 Response Units: mv

Z1= 0.00	R1= 20.9	T1= 8.40
R2= 20.9	Z2= 0.00	T2= 8.40
Z3= 0.00	T3= 8.30	R3= 20.9

Avg. Conc. of Cont Cyl. 18.59 ppm

Concentration= $Ax^4+Bx^3+Cx^2+DX+E$
A =0.00000000689
B =-0.000002094
C =0.0006717
D =0.93997
E =0.004755

Date: Response Units:

Z1= R1=		T1=
R2=	Z2=	T2=
Z3=	T3=	R3=

Avg. Conc. of Cont Cyl.

Date: Response Units:

Z1=		T1=
R2=		T2=
Z3=	T3=	R3=

Avg. Conc. of Cont Cyl.

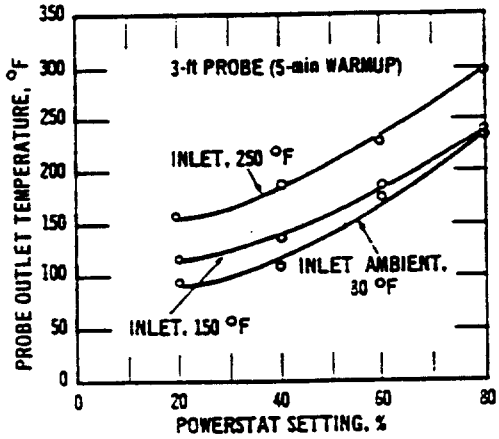
Concentration=

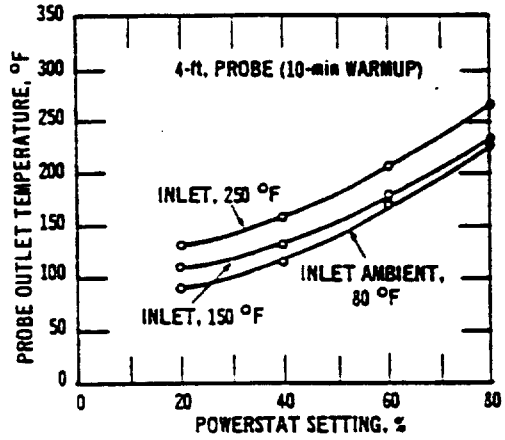
Special Notes

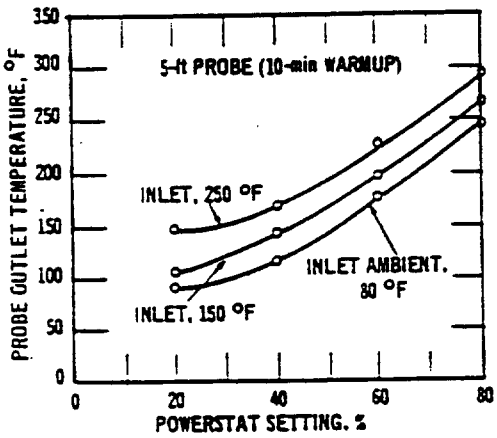
Analyst: Joseph De La Torre

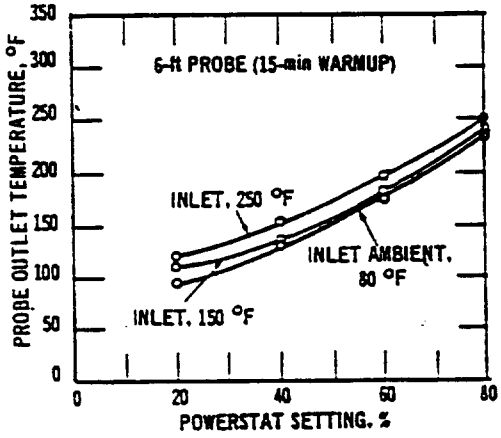
PROBE HEAT CALIBRATION

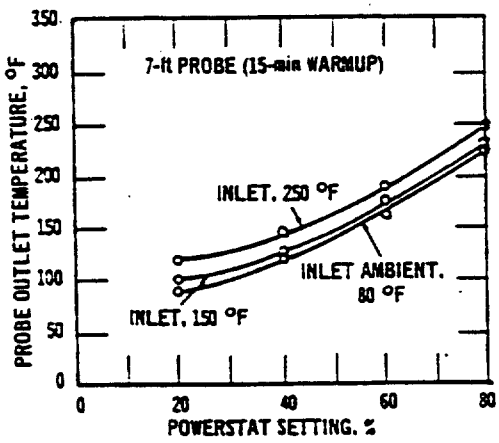
Sample probes are constructed as outlined in EPA publication PB–209 022 "Maintenance, Calibration, and Operation of Isokinetic Source Sampling Equipment". The Figures below from this publication are used to determine probe heat settings to maintain a probe temperature of 250 °F.











NOTE: Flow rate held constant at 0.75; 50% change in flow rate has little effect on probe temperature.

DRY GAS METER AND ORIFICE CALIBRATION

Meter Box # Brown IV Barometric Press. 29.38 IN. HG.

Date 18-Jan-93 Performed by T. Delfino

Calibration Meter Y 1.00014

	RUN 1	RUN 2	RUN 3	RUN 4	RUN 5	RUN 6
VACUUM ("Hg)	3	5	5	5	5	5
dHw ("H2O)	0.00	0.00	0.00	0.00	0.00	0.00
dHd ("H2O)	0.50	1.00	1.50	2.00	3.00	4.00
INITIAL WTM	866.883	873.433	931.482	833.099	947.264	977.798
FINAL WTM	873.178	931.327	946.881	866.342	977.357	1011.223
INITIAL DGM	918.813	925.631	986.853	884.158	3.643	36.108
FINAL DGM	925.371	986.665	1003.242	918.243	35.647	71.736
TEMP. WTM (°F)	62.0	58.0	58.0	59.0	57.0	57.0
TEMP. DGM (°F)	75.0	82.0	83.0	76.0	87.0	88.0
TEST TIME (MIN.)	15.0	101.0	22.0	41.0	31.0	30.0
CALCULATIONS :						
NET VOLUME WTM (Vw)	6.296	57.902	15.401	33.248	30.097	33.430
NET VOLUME DGM (Vd)	6.558	61.034	16.389	34.085	32.004	35.628
Y	0.983	0.990	0.981	1.002	0.988	0.985
	ACCEPTABLE Y RANGE = 0.968 TO 1.008					
dH@	1.56	1.63	1.63	1.65	1.68	1.70
	ACCEPTABLE dH@ RANGE = 1.49 TO 1.79					

AVERAGE Y = 0.988

AVERAGE dH@ = 1.64

CALCULATIONS :

Y = (Vw (Pb − (dHw / 13.6)) x (Td + 460)) / (Vd (Pb + (dHd / 13.6)) x (Tw + 460)

dH@ = 0.0317 x dHd / (Pb (Td + 460)) x ((Tw + 460) x time) / Vw) ^ 2

POST TEST METER CALIBRATION

Meter Box # Brown IV Barometric Press. 30.03 IN. HG.

Date 22-MAR-93 Performed by J-POLHAMUS

	RUN 1	RUN 2	RUN 3
VACUUM ("Hg)	10	10	10
dHw ("H2O)	0.00	0.00	0.00
dHd ("H2O)	2.50	2.50	2.50
INITIAL WTM	12.201	25.782	39.255
FINAL WTM	25.782	39.255	52.780
INITIAL DGM	641.554	655.452	669.370
FINAL DGM	655.452	669.370	683.463
TEMP. WTM (°F)	72.0	72.0	73.0
TEMP. DGM (°F)	74.0	79.0	83.0
TEST TIME (MIN.)	15.0	15.0	15.0
CALCULATIONS :			
NET VOLUME WTM (Vw)	13.581	13.473	13.525
NET VOLUME DGM (Vd)	13.898	13.918	14.093
Y	0.975	0.975	0.972

AVERAGE Y = 0.974

PRETEST Y = 0.988

DIFFERENCE, % = 1.4%

WHERE :

Y = (Vw (Pb – (dHw / 13.6)) x (Td + 460)) / (Vd (Pb + (dHd / 13.6)) x (Tw + 460)

Thermometer / Pyrometer Calibration

Date : 18-Jan-93

Calibrated by : T. Delfino

I.D. : Brown IV Pyrometer

Reference Point #	Reference * Temperature °F	Pyrometer Temperature °F	Temperature difference ** %
1	10	10	0.00
2	32	33	-3.13
3	60	60	0.00
4	100	100	0.00
5	200	200	0.00
6	300	300	0.00
7	400	399	0.25
8	500	498	0.40
9	700	700	0.00
10	900	899	0.11
11	1000	998	0.20
12	1200	1197	0.25
13	1400	1396	0.29
14	1600	1595	0.31
15	1700	1693	0.41
16	1900	1895	0.26

* Digital Calibrator Thermometer, S/N 28494/991
-60 °F to 1999 °F

** Allowable % difference = 5 %

ENGINEERING SCIENCE, INC.
2520 Pegasus Drive
Bakersfield, CA 93308
(805) 393-0272

CHAIN OF CUSTODY RECORD

Project No.	Project Name	Project Manager	Samples Sent To:	Analysis Required
WA 344	Coalinga Cogen Compliance	D.J. Wieman	ES Laboratory Bakersfield, CA	NH3
Samples Collected By: C. Mangoang	Regulatory Agency (EPA, CARB, SCAQMD, etc.): San Joaquin Valley APCD		By: Courier	

ES Lab Control No.	Test Date	Field Sample ID (Method-Run#-Sample Source)	Sample Amount	Sample Medium	Comments	NH3				
BK9303021	3/4/93	NH3 BAAQMD ST-1b, Run #1	Marked	0.1N HCL		X				
BK9303022		Run # 2	Marked			X				
BK9303023		Run # 3	Marked			X				
BK9303024		BLANK	Marked			X				

Relinquished By: (Sign & Print)	Date/Time	Received By: (Sign & Print)	Comments:
Gary McRae Phone: 393-0272	3/5/93 0800	Linda McRae Linda McRae Of: ES	
Relinquished By: (Sign & Print) Phone:	Date/Time	Received By: (Sign & Print) Of:	Comments:
Relinquished By: (Sign & Print) Phone:	Date/Time	Received By: (Sign & Print) Of:	Comments:

ENGINEERING SCIENCE, INC.
2520 Pegasus Drive
Bakersfield, CA 93308
(805) 393-0272

CHAIN OF CUSTODY RECORD

Project No.	Project Name	Project Manager	Samples Sent To:
WA344	Coalinga Cogen Compliance	D. J. Wieman	Oilwell Research, Inc. Bakersfield, CA
Samples Collected By: C. Mangoang	Regulatory Agency (EPA, CARB, SCAQMD, etc.): San Joaquin Valley APCD		By: Courier

Analysis Required: C_1-C_6 +

ES Lab Control No.	Test Date	Field Sample ID (Method-Run#-Sample Source)	Sample Amount	Sample Medium	Comments	C_1-C_6 +				
BK9303025	3/4/93	EPA Method 18, Run #1	10 l	Tedlar Bag		X				
BK9303026	↓	↓ Run #2	10 l	↓		X				
BK9303027	↓	↓ Run #3	10 l	↓		X				

Relinquished By: (Sign & Print)	Date/Time	Received By: (Sign & Print)	Comments:
G. W. McR[illegible] Phone: 393-0272	3/4/93 1505	[illegible] Of: Oilwell Research	
Relinquished By: (Sign & Print) Phone:	Date/Time	Received By: (Sign & Print) Of:	Comments:
Relinquished By: (Sign & Print) Phone:	Date/Time	Received By: (Sign & Print) Of:	Comments:

ENGINEERING SCIENCE, INC.
2520 Pegasus Drive
Bakersfield, CA 93308
(805) 393-0272

CHAIN OF CUSTODY RECORD

Project No.	Project Name	Project Manager	Samples Sent To:
WA 344	Coalinga Cogen Compliance	D.J. Wieman	Zalco Laboratory Bakersfield, CA
Samples Collected By: G. McRae	Regulatory Agency (EPA, CARB, SCAQMD, etc.): San Joaquin Valley APCD		By: Courier

ES Lab Control No.	Test Date	Field Sample ID (Method-Run#-Sample Source)	Sample Amount	Sample Medium	Comments	Analysis Required: CHONS	Analysis Required: Heating Value			
BK9303020	3/4/93	Fuel Gas Sample		SS Cylinder		X	X			

Relinquished By: (Sign & Print)	Date/Time	Received By: (Sign & Print)	Comments:
G. McRae Phone: 393-0272	3/4/93 1520	Danielle [illegible] Of: Zalco Labs	
Relinquished By: (Sign & Print) Phone:	Date/Time	Received By: (Sign & Print) Of:	Comments:
Relinquished By: (Sign & Print) Phone:	Date/Time	Received By: (Sign & Print) Of:	Comments:

APPENDIX A

FIELD DATA

ENGINEERING–SCIENCE, INC.
CEM FIELD DATA SHEET

PLANT: COALINGA COGEN
TEST LOCATION: HRSG OUTLET STACK
CEM VAN NO.: 3
DATE: 3/4/93
OPERATOR: T DELFINO

O2, %			CO2, %			NOx, ppm		
Calibration Gases :			Calibration Gases :			Calibration Gases :		
High	20.9	Cyl. # 49574	High		Cyl. #	High	23.2	Cyl. # AAL 2534
Mid	15.14	Cyl. # ALM011705	Mid		Cyl. #	Mid	12.7	Cyl. # ALM 11324
Low	4.002	Cyl. # ALM027375	Low		Cyl. #	Low	8.46	Cyl. # ALM 022850

CO, ppm			SO2, ppm			
Calibration Gases :			Calibration Gases :			Calibration Gases :
High	18.56	Cyl. # AAL2534	High		Cyl. #	High		Cyl. #
Mid	12.54	Cyl. # ALM011324	Mid		Cyl. #	Mid		Cyl. #
Low	8.352	Cyl. # ALM022850	Low		Cyl. #	Low		Cyl. #

TIME	SAMPLE POINT	O2 (%)	CO2 (%)	NOx (ppm)	CO (ppm)	SO2 (ppm)		COMMENTS / RUN #
		15.14		8.46	12.54			Span gas values used for test.
		20.9		23.2	18.56			HIGH LINEARITY check
		15.14		12.58	12.42			MID
		4.07		8.43	8.45			LOW
0815-0820	RUN-1	14.50		2.20	10.40			RUN-1
0820-0825		14.50		2.40	10.40			
0825-0830		14.48		2.23	11.00			
0830-0835		14.47		2.15	11.00			
0835-0840		14.46		2.14	10.60			
0840-0845		14.45		2.15	10.65			
		$\bar{x}$ = 14.48		$\bar{x}$ = 2.21	$\bar{x}$ = 10.68			AVG.
CALIBRATE		0.0		0.00	0.20			zero check
		15.14		8.46	12.54			SPAN check

ENGINEERING–SCIENCE, INC.
CEM FIELD DATA SHEET

PLANT: COALINGA COGEN
TEST LOCATION: HRSG OUTLET STACK
CEM VAN NO.: 3
DATE: 3/4/93
OPERATOR: T. DELFINO

TIME	SAMPLE POINT	O2 (%)	CO2 (%)	NOx (ppm)	CO (ppm)	SO2 (ppm)		COMMENTS / RUN #
		15.14		8.46	12.54			Span gas values used for test.
0900 - 0905	RUN-2	14.54		3.30	9.70			RUN-2
0905 - 0910		14.54		3.60	9.50			
0910 - 0915		14.54		3.70	9.10			
0915 - 0920		14.54		3.65	8.90			
0920 - 0925		14.54		3.63	8.90			
0925 - 0930		14.54		3.60	8.90			
		$\bar{x}$ = 14.54		$\bar{x}$ = 3.58	$\bar{x}$ = 9.17			
CALIBRATE		0.00		0.00	0.00			ZERO Check
		15.14		8.46	12.54			SPAN Check
0945 - 0950	RUN-3	14.53		3.80	9.0			RUN-3
0950 - 0955		14.53		3.80	8.3			
0955 - 1000		14.53		3.40	9.2			
1000 - 1005		14.53		3.55	9.0			
1005 - 1010		14.53		3.75	8.9			
1010 - 1015		14.53		3.70	8.6			
		$\bar{x}$ = 14.53		$\bar{x}$ = 3.67	$\bar{x}$ = 8.83			AVG.
CALIBRATE		0.00		0.00	0.00			Zero check
		15.14		8.67	12.50			SPAN Check
1030 - 1035	RUN-4	14.50		4.05	7.70			RUN-4
1035 - 1040		14.50		3.40	8.40			
1040 - 1045		14.50		3.70	8.30			
1045 - 1050		14.52		3.80	7.80			
1050 - 1055		14.55		3.25	9.10			
1055 - 1100		14.57		3.90	8.40			
		$\bar{x}$ = 14.52		$\bar{x}$ = 3.68	$\bar{x}$ = 8.35			AVG.
CALIBRATE		0.00		0.00	0.00			Zero check
		15.14		8.55	12.54			check span

ENGINEERING–SCIENCE, INC.
CEM FIELD DATA SHEET

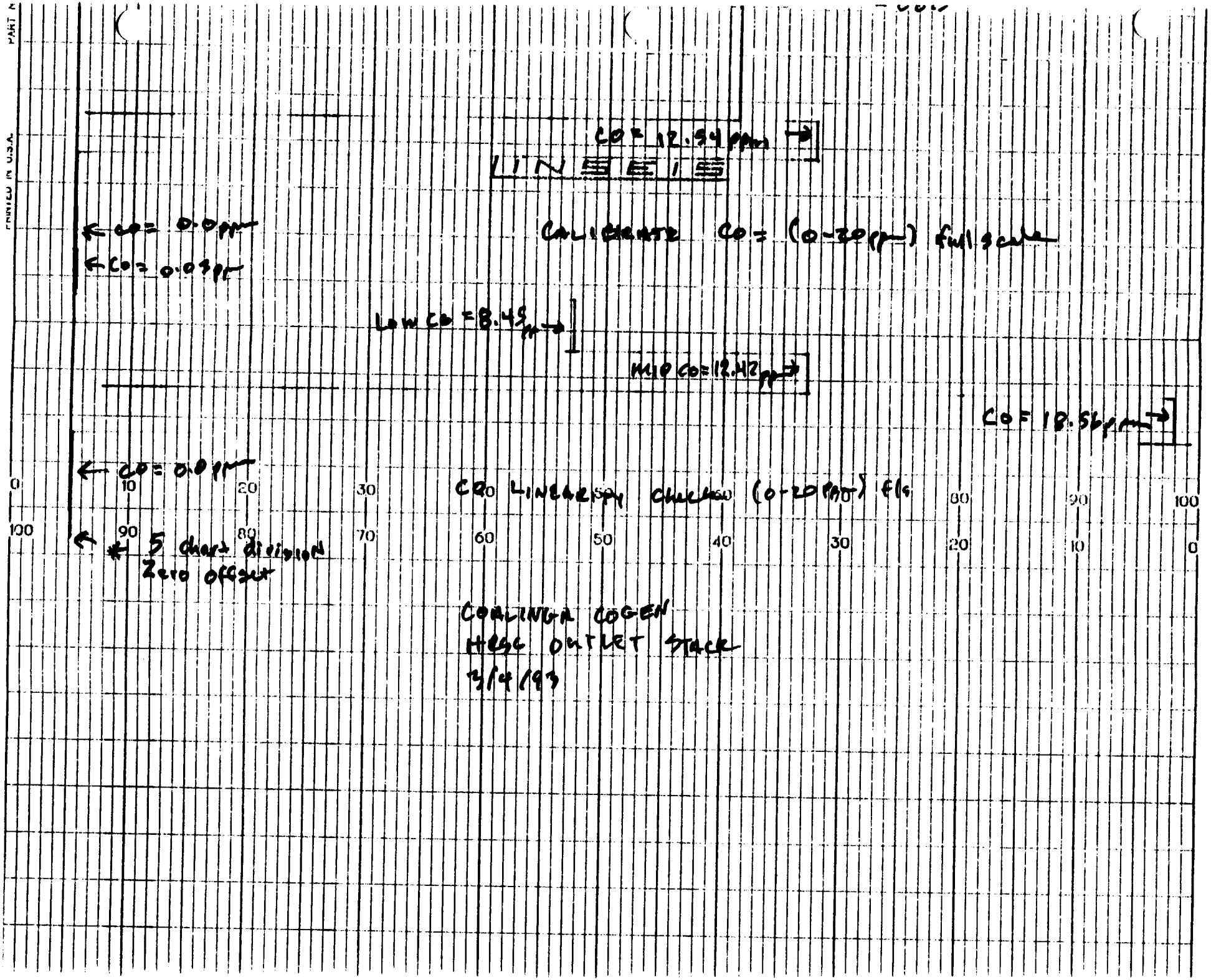
PLANT: COALINGA COGEN
TEST LOCATION: HRSG OUTLET
CEM VAN NO. 3
DATE: 3/4/93
OPERATOR: T. DELFINO

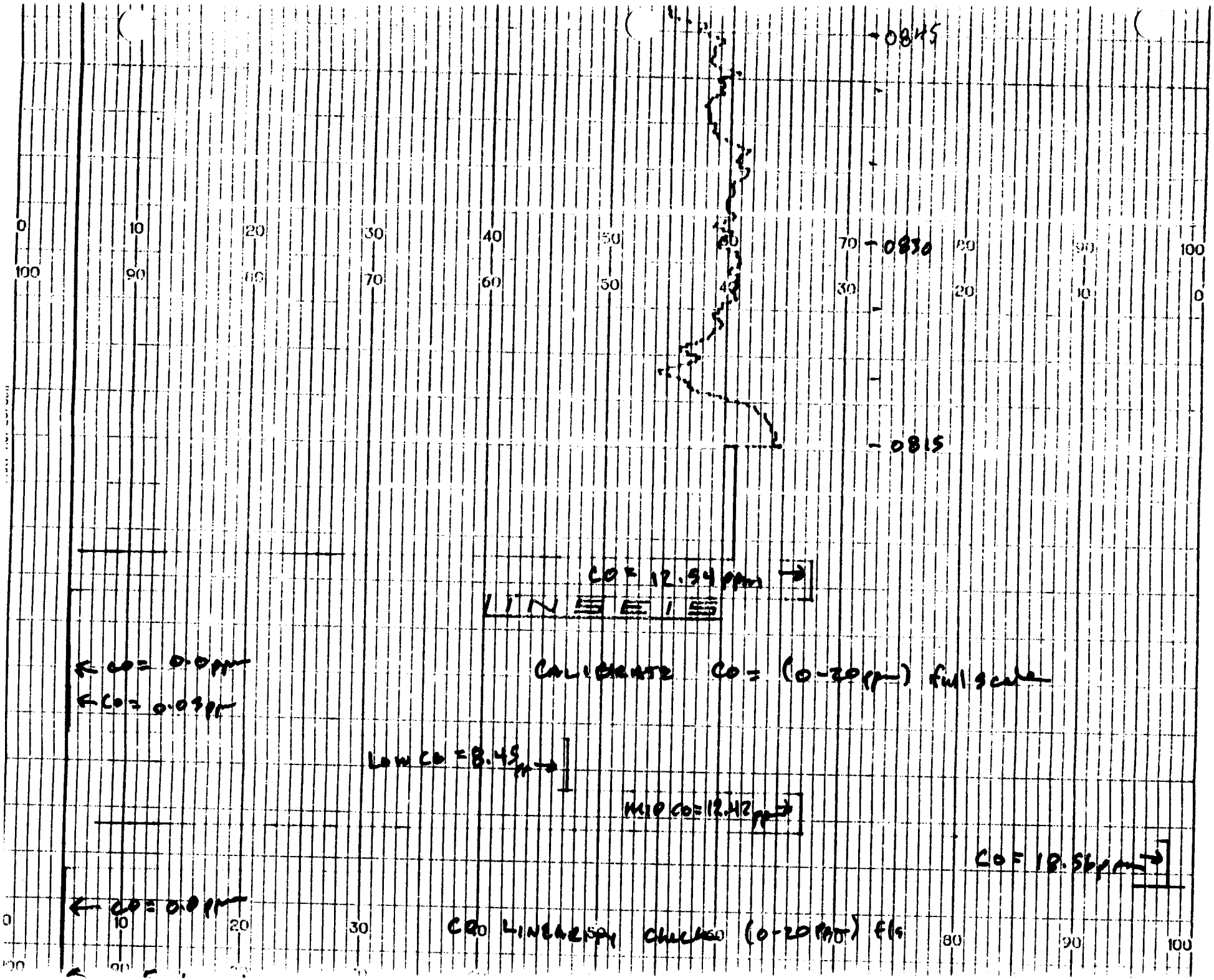
TIME	SAMPLE POINT	O2 (%)	CO2 (%)	NOx (ppm)	CO (ppm)	SO2 (ppm)		COMMENTS / RUN #
		15.14		8.46	12.54			Span gas values used for test.
1115 - 1120	RUN-5	14.57		3.62	7.95			RUN-5
1120 - 1125		14.59		4.05	8.00			
1125 - 1130		14.59		3.90	8.25			
1130 - 1135		14.59		4.30	7.80			
1135 - 1140		14.59		4.10	8.00			
1140 - 1145		14.59		3.75	7.80			
		x̄ = 14.59		x̄ = 3.95	x̄ = 7.97			AVG.
CALIBRATE		0.00		0.00	0.00			Zero Check
		15.14		8.46	12.54			SPAN Check
1200 - 1205	RUN-6	14.52		4.00	7.50			RUN-6
1205 - 1210		14.52		3.60	8.00			
1210 - 1215		14.50		3.80	8.10			
1215 - 1220		14.50		3.70	8.15			
1220 - 1225		14.48		3.55	8.40			
1225 - 1230		14.48		4.00	7.80			
		x̄ = 14.50		x̄ = 3.78	x̄ = 7.99			AVG.
CALIBRATE		0.00		0.00	0.00			Zero check
		15.08		8.46	12.54			SPAN check
1245 - 1250	RUN-7	14.55		4.00	7.80			RUN-7
1250 - 1255		14.55		4.20	7.00			
1255 - 1300		14.58		4.20	7.80			
1300 - 1305		14.58		3.70	8.00			
1305 - 1310		14.58		4.40	6.80			
1310 - 1315		14.58		4.30	6.80			
		x̄ = 14.57		x̄ = 4.13	x̄ = 7.31			AVG.
CALIBRATE		0.00		0.00	0.0			Zero check
		15.14		8.60	12.54			SPAN check

