Background Report Reference

AP-42 Section Number: 1.4

Background Chapter: 2

Reference Number: 6

Title: Gas Research Institute/WP Natural Gas @ Boise Cascade Timber and Wood Products Division #2 Package Boiler

Amtest Air Quality, Inc

Amtest Air Quality, Inc

May 1995

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SOURCE
EMISSION
EVALUATION

First Draft Issued: June 22, 1995
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Prepared For:

6

GAS RESEARCH INSTITUTE/WP NATURAL GAS
@ BOISE CASCADE
TIMBER AND WOOD PRODUCTS DIVISION
#2 PACKAGE BOILER
WHITE CITY, OREGON
MAY 2-4, 1995

Submitted by:

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We certify that the information contained herein is accurate and complete to the best of our knowledge.

[jaa\c:\w\r\gri@wp; #95-047]

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1.0 INTRODUCTION

The purpose of this source emission evaluation was to quantify emissions of particulate and condensible matter (PM), sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOC) measured as total hydrocarbons (THC), total non-methane organic carbon (TNMOC), ethane, and methane at the exhaust of a new natural gas-fired package boiler at Boise Cascade Timber and Wood Products Division in White City, Oregon. The #2 Package Boiler is rated at 800 horsepower and is equipped with low-NO_x burners. The Gas Research Institute (GRI) in Chicago, Illinois contracted Am Test-Air Quality, Inc. based in Preston, Washington to perform these source tests. This project was coordinated by WP Natural Gas (WPNG) in Medford, Oregon. The purpose of these tests was to provide data to help establish new emission factors for modern natural gas-fired boilers.

Testing and analysis procedures used for this project are presented in the July 1, 1994 edition of the Environmental Protection Agency (EPA) document Title 40, Code of Federal Regulations, Part 60 (40 CFR 60), Appendix A, Methods 1, 2, 3A, 4, 5, 6C, 7E, 10, and 25A; in the July 1, 1994 edition of Title 40 CFR Parts 1-51 (40 CFR 51), Appendix M, Method 202; and in the EPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Method TO-12 titled "Method for the Determination of Non-Methane Organic Compounds (NMOC) in Ambient Air Using Cryogenic Preconcentration and Direct Flame Ionization Detection (PDFID)." Methods 1 and 2 were performed to measure the gas velocity and temperature for calculating the volumetric flow rate. Method 3A was performed to determine the molecular weight of the gas based on measurements of oxygen (O_2) and carbon dioxide (CO_2). Method 4 was performed to measure the moisture content of the stack gas.

Method 5 was performed to quantify the total particulate matter emissions. The back-half portion of the Method 5 sample train was analyzed to quantify condensible particulate matter (CPM) emissions using EPA Method 202 procedures. Method 6C was performed to measure the parts per million (ppm) of sulfur dioxide (SO_2) using an ultraviolet analyzer. Method 7E was performed to measure the ppm of nitrogen oxides (NO_x) using a chemiluminescent analyzer. Method 10 was performed to measure the ppm of carbon monoxide (CO) using a gas filter correlation non-dispersive infrared analyzer (NDIR). Method 25A was performed to measure the ppm of volatile organic compounds (VOC) measured as total hydrocarbons (THC), as propane, using a flame ionization analyzer (FIA). During each Method 5 test, integrated samples of the stack gas were collected in Tedlar® bags for total non-methane organic carbon (TNMOC), ethane, and methane analysis. Compendium Method TO-12 was used to quantify TNMOC emissions and a gas chromatograph equipped with a flame ionization detector (GC-FID) was used to quantify ethane and methane emissions.

Three (3) 8-hour particulate matter tests were performed at the #2 Package Boiler stack over a 3-day period (1 test per day). The boiler operated at steam production rates of 23,800 pounds per hour (lb/hr), 23,700 lb/hr, and 22,900 lb/hr on May 2, 3, and 4, 1995, respectively. Due to the low sulfur content of the natural gas, WP Natural Gas determined that it was unnecessary to correct back-half CPM emissions for sulfate content. Gaseous emissions tests were performed during the times when particulate matter tests were being performed.

Mr. Douglas M. Albertson and Mr. Aaron C. Porter of Am Test-Air Quality, Inc. conducted the field sampling and in-field sample recovery. Ms. Stacy Akin and Ms. Jeanne Thompson performed the gravimetric analysis and the Method 202 titrations in the Am Test-Air Quality laboratory. Mr. Kris A. Hansen, Ms. Angela F. Blaisdell, Ms. Judy

A. Aasland, Ms. Annika Woehr, and Ms. Sara E. Prescott performed data reduction, quality assurance review, and report preparation. CH2M Hill's Corvallis Applied Sciences Laboratory in Corvallis, Oregon analyzed the TO-12 and GC-FID samples for this project. Mr. Chuck Gates of WP Natural Gas, Dr. Rob Meyer of the Gas Research Institute, and Mr. Bob Morris of Boise Cascade's Timber and Wood Products Division coordinated this project. Mr. Richard Cole of WP Natural Gas manually logged the natural gas usage data during the emissions tests. Mr. Kenan C. Smith of the State of Oregon Department of Environmental Quality (ODEQ) in Medford, Oregon; Mr. Mark Ludwiczak of Radian Corporation in Sacramento, California (representing EPA); and Mr. Kris Ransom of WP Natural Gas were on-site during the emissions tests.

2.0
SUMMARY OF RESULTS

The following subsections of this report present the results from the emissions tests performed on May 2-4, 1995 at the #2 Package Boiler stack. Refer to the Table of Contents to locate specific information for each test method. The summary tables in this section contain information obtained from computer printouts of results for each individual run which are included in Appendix A of this report. Appendix B of this report contains the laboratory analysis data. Appendix C of this report contains example calculations of results and copies of the original field data sheets. Appendix D of this report contains WP Natural Gas process information and fuel usage data collected during the emissions tests. Appendix E of this report contains miscellaneous supporting information. Sampling deviations and/or process difficulties are discussed in Section 3.0 of this report titled "Project Overview/Exceptions."

2.1 EPA Method 5 - Total Particulate Matter

Three (3) 460 to 480-minute Method 1, 2, 3A, 4, and 5 tests were performed at the #2 Package Boiler stack on May 2-4, 1995 to quantify particulate and condensible matter emissions. The boiler operated at steam production rates of 23,800 pounds per hour (lb/hr), 23,700 lb/hr, and 22,900 lb/hr on May 2, 3, and 4, 1995, respectively. Particulate and condensible matter emissions are summarized on the following computer printout titled "Summary of Results - Methods 1, 2, 3A, 4, and 5.

The particulate matter emission concentration (front-half, back-half and total) is presented in units of grains per dry standard cubic foot (gr/dscf) uncorrected and corrected to 3% oxygen (O_2). The total particulate matter emission concentration is also presented in milligrams per dry standard cubic meter (mg/dscm). Front-half, back-half, and total particulate matter emission rates are presented in units of pounds per hour (lb/hr). Front-half, back-half, and total particulate matter emission factors are presented in units of pounds of particulate matter per million standard cubic feet of gas fired (lb/MMscf).

AMTEST AIR QUALITY, INC.

SUMMARY OF RESULTS - METHODS 1, 2, 3A, 4 AND 5
AM TEST - AIR QUALITY, INC.

FILE NAME: Y510\GRIM5SUM
CLIENT: GRI/WP Natural Gas @ Boise Cascade Corporation
LOCATION: White City, Oregon

#2 Package Boiler

	RUN #1	RUN #2	RUN #3	AVERAGE
LAB #:	8131	8132	8133	
DATE:	5/2/95	5/3/95	5/4/95	
START TIME:	1030	0803	0800	
STOP TIME:	1836	1607	1606	
SAMPLE LENGTH (minutes):	480.0	480.0	454.8	
STEAM PRODUCTION RATE (lb/hr):	23800	23700	22900	23467
NATURAL GAS USAGE (scf/hr):	30658	33259	29837	31251
VOLUME SAMPLED (cubic feet):	190.469	193.763	181.716	188.649
VOLUME SAMPLED (dry std. cubic feet):	181.463	184.574	175.756	180.598
VOLUME SAMPLED (dry std. cubic meters):	5.139	5.227	4.978	5.115
STACK GAS MOISTURE (percent):	16.73	16.69	16.91	16.78
BAROMETRIC PRESSURE (inches of Hg):	28.70	28.75	28.65	28.70
STATIC PRESSURE (inches of H2O):	-0.35	-0.36	-0.35	-0.35
STACK PRESSURE (inches of Hg):	28.67	28.72	28.62	28.67
STACK TEMPERATURE (degrees F.):	276.3	278.7	278.4	277.8
STACK TEMPERATURE (degrees R.):	736.3	738.7	738.4	737.8
CARBON DIOXIDE (percent):	10.1	10.2	10.2	10.2
OXYGEN (percent):	3.3	3.3	3.0	3.2
CARBON MONOXIDE (ppm):	1.8	4.4	3.0	3.1
MOLECULAR WEIGHT (dry, g/g-mole):	29.75	29.76	29.75	29.75
MOLECULAR WEIGHT (wet, g/g-mole):	27.78	27.80	27.76	27.78
AVERAGE VELOCITY HEAD (inches of H2O):	0.584	0.624	0.635	0.614
PITOT TUBE Cp:	0.84	0.84	0.84	
STACK GAS VELOCITY (feet per second):	52.7	54.6	55.2	54.2
STACK DIAMETER (inches):	24.0	24.0	24.0	
STACK AREA (square feet):	3.14	3.14	3.14	
AIRFLOW (dry std. cubic feet per min.):	5689	5879	5909	5826
AIRFLOW (actual cubic feet per min.):	9943	10284	10397	10208
NOZZLE DIAMETER (inches):	0.194	0.194	0.194	
ISOKINETICS (percent):	102	100	100	

