PALOS VERDES LANDFILL
REMEDIAL INVESTIGATION REPORT

APPENDIX D.4

POLYCHLORINATED DIBENZO-P-DIOXIN AND POLYCHLORINATED DIBENZOFURAN EMISSIONS TESTS ON THE PALOS VERDES ENERGY RECOVERY FROM LANDFILL GAS (PVERG) FACILITY, UNIT 2 (CARNOT)

POLYCHLORINATED DIBENZO-P-DIOXIN AND POLYCHLORINATED DIBENZOFURAN EMISSIONS TESTS ON THE PALOS VERDES ENERGY RECOVERY FROM LANDFILL GAS (PVERG) FACILITY, UNIT 2 NOVEMBER 1993

Prepared For:

COUNTY SANITATION DISTRICTS OF LOS ANGELES COUNTY
Whittier, California

For Submittal To:

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Prepared By:

Derek V. Kumm

CARNOT
Tustin, California

FEBRUARY 1994

REVIEW AND CERTIFICATION

All work, calculations, and other activities and tasks performed and documented in this report were carried out under my direction and supervision.

Derek V. Kumm Date 2/23/94

Derek V. Kumm
Chemist
Chemical Emissions Assessment Division

I have reviewed, technically and editorially, details, calculations, results, conclusions and other appropriate written material contained herein, and hereby certify that the presented material is authentic and accurate.

Arlene C. Bell Date 2/25/94

Arlene C. Bell
Manager
Chemical Emissions Assessment Division

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SECTION 1.0

INTRODUCTION

Carnot was contracted by the County Sanitation Districts of Los Angeles County (LACSD) to perform a series of air emission related tests on the Palos Verdes Energy Recovery from Landfill Gas (PVERG) Facility, Unit 2.

Emission tests were conducted on Unit 2 at the boiler exhaust. Table 1-1 presents a test matrix of the parameters measured at this location. The emission tests were conducted on November 23 and 24, 1993. Testing was performed by Craig Fry, Rick Madrigal, Bob Conklin and Matt Dugan of Carnot. The testing was coordinated by Dr. Moon S. Chung of the LACSD. The boiler was maintained at steady load throughout the testing period by LACSD personnel.

A summary of the emission test results are presented in Table 1-2. Detailed test results are presented in Section 4.0 and a discussion is presented in Section 5.0. All raw data and calculations can be found in the Appendices.

TABLE 1-1
PARAMETERS MEASURED
PVERG, UNIT 2 EXHAUST

Oxygen (O_2)
Carbon Dioxide (CO_2)
Moisture (H_2O)
Flow Rate
Carbon Monoxide (CO)
Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans (PCDD/PCDF)

TABLE 1-2
SUMMARY OF TEST RESULTS
PALOS VERDES LANDFILL, BOILER NO. 2
NOVEMBER, 1993

Parameter	Exhaust[1]
O_2, % dry	2.54
CO_2, % dry	15.14
H_2O, %	17.4
Flow Rate, dscfm	13,462
CO:	
ppm	<1
ppm @ 3% O_2	<1
lb/hr	<0.06
Total PCDD/PCDF[2]:	
ng/m^3	<0.21
lb/hr	$<1.1 \times 10^{-8}$
Total Toxic Equivalents by CA DOHS Method[2]:	
ng/m^3	ND<0.069
lb/hr	ND<3.5×10^{-9}

NOTES:
(1) The results in this table are the averages of triplicate measurements.
(2) Calculated using full detection limit values.

SECTION 2.0

TEST UNIT DESCRIPTION

The Palos Verdes Energy Recovery from Landfill Gas Facility (PVERG) consists of two identical Zurn Keystone landfill gas fired boilers. Unit 2 was tested in this emission test series. The steam production of both boilers is used to drive a steam turbine generator with a maximum electrical output of 13.0 megawatts. Each boiler fires approximately 3,600 scfm of landfill gas with supplemental natural gas which makes up 25% of the total Btu content. The natural gas is used because of the low Btu value (200 Btu/scf) of the inactive landfill gas fuel.

SECTION 3.0

TEST DESCRIPTION

3.1 TEST CONDITIONS

LACSD personnel maintained steady load operations throughout the test period. The boiler was set to run at nominal load. Temperature, fuel flow rate and fuel Btu values were monitored by LACSD throughout the test periods; Table 3-1 summarizes the boiler operating conditions.

TABLE 3-1
PVERG TEST OPERATING CONDITIONS

Parameter	Condition
Boiler Excess Oxygen	2.54%
Landfill Gas Flow Rate	3,643 scfm
Natural Gas Flow Rate	230 scfm
Landfill Gas Heating Value	219 Btu/scf
Generator Output	10.1 MW

3.2 SAMPLE LOCATIONS

Samples from the boiler exhaust were collected via two ports in the stack wall. The ports are 4 inch I.D. and are located 90° apart on the circumference of the stack. The ports are 20.5 feet above the nearest flow disturbance and 5 feet, 4 inches below the top of the stack. Figure 3-1 is a schematic drawing of the PVERG stack sampling location. All tests requiring isokinetic sampling were conducted using a full 16-point traverses of the sample plane.

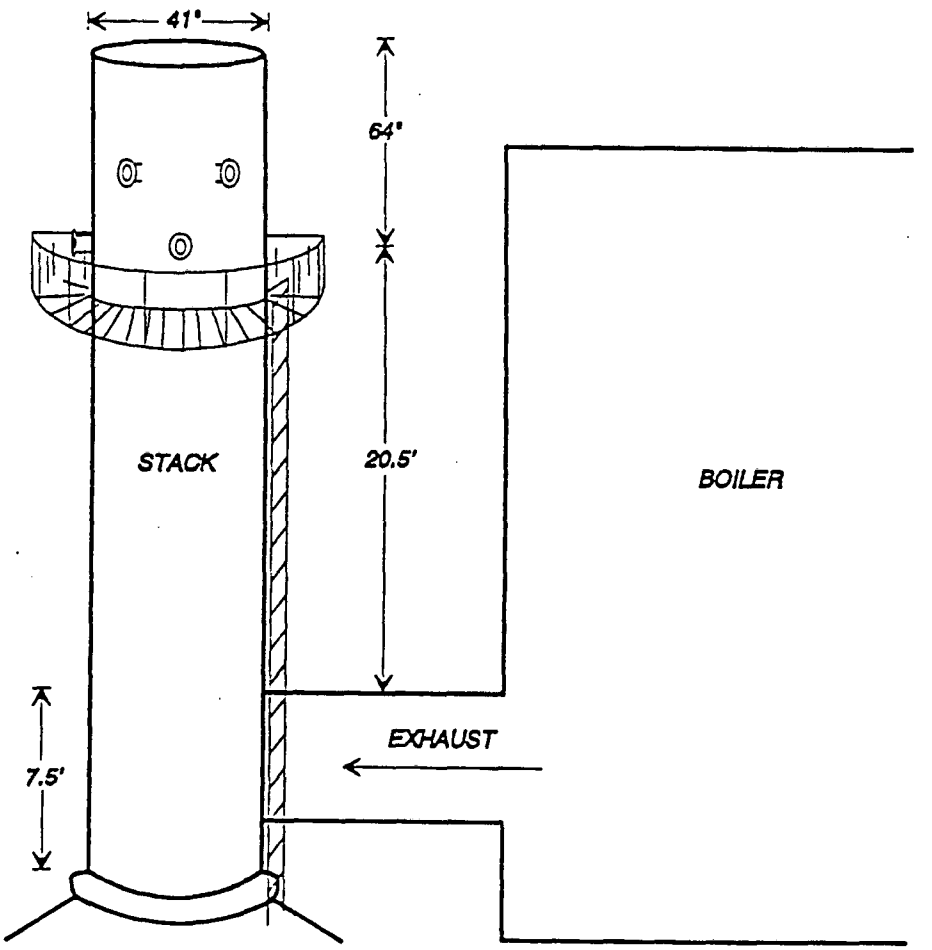


Figure 3-1. PVERG Unit 2, Exhaust Sample Location

3.3 TEST PROCEDURES

The test procedures followed for the boiler exhaust measurements are summarized below in Sections 3.3.1-3.3.4. Further detail is presented in Appendix A.

3.3.1 Oxygen, Carbon Dioxide and Carbon Monoxide

Measurements of CO, O_2 and CO_2 at the stack sampling location were conducted using SCAQMD Method 100.1 sampling with Carnot's continuous emission monitoring system (CEMS). This system is described in detail in Appendix A. A brief overview is presented here.

The sample is withdrawn from the stack through a stainless steel probe connected to a 15' heated teflon line (250°F). The sample then travels through a moisture knockout cooled with ice and water. A peristaltic pump continuously drains the knockout. After the knockout, the sample travels to the ground, via a teflon line, into an additional conditioning and filter system. Leak checks were conducted prior to and at the completion of the test project. The leak checks were conducted by operating the sample pump, plugging the probe inlet and all pressure side system exits except for one analyzer rotameter, then measuring the leakage rate on that rotameter. EPA Protocol 1 Calibration Gas were used for CO analyzer calibration. All other gases were manufacturer certified to be $\pm 1\%$ and traceable to NIST. In accordance with SCAQMD Method 100.1 procedures, a pre- and post-test system bias check was conducted for each test run. The system bias check was conducted by delivering zero and span gas to the CEMS probe tip and recording the as-found species concentration. No analyzer adjustments were made between these pre- and post-system bias checks. Calculations for the correction of measured system bias and instrument draft were then applied to each test run. The allowable limit of system bias deviation is 5% of instrument range.

Triplicate emissions measurements were performed to determine carbon monoxide emissions as well as oxygen and carbon dioxide concentrations. The average concentrations were determined during each test for a period of 240 minutes. These test averages were then corrected for measured system bias and drift.

CEMS measurements of O_2 and CO_2 were conducted during all PCDD/PCDF tests to calculate flue gas molecular weight and to determine operational status of the boiler.

3.3.2 Moisture

Moisture was measured according to SCAQMD Method 4.1 in conjunction with all PCDD/PCDF tests.

3.3.3 Flow Rate

Exhaust gas flow rate was determined in conjunction with all PCDD/PCDF tests in accordance with SCAQMD Method 2.1.

3.3.4 Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans (PCDD/PCDF)

Triplicate samples for PCDD/PCDF were collected according to CARB Method 428. In this procedure, a sample is withdrawn isokinetically from the source and passed through a heated Method 5 filter followed by a water-cooled XAD-2 resin module. The resin module is followed by an impinger train to collect moisture and any species that might pass through the resin. A field blank was conducted by transporting a complete train to the sample location, conducting a leak check, then recovering it in the same manner as a sample. A method blank was also conducted by the laboratory by analyzing an unused portion of the same XAD-2 resin batch as supplied for the sampling program. These blanks are for informational purposes only; PCDD/PCDF data is not blank corrected by the laboratory. Field spikes (surrogates) and recovery spikes (internals) were added prior to sampling and prior to extraction, respectively, as prescribed by the CARB Method 428 Protocol. Acceptable recovery of these spikes is 50-150%. All sample and blanks were analyzed for total tetra through octa PCDD and PCDF plus all 2,3,7,8- substituted isomers using high-resolution gas chromatography/low-resolution mass spectrometry (HRGC/LRMS). Table 3-2 summarizes the pertinent information for the PCDD/PCDF tests.

TABLE 3-2
DIOXIN/FURAN TEST INFORMATION
CARB METHOD 428
PVERG UNIT 2
NOVEMBER 1993

Sampling Method	CARB Method 428
Analytical Method	HRGC/LRMS for Dioxin/Furan
Analytical Laboratory	Zenon Environmental
Actual Method Detection Limits	0.0087-0.042 ng/m^3 per homologue class
Sample Volumes	3.4 m^3
Surrogate Spiking	Pre- and post-test laboratory spikes using appropriate surrogate compounds as per CARB Method 428 by Zenon Environmental
Blank	Full field blank train assembled, recovered and analyzed
Recovery	Filter stored in petri dishes lined with hexane rinsed aluminum foil
	XAD-2 column wrapped to protect from light and stored at 0-4°C
	Impinger liquid stored in pre-cleaned glass bottles
	Sample Train rinsed 3 times each with methanol, toluene and methylene chloride
	Organic rinses stored in pre-cleaned glass bottles
	All sample fractions stored and shipped cold 0-4°C
Fractions Analyzed	Probe wash, filter, sorbent module, connecting glassware rinse and solvent rinse combined
Chain of Custody	Maintained by Carnot and Zenon on all samples
Glassware Cleaning	Thorough cleaning followed by organic-free DI H_2O, methanol, toluene and methylene chloride rinses, followed by high temperature bake

SECTION 4.0

RESULTS

The results of the tests are presented in the following tables:

Table Number	Table Title
4-1	General Emission Results, PVERG Unit 2
4-2	PCDD/PCDF Emissions Summary, PVERG Unit 2
4-3	PCDD/PCDF Toxic Equivalents by CA DOHS Method, PVERG Unit 2

TABLE 4-1
GENERAL EMISSION RESULTS
PVERG UNIT 2
NOVEMBER 1993

Parameter	Test No. 1	Test No. 2	Test No. 3	Average
O_2, % dry	2.47	2.57	2.58	2.54
CO_2, % dry	15.01	15.28	15.13	15.14
H_2O, %	17.9	17.3	17.0	17.4
Flow Rate, dscfm	13,408	13,552	13,425	13,462
CO:				
ppm	<1	<1	<1	<1
ppm @ 3% O_2	<1	<1	<1	<1
lb/hr	<0.06	<0.06	<0.06	<0.06
Total PCDD/PCDF(1):				
ng/m^3	<0.19	<0.20	<0.23	<0.21
lb/hr	$<9.5 \times 10^{-9}$	$<1.0 \times 10^{-8}$	$<1.2 \times 10^{-8}$	$<1.1 \times 10^{-8}$
Total Toxic Equivalents by CA DOHS Method(1):				
ng/m^3	ND<0.068	ND<0.067	ND<0.074	ND<0.069
lb/hr	$ND<3.4 \times 10^{-9}$	$ND<3.4 \times 10^{-9}$	$ND<3.7 \times 10^{-9}$	$ND<3.5 \times 10^{-9}$

Notes:
(1) Calculated using full detection limit values.

TABLE 4-2
PCDD/PCDF EMISSIONS SUMMARY
PVERG UNIT 2
NOVEMBER 1993

TEST NO.	1-DIOXIN	2-DIOXIN	3-DIOXIN	AVERAGE		FIELD BLANK (1)
DATE	11/23/93	11/24/93	11/24/93			
FLOW RATE, dsfcm	13,408	13,552	13,514			
SAMPLE VOLUME, dscf	120.335	121.059	123.270			
O_2, %	2.47	2.56	2.58			
CO_2, %	15.01	15.28	15.13			
Component	ng/m³	ng/m³	ng/m³	ng/m³	lb/hr	ng/m³
2378 TCDD	ND<0.013	ND<0.015	ND<0.013	ND<0.014	ND<6.8×10^{-10}	ND<0.023
12378 PeCDD	ND<0.018	ND<0.018	ND<0.021	ND<0.019	ND<9.5×10^{-10}	ND<0.019
123478 HxCDD	ND<0.018	ND<0.018	ND<0.040	ND<0.025	ND<1.3×10^{-9}	ND<0.026
123678 HxCDD	ND<0.018	ND<0.018	ND<0.037	ND<0.024	ND<1.2×10^{-9}	ND<0.022
123789 HxCDD	ND<0.018	ND<0.018	ND<0.036	ND<0.023	ND<1.2×10^{-9}	ND<0.022
1234678 HpCDD	ND<0.014	ND<0.0090	ND<0.017	ND<0.013	ND<6.7×10^{-10}	ND<0.0094
OCDD	0.053	0.067	ND<0.049	<0.056	<2.8×10^{-9}	0.086
2378 TCDF	ND<0.013	ND<0.011	ND<0.016	ND<0.014	ND<6.8×10^{-10}	ND<0.011
12378 PeCDF	ND<0.010	ND<0.0093	ND<0.0083	ND<0.0092	ND<4.6×10^{-10}	ND<0.0059
23478 PeCDF	ND<0.010	ND<0.0090	ND<0.0083	ND<0.0090	ND<4.5×10^{-10}	ND<0.0056
123478 HxCDF	ND<0.014	ND<0.0088	ND<0.022	ND<0.015	ND<7.5×10^{-10}	ND<0.010
123678 HxCDF	ND<0.012	ND<0.0090	ND<0.019	ND<0.013	ND<6.7×10^{-10}	ND<0.0089
234678 HxCDF	ND<0.014	ND<0.0093	ND<0.021	ND<0.015	ND<7.5×10^{-10}	ND<0.010
123789 HxCDF	ND<0.014	ND<0.0090	ND<0.023	ND<0.015	ND<7.7×10^{-10}	ND<0.011
1234678 HpCDF	ND<0.018	ND<0.018	ND<0.017	ND<0.018	ND<8.9×10^{-10}	ND<0.018
1234789 HpCDF	ND<0.018	ND<0.018	ND<0.018	ND<0.018	ND<9.0×10^{-10}	ND<0.018
OCDF	ND<0.012	ND<0.0093	ND<0.016	ND<0.013	ND<6.4×10^{-10}	ND<0.010
TOTAL TCDD	ND<0.013	ND<0.015	ND<0.013	ND<0.014	ND<6.8×10^{-10}	ND<0.023
TOTAL PeCDD	ND<0.018	ND<0.018	ND<0.021	ND<0.019	ND<9.5×10^{-10}	ND<0.019
TOTAL HxCDD	ND<0.018	ND<0.018	ND<0.037	ND<0.024	ND<1.2×10^{-9}	ND<0.023
TOTAL HpCDD	ND<0.014	ND<0.0090	ND<0.017	ND<0.013	ND<6.7×10^{-10}	ND<0.0094
TOTAL TCDF	ND<0.021	ND<0.029	ND<0.034	ND<0.028	ND<1.4×10^{-9}	ND<0.059
TOTAL PeCDF	ND<0.010	ND<0.0090	ND<0.0083	ND<0.0090	ND<4.5×10^{-10}	ND<0.0056
TOTAL HxCDF	ND<0.013	ND<0.0090	ND<0.021	ND<0.015	ND<7.4×10^{-10}	ND<0.010
TOTAL HpCDF	ND<0.018	ND<0.018	ND<0.017	ND<0.018	ND<8.9×10^{-10}	ND<0.018
TOTAL PCDD/PCDF	<0.19	<0.20	ND<0.23	<0.21	<1.1×10^{-8}	<0.26

ND< Species not detected.
(1) The field blank is calculated using the average sample volume for these tests.

TABLE 4-3
PCDD/PCDF TOXIC EQUIVALENTS BY CA DOHS METHOD
PVERG UNIT 2
NOVEMBER 1993

Test No.		1-Dioxin		2-Dioxin		3-Dioxin		Average
Component	CA DOHS Factors	ng/m³	CA Tox. Equiv. ng/m³	ng/m³	CA Tox. Equiv. ng/m³	ng/m³	CA Tox. Equiv. ng/m³	CA Tox. Equiv. ng/m³
2378 TCDD	1.0000	ND<0.013	ND<0.013	ND<0.015	ND<0.015	ND<0.013	ND<0.013	ND<0.014
12378 PeCDD	1.0000	ND<0.018	ND<0.018	ND<0.018	ND<0.018	ND<0.021	ND<0.021	ND<0.019
123478 HxCDD	0.0300	ND<0.018	ND<0.00054	ND<0.018	ND<0.00053	ND<0.040	ND<0.0012	ND<0.00076
123678 HxCDD	0.0300	ND<0.018	ND<0.00054	ND<0.018	ND<0.00053	ND<0.037	ND<0.0011	ND<0.00073
123789 HxCDD	0.0300	ND<0.018	ND<0.00053	ND<0.018	ND<0.00054	ND<0.034	ND<0.0010	ND<0.00070
1234678 HpCDD	0.0300	ND<0.014	ND<0.00042	ND<0.0090	ND<0.00027	ND<0.017	ND<0.00050	ND<0.00040
OCDD	0.0000	0.053	0.00000	0.067	0.00000	ND<0.049	0.00000	0.00000
2378 TCDF	1.0000	ND<0.013	ND<0.013	ND<0.011	ND<0.011	ND<0.016	ND<0.016	ND<0.014
12378 PeCDF	1.0000	ND<0.010	ND<0.010	ND<0.0093	ND<0.0093	ND<0.0083	ND<0.0083	ND<0.0092
23478 PeCDF	1.0000	ND<0.010	ND<0.010	ND<0.0090	ND<0.0090	ND<0.0083	ND<0.0083	ND<0.0090
123478 HxCDF	0.0300	ND<0.014	ND<0.00041	ND<0.0088	ND<0.00026	ND<0.022	ND<0.00065	ND<0.00044
123678 HxCDF	0.0300	ND<0.012	ND<0.00036	ND<0.0090	ND<0.00027	ND<0.019	ND<0.00057	ND<0.00040
234678 HxCDF	0.0300	ND<0.014	ND<0.00041	ND<0.0093	ND<0.00028	ND<0.021	ND<0.00064	ND<0.00045
123789 HxCDF	0.0300	ND<0.014	ND<0.00043	ND<0.0090	ND<0.00027	ND<0.023	ND<0.00068	ND<0.00046
1234678 HpCDF	0.0300	ND<0.018	ND<0.00055	ND<0.018	ND<0.00053	ND<0.017	ND<0.00052	ND<0.00053
1234789 HpCDF	0.0300	ND<0.018	ND<0.00053	ND<0.018	ND<0.00053	ND<0.018	ND<0.00055	ND<0.00054
OCDF	0.0000	ND<0.012	0.00000	ND<0.0093	0.00000	ND<0.016	0.00000	0.00000
Total PCDD Toxic Equiv., ng/m³			ND<0.033		ND<0.035		ND<0.037	ND<0.035
Total PCDF Toxic Equiv., ng/m³			ND<0.035		ND<0.032		ND<0.037	ND<0.035
Total Toxic Equiv., ng/m³ (2,3,7,8 TCDD Equiv.)			ND<0.068		ND<0.067		ND<0.074	ND<0.069
Total Toxic Equiv., lb/hr (2,3,7,8 TCDD Equiv.)			ND<3.4 x 10^{-9}		ND<3.4 x 10^{-9}		ND<3.7 x 10^{-9}	ND<3.5 x 10^{-9}

Species other than those presented have CA DOHS factors equal to zero.
ND< - Species not detected.

SECTION 5.0

DISCUSSION

All measurements were conducted triplicate. Laboratory data and emission calculation spreadsheets are presented in Appendix C. Raw laboratory data is maintained at Carnot. General Emissions calculations are presented in Appendix D.

5.1 PCDD/PCDF MEASUREMENTS

Analysis by HRGC/LRMS showed most species were not detected. The detection limits were low in the range of 0.0083 to 0.049 ng/m^3. Tetra and penta substituted PCDD and PCDF were not detected in any sample. Octachlorodibenzo-p-dioxin (OCDD) was the only species detected in these samples. It was detected in two of the three replicates.

The field blank showed similar results to the samples in that OCDD was the only species detected. It is important to note that OCDD was detected in the field blank at 0.086 ng/m^3, or 150% of the average sample concentration. The concentration of PCDD/PCDF in the field blank was calculated using the average standard volume of the triplicate samples. Internal standard recoveries for samples and blanks ranged from 75-110% indicating proper laboratory procedures and accurate analysis. Field spike recoveries ranged from 69-98% for the two surrogates $^{37}Cl_4$-2378-TCDD and $^{13}C_{12}$-1234678-H_pCDD. The third surrogate, $^{13}C_{12}$-123789-H_xCDD, showed recoveries between 108 and 149%. This was due to a chemical interference. Though the field spike was flagged by the laboratory because of the method ratio criteria, the field spike still met the recovery criteria of 50% to 150%. The sample results did not exhibit this problem. No hexa- substituted isomers were detected in the samples; therefore, no high bias (false positive) occurred.

APPENDIX A
MEASUREMENT PROCEDURES

Continuous Emissions Monitoring System

Oxygen (O_2) by Continuous Analyzer

Carbon Dioxide (CO_2) by Continuous Analyzer

Carbon Monoxide (CO) by NDIR/Gas Filter Correlation

Semi-Volatile Organic Sampling Train Procedures

Stack Gas Velocity and Volumetric Flow Rate

Determination of Moisture in Stack Gases

Continuous Emissions Monitoring System

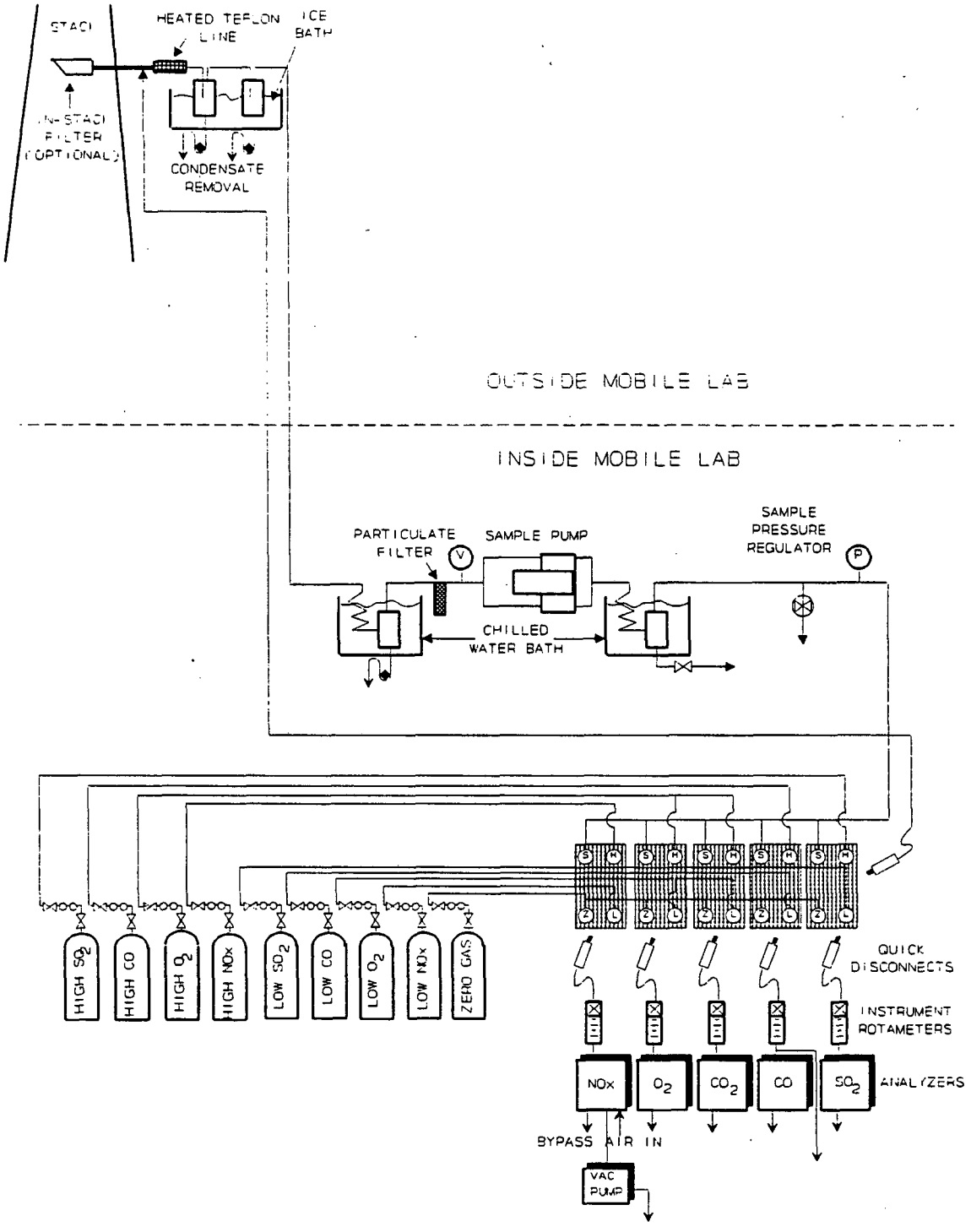
O_2, CO, CO_2, NO, NO_x and SO_2 are measured using an extractive continuous emissions monitoring (CEM) package, shown in the following figure. This package is comprised of three basic subsystems. They are: (1) the sample acquisition and conditioning system, (2) the calibration gas system, and (3) the analyzers themselves. This section presents a description of the sampling and calibration systems. Descriptions of the analyzers used in this program and the corresponding reference test methods follow. Information regarding quality assurance information on the system, including calibration routines and system performance data follows.

The sample acquisition and conditioning system contains components to extract a representative sample from the stack or flue, transport the sample to the analyzers, and remove moisture and particulate material from the sample. In addition to performing the tasks above, the system must preserve the measured species and deliver the sample for analysis intact. The sample acquisition system extracts the sample through a stainless steel probe. The probe is insulated or heated as necessary to avoid condensation. If the particulate loading in the stack is high, a sintered stainless steel filter is used on the end of the probe.

Where water soluble NO_2 and/or SO_2 are to be measured, the sample is drawn from the probe through a heated teflon sample line into an on-stack cooled (approximately 35-40°F) water removal trap. The trap consists of stainless steel flasks in a bath of ice and water. This design removes the water vapor by condensation. The contact between the sample and liquid water is minimized and the soluble NO_2 and SO_2 are conserved. This system meets the requirements of EPA Method 20. The sample is then drawn through a teflon transport line, particulate filter, secondary water removal and into the sample pump. The pump is a dual head, diaphragm pump. All sample-wetted components of the pump are stainless steel or teflon. The pressurized sample leaving the pump flows through a third condensate trap in a refrigerated water bath ($\approx$38°F) for final moisture removal. A drain line and valve are provided to constantly expel any condensed moisture from the dryer at this point. After the dryer, the sample is directed into a distribution manifold. Excess sample is vented through a back-pressure regulator, maintaining a constant pressure of 5-6 psig to the analyzer rotameters.

The calibration system is comprised of two parts: the analyzer calibration, and the system bias check (dynamic calibration). The analyzer calibration equipment includes pressurized cylinders of certified span gas. The gases used are, as a minimum, certified to 1% by the manufacturer. Where necessary to comply with reference method requirements EPA Protocol 1 gases are used. The cylinders are equipped with pressure regulators which supply the calibration gas to the analyzers at the same pressure and flow rate as the sample. The selection of zero, span, or sample gas directed to each analyzer is accomplished by operation of the sample/calibration selector fittings.

The system bias check is accomplished by transporting the same gases used to zero and span the analyzers to the sample system as close as practical to the probe inlet. This is done either by attaching the calibration gas supply line to the probe top with flexible tubing or by actuation of a solenoid valve located at the sample conditioner inlet (probe exit). The span gas is exposed to the same elements as the sample and the system response is documented. The analyzer indications for the system calibration check must agree within 5% of the analyzer calibration. Values are adjusted and changes/repairs are made to the system to compensate for any difference in analyzer readings. Specific information on the analytical equipment and test methods used is provided in the following pages.



Schematic of CEM System

Method:	**Oxygen (O_2) by Continuous Analyzer**
Applicable Reference Methods:	EPA 3A, EPA 20, ARB 100, BA ST-14, SCAQMD 100.1
Principle:	A sample is continuously drawn from the flue gas stream, conditioned, and conveyed to the instrument for direct readout of O_2 concentration.
Analyzer:	Teledyne Model 326A
Measurement Principle:	Electrochemical cell
Ranges:	0-5, 0-10, 0-25% O_2
Accuracy:	1% of full scale
Output:	0-100 mV, linear
Interferences:	Halogens and halogenated compounds will cause a positive interference. Acid gases will consume the fuel cell and cause a slow calibration drift.
Response Time:	90% <7 seconds
Sampling Procedure:	A representative flue gas sample is collected and conditioned using the CEM system described previously. If Method 20 is used, that method's specific procedures for selecting sample points are used. Otherwise, stratification checks are performed at the start of a test program to select single or multiple-point sample locations.
Analytical Procedure:	An electrochemical cell is used to measure O_2 concentration. Oxygen in the flue gas diffuses through a Teflon membrane and is reduced on the surface of the cathode. A corresponding oxidation occurs at the anode internally, and an electric current is produced that is proportional to the concentration of oxygen. This current is measured and conditioned by the instrument's electronic circuitry to give an output in percent O_2 by volume.
Special Calibration Procedure:	The measurement cells used with the O_2 instrument have to be replaced on a regular basis. After extended use, the cell tend to produce a nonlinear response. Therefore, a three-point calibration is performed at the start of each test day to check for linearity. If the response is not linear ($\pm$ 2% of scale), the cell is replaced.

Method:	**Carbon Dioxide (CO_2) by Continuous Analyzer**
Applicable Reference Methods:	EPA 3A, ARB 100, BA ST-5, SCAQMD 100.1
Principle:	A sample is continuously drawn from the flue gas stream, conditioned, and conveyed to the instrument for direct readout of CO_2 concentration.
Analyzer:	Horiba PIR 2000
Measurement Principle:	Non-dispersive infrared (NDIR)
Accuracy:	1% of full scale
Ranges:	0-5, 0-10, 0-25%
Output:	0-10 mV
Interferences:	A possible interference includes water. Since the instrument receives dried sample gas, this interference is not significant.
Response Time:	1.2 seconds
Sampling Procedure:	A representative flue gas sample is collected and conditioned using the CEM system described previously.
Analytical Procedure:	Carbon dioxide concentrations are measured by short path length non-dispersive infrared analyzers. These instruments measure the differential in infrared energy absorbed from energy beams passed through a reference cell (containing a gas selected to have minimal absorption of infrared energy in the wavelength absorbed by the gas component of interest) and a sample cell through which the sample gas flows continuously. The differential absorption appears as a reading on a scale of 0 to 100%.

Method:	**Carbon Monoxide (CO) by NDIR/Gas Filter Correlation**
Applicable Reference Methods:	EPA 10; ARB 1-100; BA ST-6, SCAQMD 100.1
Principle:	A sample is continuously drawn from the flue gas stream, conditioned, and conveyed to the instrument for direct readout of CO concentration.
Analyzer:	TECO, Model 48
Measurement Principle:	NDIR/Gas Filter Correlation
Precision:	0.1% ppm
Ranges:	0-5, 0-10, 0-25, 0-50, 0-100, 0-250, 0-500, 0-1000, 0-5000 ppm
Output:	0-100 mV
Interferences:	Negligible interference from water and CO_2
Rise/Fall Times (0-95%)	1 minute @ 1 lpm flow, 30 second integration time
Sampling Procedure:	A representative flue gas sample is collected and conditioned using the CEM system described previously. Sample point selection has been described previously.
Analytical Procedure:	Radiation from an infrared source is chopped and then passed through a gas filter which alternates between CO and N_2 due to rotation of a filter wheel. The radiation then passes through a narrow band-pass filter and a multiple optical pass sample cell where absorption by the sample gas occurs. The IR radiation exits the sample cell and falls on a solid state IR detector.