ENGINEERING–SCIENCE, INC.
CEM FIELD DATA SHEET

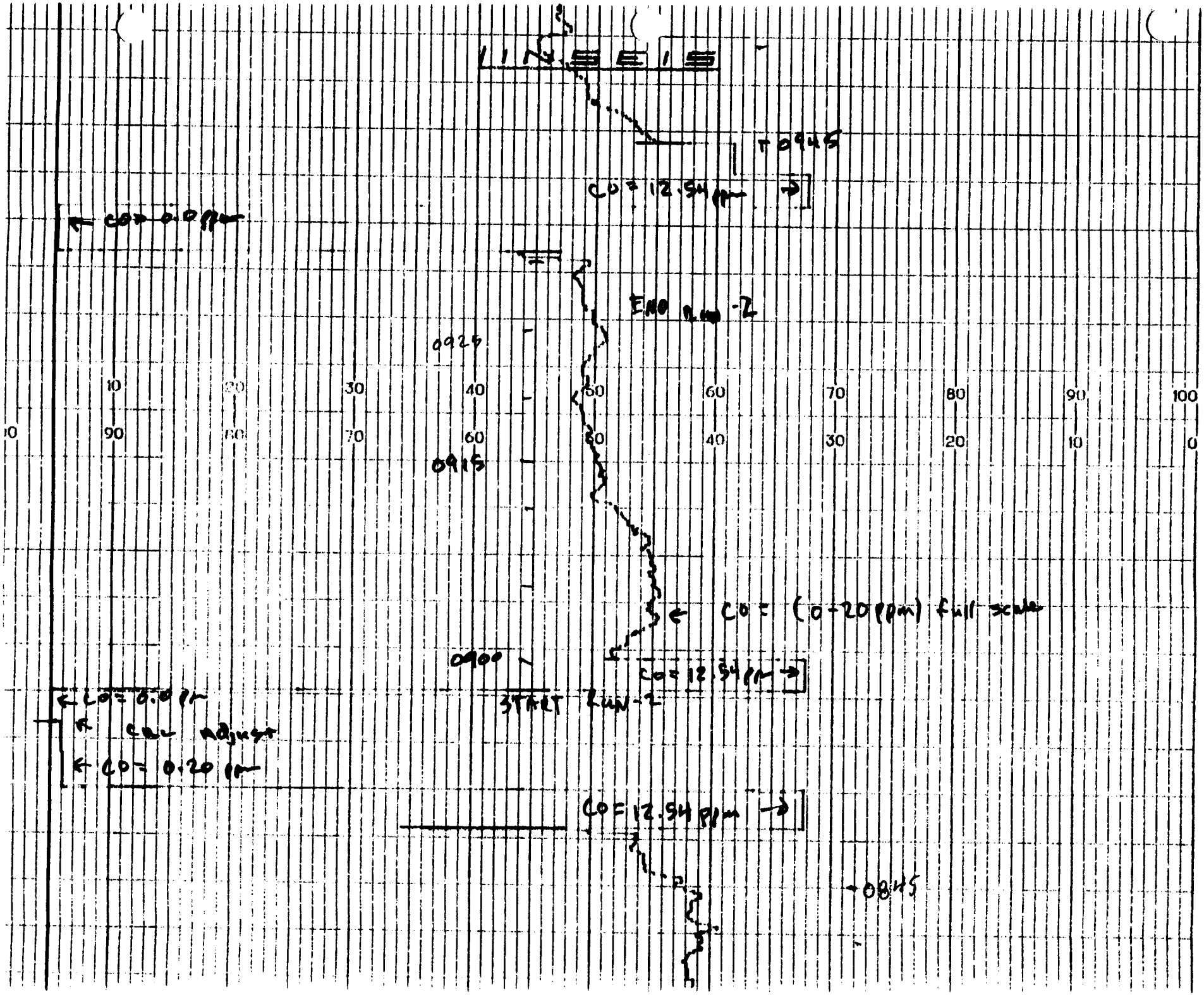
PLANT: COALINGA COGEN
TEST LOCATION: HRSG OUTLET STACK
CEM VAN NO.: 3
DATE: 3/4/93
OPERATOR: T. DELFINO

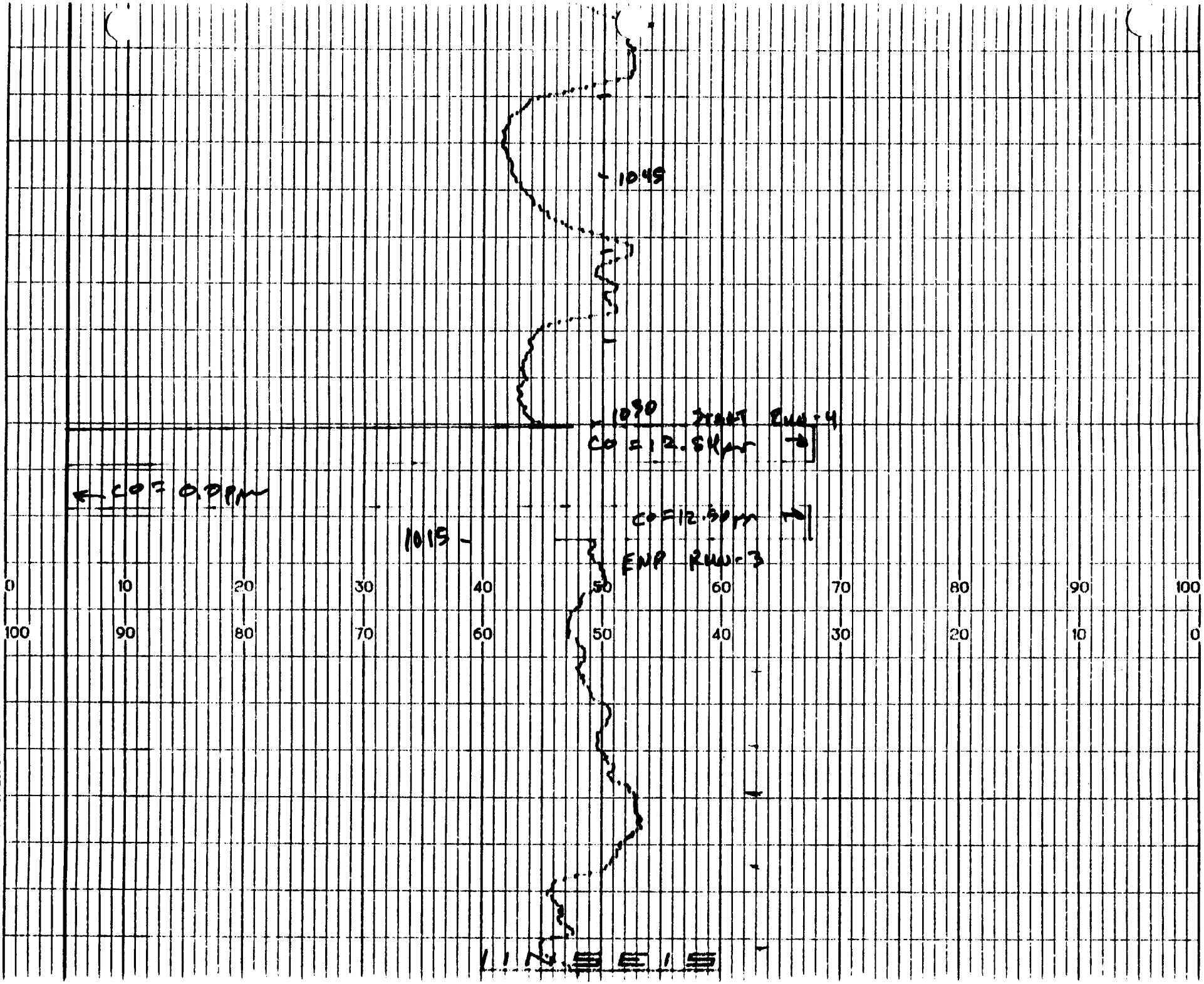
TIME	SAMPLE POINT	O2 (%)	CO2 (%)	NOx (ppm)	CO (ppm)	SO2 (ppm)		COMMENTS / RUN #
		15.14		8.46	12.54			Span gas values used for test.
1330 - 1335	RUN-8	14.55		4.30	7.40			RUN-8
1335 - 1340		14.55		4.40	7.00			
1340 - 1345		14.55		4.20	7.80			
1345 - 1350		14.55		4.25	7.75			
1350 - 1355		14.58		4.25	7.50			
1355 - 1400		14.60		4.40	7.20			
		x̄= 14.56		x̄= 4.30	x̄= 7.44			AVG.
calibrate		0.00		0.00	0.00			ZERO check
		15.14		8.33	12.54			SPAN check
1415 - 1420	RUN-9	14.55		4.15	7.90			RUN-9
1420 - 1425		14.59		4.27	7.70			
1425 - 1430		14.55		4.27	7.60			
1430 - 1435		14.55		4.20	7.70			
1435 - 1440		14.55		4.30	7.60			
1440 - 1445		~~14.55~~ 1453		4.40	7.50			
		x̄= 14.56		x̄= 4.27	x̄= 7.67			AVG.
calibrate		0.00		0.00	0.00			Zero check
		15.14		8.46	12.54			SPAN check
1500 - 1505	RUN-10	14.60		4.30	7.40			RUN-10
1505 - 1510		14.61		3.80	8.10			
1510 - 1515		14.60		4.10	7.60			
1515 - 1520		14.61		4.60	7.5			
1520 - 1525		14.61		3.70	8.2			
1525 - 1530		14.62		4.30	7.80			
		x̄= 14.61		x̄= 4.13	x̄= 7.77			AVG.
calibration		0.0		0.00	0.00			ZERO check
		15.14		8.53	12.54			SPAN check
		15.05		8.38	12.50			SYSTEM BIAS CK ✓

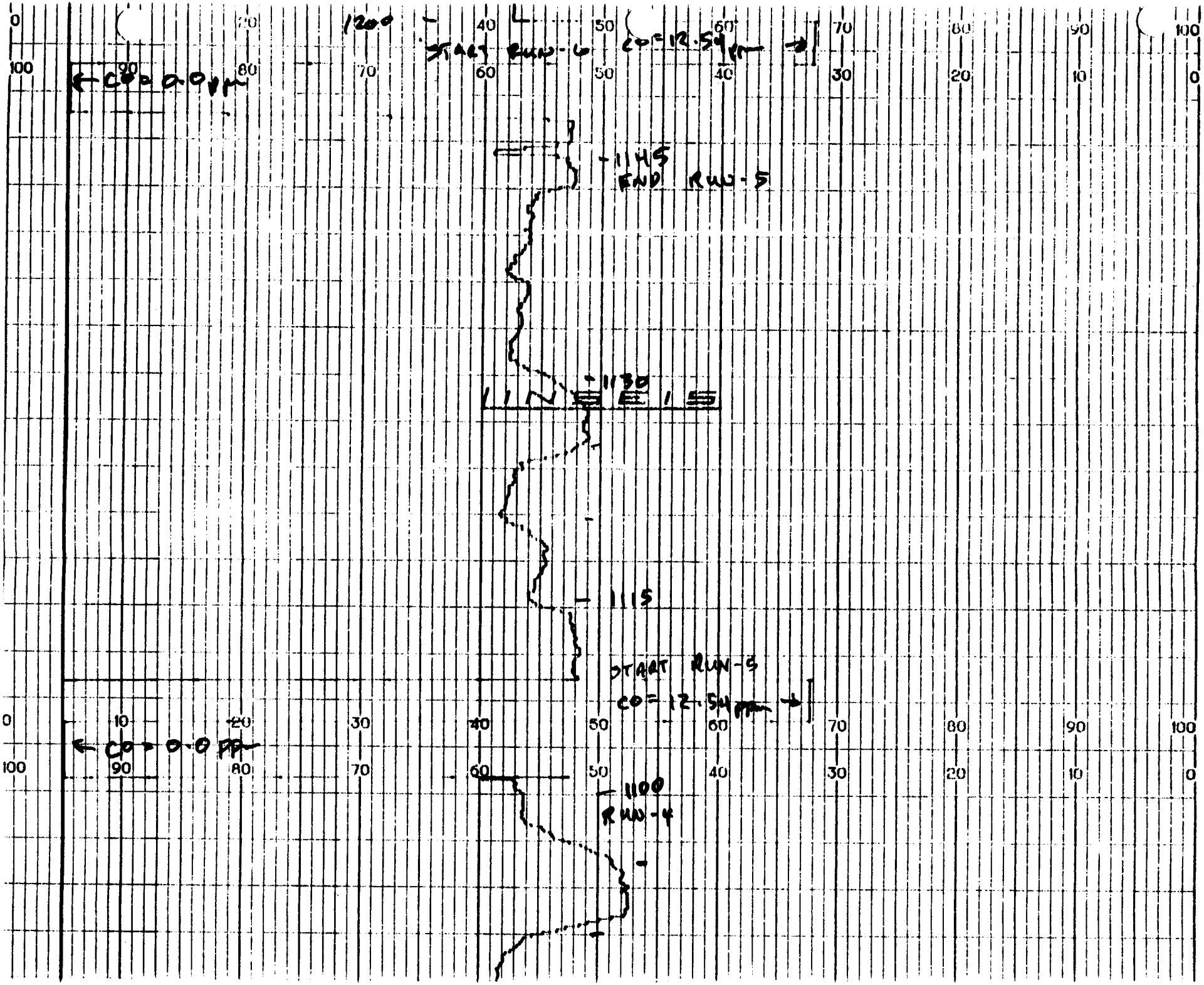

CO = 12.54 ppm
LINSEIS
CALIBRATE CO = (0-20 ppm) full scale
← CO = 0.0 ppm
← CO = 0.03 ppm
LOW CO = 8.45 ppm
MID CO = 12.42 ppm
CO = 18.56 ppm
← CO = 0.0 ppm
CO LINEARITY CHECK (0-20 PPM) f/s
← * 5 chart division
Zero offset
COALINGA COGEN
HRSG OUTLET STACK
3/4/93
0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0

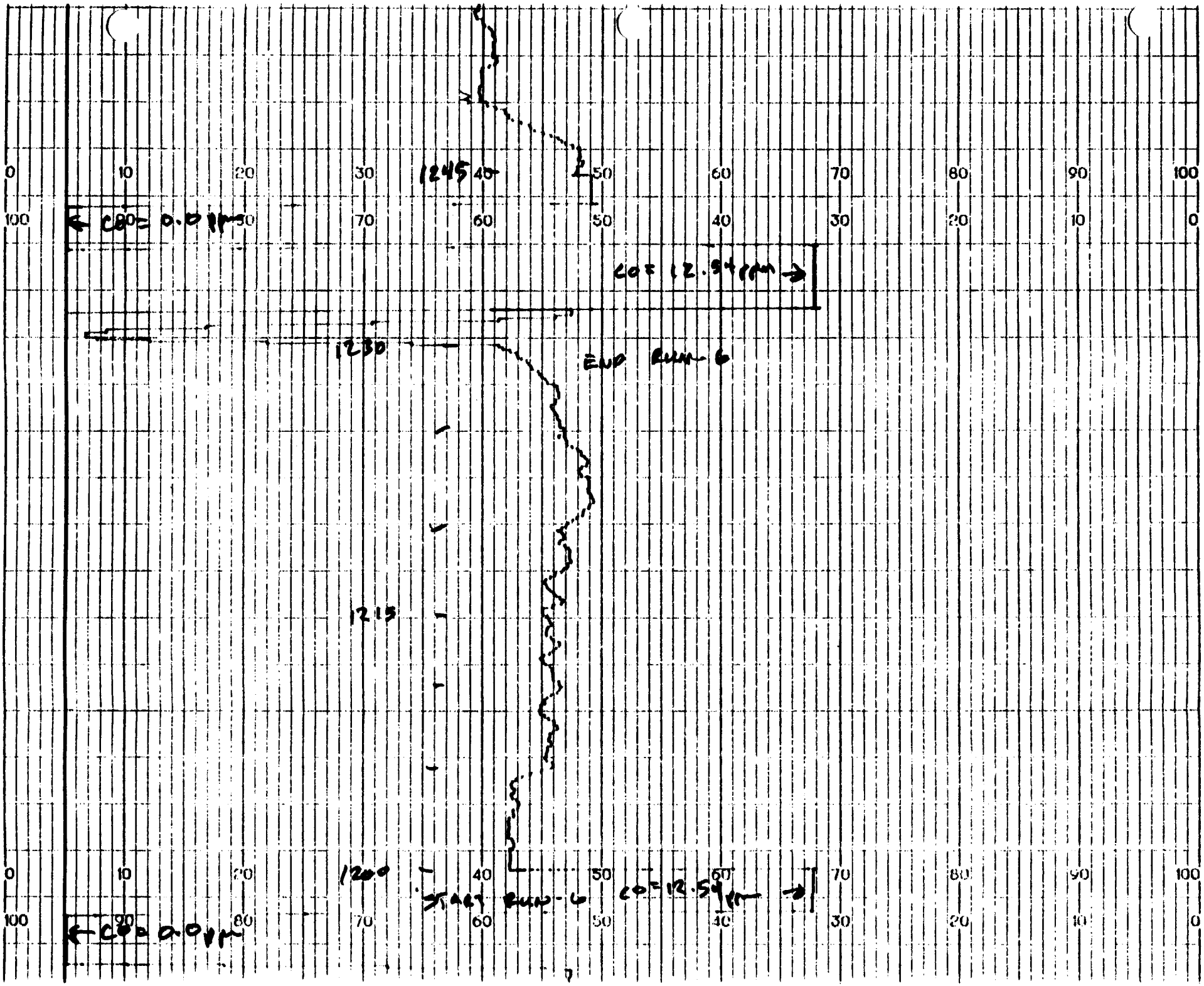


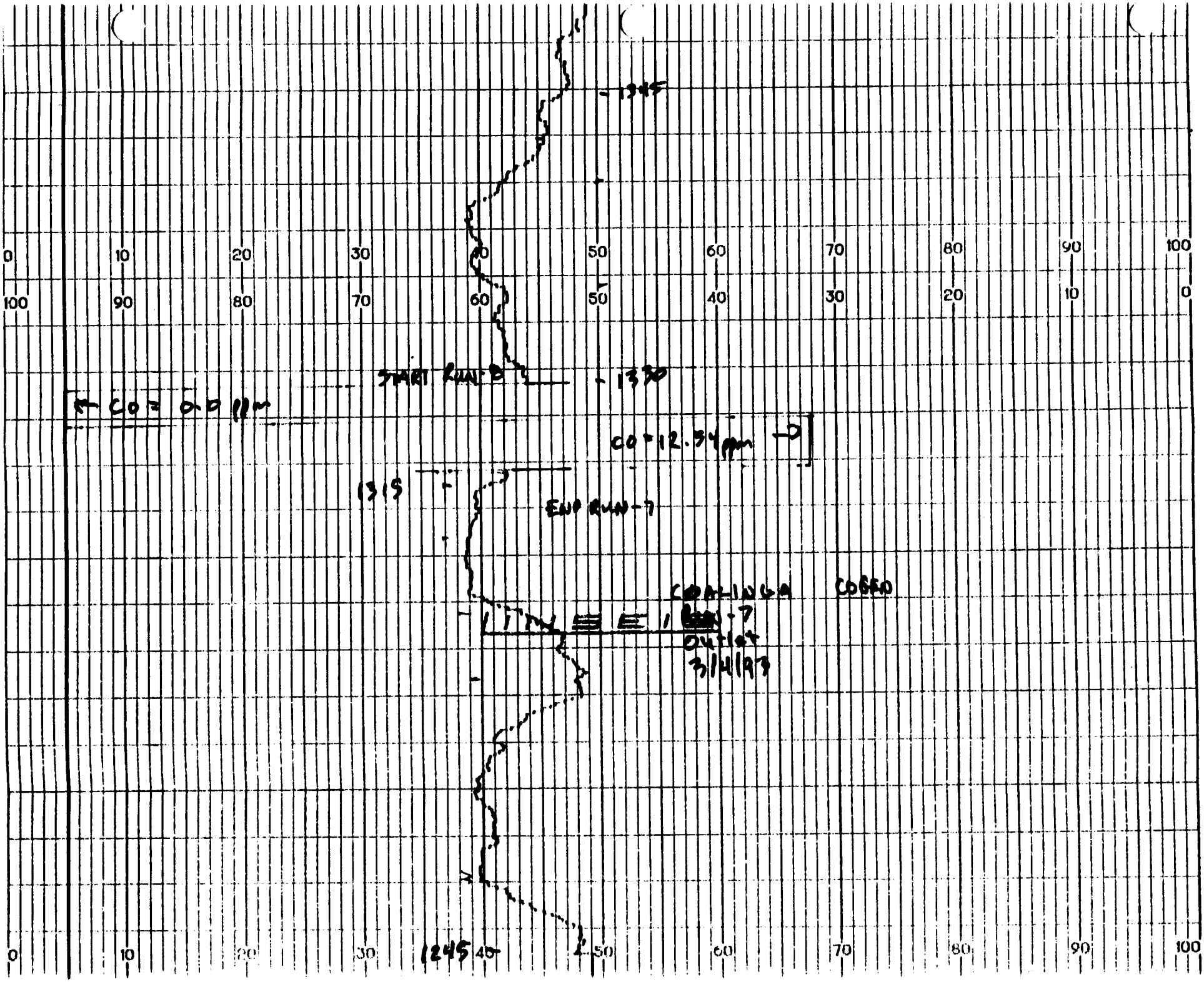
0845
0830
0815
CO = 12.54 ppm
LINSEIS
CALIBRATE CO = (0-20 ppm) full scale
← CO = 0.0 ppm
← CO = 0.03 ppm
LOW CO = 8.45 ppm
MID CO = 12.42 ppm
CO = 18.56 ppm
← CO = 0.0 ppm
CO LINEARITY CHECK (0-20 PPM) F/S