PARTICULATE MATTER EMISSION RESULTS

	RUN #1	RUN #2	RUN #3	AVERAGE
FRONT-HALF PARTICULATE MATTER EMISSION CONC. (gr/dscf):	0.0008	0.0002	0.0001	0.0004
BACK-HALF PARTICULATE MATTER EMISSION CONC. (gr/dscf):	0.0006	0.0002	0.0005	0.0004
TOTAL PARTICULATE EMISSION CONCENTRATION (gr/dscf):	0.0014	0.0003	0.0007	0.0008
TOTAL PARTICULATE EMISSION CONCENTRATION (gr/dscf @ 3% O2):	0.0014	0.0003	0.0007	0.0008
TOTAL PARTICULATE EMISSION CONCENTRATION (mg/dscm):	3.15	0.783	1.52	1.82
FRONT-HALF PARTICULATE EMISSION RATE (lb/hr):	0.038	0.008	0.006	0.017
BACK-HALF PARTICULATE EMISSION RATE (lb/hr):	0.029	0.009	0.028	0.022
TOTAL PARTICULATE EMISSION RATE (lb/hr):	0.067	0.017	0.034	0.039
FRONT-HALF PARTICULATE EMISSION FACTOR (lb/MMscf):	1.24	0.24	0.20	0.56
BACK-HALF PARTICULATE EMISSION FACTOR (lb/MMscf):	0.95	0.27	0.94	0.72
TOTAL PARTICULATE EMISSION FACTOR (lb/MMscf):	2.19	0.51	1.14	1.28

2.2 EPA Method 3A, 6C, 7E, 10 and 25A - Sulfur Dioxide, Nitrogen Oxides, Carbon Monoxide, and Total Hydrocarbons

Six (6) 60 to 300-minute Method 3A, 6C, 7E, 10, and 25A tests were performed on May 2-4, 1995 at the #2 Package Boiler Stack to quantify concentrations of carbon dioxide (CO_2) and oxygen (O_2) for molecular weight calculations and emission concentrations of sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), and volatile organic compounds (VOC) measured as total hydrocarbons (THC). Two (2) runs were performed each day. The alpha-numeric designation (1A, 1B, 2A, 2B, 3A, and 3B) was not established on the field data sheets, but is presented on the summary table for clarification. Airflow data obtained from the Method 5 tests were utilized to calculate emission rates in units of pounds per hour (lb/hr). The boiler operated at steam production rates of 23,800 pounds per hour (lb/hr), 23,700 lb/hr, and 22,900 lb/hr on May 2, 3, and 4, 1995, respectively. SO_2, NO_x, CO, and THC emission concentrations and emission rates are summarized on the following computer printout titled "Summary of Results - Methods 3A, 6C, 7E, 10, and 25A."

Emission concentrations of O_2, CO_2, SO_2, NO_x, and CO were measured continuously on a dry basis in units of percent (%) or parts per million (ppm) using instrumental reference methods. Emission concentrations of total hydrocarbons (THC) were measured continuously on a hot, wet basis in units of ppm using an instrumental reference method. Data from the instruments were recorded once per minute. The data were averaged and the average values were bias-corrected for calibration drift. Moisture data from the concurrent Method 5 test periods were utilized to convert the wet ppm THC data to a dry basis. Emission rates are reported in units of lb/hr and/or pounds of pollutant per million Btu (lb/MMBtu). Emission factors are presented in units of pounds of pollutant per million standard cubic feet of gas fired (lb/MMscf). Copies of the bias-corrected averages for each Method 3A, 6C, 7E, 10, and 25A are included in Appendix A of this report in printouts titled "Calibration Summary - Gaseous Emission Monitors."

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AIR QUALITY, INC.

SUMMARY OF RESULTS - METHODS 3A, 6C, 7E, 10 AND 25A
AM TEST-AIR QUALITY, INC.

FILE NAME: Y510\GRIGASSM
CLIENT: GRI/WP Natural Gas @ Boise Cascade Corporation
LOCATION: White City, Oregon

#2 Package Boiler

	RUN #1A	RUN #1B	RUN #2A	RUN #2B	RUN #3A	RUN #3B	AVERAGE
DATE:	5/2/95	5/2/95	5/3/95	5/3/95	5/4/95	5/4/95	
START TIME:	1030	1458	0811	1239	0800	1229	
STOP TIME:	1430	1958	1211	1640	1200	1607	
SAMPLE LENGTH (minutes):	240.0	300.0	240.0	241.0	240.0	218.0	
STEAM PRODUCTION RATE (lb/hr):	23800	23800	23700	23700	22900	22900	23467
NATURAL GAS USAGE (scf/hr):	30658	30658	33259	33259	29837	29837	31251
AIRFLOW (dry std. cubic feet per min.):	5689	5689	5879	5879	5909	5909	5826
AVERAGE STACK GAS MOISTURE (%):	16.73	16.73	16.69	16.69	16.91	16.91	16.78
Bws:	0.1673	0.1673	0.1669	0.1669	0.1691	0.1691	0.1678
OXYGEN (percent):	3.2	3.3	3.3	3.2	3.0	3.0	3.2
METHOD 19 FUEL FACTOR:	8546	8546	8546	8546	8546	8546	8546
METHOD 6C - SULFUR DIOXIDE (SO2)							
SO2 EMISSION CONCENTRATION (ppm):	1.5	0.6	0.7	0.5	1.3	0.6	0.9
SO2 EMISSION CONCENTRATION (ppm @ 3% O2):	1.5	0.6	0.7	0.5	1.3	0.6	0.9
SO2 EMISSION RATE (lb/hr):	0.085	0.034	0.041	0.029	0.077	0.035	0.050
SO2 EMISSION RATE (lb/MMBtu):	0.0025	0.0010	0.0012	0.0008	0.0022	0.0010	0.0014
SO2 EMISSION FACTOR (lb/MMscf):	2.77	1.11	1.23	0.88	2.56	1.18	1.62
METHOD 7E - NITROGEN OXIDES (NOx)							
NOx EMISSION CONCENTRATION (ppm):	32.7	31.6	31.0	32.0	30.6	30.1	31.3
NOx EMISSION CONCENTRATION (ppm @ 3% O2):	33.1	32.1	31.5	32.4	30.6	30.1	31.6
NOx EMISSION RATE (lb/hr):	1.33	1.29	1.31	1.35	1.30	1.27	1.31
NOx EMISSION RATE (lb/MMBtu):	0.0394	0.0383	0.0376	0.0386	0.0365	0.0359	0.0377
NOx EMISSION FACTOR (lb/MMscf):	43.47	42.01	39.26	40.53	43.42	42.71	41.90
METHOD 10 - CARBON MONOXIDE (CO)							
CO EMISSION CONCENTRATION (ppm):	2.0	1.6	5.9	2.9	3.1	2.9	3.1
CO EMISSION CONCENTRATION (ppm @ 3% O2):	2.0	1.6	6.0	2.9	3.1	2.9	3.1
CO EMISSION RATE (lb/hr):	0.050	0.040	0.151	0.074	0.080	0.075	0.078
CO EMISSION FACTOR (lb/MMscf):	1.62	1.30	4.55	2.24	2.68	2.51	2.48
METHOD 25A - TOTAL HYDROCARBONS (THC) (as Propane)							
THC EMISSION CONCENTRATION (ppm, wet):	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	~ 0.1
THC EMISSION CONCENTRATION (ppm, dry):	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	~ 0.1
THC EMISSION CONCENTRATION (ppm @ 3% O2):	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	~ 0.1
THC EMISSION RATE (lb/hr):	< 0.005	0.005	< 0.005	< 0.005	< 0.005	< 0.005	~ 0.005
THC EMISSION FACTOR (lb/MMscf):	< 0.15	< 0.15	< 0.15	< 0.15	< 0.16	< 0.16	~0.15

< = less than the detection limit of the instrument

2.3 Total Non-Methane Organic Carbon, Ethane, and Methane

During each Method 5 test period, two (2) integrated samples of the stack gas were collected in Tedlar® bags for total non-methane organic carbon (TNMOC), ethane, and methane analysis. Airflow data obtained from the Method 5 tests were utilized to calculate TNMOC, ethane, and methane emission rates in units of pounds per hour (lb/hr). Natural gas fuel usage data obtained from WP Natural Gas were utilized to calculate emission factors in units of pounds per million standard cubic feet of gas fired (lb/MMscf). TNMOC, ethane, and methane emission rates and emission factors are summarized in the table below and on the computer printout titled "Emission Results TO-12 Total Non-Methane Organic Carbon, Ethane, and Methane by GC-FID located in Appendix A of this report.