Method: **Semi-volatile Organic Sampling Train (Semi-VOST)**

References: CARB Method 428 (for PCDD/PCDF)
CARB Method 429 (for PAH)
ASME Modified Method 5

Principle: A metered flue gas sample is collected isokinetically, and semi-volatile organic compounds are collected on a heated filter, on water-cooled XAD-2 resin module, and in an iced impinger bath. Depending upon the specific test requirements, the samples are then analyzed for dioxins/furans or polycyclic aromatic hydrocarbons (PAH) species. This section discusses the sampling and sample handling techniques for the semi-VOST method.

Sample Train Preparation: Because of the very low detection limits of the analytical techniques, thorough cleaning of sample train components prior to testing is vital. Prior to testing, all glassware is cleaned in Carnot's laboratory with high purity water, acetone, and hexane rinses, and then baked at high temperature. Resin modules are cleaned and loaded with purified resin by the contract laboratory within one week of the scheduled test date. Batches of Whatman 934AH fiberglass filters are toluene-rinsed and proofed by the contract laboratory. Individual filters are then tared and stored in petri dishes lined with hexane rinsed aluminum foil.

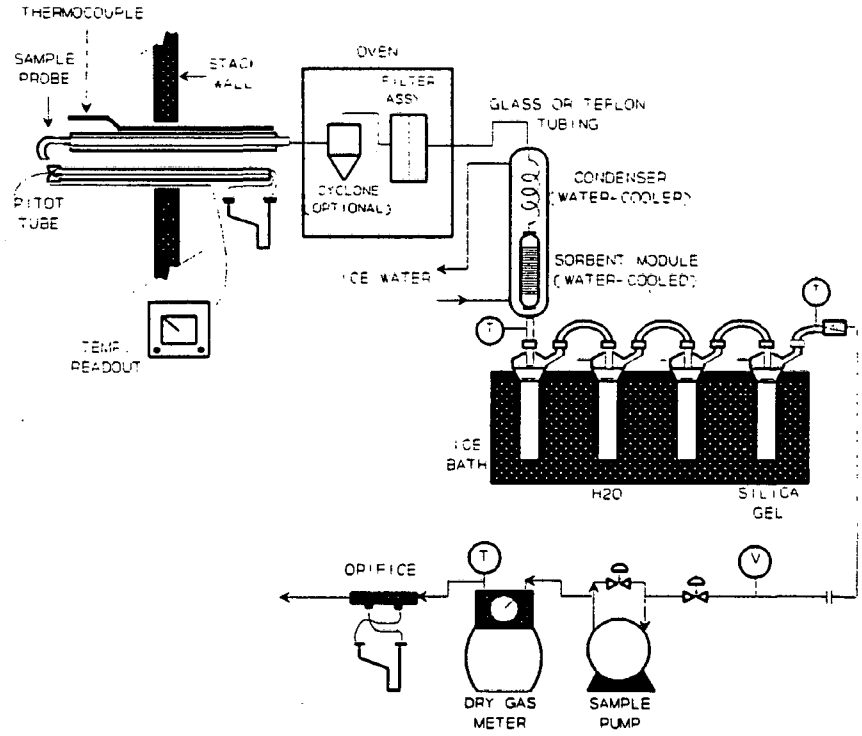
Sample train assembly is performed in an on-site clean room by experienced personnel.

Sampling: The sample train is shown in the attached figure. Sample is pulled through the following components:

1. Glass or nickel-coated stainless steel nozzle
2. Heated glass probe (250 $\pm$ 15 F)
3. Optional cyclone in heated oven (250 $\pm$ 15 F)
4. Filter in heated oven
5. Glass or teflon tubing
6. Condenser/sorbent module cooled with circulating ice water from impinger bath
7. Dry impinger with stub stem
8. Greenburg-Smith impinger with 100 ml DI H_2O
9. Dry impinger as a knockout
10. Impinger containing silica gel
11. Leak-free vacuum pump
12. Calibrated dry gas meter

The pump, meter, manometers, and heater controllers are all contained in a single control box (Andersen Universal or equivalent).

During final sample train assembly and leak check procedures on the stack or duct, special precautions are taken to minimize the chance of contamination. Sample train components are open to the air for as short a time as possible; and during transport to and from the stack, all components are sealed with hexane rinsed aluminum foil.



Semi-VOST Sampling Train

Sample Recovery: All sample recovery is performed in Carnot's laboratory or an on-site clean room. Following sampling the resin module is sealed with glass caps and stored in a refrigerator or ice chest, the filter is placed in a light-proofed petri dish, and all glassware components are rinsed. The rinse consists of three rinses each of the solvents specified in CARB Method 428 or 429. All solvents are high purity GC/MS grade, the squirt bottles are teflon, and the sample bottles are amber glass with teflon-lined caps. Water fractions are placed in separate bottles from the solvent rinses to simplify extraction procedures for the contract laboratory.

Field Blank: At least once during each test series, a field blank sample is collected. This consists of assembling a sample train transporting it to and from the stack, leak checking it, and recovering it. This sample is analyzed using the same procedures as for the test samples.

Sample Custody: Full chain of custody is maintained on all reagents, sample trains, and samples by Carnot and by contract laboratories. In addition to formal documentation by the sample custodians, sample data sheets are initialed by the individuals who assemble and recover each sample train component.

Method: **Stack Gas Velocity and Volumetric Flow Rate**

Reference: EPA Method 2, SCAQMD Method 2.1, ARB Method 2

Principle: The average gas velocity in a stack is determined from the measurement of the gas density and from the measurement of the average velocity head using a Type-S (Stausscheibe) Pitot tube.

Sampling Procedure: The velocity head and temperature are measured at traverse points specified by EPA Method 1 or SCAQMD Method 1.1. The velocity is measured using a Type-S Pitot tube and an inclined water manometer. The flow coefficient of the pitot tube is known. Temperature of the gas is measured using a thermocouple. The stack gas molecular weight is determined from independent measurements of O_2, CO_2, and H_2O concentrations.

Sample Analysis and Recovery: The stack gas velocity is determined from the measured average velocity head, the measured average temperature, the measured average duct static pressure, the measured dry concentrations of O_2 and CO_2, and the measured concentration of H_2O. The velocity is determined from the following set of equations:

$$V_S = 2.90 C_p \sqrt{\Delta p T_s \left[\frac{29.92}{P_s}\right]\left[\frac{28.95}{MW_{wet}}\right]} \quad [\text{ ft/s }]$$

Δp = *Velocity/Head, inches* H_2O [in. H_2O]

T_s = *Gas Temperature, degrees R* [R]

P_s = *Absolute Static Pressure* [in Hg]

C_p = *Pitot Flow Coefficient* [unitless]

$$MW_{wet} = [(0.44)(\%CO_2)+(0.32)(\%O_2)+(0.28)(\%N_2)](1-\frac{\%H_2O}{100})+(18)(\frac{\%H_2O}{100})$$

The stack gas volumetric flow rate is determined from the measured stack gas velocity, the area of the stack at the measurement plane, and the measured gas temperature and pressure. The volumetric flow rate is determined from the following set of equations:

$$Q = (V_s)(AREA)(60) \quad [\text{ wacfm }]$$

$$Q_{ws} = Q\left[\frac{T_{ref}}{T_s}\right]\left[\frac{P_s}{29.92}\right] \quad [\text{ wscfm }]$$

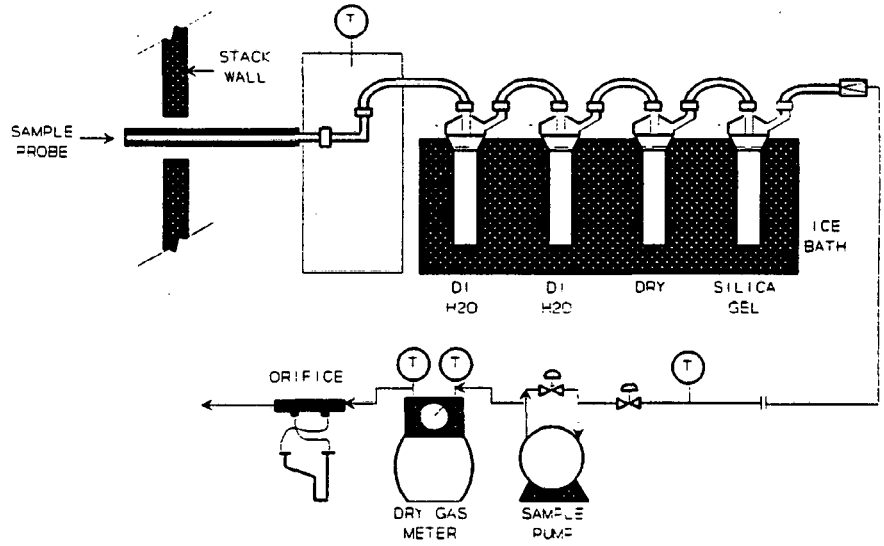
$$Q_{sd} = Q_{ws}\left[1-\frac{\%H_2O}{100}\right] \quad [\text{ dscfm }]$$

Method: **Determination of Moisture in Stack Gases**

Applicable Ref. Methods: EPA 4, ARB 1-4, SCAQMD 4.1

Principle: A gas sample is extracted at a constant rate from the source; moisture is removed from the sample stream and determined volumetrically or gravimetrically.

Sampling Procedure: The sample train used in the tests is shown in the following figure. The sample is drawn at a constant rate through a stainless steel probe. The probe is connected to an impinger train by Teflon tubing. The train consists of two Greenburg-Smith impingers which contain 100 ml water, an empty impinger as a knockout, and an impinger containing silica gel to protect the pump from moisture.



Sample Train for Determination of Moisture by EPA Method 4

Sample Recovery and Analysis: Following testing, moisture content is determined gravimetrically from initial and final impinger weights.

APPENDIX B
QUALITY ASSURANCE

Appendix B.1

Quality Assurance Program Summary

QUALITY ASSURANCE PROGRAM SUMMARY AND ARB CERTIFICATION

Carnot ensures the quality and validity of its emission measurement and reporting procedures through a rigorous quality assurance (QA) program. The program is developed and administered by an internal QA Officer and encompasses seven major areas:

1. Development and use of an internal QA manual.
2. QA reviews of reports, laboratory work, and field testing.
3. Equipment calibration and maintenance.
4. Chain of custody.
5. Training.
6. Knowledge of current test methods.
7. Agency certification.

Each of these areas is discussed individually below.

Quality Assurance Manual. Carnot has prepared a QA Manual according to EPA guidelines. The manual serves to document and formalize all of Carnot's QA efforts. The manual is constantly updated, and each member of the Source Test Division is required to read and understand its contents. The manual includes details on the other six QA areas discussed below.

QA Reviews. Carnot's review procedure includes review of each source test report by the QA Officer, and spot check reviews of laboratory and field work.

The most important review is the one that takes place before a test program begins. The QA Officer works closely with Source Test Division personnel to prepare and review test protocols. Test protocol review includes selection of appropriate test procedures, evaluation of any interferences or other restrictions that might preclude use of standard test procedures, and evaluation and/or development of alternate procedures.

Equipment Calibration and Maintenance. The equipment used to conduct the emissions measurements is maintained according to the manufacturer's instructions to ensure proper operation. In addition to the maintenance program, calibrations are carried out on each measurement device according to the schedule outlined by the California Air Resources Board (CARB). The schedule for maintenance and calibrations are given in Tables B-1 and B-2. Quality control checks are also conducted in the field for each test program. The following is a partial list of checks made as part of each CEM system test series.

- Sample acquisition and conditioning system leak check.
- 2-point analyzer calibrations (all analyzers)
- 3-point analyzer calibrations (analyzers with potential for linearity errors).
- Complete system calibration check ("dynamic calibration" through entire sample system).

- Periodic analyzer calibration checks (once per hour) are conducted at the start and end of each test run. Any change between pre- and post-test readings are recorded.

- All calibrations are conducted using gases certified by the manufacturer to be + 1% of label value (NBS traceable).

Calibration and CEM performance data are fully documented, and are included in each source test report.

Chain of Custody. Carnot maintains full chain of custody documentation on all samples and data sheets. In addition to normal documentation of changes between field sample custodians, laboratory personnel, and field test personnel, Carnot documents every individual who handles any test component in the field (e.g., probe wash, impinger loading and recovery, filter loading and recovery, etc.).

Samples are stored in a locked area to which only Source Test Division personnel have access. Neither other Carnot employees nor cleaning crews have keys to this area.

Data sheets are copied immediately upon return from the field, and this first generation copy is placed in locked storage. Any notes made on original sheets are initialed and dated.

Training. Personnel training is essential to ensure quality testing. Carnot has formal and informal training programs which include:

1. Attendance at EPA-sponsored training courses.
2. Enrollment in EPA correspondence courses.
3. A requirement for all technicians to read and understand Carnot's QA Manual.
4. In-house training and QA meetings on a regular basis.
5. Maintenance of training records.

Knowledge of Current Test Methods. With the constant updating of standard test methods and the wide variety of emerging test methods, it is essential that any qualified source tester keep abreast of new developments. Carnot subscribes to services which provide updates on EPA and CARB reference methods, and on EPA, CARB and SCAQMD rules and regulations. Additionally, source test personnel regularly attend and present papers at testing and emission-related seminars and conferences. Carnot personnel maintain membership in the Air Pollution Control Association, the Source Evaluation Society, and the ASME Environmental Control Division.

AGENCY CERTIFICATION

Carnot is certified by the CARB as an independent source test contractor for gaseous and particulate measurements. Carnot also participates in EPA QA audit programs for Methods 5, 6 and 7.

TABLE B-1
SAMPLING INSTRUMENTS AND EQUIPMENT CALIBRATION SCHEDULE
As Specified by the CARB

Instrument Type	Frequency of Calibration	Standard of Comparison or Method of Calibration	Acceptance Limits
Orifice Meter (large)	12 months	Calibrated dry test meter	± 2% of volume measured
Dry Gas Meter	12 months or when repaired	Calibrated dry test meter	± 2% of volume measured
S-Type Pitot (for use with EPA-type sampling train	6 months	EPA Method 2	Cp constant (+5%) over working range; difference between average Cp for each leg must be less than 2%
Vacuum Gauges Pressure Gauges	6 months	Manometer	± 3%
Field Barometer	6 months	Mercury barometer	± 0.2" Hg
Temperature Measurement	6 months	NBS mercury thermometer or NBS calibrated platinum RTD	± 4°F for <400°F ± 1.5% for >400°F
Temperature Readout Devices	6 months	Precision potentiometer	± 2% full scale reading
Analytical Balance	12 months (check prior to each use)	Should be performed by manufacturer or qualified laboratory	± 0.3 mg of stated weight
Probe Nozzles	12 Months	Nozzle diameter check micrometer	Range < ± 0.10 mm for three measurements
Continuous Analyzers	Depends upon use, frequency and performance	As specified by manufacturers operating manuals, EPA NBS gases and/or reference methods	Satisfy all limits specified in operating specifications

TABLE B-2
EQUIPMENT MAINTENANCE SCHEDULE
Based on Manufacturer's Specifications and Carnot Experience

Equipment	Performance Requirement	Maintenance Interval	Corrective Action
Pumps	1. Absence of leaks 2. Ability to draw manufacturer required vacuum and flow	Every 500 hours of operation or 6 months, whichever is less	1. Visual inspection 2. Clean 3. Replace worn parts 4. Leak check
Flow Measuring Device	1. Free mechanical movement 2. Absence of malfunction	Every 500 hours of operation or 6 months, whichever is less After each test, if used in H_2S sampling or other corrosive atmospheres	1. Visual inspection 2. Clean 3. Calibrate
Sampling Instruments	1. Absence of malfunction 2. Proper response to zero, span gas	As required by the manufacturer	As recommended by manufacturer
Integrated Sampling Tanks	Absence of leaks	Depends on nature of use	1. Steam clean 2. Leak check
Mobile Van Sampling Systems	Absence of leaks	Depends on nature of use	1. Change filters 2. Change gas dryer 3. Leak check 4. Check for system contamination
Sampling Lines	Sample degradation less than 2%	After each test or test series	Blow filtered air through line until dry

Appendix B.2

ARB Certification

State of California
AIR RESOURCES BOARD

Executive Order G-836

Approval to Carnot
To Conduct Testing as an Independent Contractor

WHEREAS, the Air Resources Board ("Board"), pursuant to Section 41512 of the California Health and Safety Code, has established the procedures contained in Section 91200-91220, Title 17, California Code of Regulations, to allow the use of independent testers for compliance tests required by the Board; and

WHEREAS, pursuant to Sections 91200-91220, Title 17, California Code of Regulations, the Executive Officer has determined that Carnot meets the requirements of the Board for conducting Board Test Methods 1, 2, 3, 4, 5, 6, 8, 10, and 100 (NOx, O2) when the following conditions are met:

1. Carnot conducts Board Test Method 100 for O2 using a Teledyne 326 analyzer with either a A5 or a B1 sensor, or a paramagnetic analyzer.

NOW, THEREFORE, BE IT ORDERED that Carnot is granted an approval, from the date of execution of this order, until June 30, 1994 to conduct the tests listed above, subject to compliance with Section 91200-91220, Title 17, California Code of Regulations.

BE IT FURTHER ORDERED that during the approved period the Executive Officer or his or her authorized representative may field audit one or more tests conducted pursuant to this order for each type of testing listed above.

Executed this 14th day of June 1993, at Sacramento, California.

James J. Morgester, Chief
Compliance Division

State of California

Air Resources Board

Approved Independent Contractor

Carnot

This is to certify that the company listed above has been approved by the Air Resources Board to conduct compliance testing pursuant to Section 91207, Title 17, California Code of Regulations, until June 30, 1994, for those test methods listed below:

ARB Source Test Methods:
1, 2, 3, 4, 5, 6, 8, 10, 100(NOx, O2)

James J. Morgester, Chief
Compliance Division

Laura McKinney, Manager
Investigation and Certification Section

Appendix B.3

Calibration Data

CARNOT

DRY GAS METER CALIBRATION

FIELD METER

FIELD GAS METER I.D....ES-19

DATE..... 2-3-94

FIELD METER LAST Yd....1.0220

BAROMETRIC PRESSURE.... 30.15

CALIBRATION BY..... RM

TEST METER INFO.

TEST METER ID..... ES-13

TEST METER LAST CAL.. 1/7/94

TEST METER Yd FACTOR 0.9979

LEAK CHECK IN/OUT... 16

ALLOWABLE CRITERIA

INDIVIDUAL Yd=0.01

Yd <=2% OF GEN AVG

0.98<AVG. Yd>1.02

H@<=0.2 OF AVG. H@

FIELD METER				TEST METER			RESULTS				
VOLUME cu.ft.	TEMP ave'F	DELTA H "H2O	TIME min.	VOLUME cu.ft.	TEMP. 'F	PRESS. "H2O	Q cfm	Y	H@	AVE.Y	AVG. H@
5.842	81.0	0.35	16	5.614	61.0	-0.30	0.365	0.994	1.52	0.9934	1.52
5.839	80.0	0.35	16	5.612	60.0	-0.30	0.365	0.994	1.51		
5.859	79.0	0.35	16	5.636	61.0	-0.30	0.366	0.992	1.51		
5.630	83.0	0.50	13	5.411	62.0	-0.40	0.433	0.995	1.54	0.9970	1.55
5.625	83.0	0.50	13	5.407	62.0	-0.40	0.433	0.996	1.54		
5.580	78.0	0.50	13	5.447	63.0	-0.40	0.429	1.000	1.54		
5.331	85.0	0.80	10	5.195	63.0	-0.70	0.533	1.010	1.59	1.0135	1.59
5.319	88.0	0.80	10	5.189	63.0	-0.70	0.532	1.016	1.58		
5.342	88.0	0.80	10	5.202	63.0	-0.70	0.534	1.014	1.57		
5.375	89.0	1.00	9	5.196	63.0	-0.90	0.597	1.008	1.60	1.0061	1.60
5.371	85.0	1.00	9	5.212	63.0	-0.90	0.597	1.004	1.60		
5.378	88.0	1.00	9	5.198	63.0	-0.90	0.598	1.006	1.60		
5.854	88.0	1.20	9	5.655	63.0	-1.00	0.650	1.005	1.62	1.0035	1.63
5.836	86.0	1.20	9	5.651	63.0	-1.00	0.648	1.003	1.63		
5.847	87.0	1.20	9	5.647	63.0	-1.00	0.650	1.003	1.63		

5 CU. FT. /RUN IS SATISFIED

AVERAGE Yd = 1.0026

AVERAGE DELTA H@ = 1.58

AVERAGE cfm @^H=1.0 = 0.597

PASS-INDIVIDUAL Yd VALUES MEET (0.01) LIMITS
PASS -INDIVIDUAL Yd VALUES WITHIN (.98/1.02) LIMITS
PASS-Yd WITHIN 2% / AVG
PASS- DELTA H@ VALUES WITHIN ALLOWABLE (.2) LIMITS

POST TEST DRY GAS METER CALIBRATION CHECK

CALIBRATED BY JM
DATE 11/11/93
FIELD GAS METER I.D. ES-19
INITIAL Yd 1.022
INITIAL H@ 1.560

DATA ENTRY BY CHF
BAROMETRIC PRESSURE 29.87
TEST METETER ES-13
TEST METER Y (Yt) 1.0021
TEST METER LAST CAL. 7/30/93

FIELD METER				TEST METER				RESULTS	
VOLUME cu.ft.	TEMP. IN	TEMP. OUT	DELTA "H2O	TIME min.	VOLUME cu.ft.	TEMP. Avg.	DELTA "H2O	Q cfm	Y
8.386	92.0	87.0	2.00	10	8.494	67.5	-2	0.839	1.045
8.170	89.0	85.0	2.00	10	8.381	67.5	-2	0.817	1.053
8.147	94.0	84.0	2.00	10	8.381	67.5	-2	0.815	1.060
						AVERAGES		0.823	1.053

PASS - INDIVIDUAL Yd VALUES ACCEPTABLE
PASS - INDIVIDUAL DELTA H@ VALUES ACCEPTABLE
PASS - POST TEST Yd WITHIN LIMITS

CARNOT

DRY GAS METER CALIBRATION

FIELD METER

FIELD GAS METER I.D....ES-30

DATE..... 1-25-94

FIELD METER LAST Yd....1.0031

BAROMETRIC PRESSURE.... 30.14

CALIBRATION BY..... RM

TEST METER INFO.

TEST METER ID..... ES-13

TEST METER LAST CAL.. 1/7/94

TEST METER Yd FACTOR 0.9979

LEAK CHECK IN/OUT... 15

ALLOWABLE CRITERIA

INDIVIDUAL Yd=0.01

Yd <=2% OF GEN AVG

0.98<AVG. Yd>1.02

H@<=0.2 OF AVG. H@

FIELD METER				TEST METER			RESULTS				
VOLUME cu.ft.	TEMP ave'F	DELTA H "H2O	TIME min.	VOLUME cu.ft.	TEMP. 'F	PRESS. "H2O	Q cfm	Y	H@	AVE.Y	AVG. H@
5.606	68.0	0.35	18	5.568	62.0	-0.20	0.311	1.001	2.01	1.0005	2.02
5.599	69.0	0.35	18	5.577	63.0	-0.20	0.311	1.004	2.00		
5.604	68.0	0.35	18	5.549	63.0	-0.20	0.311	0.996	2.03		
5.391	67.0	0.50	15	5.379	61.0	-0.30	0.359	1.005	2.13	1.0050	2.11
5.408	67.0	0.50	15	5.398	61.0	-0.30	0.361	1.006	2.12		
5.479	68.0	0.50	15	5.462	62.0	-0.30	0.365	1.004	2.07		
5.380	66.0	0.80	12	5.393	61.0	-0.50	0.448	1.007	2.18	1.0055	2.17
5.418	66.0	0.80	12	5.420	61.0	-0.50	0.452	1.005	2.16		
5.418	66.0	0.80	12	5.422	61.0	-0.50	0.452	1.005	2.16		
5.477	66.0	1.00	11	5.499	61.0	-0.60	0.498	1.008	2.21	1.0078	2.21
5.485	66.0	1.00	11	5.511	61.0	-0.60	0.499	1.008	2.20		
5.488	66.0	1.00	11	5.509	61.0	-0.60	0.499	1.007	2.20		
5.325	66.0	1.20	10	5.374	61.0	-0.80	0.533	1.012	2.30	1.0109	2.29
5.324	66.0	1.20	10	5.356	61.0	-0.80	0.532	1.009	2.31		
5.385	66.0	1.20	10	5.437	61.0	-0.80	0.539	1.012	2.24		

5 CU. FT. /RUN IS SATISFIED

AVERAGE Yd = 1.0059

AVERAGE DELTA H@ = 2.16

AVERAGE cfm @^H=1.0 = 0.498

PASS-INDIVIDUAL Yd VALUES MEET (0.01) LIMITS
PASS -INDIVIDUAL Yd VALUES WITHIN (.98/1.02) LIMITS
PASS-Yd WITHIN 2% / AVG
PASS- DELTA H@ VALUES WITHIN ALLOWABLE (.2) LIMITS

CARNOT

DRY GAS METER CALIBRATION

FIELD GAS METER I.D....ES-30 TEST METER ID.....: ES-13

DATE.....8/10/93 TEST METER LAST CAL..7/30/93

BAROMETRIC PRESSURE....29.96 TEST METER CAL FACTOR 1.0021 = Yt

CALIBRATION BY.....BC LEAK CHECK.....15"

FIELD METER				TEST METER				RESULTS			
VOLUME cu.ft.	TEMP.a 'F	DELTA H "H2O	TIME min.	VOLUME cu.ft.	TEMP. 'F	PRESS. "H2O	Q cfm	Y	H@	AVE.Y	AVG. H@
5.458	74.3	0.50	15	5.649	71.0	0.38	0.364	1.043	1.97	1.0452	1.98
5.427	75.3	0.50	15	5.639	72.0	0.38	0.362	1.047	1.98		
5.446	76.5	0.50	15	5.633	72.0	0.38	0.363	1.045	1.98		
5.342	75.5	0.80	12	5.552	71.0	0.60	0.445	1.050	2.08	1.0498	2.08
5.368	77.3	0.80	12	5.554	71.0	0.60	0.447	1.049	2.08		
5.374	77.5	0.80	12	5.571	71.0	0.60	0.448	1.051	2.06		
4.958	75.8	1.00	10	5.136	71.5	0.70	0.496	1.046	2.12	1.0450	2.14
4.953	75.3	1.00	10	5.116	72.0	0.70	0.495	1.041	2.14		
4.927	77.0	1.00	10	5.112	72.0	0.70	0.493	1.049	2.14		
6.646	78.0	2.00	7	6.912	72.0	1.30	0.949	1.052	1.14	1.0517	1.94
4.682	79.5	2.00	7	4.850	72.0	1.30	0.669	1.051	2.32		
4.668	79.5	2.00	7	4.846	72.5	1.30	0.667	1.052	2.33		
5.224	78.8	3.00	6	5.430	73.0	2.00	0.871	1.050	2.05	1.0505	2.18
5.070	80.0	3.00	6	5.253	73.0	2.00	0.845	1.049	2.19		
4.946	79.0	3.00	6	5.146	73.0	2.00	0.824	1.052	2.29		
								AVERAGE =		1.0484	2.06
								AVERAGE cfm @^H=1.0 =			0.495
										*******	********

CARNOT
SPAN GAS RECORD

CLIENT/LOCATION: PV Boiler DATE: 11-22-93

BY: CHF

GAS	SPAN CYLINDER		AUX. SPAN CYLINDER	
	CYLINDER NO.	CONCENTRATION	CYLINDER NO.	CONCENTRATION
ZERO				
NOx	ALM25743	12.86	AAL2489	23.44 / 92.76
O_2	ALM5661	5.02	AAL1791	7.997
CO	AAL21120	10.55/52.75	AAL8056	17.2/86.0
CO_2	ALM5661	15.1	AAL1791	22.35/89.4
SO_2				

CARNOT
INSTRUMENT LINEARITY

	ANALYZER				
	O_2	CO_2	CO	NOx	SO_2
ANALYZER RANGE	0-10	0-25	0-20	0-25	
SET TO HIGH STD (80-90% OF RANGE)	7.997	22.35	17.2	23.44	
ACTUAL VALUE OF LOW STD	5.02	15.1	10.55	12.86	
AS-FOUND LOW STD (50-60% OF RANGE)	5.16	15.15	10.6	12.45	
DIFFERENCE IN % OF FULL SCALE					

% ERROR CALCULATION:

$$\frac{\text{(AS FOUND - ACTUAL VALUE OF SPAN)}}{\text{RANGE}} \times 100$$

ALLOWABLE DEVIATION IS 2% OF FULL SCALE (2 SQUARES ON STRIP CHART).

CARNOT

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: 06/04/92
Our Project No: 19562
Your P.O. No: 8346
Page 1 of 1
Expiration Date: 12/93

CARNOT
ATTN: JIM MULLIGAN
15991 RED HILL AVE
SUITE 110
TUSTIN CA 92680

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES

Certified Per Traceability Protocol No. 1 Procedure No. G1 Cylinder No. ALM025743 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
NITRIC OXIDE	12.53 PPM	GMIS TRACEABLE	ALM001512	22.39 PPM	THERMO-ELECTRON	04/10/92	CHEMI-LUMINESCENT
		TO SRM2629A			10AR 14853-150		
NOX	12.86 PPM						

BALANCE GAS NITROGEN

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

Component NITRIC OXIDE
First Analysis Date 05/26/92 Units mv

Z 0.00	R 89.18	T 49.72
R 89.22	Z 0.00	T 49.82
Z -0.10	T 49.76	R 88.92

Mean Test Assay 12.51 PPM

Second Analysis Date 06/02/92 Units mv

Z 0.00	R 89.35	T 50.09
R 89.67	Z 0.15	T 50.35
Z -0.35	T 50.20	R 89.89

Mean Test Assay 12.55 PPM

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 _____

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 C. KING

Approved By: _____
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
CARNOT
15991 RED HILL AVE
SUITE 110
TUSTIN, CA 92680

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

Purchase Order 9895
Project # 25796.003

ANALYTICAL INFORMATION

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

Cylinder Number AAL2489
Cylinder Pressure 2000 psig
Certification Date 06-09-93
Previous Certification Dates NONE
Acid Rain Exp 12-09-94
General Exp 06-09-95

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
NITRIC OXIDE	23.09 PPM	± 1 % NIST Traceable

Balance Gas: Nitrogen

NOX	23.44 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	01-94	ALM033911	24.97 ppm

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
TECO / 10AR / 38644-258	04-30-93	Chemi-Luminescent

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

Components: Nitric Oxide

First Triad Analysis

Date: 06-02-93 Response Units: mv

Z1=	0.00	R1=	95.96	T1=	88.50
R2=	96.12	Z2=	0.00	T2=	88.67
Z3=	0.00	T3=	88.65	R3=	96.10

Avg. Conc. of Cust Cyl. 23.03 ppm

Date: Response Units: mv

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.

Second Triad Analysis

Date: 06-09-93 Response Units: mv

Z1=	0.00	R1=	96.23	T1=	89.20
R2=	96.20	Z2=	0.00	T2=	89.14
Z3=	0.00	T3=	89.19	R3=	96.25

Avg. Conc. of Cust Cyl. 23.14 ppm

Date: Response Units: mv

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.

Calibration Curve

Concentration= Ax + B
A =1.001
B =0.05283

Concentration=

Concentration=

Special Notes : If this product is used for Aicd Rain Rule Compliance, the Acid Rain Expiration Date noted above applies per 40 CFR Part 75, Appendix H. Otherwise the General Expiration Date applies

Analyst Joseph De La Torre

Scott Specialty Gases, Inc.

Shipped From: 2600 CAJON BLVD.
SAN BERNARDINO CA 92411
Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ANALYSIS

CARNOT

C/O SSG PAD
2600 CAJON BOULEVARD
SAN BERNARDINO CA 92411

PROJECT #: 02-25802-002
PO#: 9895
ITEM #: 0202C3002504AL
DATE: 5/28/93

CYLINDER #: ALM005661 ANALYTICAL ACCURACY: +/-2%
FILL PRESSURE: 2000 PSIG
BLEND TYPE : CERTIFIED MASTER GAS

COMPONENT	REQUESTED GAS CONC	MOLES	ANALYSIS (MOLES)	
CARBON DIOXIDE	15.	PCT	15.1	PCT
OXYGEN	5.	PCT	5.02	PCT
NITROGEN - OXYGEN FREE		BAL		BAL

CERTIFIED

6/14 BIN#1 2000 PSIG

NIST TRACEABLE TO CRM1675
NIST TRACEABLE TO CRM2659

ANALYST: MAYNARD JOHNSON

APPROVED BY: ROBERT SHEALY

RECEIVED
DEC 0 1992
CARNOT

Scott Specialty Gases, Inc.

Shipped From: 2600 CAJON BLVD.
SAN BERNARDINO CA 92411
Phone: 714-887-2571 Fax: 714-887-0549

CERTIFICATE OF ANALYSIS

CARNOT
ATTN: RICK MADRIGAL
15991 RED HILL AVE
SUITE 110
TUSTIN CA 92680

PROJECT #: 02-22561
PO#: 9113 ITEM # 2
ITEM #: 0202CB013601AL
DATE:11/20/92

CYLINDER #: AAL1791
FILL PRESSURE: 1920 PSIG

ANALYTICAL ACCURACY: +/-1%

COMPONENT	REQUESTED GAS CONC	MOLES	ANALYSIS (MOLES)	
CARBON DIOXIDE	22.5	PCT	22.48	PCT
OXYGEN	8.	PCT	7.998	PCT
NITROGEN		BAL		BAL

CARNOT 11/23 BIN#3
CERTIFIED TO HAVE BEEN BLENDED

GRAVIMETRIC MASTER GAS -
AGAINST NIST CERTIFIED WEIGHTS

ANALYST: MJ
MAYNARD JOHNSON

APPROVED BY:
DR. ARMAND LANGE, PH.D

JIM MULLIGAN
15991 RED HILL AVE
SUITE 110
TUSTIN CA 92680

Scott Specialty Gases, Inc.

