

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

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Crystal Geyser Water Company
1233 East California Avenue
Bakersfield, California 93304

BOILER #1

Prepared by
Steiner Environmental, Inc.
4930 Boylan Street
Bakersfield, California 93308

INITIAL COMPLIANCE TEST

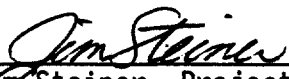
February 26, 1993

San Joaquin Valley Unified APCD Number S-0798-0001-01

Report PS-93-3042/Project 7305-93

Test Team Leader: Jim McSweeney

Approved by :


Jim Steiner, Project Manager
March 9, 1993

SUMMARY OF SOURCE TEST RESULTS

Company : CRYSTAL GEYSER WATER CO. Test Date: FEB 26, 1993 APCD No.: S-0798-0001-01 Unit No. : BOILER #1
SOURCE

POLLUTANT	INLET		OUTLET		Removal Percent	Emission Factor Outlet
	Concentration	Mass Flow Rate	Concentration	Mass Flow Rate		
	gr/scf @12% CO2	ppm(v)	gr/scf @12% CO2	ppm(v) @O2 CORR*	lb/hr	lb/MMBtu as Sulfur
Particulate						
avg.						
Sulfate						
avg.						
SO2 (wet)						
avg.						
NOx as NO2 (dry)						
avg.						
HC (> C1)						
avg.						
CO						
avg.						
avg.						
Scrubber Liquor Analysis :	Chlorides -		Specific Gravity -			
For Kern County Use Only						

Comments : 3.0 % O2 correction.

APCD 3/6

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SECTION 1

INTRODUCTION

At the request of Triple S Manufacturing Company, on behalf of the Crystal Geyser Water Company, Steiner Environmental, Inc. conducted a series of emission measurements on the effluent of an existing boiler serving the Crystal Geyser Water Company (SJVUAPCD S-0798-0001-01) located in Bakersfield, California. These tests were conducted on February 26, 1993. The purpose of these tests was to determine compliance with SJVUAPCD Rules and Regulations.

Crystal Geyser owns and operates a small natural gas fired boiler rated at 10.5 MMBtu/hr at its plant in Bakersfield, California. This unit has no NO_x controls.

Triplicate 30-minute tests were conducted for NO_x, CO, CO₂ and O₂ using CARB Method 1-100. A sample of the natural gas fired in the boiler was collected and analyzed for CHNOS, specific gravity, moisture and Btu using ASTM Methods.

Messrs. Charles Reshard and Jim McSweeney of Steiner Environmental conducted these tests. Mr. David Hurley of Triple S Manufacturing was present to observe the testing. Mr. Greg LaFlore with the SJVUAPCD was present to observe the test program.

SECTION 2
WET METHOD DATA SUMMARIES

G. CONTINUOUS MONITOR DATA

CRYSTAL GEYSER WATER CO
BOILER #1

Date : 2/26/93

3 % O2 Correction

Nitrogen Dioxide

Run #	% O2	Corrected ppm (dry)	Corrected ppm (dry) @O2 Corr.*	lb/hr
1	1.28	75.34	68.74	
2	1.29	75.20	68.66	
3	1.30	75.84	69.25	
Average	1.29	75.46	68.88	

Sulfur Dioxide

Run #	ppm (wet)	ppm (dry)	lb/hr
1			
2			
3			
Average			

Carbon Monoxide

Run #	Corrected ppm (dry)	lb/hr
1	0.34	
2	0.44	
3	0.33	
Average	0.37	

SECTION 3

WET TEST METHOD CALCULATIONS

(Not Applicable to this report)

SECTION 4
CONTINUOUS METHODS DATA

A. CALIBRATION AND CORRECTION DATA

Company : CRYSTAL GEYSER WATER CO Date : 2/26/93
 Station : BOILER #1 Test Run : 1
 Test Condition:

Concentration : Drift Uncorrected (A) / Corrected (B)											
Point #	%O2		%CO2		ppm CO		ppm SO2		ppm NOx		
	A	B	A	B	A	B	A	B	A	B	
1	1.33	1.32	11.04	11.08	0.40	0.40			75.10	75.08	
2	1.28	1.24	10.96	11.08	0.30	0.30			75.60	75.55	
3	1.34	1.28	11.16	11.37	0.30	0.31			75.50	75.41	
MEAN		1.28		11.18		0.34					75.34

	%O2		%CO2		ppm CO		ppm SO2		ppm NOx		
Zero Check		0.01		0.00		0.00					1.40
Span Check		4.21		7.85		199.00					81.90
Cal. Gas		4.00		8.03		203.00					81.90
Scf		0.01667		-0.00747		-0.00657					-0.00570
Zcf		0.00333		0.00000		0.00000					0.46667

Scf, Span Drift Correction Factor = (% Drift / 100) / # of Readings
 Zcf, Zero Drift Correction Factor = Zero Drift / # of Readings
 Cz, Zero Corr. Concentration = measured value - [Zcf x (Point # - 0.5)]
 B, Corrected Concentration = Cz / [1 + (Scf x (Point # - 0.5))]

A. CALIBRATION AND CORRECTION DATA

Company : CRYSTAL GEYSER WATER CO Date : 2/26/93
 Station : BOILER #1 Test Run : 2
 Test Condition:

Concentration : Drift Uncorrected (A) / Corrected (B)											
Point #	%O2		%CO2		ppm CO		ppm SO2		ppm NOx		
	A	B	A	B	A	B	A	B	A	B	
1	1.29	1.29	11.26	11.30	0.30	0.30			75.20	75.15	
2	1.29	1.29	11.22	11.33	0.30	0.30			75.30	75.16	
3	1.30	1.30	11.12	11.30	0.70	0.72			75.50	75.27	
MEAN	1.29		11.31		0.44						75.20

Concentration : Drift Uncorrected (A) / Corrected (B)											
Point #	%O2		%CO2		ppm CO		ppm SO2		ppm NOx		
	A	B	A	B	A	B	A	B	A	B	
Zero Check	0.00		0.00		0.00				0.00		
Span Check	3.99		7.88		197.00				82.20		
Cal. Gas	4.00		8.03		203.00				81.90		
Scf	-0.00083		-0.00623		-0.00985				0.00122		
Zcf	0.00000		0.00000		0.00000				0.00000		

Scf, Span Drift Correction Factor = (% Drift / 100) / # of Readings
 Zcf, Zero Drift Correction Factor = Zero Drift / # of Readings
 Cz, Zero Corr. Concentration = measured value - [Zcf x (Point # - 0.5)]
 B, Corrected Concentration = Cz / [1 + (Scf x (Point # - 0.5))]

