AP-42 Section Number: 1.3

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Title: Air Toxic Emissions Testing at Morro Bay Unit 3 for Pacific Gas and Electric Company

May 1990

CARNOT

AIR TOXICS EMISSIONS TESTING AT MORRO BAY UNIT 3

March 1-5, 1990

Prepared For:

PACIFIC GAS AND ELECTRIC COMPANY
San Francisco, California

For Inclusion In:

Air Toxics Hot Spots Inventory
required under
AB2588

Prepared By:

Kevin C. Hopkins
Lisa A. Green

CARNOT

formerly the California Division of
ENERGY SYSTEMS ASSOCIATES

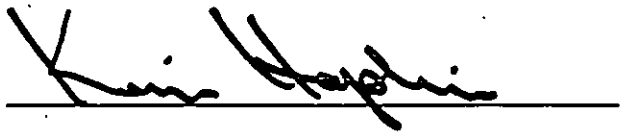
Tustin, California

MAY 1990

CR 71109-2088

REPORT CERTIFICATION

The sampling and analysis performed for this report was carried out under my direction and supervision.



Date 6/1/90

I have reviewed all testing details and results in this test report and hereby certify that the test report is authentic and accurate.

Date 6/1/90

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SECTION 1.0

INTRODUCTION AND SUMMARY

Carnot, formerly the California Division of Energy Systems Associates, was contracted by Pacific Gas and Electric Company (PG&E) to conduct air toxics emission testing at Morro Bay Power Plant, Unit 3 as required as the California Air Toxics Hot Spots Information and Assessment Act of 1987 (AB2588). Tests were conducted at full load as follows:

Emission Tests While Burning Natural Gas

Flue gas samples were collected in triplicate using single point sampling and analyzed for the following substances:

- Benzene
- Formaldehyde

Flue gas flowrate and moisture content were determined using CARB Methods 2 and 4.

Emission Test While Burning Residual Fuel Oil

Flue gas samples were collected downstream of the boiler air preheaters and analyzed for the following substances:

- Benzene
- Formaldehyde
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Arsenic
- Beryllium
- Cadmium
- Chromium (Total and Hexavalent)
- Copper
- Lead
- Manganese
- Mercury
- Nickel

- Phosphorus
- Selenium
- Zinc

Flue gas flowrate and moisture content were determined using CARB Method 2 and 4. A residual fuel oil sample was analyzed for metals (EPA Method 6010), sulfur (ASTM Method D129-64), chlorides (ASTM Method D808-87), radionuclides and higher heating value.

The tests were conducted on March 1-5, 1990. The Carnot test team members were: Vikram Reddy, Kevin Hopkins, Jim Mulligan, Russ Pence, and Mike Schmitt. Bob Beard and Bob Wagoner of PG&E coordinated the tests. The testing was observed by a representative of the San Luis Obispo Air Pollution Control District.

Tables 1-1 , 1-2, 1-3, and 1-4 summarize the results of this test program. Detailed results are included in Section 4.0.

TABLE 1-1
SUMMARY OF ORGANIC EMISSIONS
PG&E MORRO BAY UNIT 3
MARCH 1990

Species	Fuel Oil	Natural Gas
Benzene,		
ppb	ND <1	ND <1
lb/hr	ND $<8.89 \times 10^{-3}$	ND $<8.67 \times 10^{-3}$
lb/MMBtu	ND $<2.50 \times 10^{-6}$	ND $<2.34 \times 10^{-6}$
$lb/KSCF_{fuel}$	ND $<2.78 \times 10^{-3}$	ND $<2.42 \times 10^{-6}$
Formaldehyde		
$\mu g/m^3$	<210.6	<23.9
ppb	<166	<19
lb/hr	<0.470	<0.063
lb/MMBtu	$<1.65 \times 10^{-4}$	<1.43 ~~<1.70~~ $\times 10^{-5}$
$lb/KSCF_{fuel}$	$<1.8 \times 10^{-1}$	<1.48 ~~<1.76~~ $\times 10^{-5}$ RW
PAH (total)		
lb/hr	$<1.49 \times 10^{-2}$	—
lb/MMBtu	$<4.41 \times 10^{-6}$	—
$lb/KSCF_{fuel}$	$<4.81 \times 10^{-3}$	—

ND < - species not detected
< - species not detected in at least one replicate sample

TABLE 1-2
SUMMARY OF METALS EMISSIONS
PG&E MORRO BAY UNIT 3 FUEL OIL
MARCH 1990

Species	lb/hr	lb/MMBtu	$lb/KSCF_{fuel}$
Arsenic	2.13×10^{-2}	6.73×10^{-6}	7.34×10^{-3}
Beryllium	$<6.78 \times 10^{-4}$	$<2.14 \times 10^{-7}$	$<2.34 \times 10^{-4}$
Cadmium	2.31×10^{-3}	7.20×10^{-7}	7.86×10^{-4}
Cadmium by CARB 424	$<2.15 \times 10^{-3}$	$<6.71 \times 10^{-7}$	$<7.32 \times 10^{-4}$
Total Chromium	1.29×10^{-2}	4.04×10^{-6}	4.41×10^{-3}
Hexavalent Chromium	$<2.68 \times 10^{-3}$	$<8.39 \times 10^{-7}$	$<9.15 \times 10^{-4}$
Copper	2.22×10^{-2}	6.99×10^{-6}	7.63×10^{-3}
Lead	5.16×10^{-2}	1.60×10^{-5}	1.75×10^{-2}
Manganese	5.46×10^{-2}	1.74×10^{-5}	1.90×10^{-2}
Mercury	ND $<1.11 \times 10^{-1}$	ND $<3.48 \times 10^{-5}$	ND $<3.80 \times 10^{-2}$
Nickel	1.16	3.70×10^{-4}	4.04×10^{-1}
Selenium	$<1.21 \times 10^{-2}$	$<3.78 \times 10^{-6}$	$<4.12 \times 10^{-3}$
Zinc	$<3.43 \times 10^{-1}$	$<1.06 \times 10^{-4}$	$<1.16 \times 10^{-1}$
Phosphorous *	1.44	4.44×10^{-4}	4.84×10^{-1}

ND < - species not detected in any of the samples fractions
< - species not detected in at least one of the sample fractions

* Phosphorous estimated from fuel oil analysis

TABLE 1-3
FUEL ANALYSIS SUMMARY
PG&E MORRO BAY UNIT 3
MARCH 1990

Parameter	Average
Btu/lb (HHV)	18,764
Carbon, %	84.59
Hydrogen, %	12.04
Oxygen, %	2.87
Sulfur, %	0.35
Chlorine, mg/L	130
Arsenic, mg/L	ND <1.1
Beryllium, mg/L	ND <0.2
Cadmium, mg/L	ND <0.2
Chromium, mg/L	0.32
Hexavalent Chromium, mg/L	ND <0.50
Copper, mg/L	ND <0.4
Lead, mg/L	ND <1.1
Mercury, mg/L	ND <0.10
Manganese, mg/L	0.66
Nickel, mg/L	23
Selenium, mg/L	ND <1.1
Zinc, mg/L	0.95
Phosphorous, mg/L	7.78

ND < - species not detected in any of the replicate samples

TABLE 1-4
FUEL ANALYSIS SUMMARY FOR RADIONUCLIDES
PG&E MORRO BAY UNIT 3
MARCH, 1990

Type	Sample Average PCI/g	Average Error PCI/g
Alpha	6.19×10^{-1}*	1.04
Beta	3.65×10^{-1}*	9.03×10^{-1}
K-40 Gamma	1.00	4.19×10^{-1}
Other Gamma as CS137	9.58×10^{-3}*	1.74×10^{-2}

* Result less than overall analytical error

SECTION 2.0

UNIT DESCRIPTION

Morro Bay Unit 3 is a Babcock and Wilcox radiant reheat boiler with a rated capacity of 2.16 x 10^6 lb/hr steam flow (350 MW net). Steam conditions are 2725 psig with 1053°F superheat temperature and 1003° reheat temperature. The unit can operate with either natural gas or fuel oil.

SECTION 3.0

TEST DESCRIPTION

This section discusses the test conditions, test schedule, sample location and test procedures.

3.1 TEST CONDITIONS AND SCHEDULE

All tests were performed with the boiler operating at least 96% of full rated load (350 MW). The boiler was operated under normal control settings throughout the test program. As required by the San Luis Obispo APCD, continuous sootblowing was in effect while firing oil. Table 3-1 lists the unit load and heat input during each test.

Testing was conducted on fuel oil from March 1-5, 1990. Triplicate tests were performed for each analyte. Benzene, formaldehyde, velocity and moisture tests were conducted on gas fuel on March 6, 1990. The testing schedule is presented in Table 3-1.

3.2 SAMPLE LOCATION

Measurements were performed at the existing sample ports located in the duct between the boiler air preheater and the stack. The duct measured 21.6 feet by 15.0 feet at the sampling location and there were 7 sample ports per duct. For each isokinetic test, a four-point traverse was made at each sample port providing a 28-point measurement grid. A sketch of the sample location is provided in Appendix C.1 of this report.

TABLE 3-1
UNIT OPERATIONS AND TEST CHRONOLOGY
PG&E MORRO BAY UNIT 3

Test No.	Type of Test	Date	Time	Fuel	Load MW	Thermal Input* MMBtu/hr
2A-Form	Formaldehyde	3/1/90	1905/1935	Oil	342	3,242
2B-Form	Formaldehyde	3/1/90	1953/2023	Oil	342	3,242
3-Mtls	Metals	3/2/90	940/1209	Oil	340	3,258
3-Cd	Cadmium	3/2/90	934/1219	Oil	340	3,258
4-Mtls	Metals	3/2/90	1426/1643	Oil	340	3,258
4-Cd	Cadmium	3/2/90	1426/1648	Oil	340	3,258
5-Cr	Cr/Cr^{+6}	3/3/90	922/1156	Oil	335	3,212
6-Mtls	Metals	3/3/90	1601/1810	Oil	335	3,212
6-Cd	Cadmium	3/3/90	1559/1812	Oil	335	3,212
7-PAH	PAH	3/4/90	932/1300	Oil	335	3,204
7-Cr	Cr/Cr^{+6}	3/4/90	944/1102	Oil	335	3,204
8-Cr	Cr/Cr^{+6}	3/4/90	1405/1620	Oil	335	3,204
8-PAH	PAH	3/4/90	1502/1834	Oil	335	3,204
9-A,B,C	Benzene	3/5/90	925/1105	Oil	345	3,284
9-PAH	PAH	3/5/90	844/1205	Oil	345	3,284
10-Vel	Flowrate	3/6/90	913/1021	Gas	342	2,950
10-A,B,C	Benzene	3/6/90	940/1115	Gas	342	2,950
10A-Form	Formaldehyde	3/6/90	1032/1102	Gas	342	2,950
10B-Form	Formaldehyde	3/6/90	1110/1140	Gas	342	2,950
10C-Form	Formaldehyde	3/6/90	1147/1217	Gas	342	2,950

* Oil flowrates measured using a totalizing flow meter. Gas flows recorded on control room strip charts.

3.3 TEST PROCEDURES

Test procedures for the measurement of non-criteria pollutants are presented in Table 3-2. This table summarizes the number of test replicates, test durations, test methods and method detection limits achieved for this test program. Descriptions of standard procedures are included in Appendix A. Additional information and modifications to standard procedures are presented in the following sections.

By special permission of the San Luis Obispo County Air Pollution Control District, in-stack filtration was used for all isokinetic tests. The unusually long probe used to the traverse the air preheater flue gas outlet duct precluded the use of normal externally heated Method 5 filters. The in-stack filter holder lining and the probe lining were teflon to eliminate metal contamination of the sample.

3.3.1 Gaseous Emissions

Gaseous emissions (O_2 and CO_2) were measured using Carnot's Continuous Emissions Monitor (CEM) described in Appendix A. This system meets EPA and CARB requirements for gaseous species. A portable O_2 sensor was used to perform a 28 point O_2 traverse in conjunction with each isokinetic test. CO_2 was measured continuously at a fixed point in the duct.

O_2 and CO_2 were measured in conjunction with all tests according to EPA Method 3A to provide data for molecular weight and dilution calculations.

3.3.2 Velocity and Moisture

Velocity and moisture were determined in conjunction with all isokinetic tests according to EPA Methods 1, 2, and 4. Non-isokinetic single point tests were performed during separate velocity traverses. The average duct velocity is applied to the single point test.

In addition to normal Method 2 procedures for determining the average velocity, periodic checks on the sensitivity to pitch angle were performed. These checks were to verify the validity of the pitot measurements in the deepest sampling points where aerodynamic forces on the emersed probe may affect the orientation of the probe head. With the probe emersed at the maximum depth and pointed into the flow, it was positioned at pitch angles of approximately +15 and -15 degrees. No significant verification in the pitot ΔP was observed during these checks.

TABLE 3-2
TEST PROCEDURES
PG&E MORRO BAY UNIT 3
MARCH 1990

Parameter	No. Replicates	Test Duration (min.)	Measurement Principle	Reference Method	Method Detection Limit
PAH	3	180	GC/MS	CARB 429	13 ng/m^3 per species
Formaldehyde	3*	30	HPLC	CARB 430	8 ppb
Benzene	3*	Tedlar Bag	GC/PID	CARB 410A	1-4 ppb
Total Chromium	3	120	AAS	CARB 425	0.3 µg/m^3**
Hexavalent Chromium	3	120	Ion Chromatography	CARB 425	0.5 µg/m^3**
Metals (As, Be, Cd, Cr, Cu, Pb, Mn, Hg, Ni, P, Se, Zn)	3	120	AAS	Draft EPA Metals Method	0.1-13 µg/m^3**
Cadmium	3	120	Flame AA	CARB 424	0.3 µg/m^3
O_2	In conjunction with all tests		Electrochemical cell	EPA 3A	<0.5%
CO_2	In conjunction with all tests		Nondispersive infrared	EPA 3A	<0.5%
Velocity & Moisture	In conjunction with all isokinetic tests and separately on gas fuel		Pitot Traverse Gravimetric	EPA 1,2 EPA 4	
Fuel Oil	2	--	Metals	EPA Method 6010	
			Sulfur	ASTM Method D129-64	
			Chlorides	ASTM Method D808-87	

* Three replicates while firing fuel oil and three replicates while firing gas

** Assumes 2 m^3 sample size

3.3.3 Metals

Table 3-3 summarizes the analytical methods and detection limits for trace metals tests. Reagents and filter blanks were analyzed for all trace metals. A mandatory check for matrix effects was performed for each metal, except hexavalent chromium, by spiking one sample. If the recovery was less than ± 25% of nominal, all samples were analyzed using the method of standard additions. A duplicate analysis was performed for each metal. Acceptable criteria for duplicates was ± 10%. Because of matrix effects for some metals, 0% recovery was reported for graphite furnace measurements. The following criteria were then established for this test series:

- For GFAAS, results with recoveries of less than ± 25% of nominal then the method of standard additions was used.
- Where GFAAS showed no response to standard additions, ICP was used.
- Where GFAAS detection limits were higher than ICP, then ICP was used.

Recoveries are listed with the metals data in Appendix C.7.

Triplicate samples were collected for metals analysis; two samples at the north duct and one sample at the south duct. Arsenic, beryllium, cadmium, total and hexavalent chromium, copper, lead, manganese, mercury, nickel, selenium and zinc were determined for AB2588 reporting requirements and permit conditions. Samples for metals analysis were collected by three separate sample trains are discussed in the following subsections.

3.3.3.1 Combined Metals Train

Samples to be analyzed for arsenic, beryllium, cadmium, copper, lead, manganese, mercury, nickel, selenium, and zinc, were collected using an EPA draft metals method titled "Methodology for the Determination of Metals Emissions in Exhaust Gases from Stationary Source Combustion Processes". This method is attached in Appendix A. The sample train is of the same configuration as a CARB Method 5 train, with the following exceptions:

1. In lieu of an external heated Method 5 filter, an in-stack filter was used. The filter holder and the probe were teflon lined to eliminate metal contamination of the sample.
2. The filter is Teflon coated fiberglass to minimize interferences.

TABLE 3-3
TRACE METALS ANALYSIS
PG&E MORRO BAY UNIT 3

Metal	Sampling Method	Analytical Method	Detection Limit* ug/m^3
Beryllium	Draft EPA Metals Method	ICP	0.06
Chromium	Modified CARB 425	Graphite Furnace AA	0.3
Hexavalent Chromium	Modified CARB 425 w/0.02N $NaHCO_3$	Ion chromatography	0.6
Arsenic	Draft EPA Metals Method	Graphite Furnace AA (Std. Additions)	0.3
Cadmium	Draft EPA Metals Method	ICP	0.1
Copper	Draft EPA Metals Method	ICP	0.7
Lead	Draft EPA Metals Method	Graphite Furnace AA (Std. Additions)	3.2
Manganese	Draft EPA Metals Method	ICP	0.6
Mercury	Draft EPA Metals Method	Cold Vapor AA	13
Nickel	Draft EPA Metals Method	ICP	0.6
Nickel	CARB 433	Flare AA	0.5
Selenium	Draft EPA Metals Method	Graphite Furnace AA (Std. Additions)	3.4
Zinc	Draft EPA Metals Method	ICP	0.6

* Assume 2 m^3 per sample

3. The first two impingers contain dilute nitric acid and hydrogen peroxide to collect any volatile metals which pass through the filter.

4. The third impinger contains an acidified potassium permanganate solution to collect any mercury that is not collected in the nitric acid impingers.

Analyses for these metals was performed by ICP, graphite furnace and cold vapor atomic absorption, depending upon the metal. Decomposition of each sample fraction is described in the EPA draft method. Whenever possible, decomposed sample portions were concentrated and combined, with regard to preventing loss of volatile metals, to achieve the lowest detection limits possible for these samples. Five percent of the decomposed probe wash/filter extract and 5% of the nitric acid/peroxide impinger catch was removed for mercury analysis. The remaining 95% of these sample portions was concentrated to a total volume of 50 ml and analyzed for metals. The probe wash/filter portions and the impinger catch portions were analyzed separately. The $KMnO_4$ impinger portion was analyzed for mercury only.

3.3.3.2 **Chromium Train**

CARB Method 425 was used for total and hexavalent chromium. In order to achieve a low detection limit, a separate sample train was used. Ion chromatography was chosen as the analytical method, which provides lower detection limits than the colorimetric method.

Triplicate samples were collected at each condition. Hexavalent chromium was determined from half of each sample by RTI in North Carolina.

Total chromium was analyzed using the remaining half of the sample according to CARB Method 425. The analyses were performed by graphite furnace atomic absorption by Curtis and Tompkins in their Los Angeles and Berkeley laboratories.

3.3.3.3 **Cadmium Train**

In addition to the combined metals train, a separate train was run for cadmium using CARB 424. This was performed at the request of the California Air Resources Board for inclusion in the CARB Metals Validation Study.

3.3.4 PAH

PAH samples was collected according to the sampling procedures of CARB Method 429. This method is known as the semi-VOST or "Modified Method 5". Table 3-4 summarizes the pertinent information for these tests. In this procedure, a sample is collected isokinetically and passed through an in-stack filter followed by a teflon lined probe and an XAD-2 sorbent module in a water-cooled jacket. The sorbent module is followed by an impinger train to collect moisture and any semi-volatile species that might pass through the resin.

TABLE 3-4
PAH TEST INFORMATION

Sampling Method	CARB 429 (Modified Method 5)
Analytical Method	GC/MS
Analytical Laboratory	Zenon Environmental
Expected Levels	Less than 10 ng/m^3 per species
Analytical Lower Detection Limit	PAH 10-100 ng per species
Sample Volumes	2-3 m^3 (3-hr sample)
Internal Standards	Added to post-test samples
Surrogate Standards	Added to resin prior to sampling
Blank	Full field blank train used
Fractions to be Analyzed	Probe wash, filter, sorbent module, connecting glassware rinse, and first impinger combined
Chain of Custody	Maintained by Carnot and Zenon on all samples
Sample Train Assembly and Recovery	Performed in on-site clean room to minimize chance of contamination
Glassware Cleaning	Acid cleaning followed by DIH_2O, acetone, and hexane rinses and high temperature bake

Sample analysis was performed by Zenon Environmental in Burlington, Ontario. Zenon also prepared the resin, loaded the modules, and extracted the modules and other fractions according to CARB procedures. Appropriate laboratory spikes were introduced to the samples by Zenon and the percent recovery was reported along with the results.

GC/MS with selected ion monitoring was used to analyze PAH. This procedure provides the lowest detection limits possible for these samples. In accordance with Appendix C-1 of "Emission Inventory Criteria and Guidelines" the following PAH species were quantified:

Acenaphthene
Acenaphthylene
Anthracene
Benz[a]anthracene
Benzo[b]fluoranthene
Benzo[k]fluoranthene
Benzo[a]pyrene
Benzo[g,h,i]perylene
Chrysene
Dibenz[a,h]anthracene
Fluoranthene
Fluorene
Indeno[1,2,3,-cd]pyrene
Naphthalene
Phenanthrene
Pyrene

A full field blank was collected and analyzed for PAH. For a field blank, a separate sample train was assembled, transported, leak checked, rinsed, and recovered in the same way as the sample train. This provided a blank value not only for the analytical procedures but also for the reagents, filter, and any possible contamination introduced by sample handling.

3.3.5 Benzene

Samples for benzene were collected in Tedlar Bags and analyzed by gas chromatography/mass spectroscopy by Truesdail Laboratories in Irvine, California.

3.3.6 Formaldehyde

Triplicate samples for formaldehyde were collected non-isokinetically as per CARB Method 430 using midget impingers in acidic 2, 4-dinitrophenylhydrazine solution. The analysis for formaldehyde was performed by reverse phase HPLC by Radian Laboratories in Austin, Texas. A field blank and a field spike were also submitted for analysis.

3.3.7 Fuel Analysis

Duplicate samples of fuel oil were analyzed by Curtis and Tompkins for metals (EPA Method 6010), sulfur (ASTM Method D129-64), and chlorides ASTM Method D808-87. Ultimate and proximate analysis were also performed by Curtis and Tompkins. Duplicate samples were submitted to United States Testing Company, Richmond Division. for radiochemical analysis.

Natural gas analysis was performed at the Morro Bay Plant by PG&E.

3.4 QUALITY ASSURANCE

Carnot has a rigorous ongoing QA program to ensure that high-quality data is obtained and to ensure full documentation of test details. The QA program includes:

1. Appointment of a Quality Assurance officer for Carnot's Source Test Division.
2. Preparation of a QA manual for internal use.
3. Standardization of reporting and review procedures.
4. Implementation of chain of custody procedures on all samples and data sheets.
5. Scheduling of internal QA and training meetings.
6. Complete documentation of instrument calibration and CEM performance data.
7. Adherence to method-specific QA procedures for all testing.
8. Personnel training.
9. Monitoring of new and emerging methods and technologies.

Specific QA data which is included in the appendices of this report are:

1. Equipment calibration data
2. CEM calibration
3. CEM performance data
4. Chain of custody on all samples

Carnot participates in EPA's audit programs for Methods, 5, 6, and 7, and is certified by the California Air Resources Board under its Independent Source Tester's Approval program. Additional QA information is presented in Appendix B.

SECTION 4.0

RESULTS

This section presents the results of the emission tests performed at Moss Landing Power Plant, Boiler and discussions of relevant sampling and analysis details that impact the results. All data sheets, calculations, laboratory reports and quality assurance information are included in the Appendices.

Many of the results presented in this section have an "ND <" or a "<" qualification. "ND <" signifies that the species was not detected, and the number following this symbol is the detection limit. The "<" qualification signifies that the species was either not detected in at least one of the sample fractions (front half or back half) of at least one of the replicates, or that the result after the blank correction is applied is lower than the sample detection limit. The number following the "<" symbol is the average the detection limit with any detectable levels.

Detailed results of the tests are presented in the following subsections:

4.1 PAH

PAH samples were analyzed by Zenon Environmental, Ontario, Canada. Results for the PAH tests are presented in Table 4-1.

TABLE 4-1
POLYCYCLIC AROMATIC HYDROCARBON EMISSIONS
PG&E MORRO BAY UNIT 3
MARCH 1990

Test No.	7-PAH	8-PAH	9-PAH	Stack Average		
Date:	3/4/90	3/4/90	3/5/90			
	µg/m³	µg/m³	µg/m³	µg/m³	lb/hr	lb/MMBtu
Naphthalene	4.647	3.203	8.354	5.401	1.41×10^{-2}	4.18×10^{-6}
Acenaphthylene	ND <0.013	ND <0.011	ND <0.012	ND <0.012	ND $<3.12 \times 10^{-5}$	ND $<9.22 \times 10^{-9}$
Acenaphthene	0.155	0.229	0.018	0.134	3.44×10^{-4}	1.02×10^{-7}
Fluorene	<0.013	0.028	<0.012	<0.017	$<4.55 \times 10^{-5}$	$<3.15 \times 10^{-8}$
Phenanthrene	<0.013	0.018	<0.012	<0.014	$<3.72 \times 10^{-5}$	$<1.10 \times 10^{-8}$
Anthracene	<0.013	<0.011	<0.012	<0.012	$<3.12 \times 10^{-5}$	$<9.22 \times 10^{-9}$
Fluoranthene	<0.013	<0.011	<0.012	<0.012	$<3.12 \times 10^{-5}$	$<9.22 \times 10^{-9}$
Pyrene	0.014	ND <0.011	ND <0.012	<0.012	$<3.21 \times 10^{-5}$	$<9.48 \times 10^{-9}$
Benz(a)anthracene	ND <0.013	ND <0.011	ND <0.012	ND <0.012	ND $<3.12 \times 10^{-5}$	ND $<9.22 \times 10^{-9}$
Chrysene	ND <0.013	ND <0.011	ND <0.012	ND <0.012	ND $<3.12 \times 10^{-5}$	ND $<9.22 \times 10^{-9}$
Benzo(b+k)fluoranthene	ND <0.013	ND <0.011	ND <0.012	ND <0.012	ND $<3.12 \times 10^{-5}$	ND $<9.22 \times 10^{-9}$
Benzo(a)pyrene	ND <0.013	ND <0.011	ND <0.012	ND <0.012	ND $<3.12 \times 10^{-5}$	ND $<9.22 \times 10^{-9}$
Indeno(1,2,3-cd)pyrene	ND <0.013	ND <0.011	ND <0.012	ND <0.012	ND $<3.12 \times 10^{-5}$	ND $<9.22 \times 10^{-9}$
Dibenzo(a,h)anthracene	ND <0.013	ND <0.011	ND <0.012	ND <0.012	ND $<3.12 \times 10^{-5}$	ND $<9.22 \times 10^{-9}$
Benzo(g,h,i)perylene	ND <0.013	ND <0.011	ND <0.012	ND <0.012	ND $<3.12 \times 10^{-5}$	ND $<9.22 \times 10^{-9}$
TOTAL PAH,	<4.97	<3.603	<8.523	<5.70	$<1.49 \times 10^{-2}$	$<4.41 \times 10^{-6}$

Results corrected for field blanks

ND < - species not detected
< - species below detection limit after blank correction applied

4.2 BENZENE

Triplicate samples for benzene analysis were collected in tedlar bags for each fuel type and analyzed by Truesdail Laboratories, Inc. in Tustin, CA. Benzene was not detected in any of the samples. Results are presented in Table 4-2.

TABLE 4-2
BENZENE RESULTS
PG&E MORRO BAY UNIT 3
MARCH 1990

WITH UNIT ON FUEL OIL				
Test No.	9A-Benz	9B-Benz	9C-Benz	Average
Date	03/5/90	03/5/90	03/5/90	
ppb	ND <1	ND <1	ND <1	ND <1
lb/hr	ND $<8.89 \times 10^{-3}$	ND $<8.89 \times 10^{-3}$	ND $<8.89 \times 10^{-3}$	ND $<8.89 \times 10^{-3}$
lb/MMBtu	ND $<2.50 \times 10^{-6}$	ND $<2.50 \times 10^{-6}$	ND $<2.50 \times 10^{-6}$	ND $<2.50 \times 10^{-6}$

WITH UNIT ON NATURAL GAS				
Test No.	10A-Benz	10B-Benz	10C-Benz	Average
Date	03/6/90	03/6/90	03/6/90	
ppb	ND <1	ND <1	ND <1	ND <1
lb/hr	ND $<8.67 \times 10^{-3}$	ND $<8.67 \times 10^{-3}$	ND $<8.67 \times 10^{-3}$	ND $<8.67 \times 10^{-3}$
lb/MMBtu	ND $<2.34 \times 10^{-6}$	ND $<2.34 \times 10^{-6}$	ND $<2.34 \times 10^{-6}$	ND $<2.34 \times 10^{-6}$

ND - not detected

4.3 FORMALDEHYDE

Formaldehyde samples were analyzed by Radian Corporation, Morrisville, N.C. The formaldehyde results are presented in Table 4-3.

TABLE 4-3
FORMALDEHYDE RESULTS
PG&E MORRO BAY UNIT 3
MARCH 1990

WITH UNIT ON FUEL OIL

Test No.	2A-Form	2B-Form	4-Form	Stack Average
Date	03/1/90	03/1/90	03/2/90	
$\mu g/m^3$	376.4	248	ND <7.2	<210.6
ppb	297	196	ND <6	<166
lb/MMBtu	2.95×10^{-4}	1.94×10^{-4}	ND $<5.73 \times 10^{-6}$	$<1.65 \times 10^{-4}$
lb/hr	0.84	0.55	ND $<1.8 \times 10^{-2}$	<0.47

WITH UNIT ON NATURAL GAS

Test No.	10A-Form	10B-Form	10C-Form	Stack Average
Date	03/6/90	03/6/90	03/6/90	
$\mu g/m^3$	ND <8.6	ND <8.2	54.9	<23.9
ppb	ND <7	ND <6	43	<19
lb/MMBtu	ND $<6.08 \times 10^{-6}$	ND $<5.84 \times 10^{-6}$	3.09×10^{-5}	< 1.43 ~~1.70~~ $\times 10^{-5}$ FNW
lb/hr	ND $<2.25 \times 10^{-2}$	ND $<2.16 \times 10^{-2}$	1.44×10^{-1}	$<6.27 \times 10^{-2}$

4.4 TRACE METALS

Results of the EPA combined metals tests are presented in Table 4-4. Complete metals analyses are included in Appendix C.7. This appendix includes the distribution of metals concentration between the probe/filter and impinger fractions, the extent to which non-detectable levels contribute to the overall reported concentration and blank corrections.

3

TABLE 4-4
RESULTS OF METALS TESTS
PG&E MORRO BAY UNIT 3
MARCH 1990

Test No.	3-Mtls	4-Mtls	6-Mtls	Stack Average		
	µg/m³	µg/m³	µg/m³	µg/m³	lb/hr	lb/MMBtu
Arsenic	11.32	4.87	9.91	8.70	2.13×10^{-2}	6.73×10^{-6}
Beryllium	0.35	ND <0.09	0.39	<0.28	$<6.78 \times 10^{-4}$	$<2.14 \times 10^{-7}$
Cadmium	0.72	1.09	0.99	0.93	2.31×10^{-3}	7.20×10^{-7}
Copper	13.58	10.90	2.75	9.08	2.22×10^{-2}	6.99×10^{-6}
Lead	8.30**	20.35**	33.56**	20.73	5.16×10^{-2}	1.60×10^{-5}
Manganese	46.02	9.45	12.20*	22.56	5.46×10^{-2}	1.74×10^{-5}
Mercury	ND <39.99	ND <49.42	ND <45.76	ND <45.05	ND $<1.11 \times 10^{-1}$	ND $<3.48 \times 10^{-5}$
Nickel	716.76	19.62	694.00	476.79	1.16	3.70×10^{-4}
Selenium	<4.60	ND <4.51	ND <5.57	<4.89	$<1.21 \times 10^{-2}$	$<3.78 \times 10^{-6}$
Zinc	<85.26	239.81	<87.70	<137.59	$<3.43 \times 10^{-1}$	$<1.06 \times 10^{-4}$

ND < - Species not detected in any of the sample fractions
< - Species not detected in at least one of the sample fractions
* Front half only - impinger contaminated by $KMnO_4$
** Not corrected for blanks; blank results too high

4.5 TOTAL AND HEXAVALENT CHROMIUM

Results for chromium tests are presented in Table 4-5. This table present air emissions data and hexavalent chromium to total chromium ratios as requested by CA DOHS. Analytical data is in Appendix C.8.

TABLE 4-5
TOTAL CHROMIUM AND HEXAVALENT CHROMIUM PG&E MORRO BAY UNIT 3
MARCH 1990

Species	Test 5-Cr	Test 7-Cr	Test 8-Cr	Stack Average
Hexavalent Chromium:				
$\mu g/m^3$	<1.72	ND <0.76	<0.83	<1.10
lb/hr	$<4.17 \times 10^{-3}$	ND $<1.87 \times 10^{-3}$	$<2.01 \times 10^{-3}$	$<2.68 \times 10^{-3}$
lb/MMBtu	$<1.28 \times 10^{-6}$	ND $<5.54 \times 10^{-7}$	$<6.89 \times 10^{-7}$	$<8.39 \times 10^{-7}$
Total Chromium:				
$\mu g/m^3$	4.66	6.90	4.38	5.31
lb/hr	1.13×10^{-2}	1.69×10^{-2}	1.06×10^{-2}	1.29×10^{-2}
lb/MMBtu	3.45×10^{-6}	5.02×10^{-6}	3.66×10^{-6}	4.04×10^{-6}

ND < - Species not detected in any sample fraction
< - Species not detected in at least one sample fraction

4.6 CADMIUM BY CARB 424

Results for the alternate cadmium method are presented in Table 4-6. Included in this table are the cadmium results from the combined EPA metals tests which were performed simultaneously. This data is presented as part of the CARB Metals Validation Study. Results indicate that cadmium emissions by the EPA method were 7 to 9 percent higher than the emissions measured by CARB 433.

TABLE 4-6
COMPARISON OF CADMIUM EMISSIONS BY TEST METHOD

Test	$\mu g/m^3$	lb/hr	lb/MMBtu
Cd by CARB 424			
3-CD	1.45	3.72×10^{-3}	1.14×10^{-6}
4-CD	0.73	1.81×10^{-3}	5.97×10^{-7}
6-CD	ND <0.36	ND $<9.17 \times 10^{-4}$	ND $<2.72 \times 10^{-7}$
Stack Emission	<0.85	$<2.15 \times 10^{-3}$	$<6.71 \times 10^{-7}$
Cd by EPA 6010			
3-Mtls	0.72	1.70×10^{-3}	5.53×10^{-7}
4-Mtls	1.09	2.76×10^{-3}	8.35×10^{-7}
6-Mtls	0.99	2.47×10^{-3}	7.73×10^{-7}
Stack Emission	0.93	2.31×10^{-3}	7.20×10^{-7}
% Difference	9.4	7.4	7.3

4.7 FUEL ANALYSIS

The results of oil fuel analysis are shown in Tables 4-7 and 4-8. The results of radio chemical analysis show that the level of radiation on the fuel oil sample was less than the analytical error for alpha, beta, and gamma emissions except for K-40, potassium-40 is a naturally occurring isotope which is usually present in proportion to the amount of total potassium in the sample.