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

2600 CAJON BLVD., SAN BERNARDINO, CA 92405

Shipped From: Scott SAN BERNARDINO, CA
Date Shipped 05/18/92
Our Project No: 19562
Your P.O. No: 8346
Page 1 of 1
Expiration Date: 11/93

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES

Certified Per Traceability Protocol No. 1 Procedure No. G1 Cylinder No. AAL21120 Cylinder Pressure 2015 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 MONOXIDE	10.55 PPM	CRM2635	AAL9760	24.30 PPM	HORIBA AIA-24 4564403	02/10/92	INFRA-RED

BALANCE GAS NITROGEN
ANALYZER READINGS: Z = Zero Gas T = Test Gas R = Reference Gas

Component CARBON MONOXIDE
First Analysis Date 05/07/92 Units mv

Z 00.00	R 47.8	T 20.9			
R 47.8	Z 00.03	T 20.8			
Z 00.02	T 20.9	R 47.8			

Mean Test Assay 10.56 PPM

Second Analysis Date 05/13/92 Units mv

Z 00.00	R 47.8	T 20.8			
R 47.8	Z 00.01	T 20.8			
Z 00.04	T 20.8	R 47.8			

Mean Test Assay 10.53 PPM

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 _____

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 M. JOHNSON

Approved By: _____
A.F. LANGE, Ph.D., MANAGER, Q

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
CARNOT
RICK MADRIGAL
15991 RED HILL AVE
SUITE 110
TUSTIN, CA 92680

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

Purchase Order 1354
Project # 28068.002

ANALYTICAL INFORMATION

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

Cylinder Number AAL8056 **Certification Date** 10-21-93 **GENERAL Date** 10-21-96
Cylinder Pressure 1900 psig ACID RAIN DATE

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
CARBON MONOXIDE	17.20 PPM	± 1 % NIST Traceable

Balance Gas: Nitrogen

*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	11-95	ALM026614	96.23 ppm

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
Horiba / OPE-135D / 56565502	08-23-93	NDIR

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

Components: Carbon Monoxide

First Triad Analysis

Date: 10-14-93 Response Units: mv
Z1= 0.00 R1= 97.0 T1= 18.1
R2= 97.0 Z2= 0.00 T2= 18.1
Z3= 0.00 T3= 18.2 R3= 97.0
Avg. Conc. of Cust Cyl. 17.20 ppm

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

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

Second Triad Analysis

Date: 10-21-93 Response Units: mv
Z1= 0.00 R1= 97.0 T1= 18.2
R2= 97.0 Z2= 0.00 T2= 18.1
Z3= 0.00 T3= 18.1 R3= 97.0
Avg. Conc. of Cust Cyl. 17.20 ppm

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

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

Calibration Curve

Concentration= Ax^2+Bx+C
A = 0.0005081
B = 0.9438
C = 0.07474

Concentration=

Concentration=

SPECIAL NOTES: IF THIS PRODUCT IS USED FOR ACID RAIN COMPLIANCE, THE ACID RAIN EXPIRATION DATE NOTED ABOVE APPLIES PER 40 CFT PART 75 APPENDIX H. OTHERWISE THE GENERAL EXPIRATION DATE APPLIES.

ANALYST: Thomas E. Dolan

Appendix B.4

Chain of Custody

CERTIFICATION OF SAMPLE RECEIPT

PROJECT # 10391 | OUTSIDE LAB REQUIRED (Y/N) Y | SAMPLE DATE 11/23-24/93

CLIENT/LOCATION _____ | PROJECT MANAGER Craig Fey

SAMPLE LOCATION LFG Boiler Ex | METHOD(S) CARB 428 | TECHNICIAN _____

COMPLIANCE TEST (Y/N) Y | DATE DUE _____

TEST #	COMPLETE DESCRIPTION
	CARB 428 Samples LFG Fired Boiler Exhaust
1-Dioxin	2 bottles each Solvent and H_2O, 1 Filter, 1 column
2-Diox	↓ ↓ ↓
3-Diox	↓ ↓ ↓
F Blank-Diox	↓ only one H_2O bottle ↓ ↓

CHAIN OF CUSTODY PRIOR TO SHIPMENT:

RELEASED BY	DATE	TIME	RECEIVED BY	DATE	TIME
[signature]	11/24/93	18:52	[signature]	11/29/93	08:00
	/ /	:		/ /	:
	/ /	:		/ /	:

OUTSIDE LAB INFORMATION

SAMPLES SHIPPED TO _____

_____

_____

PHONE: ( ) –

CARNOT SHIPPER _____

DATE / /

CARRIER # _____

AIR BILL # _____

RECIPIENT _____

COMPANY _____

DATE / /

15991 Red Hill Ave., Suite 110, Tustin, California 92680-7388 (714) 259-9520 - FAX (714) 259-0372

CARNOT

CERTIFICATION OF SAMPLE RECEIPT

PROJECT # 10 391 | OUTSIDE LAB REQUIRED (Y/N) Y | SAMPLE DATE / /

CLIENT/LOCATION | PROJECT MANAGER C. Fry

SAMPLE LOCATION | METHOD(S) CARB 428 | TECHNICIAN

COMPLIANCE TEST (Y/N) YES | DATE DUE

TEST #	COMPLETE DESCRIPTION
1- Dioxin	XAD-2 resin, filter # 110-3171, organic rinse (2), H_2O (2)
2- Dioxin	XAD-2 resin, filter # 110-3172, organic rinse (2), H_2O (2)
3- Dioxin	XAD-2 resin, filter # 110-3174, organic rinse (2), H_2O (2)
FB-Dioxin	XAD-2 resin, filter # 110-3173, organic rinse (2), H_2O (2)

CHAIN OF CUSTODY PRIOR TO SHIPMENT:

RELEASED BY	DATE	TIME	RECEIVED BY	DATE	TIME
Derek Kumm	11/29/93	:	K Stephenson	93/11/30	10:20am
	/ /	:		/ /	:
	/ /	:		/ /	:

OUTSIDE LAB INFORMATION

SAMPLES SHIPPED TO ZENON ATTN: RON MCLEOD
5555 N. SERVICE RD.
BURLINGTON ON, CANADA L7L 5H7
PHONE: (416) 332-8788

CARNOT SHIPPER DEREK KUMM
DATE 11/29/93
CARRIER # FED EX
AIR BILL #
RECIPIENT K Stephenson
COMPANY ZEL
DATE 93/11/30

15991 Red Hill Ave., Suite 110, Tustin, California 92680-7388 (714) 259-9520 - FAX (714) 259-0372

APPENDIX C

FIELD AND LABORATORY DATA SUMMARIES

Appendix C.1

Sample Location

CARNOT

SAMPLING POINT LOCATION DATA - EPA METHOD 1

PLANT: PVLF Boiler Unit 2 DATA BY: BAC

DATE: 11/23/93

TEST LOCATION: STACK

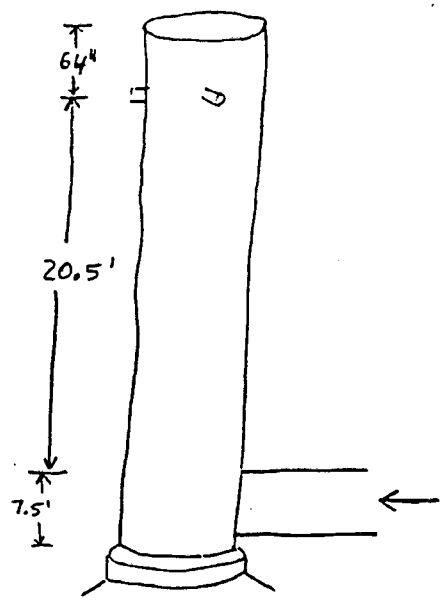


Diagram of Sampling Location

UPSTREAM DIST./DIA.: 1.56

DOWNSTREAM DIST./DIA.: 6.00

COUPLING LENGTH: 5.5"

NO. OF SAMPLING PTS.: 16

STACK DIMENSION: 41"

STACK AREA, FT²: 9.168

SAMPLE POINT	% OF DIAMETER	IN. FROM NEAR WALL	IN. FROM NOZZLE*
1	3.2	1.3	6.8
2	10.5	4.3	9.8
3	19.4	7.95	13.5
4	32.3	13.2	18.7
5	67.7	27.8	33.3
6	80.6	33.0	38.5
7	89.5	36.7	42.2
8	96.8	39.7	45.2

*INCHES FROM WALL PLUS COUPLING LENGTH

CARNOT

Appendix C.2

CEM Data and Strip Charts

Average NOx and CO Emissions
PVERG Unit 2
November 1993

Test No.	Qsd* dscfm	O2, %	CO2, %	NOx ppm	NOx ppm @ 3% O2	NOx lb/hr**	CO ppm	CO ppm @ 3% O2	CO lb/hr
1-Dioxin	13,408	2.47	15.01	23.07	22.41	2.25	< 1	< 0.97	< 0.06
2-Dioxin	13,552	2.57	15.28	23.23	22.69	2.29	< 1	< 0.98	< 0.06
3-Dioxin	13,425	2.58	15.13	23.64	23.10	2.31	< 1	< 0.98	< 0.06
Average	**13,462**	**2.54**	**15.14**	**23.31**	**22.73**	**2.28**	**< 1**	**< 0.97**	**< 0.06**

*Flow rates are from tests 1- through 3-Dioxin

**NOx mass emissions are calculated as NO2 (46.01 lb/lb mole).

NOTE: NOx and CO concentrations are the drift-corrected average values for the full 240 minute PCDD/PCDF tests.

CARNOT
CEM PERFORMANCE DATA

CLIENT/LOCATION: PV Flare, Boiler DATE: 11-23-93

BY: CMC

SYSTEM CONFIGURATION				
ANALYZERS IN SERVICE				
ANALYZERS:	O_2	CO_2	CO	NOx
MODEL:	Teledyne	Horiba	Thermo Elec	Thermo Elec
SERIAL NO.:			45	13

PROBE		SAMPLE CONDITIONER	
LENGTH:	6'	CONDENSER-VACUUM SIDE (CHECK FLOW):	✓
LINER MATERIAL:	Inconel	CONDENSER-PRESSURE SIDE (CHECK FLOW):	✓
HEATED PROBE (Y/N):	N	CONDENSER TEMPERATURE:	36
HEATED LINE (Y/N):	Y	FILTER CONDITION (COND. OR DATE LAST CHANGED):	Good
SAMPLE LINE		**SYSTEM LEAK CHECK**	
LENGTH:	3/8" 100 ft.	PRE-TEST (cfh):	00.000
LINER MATERIAL:	Teflon	POST-TEST (cfh):	0.00
SYSTEM BIAS LINE:	100 Teflon 1/4"	LEAK RATE (%) = POST-TEST (cfh) / SYSTEM FLOW RATE (cfm) x 60 x 100 = ____ %	
ON-STACK CONDITIONER		**NOx CONVERSION EFFICIENCY**	
IN SERVICE (Y/N):	Y	HIGH CAL NOx	Good
KNOCK-OUT CONDITION (CHECK FLOW):	✓	HIGH CAL NO (AS FOUND)	1
COOLANT:	Ice + H_2O	LOW CAL NOx	
		LOW CAL NO (AS FOUND)	1

OPERATING CONDITIONS			
SAMPLE PRESSURE:	5	SYSTEM RESPONSE TIME CHECK	
SAMPLE VACUUM:	10	UPSCALE:	38 sec.
NOx VACUUM:	30	DOWNSCALE:	79 sec.

CARNOT

CEM System Bias and Linearity Correction Calculations

Client: LACSD
Unit: Boiler - Dioxins
Location Palos Verdes Landfill
Test No. 1-CEM-Diox

	O2	CO2	CO	NOx	Acceptance Criteria	Run Status
Linearity						
Analyzer Range	10	25	20	25		
High Cal	7.997	22.35	17.20	23.44		
Low Cal	5.02	15.10	10.55	12.86		
Analyzer Reads	5.16	15.15	10.60	12.45		
Analyzer Cal. Error,%	1.4	0.2	0.2	-1.6	< 2%	PASS
System Bias						
Pretest Bias						
Zero	0.02	0.12	-0.05	-0.02	< 5%	PASS
Span	5.00	15.02	10.60	12.70	< 5%	PASS
Posttest Bias						
Zero	0.05	0.05	0.20	0.03	< 5%	PASS
Span	5.10	15.50	10.68	12.98	< 5%	PASS
Span Value	5.02	15.10	10.55	12.86		
Zero Drift, %	0.30	-0.28	1.25	0.20	< 3%	PASS
Span Drift, %	1.00	1.92	0.40	1.12	< 3%	PASS
Test Averages						
Test Raw Averag	2.50	15.17	<1	23.03		
Corrected Avera	2.47	15.01	<1	23.07		

CEM System Bias and Linearity Correction Calculations

Client: LACSD
Unit: Boiler - Dioxins
Location Palos Verdes Landfill
Test No. 2-CEM-Diox

	O2	CO2	CO	NOx	Acceptance Criteria	Run Status
Linearity						
Analyzer Range	10	25	20	25		
High Cal	7.997	22.35	17.20	23.44		
Low Cal	5.02	15.10	10.55	12.86		
Analyzer Reads	5.16	15.15	10.60	12.45		
Analyzer Cal. Error,%	1.4	0.2	0.2	-1.6	< 2%	PASS
System Bias						
Pretest Bias						
Zero	0.05	0.12	0.00	0.08	< 5%	PASS
Span	5.03	15.15	10.45	12.65	< 5%	PASS
Posttest Bias						
Zero	0.02	0.12	-0.15	0.27	< 5%	PASS
Span	4.98	15.07	10.30	12.39	< 5%	PASS
Span Value	5.02	15.10	10.55	12.86		
Zero Drift, %	-0.30	0.00	-0.75	0.76	< 3%	PASS
Span Drift, %	-0.50	-0.32	-0.75	-1.04	< 3%	PASS
Test Averages						
Test Raw Averag	2.57	15.29	<1	22.47		
Corrected Avera	2.56	15.28	<1	23.23		

CEM System Bias and Linearity Correction Calculations

Client: LACSD
Unit: Boiler - Dioxins
Location Palos Verdes Landfill
Test No. 3-CEM-Diox

	O2	CO2	CO	NOx	Acceptance Criteria	Run Status
Linearity						
Analyzer Range	10	25	20	25		
High Cal	7.997	22.35	17.20	23.44		
Low Cal	5.02	15.10	10.55	12.86		
Analyzer Reads	5.16	15.15	10.60	12.45		
Analyzer Cal. Error,%	1.4	0.2	0.2	-1.6	< 2%	PASS
System Bias						
Pretest Bias						
Zero	0.02	0.12	-0.20	0.27	< 5%	PASS
Span	5.03	15.02	10.40	12.73	< 5%	PASS
Posttest Bias						
Zero	0.00	0.06	-0.29	0.02	< 5%	PASS
Span	5.05	15.07	10.60	12.92	< 5%	PASS
Span Value	5.02	15.10	10.55	12.86		
Zero Drift, %	-0.20	-0.24	-0.45	-1.00	< 3%	PASS
Span Drift, %	0.20	0.20	1.00	0.76	< 3%	PASS
Test Averages						
Test Raw Averag	2.60	15.07	<1	23.45		
Corrected Avera	2.58	15.13	<1	23.64		

CARNOT

PAGE ___ OF ___

REFERENCE METHOD GASEOUS MEASUREMENTS

CLIENT/LOCATION: PV Pilot

CONDITION:

DATE: 11-23-93

OPERATOR: CHE

TEST NUMBER: 1-Dilox

TEST LOCATION: Exhaust

TEST NO.	TIME	SAMPLE POINT/ CONDITION	DRY, UNCORRECTED							CORRECTED TO ___% ___, DRY		
			O_2	CO_2	CO	NOx	NO	NO_2	SO_2	CO	NOx	SO_2
SPAN GAS CONCENTRATION												
		AS FOUND ANAL. SPAN										
		SYSTEM ZERO	.02	.12	-0.05	-.02						
		SYSTEM SPAN	5.00	15.02	10.60	12.70						
	BEGIN 1431	Start										
	END 954	End										
	BEGIN ___											
	END ___											
	BEGIN ___											
	END ___											
	BEGIN ___	~~Avg~~	~~2.5~~	~~15.0~~	~~<1~~	~~23.0~~						
	END ___											
	BEGIN ___											
	END ___											
	BEGIN ___											
	END ___											
	BEGIN ___											
	END ___											
	BEGIN ___											
	END ___											
	BEGIN ___											
	END ___											
	BEGIN ___											
	END ___											
		SYSTEM ZERO	.05	.05	0.20	.03						
		SYSTEM SPAN	5.53	15.5	10.68	12.98						
RAW AVERAGE			2.5	15.17	<1	23.03						
CORRECTED AVERAGE			2.47	15.01	<1	23.07						
COMMENTS:												

CARNOT

PMF-039

CARNOT

PAGE ___ OF ___

REFERENCE METHOD GASEOUS MEASUREMENTS

CLIENT/LOCATION: PV Boiler

CONDITION:

DATE: 11-24-93

OPERATOR: CHE

TEST NUMBER: 2-Diox

TEST LOCATION: [illegible]

TEST NO.	TIME		SAMPLE POINT/ CONDITION	DRY, UNCORRECTED							CORRECTED TO ___% ___, DRY		
				O_2	CO_2	CO	NOx	NO	NO_2	SO_2	CO	NOx	SO_2
SPAN GAS CONCENTRATION													
			AS FOUND ANAL. SPAN										
			SYSTEM ZERO	.05	.12	0.0	0.08						
			SYSTEM SPAN	5.07	15.15	10.45	1265						
	BEGIN	810	Start										
	END												
	BEGIN												
	END	1220	End										
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
			SYSTEM ZERO	.02	.012	-.15	.27						
			SYSTEM SPAN	4.98	15.07	10.30	1239						
RAW AVERAGE				2.57	15.29	<1	22.47						
CORRECTED AVERAGE				2.56	15.28	<1	23.23						
COMMENTS:													

CARNOT

PMF-039

CARNOT

PAGE ___ OF ___

REFERENCE METHOD GASEOUS MEASUREMENTS

CLIENT/LOCATION: PVBoilers CONDITION: _____

DATE: 11-24-93 OPERATOR: CHE

TEST NUMBER: 3-Dio2 TEST LOCATION: Exhaust

TEST NO.	TIME	SAMPLE POINT/ CONDITION	DRY, UNCORRECTED							CORRECTED TO ___% ___. DRY		
			O_2	CO_2	CO	NOx	NO	NO_2	SO_2	CO	NOx	SO_2
SPAN GAS CONCENTRATION												
		AS FOUND ANAL. SPAN										
		SYSTEM ZERO	.02	.12	-.20	0.27						
		SYSTEM SPAN	5.03	15.02	10.40	12.73						
	BEGIN 1243	Start										
	END											
	BEGIN											
	END 1458	End										
	BEGIN											
	END											
	BEGIN	~~Adj~~	~~2.6~~	~~15.1~~								
	END											
	BEGIN											
	END											
	BEGIN											
	END											
	BEGIN											
	END											
	BEGIN											
	END											
	BEGIN											
	END											
	BEGIN											
	END											
	BEGIN											
	END											
		SYSTEM ZERO	0,0	0,06	-.29	.02						
		SYSTEM SPAN	5.05	15.07	10,6	12.92						
RAW AVERAGE			2.60	15.07	<1	23.45						
CORRECTED AVERAGE			2.58	15.13	<1	23.64						
COMMENTS:												

CARNOT

TA FILE: DATA79.EXM, NOV 23rd. 1993 RUN START : 14:44:16 - STOP : 19:08:50

TEST INFORMATION

IENT :PV BOILER
TE(S) :
NIT(S) :
'LE ID :1-DIOX

PERSONNEL

OPERATOR :CHF
ASSISTANT:
CLIENT :
APCD :

ETUP/CALIBRATION INFORMATION

AS	FS	IC:	GAS 1	GAS 2	GAS 3	GAS 4	GAS 5	LC:	GAS 1	GAS 2	GAS 3	GAS 4	GAS 5	SC:	GAS 1	GAS 2	GAS 3	GAS 4	GAS 5
02 (%):	10.0		0.0			8.0	5.0		5.0	0.0	0.0				5.0		0.0		
02 (%):	25.0			0.0		22.6	15.1		15.1	0.0					15.1		0.0		
CO (ppm):	20.0				0.0	84.8	55.6		0.0	0.0					0.0		10.6		
Ox (ppm):	25.0				0.0	91.5	51.2		0.0	12.9						12.9	0.0		
( ):	1.0																		
( ):	1.0																		
( ):	1.0																		
( ):	1.0																		

PERATOR MESSAGES:

IFT CORRECTED EMMISSIONS DATA (summary-Reference Method)

RAW -	O2 %	CO2 %	CO ppm	NOx ppm					P/F PARM	P/F	CALCS-	O2 %	CO2 %	CO PPM	NOx PPM	NOxc PPM	COc PPM		
MAXIMUM:	5.12	7.73	3.60	17.33	0.00	0.00	0.00	0.00				***	***	***	***	***	***	***	***
MINIMUM:	-0.43	3.79	-0.51	-6.33	0.00	0.00	0.00	0.00				***	***	***	***	***	***	***	***
AVERAGE:	-0.25	7.43	-0.19	16.32	0.00	0.00	0.00	0.00				***	***	***	***	***	***	***	***

EQUATIONS:

Chan 0 = CH0
Chan 1 = CH1
Chan 2 = CH2
Chan 3 = CH3
Chan 4 = CH3*(17.9/(20.9-CH0))
Chan 5 = CH2*(17.9/(20.9-CH0))
Chan 6 = CH3*(17.9/(20.9-CH0))

CLIENT : PV BOILER FILE ID: 1-DIOX
SITE : RUN : DATA79.EXM, NOV 23rd, 1993

Mark Run Start @: 14:45:16 Mark Run Stop @: 21:14:16

	O2 %	CO2 %	CO ppm	NOx ppm					P/F PARM	P/F	CALCS-	O2 %	CO2 %	CO PPM	NOx PPM	NOxc PPM	COc PPM	
RAW -																		
PRE-TEST CAL VALUES:																		
IC ZRO:	****	****	****	****	****	****	****	****	2.0%	0.0%	-P	PERFORMED AT TIME --:--:--						
IC SPN:	****	****	****	****	****	****	****	****										
SC ZRO:	0.02	0.12	-0.05	-0.02	****	****	****	****	5.0%	0.5%	-P	PERFORMED AT TIME 14:47:31						
BIAS ZRO:	**** %	**** %	**** %	**** %	**** %	**** %	**** %	**** %	5.0%	-1.0%	-P							
SC SPN:	5.00	15.02	10.60	12.70	****	****	****	****										
BIAS SPN:	**** %	**** %	**** %	**** %	**** %	**** %	**** %	**** %	5.0%	-1.0%	-P							

NON-DRIFT CORRECTED EMISSIONS DATA (summery)

MAXIMUM:	7.87	15.23	1.92	23.62	0.00	0.00	0.00	0.00		***	***	***	***	***	***	***	***	
MINIMUM:	2.32	11.30	-0.19	-0.03	0.00	0.00	0.00	0.00		***	***	***	***	***	***	***	***	
AVERAGE:	2.49	14.94	-0.03	22.62	0.00	0.00	0.00	0.00		***	***	***	***	***	***	***	***	

	O2 %	CO2 %	CO ppm	NOx ppm					CALCS -	O2 %	CO2 %	CO PPM	NOx PPM	NOxc PPM	COc PPM			Code
RAW -																		
NON-DRIFT CORRECTED EMMISSIONS DATA (detailed)																		
ST:14:45:16																		
... 0.0	7.87	13.16	1.92	-0.03	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
...15.0	~~2.32~~	~~11.30~~	~~1.58~~	~~16.53~~	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
...30.0	2.52	15.21	-0.10	23.09	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
...45.1	2.52	15.14	-0.07	23.54	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
...60.2	2.52	15.12	-0.07	23.62	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
...75.3	2.54	15.17	-0.10	22.87	23.03 0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
...90.4	2.51	15.20	-0.03	23.38	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..105.4	2.53	15.20	-0.02	23.55	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..120.5	2.53	15.17	-0.19	23.08	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..135.6	2.47	15.23	-0.17	23.11	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..150.7	2.48	15.18	-0.19	22.83	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..165.8	2.49	15.16	-0.14	22.85	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..180.9	2.48	15.16	-0.17	22.70	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..195.9	2.50	15.15	-0.17	22.53	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..211.0	2.49	15.14	-0.14	22.53	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..226.1	2.50	15.13	-0.15	22.75	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..241.2	2.48	15.16	-0.15	22.79	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..256.3	2.51	15.12	-0.16	22.71	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..262.3	6.27	11.17	0.55	10.02	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	

This average contains a dP to zero at start

Contains a small spike

verage 2.5 15.17 -0.13 ~~23.0~~ 23.03

00 → 1900

responding to 1-DIOX

451 → 1904

CLIENT : PV BOILER
SITE :

FILE ID: 1-DIOX
RUN : DATA79.EXM, NOV 23rd, 1993

RAW -	O2 %	CO2 %	CO ppm	NOx ppm					CALCS -	O2 %	CO2 %	CO PPM	NOx PPM	NOxc PPM	COc PPM		Code
POST-TEST CAL VALUES:																	
IC ZRO:	****	****	****	****	****	****	****	****	2.0% 0.0% -P PERFORMED AT TIME —:—:—								
IC SPN:	****	****	****	****	****	****	****	****									
SC ZRO:	5.52	15.14	0.10	12.57	****	****	****	****	5.0%1156444859800000000.0% -F PERFORMED AT TIME 19:06:48								
IAS ZRO:	**** %	**** %	**** %	**** %	**** %	**** %	**** %	**** %	5.0% -1.0% -P								
SC SPN:	5.54	15.02	0.39	-0.02	****	****	****	****									
IAS SPN:	**** %	**** %	**** %	**** %	**** %	**** %	**** %	**** %	5.0% -1.0% -P								
ZRO DRFT:	-54.94 %	-60.06 %	-0.73 %	-50.34 %	0.00 %	0.00 %	0.00 %	0.00 %									
SPN DRFT:	0.00 %	0.00 %	-1853.58 %	0.00 %	0.00 %	0.00 %	0.00 %	0.00 %									

CLIENT : PV BOILER
SITE :

FILE ID: 1-DIOX
RUN : DATA79.EXP, NOV 23rd, 1993

GAS	EMISSION LIMITS LIMIT	UNITS	M.W.	GAS COMP %		PHYSICAL DATA		
O2:	0.00		0.00	0.00	BAR PRES.:	30.00	inch Hg.	
CO2:	0.00		0.00	0.00	PROCESS :	INCIN		
CO:	0.00		0.00	0.00	PROC.RATE:	0.00		MW
NOx:	0.00		0.00	0.00	FUEL :	VAPOR		
:	0.00		0.00	0.00	FUEL RATE:	28.00	klb/hr	
:	0.00		0.00	0.00	STACK DIA:	0.00	inches	
:	0.00		0.00	0.00	F FACTOR :	0.00		
:	0.00		0.00	0.00	Q-STK GAS:	0.00	0F6:22B0	
					PIT(inWC):	0.00	:22B5	86

GAS	INSTRUMENT INFORMATION MAKE	MODEL	SCALE	FLOW	RECORDER TRACE I.D. CHANNEL	PEN TYPE	COLOR
O2 %:	Teledyne	0-10		1			
CO2 %:	Horiba		0-25%				
CO ppm:	TECO		0-100ppm				
NOx ppm:	TECO	0-100ppm					
:							
:							
:							
:							

CARNOT

TA FILE: DATA80.EXM, NOV 24th, 1993 RUN START : 07:54:22 - STOP : 12:31:23

TEST INFORMATION

LIENT :PV-BOILER
ITE(S) :
NIT(S) :
ILE ID :2-DIOX

PERSONNEL

OPERATOR :CHF
ASSISTANT:
CLIENT :
APCD :

ETUP/CALIBRATION INFORMATION

AS	FS	IC:	GAS 1	GAS 2	GAS 3	GAS 4	GAS 5	LC:	GAS 1	GAS 2	GAS 3	GAS 4	GAS 5	SC:	GAS 1	GAS 2	GAS 3	GAS 4	GAS 5
O2 (%):	10.0		0.0			8.0	5.0		5.0	0.0	0.0				5.0		0.0		
CO2 (%):	25.0			0.0		22.6	15.1		15.1	0.0					15.1		0.0		
CO (ppm):	20.0				0.0	84.8	55.6		0.0	0.0					0.0		10.6		
NOx (ppm):	25.0				0.0	91.5	51.2		0.0	12.9						12.9	0.0		
( ):	1.0																		
( ):	1.0																		
( ):	1.0																		
( ):	1.0																		

OPERATOR MESSAGES:

IFT CORRECTED EMMISSIONS DATA (summary-Reference Method)

AN -	O2 %	CO2 %	CO ppm	NOx ppm					P/F PARM	P/F	CALCS-	O2 %	CO2 %	CO PPM	NOx PPM	NOxc PPM	COc PPM		
AXIMUM:	5.05	15.32	10.47	23.78	0.00	0.00	0.00	0.00				***	***	***	***	***	***	***	***
INIMUM:	2.54	9.87	-0.36	8.54	0.00	0.00	0.00	0.00				***	***	***	***	***	***	***	***
VERAGE:	2.72	14.90	-0.14	20.63	0.00	0.00	0.00	0.00				***	***	***	***	***	***	***	***

EQUATIONS:

```
han 0 = CH0
han 1 = CH1
han 2 = CH2
han 3 = CH3
han 4 = CH3*(17.9/(20.9-CH0))
han 5 = CH2*(17.9/(20.9-CH0))
an 6 = CH3*(13.9/(20.9-CH0))
```

CLIENT : PV BOILER
SITE :

FILE ID: 2-DIOX
RUN : DATA80.EXM, NOV 24th, 1993

Mark Run Start @: 07:55:22 Mark Run Stop @: 14:24:23

	O2	CO2	CO	NOx					P/F			O2	CO2	CO	NOx	NOxc	COc	
RAW -	%	%	ppm	ppm					PARM	P/F	CALCS-	%	%	PPM	PPM	PPM	PPM	
PRE-TEST CAL VALUES:																		
IC ZRO:	****	****	****	****	****	****	****	****	2.0%	0.0% -P	PERFORMED AT TIME --:--:--							
IC SPN:	****	****	****	****	****	****	****	****										
SC ZRO:	0.05	0.12	0.00	0.08	****	****	****	****	5.0%	36.1% -F	PERFORMED AT TIME 07:58:35							
BIAS ZRO:	**** %	**** %	**** %	**** %	**** %	**** %	**** %	**** %	5.0%	-1.0% -P								
SC SPN:	5.03	15.14	10.45	12.65	****	****	****	****										
BIAS SPN:	**** %	**** %	**** %	**** %	**** %	**** %	**** %	**** %	5.0%	-1.0% -P								

NON-DRIFT CORRECTED EMISSIONS DATA (summary)

MAXIMUM:	5.04	15.32	10.40	23.88	0.00	0.00	0.00	0.00	***	***	***	***	***	***	***	***		
MINIMUM:	2.53	9.87	-0.43	8.64	0.00	0.00	0.00	0.00	***	***	***	***	***	***	***	***		
AVERAGE:	2.70	14.90	-0.22	20.73	0.00	0.00	0.00	0.00	***	***	***	***	***	***	***	***		

	O2	CO2	CO	NOx					CALCS -	O2	CO2	CO	NOx	NOxc	COc			Code
RAW -	%	%	ppm	ppm						%	%	PPM	PPM	PPM	PPM			
NON-DRIFT CORRECTED EMMISSIONS DATA (detailed)																		
ST:07:55:22																		
... 0.0	5.04	15.18	10.40	13.03	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
...15.0 ø	~~3.28~~	~~9.87~~	~~-1.89~~	~~14.21~~	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
...30.0	2.53	15.26	-0.10	23.22	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
...45.1	2.54	15.29	-0.10	23.31	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
...60.2	2.56	15.31	-0.25	23.69	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
...75.3	2.56	15.30	-0.34	23.88	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
...90.4	2.62	15.29	-0.40	23.79	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..105.4	2.61	15.29	-0.41	~~8.64~~	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..120.5	2.56	15.31	-0.40	~~20.01~~ 21.5	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..135.6	2.58	15.28	-0.41	21.71	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..150.7	2.57	15.32	-0.38	22.03	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..165.8	2.57	15.30	-0.39	21.83	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..180.9	2.58	15.30	-0.37	21.68	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..195.9	2.60	15.29	-0.40	21.98	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..211.0	2.57	15.30	-0.42	22.33	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..226.1	2.58	15.26	-0.41	22.25	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..241.2	2.55	15.26	-0.39	22.14	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..256.3	2.55	15.26	-0.43	22.18	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..271.4	4.26	13.65	-0.17	14.23	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	
..274.9	-0.01	0.00	5.88	4.76	0.00	0.00	0.00	0.00		****	****	****	****	****	****	****	****	

average 2.57 15.29 -0.35 ~~21.64~~ 22.47
0→1220

responding to 2-DIOX
810→1220

NOx recal from 927→943

to 256 2.57 15.30

CLIENT : PV BOILER
SITE :

FILE ID: 2-DIOX
RUN : DATA80.EXM, NOV 24th, 1993

	O2	CO2	CO	NOx					O2	CO2	CO	NOx	NOxc	COc		
RAW -	%	%	ppm	ppm					CALCS -	%	%	PPM	PPM	PPM		Code
POST-TEST CAL VALUES:																
IC ZRO:	****	****	****	****	****	****	****	****	2.0%	0.0%	-P	PERFORMED AT TIME --:--:--				
IC SPN:	****	****	****	****	****	****	****	****								
SC ZRO:	0.02	0.12	-0.15	0.27	****	****	****	****	5.0%	1.2%	-P	PERFORMED AT TIME 12:26:41				
BIAS ZRO:	**** %	**** %	**** %	**** %	**** %	**** %	**** %	**** %	5.0%	-1.0%	-P					
SC SPN:	4.98	15.07	10.30	12.39	****	****	****	****								
BIAS SPN:	**** %	**** %	**** %	**** %	**** %	**** %	**** %	**** %	5.0%	-1.0%	-P					
ZRO DRFT:	0.25 %	0.00 %	0.73 %	-0.76 %	0.00 %	0.00 %	0.00 %	0.00 %								
SPN DRFT:	0.00 %	0.00 %	-0.01 %	0.00 %	0.00 %	0.00 %	0.00 %	0.00 %								

CLIENT : PV BOILER
SITE :

FILE ID: 2-DIOX
RUN : DATA80.EXM. NOV 24th. 1993

GAS	EMISSION LIMITS LIMIT	UNITS	M.W.	GAS COMP %
O2:	0.00		0.00	0.00
CO2:	0.00		0.00	0.00
CO:	0.00		0.00	0.00
NOx:	0.00		0.00	0.00
:	0.00		0.00	0.00
:	0.00		0.00	0.00
:	0.00		0.00	0.00
:	0.00		0.00	0.00

PHYSICAL DATA

BAR PRES.:	30.00	inch Hg.
PROCESS :	INCIN	
PROC.RATE:	0.00	MW
FUEL :	VAPOR	
FUEL RATE:	28.00	Klb/hr
STACK DIA:	0.00	inches
F FACTOR :	0.00	
Q-STK GAS:	0.00	0F6:22B0
PIT(inWC):	0.00	:22B5 86

INSTRUMENT INFORMATION / RECORDER TRACE I.D.