LINES
0945
CO = 12.54 ppm
← CO = 0.0 ppm
END RUN-2
0925
10 20 30 40 50 60 70 80 90 100
90 80 70 60 50 40 30 20 10 0
0915
← CO = (0-20 ppm) full scale
0900
CO = 12.54 ppm
START RUN-2
← CO = 0.0 ppm
← CO adjust
← CO = 0.20 ppm
CO = 12.54 ppm
0845

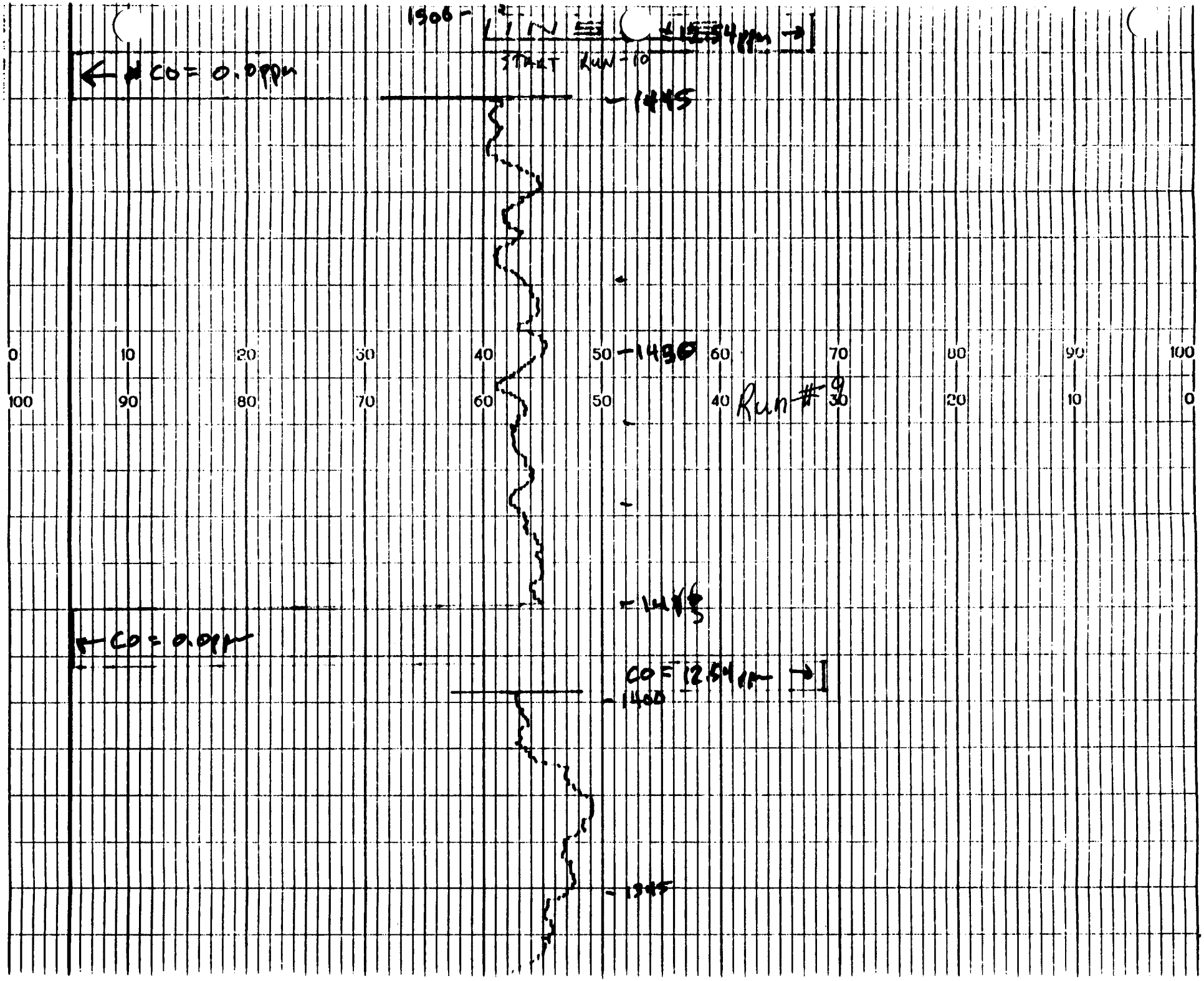

1045
1030
START RUN-4
CO = 12.5 ppm
← CO = 0 ppm
CO = 12.5 ppm
1015
END RUN-3
0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0
PART NO. LU/8011


1200
START RUN-6
CO=12.54 ppm
CO=0.0 ppm
1145
END RUN-5
1130
1115
START RUN-5
CO=12.54 ppm
CO=0.0 ppm
1100
RUN-4

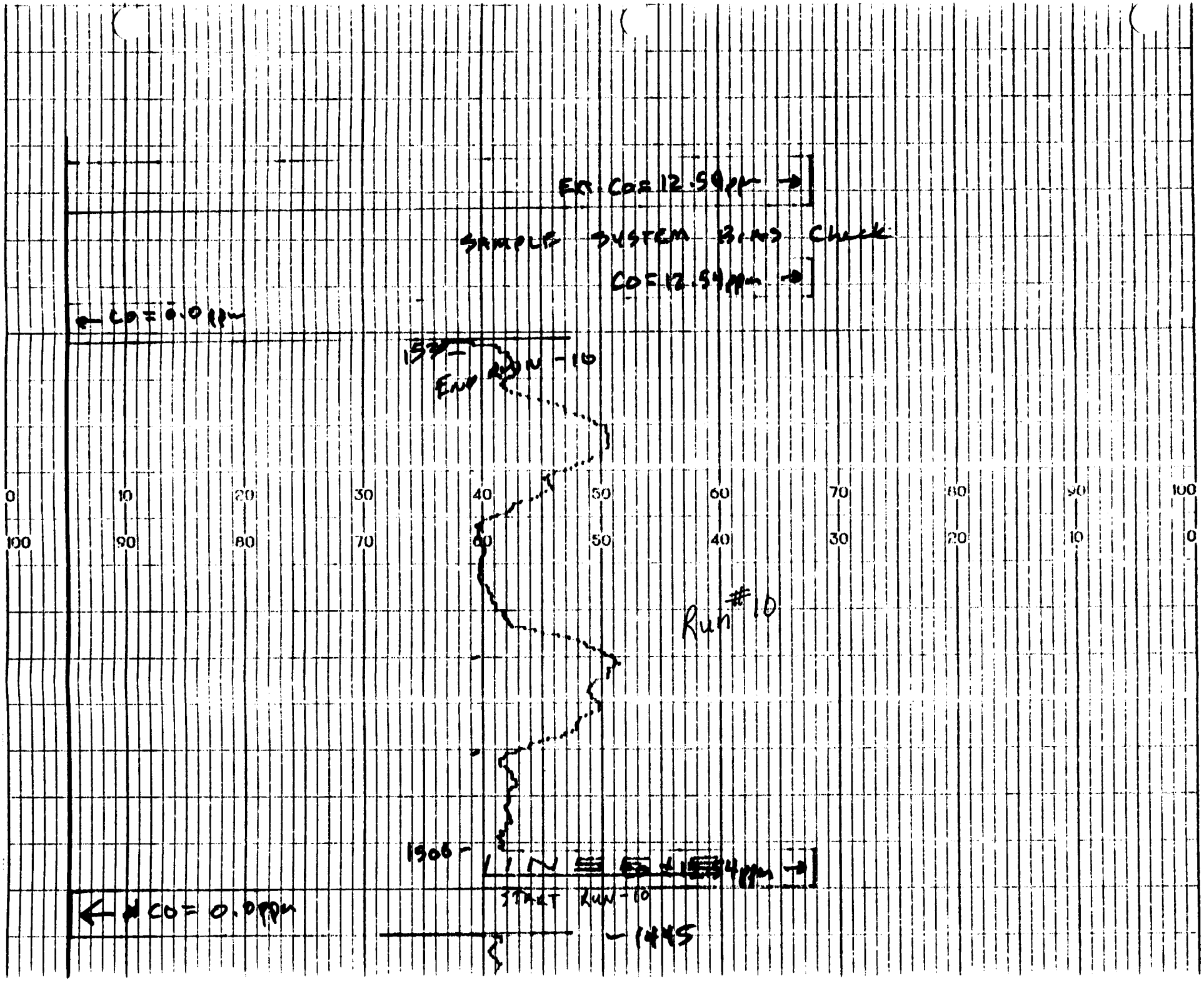

0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0
1245
CO = 0.0 ppm
CO = 12.54 ppm
1230
END RUN-6
1215
1200
START RUN-6
CO = 12.54 ppm
CO = 0.0 ppm



1345
START RUN-8
1330
← CO = 0.0 ppm
CO = 12.34 ppm →
1315
END RUN-7
COALINGA COGEN
RUN-7
Outlet
3/4/93
1245
0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0



1500 -
START RUN-10
CO = 0.0ppm
1445
1430
Run #9
CO = 0.0ppm
CO = 12.54ppm
1400
1345
0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0



Ext. CO = 12.54 ppm
SAMPLE SYSTEM BIAS Check
CO = 12.54 ppm
CO = 0.0 ppm
1530
END RUN - 10
0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0
Run #10
1506
START RUN - 10
CO = 0.0 ppm
1445

O2 = 15.14% →

NOx = 8.46 ppm →

← O2 = 0.0%

← NOx = 0.0 ppm

Change NOx span (0-10 ppm) Full scale + Calibrate

LOW NOx = 8.38 ppm →

MID NOx = 12.58 ppm

HIGH NOx = 25.2 ppm

NOx Linearity Check (0-25 ppm) 6/6

0 10 20 30 40 50 60 70 80 90 100

← LOW O2 = 4.07%

100 90 80 70 60 50 40 30 20 10 0

MID O2 = 15.14% →

← NOx = 0.0 ppm

HIGH O2 = 20.9% →

O2 Linearity Check (0-25%) Full span

O2 = 20.9% →

NOx = 8.46 ppm →

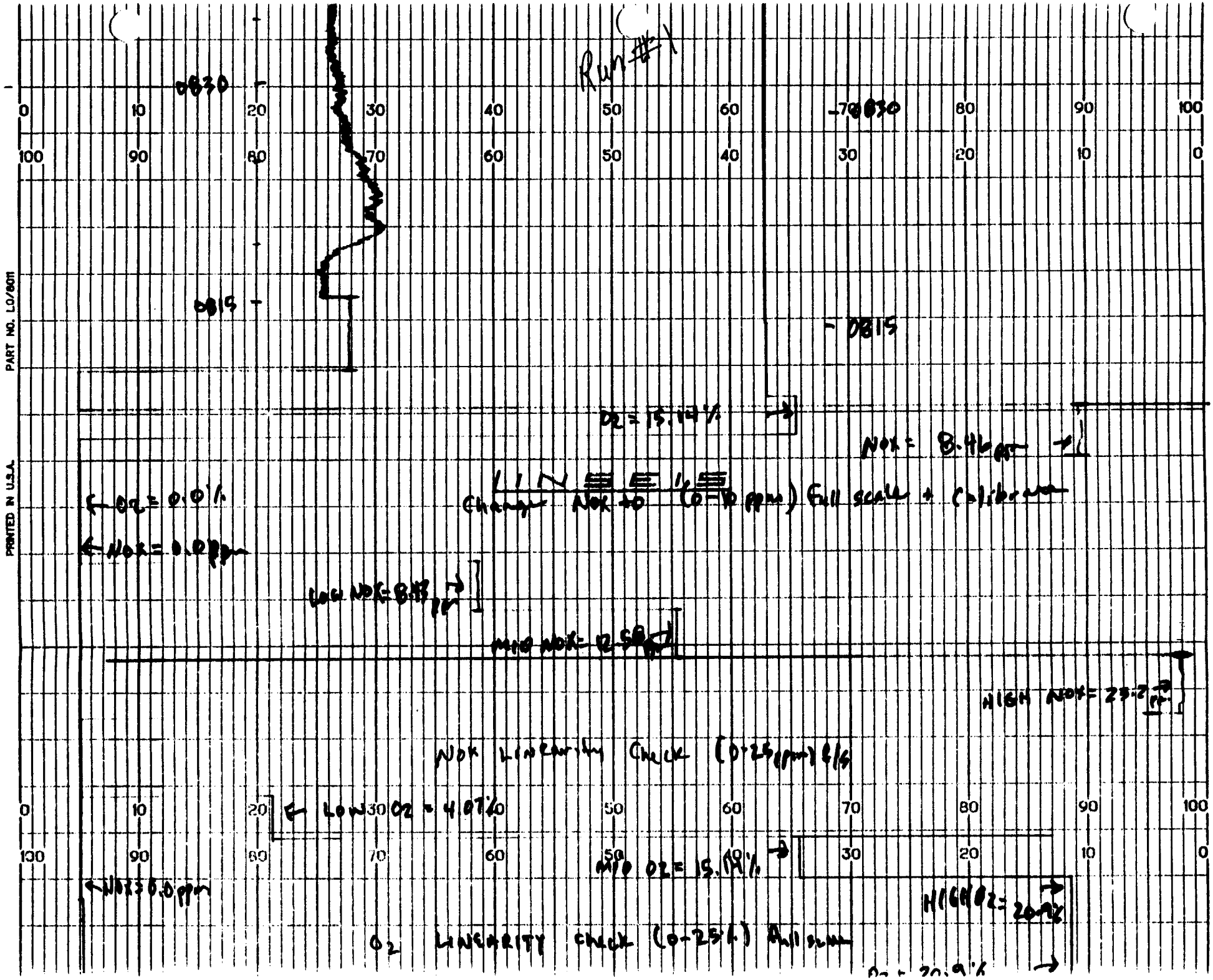
← NOx = 0.0 ppm

← O2 = 0.0%

INITIAL CALIBRATION

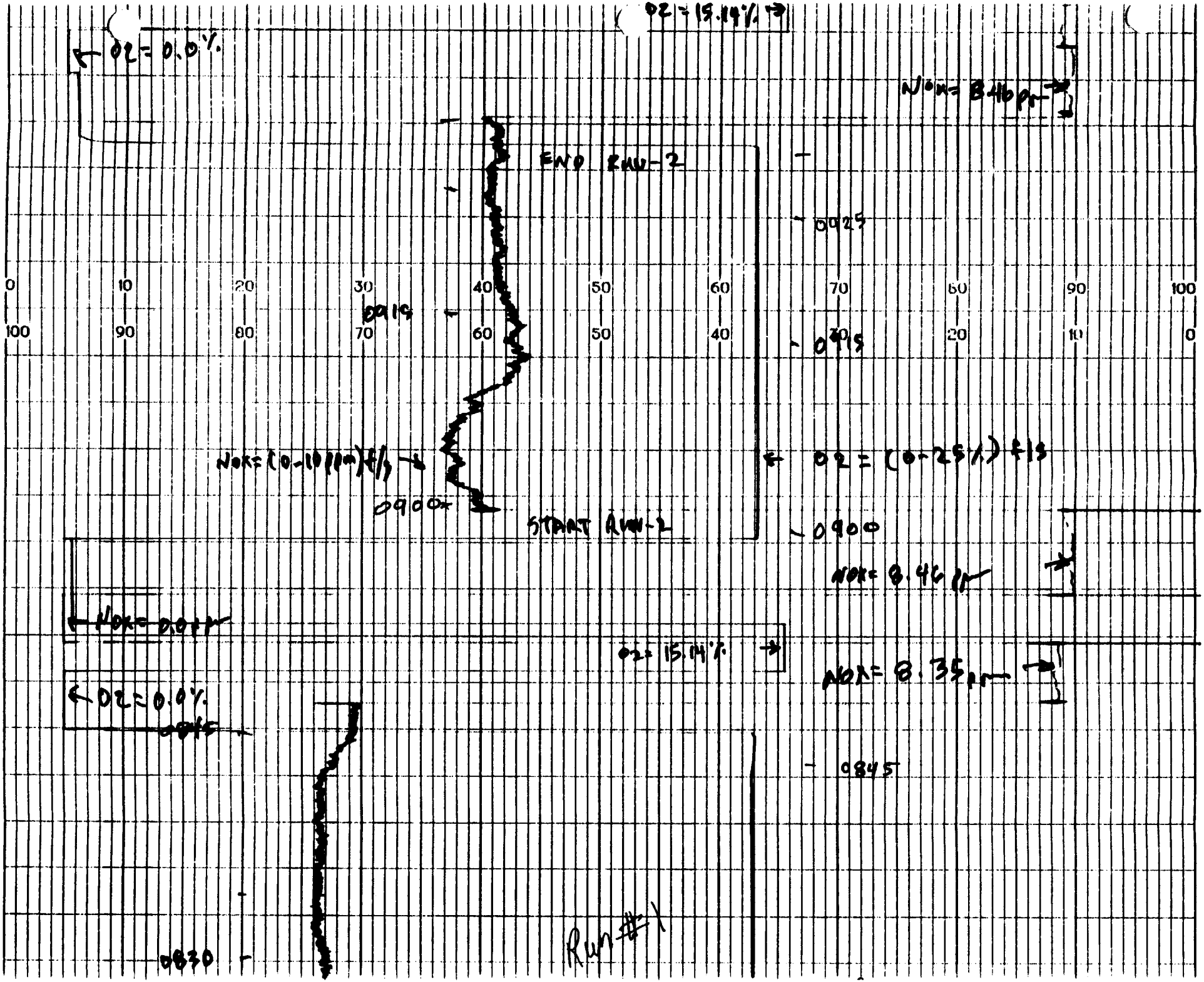
← 2.5 chart division zero offset

COALINGA COGEN
HRSG OUTLET STACK
3/4/93

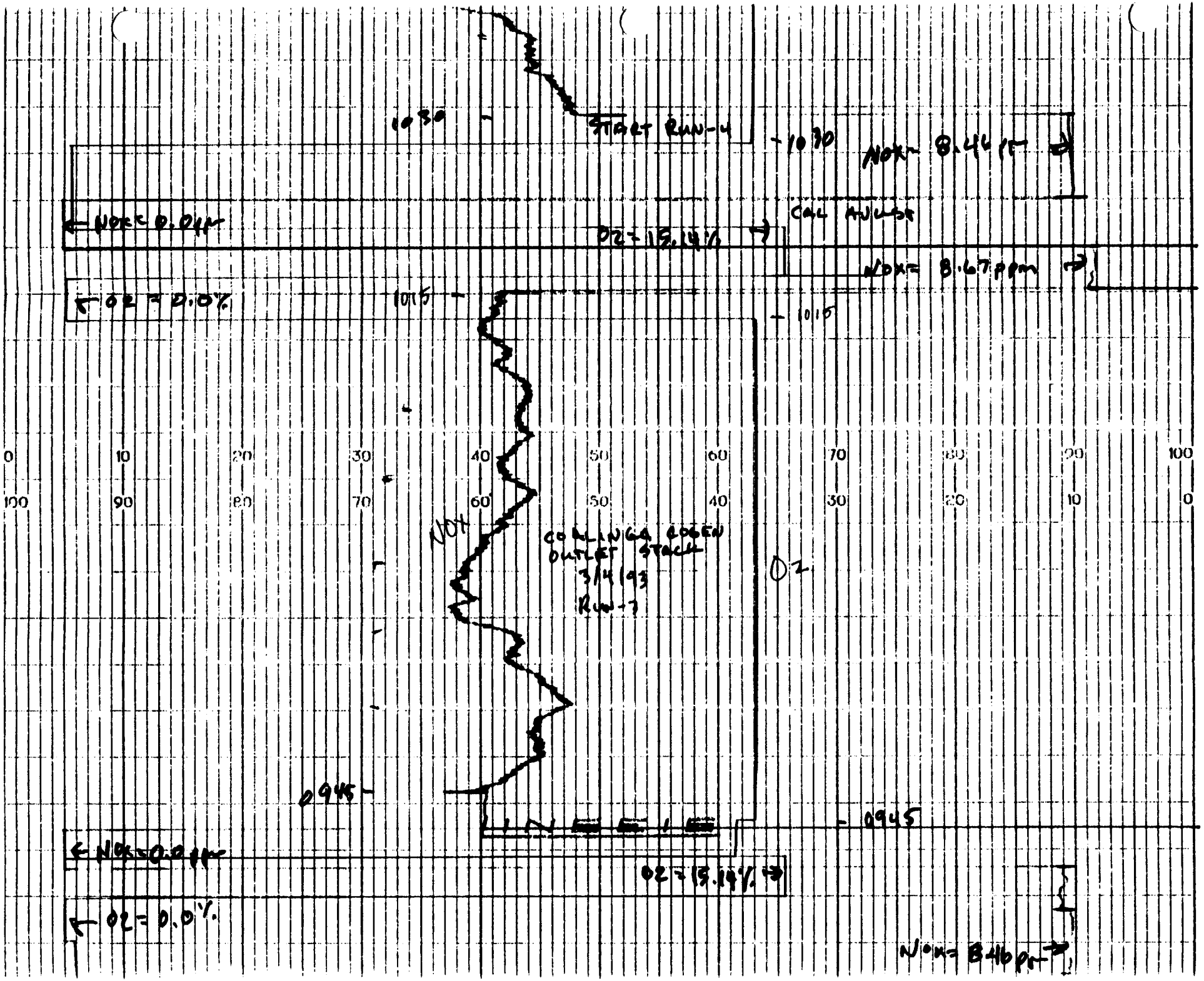


PART NO. LO/8011

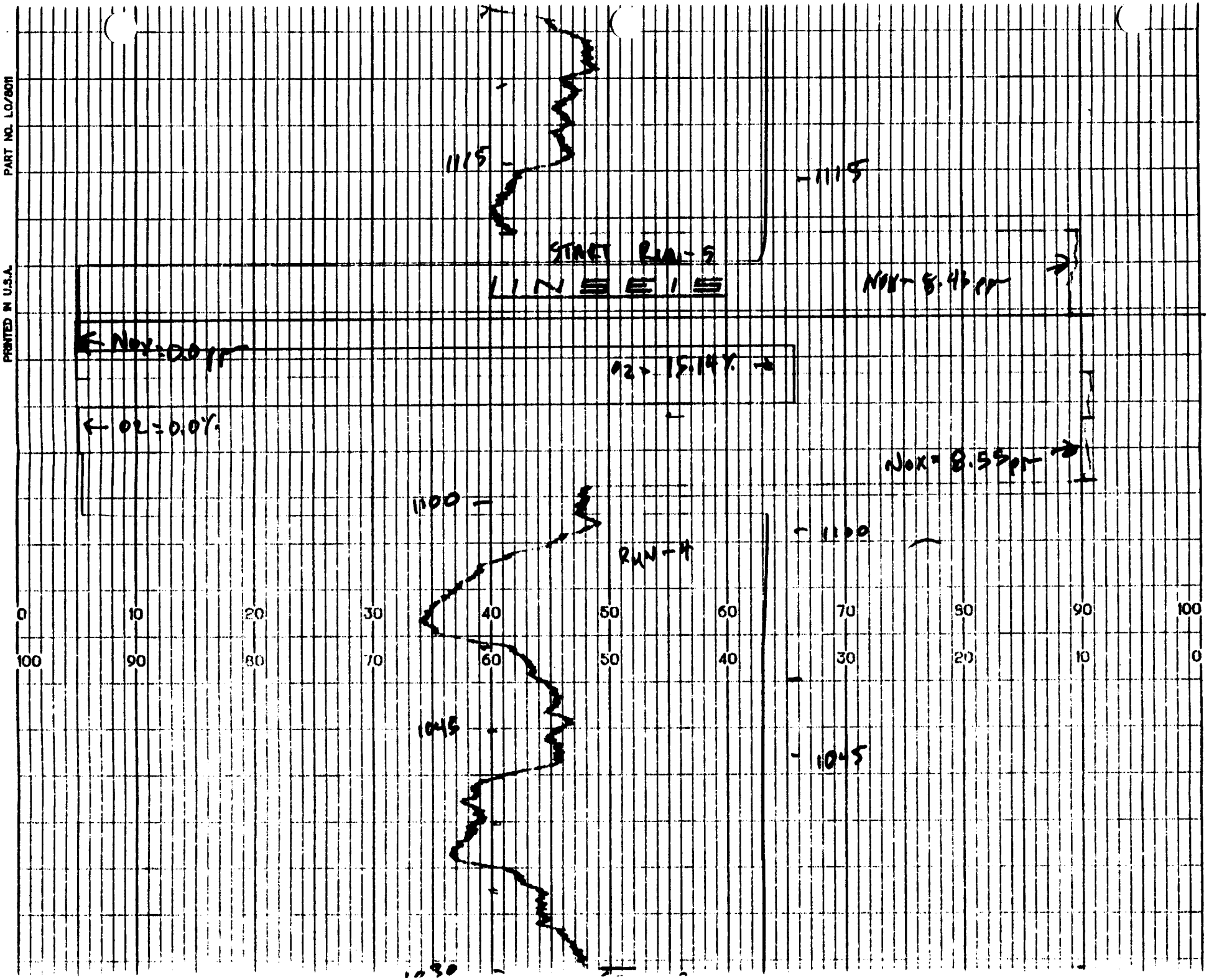
PRINTED IN U.S.A.



