MID Modesto Irrigation District
Water and Power

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January 2, 1990

United States
Environmental Protection Agency
Region IX
215 Fremont Street
San Francisco, California 94106

SUBJECT: NSR 4-4-8, SJ 79-16

Attention: Mr. David P. Howekamp, Director Air Management Division

Dear Mr. Howekamp:

Enclosed please find one copy of the air emission test report prepared by Ecoserve, Inc., for McClure Generating Unit No. 2 from data collected on September 28, 1990.

The test results for the CO emission level indicated that two of the three sample runs were apparently out of compliance. Elements which may have contributed to these test results were:

Run #1: The water injection was apparently at a level of 50 gpm and the CO was measured at 0.091 lbs./MMBTU.

Run #2: The water injection was set at a level of 44.8 gpm and the CO was measured to be in compliance.

Run #3: The water injection was apparently at a level of 44.8 gpm and the CO was measured at 0.074 lbs./MMBTU which isn't consistent with any previous test results on this unit.

As demonstrated in the emissions test performed in June 1987, this unit requires water injection levels between 40 and 44 gpm for distillate fuel. While normal practice is to operate the unit as described in the procedures set forth in our letter to the EPA dated July 10, 1987, it is unknown at this time why the operating system was set at approximately 50 gpm during the test. Listed below is a summary of the results.

Summary of results from the attached Ecoserve, Inc. report:

	11:01-11:30 Run 1	11:46-12:26 Run 2	12:51-13:31 Run 3	Compliance
CO lbs/MMBTU	.091	.044	.074	.05
NOx lbs/MMBTU	.132	.158	.158	.23

Water Injection:

Time	Rate GPM
10:10	50.28
11:30	50.20
13:05	44.47
14:25	44.47

The District proposes the following implementation plan and schedule to address the issue:

A. Proceed to rerun the NOx and CO emissions tests required by the above referenced permit for McClure Generating Unit No. 2. This testing will be performed with the normal operating procedures to the water injection equipment to meet the water and fuel parameters as presented in the Performance Test Report of 1987, and to log the water injection rate and the fuel flow rate on thirty-minute intervals while operating in this mode. This testing will be scheduled to be performed in February of 1991.

B. Continue to investigate long-term solutions to return the unit to fully automatic operation as per our letter to the EPA dated July 10, 1987. The District has implemented several mitigation measures, including extensive review by the manufacturer and completing a combustion inspection on the unit in March of 1990. The District will obtain the services of a consultant to evaluate the situation and make recommendations to resolve the issue. It is anticipated that these services will be obtained by the District in the first quarter of 1991.

If there are any questions concerning this matter, please feel free to contact this office at (209) 578-2516.

Sincerely,

MODESTO IRRIGATION DISTRICT

Gregory E Salyer

GREGORY E. SALYER
Senior Electrical Engineer

GES/kse
Enclosure

cc: Chief Stationary Source Control Division
California Air Resources Board

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DETERMINATION OF POLYCYLIC AROMATIC HYDROCARBONS, FORMALDEHYDE, CO, AND NOX EMISSIONS FROM TURBINE UNIT #2 AT THE MODESTO IRRIGATION DISTRICT McCLURE ROAD GENERATION STATION MODESTO, CALIFORNIA

November 28, 1990

Prepared for:

Mr. SPENCER TACKE

Modesto Irrigation District
1231 Eleventh ST.
P.O. BOX 4060
Modesto, California 95352

Report #: 1425

Prepared By:

David LeBarron

Approved By:

Bruce Randall

Source Testing • Ambient Monitoring • Modeling • Risk Assessment • Permiting • Industrial Hygiene

TABLE OF CONTENTS

TABLE OF TABLES

INTRODUCTION

A Gas Turbine was tested to determine its emissions of toxic air contaminants. Ecoserve, Inc. performed the tests on Unit #2 located at the Modesto Irrigation District, McClure Road Generating Station Modesto, California. The tests were conducted for Modesto Irrigation District from September 26 to 28, 1990 to provide emissions inventory data for compliance with California AB 2588. The Ecoserve team included David LeBarron, Mike Dials and George Wilton, and the tests were observed and coordinated by Spencer Tacke of M.I.D.

The emissions of polycyclic aromatic hydrocarbons (PAH), formaldehyde, CO, and NOx were measured from the turbine exhaust stack when the unit was fired on Distillate #2. The emissions of Formaldehyde were also measured when the unit was fired on Natural Gas. Triplicate runs of each test method were performed. A summary of the test methods employed during the sampling program is listed below.

Parameter	Test Methods
PAH's	CARB-Method-429
Formaldehyde	CARB-Method-430
CO and NOx	CARB-Method-1-100 -EPA-Method-20

Table 1.: Test Methods used at Modesto Irrigation District

The sampling and analysis methods, data, calculations and results are presented in this report. A written summary of the results and an explanation of any sampling or analysis problems can be found in the Discussion of Results. The Summary of Results presents in tabular form the stack gas conditions and the emission rates of the toxic compounds. The sampling and analysis methods are described in the Test Methods section, which also includes the calculation procedures. The field data sheets, laboratory results and calibration data are all included in the Appendices.

DISCUSSION OF RESULTS

The results have been summarized and presented in the tables that follow in the Summary of Results section. The Formaldehyde emission results are presented on a single page for each of the fuels, and the PAH's and Constant Monitoring results are presented on a separate pages.

The PAH sampling runs were performed without any sampling from Port "D". This port was blocked by the scaffolding. The volumetric flow rates were measured using all ports and traverse points while the turbine was fired on Natural Gas and Distillate #2. These measurements are used to calculate the emission rates of Formaldehyde, CO, and NOx.

Calculation of Results:

All results were calculated without correction for blanks. The field blank results have been provided for comparison. Any result that was below the analytical detection limit has been reported as "less than" a certain value. These "less than" results represent the calculated concentration and emission rate detection limits for each compound for that test run.

Process Data:

Process data was recorded by M.I.D. personnel and is included in Appendix C. of this report. Process fuel consumption was measured by M.I.D. personnel, and the data is included in Appendix C. of this report. Fuel samples were taken for laboratory analysis of Composition, EPA "f" factor, Metals, Gross Alpha scan, and Radionuclides Ra226 and Ra228. The results of these analysis are presented in Appendix A.

PAH Emissions Testing:

The PAH results are presented in Table 5. The field blank contained a detectable amount of Naphthalene. All the other compounds were reported as below the detection limit for the blank.

All three PAH runs were within the 90% to 110% isokinetic sampling specification. Naphthalene and Phenanthrene were the only compounds with concentrations greater than the detection limit

Formaldehyde Emissions Testing:

The formaldehyde results are presented in Tables 2 and 3. The sampling system was modified to included the following: A six foot quartz glass probe inserted into Port "C", The use of the quartz glass was required to resist the high duct temperatures and duct velocities. The probe was then connected a ground glass Warner fitting on one end of a virgin Teflon sampling line. The other end of the sampling line was connected to the impinger train charged with DNPH.

The first Natural Gas sampling run of Formaldehyde was higher than the second and third runs. The second and third runs had similar concentrations. Therefore, the first run may have been contaminated during the lengthy leak check, and is disregarded in the average emission rate of 0.138 lb\hr.

The first Distillate #2 sampling run of Formaldehyde was higher than the second and third runs. The second and third runs had similar concentrations. Therefore, the first run may have been contaminated during the lengthy leak check, and is disregarded in the average emission rate of 0.074 lb\hr.

The blanks for both sets of Formaldehydes were well below the concentrations observed in the samples.

Constant Monitoring Emissions Testing

The results from the Constant Monitoring testing are presented in Table 4.

The concentrations of NOx and CO were measured at those points in the duct that had the lowest concentrations of Oxygen. These points were determined to be the following: port "C" at points 2 through 5, and port "G" at points 2 through 5. During the sampling run each point was measured for 5 minutes for a total sampling time of forty minutes. The sampling run started at port "G", point 5, and then concluded at port "C", point 2. This method is sited from 40CFR60, Appendix A, Method 20.

TABLE 2

SUMMARY OF RESULTS

FORMALDEHYDE TESTING

CONCENTRATION AND EMISSION DATA

CLIENT: MODESTO IRRIGATION DISTRICT

UNIT: TURBINE UNIT #2: Natural Gas

TEST DATES: SEPTEMBER 26, 1990

RUN:	1	2	3
PROCESS CONDITIONS			
Volume Flow Rate			
(ACFM) :		1,475,900	
(SDCFM) :		528,900	
FORMALDEHYDE EMISSIONS			
Laboratory result (mg) :	0.058	0.00106	0.00104
Concentration : (ppm v\v dry) :	3.09	0.055	0.055
Emission Rate : (lb/hr) :	7.77	0.138	0.137
Blank (mg) (1) :	0.0006		

1. The field blank was procured immediately following the third sampling run.

TABLE 3

SUMMARY OF RESULTS

FORMALDEHYDE

CONCENTRATION AND EMISSION DATA

CLIENT: MODESTO IRRIGATION DISTRICT

UNIT: TURBINE UNIT #2: Distillate #2

TEST DATES: SEPTEMBER 26, 1990

RUN:	1	2	3
PROCESS CONDITIONS			
Volume Flow Rate			
(ACFM) :		1,048,200	
(SDCFM) :		363,600	
FORMALDEHYDE EMISSIONS			
Laboratory result			
(mg) :	0.0139	0.000716	0.00092
Concentration :			
(ppm v\v dry) :	0.727	0.038	0.048
Emission Rate :			
(lb/hr) :	1.25	0.065	0.083
Blank (mg) (1) :	0.0010		

1. The field blank was procured immediately following the third sampling run.

TABLE 4

SUMMARY OF RESULTS

GASEOUS EMISSIONS COMPLIANCE TESTING

CLIENT: MODESTO IRRIGATION DISTRICT

SITE: MODESTO, CALIFORNIA

UNIT: TURBINE UNIT #2: Distillate #2

TEST DATE: SEPTEMBER 28, 1990

RUN:	1	2	3
TIME:	1101-1139	1146-1226	1251-1331
Volumetric Flow Rate			
ACFM		1,048,200	
SDCFM		363,600	
GASEOUS EMISSIONS Concentration			
CO2, % v\v dry	3.2	3.2	2.0
O2, % v\v dry	15.2	15.1	15.4
CO, ppm v\v dry	37.4	18.5	29.4
NOx, ppm v\v dry	33.3	40.5	38.4
NOx, ppm @ 15% O2	34.5	41.2	41.2
Emission Rate			
CO, lb/hr	60.2	29.8	47.3
NOx as NO2, lb/hr	88.1	107.1	101.6
CO, lb/MMBtu	0.091	0.044	0.074
NOx as NO2, lb/MMBtu	0.132	0.158	0.158

TABLE 5

SUMMARY OF RESULTS

POLYCYCLIC AROMATIC HYDROCARBON TESTING

EMISSION DATA

CLIENT: MODESTO IRRIGATION DISTRICT

UNIT: TURBINE UNIT #2: Distillate #2

TEST DATES: SEPTEMBER 27-28, 1990

RUN No.	1	2	3
PROCESS CONDITIONS			
Volume Flow Rates			
(ACFM) :	1246900	1002600	1116500
(SDCFM) :	611300	477500	516400
Fixed Gases			
O2 (%vol dry) :	12.4	12.4	12.4
CO2 (%vol dry) :	7.8	7.8	7.8
H2O (%vol) :	5.5	9.1	11.5
Sample Volume (SDCF) :	33.628	41.202	58.964
PAH RESULTS :			
Emission Rate (lb/hr * E-3)			
Naphthalene :	326.0	144.0	205.0
Acenaphthalene :	<3.6	<2.3	<1.7
Acenaphthene :	<3.6	<2.3	<1.7
Fluorene :	<3.6	<2.3	<1.7
Phenanthrene :	7.7	2.3	1.7
Anthracene :	<3.6	<2.3	<1.7
Fluoranthene :	<3.6	<2.3	<1.7
Pyrene :	<3.6	<2.3	<1.7
Benzo(a)anthracene :	<3.6	<2.3	<1.7
Chrysene :	<3.6	<2.3	<1.7
Benzo(b)fluoranthene :	<3.6	<2.3	<1.7
Benzo(k)fluoranthene :	<3.6	<2.3	<1.7
Benzo(a)pyrene :	<3.6	<2.3	<1.7
Benzo(ghi)perylene :	<3.6	<2.3	<1.7
Dibenzo(ah)anthracene :	<3.6	<2.3	<1.7
Ideno(123-cd)pyrene :	<3.6	<2.3	<1.7

POLYCYCLIC AROMATIC HYDROCARBON EMISSIONS

REF: State of California Air Resources Board, Stationary Source Test Methods, Method 429, March 23, 1988.

SAMPLING PROCEDURE:

The sampling apparatus consisted of a quartz nozzle, heater wrapped probe and heated filter holder connected via Teflon tubing to a condenser and XAD-2 resin cartridge followed by a series of impinger-absorbers immersed in an ice water bath. The first two impingers each contained 100 ml of deionized, distilled water, the third was empty and the fourth impinger contained indicating silica gel. The absorption train was followed in series by a diaphragm pump, dry gas meter and a calibrated restriction orifice fitted with a magnehelic differential pressure gauge.

Prior to testing, duct dimensions were measured. Suitable sampling points were determined from the number of duct diameters upstream and downstream from a flow disturbance. An initial traverse was performed to determine average stack conditions and check for cyclonic flow. Based on the results of the initial traverse, nozzle size and orifice constant were determined. The sampling apparatus was leak checked prior to sampling and at the conclusion of sampling. The probe and filter heaters were brought to temperature and the nozzle positioned at the first sampling point. The pump was immediately started and adjusted to obtain the isokinetic sampling rate.

Duct conditions were monitored throughout the sampling period with a type "S" pitot tube and a thermocouple simultaneously positioned at the traverse point. Conditions at the sampling apparatus and metering device were constantly monitored and regularly recorded on a field data sheet. Isokinetic sampling rate in terms of orifice differential pressure was calculated for each set of duct and sampling apparatus conditions.

On completion of sampling from all usable traverse points, the apparatus was removed, leak checked, sealed from possible contamination and transported to the laboratory. Replicate samples were taken as indicated by the data sheets.

Concurrent with each metal sampling run, an integrated gas sample was withdrawn from the summation of the traverse points through the train and collected in a bladder bag at the outlet of the meter.

ANALYTICAL PROCEDURE:

The weight increase of the impingers was measured and recorded for calculation of percent water. The contents of the sample bladder were analyzed by Orsat for fixed gas and molecular weight determination.

Sample was recovered from the nozzle, probe and front half filter holder sections with a series of three rinses of methylene chloride, toluene, and methanol and a rubber policeman. The filter section was recovered and placed in a petri dish. The flexible Teflon line, condenser and the first two impingers were rinsed with a series of three rinses of methylene chloride, toluene, and methanol and the contents were placed with the impinger catch for the first two impingers. The resin cartridge was sealed from contamination. All samples were placed on ice after collection.

After the samples were extracted, the processed extract was analyzed for PAH's using high-resolution capillary column gas chromatography coupled with low resolution mass spectrometry (HRGC/LRMS). The analysis was performed by Eureka Laboratories, Inc., Sacramento, CA.

A field blank was performed for each set of three runs. The blank was collected identically to each sampling run.

An estimate of sampling accuracy was performed by calculation of percent isokinetic rate over the entire sampling period.

FORMALDEHYDE EMISSIONS

REF: State of California Air Resources Board, Stationary Source Test Methods, Volume III, Method 430, March 23, 1988.

SAMPLING PROCEDURE:

The sampling apparatus consisted of a Teflon tubing probe connected to a gas absorption Wheaton midget impinger train. The three midget gas impingers were connected in series to a calibrated pump/meter assembly. The first and second impingers contained 15ml of 2,4-dinitrophenylhydrazine (DNPH) and the third contained silica gel.

The sampling rate was approximately 500 ml/min.

At the conclusion of sampling, the entire sampling train was leak-checked, then disassembled. The absorbing solution was recovered by tightening Teflon lined caps onto the first two midget impingers.

ANALYSIS PROCEDURE:

The sample containers were transported to the Ecoserve laboratory for log-in and packaging. The samples were sent to Enseco Inc.-Cal Lab Analytical for analysis of formaldehyde by high performance liquid chromatography (HPLC).

CONSTANT MONITORING

REF: Bay Area AQMD, Manual of Procedures, San Francisco, CA, Methods ST-5, ST-6, ST-13A, ST-14, ST-19A, January, 1982

: State of California, Air Resources Board, Draft Stationary Source Test Methods, Method 1-100, June, 1979

METHOD SUMMARY:

A representative sample of duct gas was extracted through a probe, condenser and sample line by a pump. The sample was then pumped into a sampling manifold for distribution to one or more sample analyzers. The analyzers output a continuous analog recording of the concentrations of the analyzed gases in the sample. All analyzers were calibrated with EPA Protocol gases (traceable to National Bureau of Standards SRMs) or with recently analyzed gases (analysis by EPA Reference Methods).

SAMPLING SYSTEM:

A stainless steel probe was positioned in the duct. The end of the probe was located at a point of average duct flow and average pollutant concentrations. The probe was connected with a short (about 4 feet) Teflon line to a sample conditioning train. The conditioning train included three glass knockout traps connected in series with glass unions and immersed in an ice bath. The train was connected with a Teflon line (1/4 inch o.d.) to the pneumatic delivery system which was housed in the monitoring van.

PNEUMATIC DELIVERY SYSTEM:

The Teflon sample line delivered sample gas through an in-line Balston filter to the Teflon-lined diaphragm sample pump. The flow rate of the sample gas was regulated with main and bypass-flow needle valves and was read on the main flow meter (typical setting 10 SCFH). A 10 PSI pressure-relief valve kept the entire system pressure at a safe level. The manifold pressure was regulated with an exhaust needle valve and was read on the pressure gauge (typical setting 1 PSI). The sample in the manifold was delivered through needle valves and flow meters to the various analyzers.

LEAK CHECK PROCEDURE:

The sampling system was checked for leaks by plugging the end of the probe. The exhaust needle valve was closed and the entire sample flow was directed through one analyzer flow meter (range 0-1.0 SCFH). The bypass valve was closed until the vacuum gauge showed at least 15 inches Hg. vacuum. The leak rate was observed at the analyzer flow meter (maximum allowable 2% of total sample flow). The system was checked for leaks before and after sampling.

CALIBRATION PROCEDURE:

Each analyzer was calibrated before and after each sample run. Either a Hoke four-way selector valve or a series of 3-way solenoid valves were used to direct the flow of the various calibration gases into the sample manifold. Each analyzer was calibrated with a zero gas (typically, ambient air or zero grade Nitrogen) and with a span gas (typical span gas concentration 60 to 90 percent of analyzer full scale and/or similar to expected sample concentration). All zero and span checks were recorded and noted on the recorder strip charts.

STRIP CHART DATA REDUCTION:

The analog recordings were averaged over time periods as shown on the data pages (typically 4 minutes, 20 minutes or 40 minutes). The data for each averaging period was digitized and recorded as average percent of full scale. These sample readings were then compared with the zero and span gas readings for calculations of the average concentration for each averaging period.

Any drift of the zero and span readings from the beginning to the end of a sampling period was corrected by calculating apparent zero and span readings for the midpoint of each averaging period. The sample average concentrations were then calculated from the sample readings and the apparent zero and span readings.

CONSTANT MONITORING

ANALYZERS:

Thermo Electron Model 10 Nitrogen Oxides Analyzer

The Thermo Electron chemiluminescent analyzer is used to measure parts per million of Nitrogen Oxides in the dry sample gas. The analyzer measures the concentration of NOx by converting NOx to NO and then measuring the light emitted by the reaction of NO with ozone.

The sample gas is drawn into the analyzer by a vacuum pump which partially evacuates the reaction chamber. The sample flows through a NO2 to NO converter for NOx analysis or may pass through the converter for NO analysis. The sample then flows through a temperature controlled critical orifice into the partially evacuated reaction chamber.

Ambient air is also drawn into the analyzer as a source for the generation of ozone. The air flows through a desiccant cartridge for drying, then through an ozone generator which converts some of the oxygen in the air to ozone. The ozonated air then flows through a temperature controlled critical orifice into the reaction chamber.

The sample gas and the ozonated air are mixed in the reaction chamber, where the following reaction takes place:

$$NO + O3 \rightarrow NO2 + O2 + hv$$

The intensity of the chemiluminescence is proportional to the concentration of NO in the reaction chamber. The light emitted by this chemiluminescent reaction shines through a window in the chamber onto a photomultiplier tube (PMT). A spinning chopper wheel between the reaction chamber and the PMT allows the dark PMT output to be compared electronically with the PMT output with light generated by the above reaction. The signal is processed electronically and output for recording of the concentration of NO (or NOx if the converter is used).

CONSTANT MONITORING

ANALYZERS:

Infrared Industries IR-702 Carbon Dioxide \ Carbon Monoxide

The Infrared Industries non-dispersive infrared analyzer is used to measure the percent dry volume of Carbon Dioxide and Carbon Monoxide in the dry sample gas. The analyzer determines CO2/CO concentrations by measuring the absorption of specific wavelengths of infrared radiation.

The sample gas flows through a cylindrical cell. An infrared source located at the focal point of a concave mirror shines a beam through the sample cell and through a parallel reference cell which contains ambient air. A coaxial chopper disc rotates to send the infrared beams alternately through the sample and reference cells. The radiant beams, after passing through the two cells, are reflected by a second mirror onto two photon detectors with spectral filters. The detectors convert the optical energy from the radiant beams into electrical signals. The signals from the beams passing through the reference cell are compared to the signals from the sample cell beams. Any absorption of the infrared beam in the sample cell by CO2/CO in the sample gas will cause a proportional difference in the signals from the sample cell and the reference cell beams. This signal difference is converted electronically to an output signal that is linearly proportional to the concentration of CO2/CO in the sample gas.

Teledyne Analytical Instruments Series 320 Oxygen Analyzer

The Teledyne Analytical Instruments fuel cell oxygen detector continuously measures the percentage of oxygen in a gas atmosphere. The analyzer utilizes a micro-fuel cell which consumes oxygen from the atmosphere around the cell and generates a proportional electric current.

Sample gas is passed over a gas permeable membrane in the fuel-cell chamber. Oxygen diffuses through the membrane and oxidizes lead on the anode. The electron current resulting from this reaction is amplified and output to a built-in meter and a recorder port. A selective range attenuation circuit and a temperature compensation circuit generate temperature compensated outputs for all ranges.

DETERMINATION OF VELOCITY AND VOLUME FLOW RATE, MOLECULAR WEIGHT AND PERCENT MOISTURE

REF: EPA, Code of Federal Regulations, Title 40, Part 60, Appendix A, Methods 1-4, 1981
: South Coast AQMD, Source Testing Manual, Los Angeles, CA, April, 1981
: State of California, Air Resources Board, Draft Stationary Source Test Methods, Method 1-4, June, 1979

DETERMINATION OF MOLECULAR WEIGHT AND PERCENT MOISTURE:

APPARATUS:

A stainless steel probe with glass wool plug or glass fiber filter was inserted into the duct. The probe was connected via a short length of Teflon tubing to the impinger train which consisted of a series of pre-weighed impinger-absorbers connected in tandem and immersed in an ice bath. The absorption train was followed in series by a diaphragm pump, dry test meter and a calibrated restriction orifice fitted with a magnehelic differential pressure gauge.

SAMPLING PROCEDURE:

The apparatus was leak checked, and the initial dry test meter reading recorded. The pump was started, and adjusted to sample at a rate of approximately 0.5 CFM. At five minute intervals, the pressure drop across the orifice, and the temperature of the gas entering the meter were recorded. At the end of the test period, the pump was turned off, and the final meter reading recorded. The apparatus was leak checked, and the sample analyzed.

ANALYTICAL PROCEDURE:

Carbon dioxide and oxygen were determined by constant monitoring. The method of detection was NDIR and a micro fuel cell respectively. Nitrogen was determined by difference.
Each impinger-absorber was weighed, and the net weight gain of each was determined to the nearest 0.5 gram.

DETERMINATION OF VELOCITY AND VOLUME FLOW RATE:

In order to perform the traverse, duct dimensions were measured and suitable sampling points were selected. The duct was then traversed to determine gas temperatures and velocity heads.
Duct velocity heads were measured with either a type "S" or a standard pitot tube connected to a Magnehelic differential pressure gauge. Duct static pressure was determined by rotating the pitot tubes near the center of the duct such that a null or zero reading was obtained on the pressure gauge.

DETERMINATION OF VELOCITY AND VOLUME FLOW RATE: (Continued)

The line leading to either the impact or vacuum side of the pressure gauge was disconnected to determine whether the duct static pressure was negative or positive.
Duct temperatures were measured with a type "K" thermocouple connected to a potentiometer.