GAS	MAKE	MODEL	SCALE	FLOW	CHANNEL	PEN TYPE	COLOR
O2 %:	Teledyne	O-10		1			
CO2 %:	Horiba		0-25%				
CO ppm:	TECO		0-100ppm				
NOx ppm:	TECO	O-100ppm					
:							
:							
:							
:							

CARNOT

DATA FILE: DATA81.EXM, NOV 24th, 1993 RUN START : 12:31:57 - STOP : 15:08:40

TEST INFORMATION

CLIENT :PV BOILER
SITE(S) :
UNIT(S) :
FILE ID :3-DIOX

PERSONNEL

OPERATOR :CHF
ASSISTANT:
CLIENT :
APCD :

SETUP/CALIBRATION INFORMATION

GAS	FS	IC: GAS 1	GAS 2	GAS 3	GAS 4	GAS 5	LC: GAS 1	GAS 2	GAS 3	GAS 4	GAS 5	SC: GAS 1	GAS 2	GAS 3	GAS 4	GAS 5
O2 (%):	10.0	0.0			8.0	5.0	5.0	0.0	0.0			5.0		0.0		
CO2 (%):	25.0		0.0		22.6	15.1	15.1	0.0				15.1		0.0		
CO (ppm):	20.0			0.0	84.8	55.6	0.0	0.0				0.0		10.6		
NOx (ppm):	25.0			0.0	91.5	51.2	0.0	12.9					12.9	0.0		
( ):	1.0															
( ):	1.0															
( ):	1.0															
( ):	1.0															

OPERATOR MESSAGES:

DRIFT CORRECTED EMISSIONS DATA (summary-Reference Method)

RAW -	O2 %	CO2 %	CO ppm	NOx ppm					P/F PARM	P/F	CALCS-	O2 %	CO2 %	CO PPM	NOx PPM	NOxc PPM	COc PPM		
MAXIMUM:	4.95	15.14	2.11	23.85	0.00	0.00	0.00	0.00				***	***	***	***	***	***	***	***
MINIMUM:	2.52	0.13	-0.22	11.95	0.00	0.00	0.00	0.00				***	***	***	***	***	***	***	***
AVERAGE:	2.73	14.43	0.05	21.39	0.00	0.00	0.00	0.00				***	***	***	***	***	***	***	***

EQUATIONS:

Chan 0 = CH0
Chan 1 = CH1
Chan 2 = CH2
Chan 3 = CH3
Chan 4 = CH3*(17.9/(20.9-CH0))
Chan 5 = CH2*(17.9/(20.9-CH0))
Chan 6 = CH3*(13.9/(20.9-CH0))

DATE : NOV 29th, 1993

CLIENT : PV BOILER
SITE :

Mark Run Start @: 12:32:57 . Mark [illegible]

	O2	CO2		NOx													
Mk -	%	%	ppm	ppm													
PRE-TEST CAL VALUES:																	
SC ZRO:	****	****	****	****	****	****	****	****	2.0%								
SC SPN:	****	****	****	****	****	****	****	****									
GAS ZRO:	**** %	**** %	**** %	**** %	**** %	**** %	**** %	**** %									
GAS SPN:	**** %	**** %	**** %	**** %	**** %	**** %	**** %	**** %									

NON-DRIFT CORRECTED EMISSIONS DATA (summary)

MAXIMUM:	5.00	15.11	2.05	28.97	0.00					***	***	***	***	***	***	***	***	***
MINIMUM:	2.57	9.36	-0.27	22.82	0.00					***	***	***	***	***	***	***	***	***
AVERAGE:	2.78	14.49	-0.00	24.51	0.00					***	***	***	***	***	***	***	***	***

	O2	CO2	CO	NOx						CALCS -	O2	CO2	CO	NOx	NOxc	COc			Code
RUN -	%	%	PPM	PPM							%	%	PPM	PPM	PPM	PPM			
NON-DRIFT CORRECTED EMMISSIONS DATA (detailed)																			
ST:12:32:57																			
... 0.0	5.00	0.10	0.02	12.91	0.00	0.00	0.00	0.00			****	****	****	****	****	****	****	****	
...15.0	~~2.93~~	~~9.43~~	~~2.05~~	~~12.07~~	0.00	0.00	0.00	0.00			****	****	****	****	****	****	****	****	
...30.0	2.60	15.10	-0.26	22.82	0.00	0.00	0.00	0.00			****	****	****	****	****	****	****	****	
...45.1	2.57	15.11	-0.26	23.03	0.00	0.00	0.00	0.00			****	****	****	****	****	****	****	****	
...60.2	2.58	15.11	-0.27	23.16	0.00	0.00	0.00	0.00			****	****	****	****	****	****	****	****	
...75.3	2.58	15.06	-0.24	23.76	0.00	0.00	0.00	0.00			****	****	****	****	****	****	****	****	
...90.4	2.62	15.02	-0.25	23.73	0.00	0.00	0.00	0.00			****	****	****	****	****	****	****	****	
..105.4	2.60	15.06	-0.23	23.97	0.00	0.00	0.00	0.00			****	****	****	****	****	****	****	****	
..120.5	2.62	15.04	-0.25	23.70	0.00	0.00	0.00	0.00			****	****	****	****	****	****	****	****	
..135.6	2.59	15.05	-0.25	23.43	0.00	0.00	0.00	0.00			****	****	****	****	****	****	****	****	
..150.7	4.08	14.03	-0.05	15.38	0.00	0.00	0.00	0.00			****	****	****	****	****	****	****	****	
..154.2	0.13	0.02	2.51	8.51	0.00	0.00	0.00	0.00			****	****	****	****	****	****	****	****	

avge 2.60 15.07 -025 23.45
7→1458
avg only to 3-Diox
243→1458

CLIENT : PV BOILER
SITE :

FILE ID: 3-DIOX
RUN : DATA81.EXM, NOV 24th, 1993

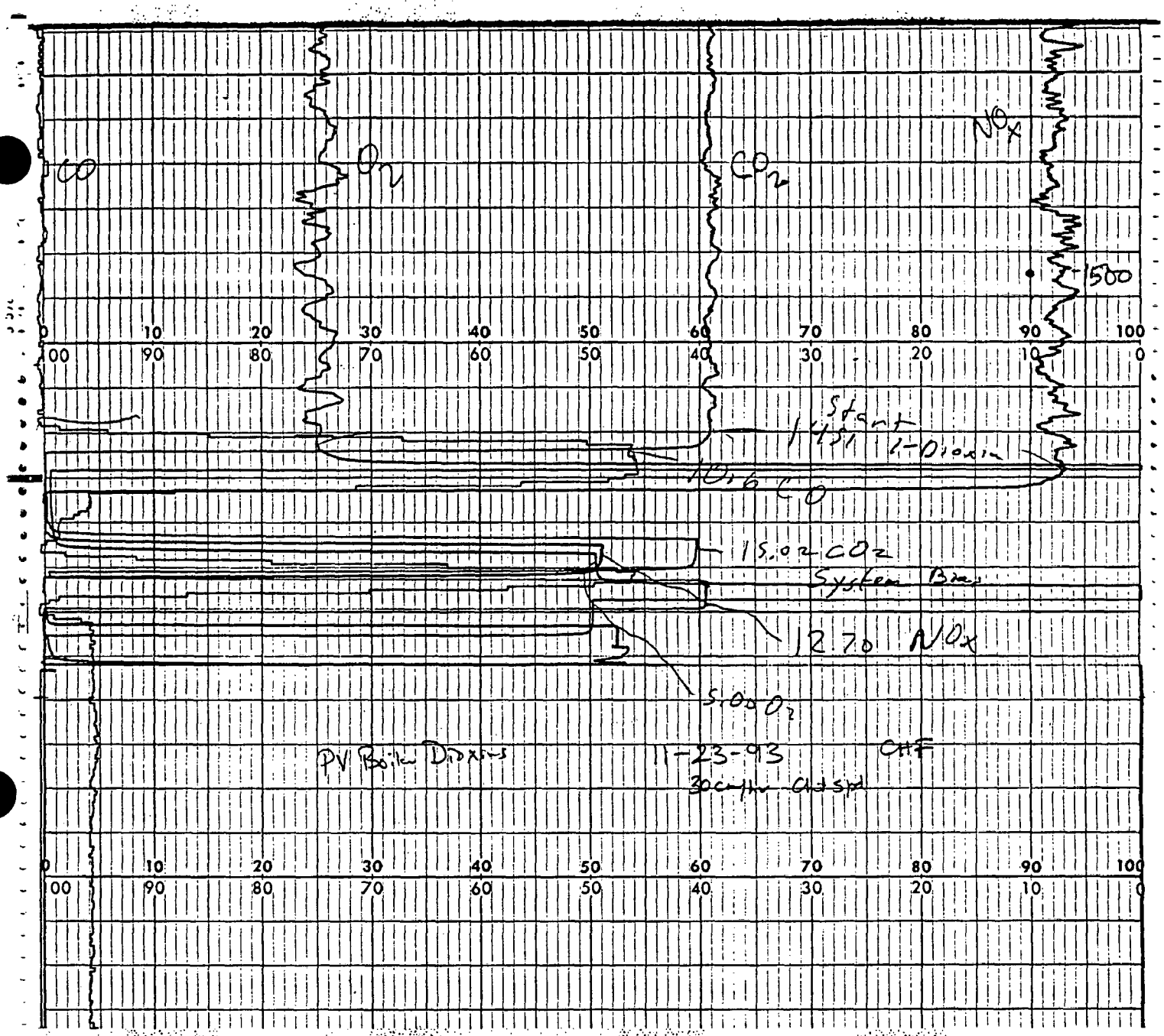
	O2	CO2	CO	NOx					O2	CO2	CO	NOx	NOxc	COc		
T-	%	%	ppm	ppm				CALCS -	%	%	PPM	PPM	PPM	PPM		Code
ST-TEST CAL VALUES:																
IC ZRO:	****	****	****	****	****	****	****	****	2.0%	0.0% -P	PERFORMED AT TIME --:--:--					
C SPN:	****	****	****	****	****	****	****	****								
SC ZRO:	0.12	0.06	-0.29	0.50	****	****	****	****	5.0%1156444858800000000.0% -F		PERFORMED AT TIME 15:03:29					
AS ZRO:	**** %	**** %	**** %	**** %	**** %	**** %	**** %	**** %	5.0% -1.0% -P							
C SPN:	5.05	15.07	10.25	12.92	****	****	****	****								
S SPN:	**** %	**** %	**** %	**** %	**** %	**** %	**** %	**** %	5.0% -1.0% -P							
DRFT:	-0.98 %	0.25 %	0.48 %	-0.93 %	0.00 %	0.00 %	0.00 %	0.00 %								
DRFT:	0.00 %	0.00 %	-0.25 %	0.00 %	0.00 %	0.00 %	0.00 %	0.00 %								

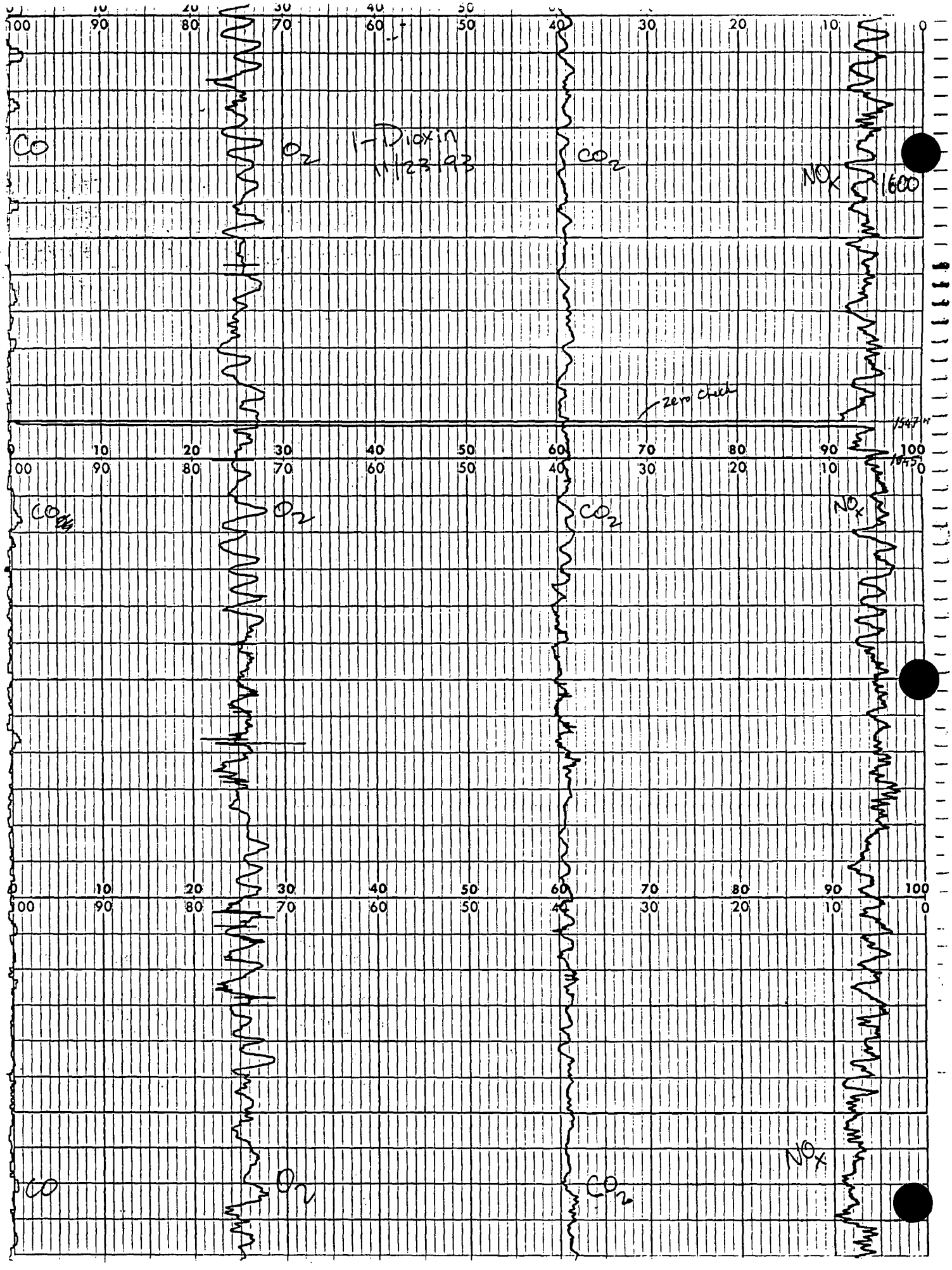
CLIENT : PV BOILER
SITE :

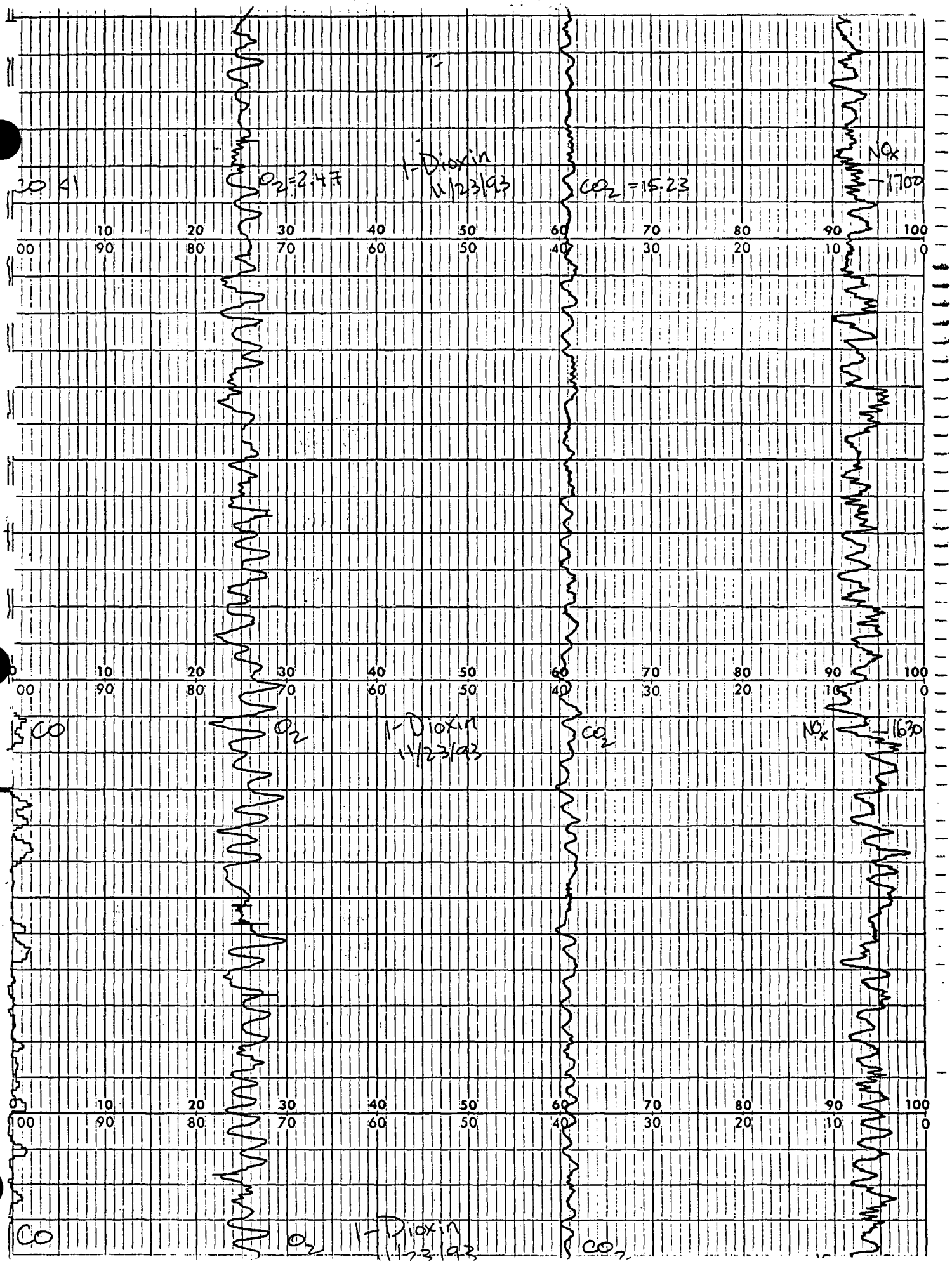
FILE ID: 3-DIOX
RUN : DATA81.EXM, NOV 24th, 1993

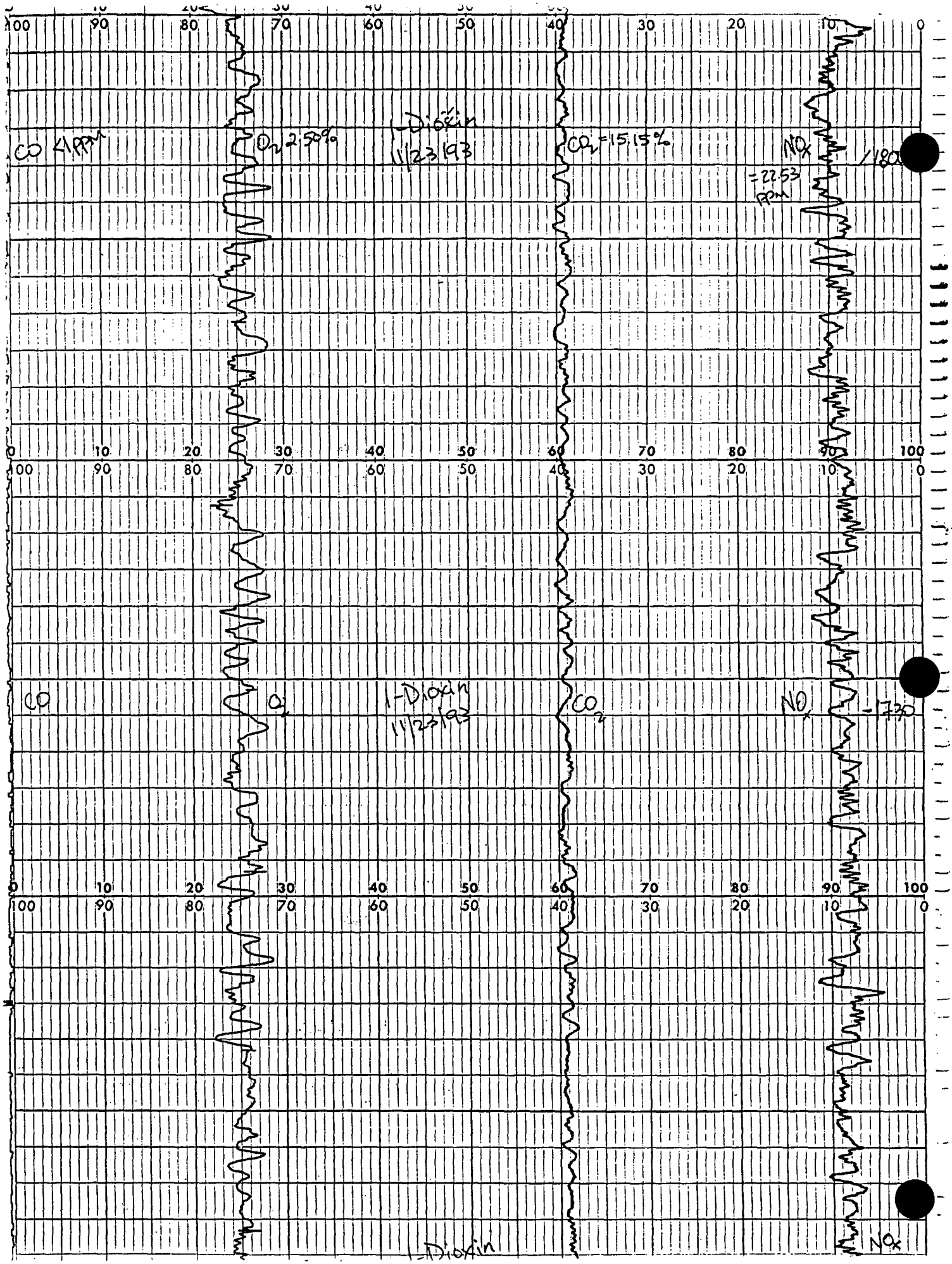
	EMISSION LIMITS		M.W.	GAS COMP %	PHYSICAL DATA		
GAS	LIMIT	UNITS					
O2:	0.00		0.00	0.00	BAR PRES.:	30.00	inch Hg.
CO2:	0.00		0.00	0.00	PROCESS :	INCIN	
CO:	0.00		0.00	0.00	PROC.RATE:	0.00	M
NOx:	0.00		0.00	0.00	FUEL :	VAPOR	
:	0.00		0.00	0.00	FUEL RATE:	28.00	klb/hr
:	0.00		0.00	0.00	STACK DIA:	0.00	inches
:	0.00		0.00	0.00	F FACTOR :	0.00	
:	0.00		0.00	0.00	Q-STK GAS:	0.00	0F6:22B0
					PIT(inWC):	0.00	:22B5 8

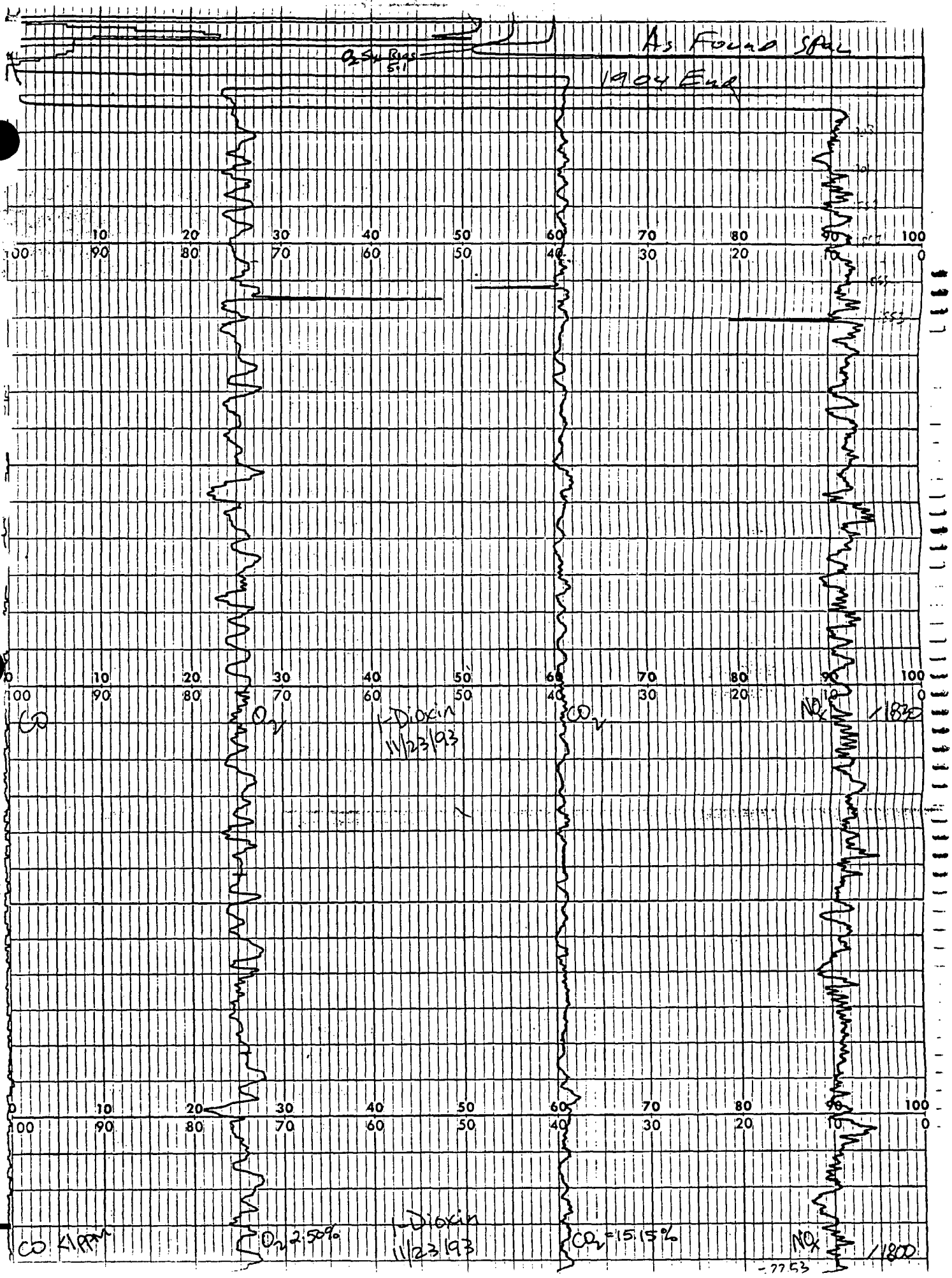
	INSTRUMENT INFORMATION				RECORDER TRACE I.D.		
GAS	MAKE	MODEL	SCALE	FLOW	CHANNEL	PEN TYPE	COLOR
O2 %:	Teledyne	0-10		1			
CO2 %:	Horiba		0-25%				
CO ppm:	TECO		0-100ppm				
NOx ppm:	TECO	0-100ppm					
:							
:							
:							
:							

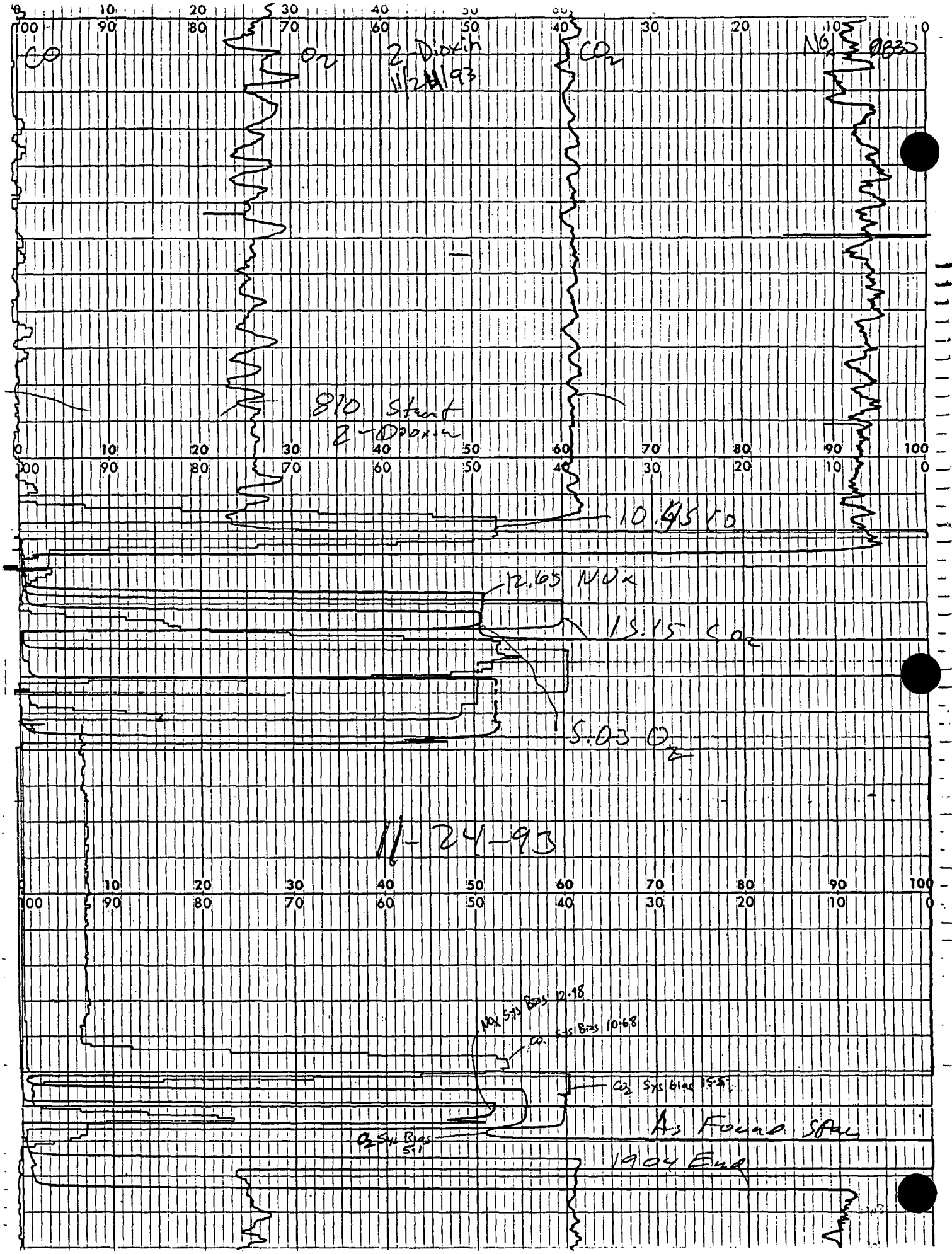

CO
O2
CO2
NOx
1500
0
10
20
30
40
50
60
70
80
90
100
00
90
80
70
60
50
40
30
20
10
0
Start
1451
1-Dioxin
10.6 CO
15.0 CO2
System Bias
1270 NOx
5.00 O2
PV Boiler Dioxins
11-23-93
CHF
30 cu/ft/hr Charcoal

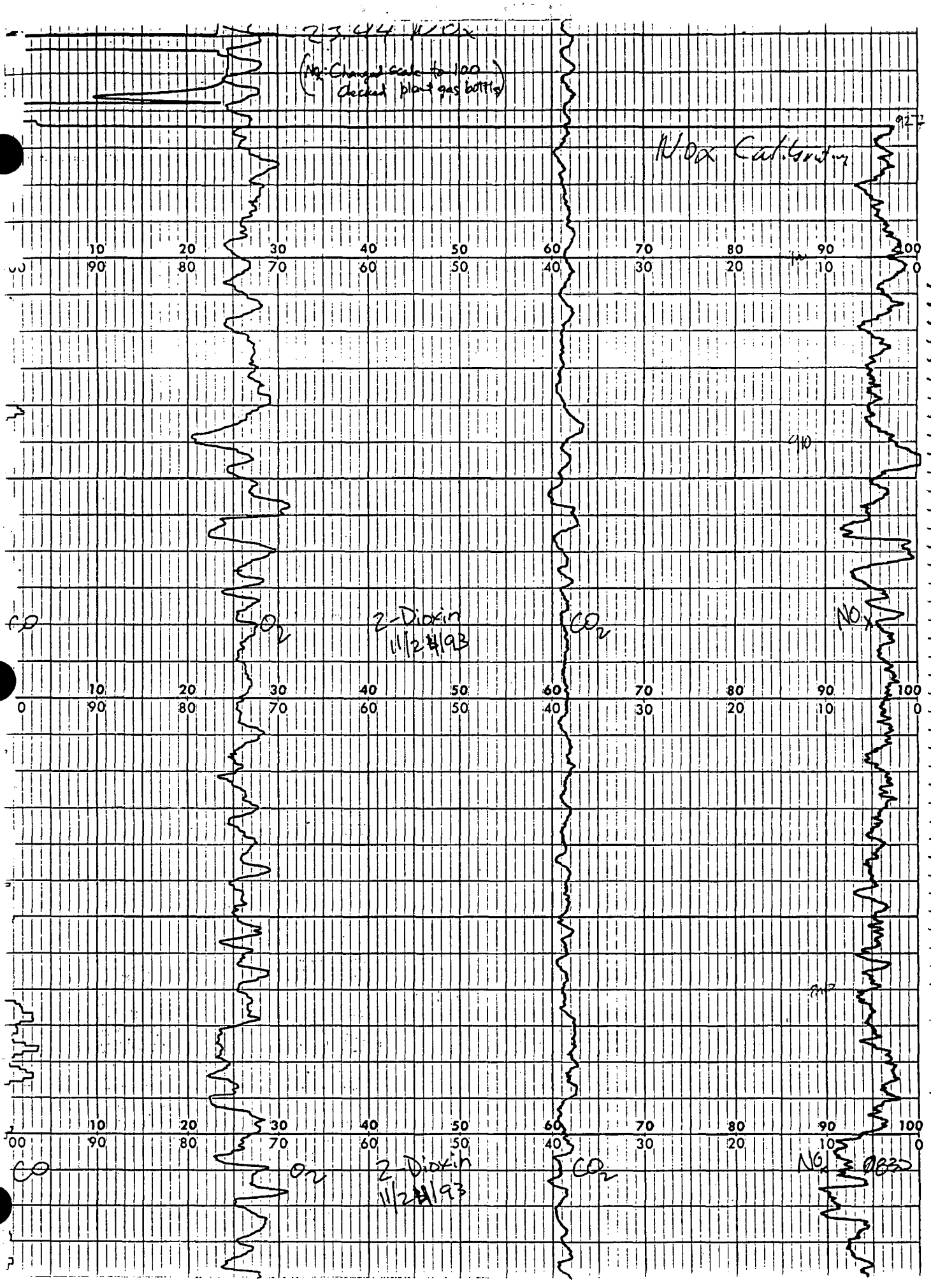

CO
O2
CO2
NOx
1600
1-D Dioxin
11/22/93
zero check
1547 H
1645
CO
O2
CO2
20x
CO
O2
CO2
20x