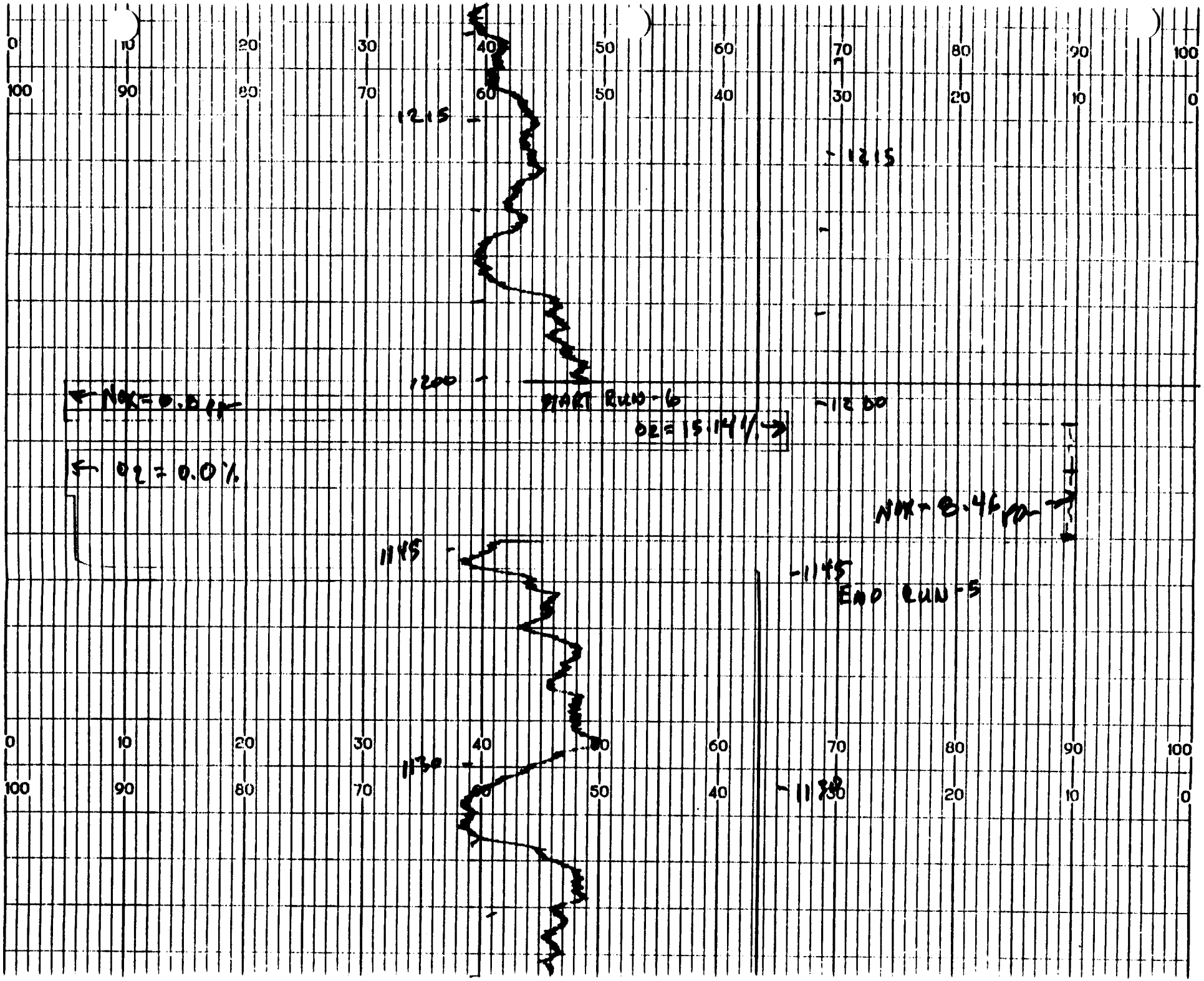
O2 = 15.14%
O2 = 0.0%
NOx = 8.46 ppm
END RUN-2
0925
0915
0915
NOx = (0-10 ppm) f/s
O2 = (0-25%) f/s
0900
START RUN-2
0900
NOx = 8.46 ppm
NOx = 0.0 ppm
O2 = 15.14%
NOx = 8.35 ppm
O2 = 0.0%
0845
0845
0830
Run #1



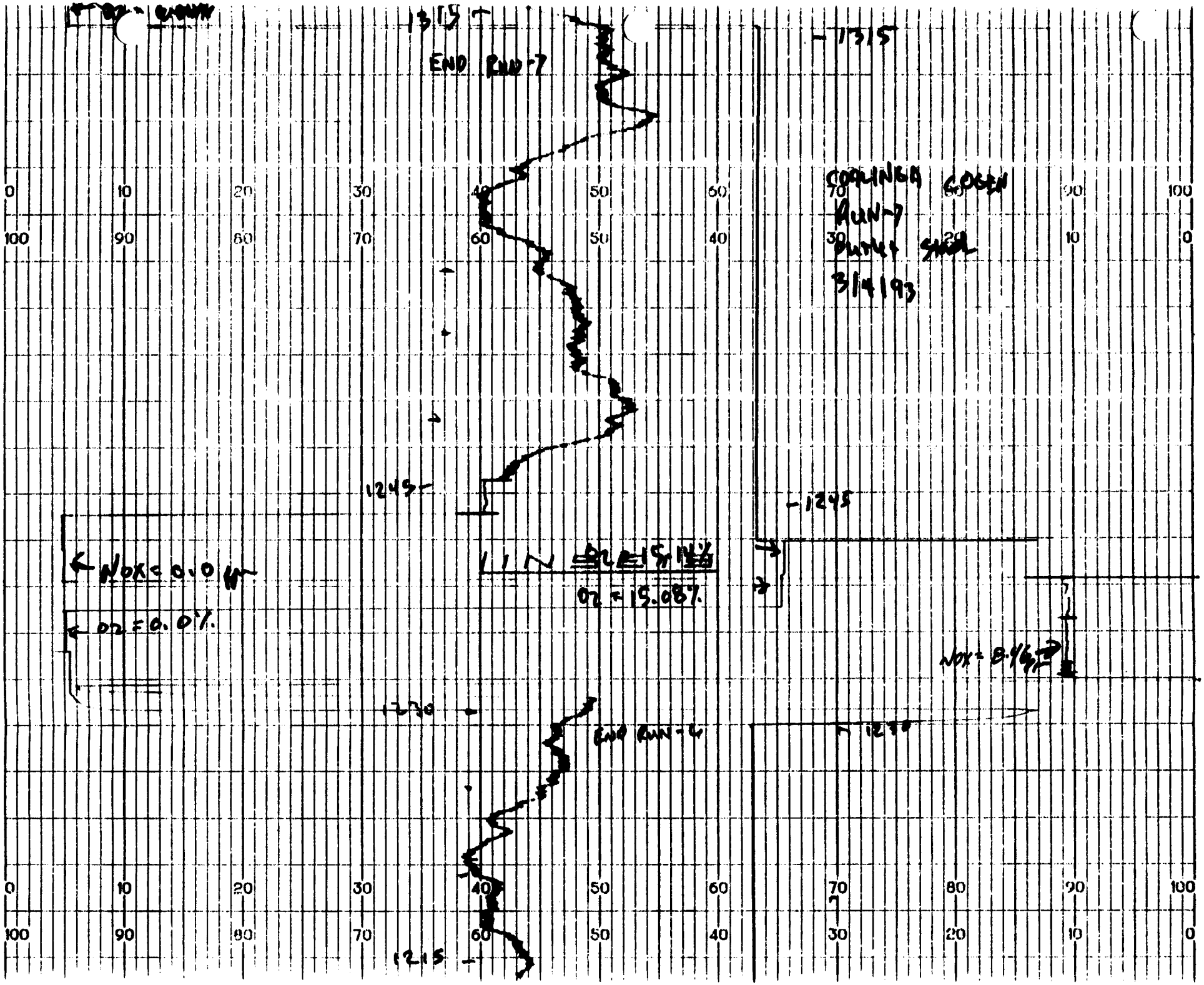
1030
START RUN-4
1030
NOX = 8.46 ppm
CAL ANALYSIS
NOX = 0.0 ppm
O2 = 15.14%
NOX = 8.67 ppm
O2 = 0.0%
1015
1015
0
10
20
30
40
50
60
70
80
90
100
100
90
80
70
60
50
40
30
20
10
0
NOX
COALINGA COGEN
OUTLET STACK
3/4/93
RUN-7
O2
0945
0945
NOX = 0.0 ppm
O2 = 15.14%
O2 = 0.0%
NOX = 8.46 ppm



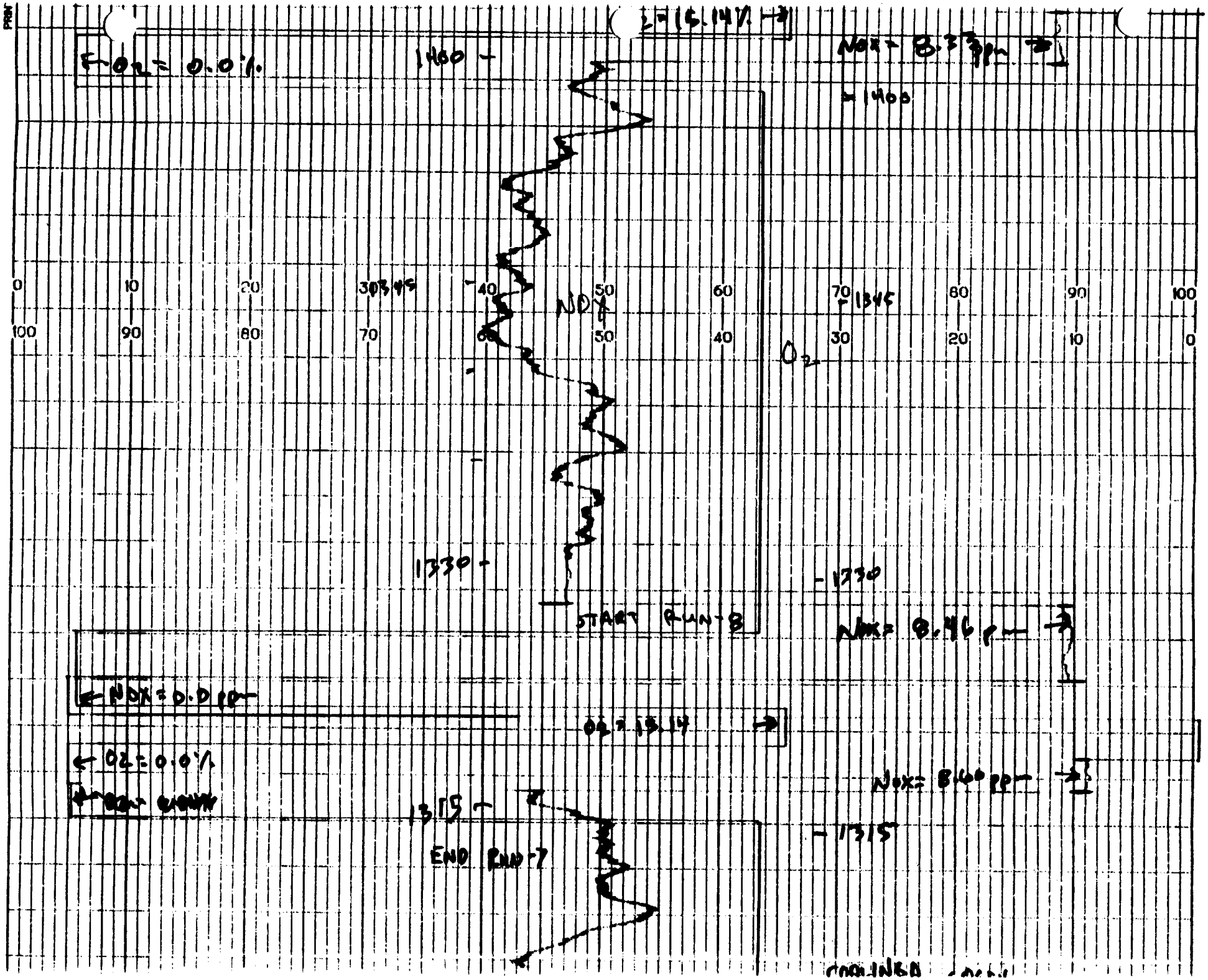
PRINTED IN U.S.A. PART NO. LO/8011

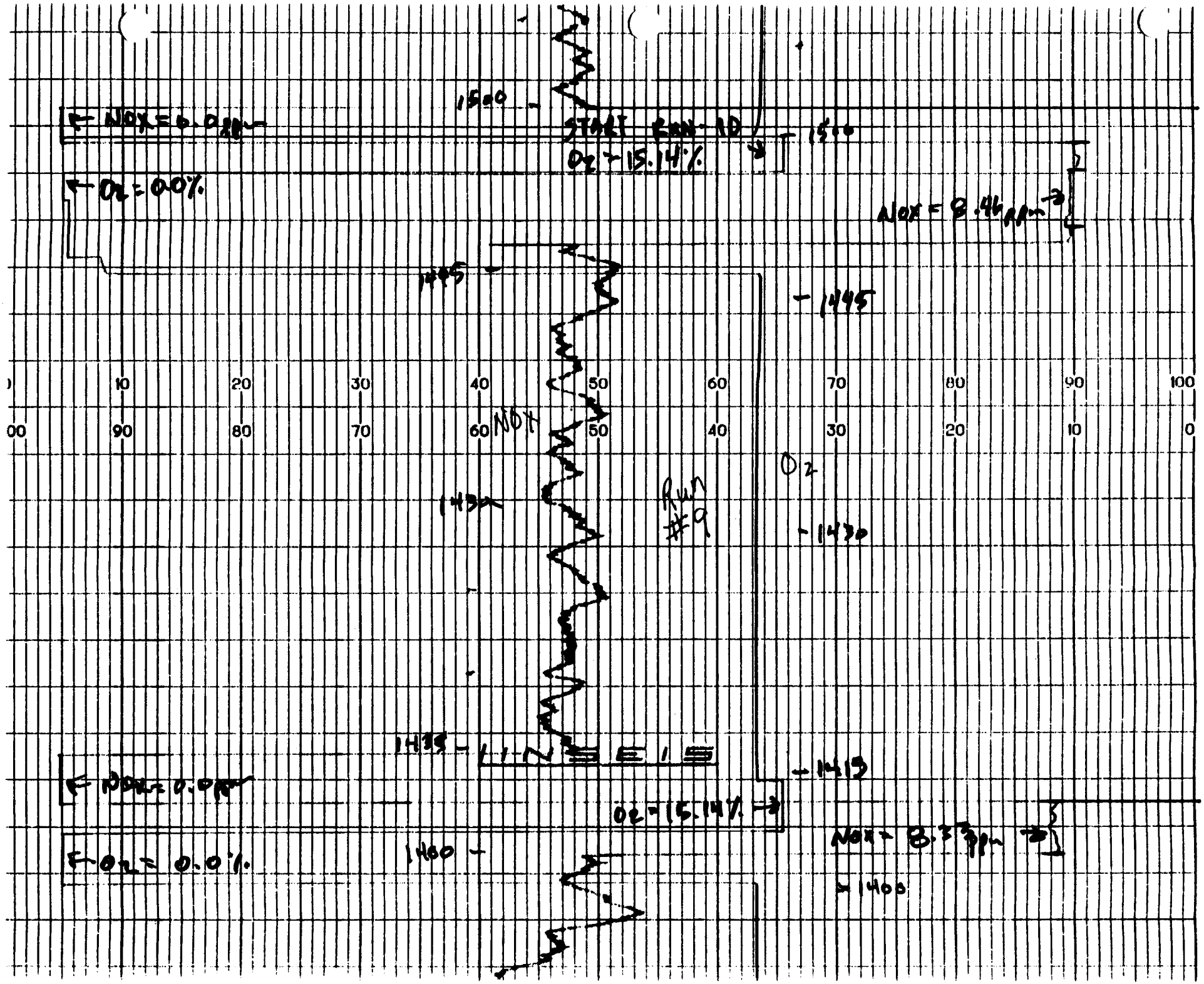


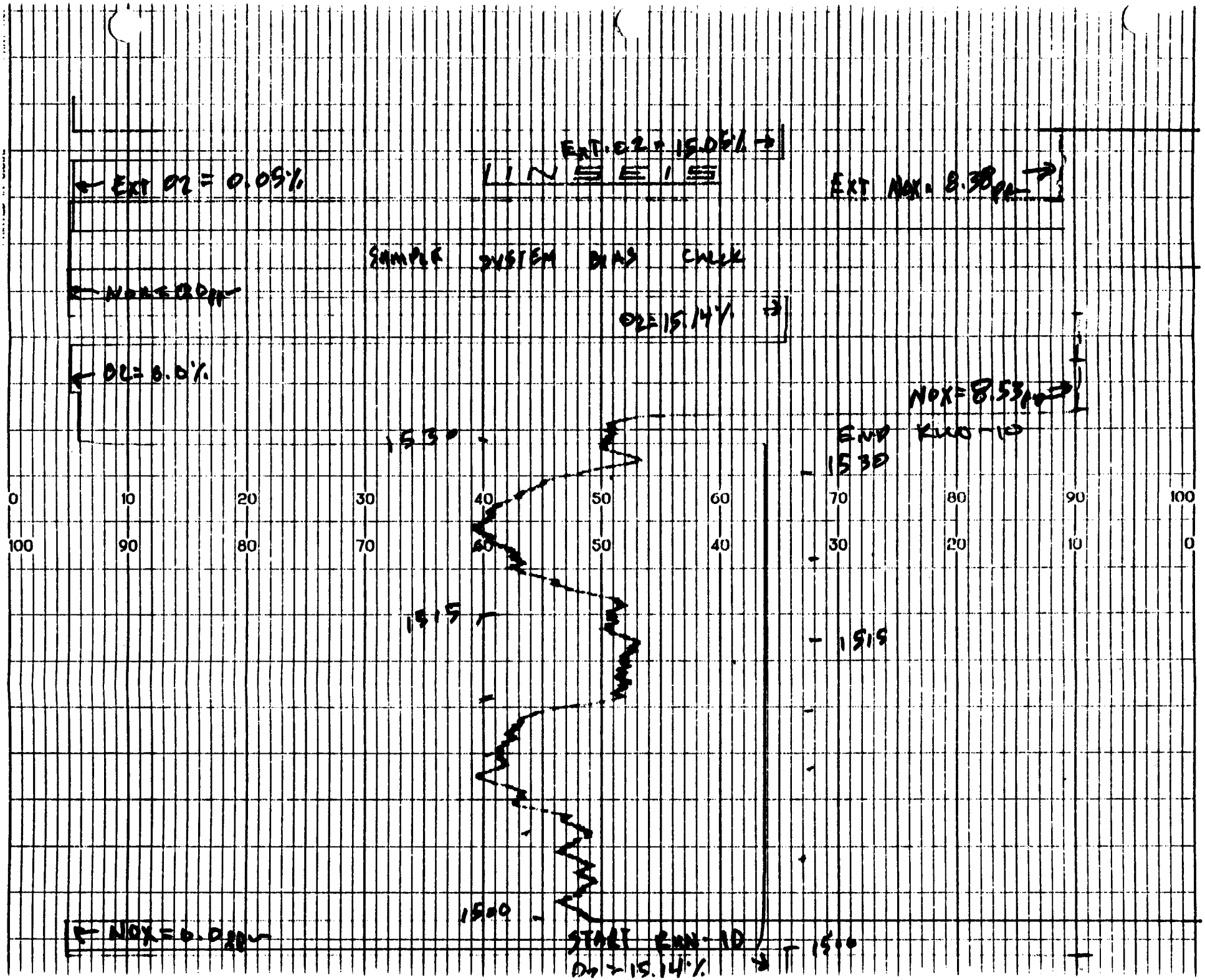
1215
1200
START RUN-6
O2 = 15.14%
NOX = 0.0 ppm
O2 = 0.0%
NOX = 8.46 ppm
1145
END RUN-5
1130



1315
END RUN-7
1315
COALINGA COGEN
RUN-7
3/4/93
1245
1245
NOX = 0.0
O2 = 0.0%
O2 = 15.08%
NOX = 8.46
1230
END RUN-6
1230
1215


O2 = 15.14%
NOX = 8.3 ppm
O2 = 0.0%
1400
1400
0
10
20
30 1345
40
50
60
70 1345
80
90
100
100
90
80
70
60
50
40
30
20
10
0
NOX
O2
1330
1330
START RUN-8
NOX = 8.46 ppm
NOX = 0.0 ppm
O2 = 15.14
O2 = 0.0%
NOX = 8.60 ppm
1315
1315
END RUN-7


START RUN-10
O2 = 15.14%
NOX = 0.0 ppm
O2 = 0.0%
NOX = 8.46 ppm
1500
1495
1490
1485
1480
1500
1495
1490
1485
1480
NOX
O2
Run #9
O2 = 15.14%
NOX = 8.3 ppm
NOX = 0.0 ppm
O2 = 0.0%
10 20 30 40 50 60 70 80 90 100
90 80 70 60 50 40 30 20 10 0



EXT. O2 = 15.05%
LINSEIS
EXT O2 = 0.05%
EXT NOX = 8.38 ppm
SAMPLE SYSTEM BIAS CHECK
NOX = 0.0 ppm
O2 = 15.14%
O2 = 0.0%
NOX = 8.53 ppm
END RUN-10
1530
1515
1500
START RUN-10
O2 = 15.14%
NOX = 0.0 ppm
0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0

FIELD DATA SHEET

ENGINEERING–SCIENCE, INC.