A. CALIBRATION AND CORRECTION DATA

Company : CRYSTAL GEYSER WATER CO Date : 2/26/93
 Station : BOILER #1 Test Run : 3
 Test Condition:

Concentration : Drift Uncorrected (A) / Corrected (B)										
Point #	%O2		%CO2		ppm CO		ppm SO2		ppm NOx	
	A	B	A	B	A	B	A	B	A	B
1	1.29	1.29	11.24	11.22	0.30				75.50	75.50
2	1.30	1.31	11.30	11.23	0.30				75.90	75.90
3	1.28	1.29	11.26	11.15	0.40				76.10	76.11
MEAN		1.30		11.20	0.33					75.84

	%O2		%CO2		ppm CO		ppm SO2		ppm NOx	
	A	B	A	B	A	B	A	B	A	B
Zero Check		0.00		-0.02		0.00				-0.10
Span Check		3.96		8.12		203.00				81.90
Cal. Gas		4.00		8.03		203.00				81.90
Scf		-0.00333		0.00457						0.00041
Zcf		0.00000		-0.00667						-0.03333

Scf, Span Drift Correction Factor = (% Drift / 100) / # of Readings
 Zcf, Zero Drift Correction Factor = Zero Drift / # of Readings
 Cz, Zero Corr. Concentration = measured value - [Zcf x (Point # - 0.5)]
 B, Corrected Concentration = Cz / [1 + (Scf x (Point # - 0.5))]

B. ZERO AND SPAN DRIFT PERCENT CALCULATIONS

Company : CRYSTAL GEYSER WATER Date : 2/26/93

Station : BOILER #1

Run 1	O2 (%)	CO2 (%)	CO (ppm)	SO2 (ppm)	NOx (ppm)
Initial Span	4.00	8.03	203.00		81.90
Measured Span	4.21	7.85	199.00		81.90
Zero Drift	0.01	0.00	0.00		1.40
Final, Actual Span	4.20	7.85	199.00		80.50
Percent Drift	5.0	-2.2	-2.0		-1.7
*****	*****	*****	*****	*****	*****
Run 2	O2 (%)	CO2 (%)	CO (ppm)	SO2 (ppm)	NOx (ppm)
Initial Span	4.00	8.03	203.00		81.90
Measured Span	3.99	7.88	197.00		82.20
Zero Drift	0.00	0.00	0.00		0.00
Final, Actual Span	3.99	7.88	197.00		82.20
Percent Drift	-0.2	-1.9	-3.0		0.4
*****	*****	*****	*****	*****	*****
Run 3	O2 (%)	CO2 (%)	CO (ppm)	SO2 (ppm)	NOx (ppm)
Initial Span	4.00	8.03	203.00		81.90
Measured Span	3.96	8.12	203.00		81.90
Zero Drift	0.00	-0.02	0.00		-0.10
Final, Actual Span	3.96	8.14	203.00		82.00
Percent Drift	-1.0	1.4	0.0		0.1

Final, Actual Span = Measured Span - Zero Drift

Percent Drift = (Final, Actual Span - Initial Span) / Initial Span x 100

EMISSION RATE CALCULATIONS

PLANT : CRYSTAL GEYSER WATER CO
SOURCE : BOILER #1

Temp. Std. : 60 dF
Press. Std.: 29.92 in. Hg. 3 % O2 Correction

Run No.	1	2	3	AVERAGE
Date	2/26/93	2/26/93	2/26/93	
Oxygen (%)	1.28	1.29	1.30	1.29
Qs(std), dscfm				
NOx, ppm	75.34	75.20	75.84	75.46
SO2, ppm				
CO, ppm	0.34	0.44	0.33	0.37
HC, ppm				
F-Factor	8487.88	8487.88	8487.88	8487.88

NOx, MW = 46.005

NOx, lb/hr

NOx, ppm @ O2	68.74	68.66	69.25	68.88
NOx, lb/MMBtu	0.0826	0.0825	0.0832	0.0828

SO2, MW = 64.058

SO2, lb/hr

SO2, ppm @ O2

SO2, lb/MMBtu

CO, MW = 28.010

CO, lb/hr

CO, ppm @ O2	0.31	0.40	0.30	0.34
CO, lb/MMBtu	0.0002	0.0003	0.0002	0.0002

HC, MW = 16.043

HC, lb/hr

HC, ppm @ O2

HC, lb/MMBtu

$$* \text{ lb/hr} = 8.223\text{E-}5 \times Qs(\text{std}) \times MW \times \text{ppm} / (T_{\text{std}} + 460)$$

$$* \text{ ppm @ O2} = \text{ppm measured} \times [(20.9 - \text{O2\% correction}) / (20.9 - \text{\%O2 measured})]$$

$$* \text{ lb/MMBtu} = F\text{-Factor} \times MW \times [1.3711\text{E-}6 / (T_{\text{std}} + 460)] \times [20.9 / (20.9 - \text{O2\%})] \times \text{ppm}$$

$$* \text{ lb/Bbl} = (\text{lb/MMBtu}) \times (\text{MMBtu/Bbl})$$

SECTION 5

ANALYSIS PROCEDURES

This section of the report describes the procedures used to analyze the samples collected during the test program. Pacific Gas Technology performed the gas analysis.

5.1 FUEL

A sample of the fuel fired during this test program was collected and sent to Pacific Gas Technology for analysis. Analysis was performed by PGT in accordance with EPA Title 40 Section 60.45. The specific procedures are itemized in Table 5-1. The results appear at the end of this section.

TABLE 5-1. FUEL ANALYSIS METHODS
LABORATORY TEST PROCEDURES FOR FUEL OILS AND FUEL GASES

Reference: EPA Title 40, Section 60.45

FUEL OIL TESTS:

Sediment and Water, Vol. %	ASTM D4007-81
Gravity by Hydrometer (API)	ASTM D1298-80
API Gravity Corrected to 60°F	ASTM Table 5A
Gross Calorific Value (Btu/lb)	ASTM D2015-77
Ultimate Analysis (C, H, O, N, S, wt. %)	
Carbon, Hydrogen	ASTM D3178-73
Nitrogen (chemiluminescence detector)	ASTM D3431-80
Sulfur	ASTM D2622-82
Ash	ASTM D482
Oxygen	ASTM D3176-74

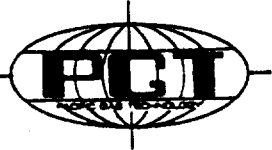
GASEOUS FUELS BY GAS-LIQUID CHROMATOGRAPHY:

Gas Analysis	ASTM D1945-81
Sulfur Analysis	CPA B16
Calculation of Gross Calorific Value	ASTM D3588-81
Component Weight %, F-factor calculations	EPA 40:60.45