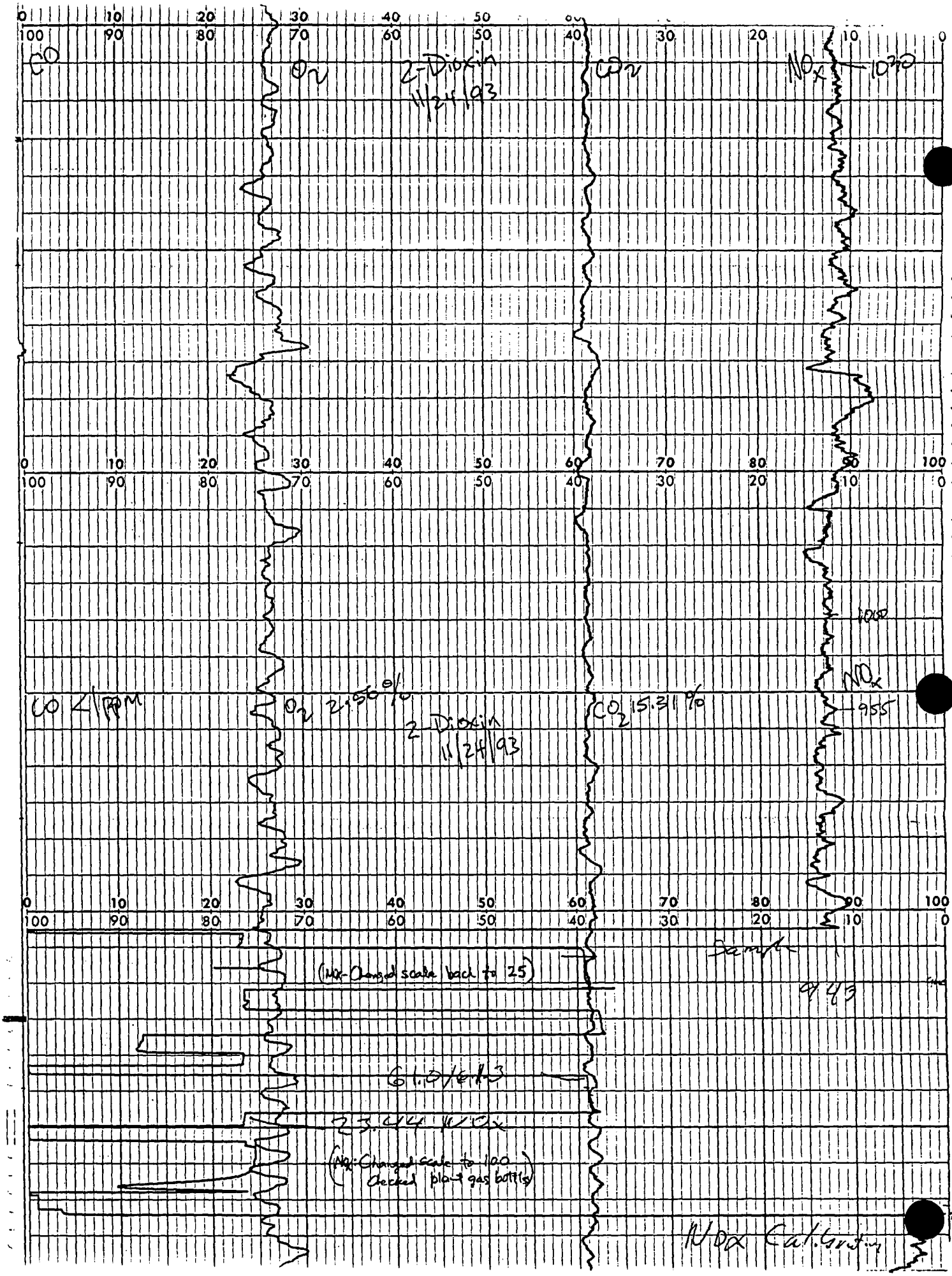

CO
O_2=2.47
1-Dioxin
11/23/93
CO_2=15.23
NOx
1700
CO
O_2
1-Dioxin
11/23/93
CO_2
NOx
1630
CO
O_2
1-Dioxin
11/23/93
CO_2

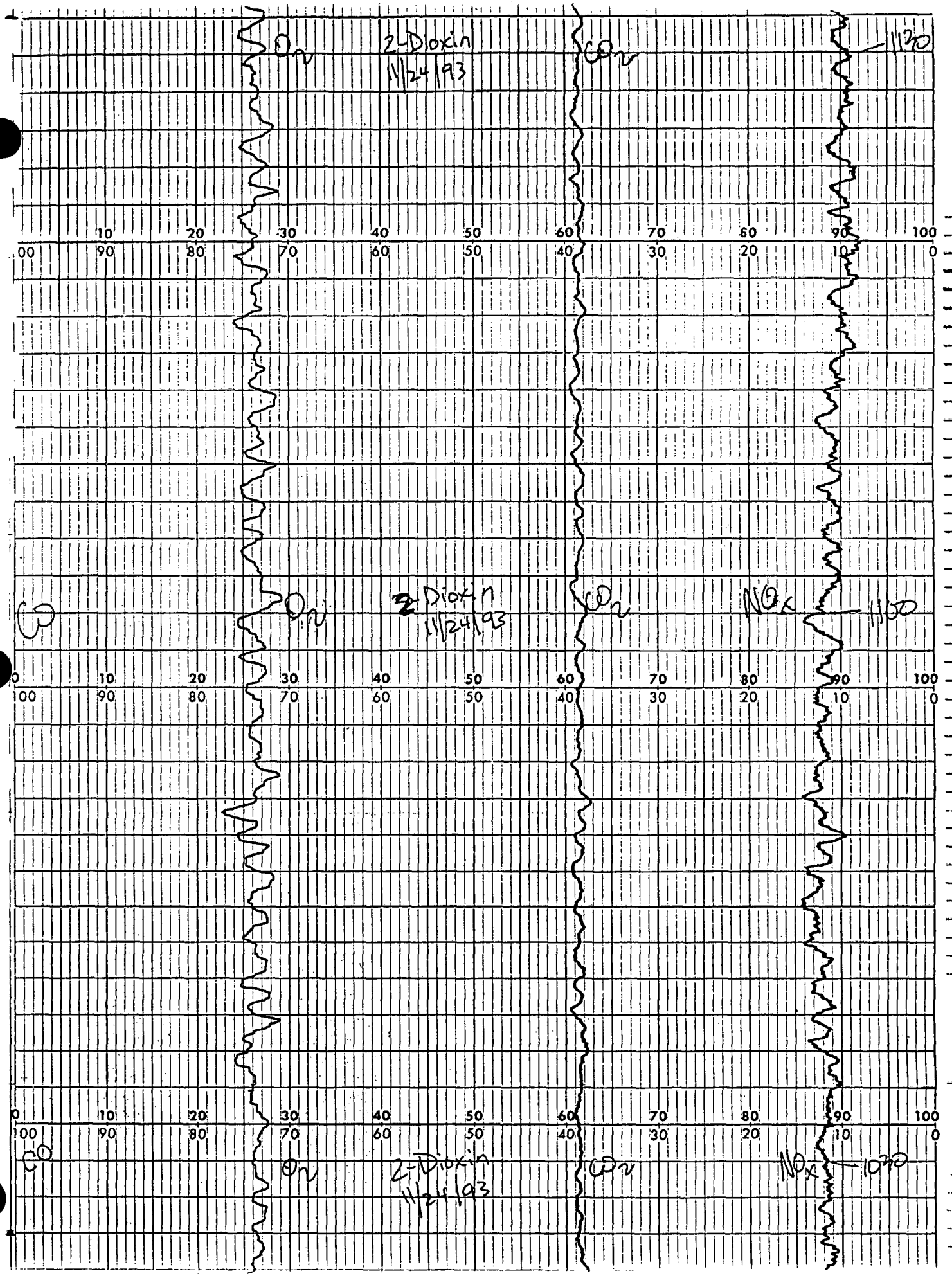

CO 41 PPM
O2 2.59%
1-Dioxin
11/23/93
CO2 = 15.15%
NOx
1180
= 22.53 PPM
CO
O2
1-Dioxin
11/23/93
CO2
NOx
1730
1-Dioxin
NOx

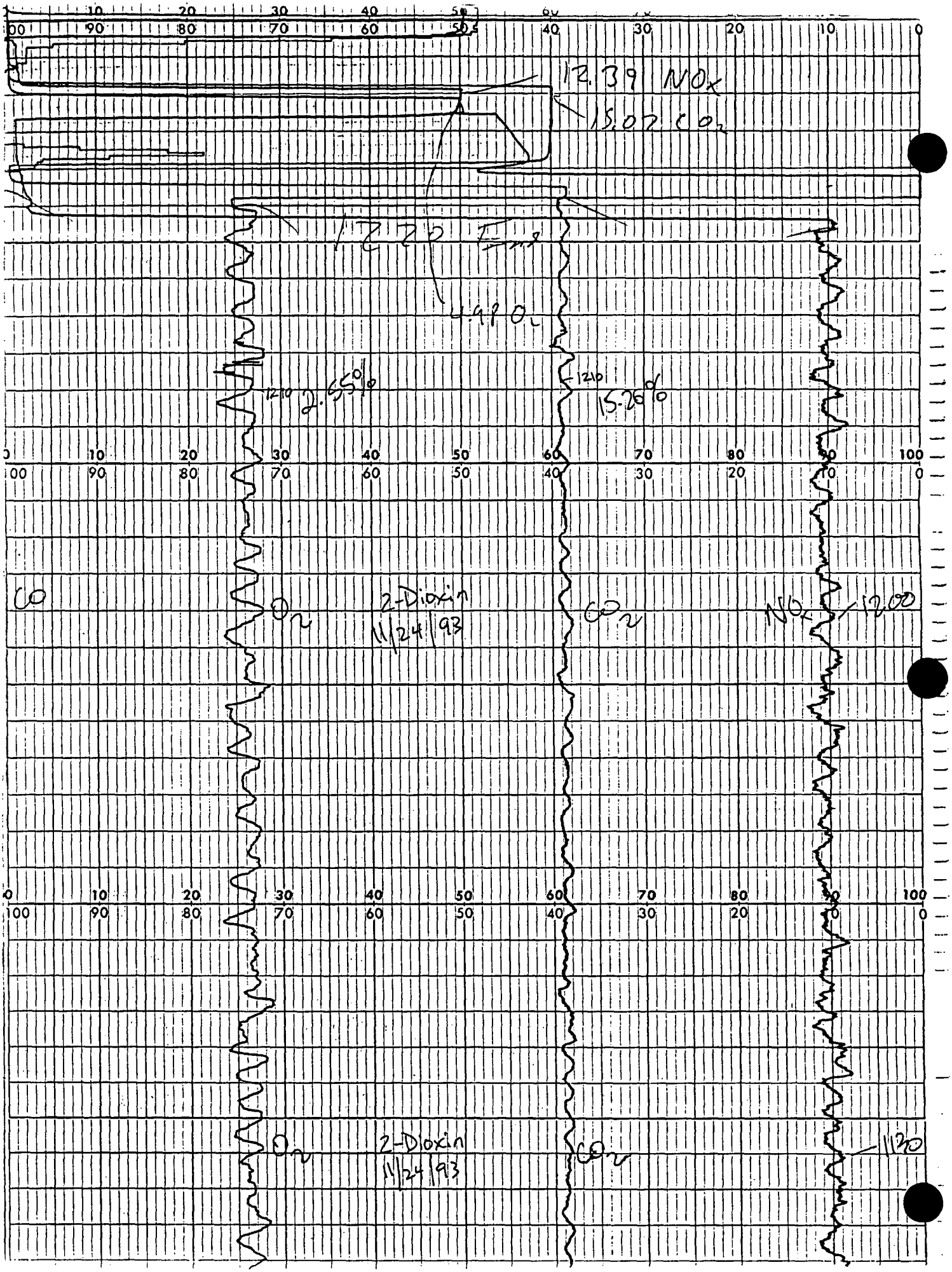

As Found Spec
1904 End
O2 5% Bias 5:1
CO
O2
CO2
NOx
1-Dioxin
11/23/93
1-Dioxin
11/23/93
CO <1PPM
O2=2.58%
CO2=15.15%
NOx
1800
1800
-7753

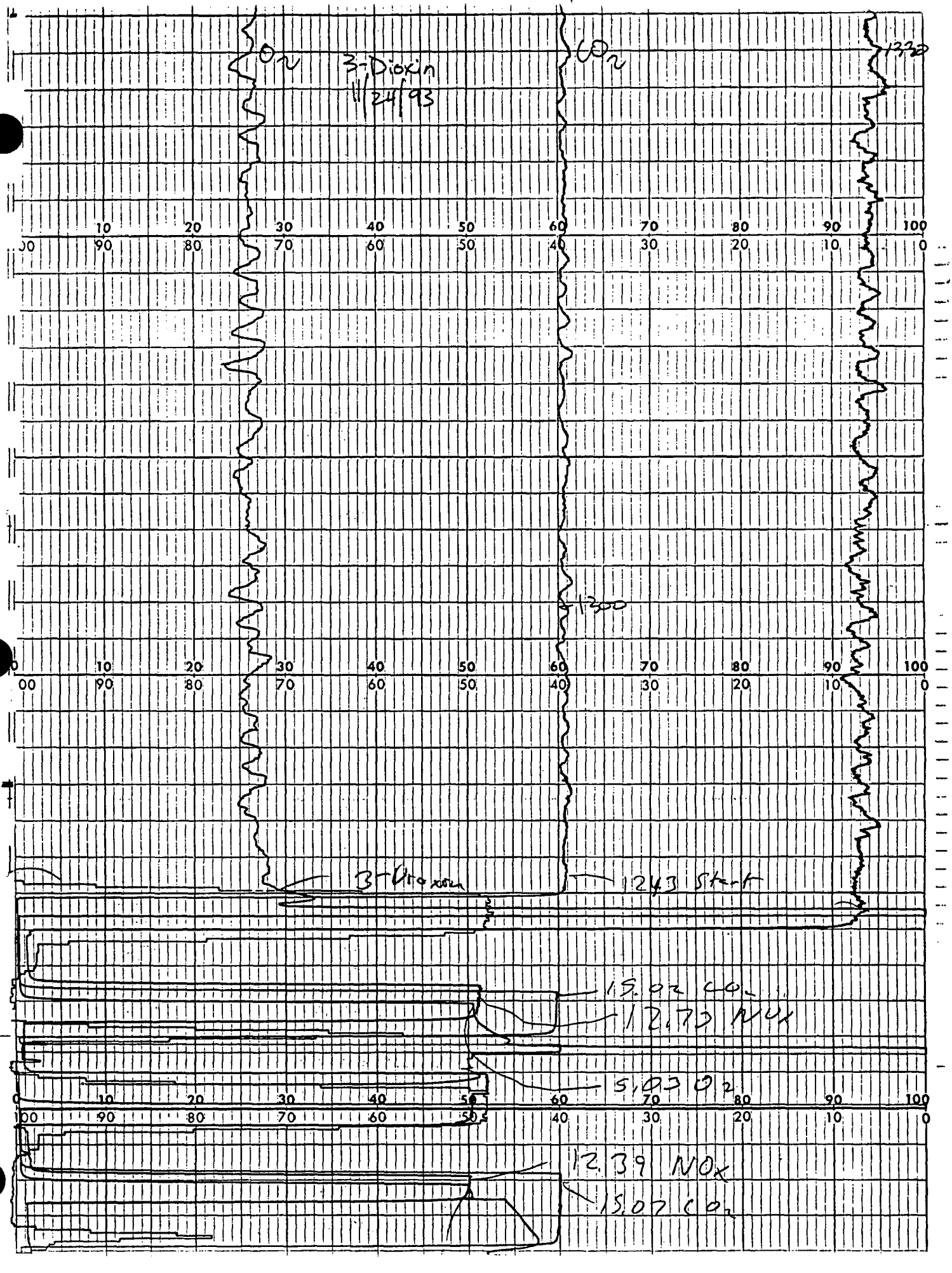

CO
O2
2 Dioxin
11/24/93
CO2
NOx 0833
810 Start
2-Dioxin
10.65 O2
12.65 NOx
15.15 CO2
5.03 O2
11-24-93
NOx Sys Bias 12.98
CO Sys Bias 10.68
CO2 Sys Bias 15.5
O2 Sys Bias 5.1
As Found Span
1904 End

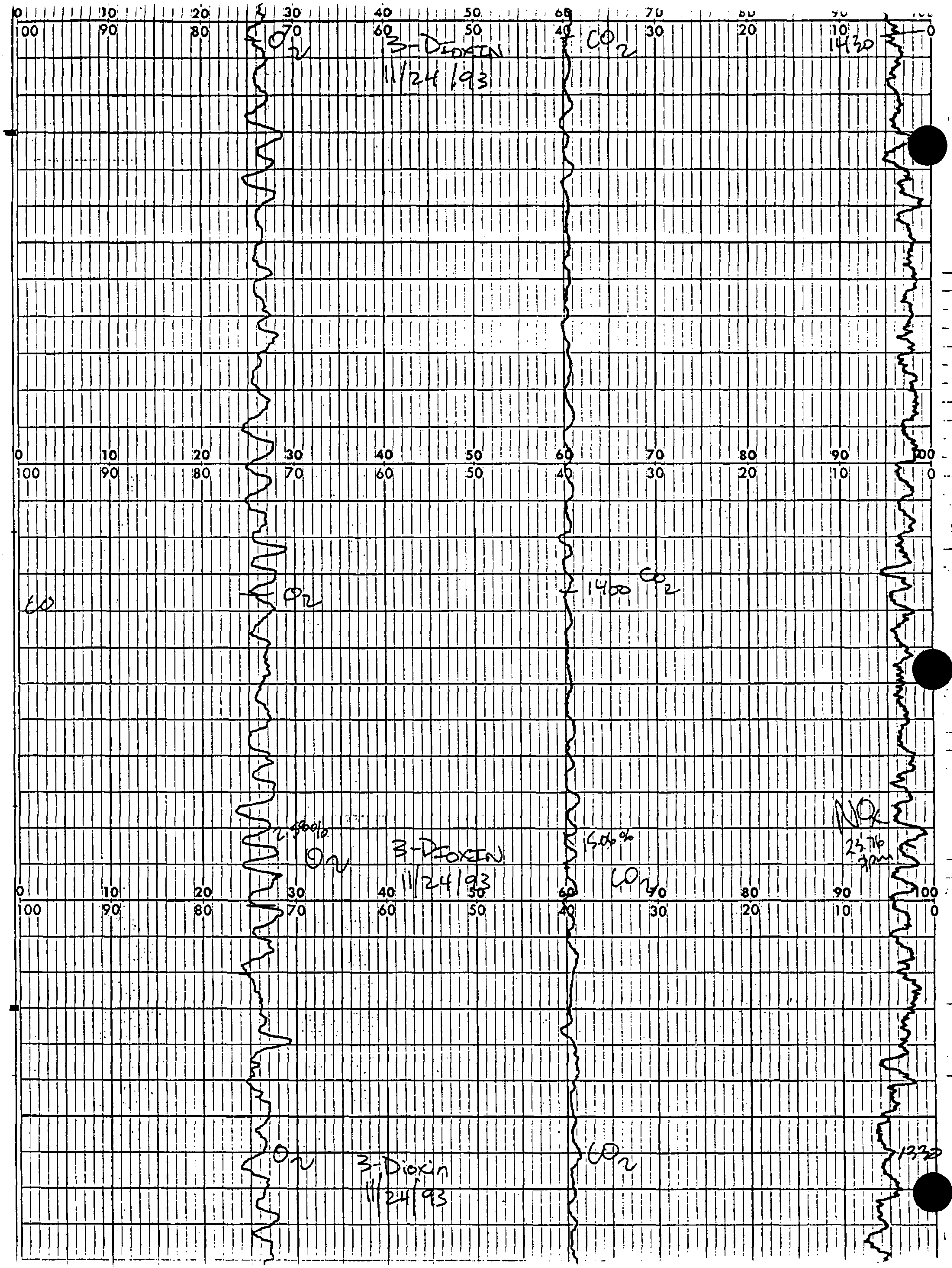

NOx Cal. Gas
(NOx Changed scale to 100
Checked plant gas bottle)
2-Dioxin
11/24/93
CO
O2
CO2
NOx
2-Dioxin
11/24/93
CO
O2
CO2
NOx


CO
O2
2-Dioxin
11/24/93
CO2
NOx
10ppm
CO 4 ppm
O2 2.95 %
2-Dioxin
11/24/93
CO2 15.31 %
100
NOx
955
Sample
(NOx-Changed scale back to 25)
(NOx: Changed scale to 100
Checked plant gas bottles)
NOx Cal. Gas

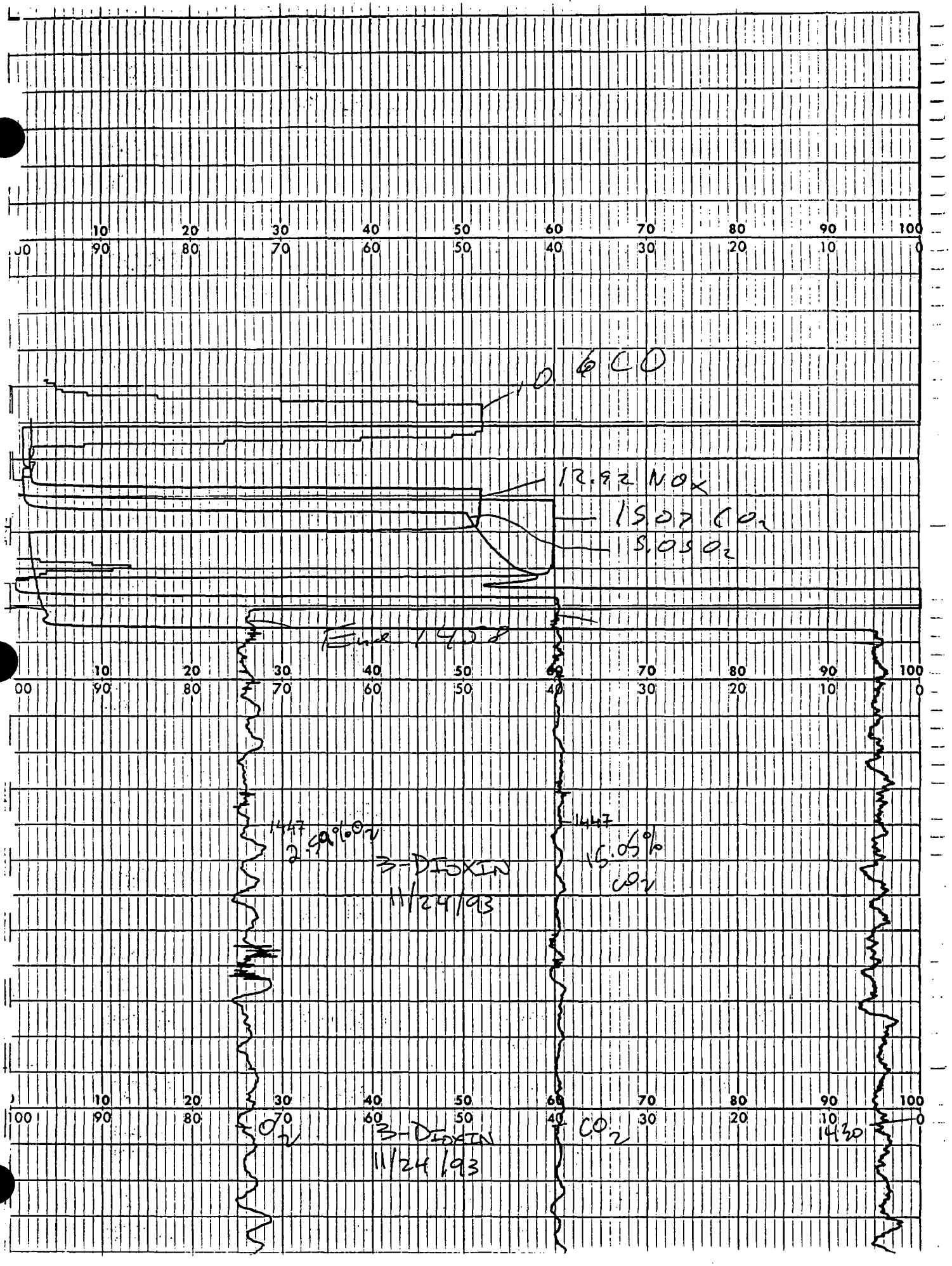

2-Dioxin
11/24/93
O2
CO2
1120
CO
2-Dioxin
11/24/93
O2
CO2
NOx
1100
CO
4-Dioxin
11/24/93
O2
CO2
NOx
1020


12.39 NOx
15.02 CO2
1220
4.9 O2
1210
2.65%
1210
15.26%
CO
O2
2-Dioxin
11/24/93
CO2
NOx 1200
O2
2-Dioxin
11/24/93
CO2
1120


O2
3-Dioxin
11/24/93
CO2
1330
1300
3-Dioxin
1243 Start
15.02 CO2
12.73 NOx
5.03 O2
12.39 NOx
15.07 CO2



0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0
O2
3-DIOXIN
11/24/93
CO2
1430
O2
1400 CO2
O2
3-DIOXIN
11/24/93
15.06%
CO2
NOx
O2
3-Dioxin
11/24/93
CO2
1330


10 ppm CO
12.8 ppm NOx
15.0% O_2
5.0% O_2
Time 1458
1447
2.9% O_2
3-DIOXIN
11/24/93
1447
15.0% O_2
O_2
3-DIOXIN
11/24/93
CO_2
1430

Appendix C.3

Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans

DIOXIN/FURAN EMISSIONS
PVERG UNIT 2
NOVEMBER 1993

CLIENT:	LACSD/PVERG	INITIALS:	DVK
LOCATION:	UNIT 2 OUTLET	VMSTD(DSCF):	120.34
PROJECT NO:	11 391	QSD(DSCF/MIN):	13,408
TEST DATE:	11/23/93	CO2,%:	15.01
TEST NUMBER:	1-DIOXIN	O2,%:	2.47
T REF (F)	60		

Component	ng/train		ng/dscm		lb/hr	
2378 TCDD	ND<	0.043	ND<	0.013	ND<	6.3E-10
12378 PeCDD	ND<	0.061	ND<	0.018	ND<	9.0E-10
123478 HxCDD	ND<	0.061	ND<	0.018	ND<	9.0E-10
123678 HxCDD	ND<	0.061	ND<	0.018	ND<	9.0E-10
123789 HxCDD	ND<	0.060	ND<	0.018	ND<	8.8E-10
1234678 HpCDD	ND<	0.048	ND<	0.014	ND<	7.1E-10
OCDD		0.18		0.053		2.7E-09
2378 TCDF	ND<	0.044	ND<	0.013	ND<	6.5E-10
12378 PeCDF	ND<	0.034	ND<	0.010	ND<	5.0E-10
23478 PeCDF	ND<	0.033	ND<	0.010	ND<	4.9E-10
123478 HxCDF	ND<	0.047	ND<	0.014	ND<	6.9E-10
123678 HxCDF	ND<	0.041	ND<	0.012	ND<	6.0E-10
234678 HxCDF	ND<	0.047	ND<	0.014	ND<	6.9E-10
123789 HxCDF	ND<	0.049	ND<	0.014	ND<	7.2E-10
1234678 HpCDF	ND<	0.062	ND<	0.018	ND<	9.1E-10
1234789 HpCDF	ND<	0.060	ND<	0.018	ND<	8.8E-10
OCDF	ND<	0.042	ND<	0.012	ND<	6.2E-10
TOTAL TCDD	ND<	0.043	ND<	0.013	ND<	6.3E-10
TOTAL PeCDD	ND<	0.061	ND<	0.018	ND<	9.0E-10
TOTAL HxCDD	ND<	0.060	ND<	0.018	ND<	8.8E-10
TOTAL HpCDD	ND<	0.048	ND<	0.014	ND<	7.1E-10
TOTAL TCDF	ND<	0.073	ND<	0.021	ND<	1.1E-09
TOTAL PeCDF	ND<	0.033	ND<	0.0097	ND<	4.9E-10
TOTAL HxCDF	ND<	0.046	ND<	0.013	ND<	6.8E-10
TOTAL HpCDF	ND<	0.060	ND<	0.018	ND<	8.8E-10
TOTAL PCDD/PCDF	**<**	**0.65**	**<**	**0.19**	**<**	**9.5E-09**

ND< Species not detected

Calculations:
ng/dscm=ng/train/ Vmstd,dscf* 35.31dscf/m^3
lb/hr=ng/train/ Vmstd,dscf*Qsd, dscf/min*60 min/hr/454 x 10^ 9 ng/lb

2/3/94 4:04 PM ✓ DK

DIOXIN/FURAN EMISSIONS
PVERG UNIT 2
NOVEMBER 1993

CLIENT:	LACSD/PVERG	INITIALS:	DVK
LOCATION:	UNIT 2 OUTLET	VMSTD(DSCF):	121.06
PROJECT NO:	11 391	QSD(DSCF/MIN):	13,552
TEST DATE:	11/24/93	CO2,%:	15.28
TEST NUMBER:	2-DIOXIN	O2,%:	2.56
T REF (F):	60		

Component	ng/train		ng/dscm		lb/hr	
2378 TCDD	ND<	0.053	ND<	0.015	ND<	7.8E-10
12378 PeCDD	ND<	0.060	ND<	0.018	ND<	8.9E-10
123478 HxCDD	ND<	0.061	ND<	0.018	ND<	9.0E-10
123678 HxCDD	ND<	0.060	ND<	0.018	ND<	8.9E-10
123789 HxCDD	ND<	0.062	ND<	0.018	ND<	9.2E-10
1234678 HpCDD	ND<	0.031	ND<	0.0090	ND<	4.6E-10
OCDD		0.23		0.067		3.4E-09
2378 TCDF	ND<	0.039	ND<	0.011	ND<	5.8E-10
12378 PeCDF	ND<	0.032	ND<	0.0093	ND<	4.7E-10
23478 PeCDF	ND<	0.031	ND<	0.0090	ND<	4.6E-10
123478 HxCDF	ND<	0.030	ND<	0.0088	ND<	4.4E-10
123678 HxCDF	ND<	0.031	ND<	0.0090	ND<	4.6E-10
234678 HxCDF	ND<	0.032	ND<	0.0093	ND<	4.7E-10
123789 HxCDF	ND<	0.031	ND<	0.0090	ND<	4.6E-10
1234678 HpCDF	ND<	0.060	ND<	0.018	ND<	8.9E-10
1234789 HpCDF	ND<	0.061	ND<	0.018	ND<	9.0E-10
OCDF	ND<	0.032	ND<	0.0093	ND<	4.7E-10
TOTAL TCDD	ND<	0.053	ND<	0.015	ND<	7.8E-10
TOTAL PeCDD	ND<	0.060	ND<	0.018	ND<	8.9E-10
TOTAL HxCDD	ND<	0.062	ND<	0.018	ND<	9.2E-10
TOTAL HpCDD	ND<	0.031	ND<	0.0090	ND<	4.6E-10
TOTAL TCDF	ND<	0.098	ND<	0.029	ND<	1.4E-09
TOTAL PeCDF	ND<	0.031	ND<	0.0090	ND<	4.6E-10
TOTAL HxCDF	ND<	0.031	ND<	0.0090	ND<	4.6E-10
TOTAL HpCDF	ND<	0.061	ND<	0.018	ND<	9.0E-10
TOTAL PCDD/PCDF	**<**	**0.69**	**<**	**0.20**	**<**	**1.0E-08**

ND< Species not detected

Calculations:
ng/dscm=ng/train/ Vmstd,dscf* 35.31dscf/m^3
lb/hr=ng/train/ Vmstd,dscf*Qsd, dscf/min*60 min/hr/454 x 10^ 9 ng/lb

2/3/94 4:05 PM ✓ DK

DIOXIN/FURAN EMISSIONS
PVERG UNIT 2
NOVEMBER 1993

CLIENT:	LACSD/PVERG	INITIALS:	DVK
LOCATION:	UNIT 2 OUTLET	VMSTD(DSCF):	123.27
PROJECT NO:	11 391	QSD(DSCF/MIN):	13,514
TEST DATE:	11/24/93	CO2,%:	15.13
TEST NUMBER:	**3-DIOXIN**	O2,%:	2.58
T REF (F):	60		

Component	ng/train		ng/dscm		lb/hr	
2378 TCDD	ND<	0.044	ND<	0.013	ND<	6.4E-10
12378 PeCDD	ND<	0.073	ND<	0.021	ND<	1.1E-09
123478 HxCDD	ND<	0.14	ND<	0.040	ND<	2.0E-09
123678 HxCDD	ND<	0.13	ND<	0.037	ND<	1.9E-09
123789 HxCDD	ND<	0.12	ND<	0.034	ND<	1.7E-09
1234678 HpCDD	ND<	0.058	ND<	0.017	ND<	8.4E-10
OCDD	ND<	0.17	ND<	0.049	ND<	2.5E-09
2378 TCDF	ND<	0.057	ND<	0.016	ND<	8.3E-10
12378 PeCDF	ND<	0.029	ND<	0.0083	ND<	4.2E-10
23478 PeCDF	ND<	0.029	ND<	0.0083	ND<	4.2E-10
123478 HxCDF	ND<	0.076	ND<	0.022	ND<	1.1E-09
123678 HxCDF	ND<	0.066	ND<	0.019	ND<	9.6E-10
234678 HxCDF	ND<	0.075	ND<	0.021	ND<	1.1E-09
123789 HxCDF	ND<	0.079	ND<	0.023	ND<	1.1E-09
1234678 HpCDF	ND<	0.060	ND<	0.017	ND<	8.7E-10
1234789 HpCDF	ND<	0.064	ND<	0.018	ND<	9.3E-10
OCDF	ND<	0.057	ND<	0.016	ND<	8.3E-10
TOTAL TCDD	ND<	0.044	ND<	0.013	ND<	6.4E-10
TOTAL PeCDD	ND<	0.073	ND<	0.021	ND<	1.1E-09
TOTAL HxCDD	ND<	0.13	ND<	0.037	ND<	1.9E-09
TOTAL HpCDD	ND<	0.058	ND<	0.017	ND<	8.4E-10
TOTAL TCDF	ND<	0.12	ND<	0.034	ND<	1.7E-09
TOTAL PeCDF	ND<	0.029	ND<	0.0083	ND<	4.2E-10
TOTAL HxCDF	ND<	0.074	ND<	0.021	ND<	1.1E-09
TOTAL HpCDF	ND<	0.060	ND<	0.017	ND<	8.7E-10
TOTAL PCDD/PCDF	**ND<**	**0.82**	**ND<**	**0.23**	**ND<**	**1.2E-08**

ND< Species not detected

Calculations:
ng/dscm=ng/train/ Vmstd,dscf* 35.31dscf/m^3
lb/hr=ng/train/ Vmstd,dscf*Qsd, dscf/min*60 min/hr/454 x 10^ 9 ng/lb