CALCULATIONS

METHOD 1: DETERMINATION OF TRAVERSE POINT LOCATIONS

Circular Duct:
t.p. (1st half) = D/2 - (D/2k)*[k(k+1-2n)]1/2
t.p. (2nd half) = D/2 + (D/2k) * [k(2n-1)]1/2
Where n = 1 to k/2

Rectangular Duct:
t.p. = W/2k + (n-1) * W/k
Where k = (W/L) * (number of ports)
n = 1 to k

METHOD 2: VELOCITY AND VOLUME FLOW RATE

Duct gas velocity at any traverse point :
vd= 85.49 * Cp * sqrt[Td *(dP/Pd/MW)]

Volumetric Flow Rate:
Qd = vd(avg) * Ad * 60 = ACFM
Qstd(wet) = Qd * (Tstd/Td) * (Pd/Pstd) = SCFM
Qstd(dry) = Qstd(wet) * (1-(%H2O/100)) = SDCFM

METHOD 3: DRY MOLECULAR WEIGHT

MW(dry) = (%CO2/100)*(44) + (%O2/100)*(32) + (%N2/100)*(28)

MW(wet) = MW(dry)*[1-(%H2O/100)] + (%H2O/100)*18

METHOD 4: DETERMINATION OF MOISTURE CONTENT

%H2O = (XH2O*100)/(XH2O+Xgas)
Where:
XH2O = W/18
Xgas = 1.195*Vm(Tstd/Tm)[(Pbar+dH/13.6)/Pstd]

METHOD 5: DETERMINATION OF PAH EMISSIONS

Isokinetic sampling rate at any traverse point:

$$Qm = Qn * [Pd*Tm/(Pm*Td)]*(1 - \%H2O/100)$$

where $Qn=60 * vn * An$ and for isokinetic sampling, $vn=vd$

Orifice pressure drop at isokinetic sampling rate:

$$dH = Qo * (Pbar/km2 * Tm) * \frac{[MW-(0.18 * \%H2O)]}{(1-\%H2O/100)}$$

where $Qo= 1.23 * Qm - 0.23 * Qm(2-Qm)$ (for non-linear orifice)

Percent of isokinetic sampling:

$$I=\{[(Td/Pd)*(0.00267*W+(Vm/Tm(avg))*(Pbar+dH(avg)/13.6)]/[t*vd(avg)*An*60]\}*100$$

PAH Concentration and Emissions:

$$C = (m * K1 * 1,000)/(MW1 * Vm(std))$$

where K1 = 0.8365 for 60 deg F standard conditions
= 0.849 for 68 deg F standard conditions
= 0.853 for 70 deg F standard conditions

$$ER = C * MW1 * Qstd(dry) * K2$$

where K2 = 1.581*10^-7 for 60 deg F standard conditions
= 1.557*10^-7 for 68 deg F standard conditions
= 1.552*10^-7 for 70 deg F standard conditions

Symbol Identification:
Subscripts d, m and n denote duct, dry gas meter and nozzle respectively. Subscripts std, bar and avg denote standard, barometric and average

A = area, square feet
C = PAH concentration, ppm
D = duct diameter
Cp = pitot tube correction, unitless
E.R.= emission rate of PAH, lb/hr
dH = orifice differential pressure, inches H_2O
I = percent of isokinetic sampling
k = number of traverse points
km = orifice constant, unitless
m = mass of PAH collected, milligrams
MW1 = molecular weight of PAH, g/mole
MW = wet molecular weight of duct gas, g/mole
P = absolute pressure, inches Hg
dP = velocity pressure head, inches H_2O
Q = volume flow rate, CFM
Qo = parameter of volume flow rate through the orifice
T = absolute temperature, R
t = time of sampling period, minutes
Vm = gas volume, CF
v = velocity, feet/second
W = water collected, grams
X = mole fraction of component
%CO_2= duct CO_2 content, percent volume dry
%H_2O= duct gas water content, percent volume
%N_2 = duct N_2 concentration, percent volume dry
%O_2 = duct O_2 concentration, percent volume dry

FORMALDEHYDE CALCULATIONS:

Symbol Identification:

C = concentration, ppm vol. dry
ER = emission rate, lb/hr
K1 = conversion constant, CF/mole
K2 = conversion constant, lb*mole*min/mg*CF*hr
m = total mass of formaldehyde in sample, mg
MW = molecular weight of formaldehyde, 30.0 gm/mole
Qstd(dry) = stack volume flow rate at standard conditions, SDCFM
Vm(std) = meter volume at standard conditions, SDCF

Equations:

$$C = (m * K1 * 1000)/(MW * Vm(std))$$

where K1 = 0.8365 for 60 deg F standard conditions
= 0.849 for 68 deg F standard conditions
= 0.853 for 70 deg F standard conditions

$$ER = C * MW * Qstd(dry) * K2$$

where K2 = $1.581 * 10^{-7}$ for 60 deg F standard conditions
= $1.557 * 10^{-7}$ for 68 deg F standard conditions
= $1.552 * 10^{-7}$ for 70 deg F standard conditions

CONSTANT MONITORING CALCULATIONS

(Strip Chart Analysis):

Calculations were performed based on the following equations:

Symbol Identification

Subscripts i and f indicate initial and final respectively (beginning and end of sampling period)

z = zero reading, % full scale
s = span reading, % full scale
t = averaging time period numbered 1 to n
n = number of t's in the sampling period
Delta z = rate of change of zero reading, % full scale/time interval
Delta s = rate of change of span reading, % full scale/time interval
Rt = average sample reading over time t, % full scale
zt = corrected (apparent) zero reading for midpoint of t, % full scale
st = corrected (apparent) span reading for midpoint of t, % full data
Cs = span gas concentration, ppm or % vol. (as shown on data sheet)
Ct = average sample concentration for time t, ppm or % vol. (as indicated)

Equations:

Apparent Zero:

$$\text{Delta } z = (zf-zi) / n$$

For each t from 1 to n,

$$zt = \text{Delta } z/2 + \text{Delta } z * (t-1) + zi$$

Apparent Span:

$$\text{Delta } s = (sf-si) / n$$

For each t from 1 to n,

$$st = \text{Delta } s/2 + \text{Delta } s * (t-1) + si$$

Average Sample Concentrations:

$$Ct = (Rt - Zt / st - zt) * Cs$$

EMISSION RATE CALCULATIONS

PROCEDURE:

Emission rates were calculated one of two ways:
Either pollutant concentrations and duct gas volume flow rates were used to calculate the emission rates, or
Emission rates were calculated based on the EPA "F" factor for stoichiometric combustion.
The calculations were performed using the equation shown below.

CALCULATIONS:

Symbol Identification:

C = average concentration, ppm volume dry
ER1 = emission rate, lb/hr based on volume flow rates
ER2 = emission rate, lb/MMBTU
F = emission rate factor, SDCF/MMBTU
K1 = conversion constant
K2 = conversion constant
MW = molecular weight, gm/mole, NO_2= 46.01, SO_2=64.06,CO=28, etc.
%O_2 = oxygen concentration of sample, % vol. dry
Qstd(dry) = volume flow rate of duct gas at standard conditions, dry basis

EQUATIONS:

ER1 = C * MW * Qstd(dry) * K1
where K1 = 1.581 * 10-7 for 60oF standard conditions
1.557 * 10-7 for 68oF standard conditions
1.552 * 10-7 for 70oF standard conditions

ER2 = C * F * 20.9 / (20.9 - %O2)
where C = PPM * MW * K2
K2 = 2.59 * 10E-09

NOTE: Results are shown on the Results Summary pages.

PAH DATA SHEETS

POLYCYLIC AROMATIC HYDROCARBONS EMISSIONS TEST MONITOR DATA

DATE:	9-27-1990	Pbar(in.Hg.):	29.98	Nozzle #	4	Diam.(mm):	4.000
CLIENT:	MID	Pstat(in.H2O):	-4.6	Pitot Tube #	1234	Cp:	0.831
UNIT:	Turbine Unit #2	Pduct(in.Hg.):	29.64	D.G. Meter #	990	Cor.Fact.:	1.0227
SITE:		Init.MW:	28.0	Magnehelic #	371	"X" Factor:	0.4830
RUN #:	1	Init.%H2O:	14.4	Temp. Unit #		Probe Liner:	QTZ GS
				Impinger Bkt #	1	Filter Holder:	QTZ GS

PORT A				DATA					CALCULATIONS			
#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	%ISO
1	6	14	49	926	1.60	90	470.955	3	116.2	0.31	0.32	
2	5	14	52	932	2.00	90		3	130.1	0.38	0.35	
3	4	14	55	936	1.20	88		2	101.0	0.23	0.27	
4	3	14	58	930	0.49	88		1	64.4	0.09	0.17	
5	2	15	1	928	1.20	87		2	100.7	0.23	0.27	
6	1	15	4	921	2.30	87		3	139.0	0.44	0.38	
		15	7				476.652					
Sample Time =			18	929	1.47	88	5.697		108.5	0.28		108.0

PORT B				DATA					CALCULATIONS			
#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	%ISO
1	6	15	11	925	0.34	88	476.652	1	53.5	0.06	0.14	
2	5	15	14	934	1.20	88		2	100.9	0.23	0.27	
3	4	15	17	938	2.00	88		3	130.4	0.38	0.35	
4	3	15	20	931	0.84	87		1	84.3	0.16	0.23	
5	2	15	23	929	1.20	86		2	100.7	0.23	0.27	
6	1	15	26	919	2.90	84		6	156.0	0.55	0.42	
		15	29				482.397					
Sample Time =			18	929	1.41	87	5.745		104.3	0.27		113.8

PORT C				DATA					CALCULATIONS			
#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	%ISO
1	6	15	34	921	0.20	84	482.397	1	41.0	0.04	0.11	
2	5	15	37	933	0.57	84		1	69.5	0.11	0.19	
3	4	15	40	939	1.20	86		3	101.1	0.23	0.27	
4	3	15	43	931	1.80	86		4	123.4	0.34	0.33	
5	2	15	46	925	2.40	84		5	142.2	0.46	0.38	
6	1	15	49	919	3.00	84		6	158.6	0.57	0.43	
		15	52				487.880					
Sample Time =			18	928	1.53	85	5.483		106.0	0.29		107.1

PORT E				DATA					CALCULATIONS			
#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	%ISO
1	6	16	2	921	0.26	85	487.880	1	46.7	0.05	0.13	
2	5	16	5	929	0.64	86		1	73.5	0.12	0.20	
3	4	16	8	933	1.40	88		2	108.9	0.27	0.29	
4	3	16	11	937	2.10	88		3	133.6	0.40	0.36	
5	2	16	14	939	2.60	89		5	148.8	0.49	0.40	
6	1	16	17	938	2.00	87		5	130.4	0.38	0.35	
		16	20				493.643					
Sample Time =			18	933	1.50	87	5.763		107.0	0.28		111.5

PORT F				DATA					CALCULATIONS			
#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	%ISO
1	6	16	24	937	0.10	88	493.643	1	29.2	0.02	0.08	
2	5	16	27	939	1.20	88		3	101.1	0.23	0.27	
3	4	16	30	935	3.20	88		6	164.8	0.61	0.44	
4	3	16	33	931	3.50	87		7	172.1	0.66	0.46	
5	2	16	36	929	4.00	86		10	183.9	0.76	0.49	
6	1	16	39	932	5.20	88		9	209.9	0.99	0.56	
		16	42				501.217					
Sample Time =			18	934	2.87	88	7.574		143.5	0.54		109.2

PORT G				DATA					CALCULATIONS			
#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	%ISO
1	6	16	48	932	0.25	90	501.217	1	46.0	0.05	0.12	
2	5	16	51	934	0.30	89		1	50.4	0.06	0.14	
3	4	16	54	935	0.30	89		1	50.5	0.06	0.14	
4	3	16	57	930	1.60	89		1	116.3	0.31	0.31	
5	2	17	0	920	4.00	87		10	183.3	0.77	0.50	
6	1	17	3	918	6.00	90		13	224.3	1.16	0.61	
		17	6				505.461					
Sample Time =			18	928	2.08	89	4.244		111.8	0.40		77.8

Post-Test Leak Rate 0.003 CFM at 13 in. Hg.

Test Summary

Sample Time =			108	930		87	34.506		113.5	0.34		104.6
							NET CU. FT.					

POLYCYLIC AROMATIC HYDROCARBONS EMISSIONS

Data and Results:

Date:	9-27-1990	**Run #:**	PAH #3
Client:	MID	**Time:**	17:20
Unit:	Turbine Unit #2	**Project Mngr:**	DCL
Site:		**Project #:**	1425

Liquid Analysis: | **Gas Composition:** | **Selected Results:**

Absorber Type	Contents	Final	Tare	Net				
Lg. Grnbg.	H2O	568.90	533.50	35.40	%CO2 volume	7.8	Wet MW	29.09
Lg. Grnbg.	H2O	575.40	575.30	0.10	%O2 volume	12.4	Excess Air	
Lg. Grnbg.	EMPTY	415.40	415.30	0.10	%CO volume	0.0		
Lg. Grnbg.	SILICA GEL	724.10	717.30	6.80	%N2 volume	79.8	Vm Standard	33.628
				0.00	%H2O volume	5.5	%Isokinetic	96.7
			Total	42.40			Standard T	60

VELOCITY TRAVERSE & VOLUME FLOW RATE

CLIENT: MID

DATE: 9-27-1990 TIME: 14:49 -17:06
UNIT: Turbine Unit #1
SAMPLE: RUN #: PAH #1

Duct Diameter (in.)	98.0	Duct Press. (in.Hg.)	29.64	Mag Box #	371
Rectangular Duct	219.5	Vol. Per Cent H2O	5.54	Temp. Unit #	6058/6752
Area (sq.ft.)	149.4	Molecular Wt. (wet)	29.09	Pitot Tube #	1234
Standard Temp. (F)	60.0	Std Press. (in.Hg.)	29.92	Pitot Coeff.	0.831

Pt.	In. From Edge	A			B			C			E			F			G		
		Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd
1	8.0	926	1.60	113.9	925	0.34	52.5	921	0.20	40.2	921	0.26	45.8	937	0.10	28.6	932	0.25	45.1
2	24.0	932	2.00	127.6	934	1.20	98.9	933	0.57	68.2	929	0.64	72.1	939	1.20	99.1	934	0.30	49.5
3	40.0	936	1.20	99.0	938	2.00	127.9	939	1.20	99.1	933	1.40	106.8	935	3.20	161.6	935	0.30	49.5
4	56.0	930	0.49	63.1	931	0.84	82.7	931	1.80	121.0	937	2.10	131.0	931	3.50	168.8	930	1.60	114.1
5	72.0	928	1.20	98.7	929	1.20	98.8	925	2.40	139.5	939	2.60	145.9	929	4.00	180.3	920	4.00	179.7
6	88.0	921	2.30	136.3	919	2.90	153.0	919	3.00	155.6	938	2.00	127.9	932	5.20	205.8	918	6.00	220.0

RESULTS:

Avg. Vel. (Vd) 139.1 FPS @ 533 F and 29.6 in. Hg.

Volume Flow Rate	Qd	1246.9	X1000 ACFM
	Qstd (wet)	647.1	X1000 SCFM
	Qstd (dry)	611.3	X1000 SDCFM

POLYCYLIC AROMATIC HYDROCARBONS EMISSIONS TEST MONITOR DATA

DATE:	9-27-1990	Pbar(in.Hg.):	29.94	Nozzle #	5	Diam.(mm):	5.000
CLIENT:	MID	Pstat(in.H2O):	-4.6	Pitot Tube #	1234	Cp:	0.831
UNIT:	Turbine Unit #2	Pduct(in.Hg.):	29.60	D.G. Meter #	990	Cor.Fact.:	1.0227
SITE:		Init.MW:	28.0	Magnehelic #	371	"X" Factor:	0.5199
RUN #:	PAH -#2	Init.%H2O:	14.4	Temp. Unit #		Probe Liner:	QTZ GS
				Impinger Bkt #	1	Filter Holder:	QTZ GS

PORT A				DATA					CALCULATIONS			
#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	%ISO
1	6	12	40	912	0.86	90	509.338	2	84.8	0.18	0.36	
2	5	12	44	929	0.74	91	510.702	2	79.1	0.15	0.34	
3	4	12	48	933	0.32	91	511.940	1	52.1	0.07	0.22	
4	3	12	52	931	0.12	93	512.817	1	31.9	0.02	0.14	
5	2	12	56	935	0.56	95	513.318	3	69.0	0.12	0.29	
6	1	13	0	937	1.30	95	514.698	7	105.2	0.27	0.45	
		13	4				516.521					
Sample Time =			24	930	0.65	93	7.183		70.3	0.13		100.1

PORT B				DATA					CALCULATIONS			
#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	%ISO
1	6	13	8	907	0.14	95	516.521	1	34.1	0.03	0.15	
2	5	13	12	916	0.16	89	517.124	1	36.6	0.03	0.16	
3	4	13	16	919	0.72	91	517.690	3	77.8	0.15	0.33	
4	3	13	20	921	0.30	93	519.128	2	50.2	0.06	0.21	
5	2	13	24	917	0.64	95	519.986	3	73.3	0.13	0.32	
6	1	13	28	924	1.40	95	521.388	7	108.6	0.29	0.47	
		13	32				523.440					
Sample Time =			24	917	0.56	93	6.919		63.4	0.12		106.0

PORT C				DATA					CALCULATIONS			
#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	%ISO
1	6	13	47	914	0.20	92	523.447	2	40.9	0.04	0.18	
2	5	13	51	914	0.20	91	524.160	2	40.9	0.04	0.18	
3	4	13	54	916	0.50	91	524.589	3	64.7	0.10	0.28	
4	3	13	58	913	0.77	93	525.754	6	80.3	0.16	0.35	
5	2	14	2	922	1.40	94	527.286	7	108.6	0.29	0.46	
6	1	14	6	926	1.70	95	529.310	8	119.6	0.35	0.51	
		14	10				531.514					
Sample Time =			24	918	0.80	93	8.067		75.9	0.17		105.8

PORT E DATA CALCULATIONS

#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	XISO
1	6	14	15	916	0.20	93	531.513	2	40.9	0.04	0.18	
2	5	14	19	920	0.22	90	532.197	2	43.0	0.05	0.18	
3	4	14	23	918	0.60	89	532.864	4	71.0	0.12	0.30	
4	3	14	27	927	1.00	86	534.154	5	91.9	0.20	0.39	
5	2	14	31	931	1.30	88	535.864	6	105.0	0.27	0.44	
6	1	14	35	934	0.94	89	537.741	5	89.3	0.19	0.38	
		14	39				539.358					
Sample Time =			24	924	0.71	89	7.845		73.5	0.15		105.2

PORT F DATA CALCULATIONS

#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	XISO
1	6	14	54	900	0.12	88	539.358	1	31.5	0.03	0.14	
2	5	14	58	923	0.10	86	539.850	1	29.0	0.02	0.12	
3	4	15	2	924	0.30	87	540.243	3	50.3	0.06	0.21	
4	3	15	6	926	0.58	88	541.110	4	70.0	0.12	0.30	
5	2	15	10	928	0.92	89	542.386	6	88.2	0.19	0.37	
6	1	15	14	934	1.40	90	544.005	8	109.0	0.29	0.46	
		15	18				545.995					
Sample Time =			24	923	0.57	88	6.637		63.0	0.12		103.8

PORT G DATA CALCULATIONS

#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	XISO
1	6	15	38	917	0.26	88	545.995	3	46.7	0.05	0.20	
2	5	15	42	927	0.26	88		3	46.9	0.05	0.20	
3	4	15	46	928	0.26	88		3	46.9	0.05	0.20	
4	3	15	50	927	0.26	89		3	46.9	0.05	0.20	
5	2	15	54	927	0.95	89		6	89.6	0.20	0.38	
6	1	15	58	932	2.00	89		8	130.2	0.41	0.55	
		16	2				551.962					
Sample Time =			24	926	0.67	89	5.967		67.9	0.14		86.8

Post-Test Leak Rate 0.005 CFM at 14 in. Hg.

Test Summary

Sample Time =			144	923		91	42.618		69.0	0.14		101.3

NET CU. FT.

POLYCYLIC AROMATIC HYDROCARBONS EMISSIONS

Data and Results:

Date:	9-27-1990	**Run #:**	PAH #3
Client:	MID	**Time:**	17:20
Unit:	Turbine Unit #2	**Project Mngr:**	DCL
Site:		**Project #:**	1425

Liquid Analysis:

Absorber Type	Contents	Final	Tare	Net
Lg. Grnbg.	H2O	619.20	536.60	82.60
Lg. Grnbg.	H2O	575.80	574.60	1.20
Lg. Grnbg.	EMPTY	416.30	416.50	-0.20
Lg. Grnbg.	SILICA GEL	738.60	733.40	5.20
				0.00
			Total	88.80

Gas Composition:

%CO2 volume	7.8
%O2 volume	12.4
%CO volume	0.0
%N2 volume	79.8
%H2O volume	9.1

Selected Results:

Wet MW	28.67
Excess Air	
Vm Standard	41.202
%Isokinetic	96.9
Standard T	60

VELOCITY TRAVERSE & VOLUME FLOW RATE

CLIENT: MID

DATE: 9-27-1990 TIME: 12:40 -16:02
UNIT: Turbine Unit #1
SAMPLE: RUN #: PAH -#2

Duct Diameter (in.)	98.0	Duct Press. (in.Hg.)	29.60	Mag Box #	371
Rectangular Duct	219.5	Vol. Per Cent H2O	9.11	Temp. Unit	#6058/6752
Area (sq.ft.)	149.4	Molecular Wt. (wet)	28.67	Pitot Tube #	1234
Standard Temp. (F)	60.0	Std Press. (in.Hg.)	29.92	Pitot Coeff.	0.831

Pt.	In. From Edge	A			B			C			E			F			G		
		Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd
1	8.0	912	0.86	83.8	907	0.14	33.7	914	0.20	40.4	916	0.20	40.5	900	0.12	31.2	917	0.26	46.1
2	24.0	929	0.74	78.2	916	0.16	36.2	914	0.20	40.4	920	0.22	42.5	923	0.10	28.7	927	0.26	46.3
3	40.0	933	0.32	51.5	919	0.72	76.8	916	0.50	64.0	918	0.60	70.1	924	0.30	49.7	928	0.26	46.3
4	56.0	931	0.12	31.5	921	0.30	49.6	913	0.77	79.3	927	1.00	90.8	926	0.58	69.1	927	0.26	46.3
5	72.0	935	0.56	68.2	917	0.64	72.4	922	1.40	107.3	931	1.30	103.7	928	0.92	87.1	927	0.95	88.5
6	88.0	937	1.30	103.9	924	1.40	107.3	926	1.70	118.4	934	0.94	88.3	934	1.40	107.7	932	2.00	128.7

RESULTS:

Avg. Vel. (Vd) 111.9 FPS @ 522 F and 29.6 in. Hg.

Volume Flow Rate	Qd	1002.6	X1000 ACFM
	Qstd (wet)	525.4	X1000 SCFM
	Qstd (dry)	477.5	X1000 SDCFM

POLYCYLIC AROMATIC HYDROCARBONS EMISSIONS TEST MONITOR DATA

DATE:	9-27-1990	Pbar(in.Hg.):	29.94	Nozzle #	5b	Diam.(mm):	5.000
CLIENT:	MID	Pstat(in.H20):	-4.6	Pitot Tube #	1234	Cp:	0.831
UNIT:	Turbine Unit #2	Pduct(in.Hg.):	29.60	D.G. Meter #	990	Cor.Fact.:	1.0227
SITE:		Init.MW:	28.0	Magnehelic #	371	"X" Factor:	0.5199
RUN #:	PAH #3	Init.%H20:	14.4	Temp. Unit #		Probe Liner:	QTZ GS
				Impinger Bkt #	1	Filter Holder:	QTZ GS

PORT A

				DATA					CALCULATIONS			
#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	%ISO
1	6	17	20	901	1.20	85	552.523	7	99.7	0.25	0.43	
2	5	17	24	922	0.95	85	554.710	6	89.4	0.19	0.38	
3	4	17	28	922	0.60	86	556.337	5	71.1	0.12	0.30	
4	3	17	32	924	0.42	87	557.676	3	59.5	0.09	0.25	
5	2	17	36	927	1.30	88	558.651	7	104.8	0.27	0.44	
6	1	17	40	930	2.20	87	560.550	4	136.5	0.45	0.57	
		17	44				562.913					
Sample Time =			24	921	1.11	86	10.390		93.5	0.23		109.6

PORT B

				DATA					CALCULATIONS			
#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	%ISO
1	6	17	53	912	0.60	87	562.917	3	70.8	0.12	0.30	
2	5	17	57	924	1.00	86	564.240	7	91.8	0.21	0.39	
3	4	18	1	923	2.00	86	565.871	12	129.8	0.41	0.55	
4	3	18	5	927	1.20	87	568.270	8	100.7	0.25	0.42	
5	2	18	9	930	1.50	88	570.123	9	112.7	0.31	0.47	
6	1	18	13	934	2.60	89	572.154	13	148.6	0.53	0.62	
		18	17				574.765					
Sample Time =			24	925	1.48	87	11.848		109.1	0.30		107.3

PORT C

				DATA					CALCULATIONS			
#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	%ISO
1	6	18	23	912	0.14	88	574.766	2	34.2	0.03	0.15	
2	5	18	27	922	0.52	86	575.397	4	66.2	0.11	0.28	
3	4	18	54	926	1.60	86	576.584	10	116.2	0.33	0.49	
4	3	18	58	926	1.70	86	578.710	11	119.8	0.35	0.50	
5	2	19	2	929	2.00	87	580.960	12	130.1	0.41	0.55	
6	1	19	6	934	3.00	89	583.499	15	159.6	0.61	0.67	
		19	10				586.355					
Sample Time =			24	925	1.49	87	11.589		104.4	0.31		68.3

PORT E

				DATA					CALCULATIONS			
#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	XISO
1	6	18	51	916	0.36	89	586.356	3	54.9	0.07	0.23	
2	5	18	55	920	0.62	88	587.154	5	72.2	0.13	0.31	
3	4	18	59	923	1.40	86	588.410	10	108.6	0.29	0.46	
4	3	19	3	929	2.00	85	590.372	12	130.1	0.41	0.55	
5	2	19	7	933	2.10	85	592.352	13	133.5	0.43	0.56	
6	1	19	11	935	1.80	85	595.000	13	123.7	0.37	0.52	
		19	15				597.631					
Sample Time =			24	926	1.38	86	11.275		103.8	0.28		107.7

PORT F

				DATA					CALCULATIONS			
#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	XISO
1	6	19	19	910	0.14	88	597.631	2	34.2	0.03	0.15	
2	5	19	23	921	0.36	86		3	55.0	0.07	0.23	
3	4	19	27	924	0.85	87		5	84.7	0.17	0.36	
4	3	19	31	926	1.60	88		10	116.2	0.33	0.49	
5	2	19	35	932	1.80	89		11	123.5	0.37	0.52	
6	1	19	39	933	2.20	90		11	136.6	0.45	0.58	
		19	43				607.521					
Sample Time =			24	924	1.16	88	9.890		91.7	0.24		106.4

PORT G

				DATA					CALCULATIONS			
#	TP	Hour	Minute	Td	DP	Tm	Vm	Vacuum	Vd	DH	Qm	XISO
1	6	19	46	915	0.00	90	607.521		0.0	0.00	0.00	
2	5	19	46	915	0.00	89			0.0	0.00	0.00	
3	4	19	46	915	0.00	88			0.0	0.00	0.00	
4	3	19	46	915	0.27	88		2	47.6	0.06	0.20	
5	2	19	50	930	1.20	84		8	100.8	0.24	0.42	
6	1	19	54	933	2.00	83		12	130.3	0.41	0.54	
		19	58				613.098					
Sample Time =			24	921	0.58	87	5.577		46.4	0.12		119.6

Post-Test Leak Rate 0.010 CFM at 10 in. Hg.