Sample Run #	Total Non-Methane Organic Carbon Emission Rate (lb/hr)	TNMOC Emission Factor (lb/MMscf)	Ethane Emission Rate (lb/hr)	Ethane Emission Factor (lb/MMscf)	Methane Emission Rate (lb/hr)	Methane Emission Factor (lb/MMscf)
1	0.026	0.84	< 0.126	< 4.12	< 0.142	< 4.63
2	0.028	0.83	< 0.130	< 3.92	< 0.147	< 4.41
3	0.031	1.03	< 0.131	< 4.40	< 0.148	< 4.95
Average	0.028	0.90	< 0.129	< 4.15	< 0.145	< 4.66

3.0
PROJECT OVERVIEW/EXCEPTIONS

During run 1 on May 2, 1995 of the Method 5 emissions tests, it was discovered that one (1) feed water pump had failed, and that the remaining feed water pump could only supply approximately 95% of full load rating. For runs 2 and 3 of the Method 5 emissions tests, 100% full load rating was achieved by repairing and installing an alternate pump.

Due to a boiler outage, run 3 of the Method 5 emissions tests was 454.8 minutes in duration. Since point #S-12 was not sampled, the gas volume collected for the run was slightly less than during runs 1 and 2. The overall impact on the data is considered minimal because of the uniform flow profile and comparable results between the three (3) test periods.

An acceptable leak check of less than 0.02 cfm at the highest vacuum rate (or greater) used during the test preceded and followed each Method 5 run. The average percentage isokinetics for each Method 5 run were within the acceptable limits of 100 $\pm$ 10%.

The post-test nitrogen purge discussed in Method 202 was not performed for this project because SO_2 emissions were very low. Since the pH of the impinger solutions was low (between 3.2 and 3.3), the back-half portion of the Method 5 sample train was analyzed to quantify condensible particulate matter (CPM) emissions using EPA Method 202 procedures. Due to the low sulfur content of the natural gas, WP Natural Gas determined that it was unnecessary to correct back-half CPM emissions for sulfate content. Copies of the Method 202 titration laboratory data are included in Appendix C of this report for informational purposes only.

Mr. Keenan Smith of ODEQ requested that Am Test process trip blank and field blanks along with the Method 5 samples. Trip (reagent) blank gravimetric laboratory data were utilized to blank-correct particulate matter emissions data. A Method 5 field blank sample was collected on-site for gravimetric analysis in the Am Test laboratory. Field blank data were reduced using average Method 5 data and are presented on a computer printout included in Appendix A of this report. Copies of the gravimetric laboratory analysis results for blank samples are included in Appendix C of this report.

Per Mr. Mark Ludwiczak of Radian Corporation's in-field request, Am Test lowered the range of the NO_x and CO analyzers to 0-100 ppm for runs 2 and 3. Run 1 was performed with the NO_x analyzer set to a range of 0-200 ppm NO_x, and the CO analyzer was set to a range of 0-500 ppm CO. Emissions results were summarized by load condition, with only runs performed at the same condition being averaged together. The range of the SO_2 analyzer was 0-1,000 ppm during all three (3) runs. Ideally, the analyzer should have been calibrated and operated on a lower range since SO_2 emissions were expected to be low. The linearity of the analyzer was checked at 0, 89.7 and 212 ppm. Fuel gas sulfur laboratory analysis data should be used to calculate SO_2 emissions from this source.

The S-type pitot tube used for this project was newly constructed to meet the exact Method 2 specifications which allows $C_p = 0.84$. The pitot calibration was performed post-test on July 14, 1995.

During run #3B on May 4, 1995 of the gaseous emissions testing, 1-minute data data collected during 1534-1547 were deleted from the run due to boiler outage.

4.0

SOURCE OPERATION

The #2 Package Boiler at Boise Cascade Timber and Wood Products Division facility is used to generate process steam for the drying kilns. The Cleaver-Brooks, Model No. CB1 700-800 boiler (serial no. L-93181) is rated at 800 horsepower and is equipped with low-NO_x burners. The maximum fuel firing rate for this boiler is 33,476,000 MMBtu. The Gas Research Institute (GRI) in Chicago, Illinois contracted Am Test-Air Quality, Inc. based in Preston, Washington to perform these source tests. This project was coordinated by WP Natural Gas (WPNG) in Medford, Oregon. The purpose of these tests was to gather data to help establish new emission factors for modern natural gas-fired boilers. A "Source and Process Information" sheet completed by Am Test personnel is included in the appendices of this report along with process data provided by WP Natural Gas.

5.0
SAMPLING AND ANALYSIS PROCEDURES

5.1 EPA Methods 1 and 2 - Velocity, Temperature, and Airflow

EPA Method 1 procedures were used to assure that representative measurements of volumetric flow rate were obtained by dividing the cross-section of the stack or duct into a number of equal areas, and then locating a traverse point within each of the equal areas. Refer to the "Stack Schematic and Location of Sample Points" data sheet and/or the figure titled, "Location of Sampling Ports and Traverse Points", located in the appendices of this report, for a schematic of the stack and the point locations selected for testing. Method 2 was performed to measure the stack gas velocity using a type S or a standard pitot tube, and the gas temperature using a calibrated thermocouple probe connected to a digital thermocouple indicator. The type S pitot tubes were connected with tubing to an oil-filled inclined manometer, magnehelic gauges or a Shortridge® Instruments, Inc. Airdata Multimeter ADM-850 which is special low flow pressure measurement device to obtain velocity measurements. The pitot tube lines were leak-checked and the pressure measurement device was leveled and zeroed prior to use. Calibration information for each pressure and temperature measurement device used are included in the appendices of this report.

5.2 EPA Method 3A - Molecular Weight

The stack gas composition was determined using EPA Method 3A procedures, which allow the use of instrumental analyzers. A paramagnetic or electrochemical analyzer was used to measure the percent (%) oxygen (O_2), and a non-dispersive infrared (NDIR) analyzer was used to measure the % carbon dioxide (CO_2). The manufacturer and model number for the specific analyzers used are detailed on the "Continuous Analyzer Checklist" in the appendices of this report. Certified O_2 and CO_2 gases were utilized to check the calibration of the instruments after each test. The O_2 and CO_2 data were used to calculate the molecular weight of the stack gas.

The Method 3A sample system is illustrated in the figure titled "EPA Method 3A, 6C, 7E, and 10 Sample Train" in the appendices of this report. Also included in the appendices are specifications for the analyzers used along with copies of the certificates of analysis for the calibration gases used. An effluent gas sample was drawn through a stainless steel sampling probe and out-of-stack filter which were sufficiently heated to prevent condensation. A calibration valve was connected to the inlet of the probe for the purpose of introducing calibration gas to flood the probe. The gas sample passed through a refrigerator type moisture removal system which continuously removed condensate from the sample gas. A Teflon sample line was used to transport the gas sample to the continuous monitoring system. A Teflon coated leak-free pump was utilized to pull the sample gas through the system at a flow rate sufficient to minimize the response time of the measurement system. A sample flow rate control valve and rotameter were used to maintain a constant sampling rate within 10 percent. Data from the instruments were recorded once per minute using a data acquisition system.

The combustion gas measurement system was assembled on-site, calibration gases were introduced, and adjustments were made to calibrate the instrument. The sampling system components were adjusted to achieve appropriate sampling rates. Sampling was continuous, with a calibration check (calibrated upstream of the analyzers) at the end of every test run and a sampling system bias check (calibrated through the probe) at the end of every three (3) runs (maximum).

5.3 EPA Method 4 - Moisture

The percent moisture in the gas stream was quantified by weighing the impingers to 0.1 grams before and after each Method 5 test using a digital top-loading balance. The net weight (final minus initial) was used to calculate the amount of moisture condensed from the known volume of stack gas collected.

5.4 EPA Method 5/202 - Particulate and Condensible Matter

The sample train used for collecting particulate matter samples was an EPA Method 5 design as illustrated in the figure titled "Method 5 Sample Train" in the appendices of this report. The "Sample Train Information Sheet" (also in the appendices) details the type of nozzle, probe, probe liner and filter used along with the contents of the sample train impingers. The gas is drawn from the stack through a nozzle and heated probe liner, through a pre-tared front-half filter, and into a Method 5 impinger train for collecting condensible particulate matter. A stainless steel probe sheath with a heated quartz probe liner was used to draw gas from the filter to the impinger train. The probe was equipped with type S pitot tubes for measuring gas velocity and a thermocouple sensor for measuring stack gas temperature. The thermocouple sensor was connected to a digital thermocouple indicator which was used to measure the stack gas temperature at each sample point. The temperature of the probe liner was monitored to assure that condensation did not occur within the probe liner. The nozzle, probe liner and filter are often referred to as the "front-half" of the sample train. Following the filter was a probe and condenser (impinger) section which, by convention, is referred to as the "back-half." The impinger section was maintained at a temperature below 68° F by keeping ice on the impingers. The temperature at the outlet of the silica gel bubbler was monitored to verify that it did not exceed 68° F during a test. Note: Some subparts or methods specify alternate temperatures for the probe liner, filter holder box and impinger ice bath. The "Sample Train Information Sheet" details any exceptions.