2/22/94 9:14 AM ✓ DK

AVERAGE DIOXIN/FURAN EMISSIONS
PVERG UNIT 2
NOVEMBER 1993

NAME	ng/dscm		lb/hr	
2378 TCDD	ND<	0.014	ND<	6.8E-10
12378 PeCDD	ND<	0.019	ND<	9.5E-10
123478 HxCDD	ND<	0.025	ND<	1.3E-09
123678 HxCDD	ND<	0.024	ND<	1.2E-09
123789 HxCDD	ND<	0.023	ND<	1.2E-09
1234678 HpCDD	ND<	0.013	ND<	6.7E-10
OCDD	<	0.056	<	2.8E-09
2378 TCDF	ND<	0.014	ND<	6.8E-10
12378 PeCDF	ND<	0.0092	ND<	4.6E-10
23478 PeCDF	ND<	0.0090	ND<	4.5E-10
123478 HxCDF	ND<	0.015	ND<	7.5E-10
123678 HxCDF	ND<	0.013	ND<	6.7E-10
234678 HxCDF	ND<	0.015	ND<	7.5E-10
123789 HxCDF	ND<	0.015	ND<	7.7E-10
1234678 HpCDF	ND<	0.018	ND<	8.9E-10
1234789 HpCDF	ND<	0.018	ND<	9.0E-10
OCDF	ND<	0.013	ND<	6.4E-10
TOTAL TCDD	ND<	0.014	ND<	6.8E-10
TOTAL PeCDD	ND<	0.019	ND<	9.5E-10
TOTAL HxCDD	ND<	0.024	ND<	1.2E-09
TOTAL HpCDD	ND<	0.013	ND<	6.7E-10
TOTAL TCDF	ND<	0.028	ND<	1.4E-09
TOTAL PeCDF	ND<	0.0090	ND<	4.5E-10
TOTAL HxCDF	ND<	0.015	ND<	7.4E-10
TOTAL HpCDF	ND<	0.018	ND<	8.9E-10
TOTAL PCDD/PCDF	**<**	**0.21**	**<**	**1.1E-08**

ND< Species not detected

2/22/94 9:16 AM DK

DIOXIN/FURAN TOXIC EQUIVALENTS DATA
CALIFORNIA DOHS METHOD
PVERG UNIT 2
NOVEMBER 1993

CLIENT:	LACSD/PVERG	INTITIALS:	DVK
LOCATION:	UNIT 2 OUTLET	VMSTD(DSCF):	120.34
PROJECT NO:.	11 391	QSD(DSCF/MIN):	13,408
TESTDATE:	11/23/93	QSD(dscm/min)	379.72
TEST NUMBER:	1-DIOXIN	CO2,%:	15.01
		O2%:	2.47

Component	ng/dscm	CA DOHS FACTORS	TOXIC EQUIV*
2378 TCDD	0.013	1.00000	0.01262
OTHER TCDD	0.000	0.00000	0.00000
12378 PCDD	0.018	1.00000	0.01790
OTHER PCDD	0.000	0.00000	0.00000
123478 HXCDD	0.018	0.03000	0.00054
123678 HXCDD	0.018	0.03000	0.00054
123789 HXCDD	0.018	0.03000	0.00053
OTHER HXCDD	-0.036	0.00000	0.00000
1234678 HPCDD	0.014	0.03000	0.00042
OTHER HPCDD	0.000	0.00000	0.00000
OCDD	0.053	0.00000	0.00000
2378 TCDF	0.013	1.00000	0.01291
OTHER TCDF	0.009	0.00000	0.00000
12378 PCDF	0.010	1.00000	0.00998
23478 PCDF	0.010	1.00000	0.00968
OTHER PCDF	-0.010	0.00000	0.00000
123478 HXCDF	0.014	0.03000	0.00041
123678 HXCDF	0.012	0.03000	0.00036
234678 HXCDF	0.014	0.03000	0.00041
123789 HXCDF	0.014	0.03000	0.00043
OTHER HXCDF	-0.040	0.00000	0.00000
1234678 HPCDF	0.018	0.03000	0.00055
1234789 HPCDF	0.018	0.03000	0.00053
OTHER HPCDF	-0.018	0.00000	0.00000
OCDF	0.012	0.00000	0.00000
TOTAL PCDD/PCDF	0.19		
TOTAL PCDD TOX EQUIV*			0.033
TOTAL PCDF TOX EQUIV*			0.035
TOTAL TOX EQUIV* (2,3,7,8 TCDD EQUIV)			0.068
TOTAL PCDD/PCDF, lb/hr:			9.5E-09
TOTAL TOXIC EQUIV., lb/hr:			3.4E-09

* ALL TOXIC EQUIVALENT VALUES ARE IN UNITS OF ng/dscm

2/3/94 4:31 PM DK

DIOXIN/FURAN TOXIC EQUIVALENTS DATA
CALIFORNIA DOHS METHOD
PVERG UNIT 2
NOVEMBER 1993

CLIENT:	LACSD/PVERG	INTITIALS:	DVK
LOCATION:	UNIT 2 OUTLET	VMSTD(DSCF):	121.06
PROJECT NO:	11 391	QSD(DSCF/MIN):	13,552
TESTDATE:	11/24/93	QSD(dscm/min)	383.80
TEST NUMBER:	2-DIOXIN	CO2,%:	15.28
		O2%:	2.56

Component	ng/dscm	CA DOHS FACTORS	CA TOXIC EQUIV*
2378 TCDD	0.015	1.00000	0.01546
OTHER TCDD	0.000	0.00000	0.00000
12378 PCDD	0.018	1.00000	0.01750
OTHER PCDD	0.000	0.00000	0.00000
123478 HXCDD	0.018	0.03000	0.00053
123678 HXCDD	0.018	0.03000	0.00053
123789 HXCDD	0.018	0.03000	0.00054
OTHER HXCDD	-0.035	0.00000	0.00000
1234678 HPCDD	0.009	0.03000	0.00027
OTHER HPCDD	0.000	0.00000	0.00000
OCDD	0.067	0.00000	0.00000
2378 TCDF	0.011	1.00000	0.01138
OTHER TCDF	0.017	0.00000	0.00000
12378 PCDF	0.009	1.00000	0.00933
23478 PCDF	0.009	1.00000	0.00904
OTHER PCDF	-0.009	0.00000	0.00000
123478 HXCDF	0.009	0.03000	0.00026
123678 HXCDF	0.009	0.03000	0.00027
234678 HXCDF	0.009	0.03000	0.00028
123789 HXCDF	0.009	0.03000	0.00027
OTHER HXCDF	-0.027	0.00000	0.00000
1234678 HPCDF	0.018	0.03000	0.00053
1234789 HPCDF	0.018	0.03000	0.00053
OTHER HPCDF	-0.018	0.00000	0.00000
OCDF	0.009	0.00000	0.00000
TOTAL PCDD/PCDF	0.20		
TOTAL PCDD TOX EQUIV*			0.035
TOTAL PCDF TOX EQUIV*			0.032
TOTAL TOX EQUIV* (2,3,7,8 TCDD EQUIV)			0.067
TOTAL PCDD/PCDF, lb/hr:			1.0E-08
TOTAL TOXIC EQUIV., lb/hr:			3.4E-09

* ALL TOXIC EQUIVALENT VALUES ARE IN UNITS OF ng/dscm

2/3/94 4:31 PM DK

DIOXIN/FURAN TOXIC EQUIVALENTS DATA
CALIFORNIA DOHS METHOD
PVERG UNIT 2
NOVEMBER 1993

CLIENT:	LACSD/PVERG	INTITIALS:	DVK
LOCATION:	UNIT 2 OUTLET	VMSTD(DSCF):	123.27
PROJECT NO:	11 391	QSD(DSCF/MIN):	13,514
TESTDATE:	11/24/93	QSD(dscm/min)	382.73
TEST NUMBER:	**3-DIOXIN**	CO2,%:	15.13
		O2%:	2.58

Component	ng/dscm	CA DOHS FACTORS	CA TOXIC EQUIV*
2378 TCDD	0.013	1.00000	0.01260
OTHER TCDD	0.000	0.00000	0.00000
12378 PCDD	0.021	1.00000	0.02091
OTHER PCDD	0.000	0.00000	0.00000
123478 HXCDD	0.040	0.03000	0.00120
123678 HXCDD	0.037	0.03000	0.00112
123789 HXCDD	0.034	0.03000	0.00103
OTHER HXCDD	-0.074	0.00000	0.00000
1234678 HPCDD	0.017	0.03000	0.00050
OTHER HPCDD	0.000	0.00000	0.00000
OCDD	0.049	0.00000	0.00000
2378 TCDF	0.016	1.00000	0.01633
OTHER TCDF	0.018	0.00000	0.00000
12378 PCDF	0.008	1.00000	0.00831
23478 PCDF	0.008	1.00000	0.00831
OTHER PCDF	-0.008	0.00000	0.00000
123478 HXCDF	0.022	0.03000	0.00065
123678 HXCDF	0.019	0.03000	0.00057
234678 HXCDF	0.021	0.03000	0.00064
123789 HXCDF	0.023	0.03000	0.00068
OTHER HXCDF	-0.064	0.00000	0.00000
1234678 HPCDF	0.017	0.03000	0.00052
1234789 HPCDF	0.018	0.03000	0.00055
OTHER HPCDF	-0.018	0.00000	0.00000
OCDF	0.016	0.00000	0.00000
TOTAL PCDD/PCDF	**0.23**		
TOTAL PCDD TOX EQUIV*			**0.037**
TOTAL PCDF TOX EQUIV*			**0.037**
TOTAL TOX EQUIV* (2,3,7,8 TCDD EQUIV)			**0.074**
TOTAL PCDD/PCDF, lb/hr:			**1.2E-08**
TOTAL TOXIC EQUIV., lb/hr:			**3.7E-09**

* ALL TOXIC EQUIVALENT VALUES ARE IN UNITS OF ng/dscm

2/22/94 9:20 AM ✓DK

AVERAGE DIOXIN/FURAN TOXIC EQUIVALENTS DATA
CALIFORNIA DOHS METHOD
PVERG UNIT 2
NOVEMBER 1993

Component	ng/dscm	CA DOHS FACTORS	CA TOXIC EQUIV*
2378 TCDD	0.0136	1.00000	0.01356
OTHER TCDD	0.000	0.00000	0.00000
12378 PCDD	0.0188	1.00000	0.01877
OTHER PCDD	0.000	0.00000	0.00000
123478 HXCDD	0.0253	0.03000	0.00076
123678 HXCDD	0.0242	0.03000	0.00073
123789 HXCDD	0.0234	0.03000	0.00070
OTHER HXCDD	-0.049	0.00000	0.00000
1234678 HPCDD	0.013	0.03000	0.00040
OTHER HPCDD	0.000	0.00000	0.00000
OCDD	0.056	0.00000	0.00000
2378 TCDF	0.014	1.00000	0.01354
OTHER TCDF	0.015	0.00000	0.00000
12378 PCDF	0.0092	1.00000	0.00921
23478 PCDF	0.0090	1.00000	0.00901
OTHER PCDF	-0.009	0.00000	0.00000
123478 HXCDF	0.015	0.03000	0.00044
123678 HXCDF	0.0133	0.03000	0.00040
234678 HXCDF	0.0149	0.03000	0.00045
123789 HXCDF	0.0153	0.03000	0.00046
OTHER HXCDF	-0.044	0.00000	0.00000
1234678 HPCDF	0.018	0.03000	0.00053
1234789 HPCDF	0.018	0.03000	0.00054
OTHER HPCDF	-0.0180	0.00000	0.00000
OCDF	0.0127	0.00000	0.00000
TOTAL PCDD/PCDF	**0.208**		
TOTAL PCDD TOX EQUIV*			**0.035**
TOTAL PCDF TOX EQUIV*			**0.035**
TOTAL TOX EQUIV* (2,3,7,8 TCDD EQUIV)			**0.069**
TOTAL PCDD/PCDF, lb/hr:			**1.1E-08**
TOTAL TOXIC EQUIV., lb/hr:			**3.5E-09**

* ALL TOXIC EQUIVALENT VALUES ARE IN UNITS OF ng/dscm

2/22/94 9:19 AM ✓ DK

DIOXIN/FURAN BLANK LEVELS
PALOS VERDES PVERG UNIT
NOVEMBER 1993

Component	Method Blank ng		Field Blank ng	
2378 TCDD	ND<	0.098	ND<	0.078
12378 PeCDD	ND<	0.062	ND<	0.064
123478 HxCDD	ND<	0.13	ND<	0.087
123678 HxCDD	ND<	0.11	ND<	0.076
123789 HxCDD	ND<	0.11	ND<	0.075
1234678 HpCDD	ND<	0.048	ND<	0.032
OCDD		0.12		0.290
2378 TCDF	ND<	0.029	ND<	0.036
12378 PeCDF	ND<	0.053	ND<	0.020
23478 PeCDF	ND<	0.053	ND<	0.019
123478 HxCDF	ND<	0.073	ND<	0.035
123678 HxCDF	ND<	0.063	ND<	0.030
234678 HxCDF	ND<	0.072	ND<	0.035
123789 HxCDF	ND<	0.076	ND<	0.037
1234678 HpCDF	ND<	0.061	ND<	0.061
1234789 HpCDF	ND<	0.064	ND<	0.061
OCDF	ND<	0.046	ND<	0.033
TOTAL TCDD	ND<	0.098	ND<	0.0780
TOTAL PeCDD	ND<	0.062	ND<	0.0640
TOTAL HxCDD	ND<	0.12	ND<	0.079
TOTAL HpCDD	ND<	0.048	ND<	0.0320
TOTAL TCDF	ND<	0.23	ND<	0.2000
TOTAL PeCDF	ND<	0.053	ND<	0.0190
TOTAL HxCDF	ND<	0.071	ND<	0.034
TOTAL HpCDF	ND<	0.065	ND<	0.061

ND< Species not detected

2/2/94 4:16 PM DK

CARNOT SOURCE TEST DATA SUMMARY
DIOXIN/FURAN
STACK

Client/Location	LACSD/PVERG	Reference Temp (F)	60
Unit	Boiler No. 2	Fuel	LFG
Sample Location	Stack	Data By	DK
Operating Condition	*	Date of Data Entry	1/28/94

Test No	1-DIOXIN	2-DIOXIN	3-DIOXIN	Average
Date	11/23/93	11/24/93	11/24/93	*
Test Method	CARB 428	CARB 428	CARB 428	*
Sample Train	ES-19	ES-19	ES-30	*
Pitot Factor	0.840	0.840	0.840	*
Meter Cal Factor	1.0003	1.0003	1.0484	*
Stack Area (sq ft)	9.17	9.17	9.17	*
Sample Time (Min)	240	240	240	*
Bar Press (in Hg)	29.85	29.85	29.85	*
Nozzle Diam (in)	0.258	0.258	0.258	*
Start/Stop Time	1450/1906	0810/1220	1050/1500	*
Stack Press (iwg)	-0.29	-0.08	-0.10	-0.155
Stack Temp (F)	336.4	334.7	341.8	337.6
Velocity Head (iwg)	0.4283	0.4320	0.4247	0.428
Stack O2 (%)	2.47	2.56	2.58	2.54
Stack CO2 (%)	15.01	15.28	15.13	15.14
Meter Vol (acf)	125.944	126.115	120.414	124.158
Meter Temp (F)	84.4	81.8	72.7	79.7
Meter Press (iwg)	0.99	0.95	1.12	1.02
Liquid Vol (ml)	563.5	544.8	517.2	541.8
Std Sample Vol (SCF)	120.335	121.059	123.270	121.555
Std Sample Vol (SCM)	3.407	3.428	3.491	3.442
Std Sample Vol (Nm^3)	3.175	3.194	3.253	3.207
Moisture Fraction	0.179	0.173	0.163	0.172
Stack Gas Mol Wt	28.27	28.38	28.48	28.37
Stack Gas Velocity (ft/sec)	45.60	45.65	45.38	45.55
Stack Flow Rate (wacfm)	25,092	25,118	24,970	25,060
Stack Flow Rate (dscfm)	13,411	13,555	13,514	13,493
Isokinetic Ratio (%)	94.4	94.0	96.0	94.8

✓ DK

CARNOT

SAMPLE TRAIN TEST DATA

CLIENT PV, Boiler UNIT 2 TEST NO. 1-Dioxin METHOD 428 PAGE 1 OF 2
SAMPLE LOCATION Boiler outlet TEST CONDITION _____ AMB. TEMP., °F _____ PROJECT # 10391
OPERATOR/ASSISTANT Rielcm/MD METER VOL. (START/END) 205,337 / 331.273 DATE 11-23-93

PRE-TEST DATA:

Barometric Press., in. Hg.	29.85
Assumed Stack Press.	
Assumed Moisture	
Assumed Molecular Wt.	
Assumed ΔP	
Assumed ΔH	
Stack Diameter, in.	
Sample Time: Total	240
per point	15
Total of Traverse Points	16

ΔH = ~~2.39~~ / ×2.28 x ΔP

EQUIPMENT INFO:

Meter No.	ES-19
Meter, Yd.	1.0003
CFM @ ΔH = 1.0	.572
Pitot ID, Cp	.84
O_2/CO_2 Method	CEM
Teflon Connecting Line (Y/N)	YES
Probe: Mat'l	Glass
Length	8'
Nozzle: Mat'l	Glass
Diam.	.258
Filter: No.	110-3171
Mat'l	Glass

Imp.	Mat'l	Wt.(End)	Wt.(Start)	Wt.(g)
#1	Ø	966.4	465.6	500.8
#2	H_2O	624.4	603.3	21.1
#3	Ø	485.1	483.7	1.4
#4	SG	867.6	827.4	40.2
#5				
Total	Column No 37114			563.5

POST TEST INFO:
Filter Appearance
Impinger Appearance
Silica Gel Spent (Y/N)

SAMPLE TRAIN LEAK CHECK:

	CFM	Vac.	Pitot	Init.
Pre-Test	.000	15"	✓	KM
Post-Test	.000	11"	✓	KM

PRE-TEST CALIBRATION CHECK:

	Time	ΔH	Meter Reading	Meter Temp. In	Meter Temp. Out
Init.					
Final					

SAMPLE POINT	TIME	METER CONDITIONS ΔP	ΔH	METER READING	TEMPERATURES, °F STACK	PROBE	METER IN	METER OUT	OVEN	Column IMP. OUT	O_2	VAC.	STATIC PRESS. iwg	CHAIN OF CUSTODY INFORMATION
E-8	1450	.35	.84	205.339	333	275	87	83	275	55	2.7	4.3		Impingers Loaded CHK
7	1505	.38	.91	212.862	335	275	94	83	260	53	2.7	6.0		Impingers Recovered
6	1520	.41	.98	220.728	335	28	94	82	275	39	2.6	6.0	-.21	Filter Loaded CHK
5	1535	.45	1.08	228.924	336	225	95	82	246	41	2.8	6.1		Filter Recovered
4	1550	.52	1.24	237.332	340	258	96	83	259	46	2.8	7.0		Probe Wash
Lost Power	1605			243.048										TEST SUMMARY
start up 3	1609	.50	1.20	243.048	340	225	91	81	275	37	2.8	7.2		Calculated by
* 2	1624	.41	.93	252.043	340	275	95	80	275	41	2.8	6.0		Checked by
1	1639	.40	.96	260.403	340	237	92	80	275	40	2.8	6.1		Sample Vol., cf
STOP	1654			268.250										Stack Press., iwg
														ΔH, iwg
														ΔP, iwg
														Meter Temp., °F
														Stack Temp., °F
														Water Collected, g
														O_2/CO_2
														Comments:

PMF-057

CARNOT P.V. Boilers

SAMPLE TRAIN TEST DATA

CLIENT P.V. Boilers | UNIT 2 | TEST NO. 1-Dioxin | METHOD 23.5 | PAGE 1 OF 2
SAMPLE LOCATION Boiler Outlet | TEST CONDITION | AMB. TEMP., °F | PROJECT # 10837
OPERATOR/ASSISTANT Rick M / MD | METER VOL. (START/END) / | DATE 11-23-97

PRE-TEST DATA:
Barometric Press., in. Hg.
Assumed Stack Press.
Assumed Moisture
Assumed Molecular Wt.
Assumed ΔP
Assumed ΔH
Stack Diameter, in.
Sample Time: Total
per point
Total of Traverse Points
ΔH = 2.20 x ΔP

EQUIPMENT INFO: EQ 19
Meter No.
Meter, Yd. 1.0003
CFM @ ΔH = 1.0 0.572
Pitot ID, Cp
O_2/CO_2 Method S
Teflon Connecting Line (Y/N) Y
Probe: Mat'l
Length
Nozzle: Mat'l
Diam.
Filter: No.
Mat'l

Imp.	Mat'l	Wt.(End)	Wt.(Start)	Wt.(g)
#1				
#2				
#3				
#4				
#5				
Total				

Page 1 of 1

POST TEST INFO:
Filter Appearance
Impinger Appearance
Silica Gel Spent (Y/N)

SAMPLE TRAIN LEAK CHECK:

	CFM	Vac.	Pitot	Init.
Pre-Test				
Post-Test				

PRE-TEST CALIBRATION CHECK:

	Time	ΔH	Meter Reading	Meter Temp. In	Meter Temp. Out
Init.					
Final					

SAMPLE POINT	TIME	METER CONDITIONS ΔP	ΔH	METER READING	TEMPERATURES, °F STACK	PROBE	METER IN	METER OUT	OVEN	IMP. OUT	O_2	VAC.	STATIC PRESS. iwg
*S-8	1700	.38	.41	268.250	337	254	85	78	260	45	2.4	5.5	
7	1721	.50	1.10	275.648	337	268	90	73	258	45	2.8	6.8	
6	1736	.49	1.06	284.406	336	248	91	78	248	46	2.8	6.5	-.31
5	1751	.46	1.01	292.545	336	252	90	77	254	48	2.6	6.1	
4	1806	.48	1.06	300.675	336	263	89	76	254	49	2.6	6.5	
3	1821	.44	.97	308.943	334	259	89	75	260	52	2.6	6.0	
2	1836	.37	.81	316.903	334	258	87	75	268	55	2.6	5.5	
1	1851	.35	.77	324.112	333	259	86	74	272	55	2.6	5.5	
STOP	1906			331.283									
AVG.	240 min	0.4312	0.985	125.944	336.375	254.375	88.1	1188	260.125	1/1.8125	2.725	6.06	-.285
		0.4173											

CHAIN OF CUSTODY INFORMATION
Impingers Loaded CHL
Impingers Recovered CHL
Filter Loaded CHL
Filter Recovered CHL
Probe Wash CHL

TEST SUMMARY
Calculated by: RM
Checked by: BAC
Sample Vol., cf 125.914 ✓
Stack Press., iwg -.285 ✓
ΔH, iwg 0.9850 ✓
ΔP, iwg 0.4312 0.4283 BAC
Meter Temp., °F 81.4063 ✓
Stack Temp., °F 336.375 ✓
Water Collected, g 563.5 ✓
O_2/CO_2 2.-125 ✓
Comments

CARNOT

SAMPLE TRAIN TEST DATA

CLIENT PV Boilers UNIT # 2 TEST NO. 2-Dioxin METHOD 428 PAGE (1) OF (2)
SAMPLE LOCATION exhaust TEST CONDITION _____ AMB. TEMP., °F _____ PROJECT # 10391
OPERATOR/ASSISTANT BC/MD METER VOL. (START/END) 331.525 1457.640 DATE 4/24/93

PRE-TEST DATA:

Barometric Press., in. Hg.	29.85
Assumed Stack Press.	
Assumed Moisture	
Assumed Molecular Wt.	
Assumed ΔP	
Assumed ΔH	
Stack Diameter, in.	
Sample Time: Total	
per point	
Total of Traverse Points	

ΔH = 2.19 (Meter 93 / Stack 336) x ΔP

EQUIPMENT INFO:

Meter No.	55-19
Meter, Yd.	1.003
CFM @ ΔH = 1.0	.572
Pitot ID, Cp	.84
O_2/CO_2 Method	Fyrite/CEM
Teflon Connecting Line (Y/N)	Y
Probe: Mat'l	glass
Length	6'
Nozzle: Mat'l	glass
Diam.	.258
Filter: No.	110.3172
Mat'l	glass

Column no. 37113

Imp.	Mat'l	Wt.(End)	Wt.(Start)	Wt.(Δ)
#1	Ø	863.8	492.3	371.5
#2	H_2O	741.0	612.5	128.5
#3	Ø	474.8	473.9	.9
#4	SG	353.0	808.1	144.9
#5				
Total				544.8

POST TEST INFO:
Filter Appearance
Impinger Appearance
Silica Gel Spent (Y/N)

SAMPLE TRAIN LEAK CHECK:

	CFM	Vac.	Pitot	Init.
Pre-Test	.00	13"	ok	BC
Post-Test	.00	13.5"	ok	BC

PRE-TEST CALIBRATION CHECK:

	Time	ΔH	Meter Reading	Meter Temp. In	Meter Temp. Out
Init.					
Final					

SAMPLE POINT	TIME	METER CONDITIONS ΔP	ΔH	METER READING	TEMPERATURES, °F STACK	PROBE	METER IN	METER OUT	OVEN	IMP. OUT	O_2	VAC.	STATIC PRESS. iwg
5 8	810	.29	.64	331.525	335	269	73	63	249	45	3.0	6	
7	825	.41	.90	338.1	334	270	83	68	272	45	2.8	8	
6	840	.41	.90	345.6	335	257	86	71	256	46	3.5	8	
5	855	.44	.96	353.6	335	269	86	73	249	50	3.3	8	-.07
STOP TEST #1	900			359.844		TRIP	CIRCUIT						
START TEST #2	911			359.844									
4 2	913	.46	1.01	360.8	334	223	86	74	242	56	2.9	9.5	
3 1	928	.45	.99	369.0	334	257	89	75	239	52	2.7	9.5	
2 ~~TRIP~~	943	.44	.96	377.1	333	263	89	76	245	54	2.6	9.5	
1	958	.44	.96	385.4	332	258	90	76	252	54	2.7	9	
STOP	1013			393.023		LEAK CHECK	-GOOD	.003 @ 10	11				

CHAIN OF CUSTODY INFORMATION	
Impingers Loaded	CHF
Impingers Recovered	CHF
Filter Loaded	CHF
Filter Recovered	CHF
Probe Wash	CHF
TEST SUMMARY	
Calculated by:	BAC
Checked by:	BAC
Sample Vol., cf	126.115 ✓
Stack Press., iwg	-0.08 ✓
ΔH, iwg	0.9619 ✓
ΔP, iwg	0.4320
Meter Temp., °F	81.84
Stack Temp., °F	334.69 ✓
Water Collected, g	544.8 ✓
O_2/CO_2	2.39
Comments:	

CARNOT

SAMPLE TRAIN TEST DATA

CLIENT R Baker UNIT _____ TEST NO. 2 Dick METHOD _____ PAGE 2 OF 2
SAMPLE LOCATION _____ TEST CONDITION _____ AMB. TEMP., °F _____ PROJECT # 10391
OPERATOR/ASSISTANT _____ METER VOL. (START/END) 1 DATE 11/24/93

PRE-TEST DATA:

Barometric Press., in. Hg.	
Assumed Stack Press.	
Assumed Moisture	
Assumed Molecular Wt.	
Assumed ΔP	
Assumed ΔH	
Stack Diameter, in.	
Sample Time: Total	
per point	
Total of Traverse Points	

ΔH = 2.19 x ΔP

EQUIPMENT INFO:

Meter No.	
Meter, Yd.	
CFM @ ΔH = 1.0	
Pitot ID, Cp	
O_2/CO_2 Method	
Teflon Connecting Line (Y/N)	
Probe: Mat'l	
Length	
Nozzle: Mat'l	
Diam.	
Filter: No.	
Mat'l	

Imp.	Mat'l	Wt.(End)	Wt.(Start)	Wt.(g)
#1				
#2				
#3				
#4				
#5				
Total				

SEE PAGE #1

POST TEST INFO:

Filter Appearance	
Impinger Appearance	
Silica Gel Spent (Y/N)	

SAMPLE TRAIN LEAK CHECK:

	CFM	Vac.	Pitot	Init.
Pre-Test				
Post-Test				

PRE-TEST CALIBRATION CHECK:

	Time	ΔH	Meter Reading	Meter Temp. In	Meter Temp. Out
Init.					
Final					

SAMPLE POINT	TIME	METER CONDITIONS ΔP	ΔH	METER READING	TEMPERATURES, °F STACK	PROBE	METER IN	METER OUT	OVEN	IMP. OUT	O_2	VAC.	STATIC PRESS. iwg	CHAIN OF CUSTODY INFORMATION
E 8	1020	.33	.72	393.098	332	246	80	77	252	106	2.8	8		Impingers Loaded
7	1035	.37	.81	400.1	333	270	89	78	246	55	2.9	9		Impingers Recovered
6	1050	.42	.92	408.0	333	257	91	78	243	50	2.0	9.5		Filter Loaded
5	1105	.46	1.01	415.6	334	274	91	78	237	50	2.9	10	-.09	Filter Recovered
4	1120	.52	1.14	423.6	337	276	94	78	241	52	2.9	10.5		Probe Wash
3	1135	.53	1.16	432.3	338	278	94	78	253	58	2.9	10.5		TEST SUMMARY
2	1150	.50	1.10	441.1	338	262	96	80	255	55	2.7	10.5		Calculated by:
1	1205	.48	1.05	450.2	338	261	97	82	266	51	2.8	10		Checked by:
STOP	1220			457.640										Sample Vol., c.f.
														Stack Press., iwg
														ΔH, iwg
														ΔP, iwg
														Meter Temp., °F
														Stack Temp., °F
														Water Collected, g
														O_2/CO_2
														Comments:

CARNOT

SAMPLE TRAIN TEST DATA

CLIENT PV Boiler | UNIT #2 | TEST NO. 3-Dioxin | METHOD 428 | PAGE 1 OF 1
SAMPLE LOCATION Exhaust | TEST CONDITION | AMB. TEMP., °F | PROJECT # 1039
OPERATOR/ASSISTANT JC/MO | METER VOL. (START/END) 993.746 / 1114.160 | DATE 8/24/94

PRE-TEST DATA:
Barometric Press., in. Hg. 29.85
Assumed Stack Press.
Assumed Moisture
Assumed Molecular Wt.
Assumed ΔP
Assumed ΔH
Stack Diameter, in.
Sample Time: Total
per point
Total of Traverse Points

ΔH = ~~2.9~~ 2.6 x ΔP
~~2.64~~

EQUIPMENT INFO:
Meter No. E5-30
Meter, Yd. 1.0484
CFM @ ΔH = 1.0 .495
Pilot ID, Cp .84
O_2/CO_2 Method PART/CEM
Tolion Connecting Line (Y/N) Y
Probe: Mat'l Glass
Length 6
Nozzle: Mat'l Glass
Diam. .258
Filter: No. 110-3174
Mat'l Glass
Column No. 37117

Imp.	Mat'l	Wt.(End)	Wt.(Start)	Wt.(g)
#1	Ø	934.0	463.1	470.9
#2	H_2O	599.0	595.9	3.1
#3	Ø	4863	485.1	1.2
#4	SG	875.1	833.1	42.0
#5				
Total				517.2

POST TEST INFO:
Filter Appearance
Impingor Appearance
Silica Gel Spent (Y/N)

SAMPLE TRAIN LEAK CHECK:

	CFM	Vac.	Pitot	Init.
Pre-Test	.005	13"	OK	BC
Post-Test	.007	6.5	OK	BC

PRE-TEST CALIBRATION CHECK:

	Time	ΔH	Meter Reading	Meter Temp. In	Meter Temp. Out
Init.					
Final					

SAMPLE POINT	TIME	METER CONDITIONS ΔP	ΔH	METER READING	TEMPERATURES, °F STACK	PROBE	METER IN	METER OUT	OVEN	IMP. OUT	O_2	VAC.	STATIC PRESS. iwg	CHAIN OF CUSTODY INFORMATION
S 18	1050	.41/.32	1.08	993.746	339	213	68	66	286	35	3.0	5.5		Impingers Loaded CHF
2	1105	.46	1.21	001.1	340	272	71	66	266	36	3.0	7.5		Impingers Recovered
3	1120	.46	1.21	8.7	340	233	74	67	273	39	3.1	8		Filter Loaded CHF
4	1135	.46	1.21	16.2	341	235	74	67	283	40	3.2	8	-.11	Filter Recovered
5	1150	.49	1.29	24.1	340	253	75	68	296	41	3.1	8		Probe Wash
6	1205	.36	.95	32.1	344	267	78	70	225	46	3.3	7		**TEST SUMMARY**
7	1220	.36	.95	38.6	341	282	78	71	249	49	3.1	7		Calculated by: BAC
8	1235	.35	.92	45.9	341	260	77	72	275	51	3.2	7		Checked by: BAC
STOP	1250			52.745		LEAK CHECK - 0.000 - .003 @ 10								Sample Vol., cf. 120.414 ✓
E 8	1300	.34	.90	52.792	339	244	72	70	222	ICE	3.2	7		Stack Press., iwg -0.10 ✓
7	1315	.36	.95	59.9	342	279	76	71	234	45	2.8	7.5		ΔH, iwg 1.12 3.1 ✓
6	1330	.40	1.04	67.2	339	255	77	71	213	44	3.2	7.5	-.09	ΔP, iwg 0.4247
5	1345	.42	1.09	74.3	341	246	76	72	275	45	2.8	7.5		Meter Temp., °F 72.72 ✓
4	1400	.55	1.43	81.9	343	248	77	72	256	45	3.1	9		Stack Temp., °F 341.75 ✓
3	1415	.51	1.33	90.7	346	249	78	72	222	53	3.0	9		Water Collected, g 517.2 ✓
2	1430	.41	1.22	98.4	346	239	78	73	248	55	3.0	8.5		O_2/CO_2 3.08 ✓
1	1445	.43	1.19	106.4	346	243	77	71	263	62	3.2	8.5		Comments:
STOP	1500			114.160										

CARNOT

SAMPLE TRAIN TEST DATA Dioxins

CLIENT PVLP Boiler UNIT 2 TEST NO. FIELD BLANK METHOD 428 PAGE 1 OF _____

SAMPLE LOCATION South TEST CONDITION _____ AMB. TEMP., °F _____ PROJECT # 3.39

OPERATOR/ASSISTANT AD METER VOL. (START/END) / DATE 11/7

PRE-TEST DATA:

Barometric Press., in. Hg.	
Assumed Stack Press.	
Assumed Moisture	
Assumed Molecular Wt.	
Assumed ΔP	
Assumed ΔH	
Stack Diameter, In.	
Sample Time: Total	
per point	
Total of Traverse Points	

ΔH = _____ x ΔP

EQUIPMENT INFO:

Meter No.	
Meter, Yd.	
CFM @ ΔH = 1.0	
Pitot ID, Cp	
O_2/CO_2 Method	
Tollon Connecting	
Line (Y/N)	
Probe: Mat'l	
Length	
Nozzle: Mat'l	
Diam.	
Filter: No.	110-3173
Mat'l	
Column #	37116

Imp.	Mat'l	Wt.(End)	Wt.(Start)	Wt.(g)
#1	65		470.0	=
#2	1.0		638.5	=
#3	✓		536.3	=
#4	Sil		762.3	=
#5				=
Total				

POST TEST INFO:

Filter Appearance _____

Impinger Appearance _____

Silica Gel Spent (Y/N) _____

SAMPLE TRAIN LEAK CHECK:

	CFM	Vac.	Pitot	Init.
Pre-Test	00	15		BC
Post-Test				

PRE-TEST CALIBRATION CHECK:

	Time	ΔH	Meter Reading	Meter Temp. In	Meter Temp. Out
Init.					
Final					

SAMPLE POINT	TIME	METER CONDITIONS ΔP	ΔH	METER READING	TEMPERATURES, °F STACK	PROBE	METER IN	METER OUT	OVEN	IMP. OUT	O_2	VAC.	STATIC PRESS. iwg

CHAIN OF CUSTODY INFORMATION

Impingers Loaded 11/

Impingers Recovered

Filter Loaded

Filter Recovered

Probe Wash

TEST SUMMARY

Calculated by:

Checked by:

Sample Vol., c.f.