PROCEDURES FOR SCRUBBER LIQUOR ANALYSIS:

Specific Gravity	ASTM D1429
Chlorides	ASTM D512-67

PACIFIC GAS TECHNOLOGY

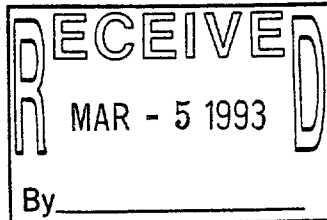


2122 Q Street
Bakersfield, California 93301
805/324-1317
Fax: 805/324-2746

GAS ANALYSIS BY CHROMATOGRAPH

STEINER ENVIRONMENTAL, INC
4930 Boylan Street
Bakersfield, CA 93308

Attention: Jim Steiner



SAMPLED: 26-Feb-93

SUBMITTED: 1-Mar-93

REPORTED: 3-Mar-93

LAB # 6038-6

Sample ID : CHRYSTAL GEYSER
BOILER #1
NATURAL GAS

STEINER ID # 33807

ANALYZED GAS

	MOLE %	WT %	CHONS WT %
OXYGEN	0.06	0.11	CARBON 72.66
NITROGEN	0.70	1.15	HYDROGEN 23.66
CARBON DIOXIDE	1.28	3.32	OXYGEN 2.52
HYDROGEN	ND	0.00	NITROGEN 1.15
CARBON MONOXIDE	ND	0.00	SULFUR 0.00
HYDROGEN SULFIDE	ND	0.00	
METHANE	95.32	90.01	
ETHANE	2.03	3.59	
PROPANE	0.45	1.17	
iso-BUTANE	0.04	0.14	
n-BUTANE	0.05	0.17	
iso-PENTANE	0.01	0.04	
n-PENTANE	0.01	0.04	
HEXANE +	0.05	0.25	
TOTAL:	100.00		

SPECIFIC GRAVITY * : 0.587

SPECIFIC VOLUME : 22.42 cu ft/lb

HYDROGEN SULFIDE : ppm (GC/FPD)
STEINER ID # :

TOTAL * DRY : 1016
BTU/cu ft

NET * DRY : 915
BTU/cu ft

WET : 998

WET : 899

BTU/lb : 22776

BTU/lb : 20519

* CALCULATED ACCORDING TO : ASTM D-3588

SECTION 6

SAMPLING PROCEDURES

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

6.1 SAMPLING PROCEDURES FOR CONTINUOUS MONITORING

The continuous monitors used in the Steiner Environmental Mobile Monitoring Lab are shown in Table 6-1. Figure 6-1 is a schematic of the continuous monitoring system. The procedures used to continuously monitor stack gases for NO_x , O_2 , CO and CO_2 strictly follow CARB Method 1-100.

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

TABLE 6-1. CONTINUOUS MONITORING LAB - TRAILERS 1, 2 AND 4

NO_x CHEMILUMINESCENT ANALYZER - THERMO ELECTRON MODEL 10

Response Time (0-90%)	1.5 sec -- NO mode; 1.7 sec -- NO _x mode
Zero Drift	Negligible after 1/2 hour warmup
Linearity	±1% of full scale
Accuracy	Derived from the NO or NO ₂ calibration gas, ±1% of full scale
Output	0-10 V
Operating Ranges	0-2, 10, 25, 100, 250, 1000, 2500 and 10,000 ppm
Flowrate = 2 scfh	0-2.5

O₂ ANALYZER, FUEL TYPE - TELEDYNE MODEL 326

Response Time (0-90%)	60 seconds
Accuracy	±1% of scale at constant temperatures; ±1% of scale of ±5% of reading, whichever is greater, over the operating temperature range
Output	0-1 V
Operating Ranges	0-5%, 10%, 25% O ₂
Flowrate	2 scfh

CO₂/CO INFRARED ANALYZER - ANARAD MODEL AR-600

Response Time (0-90%)	5 seconds
Zero Drift	±1%
Span Drift	±1%
Linearity	1%
Resolution	Less than 1% of full scale
Output	0-1 V
Operating Ranges	0-20% CO ₂ /0-10,000 ppm CO
Flowrate	1000 cc/min

CO GAS FILTER CORRELATION - THERMO ELECTRON MODEL 48

Response Time (0-95%)	1 minute
Zero Drift	±0.2 ppm CO
Span Drift	Less than 1% full scale in 24 hours
Linearity	±1% full scale, all ranges
Accuracy	±0.1 ppm CO
Output	0-10 V
Operating Ranges	1, 2, 5, 10, 20, 50, 100, 200, 500, 1000 ppm
Flowrate	.5 - 2 lpm

SO₂ UV ANALYZER - DUPONT MODEL 400

Response Time (0-90%)	Less than 60 seconds
Zero Drift	Less than 2% full scale in 24 hours
Linearity	±1% full scale
Accuracy	±2% full scale
Output	0-5 V
Operating Ranges	0-100 ppm, 1-1000 ppm
Flowrate	500 - 1500 cc/min

STRIP CHART RECORDERS (3) - LINSEIS 7025

Pen Response	0.35 seconds Full Scale
Input Spans	1, 2, 5, 10, 20, 50, 100 MV
Zero Set	Stable across entire chart-width ±100%
Accuracy	.35% of Span
Dead Band	.15% of Span
Linearity	.25% of Span
Chart Speed	1, 2, 5, 10, 20, 50, 100 cm/min; 1, 2, 5, 10, 20, 50 cm/hr; fast advance 100 cm/min; LED indicator; forward and reverse selector
Recording Pen	Fiber tip pen
Chart Width	250 mm

SCOTSMAN TRAILER

Fully Insulated	Air Conditioned -- 8 feet x 14 feet x 11 feet
-----------------	---