Test Summary

Sample Time =	144	924	87	60.569 NET CU. FT.	91.5	0.25	97.8

POLYCYCLIC AROMATIC HYDROCARBONS EMISSIONS

Data and Results:

Date:	9-27-1990	Run #:	PAH #3
Client:	MID	Time:	17:20
Unit:	Turbine Unit #2	Project Mngr:	DCL
Site:		Project #:	1425

Liquid Analysis: / **Gas Composition:** / **Selected Results:**

Absorber Type	Contents	Final	Tare	Net				
Lg. Grnbg.	H2O	612.30	536.60	75.70	%CO2 volume	7.8	Wet MW	28.40
Lg. Grnbg.	H2O	573.30	574.60	-1.30	%O2 volume	12.4	Excess Air	
Lg. Grnbg.	EMPTY	415.80	414.90	0.90	%CO volume	0.0		
Lg. Grnbg.	SILICA GEL	793.30	704.30	89.00	%N2 volume	79.8	Vm Standard	58.964
				0.00	%H2O volume	11.5	%Isokinetic	107.5
			Total	164.30			Standard T	60

VELOCITY TRAVERSE & VOLUME FLOW RATE

CLIENT: MID

DATE: 9-27-1990 TIME: 17:20 -19:58
UNIT: Turbine Unit #1
SAMPLE: RUN #: PAN #3

Duct Diameter (in.)	98.0	Duct Press. (in.Hg.)	29.60	Mag Box #	371
Rectangular Duct	219.5	Vol. Per Cent H2O	11.47	Temp. Unit	#6058/6752
Area (sq.ft.)	149.4	Molecular Wt. (wet)	28.40	Pitot Tube #	1234
Standard Temp. (F)	60.0	Std Press. (in.Hg.)	29.92	Pitot Coeff.	0.831

Pt.	In. From Edge	A			B			C			E			F			G		
		Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd
1	8.0	901	1.20	99.0	912	0.60	70.3	912	0.14	34.0	916	0.36	54.5	910	0.14	33.9	915	0.00	0.0
2	24.0	922	0.95	88.8	924	1.00	91.2	922	0.52	65.7	920	0.62	71.7	921	0.36	54.6	915	0.00	0.0
3	40.0	922	0.60	70.6	923	2.00	128.9	926	1.60	115.4	923	1.40	107.8	924	0.85	84.0	915	0.00	0.0
4	56.0	924	0.42	59.1	927	1.20	100.0	926	1.70	118.9	929	2.00	129.1	926	1.60	115.4	915	0.27	47.2
5	72.0	927	1.30	104.0	930	1.50	111.9	929	2.00	129.1	933	2.10	132.5	932	1.80	122.7	930	1.20	100.1
6	88.0	930	2.20	135.5	934	2.60	147.5	934	3.00	158.5	935	1.80	122.8	933	2.20	135.6	933	2.00	129.3

RESULTS:

Avg. Vel. (Vd) 124.6 FPS @ 525 F and 29.6 in. Hg.

Volume Flow Rate	Qd	1116.5	X1000 ACFM
	Qstd (wet)	583.3	X1000 SCFM
	Qstd (dry)	516.4	X1000 SDCFM

DATA SHEETS

CONSTANT MONITORING

CONSTANT MONITORING

DATA AND RESULTS:

Client: M.I.D.
Date: 9-28-1990
Unit: Turbine Unit #2
Site:

Analyzer: IR
Model Number: 702
Analyzer Range: 0-20%
Recorder Range: -5 to 95% F.S.
Zero Gas: Nitrogen
Span Gas: CO2
Cyl #: K810453
Value: 15
Units: % Volume
Interval(min): 5

RUN 1

Analysis Interval		Time Hour	Minute	Analyzer response % Full Scale		[Conc.]
Initial Zero		10	50	7.5	-	0.0
Initial Span		10	55	89.0	-	15.0
Interval	1	11	1	24.5	-	3.1
Interval	2	11	6	25.0	-	3.2
Interval	3	11	11	25.0	-	3.2
Interval	4	11	16	25.0	-	3.2
Interval	5	11	21	24.5	-	3.1
Interval	6	11	26	25.0	-	3.2
Interval	7	11	31	25.0	-	3.2
Interval	8	11	36	24.5	-	3.1
Final Zero		11	39	8.0	-	0.0
Final Span		11	43	88.5	-	15.0

Zero Drift %FS = 0.5
Span Drift %FS = -1.0

Run Average 3.2

CONSTANT MONITORING

DATA AND RESULTS:

Client: M.I.D.
Date: 9-28-1990

Unit: Turbine Unit #2
Site:

Analyzer: IR
Model Number: 702
Analyzer Range: 0-20%
Recorder Range: -5 to 95% F.S.

Zero Gas: Nitrogen
Span Gas: CO2
Cyl #: K810453
Value: 15
Units: % Volume
Interval(min): 5

RUN 2

Analysis Interval		Time Hour	Minute	Analyzer response % Full Scale		[Conc.]
Initial Zero		11	39	8.0	-	0.0
Initial Span		11	43	88.5	-	15.0
Interval	1	11	46	24.5	-	3.1
Interval	2	11	51	24.5	-	3.1
Interval	3	11	56	25.0	-	3.2
Interval	4	12	1	25.0	-	3.2
Interval	5	12	6	25.0	-	3.2
Interval	6	12	11	25.0	-	3.2
Interval	7	12	16	25.0	-	3.2
Interval	8	12	21	24.5	-	3.1
Final Zero		12	31	7.5	-	0.0
Final Span		12	40	88.5	-	15.0

Zero Drift %FS = -0.5
Span Drift %FS = 0.5

Run Average 3.2

CONSTANT MONITORING

DATA AND RESULTS:

Client:	M.I.D.	Unit:	Turbine Unit #2
Date:	9-28-1990	Site:	
Analyzer:	IR	Zero Gas:	Nitrogen
Model Number:	702	Span Gas:	CO2
Analyzer Range:	0-20%	Cyl #:	K810453
Recorder Range:	-5 to 95% F.S.	Value:	15
		Units:	% Volume
		Interval(min):	5

RUN 3

Analysis Interval		Time Hour	Minute	Analyzer response % Full Scale		[Conc.]
Initial Zero		12	31	7.5	-	0.0
Initial Span		12	40	88.5	-	15.0
Interval	1	12	51	24.5	-	2.5
Interval	2	12	56	25.0	-	2.4
Interval	3	13	1	24.5	-	2.2
Interval	4	13	6	24.0	-	2.0
Interval	5	13	11	24.5	-	1.9
Interval	6	13	16	24.5	-	1.8
Interval	7	13	21	24.0	-	1.5
Interval	8	13	26	24.0	-	1.4
Final Zero		12	35	8.0	-	0.0
Final Span		12	38	88.0	-	15.0

Zero Drift %FS = 0.5

Span Drift %FS = -1.0

Run Average 2.0

CONSTANT MONITORING

DATA AND RESULTS:

Client:	M.I.D.	Unit:	Turbine Unit #2
Date:	9-28-1990	Site:	
Analyzer:	Teledyne	Zero Gas:	Nitrogen
Model Number:	320	Span Gas:	O2
Analyzer Range:	0-25%	Cyl #:	K810453
Recorder Range:	-5 to 95% F.S.	Value:	8
		Units:	% Volume
		Interval(min):	5

RUN 1

Analysis Interval		Time Hour	Minute	Analyzer response % Full Scale		[Conc.]
Initial Zero		10	50	11.0	-	0.0
Initial Span		10	55	42.0	-	8.0
Interval	1	11	1	70.0	-	15.0
Interval	2	11	6	72.0	-	15.4
Interval	3	11	11	72.5	-	15.4
Interval	4	11	16	73.0	-	15.4
Interval	5	11	21	73.5	-	15.4
Interval	6	11	26	73.0	-	15.2
Interval	7	11	31	72.5	-	15.0
Interval	8	11	36	71.0	-	14.5
Final Zero		11	39	9.5	-	0.0
Final Span		11	43	42.0	-	8.0

Zero Drift %FS = -1.5 Run Average 15.2
Span Drift %FS = 1.5

CONSTANT MONITORING

DATA AND RESULTS:

Client: M.I.D.
Date: 9-28-1990

Unit: Turbine Unit #2
Site:

Analyzer: Teledyne
Model Number: 320
Analyzer Range: 0-25%
Recorder Range: -5 to 95% F.S.

Zero Gas: Nitrogen
Span Gas: O2
Cyl #: K810453
Value: 8
Units: % Volume
Interval(min): 5

RUN 2

Analysis Interval		Time Hour	Minute	Analyzer response % Full Scale		[Conc.]
Initial Zero		11	39	9.5	-	0.0
Initial Span		11	43	42.0	-	8.0
Interval	1	11	46	72.0	-	15.4
Interval	2	11	51	72.5	-	15.5
Interval	3	11	56	71.5	-	15.3
Interval	4	12	1	70.5	-	15.1
Interval	5	12	6	70.0	-	15.0
Interval	6	12	11	70.0	-	15.0
Interval	7	12	16	69.0	-	14.8
Interval	8	12	21	68.5	-	14.7
Final Zero		12	31	7.0	-	0.0
Final Span		12	40	37.5	-	8.0

Zero Drift %FS = -2.5
Span Drift %FS = -2.0

Run Average 15.1

CONSTANT MONITORING

DATA AND RESULTS:

Client: M.I.D.
Date: 9-28-1990

Unit: Turbine Unit #2
Site:

Analyzer: Teledyne
Model Number: 320
Analyzer Range: 0-25%
Recorder Range: -5 to 95% F.S.

Zero Gas: Nitrogen
Span Gas: O2
Cyl #: K810453
Value: 8
Units: % Volume
Interval(min): 5

RUN 3

Analysis Interval		Time Hour	Minute	Analyzer response % Full Scale		[Conc.]
Initial Zero		12	31	7.0	-	0.0
Initial Span		12	40	37.5	-	8.0
Interval	1	12	51	65.5	-	15.3
Interval	2	12	56	65.5	-	15.3
Interval	3	13	1	65.5	-	15.3
Interval	4	13	6	66.5	-	15.6
Interval	5	13	11	66.5	-	15.6
Interval	6	13	16	65.5	-	15.3
Interval	7	13	21	65.0	-	15.2
Interval	8	13	26	65.0	-	15.2
Final Zero		12	35	7.0	-	0.0
Final Span		12	38	37.5	-	8.0

Zero Drift %FS = 0.0
Span Drift %FS = 0.0

Run Average 15.4

CONSTANT MONITORING

DATA AND RESULTS:

Client: M.I.D.
Date: 9-28-1990

Unit: Turbine Unit #2
Site:

Analyzer: IR
Model Number: 702
Analyzer Range: 0-3000
Recorder Range: -5 to 95% F.S.

Zero Gas: Nitrogen
Span Gas: CO
Cyl #: ALM-14369
Value: 2541
Units: ppm
Interval(min): 5

RUN 1

Analysis Interval		Time Hour	Minute	Analyzer response % Full Scale		[Conc.]
Initial Zero		10	50	4.0	-	0.0
Initial Span		10	55	93.5	-	2541.0
Interval	1	11	1	5.5	-	38.8
Interval	2	11	6	5.5	-	37.4
Interval	3	11	11	5.5	-	36.0
Interval	4	11	16	6.5	-	63.1
Interval	5	11	21	6.0	-	47.4
Interval	6	11	26	5.5	-	31.7
Interval	7	11	31	5.5	-	30.3
Interval	8	11	36	5.0	-	14.5
Final Zero		11	39	4.5	-	0.0
Final Span		11	43	93.5	-	2541.0

Zero Drift %FS = 0.5
Span Drift %FS = -0.5

Run Average 37.4

CONSTANT MONITORING

DATA AND RESULTS:

Client: M.I.D.
Date: 9-28-1990
Unit: Turbine Unit #2
Site:

Analyzer: IR
Model Number: 702
Analyzer Range: 0-3000
Recorder Range: -5 to 95% F.S.
Zero Gas: Nitrogen
Span Gas: CO
Cyl #: ALM-14369
Value: 2541
Units: ppm
Interval(min): 5

RUN 2

Analysis Interval		Time Hour	Minute	Analyzer response % Full Scale		[Conc.]
Initial Zero		11	39	4.5	-	0.0
Initial Span		11	43	93.5	-	2541.0
Interval	1	11	46	5.5	-	33.8
Interval	2	11	51	4.5	-	8.0
Interval	3	11	56	4.5	-	10.7
Interval	4	12	1	4.5	-	13.5
Interval	5	12	6	4.5	-	16.3
Interval	6	12	11	4.5	-	19.1
Interval	7	12	16	4.5	-	21.9
Interval	8	12	21	4.5	-	24.7
Final Zero		12	31	3.5	-	0.0
Final Span		12	40	90.0	-	2541.0

Zero Drift %FS = -1.0
Span Drift %FS = -2.5
Run Average 18.5

CONSTANT MONITORING

DATA AND RESULTS:

Client: M.I.D.
Date: 9-28-1990

Unit: Turbine Unit #2
Site:

Analyzer: IR
Model Number: 702
Analyzer Range: 0-3000
Recorder Range: -5 to 95% F.S.

Zero Gas: Nitrogen
Span Gas: CO
Cyl #: ALM-14369
Value: 2541
Units: ppm
Interval(min): 5

RUN 3

Analysis Interval		Time Hour	Minute	Analyzer response % Full Scale		[Conc.]
Initial Zero		12	31	3.5	-	0.0
Initial Span		12	40	90.0	-	2541.0
Interval	1	12	51	4.5	-	29.4
Interval	2	12	56	4.5	-	29.4
Interval	3	13	1	4.5	-	29.4
Interval	4	13	6	4.5	-	29.4
Interval	5	13	11	4.5	-	29.4
Interval	6	13	16	4.5	-	29.4
Interval	7	13	21	4.5	-	29.4
Interval	8	13	26	4.5	-	29.4
Final Zero		12	35	3.5	-	0.0
Final Span		12	38	90.0	-	2541.0

Zero Drift %FS = 0.0
Span Drift %FS = 0.0

Run Average 29.4

CONSTANT MONITORING

DATA AND RESULTS:

Client: M.I.D.
Date: 9-28-1990

Unit: Turbine Unit #2
Site:

Analyzer: TECO
Model Number: 10
Analyzer Range: 0-1000
Recorder Range: -5 to 95% F.S.

Zero Gas: Nitrogen
Span Gas: NOX
Cyl #: ALM-14369
Value: 816.9
Units: ppm
Interval(min): 5

RUN 1

Analysis Interval		Time Hour	Minute	Analyzer response % Full Scale		[Conc.]
Initial Zero		10	50	5.5	-	0.0
Initial Span		10	55	86.5	-	816.9
Interval	1	11	1	8.8	-	33.3
Interval	2	11	6	8.8	-	33.3
Interval	3	11	11	8.8	-	33.3
Interval	4	11	16	8.8	-	33.3
Interval	5	11	21	8.8	-	33.3
Interval	6	11	26	8.8	-	33.3
Interval	7	11	31	8.8	-	33.3
Interval	8	11	36	8.8	-	33.3
Final Zero		11	39	5.5	-	0.0
Final Span		11	43	85.0	-	816.9

Zero Drift %FS = 0.0
Span Drift %FS = -1.5

Run Average 33.3

CONSTANT MONITORING

DATA AND RESULTS:

Client: M.I.D.
Date: 9-28-1990

Unit: Turbine Unit #2
Site:

Analyzer: TECO
Model Number: 10
Analyzer Range: 0-1000
Recorder Range: -5 to 95% F.S.

Zero Gas: Nitrogen
Span Gas: NOX
Cyl #: ALM-14369
Value: 816.9
Units: ppm
Interval(min): 5

RUN 2

Analysis Interval		Time Hour	Minute	Analyzer response % Full Scale		[Conc.]
Initial Zero		11	39	5.5	-	0.0
Initial Span		11	43	85.0	-	816.9
Interval	1	11	46	9.0	-	36.0
Interval	2	11	51	9.5	-	41.1
Interval	3	11	56	9.5	-	41.1
Interval	4	12	1	9.5	-	41.1
Interval	5	12	6	9.5	-	41.1
Interval	6	12	11	9.5	-	41.1
Interval	7	12	16	9.5	-	41.1
Interval	8	12	21	9.5	-	41.1
Final Zero		12	31	5.5	-	0.0
Final Span		12	40	84.0	-	816.9

Zero Drift %FS = 0.0
Span Drift %FS = -1.0

Run Average 40.5

CONSTANT MONITORING

DATA AND RESULTS:

Client:	M.I.D.	Unit:	Turbine Unit #2
Date:	9-28-1990	Site:	
Analyzer:	TECO	Zero Gas:	Nitrogen
Model Number:	10	Span Gas:	NOX
Analyzer Range:	0-1000	Cyl #:	ALM-14369
Recorder Range:	-5 to 95% F.S.	Value:	816.9
		Units:	ppm
		Interval(min):	5

RUN 3

Analysis Interval		Time Hour	Minute	Analyzer response % Full Scale		[Conc.]
Initial Zero		12	31	5.5	-	0.0
Initial Span		12	40	84.0	-	816.9
Interval	1	12	51	9.5	-	41.6
Interval	2	12	56	9.5	-	41.6
Interval	3	13	1	9.5	-	41.6
Interval	4	13	6	9.0	-	36.4
Interval	5	13	11	9.0	-	36.4
Interval	6	13	16	9.0	-	36.4
Interval	7	13	21	9.0	-	36.4
Interval	8	13	26	9.0	-	36.4
Final Zero		12	35	5.5	-	0.0
Final Span		12	38	82.5	-	816.9

Zero Drift %FS = 0.0 Run Average 38.4

Span Drift %FS = -1.5

DATA SHEETS

VOLUMETRIC FLOW RATES

INITIAL MOLECULAR WEIGHT AND PERCENT WATER

CLIENT:	Modesto Irrigation District		
DATE:	26 September 1990	TIME:	1015-1045
UNIT:	Turbine Unit #2		
SAMPLE:	Natural Gas	RUN #:	Only

PRESSURE

Pbar (in. Hg)	29.95
Pstatic (in. H2O)	-4
Pduct (in. Hg)	29.66

TEMPERATURE

Standard (°F)	60
Duct (°F)	864

METER DATA

Initial Meter	259.799
Final Meter	275.113
Meter Temp (°F)	84
?H (in. H2O)	1.70
Avg Y	1.0118

WATER COLLECTION

Final Wt. (g)	2256.1
Tare Wt. (g)	2228.5
Net Water (g)	27.6

FIXED GASES (Vol. % dry)

Oxygen	15.0
Carbon Dioxide	3.0
Nitrogen	82.0

RESULTS:

Dry M.W.	29.08
Vm std.	14.89
%H2O	7.93
Wet M.W.	28.20

VELOCITY TRAVERSE & VOLUME FLOW RATE

CLIENT: Modesto Irrigation District

DATE: 26 September 1990 TIME: 1015-1045
UNIT: Turbine Unit #2
SAMPLE: Natural Gas RUN #: Only

Duct Diameter (in.)	98.0	Duct Press. (in.Hg.)	29.66	Mag Box #	374
Rectangular Duct	219.5	Vol. Per Cent H20	7.93	Temp. Unit #	6058/6752
Area (sq.ft.)	149.38	Molecular Wt. (wet)	28.20	Pitot Tube #	1201/PT2
Standard Temp. (%F)	60.0	Std Press. (in.Hg.)	29.92	Pitot Coeff.	0.820

Pt.	In. From Edge	A			B			C			D			E			F			G		
		Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd
1	8.0	851	2.60	141.5	810	3.80	168.4	843	5.00	195.7	825	5.80	209.3	808	5.20	196.8	850	6.00	214.9	854	6.00	215.2
2	24.0	866	3.10	155.4	866	5.20	201.3	873	5.80	213.1	872	5.60	209.4	864	4.80	193.2	867	3.70	169.9	863	3.80	171.9
3	40.0	876	3.00	153.5	873	6.00	216.8	875	5.00	198.0	876	5.00	198.1	867	4.00	176.6	869	2.80	147.9	863	1.40	104.3
4	56.0	876	3.20	158.5	874	6.60	227.5	875	4.20	181.5	876	4.00	177.2	868	3.00	153.0	869	1.80	118.6	856	0.00	0.0
5	72.0	874	4.00	177.1	873	4.40	185.6	872	2.00	125.1	874	2.50	140.0	867	1.80	118.5	866	0.98	87.4	855	0.00	0.0
6	88.0	871	3.60	167.8	872	3.00	153.2	870	1.60	111.8	870	1.80	118.6	864	1.40	104.4	864	0.50	62.4	851	0.00	0.0

RESULTS:

Average Velocity (Vd) 164.7 FPS @ 864 F and 29.7 in. Hg.

Volume Flow Rate	Qd	1475.9	X1000 ACFM
	Qstd (wet)	574.5	X1000 SCFM
	Qstd (dry)	528.9	X1000 SDCFM

INITIAL MOLECULAR WEIGHT AND PERCENT WATER

CLIENT: Modesto Irrigation District

DATE:	27 September 1990	TIME:	1100-1130
UNIT:	Turbine Unit #2		
SAMPLE:	DISTILLATE #2	RUN #:	Only

PRESSURE		TEMPERATURE	
Pbar (in. Hg)	30.05	Standard (°F)	60
Pstatic (in. H2O)	-4	Duct (°F)	924
Pduct (in. Hg)	29.76		

METER DATA		WATER COLLECTION	
Initial Meter	275.213	Final Wt. (g)	2280.8
Final Meter	290.701	Tare Wt. (g)	2256.1
Meter Temp (°F)	93		
?H (in. H2O)	1.70	Net Water (g)	24.7
Avg Y	1.0118		

FIXED GASES (Vol. % dry)

Oxygen	15.0
Carbon Dioxide	3.0
Nitrogen	82.0

RESULTS:

Dry M.W.	29.08
Vm std.	14.86
%H2O	7.17
Wet M.W.	28.29

ECOSERVE, Inc.
ENVIRONMENTAL SERVICES

VELOCITY TRAVERSE & VOLUME FLOW RATE

CLIENT: Modesto Irrigation District

DATE: 26 September 1990 TIME: 1100-1130
UNIT: Turbine Unit #1
SAMPLE: D2 RUN #: Only

Duct Diameter (in.)	98.0	Duct Press. (in.Hg.)	29.76	Mag Box #	374
Rectangular Duct	219.5	Vol. Per Cent H20	7.17	Temp. Unit #	6058/6752
Area (sq.ft.)	149.38	Molecular Wt. (wet)	28.29	Pitot Tube #	1201/PT2
Standard Temp. (%F)	60.0	Std Press. (in.Hg.)	29.92	Pitot Coeff.	0.820

Pt.	In. From Edge	A			B			C			D			E			F			G		
		Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd	Td	Dp	Vd
1	8.0	920	2.20	133.1	880	3.40	163.1	897	3.80	173.5	891	4.00	177.6	826	3.80	168.9	913	4.20	183.5	919	4.20	183.9
2	24.0	932	2.00	127.5	921	2.00	127.0	923	3.00	155.6	923	3.40	165.7	925	3.00	155.8	933	2.40	139.7	928	2.60	145.2
3	40.0	935	1.00	90.3	927	1.20	98.6	928	2.20	133.5	930	2.00	127.4	929	2.40	139.5	936	1.60	114.2	918	0.58	68.3
4	56.0	937	1.60	114.2	933	2.40	139.7	933	1.40	106.7	930	2.00	127.4	933	1.40	106.7	933	1.20	98.8	918	0.00	0.0
5	72.0	938	2.00	127.8	935	1.00	90.3	933	0.74	77.6	930	0.94	87.3	933	0.70	75.5	929	0.38	55.5	919	0.00	0.0
6	88.0	938	1.80	121.2	934	0.78	79.7	931	0.38	55.6	929	0.52	64.9	932	0.58	68.7	929	0.18	38.2	918	0.00	0.0

RESULTS:

Average Velocity (Vd) 117.0 FPS @ 924 F and 29.8 in. Hg.