Company: Coalinga Cogen
Test Location: Outlet
Test Method / Parameter: BAAQMD ST-1b / NH_3
Run #: 1
Date: 3/4/93
Operator: CNM
K-FACTOR:

Stack Dimensions
Barometric Pressure: 29.52 "Hg
Static Pressure: "H_2O
Pitot Coeff.: ~~0.84~~
Filter #: UNTARED
Control Box #: BR IV
Orifice dH@ / y: 1.64 / 0.988
Probe Type / Length: G / 4'
Nozzle # / Size: N/A

IMPINGER CONTENTS, grams				
Impinger	Contents	Final	Initial	Net
1	0.1N HCL	668.2	616.6	51.6
2	0.1N HCL	568.4	593.4	-25.0
3	Empty	499.3	495.8	3.8
4				
5				
Silica Gel		787.3	782.6	4.7
			TOTAL:	35.1

GAS COMPOSITION			
Time	O2	CO2	CO

LEAK RATE	cfm / lpm	"Hg Vacuum
Initial	0.005	15
Final	0.000	5

Sample Point	Time 0815	Gas Meter (ft³ or liters)	dP "H2O	dH "H2O	Temperature, °F Meter	Stack	Probe	Oven	Impinger	Vacuum "Hg	Rotameter (liters/min)	Comments
Center	0	750.910	N.A.	1.3	70	328	250	251	50	3	N.A.	START: 0815 hrs.
	5	754.3	"	1.3	74	328	250	253	50	3	"	
	10	757.6	"	1.3	77	328	250	249	51	3	"	
	15	760.9	"	1.3	79	326	250	250	51	3	"	
	20	764.2	"	1.3	81	325	250	257	53	3	"	
	25	767.5	"	1.3	82	324	250	259	54	3	"	
	30	770.923	—	END		RUN		#1	—	—	—	END: 0845 hrs.
Total/Avg.	30.0	20.013		1.30	77.17							

FIELD DATA SHEET

ENGINEERING–SCIENCE, INC.

Company: Coalinga Cogen
Test Location: Outlet Stack
Test Method / Parameter: BAAQMD ST-1b / NH_3

Run #: ~~3~~ 2
Date: 3/4/93
Operator: CNM

K–FACTOR:

Stack Dimensions
Barometric Pressure: 29.52 "Hg
Static Pressure: "H_2O
Pitot Coeff.: 0.84
Filter #: UNTARED
Control Box #: BR IV
Orifice dH@ / y: 1.64 / 0.988
Probe Type / Length: Glass / 4'
Nozzle # / Size: N/A

IMPINGER CONTENTS, grams				
Impinger	Contents	Final	Initial	Net
1	0.1N HCL	609.6	590.1	19.5
2	0.1N HCL	599.2	589.8	9.4
3	Empty	495.5	493.4	2.1
4				
5				
Silica Gel		775.8	771.6	4.2
			TOTAL:	35.2

GAS COMPOSITION			
Time	O2	CO2	CO

LEAK RATE	cfm / lpm	"Hg Vacuum
Initial	0.002	15
Final	0.000	5

Sample Point	Time 0900	Gas Meter (ft³ or liters)	dP "H2O	dH "H2O	Temperature, °F Meter	Stack	Probe	Oven	Impinger	Vacuum "Hg	Rotameter (liters/min)	Comments
Center	0	771.045	N.A.	1.3	83	327	250	251	51	3	N.A.	START: 0900 hrs.
	5	774.4	"	1.3	84	328	250	255	51	3	"	
	10	777.7	"	1.3	83	328	250	247	52	3	"	
	15	781.1	"	1.3	82	327	250	250	52	3	"	
	20	784.4	"	1.3	81	326	250	245	54	3	"	
	25	787.8	"	1.3	82	327	250	243	54	3	"	
	30	791.003	END		RUN		# 2					END: 0930 hrs.
Total/Avg	30.0	19.958		1.30	82.50							

FIELD DATA SHEET

ENGINEERING–SCIENCE, INC.

Company: Coalinga Cogen
Test Location: Outlet
Test Method / Parameter: BAAQMD ST-1b

Run #: 3
Date: 3/4/93
Operator: CNM

K–FACTOR:

Stack Dimensions
Barometric Pressure: 29.52 "Hg
Static Pressure: "H_2O
Pitot Coeff.: ~~0.84~~
Filter #: UNTARED
Control Box #: BR IV
Orifice dH@ / y: 1.64 / 0.988
Probe Type / Length: G / 4'
Nozzle # / Size: N/A

IMPINGER CONTENTS, grams				
Impinger	Contents	Final	Initial	Net
1	0.1 N HCL	612.4	591.8	20.6
2	0.1 N HCL	624.8	615.1	9.7
3	Empty	497.4	495.2	2.2
4				
5				
Silica Gel		791.6	787.2	4.4
			TOTAL:	36.9

GAS COMPOSITION			
Time	O2	CO2	CO

LEAK RATE	cfm / lpm	"Hg Vacuum
Initial	0.003	15
Final	0.000	5

Sample Point	Time 0945	Gas Meter (ft³ or liters)	dP "H2O	dH "H2O	Temperature, °F Meter	Stack	Probe	Oven	Impinger	Vacuum "Hg	Rotameter (liters/min)	Comments
Center	0	791.681	N.A.	1.3	78	324	250	249	52	3	N.A.	START: 0945 hrs.
	5	795.0	"	1.3	78	325	250	251	53	3	"	
	10	798.3	"	1.3	79	324	250	250	53	3	"	
	15	801.6	"	1.3	80	325	250	253	54	3	"	
	20	804.9	"	1.3	79	324	250	252	55	3	"	
	25	808.2	"	1.3	80	324	250	250	56	3	"	
	30	811.545			END RUN #3							END: 1015 hrs.
Total/Avg	30.0	19.864		1.30	79.00							

INTEGRATED BAG GAS SAMPLING
FIELD DATA SHEET

Company: COALINGA COGEN

Date: 3-4-93

Test Location: STACK OUTLET

Test Method / Parameter: EPA Method 18 / Hc

ENGINEERING–SCIENCE, INC.

Run No.	Laboratory No.	Start Time	Rotameter (liter/min)	End Time	Rotameter (liter/min)	Total Time (min)	Leak Rate (liter/min)	Comments
1	BK9303025	0815	0.33	0845	0.33	30	0.0	
2	BK9303026	0900	0.33	0930	0.33	30	0.0	
3	BK9303027	0945	0.33	1015	0.33	30	0.0	

Note: Using a 10 liter sample bag, set the flowrate as follows: 15 min sample = 0.67 l/min; 30 min sample = 0.33 l/min; 60min sample = 0.17 l/min.

APPENDIX B

LABORATORY DATA

Pg #

Project # WA344

Analysis For: NH_3

Company: Coalinga Cogen

Sample Dates: 3/4/93

Source: Outlet stack

Method and Handling: Samples collected by BAAQMD ST-1b. Analyzed by Ion Selective Electrode (ISE). Calibrated ISE Meter w/ 1ppm, 10ppm, and 100ppm standards. 1ppm = 76.9 MV, 10ppm = 21.6 MV, 100ppm = -36.8 MV. ISE Meter calculated slope = -59.0 MV. ISE Meter corrects slope automatically for blank water value.

Identification		Raw Data						Comments/Descriptions
Sample ID Number	Run Number	Total Sample Volume,ml	Aliquot Sample Volume,ml	MV (millivolts)	ppm	mg/sample		
BK9303021	1a	351	100	61.4	1.96	.688	.667	93.9 % Dup
BK9303021	1b	351	100	62.8	1.84	.646		
BK9303022	2a	303	100	79.9	.848	.257		
BK9303022	2sp	303	100	45.5	3.83	—		Added 50 ml of 10 ppm Std = 3.33 ppm sample
BK9303023	3	310	100	73.9	1.13	.350		3.83/(3.33+.848) x 100 = 91.7% Rec
BK9303024	B1	100	100	152.0	0.000	0.000		
	QC	100	100	-37.3	102	102% Conf		

Analyst	LM
Date	3/25/93

oilwell research, inc.
ANALYTICAL LABORATORIES

PRECISION ANALYSIS / QUALITY SERVICE

Established 1949

California State Approved
Testing Laboratory

3161 Pegasus Drive
P.O. Box 80475
Bakersfield, CA
93380-0475
805 392-8811

NPDES Permit Analysis
Injection Water Quality
Reservoir Fluid Analysis
Natural Gas Analysis
Enhanced Recovery
Drilling & Production Support

March 11, 1993

Attention: Mr. Gary McRae
ENGINEERING SCIENCE, INC.
2520 Pegasus Drive
Bakersfield, CA 93308

Ref: Lab No. 93-1853

Enclosed please find your report of analysis performed on the samples submitted to our lab on March 4, 1993.

All measureable results greater than the detection limits were rechecked and a blank run to verify the results.

We thank you for this opportunity to be of service. If you should have any questions concerning this report, or require further analysis, please do not hesitate to call.

Respectfully submitted,

Ronald P. Heff
RPH/sj

enclosures

Our letters and reports are for the exclusive use of the clients to whom they are addressed. The use of our names must receive our prior written approval. Our letters and reports apply only to the samples tested and are not necessarily indicative to the qualities of identical or similar products.

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ANALYTICAL LABORATORIES

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Attention: Mr. Gary McRae
ENGINEERING SCIENCE, INC.
2520 Pegasus Drive
Bakersfield, CA 93308

Report Date: March 11, 1993
Sampled: March 4, 1993
Submitted: March 4, 1993
Lab No. 93-1853-1

LABORATORY TEST REPORT

Project Name: Coalinga Cogen Compliance
Project No.: WA344
Sample ID: Run #1
Control No. BK93030025

Analyzed For: Trace Hydrocarbons
Method: EPA 18

Component	Found	Units	MDL
Methane	ND	ppm	1.0
Ethane	ND	ppm	1.0
Propane	ND	ppm	1.0
Butane	ND	ppm	1.0
Pentane	ND	ppm	1.0
Hexanes +	1.0	ppm	1.0

ND: None Detected
MDL: Method Detection Limit

Date Analyzed: 10-Mar-93
Analyst: S. Harris

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Attention: Mr. Gary McRae
ENGINEERING SCIENCE, INC.
2520 Pegasus Drive
Bakersfield, CA 93308

Report Date: March 11, 1993
Sampled: March 4, 1993
Submitted: March 4, 1993
Lab No. 93-1853-2

LABORATORY TEST REPORT

Project Name: Coalinga Cogen Compliance
Project No.: WA344
Sample ID: Run #2
Control No. BK93030026

Analyzed For: Trace Hydrocarbons
Method: EPA 18

Component	Found	Units	MDL
Methane	ND	ppm	1.0
Ethane	ND	ppm	1.0
Propane	ND	ppm	1.0
Butane	ND	ppm	1.0
Pentane	ND	ppm	1.0
Hexanes +	1.6	ppm	1.0

ND: None Detected
MDL: Method Detection Limit

Date Analyzed: 10-Mar-93
Analyst: S. Harris

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oilwell research, inc.
ANALYTICAL LABORATORIES

Established 1949

Attention: Mr. Gary McRae
ENGINEERING SCIENCE, INC.
2520 Pegasus Drive
Bakersfield, CA 93308

Report Date: March 11, 1993
Sampled: March 4, 1993
Submitted: March 4, 1993
Lab No. 93-1853-3

LABORATORY TEST REPORT

Project Name: Coalinga Cogen Compliance
Project No.: WA344
Sample ID: Run #3
Control No. BK93030027

Analyzed For: Trace Hydrocarbons
Method: EPA 18

Component	Found	Units	MDL
Methane	ND	ppm	1.0
Ethane	ND	ppm	1.0
Propane	ND	ppm	1.0
Butane	ND	ppm	1.0
Pentane	ND	ppm	1.0
Hexanes +	ND	ppm	1.0

ND: None Detected
MDL: Method Detection Limit

Date Analyzed: 10-Mar-93
Analyst: S. Harris

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805 392-8811

ZALCO LABORATORIES, INC.
Analytical & Consulting Services

ENGINEERING SCIENCE
2520 Pegasus Drive
Bakersfield, CA 93308

Lab. No.: 035013_001
Received: Mar 4, 1993
Reported: Mar 4, 1993

Attention: Gary McRae

Sample Description: Coalinga Cogen WA344 BK9303020 Fuel Gas Sample 3/4/93

* CHROMATOGRAPHIC ANALYSIS (Z 1635) *

Components	Mole %	Wt %	CHONS	Wt %
Hydrogen	0.000	0.000	CARBON	72.37
Carbon Dioxide	2.157	5.243	HYDROGEN	22.72
Oxygen	.049	.087	OXYGEN	3.90
Nitrogen	.649	1.004	NITROGEN	1.00
Carbon Monoxide	0.000	0.000	SULFUR	0.00
Hydrogen Sulfide	0.000	0.000		
Methane	88.563	78.481	Totals	99.99
Ethane	7.540	12.523	Total H/C	.31
Propane	.907	2.210		
IsoButane	.046	.146		
N-Butane	.071	.229		
IsoPentane	.008	.031		
N-Pentane	.006	.024		
Hexanes+	.005	.023		
Totals =	100.000	100.000		

SPECIFIC GRAVITY (Air = 1)		.6263
SPECIFIC VOLUME, cu.ft./lb	*	20.92
GROSS CALORIFIC VALUE, BTU/cu.ft.	*	1041.89
GROSS CALORIFIC VALUE, BTU/cu.ft.	**	1059.91
GROSS CALORIFIC VALUE, BTU/lb	**	22175.10
NET CALORIFIC VALUE, BTU/cu.ft.	**	956.81
NET CALORIFIC VALUE, BTU/lb	**	20017.99
DSCF EXHAUST PER SCF FUEL (0% Oxygen)		9.0074
COMPRESSIBILITY FACTOR 'Z' (60 F,1 ATM)		.9976
EPA 'F' Factor @ 68 F:	8647.843 DSCF / MM Btu.	
KCAPCD 'F' Factor @ 60 F:	8518.126 DSCF / MM Btu.	

* Water Saturated ** Dry Gas @ 60 F, 14.73 psia

Analyst

Jim Etherton
Laboratory Director

4309 Armour Avenue Bakersfield, California 93308
(805) 395-0539 FAX (805) 395-3069

APPENDIX C

PLANT DATA

***** Coalinga Cogeneration Company *****
Coalinga, Fresno County, CA 93210

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
08:00	313.81	5.89	3.90	.66	28.25

One Hour Log

Time hh:mm	Gas mmBTU	O2 Pct	CO ppm	CO ppmC	CO #/mmBTU	CO #/hrC	NOx (Stack) ppm	NOx (Stack) ppmC	NOx (Stack) #/mmBTU	NOx (Stack) #/hrC
08:00	3579.00	14.49	8.37	7.70	.017	8.34	3.56	3.28	.012	5.83

	Air #/sec	Gas #/sec	H2O #/sec	NH3 SCFH	NH3 Slip ppmC	NH3 Slip #/hr	Inj. Ratio	H2O gal/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
08:00	314.80	5.93	3.83	632.60	4.11	2.51	.65	27.74	.92	43.97	733.800

Description	Date	Time hh:mm	Zero Expectd	Zero Actual	Zero %Drift	Upscale Expectd	Upscale Actual	Upscale %Drift	Fail 1 Dy	Fail 5 Dy
NOx ppm (SCR)	03/04/93	08:12	0.000	-.310	-.31	82.800	83.033	.23		

Description	Date	Time hh:mm	Zero Expectd	Zero Actual	Zero %Drift	Upscale Expectd	Upscale Actual	Upscale %Drift	Fail 1 Dy	Fail 5 Dy
O2 pct	03/04/93	08:12	0.000	.020	.02	14.850	14.902	.05		

Description	Date	Time hh:mm	Zero Expectd	Zero Actual	Zero %Drift	Upscale Expectd	Upscale Actual	Upscale %Drift	Fail 1 Dy	Fail 5 Dy
CO ppm	03/04/93	08:12	0.000	.039	.08	39.300	39.387	.17		

Description	Date	Time hh:mm	Zero Expectd	Zero Actual	Zero %Drift	Upscale Expectd	Upscale Actual	Upscale %Drift	Fail 1 Dy	Fail 5 Dy
NOx ppm (STACK)	03/04/93	08:12	0.000	-.020	-.20	7.840	7.913	.73		

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
08:15	Other	Other	Other	Other	Other	Maint	Other	Other	Other	Other	Maint

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
08:15	659.89	Other	Other	Maint	Maint	Other	Other	734.23

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
08:15	313.21	5.88	3.99	.68	28.86

Fifteen Minute Log

Daily Logs for Thu 04 Mar 1999

***** Coalinga Cogeneration Company *****

Coalinga, Fresno County, CA 93210

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
08:30	14.50	9.50	8.76	.020	9.40	9.09	2.39	2.21	.008	3.88	4.27

NH3 Slip

	NH3 SCFH	15 min ppmC	15 min #/hr	1 hr ppmC	1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
08:30	660.45	6.18	3.75	5.57	3.39	.998	42.25	734.10

RA Run #1

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
08:30	312.55	5.89	3.93	.67	28.48

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
08:45	14.51	9.23	8.53	.019	9.18	9.12	2.31	2.13	.008	3.76	4.10

NH3 Slip

	NH3 SCFH	15 min ppmC	15 min #/hr	1 hr ppmC	1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
08:45	658.96	6.16	3.74	5.77	3.51	.999	42.08	734.20

RA Run #1

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
08:45	312.71	5.91	3.89	.66	28.18

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
09:00	14.53	8.37	7.75	.017	8.33	8.97	2.93	2.71	.010	4.78	4.14

NH3 Slip

	NH3 SCFH	15 min ppmC	15 min #/hr	1 hr ppmC	1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
09:00	636.94	4.69	2.85	5.67	3.45	.950	42.73	734.33

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
09:00	312.89	5.90	3.82	.65	27.65

One Hour Log

Time hh:mm	Gas mmBTU	O2 Pct	CO ppm	CO ppmC	CO #/mmBTU	CO #/hrC	NOx (Stack) ppm	NOx (Stack) ppmC	NOx (Stack) #/mmBTU	NOx (Stack) #/hrC
09:00	3451.00	14.51	9.03	8.33	.019	8.96	2.55	2.35	.009	4.15

	Air #/sec	Gas #/sec	H2O #/sec	NH3 SCFH	NH3 Slip ppmC	NH3 Slip #/hr	Inj. Ratio	H2O gal/hr	NH3/NOx Ratio	SCR NOx	SCR Temp

***** Coalinga Cogeneration Company *****
Coalinga, Fresno County, CA 93210

09:00	312.80	5.89	3.91	654.10	5.67	3.44	.66	28.29	.98	42.40	734.200

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
09:15	14.53	8.27	7.66	.017	8.23	8.79	3.53	3.27	.012	5.76	4.55

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
09:15	600.61	3.38	2.05	5.10	3.10	.908	42.25	734.33

RA Run# 2

	Air #/sec	Gas #/sec	H20 #/sec	Inj. Ratio	H20 gal/hr
09:15	312.42	5.89	3.86	.66	27.97

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
09:30	14.54	7.57	7.02	.016	7.49	8.31	3.71	3.44	.013	6.01	5.08

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
09:30	603.63	3.27	1.98	4.37	2.65	.901	42.87	734.52

RA RUN # 2

	Air #/sec	Gas #/sec	H20 #/sec	Inj. Ratio	H20 gal/hr
09:30	311.72	5.85	3.81	.65	27.61

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
09:45	14.54	8.23	7.64	.017	8.18	8.06	3.50	3.25	.012	5.71	5.56

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
09:45	591.76	3.20	1.94	3.64	2.20	.904	41.90	734.34

	Air #/sec	Gas #/sec	H20 #/sec	Inj. Ratio	H20 gal/hr
09:45	311.60	5.88	3.88	.66	28.07

Fifteen Minute Log

***** Coalinga Cogeneration Company *****
Coalinga, Fresno County, CA 93210

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
1[illegible]0	14.56	7.49	6.96	.016	7.43	7.83	3.68	3.42	.012	5.98	5.87

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
10:00	597.95	3.06	1.85	3.23	1.96	.897	42.69	734.19

RA Run # 3

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
10:00	311.56	5.85	3.81	.65	27.60

One Hour Log

Time hh:mm	Gas mmBTU	O2 Pct	CO ppm	CO ppmC	CO #/mmBTU	CO #/hrC	NOx (Stack) ppm	NOx (Stack) ppmC	NOx (Stack) #/mmBTU	NOx (Stack) #/hrC
10:00	3453.00	14.54	7.89	7.32	.016	7.83	3.60	3.35	.012	5.87

	Air #/sec	Gas #/sec	H2O #/sec	NH3 SCFH	NH3 Slip ppmC	NH3 Slip #/hr	Inj. Ratio	H2O gal/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
10:00	311.80	5.87	3.84	598.50	3.23	1.95	.65	27.81	.90	42.42	734.300

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
10:15	14.56	7.49	6.97	.016	7.42	7.63	3.68	3.42	.013	5.96	5.92

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
10:15	593.33	3.00	1.81	3.13	1.89	.895	42.52	733.59

RA Run # 3

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
10:15	310.82	5.84	3.80	.65	27.54

Alarm: Maint Request recorded Thu 04 Mar 1993 1021

Clear: Maint Request recorded Thu 04 Mar 1993 1026

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
1[illegible]30	14.57	7.26	6.77	.015	7.20	7.56	3.93	3.67	.013	6.39	6.01

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp

***** Coalinga Cogeneration Company *****
Coalinga, Fresno County, CA 93210

10:30	583.62	2.95	1.77	3.05	1.84	.889	42.38	733.57

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
10:30	309.92	5.83	3.75	.64	27.14

Fifteen Minute Log

Time	O2	CO 15 min			CO 1 hr	NOx (Stack) 15 min			NOx 1 hr
hh:mm	Pct	ppm	ppmC	#/mmBTU	#/hrC	#/hrC	ppm	ppmC	#/mmBTU	#/hrC	#/hrC
10:45	14.56	6.93	6.44	.014	6.86	7.23	3.76	3.50	.013	6.10	6.11

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
10:45	587.95	2.85	1.72	2.97	1.79	.890	42.56	733.97

RA Run #4

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
10:45	309.63	5.84	3.72	.64	26.92

Fifteen Minute Log

T	O2	CO 15 min			CO 1 hr	NOx (Stack) 15 min			NOx 1 hr
hh:mm	Pct	ppm	ppmC	#/mmBTU	#/hrC	#/hrC	ppm	ppmC	#/mmBTU	#/hrC	#/hrC
11:00	14.55	6.88	6.39	.014	6.80	7.07	3.74	3.47	.013	6.06	6.13

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
11:00	583.75	2.76	1.65	2.89	1.74	.889	42.41	734.43

RA Run #4

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
11:00	309.03	5.83	3.72	.64	26.90

One Hour Log

Time	Gas	O2	CO				NOx (Stack)			
hh:mm	mmBTU	Pct	ppm	ppmC	#/mmBTU	#/hrC	ppm	ppmC	#/mmBTU	#/hrC
11:00	3457.00	14.56	7.13	6.63	.015	7.06	3.76	3.50	.013	6.11

	Air #/sec	Gas #/sec	H2O #/sec	NH3 SCFH	NH3 Slip ppmC	NH3 Slip #/hr	Inj. Ratio	H2O gal/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
11:00	309.90	5.84	3.75	587.20	2.89	1.74	.64	27.13	.89	42.47	733.900

Fifteen Minute Log

CO ---------- NOx (Stack) ----------

Daily Logs for Thu 04 Mar 1993
***** Coalinga Cogeneration Company *****
Coalinga, Fresno County, CA 93210