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

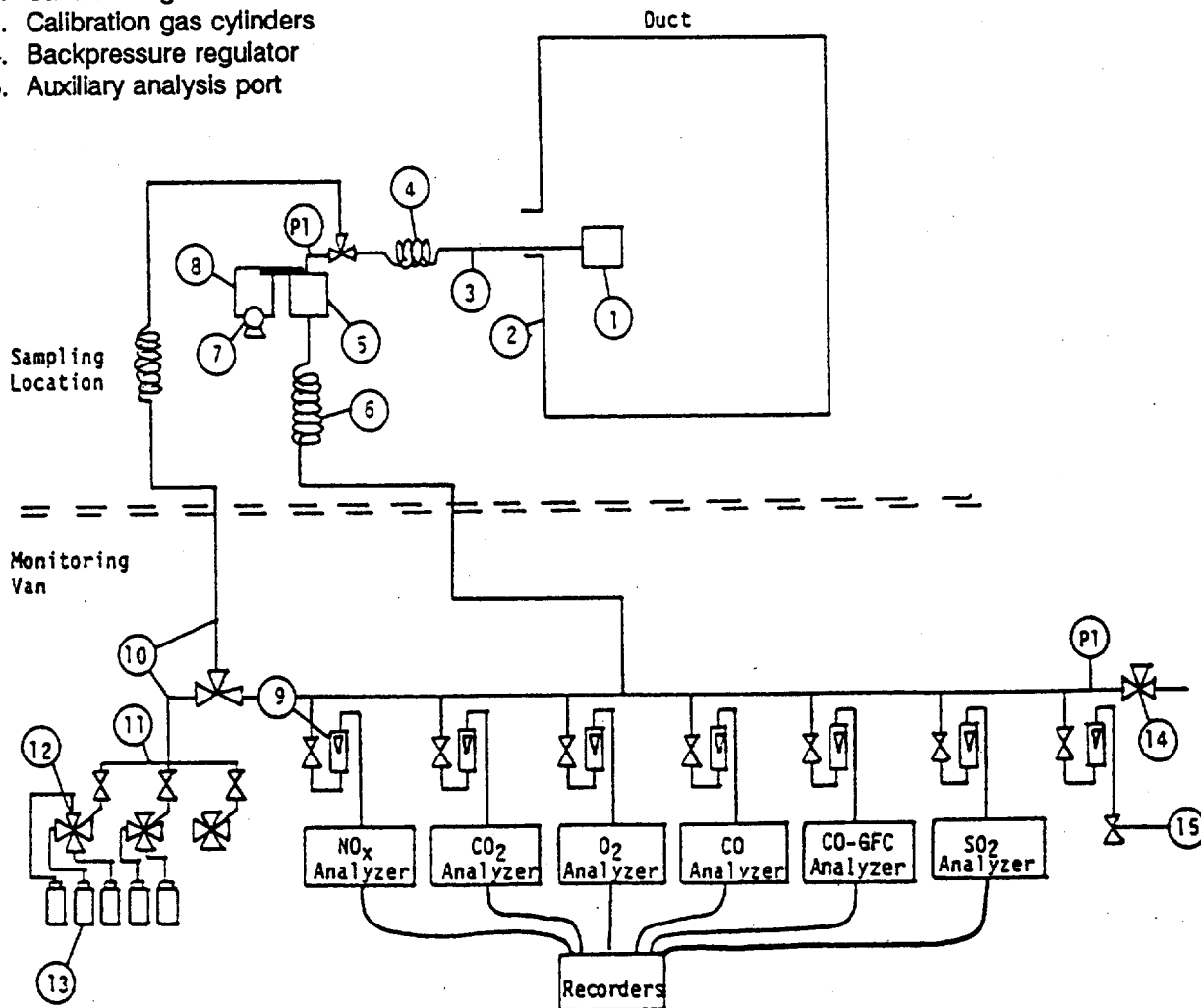


FIGURE 6-1. SCHEMATIC OF CONTINUOUS MONITORING SYSTEM

Calibrations of the continuous analyzers were performed using EPA Protocol 1 calibration gases ($\pm 1\%$) for NO_x and NBS certified calibration gases ($\pm 1\%$) for CO , CO_2 and O_2 . Copies of the gas certifications are included in the Quality Assurance Section of this report. All pertinent data (date, time, test locations, analyzer range, cal gas value) were recorded on both the field data sheets and continuous analyzer strip charts in the field.

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

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

An external calibration of the sampling system was performed at the start of a test day. EPA Protocol 1 gas was flowed through the entire sampling system from the probe tip. The response of the analyzers had to be within $\pm 5\%$ of the certified tank value before testing could proceed. An external calibration was also performed at the end of each test day.

Test data were collected by recording 10-minute averages from the strip chart recordings onto the field data sheets. Data collected over

the test period were averaged and reported. A fuel analysis was used to calculate the F-factor, dscf/MMBtu corrected to zero percent O₂ (standard conditions 60°F, 29.92 inches Mercury), as described in 40 CFR 60.45. The pollutant concentration and the F-factor were used to calculate an emission factor in lb/MMBtu.