The sample train was connected to a control box by means of an umbilical cord which contained a vacuum hose, pitot lines, thermocouple wires, and a 4-wire electrical cord. The control box (meter box) was used to monitor stack conditions and to facilitate isokinetic sampling. The control box consists of a leak-free pump used to pull the stack gas through the sample train, fine and coarse metering valves to control the sampling rate, a vacuum gauge which measures the pressure drop from the sampling nozzle to the metering valves, and a calibrated dry gas meter readable to 0.001 cubic feet. The dry gas meter inlet and outlet temperatures were monitored by thermocouples which were connected to a multichannel thermocouple indicator. The dry gas meter calibration factor, Y, was determined by calibrating the meter against a wet test meter or calibrated dry gas meter. At the outlet of the dry gas meter was a calibrated orifice which was used to monitor the flow of gas through the metering system to assure that samples were collected isokinetically. The pressure drop across the orifice was monitored at each sample point. The pitot tubes utilized to measure stack gas velocity were connected to the control box via the umbilical cord. The control box contained either low and high range magnehelic gauges or an incline manometer, which were used for the velocity measurement.

Stack condition measurements were made prior to collecting a sample, including measurements of velocity, temperature and a check for cyclonic flow in the stack. A sample nozzle was selected and isokinetic operating parameters were established utilizing a Hewlett-Packard programmable calculator. The sampling nozzle, probe and prefilter connective glassware were cleaned and rinsed with dichloromethane prior to use. The sample train was assembled and determined to be leak free following the procedures outlined in Method 5. The sample nozzle was positioned in the stack at the first sample point. The sample pump was turned on, and the gas sampling rate was adjusted for isokinetic sampling. The front-half of the sample train was recovered with acetone per EPA Method 5 procedures and the particulate matter was quantified gravimetrically after evaporation of the acetone. The back-half of the sample train was recovered per EPA Method 202.

To perform the Method 202 back-half analysis, the impinger solutions were recovered into a graduated cylinder. The impingers were rinsed with deionized water and the rinses were combined with the contents of the graduated cylinder and the final volume was recorded. The condensible matter was quantified in the Am Test laboratory by performing a solvent extraction using a separatory funnel on the remaining impinger solution. The impingers were given a final rinse with 75 mL of CH_2Cl_2, which was collected in a glass sample container for later use in the first extraction. Two (2) additional 75 mL portions of CH_2Cl_2 were used for a total of three (3) 75 mL extractions. The organic layer was transferred to a tared 150 mL beaker and this beaker's contents were allowed to evaporate in an evaporation chamber at ambient temperature to dryness, the beakers were desiccated, then weighed to a constant weight. The water layer was transferred to a tared 150 mL beaker with glass boiling beads and this beaker's contents were heated on a hot plate to boiling until approximately 50 milliliters remained in the beaker. The remaining 50 milliliters in the beaker were evaporated to dryness in an oven at 105^{o} C. The dried residue from the water layer for each sample was redissolved in 100 mL deionized water (DI H_2O). The solution was titrated with 0.1 N ammonium hydroxide (NH_4OH) to a PH of approximately 7.0 and the evaporation step was repeated. Sulfuric acid (H_2SO_4) present in the condensible particulate matter is hydroscopic, which creates an erroneous particulate weight. The ammonium reacts with the H_2SO_4 in an acid-base reaction which occurs during the titration procedure allowing a more accurate weight of condensible particulate matter to be obtained. Sample blanks containing DI water and CH_2Cl_2 were analyzed in an identical fashion as the representative "section." All beakers were desiccated for at least 24 hours and weighed to constant weights of $\pm$0.5 milligrams after their contents had evaporated. The total particulate matter weight is the sum of the net weights of the particulate matter found on the filter plus the net weights found in the beakers containing sample, minus the weight of the NH_4^+ added minus the acetone, water and methylene chloride blank concentrations. Method 202 allows a correction only of the ammonium added during the titration procedure. The mass of $SO_4^=$ was calculated based on the known amount of NH_4^+ added and the sulfate corrected particulate matter results are shown on the individual computer printouts. The $SO_4^=$ corrected particulate matter weight is the final net weight minus the net weight of the $SO_4^=$ calculated by titration. EXCEPTION: Due to the low sulfur content of the natural gas, WP Natural Gas determined that it was unnecessary to correct back-half CPM emissions for sulfate content.

5.5 EPA Method 6C - Sulfur Dioxide (SO_2)

Sulfur dioxide (SO_2) data were collected using Method 6C, which is an instrumental method. A gas sample was continuously extracted from the stack and passed through an ultraviolet analyzer which measures the parts per million (ppm) SO_2 on a dry basis. The manufacturer and model number for the specific analyzers used are detailed on the "Continuous Analyzer Checklist" in the appendices of this report. Measurements from the instrument were recorded once per minute.

The Method 6C sample system is illustrated in the figure titled "EPA Method 3A, 6C, 7E, and 10 Sample Train" in the appendices of this report. An effluent gas sample was drawn through the same sample conditioning system described for Method 3A testing. A linearity check was performed prior to sampling using zero, mid-range and high-range span gas. Sampling was continuous, with a calibration check using zero and span gas after each run.

5.6 EPA Method 7E - Nitrogen Oxides (NO_x)

Nitrogen oxides (NO_X) data were collected using Method 7E, which is an instrumental method. A gas sample was continuously extracted from the stack and passed through a chemiluminescent analyzer which measures the parts per million (ppm) NO_X on a dry basis. The manufacturer and model number for the specific analyzers used are detailed on the "Continuous Analyzer Checklist" in the appendices of this report. Measurements from the instrument were recorded once per minute.

The Method 7E sample system is illustrated in the figure titled "EPA Method 3A, 6C, 7E, and 10 Sample Train" in the appendices of this report. An effluent gas sample was drawn through the same sample conditioning system described for Method 3A testing. A linearity check was performed prior to sampling using zero, mid-range and high-range span gas. Sampling was continuous, with a calibration check using zero and span gas after each run.

5.7 EPA Method 10 - Carbon Monoxide (CO)

Carbon monoxide (CO) data were collected using Method 10, which is an instrumental method. A gas sample was continuously extracted from the stack and passed through a gas filter correlation non-dispersive infrared (NDIR) analyzer which measures the parts per million (ppm) CO on a dry basis. The manufacturer and model number for the specific analyzers used are detailed on the "Continuous Analyzer Checklist" in the appendices of this report. Measurements from the instrument were recorded once per minute.

The Method 10 sample system is illustrated in the figure titled "EPA Method 3A, 6C, 7E, and 10 Sample Train" in the appendices of this report. An effluent gas sample was drawn through the same sample conditioning system described for Method 3A testing. +A linearity check was performed prior to sampling using zero, mid-range and high-range span gas. Sampling was continuous, with a calibration check using zero and span gas after each run.

5.8 EPA Method 25A - Total Hydrocarbons (THC)

To quantify emissions of volatile organic compounds (VOC), a portion of the stack gas was continuously extracted and passed through a Method 25A total hydrocarbon (THC) analyzer. The stack gas was drawn from the stack through a heated stainless steel probe, an out-of-stack heated filter, and a heated teflon-lined sample line with the temperature maintained above 150° C. The stack gas was analyzed for total hydrocarbons (THC), using a total hydrocarbon flame ionization analyzer (FIA). The manufacturer and model number for the specific analyzers used are detailed on the "Continuous Analyzer Checklist" in the appendices of this report. The instrument maintains a constant internal temperature of 160° C. Copies of the specifications for this instrument are included in the appendices of this report. The analyzer was calibrated with standard EPA Protocol 1 propane gases, and propane concentrations were reported on a wet parts per million basis. Moisture data collected during each test period were used to convert the wet ppm data to a dry basis. Measurements from the instrument were digitally recorded once per minute. Sampling was continuous, with a calibration check using zero and span gas after each run.

5.9 Total Non-Methane Organic Carbon (TNMOC), Ethane and Methane

Emissions of total non-methane organic carbon (TNMOC) were quantified using Compendium Method TO-12. This is an ambient air sampling method included in the EPA document Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. The integrated samples were collected in Tedlar® bags and analyzed for TNMOC using a gas chromatograph equipped with a flame ionization detector (FID). A sample from the integrated bag is cryogenically trapped in liquid argon and then purged with helium. The helium purge removes nitrogen, oxygen, carbon dioxide, carbon monoxide, and methane from the sample.

Each bag was labeled with an identification tag before it was returned to the contract laboratory for analysis. Upon return receipt of the canisters by the contract laboratory, the pressure of each bag was checked by attaching a pressure gauge to the canister inlet and opening the valve briefly to note the pressure. The sample bag was connected to the inlet of the GC-MS-SCAN analytical system. A mass flow controller was placed on the bag and the valve was opened. Following preliminary flushing, the bag flow was vented past a tee inlet to the analytical system. The sample was preconcentrated in a cryogenic trap, then the trapped analytes were thermally desorbed onto the head of the column to be separated and scanned. Primary identification is based on retention time and relative abundance of eluting ions as compared to the spectral library stored on the hard disk of the GC-MS data system. The concentration of each compound was calculated using the previously established response factors. TNMOC emissions were reported as propane equivalent. A gas chromatograph equipped with a flame ionization detector (GC-FID) was used to quantify ethane and methane emissions.

6.0
QUALITY ASSURANCE PLAN

The purpose of the quality assurance plan is to provide guidelines for achieving quality control in air pollution measurements. The detailed procedures which are utilized are included in the Environmental Protection Agency's (EPA's) reference manual titled Quality Assurance Handbook for Air Pollution Measurement Systems, Volume 3, EPA-600/4-77-027b. These procedures are followed throughout equipment preparation, field sampling, sample recovery, analysis and data reduction. Am Test-Air Quality, Inc.'s quality assurance procedures are discussed below.