Stack Press., iwg

ΔH, iwg

ΔP, iwg

Meter Temp., °F

Stack Temp., °F

Water Collected, g

O_2/CO_2

Comments:

PCDD/F Analysis
In MM5 Trains for CARNOT

A report by

ZENON ENVIRONMENTAL INC.

5555 North Service Rd.
Burlington, Ontario
L7L 5H7

February 7, 1994

Project No.:	AN931089
Lab No:	040623-26
Carnot Project No.:	10391

TABLE OF CONTENTS

1.0 INTRODUCTION:

Samples derived from recovered MM5 trains were delivered to Zenon Environmental Laboratories for the analysis of polychlorinated dibenzo(p)dioxins and dibenzofurans (PCDD/F).

The PCDD/F analysis was performed according to California Air Resources Board (CARB) method 428 protocols with exceptions as noted in Section 2.

Field spikes (surrogates) of isotopically labelled PCDD/F and recovery spikes (internals) were added prior to sampling and prior to extractions respectively as prescribed by the 428 protocol.

Section 2 of the following report details the analytical methodology, Section 3 discusses the analytical data, Section 4 outlines QA/QC and the analytical data are presented in the Appendices at the end of the report.

2.0 ANALYTICAL METHODOLOGY:

2.1 TRAIN PREPARATION & EXTRACTION:

The samples were prepared and extracted in strict accordance to CARB 428 (as adopted March 23rd 1988 and amended September 12th 1990) protocols.

2.2 PCDD/F ANALYSIS VIA CARB METHOD 428

The PCDD/F portion of the extract was cleaned and analysed via CARB method 428 protocols with the following options and modifications:

a) The samples were analysed via HP 5972 MSD low resolution mass spectrometry using an HP 5972 MSD.

3.0 ANALYTICAL RESULTS

The analytical data for the MM5 trains samples with the associated laboratory method blank data are presented in the Appendices at the end of this report. The PCDD/F data are not corrected for laboratory method blank but are corrected for internal standard recoveries.

4.0 QUALITY CONTROL/QUALITY ASSURANCE (QA/QC)

A complete QA/QC program is employed by ZENON. The elements of this program and a brief discussion of each of the elements are presented below:

Sample Custody

Strict chain of custody is maintained for samples analysed in this project. Samples received from the field were signed off upon delivery and immediately entered into ZENON's lab information system. Prior to extraction, samples were stored under refrigeration in a secure area. All technologists working on this project have kept accurate records of all actions taken with the samples. ZENON also has a security system in place that ensures unauthorised entry into the lab area is immediately known and appropriate staff and police are contacted.

Laboratory Method Blanks

A method blank is an analysis incorporating all aspects of the analysis, excluding the sample. Included is an unused portion of the same resin batch as supplied for the sampling programme. In this study, a method blank was processed for the group samples. The uncorrected laboratory method blank data are presented with the sample data in the Appendices at the end of the report.

Blank Resin Matrix Spikes

A portion of the same resin as supplied for the sampling programme is spiked with unlabelled (native) analytes and analysed within the sample batch. These blank matrix spike data are presented with the sample data in the Appendices at the end of the report.

Standards -Internal, Surrogate & Recovery

ZENON uses both native and labelled PCDD/F standards as identified in the CARB method 428 protocol. Field or surrogate spikes were added prior to sampling. Every sample was fortified with internal standards from each contaminant group prior to the start of analysis and each extract was fortified with a recovery standard just prior to injection. Five point calibrations were used to define the response curve characteristics.

Data File
All data acquired on the GC/MS systems will be maintained on magnetic tape for a period of three months past the conclusion of the project. The use of the sample analysis logs on the GC/MS systems allows for the rapid identification of the analysis dates and archive tapes.

Quantitation Calculations
As part of the QA/QC in this project, all calculations were performed by computer. Data files will be maintained for three months beyond the end of the project. Copies of all data reports and correspondence will be maintained in the completed project file for six months.

Data Reports and Verification
Transcriptions of the GC/MS data to the ZEL data computers are normally performed by automated electronic transfer. Occasionally, the data are entered manually. Regardless of the approach, the responsibility for the initial data analysis and data transfer resides with one analyst with verification and validation by a second analyst.

APPENDIX 1

ANALYTICAL RESULTS

Zenon **Environmental** **Laboratories**

5555 North Service Road
Burlington Ontario
Canada L7L 5H7

Tel 905 332 8788
Fax 905 332 9169

Certificate of Analysis

CLIENT INFORMATION

Attention: Marc A. Rodabaugh
Client Name: Carnot
Project: 10391
Project Desc: MM5 Train Analyses

Address: 110-15991 Red Hill Avenue
Tustin, CA
92680-7388
Fax Number: 714-259-0372
Phone Number: 714-259-9520

LABORATORY INFORMATION

Contact: Ron McLeod/Yvonne Bond
Project: AN931089
Date Received: 93/11/30
Date Reported: 94/01/21

Submission No.: 3L0036
Sample No.: 040623-040626

Regional Laboratories:
British Columbia
Ontario
Quebec

NOTES: ***'-' = not analysed '<' = less than Method Detection Limit (MDL) 'NA' = no data available***
All organic data is blank corrected except for PCDD/F, Hi-Res MS and CLP volatile analyses
Solids data is based on dry weight except for biota analyses.
Organic analyses are not corrected for extraction recovery standards except for isotope dilution methods, (i.e. CARB 429 PAH, all PCDD/F and DBD/DBF analyses)

Methods used by Zenon are based upon those found in 'Standard Methods for the Examination of Water and Wastewater', Seventeenth Edition. Other methods are based on the principles of MISA or EPA methodologies.

All work recorded herein has been done in accordance with normal professional standards using accepted testing methodologies, quality assurance and quality control procedures except where otherwise agreed to by the client and testing company in writing. Any and all use of these test results shall be limited to the actual cost of the pertinent analysis done. There is no other warranty expressed or implied.

COMMENTS:
"NS"=Not spiked
"*"= Chemical interference - ratio criteria not met

Certified by: R.A. McLeod

	Client ID:	Laboratory		Blank Matrix	% Recoveries	Blank Matrix	% Recoveries
	Zenon ID:	Method		Spike #1		Spike #2	
	Date Sampled:	Blank					
Component	**Units**						
PCDD/F /F # OF ISOMERS							
Total Tetrachlorodibenzofurans	ng	<0.23	0	4.8	95	4.8	95
Total Pentachlorodibenzofurans	"	<0.053	0	9.6	96	10	103
Total Hexachlorodibenzofurans	"	<0.071	0	24	119	24	121
Total Heptachlorodibenzofurans	"	<0.065	0	12	115	12	120
Octachlorodibenzofuran	"	<0.046	0	12	120	12	117
Total Tetrachlorodibenzo-p-dioxins	"	<0.098	0	5.6	113	5.4	108
Total Pentachlorodibenzo-p-dioxins	"	<0.062	0	5.1	101	5.3	105
Total Hexachlorodibenzo-p-dioxins	"	<0.12	0	18	119	18	120
Total Heptachlorodibenzo-p-dioxins	"	<0.048	0	5.8	116	6.1	121
Octachlorodibenzo-p-dioxin	"	0.12	1	12	118	12	120
Internal Recoveries	%						
2,3,7,8-T4CDD-13C12		56		82	82	87	87
2,3,7,8-T4CDF-13C12		57		85	85	92	92
1,2,3,7,8-P5CDD-13C12		78		103	103	103	103
1,2,3,6,7,8-H6CDD-13C12		99		100	100	93	93
1,2,3,4,6,7,8-H7CDD-13C12		94		109	109	98	98
OCDD-13C12		98		114	114	103	103
Surrogate Recoveries	%						
2,3,7,8-T4CDD-37Cl4		NS		NS	NS	NS	NS
1,2,3,7,8,9-H6CDD-13C12		NS		NS	NS	NS	NS
1,2,3,4,6,7,8-H7CDF-13C12		NS		NS	NS	NS	NS

		FB		1-Dioxin		2-Dioxin		3-Dioxin	
Client ID:		Dioxin							
Zenon ID:		040623 93		040624 93		040625 93		040626 93	
Date Sampled:		93/11/29		93/11/23		93/11/24		93/11/24	
Component	**Units**								
PCDD/F /F # OF ISOMERS									
Total Tetrachlorodibenzofurans	ng	<0.20	0	<0.073	0	<0.098	0	<0.12	0
Total Pentachlorodibenzofurans	"	<0.019	0	<0.033	0	<0.031	0	<0.029	0
Total Hexachlorodibenzofurans	"	<0.034	0	<0.046	0	<0.031	0	<0.074	0
Total Heptachlorodibenzofurans	"	<0.061	0	<0.060	0	<0.061	0	<0.060	0
Octachlorodibenzofuran	"	<0.033	0	<0.042	0	<0.032	0	<0.057	0
Total Tetrachlorodibenzo-p-dioxins	"	<0.078	0	<0.043	0	<0.053	0	<0.044	0
Total Pentachlorodibenzo-p-dioxins	"	<0.064	0	<0.061	0	<0.060	0	<0.073	0
Total Hexachlorodibenzo-p-dioxins	"	<0.079	0	<0.060	0	<0.062	0	<0.13	0
Total Heptachlorodibenzo-p-dioxins	"	<0.032	0	<0.048	0	<0.031	0	<0.058	0
Octachlorodibenzo-p-dioxin	"	0.29	1	0.18	1	0.24	1	<0.17	1
Internal Recoveries	%								
2,3,7,8-T4CDD-13C12		76		83		91		78	
2,3,7,8-T4CDF-13C12		75		87		103		86	
1,2,3,7,8-P5CDD-13C12		90		95		103		94	
1,2,3,6,7,8-H6CDD-13C12		93		102		110		94	
1,2,3,4,6,7,8-H7CDD-13C12		88		95		99		92	
OCDD-13C12		88		100		100		94	
Surrogate Recoveries	%								
2,3,7,8-T4CDD-37Cl4		69		81		91		77	
1,2,3,7,8,9-H6CDD-13C12		115		149*		144*		108*	
1,2,3,4,6,7,8-H7CDF-13C12		76		89		98		87	

	Client ID:	Laboratory	Blank Matrix	% Recoveries	Blank Matrix	% Recoveries
	Zenon ID:	Method	Spike #1		Spike #2	
	Date Sampled:	Blank				
Component	**Units**					
2,3,7,8-Cl4-Dibenzofuran	ng	<0.029	-	-	-	-
2,3,7,8-Cl4-Dibenzo-p-dioxin	"	<0.098	-	-	-	-
1,2,3,7,8-Cl5-Dibenzofuran	"	<0.053	-	-	-	-
2,3,4,7,8-Cl5-Dibenzofuran	"	<0.053	-	-	-	-
1,2,3,7,8-Cl5-Dibenzo-p-dioxin	"	<0.062	-	-	-	-
1,2,3,4,7,8-Cl6-Dibenzofuran	"	<0.073	-	-	-	-
1,2,3,6,7,8-Cl6-Dibenzofuran	"	<0.063	-	-	-	-
2,3,4,6,7,8-Cl6-Dibenzofuran	"	<0.072	-	-	-	-
1,2,3,7,8,9-Cl6-Dibenzofuran	"	<0.076	-	-	-	-
1,2,3,4,7,8-Cl6-Dibenzo-p-dioxin	"	<0.13	-	-	-	-
1,2,3,6,7,8-Cl6-Dibenzo-p-dioxin	"	<0.11	-	-	-	-
1,2,3,7,8,9-Cl6-Dibenzo-p-dioxin	"	<0.11	-	-	-	-
1,2,3,4,6,7,8-Cl7-Dibenzofuran	"	<0.061	-	-	-	-
1,2,3,4,7,8,9-Cl7-Dibenzofuran	"	<0.064	-	-	-	-
1,2,3,4,6,7,8-Cl7-Dibenzo-p-dioxin	"	<0.048	-	-	-	-
1,2,3,4,6,7,8,9-Cl8-Dibenzofuran	"	<0.046	-	-	-	-
1,2,3,4,6,7,8,9-Cl8-Dibenzo-p-dioxin	"	0.12	-	-	-	-

		FB			
	Client ID:	Dioxin	1-Dioxin	2-Dioxin	3-Dioxin
	Zenon ID:	040623 93	040624 93	040625 93	040626 93
	Date Sampled:	93/11/29	93/11/23	93/11/24	93/11/24
Component	**Units**				
2,3,7,8-Cl4-Dibenzofuran	ng	<0.036	<0.044	<0.039	<0.057
2,3,7,8-Cl4-Dibenzo-p-dioxin	"	<0.078	<0.043	<0.053	<0.044
1,2,3,7,8-Cl5-Dibenzofuran	"	<0.020	<0.034	<0.032	<0.029
2,3,4,7,8-Cl5-Dibenzofuran	"	<0.019	<0.033	<0.031	<0.029
1,2,3,7,8-Cl5-Dibenzo-p-dioxin	"	<0.064	<0.061	<0.060	<0.073
1,2,3,4,7,8-Cl6-Dibenzofuran	"	<0.035	<0.047	<0.030	<0.076
1,2,3,6,7,8-Cl6-Dibenzofuran	"	<0.030	<0.041	<0.031	<0.066
2,3,4,6,7,8-Cl6-Dibenzofuran	"	<0.035	<0.047	<0.032	<0.075
1,2,3,7,8,9-Cl6-Dibenzofuran	"	<0.037	<0.049	<0.031	<0.079
1,2,3,4,7,8-Cl6-Dibenzo-p-dioxin	"	<0.087	<0.061	<0.061	<0.14
1,2,3,6,7,8-Cl6-Dibenzo-p-dioxin	"	<0.076	<0.061	<0.060	<0.13
1,2,3,7,8,9-Cl6-Dibenzo-p-dioxin	"	<0.075	<0.060	<0.062	<0.12
1,2,3,4,6,7,8-Cl7-Dibenzofuran	"	<0.061	<0.062	<0.060	<0.060
1,2,3,4,7,8,9-Cl7-Dibenzofuran	"	<0.061	<0.060	<0.061	<0.064
1,2,3,4,6,7,8-Cl7-Dibenzo-p-dioxin	"	<0.032	<0.048	<0.031	<0.058
1,2,3,4,6,7,8,9-Cl8-Dibenzofuran	"	<0.033	<0.042	<0.032	<0.057
1,2,3,4,6,7,8,9-Cl8-Dibenzo-p-dioxin	"	0.29	0.18	0.23	<0.17

Appendix C.4

Unit Operation Data

PALOS VERDES ENERGY RECOVERY FROM GAS FACILITY

DAILY PRODUCTION SUMMARY
(15 MINUTE DATA)

Date	Time	Turbine Gross Power MW	Turbine Net Power MW	Turbine Parasitic Load MW	Boiler #1 LFG Burned 1000 scfm	Boiler #1 Pilot Gas 1000 scfm	Boiler #1 Total Heat Input mm btu/hr	Boiler #1 Steam Flow 1000 lb/hr	Boiler #2 LFG Burned 1000 scfm	Boiler #2 Pilot Gas 1000 scfm	Boiler #2 Total Heat Input mm btu/hr	Boiler #2 Steam Flow 1000 lb/hr	LFG LFG Burned btu/scf	LFG LFG Available 1000 scfm	Heat Rate btu/kwh nt	LFG Usage Factor
11/23/93	12:15	11.006	9.998	1.01	3.654	0.22	62.4	47.3	3.651	0.23	62.3	48.9	221.8	7.303	12,472	1.00
11/23/93	12:30	10.972	9.973	1.00	3.680	0.22	62.5	48.0	3.635	0.22	62.5	49.1	221.7	7.311	12,514	1.00
11/23/93	12:45	10.888	9.897	0.99	3.554	0.22	62.3	47.3	3.628	0.22	62.4	49.3	221.7	7.214	12,604	1.00
11/23/93	13:00	10.881	9.886	0.99	3.596	0.22	62.5	46.9	3.632	0.22	62.4	49.5	221.7	7.207	12,637	1.00
11/23/93	13:15	10.854	9.955	1.00	3.622	0.22	62.4	47.2	3.621	0.22	62.5	49.5	220.6	7.254	12,544	1.00
11/23/93	13:30	10.989	9.969	1.00	3.676	0.22	62.5	48.1	3.615	0.22	62.6	49.5	222.4	7.306	12,525	1.00
11/23/93	13:45	11.009	9.998	1.00	3.652	0.23	62.8	48.2	3.629	0.23	62.7	49.7	222.1	7.298	12,554	1.00
11/23/93	14:00	11.263	10.231	1.01	3.785	0.23	64.9	50.5	3.580	0.23	62.6	49.7	222.1	7.376	12,460	1.00
11/23/93	14:15	11.269	10.248	1.03	3.801	0.23	64.7	50.5	3.603	0.23	62.3	49.7	220.6	7.395	12,395	1.00
11/23/93	14:30	11.137	10.122	1.02	3.782	0.23	64.2	49.8	3.633	0.23	62.0	49.4	218.7	7.386	12,465	1.00
11/23/93	14:45	11.219	10.216	1.02	3.696	0.23	63.9	49.5	3.658	0.23	61.7	49.3	217.2	7.382	12,294	1.00
11/23/93	15:00	11.077	10.066	1.01	3.744	0.23	63.4	49.2	3.596	0.23	61.3	49.1	215.4	7.371	12,390	1.00
11/23/93	15:15	11.117	10.099	1.02	3.734	0.23	63.3	49.3	3.605	0.23	61.2	49.0	215.4	7.377	12,325	0.99
11/23/93	15:30	11.102	10.099	1.00	3.716	0.23	62.4	48.7	3.652	0.23	61.7	49.6	213.9	7.404	12,292	1.00
11/23/93	15:45	11.003	9.989	1.01	3.708	0.23	62.1	48.7	3.650	0.23	61.5	49.7	212.3	7.351	12,371	1.00
11/23/93	16:00	11.088	10.061	1.02	3.740	0.23	61.8	49.1	3.646	0.24	61.3	49.6	211.9	7.417	12,240	1.00
11/23/93	16:15	11.186	10.096	1.02	3.758	0.22	61.6	49.1	3.668	0.23	61.0	49.5	211.4	7.391	12,146	1.00
11/23/93	16:30	11.006	10.108	1.01	3.690	0.22	61.3	48.5	3.626	0.23	60.8	49.4	209.1	7.383	12,078	0.99
11/23/93	16:45	10.935	9.895	1.02	3.754	0.22	60.8	48.0	3.643	0.24	60.4	49.2	206.4	7.391	12,245	1.00
11/23/93	17:00	10.952	9.936	1.02	3.740	0.22	60.4	48.5	3.627	0.23	60.0	49.0	206.4	7.379	12,112	1.00
11/23/93	17:15	10.939	9.917	1.02	3.730	0.22	60.4	48.1	3.642	0.23	59.9	49.0	206.3	7.396	12,132	1.00
11/23/93	17:30	10.874	9.850	1.02	3.758	0.22	60.2	48.3	3.644	0.23	59.8	48.9	205.0	7.421	12,185	1.00
11/23/93	17:45	10.888	9.942	1.02	3.744	0.22	60.0	48.1	3.666	0.23	59.6	48.7	204.0	7.360	12,028	1.01
11/23/93	18:00	10.962	9.923	1.02	3.690	0.22	59.8	47.6	3.683	0.23	59.4	48.7	203.4	7.366	12,016	1.00
11/23/93	18:15	10.891	9.851	1.03	3.750	0.22	59.7	47.9	3.637	0.23	59.4	48.7	203.0	7.408	12,050	1.00
11/23/93	18:30	10.888	9.877	1.01	3.798	0.22	59.8	48.1	3.649	0.23	59.3	48.5	202.8	7.400	12,053	1.01
11/23/93	18:45	10.803	9.775	1.02	3.791	0.22	59.6	47.8	3.645	0.23	59.0	48.4	201.5	7.438	12,135	1.00
11/23/93	19:00	10.898	9.868	1.04	3.768	0.22	59.4	47.5	3.646	0.23	59.0	48.5	201.9	7.466	12,002	1.00
11/23/93	19:15	10.857	9.832	1.03	3.795	0.22	59.4	48.0	3.650	0.23	58.9	48.2	201.5	7.442	12,030	1.00
11/23/93	19:30	10.891	9.864	1.03	3.676	0.22	59.2	47.0	3.686	0.23	59.0	48.4	200.2	7.400	11,991	0.99
11/23/93	19:45	10.854	9.824	1.03	3.780	0.22	59.2	47.5	3.641	0.23	58.7	48.2	200.7	7.433	12,001	1.00
11/23/93	20:00	10.681	9.701	1.01	3.704	0.22	58.5	46.2	3.632	0.23	58.7	48.2	199.9	7.339	12,079	1.00
11/23/93	20:15	10.776	9.693	1.02	3.722	0.22	58.1	46.5	3.627	0.24	58.7	48.1	200.4	7.358	12,046	1.00
11/23/93	20:30	10.793	9.681	1.02	3.738	0.22	58.6	46.7	3.627	0.24	58.8	48.3	200.2	7.366	12,107	1.00
11/23/93	20:45	10.793	9.767	1.02	3.642	0.22	58.3	47.0	3.660	0.24	58.7	48.2	200.7	7.327	11,989	1.00
11/23/93	21:00	10.742	9.724	1.02	3.722	0.22	58.3	46.9	3.615	0.24	58.8	48.3	201.0	7.340	12,061	1.00
11/23/93	21:15	10.732	9.780	1.01	3.738	0.22	58.5	46.9	3.661	0.24	59.0	48.5	201.2	7.347	12,009	1.01
11/23/93	21:30	10.742	9.722	1.02	3.740	0.22	58.4	46.7	3.650	0.23	58.8	48.2	200.2	7.377	12,047	1.00
11/23/93	21:45	10.750	9.728	1.02	3.684	0.22	58.4	46.8	3.678	0.23	58.6	48.2	199.9	7.416	12,034	0.99
11/23/93	22:00	10.678	9.718	1.02	3.686	0.22	58.4	46.1	3.682	0.22	58.6	48.7	200.3	7.383	12,042	1.00
11/23/93	22:15	10.769	9.748	1.03	3.736	0.22	58.3	46.4	3.726	0.22	58.4	48.5	199.9	7.447	11,974	1.00
11/23/93	22:30	10.827	9.777	1.01	3.664	0.22	58.1	47.0	3.723	0.22	58.5	48.5	200.0	7.413	11,929	1.00
11/23/93	22:45	10.816	9.854	1.03	3.678	0.22	58.2	46.1	3.736	0.22	58.4	48.4	199.9	7.362	11,832	1.01
11/23/93	23:00	10.794	9.766	1.03	3.718	0.22	58.1	47.1	3.718	0.22	58.3	48.6	200.2	7.424	11,924	1.00
11/23/93	23:15	10.888	9.853	1.03	3.662	0.22	58.2	47.2	3.727	0.22	58.4	48.6	199.8	7.413	11,831	1.00
11/23/93	23:30	10.854	9.818	1.04	3.674	0.22	58.1	46.4	3.728	0.22	58.5	48.6	200.8	7.392	11,874	1.00
11/23/93	23:45	10.915	9.848	1.02	3.646	0.22	58.6	47.1	3.736	0.22	58.7	48.9	201.2	7.372	11,917	1.00
11/23/93	24:00	10.834	9.822	1.03	3.686	0.22	58.5	46.4	3.720	0.22	58.8	48.9	201.4	7.326	11,947	1.01
Maximum		11.269	10.248	1.04	3.801	0.23	64.9	50.5	3.736	0.24	62.7	50.1	461.9	7.447	12,714	1.01
Average		10.833	9.829	1.01	3.650	0.22	59.8	47.1	3.645	0.23	60.1	48.8	210.1	7.298	12,200	1.00

Test #: 4-H_2O-2

3.632 lb/scfm LFG

1-Dioxin

1-Dioxin

COUNTY SANITATION DISTRICTS OF LOS ANGELES COUNTY DATE: 12/07/93 PAGE: 1

PALOS VERDES ENERGY RECOVERY FROM GAS FACILITY
DAILY EMISSIONS SUMMARY
(15 MINUTE DATA)

		Boiler 501 (SCAQMD PIC No. 134321)							Boiler 502 (SCAQMD PIC No. 134322)						
Date	Time	Heat Input	Steam Flow	Stack NOX	Uncorr NOX	Outlet O2	Stack O2	Corr NOX	Heat Input	Steam Flow	Stack NOX	Uncorr NOX	Outlet O2	Stack O2	Corr NOX
		mm btu/hr	1000 lb/hr	lb/hr	ppmv	%	%	ppmv	mm btu/hr	1000 lb/hr	lb/hr	ppmv	%	%	ppmv
11/24/93	00:15	58.6	47.1	1.6	21.0	1.7	5.9	25.[illegible]	58.8	48.[illegible]	1.7	25.6	1.5	2.7	25.1
11/24/93	00:30	58.6	47.6	1.6	21.2	1.6	5.8	25.2	58.8	49.[illegible]	1.7	25.8	1.6	2.6	25.2
11/24/93	00:45	58.6	47.7	1.6	21.2	1.5	6.0	25.4	58.8	49.[illegible]	1.7	25.9	1.6	2.6	25.4
11/24/93	01:00	58.8	48.2	1.7	21.6	1.5	5.7	25.5	59.0	49.[illegible]	1.8	26.3	1.7	2.6	25.7
11/24/93	01:15	58.9	47.2	1.7	21.4	1.8	5.9	25.5	59.0	49.[illegible]	1.8	26.5	1.6	2.6	26.0
11/24/93	01:30	58.5	47.7	1.6	21.2	1.8	6.0	25.5	59.0	49.[illegible]	1.8	26.7	1.8	2.5	26.0
11/24/93	01:45	58.8	47.0	1.7	21.4	1.8	5.8	25.5	58.8	48.[illegible]	1.8	26.5	1.7	2.6	25.9
11/24/93	02:00	58.6	47.6	1.7	21.4	1.7	5.8	25.4	57.8	47.[illegible]	1.7	26.1	1.6	2.6	25.6
11/24/93	02:15	58.3	48.1	1.6	21.3	1.6	5.9	25.5	57.9	48.[illegible]	1.7	26.0	1.8	2.6	25.5
11/24/93	02:30	58.5	47.6	1.7	21.7	1.7	5.8	25.7	57.9	48.[illegible]	1.7	26.3	1.7	2.6	25.7
11/24/93	02:45	58.4	47.8	1.7	21.5	1.7	5.9	25.6	58.0	48.[illegible]	1.7	26.3	1.7	2.6	25.7
11/24/93	03:00	58.6	47.3	1.7	21.4	1.8	5.9	25.6	58.1	48.[illegible]	1.7	26.3	1.7	2.5	25.7
11/24/93	03:15	58.6	47.5	1.7	21.5	1.6	6.0	25.8	58.0	48.[illegible]	1.7	26.3	1.8	2.6	25.7
11/24/93	03:30	58.6	47.9	1.7	21.8	1.5	5.8	25.8	58.1	48.[illegible]	1.7	26.4	1.8	2.6	25.9
11/24/93	03:45	58.8	47.9	1.7	21.8	1.7	5.8	25.8	58.2	48.[illegible]	1.8	26.8	1.7	2.5	26.1
11/24/93	04:00	58.9	47.8	1.7	21.7	1.9	5.9	26.0	58.2	48.[illegible]	1.8	26.7	1.5	2.6	26.1
11/24/93	04:15	58.8	48.2	1.7	21.6	1.5	6.0	25.9	58.3	48.[illegible]	1.8	26.8	1.7	2.6	26.2
11/24/93	04:30	58.8	48.4	1.7	21.9	1.7	5.8	25.9	58.3	48.[illegible]	1.8	26.8	1.8	2.6	26.2
11/24/93	04:45	58.7	47.9	1.7	21.7	1.8	5.9	25.9	58.2	48.[illegible]	1.8	26.7	1.7	2.5	26.0
11/24/93	05:00	58.6	47.2	1.7	21.8	1.5	5.8	25.9	58.1	48.[illegible]	1.8	26.8	1.7	2.6	26.2
11/24/93	05:15	58.3	46.7	1.7	21.8	2.1	5.8	25.9	57.9	48.[illegible]	1.8	26.7	1.6	2.6	26.1
11/24/93	05:30	58.3	48.2	1.7	21.7	1.7	5.8	25.8	57.9	48.[illegible]	1.8	26.7	1.7	2.6	26.0
11/24/93	05:45	58.5	47.5	1.7	21.9	1.9	5.7	25.8	57.8	48.[illegible]	1.7	26.4	1.8	2.6	25.8
11/24/93	06:00	58.5	47.7	1.7	21.6	1.6	5.9	25.8	57.9	48.[illegible]	1.7	26.5	1.7	2.5	25.8
11/24/93	06:15	58.5	47.2	1.7	21.5	1.6	5.9	25.7	57.8	48.[illegible]	1.7	26.5	1.7	2.5	25.7
11/24/93	06:30	58.5	47.4	1.7	21.9	1.7	5.8	25.9	57.8	48.[illegible]	1.8	26.5	1.7	2.5	25.8
11/24/93	06:45	58.5	46.9	1.7	21.6	1.7	6.0	25.9	57.9	48.[illegible]	1.8	26.6	1.7	2.6	26.0
11/24/93	07:00	58.3	48.2	1.7	21.7	1.6	5.8	25.8	58.3	48.[illegible]	1.8	26.7	1.7	2.6	26.1
11/24/93	07:15	58.4	47.7	1.7	21.8	1.5	5.8	25.8	58.1	48.[illegible]	1.8	26.8	1.7	2.5	26.1
11/24/93	07:30	58.5	47.9	1.7	21.8	1.7	5.8	25.7	58.1	48.[illegible]	1.7	26.2	1.6	2.7	25.8
11/24/93	07:45	58.8	48.5	1.7	21.8	1.7	5.8	25.8	58.4	48.[illegible]	1.7	26.3	1.6	2.7	25.8
11/24/93	08:00	59.8	48.0	1.7	21.8	1.8	5.8	25.9	59.2	48.[illegible]	1.8	26.6	1.7	2.7	26.1
11/24/93	08:15	59.8	47.9	1.7	21.9	1.6	5.7	25.7	58.9	48.[illegible]	1.8	26.5	1.5	2.5	25.8
11/24/93	08:30	59.8	47.0	1.7	21.9	1.7	5.7	25.7	58.9	48.[illegible]	1.8	26.5	1.8	2.5	25.8
11/24/93	08:45	59.8	48.2	1.7	21.9	1.7	5.7	25.7	58.9	48.[illegible]	1.8	26.5	1.4	2.5	25.8
11/24/93	09:00	59.8	48.8	1.7	21.9	1.7	5.7	25.7	58.9	48.[illegible]	1.8	26.5	1.7	2.5	25.8
11/24/93	09:15	61.5	48.5	1.6	20.1	1.9	5.9	24.[illegible]	60.5	49.[illegible]	1.7	25.5	1.8	2.5	24.8
11/24/93	09:30	61.7	48.2	1.6	20.4	1.6	5.7	23.9	60.8	49.[illegible]	1.7	24.8	1.5	2.6	24.3
11/24/93	09:45	62.1	48.8	1.6	20.2	1.8	5.8	23.9	61.0	49.[illegible]	1.7	24.8	1.7	2.6	24.3
11/24/93	10:00	61.9	48.4	1.6	19.9	1.8	5.7	23.3	61.3	49.[illegible]	1.7	24.8	1.8	2.5	24.1
11/24/93	10:15	62.4	48.9	1.6	19.9	1.7	5.8	23.6	61.5	49.[illegible]	1.7	24.5	1.6	2.6	24.0
11/24/93	10:30	62.8	48.9	1.6	19.7	1.7	5.8	23.4	62.6	50.[illegible]	1.7	24.4	1.7	2.6	23.9
11/24/93	10:45	62.9	48.5	1.5	19.4	1.6	5.8	23.0	62.8	50.[illegible]	1.7	24.5	1.5	2.6	23.9
11/24/93	11:00	63.3	49.2	1.5	19.3	1.8	5.8	22.9	63.2	50.[illegible]	1.7	24.0	1.7	2.7	23.7
11/24/93	11:15	63.5	49.0	1.6	19.6	1.8	5.8	23.[illegible]	63.5	50.[illegible]	1.7	24.6	1.7	2.6	24.1
11/24/93	11:30	63.4	48.7	1.5	19.4	1.7	5.9	23.1	63.3	50.[illegible]	1.7	24.6	1.7	2.7	24.2
11/24/93	11:45	63.7	49.1	1.6	19.8	1.7	5.7	23.4	63.4	50.[illegible]	1.7	24.5	1.7	2.7	24.1
11/24/93	12:00	63.6	48.4	1.5	19.1	1.7	5.9	22.9	63.5	50.[illegible]	1.7	24.3	1.7	2.7	23.9

2 Dioxin

3 Dioxin

PALOS VERDES ENERGY RECOVERY FROM GAS FACILITY
DAILY EMISSIONS SUMMARY
(15 MINUTE DATA)