The results of the natural gas analysis are shown in Table 4-9.

TABLE 4-7
FUEL ANALYSIS SUMMARY
PG&E ~~MOSS LANDING~~
~~FEBRUARY~~ 1990

Parameter	Sample #1	Sample #2	Average
Btu/lb (HHV)	18,791	18,736	18,764
Carbon, % wt	84.27	83.90	84.59
Hydrogen, % wt	12.26	11.82	12.04
Oxygen, % wt	1.98	3.76	2.87
Sulfur, %	0.31	0.39	0.35
Chlorine, mg/L	130	130	130
Arsenic, mg/L	ND <1.1	ND <1.1	ND <1.1
Beryllium, mg/L	ND <0.2	ND <0.2	ND <0.2
Cadmium, mg/L	ND <0.2	ND <0.2	ND <0.2
Chromium, mg/L	0.28	0.36	0.32
Hexavalent Chromium, mg/L	ND <0.50	ND <0.50	ND <0.50
Copper, mg/L	ND <0.4	ND <0.4	ND <0.4
Lead, mg/L	ND <1.1	ND <1.1	ND <1.1
Mercury, mg/L	ND <0.10	ND <0.10	ND <0.10
Manganese, mg/L	0.21	1.1	0.66
Nickel, mg/L	22	24	23
Selenium, mg/L	ND <1.1	ND <1.1	ND <1.1
Zinc, mg/L	0.98	0.92	0.95
Phosphorous, mg/L	7.36	8.20	7.78

ND - not detected

TABLE 4-8
FUEL ANALYSIS FOR RADIONUCLIDES
PG&E MORRO BAY UNIT 3
MARCH 1990

Type	Sample No. 1 PCI/g	Sample No. 2 PCI/g	Sample Average PCI/g	Average Error PCI/g
Alpha	4.54×10^{-1}	7.84×10^{-1}	6.19×10^{-1}*	1.04
Beta	4.62×10^{-1}	2.67×10^{-1}	3.65×10^{-1}*	0.90
K-40 Gamma	1.17	0.83	1.00	0.420
Other Gamma	8.95×10^{-3}	1.02×10^{-2}*	9.58×10^{-3}*	1.73×10^{-2}

* Results less than analytical error

TABLE 4-9
NATURAL GAS ANALYSIS
PG&E MORRO BAY UNIT 3
MARCH 6, 1990

Species	Volume %	lb/lb mole			
		C	H	O	N
CH_4	92.702	11.12	3.71	0.00	0.00
C_2H_6	4.172	1.00	0.25	0.00	0.00
C_3H_8	.634	0.23	0.05	0.00	0.00
C_4H_{10}-I	0.043	0.02	0.00	0.00	0.00
C_4H_{10}-N	0.053	0.03	0.01	0.00	0.00
C_5H_{12}-I	0.017	0.01	0.00	0.00	0.00
C_5H_{12}-N	0.013	0.01	0.00	0.00	0.00
C_6H_6	0.021	0.02	0.00	0.00	0.00
CO_2	1.399	0.17	0.00	0.45	0.00
N_2	0.954	0.00	0.00	0.00	0.27
Total wt %		72.67	23.21	2.58	1.54

Molecular weight = 17.34 lb/lb mole
HHV = 1036.0 Btu/scf
F_{68} = 8586 dscf/10^6 Btu @ 0% O_2
F_{60} = 8456 dscf/10^6 Btu @ 0% O_2

E∫A

DRY GAS METER CALIBRATION DATA

Date 1-17-90 By CF

Field Dry Gas Meter ID ES-28

Barometric Pressure (P_b) 29.93 (in.Hg)

Test Meter ID. ES-13

Test Meter Y_d 1.000

Date Last Calib. 12-14-89

Approx Flow Rate cfm	Field Dry Gas Meter							Time (θ) min.	Test Meter							Actual Flow Rate (Q) cfm
				Temperatures, °F								Temperatures, °F				
	Final Volume	Initial Volume	Volume (V_{dg}) ft^3	Inlet (t_i)	Outlet (t_o)	Average (t_d)	Pressure (ΔH) in.H_2O		Final Volume	Initial Volume	Volume (V_{tm}) ft^3	Inlet (t_i)	Outlet (t_o)	Average (t_{tm})	Pressure in.H_2O	
0.40	83.616	78.603		84	72		.4	13.5	56.193	51.354		65	66		0	
	88.441	83.616		88	78		.4	13	60.817	56.193		65	66		0	
	93.255	88.441		90	81		.4	13	65.391	60.817		65	66		0	
0.60	99.663	93.255		90	82		.7	13	71.469	65.391		62	66		0	
	04.561	99.663		92	81		.7	10	76.114	71.469		62	66		0	
	09.485	04.561		92	81		.7	10	80.784	76.114		62	66		0	
0.80	14.112	9.485	4.627	95	81		1.0	8	85.176	80.784		62	66		0	
	18.749	14.112		96	81		1.0	8	89.580	85.176		64	66		0	
	23.301	18.749		97	82		1.0	8	94.002	89.580		64	66		0	
1.00	57.596	51.156	6.440	104	84		2.0	8	23.023	20.886		66	67		0	
	63.960	57.596		104	85		2.0	8	33.102	27.037		66	67		0	
	70.351	63.960		104	86		2.0	8	39.182	33.102		66	67		0	
1.20	78.244	70.351		110	88		4.0	7	46.704	39.182		66	67		0	
	86.186	78.244		110	88		4.0	7	54.268	46.704		66	67		0	
	96.269	86.186		110	89		4.0	7	63.899	54.268		66	67		0	

C = ΔH/c

.578

ANDERSEN
SAMPLERS INCORPORATED

4215 WENDELL DRIVE ◻ ATLANTA, GEORGIA 30336

CONTROL UNIT CALIBRATION

Date 2-18-85 Unit Number 385-260 (ES-11)

Barometric pressure, P_b = 30.28 in Hg. Model Number 90-800

Orifice manometer setting, ΔH in. H_2O	Gas volume, wet test meter V_w, ft^3	Gas volume, dry gas meter V_d, ft^3	Temperature: Wet test Meter t_w, °R	Temperature: Dry gas meter Inlet t_{di}, °R	Temperature: Dry gas meter Outlet t_{do}, °R	Temperature: Dry gas meter Average t_d, °R	Time θ, min	Y	ΔH@
1.0	5	5.37	72/532	125	95	110/570	9.40	1.00	1.89
2.0	5	5.37	72/532	131	97	114/574	6.69	1.00	1.90
4.0	5	5.36	72/532	136	98	117/577	4.77	1.00	1.93
								1.00	1.91

Calculations

ΔH	$\frac{\Delta H}{13.6}$	Y: $\frac{V_w P_b \left(t_d \right)}{V_d \left(P_b + \frac{\Delta H}{13.6} \right) \left(t_w \right)}$	ΔH@: $\frac{0.0317\ \Delta H}{P_b \left(t_{d\theta} \right)} \left[\frac{\left(t_w \right) \theta}{V_w} \right]^2$
1.0	0.0735		
2.0	0.147		
4.0	0.294		

Y = Ratio of accuracy of wet test meter to dry test meter. Tolerance : ± 0.01

ΔH@ = Orifice pressure differential that gives 0.75 cfm of air at 70°F and 29.92 inches of mercury, in. H_2O. Tolerance : ± 0.15

Calibrated by: MJC

ENERGY SYSTEMS ASSOCIATES

DRY GAS METER CALIBRATION

FIELD GAS METER I.D. ES-11 TEST METER ES-13

DATE 1/16/90 TEST METER LAST CAL. 1.000 = Yt

BAROMETRIC PRESSURE 30.05

FIELD METER			TEST METER				RESULTS				
VOLUME cu.ft.	TEMP. 'F	DELTA H "H2O	TIME min.	VOLUME cu.ft.	TEMP. 'F	PRESS. "H2O	Q cfm	Y	H@	AVE.Y	AVG. H@
4.55	85.5	0.4	13	4.434	70	0	0.35	1.002	1.86	0.9990	1.85
4.96	96.5	0.45	13	4.736	69.5	0	0.38	1.002	1.80		
4.65	107.	0.4	13	4.312	69.5	0	0.36	0.992	1.89		
5.17	118	0.7	11	4.725	68.5	0	0.47	0.998	1.93	0.9974	1.91
4.77	122	0.7	10	4.322	67.5	0	0.48	0.998	1.89		
5.26	124.	0.7	11	4.745	68	0	0.48	0.996	1.89		
4.56	126.	1	8	4.082	67.5	0	0.57	0.994	1.92	0.9942	1.93
4.54	128.	1	8	4.054	67.5	0	0.57	0.994	1.94		
4.58	130	1	8	4.079	67.5	0	0.57	0.994	1.91		
5.57	131	2	7	4.956	67.5	0	0.80	0.992	1.98	0.9838	2.03
5.85	132.	2	7	4.79	67	0	0.84	0.916	2.11		
5.77	83.5	2	8	5.835	64.5	0	0.72	1.043	2.00		
6.38	96	4	6	6.127	64.5	0	1.06	1.008	2.00	1.0100	1.99
6.48	101.	4	6	6.168	65	0	1.08	1.009	1.96		
6.43	108	4	6	6.073	65	0	1.07	1.013	1.99		
								AVERAGE		0.9968	1.94
										*******	*********

ME/ Mono Bay
for Humboldt
post Moss Landing

ENERGY SYSTEMS ASSOCIATES POST TEST DRY GAS METER CALIBRATION CHECE

CALIBRATED BY VK
DATE 03/11/90
FIELD GAS METER I.D. ES-11
INITIAL Yd 1.000
INITIAL H@ 1.910

DATA ENTRY BY JJM
BAROMETRIC PRESSURE 30
TEST METER ES-13
TEST METER Y (Yt) 1.000
TEST METER LAST CAL. 12/89

FIELD METER				TEST METER			RESULTS		
VOLUME cu.ft.	TEMP. IN	TEMP OUT	DELTA "H2O	TIME min.	VOLUM cu.ft	TEMP. 'F	Q cfm	Y	H@
5.45	72.5	59.25	1.00	10	5.27	57.25	0.54	0.981	1.96
5.54	73.5	63	1.05	10	5.39	57.5	0.55	0.992	1.95
5.53	80	65.5	1.00	10	5.35	57.5	0.55	0.994	1.88
						AVERAGES		0.989	1.93

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

State of California
AIR RESOURCES BOARD

Executive Order G-482

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 Energy Systems Associates meets the requirements of the Board for conducting ARB Test Methods 1-1, 1-2, 1-3, 1-4, 1-5, 1-6, 1-8, 1-10, and 1-100 (NOx, and 02).

NOW, THEREFORE, BE IT ORDERED that Energy Systems Associates is granted an approval, from the date of execution of this order, until June 30, 1990 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 at Sacramento, California, this 19TH day of JUNE 1989.

James J. Morgester, Chief
Compliance Division

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.

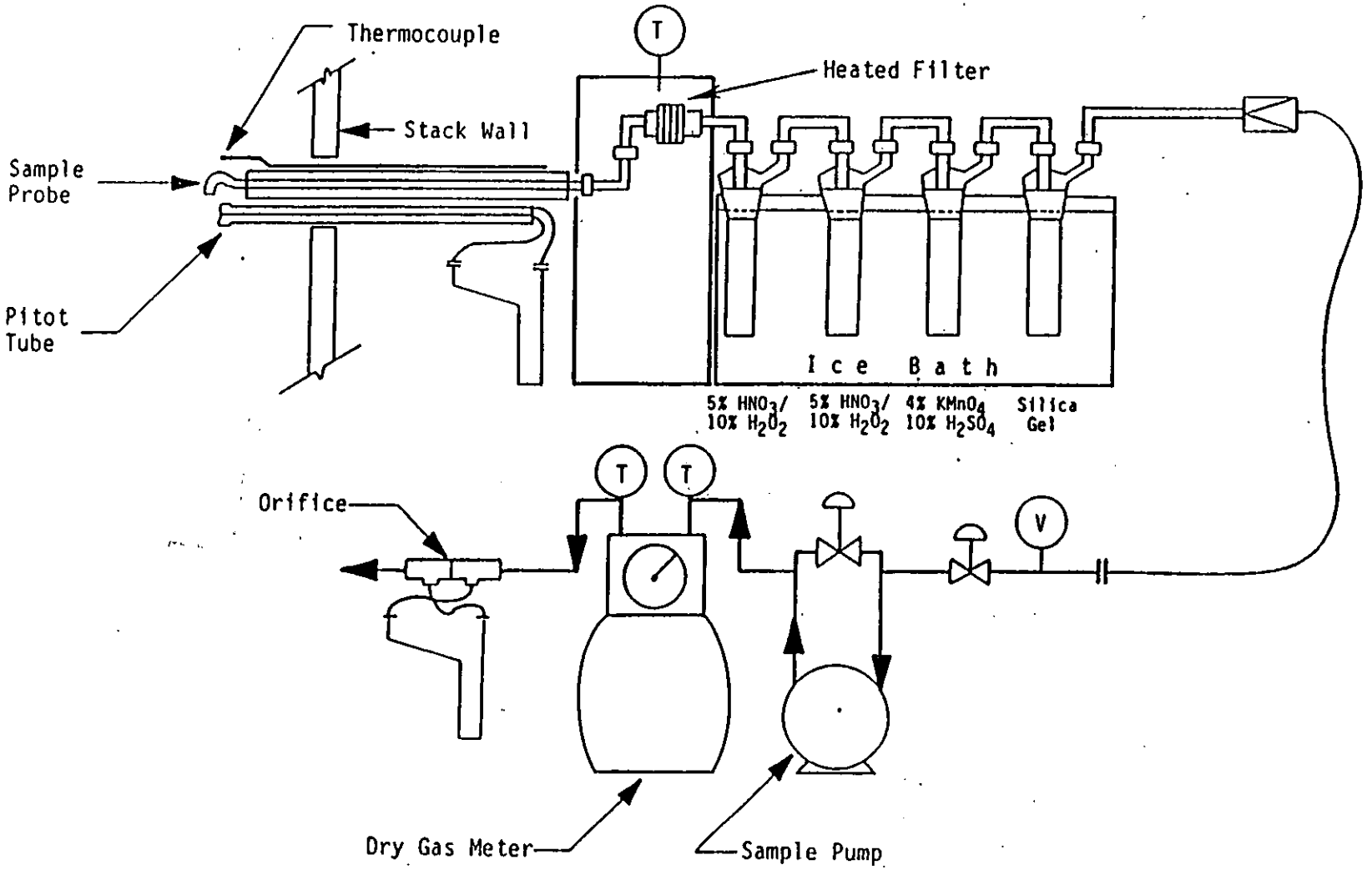
AGENCY CERTIFICATION

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.

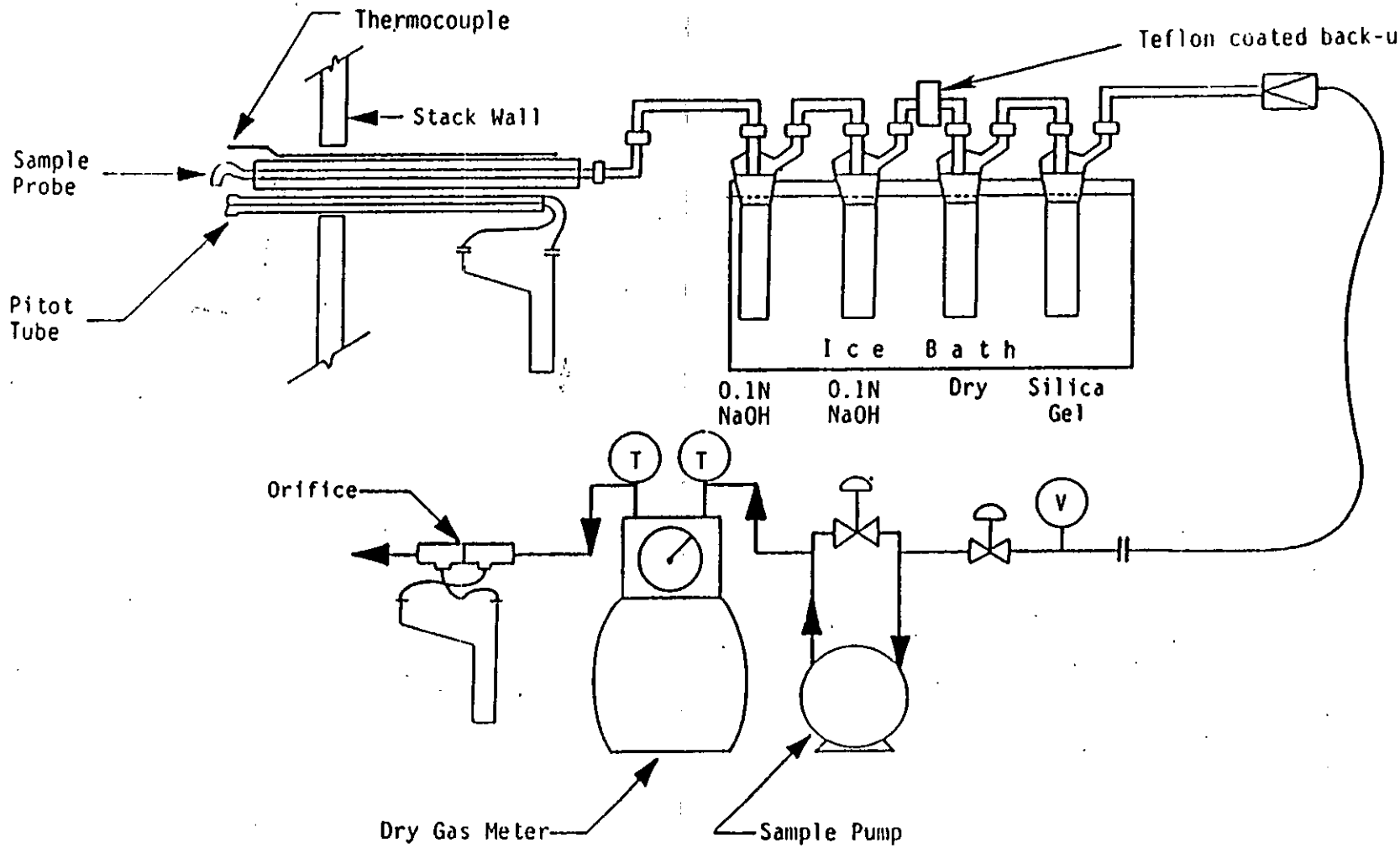
Additionally, Carnot's QA Officer is actively participating on a Source Evaluation Society committee to develop a nationwide accreditation program for source testers.

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 the 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 (checked 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 on use, frequency, and performance	As specified by manufacturers operating manuals, EPA NBS gases, and/ or ref. methods	Satisfy all limits specified in operating specifications



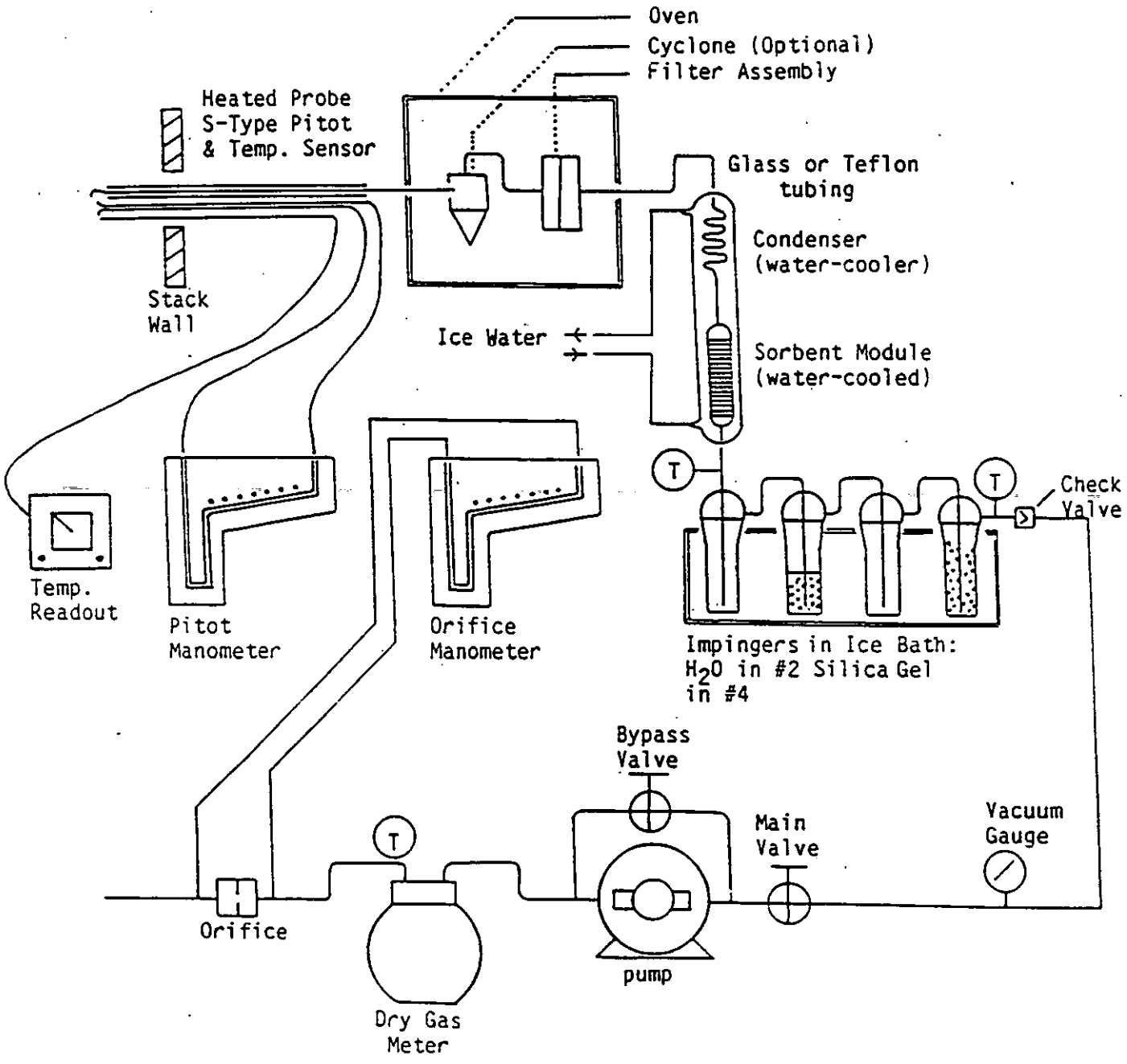
Sample Train for Determination of Metals by EPA Multimetals Method

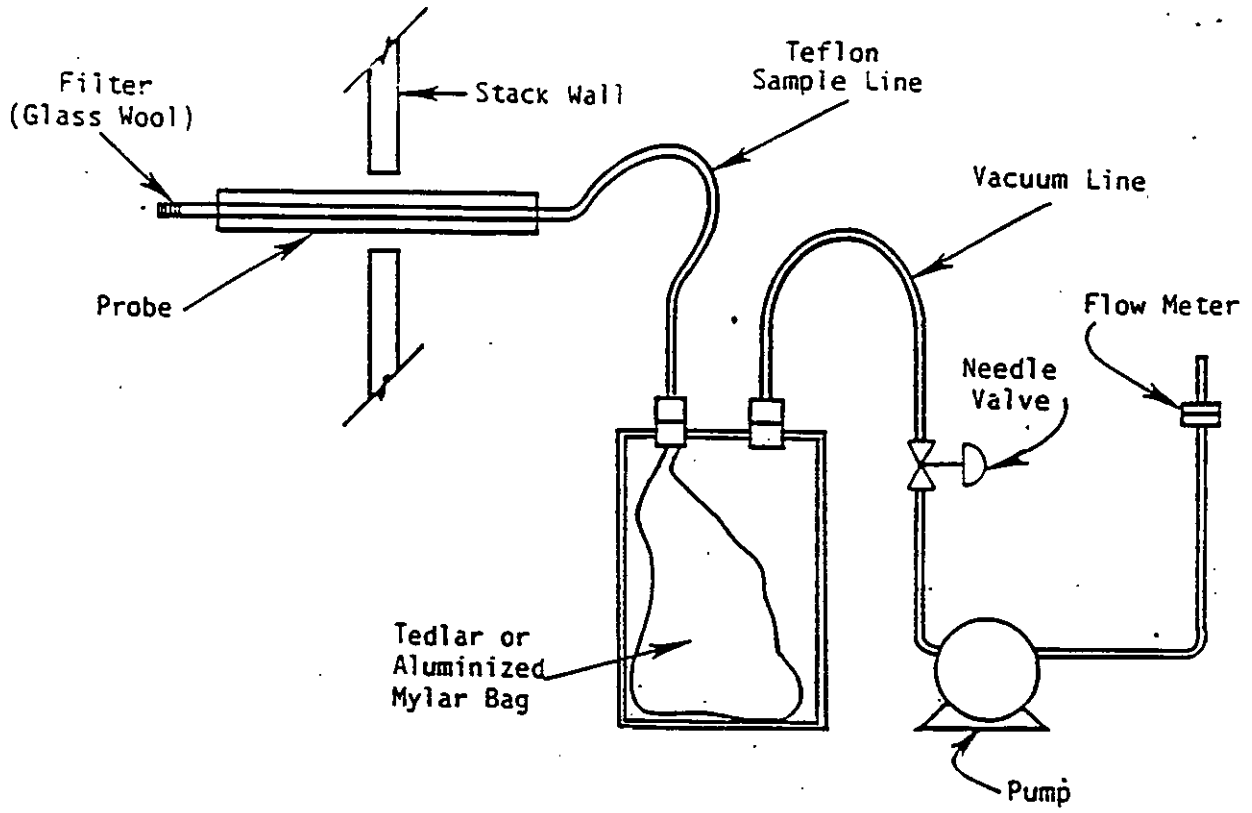


Sample Train for Determination of Total and Hexavalent Chromium by Wet Impingement Method CARB Method 425

Method:	Formaldehyde by HPLC
Reference:	CARB Method 430
Principle:	A metered gas sample is collected non-isokinetically in acidic 2,4-dinitrophenylhydrazine (DNPH) solution. Formaldehyde reacts with DNPH to form the 2,4-dinitrophenylhydrazone derivative. The concentration of this formaldehyde derivative is determined by reverse phase HPLC with an ultraviolet absorption detector.
Sampling Procedure:	A dry metered gas sample is collected through teflon tubing into an iced midget impinger train containing 20 ml of aqueous acidic DNPH solution. Samples are recovered with DNPH solution into precleaned glass bottles, refrigerated and analyzed within 7 days.
Analytical Procedure:	The concentration of the resulting formaldehyde derivative is quantitated after organic solvent extraction using reverse phase HPLC with an ultraviolet absorption detector. Formaldehyde in the sample is identified and quantitated by comparison of peak retention times and peak areas with those of standard solutions.

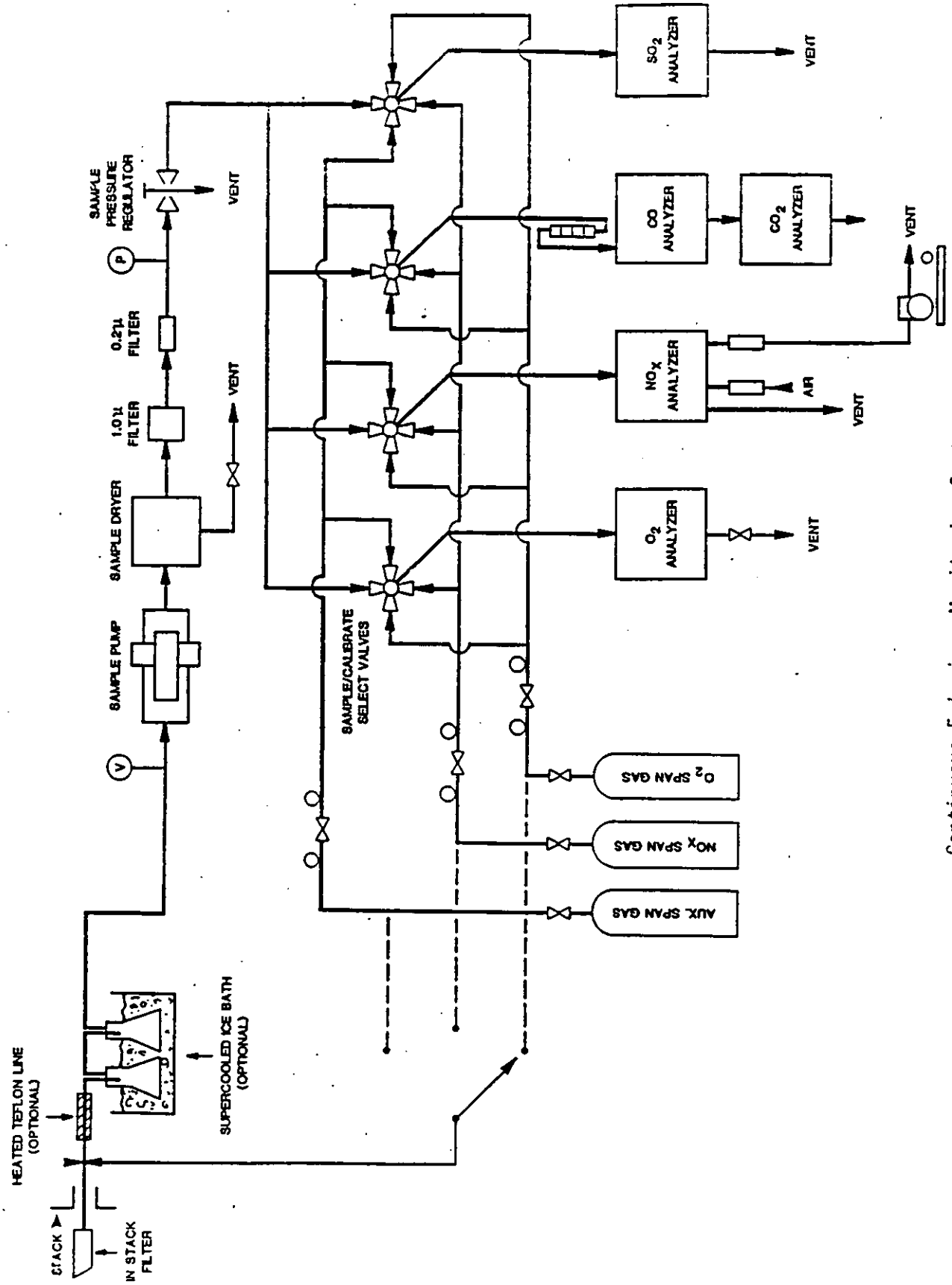
Semi-VOST Sampling Train





Sample Train for Determination of Volatile Organic Compounds (VOC) by EPA 601/602

Method:	Carbon Dioxide (CO_2) by Continuous Analyzer
Applicable Ref. Methods:	EPA 3A, ARB 100, BA ST-5
Principle:	A sample is continuousiy 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:	Nondispersive 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 pathlength nondispersive 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%.



Continuous Emissions Monitoring System

ES-28

ANDERSEN Samplers INC.

4801 FULTON IND. BLVD., ATLANTA, GA 30336

CONTROL UNIT CALIBRATION

Date 8-16-89 Unit Number 889-425

Barometric pressure, P_b = 29.27 in Hg. Model Number 90-800

Orifice manometer setting, ΔH in. H_2O	Gas volume, wet test meter V_w, ft^3	Gas volume, dry gas meter V_d, ft^3	Temperature: Wet test Meter t_w, °R	Temperature: Dry gas meter Inlet t_{di}, °R	Temperature: Dry gas meter Outlet t_{do}, °R	Temperature: Dry gas meter Average t_d, °R	Time θ, min	Y	ΔH@
1.0	5	5,182	77/537	113	82/542	97.5/557.5	8.85	1.00	1.81
2.0	5	5,187	77/537	120	83/543	101.5/561.5	6.35	1.00	1.86
4.0	5	5,175	77/537	124	85/545	109.6/564.5	4.55	1.01	1.90
								1.00	1.86

Calculations

ΔH	$\frac{\Delta H}{13.6}$	Y: $\frac{V_w P_b \left(t_d \right)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)\left(t_w \right)}$	ΔH@: $\frac{0.0317\ \Delta H}{P_b \left(t_{do} \right)} \left[\frac{\left(t_w \right) \theta}{V_w}\right]^2$
1.0	0.0735		
2.0	0.147		
4.0	0.294		

Y = Ratio of accuracy of wet test meter to dry test meter. Tolerance : ± 0.01

ΔH@ = Orifice pressure differential that gives 0.75 cfm of air at 70°F and 29.92 inches of mercury, in. H_2O. Tolerance : ± 0.15

Appendix B.3

CEM Performance Data

SPAN GAS RECORD

Date 02-27-90

Client/Location P.G.&E. Morro Bay

By VR

Gas	Span Cylinder		Aux. Span Cylinder	
	Cylinder No.	Concentration	Cylinder No.	Concentration
Zero	ALM - ~~2271~~ 7351			
NOx	ALM-7351	229.8		
O2	ALM-008830	4.95%	Batch # 53-4	7.967
CO	Batch # 53-4 Oxygen source for	85.2 ppm		
CO2	~~ALM~~ Batch # 53-4	22.522 %	ALM 008830	14.924
SO2				

INSTRUMENT LINEARITY

	Analyzer				
	O2	CO2	CO	NOx	SO2
Analyzer Range	0-10%	0-25%	0-100	0-25	—
Set to High STD (80-90% of Range)					
As-Found Low STD (50-60% of Range)					
Actual Value of Low STD					
Difference in % of Full Scale					

Allowable deviation is 2% of full scale (2 squares on strip chart).