6.1 Calibration Procedures and Frequency

Field equipment utilized for on-site measurements is calibrated at a frequency recommended by the equipment manufacturer or industry practice. Prior to field use, each instrument is calibrated and the calibration value is recorded. If any measuring or test device requiring calibration cannot immediately be removed from service, the Project Manager may extend the calibration cycle providing a review of the equipment's history warrants the issuance of an extension. No equipment will be extended more than twice a calibration cycle, nor will the extension exceed one-half the prescribed calibration cycle. Test equipment consistently found to be out of calibration will be repaired or replaced.

The sample nozzles used to collect isokinetic samples are calibrated on-site before sampling using digital inside calipers readable to 0.001 inch. Three (3) measurements were taken at varying points around the inside of the nozzle tip and averaged. The dry gas meters used to accurately measure sample volumes are calibrated using a standard laboratory dry gas meter. The type S pitot tubes utilized for velocity determination are calibrated using Method 2, Section 4.1, and are inspected regularly for wear. The magnehelic gauges used for pressure measurements are checked against an oil-filled manometer. The digital thermocouple indicators used for temperature measurement have a readability of 1 degree Fahrenheit and are periodically re-certified by the manufacturer. Each thermocouple probe used to monitor temperature is checked periodically at three (3) temperature settings. Copies of calibration information for each measurement device used are included in the appendices of this report. A barometer readable to 0.01 inches of mercury is used in the field to obtain barometric pressure readings. Barometers are checked routinely against a mercury barometer in Am Test's laboratory.

The gaseous measurement systems are capable of meeting the system performance specifications detailed in 40 CFR 60, Appendix A, Method 6C, Section 4. For meeting these specifications, the analyzer's calibration error must be less than ± 2 percent of the span for the zero, mid-range, and high-range calibration gases. The sampling system bias must be less than $\pm 5\%$ of the span for the zero, and mid- or high-range calibration gases. The zero drift must be less than $\pm 3\%$ of the span over the period of each run. The calibration drift must be less than $\pm 3\%$ of the span over the period of each run. Copies of the certificates of analysis for each tank of calibration gas used are included in the appendices of this report. The calibration gases were analyzed following the EPA Traceability Protocol Number 1, or next best available. Purified nitrogen was utilized for the zero gas.

All reagents used for this project conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, or are the best available grade. In the laboratory, reagent and filter blanks are carried throughout the gravimetric analysis procedures. The samples are weighed to constant weights of ± 0.5 milligrams following desiccation in a cabinet desiccator. The desiccators contain electronic dehumidifiers which automatically maintain the humidity inside the desiccators. The dehumidifiers automatically recharge the internal desiccant every 5.5 hours. An Airguide humidity indicator accurate to $\pm 1\%$ is used to check the humidity inside each desiccator when obtaining tare and final weights. A small container of indicating silica gel is placed in the desiccators to maintain the desired humidity. The Mettler AE163 electronic balance used to obtain weights is set to a time integrating mode (100,000 readings per minute) with a readability of 0.01 milligrams. The balance is calibrated prior to every weighing session and an audit is performed with class S weights once a week. The calibration of Am Test's Mettler balances is checked by the manufacturer on a yearly basis.

Support equipment is defined as all equipment, not previously discussed, that is required for completing an environmental monitoring or measurement task. This equipment may include storage and transportation containers, sample recovery glassware, and communications gear. Support equipment is periodically inspected to maintain the performance standards necessary for proper and efficient execution of all tasks and responsibilities.

During a project, a systems audit is performed, consisting of an on-site qualitative inspection and review of the total measurement system. This inspection is conducted on a daily basis by the Project Leader. During the systems audit, the auditor observes the procedures and techniques of the field team in the following general areas:

- Setting up and leak testing the sample train
- Isokinetic sampling check (if applicable)
- Final leak check of the sample train
- Sample recovery

Visual inspections of pitot tubes, glassware, and other equipment are also made. The main purpose of a systems audit is to ensure that the measurement system will generate valid data, if operated properly.

6.2 Sample Recovery and Field Documentation

Data collected during each test, are immediately inspected for completeness and placed under the custody of the Project Leader until custody is transferred when the samples were returned to the Air Quality laboratory. Sample recovery is carried out in a suitable area free from particulate matter contamination. Each sample is assigned an identifying lab number to assist the chemists in tracking the sample.

6.3 Chain of Custody

The history of each sample was documented from collection through all transfers of custody until it was transferred to the analytical laboratory. Copies of the chain of custody forms are included in the appendices of this report. Internal laboratory records document the custody of the samples through their final disposition. Care was taken to record precisely the sample type, sample time, and sample location and to help ensure that the sample number on the label exactly matches those numbers on the sample logsheet and the chain-of-custody record. The persons undertaking the actual sampling in the field were responsible for the care and custody of the samples collected until they were properly transferred or dispatched. Sample labels were completed for each sample bottle using water-proof ink.

6.4 Transfer of Custody and Shipment

All sample shipping containers were accompanied by an analysis request or chain-of-custody record form when they left the site. When transferring the possession of samples, the individuals relinquishing and receiving the samples signed, dated, and noted the time on the record. This record documents sample custody transfer from the sampler, often through another person, to the analyst in the laboratory.

The laboratory representative who accepted the incoming sample shipment signed and dated the chain-of-custody record, completing the sample transfer process. It is the laboratory's responsibility to maintain internal logbooks and custody records throughout sample preparation and analysis in accordance with the laboratory's written QA Plan.

It is important to maintain the integrity of the samples from the time of collection until the analyses are performed. The samples were preserved during transportation and storage to prevent or retard degradation or modification of chemicals in samples. The samples were kept cool with blue ice packets placed in the coolers the sample were shipped in.

6.5 Data Reduction, Validation, and Reporting

Raw data are handled according to strict guidelines when being transposed into computer files or to other logs. The guidelines include document receipt control procedures, file review, and sign-off by a project assistant. Raw data are entered into the appropriate computer spreadsheet by a "processor", then the entered figures are checked for accuracy by a "checker", different from the "processor." Any mistakes are corrected, and figures are rechecked and signed off by the "checker." In addition, a by-hand calculation check of each spreadsheet is made using a hand-held calculator to validate the computer output. All data generated by each phase of a laboratory or field sampling program are reviewed by the senior reviewer. The data package is signed off by the senior reviewer prior to releasing the data for report preparation.

The test results were calculated according to EPA 40 CFR 60 criteria. Copies of the pertinent equations used to derive these results are included in the appendices of this report. Standard conditions are 68° F and 29.92 inches of mercury. The average values from instrumental analyzer readings were computed and bias corrected for each test period. The average gas effluent concentration was determined from the average gas concentration displayed by the gas analyzer, adjusted for the zero and upscale sampling system bias checks. Calculations are on a dry basis (except THC) using the following equation:

$$C_{gas} = (C - C_o) * (C_{ma}/(C_m - C_o)$$

where:

C_{gas} = Effluent gas concentration, dry basis

C = Average gas concentration indicated by analyzer, dry basis

C_o = Average of initial and final system calibration bias check responses for the zero gas

C_{ma} = Actual concentration of the upscale calibration gas

C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas

7.0
METHODOLOGY REFERENCES

EPA. Title 40 Code of Federal Regulations, Part 60 (40 CFR 60), Appendix A, Reference Methods 1, 2, 3A, 4, 5, 6C, 7E, 10 and 25A. July 1, 1994.

EPA. Title 40 Code of Federal Regulations, Parts 1-51 (40 CFR 51), Appendix M, Reference Methods 202. July 1, 1994.

EPA. EPA 450/2-79-006, APTI Course, "Course 450 - Source Sampling For Particulate Pollutants", December 1979.

EPA. EPA 468/2-81-009, APTI Course, "Course 468 - Source Sampling For Gaseous Pollutants", May 1981.

EPA. <u>Quality Assurance Handbook for Air Pollution Measurement Systems</u>, Volume 3, EPA-60/4-77-027b.

EPA. EPA 600/4-89/017, <u>EPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air</u>, Method TO-12, "Method for the Determination of Non-Methane Organic Compounds (NMOC) in Ambient Air Using Cryogenic Preconcentration and Direct Flame Ionization Detection (PDFID)", June 1988.

APPENDIX A

Computer Printouts of Results

METHODS 1, 2, 3A, 4 AND 5
AM TEST-AIR QUALITY, INC.