Volume Flow Rate	Qd	1048.2	X1000 ACFM
	Qstd (wet)	391.7	X1000 SCFM
	Qstd (dry)	363.6	X1000 SDCFM

APPENDIX A
PAH EMISSIONS CALCULATIONS
LABORATORY RESULTS

POLYCYLIC AROMATIC HYDROCARBONS
ARB 429

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

Order No: 90-10-016
Hazardous Waste Testing
Certification: E765

CLIENT: ECOSERVE
PROJECT #: 1425
SAMPLE ID: ECO1425-PAH-1

DATE RECEIVED: 10/02/1990
DATE EXTRACTED: 10/09/1990
DATE COMPLETED: 10/15/1990
DATE SAMPLED: 09/27/1990

COMPOUND	CONCENTRATION ug/emission	PQL * ug/emission
Naphthalene	136	1.5
Acenaphthylene	<1.5	1.5
Acenaphthene	<1.5	1.5
Fluorene	<1.5	1.5
Phenanthrene	3.2	1.5
Anthracene	<1.5	1.5
Fluoranthene	<1.5	1.5
Pyrene	<1.5	1.5
Benzo(a)anthracene	<1.5	1.5
Chrysene	<1.5	1.5
Benzo(b)fluoranthene	<1.5	1.5
Benzo(k)fluoranthene	<1.5	1.5
Benzo(a)pyrene	<1.5	1.5
Benzo(g,h,i)perylene	<1.5	1.5
Dibenzo(a,h)anthracene	<1.5	1.5
Indeno(1,2,3-cd)pyrene	<1.5	1.5

	% Surrogate Spike Recovery
Benzo(a)anthracene-d12	60%
Methyl-Naphthalene-d10	37%

* Instrument Detection Limit are 1.5 ug/ml, and samples extract final volume are 1 ml. The practical Detection Limit is 1.5 ug/emission.

Chung P L.

Chung P. LY, Ph.D.
Chemist

October 18, 1990
Date

COPY

POLYCYLIC AROMATIC HYDROCARBONS
ARB 429

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

Order No: 90-10-016
Hazardous Waste Testing
Certification: E765

CLIENT: ECOSERVE
PROJECT #: 1425
SAMPLE ID: BLANK

DATE RECEIVED: 10/02/1990
DATE EXTRACTED: 10/09/1990
DATE COMPLETED: 10/15/1990

COMPOUND	CONCENTRATION ug/emission	PQL * ug/emission
Naphthalene	<1.5	1.5
Acenaphthylene	<1.5	1.5
Acenaphthene	<1.5	1.5
Fluorene	<1.5	1.5
Phenanthrene	<1.5	1.5
Anthracene	<1.5	1.5
Fluoranthene	<1.5	1.5
Pyrene	<1.5	1.5
Benzo(a)anthracene	<1.5	1.5
Chrysene	<1.5	1.5
Benzo(b)fluoranthene	<1.5	1.5
Benzo(k)fluoranthene	<1.5	1.5
Benzo(a)pyrene	<1.5	1.5
Benzo(g,h,i)perylene	<1.5	1.5
Dibenzo(a,h)anthracene	<1.5	1.5
Indeno(1,2,3-cd)pyrene	<1.5	1.5

	% Surrogate Spike Recovery
Benzo(a)anthracene-d12	58%
Methyl-Naphthalene-d10	-

* Instrument Detection Limit are 1.5 ug/ml, and samples extract final volume are 1 ml. The practical Detection Limit is 1.5 ug/emission.

Chung P. Li, Ph.D.
Chemist

October 18, 1990
Date

POLYCYLIC AROMATIC HYDROCARBONS
ARB 429

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

Order No: 90-10-016
Hazardous Waste Testing
Certification: E765

CLIENT: ECOSERVE
PROJECT #: 1425
SAMPLE ID: ECO1425-PAH-2

DATE RECEIVED: 10/02/1990
DATE EXTRACTED: 10/09/1990
DATE COMPLETED: 10/15/1990
DATE SAMPLED: 09/27/1990

COMPOUND	CONCENTRATION ug/emission	PQL * ug/emission
Naphthalene	94	1.5
Acenaphthylene	<1.5	1.5
Acenaphthene	<1.5	1.5
Fluorene	<1.5	1.5
Phenanthrene	1.5	1.5
Anthracene	<1.5	1.5
Fluoranthene	<1.5	1.5
Pyrene	<1.5	1.5
Benzo(a)anthracene	<1.5	1.5
Chrysene	<1.5	1.5
Benzo(b)fluoranthene	<1.5	1.5
Benzo(k)fluoranthene	<1.5	1.5
Benzo(a)pyrene	<1.5	1.5
Benzo(g,h,i)perylene	<1.5	1.5
Dibenzo(a,h)anthracene	<1.5	1.5
Indeno(1,2,3-cd)pyrene	<1.5	1.5

	% Surrogate Spike Recovery
Benzo(a)anthracene-d12	76%
Methyl-Naphthalene-d10	23%

* Instrument Detection Limit are 1.5 ug/ml, and samples extract final volume are 1 ml. The practical Detection Limit is 1.5 ug/emission.

Chung P. L.
Chung P. Liu Ph.D.
Chemist

October 18, 1990
Date

POLYCYLIC AROMATIC HYDROCARBONS
ARB 429

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

Order No: 90-10-016
Hazardous Waste Testing
Certification: E765

CLIENT: ECOSERVE
PROJECT #: 1425
SAMPLE ID: ECO1425-PAH-3

DATE RECEIVED: 10/02/1990
DATE EXTRACTED: 10/09/1990
DATE COMPLETED: 10/15/1990
DATE SAMPLED: 09/27/1990

COMPOUND	CONCENTRATION ug/emission	PQL * ug/emission
Naphthalene	177	1.5
Acenaphthylene	<1.5	1.5
Acenaphthene	<1.5	1.5
Fluorene	<1.5	1.5
Phenanthrene	1.5	1.5
Anthracene	<1.5	1.5
Fluoranthene	<1.5	1.5
Pyrene	<1.5	1.5
Benzo(a)anthracene	<1.5	1.5
Chrysene	<1.5	1.5
Benzo(b)fluoranthene	<1.5	1.5
Benzo(k)fluoranthene	<1.5	1.5
Benzo(a)pyrene	<1.5	1.5
Benzo(g,h,i)perylene	<1.5	1.5
Dibenzo(a,h)anthracene	<1.5	1.5
Indeno(1,2,3-cd)pyrene	<1.5	1.5

	% Surrogate Spike Recovery
Benzo(a)anthracene-d12	64%
Methyl-Naphthalene-d10	52%

* Instrument Detection Limit are 1.5 ug/ml, and samples extract final volume are 1 ml. The practical Detection Limit is 1.5 ug/emission.

Chung P. L.
Chung P. Li Ph.D.
Chemist

October 18, 1990
Date

POLYCYLIC AROMATIC HYDROCARBONS
ARB 429

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

Order No: 90-10-016
Hazardous Waste Testing
Certification: E765

CLIENT: ECOSERVE
PROJECT #: 1425
SAMPLE ID: ECO1425-PAH-BLNK

DATE RECEIVED: 10/02/1990
DATE EXTRACTED: 10/09/1990
DATE COMPLETED: 10/15/1990
DATE SAMPLED: 09/27/1990

COMPOUND	CONCENTRATION ug/emission	PQL * ug/emission
Naphthalene	129	1.5
Acenaphthylene	<1.5	1.5
Acenaphthene	<1.5	1.5
Fluorene	<1.5	1.5
Phenanthrene	<1.5	1.5
Anthracene	<1.5	1.5
Fluoranthene	<1.5	1.5
Pyrene	<1.5	1.5
Benzo(a)anthracene	<1.5	1.5
Chrysene	<1.5	1.5
Benzo(b)fluoranthene	<1.5	1.5
Benzo(k)fluoranthene	<1.5	1.5
Benzo(a)pyrene	<1.5	1.5
Benzo(g,h,i)perylene	<1.5	1.5
Dibenzo(a,h)anthracene	<1.5	1.5
Indeno(1,2,3-cd)pyrene	<1.5	1.5

	% Surrogate Spike Recovery
Benzo(a)anthracene-d12	64%
Methyl-Naphthalene-d10	15%

* Instrument Detection Limit are 1.5 ug/ml, and samples extract final volume are 1 ml. The practical Detection Limit is 1.5 ug/emission.

Chung P. L.
Chung P. Li, Ph.D.
Chemist

October 18, 1990
Date

POLYCYLIC AROMATIC HYDROCARBONS
ARB 429

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

Order No: 90-10-016
Hazardous Waste Testing
Certification: E765

CLIENT: ECOSERVE
PROJECT #: 1425
SAMPLE ID: REAGENT SPIKE RECOVERY

DATE RECEIVED: 10/02/1990
DATE EXTRACTED: 10/05/1990
DATE COMPLETED: 10/15/1990

COMPOUND	SPIKE RECOVERY
Naphthalene	77%
Acenaphthylene	81%
Acenaphthene	93%
Fluorene	92%
Phenanthrene	86%
Anthracene	87%
Fluoranthene	95%
Pyrene	93%
Benzo(a)anthracene	101%
Chrysene	94%
Benzo(b)fluoranthene	113%
Benzo(k)fluoranthene	115%
Benzo(a)pyrene	118%
Benzo(g,h,i)perylene	109%
Dibenzo(a,h)anthracene	97%
Indeno(1,2,3-cd)pyrene	93%

	% Surrogate Spike Recovery
Benzo(a)anthracene-d12	92%
Methyl-Naphthalene-d10	-

Chung P. Li, Ph.D.
Chemist

October 18, 1990
Date

POLYCYLIC AROMATIC HYDROCARBONS
ARB 429

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

Order No: 90-10-016
Hazardous Waste Testing
Certification: E765

CLIENT: ECOSERVE
PROJECT #: 1425
SAMPLE ID: REAGENT SPIKE RECOVERY DUPLICATE

DATE RECEIVED: 10/02/1990
DATE EXTRACTED: 10/05/1990
DATE COMPLETED: 10/15/1990

COMPOUND	SPIKE RECOVERY
Naphthalene	73%
Acenaphthylene	76%
Acenaphthene	89%
Fluorene	88%
Phenanthrene	83%
Anthracene	81%
Fluoranthene	89%
Pyrene	88%
Benzo(a)anthracene	97%
Chrysene	93%
Benzo(b)fluoranthene	109%
Benzo(k)fluoranthene	100%
Benzo(a)pyrene	103%
Benzo(g,h,i)perylene	112%
Dibenzo(a,h)anthracene	107%
Indeno(1,2,3-cd)pyrene	93%

	% Surrogate Spike Recovery
Benzo(a)anthracene-d12	90%
Methyl-Naphthalene-d10	-

Chung P. Liu Ph.D.
Chemist

October 18, 1990
Date

COPY

FORMALDEHYDE ANALYSIS
By DNPH Derivatization and HPLC
Method CARB 430

EUREKA LABORATORIES, INC.
6790 Florin-Perkins Road
Sacramento, CA 95828
(916) 381-7953

Order No: 90-10-016
Hazardous Waste Testing
Certification: E765

CLIENT: ECOSERVE
PROJECT #: 1425

DATE RECEIVED: 10/02/1990
DATE EXTRACTED: 10/05/1990
DATE COMPLETED: 10/12/1990
DATE SAMPLED: 09/27/1990

SAMPLE ID.	FORMALDEHYDE CONTENT (ug/L DNPH Solution)	Sample Volume (ml)	Detection Limit ug/L (ppb)
ECO1425-NG1	145	40	15
ECO1425-NG2	26.4	40	15
ECO1425-NG3	26.1	40	15
ECO1425-D21	34.8	40	15
ECO1425-D22	17.9	40	15
ECO1425-D23	23.0	40	15
ECO1425-D2 BLANK	<30	20	30 **
ECO1425-NG BLANK	40.5	25	24
METHOD BLANK	<15		15

* REAGENT SPIKE RECOVERY - 96%
* REAGENT SPIKE RECOVERY DUP. 96%

* Reagent spike set is used due to insufficient sample provided.

** Higher detection limit due to less sample volume.

Mark Shih, Ph.D.
Chemist

October 30, 1990
Date

ZALCO LABORATORIES, INC.
Analytical & Consulting Services

Ecoserve
690 A. Garcia Ave.
Pittsburg, CA 94565

Laboratory No: 25290-1
Date Received: 10-4-90
Date Reported: 10-18-90

Attention: Rowena Romero

Sample: Fuel Oil

Sample Description: ECO 1425-1 sampled on 9-28-90

AB 2588 - Air Toxics

	Total Concentration mg/kg	MRL	Method/ Reference
Arsenic, As	< 0.5	0.5	7061/1
Beryllium, Be	< 0.5	0.5	6010/1
Cadmium, Cd	< 0.5	0.5	6010/1
Chromium, Cr	< 2.5	2.5	6010/1
Chromium, (VI)		0.05	6010/1
Copper, Cu	< 2.5	2.5	6010/1
Lead, Pb	< 2.5	2.5	6010/1
Manganese, Mn	< 1.5	1.5	6010/1
Mercury, Hg	< 0.02	0.02	7471/1
Nickel, Ni	< 2.5	2.5	6010/1
Selenium, Se	< 0.05	0.05	7741/1
Zinc, Zn	28	2.5	6010/1

Method References:
1. EPA SW-846, 1986 3rd Edition

MRL = Minimum Reporting Levels

John Zaletel
for Richard E. Penner
Laboratory Director

RLP/jr

ZALCO LABORATORIES, INC.
Analytical & Consulting Services

Ecoserve
690 A. Garcia Ave.
Pittsburg, CA 94565

Laboratory No: 25290-1
Date Received: 10-4-90
Date Reported: 10-18-90

Attention: Rowena Romero

Sample: Fuel Oil

Sample Description: ECO 1425-1 sampled on 9-28-90

COMPLIANCE FUEL OIL ANALYSIS

Bottom Sediment & Water
(ASTM D 96)

	vol. %
Total Cut	< 0.05
Emulsion	< 0.05
Water	< 0.05
Sediment	< 0.05

API Gravity @ 60 °F (ASTM D 287)	33.3
Specific Gravity @ 60 °F	0.859
Density, lbs/bbl @ 60 °F	300

Gross Heating Value:
(ASTM D 240)

cal/g	10880
Btu/lb	19590
Btu/gal	140100
Btu/bbl	5882000

Elemental Analysis
(CFR 40:60.45)

	As Rec'd wt. %
Carbon	87.35
Hydrogen	12.19
Oxygen	0.20
Nitrogen	0.23
Sulfur	0.03
Ash	< 0.01

"F" Factors	DSCF/MMBtu
EPA @ 68 °F	9085
KCAPCD @ 60 °F	8949

Total Chloride, Cl, ppm (EPA 9076)	5.1

John Zaletel
Richard L. Penner
Laboratory Director

RLP/jr

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

ZALCO LABORATORIES, INC.
Analytical & Consulting Services

Ecoserve
690 A. Garcia Ave.
Pittsburg, CA 94565

Laboratory No: 25290-2
Date Received: 10-4-90
Date Reported: 10-18-90

Attention: Rowena Romero

Sample: Diesel

Sample Description: ECO 1425-2 sampled on 9-28-90

AB 2588 - Air Toxics

	Total Concentration mg/kg	MRL	Method/ Reference
Arsenic, As	< 0.5	0.5	7061/1
Beryllium, Be	< 0.5	0.5	6010/1
Cadmium, Cd	< 0.5	0.5	6010/1
Chromium, Cr	< 2.5	2.5	6010/1
Chromium, (VI)		0.05	6010/1
Copper, Cu	< 2.5	2.5	6010/1
Lead, Pb	< 2.5	2.5	6010/1
Manganese, Mn	< 1.5	1.5	6010/1
Mercury, Hg	< 0.02	0.02	7471/1
Nickel, Ni	< 2.5	2.5	6010/1
Selenium, Se	0.058	0.05	7741/1
Zinc, Zn	24	2.5	6010/1

Method References:
1. EPA SW-846, 1986 3rd Edition

MRL = Minimum Reporting Levels

John Zaletel
for Richard L. Penner
Laboratory Director

RLP/jr

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

ZALCO LABORATORIES, INC.

Analytical & Consulting Services

Ecoserve
690 A. Garcia Ave.
Pittsburg, CA 94565

Laboratory No: 25290-2
Date Received: 10-4-90
Date Reported: 10-18-90

Attention: Rowena Romero

Sample: Fuel Oil

Sample Description: ECO 1425-2 sampled on 9-28-90

COMPLIANCE FUEL OIL ANALYSIS

Bottom Sediment & Water
(ASTM D 96)

	vol. %
Total Cut	< 0.05
Emulsion	< 0.05
Water	< 0.05
Sediment	< 0.05

API Gravity @ 60 °F (ASTM D 287)	33.3
Specific Gravity @ 60 °F	0.859
Density, lbs/bbl @ 60 °F	300

Gross Heating Value:
(ASTM D 240)

cal/g	10870
Btu/lb	19560
Btu/gal	139900
Btu/bbl	5875000

Elemental Analysis
(CFR 40:60.45)

	As Rec'd wt. %
Carbon	87.28
Hydrogen	12.29
Oxygen	0.30
Nitrogen	0.09
Sulfur	0.04
Ash	< 0.01

"F" Factors	DSCF/MMBtu
EPA @ 68 °F	9108
KCAPCD @ 60 °F	8972

Total Chloride, Cl, ppm (EPA 9076)	5.9

John Zaletel
for Richard L. Penner
Laboratory Director

RLP/jr

HAZEN

Hazen Research, Inc.
4601 Indiana St. • Golden, Colo. 80403
Tel: (303) 279-4501 • Telex 45-860
FAX: (303) 278-1528

DATE October 30 1990
HRI PROJECT 002-13-Y
HRI SERIES NO. J91/90
DATE RECD. 10/4/90
CUST P.O.#

ECOSERVE Inc.
Rowena R. Romero
690 A Garcia Avenue
Pittsburg California 94565

REPORT OF ANALYSIS

SAMPLE NO. J91/90-1
SAMPLE IDENTIFICATION: ECO1425-1 Fuel Oil 9/28/90

Gross Alpha pCi/g,(+-Precision*)	0.1(+-0.2)
Radium 226 pCi/g,(+-Precision*)	0.0(+-1.0)
Radium 228 pCi/g,(+-Precision*)	0.0(+-2.8)

By:

Robert Rostad
Laboratory Manager

---

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level,1.96 x sigma

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600 A Garcia Avenue
Pittsburg California 94565

REPORT OF ANALYSIS

SAMPLE NO. J91/90-2
SAMPLE IDENTIFICATION: ECO1425-2 Fuel Oil 9/28/90

Gross Alpha pCi/g,(+-Precision*)	0.0(+-0.1)
Radium 226 pCi/g,(+-Precision*)	0.0(+-0.9)
Radium 228 pCi/g,(+-Precision*)	0.0(+-3.0)

By:

Robert Rostad
Laboratory Manager

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level,1.96 x sigma

APPENDIX B
CALIBRATION DATA

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 6/27/90 Meter box number #635

Barometric pressure, P_b = 29.84 in. Hg Calibrated by EA

Orifice manometer setting (ΔH), in. H_2O	Gas volume		Temperatures						
	Wet test meter (V_w), ft^3	Dry gas meter (V_d), ft^3	Wet test meter (t_w), °F	Dry gas meter			Time (θ), min	Y_i	$\Delta H@_i$ in. H_2O
				Inlet (t_{d_i}), °F	Outlet (t_{d_o}), °F	Avg[a] (t_d), °F			
0.5	5.149 5	5.192	79	—	—	87.25	15	1.0056	
1.0	7.975 5	7.981	79	—	—	90.50	15	1.0180	
1.5	9.696 10	9.876	79	—	—	94.25	15	1.0058	
2.0	11.196 10	11.604	79	—	—	96.50	15	1.0178	
3.0	10	—	—	—	—	—	—	—	—
4.0	10	—	—	—	—	—	—	—	—
							Avg	1.0118	

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$	$\Delta H@_i = \frac{0.0317 \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460) \theta}{V_w}\right]^2$
0.5	0.0368	1.0056	
1.0	0.0737	1.0180	
1.5	0.110	1.0058	
2.0	0.147	1.0178	
3.0	0.221	—	—
4.0	0.294	—	—

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d.

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 5-10-90 Meter box number 990

Barometric pressure, P_b = 29.80 in. Hg Calibrated by EL/FKF

Orifice manometer setting (ΔH), in. H_2O	Gas volume		Temperatures				Time (θ), min	Y_i	$\Delta H@_i$ in. H_2O
	Wet test meter (V_w), ft^3	Dry gas meter (V_d), ft^3	Wet test meter (t_w), °F	Dry gas meter					
				Inlet (t_{d_i}), °F	Outlet (t_{d_o}), °F	Avg[a] (t_d), °F			
0.5	5.787 5	5.904	69.8°	—	-	83°	15	1.0049	
1.0	8.051 5	8.390	69.8°	—	-	89°	15	0.9919	
1.5	10.644 10	10.452	69.8°	—	-	94°	15	1.0663	
2.0	13.826 10	14.212	69.8°	—	—	100°	15	1.0232	
3.0	14.737 10	15.195	69.8°	—	-	105	15	1.0267	
4.0	16.851 10	17.514	69.8°	—	-	109	15	1.0232	
							Avg	1.0227	1.6271

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \dfrac{V_w\, P_b(t_d + 460)}{V_d(P_b + \frac{\Delta H}{13.6})\,(t_w + 460)}$	$\Delta H@_i = \dfrac{0.0317\ \Delta H}{P_b\ (t_d + 460)}\left[\dfrac{(t_w + 460)\ \theta}{V_w}\right]^2$
0.5	0.0368	1.0049	1.8405
1.0	0.0737	0.9919	1.8804
1.5	0.110	1.0663	1.5448
2.0	0.147	1.0232	1.2226
3.0	0.221	1.0267	1.6285
4.0	0.294	1.0232	1.6458

---

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d.

```
Pitot Tube Type:        12 Ft. SS
Calibrated By:          rw
Date:                   9/17/1990
                                        # 1201

        | A side Calibration |
--------------------------------------------------------------
| del P (std)  del P (s)   Cp (s)   Dev.
|
|      0.41      0.60      0.818    0.000
|      0.41      0.60      0.818    0.000
|      0.41      0.60      0.818    0.000
|
|                           Avg:   Avg:
|                          0.818    0.000 Acceptable
|                                        (Must be <.01)
| Std. Dev. of Avg. Dev.:       0 Acceptable
|                                (Must be <.02)
--------------------------------------------------------------

        | B side Calibration |
--------------------------------------------------------------
| del P (std)  del P (s)   Cp (s)   Dev.
|
|      0.72      1.10      0.800    0.022
|      0.75      1.05      0.836    0.014
|      0.74      1.05      0.831    0.008
|
|                           Avg:   Avg:
|                          0.822    0.015 Unacceptable
|                                        (Must be <.01)
| Std. Dev. of Avg. Dev.:   0.006 Acceptable
|                                (Must be <.02)
--------------------------------------------------------------

*****************************************************
*                                                   *
*        Results:                                   *
*                                                   *
*                 Cp A:     0.818                   *
*                 Cp B:     0.822                   *
*          Cp A - Cp B:     0.004 (Must be <.01)    *
*            Avg. Cp:       0.820                   *
*                                                   *
*****************************************************
```

```
Pitot Tube ID#:        1234
Pitot Tube Type:       12 ft. glass /Carbon Skd Sheath
Calibrated By:         rw,md
Date:                  09/25/90


        ¦ A side Calibration  ¦
 -------------------------------------------------------------------
¦   del P (std)  del P (s)   Cp (s)   Dev.                          ¦
¦                                                                   ¦
¦         0.50      0.71      0.831    0.000                        ¦
¦         0.50      0.71      0.831    0.000                        ¦
¦         0.50      0.71      0.831    0.000                        ¦
¦                                                                   ¦
¦                             Avg:   Avg:                           ¦
¦                             0.830    0.000 Acceptable             ¦
¦                                             (Must be <.01)        ¦
¦  Std. Dev. of Avg. Dev.:        0 Acceptable                      ¦
                                   (Must be <.02)
 -------------------------------------------------------------------


        ¦ B side Calibration  ¦
 -------------------------------------------------------------------
¦   del P (std)  del P (s)   Cp (s)   Dev.                          ¦
¦                                                                   ¦
¦         0.51      0.74      0.821    0.004                        ¦
¦         0.51      0.75      0.816    0.002                        ¦
¦         0.51      0.75      0.816    0.002                        ¦
¦                                                                   ¦
¦                             Avg:   Avg:                           ¦
¦                             0.818    0.002 Acceptable             ¦
¦                                             (Must be <.01)        ¦
¦  Std. Dev. of Avg. Dev.:    0.001 Acceptable                      ¦
                                   (Must be <.02)                   ¦
 -------------------------------------------------------------------

*****************************************************
*                                                   *
*        Results:                                   *
*                                                   *
*                 Cp A:     0.831                   *
*                 Cp B:     0.818                   *
*          Cp A - Cp B:     0.012 (Must be <.01)    *
*              Avg. Cp:     Use Cp A or Cp B        *
*                                                   *
*****************************************************
```

APPENDIX C
PROCESS DATA

DATE: Sept 28, 1990

MODESTO IRRIGATION DISTRICT
McCLURE GENERATING STATION
GAS TURBINE No. 2

EPA Test Run on Dist. Fuel

OPERATING DATA LOG

DATA IS TO BE RECORDED AT ANY LOAD SUSTAINED OVER 30 MINUTES..
IF MACHINE IS AT FULL LOAD, RECORD DATA ONCE PER HOUR.