APPENDIX C

DATA SHEETS, LABORATORY REPORTS, AND SPECIFIC EMISSION CALCULATIONS

Appendix C.1

Sample Location

SAMPLING POINT LOCATION DATA EPA Method 1

Plant PG&E, Morro Bay

Date 03-01-90

Test Location Inlet to stack

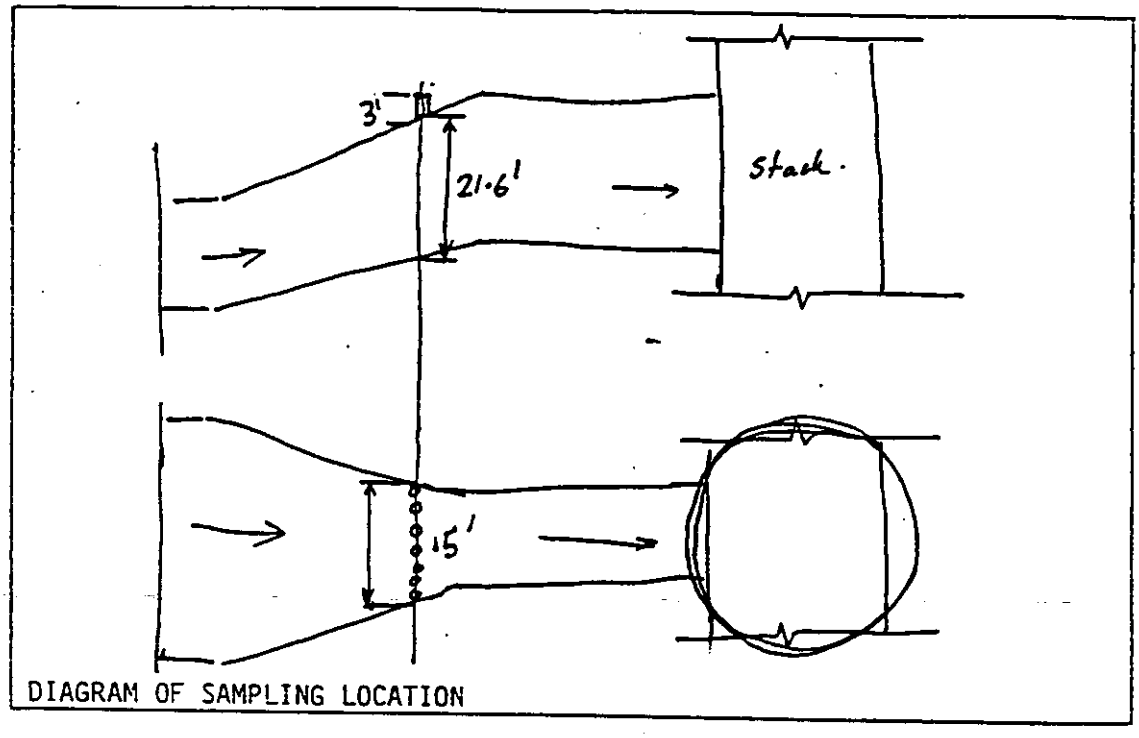


DIAGRAM OF SAMPLING LOCATION

Upstream Dist./Dia. _____

Downstream Dist./Dia. _____

No. of Sampling Pts. _____

Stack Dimension _____

Stack Area, ft^2 _____

Sample Point	% of Diameter	Inches from near wall
1		32 1/2
2		97 1/8
3		162
4		226 3/4

Appendix C.2

Unit 3 Operating Data

EJA

PROCESS DATA

Client P. G. & E, Morro Bay Date 03-01-90 02-27-90

~~Location~~ Test # 1 Data by VR

Test No.	1	2	3	Meter #	Pen Color	4
Date	03-01-90	03/1	3/2			3/2
Time	13:59	1908	1021			1530
Load, MW	340.0	342	340			340
O_2, % 1-3	1.70	1.84	3.04			2.97
2-3	1.61	1.56	2.42			2.54
3-3	1.99	1.92	1.65			1.61
4-3	1.74	1.73	1.39			1.36
Total Fuel Flow, MBtu/hr	3108 3.1	3.1	3.1	312	Red	3.1
Gas Flow, MBtu/hr	0	0	0	312	Green	0
Oil Flow MBtu/hr	3.35	3.35	3.35	312	Purple	3.35
Air Flow, M lb/hr	~~285~~	2.5/2.9	005	311	Blue	005
Steam Flow, M lb/hr	2.25	2.25	2.20	311	Red	2.20
O_2 % "	2.0	2.0	2.1	307	Green	21
E.O. Heater Disch, °F	145	175	175	306	Purple	177
E.O. Heater Suc, °F	131	240	225	306	Red	125
Feed Water Flow, M lb/hr	2.25	2.25	2.20	305	Red	2.15
Reheater out E, °F	1000		1000	304	Red	
Reheater out W, °F	>1200 ??		1200	304	Blue	
Reheater in E, °F	1052		650	304	Green	
Reheater W, °F	1052		650	304	Purple	
Final Steam out E, °F	1045		1050	303	Red	
Final Steam out W, °F	1050		1050	303	Blue	
Final Steam in E, °F	1000	S.A.T.	990	303	Green	
Final Steam in W, °F	1012		990	303	Purple	
E Sec. Superheat out, °F	1000			302	Red	
W Sec. Superheat out, °F	1000			302	Blue	

Comments/Notes

EJA

PROCESS DATA

Client P.G. & E Morro Bay Date 03-01-90

Location Test #1 Data by VR

	Test No.	1	2	3	Meter #	Pen Color	4
	Date						
	Time						
E	Sec. Superheater IN, °F	750	750		302	Green	
W	Sec Superheater IN, °F	770	770		302	Purple	
	APH Air IN, W, °F	77	77	76	309	# 7	77
	APH Air IN E, °F	76	76	76	309	# 8	76
	APH Air OUT, W, °F	568	573	574	309	# 9	571
	APH Air OUT, E, °F	578	578	585	309	# 10	581
	APH Gas IN W, °F	712	713	718	309	# 11	717
	APH Gas IN E, °F	712	709	723	309	# 12	717
	APH Gas OUT W, °F	267	266	270	309	# 13	267
	APH Gas OUT E, °F	—	005	005	309	# 14	005
	Fuel Oil Ret. Diff., psig	190	190	190	PDI 2		198
	F. Oil Supply, lb/hr	180	180	180	FI 10		180
	F Oil Pump Suction, psig	14	14	14	PI 48		14
	F Oil Burner Return, psig	8	9	8	PI 122		8
	F Oil Burner Supply, psig	12	11	11	PI 24		11
	Gas Supply HDR, psig	100	100	100	PI 30		106
	Burner HDR, psig	0	0	0	PI 6		0
	Burner/Furnace Diff., iwg	0	0	0	PDI 16		0
	Fan Discharge W, iwg	23	23	23	PI 103		23
	Fan Discharge E, iwg.	23	25	25	PI 104		25
	W.B. Front, iwg	19	19	19	PI 37		19
	WB/Furnace Diff, iwg	3.2	3.2	3.0	PDI 17		3.1
	Furnace Pres iwg.	16.5	16.5	17	PI 26		17
	F.G. to APH W,	3.5	3.5	3.5	PI 45		3.5
	F.G. to APH E,	0	0	\	PI 47		0

Comments/Notes

ESA DS-002

EJA

PROCESS DATA

Client P.G. & E Morro Bay Unit 3 Date

Location Data by

Test No.	5	6	7	Meter #	Pen Color	8
Date						
Time						
E Sec. Superheater IN °F		SALT	760	302	Green	760
W Sec Superheater IN, °F		SALT	760	302	Purple	760
APH Air IN. W, °F	75	75	77	409	# 7	78
APH Air IN E, °F	75	75	75	409	# 8	77
APH Air OUT, W, °F	575	570	572	409	# 9	572
APH Air OUT, E, °F	581	578	579	409	# 10	577
APH Gas IN W, °F	715	711	710	409	# 11	708
APH Gas IN E, °F	710	709	714	409	# 12	711
APH Gas OUT W, °F	265	265	268	409	# 13	268
APH Gas OUT E, °F	005	005	005	409	# 14	605
Fuel Oil Ret. Diff., psig	190	190	190	PDI 2		196
F. Oil Supply lb/hr	180	180	180	FI 10		180
F Oil Pump Suction, psig	12	12	12	PI 48		12
F Oil Burner Return, psig	8	8	8	PI 122		0
F Oil Burner Supply, psig	11	11	10.5	PI 24		12.5
Gas Supply HDR, psig	100	100	100	PI 30		100
Burner HDR, psig	0	0	0	PI 6		0
Burner/Furnac. Diff., iwg	0	0	0	PDI 16		0
Fan Discharge W, iwg	23	23	22	PI 103		22
Fan Discharge E, iwg.	25	25	23	PI 104		24
W.B. Front, iwg	19	19	18	PI 37		18
WB/Furance Diff, iwg	3	3	3	PDI 17		3
Furnace Pres iwg.	16.5	16.5	15.5	PI 26		15.5
F.G. to APH W,	3.5	3.5	3.5	PI 45		3.5
FG to APH E,	0	0	0	PI 47		0

Comments/Notes

ESA DS-002

EJA

PROCESS DATA

Client P.G. & E. Morro Bay Unit 3 Date 02-27-90

Location _____ Data by _____

Test No.	9	10		Heter #	Pen Color	
Date	3/5	3/6				
Time	1000	906				
Load, MW	345	342				
O_2, % 1-3	3.57	1.63				
2-3	3.16	005				
3-3	1.98	-11				
4-3	1.85	0.47				
Total Fuel Flow, MBtu/hr	3.1	2.95		312	Red	
Gas Flow, MBtu/hr	6	2.95		312	Green	
Oil Flow MBtu/hr	3.0	0		312	Purple	
Air Flow, Mlb/hr	3.3	3.0		311		
Steam Flow, Mlb/hr	2.22	2.20		311	Red	
O_2 % ,C	2.2	2.0		307	Green	
E.O. Heater Disch, °F	175	—		306	Purple	
E.O. Heater Suc, °F	256	—		306	Red	
Feedwater Flow, Mlb/hr	2.2	2.15		305	Red	
Reheater out E, °F	995	016		304	Red	
Reheater out W, °F	1050	1010		304	Blue	
Reheater in E, °F	659	~~1000~~600		304	Green	
Reheater W, °F	7800	7800		304	Purple	
Final Steam out E, °F	1045	1050		303	Red	
Final Steam out W, °F	1050	1036		303	Blue	
Final Steam in E, °F	978	1006		303	Green	
Final Steam in W, °F	1010	1000		303	Purple	
E Sec. Superheat. out, °F	1000	1000		302	Red	
W Sec. Superheat out, °F	1000	1001		302	Blue	

Comments/Notes _____

ESA DS-002

EJA

PROCESS DATA

Client P.G.& E, Morro Bay Date

Location Data by

Test No.	9	10			Meter #	Pen Color
Date						
Time						
Superheater out. Pr.	2405	2430			PI 53	
No.3 FD Fan W, Amps	255	230				
No.3 FD Fan E, Amps	250	230				
Emissions Console						
NOx ppm	345	245				
No ppm	240	190				
CO_2 %	9.5	7.5				
Gas Flow MCFHW	0	5171.8				
Oil Flow		0				
LTA	7-12	.5				
Oil Flow Meter	Start→	976775		Stop→	902	
	Stop.→	983528			1203	

Comments/Notes

Appendix C3

CEM Data and Strip Charts

Energy Systems Associates A CORPORATION
15991 RED HILL AVE., SUITE 110, TUSTIN, CALIFORNIA 92680

SUBJECT Morro Bay Unit 3 Air Toxics Test — JOB NO. ____
O_2 & CO_2 measurements by CEM

SHEET NO. ____ of ____

COMPUTED BY K. Hopkins DATE 3/27 CHECKED BY ____ DATE ____

Test No.	O_2, %*	CO_2, %+
2-Cr	4.04	12.75
3-Mtls	4.02	11.85
3-Cd	4.02	11.85
4-Mtls	4.65	12.11
4-Cd	4.65	12.11
5-Cr	4.60	12.22
6-Mtls	4.70	11.85
6-Cd	4.70	11.85
7-Cr	4.51	12.19
7-PAH	4.44	12.24
8-Cr	4.50	12.25
8-PAH	4.33	12.33
9-PAH	5.63	11.17
10-Vel	4.60	9.38
8-PAH	4.33	12.33

* O_2 from strip charts

+ CO_2 from computer log

16:20:32	0.000	0.000	0.000	0.000	12.777		1
16:25:31	0.000	0.000	0.000	0.000	12.749		1
16:30:31	0.000	0.000	0.000	0.000	12.718		1
16:35:31	0.000	0.000	0.000	0.000	12.719		1
16:40:31	0.000	0.000	0.000	0.000	12.735		1
16:45:31	0.000	0.000	0.000	0.000	12.768		1
16:50:30	0.000	0.000	0.000	0.000	12.698		1
16:55:30	0.000	0.000	0.000	0.000	12.722		1
17: 0:30	0.000	0.000	0.000	0.000	12.681		1
17: 5:30	0.000	0.000	0.000	0.000	12.745		1
17:10:29	0.000	0.000	0.000	0.000	12.725		1
17:15:29	0.000	0.000	0.000	0.000	12.702		1
17:20:29	0.000	0.000	0.000	0.000	12.715		1
17:25:29	0.000	0.000	0.000	0.000	12.681		1
17:30:28	0.000	0.000	0.000	0.000	12.765		1
17:35:28	0.000	0.000	0.000	0.000	12.817		1
17:40:28	0.000	0.000	0.000	0.000	12.785		1
17:45:28	0.000	0.000	0.000	0.000	12.765		1
17:50:28	0.000	0.000	0.000	0.000	12.742		1
17:55:27	0.000	0.000	0.000	0.000	12.781		1
18: 0:27	0.000	0.000	0.000	0.000	12.732		1
18: 5:27	0.000	0.000	0.000	0.000	12.733		1
18:10:27	0.000	0.000	0.000	0.000	12.709		1
18:15:26	0.000	0.000	0.000	0.000	12.747		1
18:20:26	0.000	0.000	0.000	0.000	12.769		1
18:25:26	0.000	0.000	0.000	0.000	12.735	2-Cr	1
18:30:26	0.000	0.000	0.000	0.000	12.753		1
18:35:26	0.000	0.000	0.000	0.000	12.756		1
18:40:25	0.000	0.000	0.000	0.000	12.751		1
18:45:25	0.000	0.000	0.000	0.000	12.780		1
18:50:25	0.000	0.000	0.000	0.000	12.772		1
18:55:25	0.000	0.000	0.000	0.000	12.760		1
19: 0:24	0.000	0.000	0.000	0.000	12.730		1
19: 5:24	0.000	0.000	0.000	0.000	12.773		1
19:10:24	0.000	0.000	0.000	0.000	12.782		1
19:15:24	0.000	0.000	0.000	0.000	12.733		1
19:20:23	0.000	0.000	0.000	0.000	12.726	CO_2 = 12.75%	1
19:25:23	0.000	0.000	0.000	0.000	12.711		1
19:30:23	0.000	0.000	0.000	0.000	12.779		1
19:35:23	0.000	0.000	0.000	0.000	12.757		1
19:40:23	0.000	0.000	0.000	0.000	12.724		1
19:45:22	0.000	0.000	0.000	0.000	12.709		1
19:50:22	0.000	0.000	0.000	0.000	12.754		1
19:55:22	0.000	0.000	0.000	0.000	12.796		1
20: 0:22	0.000	0.000	0.000	0.000	7.297		1
20: 5:21	0.000	0.000	0.000	0.000	11.097		1
20:10:21	0.000	0.000	0.000	0.000	11.234		1
20:15:21	0.000	0.000	0.000	0.000	11.716		1
20:20:21	0.000	0.000	0.000	0.000	12.140		1
20:25:21	0.000	0.000	0.000	0.000	12.626		1
20:30:20	0.000	0.000	0.000	0.000	5.132		1
20:35:20	0.000	0.000	0.000	0.000	0.268		1
20:40:20	0.000	0.000	0.000	0.000	0.410		1

14: 4:47	0.000	0.000	0.000	0.000	12.523		1
14: 9:46	0.000	0.000	0.000	0.000	12.597		1
14:14:46	0.000	0.000	0.000	0.000	1.426		1
14:19:46	0.000	0.000	0.000	0.000	0.031		1
14:24:46	0.000	0.000	0.000	0.000	0.022		3
14:29:46	0.000	0.000	0.000	0.000	12.012		2
14:34:45	0.000	0.000	0.000	0.000	0.031		2
14:39:45	0.000	0.000	0.000	0.000	0.027		2
14:44:45	0.000	0.000	0.000	0.000	0.023		2
14:49:45	0.000	0.000	0.000	0.000	0.028		2
14:54:44	0.000	0.000	0.000	0.000	0.029		2
14:59:44	0.000	0.000	0.000	0.000	0.024	4-MHz	2
15: 4:44	0.000	0.000	0.000	0.000	0.025	4-Cφ	2
15: 9:44	0.000	0.000	0.000	0.000	0.033		2
15:14:44	0.000	0.000	0.000	0.000	0.017		2
15:19:43	0.000	0.000	0.000	0.000	0.024		2
15:24:43	0.000	0.000	0.000	0.000	0.023		2
15:29:43	0.000	0.000	0.000	0.000	5.438		2
15:34:43	0.000	0.000	0.000	0.000	12.212		2
15:39:42	0.000	0.000	0.000	0.000	12.234		2
15:44:42	0.000	0.000	0.000	0.000	12.225		2
15:49:42	0.000	0.000	0.000	0.000	12.262		2
15:54:42	0.000	0.000	0.000	0.000	12.227	CO_2 = 12.1%	2
15:59:42	0.000	0.000	0.000	0.000	12.240		2
16: 4:41	0.000	0.000	0.000	0.000	12.028		2
16: 9:41	0.000	0.000	0.000	0.000	12.003		2
16:14:41	0.000	0.000	0.000	0.000	12.020		2
16:19:41	0.000	0.000	0.000	0.000	8.135		2
16:24:40	0.000	0.000	0.000	0.000	11.975		2
16:29:40	0.000	0.000	0.000	0.000	11.976		2
16:34:40	0.000	0.000	0.000	0.000	11.954		2
16:39:40	0.000	0.000	0.000	0.000	12.032		2
16:44:39	0.000	0.000	0.000	0.000	11.994		2
16:49:39	0.000	0.000	0.000	0.000	11.952		2
16:54:39	0.000	0.000	0.000	0.000	11.944		2
16:59:39	0.000	0.000	0.000	0.000	12.002		2
17: 4:39	0.000	0.000	0.000	0.000	12.011		2
17: 9:38	0.000	0.000	0.000	0.000	11.966		2
17:14:38	0.000	0.000	0.000	0.000	11.864		2
17:19:38	0.000	0.000	0.000	0.000	11.950		2
17:24:38	0.000	0.000	0.000	0.000	11.916		2
17:29:37	0.000	0.000	0.000	0.000	11.977		2
17:34:37	0.000	0.000	0.000	0.000	11.899		2
17:39:37	0.000	0.000	0.000	0.000	11.882		2
17:44:37	0.000	0.000	0.000	0.000	11.896		2
17:49:37	0.000	0.000	0.000	0.000	11.900		2
17:54:36	0.000	0.000	0.000	0.000	11.887		2
17:59:36	0.000	0.000	0.000	0.000	11.858		2
18: 4:36	0.000	0.000	0.000	0.000	2.719		2
18: 9:36	0.000	0.000	0.000	0.000	0.045		2
18:14:35	0.000	0.000	0.000	0.000	0.054		2
18:19:35	0.000	0.000	0.000	0.000	0.059		2

12:18:45	0.000	0.000	0.000	0.000	11.769	2
12:23:45	0.000	0.000	0.000	0.000	11.757	2
12:28:45	0.000	0.000	0.000	0.000	11.792	2
12:33:44	0.000	0.000	0.000	0.000	10.884	2
12:38:44	0.000	0.000	0.000	0.000	12.699	2
12:43:44	0.000	0.000	0.000	0.000	12.677	2
12:48:44	0.000	0.000	0.000	0.000	12.704	2
12:53:43	0.000	0.000	0.000	0.000	12.695	2
12:58:43	0.000	0.000	0.000	0.000	12.681	2
13: 3:43	0.000	0.000	0.000	0.000	12.718	2
13: 8:43	0.000	0.000	0.000	0.000	12.663	2
13:13:43	0.000	0.000	0.000	0.000	12.685	2
13:18:42	0.000	0.000	0.000	0.000	12.672	2
13:23:42	0.000	0.000	0.000	0.000	12.614	2
13:28:42	0.000	0.000	0.000	0.000	12.653	2
13:33:42	0.000	0.000	0.000	0.000	12.638	2
13:38:41	0.000	0.000	0.000	0.000	12.590	2
13:43:41	0.000	0.000	0.000	0.000	12.635	2
13:48:41	0.000	0.000	0.000	0.000	12.626	2
13:53:41	0.000	0.000	0.000	0.000	12.639	2
13:58:40	0.000	0.000	0.000	0.000	12.648	2
14: 3:40	0.000	0.000	0.000	0.000	12.628	2
14: 8:40	0.000	0.000	0.000	0.000	12.602	2
14:13:40	0.000	0.000	0.000	0.000	12.645	2
14:18:40	0.000	0.000	0.000	0.000	12.579	2
14:23:39	0.000	0.000	0.000	0.000	12.615	2
14:28:39	0.000	0.000	0.000	0.000	12.629	2
14:33:39	0.000	0.000	0.000	0.000	12.606	2
14:38:39	0.000	0.000	0.000	0.000	12.619	2
14:43:38	0.000	0.000	0.000	0.000	12.614	2
14:48:38	0.000	0.000	0.000	0.000	12.637	2
14:53:38	0.000	0.000	0.000	0.000	12.641	2
14:58:38	0.000	0.000	0.000	0.000	12.648	2
15: 3:38	0.000	0.000	0.000	0.000	12.667	2
15: 8:37	0.000	0.000	0.000	0.000	12.646	2
15:13:37	0.000	0.000	0.000	0.000	12.631	2
15:18:37	0.000	0.000	0.000	0.000	12.634	2
15:23:37	0.000	0.000	0.000	0.000	12.613	2
15:28:36	0.000	0.000	0.000	0.000	12.687	2
15:33:36	0.000	0.000	0.000	0.000	12.624	2
15:38:36	0.000	0.000	0.000	0.000	12.612	2
15:43:36	0.000	0.000	0.000	0.000	12.610	2
15:48:36	0.000	0.000	0.000	0.000	12.651	2
15:53:35	0.000	0.000	0.000	0.000	12.659	2
15:58:35	0.000	0.000	0.000	0.000	12.658	2
16: 3:35	0.000	0.000	0.000	0.000	12.659	2
16: 8:35	0.000	0.000	0.000	0.000	12.622	2
16:13:34	0.000	0.000	0.000	0.000	5.519 → root change	2
16:18:34	0.000	0.000	0.000	0.000	11.783	2
16:23:34	0.000	0.000	0.000	0.000	11.809	2
16:28:34	0.000	0.000	0.000	0.000	11.613	2
16:33:33	0.000	0.000	0.000	0.000	11.644	6-MHS 2
16:38:33	0.000	0.000	0.000	0.000	11.593	6-Cd 2
16:43:33	0.000	0.000	0.000	0.000	11.612	2
16:48:33	0.000	0.000	0.000	0.000	11.586	2
16:53:33	0.000	0.000	0.000	0.000	11.551	2
16:58:32	0.000	0.000	0.000	0.000	11.558	2
17: 3:32	0.000	0.000	0.000	0.000	11.571	2
17: 8:32	0.000	0.000	0.000	0.000	11.601	2
17:13:32	0.000	0.000	0.000	0.000	11.593	2
17:18:31	0.000	0.000	0.000	0.000	11.557	2
17:23:31	0.000	0.000	0.000	0.000	11.579	2
17:28:31	0.000	0.000	0.000	0.000	11.584	2
17:33:31	0.000	0.000	0.000	0.000	11.308	2
17:38:31	0.000	0.000	0.000	0.000	11.303	2
17:43:30	0.000	0.000	0.000	0.000	11.353	2

TSA Monitor Data File

File name : moro0304
Date : 3- 4-1990
Start Time : 9: 3: 6
Sample Interval : 300 sec

O2 range : 10
NOx range : 250
CO range : 100
SO2 range : 500
CO2 range : 25

TIME	O2	NOx	CO	SO2	CO2		MODE
9: 8: 8	0.000	0.000	0.000	0.000	11.742		1
9:13: 8	0.000	0.000	0.000	0.000	11.609		1
9:18: 7	0.000	0.000	0.000	0.000	11.864		1
9:23: 7	0.000	0.000	0.000	0.000	11.889		1
9:28: 7	0.000	0.000	0.000	0.000	11.797		1
9:33: 7	0.000	0.000	0.000	0.000	11.704		1
9:38: 6	0.000	0.000	0.000	0.000	11.709		1
9:43: 6	0.000	0.000	0.000	0.000	11.788		1
9:48: 6	0.000	0.000	0.000	0.000	11.759		1
9:53: 6	0.000	0.000	0.000	0.000	11.805		1
9:58: 6	0.000	0.000	0.000	0.000	11.799		1
10: 3: 5	0.000	0.000	0.000	0.000	11.732		1
10: 8: 5	0.000	0.000	0.000	0.000	11.318		1
10:13: 5	0.000	0.000	0.000	0.000	12.367	7-Cr	1
10:18: 5	0.000	0.000	0.000	0.000	12.416		1
10:23: 4	0.000	0.000	0.000	0.000	12.437		1
10:28: 4	0.000	0.000	0.000	0.000	12.427		1
10:33: 4	0.000	0.000	0.000	0.000	12.422		1
10:38: 4	0.000	0.000	0.000	0.000	12.380		1
10:43: 3	0.000	0.000	0.000	0.000	12.356		1
10:48: 3	0.000	0.000	0.000	0.000	12.426		1
10:53: 3	0.000	0.000	0.000	0.000	12.473		1
10:58: 3	0.000	0.000	0.000	0.000	12.376		1
11: 3: 3	0.000	0.000	0.000	0.000	12.338		1
11: 8: 2	0.000	0.000	0.000	0.000	12.363		1
11:13: 2	0.000	0.000	0.000	0.000	12.393	12.19%	1
11:18: 2	0.000	0.000	0.000	0.000	12.422		1
11:23: 2	0.000	0.000	0.000	0.000	12.358		1
11:28: 1	0.000	0.000	0.000	0.000	12.338		1
11:33: 1	0.000	0.000	0.000	0.000	12.365		1
11:38: 1	0.000	0.000	0.000	0.000	11.568		1
11:43: 1	0.000	0.000	0.000	0.000	12.349		1
11:48: 1	0.000	0.000	0.000	0.000	12.215		1
11:53: 0	0.000	0.000	0.000	0.000	12.240		1
11:58: 0	0.000	0.000	0.000	0.000	12.275		1
12: 3: 0	0.000	0.000	0.000	0.000	12.160		1
12: 8: 0	0.000	0.000	0.000	0.000	12.331		1
12:12:59	0.000	0.000	0.000	0.000	12.352		1
12:17:59	0.000	0.000	0.000	0.000	12.287		1
12:22:59	0.000	0.000	0.000	0.000	12.372	7-PAH	1
12:27:59	0.000	0.000	0.000	0.000	12.391		1
12:32:59	0.000	0.000	0.000	0.000	12.352		1
12:37:58	0.000	0.000	0.000	0.000	12.336	CO_2 =	1
12:42:58	0.000	0.000	0.000	0.000	12.339	12.24%	1
12:47:58	0.000	0.000	0.000	0.000	12.359		1
12:52:58	0.000	0.000	0.000	0.000	12.327		1
12:57:57	0.000	0.000	0.000	0.000	12.314		1
13: 2:57	0.000	0.000	0.000	0.000	12.334		1
13: 7:57	0.000	0.000	0.000	0.000	12.318		1
13:12:57	0.000	0.000	0.000	0.000	12.364		1
13:17:56	0.000	0.000	0.000	0.000	12.347		1

TSA Monitor Data File

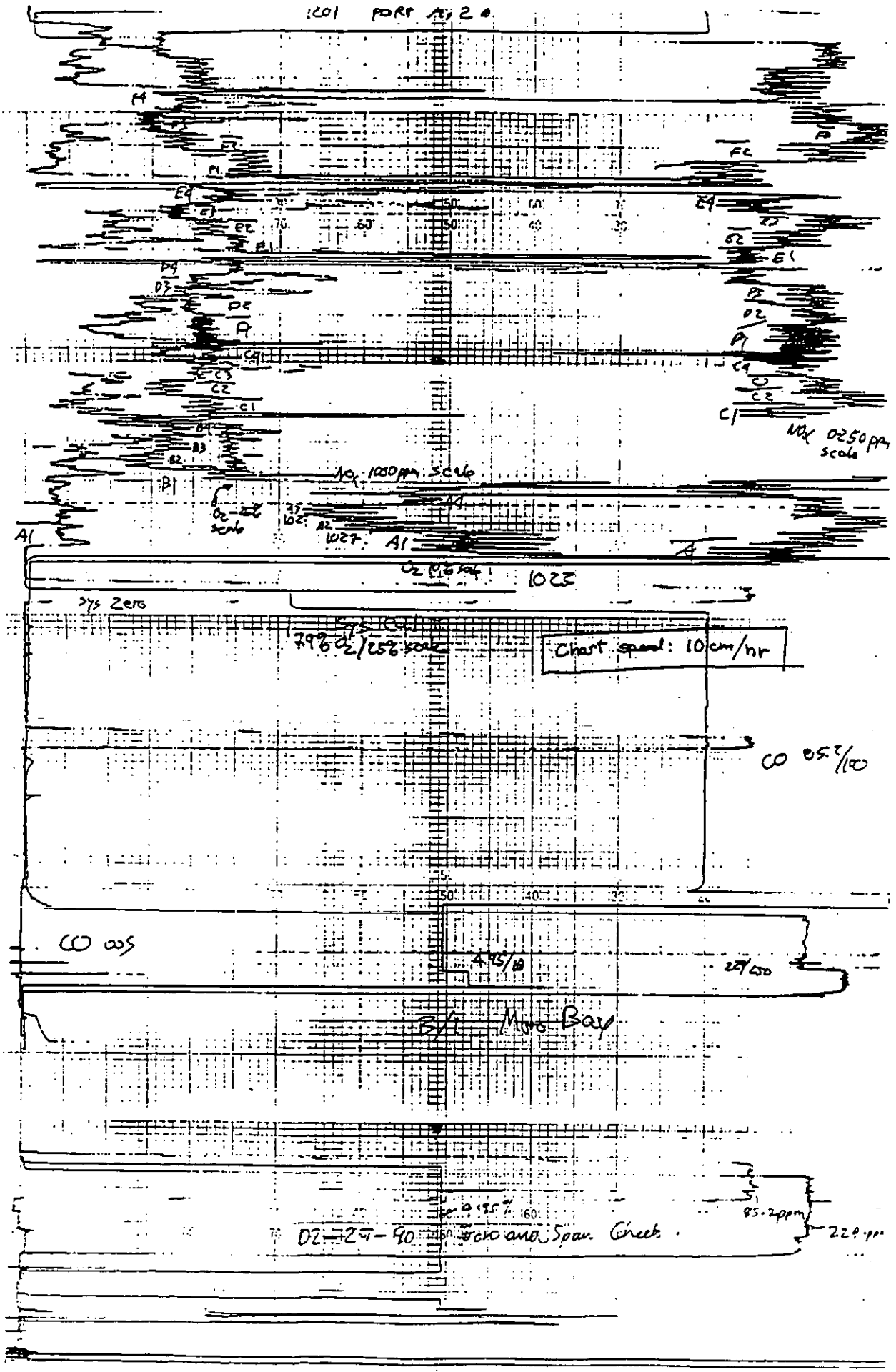
File name : moro0305
Date : 3- 5-1990
Start Time : 8:35:40
Sample Interval : 300 sec

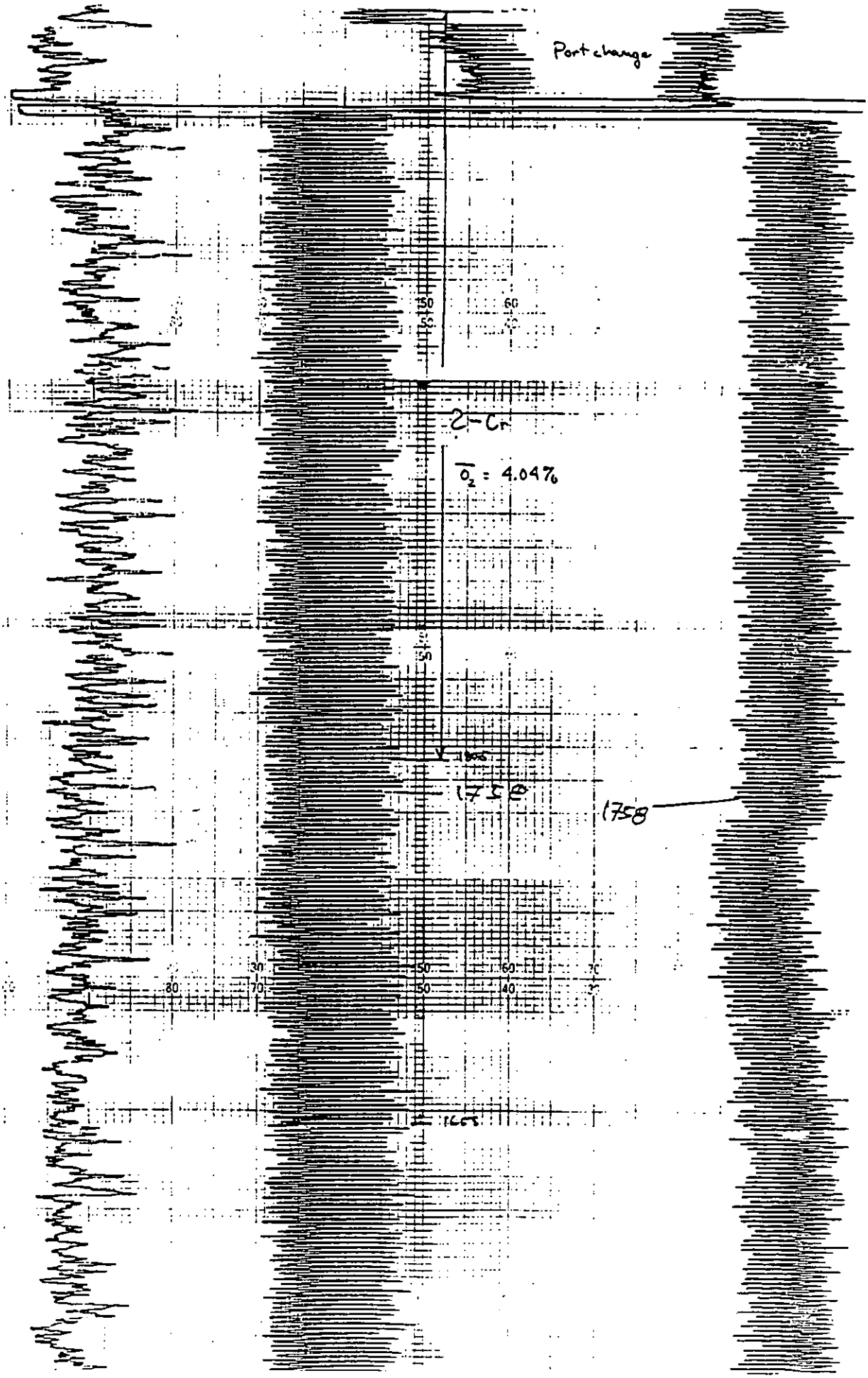
O2 range : 10
NOx range : 1000
CO range : 100
SO2 range : 500
CO2 range : 25