SECTION 7

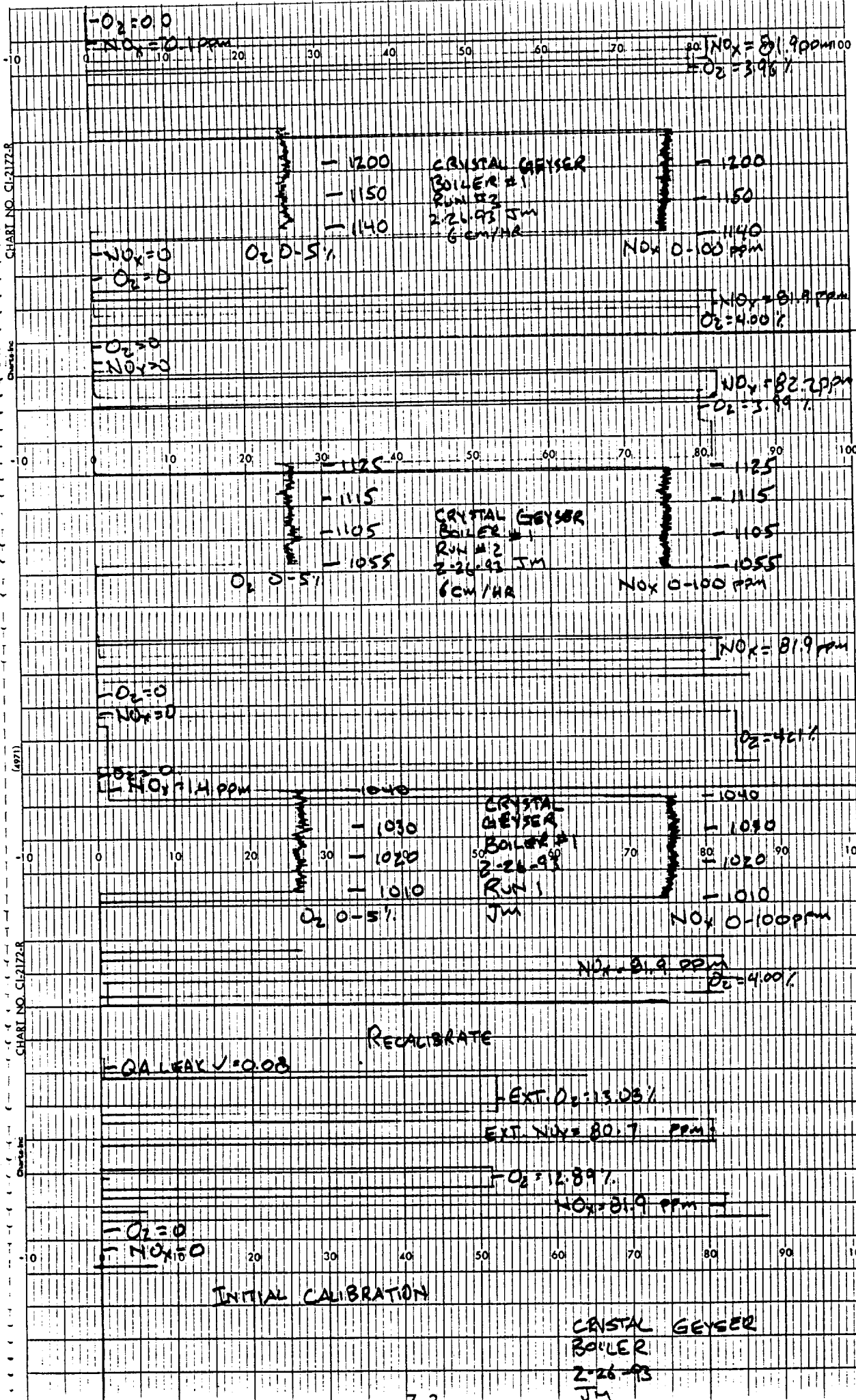
RAW DATA

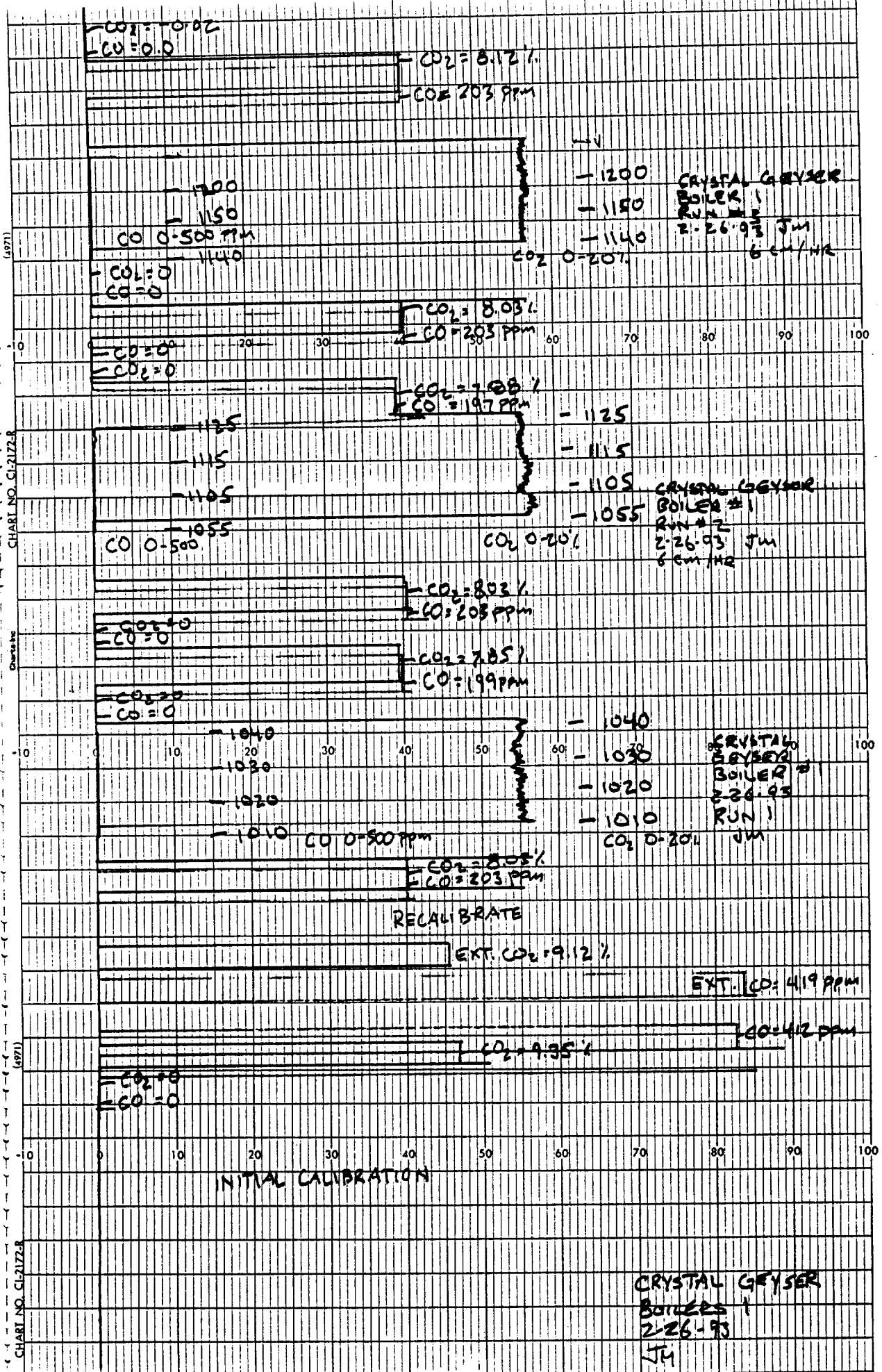
CONTINUOUS MONITOR DATA SHEET

Plant CRYSTAL GEYSER APCD Witness/Number _____
 Date 2/26/93 Run No. 1-3 Client Rep DAVID HURLEY
 Test Location Boiler #1 Generator Type _____
 Operator JM/CB Burner Type _____
 Fuel Type NAT. GAS Trailer No. Z O₂ Controller Type _____

[Dry Uncorrected]