START-UP DATA

START TIME: 0754
EMERGENCY STOPS: 50
START-UP TIME: 9
FIRED TIME (HRS): 3195.5

LUBE TANK LEVEL: Full
COOLING WATER TANK LEVEL: Full
NATURAL GAS SHUT-OFF VALVE: closed
FUEL SELECTED: Dist.
GAS PRESSURE: N/A

SHUT-DOWN DATA

EMERGENCY STOPS: 50
FIRED TIME (HRS): 3207.8
RUN TIME (HRS): 12.3
MANUAL INITIATED START COUNTER: 570
FAST LOAD START COUNTER: 4
TOTAL START COUNTER: 584
GENERATOR BREAKER COUNTER: 652
FUEL FLOW METER: RESETTABLE: 60045
FUEL TANK IN USE (No.): 2
LUBE PUMP / TURNING GEAR ON: ✓
GAS SHUT-OFF VALVE CLOSED: ✓

PG&E NATURAL GAS METER:
START: N STOP: A cf
DIFF: x 1,000 = cf
DANIEL'S FLOW COMPUTER TOTALIZED:
START: N STOP: A lbs
DIFF: x 228 = cf
PG&E vs. DANIEL'S FLOW IN % ERROR
TOTALIZED: 9104914
LEVEL: 17' 10"
LUBE TANK LEVEL: Full
FUEL OIL SELECTED: ✓

☒ - READINGS TAKEN

☐ - NO READINGS TAKEN

MEMORY LOCATION	TIME	1010	1130	1305	1425
	LOAD	56	55.84	55	54.8
	FUEL	DIST	DIST	DIST	DIST
01	HP TURBINE SPEED %	100	100	100	100
02	VCE	12.99	12.96	12.82	12.82
0B	MAX. ALLOWABLE SPREAD	94	94	94	94
0C	SPREAD 1	52	50	49	48
0D	SPREAD 2	43	44	37	38
0E	LCE	13.00	12.98	12.81	12.83
0F	GCE	.28	.28	.27	.27
10	DIST. FUEL FLOW (gpm)	87.1	86.7	85.4	85.3
64	GAS FUEL FLOW #/sec.	.01	.01	.01	.01
12	WATER FLOW	50.28	50.20	44.47	44.47
17	INLET AIR (F)	61	62	64	65
33	AMBIENT AIR (F) / HUMIDITY	70/	71/57.4	77/	79/
	EVAPORATIVE COOLER	ON	ON	ON	ON

PRESSURES (PSIG)

03	COMPRESSOR DISCHARGE (PCD)	119.7	119.3	118.4	117.8
11	SRV INTERVOLUME PRESSURE (VOLTS)	2.44	2.43	2.42	2.40
DANIELS COMPUTER	1. RATE	N/A	N/A	N/A	N/A
	2. PRESSURE				
	3. TEMPERATURE				
	4. Δp H1 OR H2				
	5. P/T				
	GAS PRESSURE TRENCH				
	GAS PRESSURE MANIFOLD				
	GAS PRESS. CNTRL VALVE OUTLET				
	GAS PRESSURE INTERVOLUME	N/A	N/A	N/A	N/A
R4 66	H_2O offset ~~PG&E GAS FLOW CU. FT./MIN.~~	2.02	2.03	2.03	2.03
	H_2O Temp. ~~PG&E GAS FLOW #/HOUR (est.)~~	72°	73°	74°	73

PRESSURES (PSIG)

FUEL OIL AFTER MAIN FILTER	68	67	67	68
FUEL OIL FILTER DIFFERENTIAL	0	0	0	0
LUBRICANT - MAIN PUMP DISCHARGE	104	104	104	104
LUBRICANT - BEARING HEADER	26	26	26	26
ATOMIZING AIR MANIFOLD	188	188	186	185
COOLING & SEALING AIR DISCHARGE	122	122	121	121
COOLING WATER HEADER	82	83	84	86
TRIP OIL	1380	1380	1380	1380
HYDRAULIC FILTER DIFFERENTIAL	0	0	0	0
LUBE FILTER DIFFERENTIAL	2	2	2	2
FUEL NOZZLE - No. 1	400	400	395	395
FUEL NOZZLE - No. 2	385	380	375	375
FUEL NOZZLE - No. 3	415	415	410	410
FUEL NOZZLE - No. 4	415	410	410	405
FUEL NOZZLE - No. 5	395	395	385	380
FUEL NOZZLE - No. 6	415	415	410	405
FUEL NOZZLE - No. 7	400	400	390	385
FUEL NOZZLE - No. 8	425	425	420	415
FUEL NOZZLE - No. 9	395	395	390	385
FUEL NOZZLE - No. 10	420	420	415	410
HP FUEL FILTER - OUT	445	445	440	435
HP FUEL FILTER - DIFFERENTIAL	0	0	0	0

TEMPERATURES (F)

07	TURBINE EXHAUST M.I.D. VALUE	929	932	932	936
1A	COMPRESSOR DISCHARGE No.1 (TCD-1)	562	563	564	565
1B	COMPRESSOR DISCHARGE No.2 (TCD-2)	568	569	569	570
21	TURBINE EXHAUST - No.1 (TTX-1)	942	940	943	943
22	TURBINE EXHAUST - No.2 (TTX-2)	901	901	904	903
23	TURBINE EXHAUST - No.3 (TTX-3)	912	912	913	914
24	TURBINE EXHAUST - No.4 (TTX-4)	912	913	918	918
25	TURBINE EXHAUST - No.5 (TTX-5)	929	931	935	937
26	TURBINE EXHAUST - No.6 (TTX-6)	924	925	930	932
27	TURBINE EXHAUST - No.7 (TTX-7)	928	927	928	929
28	TURBINE EXHAUST - No.8 (TTX-8)	947	947	950	951
29	TURBINE EXHAUST - No.9 (TTX-9)	953	952	953	956
2A	TURBINE EXHAUST - No.10 (TTX-10)	943	940	942	945
2B	TURBINE EXHAUST - No.11 (TTX-11)	932	931	933	935
2C	TURBINE EXHAUST - No.12 (TTX-12)	935	937	940	942
2D	TURBINE EXHAUST - No.13 (TTX-13)	923	927	929	930
34	1ST.-STAGE FORWARD WHEELSPACE (1F01)	832	839	843	844
35	1ST.-STAGE FORWARD WHEELSPACE (1F02)	833	841	848	848
36	1ST.-STAGE AFT WHEELSPACE (1A01)	791	793	796	796
37	1ST.-STAGE AFT WHEELSPACE (1A02)	810	811	813	814
38	2ND.-STAGE FORWARD WHEELSPACE (2F01)	767	768	772	772
39	2ND.-STAGE FORWARD WHEELSPACE (2F02)	779	781	782	784
3A	2ND.-STAGE AFT WHEELSPACE (2A01)	633	638	640	641
3B	2ND.-STAGE AFT WHEELSPACE (2A02)	632	636	639	639
3C	3RD.-STAGE FORWARD WHEELSPACE (3F01)	672	675	572	678
3D	3RD.-STAGE FORWARD WHEELSPACE (3F02)	681	685	688	687
3E	3RD.-STAGE AFT WHEELSPACE (3A01)	490	499	505	503
3F	3RD.-STAGE AFT WHEELSPACE (3A02)	489	496	501	500
	LUBE BEARING HEADER	121	123	126	128
	LUBE TANK	145	147	150	152
	FUEL FORWARDING	[illegible]	[illegible]	[illegible]	[illegible]

VIBRATION DATA

CHANNEL No. 1 - TURBINE No. 1 BEARING:	.18	.19	.19	.20
CHANNEL No. 2 - TURBINE No. 2 BEARING:	.13	.13	.11	.13
CHANNEL No. 3 - No. 1 GENERATOR BEARING:	.28	.33	.34	.32
CHANNEL No. 4 - No. 2 GENERATOR BEARING:	.16	.16	.17	.16

GENERATOR

OUTPUT VOLTAGE KV 1-2:		14.3	14.15	14.1	14.2
OUTPUT VOLTAGE KV 2-3:		14.35	14.2	14.15	14.3
OUTPUT VOLTAGE KV 3-1:		14.3	14.15	14.1	14.25
PHASE CURRENT KA 1:		2.22	2.21	2.20	2.19
PHASE CURRENT KA 2:		2.27	2.25	2.23	2.22
PHASE CURRENT KA 3:		2.21	2.20	2.19	2.18
M - VARS:		0	0	0	0
INCOMING VOLTAGE KV:		14.45	14.50	14.45	14.45
FIELD CURRENT:		300	303	300	300
FIELD VOLTS:		155	155	158	155
STATOR TEMPERATURE (C)	1 - TEST:	70	70	70	70
	2 - ACTUAL:	81	85	89	90
	3 - ACTUAL:	79	82	86	87
	4 - ACTUAL:	74	77	82	82
	5 - ACTUAL:	79	82	86	87
	6 - ACTUAL:	74	77	81	82
	7 - ACTUAL:	34	36	40	40
	8 - ACTUAL:	32	34	37	39

MEMORY LOCATION	TIME	1600	1730	1915	
	LOAD	54.9	54.92	54.7	
	FUEL	DIST	DIST	DIST	
01	HP TURBINE SPEED %	100	100	100	
02	VCE	12.86	12.78	12.76	
0B	MAX. ALLOWABLE SPREAD	95	94	94	
0C	SPREAD 1	49	49	44	
0D	SPREAD 2	37	37	33	
0E	LCE	12.82	12.78	12.75	
0F	GCE	.27	.27	.27	
10	DIST. FUEL FLOW (gpm)	85.6	84.9	85.0	
64	GAS FUEL FLOW #/sec.	.01	.01	.01	
12	WATER FLOW	44.39	44.43	44.56	
17	INLET AIR (F)	66	67	65	
33	AMBIENT AIR (F) / HUMIDITY	84/	85/	77/53	/
	EVAPORATIVE COOLER	ON	ON	ON	
	PRESSURES (PSIG)				
03	COMPRESSOR DISCHARGE (PCD)	117.0	116.8	117.6	
11	SRV INTERVOLUME PRESSURE (VOLTS)	2.39	2.39	2.40	
DANIELS COMPUTER	1. RATE	N/A	N/A	N/A	
	2. PRESSURE				
	3. TEMPERATURE				
	4. Δp H1 OR H2				
	5. P/T				
	GAS PRESSURE TRENCH				
	GAS PRESSURE MANIFOLD				
	GAS PRESS. CNTRL VALVE OUTLET				
	GAS PRESSURE INTERVOLUME	N/A	N/A	N/A	
#66	H_2O OFFSET ~~PG&E GAS FLOW CU. FT./MIN~~	2.03	2.03	2.03	
	H2O Temp ~~PG&E GAS FLOW $/HOUR (cal.)~~	74	74	73	

PRESSURES (PSIG)

FUEL OIL AFTER MAIN FILTER	68	68	68	
FUEL OIL FILTER DIFFERENTIAL	0	0	0	
LUBRICANT - MAIN PUMP DISCHARGE	104	104	104	
LUBRICANT - BEARING HEADER	26	26	26	
ATOMIZING AIR MANIFOLD	185	184	185	
COOLING & SEALING AIR DISCHARGE	120	120	120	
COOLING WATER HEADER	87	87	85	
TRIP OIL	1375	1375	1380	
HYDRAULIC FILTER DIFFERENTIAL	0	0	0	
LUBE FILTER DIFFERENTIAL	2	2	2	
FUEL NOZZLE - No. 1	390	390	390	
FUEL NOZZLE - No. 2	370	375	375	
FUEL NOZZLE - No. 3	405	410	410	
FUEL NOZZLE - No. 4	405	405	405	
FUEL NOZZLE - No. 5	380	380	380	
FUEL NOZZLE - No. 6	405	410	410	
FUEL NOZZLE - No. 7	385	390	390	
FUEL NOZZLE - No. 8	415	415	415	
FUEL NOZZLE - No. 9	380	385	380	
FUEL NOZZLE - No. 10	405	410	410	
HP FUEL FILTER - OUT	435	440	440	
HP FUEL FILTER - DIFFERENTIAL	0	0	0	

TEMPERATURES (F)

07	TURBINE EXHAUST M.I.D. VALUE	940	939	931	
1A	COMPRESSOR DISCHARGE No.1 (TCD-1)	566	566	565	
1B	COMPRESSOR DISCHARGE No.2 (TCD-2)	572	572	570	
21	TURBINE EXHAUST - No.1 (TTX-1)	947	949	942	
22	TURBINE EXHAUST - No.2 (TTX-2)	909	908	905	
23	TURBINE EXHAUST - No.3 (TTX-3)	917	921	916	
24	TURBINE EXHAUST - No.4 (TTX-4)	923	923	919	
25	TURBINE EXHAUST - No.5 (TTX-5)	942	939	933	
26	TURBINE EXHAUST - No.6 (TTX-6)	937	936	930	
27	TURBINE EXHAUST - No.7 (TTX-7)	937	934	924	
28	TURBINE EXHAUST - No.8 (TTX-8)	958	952	948	
29	TURBINE EXHAUST - No.9 (TTX-9)	959	954	953	
2A	TURBINE EXHAUST - No.10 (TTX-10)	951	946	942	
2B	TURBINE EXHAUST - No.11 (TTX-11)	940	937	931	
2C	TURBINE EXHAUST - No.12 (TTX-12)	948	944	941	
2D	TURBINE EXHAUST - No.13 (TTX-13)	938	935	928	
34	1ST.-STAGE FORWARD WHEELSPACE (1F01)	847	850	850	
35	1ST.-STAGE FORWARD WHEELSPACE (1F02)	853	854	856	
36	1ST.-STAGE AFT WHEELSPACE (1A01)	799	799	795	
37	1ST.-STAGE AFT WHEELSPACE (1A02)	817	816	813	
38	2ND.-STAGE FORWARD WHEELSPACE (2F01)	775	774	770	
39	2ND.-STAGE FORWARD WHEELSPACE (2F02)	787	787	783	
3A	2ND.-STAGE AFT WHEELSPACE (2A01)	643	643	641	
3B	2ND.-STAGE AFT WHEELSPACE (2A02)	641	641	639	
3C	3RD.-STAGE FORWARD WHEELSPACE (3F01)	515	586	558	
3D	3RD.-STAGE FORWARD WHEELSPACE (3F02)	689	690	687	
3E	3RD.-STAGE AFT WHEELSPACE (3A01)	505	506	503	
3F	3RD.-STAGE AFT WHEELSPACE (3A02)	501	503	501	
	LUBE BEARING HEADER	131	132	125	
	LUBE TANK	155	156	150	
	FUEL FORWARDING	77	77	77	

VIBRATION DATA

CHANNEL No. 1 - TURBINE No. 1 BEARING:	.21	.21	.21	
CHANNEL No. 2 - TURBINE No. 2 BEARING:	.14	.17	.12	
CHANNEL No. 3 - No. 1 GENERATOR BEARING:	.33	.33	.35	
CHANNEL No. 4 - No. 2 GENERATOR BEARING:	.15	.15	.14	

GENERATOR

OUTPUT VOLTAGE KV 1-2:		14.2	14.25	14.25	
OUTPUT VOLTAGE KV 2-3:		14.3	14.3	14.3	
OUTPUT VOLTAGE KV 3-1:		14.25	14.25	14.25	
PHASE CURRENT KA 1:		2.19	2.17	2.18	
PHASE CURRENT KA 2:		2.22	2.21	2.22	
PHASE CURRENT KA 3:		2.17	2.15	2.16	
M - VARS:		0	0	0	
INCOMING VOLTAGE KV:		14.45	14.5	14.5	
FIELD CURRENT:		300	300	303	
FIELD VOLTS:		160	160	160	
STATOR TEMPERATURE (C)	1 - TEST:	70	70	70	
	2 - ACTUAL:	91	92	91	
	3 - ACTUAL:	89	89	88	
	4 - ACTUAL:	84	85	83	
	5 - ACTUAL:	89	90	88	
	6 - ACTUAL:	84	85	83	
	7 - ACTUAL:	43	44	41	
	8 - ACTUAL:	40	41	39	

McCLURE REVENUE AND FUEL INFORMATION SHEET

DATE: Sept 28, 1990

#1 GEN KWH (#857)	N/A	#2 GEN KWH (#917)	99878.9
#1 AUX (#876) START	03626.8	#2 AUX (#093) START	3410.0
STOP	03627.0	STOP	3412.3
#1 PRIMARY (#661)	N/A	#2 PRIMARY (#663)	1759.5
#1 BACK-UP (#878)		#2 BACK-UP (#646)	1424.7
#1 KVARH (#662)		#2 KVARH (#194)	0073.3

#1 GENERATOR DEMAND				#2 GENERATOR DEMAND			
MACHINE	N/A	TIME		MACHINE	1.0	TIME	1200
SYSTEM		TIME		SYSTEM	.96	TIME	1630

STATION SERVICE METER (#689) START 0571.2 STOP 0571.9

REMARKS:

DATE: Sept 27, 1990

MODESTO IRRIGATION DISTRICT
McCLURE GENERATING STATION
GAS TURBINE No. 2

EPA TEST RUN ON DIST. FUEL

OPERATING DATA LOG

DATA IS TO BE RECORDED AT ANY LOAD SUSTAINED OVER 30 MINUTES..
IF MACHINE IS AT FULL LOAD, RECORD DATA ONCE PER HOUR.

START-UP DATA

START TIME: 0805
EMERGENCY STOPS: 50
START-UP TIME: 10 MIN
FIRED TIME (HRS): 3184.7

LUBE TANK LEVEL: Full
COOLING WATER TANK LEVEL: Full
NATURAL GAS SHUT-OFF VALVE: Closed
FUEL SELECTED: Dist
GAS PRESSURE: N/A

SHUT-DOWN DATA

EMERGENCY STOPS: 50
FIRED TIME (HRS): 3195.4
RUN TIME (HRS): 10.7
MANUAL INITIATED START COUNTER: 569
FAST LOAD START COUNTER: 4
TOTAL START COUNTER: 583
GENERATOR BREAKER COUNTER:
FUEL FLOW METER: RESETTABLE: 519417
FUEL TANK IN USE (No.): 2
LUBE PUMP / TURNING GEAR ON: ✓
GAS SHUT-OFF VALVE CLOSED: ✓

PG&E NATURAL GAS METER:
START: N/A STOP: N/A cf
DIFF: ______ x 1,000 = ______ cf
DANIEL'S FLOW COMPUTER TOTALIZED:
START: ______ STOP: ______ lbs
DIFF: ______ x 228 = ______ cf
PG&E vs. DANIEL'S FLOW IN % ERROR ______
TOTALIZED: 09044869
LEVEL: 20'8"
LUBE TANK LEVEL: ✓
FUEL OIL SELECTED: ✓

☒ - READINGS TAKEN ☐ - NO READINGS TAKEN

EPA TEST DATA on DIST

74.51

MEMORY LOCATION	TIME	56mw 0830	1010	1140	1300	1930
	LOAD	Temp Control at 1300	56	56	55.63	53.09
	FUEL	manual H20 at 1400 44.1 GPM ADS to 40	DIST	DIST	DIST	DIST
01	HP TURBINE SPEED %	at 1440	100	100	100	100
02	VCE		12.98	13.00	12.95	12.86
0B	MAX. ALLOWABLE SPREAD		95	96	97	97
0C	SPREAD 1		58	59	53	52
0D	SPREAD 2		47	47	48	41
0E	LCE		12.99	13.01	12.94	12.82
0F	GCE		.27	.28	0	.27
10	DIST. FUEL FLOW (gpm)		87.5	86.7	86.7	85.5
64	GAS FUEL FLOW #/sec.		.01	.01	0	0
12	WATER FLOW		51.31	50.24	50.11	43.96
17	INLET AIR (F)		68	71	76	78
33	AMBIENT AIR (F) / HUMIDITY		70/76	75/62	78/57	81/48.7
	EVAPORATIVE COOLER		OFF	OFF	OFF	OFF
	PRESSURES (PSIG)					
03	COMPRESSOR DISCHARGE (PCD)		118.6	118.0	117.2	115.8
11	SRV INTERVOLUME PRESSURE (VOLTS)		2.42	2.40	2.38	2.36
DANIELS COMPUTER	1. RATE				N/A	N/A
	2. PRESSURE					
	3. TEMPERATURE					
	4. Δp H1 OR H2					
	5. P/T					
	GAS PRESSURE TRENCH					
	GAS PRESSURE MANIFOLD					
	GAS PRESS. CNTRL VALVE OUTLET					
	GAS PRESSURE INTERVOLUME					
66	H20 OFF-SET ~~[illegible]~~				2.03	2.02
	H2O TEMP. ~~[illegible]~~)				76	76

PRESSURES (PSIG)

FUEL OIL AFTER MAIN FILTER	69	69	68	68
FUEL OIL FILTER DIFFERENTIAL	0	0	0	0
LUBRICANT - MAIN PUMP DISCHARGE	104	104	104	104
LUBRICANT - BEARING HEADER	26.5	26.0	26	26
ATOMIZING AIR MANIFOLD	187	186	184	184
COOLING & SEALING AIR DISCHARGE	121	121	120	119
COOLING WATER HEADER	82	83	85	86
TRIP OIL	1380	1375	1380	1380
HYDRAULIC FILTER DIFFERENTIAL	0	0	0	0
LUBE FILTER DIFFERENTIAL	3.0	3.0	2	2
FUEL NOZZLE - No. 1	400	400	400	400
FUEL NOZZLE - No. 2	388	390	390	380
FUEL NOZZLE - No. 3	420	420	420	410
FUEL NOZZLE - No. 4	415	415	415	410
FUEL NOZZLE - No. 5	400	400	400	390
FUEL NOZZLE - No. 6	420	415	420	410
FUEL NOZZLE - No. 7	400	400	400	395
FUEL NOZZLE - No. 8	430	430	430	425
FUEL NOZZLE - No. 9	400	400	400	390
FUEL NOZZLE - No. 10	420	420	420	410
HP FUEL FILTER - OUT	440	440	445	435
HP FUEL FILTER - DIFFERENTIAL	0	0	0	0

TEMPERATURES (F)

07	TURBINE EXHAUST M.I.D. VALUE	947	955	969	971
1A	COMPRESSOR DISCHARGE No.1 (TCD-1)	573	576	583	584
1B	COMPRESSOR DISCHARGE No.2 (TCD-2)	580	583	590	592
21	TURBINE EXHAUST - No.1 (TTX-1)	957	964	978	979
22	TURBINE EXHAUST - No.2 (TTX-2)	918	925	941	939
23	TURBINE EXHAUST - No.3 (TTX-3)	927	935	946	950
24	TURBINE EXHAUST - No.4 (TTX-4)	929	936	951	952
25	TURBINE EXHAUST - No.5 (TTX-5)	946	956	968	971
26	TURBINE EXHAUST - No.6 (TTX-6)	942	952	965	967
27	TURBINE EXHAUST - No.7 (TTX-7)	946	955	964	963
28	TURBINE EXHAUST - No.8 (TTX-8)	966	977	987	987
29	TURBINE EXHAUST - No.9 (TTX-9)	973	984	993	991
2A	TURBINE EXHAUST - No.10 (TTX-10)	961	969	984	981
2B	TURBINE EXHAUST - No.11 (TTX-11)	953	963	975	974
2C	TURBINE EXHAUST - No.12 (TTX-12)	953	960	975	976
2D	TURBINE EXHAUST - No.13 (TTX-13)	942	951	965	967
34	1ST.-STAGE FORWARD WHEELSPACE (1F01)	835	846	856	860
35	1ST.-STAGE FORWARD WHEELSPACE (1F02)	835	847	859	863
36	1ST.-STAGE AFT WHEELSPACE (1A01)	806	813	822	824
37	1ST.-STAGE AFT WHEELSPACE (1A02)	825	831	840	841
38	2ND.-STAGE FORWARD WHEELSPACE (2F01)	780	787	795	796
39	2ND.-STAGE FORWARD WHEELSPACE (2F02)	792	798	805	807
3A	2ND.-STAGE AFT WHEELSPACE (2A01)	644	651	659	662
3B	2ND.-STAGE AFT WHEELSPACE (2A02)	642	649	658	659
3C	3RD.-STAGE FORWARD WHEELSPACE (3F01)	*492	682	699	562
3D	3RD.-STAGE FORWARD WHEELSPACE (3F02)	692	702	712	714
3E	3RD.-STAGE AFT WHEELSPACE (3A01)	492	506	515	518
3F	3RD.-STAGE AFT WHEELSPACE (3A02)	491	504	512	514
	LUBE BEARING HEADER	121	125	128	129
	LUBE TANK	145	149	152	153
	FUEL FORWARDING	73	75	76	76

BAD T.C.?