Time hh:mm	O2 Pct	15 min ppm	15 min ppmC	15 min #/mmBTU	15 min #/hrC	1 hr #/hrC	15 min ppm	15 min ppmC	15 min #/mmBTU	15 min #/hrC	1 hr #/hrC
1[illegible]:15	14.56	6.84	6.36	.014	6.74	6.90	3.79	3.53	.013	6.13	6.17

NH3 Slip

	NH3 SCFH	15 min ppmC	15 min #/hr	1 hr ppmC	1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
11:15	585.10	2.85	1.71	2.85	1.71	.890	42.44	734.82

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
11:15	309.30	5.82	3.70	.64	26.78

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
11:30	14.56	6.69	6.22	.014	6.58	6.75	3.95	3.67	.013	6.37	6.17

NH3 Slip

	NH3 SCFH	15 min ppmC	15 min #/hr	1 hr ppmC	1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
11:30	581.91	2.84	1.70	2.82	1.70	.886	42.45	735.13

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
11:30	308.76	5.81	3.67	.63	26.59

RA Run #5

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
11:45	14.55	6.50	6.04	.013	6.40	6.63	4.02	3.73	.014	6.48	6.26

NH3 Slip

	NH3 SCFH	15 min ppmC	15 min #/hr	1 hr ppmC	1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
11:45	583.69	2.86	1.71	2.83	1.69	.885	42.65	735.02

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
11:45	308.59	5.81	3.65	.63	26.42

RA Run #5

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
1[illegible]:00	14.56	6.61	6.15	.014	6.52	6.56	4.10	3.81	.014	6.62	6.40

NH3 Slip

	NH3 SCFH	15 min ppmC	15 min #/hr	1 hr ppmC	1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp

Daily Logs for Thu 04 Mar 1999

***** Coalinga Cogeneration Company *****

Coalinga, Fresno County, CA 93210

12:00	578.64	2.69	1.61	2.81	1.68	.880	42.54	734.97

	Air #/sec	Gas #/sec	H20 #/sec	Inj. Ratio	H20 gal/hr
12:00	308.65	5.81	3.67	.63	26.55

One Hour Log

Time hh:mm	Gas mmBTU	O2 Pct	CO ppm	CO ppmC	CO #/mmBTU	CO #/hrC	NOx (Stack) ppm	NOx (Stack) ppmC	NOx (Stack) #/mmBTU	NOx (Stack) #/hrC
12:00	3461.00	14.56	6.66	6.19	.014	6.56	3.96	3.69	.014	6.40

	Air #/sec	Gas #/sec	H20 #/sec	NH3 SCFH	NH3 Slip ppmC	NH3 Slip #/hr	Inj. Ratio	H20 gal/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
12:00	308.80	5.81	3.67	582.30	2.81	1.68	.63	26.59	.88	42.52	735.000

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
12:15	14.55	6.61	6.14	.014	6.49	6.50	3.82	3.55	.013	6.16	6.41

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
12:15	584.19	2.70	1.61	2.77	1.66	.886	42.71	735.03

RA RUN #6

	Air #/sec	Gas #/sec	H20 #/sec	Inj. Ratio	H20 gal/hr
12:15	308.17	5.80	3.71	.64	26.87

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
12:30	14.54	6.91	6.41	.014	6.79	6.55	3.89	3.61	.013	6.27	6.38

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
12:30	571.83	2.64	1.57	2.72	1.63	.883	42.04	735.28

RA RUN # 6

	Air #/sec	Gas #/sec	H20 #/sec	Inj. Ratio	H20 gal/hr
12:30	307.45	5.80	3.73	.64	26.99

Fifteen Minute Log

CO ---------- NOx (Stack) ----------

Daily Logs for the 01 Mar 1995

***** Coalinga Cogeneration Company *****

Coalinga, Fresno County, CA 93210

Time	O2	15 min				1 hr	15 min				1 hr
hh:mm	Pct	ppm	ppmC	#/mmBTU	#/hrC	#/hrC	ppm	ppmC	#/mmBTU	#/hrC	#/hrC
12:45	14.56	6.37	5.93	.013	6.26	6.52	3.95	3.68	.013	6.37	6.35

	NH3	NH3 Slip 15 min		NH3 Slip 1 hr		NH3/NOx	SCR	
	SCFH	ppmC	#/hr	ppmC	#/hr	Ratio	NOx	Temp
12:45	577.83	2.86	1.70	2.72	1.63	.886	42.36	735.71

	Air	Gas	H2O	Inj.	H2O
	#/sec	#/sec	#/sec	Ratio	gal/hr
12:45	307.17	5.80	3.68	.63	26.61

Fifteen Minute Log

		CO					NOx (Stack)				
Time	O2	15 min				1 hr	15 min				1 hr
hh:mm	Pct	ppm	ppmC	#/mmBTU	#/hrC	#/hrC	ppm	ppmC	#/mmBTU	#/hrC	#/hrC
13:00	14.58	5.98	5.58	.013	5.88	6.36	4.29	4.01	.015	6.92	6.43

	NH3	NH3 Slip 15 min		NH3 Slip 1 hr		NH3/NOx	SCR	
	SCFH	ppmC	#/hr	ppmC	#/hr	Ratio	NOx	Temp
13:00	574.83	2.68	1.59	2.72	1.62	.875	42.80	735.85

RA RUN #7

	Air	Gas	H2O	Inj.	H2O
	#/sec	#/sec	#/sec	Ratio	gal/hr
13:00	306.32	5.78	3.60	.62	26.07

One Hour Log

Time	Gas	O2	CO				NOx (Stack)			
hh:mm	mmBTU	Pct	ppm	ppmC	#/mmBTU	#/hrC	ppm	ppmC	#/mmBTU	#/hrC
13:00	3457.00	14.56	6.47	6.01	.013	6.36	3.99	3.71	.014	6.43

	Air	Gas	H2O	NH3	NH3 Slip		Inj.	H2O	NH3/NOx	SCR	
	#/sec	#/sec	#/sec	SCFH	ppmC	#/hr	Ratio	gal/hr	Ratio	NOx	Temp
13:00	307.30	5.79	3.68	577.20	2.72	1.62	.63	26.63	.88	42.48	735.500

Fifteen Minute Log

		CO					NOx (Stack)				
Time	O2	15 min				1 hr	15 min				1 hr
hh:mm	Pct	ppm	ppmC	#/mmBTU	#/hrC	#/hrC	ppm	ppmC	#/mmBTU	#/hrC	#/hrC
13:15	14.58	6.14	5.73	.013	6.01	6.23	4.18	3.91	.014	6.70	6.56

	NH3	NH3 Slip 15 min		NH3 Slip 1 hr		NH3/NOx	SCR	
	SCFH	ppmC	#/hr	ppmC	#/hr	Ratio	NOx	Temp
13:15	574.41	2.86	1.69	2.76	1.64	.881	42.61	735.97

RA RUN #7

	Air	Gas	H2O	Inj.	H2O
	#/sec	#/sec	#/sec	Ratio	gal/hr
13:15	305.32	5.75	3.61	.63	26.14

***** Coalinga Cogeneration Company *****
Coalinga, Fresno County, CA 93210

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
13:30	14.57	6.38	5.95	.013	6.23	6.09	4.00	3.73	.014	6.40	6.60

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
13:30	570.57	2.87	1.70	2.82	1.67	.885	42.17	735.98

	Air #/sec	Gas #/sec	H20 #/sec	Inj. Ratio	H20 gal/hr
13:30	304.90	5.74	3.68	.64	26.65

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
13:45	14.58	5.99	5.59	.013	5.80	5.98	4.12	3.84	.014	6.55	6.64

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
13:45	579.21	2.70	1.60	2.78	1.65	.879	43.17	736.00

RA Run #8

	Air #/sec	Gas #/sec	H20 #/sec	Inj. Ratio	H20 gal/hr
13:45	304.47	5.70	3.64	.64	26.33

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
14:00	14.59	6.75	6.31	.014	6.57	6.15	3.98	3.72	.014	6.35	6.50

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
14:00	565.97	2.68	1.59	2.78	1.64	.881	42.05	736.11

RA Run #8

	Air #/sec	Gas #/sec	H20 #/sec	Inj. Ratio	H20 gal/hr
14:00	304.69	5.71	3.72	.65	26.95

One Hour Log

Time	Gas	O2	CO	NOx (Stack)

Daily Logs for Thu 04 Mar 1993
***** Coalinga Cogeneration Company *****
Coalinga, Fresno County, CA 93210

hh:mm	mmBTU	Pct	ppm	ppmC	#/mmBTU	#/hrC	ppm	ppmC	#/mmBTU	#/hrC
14:00	3459.00	14.58	6.31	5.89	.013	6.15	4.07	3.80	.014	6.50

	Air #/sec	Gas #/sec	H20 #/sec	NH3 SCFH	-- NH3 Slip -- ppmC	#/hr	Inj. Ratio	H20 gal/hr	NH3/NOx Ratio	---- SCR ----- NOx	Temp
14:00	304.80	5.72	3.66	572.50	2.78	1.64	.64	26.52	.88	42.50	736.000

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
14:15	14.58	6.35	5.93	.013	6.17	6.19	4.14	3.86	.014	6.59	6.47

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
14:15	569.61	2.78	1.64	2.76	1.63	.880	42.39	736.15

	Air #/sec	Gas #/sec	H20 #/sec	Inj. Ratio	H20 gal/hr
14:15	304.61	5.71	3.67	.64	26.58

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
14:30	14.57	6.31	5.89	.013	6.12	6.16	4.17	3.89	.014	6.62	6.53

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
14:30	569.45	2.70	1.60	2.72	1.61	.878	42.48	736.03

RA Run #9

	Air #/sec	Gas #/sec	H20 #/sec	Inj. Ratio	H20 gal/hr
14:30	304.66	5.70	3.64	.64	26.35

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
14:45	14.57	6.19	5.77	.013	5.99	6.21	4.18	3.90	.014	6.64	6.55

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
14:45	570.77	2.69	1.59	2.71	1.60	.878	42.57	736.14

RA Run #9

	Air #/sec	Gas #/sec	H20 #/sec	Inj. Ratio	H20 gal/hr
14:45	304.95	5.69	3.65	.64	26.40

Daily Logs for the 01 Mar 1999

***** Coalinga Cogeneration Company *****

Coalinga, Fresno County, CA 93210

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
15:00	14.58	6.00	5.60	.013	5.80	6.02	4.14	3.87	.014	6.56	6.60

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
15:00	574.55	2.70	1.60	2.72	1.61	.879	42.79	736.16

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
15:00	304.99	5.68	3.64	.64	26.37

One Hour Log

Time hh:mm	Gas mmBTU	O2 Pct	CO ppm	CO ppmC	CO #/mmBTU	CO #/hrC	NOx (Stack) ppm	NOx (Stack) ppmC	NOx (Stack) #/mmBTU	NOx (Stack) #/hrC
15:00	3464.00	14.58	6.21	5.80	.013	6.02	4.16	3.88	.014	6.60

	Air #/sec	Gas #/sec	H2O #/sec	NH3 SCFH	NH3 Slip ppmC	NH3 Slip #/hr	Inj. Ratio	H2O gal/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
15:00	304.80	5.70	3.65	571.10	2.72	1.61	.64	26.42	.88	42.56	736.100

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
15:15	14.56	6.65	6.19	.014	6.46	6.09	4.00	3.72	.014	6.37	6.55

	NH3 SCFH	NH3 Slip 15 min ppmC	NH3 Slip 15 min #/hr	NH3 Slip 1 hr ppmC	NH3 Slip 1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
15:15	566.93	2.54	1.50	2.66	1.57	.878	42.21	736.23

RA Run #10

	Air #/sec	Gas #/sec	H2O #/sec	Inj. Ratio	H2O gal/hr
15:15	305.26	5.72	3.71	.65	26.85

Fifteen Minute Log

Time hh:mm	O2 Pct	CO 15 min ppm	CO 15 min ppmC	CO 15 min #/mmBTU	CO 15 min #/hrC	CO 1 hr #/hrC	NOx (Stack) 15 min ppm	NOx (Stack) 15 min ppmC	NOx (Stack) 15 min #/mmBTU	NOx (Stack) 15 min #/hrC	NOx (Stack) 1 hr #/hrC
15:30	14.58	6.52	6.08	.014	6.36	6.15	4.04	3.77	.014	6.46	6.51

NH3 ----15 min---- -----1 hr----- NH3/NOx ---- SCR -----

RA Run # 10

***** Coalinga Cogeneration Company *****
Coalinga, Fresno County, CA 93210

	SCFH	ppmC	#/hr	ppmC	#/hr	Ratio	NOx	Temp
15:30	568.81	2.58	1.53	2.63	1.56	.878	42.31	736.07

	Air #/sec	Gas #/sec	H20 #/sec	Inj. Ratio	H20 gal/hr
15:30	305.55	5.74	3.70	.65	26.82

Fifteen Minute Log

Time	O2	CO 15 min			CO 1 hr	NOx (Stack) 15 min			NOx 1 hr
hh:mm	Pct	ppm	ppmC	#/mmBTU	#/hrC	#/hrC	ppm	ppmC	#/mmBTU	#/hrC	#/hrC
15:45	14.57	6.30	5.87	.013	6.14	6.19	4.19	3.91	.014	6.70	6.52

NH3 Slip

	NH3 SCFH	15 min ppmC	15 min #/hr	1 hr ppmC	1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
15:45	573.73	2.75	1.63	2.64	1.57	.879	42.62	735.99

	Air #/sec	Gas #/sec	H20 #/sec	Inj. Ratio	H20 gal/hr
15:45	305.75	5.73	3.68	.64	26.62

Fifteen Minute Log

Time	O2	CO 15 min			CO 1 hr	NOx (Stack) 15 min			NOx 1 hr
hh:mm	Pct	ppm	ppmC	#/mmBTU	#/hrC	#/hrC	ppm	ppmC	#/mmBTU	#/hrC	#/hrC
16:00	14.57	6.56	6.11	.014	6.33	6.32	4.10	3.82	.014	6.49	6.50

NH3 Slip

	NH3 SCFH	15 min ppmC	15 min #/hr	1 hr ppmC	1 hr #/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
16:00	567.38	2.79	1.64	2.66	1.58	.882	42.31	736.11

	Air #/sec	Gas #/sec	H20 #/sec	Inj. Ratio	H20 gal/hr
16:00	303.53	5.69	3.66	.64	26.47

One Hour Log

Time	Gas	O2	CO				NOx (Stack)			
hh:mm	mmBTU	Pct	ppm	ppmC	#/mmBTU	#/hrC	ppm	ppmC	#/mmBTU	#/hrC
16:00	3448.00	14.57	6.51	6.06	.014	6.32	4.08	3.81	.014	6.50

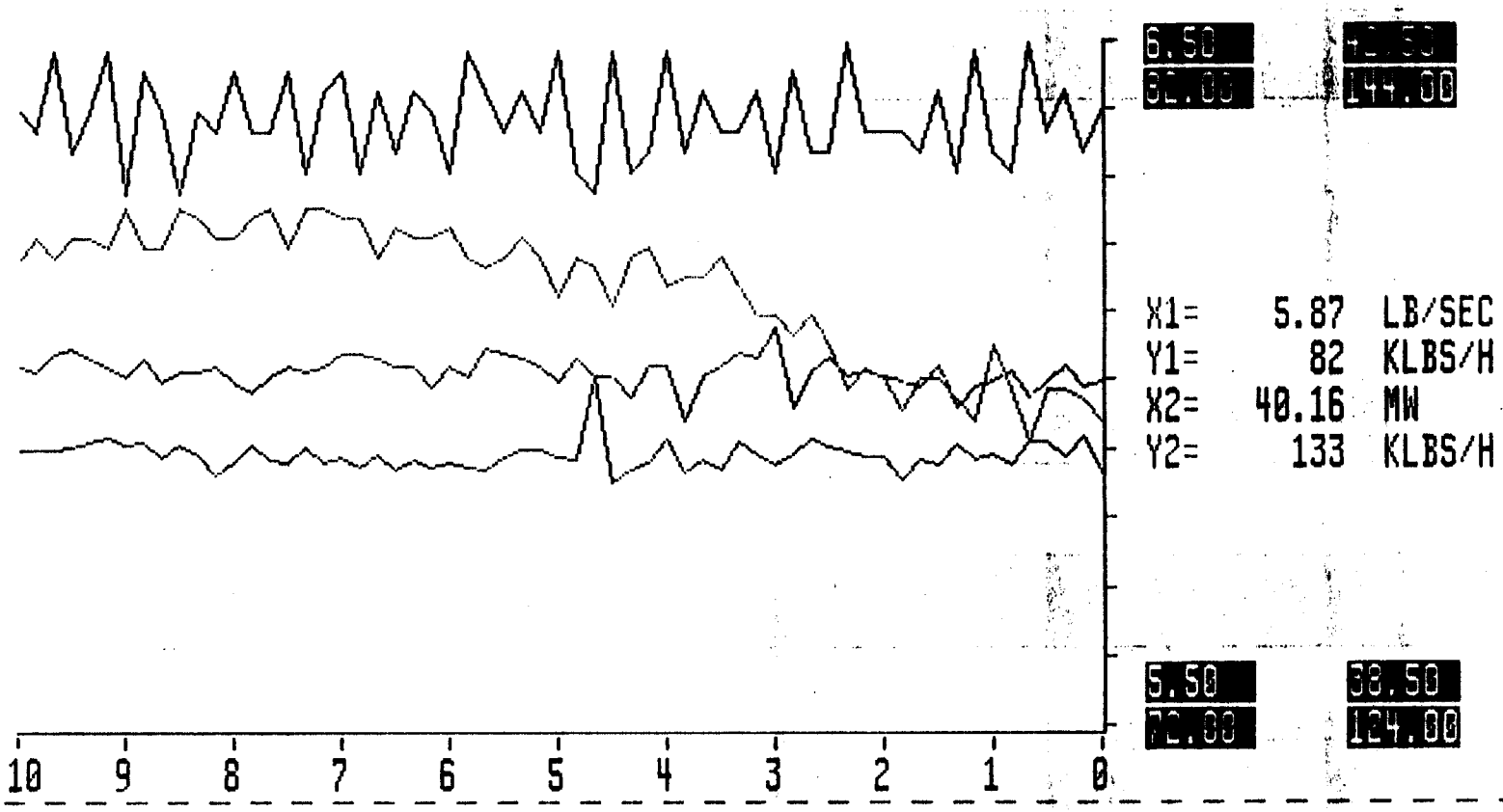
	Air #/sec	Gas #/sec	H20 #/sec	NH3 SCFH	NH3 Slip ppmC	NH3 Slip #/hr	Inj. Ratio	H20 gal/hr	NH3/NOx Ratio	SCR NOx	SCR Temp
16:00	305.00	5.72	3.69	569.20	2.66	1.58	.64	26.69	.88	42.36	736.100

Alarm: Maint Request recorded Thu 04 Mar 1993 1603

MAINSCREEN: 1251 VER: 100 SUBSCREEN: 11 VER: 102 WINDOW: 0 VER: 0
DATE: 03/04/93 TIME: 09:07:41

04/MAR/93 10 MINUTE TREND 09:07:40

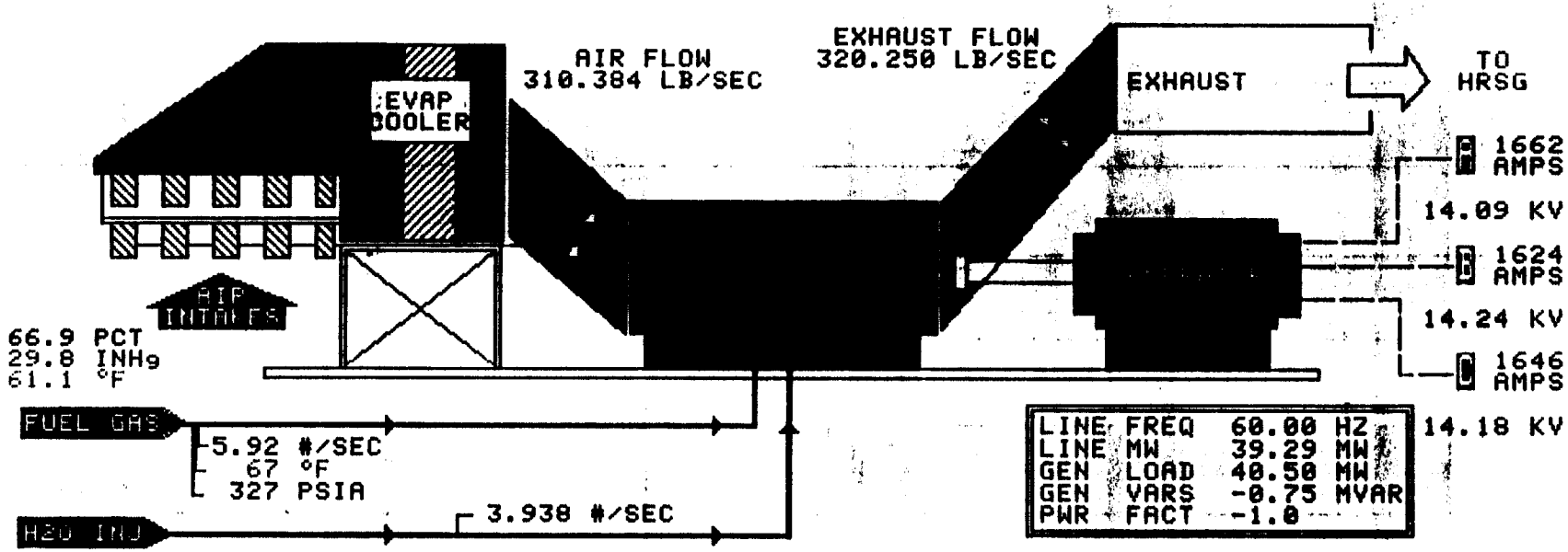
X1:FQT TOTAL FUEL FLOW (GAS) X2:DW GENERATOR LOAD
Y1:FY205KLB CALC STEAM FLOW TO WHITTIER Y2:FY206KLB CALC STEAM FLOW TO SANTA FE