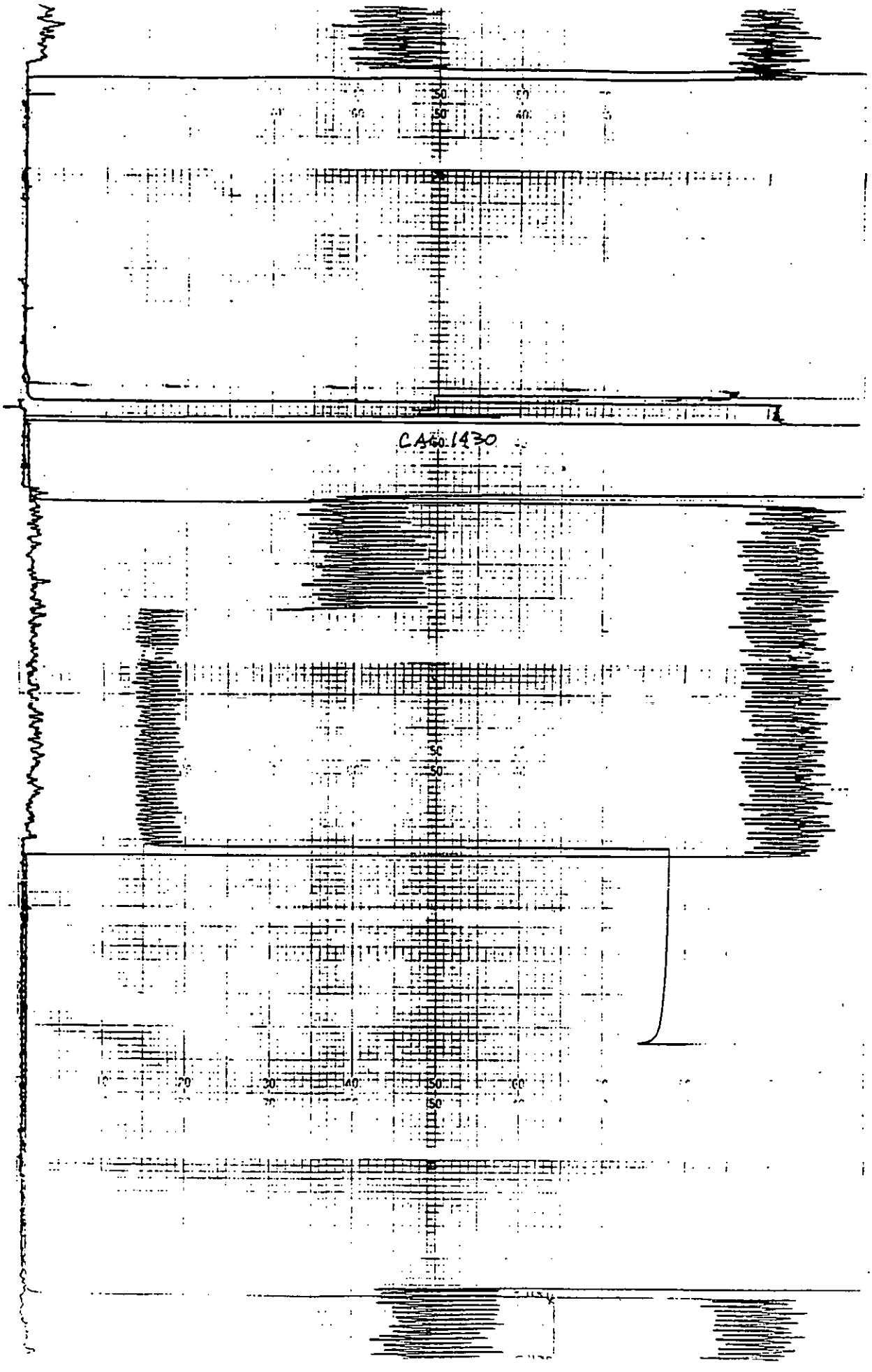
TIME	O2	NOx	CO	SO2	CO2	MODE
8:40:42	0.000	0.000	0.000	0.000	11.618	2
8:45:42	0.000	0.000	0.000	0.000	11.665	2
8:50:42	0.000	0.000	0.000	0.000	11.743	2
8:55:41	0.000	0.000	0.000	0.000	11.670	2
9: 0:41	0.000	0.000	0.000	0.000	11.461	2
9: 5:41	0.000	0.000	0.000	0.000	8.723	2
9:10:41	0.000	0.000	0.000	0.000	8.460	2
9:15:41	0.000	0.000	0.000	0.000	11.276	2
9:20:40	0.000	0.000	0.000	0.000	11.149	2
9:25:40	0.000	0.000	0.000	0.000	11.136	2
9:30:40	0.000	0.000	0.000	0.000	11.099	2
9:35:40	0.000	0.000	0.000	0.000	11.085	2
9:40:39	0.000	0.000	0.000	0.000	11.147	2
9:45:39	0.000	0.000	0.000	0.000	11.139	2
9:50:39	0.000	0.000	0.000	0.000	11.132	2
9:55:39	0.000	0.000	0.000	0.000	11.142	2
10: 0:39	0.000	0.000	0.000	0.000	11.129	2
10: 5:38	0.000	0.000	0.000	0.000	11.127	2
10:10:38	0.000	0.000	0.000	0.000	11.072	2
10:15:38	0.000	0.000	0.000	0.000	11.118	2
10:20:38	0.000	0.000	0.000	0.000	11.130	2
10:25:37	0.000	0.000	0.000	0.000	11.158	2
10:30:37	0.000	0.000	0.000	0.000	11.145	2
10:35:37	0.000	0.000	0.000	0.000	11.121	2
10:40:37	0.000	0.000	0.000	0.000	11.149	2
10:45:37	0.000	0.000	0.000	0.000	11.177	2
10:50:36	0.000	0.000	0.000	0.000	11.124	2
10:55:36	0.000	0.000	0.000	0.000	11.152	2
11: 0:36	0.000	0.000	0.000	0.000	11.141	2
11: 5:36	0.000	0.000	0.000	0.000	11.181	2
11:10:35	0.000	0.000	0.000	0.000	11.197	2
11:15:35	0.000	0.000	0.000	0.000	11.115	2
11:20:35	0.000	0.000	0.000	0.000	11.087	2
11:25:35	0.000	0.000	0.000	0.000	11.106	2
11:30:34	0.000	0.000	0.000	0.000	11.126	2
11:35:34	0.000	0.000	0.000	0.000	11.113	2
11:40:34	0.000	0.000	0.000	0.000	10.928	2
11:45:34	0.000	0.000	0.000	0.000	10.951	2
11:50:34	0.000	0.000	0.000	0.000	10.985	2
11:55:33	0.000	0.000	0.000	0.000	10.998	2
12: 0:33	0.000	0.000	0.000	0.000	11.024	2
12: 5:33	0.000	0.000	0.000	0.000	11.031	2
12:10:33	0.000	0.000	0.000	0.000	11.048	2
12:15:32	0.000	0.000	0.000	0.000	11.112	2

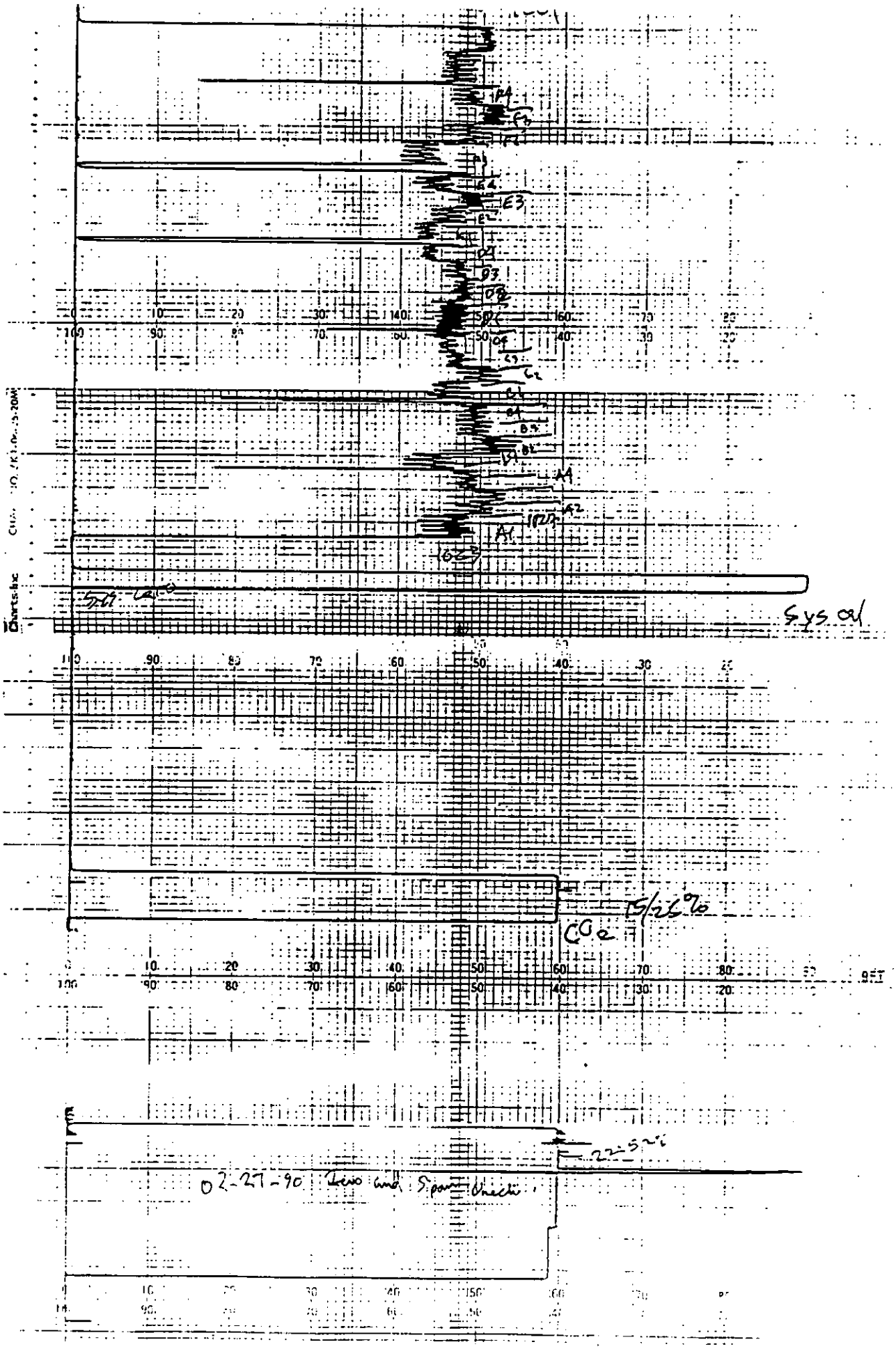
9-PAH

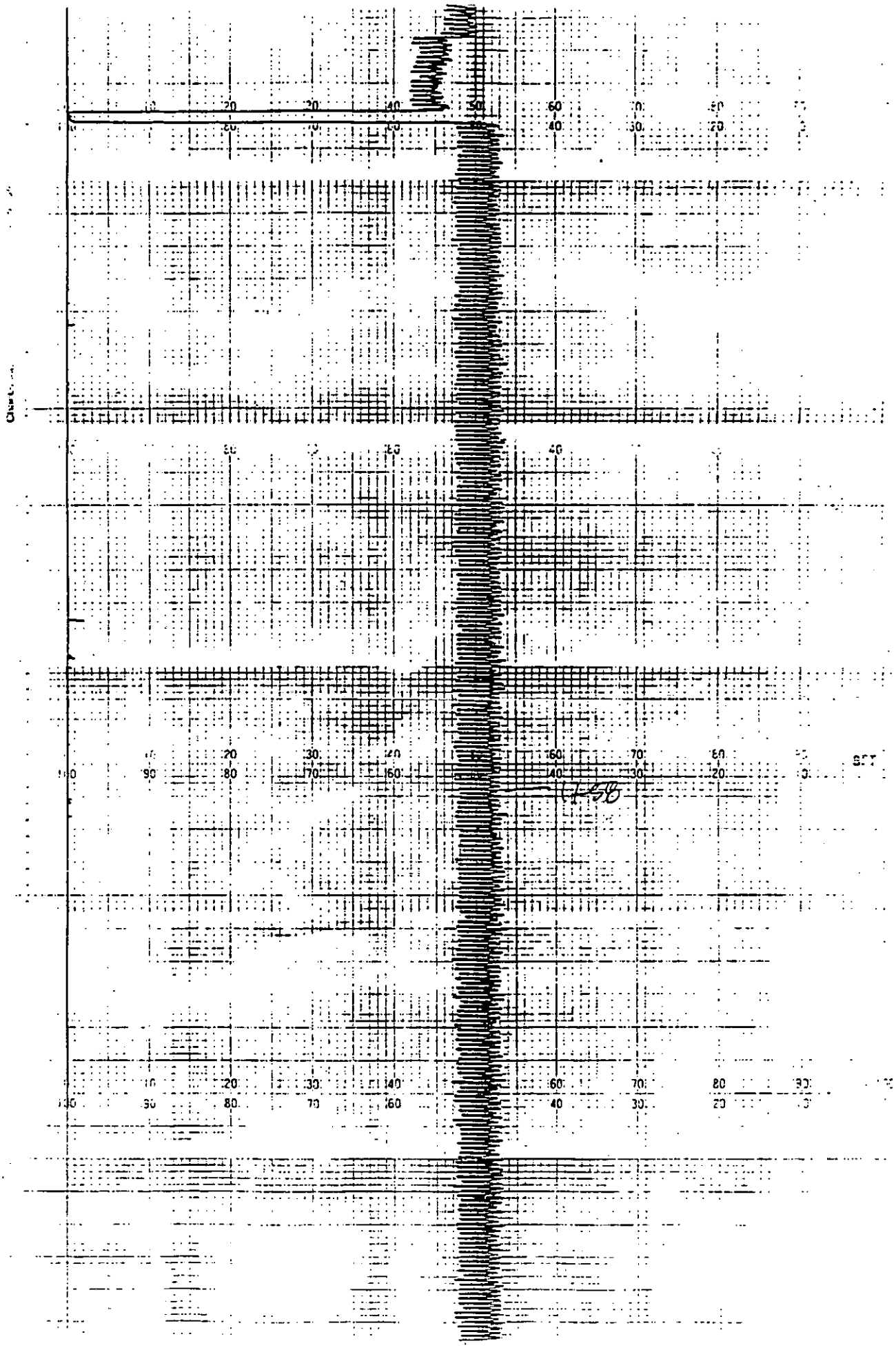
CO_2 = 11.17%

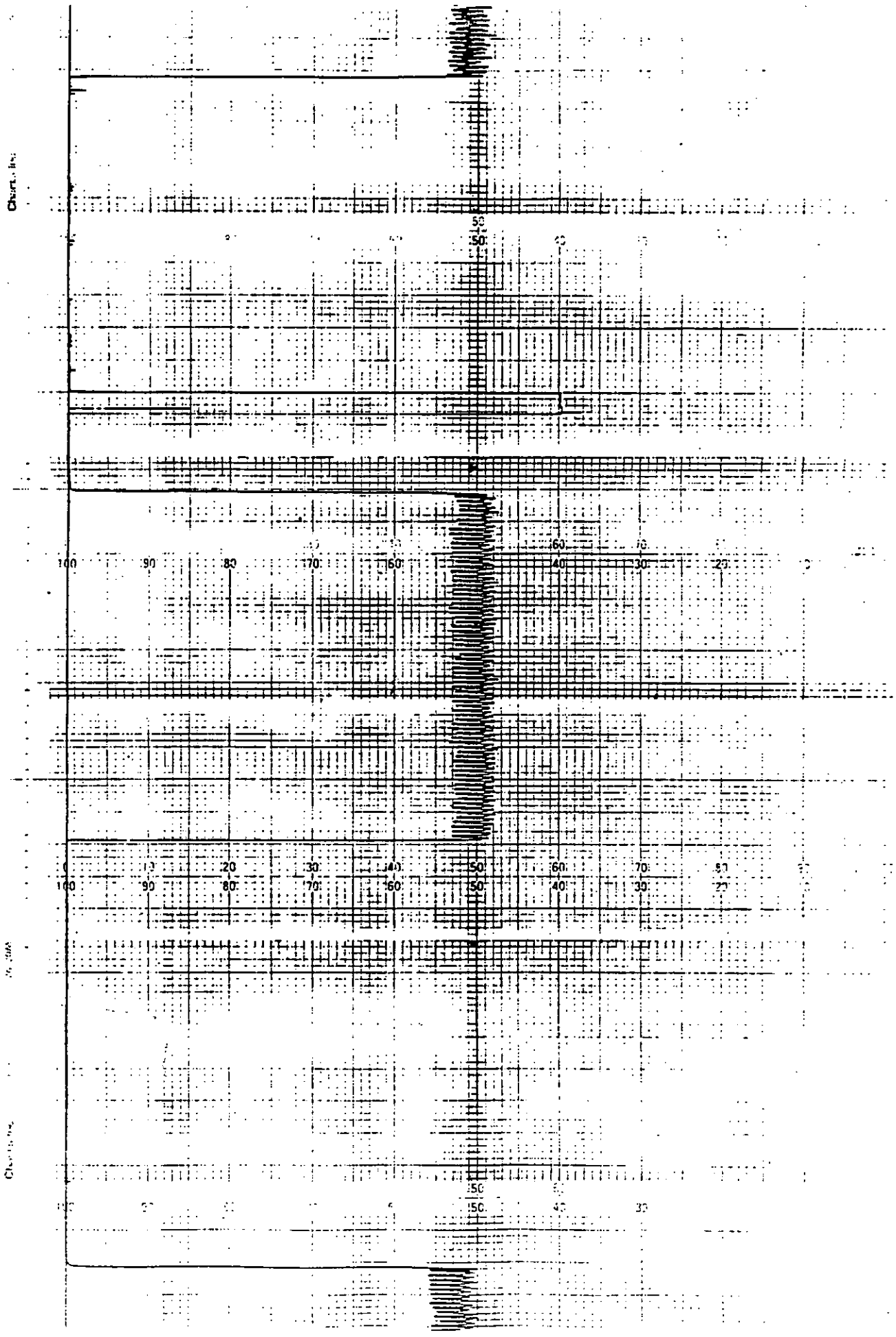

1001 PORT A; 2.0
NOx 0250 ppm scale
NOx 1000 ppm scale
O2 scale
1027
A1
O2 10% scale
1025
3% Zero
79% O2/25% scale
Chart speed: 10 cm/hr
CO 05%/100
CO 005
4.95/10
22%/100
Mid Bay
DZ-27-90 Zero and Span Check.
85.2 ppm
220 ppm

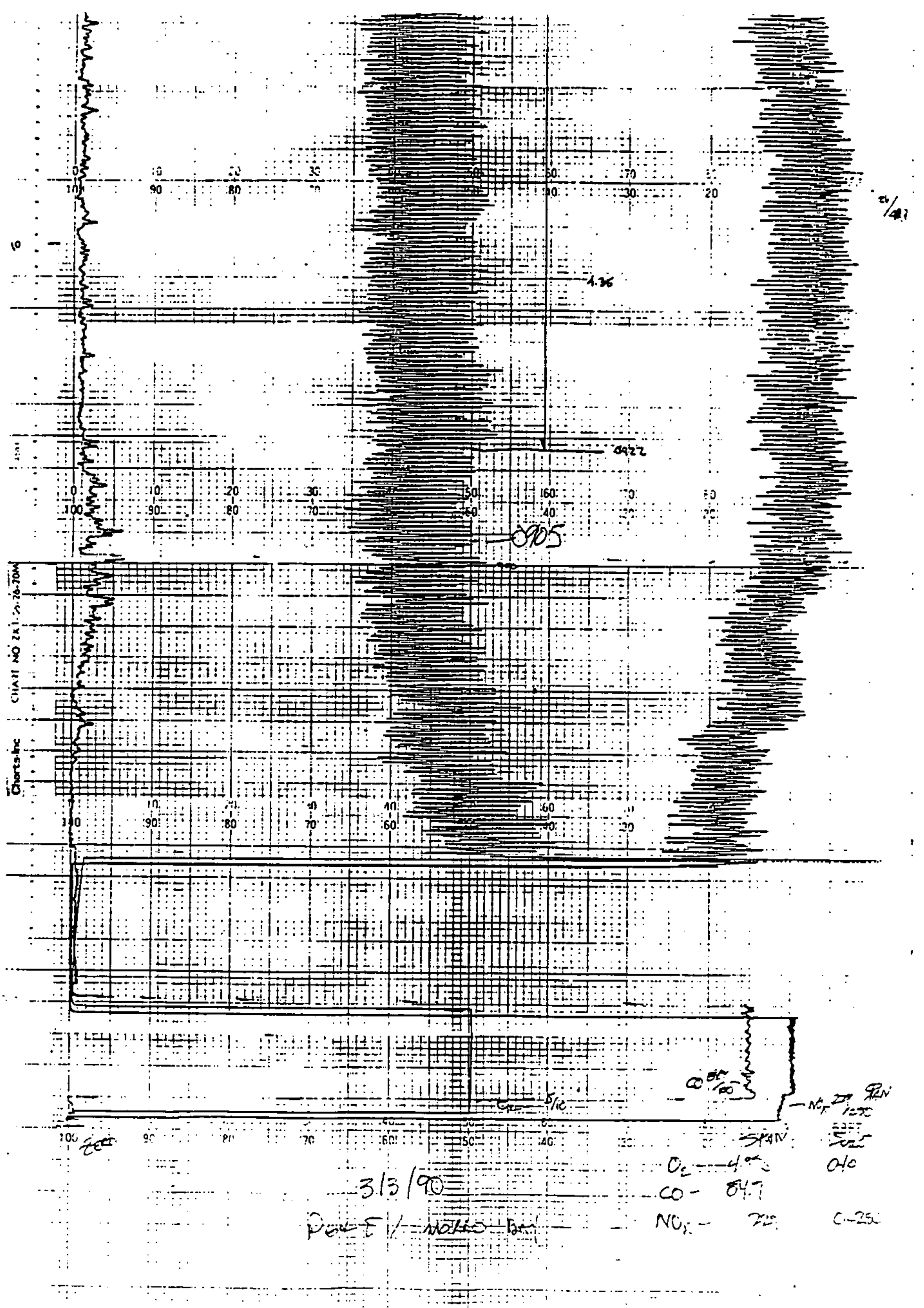

Port change
2-Cr
$\overline{O_2}$ = 4.04%
1758


CA60.1430

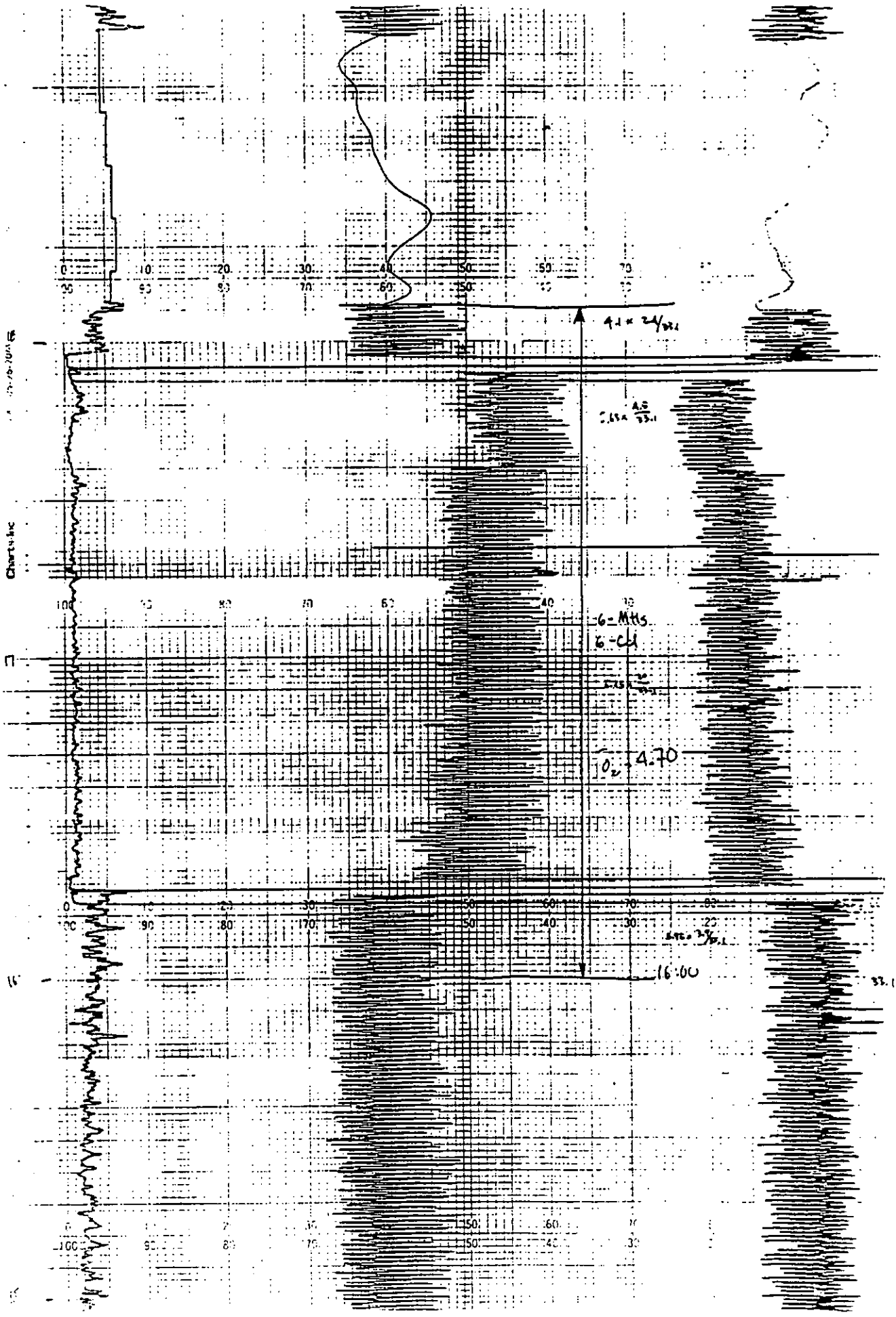

Sys cal
5/25% CO2
2.5%
02-27-90

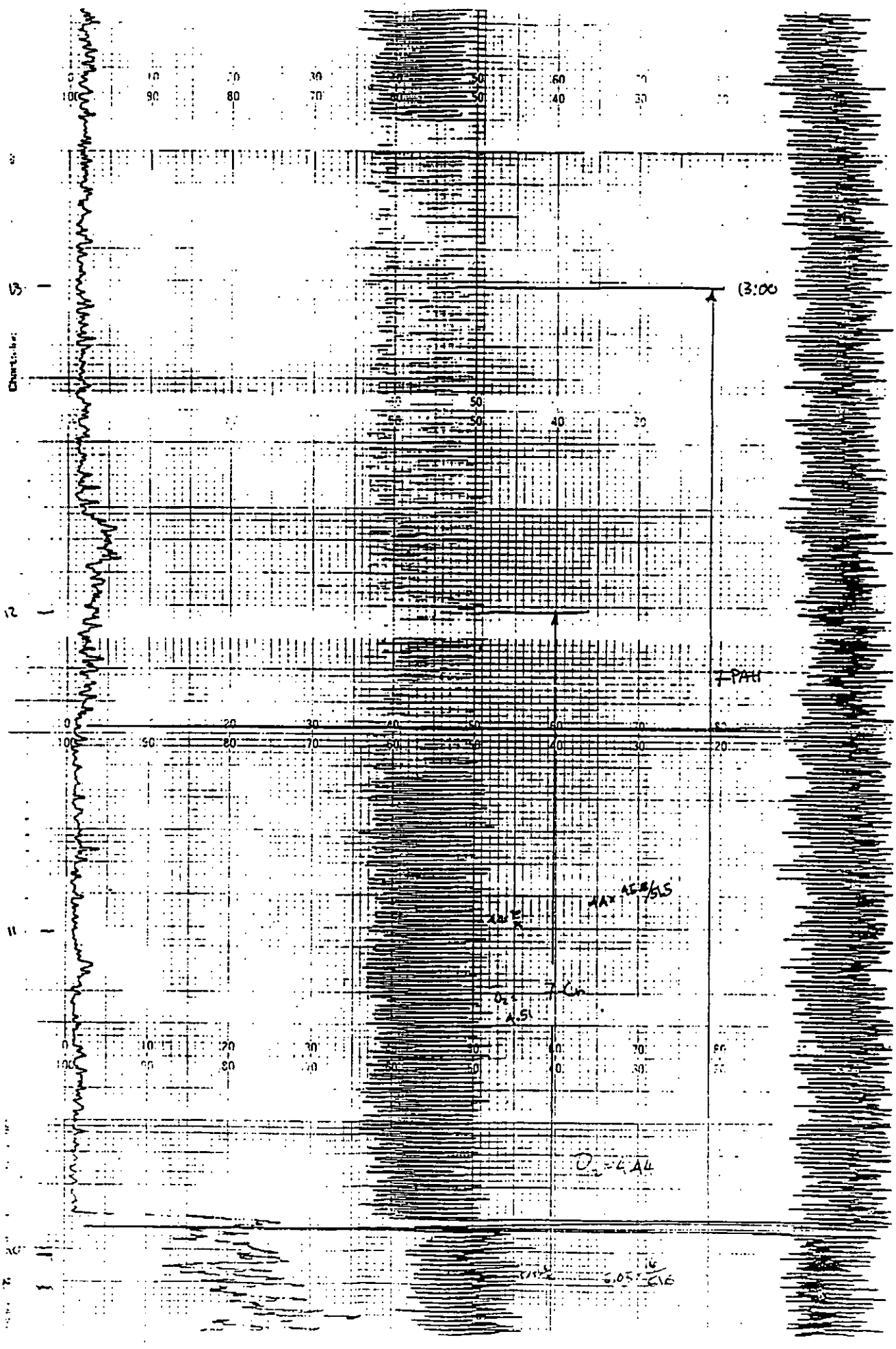


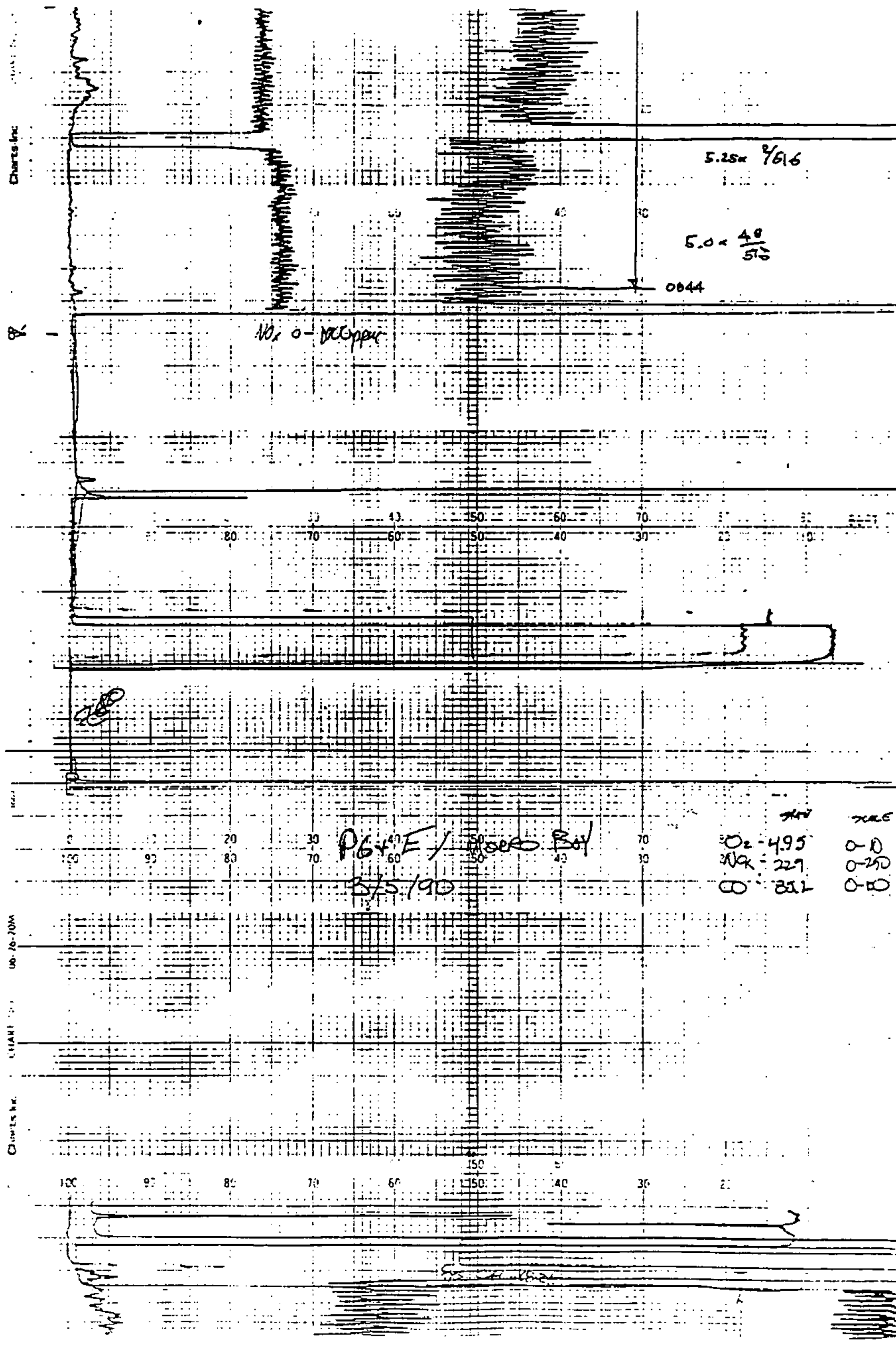




Charts-Inc
CHART NO
0922
0905
4.36
CO
NOx
SPAN
ZERO
3/3/90
O2 — 4.0
CO — 84.7
NOx — 72