2-Dioxin END

3Dioxin End

Date	Time	Boiler 501 (SCAQMD PTC No. 134321) Heat Input mm btu/hr	Steam Flow 1000 lb/hr	Stack NOX lb/hr	Uncorr NOX ppmv	Outlet O2 %	Stack O2 %	Corr NOX ppmv	Boiler 502 (SCAQMD PTC No. 134322) Heat Input mm btu/hr	Steam Flow 1000 lb/hr	Stack NOX lb/hr	Uncorr NOX ppmv	Outlet O2 %	Stack O2 %	Corr NOX ppmv
11/24/93	12:15	64.2	49.2	1.6	19.6	1.8	5.8	23.1	63.9	50.7	1.7	23.9	1.7	2.8	23.7
11/24/93	12:30	64.3	48.7	1.6	19.5	1.9	5.7	23.0	64.0	50.6	1.7	24.4	1.6	2.7	23.9
11/24/93	12:45	64.1	49.4	1.6	19.8	1.6	5.7	23.3	64.0	50.7	1.7	24.3	1.6	2.8	24.0
11/24/93	13:00	64.0	48.4	1.6	19.9	1.8	5.8	23.5	63.7	50.8	1.7	24.5	1.8	2.8	24.2
11/24/93	13:15	64.0	49.1	1.6	20.1	1.5	5.6	23.5	63.8	50.8	1.7	24.8	1.7	2.6	24.3
11/24/93	13:30	64.3	49.2	1.6	19.8	1.6	5.8	23.5	64.0	50.9	1.7	24.5	1.6	2.8	24.3
11/24/93	13:45	64.5	49.8	1.6	19.8	1.6	5.9	23.5	64.5	51.2	1.7	24.4	1.5	2.9	24.3
11/24/93	14:00	64.9	50.2	1.6	20.2	1.7	5.6	23.9	65.1	51.9	1.8	25.6	1.7	2.6	25.1
11/24/93	14:15	65.0	49.7	1.6	20.5	1.7	5.7	24.0	65.0	51.7	2.0	27.8	1.6	2.5	26.9
11/24/93	14:30	64.7	49.8	1.6	20.3	1.8	5.7	24.0	65.0	51.9	1.8	25.5	1.6	2.8	25.1
11/24/93	14:45	64.3	49.7	1.6	20.7	1.5	5.6	24.0	64.5	51.6	1.8	25.1	1.7	2.9	24.9
11/24/93	15:00	64.0	49.9	1.6	20.3	1.4	5.7	23.9	64.1	51.5	1.8	25.0	1.6	2.8	24.8
11/24/93	15:15	63.6	49.6	1.6	20.3	1.6	5.7	23.9	63.8	51.3	1.8	25.4	1.7	2.6	24.9
11/24/93	15:30	63.2	49.3	1.6	20.3	1.6	5.7	23.9	63.6	51.3	1.8	25.3	1.6	2.7	24.9
11/24/93	15:45	63.0	48.9	1.6	20.2	1.7	5.9	23.9	63.2	51.1	1.8	25.3	1.5	2.8	25.0
11/24/93	16:00	62.9	49.4	1.6	20.5	1.5	5.5	24.0	63.0	51.2	1.8	25.6	1.6	2.6	25.0
11/24/93	16:15	62.7	49.5	1.6	20.5	1.6	5.8	24.2	63.0	51.2	1.8	25.3	1.6	2.8	25.0
11/24/93	16:30	62.4	49.0	1.6	20.3	1.7	5.7	24.0	62.6	51.0	1.8	25.3	1.8	2.7	25.0
11/24/93	16:45	61.8	48.6	1.6	20.4	1.9	5.8	24.0	62.0	50.5	1.7	25.2	1.6	2.7	24.8
11/24/93	17:00	61.4	49.2	1.6	20.5	1.7	5.7	24.1	61.7	50.5	1.7	25.4	1.7	2.7	24.9
11/24/93	17:15	61.2	48.4	1.6	20.6	1.7	5.7	24.4	61.5	50.5	1.8	25.6	1.6	2.6	25.0
11/24/93	17:30	60.9	47.8	1.6	20.7	1.9	5.7	24.4	61.2	50.4	1.7	25.4	1.6	2.7	25.0
11/24/93	17:45	60.8	48.6	1.6	20.8	1.8	5.7	24.3	60.9	50.2	1.8	25.4	1.7	2.7	25.0
11/24/93	18:00	60.7	48.3	1.6	20.8	1.3	5.6	24.5	60.9	50.2	1.8	25.8	1.7	2.5	25.2
11/24/93	18:15	60.4	47.8	1.6	20.6	1.9	5.8	24.3	60.9	50.1	1.7	25.2	1.6	2.8	24.8
11/24/93	18:30	60.7	47.4	1.6	20.5	1.8	5.7	24.3	61.0	50.3	1.8	25.7	1.9	2.5	25.0
11/24/93	18:45	60.3	48.4	1.6	20.6	1.7	5.7	24.3	60.6	49.7	1.7	25.5	1.9	2.5	24.8
11/24/93	19:00	60.8	47.3	1.6	20.5	1.8	5.8	24.2	60.8	49.9	1.7	25.5	1.7	2.5	24.8
11/24/93	19:15	60.5	48.6	1.6	20.4	1.5	5.8	24.2	60.6	49.8	1.7	25.3	1.7	2.5	24.7
11/24/93	19:30	60.3	47.5	1.6	20.2	1.6	5.8	24.0	60.5	49.5	1.7	25.1	1.5	2.6	24.6
11/24/93	19:45	60.1	46.8	1.6	20.3	1.8	5.8	24.0	60.4	49.6	1.7	24.9	1.6	2.7	24.5
11/24/93	20:00	60.1	46.8	1.6	20.1	2.2	5.8	23.9	60.4	49.6	1.7	25.1	1.7	2.6	24.5
11/24/93	20:15	59.8	48.2	1.6	20.2	1.6	5.8	23.9	60.0	49.3	1.7	25.3	1.8	2.5	24.7
11/24/93	20:30	59.8	47.7	1.6	20.4	1.6	5.7	24.0	60.0	49.4	1.7	25.0	1.6	2.5	24.3
11/24/93	20:45	59.8	47.1	1.6	20.1	1.7	5.9	24.0	59.9	49.4	1.7	24.9	1.6	2.6	24.3
11/24/93	21:00	59.6	47.3	1.6	20.1	1.6	5.9	24.0	59.7	49.1	1.7	24.9	1.8	2.6	24.3
11/24/93	21:15	59.4	47.3	1.5	20.1	1.7	5.9	23.9	59.6	49.2	1.7	25.1	1.5	2.5	24.4
11/24/93	21:30	59.1	47.4	1.6	20.2	1.9	5.9	24.1	59.5	49.1	1.7	24.8	1.7	2.6	24.2
11/24/93	21:45	59.2	47.6	1.6	20.5	1.4	5.7	24.2	59.4	49.1	1.7	25.1	1.6	2.6	24.6
11/24/93	22:00	59.2	47.7	1.6	20.6	1.5	5.8	24.5	59.6	49.2	1.7	25.3	1.5	2.6	24.8
11/24/93	22:15	59.2	47.6	1.6	20.5	1.5	5.9	24.5	59.5	49.3	1.7	25.6	1.6	2.6	25.0
11/24/93	22:30	58.7	46.3	1.6	20.6	2.2	5.8	24.3	59.1	49.0	1.7	25.4	1.7	2.5	24.8
11/24/93	22:45	58.5	46.9	1.6	20.5	1.8	5.8	24.2	58.9	48.7	1.7	25.4	1.7	2.6	24.8
11/24/93	23:00	58.5	46.4	1.5	20.2	2.1	6.0	24.2	59.0	48.7	1.7	25.5	1.9	2.6	24.9
11/24/93	23:15	58.9	48.0	1.6	20.3	1.8	5.9	24.2	59.1	48.8	1.7	25.6	1.6	2.6	25.0
11/24/93	23:30	58.5	47.8	1.6	20.6	1.5	5.8	24.4	58.8	48.7	1.7	25.6	1.4	2.5	24.9
11/24/93	23:45	58.6	47.7	1.6	20.5	1.6	6.0	24.5	59.0	48.9	1.7	25.4	1.6	2.7	25.0
11/24/93	24:00	58.5	47.2	1.6	20.6	1.7	5.9	24.6	58.8	48.7	1.7	25.9	1.6	2.6	25.4
Maximum		65.0						26.0	65.1						26.9
Limit		75.0						60.0	75.0						60.0

COUNTY SANITATION DISTRICTS OF LOS ANGELES CO

PALOS VERDES ENERGY RECOVERY FROM GAS FACILI

DAILY PRODUCTION SUMMARY
(15 MINUTE DATA)

Date	Time	Turbine Gross Power	Turbine Net Power	Turbine Parasitic Load	Boiler #1 L F G Burned	Boiler #1 Pilot Gas	Boiler #1 Total Heat Input	Boiler #1 Steam Flow	Boiler #1 L F G Burned	Boiler #1 Pilot Gas	Boiler #
		MW	MW	MW	1000 scfm	1000 scfm	mm btu/hr	1000 lb/hr	1000 scfm	1000 scfm	bt
11/24/93	00:15	10.898	9.883	1.04	3.672	0.22	58.6	47.1	3.746	0.22	
11/24/93	00:30	11.030	9.876	1.04	3.700	0.22	58.6	47.6	3.704	0.22	
11/24/93	00:45	11.060	10.012	1.03	3.658	0.22	58.6	47.7	3.696	0.22	
11/24/93	01:00	11.033	9.997	1.04	3.716	0.22	58.8	48.2	3.681	0.22	
11/24/93	01:15	10.948	9.895	1.02	3.718	0.22	58.9	47.2	3.694	0.22	
11/24/93	01:30	10.959	9.919	1.04	3.708	0.22	58.5	47.7	3.702	0.22	
11/24/93	01:45	10.888	9.861	1.03	3.634	0.22	58.8	47.0	3.660	0.22	
11/24/93	02:00	10.915	9.888	1.03	3.638	0.22	58.6	47.6	3.658	0.22	
11/24/93	02:15	10.864	9.831	1.03	3.718	0.22	58.3	48.1	3.650	0.22	
11/24/93	02:30	10.871	9.832	1.02	3.640	0.22	58.5	47.6	3.657	0.22	
11/24/93	02:45	10.762	9.735	1.02	3.726	0.22	58.4	47.8	3.613	0.22	
11/24/93	03:00	10.859	9.831	1.03	3.638	0.22	58.6	47.3	3.664	0.22	
11/24/93	03:15	10.980	9.964	1.02	3.700	0.22	58.6	47.5	3.639	0.22	
11/24/93	03:30	10.921	9.894	1.03	3.712	0.22	58.6	47.9	3.637	0.22	
11/24/93	03:45	10.860	9.860	1.02	3.718	0.22	58.8	47.9	3.613	0.22	
11/24/93	04:00	10.942	9.898	1.01	3.694	0.22	58.9	47.8	3.642	0.22	
11/24/93	04:15	11.016	10.009	1.02	3.704	0.22	58.8	48.2	3.653	0.22	
11/24/93	04:30	11.019	9.991	1.03	3.652	0.22	58.8	48.4	3.666	0.22	
11/24/93	04:45	10.976	9.951	1.03	3.658	0.22	58.7	47.9	3.640	0.22	
11/24/93	05:00	10.986	9.948	1.02	3.650	0.22	58.6	47.2	3.665	0.22	
11/24/93	05:15	10.767	9.746	1.02	3.656	0.22	58.3	46.7	3.656	0.22	
11/24/93	05:30	10.955	9.930	1.03	3.714	0.22	58.3	48.2	3.653	0.22	
11/24/93	05:45	10.803	9.784	1.02	3.720	0.22	58.5	47.5	3.628	0.22	
11/24/93	06:00	10.864	9.835	1.03	3.696	0.22	58.5	47.7	3.674	0.22	
11/24/93	06:15	10.908	9.840	1.01	3.640	0.22	58.5	47.2	3.661	0.22	
11/24/93	06:30	10.969	9.849	1.03	3.708	0.22	58.5	47.4	3.649	0.22	
11/24/93	06:45	10.982	9.846	1.03	3.644	0.22	58.5	46.9	3.671	0.22	
11/24/93	07:00	10.962	9.926	1.04	3.742	0.22	58.3	48.2	3.720	0.22	
11/24/93	07:15	10.982	9.958	1.02	3.724	0.22	58.4	47.7	3.697	0.22	
11/24/93	07:30	10.799	9.796	1.04	3.714	0.22	58.5	47.9	3.648	0.22	
11/24/93	07:45	10.982	9.945	1.03	3.738	0.22	58.8	48.5	3.667	0.22	
11/24/93	08:00	10.881	9.820	1.02	3.718	0.22	59.8	48.0	3.646	0.22	
11/24/93	08:15	10.952	9.874	1.02	3.654	0.22	59.8	47.9	3.650	0.22	
11/24/93	08:30	10.818	9.811	1.01	3.680	0.22	59.8	47.0	3.612	0.22	
11/24/93	08:45	10.996	9.970	1.02	3.730	0.22	59.8	48.2	3.650	0.22	
11/24/93	09:00	11.129	9.953	1.07	3.694	0.22	59.8	48.8	3.672	0.22	
11/24/93	09:15	11.151	10.090	1.05	3.626	0.22	61.5	48.5	3.695	0.22	
11/24/93	09:30	10.933	9.872	1.06	3.712	0.22	61.7	48.2	3.652	0.22	
11/24/93	09:45	11.041	9.992	1.05	3.730	0.22	62.1	48.8	3.633	0.22	
11/24/93	10:00	11.112	10.056	1.04	3.684	0.23	61.9	48.4	3.656	0.22	
11/24/93	10:15	11.240	10.183	1.07	3.718	0.23	62.4	48.9	3.729	0.22	
11/24/93	10:30	11.196	10.167	1.07	3.690	0.23	62.8	48.9	3.724	0.22	
11/24/93	10:45	11.216	10.065	1.07	3.660	0.23	62.9	48.5	3.738	0.22	
11/24/93	11:00	11.273	10.241	1.03	3.734	0.23	63.3	49.2	3.726	0.22	
11/24/93	11:15	11.237	10.148	1.03	3.710	0.23	63.5	49.0	3.702	0.22	
11/24/93	11:30	11.250	10.213	1.04	3.716	0.23	63.4	48.7	3.702	0.22	
11/24/93	11:45	11.240	10.214	1.03	3.714	0.23	63.7	49.1	3.704	0.22	
11/24/93	12:00	11.226	10.179	1.03	3.724	0.23	63.6	48.4	3.722	0.22	

2-Dioxin START

3-Dioxin START

CLES COUNTY DATE: 12/07/93 PAGE: 1

FACILITY

oiler #2			--- L F G ---			
ilot Gas	Total Heat Input	Steam Flow	L F G	L F G Avail-able	Heat Rate	LFG Usage Factor
000 cfm	mm btu/hr	1000 lb/hr	btu/ scf	1000 scfm	btu/ kwh nt	
0.22	58.8	48.8	201.2	7.392	11,879	1.00
0.22	58.8	49.1	201.7	7.410	11,889	1.00
0.22	58.8	49.0	202.5	7.414	11,720	0.99
0.22	59.0	49.2	202.5	7.423	11,787	1.00
0.22	59.0	49.0	202.4	7.418	11,910	1.00
0.22	59.0	49.2	201.4	7.394	11,852	1.00
0.22	58.8	48.9	201.7	7.344	11,932	0.99
0.22	57.8	47.8	201.0	7.324	11,777	1.00
0.22	57.9	48.1	200.4	7.320	11,823	1.01
0.22	57.9	48.0	201.0	7.295	11,835	1.00
0.22	58.0	48.1	201.3	7.320	11,959	1.00
0.22	58.1	48.1	201.5	7.354	11,869	0.99
0.22	58.0	48.1	202.0	7.379	11,707	0.99
0.22	58.1	48.1	202.0	7.322	11,794	1.00
0.22	58.2	48.2	202.7	7.334	11,863	1.00
0.22	58.2	48.3	203.0	7.382	11,834	0.99
0.22	58.3	48.3	203.0	7.380	11,699	1.00
0.22	58.3	48.3	202.5	7.308	11,718	1.00
0.22	58.2	48.4	202.0	7.332	11,746	1.00
0.22	58.1	48.2	200.9	7.296	11,727	1.00
0.22	57.9	48.1	200.4	7.302	11,925	1.00
0.22	57.9	48.0	201.8	7.370	11,706	1.00
0.22	57.8	48.1	199.9	7.346	11,892	1.00
0.22	57.9	48.1	201.3	7.366	11,831	1.00
0.22	57.8	48.0	201.5	7.354	11,824	0.99
0.22	57.8	48.0	201.3	7.374	11,818	1.00
0.22	57.9	48.0	200.9	7.326	11,819	1.00
0.22	58.3	48.5	201.5	7.438	11,741	1.00
0.22	58.1	48.3	201.2	7.390	11,699	1.00
0.22	58.1	48.1	200.9	7.360	11,903	1.00
0.22	58.4	48.3	204.5	7.395	11,788	1.00
0.22	59.2	48.8	296.8	7.362	12,111	1.00
0.22	58.9	48.6	460.8	7.327	12,021	1.00
0.22	58.9	48.6	206.2	7.330	12,098	0.99
0.22	58.9	48.6	210.3	7.404	11,905	1.00
0.22	58.9	48.6	213.9	7.364	11,925	1.00
0.22	60.5	49.2	215.5	7.342	12,097	1.00
0.22	60.8	49.2	215.9	7.346	12,413	1.00
0.22	61.0	49.2	215.4	7.355	12,316	1.00
0.22	61.3	49.3	216.3	7.326	12,246	1.00
0.22	61.5	49.4	216.5	7.435	12,162	1.00
0.22	62.6	50.4	219.2	7.430	12,341	1.00
0.22	62.8	50.2	219.9	7.405	12,484	1.00
0.22	63.2	50.4	222.4	7.450	12,353	1.00
0.22	63.5	50.9	221.7	7.394	12,524	1.00
0.22	63.3	50.8	221.5	7.408	12,411	1.00
0.22	63.4	50.6	221.1	7.439	12,439	1.00
0.22	63.5	50.5	223.1	7.436	12,483	1.00

2-Dioxin START

3-Dioxin START

PALOS VERDES ENERGY RECOVERY FROM GAS FACILITY

DAILY PRODUCTION SUMMARY
(15 MINUTE DATA)

Date	Time	Turbine: Gross Power	Turbine: Net Power	Turbine: Parasitic Load	Boiler #1: LFG Burned	Boiler #1: Pilot Gas	Boiler #1: Total Heat Input	Boiler #1: Steam Flow	Boiler #2: LFG Burned	Boiler #2: Pilot Gas	Boiler #2: Total Heat Input	Boiler #2: Steam Flow	LFG: LFG	LFG: LFG Available	LFG: Heat Rate	LFG Usage Factor
		MW	MW	MW	1000 scfm	1000 scfm	mm btu/hr	1000 lb/hr	1000 scfm	1000 scfm	mm btu/hr	1000 lb/hr	btu/ scf	1000 scfm	btu/ kwh nt	
11/24/93	12:15	11.271	10.253	1.03	3.676	0.23	64.2	49.2	3.715	0.22	63.9	50.7	224.8	7.400	12,494	1.00
11/24/93	12:30	11.240	10.271	1.01	3.662	0.23	64.3	48.7	3.741	0.22	64.0	50.6	225.3	7.394	12,495	1.00
11/24/93	12:45	11.264	10.233	1.03	3.728	0.23	64.1	49.4	3.716	0.22	64.0	50.7	223.4	7.436	12,518	1.00
11/24/93	13:00	11.199	10.177	1.02	3.666	0.23	64.0	48.4	3.730	0.22	63.7	50.8	223.8	7.374	12,544	1.00
11/24/93	13:15	11.257	10.228	1.03	3.718	0.23	64.0	49.1	3.712	0.22	63.8	50.8	225.1	7.438	12,503	1.00
11/24/93	13:30	11.284	10.261	1.01	3.718	0.23	64.3	49.2	3.696	0.22	64.0	50.9	224.5	7.414	12,503	1.00
11/24/93	13:45	11.531	10.480	1.03	3.656	0.24	64.5	49.8	3.718	0.24	64.5	51.2	225.8	7.380	12,306	1.00
11/24/93	14:00	11.541	10.538	1.04	3.688	0.24	64.9	50.2	3.722	0.24	65.1	51.9	225.4	7.420	12,338	1.00
11/24/93	14:15	11.507	10.517	1.04	3.710	0.24	65.0	49.7	3.725	0.23	65.0	51.7	225.8	7.442	12,365	1.00
11/24/93	14:30	11.443	10.412	1.03	3.670	0.24	64.7	49.8	3.704	0.23	65.0	51.9	223.6	7.411	12,459	0.99
11/24/93	14:45	11.392	10.369	1.05	3.710	0.24	64.3	49.7	3.717	0.23	64.5	51.6	222.1	7.435	12,413	1.00
11/24/93	15:00	11.357	10.371	1.03	3.686	0.24	64.0	49.9	3.720	0.23	64.1	51.5	221.3	7.436	12,356	1.00
11/24/93	15:15	11.358	10.324	1.03	3.706	0.24	63.6	49.6	3.703	0.24	63.8	51.3	219.6	7.415	12,347	1.00
11/24/93	15:30	11.284	10.241	1.04	3.710	0.24	63.2	49.3	3.702	0.24	63.6	51.3	218.2	7.412	12,380	1.00
11/24/93	15:45	11.264	10.227	1.04	3.616	0.24	63.0	48.9	3.752	0.23	63.2	51.1	216.8	7.376	12,340	1.00
11/24/93	16:00	11.416	10.299	1.04	3.704	0.24	62.9	49.4	3.734	0.23	63.0	51.2	216.3	7.436	12,224	1.00
11/24/93	16:15	11.421	10.330	1.03	3.706	0.24	62.7	49.5	3.728	0.23	63.0	51.2	215.9	7.436	12,161	1.00
11/24/93	16:30	11.358	10.337	1.05	3.678	0.24	62.4	49.0	3.716	0.23	62.6	51.0	213.8	7.410	12,095	1.00
11/24/93	16:45	11.256	10.216	1.04	3.700	0.24	61.8	48.6	3.734	0.23	62.0	50.5	210.6	7.372	12,116	1.01
11/24/93	17:00	11.330	10.251	1.05	3.652	0.24	61.4	49.2	3.716	0.23	61.7	50.5	210.3	7.377	12,010	1.00
11/24/93	17:15	11.181	10.088	1.04	3.638	0.24	61.2	48.4	3.722	0.23	61.5	50.5	209.1	7.374	12,156	1.00
11/24/93	17:30	11.156	10.132	1.04	3.678	0.24	60.9	47.8	3.736	0.23	61.2	50.4	207.9	7.384	12,056	1.00
11/24/93	17:45	11.094	10.012	1.03	3.708	0.24	60.8	48.6	3.698	0.23	60.9	50.2	207.3	7.400	12,151	1.00
11/24/93	18:00	11.118	10.084	1.03	3.712	0.24	60.7	48.3	3.714	0.23	60.9	50.2	206.7	7.396	12,062	1.00
11/24/93	18:15	11.098	10.132	1.04	3.674	0.24	60.4	47.8	3.721	0.23	60.9	50.1	207.2	7.375	11,977	1.00
11/24/93	18:30	11.073	10.038	1.03	3.608	0.24	60.7	47.4	3.670	0.23	61.0	50.3	206.9	7.308	12,130	1.00
11/24/93	18:45	11.108	10.074	1.04	3.668	0.24	60.3	48.4	3.700	0.23	60.6	49.7	207.9	7.358	11,998	1.00
11/24/93	19:00	11.137	10.101	1.04	3.644	0.24	60.8	47.3	3.700	0.23	60.8	49.9	207.7	7.291	12,038	1.01
11/24/93	19:15	11.175	10.130	1.04	3.688	0.24	60.5	48.6	3.700	0.23	60.6	49.8	207.2	7.393	11,957	1.00
11/24/93	19:30	11.046	10.008	1.02	3.616	0.24	60.3	47.5	3.712	0.24	60.5	49.5	206.0	7.317	12,069	1.00
11/24/93	19:45	10.898	9.959	1.02	3.676	0.24	60.1	46.8	3.655	0.23	60.4	49.6	205.5	7.325	12,103	1.00
11/24/93	20:00	10.899	9.871	1.03	3.608	0.24	60.1	46.8	3.701	0.23	60.4	49.6	205.0	7.289	12,207	1.00
11/24/93	20:15	10.986	9.955	1.03	3.606	0.24	59.8	48.2	3.699	0.23	60.0	49.3	204.2	7.341	12,032	1.00
11/24/93	20:30	10.949	9.912	1.04	3.614	0.23	59.8	47.7	3.710	0.23	60.0	49.4	204.4	7.384	12,088	0.99
11/24/93	20:45	10.935	9.903	1.03	3.682	0.23	59.8	47.1	3.698	0.23	59.9	49.4	203.4	7.356	12,086	1.00
11/24/93	21:00	10.938	9.966	1.03	3.642	0.23	59.6	47.3	3.700	0.23	59.7	49.1	202.8	7.373	11,972	1.00
11/24/93	21:15	10.976	9.938	1.02	3.664	0.23	59.4	47.3	3.682	0.24	59.6	49.2	201.3	7.327	11,967	1.00
11/24/93	21:30	11.014	9.982	1.03	3.678	0.23	59.1	47.4	3.734	0.23	59.5	49.1	201.9	7.404	11,875	1.00
11/24/93	21:45	10.973	9.898	1.02	3.702	0.23	59.2	47.6	3.670	0.23	59.4	49.1	202.4	7.382	11,986	1.00
11/24/93	22:00	11.037	10.069	1.03	3.658	0.23	59.2	47.7	3.707	0.24	59.6	49.2	202.4	7.349	11,802	1.00
11/24/93	22:15	11.004	9.978	1.03	3.644	0.23	59.2	47.6	3.733	0.23	59.5	49.3	201.4	7.385	11,901	1.00
11/24/93	22:30	10.804	9.776	1.03	3.620	0.22	58.7	46.3	3.655	0.23	59.1	49.0	201.4	7.285	12,050	1.00
11/24/93	22:45	10.861	9.827	1.03	3.720	0.22	58.5	46.9	3.670	0.23	58.9	48.7	201.4	7.352	11,955	1.01
11/24/93	23:00	10.848	9.828	1.03	3.688	0.22	58.5	46.4	3.651	0.23	59.0	48.7	202.0	7.345	11,954	1.00
11/24/93	23:15	11.050	10.004	1.03	3.732	0.22	58.9	48.0	3.682	0.23	59.1	48.8	202.1	7.396	11,795	1.00
11/24/93	23:30	11.003	9.922	1.04	3.702	0.22	58.5	47.8	3.694	0.23	58.8	48.7	201.8	7.342	11,824	1.01
11/24/93	23:45	11.030	9.985	1.05	3.708	0.22	58.6	47.7	3.720	0.23	59.0	48.9	201.9	7.414	11,778	1.00
11/24/93	24:00	10.877	9.843	1.03	3.670	0.22	58.5	47.2	3.666	0.23	58.8	48.7	200.8	7.380	11,920	0.99
Maximum		11.541	10.538	1.07	3.742	0.24	65.0	50.2	3.752	0.24	65.1	51.9	460.8	7.450	12,544	1.01
Average		11.072	10.033	1.03	3.684	0.23	60.6	48.1	3.689	0.23	60.4	49.5	212.5	7.375	12,057	1.00

η-Dioxin END

3-Dioxin END

Palos Verdes Gas To Energy 11/24/93

(Boiler 502)

Date	Time	Heat Input mm btu/hr	Steam Flow 1000 lb/hr	Stack NOX lb/hr	Uncorr NOX ppmv	Econ Out O2 %
11/23/93	10:00	60.1	48.1	1.6	24.6	1.6
11/23/93	10:15	60.2	48.0	1.6	24.4	1.7
11/23/93	10:30	60.7	48.3	1.6	24.5	1.6
11/23/93	10:45	60.7	48.3	1.6	24.5	1.6
11/23/93	11:00	61.1	48.7	1.7	24.7	1.5
11/23/93	11:15	61.4	48.7	1.7	24.8	1.6
11/23/93	11:30	61.6	48.7	1.7	24.8	1.5
11/23/93	11:45	61.8	48.8	1.7	24.9	1.5
11/23/93	12:00	62.0	48.9	1.7	25.0	1.7
11/23/93	12:15	62.3	48.9	1.7	24.8	1.5
11/23/93	12:30	62.3	49.1	1.7	25.4	1.7
11/23/93	12:45	62.4	49.3	1.7	25.3	1.8
11/23/93	13:00	62.4	49.5	1.7	25.2	1.6
11/23/93	13:15	62.5	49.5	1.7	25.7	1.7

M E S S A G E S

PF: 2=System Menu 3=Function Menu 5=Down 6=Up 7=Left 8=Right
9=Directory 10=Column Left 11=Column Right
4B± a A NUM

Palos Verdes Gas To Energy 11/24/9

(Boiler 502)

Date	Time	Heat Input mm btu/hr	Steam Flow 1000 lb/hr	Stack NOX lb/hr	Uncorr NOX ppmv	Econ Out O2 %
11/23/93	13:30	62.4	49.5	1.7	25.2	1.7
11/23/93	13:45	62.7	49.7	1.7	25.6	1.8
11/23/93	14:00	62.6	49.7	1.8	25.6	1.6
11/23/93	14:15	62.3	49.7	1.8	25.6	1.7
11/23/93	14:30	62.0	49.4	1.7	25.5	1.6
11/23/93	14:45	61.7	49.3	1.7	25.4	1.5
11/23/93	15:00	61.3	49.1	1.7	25.6	1.8
11/23/93	15:15	61.2	49.0	1.7	25.3	1.7
11/23/93	15:30	61.7	49.6	1.8	25.6	1.6
11/23/93	15:45	61.5	49.7	1.7	25.7	1.8
11/23/93	16:00	61.3	49.6	1.7	25.5	1.7
11/23/93	16:15	61.0	49.5	1.7	25.6	1.8
11/23/93	16:30	60.8	49.4	1.7	25.5	1.9
11/23/93	16:45	60.4	49.2	1.7	25.5	1.9

M E S S A G E S

PF: 2=System Menu 3=Function Menu 5=Down 6=Up 7=Left 8=Right
9=Directory 10=Column Left 11=Column Right
4B± a A NUM

Palos Verdes Gas To Energy 11/24/9

(Boiler 502)

Date	Time	Heat Input mm btu/hr	Steam Flow 1000 lb/hr	Stack NOX lb/hr	Uncorr NOX ppmv	Econ Out O2 %

Palos Verdes Gas To Energy 11/24/93

(Boiler 502)

Date	Time	Heat Input mm btu/hr	Steam Flow 1000 lb/hr	Stack NOX lb/hr	Uncorr NOX ppmv	Econ Out O2 %
11/23/93	17:00	60.0	49.0	1.7	25.0	1.7
11/23/93	17:15	59.9	49.0	1.7	25.3	1.7
11/23/93	17:30	59.8	48.9	1.7	25.3	1.6
11/23/93	17:45	59.6	48.7	1.7	25.2	1.4
11/23/93	18:00	59.4	48.7	1.7	25.3	1.8
11/23/93	18:15	59.4	48.7	1.7	25.3	1.7
11/23/93	18:30	59.3	48.5	1.7	25.4	1.7
11/23/93	18:45	59.0	48.4	1.7	25.4	1.6
11/23/93	19:00	59.0	48.5	1.7	25.3	1.6
11/23/93	19:15	58.9	48.2	1.7	25.4	1.5
11/23/93	19:30	59.0	48.4	1.7	25.2	1.8
11/23/93	19:45	58.7	48.2	1.7	25.3	1.6
11/23/93	20:00	58.7	48.2	1.7	25.5	1.6

M E S S A G E S

PF: 2=System Menu 3=Function Menu 5=Down 6=Up 7=Left 8=Right
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4B± a A NUM

APPENDIX D

GENERAL EMISSIONS CALCULATIONS

EMISSION CALCULATIONS

1. Sample Volume and Isokinetics

a. Sample gas volume, dscf

$$V_{m\ std} = 0.03342\ V_m \left(P_{bar} + \frac{H}{13.6}\right)\left(\frac{T_{ref}}{T_m}\right)(Y)$$

b. Water vapor volume, scf

$$V_{w\ std} = 0.0472\ V_{lc}\left(\frac{T_{ref}}{528\ ^\circ R}\right)$$

c. Moisture content, nondimensional

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

d. Stack gas molecular weight, lb/lb mole

$$MW_{dry} = 0.44\ (\%CO_2) + 0.32\ (\%O_2) + 0.28\ (\%N_2)$$

$$MW_{wet} = MW_{dry}\ (1 - B_{wo}) + 18\ (B_{wo})$$

e. Absolute stack pressure, in Hg

$$P_s = P_{bar} + \frac{P_{sg}}{13.6}$$

f. Stack velocity, ft/sec

$$V_s = 2.90\ C_p \sqrt{\Delta P T_s}\ \sqrt{\left(\frac{29.92}{p_s}\right)\left(\frac{28.95}{MW_{wet}}\right)}$$

g. Actual stack flow rate, wacfm

$$Q = (V_s)(A_s)(60)$$

h. Standard stack gas flow rate, dscfm

$$Q_{sd} = Q\ (1 - B_{wo})\left(\frac{T_{ref}}{T_s}\right)\left(\frac{P_s}{29.92}\right)$$

i. Percent isokinetic

$$I = \left(\frac{17.32(T_s)(V_{m\ std})}{(1 - B_{wo})(\Theta)(V_s)(P_s)(D_n^2)}\right)\left(\frac{528\ ^\circ R}{T_{ref}}\right)$$

2. Particulate Emissions

a. Grain loading, gr/dscf

$$C = 0.01543 \left(\frac{M_n}{V_{m\ std}} \right)$$

b. Grain loading at 12% CO_2, gr/dscf

$$C_{12\%CO_2} = C \left(\frac{12}{\%\, CO_2} \right)$$

c. Mass emissions, lb/hr

$$M = C(Q_{sd}) \frac{(60\ \text{min/hr})}{(7000\ gr/lb)}$$

3. Gaseous Emissions, lb/hr

$$M = (ppm)(10^{-6}) \left(\frac{MW_i\ lb/lb\ mole}{SV} \right) (Q_{sd})(60\ \text{min/hr})$$

where,

SV = specific molar volume of an ideal gas:

$SV = 385.3\ ft^3/lb\ mole \quad for\ T_{ref} = 528\ °R$

$SV = 379.5\ ft^3/lb\ mole \quad for\ T_{ref} = 520\ °R$

4. Emissions Rates, lb/10^6 Btu

a. Fuel factor at 68 °F, dscf/10^6 Btu at 0% O_2

$$F_{68} = \frac{10^6 [3.64(\%H) + 1.53(\%C) + 0.14\ (\%N) + 0.57(\%S) - 0.46(\%O_2, fuel)]}{HHV,\ Btu/lb}$$

b. Fuel factor at 60 °F

$$F_{60} = F_{68} \left(\frac{520\ °R}{528\ °R} \right)$$

c. Gaseous Emissions factor

$$\left(\frac{lb}{10^6\ Btu} \right)_i = (ppm)_i\ (10^{-6}) \left(\frac{MW_i\ lb}{lb\ mole} \right) \left(\frac{1}{SV} \right) (F) \left(\frac{20.9}{20.9\ -\ \%O_2} \right)$$

d. Paticulate emission factor

$$\left(\frac{lb}{10^6\ Btu}\right) = C\left(\frac{1\ lb}{7000\ gr}\right)(F)\left(\frac{20.9}{20.9\ -\ \%O_2}\right)$$

Nomenclature:

A_s = stack area, ft^2

B_{wo} = flue gas moisture content

$C_{12\%\ CO_2}$ = particulate grain loading, gr/dscf corrected to 12% CO_2

C = particulate grain loading, gr/dscf

C_p = pitot calibration factor, dimensionless

Dn = nozzle diameter, in.

F = fuel F factor, dscf/10^6 Btu at 0% O_2

H = orifice pressure differential, iwg

I = % isokinetics

M_n = mass of collected particulate, mg

M_i = mass emissions of species i, lb/hr

MW = molecular weight of flue gas

MW_i = molecular weight of species i:

NO_x	:	46
CO	:	28
SO_x	:	64
HC	:	16