FILE NAME:	Y510\GRI-M5R1	LAB #:	8131
CLIENT:	GRI/WP Natural Gas @ BCC	START TIME:	1030 hours
LOCATION:	White City, OR	STOP TIME:	1836 hours
SAMPLE SITE:	#2 Package Boiler	SAMPLE LENGTH:	480.0 minutes
SAMPLE DATE:	May 2, 1995	OPERATORS:	Porter
RUN #:	1 - Method 5/202		

IMPINGER WEIGHTS

FINAL grams	INITIAL grams	NET grams
1079.7	647.0	432.7
894.3	599.6	294.7
663.2	652.5	10.7
567.2	565.1	2.1
833.0	799.8	33.2

TOTAL H2O GAIN:	773.4
TOTAL VOLUME (scf):	36.47
PERCENT MOISTURE:	16.73
Bws:	0.1673
INIT. METER VOLUME:	581.680
FINAL METER VOLUME:	772.149
VOLUME SAMPLED:	190.469
STD VOLUME (dscf):	181.463
STD VOLUME (dscm):	5.139
Y FACTOR:	1.003
DELTA H @:	1.666
Y FACTOR CAL. CHECK:	0.983
PERCENT ERROR (%):	-2.0

PITOT TUBE Cp:	0.84
NOZZLE DIAMETER:	0.194 inches
NOZZLE AREA:	0.0002 sq. feet
STACK DIAMETER:	24.0 inches
STACK AREA:	3.14 sq. feet
METER TEMPERATURE:	73.8 degrees F
BAROMETRIC PRES.:	28.70 inches Hg
STATIC PRESSURE:	-0.35 inches H2O
STACK PRESSURE:	28.67 inches Hg
ORIFICE PRESSURE:	0.439 inches H2O
METER PRESSURE:	28.73 inches Hg
AVERAGE CONC. CO2:	10.1 percent
AVERAGE CONC. O2:	3.3 percent
AVERAGE CONC. CO:	1.8 ppm
MOLECULAR WEIGHT:	29.75 g/g-mole-dry
MOLECULAR WEIGHT:	27.78 g/g-mole-wet
F FACTOR:	1.74

SAMPLE POINT	VELOCITY " OF H2O	TEMPERATURE °F	SAMPLE POINT	VELOCITY " OF H2O	TEMPERATURE °F
E 1	0.58	274	S 1	0.48	275
2	0.58	275	2	0.47	274
3	0.57	276	3	0.47	274
4	0.57	278	4	0.49	277
5	0.55	279	5	0.53	277
6	0.48	277	6	0.56	278
7	0.67	277	7	0.48	278
8	0.69	278	8	0.62	275
9	0.68	279	9	0.65	276
10	0.67	278	10	0.67	277
11	0.65	268	11	0.66	276
12	0.64	279	12	0.66	277

PERCENT ISOKINETICS:	102 %	
STACK GAS TEMPERATURE:	276.3 degrees F	736.3 degrees R
AVERAGE VELOCITY HEAD:	0.584 " of H2O	
STACK GAS VELOCITY:		52.7 ft/second
STACK GAS AIR FLOW:	9942.6 acf/min	5689.4 dscf/min
FRONT-HALF PARTICULATE MATTER EMISSION CONCENTRATION:		0.0008 gr/dscf
BACK-HALF PARTICULATE MATTER EMISSION CONCENTRATION:		0.0006 gr/dscf
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:		0.0014 gr/dscf
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:		0.0014 gr/dscf @ 3% O2
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:		3.15 mg/dscm
FRONT-HALF PARTICULATE MATTER EMISSION RATE:		0.038 lb/hr
BACKHALF PARTICULATE MATTER EMISSION RATE:		0.029 lb/hr
TOTAL PARTICULATE MATTER EMISSION RATE:		0.067 lb/hr

FRONT-HALF PARTICULATE MATTER MASS LOADING

FILTER NUMBER:	#125-364
TARE WEIGHT OF FILTER (grams):	1.0269
FINAL WEIGHT OF FILTER (grams):	1.0290
NET WEIGHT OF PARTICULATE MATTER (grams):	0.0021
BEAKER NUMBER:	#150-3123
TARE WEIGHT OF BEAKER (grams):	64.8088
FINAL WEIGHT OF BEAKER (grams):	64.8162
NET WEIGHT OF PARTICULATE MATTER (grams):	0.0074
VOLUME OF ACETONE (milliliters):	180.0
WT./VOL. OF ACETONE BLANK (milligrams/ml):	0.0015
NET WEIGHT OF PARTIC. DUE TO ACETONE (grams):	0.0003
TOTAL FRONT-HALF PARTICULATE MATTER (grams):	0.0092

BACK-HALF PARTICULATE MATTER MASS LOADING

"C" SECTION - CONDENSER PARTICULATE	#150-3102
TARE WEIGHT OF BEAKER (grams):	65.1292
FINAL WEIGHT OF BEAKER (grams):	65.1341
NET WEIGHT OF PARTIC. MATTER (grams):	0.0049
VOLUME OF SAMPLE USED IN EXTRACTION (mL):	900.0
ADJUSTED NET WEIGHT OF PARTIC. MATTER (grams):	0.0066
TOTAL VOLUME OF WATER (milliliters):	1217.0
VOLUME OF WATER CONDENSED (milliliters):	740.2
NET VOLUME OF WATER FOR BLANK (milliliters):	476.8
WT./VOL. OF WATER BLANK (milligrams/mL):	0.007
NET WEIGHT OF PARTIC. DUE TO WATER (grams):	0.0033
"Cx" SECTION - HYDROCARBON EXTRACTION	#150-3124/3133
TARE WEIGHT OF BEAKER (grams):	131.9303
FINAL WEIGHT OF BEAKER (grams):	131.9330
NET WEIGHT OF PARTIC. MATTER (grams):	0.0027
ADJUSTED NET WEIGHT OF PARTIC. MATTER (grams):	0.0037
TOTAL VOLUME OF CH2Cl2 (milliliters):	225.0
WT./VOL. OF CH2Cl2 BLANK (milligrams/ml):	0.000
NET WEIGHT OF PARTIC. DUE TO CH2Cl2 (grams):	0.0000
TOTAL BACK-HALF PARTICULATE MATTER (grams):	0.0069
TOTAL WEIGHT OF PARTICULATE MATTER (grams):	0.0162

METHODS 1, 2, 3A, 4 AND 5
AM TEST-AIR QUALITY, INC.

FILE NAME:	Y510\GRI-M5R2	LAB #:	8132
CLIENT:	GRI/WP Natural Gas @ BCC	START TIME:	0803 hours
LOCATION:	White City, OR	STOP TIME:	1607 hours
SAMPLE SITE:	#2 Package Boiler	SAMPLE LENGTH:	480.0 minutes
SAMPLE DATE:	May 3, 1995	OPERATORS:	Porter
RUN #:	2 - Method 5/202		

IMPINGER WEIGHTS

FINAL grams	INITIAL grams	NET grams
1071.2	643.9	427.3
920.5	604.9	315.6
672.3	666.7	5.6
555.1	553.5	1.6
836.1	802.1	34.0

TOTAL H2O GAIN:	784.1
TOTAL VOLUME (scf):	36.97
PERCENT MOISTURE:	16.69
Bws:	0.1669
INIT. METER VOLUME:	773.795
FINAL METER VOLUME:	967.558
VOLUME SAMPLED:	193.763
STD VOLUME (dscf):	184.574
STD VOLUME (dscm):	5.227
Y FACTOR:	1.003
DELTA H @:	1.666
Y FACTOR CAL. CHECK:	0.960
PERCENT ERROR (%):	-4.5

PITOT TUBE Cp:	0.84
NOZZLE DIAMETER:	0.194 inches
NOZZLE AREA:	0.0002 sq. feet
STACK DIAMETER:	24.0 inches
STACK AREA:	3.14 sq. feet
METER TEMPERATURE:	74.8 degrees F
BAROMETRIC PRES.:	28.75 inches Hg
STATIC PRESSURE:	-0.36 inches H20
STACK PRESSURE:	28.72 inches Hg
ORIFICE PRESSURE:	0.433 inches H20
METER PRESSURE:	28.78 inches Hg
AVERAGE CONC. CO2:	10.2 percent
AVERAGE CONC. O2:	3.3 percent
AVERAGE CONC. CO:	4.4 ppm
MOLECULAR WEIGHT:	29.76 g/g-mole-dry
MOLECULAR WEIGHT:	27.80 g/g-mole-wet
F FACTOR:	1.73

SAMPLE POINT	VELOCITY " OF H2O	TEMPERATURE °F	SAMPLE POINT	VELOCITY " OF H2O	TEMPERATURE °F
E 1	0.61	274	S 1	0.52	278
2	0.62	280	2	0.52	278
3	0.63	281	3	0.52	278
4	0.62	279	4	0.55	280
5	0.60	279	5	0.59	279
6	0.44	280	6	0.58	279
7	0.71	278	7	0.54	279
8	0.71	278	8	0.62	277
9	0.73	279	9	0.70	279
10	0.72	279	10	0.71	278
11	0.70	280	11	0.70	279
12	0.70	280	12	0.70	278

PERCENT ISOKINETICS:	100 %	
STACK GAS TEMPERATURE:	278.7 degrees F	738.7 degrees R
AVERAGE VELOCITY HEAD:	0.624 " of H20	
STACK GAS VELOCITY:		54.6 ft/second
STACK GAS AIR FLOW:	10284.3 acf/min	5879.3 dscf/min
FRONT-HALF PARTICULATE MATTER EMISSION CONCENTRATION:		0.0002 gr/dscf
BACK-HALF PARTICULATE MATTER EMISSION CONCENTRATION:		0.0002 gr/dscf
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:		0.0003 gr/dscf
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:		0.0003 gr/dscf @ 3% O2
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:		0.783 mg/dscm
FRONT-HALF PARTICULATE MATTER EMISSION RATE:		0.008 lb/hr
BACKHALF PARTICULATE MATTER EMISSION RATE:		0.009 lb/hr
TOTAL PARTICULATE MATTER EMISSION RATE:		0.017 lb/hr