VIBRATION DATA

CHANNEL No. 1 - TURBINE No. 1 BEARING:	.17	.18	.18	.19
CHANNEL No. 2 - TURBINE No. 2 BEARING:	.14	.15	.15	.14
CHANNEL No. 3 - No. 1 GENERATOR BEARING:	.28	.28	.29	.29
CHANNEL No. 4 - No. 2 GENERATOR BEARING:	.17	.17	.18	.17

GENERATOR

OUTPUT VOLTAGE KV 1-2:	14.3	14.3	14.1	14.2
OUTPUT VOLTAGE KV 2-3:	14.35	14.35	14.2	14.25
OUTPUT VOLTAGE KV 3-1:	14.3	14.3	14.1	14.2
PHASE CURRENT KA 1:	2.21	2.20	2.19	2.15
PHASE CURRENT KA 2:	2.22	2.23	2.22	2.19
PHASE CURRENT KA 3:	2.20	2.20	2.17	2.13
M - VARS:	1	0	0	0
INCOMING VOLTAGE KV:	14.6	14.6	14.6	14.6
FIELD CURRENT:	310	305	305	305
FIELD VOLTS:	155	155	157	158
STATOR TEMPERATURE (C) 1 - TEST:	70	70	70	70
2 - ACTUAL:	80	84	89	89
3 - ACTUAL:	77	80	84	86
4 - ACTUAL:	74	77	80	82
5 - ACTUAL:	78	81	85	87
6 - ACTUAL:	74	77	80	82
7 - ACTUAL;	33	35	39	40
8 - ACTUAL:	30	33	36	38

MEMORY LOCATION					
	TIME	1537	1700		
	LOAD	53.73	53.68		
	FUEL	DIST	DIST		
01	HP TURBINE SPEED %	100	100		
02	VCE	12.73	12.72		
0B	MAX. ALLOWABLE SPREAD	97	97		
0C	SPREAD 1	49	54		
0D	SPREAD 2	39	42		
0E	LCE	12.01	12.69		
0F	GCE	.27	—	—	—
10	DIST. FUEL FLOW (gpm)	84.1	84.0		
64	GAS FUEL FLOW #/sec.	.01	—		
12	WATER FLOW	38.32	38.28		
17	INLET AIR (F)	79	80		
33	AMBIENT AIR (F) / HUMIDITY	84/46	86/42	/	/
	EVAPORATIVE COOLER	OFF	OFF		

----------------------------- P R E S S U R E S (P S I G) -----------------------

03	COMPRESSOR DISCHARGE (PCD)	115.6	115.2		
11	SRV INTERVOLUME PRESSURE (VOLTS)	2.35	2.35		
DANIELS COMPUTER	1. RATE	N/A	N/A		
	2. PRESSURE				
	3. TEMPERATURE				
	4. ΔP H1 OR H2				
	5. P/T				
	GAS PRESSURE TRENCH				
	GAS PRESSURE MANIFOLD				
	GAS PRESS. CNTRL VALVE OUTLET				
	GAS PRESSURE INTERVOLUME	N/A			
	H_2O OFF-SET ~~POST GAS FLOW CU. FT./MIN.~~	2.03	2.03		
	H_2O TEMP ~~POST GAS FLOW #/HOUR (cal.)~~	76	76		

PRESSURES (PSIG)

FUEL OIL AFTER MAIN FILTER	68	68		
FUEL OIL FILTER DIFFERENTIAL	0	0		
LUBRICANT - MAIN PUMP DISCHARGE	104	104		
LUBRICANT - BEARING HEADER	26	26		
ATOMIZING AIR MANIFOLD	182	182		
COOLING & SEALING AIR DISCHARGE	118	118		
COOLING WATER HEADER	87	87		
TRIP OIL	1370	1380		
HYDRAULIC FILTER DIFFERENTIAL	0	0		
LUBE FILTER DIFFERENTIAL	2	2		
FUEL NOZZLE - No. 1	390	390		
FUEL NOZZLE - No. 2	368	370		
FUEL NOZZLE - No. 3	402	405		
FUEL NOZZLE - No. 4	400	400		
FUEL NOZZLE - No. 5	380	370		
FUEL NOZZLE - No. 6	405	405		
FUEL NOZZLE - No. 7	385	390		
FUEL NOZZLE - No. 8	415	420		
FUEL NOZZLE - No. 9	380	375		
FUEL NOZZLE - No. 10	405	405		
HP FUEL FILTER - OUT	430	430		
HP FUEL FILTER - DIFFERENTIAL	0	0		

TEMPERATURES (F)

07	TURBINE EXHAUST M.I.D. VALUE	972	972		
1A	COMPRESSOR DISCHARGE No.1 (TCD-1)	585	586		
1B	COMPRESSOR DISCHARGE No.2 (TCD-2)	593	595		
21	TURBINE EXHAUST - No.1 (TTX-1)	981	978		
22	TURBINE EXHAUST - No.2 (TTX-2)	940	939		
23	TURBINE EXHAUST - No.3 (TTX-3)	951	950		
24	TURBINE EXHAUST - No.4 (TTX-4)	956	956		
25	TURBINE EXHAUST - No.5 (TTX-5)	975	972		
26	TURBINE EXHAUST - No.6 (TTX-6)	972	973		
27	TURBINE EXHAUST - No.7 (TTX-7)	966	966		
28	TURBINE EXHAUST - No.8 (TTX-8)	990	990		
29	TURBINE EXHAUST - No.9 (TTX-9)	990	992		
2A	TURBINE EXHAUST - No.10 (TTX-10)	979	982		
2B	TURBINE EXHAUST - No.11 (TTX-11)	971	972		
2C	TURBINE EXHAUST - No.12 (TTX-12)	979	979		
2D	TURBINE EXHAUST - No.13 (TTX-13)	970	969		
34	1ST.-STAGE FORWARD WHEELSPACE (1F01)	861	864		
35	1ST.-STAGE FORWARD WHEELSPACE (1F02)	864	868		
36	1ST.-STAGE AFT WHEELSPACE (1A01)	826	827		
37	1ST.-STAGE AFT WHEELSPACE (1A02)	842	843		
38	2ND.-STAGE FORWARD WHEELSPACE (2F01)	799	800		
39	2ND.-STAGE FORWARD WHEELSPACE (2F02)	809	811		
3A	2ND.-STAGE AFT WHEELSPACE (2A01)	662	664		
3B	2ND.-STAGE AFT WHEELSPACE (2A02)	662	663		
3C	3RD.-STAGE FORWARD WHEELSPACE (3F01)	578	553		
3D	3RD.-STAGE FORWARD WHEELSPACE (3F02)	716	717		
3E	3RD.-STAGE AFT WHEELSPACE (3A01)	520	520		
3F	3RD.-STAGE AFT WHEELSPACE (3A02)	515	516		
	LUBE BEARING HEADER	132	132		
	LUBE TANK	155	156		
	FUEL FORWARDING	[illegible]	[illegible]		

VIBRATION DATA

CHANNEL No. 1 - TURBINE No. 1 BEARING:	.19	.19		
CHANNEL No. 2 - TURBINE No. 2 BEARING:	.14	.15		
CHANNEL No. 3 - No. 1 GENERATOR BEARING:	.29	.29		
CHANNEL No. 4 - No. 2 GENERATOR BEARING:	.16	.17		

GENERATOR

OUTPUT VOLTAGE KV 1-2:	14.2	14.25		
OUTPUT VOLTAGE KV 2-3:	14.25	14.3		
OUTPUT VOLTAGE KV 3-1:	14.2	14.25		
PHASE CURRENT KA 1:	2.12	2.1		
PHASE CURRENT KA 2:	2.18	2.17		
PHASE CURRENT KA 3:	2.10	2.1		
M - VARS:	0	0		
INCOMING VOLTAGE KV:	14.55	14.6		
FIELD CURRENT:	300	300		
FIELD VOLTS:	155	156		
STATOR TEMPERATURE (C) 1 - TEST:	70	70		
2 - ACTUAL:	89	90		
3 - ACTUAL:	87	88		
4 - ACTUAL:	82	83		
5 - ACTUAL:	88	88		
6 - ACTUAL:	82	83		
7 - ACTUAL;	41	42		
8 - ACTUAL:	39	46		

DATE: Sept 26, 1990

MODESTO IRRIGATION DISTRICT
McCLURE GENERATING STATION
GAS TURBINE No. 2

EPA TEST RUN ON GAS

OPERATING DATA LOG

DATA IS TO BE RECORDED AT ANY LOAD SUSTAINED OVER 30 MINUTES..
IF MACHINE IS AT FULL LOAD, RECORD DATA ONCE PER HOUR.

START-UP DATA

START TIME: 812
EMERGENCY STOPS: 50
START-UP TIME: 10
FIRED TIME (HRS): 3175.9

LUBE TANK LEVEL: Full
COOLING WATER TANK LEVEL: Full
NATURAL GAS SHUT-OFF VALVE: OPEN
FUEL SELECTED: GAS
GAS PRESSURE: 259

SHUT-DOWN DATA

EMERGENCY STOPS: 50
FIRED TIME (HRS): 3184.8
RUN TIME (HRS): 8.9
MANUAL INITIATED START COUNTER: 568
FAST LOAD START COUNTER: 4
TOTAL START COUNTER: 582
GENERATOR BREAKER COUNTER: 650
FUEL FLOW METER: RESETTABLE: N/A
FUEL TANK IN USE (No.): N/A
LUBE PUMP / TURNING GEAR ON: ✓
GAS SHUT-OFF VALVE CLOSED: ✓

PG&E NATURAL GAS METER:
START: 208942 STOP: 214443 cf
DIFF: 5501 x 1,000 = 5,501,000 cf
DANIEL'S FLOW COMPUTER TOTALIZED:
START: 115168 STOP: 175068 lbs
DIFF: 23,900 x 228 = 5,449,200 cf
PG&E vs. DANIEL'S FLOW IN % ERROR .05%
TOTALIZED: N/A
LEVEL: N/A
LUBE TANK LEVEL: Full
FUEL OIL SELECTED: ✓

☒ - READINGS TAKEN ☐ - NO READINGS TAKEN

9-26-90 [illegible]
ON GAS

MEMORY LOCATION	* TIME	9:35 -50 mw	1000	1100	1200	1300
	* LOAD	49.8 mw's MEASURED	49.8	49.9	50.1	50.15
	* FUEL		GAS	GAS	GAS	GAS
* 01	HP TURBINE SPEED %		100	100	100	100
* 02	VCE		12.23	12.24	12.29	12.29
0B	MAX. ALLOWABLE SPREAD		89	89	90	91
0C	SPREAD 1		47	47	46	50
0D	SPREAD 2		31	31	32	36
0E	LCE		.04	.04	.04	0
0F	GCE		12.24	12.23	12.29	12.29
* 10	DIST. FUEL FLOW (gpm)		.4	.4	.4	0
* 64	GAS FUEL FLOW #/sec.		7.83	7.81	7.86	7.87
* 12	WATER FLOW		15.25	15.21	15.25	15.21
* 17	INLET AIR (F)		66	69	72	75
* 33	AMBIENT AIR (F) / HUMIDITY		71/87.1	75/74	74/66	79/60
	EVAPORATIVE COOLER		OFF	OFF	OFF	OFF

========================= PRESSURES (PSIG) =========================

03	COMPRESSOR DISCHARGE (PCD)		115.6	115.8	114.8	114.1
11	SRV INTERVOLUME PRESSURE (VOLTS)		3.77	3.77	3.77	3.77
DANIELS COMPUTER	1. RATE		2768	2759	2780	2776
	2. PRESSURE		69.4	69.7	69.5	70.0
	3. TEMPERATURE		77.7	78.1	78.3	78.4
	4. Δp H1 OR [✓ H2]		70.2	69.9	70.8	70.4
	5. P/T		58.9	59.1	59.0	59.5
	GAS PRESSURE TRENCH		218	218	217	219
	GAS PRESSURE MANIFOLD		211	212	211	213
	GAS PRESS. CNTRL VALVE OUTLET		146	146	146	146
	GAS PRESSURE INTERVOLUME		187	187	187	187
66	H2O OFF-Sct ~~PURGE GAS FLOW CU. FT./MIN.~~		2.03	2.03	2.03	2.03
	H2O TEMP. W.I.S. ~~[illegible] GAS FLOW #/HOUR (calc)~~		74°	74°	74	75

PRESSURES (PSIG)

FUEL OIL AFTER MAIN FILTER	N/A	N/A	N/A	N/A
FUEL OIL FILTER DIFFERENTIAL	N/A	N/A	N/A	
LUBRICANT - MAIN PUMP DISCHARGE	104	104	104	104
LUBRICANT - BEARING HEADER	26	26	26	26
ATOMIZING AIR MANIFOLD	153	152	152	151
COOLING & SEALING AIR DISCHARGE	118	117	117	117
COOLING WATER HEADER	81	81	83	83
TRIP OIL	1420	1420	1420	1420
HYDRAULIC FILTER DIFFERENTIAL	0	0	0	0
LUBE FILTER DIFFERENTIAL	2	2	2	2
FUEL NOZZLE - No. 1	N/A	N/A	N/A	N/A
FUEL NOZZLE - No. 2				
FUEL NOZZLE - No. 3				
FUEL NOZZLE - No. 4				
FUEL NOZZLE - No. 5				
FUEL NOZZLE - No. 6				
FUEL NOZZLE - No. 7				
FUEL NOZZLE - No. 8				
FUEL NOZZLE - No. 9				
FUEL NOZZLE - No. 10				
HP FUEL FILTER - OUT				
HP FUEL FILTER - DIFFERENTIAL	N/A	N/A	N/A	

TEMPERATURES (F)

*	07	TURBINE EXHAUST M.I.D. VALUE	886	893	900	912
*	1A	COMPRESSOR DISCHARGE No.1 (TCD-1)	561	564	569	574
*	1B	COMPRESSOR DISCHARGE No.2 (TCD-2)	569	572	575	582
	21	TURBINE EXHAUST - No.1 (TTX-1)	886	892	905	914
	22	TURBINE EXHAUST - No.2 (TTX-2)	878	883	895	905
	23	TURBINE EXHAUST - No.3 (TTX-3)	873	880	890	899
	24	TURBINE EXHAUST - No.4 (TTX-4)	877	883	893	901
	25	TURBINE EXHAUST - No.5 (TTX-5)	886	893	904	912
	26	TURBINE EXHAUST - No.6 (TTX-6)	884	891	904	914
	27	TURBINE EXHAUST - No.7 (TTX-7)	881	885	896	907
	28	TURBINE EXHAUST - No.8 (TTX-8)	905	911	924	936
	29	TURBINE EXHAUST - No.9 (TTX-9)	889	895	910	918
	2A	TURBINE EXHAUST - No.10 (TTX-10)	874	880	889	900
	2B	TURBINE EXHAUST - No.11 (TTX-11)	858	863	874	884
	2C	TURBINE EXHAUST - No.12 (TTX-12)	888	892	902	911
	2D	TURBINE EXHAUST - No.13 (TTX-13)	904	910	919	929
	34	1ST.-STAGE FORWARD WHEELSPACE (1F01)	804	812	820	828
	35	1ST.-STAGE FORWARD WHEELSPACE (1F02)	801	810	820	829
	36	1ST.-STAGE AFT WHEELSPACE (1A01)	781	785	789	797
	37	1ST.-STAGE AFT WHEELSPACE (1A02)	785	790	796	803
	38	2ND.-STAGE FORWARD WHEELSPACE (2F01)	756	761	766	773
	39	2ND.-STAGE FORWARD WHEELSPACE (2F02)	765	769	775	781
	3A	2ND.-STAGE AFT WHEELSPACE (2A01)	629	637	642	647
	3B	2ND.-STAGE AFT WHEELSPACE (2A02)	625	634	639	645
	3C	3RD.-STAGE FORWARD WHEELSPACE (3F01)	647	666	670	520
	3D	3RD.-STAGE FORWARD WHEELSPACE (3F02)	663	676	682	687
	3E	3RD.-STAGE AFT WHEELSPACE (3A01)	468	479	487	491
	3F	3RD.-STAGE AFT WHEELSPACE (3A02)	468	481	488	492
		LUBE BEARING HEADER	120	122	124	126
		LUBE TANK	143	145	147	149
		FUEL FORWARDING	n/a	n/a	n/a	n/a

VIBRATION DATA

CHANNEL No. 1 - TURBINE No. 1 BEARING:	.18	.18	.18	.18
CHANNEL No. 2 - TURBINE No. 2 BEARING:	.10	.10	.11	.13
CHANNEL No. 3 - No. 1 GENERATOR BEARING:	.28	.26	.26	.26
CHANNEL No. 4 - No. 2 GENERATOR BEARING:	.18	.16	.17	.17

GENERATOR

OUTPUT VOLTAGE KV 1-2:	14.2	14.2	14.15	14.15
OUTPUT VOLTAGE KV 2-3:	14.25	14.25	14.2	14.2
OUTPUT VOLTAGE KV 3-1:	14.25	14.2	14.2	14.2
PHASE CURRENT KA 1:	1.99	1.97	1.98	1.99
PHASE CURRENT KA 2:	2.0	2.0	2.01	2.02
PHASE CURRENT KA 3:	1.95	1.95	1.97	1.98
M - VARS:	0	0	0	0
INCOMING VOLTAGE KV:	14.55	14.55	14.50	14.55
FIELD CURRENT:	284	285	283	283
FIELD VOLTS:	138	142	143	143
STATOR TEMPERATURE (C) 1 - TEST:	70	70	70	70
2 - ACTUAL:	74	76	78	80
3 - ACTUAL:	72	74	76	77
4 - ACTUAL:	68	70	73	74
5 - ACTUAL:	72	74	77	78
6 - ACTUAL:	68	70	73	75
7 - ACTUAL:	31	34	36	37
8 - ACTUAL:	29	31	33	34

9-26-90 [illegible] TEST RUN
ON DIST. FUEL

MEMORY LOCATION					
*	TIME	1550			
*	LOAD	50			
*	FUEL	GAS			
* 01	HP TURBINE SPEED %	100			
* 02	VCE	12.25			
0B	MAX. ALLOWABLE SPREAD	92			
0C	SPREAD 1	47			
0D	SPREAD 2	35			
0E	LCE	.04			
0F	GCE	12.26			
* 10	DIST. FUEL FLOW (gpm)	.4			
* 64	GAS FUEL FLOW #/sec.	7.86			
* 12	WATER FLOW	16.23			
* 17	INLET AIR (F)	79			
* 33	AMBIENT AIR (F) / HUMIDITY	81/	/	/	/
	EVAPORATIVE COOLER	OFF			

PRESSURES (PSIG)

03	COMPRESSOR DISCHARGE (PCD)	113.1			
11	SRV INTERVOLUME PRESSURE (VOLTS)	3.77			
DANIELS COMPUTER	1. RATE	2775			
	2. PRESSURE	71.8			
	3. TEMPERATURE	78.6			
	4. Δp H1 OR [✓ H2]	68.8			
	5. P/T	60.9			
	GAS PRESSURE TRENCH	221			
	GAS PRESSURE MANIFOLD	218			
	GAS PRESS. CNTRL VALVE OUTLET	146			
	GAS PRESSURE INTERVOLUME	188			
66	H^2O OFF-SET ~~[illegible] GAS [illegible] THERM.~~	2.03			
	H^2O TEMP. WIS ~~[illegible] GAS [illegible] HOUR [illegible]~~	76			

PRESSURES (PSIG)

FUEL OIL AFTER MAIN FILTER	N/A			
FUEL OIL FILTER DIFFERENTIAL	N/A			
LUBRICANT - MAIN PUMP DISCHARGE	104			
LUBRICANT - BEARING HEADER	26			
ATOMIZING AIR MANIFOLD	150			
COOLING & SEALING AIR DISCHARGE	116			
COOLING WATER HEADER	85			
TRIP OIL	1420			
HYDRAULIC FILTER DIFFERENTIAL	~~2~~			
LUBE FILTER DIFFERENTIAL	2			
FUEL NOZZLE - No. 1	N/A			
FUEL NOZZLE - No. 2				
FUEL NOZZLE - No. 3				
FUEL NOZZLE - No. 4				
FUEL NOZZLE - No. 5				
FUEL NOZZLE - No. 6				
FUEL NOZZLE - No. 7				
FUEL NOZZLE - No. 8				
FUEL NOZZLE - No. 9				
FUEL NOZZLE - No. 10				
HP FUEL FILTER - OUT				
HP FUEL FILTER - DIFFERENTIAL	N/A			

TEMPERATURES (F)

*07	TURBINE EXHAUST M.I.D. VALUE	920			
*1A	COMPRESSOR DISCHARGE No.1 (TCD-1)	579			
*1B	COMPRESSOR DISCHARGE No.2 (TCD-2)	586			
21	TURBINE EXHAUST - No.1 (TTX-1)	924			
22	TURBINE EXHAUST - No.2 (TTX-2)	913			
23	TURBINE EXHAUST - No.3 (TTX-3)	908			
24	TURBINE EXHAUST - No.4 (TTX-4)	910			
25	TURBINE EXHAUST - No.5 (TTX-5)	921			
26	TURBINE EXHAUST - No.6 (TTX-6)	919			
27	TURBINE EXHAUST - No.7 (TTX-7)	913			
28	TURBINE EXHAUST - No.8 (TTX-8)	942			
29	TURBINE EXHAUST - No.9 (TTX-9)	925			
2A	TURBINE EXHAUST - No.10 (TTX-10)	910			
2B	TURBINE EXHAUST - No.11 (TTX-11)	894			
2C	TURBINE EXHAUST - No.12 (TTX-12)	970			
2D	TURBINE EXHAUST - No.13 (TTX-13)	939			
34	1ST.-STAGE FORWARD WHEELSPACE (1F01)	840			
35	1ST.-STAGE FORWARD WHEELSPACE (1F02)	840			
36	1ST.-STAGE AFT WHEELSPACE (1A01)	804			
37	1ST.-STAGE AFT WHEELSPACE (1A02)	810			
38	2ND.-STAGE FORWARD WHEELSPACE (2F01)	780			
39	2ND.-STAGE FORWARD WHEELSPACE (2F02)	788			
3A	2ND.-STAGE AFT WHEELSPACE (2A01)	653			
3B	2ND.-STAGE AFT WHEELSPACE (2A02)	651			
3C	3RD.-STAGE FORWARD WHEELSPACE (3F01)	688			
3D	3RD.-STAGE FORWARD WHEELSPACE (3F02)	693			
3E	3RD.-STAGE AFT WHEELSPACE (3A01)	498			
3F	3RD.-STAGE AFT WHEELSPACE (3A02)	498			
	LUBE BEARING HEADER	128			
	LUBE TANK	151			
	FUEL FORWARDING	N/A			

VIBRATION DATA

CHANNEL No. 1 - TURBINE No. 1 BEARING: .19

CHANNEL No. 2 - TURBINE No. 2 BEARING: .13

CHANNEL No. 3 - No. 1 GENERATOR BEARING: .26

CHANNEL No. 4 - No. 2 GENERATOR BEARING: .17

GENERATOR

OUTPUT VOLTAGE KV 1-2: 14.25

OUTPUT VOLTAGE KV 2-3: 14.3

OUTPUT VOLTAGE KV 3-1: 14.25

PHASE CURRENT KA 1: 1.97

PHASE CURRENT KA 2: 2.0

PHASE CURRENT KA 3: 1.95

M - VARS: ~~0~~

INCOMING VOLTAGE KV: 14.6

FIELD CURRENT: 288

FIELD VOLTS: 145

STATOR TEMPERATURE (C) 1 - TEST: 70

2 - ACTUAL: 84

3 - ACTUAL: 81

4 - ACTUAL: 78

5 - ACTUAL: 82

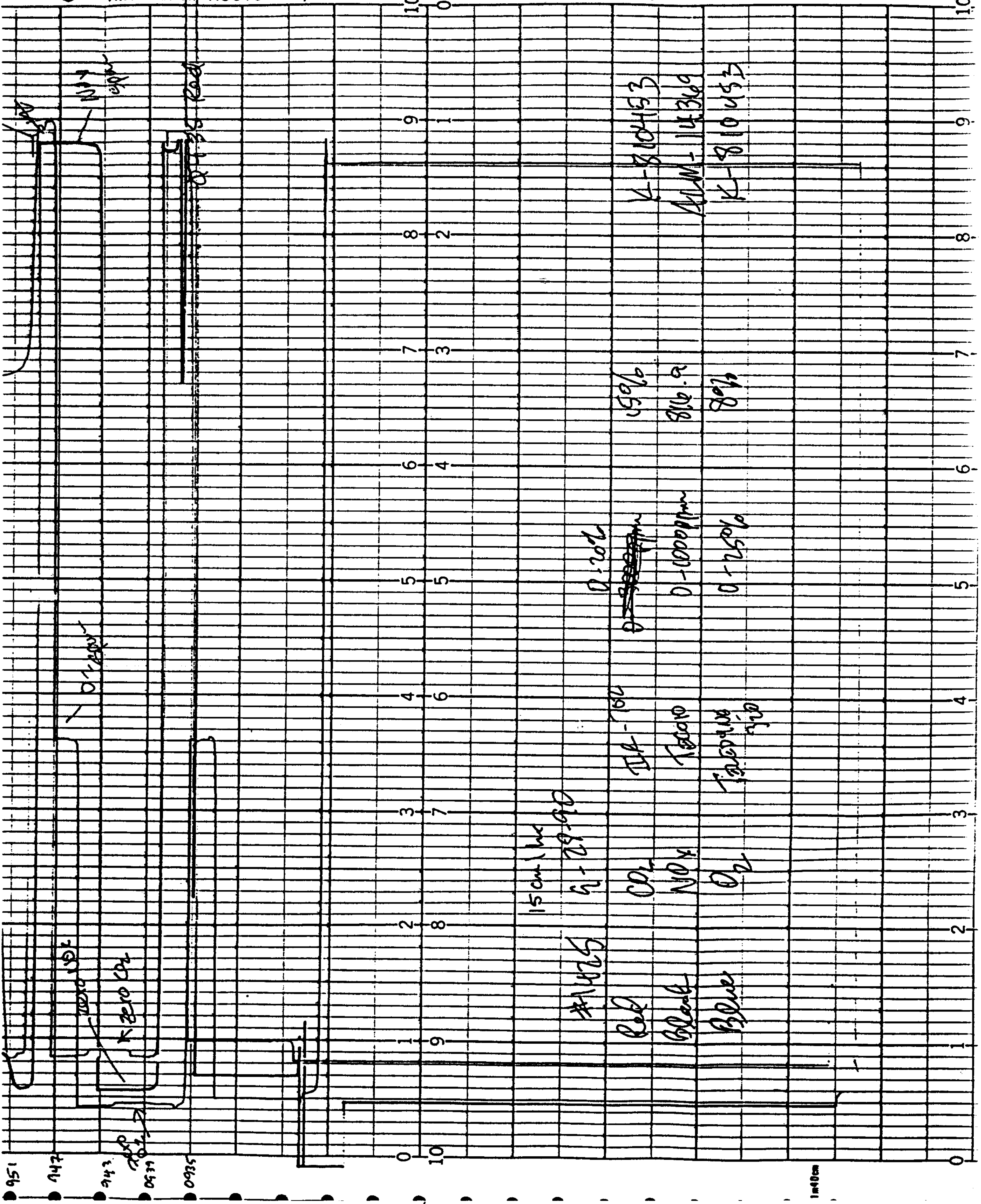
6 - ACTUAL: 78

7 - ACTUAL: 40

8 - ACTUAL: 37

APPENDIX D
COPIES OF STRIP CHARTS AND FIELD DATA SHEETS

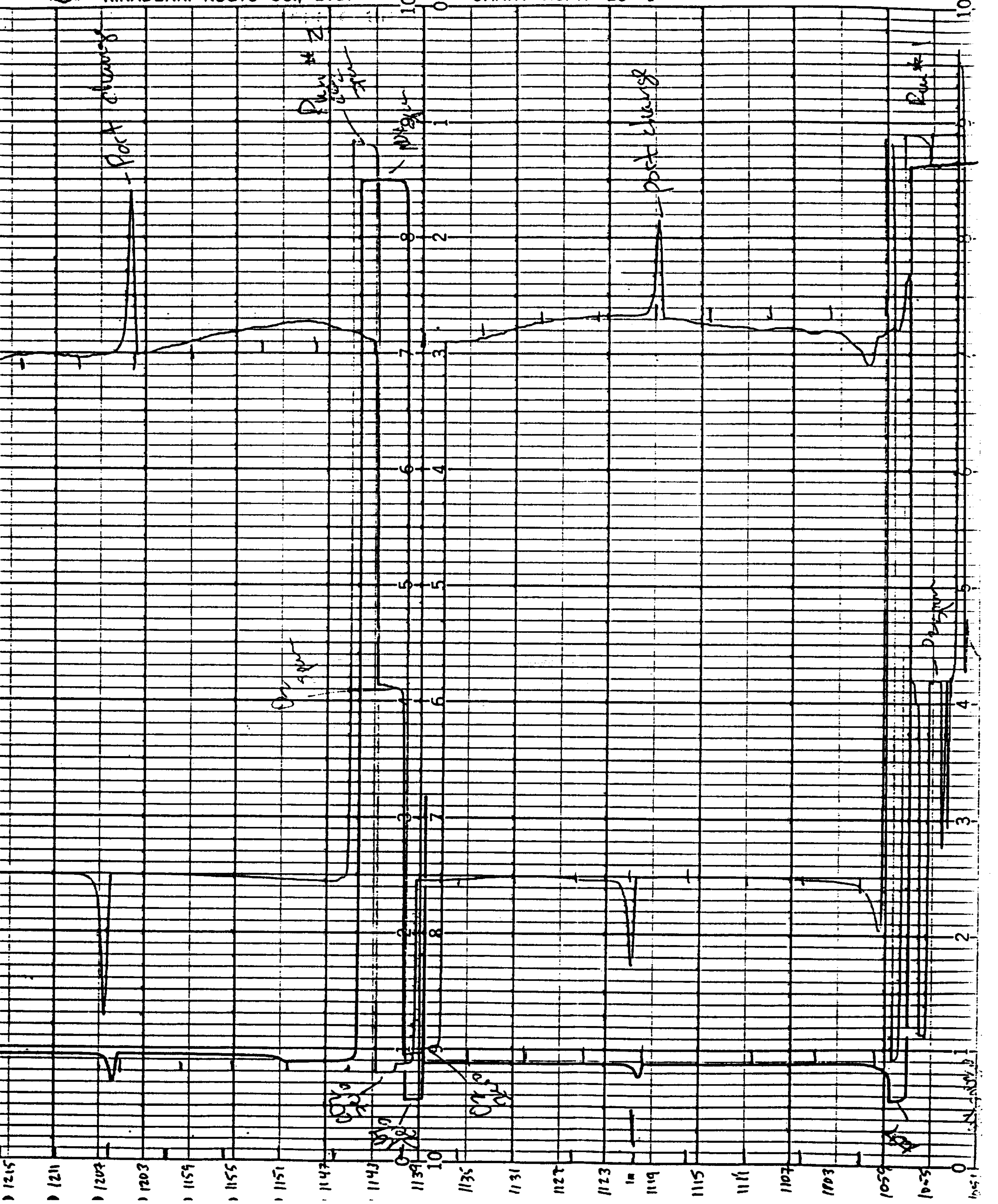
RIKADENKI KOGYO CO., LTD. CHART NO. H-25-1