COPY IN PROGRESS

MAINSCREEN: 2001 VER: 0 SUBSCREEN: 299 VER: 100 WINDOW: 0 VER: 0
DATE: 03/04/93 TIME: 09:08:52

TURBINE/GENERATOR



LINE FREQ	60.00	HZ
LINE MW	39.29	MW
GEN LOAD	40.50	MW
GEN VARS	-0.75	MVAR
PWR FACT	-1.0	

T/G TEMPERATURES		
INLET FLG.	55	°F
DISCH TEMP	656	°F
LUBE SYST	131	°F
EXHAUST	1003	°F

TOTAL FIRED HRS	11173.8
FIRED STARTS	37
PEAK FIRED HRS	0

VIBRATION	0.33	IN/S
(MAX SELECT)		
IGV ANGLE	84	DEG

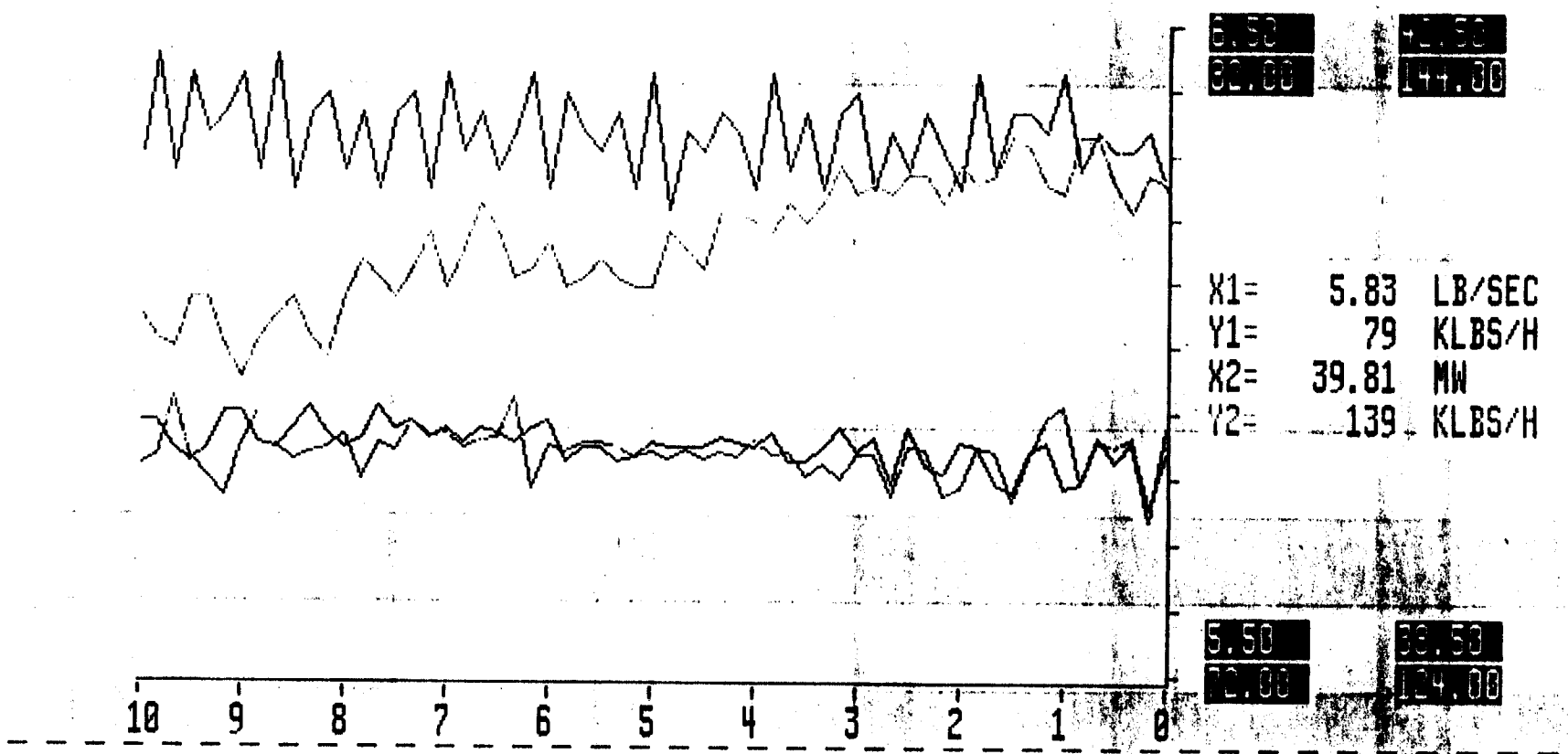
COPY IN PROGRESS

MAINSCREEN: 1251 VER: 100 SUBSCREEN: 11 VER: 102 WINDOW: 0 VER: 0
DATE: 03/04/93 TIME: 10:08:28

04/MAR/93 10 MINUTE TREND 10:08:28

X1:FQT TOTAL FUEL FLOW (GAS) X2:DW GENERATOR LOAD

Y1:FY205KLB CALC STEAM FLOW TO WHITTIER Y2:FY206KLB CALC STEAM FLOW TO SANTA FE



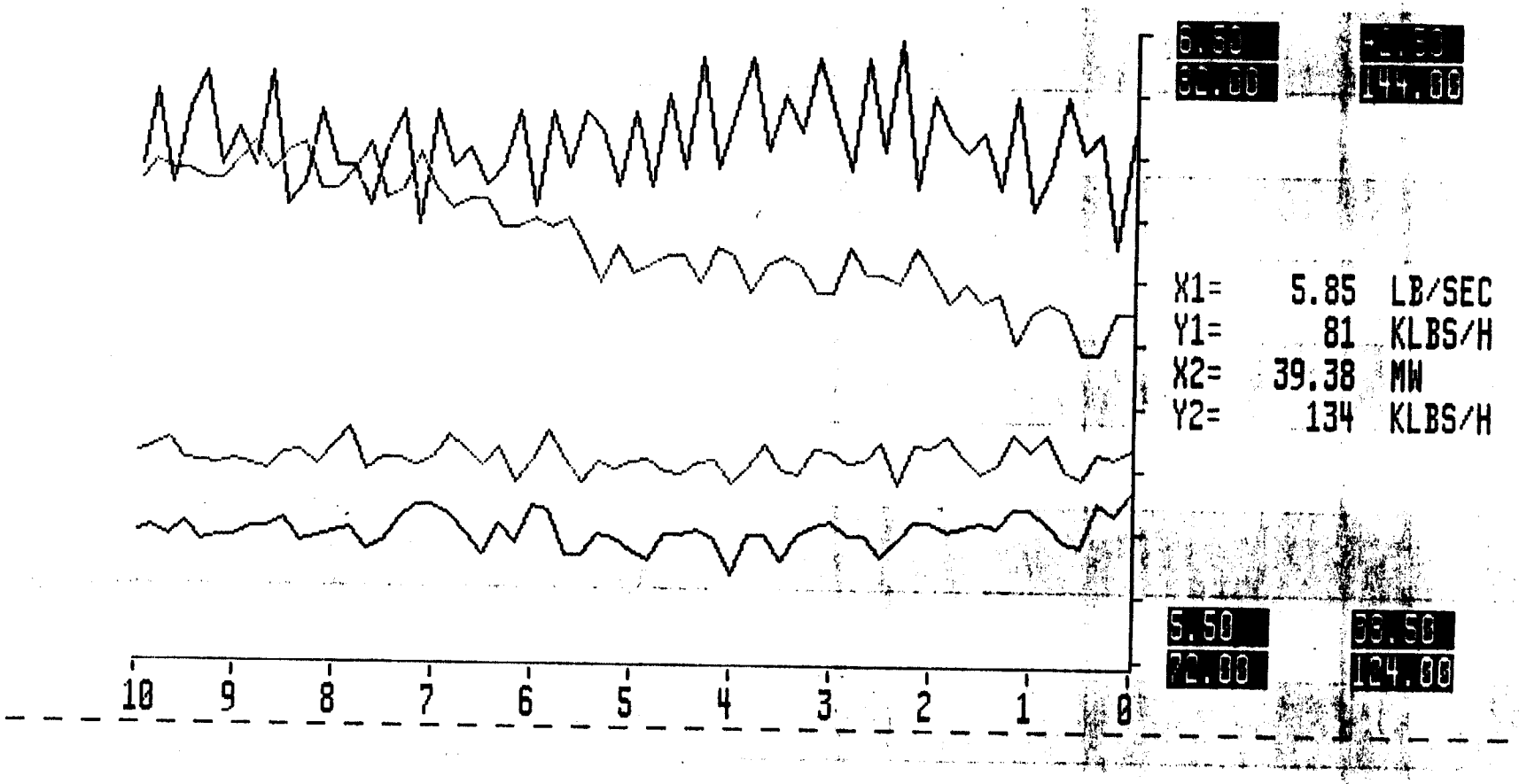
COPY IN PROGRESS

MAINSCREEN: 1251 VER: 100 SUBSCREEN: 11 VER: 102 WINDOW: 0 VER: 0
DATE: 03/04/93 TIME: 11:24:07

04/MAR/93 10 MINUTE TREND 11:24:07

X1:FQT TOTAL FUEL FLOW (GAS) X2:DW GENERATOR LOAD

Y1:FY205KLB CALC STEAM FLOW TO WHITTIER Y2:FY206KLB CALC STEAM FLOW TO SANTA FE



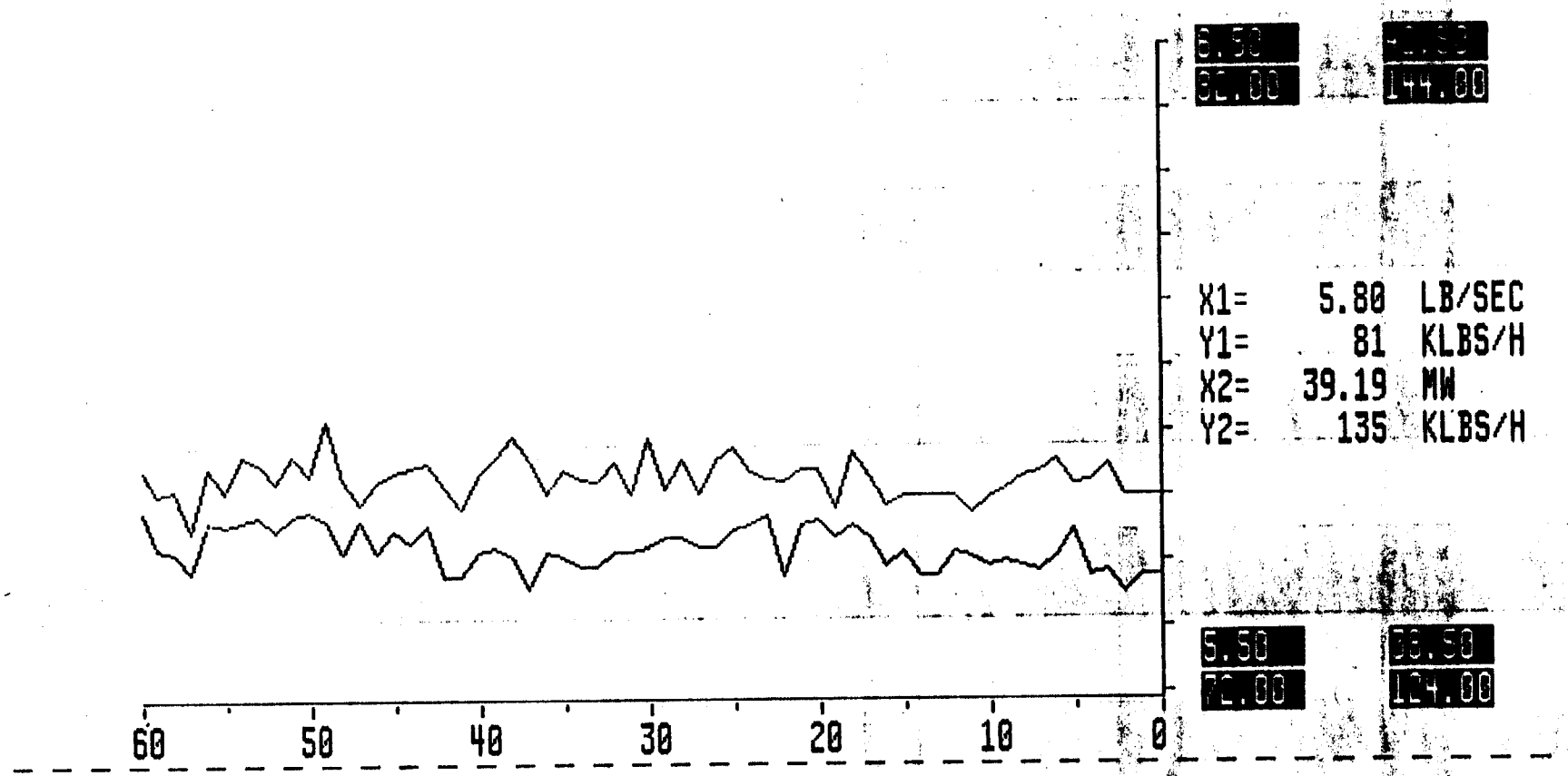
COPY IN PROGRESS

MAINSCREEN: 1252 VER: 100 SUBSCREEN: 11 VER: 102 WINDOW: 0 VER: 0
DATE: 03/04/93 TIME: 11:29:06

04/MAR/93 60 MINUTE TREND 11:29:06

X1:FQT TOTAL FUEL FLOW (GAS) X2:DW GENERATOR LOAD

Y1:FY205KLB CALC STEAM FLOW TO WHITTIER Y2:FY206KLB CALC STEAM FLOW TO SANTA FE

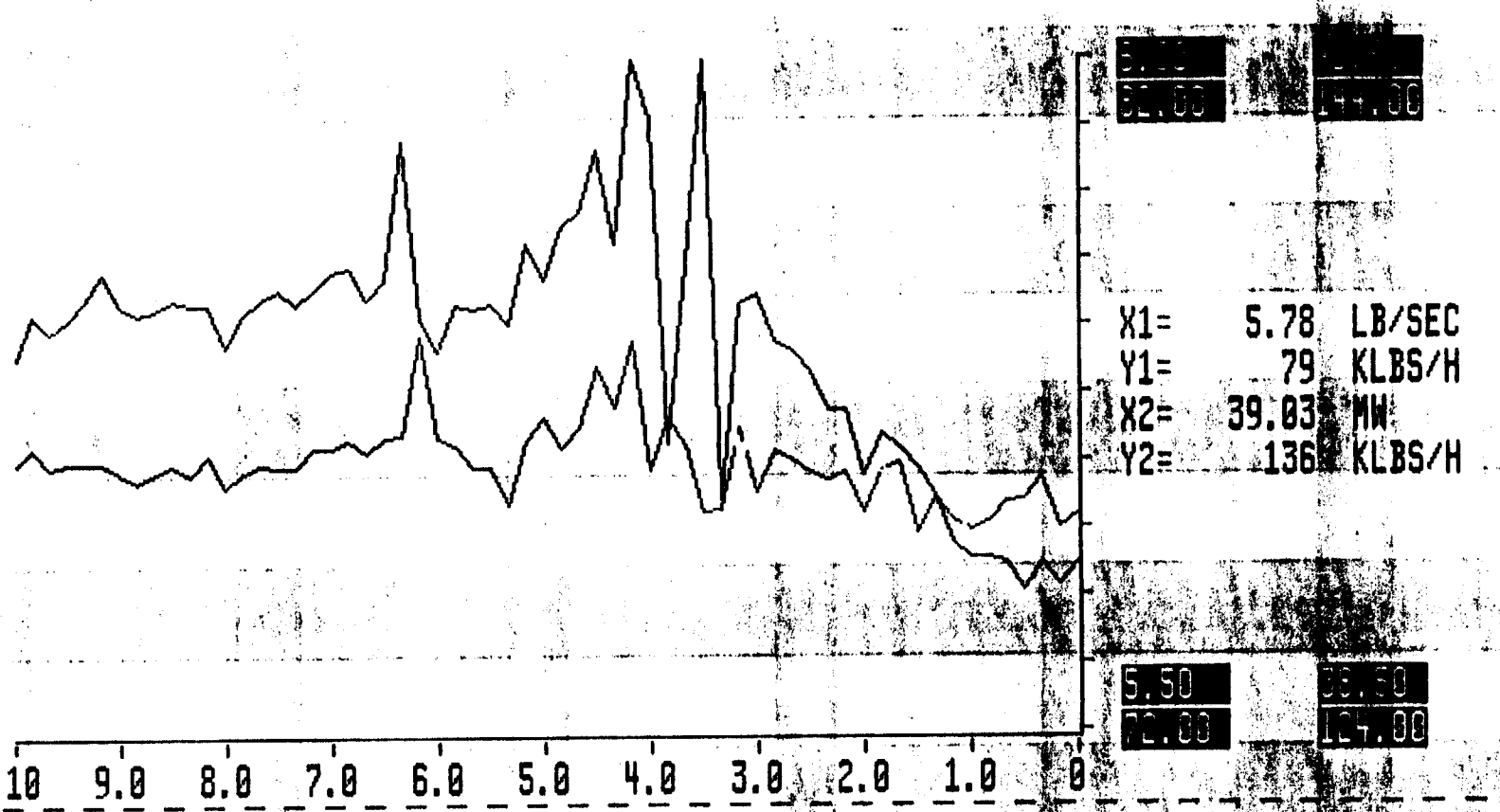


COPY IN PROGRESS

MAINSCREEN: 1257 VER: 100 SUBSCREEN: 11 VER: 102 WINDOW: 0 VER: 0
DATE: 03/04/93 TIME: 11:29:22

04/MAR/93 10 HOUR TREND 11:29:21

X1:FQT TOTAL FUEL FLOW (GAS) X2:DW GENERATOR LOAD
Y1:FY205KLB CALC STEAM FLOW TO WHITTIER Y2:FY206KLB CALC STEAM FLOW TO SANTA FE



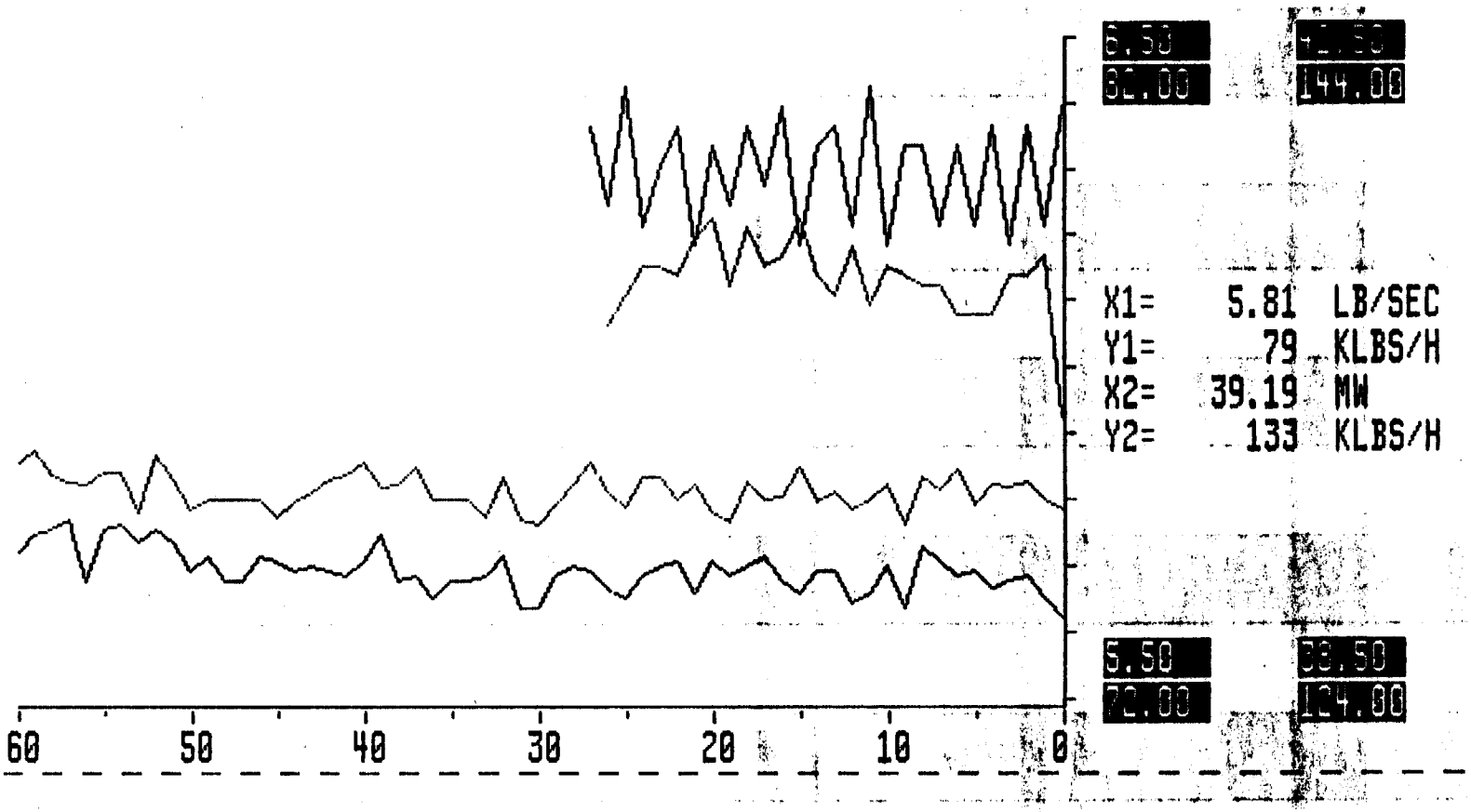
COPY IN PROGRESS

MAINSCREEN: 1252 VER: 100 SUBSCREEN: 11 VER: 102 WINDOW: 0 VER: 0
DATE: 03/04/93 TIME: 12:05:23

04/MAR/93 60 MINUTE TREND 12:05:23

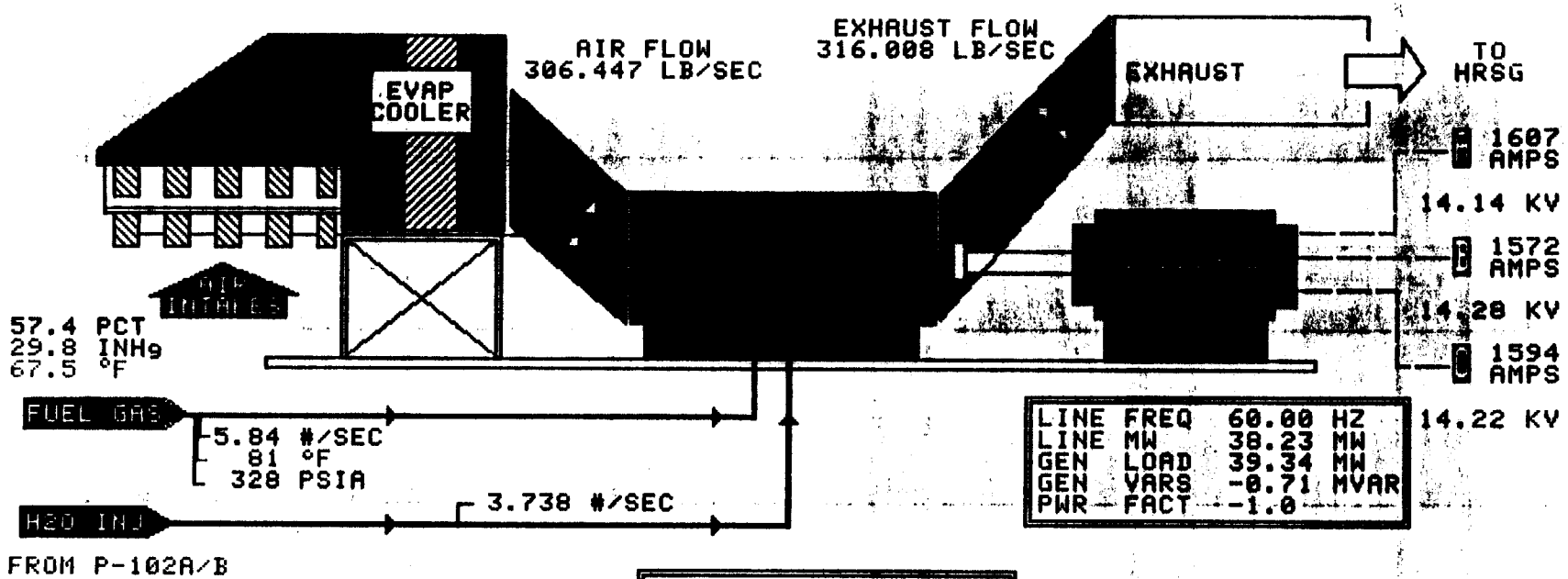
X1:FQT TOTAL FUEL FLOW (GAS) X2:DW GENERATOR LOAD