6-Mths
6-Cl
10z 4.70
16:00


(3:00
T PATH



0844
O2 - 4.95 0-10
NOx - 229 0-250
3/5/90

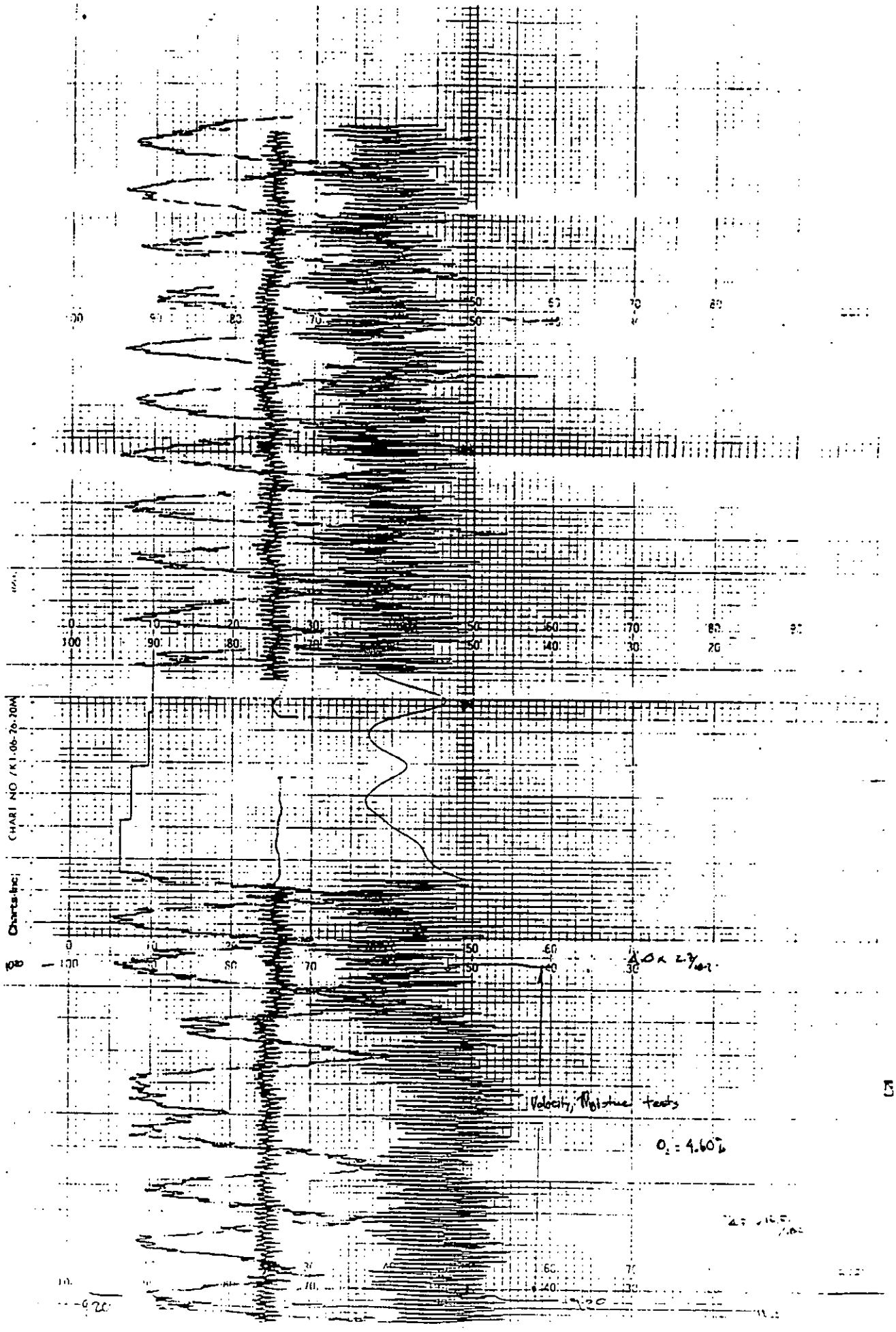
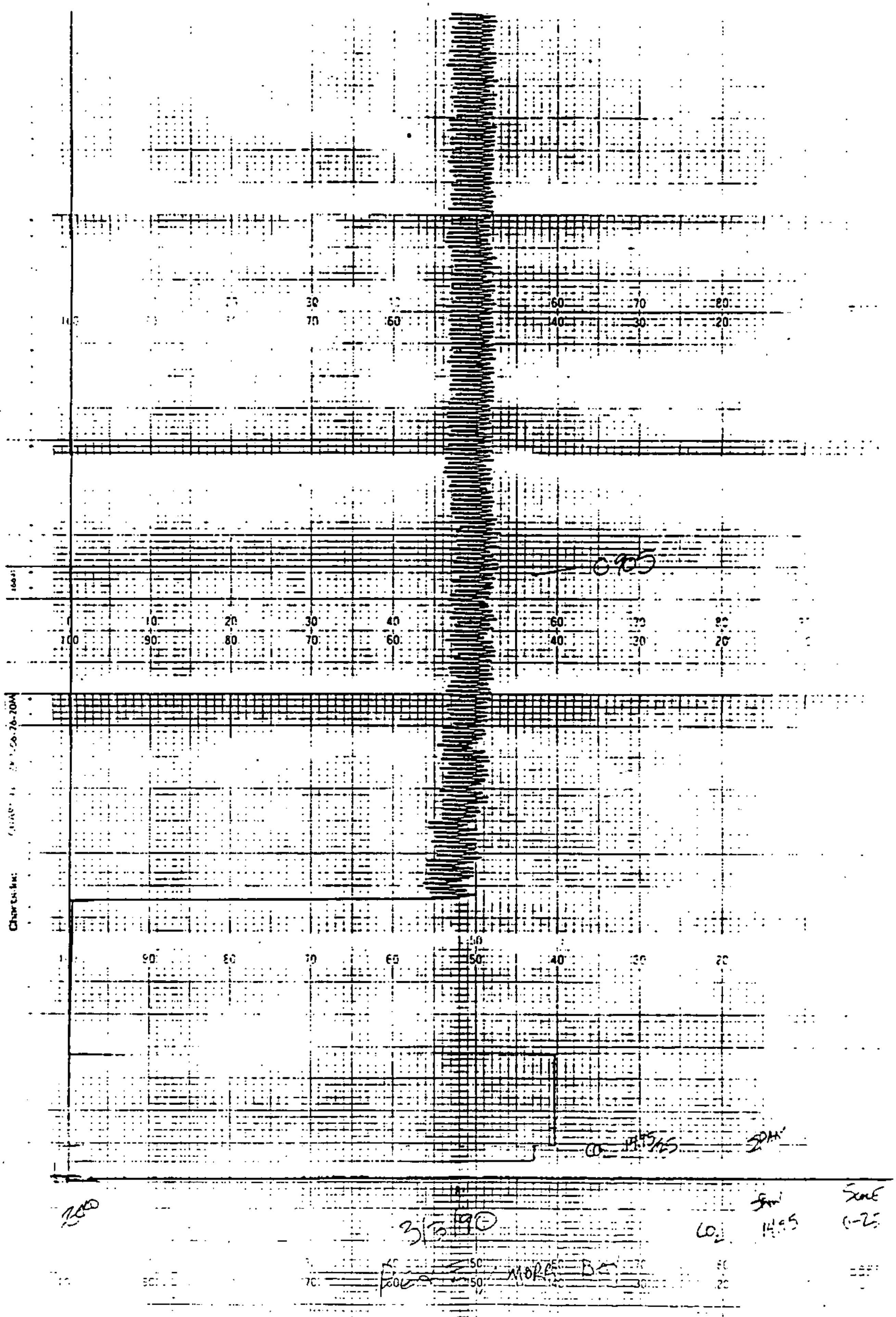
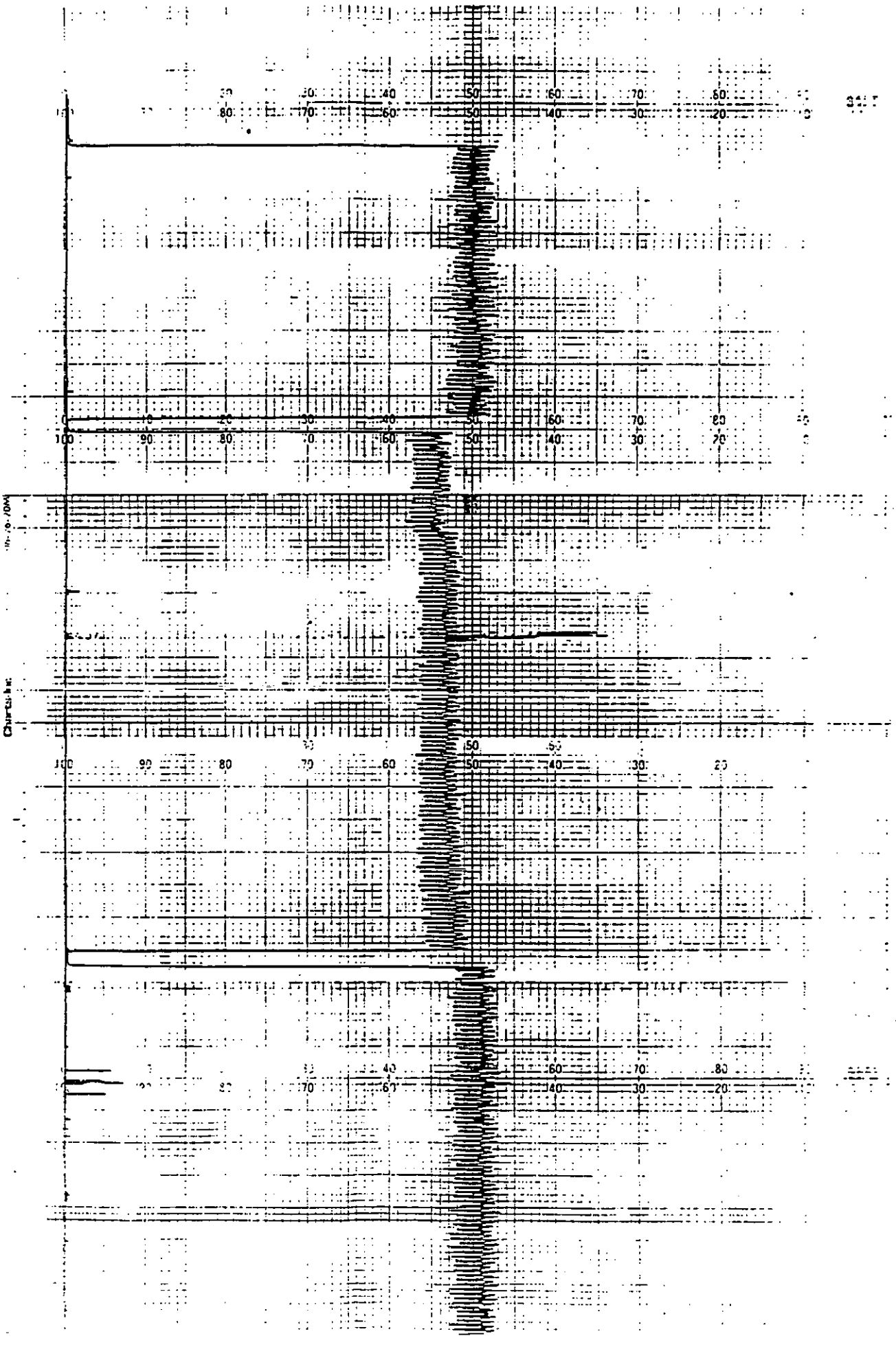
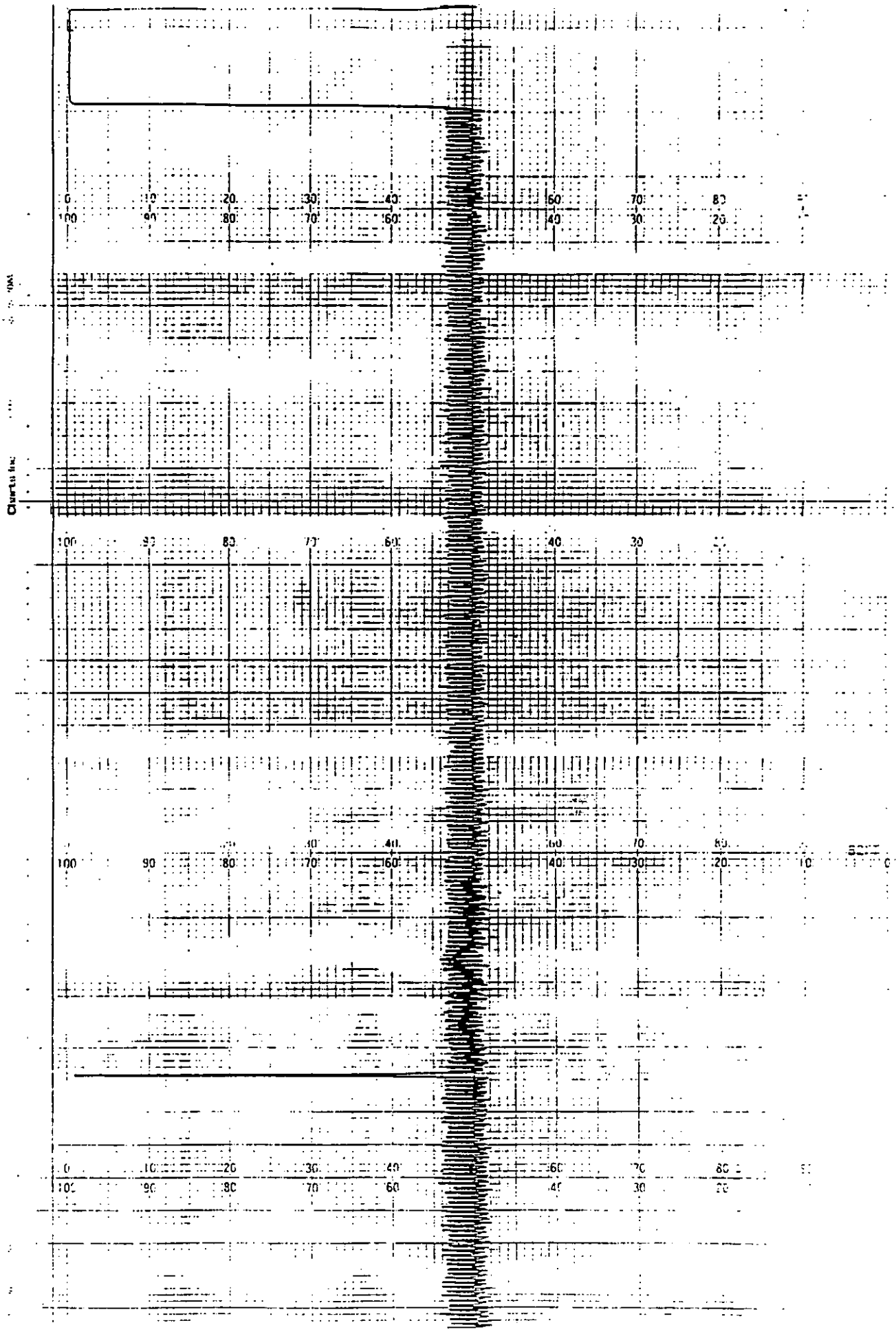
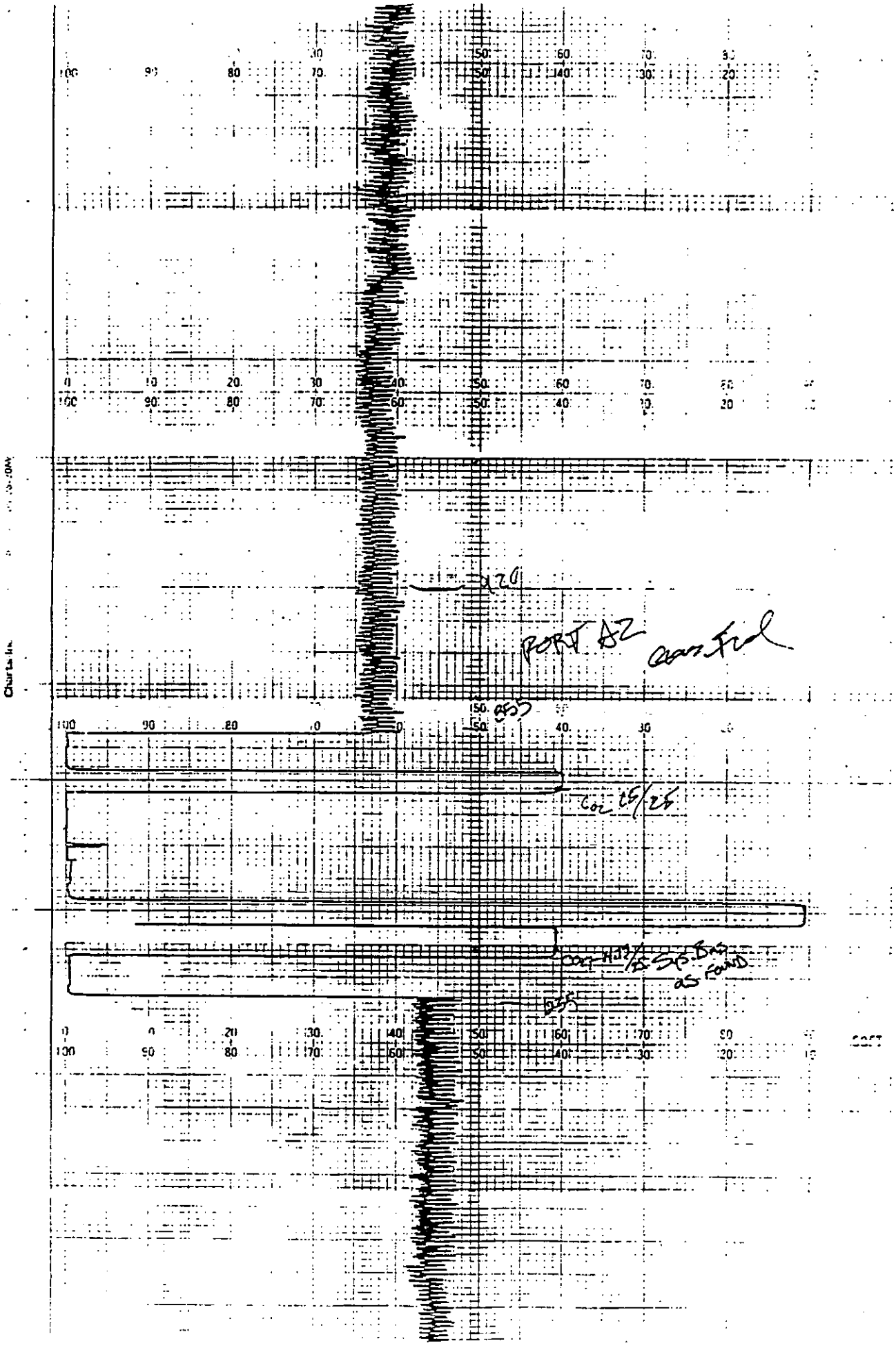


Chart Inc. CHART NO. FK1-06-76-20M
Velocity, Pitot-tube tests
$O_2 = 4.60\%$


0905
3/5/90
Span
Scale
1455
MORE






PORT AZ
as found
Cor 15/25
as found

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 25603-2
CLIENT: CARNOT
PROJECT #: 5838
LOCATION: SUBMITTED BY CLIENT
SAMPLE ID: 3-FO

DATE RECEIVED: 03/13/90
DATE ANALYZED: 03/16/90
DATE REPORTED: 04/18/90

METHODS: EPA 6010/7000
CAC TITLE 22 METALS IN AQUEOUS SOLUTIONS

METAL	RESULT	REGULATORY LIMITS STLC
	--mg/L--	
Arsenic	ND (1.1)	5
Beryllium	ND (0.2)	0.75
Cadmium	ND (0.2)	1
Chromium (total)	0.36	560
Chromium (VI)	ND (0.50)	--
Copper	ND (0.4)	25
Lead	ND (1.1)	5
Mercury	ND (0.10)	0.2
Manganese	1.1	350
Nickel	24	20
Selenium	ND (1.1)	1
Zinc	0.92	250

ND = NOT DETECTED; LIMIT OF DETECTION IN PARENTHESES.

QA/QC DATA SUMMARY:

	RPD	SPIKE		RPD	SPIKE
Arsenic	14	83	Mercury	24	102
Beryllium	<1	102	Manganese	4	89
Cadmium	5	76	Nickel	1	88
Chromium	14	96	Selenium	15	114
Copper	17	98	Zinc	1	87
Lead	2	77			

Curtis & Tompkins, Ltd., Analytical Laboratories. Since 1878
1250 S. Boyle Ave., Los Angeles, CA 90023. Phone (213) 269-7421, Fax (213) 268-5328

DATE RECEIVED: 03/13/90
DATE REPORTED: 04/18/90

LAB NUMBER: 25603

CLIENT: CARNOT

REPORT ON: TWO OIL SAMPLES

PROJECT #: 5838

LOCATION: SUBMITTED BY CLIENT

RESULTS: SEE ATTACHED

Laboratory Director

CARNOT

SUBJECT Calculation of thermal input - MM Btu/hr JOB NO. _____

Oil flow PGE Morro Bay SHEET NO. 1 of 1

COMPUTED BY K. Hoskins DATE _____ CHECKED BY _____ DATE _____

Oil fuel analysis:

SG = .9316

HHV = 18,764 $\frac{Btu}{lb}$

$$\text{Thermal input (MMBtu/hr)} = 10 \times \frac{\Delta S}{\Delta T}\ \frac{[gal]}{[min]} \times 60\ \frac{[min]}{[hr]} \times .9316 \times 62.4\ \frac{[lb]}{[ft^3]} \times \frac{1\ [ft^3]}{7.48\ [gal]} \times 18{,}764\ \frac{[BTU]}{[lb]} \times 10^{-6}$$

DATE	ΔS	ΔT	MM Btu/hr
3/1/90	9,336	252	3,242
3/2/90	13,704	368	3,258
3/3/90	10,866	296	3,212
3/4/90	9,851	269	3,204
3/5/90	6,793	181	3,284

137723

15991 RED HILL AVENUE, SUITE 110, TUSTIN, CA 92680-7386
(714) 259-9520 / Telecopy: (714) 259-0371

Energy Systems Associates A CORPORATION

CERTIFICATION OF SAMPLE RECEIPT

Samples:

Sample No. (Project No. Test No.)	Complete Description		
	Project # 21107		C 6
2-Cr (1)	Probe rinse, nozzle rinse, filter	1 bottle	TV= 105 ml
5 (2)	impinger catch, back-up filter	1 bottle	TV= 245 ml
5-Cr (1)	Probe rinse, IN-stack filter	1 bottle	TV= [illegible]
5 (2)	impinger catch, back-up filter	1 bottle	TV= 245 ml
7-Cr (1)	Probe Rinse	~~1 bottle~~	~~TV=~~
5	impinger catch, IN-stack filter, filter wash	1 bottles	TV= 375 ml
8-Cr (1)	Probe rinse, IN-stack filter	1 bottle	TV= 85 ml
5 (2)	impinger catch	1 bottles	TV= 260 ml
Blank-Cr	Sample 100 ml of .1N NaOH + 47mm teflon filter		
Blank-C-Impinger	100 ml of .1N NaOH + 63 mm teflon filter		

Chain of Custody Prior to Shipment:

Released by	Time and Date	Received by	Time and Date
[signature]	1400 3/19/90		

Samples shipped to: RTI
North Carolina

Samples shipped from ESA by: OSA Truck Date 3/19/90

Carrier: _____ Air Bill No. _____

Samples received by: [signature] Date 3/20/90

Company: RTI

15991 RED HILL AVENUE, SUITE 110, TUSTIN, CA 92680-7388 / (714) 259-9520 / Telecopy: (714) 259-0372

ESA DS-057

* Represents ½ of train

RTI Project No. : 2984

Samples : Probe Rinse, Filter and Impinger Samples
Company : ESA (P.O.# 5860)
Analyte : Cr(VI)
Method of Analysis : Ion Chromatography
Samples received : 3-20-90
Report Date : 4-4-90

Sample	Total Vol.(mL)	Cr(VI) ug/mL	Cr(VI) ug	Cr(VI) Spike ug	Cr(VI) Spike % Recovery
2-Cr Probe-Filter	105	0.0340	3.57		
2-Cr Impinger-Filter	245	ND	ND		
5-Cr Probe-Filter	130	0.00662	0.8606		
5-Cr Impinger-Filter	245	ND	ND		
5-Cr Impinger-Filter Spk				0.0100	92.4
7-Cr Probe-Imp-Filter	375	ND	ND		
8-Cr Probe-Filter	85	0.00235	0.200		
8-Cr Impinger	260	ND	ND		
Blank-Cr (Probe-Filter)	100	0.0176	1.76		
Blank Cr (Impinger-Fil)	100	0.0178	1.78		
Detection Limit		0.0014			

ND : Non-detectable; less than detection limit

Cr mg/L
4-5-90 MM

0.253
5.00 S1
0.456
10.00 S2
0.741
20.00 S3
0.01

0.06-1
0.19-2
0.25-3
0.18-4
0.06-5
0.25-10
0.81-20

0.98
-0.00

0.96
0.03

0.02-1
0.07-2
0.19-3
0.18-4
0.81-5
0.65-10
1.30-20

0.22-1
0.31-2
0.23-3
2.38-4
2.36-5
0.34-10
0.74-20

0.98
0.01

1.10
0.01

Energy Systems Associates A CORPORATION

Total Cr

CERTIFICATION OF SAMPLE RECEIPT

Samples:

Sample No. (Project No. Test No.) # 71107

Test No.	Complete Description
2-Cr	(PR: 105ml IC 245ml) TV = 350ml
5-Cr	(PR: 130ml IC 245ml) TV = 375ml
7-Cr	TV = 375ml
8-Cr	(PR: 85ml)(IC 260ml) TV = 335ml
Blank-Cr	200ml .1N NaOH + 47 0.63 um filter

Chain of Custody Prior to Shipment:

Released by	Time and Date	Received by	Time and Date
Catherine	1500 3/19/90		

Samples shipped to: CHT

Samples shipped from ESA by: hand carried Date 3/19/90

Carrier: CHT Air Bill No.

Samples received by: Paul Mood Date 3/21/90

Company Curtin + Tarpinian

15991 RED HILL AVENUE, SUITE 110 TUSTIN, CA 92680-7366 / (714) 259-9520 / Telecopy (714) 259-0372

Curtis & Tompkins, Ltd., Analytical Laboratories. Since 1878
1250 S. Boyle Ave., Los Angeles, CA 90023. Phone (213) 269-7421. Fax (213) 268-5328

DATE RECEIVED: 03/21/90
DATE REPORTED: 04/10/90

LAB NUMBER: 25654

CLIENT: CARNOT

REPORT ON: FIVE SOURCE SAMPLES

PROJECT #: 5862

LOCATION: SUBMITTED BY CLIENT

RESULTS: SEE ATTACHED

Laboratory Director

Client/Location: PG&E, Morro Bay | Unit: 1 | Test No.: 8-6 | Method: 5 | 1 of 2

Sample Location: Inlet to stack | Fuel: oil | Ambient Temp., °F: | 2 of 2

Operators: VR | RP | Meter Vol. (Start/End): 1 | Date: 03-04-90

Pre Test Data:

Barometric Press, in. Hg
Stack Area, sq. ft.
Sample Time/ Pt, min:
Assumed Stack Press
Assumed Moisture
Assumed Molecular Wt

Equipment Info:

Meter No.: 1
Meter, Yd
Pitot, Cp
CFM @ H@/Qd
Probe I.D.
Nozzle No./Dia
Filter No.

Imp.	Matl	Wt(End)		Weight (Start)		Weight (g)
#1			-		=	
#2			-		=	
#3			-		=	
#4			-		=	
Total			-		=	

Impinger Box I.D.:
Integrated Bag I.D.:

Leak Check:

Sample Train

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

Pre-Test Calibration

	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	Vacuum	Static Press. iwg
D-3	1509	0.56	0.61	608.88	256		90	78		55	5.1	6.5	
D-2	1513	0.47	0.51		265		89	78		55	5.2	6.5	
D-1	1517	0.45	0.49	612.1	269		89	78		55	5.8	7.0	
	1521			613.35									
E-4	1524	0.71	0.78	613.35	260		84	77		55	6.0	6.0	
E-3	1528	0.61	0.66	615.5	256		89	77		55	4.7	7.0	
E-2	1532	0.5	0.54	617.3	261		89	77		55	5.2	7.0	
E-1	1536	0.48	0.52	618.95	258		90	78		56	6.2	6.5	
	1540			620.55									
G-4	1544	0.73	0.79	620.55	306		83	77		58	4.3	6.0	
G-3	1548	.77	.81	622.60	312		92	78		55	3.9	8	
G-2	1552	0.73	0.79	624.21	300		91	77		55		9.0	
G-1	1556	0.75	0.81	626.2	290		93	71		55	5.0		
	1600			628.18								-	
F-4	1604	0.7	0.76	628.18	257		86	79		55	4.6	7.0	
F-3	1608	0.65	0.70	629.87	283		91	78		54	3.5	9.0	
F-2	1612	0.53	0.57	631.66	278		90	78		54	3.9	8.0	
F-1	1616	0.58	0.63	633.3	265		90	77		54	6.2	9.0	
Total/Average	1620			635.55									

Test Summary

Initial
Sample Vol., c.f.
Stack Press, iwg
ΔP ____ iwg ΔH ____ iwg
Meter Temp., °F
Stack Temp., °F
Water Collected, g
O_2/CO_2 Method
Chain of Cust. Info (Init.):
Impingers Loaded
Impingers Recovered
Filter Loaded
Filter Recovered
Probe Wash
Comments:

EST DS-022
9/1

CARNOT 05/17/90

SAMPLE TRAIN TEST SUMMARY

Client/Location	PGE/MORRO	Date	3/04/90
Test Number	7-Cr	Data By	KCH
Test Method	CARB 425	Sample Location	APH FG OUT
Fuel	OIL	Reference Temp (F)	60
Control Box #	ES-11	Unit	3
Pitot Factor	0.840	Meter Cal Factor	1.0000
Stack Area (sq ft)	324.00	Sample Time (Min)	112
Bar Press (in Hg)	30.30	Nozzle Diam (in)	0.198
Meter Vol (acf)	49.837	Meter Temp (F)	80.3
Stack Press (iwg)	-0.20	Stack Temp (F)	272.2
Vel Head (iwg)	0.6350	O2 (%): from CEM	4.51
		from portable	4.70
Liquid Vol (ml)	121.9	CO2 (%): from CEM	12.19
		calculated	12.05
Meter Press (iwg)	0.69	Start/Stop Time	0944/1120

Std Sample Vol (SCF)	48.62
Metric Sample Vol (cubic meters)	1.38
Moisture Fraction	0.104
Stack Gas Mol Wt	28.85
Stack Gas Velocity (ft/sec)	52.30
Stack Flow Rate (wacfm)	1,016,786
Stack Flow Rate (dscfm)	654,493
Isokinetic Ratio (%)	100.47

Client/Location: PG&E / Morro Bay | Unit: 3 | Test No.: 7-CR | Method: CARB 425 | Run: 1
Sample Location: Boiler Exit | Fuel: Oil | Ambient Temp., °F: | of: 2
Operators: R. Fence | Meter Vol. (Start/End): 534.796 / 584.633 | Date: 3/4/90

Pre Test Data:
- Barometric Press, in. Hg: 30.30
- Stack Area, sq. ft.:
- Sample Time/ Pt, min.: 2 hr/4 min
- Assumed Stack Press: .20
- Assumed Moisture: 9
- Assumed Molecular Wt: 29

Equipment Info:
- Meter No.: ES-11
- Meter, Yd: 1.00
- Pitot, Cp: .84
- CFH @ H = 1.0: .564
- Probe I.D.: 22' TEFLON
- Nozzle No./Dia: .198
- Filter No.:

Imp.	Matl	Wt(End)	Weight (Start)	Weight (g)
#1		710.6	605.4	105.2
#2		605.1	602.6	2.5
#3		485.0	483.2	1.8
#4		718.4	706.0	12.4
Total				

Impinger Box I.D.:
Integrated Bag I.D.:

Leak Check:

Sample Train

	CFH	Vac.	Init.	Pitot	IBS
Pre-Test	.001	15	RP.	OK	—
Post-Test	.001	21	RP.	—	—

Pre-Test Calibration

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

$\Delta H = \frac{1.08}{.96} \times \Delta P$

Sample Point	Time	Meter Conditions ΔP	ΔH	Meter Reading	Temperatures, °F Stack	Probe	Meter In	Meter Out	Oven	Imp. Out	O_2	Vacuum	Static Press. iwg
6-4	944	.80	.87	534.796	312		82	70		57		6	
-3	948	.74	.80	536.861	313		82	70		49	3.6	6	
-2	952	.67	.73	538.660	301		83	71		50		6	
-1	956	.72	.78	546710	290		83	72		52		6.5	
F-4	1000/1004	.75	.81	542.419	279		83	72		53		7	
-3	1008	.71	.77	544.621	285		86	72		52	3.6	7	
-2	1012	.60	.65	546.288	268		86	72		52		7	
-1	1016	.64	.69	548.016	275		86	72		52		8	
E-4	1020/1023	.68	.73	549.792	243		79	72		52		6	
-3	1027	.57	.62	551.725	259		85	73		52	4.9	6	
-2	1031	.51	.55	553.260	262		84	73		52		6	
-1	1035	.47	.51	554.824	260		83	73		52		6	
D-4	1039/1044	.65	.70	556.467	261		79	72		52		7	
-3	1048	.56	.61	558.400	252		86	72		50	5.4	7	
-2	1052	.50	.54	560.129	268		86	72		51		7	
-1	1056	.45	.48	561.518	264		81	72		52		7	
	1100			563.184									
Total/Average													

Test Summary:
- Initial: KH / KH
- Sample Vol., c.f.: 49.837
- Stack Press, iwg: -.20
- ΔP: .635 iwg ΔH: 0.69 iwg
- Meter Temp., °F: 80.3
- Stack Temp., °F: 272.24
- Water Collected, g: 121.9
- O_2/CO_2 Method: 4.7
- Chain of Cust. Info (init.):
  - Impingers Loaded: KH
  - Impingers Recovered: KH
  - Filter Loaded: KH
  - Filter Recovered: KH
  - Probe Wash: RP.
- Comments:

EST DS-022
Rev. 9/89

Client/Location: PG&E / MORRO BAY | Unit: 3 | Test No.: 5-CR | Method: CARB 425 | 2

Sample Location: | Fuel: GAS | Ambient Temp., °F: | of 3

Operators: KP | Meter Vol. (Start/End): / | Date: 3/2/90

Pre Test Data:
- Barometric Press, in. Hg
- Stack Area, sq. ft.
- Sample Time/ Pt, min.
- Assumed Stack Press
- Assumed Moisture
- Assumed Molecular Wt

Equipment Info:
- Meter No.
- Meter, Yd
- Pitot, Cp
- CFH @ H = 1.0
- Probe I.D.
- Nozzle No./Dia
- Filter No.

Imp.	Matl	Wt(End)	Weight (Start)	Weight (g)
#1			-	=
#2			-	=
#3			-	=
#4			-	=
Total			-	=

Impinger Box I.D.
Integrated Bag I.D.