Time	Sample Point	O ₂ %	CO ₂ %	CO ppm	SO ₂ ppm	NO ppm	NO _x ppm	Comments	Miscellaneous Information
		12.89	9.35	412.0			81.90	SPAN GAS VALUES	CALIBRATION GASES
		13.03	9.12	419.0			80.70	External Response	NO _x <u>CC109928</u>
		0.08						QA-LEAK ✓	SO ₂ _____
		4.00	8.03	203.0				SPAN GAS VALUES	CO _____
									CO/CO ₂ /O ₂ <u>CC88821, CC299</u>
1010		1.33	11.04	0.4			75.1	RUN 1 Boiler 1	CC106743
1020		1.28	10.96	0.3			75.6		Wet Bulb: _____ Dry Bulb: _____
1030		1.34	11.16	0.3			75.5	33807	Barometric Press: _____
								F.G. All	
1040		0.01	0.0	0.0			1.4	ZERO	RESPONSE TIME
		4.21	7.85	199.0			81.9	SPAN	Upscale: _____ Downscale: _____
1055		1.29	11.26	0.3			75.2	RUN 2	Upscale: _____ Downscale: _____
1105		1.29	11.22	0.3			75.3		Upscale: _____ Downscale: _____
1115		1.30	11.12	0.7			75.5		Upscale: _____ Downscale: _____
									PROCESS DATA
1125		0.0	0.0	0.0			0.0	ZERO	Fuel Flow: _____
		3.99	7.82	197.0			82.2	SPAN	Steam Flow: _____
									Rating: _____
1140		1.29	11.24	0.3			75.5	RUN 3	CONVERTER GAS
1150		1.30	11.30	0.3			75.9		Cal Gas Values Actual Values
1200		1.28	11.26	0.4			76.1		NO _____
									NO ₂ _____
1210		0.0	-0.02	0.0			-0.1	ZERO	Conv. Efficiency: _____
		3.96	8.12	203			81.9	SPAN	





Date: 2-26-93Test Location: CRYSTAL GEYSER
BOILERS #1 & 2

SAMPLE HANDLING/LOG-IN

NO	SAMPLE TYPE	VOLUME	COMMENTS
1	33807 <u>ASTM FG. All</u> Meth Sample Test		
2	33808 <u>ASTM FG. All</u> Meth Sample Test		
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

CHAIN-OF-CUSTODY

Signature

Date/Time

Signature

Date/Time

James Earl Gentry 2-26-93 1545

SECTION 8

QUALITY ASSURANCE

8.1 CONTINUOUS MONITORS QUALITY ASSURANCE

The NO_x analyzer is calibrated before and after each test using an EPA Protocol 1 gas ($\pm 1\%$) traceable to NBS. The CO, CO₂ and O₂ analyzers are calibrated before and after each test using a NBS certified gas mixture ($\pm 1\%$). Copies of the calibration gas certificates appear in the at the end of this section.

A sampling system check was performed at the beginning and end of each test day. This was done by introducing an EPA Protocol 1 gas at the sampling probe and measuring the system response. The purpose of this was to check the system for leaks and sample loss.

Multi-point calibration linearity checks of the continuous analyzers were performed on September 11, 1992 through October 4, 1992. These results were well within CARB limitations of $\pm 2\%$ of full scale. Tables 8-1 through 8-5 list the results of these checks.

TABLE 8-1. NO_x CALIBRATION SUMMARY

Monitoring Trailer: 2		Calibrated by: PES 9/12/92	
Analyzer:	TECO (Spare)	Calibrator Manufacturer:	EnviroNics
Model:	10 AR	Model:	201-1520
Serial Number:	9536-108-S	Serial Number:	1122
NO _x Standard:	Range 25: CC389, Range 100: CC72048, CC7204		
Concentration:	Range 25: 39.6 ppm, Range 100: 1039 ppm, 9760 ppm		
Cylinder Pressure:	Range 25: 2000 psi, Range 100: 1500 psi, 1900 psi		

NO_x CALIBRATION AND LINEARITY CHECKS

Range 0-10 ppm

Calibration Points	Flow, Dil. cc/min	Flow, Std. cc/min	NO _x out ppm	Chart ppm	% Difference +2% Full Scale
Zero	3515	0	0	0	0
80% URL	1200	302	7.96	7.98	0.20
1	1278	227	5.98	6.03	0.50
2	1353	153	4.03	4.08	0.50
3	1426	78	2.06	2.14	0.80

Range 0-25 ppm

Calibration Points	Flow, Dil. cc/min	Flow, Std. cc/min	NO _x out ppm	Chart ppm	% Difference +2% Full Scale
Zero	1510	0	0	0	0
80% URL	748	762	20.0	20.00	0
1	936	563	14.9	15.10	0.80
2	1126	376	9.9	10.20	0.80
3	1315	190	5.0	5.37	1.48

TABLE 8-1. NO_x CALIBRATION AND LINEARITY CHECKS (Concluded)

TECO Model 10-AR/Trailer #2/September 12, 1992

Range 0-100 ppm

Calibration Points	Flow, DI. cc/min	Flow, Std. cc/min	NO _x out ppm	Chart ppm	% Difference +2% Full Scale
Zero	3000	0	0	0	0
80% URL	2775	231	80.0	80.0	0
1	2832	175	60.3	59.6	- 0.70
2	2890	118	40.6	39.4	- 1.20
3	2947	61	20.1	19.7	- 0.40

Range 0-250 ppm

Calibration Points	Flow, DI. cc/min	Flow, Std. cc/min	NO _x out ppm	Chart ppm	% Difference +2% Full Scale
Zero	8000	0	0	0	0
80% URL	7861	165	200	200.0	0
1	7900	125	151	149.3	- 0.68
2	7943	84	102	97.5	- 1.80
3	7980	44	53	49.0	- 1.60

Range 0-1000 ppm

Calibration Points	Flow, DI. cc/min	Flow, Std. cc/min	NO _x out ppm	Chart ppm	% Difference +2% Full Scale
Zero	3015	0	0	0	0
80% URL	2768	246	796	800	+ 0.40
1	2830	185	601	602	+ 0.20
2	2890	125	403	399	- 0.40
3	2950	64	207	202	- 0.50

TABLE 8-1. NO_x CALIBRATION AND LINEARITY CHECKS (Concluded)

TECO Model 10-AR/Trailer #2/September 12, 1992

Range 0-2500 ppm

Calibration Points	Flow, Dil. cc/min	Flow, Std. cc/min	NO _x out ppm	VDC/Chart ppm	% Difference +2% Full Scale
Zero	1502	0	0	0	0
80% URL	1193	306	1995	1993	- 0.08
1	1268	231	1503	1508	+ 0.20
2	1346	155	1009	1003	- 0.24
3	1423	79	517	507	- 0.40

Range 0-10,000 ppm

Calibration Points	Flow, Dil. cc/min	Flow, Std. cc/min	NO _x out ppm	Chart ppm	% Difference +2% Full Scale
Zero	1498	0	0	0	0
80% URL *	503	1004	6512	6500	- 0.12
1	578	929	6014	6030	+ 0.16
2	886	610	3979	4050	+ 0.71
3	1193	306	1994	2038	+ 0.44

* Unable to achieve 80% URL with current Mass Flow Meters.