FRONT-HALF PARTICULATE MATTER MASS LOADING

FILTER NUMBER:	#125-362
TARE WEIGHT OF FILTER (grams):	1.0375
FINAL WEIGHT OF FILTER (grams):	1.0382
NET WEIGHT OF PARTICULATE MATTER (grams):	0.0007
BEAKER NUMBER:	#150-3125
TARE WEIGHT OF BEAKER (grams):	64.4072
FINAL WEIGHT OF BEAKER (grams):	64.4086
NET WEIGHT OF PARTICULATE MATTER (grams):	0.0014
VOLUME OF ACETONE (milliliters):	80.0
WT./VOL. OF ACETONE BLANK (milligrams/ml):	0.0015
NET WEIGHT OF PARTIC. DUE TO ACETONE (grams):	0.0001
TOTAL FRONT-HALF PARTICULATE MATTER (grams):	0.0020

BACK-HALF PARTICULATE MATTER MASS LOADING

"C" SECTION - CONDENSER PARTICULATE	#150-3103
TARE WEIGHT OF BEAKER (grams):	65.4939
FINAL WEIGHT OF BEAKER (grams):	65.4977
NET WEIGHT OF PARTIC. MATTER (grams):	0.0038
VOLUME OF SAMPLE USED IN EXTRACTION (mL):	900.0
ADJUSTED NET WEIGHT OF PARTIC. MATTER (grams):	0.0054
TOTAL VOLUME OF WATER (milliliters):	1284.0
VOLUME OF WATER CONDENSED (milliliters):	750.1
NET VOLUME OF WATER FOR BLANK (milliliters):	533.9
WT./VOL. OF WATER BLANK (milligrams/mL):	0.007
NET WEIGHT OF PARTIC. DUE TO WATER (grams):	0.0037
"Cx" SECTION - HYDROCARBON EXTRACTION	#150-3126/3134
TARE WEIGHT OF BEAKER (grams):	131.5420
FINAL WEIGHT OF BEAKER (grams):	131.5423
NET WEIGHT OF PARTIC. MATTER (grams):	0.0003
ADJUSTED NET WEIGHT OF PARTIC. MATTER (grams):	0.0004
TOTAL VOLUME OF CH2Cl2 (milliliters):	225.0
WT./VOL. OF CH2Cl2 BLANK (milligrams/ml):	0.000
NET WEIGHT OF PARTIC. DUE TO CH2Cl2 (grams):	0.0000
TOTAL BACK-HALF PARTICULATE MATTER (grams):	0.0021
TOTAL WEIGHT OF PARTICULATE MATTER (grams):	0.0041

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METHODS 1, 2, 3A, 4 AND 5
AM TEST-AIR QUALITY, INC.

FILE NAME:	Y510\GRI-M5R3	LAB #:	8133
CLIENT:	GRI/WP Natural Gas @ BCC	START TIME:	0800 hours
LOCATION:	White City, OR	STOP TIME:	1606 hours
SAMPLE SITE:	#2 Package Boiler	SAMPLE LENGTH:	454.8 minutes
SAMPLE DATE:	May 4, 1995	OPERATORS:	Porter
RUN #:	3 - Method 5/202		

IMPINGER WEIGHTS

FINAL grams	INITIAL grams	NET grams
1078.3	657.3	421.0
995.3	698.7	296.6
638.8	629.8	9.0
530.6	529.6	1.0
848.8	817.6	31.2

TOTAL H2O GAIN:	758.8
TOTAL VOLUME (scf):	35.78
PERCENT MOISTURE:	16.91
Bws:	0.1691
INIT. METER VOLUME:	967.769
FINAL METER VOLUME:	1149.485
VOLUME SAMPLED:	181.716
STD VOLUME (dscf):	175.756
STD VOLUME (dscm):	4.978
Y FACTOR:	1.003
DELTA H @:	1.666
Y FACTOR CAL. CHECK:	0.977
PERCENT ERROR (%):	-2.7

PITOT TUBE Cp:	0.84
NOZZLE DIAMETER:	0.194 inches
NOZZLE AREA:	0.0002 sq. feet
STACK DIAMETER:	24.0 inches
STACK AREA:	3.14 sq. feet
METER TEMPERATURE:	64.9 degrees F
BAROMETRIC PRES.:	28.65 inches Hg
STATIC PRESSURE:	-0.35 inches H2O
STACK PRESSURE:	28.62 inches Hg
ORIFICE PRESSURE:	0.446 inches H2O
METER PRESSURE:	28.68 inches Hg
AVERAGE CONC. CO2:	10.2 percent
AVERAGE CONC. O2:	3.0 percent
AVERAGE CONC. CO:	3.0 ppm
MOLECULAR WEIGHT:	29.75 g/g-mole-dry
MOLECULAR WEIGHT:	27.76 g/g-mole-wet
F FACTOR:	1.75

SAMPLE POINT	VELOCITY " OF H2O	TEMPERATURE °F	SAMPLE POINT	VELOCITY " OF H2O	TEMPERATURE °F
E 1	0.64	268	S 1	0.55	279
2	0.64	278	2	0.54	277
3	0.63	279	3	0.55	279
4	0.64	279	4	0.55	279
5	0.63	279	5	0.55	280
6	0.49	279	6	0.50	277
7	0.70	280	7	0.63	273
8	0.74	279	8	0.71	278
9	0.74	281	9	0.70	278
10	0.72	281	10	0.69	279
11	0.71	280	11	0.71	281
12	0.70	280			

PERCENT ISOKINETICS:	100 %	
STACK GAS TEMPERATURE:	278.4 degrees F	738.4 degrees R
AVERAGE VELOCITY HEAD:	0.635 " of H20	
STACK GAS VELOCITY:		55.2 ft/second
STACK GAS AIR FLOW:	10396.7 acf/min	5909.4 dscf/min
FRONT-HALF PARTICULATE MATTER EMISSION CONCENTRATION:		0.0001 gr/dscf
BACK-HALF PARTICULATE MATTER EMISSION CONCENTRATION:		0.0005 gr/dscf
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:		0.0007 gr/dscf
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:		0.0007 gr/dscf @ 3% O2
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:		1.52 mg/dscm
TOTAL PARTICULATE MATTER EMISSION RATE:		0.006 lb/hr
TOTAL PARTICULATE MATTER EMISSION RATE:		0.028 lb/hr
TOTAL PARTICULATE MATTER EMISSION RATE:		0.034 lb/hr

FRONT-HALF PARTICULATE MATTER MASS LOADING

FILTER NUMBER:	#125-363
TARE WEIGHT OF FILTER (grams):	1.0356
FINAL WEIGHT OF FILTER (grams):	1.0358
NET WEIGHT OF PARTICULATE MATTER (grams):	0.0002
BEAKER NUMBER:	#150-3127
TARE WEIGHT OF BEAKER (grams):	63.6513
FINAL WEIGHT OF BEAKER (grams):	63.6526
NET WEIGHT OF PARTICULATE MATTER (grams):	0.0013
VOLUME OF ACETONE (milliliters):	105.0
WT./VOL. OF ACETONE BLANK (milligrams/ml):	0.0015
NET WEIGHT OF PARTIC. DUE TO ACETONE (grams):	0.0002
TOTAL FRONT-HALF PARTICULATE MATTER (grams):	0.0013

BACK-HALF PARTICULATE MATTER MASS LOADING

"C" SECTION - CONDENSER PARTICULATE	#150-3104
TARE WEIGHT OF BEAKER (grams):	64.8937
FINAL WEIGHT OF BEAKER (grams):	64.8990
NET WEIGHT OF PARTIC. MATTER (grams):	0.0053
VOLUME OF SAMPLE USED IN EXTRACTION (mL):	900.0
ADJUSTED NET WEIGHT OF PARTIC. MATTER (grams):	0.0073
TOTAL VOLUME OF WATER (milliliters):	1245.0
VOLUME OF WATER CONDENSED (milliliters):	727.6
NET VOLUME OF WATER FOR BLANK (milliliters):	517.4
WT./VOL. OF WATER BLANK (milligrams/mL):	0.007
NET WEIGHT OF PARTIC. DUE TO WATER (grams):	0.0036
"Cx" SECTION - HYDROCARBON EXTRACTION	#150-3128/3135
TARE WEIGHT OF BEAKER (grams):	143.1354
FINAL WEIGHT OF BEAKER (grams):	143.1372
NET WEIGHT OF PARTIC. MATTER (grams):	0.0018
ADJUSTED NET WEIGHT OF PARTIC. MATTER (grams):	0.0025
TOTAL VOLUME OF CH2Cl2 (milliliters):	225.0
WT./VOL. OF CH2Cl2 BLANK (milligrams/ml):	0.000
NET WEIGHT OF PARTIC. DUE TO CH2Cl2 (grams):	0.0000
TOTAL BACK-HALF PARTICULATE MATTER (grams):	0.0062
TOTAL WEIGHT OF PARTICULATE MATTER (grams):	0.0075

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METHODS 1, 2, 3A, 4 AND 5
AM TEST-AIR QUALITY, INC.