Leak Check:

Sample Train

	CFH	Vac.	Init.	Pitot	IBS
Pre-Test					
Post-Test					

Pre-Test Calibration

	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	Vacuum	Static Press. iwg
D-4	1028	.65	.70	453.389	244		77	71		50		5	
-3	1032	.46	.50	455.250	234		84	71		48	5.7	5	
-2	1036	.45	.49	456.892	250		86	72		48	5.6	5	
-1	1040	.52	.56	458.361	255		83	71		48		5	
	1044			460.065									
E-4	1048	.66	.71	460.065	280		79	71		49		5	
-3	1052	.66	.71	462.001	247		86	72		49	5.2	6	
-2	1056	.57	.62	463.725	250		85	72		49		5	
-1	1100	.54	.58	465.510	248		86	72		49	6.5	5	
	1104			467.116									
B-4	1102/1110	.69	.75	467.116	285		79	71		51	4.8	5	
-3	1113	.75	.81	468.682	270		80	70		50	4.4	6	
-2	1118	.61	.66	470.999	260		85	71		49	5.1	5.5	
-1	1122	.59	.64	472.895	231		85	72		49	7.1	5	
	1126			474.800									
Total/Average													

Test Summary
- Initial
- Sample Vol., c.f.
- Stack Press, iwg
- ΔP ____ iwg ΔH ____ iwg
- Meter Temp., °F
- Stack Temp., °F
- Water Collected, g
- O_2/CO_2 Method
- Chain of Cust. Info (init.):
  - Impingers Loaded
  - Impingers Recovered
  - Filter Loaded
  - Filter Recovered
  - Probe Wash
- Comments: @ PT. D-4 CHECKED THE ΔP WITH PROBE IN NORMAL POSITION AGAINST MOUNTED THE PROBE FOUND IN TO THE EST DS-022 IN DA 9/8

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 25603-2
CLIENT: CARNOT
PROJECT #: 5838
LOCATION: SUBMITTED BY CLIENT
SAMPLE ID: 3-FO

DATE RECEIVED: 03/13/90
DATE ANALYZED: 04/09/90
DATE REPORTED: 04/18/90

ULTIMATE AND PROXIMATE ANALYSIS

PARAMETER	AS RECEIVED BASIS (% by Weight)
ASH CONTENT	0.02
CARBON	83.90
HYDROGEN	11.82
NITROGEN	0.11
OXYGEN	3.76
SULFUR	0.39
SPECIFIC GRAVITY	0.9322
CHLORINE BY X-RAY DIFF. (mg/L)	130
BTU/LB.	18,736

APR 11 1990

Energy Systems Associates A CORPORATION

CERTIFICATION OF SAMPLE RECEIPT

Samples:

Sample No. (Project No. Test No.	Complete Description
	Project # 7/107
447 2128	1-PAH-Blank 1 XAD-2 module, Filter # 47-126, H2O Canister (1), Organic Canister (1)
448 3/4	7-PAH 1 XAD-2 module, Filter # 47-124, H2O Canister (1), Organic Canister (1)
3/4	8-PAH 1 XAD-2 module, Filters 47-122 and
449	47-123, H2O Canister (2), Organic Canister (1)
3/5	9-PAH 1 XAD-2 module, Filters 110-899 and
450	110-900, H2O Canister (1), Organic Canister (1)

Chain of Custody Prior to Shipment:

Released by	Time and Date	Received by	Time and Date
[signature]	0900 3/8/90		

Samples shipped to: Zeon Environmental

Samples shipped from ESA by: Fed-Ex Date 3/9/90

Carrier: Air Bill No. 400-7910-9462

Samples received by: [signature] Date

Company: ZEON

15991 RED HILL AVENUE, SUITE 110, TUSTIN, CA 92680-7388 / (714) 259-9520 / Telecopy: (714) 259-0371

MAR 2 3 1990

Energy Systems Associates A CORPORATION

CERTIFICATION OF SAMPLE RECEIPT

Samples:

Sample No. (Project No. Test No.	Complete Description	
2-FO	fuel oil samples for radionuclides α, β, γ	bottle
4-FO		bottle

Chain of Custody Prior to Shipment:

Released by	Time and Date	Received by	Time and Date
Paul Ensign	3/19/90	Heidelberg	3/20/90 @ 1200

Samples shipped to: U.S. testing Richmond, VA

Samples shipped from ESA by: USA TRANSTAR Date 3/19/90

Carrier: Air Bill No. 522436

Samples received by: Tami Heidelberg Date 3/20/90

Company: US Testing

15991 RED HILL AVENUE, SUITE 110, TUSTIN, CA 92680-7388 / (714) 259-9520 / Telecopy (714) 259-0372

ESA 05-057

Energy Systems Associates A CORPORATION

Cadmium Analysis

CERTIFICATION OF SAMPLE RECEIPT

Samples: >1107>

Sample No. (Project No. Test No.	Complete Description
Reagent Blank	T47-209, 0.1 N HNO_3 (200ml)
Field Blank	≡ 63-155 (cut down) Tygon Catch & Probe rinse (1)
3-Cd	T47-188, Probe Wash, Tygon Catch)
4-Cd	T47-190, Probe Wash, Tygon Catch
6-Cd	T47-196, Probe Wash, Tygon Catch

Chain of Custody Prior to Shipment:

Released by	Time and Date	Received by	Time and Date
[signature]	1900 3/12/90		

Samples shipped to: Curtis and Tompkins

Samples shipped from ESA by: C & T Date 3/13/90

Carrier: Landsmeer Air Bill No. _____

Samples received by: Paul Mead Date 3/13/90

Company: Curtis & Tompkins

15991 RED HILL AVENUE, SUITE 110 TUSTIN, CA 92680-7388 / (714) 259-9520 / Telecopy: (714) 259-0372

c. Mass emissions, lb/hr

$$M = C \times Qsd \times (60 \text{ min/hr})/(7000 \text{ gr/lb})$$

3. Gaseous Emissions, lb/hr

$$M = ppm \times 10\text{-}6 \frac{MW_i \text{ lb/lb mole}}{SV} \times Qsd \times 60 \text{ min/hr}$$

where SV = specific molar volume of an ideal gas:

385.3 ft^3/lb mole for T_{ref} = 528 °R
379.5 ft^3/lb mole 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

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

b. Fuel factor at 60 °F

$$F_{60} = F_{68} (520 \text{ °R}/528 \text{ °R})$$

c. Gaseous emission factor

$$\text{lb/}10^6 \text{ Btu}_i = ppm_i \times 10^{-6} \times \frac{MW_i \text{ lb}}{\text{lb mole}} \times \frac{1}{SV} \times F \times \frac{20.9}{20.9-\%O_2}$$

d. Particulate emission factor

$$\text{lb/}10^6 \text{ Btu} = C \times \frac{1 \text{ lb}}{7000 \text{ gr}} \times F \times \frac{20.9}{20.9-\%O_2}$$

These calculations are routinely performed on ESA's computer.

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 25598
CLIENT: CARNOT
PROJECT #: 5837
LOCATION: SUBMITTED BY CLIENT

DATE RECEIVED: 03/13/90
DATE DIGESTED: 03/22/90
DATE ANALYZED: 04/10/90
DATE REPORTED: 04/16/90

METAL: LEAD FRONT FILTER AND PROBE/NOZZLE WASH
METHOD: METALS EMISSIONS IN EXHAUST GAS PROCEDURE DATED 8/28/89
EPA METHOD 6010

C&T ID	SAMPLE ID	SAMPLE VOLUME	LEAD ug/SAMPLE
1	REAGENT BLANK	50	35
2	FIELD BLANK	50	36
3	3-MTLS	50	8.3
4	4-MTLS	50	25
5	6-MTLS	50	40
5D	6-MTLS	50	39
5S	6-MTLS	50	84%

METHOD DETECTION LIMIT = 3 ug/SAMPLE.

QA/QC DATA INFORMATION:

RELATIVE % DIFFERENCE:	2
SPIKE % RECOVERY:	84

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 25598
CLIENT: CARNOT
PROJECT #: 5837
LOCATION: SUBMITTED BY CLIENT

DATE RECEIVED: 03/13/90
DATE DIGESTED: 03/19/90
DATE ANALYZED: 04/02/90
DATE REPORTED: 04/16/90

METAL: MANGANESE FRONT FILTER AND PROBE/NOZZLE WASH
METHOD: METALS EMISSIONS IN EXHAUST GAS PROCEDURE DATED 8/28/89
EPA METHOD 6010 - ELEMENT NOT RESPONSIVE BY GFAAS/STD ADD METHOD

C&T ID	SAMPLE ID	SAMPLE VOLUME	MANGANESE ug/SAMPLE
1	REAGENT BLANK	50	4.2
2	FIELD BLANK	50	86
3	3-MTLS	50	36
4	4-MTLS	50	8.8
5	6-MTLS	50	19
5D	6-MTLS	50	19
5S	6-MTLS	50	88%

QA/QC DATA INFORMATION:

RELATIVE % DIFFERENCE:	1
SPIKE % RECOVERY:	88

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 25598
CLIENT: CARNOT
PROJECT #: 5837
LOCATION: SUBMITTED BY CLIENT

DATE RECEIVED: 03/16/90
DATE DIGESTED: 04/05/90
DATE ANALYZED: 04/05/90
DATE REPORTED: 04/16/90

METAL: MERCURY FRONT FILTER AND PROBE/NOZZLE WASH
METHOD: METALS EMISSIONS IN EXHAUST GAS PROCEDURE DATED 8/28/89
EPA METHOD 7471

C&T ID	SAMPLE ID	SAMPLE VOLUME *	MERCURY ug/ALIQUOT
1	REAGENT BLANK	SEE NOTE	ND (22)
2	FIELD BLANK	SEE NOTE	ND (28)
3	3-MTLS	SEE NOTE	ND (14)
4	4-MTLS	SEE NOTE	ND (25)
5	6-MTLS	SEE NOTE	ND (13)
5D	6-MTLS	SEE NOTE	ND (13)
5S	6-MTLS	SEE NOTE	97%

* NOTE: 5% v/v REMOVED AT 100 MLS FOR MERCURY; REMAINING 95 MLS REDUCED TO 50 ML FOR OTHER METAL ANALYSES.

QA/QC DATA INFORMATION:

RELATIVE % DIFFERENCE:	<1
SPIKE % RECOVERY:	97

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 25598
CLIENT: CARNOT
PROJECT #: 5837
LOCATION: SUBMITTED BY CLIENT

DATE RECEIVED: 03/13/90
DATE DIGESTED: 03/19/90
DATE ANALYZED: 04/02/90
DATE REPORTED: 04/16/90

METAL: NICKEL IMPINGER CATCH
METHOD: METALS EMISSIONS IN EXHAUST GAS PROCEDURE DATED 8/28/89
EPA METHOD 6010

C&T ID	SAMPLE ID	SAMPLE VOLUME	NICKEL ug/SAMPLE
1	REAGENT BLANK	50	1.4
2	FIELD BLANK	50	31
3	3-MTLS	50	3.9
4	4-MTLS	50	2.3
5	6-MTLS	50	88
5D	6-MTLS	50	86
5S	6-MTLS	50	83%

METHOD DETECTION LIMIT = 0.6 ug/SAMPLE.

QA/QC DATA INFORMATION:

RELATIVE % DIFFERENCE:	3
SPIKE % RECOVERY:	83

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 25598
CLIENT: CARNOT
PROJECT #: 5837
LOCATION: SUBMITTED BY CLIENT

DATE RECEIVED: 03/13/90
DATE DIGESTED: 03/19/90
DATE ANALYZED: 04/02/90
DATE REPORTED: 04/16/90

METAL: SELENIUM IMPINGER CATCH
METHOD: METALS EMISSIONS IN EXHAUST GAS PROCEDURE DATED 8/28/89
EPA METHOD 6010

C&T ID	SAMPLE ID	SAMPLE VOLUME	SELENIUM ug/SAMPLE
1	REAGENT BLANK	50	ND (3.1)
2	FIELD BLANK	50	ND (2.8)
3	3-MTLS	50	ND (2.8)
4	4-MTLS	50	ND (2.8)
5	6-MTLS	50	ND (2.8)
5D	6-MTLS	50	ND (2.8)
5S	6-MTLS	50	88%

QA/QC DATA INFORMATION:

RELATIVE % DIFFERENCE:	<1
SPIKE % RECOVERY:	88

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 25598
CLIENT: CARNOT
PROJECT #: 5837
LOCATION: SUBMITTED BY CLIENT

DATE RECEIVED: 03/13/90
DATE DIGESTED: 03/19/90
DATE ANALYZED: 04/02/90
DATE REPORTED: 04/16/90

METAL: ZINC IMPINGER CATCH
METHOD: METALS EMISSIONS IN EXHAUST GAS PROCEDURE DATED 8/28/89
EPA METHOD 6010

C&T ID	SAMPLE ID	SAMPLE VOLUME	ZINC ug/SAMPLE
1	REAGENT BLANK	50	3.9
2	FIELD BLANK	50	16
3	3-MTLS	50	11
4	4-MTLS	50	16
5	6-MTLS	50	14
5D	6-MTLS	50	13
5S	6-MTLS	50	68%

METHOD DETECTION LIMIT = 0.6 ug/SAMPLE.

QA/QC DATA INFORMATION:

RELATIVE % DIFFERENCE: 4
SPIKE % RECOVERY: 68

Energy Systems Associates A CORPORATION

CERTIFICATION OF SAMPLE RECEIPT

Samples:

Sample No. (Project No. Test No.)	Complete Description
	Project # 7107
Reagent Blank	Silica T47-208, HNO_3/H_2O_2 soln Found
	$KMnO_4$ soln (100 ml)
MMS Blank (Field Blank)	Silica T47-191, Front ½, Line Rinse & Impinger
	$KMnO_4$ Impinger (125 ml)
3-MMS	Silica T47-04, Front ½, Line Rinse & Impinger,
	$KMnO_4$ impinger (116 ml)
4-MMS	Silica T47-189, Front ½, Line Rinse & Impinger,
	$KMnO_4$ impinger (124 ml)
6-MMS	Silica T47-187, Front ½, Line Rinse & Impinger,
	$KMnO_4$ impinger (132 ml

Chain of Custody Prior to Shipment:

Released by	Time and Date	Received by	Time and Date
[signature]	1800 3/12/90		

Samples shipped to: Curtis and Tompkins
Los Angeles

Samples shipped from ESA by: [signature] Date

Carrier: C&T Air Bill No.

Samples received by: Paul Mead Date 3/13/90

Company: Curtis & Tompkins, Ltd.

15991 RED HILL AVENUE, SUITE 110, TUSTIN, CA 92680-7388 / (714) 259-9520 / Telecopy (714) 259-0371

Appendix C.8

Chromium

METALS EMISSION CALCULATIONS

Client/Location: PG&E/MORRO
F Factor: 9035
Reference Temp (F): 60
Fuel: Oil

ELEMENT: HEXAVALENT CHROMIUM

Test		ug/train	Vmstd	%O2	Qsd		ug/m3	lb/hr	lb/MMbtu
5-Cr	<	2.40	49.30	5.02	647615	<	1.72	< 4.17E-03	< 1.28E-06
7-Cr	ND	1.05	48.62	4.70	654493	ND	0.76	ND1.87E-03	ND 5.54E-07
8-Cr	<	1.13	48.32	6.78	648840	<	0.83	< 2.01E-03	< 6.89E-07

Average ug/m3

< 1.10

Average lb/hr

< 2.68E-03

Average lb/MMbtu

< 8.39E-07

Energy Systems Associates A CORPORATION
15991 RED HILL AVE., SUITE 110, TUSTIN, CALIFORNIA 92680

SUBJECT Chromium Calculations / Morro Bay JOB NO. 71109

SHEET NO. 1 of 1

COMPUTED BY L. Green DATE 5/21/90 CHECKED BY _____ DATE _____

Total Chromium

	Raw result	RB	Blank Corrected Result	Aliq Correction Factor	ug/train
5 Cr	4.75	1.50	3.25	x 2	6.50
7 Cr	6.25	1.50	4.75	x 2	9.50
8 Cr	4.50	1.50	3.00	x 2	6.00

Hexavalent Chromium

		Raw result	RB	Blank Corrected Result	Aliq Correction Factor	ug/train
5 Cr	P+F	.8606	*	< 1.20	x 2	< 2.40
	Imp	NDL .343				
7 Cr	P+F + Imp	NDL .525	*	NDL .525	x 2	ND < 1.050
8 Cr	P+F	.200	*	< .564	x 2	< 1.13
	Imp	NDL .364				

* Blank higher than all samples — not subtracted

125087

Energy Systems Associates A CORPORATION

CERTIFICATION OF SAMPLE RECEIPT

Samples:

Sample No. (Project No. Test No.	Complete Description
	JT 71107
1-FO	3/1/90 > Fuel Oil
3-FO	3/3/90

Chain of Custody Prior to Shipment:

Released by	Time and Date	Received by	Time and Date
[signature]	3/12/90 1900		

Samples shipped to: Curtis and Tompkins

Samples shipped from ESA by: Landramico Date 3/13/90

Carrier C & T Air Bill No.

Samples received by: [signature] Date 3/13/90

Company: Curtis & Tompkins

15991 RED HILL AVENUE, SUITE 110, TUSTIN, CA 92680-7388 / (714) 259-9520 / Telecopy: (714) 259-0372.

Curtis & Tompkins, Ltd., Analytical Laboratories. Since 1878
1250 S. Boyle Ave., Los Angeles, CA 90023. Phone (213) 269-7421. Fax (213) 268-5328

DATE RECEIVED: 05/01/90
DATE REPORTED: 05/10/90

LAB NUMBER: 25853

CLIENT: CARNOT

REPORT ON: FOUR OIL SAMPLES

PROJECT #: 5783 & 5838

LOCATION: SUBMITTED BY CLIENT

RESULTS: SEE ATTACHED

Reviewed By Victoria Muskala

Laboratory Director

GAS FUEL "F" FACTOR CALCULATIONS

Source - PGE MORRO 3 DATE - 20-May-90
BY - KCH TIME - 19:02

SPECIES	VOL.%	lb./lb-mol.(Fuel) C	H	O	N
CH4	92.702	11.12	3.71	0.00	0.00
C2H6	4.172	1.00	0.25	0.00	0.00
C3H8	0.634	0.23	0.05	0.00	0.00
C4H10 - I	0.043	0.02	0.00	0.00	0.00
C4H10 - N	0.053	0.03	0.01	0.00	0.00
C5H12 - I	0.017	0.01	0.00	0.00	0.00
C5H12 - N	0.013	0.01	0.00	0.00	0.00
C6H6	0.021	0.02	0.00	0.00	0.00
CO2	1.399	0.17	0.00	0.45	0.00
N2	0.954	0.00	0.00	0.00	0.27
Total		12.60	4.02	0.45	0.27
WT.%	100.01	72.67	23.21	2.58	1.54
Discrepency	-0.01				

GAS MW = 17.34 lb./scf= 0.0457 BTU/SCF= 1035.95
F @(68)= 8,586 BTU/lb.= 22673.63
F @(60)= 8,456

G TEMP	29.9	64.2	26.8	26.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

STU 1034.2 FW SG 0.6017

Y - AUTO

METH	ETH	PROP	I-BUT	N-BUT	I-PEN	N-PEN	C6+	CO2	NIT	HHV	SG	STATUS	DATE/TIME
92.663	4.023	0.668	0.051	0.064	0.020	0.016	0.023	1.516	0.956	1034.70	0.6025	ON LINE	03/06/90 16:49

UNIT	MCF	EB	MWHR	MW	MR	MCF1	EB1	MCF2	EB2	MCF3	EB3
1	936.6	155.0	0.0	0.	0.	936.6	155.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0
3	2230.9	369.3	240.9	286.	9581.	2230.9	369.3	0.0	0.0	0.0	0.0
4	1857.9	307.6	0.0	0.	0.	1857.9	307.6	0.0	0.0	0.0	0.0
	MCFH	EB/HR		MCF	EB						
AS DEPT	5308.1	5492.3		6337.9	6575.7						

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
VG DP	9.8	0.0	49.9	31.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
VG PRES	26.1	0.0	24.1	27.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
VG TEMP	29.4	64.4	27.0	26.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

STU 1034.6 FW SG 0.6023

RLY - AUTO

METH	ETH	PROP	I-BUT	N-BUT	I-PEN	N-PEN	C6+	CO2	NIT	HHV	SG	STATUS	DATE/TIME
92.650	4.071	0.650	0.049	0.062	0.020	0.016	0.023	1.476	0.983	1034.82	0.6022	ON LINE	03/06/90 17:49

UNIT	MCF	EB	MWHR	MW	MR	MCF1	EB1	MCF2	EB2	MCF3	EB3
1	1181.0	195.5	0.0	0.	0.	1181.0	195.5	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0
3	2422.3	401.0	262.6	312.	9544.	2422.3	401.0	0.0	0.0	0.0	0.0
4	1836.8	304.1	0.0	0.	0.	1836.8	304.1	0.0	0.0	0.0	0.0
	MCFH	EB/HR		MCF	EB						

03/06/90 MORRO BAY POWER PLT

GAS DEPT	6676.0	6908.4		5003.3	5176.7							
	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
AVG DP	16.2	0.0	57.2	30.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVG PRES	25.8	0.0	23.8	27.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVG TEMP	27.7	64.8	26.0	26.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

FW BTU 1034.7 FW SG 0.6024

OURLY - AUTO

900 METH	ETH	PROP	I-BUT	N-BUT	I-PEN	N-PEN	C6+	CO2	NIT	HHV	SG	STATUS	DATE/TIME
92.645	4.126	0.672	0.046	0.058	0.018	0.015	0.024	1.459	0.997	1034.99	0.6019	ON LINE	03/06/90 18:55

UNIT	MCF	EB	MWHR	MW	MR	MCF1	EB1	MCF2	EB2	MCF3	EB3
1	1427.2	236.3	0.0	0.	0.	1427.2	236.3	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0
3	2869.5	475.2	313.4	311.	9477.	2869.5	475.2	0.0	0.0	0.0	0.0
4	2589.6	428.8	0.0	0.	0.	2589.6	428.8	0.0	0.0	0.0	0.0
	MCFH	EB/HR		MCF	EB						
				[illegible]	5672.9						

FW BTU 1034.3 FW SG 0.6016

Y - AUTO

METH	ETH	PROP	I-BUT	N-BUT	I-PEN	N-PEN	C6+	CO2	NIT	HHV	SG	STATUS	DATE/TIME
92.566	4.173	0.650	0.044	0.057	0.017	0.014	0.021	1.487	0.970	1035.20	0.6025	ON LINE	03/06/90 12:49

UNIT	MCF	EB	MWHR	MW	HR	MCF1	EB1	MCF2	EB2	MCF3	EB3
1	1250.4	206.9	0.0	0.	0.	1250.4	206.9	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0
3	3124.3	517.0	343.2	316.	9415.	3124.3	517.0	0.0	0.0	0.0	0.0
4	2678.2	443.2	0.0	0.	0.	2678.2	443.2	0.0	0.0	0.0	0.0

	MCFH	EB/HR	MCF	EB
	6867.4	7109.1	7122.8	7367.7

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
GAS DEPT												
AVG DP	17.6	0.0	100.3	67.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVG PRES	25.6	0.0	21.1	24.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVG TEMP	29.1	62.8	26.8	26.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

FW BTU 1034.3 FW SG 0.6012

RLY - AUTO

METH	ETH	PROP	I-BUT	N-BUT	I-PEN	N-PEN	C6+	CO2	NIT	HHV	SG	STATUS	DATE/TIME
92.546	4.222	0.663	0.047	0.061	0.019	0.016	0.022	1.413	0.992	1036.56	0.6024	ON LINE	03/06/90 13:49

UNIT	MCF	EB	MWHR	MW	HR	MCF1	EB1	MCF2	EB2	MCF3	EB3
1	1424.4	236.1	0.0	0.	0.	1424.4	236.1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0
3	2851.3	472.6	313.4	314.	9425.	2851.3	472.6	0.0	0.0	0.0	0.0
4	2660.1	440.9	0.0	0.	0.	2660.1	440.9	0.0	0.0	0.0	0.0

	MCFH	EB/HR	MCF	EB
	6902.1	7154.4	7049.7	7292.0

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
GAS DEPT												

03/06/90 MORRO BAY POWER PLT

AVG DP	23.0	0.0	91.7	65.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVG PRES	25.3	0.0	22.0	24.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVG TEMP	29.3	63.6	27.1	26.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

FW BTU 1036.9 FW SG 0.6028

HOURLY - AUTO

	METH	ETH	PROP	I-BUT	N-BUT	I-PEN	N-PEN	C6+	CO2	NIT	HHV	SG	STATUS	DATE/TIME
1500	92.746	4.034	0.631	0.046	0.059	0.018	0.015	0.022	1.461	0.969	1034.28	0.6015	ON LINE	03/06/90 14:49

UNIT	MCF	EB	MWHR	MW	HR	MCF1	EB1	MCF2	EB2	MCF3	EB3
1	1438.8	239.2	0.0	0.	0.	1438.8	239.2	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0
3	2877.0	476.4	313.7	315.	9492.	2877.0	476.4	0.0	0.0	0.0	0.0
4	2386.6	395.2	0.0	0.	0.	2386.6	395.2	0.0	0.0	0.0	0.0

	MCFH	EB/HR	MCF	EB
	6525.4	6750.2	6925.7	7175.7

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
GAS DEPT												

4 AUTO

METH	ETH	PROP	I-BUT	N-BUT	I-PEN	N-PEN	C6+	CO2	NIT	HHV	SG	STATUS	DATE/TIME
92.675	4.218	0.642	0.044	0.054	0.017	0.013	0.021	1.340	0.977	1036.73	0.6012	ON LINE	03/06/90 09:55

UNIT	MCF	EB	MWHR	MW	HR	MCF1	EB1	MCF2	EB2	MCF3	EB3
1	1250.2	207.3	0.0	0.	0.	1250.2	207.3	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0
3	3181.4	527.5	350.4	352.	9409.	3181.4	527.5	0.0	0.0	0.0	0.0
4	2678.0	444.0	0.0	0.	0.	2678.0	444.0	0.0	0.0	0.0	0.0

	MCFH	EB/HR	MCF	EB
DEPT	7072.2	7331.9	7090.4	7350.8

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
AVG DP	17.5	0.0	102.4	67.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVG PRES	25.6	0.0	21.4	24.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C.10

Radionuclides

United States Testing Company, Inc.
Richland Division
2800 GEORGE WASHINGTON WAY
RICHLAND, WASHINGTON 99352 (509) 375-3131

RADIOCHEMISTRY
EXTERNAL DOSIMETRY
NUCLEAR SERVICES
RADIOBIOASSAY
AGRICULTURAL SERVICES
ANALYTICAL CHEMISTRY
POLLUTION CONTROL
HAZARDOUS SUBSTANCE ANALYSIS

March 30, 1990

APR 4 1990

Arlene C. Bell
Carnot
15991 Red Hill Avenue, Suite 110
Tustin CA 92680-7388

Dear Ms. Bell:

Enclosed are the gamma, gross beta and gross alpha results on the Fuel Oil samples sent to our laboratory to be analysed.

If you have any questions or comments, please call me at (509) 375-3131.

Sincerely,

UNITED STATES TESTING COMPANY, INC.

David Anderson
Chemist
Radiochemistry

DA:dmk

Enclosure

xc: Robert Swoboda
File

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 25598
CLIENT: CARNOT
PROJECT #: 5837
LOCATION: SUBMITTED BY CLIENT

DATE RECEIVED: 03/13/90
DATE DIGESTED: 03/19/90
DATE ANALYZED: 04/02/90
DATE REPORTED: 04/16/90

METAL: LEAD IMPINGER CATCH
METHOD: METALS EMISSIONS IN EXHAUST GAS PROCEDURE DATED 8/28/89
METHOD OF STANDARD ADDITIONS - EPA 7421

STANDARD INFORMATION

BLANK
STD1 = 10 ul SAMPLE + 10 ul 0.00 STD
STD2 = 10 ul SAMPLE + 10 ul 25.00 STD
STD3 = 10 ul SAMPLE + 10 ul 50.00 STD

C&T ID	SAMPLE ID			LEAD ug/SAMPLE
5	6-MTLS	BLANK	0.0007	1.6
		STD1	0.0151	
		STD2	0.0261	
		STD3	0.0386	

INSTRUMENT FACTOR: 1
CORRELATION FACTOR: 0.9993
SAMPLE VOLUME 0.05

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 25598
CLIENT: CARNOT
PROJECT #: 5837
LOCATION: SUBMITTED BY CLIENT

DATE RECEIVED: 03/16/90
DATE DIGESTED: 03/19/90
DATE ANALYZED: 04/02/90
DATE REPORTED: 04/16/90

METAL: COPPER FRONT FILTER AND PROBE/NOZZLE WASH
METHOD: METALS EMISSIONS IN EXHAUST GAS PROCEDURE DATED 8/28/89
EPA METHOD 6010 - ELEMENT NOT RESPONSIVE BY GFAAS/STD ADD METHOD

C&T ID	SAMPLE ID	SAMPLE VOLUME	COPPER ug/SAMPLE
1	REAGENT BLANK	50	8.9
2	FIELD BLANK	50	18
3	3-MTLS	50	19
4	4-MTLS	50	19
5	6-MTLS	50	9.8
5D	6-MTLS	50	10
5S	6-MTLS	50	95%

LIMIT OF DETECTION = 0.8 ug/SAMPLE.

QA/QC DATA INFORMATION:

RELATIVE % DIFFERENCE:	2
SPIKE % RECOVERY:	95

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 25598
CLIENT: CARNOT
PROJECT #: 5837
LOCATION: SUBMITTED BY CLIENT

DATE RECEIVED: 03/13/90
DATE DIGESTED: 03/22/90
DATE ANALYZED: 04/10/90
DATE REPORTED: 04/16/90

METAL: CADMIUM FRONT FILTER AND PROBE/NOZZLE WASH
METHOD: METALS EMISSIONS IN EXHAUST GAS PROCEDURE DATED 8/28/89
EPA METHOD 7131

C&T ID	SAMPLE ID	SAMPLE VOLUME	CADMIUM ug/SAMPLE
1	REAGENT BLANK	50	ND (0.41)
2	FIELD BLANK	50	1.3
3	3-MTLS	50	0.68
4	4-MTLS	50	0.59
5	6-MTLS	50	ND (0.41)
5D	6-MTLS	50	ND (0.41)
5S	6-MTLS	50	77%

QA/QC DATA INFORMATION:

RELATIVE % DIFFERENCE:	<1
SPIKE % RECOVERY:	77

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 25598
CLIENT: CARNOT
PROJECT #: 5837
LOCATION: SUBMITTED BY CLIENT

DATE RECEIVED: 03/13/90
DATE DIGESTED: 03/19/90
DATE ANALYZED: 04/05/90
DATE REPORTED: 04/16/90

METAL: CADMIUM IMPINGER CATCH
METHOD: METALS EMISSIONS IN EXHAUST GAS PROCEDURE DATED 8/28/89
METHOD OF STANDARD ADDITIONS - EPA 7131

STANDARD INFORMATION

BLANK
STD1 = 10 ul SAMPLE + 10 ul 0.00 STD
STD2 = 10 ul SAMPLE + 10 ul 2.50 STD
STD3 = 10 ul SAMPLE + 10 ul 5.00 STD

C&T ID	SAMPLE ID			CADMIUM ug/SAMPLE
1	REAGENT BLANK	BLANK	0.0049	0.14
		STD1	0.1021	
		STD2	0.1810	
		STD3	0.2772	
		INSTRUMENT FACTOR:	1	
		CORRELATION FACTOR:	0.9984	
		SAMPLE VOLUME	0.05	
2	TRIP BLANK	BLANK	0.0049	1.1
		STD1	0.3607	
		STD2	0.4448	
		STD3	0.5306	
		INSTRUMENT FACTOR:	2	
		CORRELATION FACTOR:	1.0000	
		SAMPLE VOLUME	0.05	
3	3-MTLS	BLANK	0.0049	0.36
		STD1	0.1671	
		STD2	0.2347	
		STD3	0.3687	
		INSTRUMENT FACTOR:	2	
		CORRELATION FACTOR:	0.9824	
		DILUTION FACTOR:	0.05	
4	4-MTLS	BLANK	0.0049	0.94
		STD1	0.2198	
		STD2	0.2800	
		STD3	0.3372	
		INSTRUMENT FACTOR:	2	
		CORRELATION FACTOR:	0.9999	
		DILUTION FACTOR:	0.05	

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 25598
CLIENT: CARNOT
PROJECT #: 5837
LOCATION: SUBMITTED BY CLIENT

DATE RECEIVED: 03/13/90
DATE DIGESTED: 03/19/90
DATE ANALYZED: 04/02/90
DATE REPORTED: 04/16/90

METAL: BERYLLIUM IMPINGER CATCH
METHOD: METALS EMISSIONS IN EXHAUST GAS PROCEDURE DATED 8/28/89
EPA METHOD 6010 - ELEMENT NOT RESPONSIVE BY GFAAS/STD ADD METHOD

C&T ID	SAMPLE ID	SAMPLE VOLUME	BERYLLIUM ug/SAMPLE
1	REAGENT BLANK	50	ND (0.06)
2	FIELD BLANK	50	ND (0.06)
3	3-MTLS	50	ND (0.06)
4	4-MTLS	50	ND (0.06)
5	6-MTLS	50	ND (0.06)
5D	6-MTLS	50	ND (0.06)
5S	6-MTLS	50	82%

QA/QC DATA INFORMATION:

RELATIVE % DIFFERENCE:	<1
SPIKE % RECOVERY:	82

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 25598
CLIENT: CARNOT
PROJECT #: 5837
LOCATION: SUBMITTED BY CLIENT

DATE RECEIVED: 03/13/90
DATE DIGESTED: 03/19/90
DATE ANALYZED: 04/02/90
DATE REPORTED: 04/16/90

METAL: ARSENIC IMPINGER CATCH
METHOD: METALS EMISSIONS IN EXHAUST GAS PROCEDURE DATED 8/28/89
METHOD OF STANDARD ADDITIONS - EPA 7060

STANDARD INFORMATION

BLANK
STD1 = 10 ul SAMPLE + 10 ul 0.00 STD
STD2 = 10 ul SAMPLE + 10 ul 25.00 STD
STD3 = 10 ul SAMPLE + 10 ul 50.00 STD

C&T ID	SAMPLE ID			ARSENIC ug/SAMPLE
5	6-MTLS	BLANK	0.0283	3.6
		STD1	0.028	
		STD2	0.0746	
		STD3	0.1099	

INSTRUMENT FACTOR: 4
CORRELATION FACTOR: 0.9968
SAMPLE VOLUME 0.05

* NOTE: 1/4 DILUTION REQUIRED TO ACHIEVE ACCEPTABLE CF

Curtis & Tompkins, Ltd., Analytical Laboratories. Since 1878
1250 S. Boyle Ave., Los Angeles, CA 90023. Phone (213) 269-7421. Fax (213) 268-5328