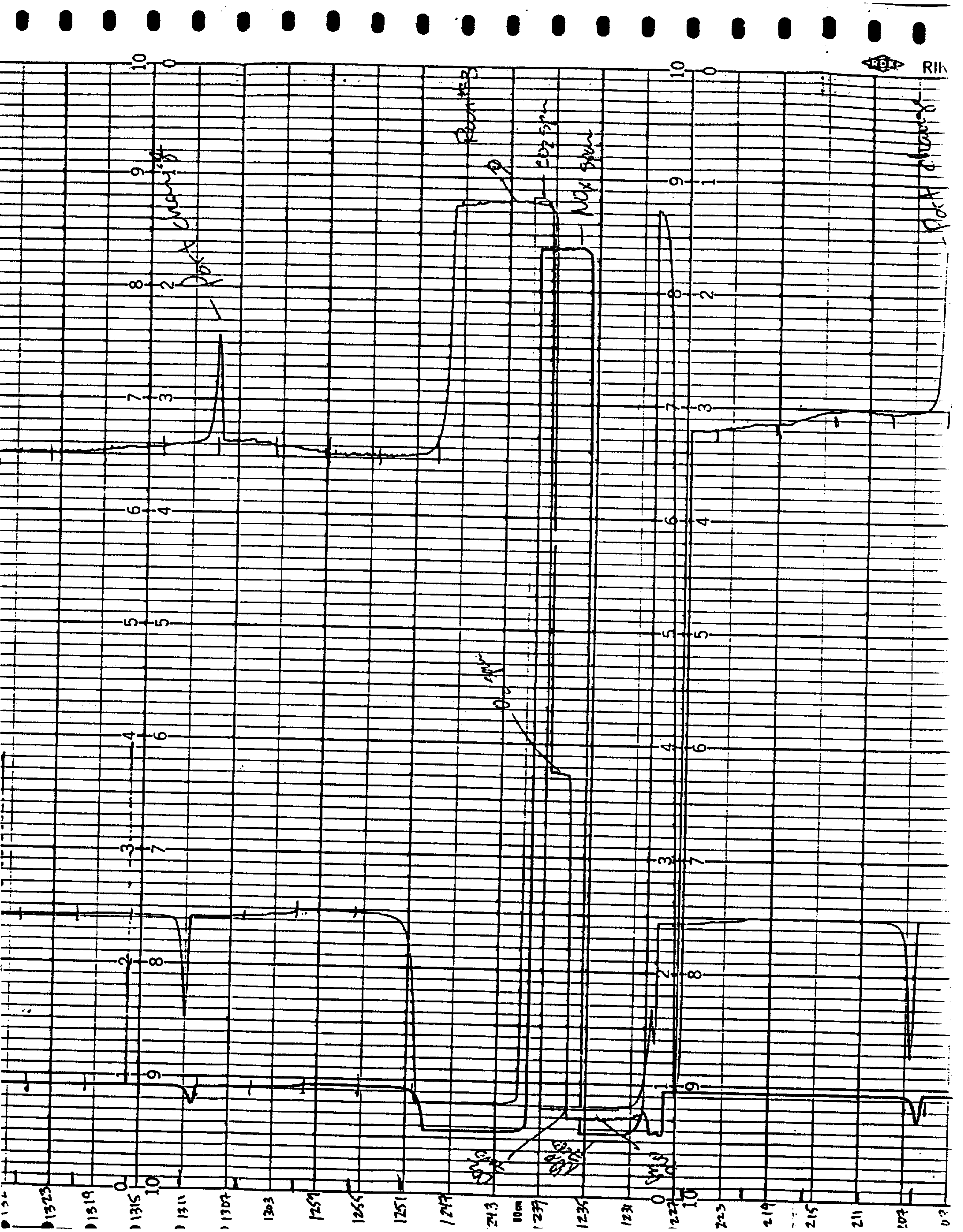


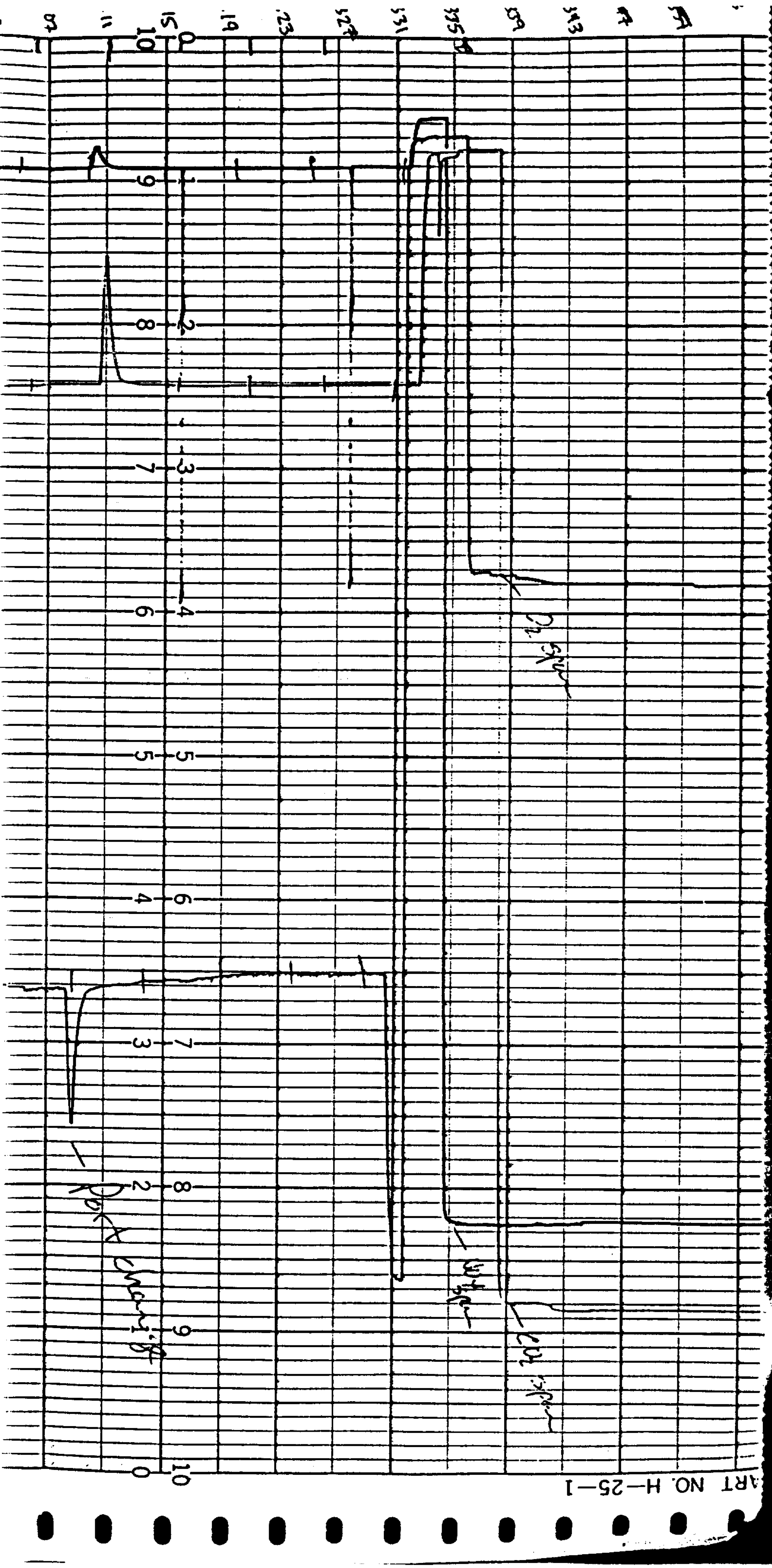
#1425	15cm/hr 4-27-90				
Red	CO_2	IR-702	0-20% ~~0-3000ppm~~	45%	K-810453
Black	NO_x	TECO10	0-10000ppm	816.9	ALM-14369
Blue	O_2	Teledyne 320	0-25%	80%	K-810453

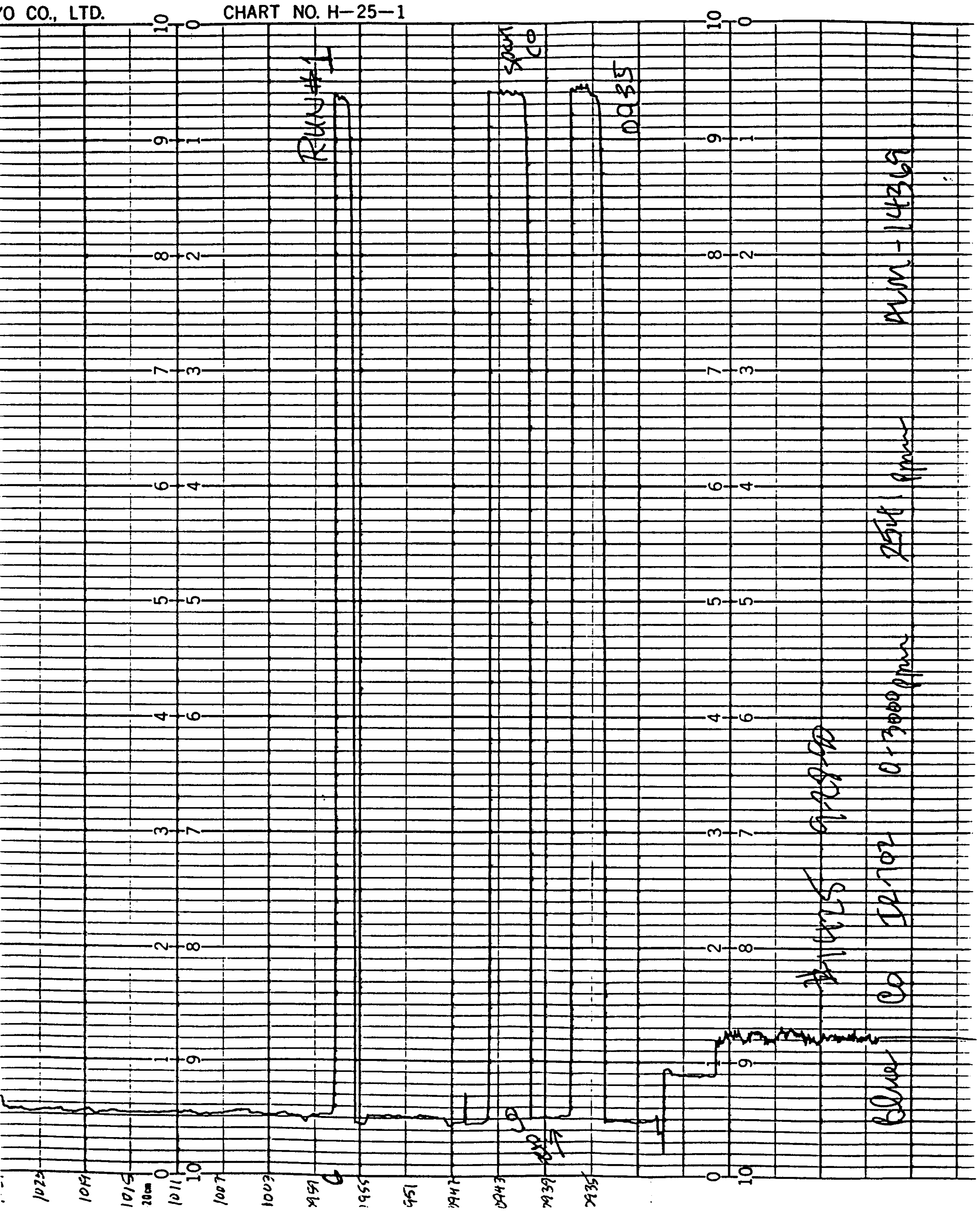
Run ★1
10
0
1
9
2
8
3
7
4
6
5
5
6
4
7
3
8
2
9
1
0
10
1103
1059
1055
1051
1047
1043
1039
1035
1031
1027
1023
1019
1015
1011
1007
1003
1000
959
955
951
947
943

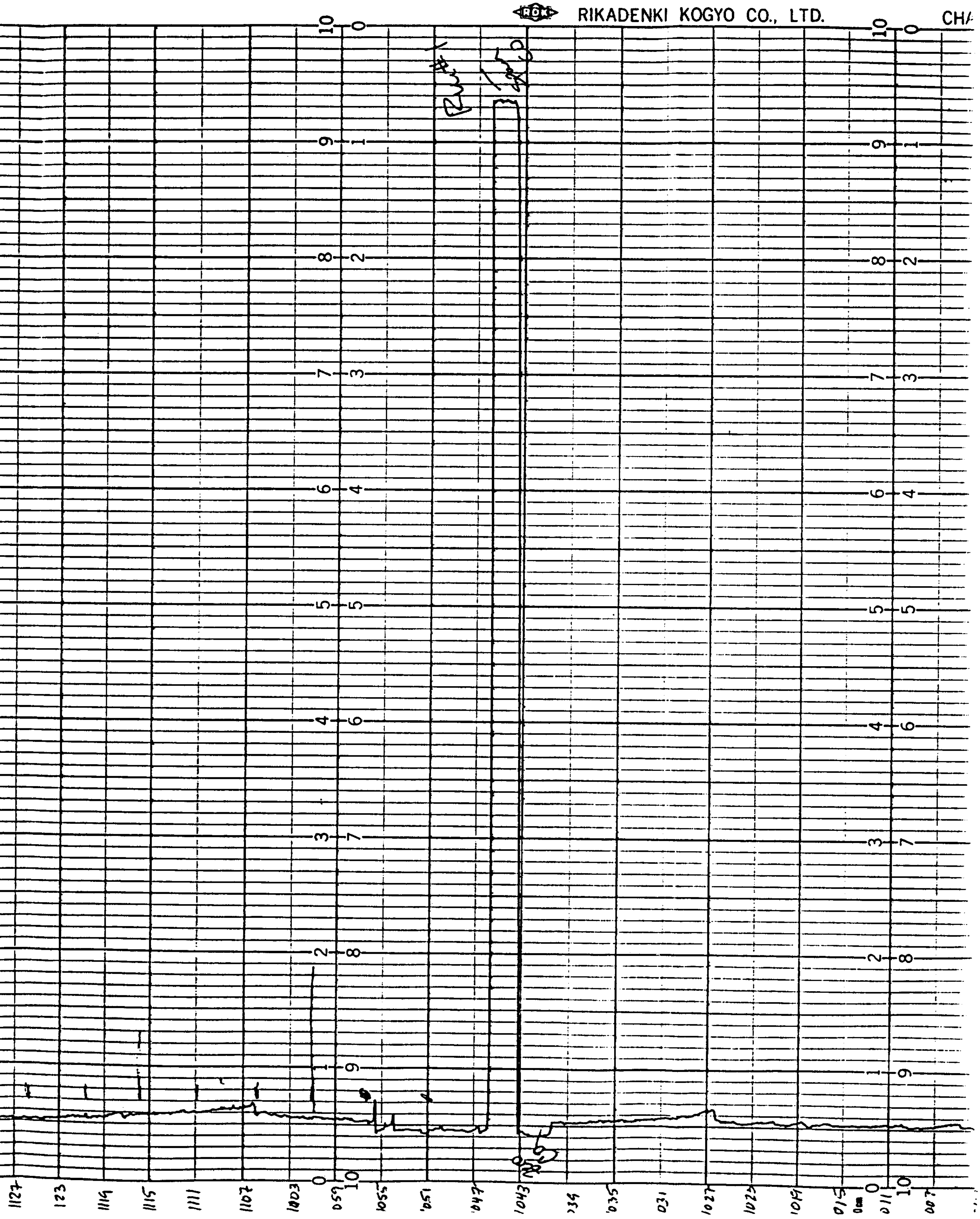
RIKADENKI KOGYO CO., LTD. CHART NO. H-25-1



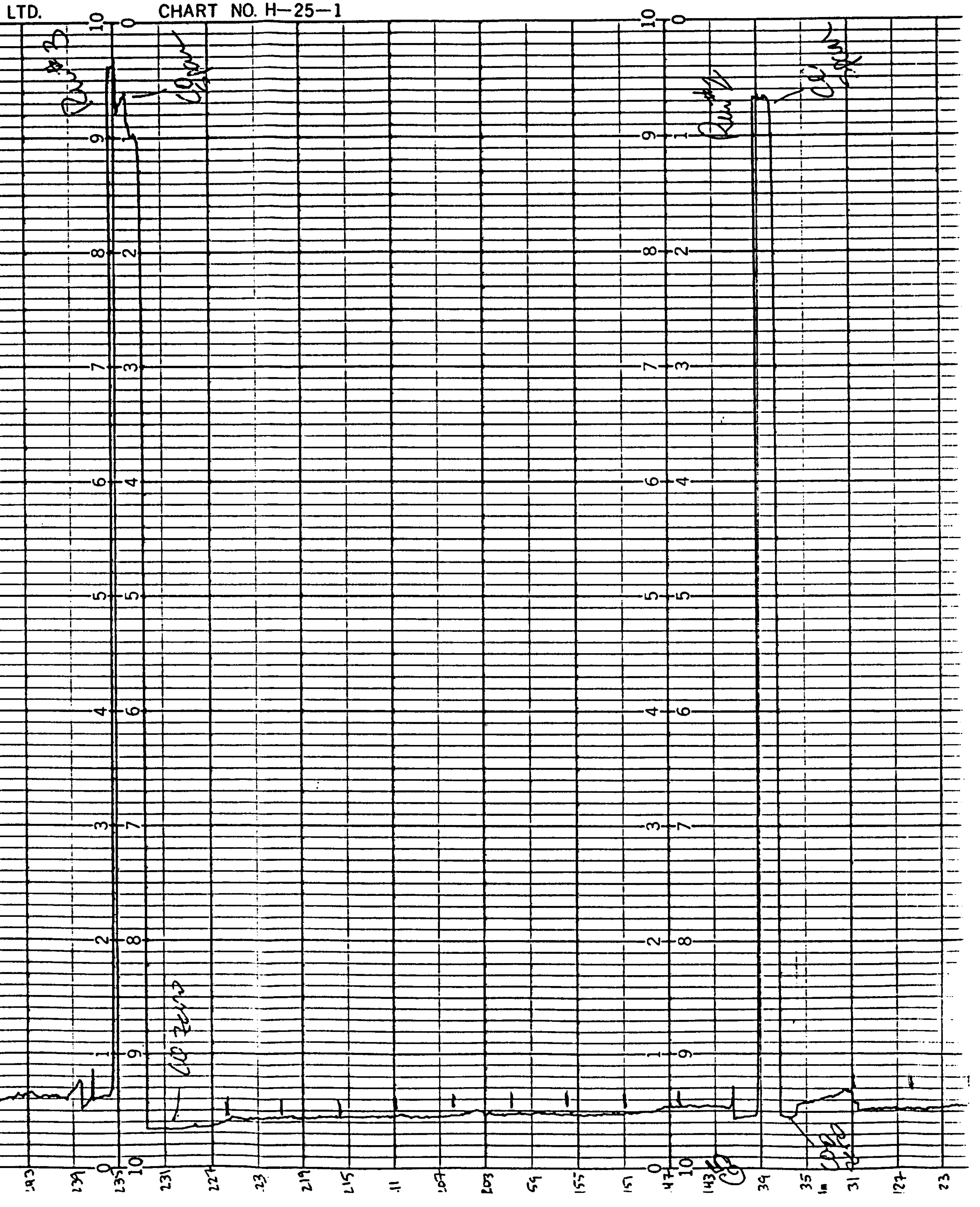

RIK
Port change
Port #2
O2
CO2 span
NOx span
Port change
O2 span
1323
1319
1315
1311
1307
1303
1259
1255
1251
1247
1243
1239
1235
1231
1227
1223
1219
1215
1211
1207
0
10
1
2
3
4
5
6
7
8
9


07
11
15
19
23
327
331
335
339
343
47
51
10 0
9 1
8 2
7 3
6 4
5 5
4 6
3 7
2 8
1 9
0 10
O2 5%
CH4 3%
CO2 3%
Rock Chamber
ART NO. H—25—1

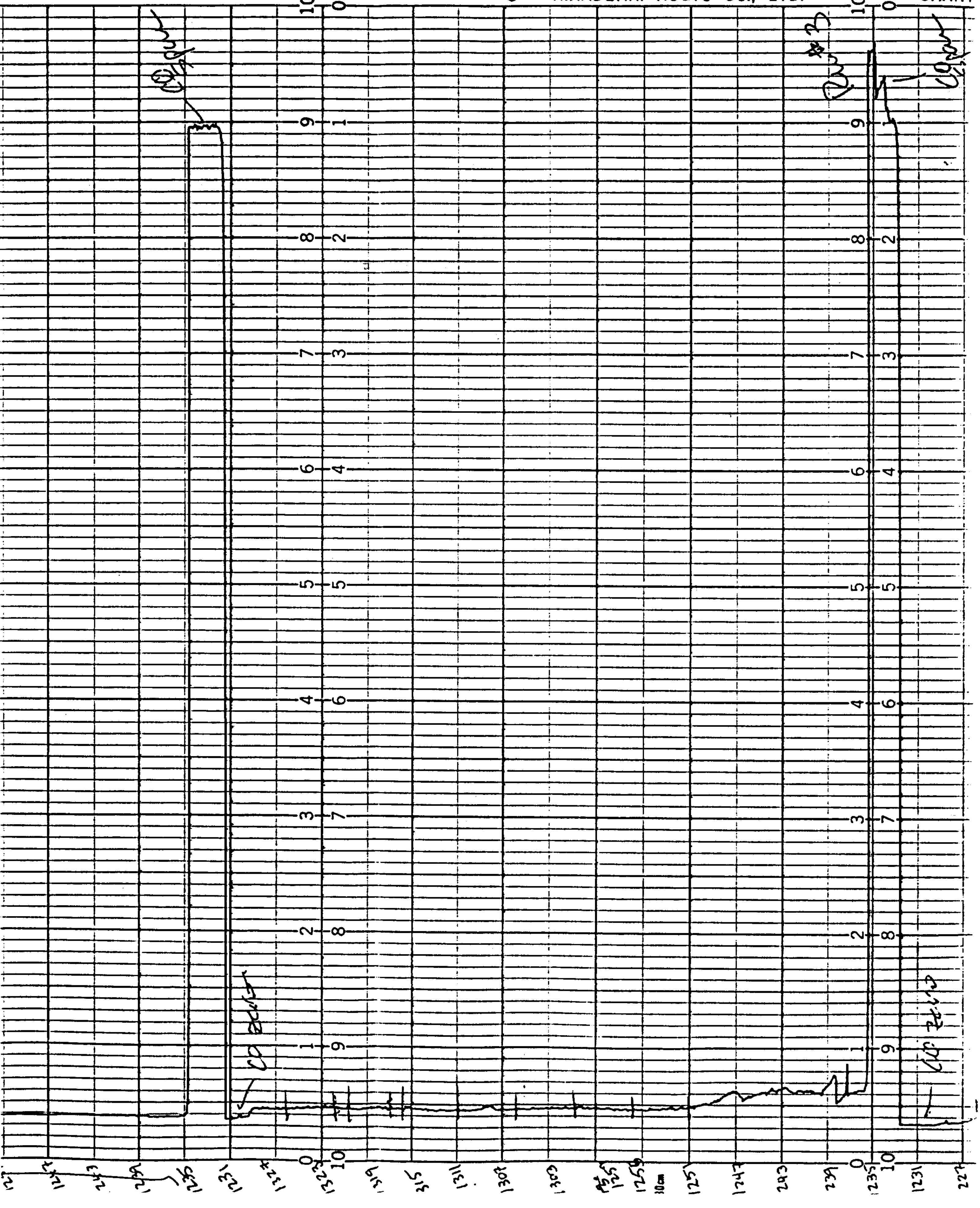
YO CO., LTD.
CHART NO. H-25-1
10
0
9
1
8
2
7
3
6
4
5
5
4
6
3
7
2
8
1
9
0
10
RUN #1
SPAN CO
0935
ZERO CO
ZERO
Hills 6-28-90
Blue CO IR702 0-3000 ppm 2514 ppm AUM-14369
1023
1019
1015
1011
1007
1003
959
955
951
947
943
939
935
20cm


RIKADENKI KOGYO CO., LTD.
CH
10 0
9 1
8 2
7 3
6 4
5 5
4 6
3 7
2 8
1 9
0 10
Run #1
1 Std. D
1127
123
1119
1115
1111
1107
1103
059
1055
051
1047
1043
35
1035
031
1027
1023
1019
015
011
007

LTD. CHART NO. H—25—1



RIKADENKI KOGYO CO., LTD. CHART



* * * *

PARTICULATE EMISSIONS
TEST MONITOR DATA

Date 1-26-90 Run ______
Client SMID
Unit Turbine
Ambient Temp. ______ °F
Press.bar ______ in. Hg
Press.static -4.0 in. H2O
Press.duct ______ in. Hg
Assumed MW ______ %H2O ______

Sample Train Temp.:
Probe ______ °F
Filter ______ °F
Sample Line ______ °F
Post-Test Leak Check:
Leak Rate ______ CFM
@ ____ in. Hg Vac.