TABLE 8-2. CO CALIBRATION SUMMARY

Monitoring Trailer: 2		Calibrated by: PES 10/4/92	
Analyzer: ANARAD		Calibrator Manufacturer:	
Model: AR 602R		Model:	
Serial Number: 1793		Serial Number:	
CO Standard: ALM1538, CC56876, CC89607			
Concentration: 8130 ppm, 3980 ppm, 1992 ppm			
Cylinder Pressure: 1800 psi, 1400 psi, 1200 psi			

CO CALIBRATION AND LINEARITY CHECKS

Range 0-10,000 ppm

Calibration Points	Flow, Dil. cc/min	Flow, Std. cc/min	CO out ppm	Chart ppm	% Difference +2% Full Scale
Zero	*	*	0	0	0
80% URL	*	*	*	*	*
1	*	*	8130	8120	- 0.10
2	*	*	3980	3850	- 1.30
3	*	*	1992	1950	- 0.42

* Not done with EnviroNics System

TABLE 8-3. CO CALIBRATION SUMMARY

Monitoring Trailer: 2		Calibrated by: PES 9/13/92	
Analyzer: TECO		Calibrator Manufacturer: Environics	
Model: 48		Model: 201-1520	
Serial Number: 48-22876-207		Serial Number: 1122	
CO Standard: CC345			
Concentration: 1001 ppm			
Cylinder Pressure: 1990 psig			

CO CALIBRATION AND LINEARITY CHECKS

Range 0-10 ppm

Calibration Points	Flow, Dil. cc/min	Flow, Std. cc/min	CO out ppm	Chart ppm	% Difference +2% Full Scale
Zero	8000	0	0	0	0
80% URL	7700	319	7.93	7.90	- 0.30
1	7780	240	5.97	6.00	+ 0.30
2	7860	161	4.00	3.97	- 0.30
3	7940	82	2.04	2.02	- 0.20

Range 0-100 ppm

Calibration Points	Flow, Dil. cc/min	Flow, Std. cc/min	CO out ppm	Chart ppm	% Difference +2% Full Scale
Zero	2011	0	0	0	0
80% URL	1836	160	80.4	80.1	- 0.30
1	3770	239	59.6	60.2	+ 0.60
2	3850	160	40.0	39.3	- 0.70
3	3930	82	20.4	18.6	- 1.80

TABLE 8-3. CO CALIBRATION AND LINEARITY CHECKS (Concluded)

TECO Model 48/Trailer #2/September 13, 1992

Range 0-1000 ppm

Calibration Points	Flow, Dil. cc/min	Flow, Std. cc/min	CO out ppm	Chart ppm	% Difference +2% Full Scale
Zero	1508	0	0	0	0
80% URL *	533	977	647.5	647	- 0.05
1	608	901	597.7	596	- 0.17
2	906	592	395.8	398	+ 0.22
3	1206	298	198.2	201	+ 0.28

*Cannot achieve 80% URL with Gas Dilution System.

TABLE 8-4. CO₂ CALIBRATION SUMMARY

Monitoring Trailer: 2		Calibrated by: PES 9/11/92	
Analyzer:	ANARAD	Calibrator Manufacturer:	Enviro-nics
Model:	AR 602R	Model:	201-1520
Serial Number:	1793	Serial Number:	1122
CO ₂ Standard:	CC86353		
Concentration:	41.20%		
Cylinder Pressure:	950 psi		

CO₂ CALIBRATION AND LINEARITY CHECKS

Range 0-20 %

Calibration Points	Flow, Dil. cc/min	Flow, Std. cc/min	CO ₂ out %	Chart %	% Difference +2% Full Scale
Zero	998	0	0	0	0
80% URL	606	390	16.13	16.12	- 0.05
1	703	292	12.09	12.21	+ 0.64
2	808	189	7.84	8.00	+ 0.80
3	886	112	4.63	4.72	+ 0.45

TABLE 8-5. O₂ CALIBRATION SUMMARY

Monitoring Trailer: 2		Calibrated by: PES 9/13/92	
Analyzer:	Teledyne	Calibrator Manufacturer:	Enviro-nics
Model:	326A	Model:	201-1520
Serial Number:	43392	Serial Number:	1122
O ₂ Standard:	CC81154		
Concentration:	20.95 ppm		
Cylinder Pressure:	2000 psi		

O₂ CALIBRATION AND LINEARITY CHECKS

Range 0-10 %

Calibration Points	Flow, Dil. cc/min	Flow, Std. cc/min	O ₂ out %	Chart %	% Difference +2% Full Scale
Zero	995	0	0	0	0
80% URL	616	375	7.94	7.94	0
1	710	282	5.96	6.07	+ 1.10
2	806	189	4.00	4.09	+ 0.90
3	899	96	2.03	2.02	- 0.10

Range 0-25 %

Calibration Points	Flow, Dil. cc/min	Flow, Std. cc/min	O ₂ out %	Chart %	% Difference +2% Full Scale
Zero	1000	0	0	0	0
80% URL	0	993	20.95	20.95	0
1	291	712	14.87	14.45	- 1.68
2	543	468	9.88	9.93	+ 0.20
3	758	236	4.97	5.12	+ 0.60

REPORT OF ANALYSIS

April 16, 1992

CUSTOMER ORDER NUMBER: SP-2750-90 R.55

PAGE 2

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COMPONENT	CONCENTRATION(v/v)	REFERENCE STANDARD	ANALYZER MAKE,MODEL,S/N,DETECTION	EXPIRATION DATE	REPLICATE ANALYSIS DATA	

CYLINDER NO.: CC109899						
			Monitor Labs Model 8448		<u>04/06/92</u>	<u>04/14/92</u>
Nitric Oxide	21.78 ± 0.22 ppm	GMIS	S/N 136	10/14/93	21.86 ppm	21.82 ppm
NOx	21.78 ppm	Cylinder #	Continuous		21.88 ppm	21.75 ppm
Nitrogen,O2-Free Balance		CC12981	Chemiluminescence		<u>21.76 ppm</u>	<u>21.65 ppm</u>
Cylinder Pressure: 2000 psig		@ 21.47 ppm	Last Cal Date: 02/28/92		Mean: 21.81 ppm	21.74 ppm

CYLINDER NO.: CC109913						
			Monitor Labs Model 8448		<u>04/09/92</u>	<u>04/16/92</u>
Nitric Oxide	11.64 ± 0.23 ppm	GMIS	S/N 136	10/16/93	11.67 ppm	11.64 ppm
NOx	11.64 ppm	Cylinder #	Continuous		11.61 ppm	11.65 ppm
Nitrogen,O2-Free Balance		CC7305	Chemiluminescence		<u>11.71 ppm</u>	<u>11.53 ppm</u>
Cylinder Pressure: 2000 psig		@ 9.74 ppm	Last Cal Date: 02/28/92		Mean: 11.66 ppm	11.61 ppm

CYLINDER NO.: CC109928						
			Monitor Labs Model 8448		<u>04/02/92</u>	<u>04/13/92</u>
Nitric Oxide	81.9 ± 0.8 ppm	GMIS	S/N 136	10/13/93	81.9 ppm	81.8 ppm
NOx	81.9 ppm	Cylinder #	Continuous		81.8 ppm	81.8 ppm
Nitrogen,O2-Free Balance		CC88868	Chemiluminescence		<u>82.1 ppm</u>	<u>82.0 ppm</u>
Cylinder Pressure: 2000 psig		@ 102.7 ppm	Last Cal Date: 03/05/92		Mean: 81.9 ppm	81.9 ppm

ppm = umole/mole

% = mole-%

The above analyses were performed in accordance with EPA-1987 Traceability Protocol # 1, Section 3.0.4, Procedure G1.