DATE RECEIVED: 03/13/90
DATE REPORTED: 04/16/90

LAB NUMBER: 25598

CLIENT: CARNOT

REPORT ON: FIVE SOURCE SAMPLES

PROJECT #: 5837

LOCATION: SUBMITTED BY CLIENT

RESULTS: SEE ATTACHED

Laboratory Director

Client/Location PG&E, Morro Bay Unit 1 Test No. 6-1115 Method 1, 2, 3

Sample Location _____ Fuel _____ Ambient Temp., °F _____ b 3

Operators VE Meter Vol. (Start/End) 1 Date 03-03-90

Pre Test Data:

Barometric Press, in. Hg _____
Stack Area, sq. ft. _____
Sample Time/ Pt, min. _____
Assumed Stack Press _____
Assumed Moisture _____
Assumed Molecular Wt _____

Equipment Info:

Meter No. _____
Meter, Yd _____
Pitot, Cp _____
CFM @ H = 1.0 _____
Probe I.D. _____
Nozzle No./Dia _____
Filter No. _____

Imp.	Matl	Wt(End)	Weight (Start)	Weight (g)
#1			-	=
#2			-	=
#3			-	=
#4			-	=
Total			-	=

Impinger Box I.D. _____
Integrated Bag I.D. _____

Leak Check:

Sample Train

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

Pre-Test Calibration

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

Sample Point	Time	Meter Conditions ΔP	ΔH	Meter Reading	Temperatures, °F Stack	Probe	Meter In	Out	Oven	Imp. Out	O_2	Vacuum	Static Press. iwg
A-4	17:54	0.55	0.49	691.938	285		80	71		55	5.5	6.0	
A-3	17:58	0.92	0.6	—	266		84	71		55		6.0	
A-2	18:02	0.83	0.74	695.02	258		85	71		55		6.0	
A-1	18:06	0.75	0.67	697.0	245		84	72		55	6.4	5.5	0.22
	18:10			699.10									
Total/Average				1.161									

Test Summary

Initial _____
Sample Vol., c.f. _____
Stack Press, iwg _____
ΔP _____ iwg ΔH _____ iwg
Meter Temp., °F _____
Stack Temp., °F _____
Water Collected, g _____
O_2/CO_2 Method _____
Chain of Cust. Info (init.):
Impingers Loaded _____
Impingers Recovered _____
Filter Loaded _____
Filter Recovered _____
Probe Wash _____
Comments: _____

EST DS-022
Rev. 9/89

Client/Location: PG&E, Morro Bay | Unit: 3 | Test No.: 6-MM5 | Method: 5 | 1
Sample Location: Inlet to stack | Fuel: Oil | Ambient Temp., °F: | of 3
Operators: VR | Meter Vol. (Start/End): 651.975 99.100 | Date: 03-03-86

Pre Test Data:
- Barometric Press, in. Hg: 30.4
- Stack Area, sq. ft.:
- Sample Time/ Pt, min.: 9 min
- Assumed Stack Press:
- Assumed Moisture:
- Assumed Molecular Wt:

Equipment Info:
- Meter No.: ES-28
- Meter, Yd: 1.00
- Pitot, Cp: 0.84
- CFM @ ΔH = 1.0: 0.573
- Probe I.D.:
- Nozzle No./Dia: 0.196
- Filter No.: 49-197

Imp.	Matl	Wt(End)	Weight (Start)	Weight (g)	Leak Check:
#1	HNO_3/H₂O	660.0	575.5	563.8	= 96.2
#2	HNO_3	604.8	604.2	600.1	= 4.7
#3	$KMnO_4$	632.9	632.2	631.3	= 1.6
#4	S.G.	678.3	678.4	665.2	= 13.1
Total					

Impinger Box I.D.:
Integrated Bag I.D.:

Sample Train

	CFM	Vac.	Init.	Pitot	IBS
Pre-Test	0.012	15	VR	✓	
Post-Test	0.001	15	VR	✓	

Pre-Test Calibration

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

$\Delta H = 0.92(\Delta P)$ $\Delta H = 0.89 \times \Delta P$

Sample Point	Time	Meter Conditions ΔH	ΔP	Meter Reading	Temperatures, °F Stack	Probe	Meter In	Meter Out	Oven	Imp. Out	O_2	Vacuum	Static Press. iwg	Test Summary
G-4	1601	0.69	0.75	651.975	307		81	73		58	4.0	4		✓KH
G-3	1607 (1609)	0.65	0.71	655.1	296		89	75		60		5		Initial RP. 47.
G-2	1609	0.68	0.8	655.9	295		87	76		59				Sample Vol., c.f. 47.159
G-1	1613	0.69	0.75	657.4			87	76		57	5.0	6.5		Stack Press, iwg .22
	1617			659.3										ΔP .646 iwg ΔH 0.58 iwg
														Meter Temp., °F 78.1 ✓
ME-4	1620	0.69	0.74	659.3	285		83	75		56		7		Stack Temp., °F 266.0 ✓
E-3	1624	0.59	0.63	661.1	275		85	75		56		7		Water Collected, g 115.6
E-2	1628 (1629)	0.51	0.56	663.1	269		85	76		56		7		O_2/CO_2 Method 5.79
E-1	1632	0.92	0.65	664.3	270		85	76		56	7.5	7		Chain of Cust. Info (Init.):
	1636			666.192										Impingers Loaded KH
														Impingers Recovered KH
E-4	1639	0.65	0.71	666.192	252		85	75		55		6.5		Filter Loaded KH
E-3	1643	0.57	0.62	667.8	241		84	74		55		6.5		Filter Recovered KH
E-2	1647	0.45	0.5	669.2	254		83	74		55	5.5	6.0		Probe Wash
E-1	1651	0.42	0.49	670	253		82	74		55		6.0		Comments:
	1655			672.458										
Total/Average		5.91					84.67	74.92						

EST DS-022
Rev. 9/86

Client/Location: PG&E MORRO BAY | Unit: 3 | Test No.: 4-MTLS | Method: | 2

Sample Location: STACK INLET | Fuel: OIL | Ambient Temp., °F: | of 2

Operators: M. Schmitt | Meter Vol. (Start/End): 1 | Date: 3/2/90

Pre Test Data:
- Barometric Press, in. Hg
- Stack Area, sq. ft.
- Sample Time/ Pt, min.
- Assumed Stack Press
- Assumed Moisture
- Assumed Molecular Wt

Equipment Info:
- Meter No.
- Meter, Yd
- Pitot, Cp
- CFM @ ΔH = 1.0
- Probe I.D.
- Nozzle No./Dia
- Filter No.

Imp.	Matl	Wt(End)	Weight (Start)	Weight (g)
#1				
#2				
#3				
#4				
Total				

Impinger Box I.D.
Integrated Bag I.D.

Leak Check:

Sample Train

	CFM	Vac.	Init. Pitot	IBS
Pre-Test				
Post-Test	.00	11	1.5	

Pre-Test Calibration

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

Sample Point	Time	Meter Conditions ΔP	Meter Conditions ΔH	Meter Reading	Temperatures, °F: Stack	Probe	Meter In	Meter Out	Oven	Imp. Out	O_2	Vacuum	Static Press. iwg
D-1	1536	.47	.43	545.291	256	—	88	77	—	53	6.2	7	
—	1540			546.788									
C-4	1546	.74	.68	546.788	280		78	76		56	.64	9	
-3	1550	.65	.60	548.872	271		84	77		53	5.5	10	
-2	1554	.62	.57	550.591	260		88	77		53	5.2	9	
-1	1558	.47	.43	552.175	250		87	77		53	6.6	8	
—	1602			553.749									
B-4	1606	.76	.70	553.744	300		79	76		55	5.1	10	
-3	1610	.75	.69	555.603	296		88	77		54		11	
-2	1614	.62	.57	557.470	271		99	78		54	5.1	10	
-1	1618	.59	.54	559.243	246		87	76		54	7.3	10	
—	1622			561.121								6	
A-4	1627	.61	.62	561.124	280		76	75		55	5.6	4	
-3	1631	.80	.74	562.865	269		86	75		54	5.0	8	
-2	1635	.74	.68	564.700	250		87	75		53	5.4	10	
-1	1639	.75	.69	566.573	246		86	75		53	6.5	10	.20
—	1643			568.192									
Total/Average													

Test Summary:
- Initial
- Sample Vol., c.f. 49.692
- Stack Press, iwg .2
- ΔP ____ iwg ΔH ____ iwg
- Meter Temp., °F
- Stack Temp., °F
- Water Collected, g
- O_2/CO_2 Method
- Chain of Cust. Info (init.):
  - Impingers Loaded
  - Impingers Recovered
  - Filter Loaded
  - Filter Recovered
  - Probe Wash
- Comments:

CARNOT 05/17/90

SAMPLE TRAIN TEST SUMMARY

Client/Location	PGE/MORRO	Date	3/02/90
Test Number	3-MTLS	Data By	KCH
Test Method	DRAFT EPA	Sample Location	APH FG OUT
Fuel	OIL	Reference Temp (F)	60
Control Box #	ES-2811	Unit	3
Pitot Factor	0.840	Meter Cal Factor	1.0000
Stack Area (sq ft)	324.00	Sample Time (Min)	112
Bar Press (in Hg)	30.40	Nozzle Diam (in)	0.198
Meter Vol (acf)	48.112	Meter Temp (F)	83.6
Stack Press (iwg)	0.31	Stack Temp (F)	268.7
Vel Head (iwg)	0.5770	O2 (%): from CEM	4.02
		from portable	5.62
Liquid Vol (ml)	104.4	CO2 (%): from CEM	11.85
		calculated	10.73
Meter Press (iwg)	0.58	Start/Stop Time	0940/1209

Std Sample Vol (SCF)	46.80
Metric Sample Vol (cubic meters)	1.33
Moisture Fraction	0.094
Stack Gas Mol Wt	28.82
Stack Gas Velocity (ft/sec)	49.65
Stack Flow Rate (wacfm)	965,269
Stack Flow Rate (dscfm)	634,443
Isokinetic Ratio (%)	99.75

Client/Location: PG&E MORRO BAY | Unit: 3 | Test No.: 3- MM5 | Method: | Run 1
Sample location: STACK DUCT | Fuel: OIL | Ambient Temp., °F: | of 2
Operators: M. SCHMITT | Meter Vol. (Start/End): 470.042 / | Date: 3/2/90

Pre Test Data:

Barometric Press, in. Hg	30.4
Stack Area, sq. ft.	
Sample Time/ Pt, min.	4
Assumed Stack Press	
Assumed Moisture	
Assumed Molecular Wt	

Equipment Info:

Meter No.	ES-28
Meter, Yd	1.00
Pitot, Cp	.84
CFM @ ΔH = 1.0	.573
Probe I.D.	24'
Nozzle No./Dia	.198
Filter No.	—

Imp.	Matl	Wt(End)	Weight (Start)	Weight (g)
#1	HNO_3/H_2O_2	662.7	564.6	98.1
#2	HNO_3/H_2O_2	610.1	605.5	4.6
#3	$KMnO_4$	590.0	589.7	.3
#4	$KMnO_4$	568.5	567.1	1.4
Total	SG	736	736	0
Impinger Box I.D.				
Integrated Bag I.D.				

Leak Check:

Sample Train

	CFM	Vac.	Init.	Pitot	IBS
Pre-Test	.004	20"	MS	OK	—
Post-Test	.002	13"	MS		

Pre-Test Calibration

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

ΔH = 1.01 ΔP (.90)

Sample Point	Time	Meter Conditions ΔP	ΔH	Meter Reading	Temperatures, °F Stack	Probe	Meter In	Meter Out	Oven	Imp. Out	O_2	Vacuum	Static Press. iwg
C-4	941	.69	.70	470.040	294	—	71	76	—	55	5.3	4	
-3	945	.85	.87	471.910	311		92	77		49	4.4	7	
-2	949	.77	.79	474.041	293		94	78		49	4.0	8	
-1	953	.93	.95	476.040	289		96	79		49	5.3	9	
—	957.20			478.233									
F-4	959	.76	.78	478.395	275		89	79		51		8	
-3	1003	.73	.74	480.480	280		91	80		50	4.0	9	
-2	1007	.59	.60	482.354	268		88	79		51	4.3	8	
-1	1011	.67	.68	484.151	269		92	80		52	6.8	9	
—	1015			486.021									
E-4	1018	.70	.71	486.021	293		85	80		54	6.6	9	
-3	1022	.65	.66	487.936	252		93	80		51	5.2	9	
-2	1026	.56	.57	489.791	260		93	79		50	5.6	9	
-1	1030	.50	.51	491.540	253		91	79		50	6.7	8	
—	1034			493.202								~~0~~	
A-4	1038	.71	.72	493.202	283		87	79		53	~~12~~	10	
C-3	1042	.68	.69	495.016	283		94	77		51	5.5	12	
-2	1046	.57	.51	946.868	268		92	80		51	5.4	9	
Total/Average													

Test Summary

Initial 48.112 ✓KH
Sample Vol., c.f. ~~48.184~~
Stack Press, iwg .0.31
ΔP ~~.574~~ .575 iwg ΔH 0.576 iwg
Meter Temp., °F 83.6 ✓
Stack Temp., °F 268.7 ✓
Water Collected, g 1044 —
O_2/CO_2 Method 5.62 $\%O_2$
Chain of Cust. Info (init.):
Impingers Loaded
Impingers Recovered
Filter Loaded
Filter Recovered
Probe Wash
Comments: * 1054 BLOWS NOZZLE .072 cfm FOR LEAK CHECK

EST DS-022
Rev. 9/89

METALS EMISSION CALCULATIONS

Client/Location: PG&E/MORRO
F Factor: 9035
Reference Temp (F): 60
Fuel: Oil

ELEMENT: ZINC

Test	ug/train	Vmstd	%O2	Qsd	ug/m3	lb/hr	lb/MMbtu
3-MTLS <	113.00	46.80	5.62	634443 <	85.26 <	2.02E-01 <	6.57E-05
4-MTLS	330.00	48.59	5.52	677726	239.81	6.08E-01	1.84E-04
6-MTLS <	115.00	46.30	5.79	665816 <	87.70 <	2.19E-01 <	6.84E-05

Average ug/m3

< 137.59

Average lb/hr

< 3.43E-01

Average lb/MMbtu

< 1.06E-04

METALS EMISSION CALCULATIONS

Client/Location: PG&E/MORRO
F Factor: 9035
Reference Temp (F): 60
Fuel: Oil

ELEMENT: SELENIUM

Test	ug/train	Vmstd	%O2	Qsd	ug/m3	lb/hr	lb/MMbtu
3-MTLS <	6.10	46.80	5.62	634443 <	4.60	< 1.09E-02	< 3.55E-06
4-MTLS ND	6.20	48.59	5.52	677726 ND	4.51	ND1.14E-02	ND 3.45E-06
6-MTLS ND	7.30	46.30	5.79	665816 ND	5.57	ND1.39E-02	ND 4.34E-06

Average ug/m3

< 4.89

Average lb/hr

< 1.21E-02

Average lb/MMbtu

< 3.78E-06

METALS EMISSION CALCULATIONS

Client/Location: PG&E/MORRO
F Factor: 9035
Reference Temp (F): 60
Fuel: Oil

ELEMENT: NICKEL

Test	ug/train	Vmstd	%O2	Qsd	ug/m3	lb/hr	lb/MMbtu
3-MTLS	950.00	46.80	5.62	634443	716.76	1.70E+00	5.53E-04
4-MTLS	27.00	48.59	5.52	677726	19.62	4.98E-02	1.50E-05
6-MTLS	910.00	46.30	5.79	665816	694.00	1.73E+00	5.41E-04

Average ug/m3

476.79

Average lb/hr

1.16E+00

Average lb/MMbtu

3.70E-04

METALS EMISSION CALCULATIONS

Client/Location: PG&E/MORRO
F Factor: 9035
Reference Temp (F): 60
Fuel: Oil

ELEMENT: MERCURY

Test	ug/train	Vmstd	%O2	Qsd	ug/m3	lb/hr	lb/MMbtu
3-MTLS ND	53.00	46.80	5.62	634443 ND	39.99 ND	9.50E-02 ND	3.08E-05
4-MTLS ND	68.00	48.59	5.52	677726 ND	49.42 ND	1.25E-01 ND	3.78E-05
6-MTLS ND	60.00	46.30	5.79	665816 ND	45.76 ND	1.14E-01 ND	3.57E-05

Average ug/m3

ND 45.05

Average lb/hr

ND 1.11E-01

Average lb/MMbtu

ND 3.48E-05

METALS EMISSION CALCULATIONS

Client/Location: PG&E/MORRO
F Factor: 9035
Reference Temp (F): 60
Fuel: Oil

ELEMENT: MANGANESE

Test	ug/train	Vmstd	%O2	Qsd	ug/m3	lb/hr	lb/MMbtu
3-MTLS	61.00	46.80	5.62	634443	46.02	1.09E-01	3.55E-05
4-MTLS	13.00	48.59	5.52	677726	9.45	2.40E-02	7.24E-06
6-MTLS *	16.00	46.30	5.79	665816 *	12.20 *	3.04E-02 *	9.51E-06

*FRONT HALF ONLY--IMPINGER CONTAMINATED.

Average ug/m3

22.56

Average lb/hr

5.46E-02

Average lb/MMbtu

1.74E-05

METALS EMISSION CALCULATIONS

Client/Location: PG&E/MORRO
F Factor: 9035
Reference Temp (F): 60
Fuel: Oil

ELEMENT: LEAD

Test	ug/train	Vmstd	%O2	Qsd	ug/m3	lb/hr	lb/MMbtu
3-MTLS	11.00	46.80	5.62	634443	8.30	1.97E-02	6.40E-06
4-MTLS	28.00	48.59	5.52	677726	20.35	5.16E-02	1.56E-05
6-MTLS	44.00	46.30	5.79	665816	33.56	8.36E-02	2.62E-05

Average ug/m3

20.73

Average lb/hr

5.16E-02

Average lb/MMbtu

1.60E-05

METALS EMISSION CALCULATIONS

Client/Location: PG&E/MORRO
F Factor: 9035
Reference Temp (F): 60
Fuel: Oil

ELEMENT: COPPER

Test	ug/train	Vmstd	%O2	Qsd	ug/m3	lb/hr	lb/MMbtu
3-MTLS	18.00	46.80	5.62	634443	13.58	3.22E-02	1.05E-05
4-MTLS	15.00	48.59	5.52	677726	10.90	2.76E-02	8.35E-06
6-MTLS	3.60	46.30	5.79	665816	2.75	6.84E-03	2.14E-06

Average ug/m3

9.08

Average lb/hr

2.22E-02

Average lb/MMbtu

6.99E-06

Energy Systems Associates A CORPORATION
15991 RED HILL AVE., SUITE 110, TUSTIN, CALIFORNIA 92680

SUBJECT PG&E / Morro Bay JOB NO. 71109

SHEET NO. 1 of 1

COMPUTED BY L Green DATE 5/21/90 CHECKED BY _____ DATE _____

$$Cd\ ug/train = \frac{(Probe\ Filter - RB) + (Impinger - RB)}{.95}$$

$$3\ mths = \frac{(.48 - ND) + (.36 - .14)}{.95} = .95$$

$$4\ mths = \frac{(.59 - ND) + (.94 - .14)}{.95} = 1.5$$

$$6\ mths = \frac{(ND < .4 + ND) + (.98 - .14)}{.95} = 1.3$$

120097

PARTICULATE TEST DATA

Client/Location PG&E / Morro Bay Unit 3 Test No. #4 - Formaldehyde Method _____ Page 1

Sample Location Boiler Exit Fuel Oil Ambient Temp., °F _____ of 1

Operators RD Meter Vol. (Start/End) 427.165 Date 3/2/90

Pre Test Data:
- Barometric Press, in. Hg 30.4
- Stack Area, sq. ft. —
- Sample Time/ Pt, min 24/5min
- Assumed Stack Press —
- Assumed Moisture —
- Assumed Molecular Wt —

Equipment Info:
- Meter No. E5-11
- Meter, Yd 1.0
- Pitot, Cp —
- CFM @ΔH = 1.0 .564
- Probe I.D. 8' Teflon
- Nozzle No./Dia —
- Filter No. —

Imp.	Matl	Wt(End)	Weight (Start)	Weight (g)
#1			100	
#2				
#3				
#4				
Total				

Impinger Box I.D. _____

Integrated Bag I.D. _____

Leak Check:

Sample Train

	CFM	Vac.	Init. Pitot	IBS
Pre-Test			OK RD	
Post-Test			OK RD	

Pre-Test Calibration

	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	Vacuum	Static Press. iwg
C-2	1730		.01	427.165			91	92		66		1	
	1735		.01	427.241			89	93					
	1740		.01	427.300			90	92				1	
	1745		.02	427.510			93	92					
	1750		.02	427.837			90	92				1	
	1755		.02	428.995			85	90					
	1800			428.375									
Total/Average													

Test Summary
- Initial _____
- Sample Vol., c.f. _____
- Stack Press, iwg _____
- ΔP _____ iwg ΔH _____ iwg
- Meter Temp., °F 90.8
- Stack Temp., °F _____
- Water Collected, g _____
- O_2/CO_2 Method _____
- Chain of Cust. Info (init.):
  - Impingers Loaded _____
  - Impingers Recovered _____
  - Filter Loaded _____
  - Filter Recovered _____
  - Probe Wash _____
- Comments: _____

EST DS-022

Client/Location: PG&E / Morro Bay | Unit: #3 | Test No.: 10A-Form | Method: 4/10

Sample Location: Boiler Exhaust Duct | Fuel: GAS | Ambient Temp., °F: | of: 1

Operators: RP | Meter Vol. (Start/End): 635.773 / 636.793 | Date: 3/8/90

Pre Test Data:

- Barometric Press, in. Hg: 30.20
- Stack Area, sq. ft.:
- Sample Time/ Pt, min.: 30min Sample Pt.
- Assumed Stack Press: —
- Assumed Moisture: —
- Assumed Molecular Wt: —

Equipment Info:

- Meter No.: FS-11
- Meter, Yd: 1.00
- Pitot, Cp: .84
- CFM @ H = 1.0: .564
- Probe I.D.: ¼" Teflon
- Nozzle No./Dia: —
- Filter No.: —

Imp.	Matl	Wt(End)	Weight (Start)	Weight (g)
#1	DMPA		100ml	
#2	DMPA		100ml	
#3	—		0	
#4				
Total				

Impinger Box I.D.:

Integrated Bag I.D.:

Leak Check:

Sample Train

	CFM	Vac.	Init.	Pitot	IBS
Pre-Test	.005	5	RP	—	—
Post-Test					

Pre-Test Calibration

	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	Out	Oven	Imp. Out	O_2	Vacuum	Static Press. iwg
F2	1032		.01	635.773			83	85				2	
	1037		.01	635.901			85	86				2	
	1042		.01	636.089			86	87				2	
	1047		.01	636.275			86	88				2	
	1052		.01	636.445			87	89				2	
	1057		.01	636.620			89	91				2	
	1102			636.793									
Total/Average													

Test Summary

- Initial
- Sample Vol., c.f.
- Stack Press, iwg
- ΔP ____ iwg ΔH ____ iwg
- Meter Temp., °F
- Stack Temp., °F
- Water Collected, g
- O_2/CO_2 Method
- Chain of Cust. Info (init.):
  - Impingers Loaded: RP
  - Impingers Recovered: RP
  - Filter Loaded
  - Filter Recovered
  - Probe Wash: RP
- Comments:

Operators R. Renee — Meter Vol. (Start/End) 637.846 / 638.805 — Date 3/6/90

Pre Test Data:

- Barometric Press, in. Hg: 30.20
- Stack Area, sq. ft.: —
- Sample Time/ Pt, min.: 3 Min Single Pt
- Assumed Stack Press: —
- Assumed Moisture: —
- Assumed Molecular Wt: —

Equipment Info:

- Meter No.: E-11
- Meter, Yd: 1.00
- Pitot, Cp: —
- CFM @ H = 1.0: .564
- Probe I.D.: ¼" Teflon
- Nozzle No./Dia: —
- Filter No.: —

Imp.	Matl	Wt(End)		Weight (Start)		Weight (g)
#1	DI WTR	____	-	10ml	=	____
#2	DI WTR	____	-	10ml	=	____
#3	—	____	-	—	=	____
#4	____	____	-	____	=	____
Total		____	-	____	=	____

Impinger Box I.D. ____

Integrated Bag I.D. ____

Leak Check:

Sample Train

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

Pre-Test Calibration

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

Sample Point	Time	Meter Conditions ΔP	Meter Conditions ΔH	Meter Conditions Meter Reading	Temperatures, °F Stack	Probe	Meter In	Meter Out	Oven	Imp. Out	O_2	Vacuum	Static Press. iwg
	1147		.01	637.846			89	91				2	
	1152		.01	638.005			91	92				2	
	1157		.01	638.165			92	94				2	
	1202		.01	638.320			91	93				2	
	1207		.01	638.482			91	93				2	
	1212		.01	638.642			94	96				2	
	1217			638.805									
Total/Average													

Test Summary

- Initial ____
- Sample Vol., c.f. ____
- Stack Press, iwg ____
- ΔP ____ iwg ΔH ____ iwg
- Meter Temp., °F ____
- Stack Temp., °F ____
- Water Collected, g ____
- O_2/CO_2 Method ____
- Chain of Cust. Info (Init.):
  - Impingers Loaded RP
  - Impingers Recovered RP
  - Filter Loaded ____
  - Filter Recovered ____
  - Probe Wash RP
- Comments: Spikes & Blanks ran with this test

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Energy Systems Associates
Radian Work Order: P0-03-055

Method:Aldehydes by HPLC (1) List:ESA Analyte List				
Sample ID:	2A-FORM (A&B)	2B-FORM (A&B)	4-FORM (A&B)	10 A-FORM (A-&B)
Factor:	0.267	0.267	0.267	0.267
Results in:	total ug	total ug	total ug	total ug
	01A	02A	03A	04A
Matrix:	AIR	AIR	AIR	AIR

	Result	Det. Limit	Result	Det. Limit	Result	Det. Limit	Result	Det. Limit
Formaldehyde	7.78	0.24	7.84	0.24	1.96	0.24	0.950 a	0.24

a Est. result less that 5 times detection limit

(1) For a detailed description of flags and technical terms in this report refer to Appendix A in this report.

Energy Systems Associates
Radian Work Order: P0-03-055

Method:Aldehydes by HPLC (1)
List:ESA Analyte List

Sample ID:	BLANK #2	MATRIX SPIKE	MATRIX SPIKE DUP	METHOD BLANK
Factor:	.267	0	0	.267
Results in:	total ug	%	%	total ug
	09A	10A	11A	12A
Matrix:	AIR	AIR	AIR	AIR

	Result	Det. Limit	Result	Det. Limit	Result	Det. Limit	Result	Det. Limit
Formaldehyde	3.55	0.24	86	0	112	0	2.86	0.24

(1) For a detailed description of flags and technical terms in this report refer to Appendix A in this report.

Energy Systems Associates
Radian Work Order: PO-03-055

Sample Identifications and Dates

Sample ID	BLANK #1	FIELD SPIKE #1	BLANK #2	MATRIX SPIKE	MATRIX SPIKE DUP	METHOD BLANK
Date Sampled						
Date Received	03/13/90	03/13/90	03/13/90	03/13/90	03/13/90	03/13/90
Matrix	AIR	AIR	AIR	AIR	AIR	AIR
	07	08	09	10	11	12
Aldehydes by HPLC						
Prepared	03/15/90	03/15/90	03/15/90	03/15/90	03/15/90	03/15/90
Analyzed	03/17/90	03/17/90	03/17/90	03/17/90	03/17/90	03/17/90
Analyst	JS	JS	JS	JS	JS	JS
File ID	ESA25	ESA26	ESA27	ETA1	ETA2	ESA29
Blank ID	ESA29	ESA29	ESA29	ESA29	ESA29	ESA29
Instrument	V5000	V5000	V5000	V5000	V5000	V5000
Report as	received	received	received	received	received	received

Appendix C.6

PAH

AVERAGE STACK PAH EMISSIONS

SPECIES		ug/dscm	lb/hr	lb/MMbtu
Naphthalene		5.401	1.41E-02	4.18E-06
Acenaphthylene	ND<	0.012	ND< 3.12E-05	ND< 9.22E-09
Acenaphthene		0.134	3.49E-04	1.02E-07
Fluorene	<	0.017	< 4.55E-05	< 1.35E-08
Phenanthrene	<	0.014	< 3.72E-05	< 1.10E-08
Anthracene	<	0.012	< 3.12E-05	< 9.22E-09
Fluoranthene	<	0.012	< 3.12E-05	< 9.22E-09
Pyrene	<	0.012	< 3.21E-05	< 9.48E-09
Benz(a)anthracene	ND<	0.012	ND< 3.12E-05	ND< 9.22E-09
Chrysene	ND<	0.012	ND< 3.12E-05	ND< 9.22E-09
Benzo(b+k)fluorant	ND<	0.012	ND< 3.12E-05	ND< 9.22E-09
Benzo(a)pyrene	ND<	0.012	ND< 3.12E-05	ND< 9.22E-09
Indeno(1,2,3-cd)py	ND<	0.012	ND< 3.12E-05	ND< 9.22E-09
Dibenzo(a,h)anthra	ND<	0.012	ND< 3.12E-05	ND< 9.22E-09
Benzo(g,h,i)peryle	ND<	0.012	ND< 3.12E-05	ND< 9.22E-09
Average Total PAH	<	5.70	< 1.49E-02	< 4.41E-06

Client/Location: PG&E / MORRO BAY | Unit: 3 | Test No.: 9-PM | Method: 4/5 | 1
Sample Location: EPRI HEATER EXIT | Fuel: OIL | Ambient Temp., °F: 62 | of 2
Operators: J. Mulligan | Meter Vol. (Start/End): 850.515 / 929.354 | Date: 3/5-6/90

Pre Test Data:

Barometric Press, in. Hg	30.
Stack Area, sq. ft.	324 Abs
Sample Time/ Pt, min.	6/168
Assumed Stack Press	
Assumed Moisture	10%
Assumed Molecular Wt	29

Equipment Info:

Meter No.	ES-28
Meter, Yd	1.00
Pitot, Cp	.84
CFM @ H = 1.0	.573
Probe I.D.	TEFLON
Nozzle No./Dia	.198
Filter No.	

Imp.	Matl	Wt(End)	Weight (Start)	Weight (g)
#1	D	648.5	- 469.8	= 178.7
#2	H_2O	584.1	- 584.2	= -0.1
#3	D	480.0	- 479.6	= .4
#4	S.G.	734.5	- 714.4	= 20.1
Total			-	=
Impinger Box I.D.				
Integrated Bag I.D.				

Leak Check:

Sample Train

	CFM	Vac.	Init.	Pitot	IBS
Pre-Test	.014	16	1M	OK	
Post-Test	.003	15	1M		

Pre-Test Calibration

	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	Vacuum	Static Press. iwg	Test Summary
START	844	.89	83	850.515	294	N/A	73	61	N/A	48		7		
4 - 4	850	.91	.85	852.358	280		82	64		38	6.0	7		Initial 78.552 KH / KH
3	856	.70	.84	856.463	265		86	65		40	5.9	8		Sample Vol., c.f. ~~76.837~~
2	902	.85	.78	859.510	250		87	71		41	7.0	8		Stack Press, iwg
STOP 1	905			862.639										ΔP 0.755 iwg ΔH 0.711 iwg
START	910	.91	.85	862.635	303		87	76		51	5.5	10		Meter Temp., °F 83.23
2 - 4	916	.89	.83	865.623	303		92	78		53	4.4	11		Stack Temp., °F 276.5
3	922	.72	.67	868.789	265		94	80		50	5.4	11		Water Collected, g 169.1
2	928	.70	.65	871.429	246		94	81		52	7.4	10		O_2/CO_2 Method 5.92
STOP 1	934			874.191										Chain of Cust. Info (Init.):
START	936	.87	.81	874.191	282		91	82		56	6.6	7		Impingers Loaded KH
3 - 4	942	.85	.78	877.174	293		95	84		56	5.5	9		Impingers Recovered KH
3	948	.61	.62	880.155	270		94	83		59	6.4	9		Filter Loaded KH
2	954	.641	.58	882.801	256		93	83		63	6.0	5		Filter Recovered KH
STOP 1	1000			885.412										Probe Wash
START	1003	.84	.78	885.412	259		90	82		53	7.1	7		Comments:
4 - 4	1009	.75	.70	888.287	260		94	82		51	6.8	10		
3	1015	.65	.61	891.168	263		93	82		50	6.1	10		
Total/Average														

CARNOT 05/17/90

SAMPLE TRAIN TEST SUMMARY

Client/Location	PGE/MORRO	Date	3/04/90
Test Number	7-PAH	Data By	KCH
Test Method	CARB 429	Sample Location	APH FG OUT
Fuel	OIL	Reference Temp (F)	60
Control Box #	ES-28	Unit	3
Pitot Factor	0.840	Meter Cal Factor	1.0000
Stack Area (sq ft)	324.00	Sample Time (Min)	168
Bar Press (in Hg)	30.30	Nozzle Diam (in)	0.196
Meter Vol (acf)	69.988	Meter Temp (F)	79.3
Stack Press (iwg)	0.05	Stack Temp (F)	267.3
Vel Head (iwg)	0.6090	O2 (%): from CEM	4.44
		from portable	5.28
Liquid Vol (ml)	160.2	CO2 (%): from CEM	12.24
		calculated	11.62
Meter Press (iwg)	0.57	Start/Stop Time	0932/1300

Std Sample Vol (SCF)	68.39
Metric Sample Vol (cubic meters)	1.94
Moisture Fraction	0.098
Stack Gas Mol Wt	28.88
Stack Gas Velocity (ft/sec)	51.01
Stack Flow Rate (wacfm)	991,542
Stack Flow Rate (dscfm)	647,370
Isokinetic Ratio (%)	97.20

Client/Location: PG&E / Moss Landing — Unit: 3 — Test No.: 8-PM4 — Method: 4/5 — Run: 1

Sample Location: Exh. Heater Exit — Fuel: Oil — Ambient Temp., °F: 60 — of: 2

Operators: S. Mulligan — Meter Vol. (Start/End): 770.037 / 847.65 — Date: 2/4/90

Pre Test Data:

Barometric Press, in. Hg	30.25
Stack Area, sq. ft.	324 Assd
Sample Time/ Pt, min.	4/120
Assumed Stack Press	
Assumed Moisture	9%
Assumed Molecular Wt	29

Equipment Info:

Meter No.	ES-28
Meter, Yd	1.00
Pitot, Cp	.84
CFM @ H = 1.0	.573
Probe I.D.	Teflon
Nozzle No./Dia	.194
Filter No.	747-173

Imp.	Matl	Wt(End)	Weight (Start)	Weight (g)
#1		625.3	469.2	156.1
#2		578.6	583.6	-5
#3		480.3	478.4	1.9
#4		724.2	696.2	28.0
Total				
Impinger Box I.D.				
Integrated Bag I.D.				