Y1:FY205KLB CALC STEAM FLOW TO WHITTIER Y2:FY206KLB CALC STEAM FLOW TO SANTA FE



MAINSCREEN: 2001 VER: 0 SUBSCREEN: 299 VER: 100 WINDOW: 0 VER: 0
DATE: 03/04/93 TIME: 12:05:37

TURBINE/GENERATOR



LINE FREQ	60.00	HZ
LINE MW	38.23	MW
GEN LOAD	39.34	MW
GEN VARS	-0.71	MVAR
PWR FACT	-1.0	

T/G TEMPERATURES		
INLET FLG.	63	°F
DISCH TEMP	666	°F
LUBE SYST	135	°F
EXHAUST	1008	°F

TOTAL FIRED HRS	11176.7
FIRED STARTS	37
PEAK FIRED HRS	0

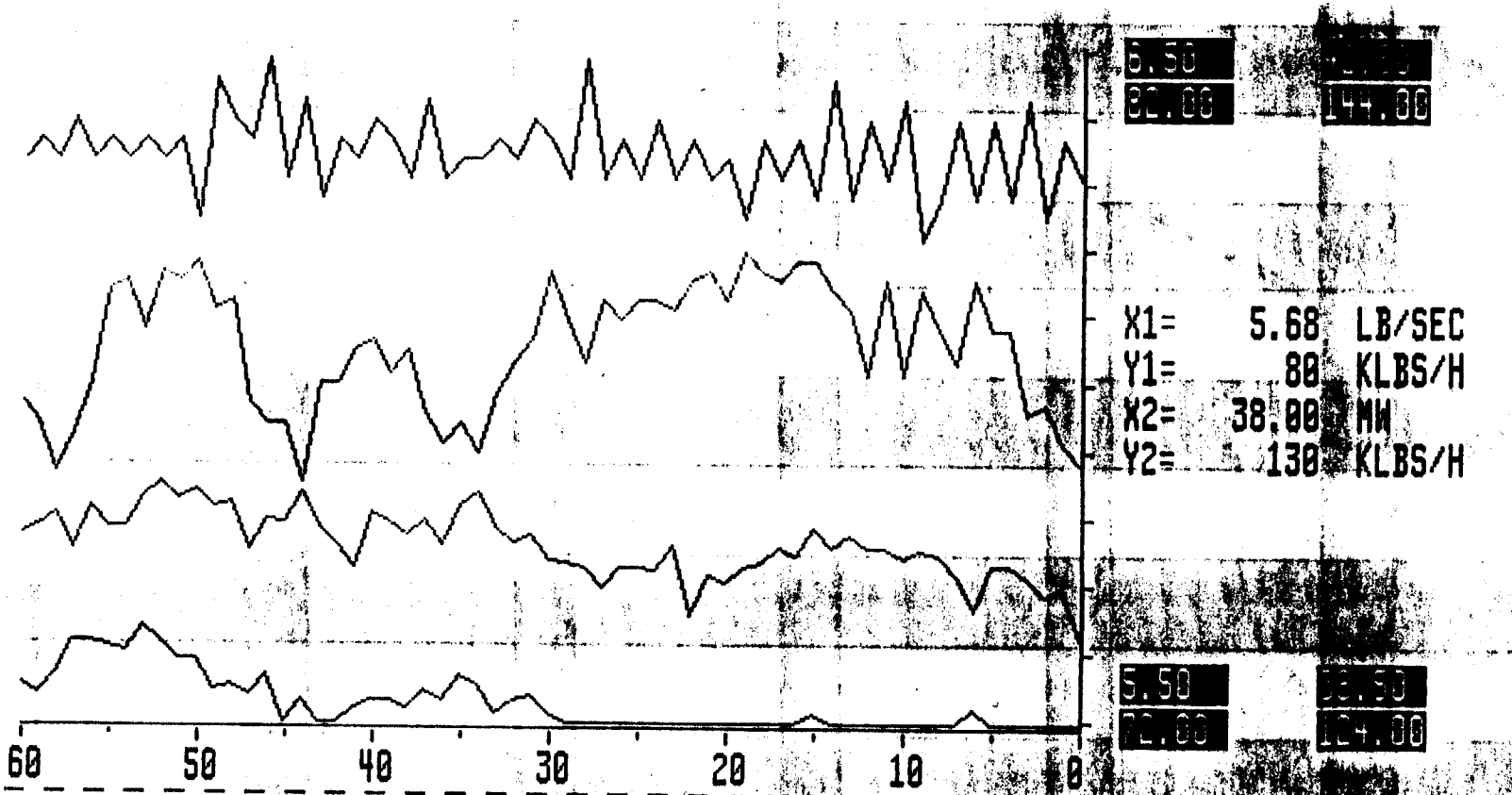
VIBRATION (MAX SELECT)	0.32 IN/S
IGV ANGLE	84 DEG

MAINSCREEN: 1252 VER: 100 SUBSCREEN: 11 VER: 102 WINDOW: 0 VER: 0
DATE: 03/04/93 TIME: 13:37:06

04/MAR/93 60 MINUTE TREND 13:37:05

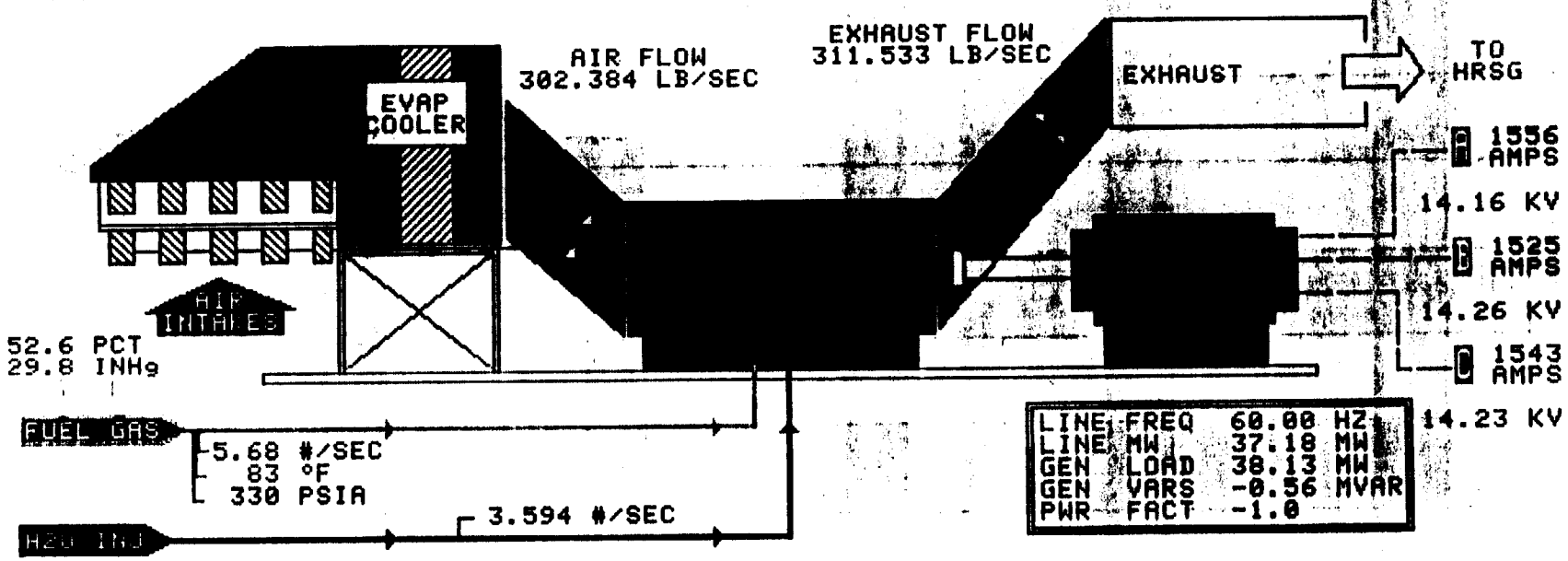
X1:FQT TOTAL FUEL FLOW (GAS) X2:DW GENERATOR LOAD

Y1:FY205KLB CALC STEAM FLOW TO WHITTIER Y2:FY206KLB CALC STEAM FLOW TO SANTA FE



MAINSCREEN: 2001 VER: 0 SUBSCREEN: 299 VER: 100 WINDOW: 0 VER: 0
DATE: 03/04/93 TIME: 13:37:38

TURBINE/GENERATOR



LINE FREQ	60.00	HZ
LINE MW	37.18	MW
GEN LOAD	38.13	MW
GEN VARS	-0.56	MVAR
PWR FACT	-1.0	

T/G TEMPERATURES		
INLET FLG.	69	°F
DISCH TEMP	673	°F
LUBE SYST	137	°F
EXHAUST	1012	°F

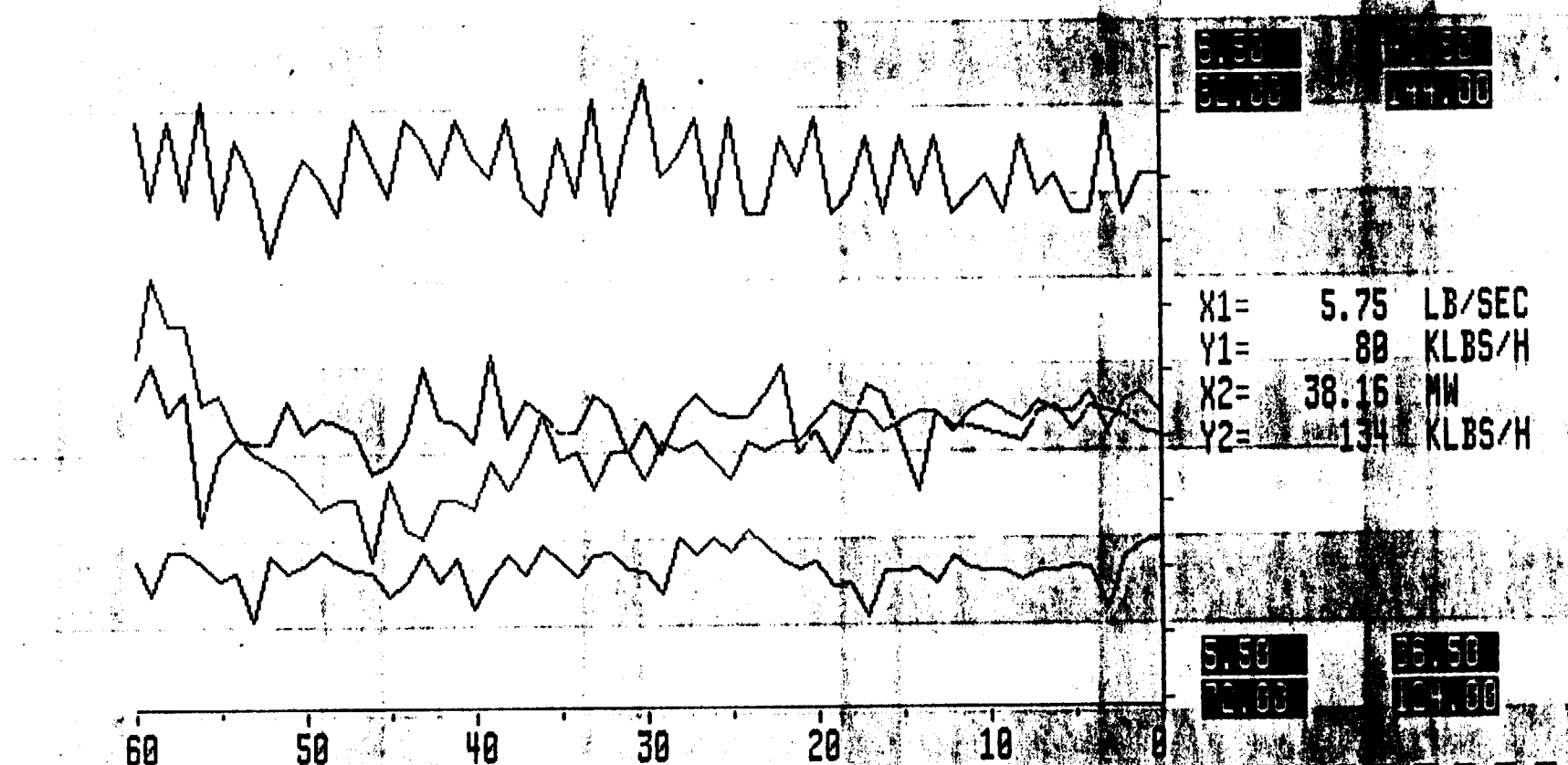
TOTAL FIRED HRS	11178.3	
FIRED STARTS	37	
PEAK FIRED HRS	0	

VIBRATION (MAX SELECT)	0.31	IN/S
IGV ANGLE	84	DEG

COPY IN PROGRESS

MAINSCREEN: 1252 VER: 100 SUBSCREEN: 11 VER: 102 WINDOW: 0 VER: 0
DATE: 03/04/93 TIME: 14:30:20

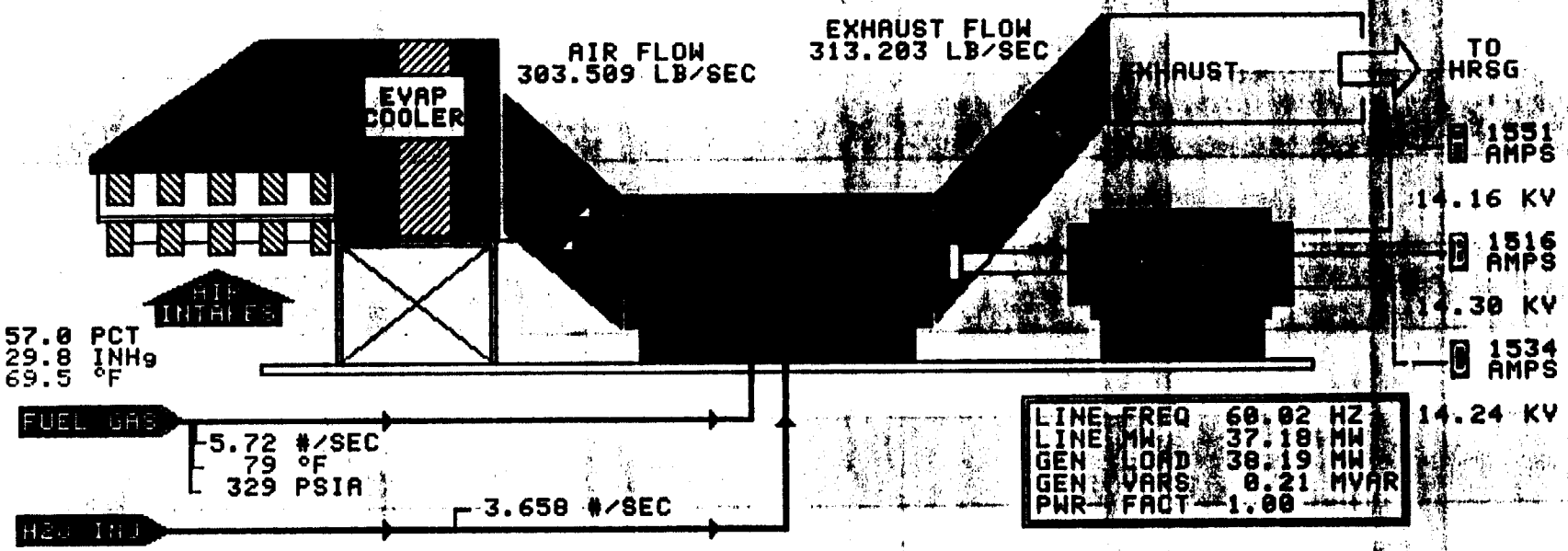
04/MAR/93 60 MINUTE TREND 14:30:20
X1:FQT TOTAL FUEL FLOW (GAS) X2:DW GENERATOR LOAD
Y1:FY205KLB CALC STEAM FLOW TO WHITTIER Y2:FY206KLB CALC STEAM FLOW TO SANTA FE



COPY IN PROGRESS

MAINSCREEN: 2001 VER: 0 SUBSCREEN: 299 VER: 100 WINDOW: 0 VER: 0
DATE: 03/04/93 TIME: 14:30:48

TURBINE/GENERATOR



LINE FREQ	60.02 HZ
LINE MW	37.18 MW
GEN LOAD	38.19 MW
GEN MVARS	0.21 MVAR
PWR FACT	1.00

T/G TEMPERATURES	
INLET FLG.	67 °F
DISCH TEMP	672 °F
LUBE SYST	131 °F
EXHAUST	1011 °F

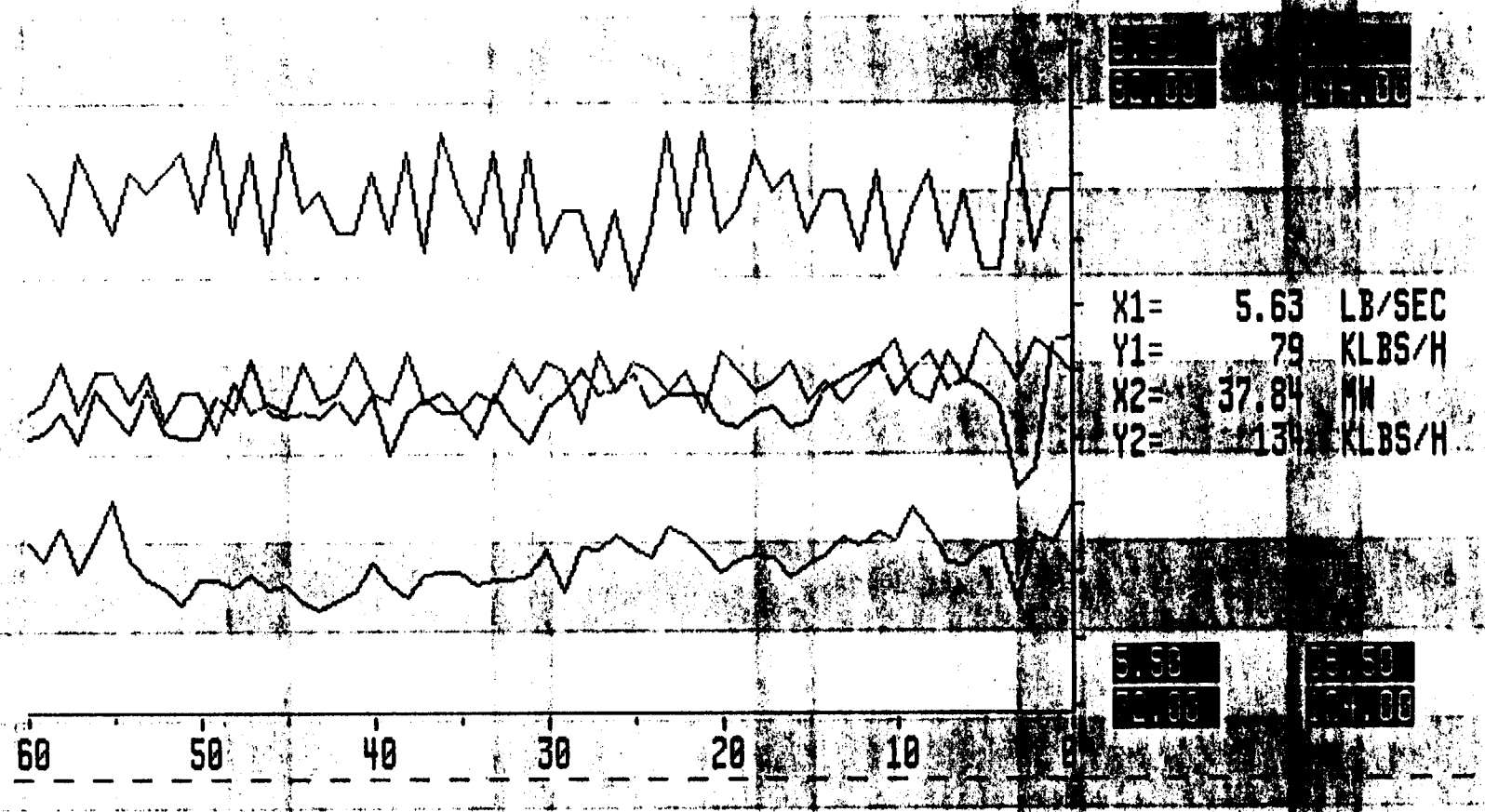
TOTAL FIRED HRS	11179.2
FIRED STARTS	37
PEAK FIRED HRS	0

VIBRATION (MAX SELECT)	0.30 IN/S
IGV ANGLE	84 DEG

COPY IN PROGRESS

MAINSCREEN: 1252 VER: 100 SUBSCREEN: 11 VER: 102 WINDOW: 0 VER: 0
DATE: 03/04/93 TIME: 15:30:36

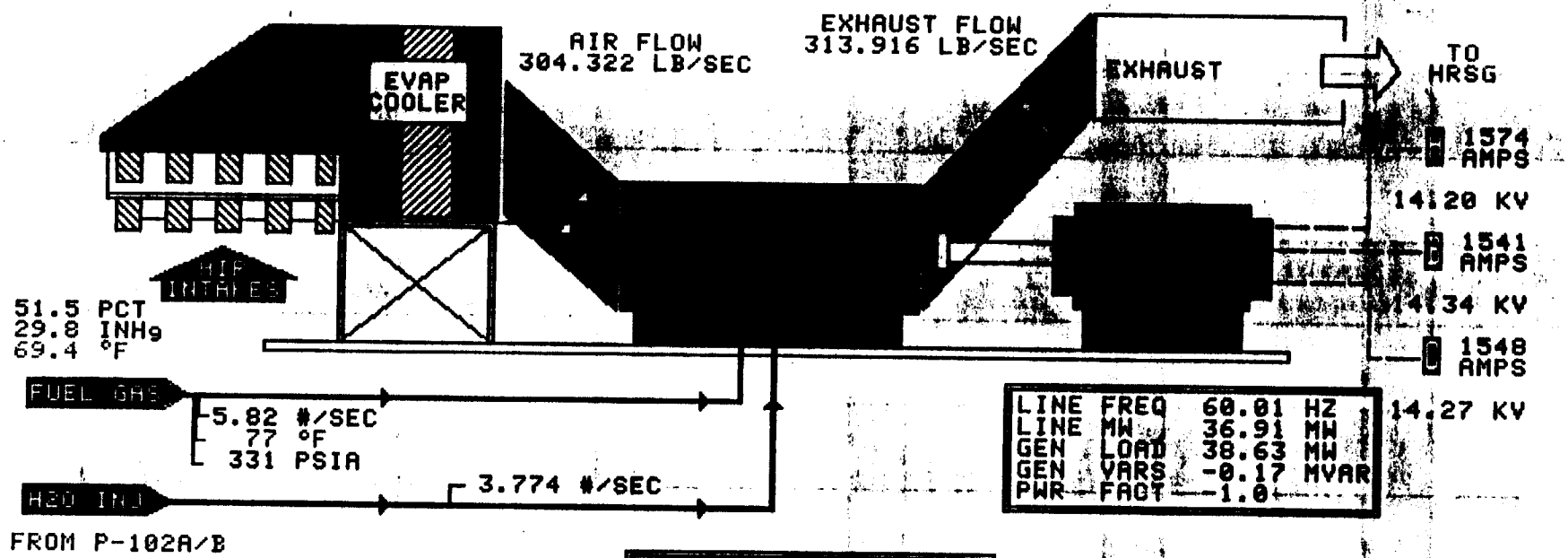
04/MAR/93 60 MINUTE TREND 15:30:36
X1:FQT TOTAL FUEL FLOW (GAS) X2:DW GENERATOR LOAD
Y1:FY205KLB CALC STEAM FLOW TO WHITTIER Y2:FY206KLB CALC STEAM FLOW TO SANTA FE



COPY IN PROGRESS

MAINSCREEN: 2001 VER: 0 SUBSCREEN: 299 VER: 100 WINDOW: 0 VER: 0
DATE: 03/04/93 TIME: 15:31:32

TURBINE/GENERATOR



LINE FREQ	60.01 HZ
LINE MW	36.91 MW
GEN LOAD	38.63 MW
GEN VARS	-0.17 MVAR
PWR FACT	-1.0

T/G TEMPERATURES	
INLET FLG.	66 °F
DISCH TEMP	671 °F
LUBE SYST	127 °F
EXHAUST	1013 °F

TOTAL FIRED HRS	11180.2
FIRED STARTS	37
PEAK FIRED HRS	0

VIBRATION (MAX SELECT)	0.29 IN/S
IGV ANGLE	84 DEG

COPY IN PROGRESS