Nozzle & Probe Mat. ______
Filter Holder Mat. ______
Filter # ______
Nozzle # ______ i.d. ______ mm
Pitot # ______ Cp ______
Temp. Unit # ______
Mag. # 378 Meter # 635
Orifice km ______

L→R

				Duct Data			~~Meter Data~~ Δp				
		Trav. Point	Time	Temp. °F	Head Δp	Velocity ft/sec	~~Vacuum "Hg~~	Temp. °F	~~Orifice ΔH, "H2O~~	Volume CF	
1	A	6 1		851	2.6		1 F 6	850	6.0		
↓		5 2		866	3.1	-	2 5	867	3.7		
		4 3		876	3.0		3 4	869	2.8		
		3 4		876	3.2		4 3	869	1.8		
6		2 5		874	4.0		5 2	866	.98		
		1 6		871	3.6		6 1	864	.50		
	B	6 1		810	3.8		6 1 6	854	6.0		
1		5 2		866	5.2		2 5	863	3.8		
↓		4 3		873	6.0		3 4	863	1.4		
		3 4		874	6.6		4 3	856	0 -		
		2 5		873	4.4		5 2	855	0 -		
		1 6		872	3.0		6 1	851	0 -		START
6											10:15
	C	6 1		843	5.0		VAC	M°	ΔP		
1		5 2		873	5.8					259.799	B Port
		4 3		875	5.0		7"	80	1.7	262.600	5
		3 4		875	4.2		7"	80	1.7	264.940	10
↓		2 5		872	2.0		7"	81	1.7	267.480	15
		1 6		870	1.6		7"	83	1.7	270.000	20
6							7"	88	1.7	272.550	25
*	D	6 1		825	5.8		7"	91	1.7	275.113	30
1		5 2		872	5.6				END		END
		4 3		876	5.0						10:45 Am
↓		3 4		876	4.0						
		2 5		874	2.5						
		1 6		870	1.8						
6											
	E	6 1		808	5.2						
1		5 2		864	4.8						
		4 3		867	4.0						
↓		3 4		868	3.0						
		2 5		867	1.8						
		1 6		864	1.4						
6											
		Total	Minutes				Max.		TOTAL		
		Average					Average				

.002 At 18'

PARTICULATE EMISSIONS

DATA & RESULTS:

Site: ____________ Run: only

Date: ____________ Time: ____________

Absorber Type	Contents	Final	Tare	Net H2O
MGS	H2O	588.2	566.5	
		548.5	547.5	547.5
				4
		446.7		
liquid trap	empty			445.6
	silica gel	672.7		6689
		2256.1	2228.5 TOTAL	

Filter Sample: Type ____________

Sample Fraction	Final Wt.	Tare Wt.	Net mgrams	Co, grains/SDCF
		TOTAL		

Gas Composition:

CO2 ______ % volume (dry)
O2 ______ % volume (dry)
CO ______ % volume (dry)
N2 ______ % volume (dry)
H2O ______ % volume

M. (wet) ______ %
Excess Air ______ SDCF
Sampled Volume ______ %
Isokinetic Rate ______ %

Particulate Concentration:

Co ______ grains/SDCF @ ______ °F and 29.92 "Hg
C ______ grains/SDCF @ ______

Emission Rate:

E.R. ______ lbs/hr @ Qstd(dry) ______ SDCFM

Dist #2
Traverse

* * * *

PARTICULATE EMISSIONS
TEST MONITOR DATA

Date 9-27-90 Run ____
Client MID
Unit #1
Ambient Temp. 70 + °F
Press.bar 30.05 in. Hg
Press.static ____ in. H2O
Press.duct ____ in. Hg
Assumed MW ____ %H2O ____

Sample Train Temp.:
Probe — °F
Filter — °F
Sample Line - °F
Post-Test Leak Check:
Leak Rate ____ CFM
@ ____ in. Hg Vac.

Nozzle & Probe Mat. S.S.
Filter Holder Mat. —
Filter # ____
Nozzle # ____ i.d. ____ mm
Pitot # 1234 Cp ____
Temp. ~~Unit #~~
Mag. # ____ Meter # 635
Orifice km ____ (Variable)

			Duct Data			Meter Data				
	Trav. Point	Time	Temp. °F	Head Δp	Velocity ft/sec	Vacuum "Hg	Temp. °F	Orifice ΔH, "H2O	Volume CF	+7= START
A	6		938	1.8		7	89	1.7	275.213	1100
	5		938	2.0		7	94	1.7	277.500	1105
	4		937	1.6		7	94	1.7		1110
	3		935	1.0		7	94	1.7	282.700	1115
	2		932	2.0		7	92	1.7	285.300	1120
	1		920	2.2		7	92	1.7	287.900	1125
* B	6	—	934	0.78		7	94	1.7	290.701	1130
	5		935	1.0						
	4		933	2.4						
	3		927	1.2						
	2		921	2.0						
	1		880	3.4						
C	6	—	931	.38		LEAK ✓				
	5		933	0.74						
	4		933	1.4			.002	AT 20"		
	3		928	2.2						
	2		923	3.0						
	1		897	3.8						
D	6	—	929	0.52						
	5		930	0.94						
	4		930	2.0						
	3		930	2.0						
	2		923	3.4						
	1		891.	4.0						
E	6	—	932	0.58						
	5		933	0.70						
	4		933	1.4						
	3		929	2.4						
	2		925	3.0						
	1		826	3.5						
F	6	—	929	.18						
	5		929	.38						
	4		933	1.7						
	3		936	1.6						
	2		933	2.4						
	1		913	4.2	0					
	Total		Minutes			Max.		TOTAL		
	Average					Average				
G	6	—	916	0						
	5		919	0						
	4		918	0,						
	3		918	0.58						
	2		928	2.6						
	1		919	4.2						

* * * *

PARTICULATE EMISSIONS

DATA & RESULTS:

Site: ______________ Run: ______________

Date: ______________ Time: ______________

Absorber Type	Contents	Final	Tare	Net H2O
		608.3	588.2	
		548.9	548.5	
liquid trap	empty	446.8	446.7	
	silica gel	676.8	672.7	
		2280.8	2256.1 TOTAL	

Filter Sample: Type ______________

Sample Fraction	Final Wt.	Tare Wt.	Net mgrams	Co, grains/SDCF
	TOTAL			

Gas Composition:

CO2 ________ % volume (dry)

O2 ________ % volume (dry)

CO ________ % volume (dry)

N2 ________ % volume (dry)

H2O ________ % volume

Mw (wet) ______________

Excess Air ______________ %

Sampled Volume ______________ SDCF

Isokinetic Rate ______________ %

Particulate Concentration:

Co ________ grains/SDCF @ ________ °F and 29.92 "Hg.

C ________ grains/SDCF @ ______________

Emission Rate:

E.R. ________ lbs/hr @ Qstd(dry) ______________ SDCFM

K factor = 0.1908 Tm = [illegible]
X = 0.4830

* * * *

STEPS For HP52S

PAH Run #1
3 min / pt.

PARTICULATE EMISSIONS
TEST MONITOR DATA

CRANKEY
LBL [4]
[√X] A
Tm (Input)
[R/S]
Ts (Input)
[R/S] A
calculates K
ΔP (Input)
Time 15:07
(times) B

Date 9-27-90 Run PAH - 1
Client MID
Unit #2 Turbine Unit
Ambient Temp. 79 °F
Press.bar 29.98 in. Hg
Press.static ______ in. H2O
Press.duct ______ in. Hg
Assumed MW ______ %H2O ______

Sample Train Temp.:
Probe 248 ± 24 °F
Filter 248 ± 24 °F
Sample Line ______ °F
Post-Test Leak Check:
Leak Rate .005 CFM
@ 13 in. Hg Vac.

Nozzle & Probe Mat Quartz
Filter Holder Mat. Quartz
Filter # ______
Nozzle # ______ i.d. 4 mm
Pitot # ______ Cp ______
Temp. Unit # ______
Mag. # ______ Meter # 990
Orifice AVY = 1.0227 ΔH@ 1.627

Final Leak √ = ___ @ ___
Final Meter Vol =

Trav. Point	Time	Duct Data Temp. °F	Head Δp	[illegible]	Meter Data Vacuum "Hg	Temp. °F	Orifice ΔH, "H2O	Volume CF
6	14:49:00	926	1.6	256, 276	3"	90	0.33	470.955
5	14:52:00	932	2.0	262, 266	3"	90	0.41	—
4	14:55:00	936	1.2	255, 264	2"	88	0.25	473.494
3	14:58:00	930	0.49	258 262	< 1"	88	0.10	—
2	15:01:00	928	1.20	264, 276	2"	87	0.25	474.802
1	15:04:00	921	2.30	265, 256	3"	87	0.47	—
6	15:11:02	925	0.34	261 251	< 1"	88	0.07	476.652
5	15:14:02	934	1.20	269, 248	2"	88	0.25	477.197
4	15:17:02	938	2.00	262, 263	3"	88	0.41	478.050
3	15:20:02	931	0.84	267, 271	< 1"	87	0.17	—
2	15:23:02	929	1.20	264, 268	2"	86	0.25	480.075
1	15:26:02	919	2.90	258, 257	6"	84	0.60	481.001
6	15:34:00	921	0.20	269, 241	< 1"	84	0.041	482.397
5	15:37	933	0.57	268, 261	< 1"	84	0.12	482.726
4	15:46	939	1.20	269, 267	3"	86	0.24	483.296
3	15:43	931	1.80	268, 269	4"	86	0.38	—
2	15:46	925	2.40	271, 266	5"	84	0.49	485.231
1	15:49	919	3.00	264, 261	6"	84	0.62	486.494
6	16:02	921	0.26	265, 256	< 1"	85	0.05	487.880
5	16:05	929	0.64	264 274	1"	86	0.13	—
4	16:08	933	1.40	266, 268	2"	88	0.29	488.671
3	16:11	937	2.10	268, 262	3"	88	0.43	489.564
2	16:14	937	2.60	269, 261	5"	89	0.53	490.687
1	16:17	938	2.00	268, 264	5"	87	0.41	492.525
6	16:24	937	0.10	268, 261	< 1"	88	0.020	493.643
5	16:27	939	1.70	271, 261	3"	58	0.24	—
4	16:30	935	3.20	274, 266	6"	88	0.65	494.667
3	16:33	931	2.50	276, 271	9"	87	0.72	495.067
2	16:36	929	4.00	265, 281	10"	86	0.82	497.616
1	16:39	921	5.20	267, 284	9"	88	1.07	499.295
6	16:48	932	0.25	271, 261	< 1"	90	.051	501.217
5	16:51	934	0.30	277, 255	< 1"	89	.061	501.734
4	16:54	935	0.30	276, 254	< 1"	89	.061	502.085
3	16:57	930	1.60	277, 256	1"	89	0.33	502.567
2	17:00	920	4.00	271, 260	10"	87	0.82	503.753
1	17:03	918	6.00	264, 266	13"	90	1.25	505.461
Total	17:06 Minutes				Max.		TOTAL	507.368
Average					Average			

End Ⓐ 476.65
End Ⓒ = 482.5
End Ⓒ: = 487.8
End Ⓔ = 493.6
End Ⓕ = 501.217

C End 15:29:02
C
126 min
D End 15:52
E
Calc'd (T)
D End = 16:20
F
C) End 16:42
* G
*
*
Max point → *
Total =

6
5
4
3
2
1

* * * *

PARTICULATE EMISSIONS

DATA & RESULTS:

Site: ______________ Run: ______________

Date: ______________ Time: ______________

Absorber Type	Contents	Final	Tare	Net H2O
C.S	100ml H2O	568.9	533.5	
C.S.	100ml H2O	575.4	575.3	
liquid trap	empty	415.4	415.3	
	silica gel	724.1	717.3	
			TOTAL	

Filter Sample: Type ______________

Sample Fraction	Final Wt.	Tare Wt.	Net grams	Co, grains/SDCF
		TOTAL		

Gas Composition:

CO2 ________ % volume (dry)
O2 ________ % volume (dry)
CO ________ % volume (dry)
N2 ________ % volume (dry)
H2O ________ % volume

MW (wet) ____________
Excess Air ____________ %
Sampled Volume ____________ SDCF
Isokinetic Rate ____________ %

Particulate Concentration:

Co ________ grains/SDCF @ ________ °F and 29.92 "Hg
C ________ grains/SDCF @ ______________

Emission Rate:

E.R. ________ lbs/hr @ Qstd(dry) ____________ SDCFM

* * * *

PARTICULATE EMISSIONS
TEST MONITOR DATA

4 min/pt

Date 9-28-90 Run #2
Client MD
Unit #1
Ambient Temp. ≈70°+ °F
Press.bar 29.94 in. Hg
Press.static ____ in. H2O
Press.duct ____ in. Hg
Assumed MW ____ %H2O ____

Sample Train Temp.:
Probe 248±25 °F
Filter 248±25 °F
Sample Line — °F
Post-Test Leak Check:
Leak Rate .005 CFM
@ 14 in. Hg Vac.

Nozzle & Probe Mat. QTZ GS
Filter Holder Mat. GLS
Filter # —
Nozzle # — i.d. 5 mm
Pitot # 1234 Cp ____
Temp. Unit #
Mag. #371 Meter # 990
Orifice ~~in~~ Fixed
Avg Y = 1.9223
ΔH@ = 1.6231

STARTED: 09:37
(Sampled 3 min)
Started Nonstop
9:40 correction bias! (A)

Final Leak ✓ = 6 —

F/PT

		Duct Data			Meter Data			
Trav. Point	Time	Temp. °F 912	Head Δp	[redacted]	Vacuum "Hg	Temp. °F	Orifice ΔH, "H2O	Volume CF
6	12:40:00	~~[illegible]~~	0.86	281, 278	~~3"~~	90	~~[illegible]~~ 0.44	509.338
5	12:44	929	0.74	289, 281	~~3~~ 2"	91	0.370	510.702
4	12:48	933	0.32	261, 289	<1"	91	0.160	511.940
3	12:52	931	0.12	260, 291	<1"	93	0.061	512.817
2	12:56	935	0.56	249, 238	3"	95	0.280	513.318
1	13:00	937	1.30	260, 240	7"	95	0.660	514.696
0	13:04	SHUT OFF					→	516,521
6	13:08:00	907	0.14	260, 241	<1"	95	0.0700	516.521
5	13:12	916	0.16	260 269	<1"	89	0.0810	517.124
4	13:16	919	0.72	254, 256	3"	91	0.370	517.690
3	13:20	921	0.30	249, 250	2"	93	0.150	519.128
2	13:24	917	0.64	261, 248	3"	95	0.330	519.986
1	13:28	924	1.40	260 248	7"	95	0.710	521.388
0	13:32	SHUT OFF					→	523.446
6	13:47	914	0.20	286, 248	2"	92	0.100	523.447
5	13:51	914	0.20	270 254	2"	91	0.100	524.160
4	13:54	916	0.50	271, 261	3"	91	0.250	524.589
3	13:58	913	0.77	270, 263	6"	93	0.394	525.754
2	14:02	922	1.40	276, 266	7"	94	0.710	527.286
1	14:06	926	1.70	274, 264	8"	95	0.864	529.310
0	14:10	SHUT	OFF				→	531.514
6	14:15	916	0.20	269, 260	~~[illegible]~~ 2"	93	0.1020	531.513
5	14:19	920	0.22	248, 251	2"	90	0.111	532.197
4	14:23	918	0.60	252, 246	4"	89	0.303	532.864
3	14:27	927	1.00	255, 248	5"	86	0.500	534.154
2	14:31	931	1.30	254, 251	6"	88	0.650	535.864
1	14:35	934	0.94	253, 255	5"	89	0.476	537.741
0	14:39	SHUT	OFF				→	539.358
6	14:54	900	0.12	261, 248	<1"	88	0.06	539.351
5	14:58	923	0.10	263, 251	<1"	86	0.05	539.850
4	15:02	924	0.30	264, 259	3"	87	0.150	540.243
3	15:06	926	0.58	266, 261	4"	88	0.2910	541.110
2	15:10	928	0.92	267, 265	6"	89	0.4620	542.386
1	15:14	934	1.40	267, 271	8"	90	0.7010	544.005
0	15:18	SHUT	OFF				→	545.995
6	15:38	917	0.26	268, 248	3"	88	0.13	545.994
5 Total	15:42 Minutes	922	0.26	267, 251	Max. 3"	88	0.13 TOTAL	547.462
4	15:46 Average	928	0.26	268, 255	Average "	88	0.13	—
3	15:50	927	0.26	267, 261	3"	89	0.13	548.267
2	15:54	927	0.950	273, 274	6"	89	0.480	549.—
1	~~15:58~~ 15:57	936	2.00	281, 271	8"	89	1.00	~~549.639~~
0	~~[illegible]~~ Shut Down 16:00						→	551.962

6x1
3?
x

(B)

4th pt
no reading
(C)

(E)

(F)

(G) 1,3,4, No Readings!

(G)

(A)

1:00
3
15:57

* * * *

PARTICULATE EMISSIONS

DATA & RESULTS:

Site: ______________

Date: ______________

Run: ______________

Time: ______________

Absorber Type	Contents	Final	Tare	Net H2O
		619.2	536.6	
		575.8	574.6	
liquid trap	empty	416.6	416.5	
	silica gel	738.6	733.4	
			TOTAL	

Filter Sample: Type ______________

Sample Fraction	Final Wt.	Tare Wt.	Net grams	Co, grains/SDCF
		TOTAL		

Gas Composition:

CO2 ________ % volume (dry)
O2 ________ % volume (dry)
CO ________ % volume (dry)
N2 ________ % volume (dry)
H2O ________ % volume

Mw (wet) ______________
Excess Air ______________ %
Sampled Volume ______________ SDCF
Isokinetic Rate ______________ %

Particulate Concentration:

Co ________ grains/SDCF @ ________ °F and 29.92 "Hg
C ________ grains/SDCF @ ______________

Emission Rate:

E.R. ________ lbs/hr @ Qstd(dry) ______________ SDCFM

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PARTICULATE EMISSIONS
TEST MONITOR DATA

Date 7/28/96 Run 3!!
Client MWD
Unit #1
Ambient Temp. 70+ °F
Press.bar ______ in. Hg
Press.static ______ in. H2O
Press.duct ______ in. Hg
Assumed MW ______ %H2O ______

Sample Train Temp.:
Probe 248±25 °F
Filter 248±25 °F
Sample Line ______ °F
Post-Test Leak Check:
Leak Rate .010 CFM
@ 10 in. Hg Vac.

Nozzle & Probe Mat. GLS
Filter Holder Mat. GLS
Filter # ______
Nozzle # ______ i.d. .5 mm
Pitot # 1234 Cp ______
Temp. Unit # 371
Mag. #371 Meter # 996
Orifice ~~%~~ ______

4 min/pt

		Duct Data E/IP			Meter Data			
Trav. Point	Time	Temp. °F	Head Δp	~~Velocity~~ ~~ft/sec~~	Vacuum "Hg	Temp. °F	Orifice ΔH in H2O	Volume CF
(A) 6	17:20	901	1.20	241,273	7"	85	[illegible]	552.523
5	17:24	922	0.95	240,288	6"	85	0.480	554.710
4	17:28	922	0.60	261,287	5"	86	0.3008	556.337
3	17:32	924	0.42	269,272	3"	87	0.2107	557.676
2	17:36	927	1.30	276,248	7"	88	0.658	558.651
1	17:40	930	2.20	266,245	9"	87	1.100	560.550
0	17:44	SHUT	OFF					→ 562.913
(B) 6	17:53	912	0.60	276,244	3"	87	0.304	562.917
5	17:57	924	1.00	269,277	7"	86	0.5007	564.240
4	18:01	923	2.00	271,276	12"	86	1.0021	565.871
3	18:05	927	1.20	270,276	8"	87	0.6010	568.270
2	18:09	930	1.50	272,274	8"	88	0.751	570.123
1	18:13	934	2.60	274,276	13"	89	1.300	572.154
0	18:17	SHUT	OFF					→ 574.765
(C) 6	18:23	912	0.14	279,241	2"	88	.0710	574.866
5	18:27	922	0.52	281,251	4"	86	0.2610	575.397
4	18:31	926	1.60	275,269	10"	86	0.800	576.584
3	18:35	926	1.70	274,271	11"	86	0.850	578.710
2	18:39	929	2.00	275,281	12"	87	1.000	580.960
1	18:43	934	3.00	274,280	15"	89	1.500	583.499
0	18:47	SHUT OFF						→ 586.355
(E) 6	18:51	916	0.36	264,260	3"	89	0.180	586.356
5	18:55	920	0.62	266,267	5"	88	0.31	587.154
4	18:59	923	1.40	264,271	10"	86	0.70	588.416
3	19:03	929	2.00	261,275	12"	85	1.00	590.372
2	19:07	933	2.10	261,273	13"	85	1.04	592.352
1	19:11	935	1.80	266,276		85	0.900	
0	19:15	SHUT	OFF					→ 597.631
(F) 6	19:19	916	0.14	267,240	2"	83	0.070	592.631
5	19:23	921	0.36	269,255	3"	81	0.180	
4	19:27	924	0.85	267,241	5"	81	0.470	
3	19:31	926	1.60	266,244	10"	81	0.710	
2	19:35	932	1.70	265,245	11"	82	0.890	
1	19:39	933	2.20			84	1.090	
0	19:43	SHUT	OFF					→ 607.521
(G) 6						88		
5 Total	Minutes				Max.		TOTAL	
4	Average				Average			
3	19:46	915	1.27			88	0.14	602.524
2	19:50	930	1.20			84	0.60	←
1	19:54	933	2.0			83	1.00	
0	19:58 shut down							→ 613.098

Con't See Shift!!

* * * *

PARTICULATE EMISSIONS

DATA & RESULTS:

Site: ____________________ Run: ____________________

Date: ____________________ Time: ____________________

Absorber Type	Contents	Final	Tare	Net H2O
		612.3	536.6	
		573.3	574.6	
liquid trap	empty	415.8	414.9	
	silica gel	793.3	704.3	
			TOTAL	

Filter Sample: Type ____________________

8
10
10
10

Sample Fraction	Final Wt.	Tare Wt.	Net grams	Co, grains/SDCF
		TOTAL		

Gas Composition:

CO2 ________ % volume (dry)

O2 ________ % volume (dry)

CO ________ % volume (dry)

N2 ________ % volume (dry)

H2O ________ % volume

Mw (wet) ________ %

Excess Air ________ %

Sampled Volume ________ SDCF

Isokinetic Rate ________ %

Particulate Concentration:

Co ________ grains/SDCF @ ________ °F and 29.92 "Hg

C ________ grains/SDCF @ ____________________

Emission Rate:

E.R. ________ lbs/hr @ Qstd(dry) ________ SDCFM