SCOTT-MARRIN, INC.

6531 BOX SPRINGS BLVD. • RIVERSIDE, CA 92507
TELEPHONE (714) 653-6780 • FAX (714) 653-2430

REPORT OF ANALYSIS NIST TRACEABLE GAS MIXTURES

STEI01

TO:

SUE POWERS
STEINER ENVIRONMENTAL INC
4930 BOYLAN ST
BAKERSFIELD, CA 93308-

DATE: 09/18/92

CUSTOMER ORDER NUMBER: SP-2750-90REL71

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CYLINDER NUMBER	COMPONENT	CONCENTRATION (v/v)	NIST TRACEABLE REFERENCE STANDARD
CC28253	Carbon Monoxide	48.5 ± 0.5 ppm	SRM 2614a
	Carbon Dioxide	9.30 ± 0.09 %	SRM 1675b
	Oxygen	12.87 ± 0.13 %	SRM 2659
	Nitrogen	Balance	

CC88821	Carbon Monoxide	48.7 ± 0.5 ppm	SRM 2614a
	Carbon Dioxide	9.35 ± 0.09 %	SRM 1675b
	Oxygen	12.89 ± 0.13 %	SRM 2659
	Nitrogen	Balance	

CC105096	Carbon Monoxide	43.1 ± 0.4 ppm	SRM 2614a
	Carbon Dioxide	9.12 ± 0.09 %	SRM 1675b
	Oxygen	11.78 ± 0.12 %	SRM 2659
	Nitrogen	Balance	

ppm = umole/mole

% = mole-%

The above analyses are traceable to the National Institute of Standards and Technology by intercomparison with the reference standards listed above.
Where indicated, volumetric and gravimetric reference standards are traceable thru use of our analytical balance. NIST Report No. MMAP 232.09/202491.

Analyst:

M.S. Calhoun

Approved:

J.T. Marrin

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

STANDARD CALIBRATION GASES IN ALUMINUM CYLINDERS



6531 BOX SPRINGS BLVD. • RIVERSIDE, CA 92507
TELEPHONE (714) 653-6780 • FAX (714) 653-2430

REPORT OF ANALYSIS
NIST TRACEABLE GAS MIXTURES

STEI01

TO:

SUE POWERS
STEINER ENVIRONMENTAL
4930 BOYLAN ST
BAKERSFIELD, CA 93308-

DATE: 01/14/93

CUSTOMER ORDER NUMBER: SP-2750-90REL84/Reanalysis

PAGE 1

CYLINDER NUMBER	COMPONENT	CONCENTRATION(V/V)	NIST TRACEABLE REFERENCE STANDARD
CC40111	Carbon Monoxide	394 + 4 ppm	SRM 1680b
	Carbon Dioxide	15.20 + 0.15 %	SRM 1675b
	Oxygen	3.90 + 0.04 %	SRM 2658a
	Nitrogen	Balance	
	Cylinder Pressure:	1200 psig	
CC299	Carbon Monoxide	412 + 4 ppm	SRM 1680b
	Carbon Dioxide	9.55 + 0.10 %	SRM 1674b
	Oxygen	1.045 + 0.010 %	SRM 2657
	Nitrogen	Balance	
	Cylinder Pressure:	1500 psig	

ppm = umole/mole

% = mole-%

The above analyses are traceable to the National Institute of Standards and Technology by intercomparison with the reference standards listed above. Where indicated, volumetric and gravimetric reference standards are traceable thru use of our analytical balance. NIST Report No. MMAP 232.09/202491.

Analyst:

M.S. Calhoun

Approved:

J.T. Marrin

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

STANDARD CALIBRATION GASES IN ALUMINUM CYLINDERS



SCOTT-MARRIN, INC.

6531 BOX SPRINGS BLVD. • RIVERSIDE, CA 92507
TELEPHONE (714) 653-6780 • FAX (714) 653-2430

REPORT OF ANALYSIS NIST TRACEABLE GAS MIXTURES

STEI01

TO:

SUE POWERS
STEINER ENVIRONMENTAL INC
4930 BOYLAN ST
BAKERSFIELD, CA 93308-

DATE: 01/04/93

CUSTOMER ORDER NUMBER: SP-2750-90REL82 / REANALYSIS

PAGE 1

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CYLINDER NUMBER	COMPONENT	CONCENTRATION(v/v)	NIST TRACEABLE REFERENCE STANDARD
CC106743	Carbon Monoxide	203.0 ± 2.0 ppm	SRM 2636
	Carbon Dioxide	8.03 ± 0.08 %	SRM 1674b
	Oxygen	4.00 ± 0.04 %	SRM 2658a
	Nitrogen	Balance	
	Cylinder Pressure: 1700 psig		
CC97817	Oxygen	5.36 ± 0.05 %	SRM 2658a
	Carbon Dioxide	8.68 ± 0.09 %	SRM 1674b
	Carbon Monoxide	18.24 ± 0.36 ppm	SRM 2613a
	Nitrogen	Balance	
	Cylinder Pressure: 900 psig		
CC73074	Oxygen	7.47 ± 0.07 %	SRM 2658a
	Carbon Dioxide	17.44 ± 0.17 %	SRM 1675b
	Carbon Monoxide	197.8 ± 2.0 ppm	SRM 2636
	Nitrogen	Balance	
	Cylinder Pressure: 1200 psig		

ppm = umole/mole

% = mole-%

The above analyses are traceable to the National Institute of Standards and Technology by intercomparison with the reference standards listed above.
Where indicated, volumetric and gravimetric reference standards are traceable thru use of our analytical balance. NIST Report No. MMAP 232.09/202491.

Analyst: Mark Monson
M.J. Monson

Approved: J.T. Marrin
J.T. Marrin

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

STANDARD CALIBRATION GASES IN ALUMINUM CYLINDERS