Leak Check:

Sample Train

	CFM	Vac.	Init. Pitot	IBS	
Pre-Test	.013	16	VM		
Post-Test	.005	26	VM		

Pre-Test Calibration

	Time	ΔH	Meter Reading	Meter Temp. In	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	Vacuum	Static Press. iwg
Start	1502	.84	.77	770.037	298	N/A	81	75	N/A	49		10	
6 4	1508	1.0	.92	772.968	310		92	79		42	3.9	12	
3	1514	.91	.83	776.376	295		93	75		43	4.8	13	
2	1520	.95	.87	779.175	297		93	80		45	5.0	14	
Stop 1	1526			782.194									
Start	1529	.82	.75	782.194	284		84	77		44	5.2	12	
E 4	1535	.80	.73	785.062	265		89	75		40	5.6	14	
3	1541	.65	.59	787.881	270		88	76		40	6.2	14	
2	1547	.69	.63	790.289	262		88	77		43	6.1	14	
Stop 1	1553			793.971									
Start	1554	.87	.80	793.071	251		85	81		50	6.3	12	
E 4	1602	.74	.69	796.060	253		93	81		46	6.2	16	
3	1608	.56	.51	798.855	255		90	81		48	6.8	14	
2	1614	.59	.54	801.289	264		85	80		48		15	
Stop 1	1620			803.689									
Start	1624	.85	.78	803.689	251		84	78		45	6.6	15	
D 4	1630	.67	.61	806.354	257		88	77		48	1.0	17	
3	1636	.59	.49	808.992	258		88	77		45	5.8	16	
Total/Average													

Test Summary

- Initial 79.284 ✓ KH VK
- Sample Vol., c.f. ~~79.684~~
- Stack Press. 0.760 ✓ iwg
- ΔP ~~0.753~~ iwg ΔH .703 iwg
- Meter Temp., °F 80.6
- Stack Temp., °F 2918 ✓
- Water Collected, g 1810 ✓
- O_2/CO_2 Method 5.55
- Chain of Cust. Info (Init.):
  - Impingers Loaded KH
  - Impingers Recovered KH
  - Filter Loaded KH
  - Filter Recovered KH
  - Probe Wash ,
- Comments:

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SAMPLE TRAIN TEST SUMMARY

Client/Location	PGE/MORRO	Date	3/04/90
Test Number	8-PAH	Data By	KCH
Test Method	CARB 429	Sample Location	APH FG OUT
Fuel	OIL	Reference Temp (F)	60
Control Box #	ES-28	Unit	3
Pitot Factor	0.840	Meter Cal Factor	1.0000
Stack Area (sq ft)	324.00	Sample Time (Min)	168
Bar Press (in Hg)	30.25	Nozzle Diam (in)	0.196
Meter Vol (acf)	79.284	Meter Temp (F)	80.6
Stack Press (iwg)	0.31	Stack Temp (F)	269.8
Vel Head (iwg)	0.7600	O2 (%): from CEM	4.33
		from portable	5.62
Liquid Vol (ml)	181.0	CO2 (%): from CEM	12.33
		calculated	11.37
Meter Press (iwg)	0.70	Start/Stop Time	1502/1834

Std Sample Vol (SCF)	77.18
Metric Sample Vol (cubic meters)	2.19
Moisture Fraction	0.098
Stack Gas Mol Wt	28.86
Stack Gas Velocity (ft/sec)	57.13
Stack Flow Rate (wacfm)	1,110,603
Stack Flow Rate (dscfm)	721,805
Isokinetic Ratio (%)	98.39

Client/Location PG&E Morro Bay Unit 3 Test No. 7-PAH Method 429

Sample Location E.C.R.E Heater Exit Fuel Oil Ambient Temp., °F 53 of 2

Operators J Mulligan Meter Vol. (Start/End) 699.742 1769.720 Date 3/1 [illegible]

Pre Test Data:

Barometric Press, in. Hg	30.30
Stack Area, sq. ft.	324 [illegible]
Sample Time/ Pt, min.	6/168
Assumed Stack Press	
Assumed Moisture	9%
Assumed Molecular Wt	29

Equipment Info:

Meter No.	ES-28
Meter, Yd	1.00
Pitot, Cp	.84
CFM @ H = 1.0	.573
Probe I.D.	ICEM
Nozzle No./Dia	.196
Filter No.	47-174

Imp.	Matl	Wt(End)		Weight (Start)		Weight (g)
#1	0	614	-	468.5	=	145.5
#2	H_2O	586.4	-	589.4	=	-3.0
#3	0	477.1	-	479.9	=	-2.8
#4	SG	714.9	-	694.4	=	20.5
Total			-		=	

Impinger Box I.D.

Integrated Bag I.D.

Leak Check:

Sample Train

	CFM	Vac.	Init.	Pitot	IBS
Pre-Test	.001	16	JM	OK	
Post-Test	.001	22	JM		

Pre-Test Calibration

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

ΔH. 0.92

Sample Point	Time	Meter Conditions ΔP	ΔH	Meter Reading	Temperatures, °F Stack	Probe	Meter In	Meter Out	Oven	Imp. Out	O_2	Vacuum	Static Press. iwg
start	932	.72	.66	699.742	273	N/A	76	69	N/A	51	5.2	6	
A 4	938	.83	.76	702.453	270		82	70		45	5.3	9	
3	944	.80	.73	705.185	249		83	71		47	5.3	9	
2	950	.84	.77	708.086	239		85	72		49	6.4	11	
stop 1	956			711.045									
start	10:00	.74	.68	711.045	292		76	72		49	4.8	9	
B - 4	1006	.87	.80	713.750	295		85	72		42	4.4	11	
3	1012	.70	.64	716.652	267		81	72		42	4.8	11	
2	1018	.69	.63	719.462	231		84	73		43	4.6	11	
stop 1	1024			721.924									
start	1028	.72	.66	721.924	286		77	73		45	5.5	9	
C - 4	1034	.74	.68	724.718	277		85	73		45		12	
3	1040	.60	.55	727.854	266		85	73		45	5.7	13	.05
2	1046	.57	.52	730.023	251		85	73		47	6.5	12	
stop 1	1052			732.521									
start	1102	.60	.55	732.521	250		80	75		52	5.6	10	
E. 4	1108	.57	.52	735.140	252		88	75		45	5.0	12	
3	1114	.55	.50	737.497	259		89	78		46	5.4	12	
Total/Average													

Test Summary

Initial	KH
Sample Vol., c.f.	69.988
Stack Press, iwg	.05
ΔP .604 iwg	ΔH 0.57 iwg
Meter Temp., °F	79.3
Stack Temp., °F	267.7
Water Collected, g	160.2
O_2/CO_2 Method	5.28
Chain of Cust. Info (init.):	
Impingers Loaded	KH
Impingers Recovered	KH
Filter Loaded	KH
Filter Recovered	KH
Probe Wash	
Comments:	

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SAMPLE TRAIN TEST SUMMARY

Client/Location	PGE/MORRO	Date	3/05/90
Test Number	9-PAH	Data By	KCH
Test Method	CARB 429	Sample Location	APH FG OUT
Fuel	OIL	Reference Temp (F)	60
Control Box #	ES-28	Unit	3
Pitot Factor	0.840	Meter Cal Factor	1.0000
Stack Area (sq ft)	324.00	Sample Time (Min)	168
Bar Press (in Hg)	30.25	Nozzle Diam (in)	0.198
Meter Vol (acf)	78.522	Meter Temp (F)	83.2
Stack Press (iwg)	0.19	Stack Temp (F)	276.5
Vel Head (iwg)	0.7550	O2 (%): from CEM	5.63
		from portable	5.92
Liquid Vol (ml)	169.1	CO2 (%): from CEM	11.17
		calculated	10.96
Meter Press (iwg)	0.71	Start/Stop Time	0844/1205

Std Sample Vol (SCF)	76.08
Metric Sample Vol (cubic meters)	2.15
Moisture Fraction	0.094
Stack Gas Mol Wt	28.87
Stack Gas Velocity (ft/sec)	57.20
Stack Flow Rate (wacfm)	1,112,039
Stack Flow Rate (dscfm)	719,645
Isokinetic Ratio (%)	95.32

Appendix C.7

Metals

Client/Location: PG&E / Morro Bay | Unit: 3 | Test No.: 3-CD | Method: | 2 of 2

Sample Location: E. P Heater Exit | Fuel: oil | Ambient Temp., °F: 61

Operators: J. Mallyan | Meter Vol. (Start/End): 1274.451 | Date: 3/2/89

Pre Test Data:
- Barometric Press, in. Hg
- Stack Area, sq. ft.
- Sample Time/ Pt, min.
- Assumed Stack Press
- Assumed Moisture
- Assumed Molecular Wt

Equipment Info:
- Meter No.
- Meter, Yd
- Pitot, Cp
- CFM @ H = 1.0
- Probe I.D.
- Nozzle No./Dia
- Filter No.

Imp.	Matl	Wt(End)	Weight (Start)	Weight (g)
#1				
#2				
#3				
#4				
Total				

Impinger Box I.D.

Integrated Bag I.D.

Leak Check:

Sample Train

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

Pre-Test Calibration

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

Start Pay One

Sample Point	Time	Meter Conditions ΔP	ΔH	Meter Reading	Temperatures, °F Stack	Probe	Meter In	Meter Out	Oven	Imp. Out	O_2	Vacuum	Static Press. iwg	Test Summary
0 - 2	1045	.23	.78	345.231	262	NA	120	105	N/A	50	6.2	7		
Stop 1	1049			351.168										Initial
START	1051	.55	.59	351.168	270		115	106		53	6.6	6		Sample Vol., c.f.
E 4	1055	.75	.85	352.785	253		120	107		51	5.4	7		Stack Press, iwg
3	1059	.68	.72	354.535	254		113	108		53	5.4	6		ΔP ____ iwg ΔH ____ iwg
2	1103	.65	.70	356.189	256		120	108		46	6.4	6		Meter Temp., °F
Stop 1	1108			358.501										Stack Temp., °F
START	1140	.71	.76	358.501	228		112	106		50	5.4	6	+.15	Water Collected, g
E 4	1144	.75	.84	360.687	255		120	106		44	5.8	6		O_2/CO_2 Method
3	1148	.67	.72	362.120	251		123	106		44	4.2	6		Chain of Cust. Info (init.):
2	1152	.64	.69	364.289	270		123	107		44	4.8	6		Impingers Loaded
Stop 1	1158			366.914										Impingers Recovered
START	1203	.49	.52	366.914	293		114	108		45	4.6	5		Filter Loaded
G 4	1207	.72	.77	368.438	290		120	108		42	4.8	7		Filter Recovered
3	1211	.75	.81	370.335	305		123	108		47	4.3	7		Probe Wash
2	1215	.83	.89	372.456	285		121	109		48	4.4	8		Comments: Re Start Test
Stop 1	1219			374.491										
Total/Average														

Client/Location PG&E | Unit 3 | Test No. A-Oil | Method ___ | 1 of 2
Sample Location ___ | Fuel oil | Ambient Temp., °F ___
Operators J. Mulligan | Meter Vol. (Start/End) 374.834 | Date 3/2/90

Pre Test Data:
- Barometric Press, in. Hg 30.4
- Stack Area, sq. ft. ___
- Sample Time/ Pt, min: 4
- Assumed Stack Press ___
- Assumed Moisture 9%
- Assumed Molecular Wt 29

Equipment Info:
- Meter No. ES-11
- Meter, Yd 1.0
- Pitot, Cp .84
- CFM @ H = 1.0 .564
- Probe I.D. Teflon
- Nozzle No./Dia .155
- Filter No. ___

Imp.	Matl	Wt(End)	Weight (Start)	Weight (g)
#1	[illegible]	677.3	582.0	95.3
#2	[illegible]	649.7	645.1	4.6
#3	[illegible]	478	472.1	5.9
#4	S.G	790.6	782.4	8.2
Total				

Impinger Box I.D. ___
Integrated Bag I.D. ___

Leak Check:

Sample Train	CFM	Vac.	Init.	Pitot	IBS
Pre-Test	.004	10	JM	ok	
Post-Test	.010	13	RP	OK	

Pre-Test Calibration

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

ΔH = 1.08

Sample Point	Time	Meter Conditions ΔP	ΔH	Meter Reading	Temperatures, °F Stack	Probe	Meter In	Out	Oven	Imp. Out	O_2	Vacuum	Static Press. iwg
Start	14:26	.76	.82	374.838	278	N/A	101	98	N/A	50	6.4	5	
A – 4	1430	.86	.91	376.750	266		108	97		46	6.2	5	
3	1434	.75	.81	378.863	242		108	98		46	6.6	5	
2	1438	.84	.90	381.	248		108	96		40	5.8	6	
Stop 1	1442			383.196									
Start	1447	.65	.74	383.196	282		103	101		48	5.4	4	
B 4	1451	.81	.87	385.275	283		104	95		46	5.9	6	
3	1455	.68	.73	387.235	287		109	96		47	4.6	7	
2	1459	.65	.70	388.893	262		105	94		47	6.0	7	
Stop 1	1503			390.935									
Start	1508	.69	.74	390.935	268		103	97		51	7.2	5	
C 4	1512	.71	.76	392.725	270		110	98		45	6.8	6	
3	1516	.60	.64	394.615	274		111	95		50	6.8	6	
2	1520	.51	.55	396.471	250		114	96		50		6	
Stop 1	1524			398.046									
Total/Average		0.713	0.76	23.208	265.83		102.43				6.21		

Test Summary
- Initial KH
- Sample Vol., c.f. 51.836
- Stack Press, iwg ± 0.27
- ΔP 0.634 iwg ΔH 0.695 iwg
- Meter Temp., °F 105.351
- Stack Temp., °F 265.83
- Water Collected, g 114
- O_2/CO_2 Method 6.52
- Chain of Cust. Info (Init.):
  - Impingers Loaded ___
  - Impingers Recovered ___
  - Filter Loaded ___
  - Filter Recovered ___
  - Probe Wash ___
- Comments: ___

Client/Location: PG&E | Unit: 3 | Test No.: 4-CD | Method: | 3 of 3
Sample Location: A | Fuel: | Ambient Temp., °F: | of
Operators: R. Hanson | Meter Vol. (Start/End): / | Date:

Pre Test Data:
- Barometric Press, in. Hg
- Stack Area, sq. ft.
- Sample Time/ Pt, min.
- Assumed Stack Press
- Assumed Moisture
- Assumed Molecular Wt

Equipment Info:
- Meter No.
- Meter, Yd
- Pitot, Cp
- CFH @ H@ 1.0
- Probe I.D.
- Nozzle No./Dia
- Filter No.

Imp.	Matl	Wt(End)	Weight (Start)	Weight (g)
#1				
#2				
#3				
#4				
Total				

Impinger Box I.D.
Integrated Bag I.D.

Leak Check:

Sample Train

	CFH	Vac.	Init.	Pitot	IBS
Pre-Test					
Post-Test					

Pre-Test Calibration

	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	Vacuum	Static Press. iwg
6-4	1630	.74	.80	418.614	266		113	98		52	6.2	10	
-3	1636	.85	.87	421.050	278		122	101		52	5.6	12	
-2	1640	.67	.72	422.891	299		124	101		54	5.2	-1	
-1	1644	.667	.72	424.395	285		122	102		54	6.2	7	+.27
	1646			426.674									
Total/Average		0.723	0.79	8.06	282.5	120.3	120.3	100.5			5.6		

Test Summary
- Initial
- Sample Vol., c.f.
- Stack Press, iwg
- ΔP ____ iwg ΔH ____ iwg
- Meter Temp., °F
- Stack Temp., °F
- Water Collected, g
- O_2/CO_2 Method
- Chain of Cust. Info (init.):
  - Impingers Loaded
  - Impingers Recovered
  - Filter Loaded
  - Filter Recovered
  - Probe Wash
- Comments:

EST DS-022
Rev. 9/89

Client/Location K6+E | Unit 3 | Test No. 6-CD | Method _____

Sample Location Boiler Exit | Fuel Oil | Ambient Temp., °F 60 | of _____

Operators R. Reece | Meter Vol. (Start/End) 483.020 / 532.310 | Date 3/2/90

Pre Test Data:

Barometric Press, in. Hg	30.4
Stack Area, sq. ft.	
Sample Time/ Pt, min.	2 Hr / 4 min
Assumed Stack Press	+.1
Assumed Moisture	9
Assumed Molecular Wt	29

Equipment Info:

Meter No.	FS-11
Meter, Yd	1.00
Pitot, Cp	.84
CFM @ H = 1.0	.564
Probe I.D.	2' Teflon
Nozzle No./Dia	.198
Filter No.	T49-196

Imp.	Matl	Wt(End)	Weight (Start)	Weight (g)
#1	H2O	685.2	580.1	105.1
#2	H2O	601.5	598.9	2.6
#3	0	477.5	475.3	2.2
#4	Sg	763.0	747.6	15.4
Total				

Impinger Box I.D. _____

Integrated Bag I.D. _____

Leak Check:

Sample Train

	CFM	Vac.	Init.	Pitot	IBS
Pre-Test	.001	16	RR	OK	—
Post-Test	.001	15	RR	OK	—

Pre-Test Calibration

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

.96

ΔH = 1.008 × ΔP

Sample Point	Time	Meter Conditions ΔP	ΔH	Meter Reading	Temperatures, °F Stack	Probe	Meter In	Meter Out	Oven	Imp. Out	O_2	Vacuum	Static Press. iwg
A-4	1559	.72	.78	483.020	265		85	72		56		4	
-3	1603	.74	.80	485.090	262		88	72		56	4.5	6	
-2	1607	.81	.86	486.781	268		89	73		55	5.2	6.5	
-1	1611	.79	.85	488.739	260		87	74		54	6.2	7	
	1615			490.767									
B-4	1618	.76	.82	490.767	307		80	72		55	4.8	5	
-3	1622	.76	.82	492.724	308		86	74		56		8	
-2	1626	.64	.69	494.690	275		89	73		56	4.9	8	
-1	1630	.64	.69	496.387	253		89	73		57		8	
	1634			498.248									
C-4	1637	.72	.78	498.248	295		80	72		56	5.8	5	
-3	1641	.64	.69	499.990	299		87	73		55	4.6	10	
-2	1645	.60	.61	501.925	268		88	73		56		11	
-1	1649	.59	.57	503.515	260		88	72		55	6.2	10.5	
	1653			505.161									
Total/Average													

Test Summary

Initial KH/KH

Sample Vol., c.f. 49.280

Stack Press, iwg _____

ΔP .663 iwg ΔH 0.67 iwg

Meter Temp., °F 77.4

Stack Temp., °F 274.5

Water Collected, g 125.3

O_2/CO_2 Method 5.09

Chain of Cust. Info (init.):

Impingers Loaded ____

Impingers Recovered ____

Filter Loaded ____

Filter Recovered ____

Probe Wash ____

Comments: _____

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Rev. 9/89

Client/Location PG&E / MORRO BAY Unit #2 Test No. 6-4 Method _____ Page 3

Sample Location BOILER TOP Fuel GAS Ambient Temp., °F _____ of 3

Operators R. PENCE Meter Vol. (Start/End) / Date 3/3/90

Pre Test Data:
- Barometric Press, in. Hg _____
- Stack Area, sq. ft. _____
- Sample Time/ Pt, min. _____
- Assumed Stack Press _____
- Assumed Moisture _____
- Assumed Molecular Wt _____

Equipment Info:
- Meter No. _____
- Meter, Yd _____
- Pitot, Cp _____
- CFM @ΔH = 1.0 _____
- Probe I.D. _____
- Nozzle No./Dia _____
- Filter No. _____

Imp.	Matl	Wt(End)	Weight (Start)	Weight (g)
#1			-	=
#2			-	=
#3			-	=
#4			-	=
Total			-	=

Impinger Box I.D. _____

Integrated Bag I.D. _____

Leak Check:

Sample Train

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

Pre-Test Calibration

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

Sample Point	Time	Meter Conditions ΔP	Meter Conditions ΔH	Meter Conditions Meter Reading	Temperatures, °F Stack	Probe	Meter In	Meter Out	Oven	Imp. Out	O_2	Vacuum	Static Press. iwg
6-4	1755	.78	.75	524.877	307		76	70		53	4.1	6	
-3	1759	.82	.79	526.729	296		83	70		53		8	
-2	1809	.67	.64	528.839	297		85	70		53	3.8	7.5	
-1	1808	.78	.75	530.416	302		82	71		53		8	
	1811			532.310									
Total/Average													

Test Summary
- Initial _____
- Sample Vol., c.f. _____
- Stack Press, iwg _____
- ΔP _____ iwg ΔH _____ iwg
- Meter Temp., °F _____
- Stack Temp., °F _____
- Water Collected, g _____
- O_2/CO_2 Method _____
- Chain of Cust. Info (init.):
  - Impingers Loaded _____
  - Impingers Recovered _____
  - Filter Loaded _____
  - Filter Recovered _____
  - Probe Wash _____
- Comments: _____

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
1250 S. Boyle Ave., Los Angeles, CA 90023. Phone (213) 269-7421. Fax (213) 268-5328

DATE RECEIVED: 03/13/90
DATE REPORTED: 03/30/90

LAB NUMBER: 25599

CLIENT: CARNOT

REPORT ON: FIVE SOURCE SAMPLES

PROJECT #: 71107

LOCATION: SUBMITTED BY CLIENT

RESULTS: SEE ATTACHED

Laboratory Director

Energy Systems Associates A CORPORATION
15991 RED HILL AVE., SUITE 110, TUSTIN, CALIFORNIA 92680

SUBJECT QC Metals / Mass Lasdrug JOB NO. 7109

SHEET NO. ___ of ___

COMPUTED BY K. Green DATE 5-21-90 CHECKED BY ___ DATE ___

Metal	RB	FB	Results	Rel Diff %	Spike Rec %
As	2.0	5.0	6.7, 11, 14, 11	27	74
	.38	NDC.28	3.8, 2.0 3.6		
Be	NDC.07	.46	.38, ND.06, .42	<1	26
	NDC.06	NDC.06	—	<1	82
Cd	NDC.41	1.3	.68, .59, NDC.41	<1	77
	.14	1.1	.36, .94, .98		
Cu	8.9	18	19, 9.8, 10	2	95
	2.5	4.6	9.1, 6.6, 5.0	4	78
Pb	35	36	8.3, 25, 40	2	84
	6.4	3.1	1.7, 2.0, 1.6		
Mn	4.2	86	36, 8.8 19	1	88
	NDC.62	3.0	27, 8.4, 290	4	91
Hg	ND	—	—	<1	104
				<1	97
Ni	2.5	900	900, 27, 780	<1	99
	1.4	31	3.9 2.3 88		
Se	14	6.0	8.2, ND, ND	<1	88
	ND	—	—		
Zn	1300	1200	1200, 1600, 1100	1	99
	3.9	16	" " "	4	68

120087

Energy Systems Associates A CORPORATION
15991 RED HILL AVE., SUITE 110, TUSTIN, CALIFORNIA 92680

SUBJECT PG&E / Morro Bay JOB NO. 71109

SHEET NO. 1 of 1

COMPUTED BY L Green DATE 5/21/90 CHECKED BY _____ DATE _____

$$As\ \mu g/train = \frac{(Probe\ Filter - RB) + (Impinger - RB)}{.95}$$

$$3\ mtls = \frac{(12.5 - 2.0) + (3.8 - .38)}{.95} = 14.6$$

$$4\ mtls = \frac{(6.7 - 2.0) + (2.0 - .38)}{.95} = 6.7$$

$$6\ mtls = \frac{(11 - 2.0) + (3.6 - .38)}{.95} = 12.9$$

METALS EMISSION CALCULATIONS

Client/Location: PG&E/MORRO
F Factor: 9035
Reference Temp (F): 60
Fuel: Oil

ELEMENT: CADMIUM by CARB 424

Test	ug/train	Vmstd	%O2	Qsd	ug/m3	lb/hr	lb/MMbtu
3-CD	2.00	48.62	5.95	683709	1.45	3.72E-03	1.14E-06
4-CD	1.00	48.48	6.52	665168	0.73	1.81E-03	5.97E-07
6-MTLS ND<	0.50	48.43	5.09	671959 ND<	0.36	ND<9.17E-04	2.72E-07

Average ug/m3

< 0.85

Average lb/hr

< 2.15E-03

Average lb/MMbtu

< 6.71E-07

Appendix C.4

Benzene

CARNOT

Benzene Emissions

Client/Location: PG&E/MORRO BAY UNIT 3

Reference Temp (F)	60		
F Factor, Gas	8456	F Factor, Oil	9035
O2,% Gas	5.37	O2,% Oil	5.92
Stack Flow Rate,Gas fuel(dscfm)	701757	Stack Flow Rate,Oil(dscfm)	719645

GAS FUEL		Benzene		Oil Fuel		Benzene	
TEST	10A, ppb	ND<	1	TEST	9A, ppb	ND<	1
	10B, ppb	ND<	1		9B, ppb	ND<	1
	10C, ppb	ND<	1		9C, ppb	ND<	1
	AVG, ppb	ND<	1		AVG, ppb	ND<	1
	STACK AVG, lb/hr	ND<	8.67E-03		STACK AVG, lb/hr	ND<	8.89E-03
	AVG, lb/MMbtu	ND<	2.34E-06		AVG, lb/MMbtu	ND<	2.50E-06

E/A

TEDLAR BAG DATA

Client/Project PG&E / MORRO BAY

Date 3-5-90 Unit #3 By RP.

	Bag ID No.	Bag ID No.	Bag ID No.
Test No.	9A - HC	9B - HC	9C - HC
Sample Rate	.5 l/min	.5 l/min	.5 l/min
Start Time	925	1005	1045
Stop Time	950	1025	1105
Sample Location	F-2	B-2	D-2

Date 3-6-90 Unit #3 By RP.

	Bag ID No.	Bag ID No.	Bag ID No.
Test No.	10A - HC	10B - HC	10C - HC
Sample Rate	.5 l/min	.5 l/min	.5 l/min
Start Time	940	1025	1055
Stop Time	1010	1045	1115
Sample Location	G2	D2	B-2

Notes: PURGED BOTH SAMPLE LINE AND TEDLAR BAGS PRIOR TO PULLING SAMPLE.
3-5-90 UNIT #3 ON OIL
3-6-90 UNIT #3 ON GAS

ESA DS-070

Client/Location PG&E / Morro Bay Unit 3 Test No. 10-hour run Method M4 1 2

Sample Location Exit Heater Exit Fuel gas Ambient Temp., °F _____ of 2

Operators J. Mullighan Meter Vol. (Start/End) 1 Date 2/5/90

Pre Test Data:
- Barometric Press, in. Hg _____
- Stack Area, sq. ft. _____
- Sample Time/ Pt, min. _____
- Assumed Stack Press _____
- Assumed Moisture _____
- Assumed Molecular Wt _____

Equipment Info:
- Meter No. AHO
- Meter, Y
- Pitot, Cp
- CFM @ H = 1.0
- Probe I.D.
- Nozzle No./Dia
- Filter No.

Imp.	Matl	Wt(End)	-	Weight (Start)	=	Weight (g)
#1			-		=	
#2			-		=	
#3			-		=	
#4			-		=	
Total			-		=	

Impinger Box I.D. _____

Integrated Bag I.D. _____

Leak Check:

Sample Train

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

Pre-Test Calibration

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

Sample Point	Time	Meter Conditions ΔP	ΔH	Meter Reading	Temperatures, °F Stack	Probe	Meter In	Out	Oven	Imp. Out	O_2	Vacuum	Static Press. iwg
0 2	9:52	.56	1.5	945.738	295	N/A	84	77	N/A	58	5.8	7	
stop 1	9:54:30			946.771									
start	9:58:30	.87	1.5	946.771	278		83	78		58	6.2	7	
C — 4	10 00	.80	1.5	947.968	272		84	78		58	4.8	7	
3	10:01:30	.74	1.5	948.985	272		87	78		59	4.6	7	
2	10 03	.59	1.5	950.051	263		87	78		59	6.4	7	
stop 1	10 04:30			951.164									
start	10 06	.83	1.5	951.164	295		92	75		61	4.4	7	
B — 4	10 07:30	.95	1.5	952.534	295		87	75		61	4.0	7	
3	10 09	.70	1.5	953.450	278		98	78		62	5.2	7	
A 2	10 10:30	.60	1.5	954.438	270		99	80		62	6.4	7	
stop 1	10 12			955.737									
start	10 15	.82	1.5	955.737	287		88	80		64	4.8	7	
A — 4	10 16:30	.54	1.5	956.750	277		87	80		63	4.4	7	
3	10:18	.80	1.5	957.908	258		99	81		64	4.3	9	
2	10:19:30	.74	1.6	959.038	249		100	81		65	6.2	7	
stop 1	10 21			960.615									
Total/Average													

Test Summary
- Initial _____
- Sample Vol., c.f. _____
- Stack Press, iwg _____
- ΔP _____ iwg ΔH _____ iwg
- Meter Temp., °F _____
- Stack Temp., °F _____
- Water Collected, g _____
- O_2/CO_2 Method _____
- Chain of Cust. Info (init.):
  - Impingers Loaded _____
  - Impingers Recovered _____
  - Filter Loaded _____
  - Filter Recovered _____
  - Probe Wash _____
- Comments: _____

Appendix C.5

Formaldehyde

FORMALDEHYDE EMISSION CALCULATIONS

CLIENT/LOCATION: PG&E/MORRO BAY UNIT 3
FUEL: OIL
F Factor: 9035
Reference Temp (F) 60

Test	ug/trai	Vmstd	%O2	Qsd	ug/dscf	ug/m3	ppb	lb/hr	lb/MMbtu
2A-FORM	4.37	0.41	5.86	595108	10.7	376.4	297	8.38E-01	2.95E-04
2B-FORM	4.43	0.63	5.86	595108	7.0	248.0	196	5.52E-01	1.94E-04
4-FORM	ND< 0.24	1.17	6.02	671447	ND< 0.2	ND< 7.2	ND< 6	ND<1.82E-02	ND<5.73E-06
AVERAGE:				620554	< 6.0	< 210.6	< 166	< 4.70E-01	< 1.65E-04

Client/Location: PG&E MORRO BAY | Unit: 3 | Test No.: 123A | Method: FERRALLEN/IX | of: 1

Sample Location: STACK DUCT | Fuel: OIL | Ambient Temp., °F: | Date: 3/11/90

Operators: M. Schmitt | Meter Vol. (Start/End): /

Pre Test Data:

- Barometric Press, in. Hg
- Stack Area, sq. ft.
- Sample Time/ Pt, min.
- Assumed Stack Press
- Assumed Moisture
- Assumed Molecular Wt

Equipment Info:

- Meter No.: ES-28
- Meter, Yd: 1.00
- Pitot, Cp: —
- CFM @ H = 1.0: .573
- Probe I.D.: 10' TFE
- Nozzle No./Dia: —
- Filter No.: —

Imp.	Matl	Wt(End)		Weight (Start)	Weight (g)
#1	DNTH	A	-	10ML	=
#2	DNTH	B	-	10ML	=
#3	EMPTY	C	-	—	=
#4	SG		-		=
Total			-		=

Impinger Box I.D.:

Integrated Bag I.D.:

Leak Check:

Sample Train

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

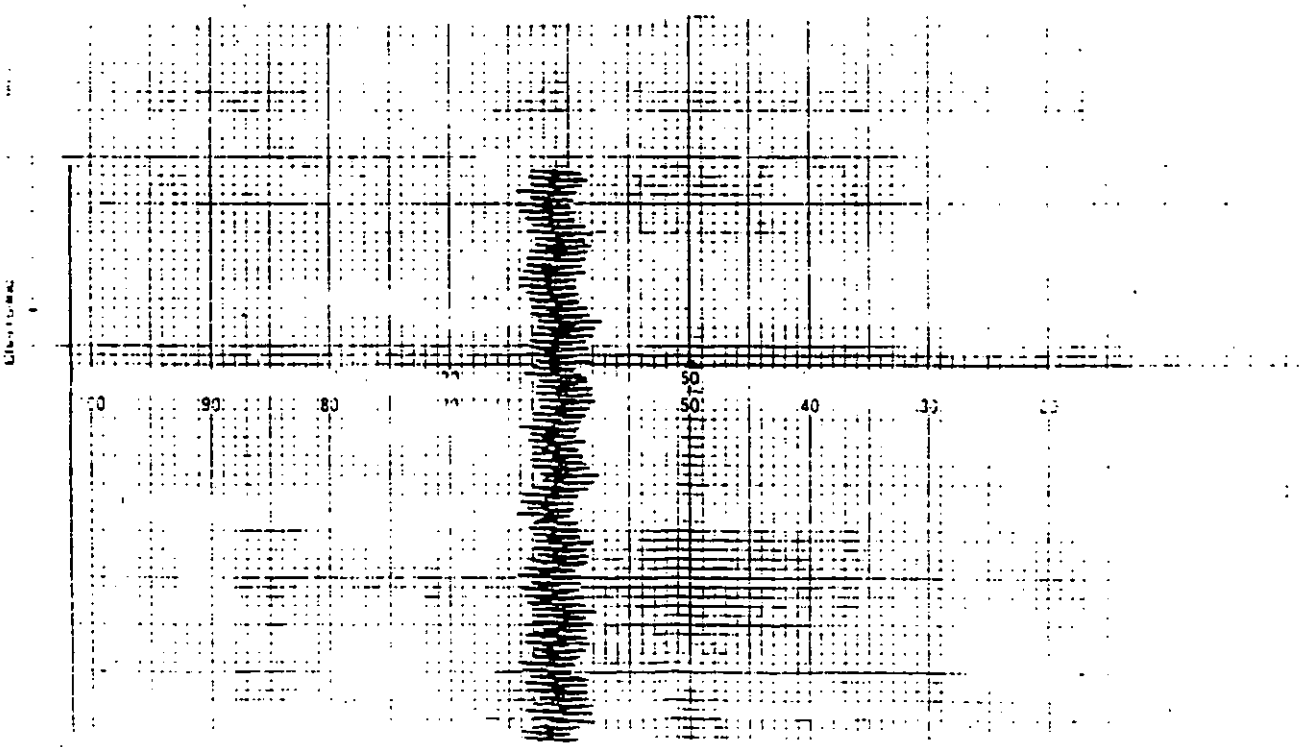
Pre-Test Calibration

	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	Vacuum	Static Press. iwg
B-2	1905			468.625			70	74					
	1910			468.730			71	75					
	1915			468.795			70	74					
	1920			468.861			70	74					
	1925			468.928			70	74					
	1930			468.990			70	74					
	1935			469.064									
Total/Average													

Test Summary

- Initial: KU
- Sample Vol., c.f.: .441
- Stack Press, iwg
- ΔP ____ iwg ΔH ____ iwg
- Meter Temp., °F: 72.2
- Stack Temp., °F
- Water Collected, g
- O_2/CO_2 Method
- Chain of Cust. Info (init.):
  - Impingers Loaded
  - Impingers Recovered
  - Filter Loaded
  - Filter Recovered
  - Probe Wash
- Comments:


90
80
50
40