FILE NAME:	Y510\GRIM5BL	LAB #:	Blank
CLIENT:	GRI/WP Natural Gas @ BCC	START TIME:	NA hours
LOCATION:	White City, OR	STOP TIME:	NA hours
SAMPLE SITE:	#2 Package Boiler	SAMPLE LENGTH:	473.3 minutes
SAMPLE DATE:	May 2-4, 1995	OPERATORS:	Porter
RUN #:	Field Blank - Method 5		

IMPINGER WEIGHTS

FINAL grams	INITIAL grams	NET grams
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---	---	---
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TOTAL H2O GAIN:	---
TOTAL VOLUME (scf):	---
PERCENT MOISTURE:	16.80
Bws:	0.1680
INIT. METER VOLUME:	---
FINAL METER VOLUME:	---
VOLUME SAMPLED:	187.740
STD VOLUME (dscf):	180.165
STD VOLUME (dscm):	5.103
Y FACTOR:	---
DELTA H @:	---
Y FACTOR CAL. CHECK:	---
PERCENT ERROR (%):	---

PITOT TUBE Cp:	0.84
NOZZLE DIAMETER:	0.194 inches
NOZZLE AREA:	0.0002 sq. feet
STACK DIAMETER:	24.0 inches
STACK AREA:	3.14 sq. feet
METER TEMPERATURE:	71.2 degrees F
BAROMETRIC PRES.:	28.70 inches Hg
STATIC PRESSURE:	-0.36 inches H2O
STACK PRESSURE:	28.67 inches Hg
ORIFICE PRESSURE:	0.439 inches H2O
METER PRESSURE:	28.73 inches Hg
AVERAGE CONC. CO2:	10.2 percent
AVERAGE CONC. O2:	3.2 percent
AVERAGE CONC. CO:	3.7 ppm
MOLECULAR WEIGHT:	29.76 g/g-mole-dry
MOLECULAR WEIGHT:	27.78 g/g-mole-wet
F FACTOR:	1.74

SAMPLE POINT	VELOCITY " OF H2O	TEMPERATURE °F	SAMPLE POINT	VELOCITY " OF H2O	TEMPERATURE °F
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PERCENT ISOKINETICS:	--- %	
STACK GAS TEMPERATURE:	278.6 degrees F	738.6 degrees R
AVERAGE VELOCITY HEAD:	0.630 " of H20	
STACK GAS VELOCITY:		54.9 ft/second
STACK GAS AIR FLOW:	10341 acf/min	5894 dscf/min
FRONT-HALF PARTICULATE MATTER EMISSION CONCENTRATION:		0.0001 gr/dscf
BACK-HALF PARTICULATE MATTER EMISSION CONCENTRATION:		-0.0004 gr/dscf
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:		-0.0003 gr/dscf
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:		-0.0003 gr/dscf @ 3% O2
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:		-0.736 mg/dscm
FRONT-HALF PARTICULATE MATTER EMISSION RATE:		0.006 lb/hr
BACKHALF PARTICULATE MATTER EMISSION RATE:		-0.023 lb/hr
TOTAL PARTICULATE MATTER EMISSION RATE:		-0.016 lb/hr

FRONT-HALF PARTICULATE MATTER MASS LOADING

FILTER NUMBER:	#125-378
TARE WEIGHT OF FILTER (grams):	1.0353
FINAL WEIGHT OF FILTER (grams):	1.0353
NET WEIGHT OF PARTICULATE MATTER (grams):	0.0000
BEAKER NUMBER:	#150-3129
TARE WEIGHT OF BEAKER (grams):	79.1020
FINAL WEIGHT OF BEAKER (grams):	79.1036
NET WEIGHT OF PARTICULATE MATTER (grams):	0.0016
VOLUME OF ACETONE (milliliters):	83.0
WT./VOL. OF ACETONE BLANK (milligrams/ml):	0.0015
NET WEIGHT OF PARTIC. DUE TO ACETONE (grams):	0.0001
TOTAL FRONT-HALF PARTICULATE MATTER (grams):	0.0015

BACK-HALF PARTICULATE MATTER MASS LOADING

"C" SECTION - CONDENSER PARTICULATE	#150-3105
TARE WEIGHT OF BEAKER (grams):	80.7255
FINAL WEIGHT OF BEAKER (grams):	80.7280
NET WEIGHT OF PARTIC. MATTER (grams):	0.0025
VOLUME OF SAMPLE USED IN EXTRACTION (mL):	539.0
ADJUSTED NET WEIGHT OF PARTIC. MATTER (grams):	0.0026
TOTAL VOLUME OF WATER (milliliters):	559.0
VOLUME OF WATER CONDENSED (milliliters):	---
NET VOLUME OF WATER FOR BLANK (milliliters):	559.0
WT./VOL. OF WATER BLANK (milligrams/mL):	0.007
NET WEIGHT OF PARTIC. DUE TO WATER (grams):	0.0039
"Cx" SECTION - HYDROCARBON EXTRACTION	#150-3131/3136
TARE WEIGHT OF BEAKER (grams):	132.6674
FINAL WEIGHT OF BEAKER (grams):	132.6674
NET WEIGHT OF PARTIC. MATTER (grams):	0.0000
ADJUSTED NET WEIGHT OF PARTIC. MATTER (grams):	0.0000
TOTAL VOLUME OF CH2Cl2 (milliliters):	225.0
WT./VOL. OF CH2Cl2 BLANK (milligrams/ml):	0.000
NET WEIGHT OF PARTIC. DUE TO CH2Cl2 (grams):	0.0000
TOTAL BACK-HALF PARTICULATE MATTER (grams):	-0.0052
TOTAL WEIGHT OF PARTICULATE MATTER (grams):	-0.0038

GRI @ WP NATURAL GAS
WHITE CITY, OREGON
MOLE FRACTIONS

DATE & TIME	H2 %	C1 %	C2 %	C3 %	iC4 %	nC4 %	iC5 %	nC5 %	C6+ %	N2 %	CO2 %	F FACTOR
4/30/95	0	95.577	2.889	0.597	0.081	0.000	0.026	0	0.009	0.614	0.050	8546

FILE NAME: Y510\FFACTOR

CALIBRATION SUMMARY - GASEOUS EMISSION MONITORS

FILE NAME: DG112\WPG52R1
CLIENT: WP Natural Gas
LOCATION: White City, Oregon
SITE LOCATION: #2 Cleaver Brooks Package Boiler Stack
SAMPLE DATE: May 2, 1995
RUN #: 1 - Methods 3A, 6C, 7E, 10 and 25A
SAMPLE TIMES: 10:30-14:30
LOAD: 95%

PARAMETER	MEASUREMENT UNIT	INITIAL ZERO CHECK	FINAL ZERO CHECK	INITIAL SPAN CHECK	FINAL SPAN CHECK	UPSCALE CAL. GAS VALUE Cma	AVERAGE ZERO BIAS Co	AVERAGE SPAN BIAS Cm	AVERAGE MEASURED CONC. C
Carbon Dioxide (CO2)	%	0.0	0.0	15.0	15.0	15.00	0.0	15.0	10.1
Oxygen (O2)	%	0.0	0.0	5.0	5.0	5.03	0.0	5.0	3.2
Carbon Monoxide (CO)	ppm	0.3	0.3	29.6	29.6	30.1	0.3	29.6	2.2
Sulfur Dioxide (SO2)	ppm	0.3	0.4	90.0	89.7	89.7	0.4	89.9	1.8
Nitrogen Oxides (NOx)	ppm	0.0	1.1	25.1	24.8	25.22	0.6	25.0	32.2
Total Hydrocarbons (THC)	ppm	0.0	0.1	25.4	26.0	25.4	0.1	25.7	0.0

PARAMETER	EFFLUENT GAS CONCENTRATION Cgas
Carbon Dioxide (CO2)	10.1 %
Oxygen (O2)	3.2 %
Carbon Monoxide (CO)	2.0 ppm
Sulfur Dioxide (SO2)	1.5 ppm
Nitrogen Oxides (NOx)	32.7 ppm
Total Hydrocarbons (THC)	-0.0 ppm

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CALIBRATION SUMMARY - GASEOUS EMISSION MONITORS

FILE NAME: DG112\WPG52R2
CLIENT: WP Natural Gas
LOCATION: White City, Oregon
SITE LOCATION: #2 Cleaver Brooks Package Boiler Stack
SAMPLE DATE: May 2, 1995
RUN #: 2 - Methods 3A, 6C, 7E, 10 and 25A
SAMPLE TIMES: 14:58-19:58
LOAD: 95%

PARAMETER	MEASUREMENT UNIT	INITIAL ZERO CHECK	FINAL ZERO CHECK	INITIAL SPAN CHECK	FINAL SPAN CHECK	UPSCALE CAL. GAS VALUE Cma	AVERAGE ZERO BIAS Co	AVERAGE SPAN BIAS Cm	AVERAGE MEASURED CONC. C
Carbon Dioxide (CO2)	%	0.0	0.0	15.0	15.0	15.00	0.0	15.0	10.0
Oxygen (O2)	%	0.0	0.0	5.0	5.0	5.03	0.0	5.0	3.3
Carbon Monoxide (CO)	ppm	0.3	0.2	29.6	29.6	30.1	0.3	29.6	1.8
Sulfur Dioxide (SO2)	ppm	0.4	0.3	89.7	96.0	89.7	0.4	92.9	1.0
Nitrogen Oxides (NOx)	ppm	1.1	0.7	24.8	26.2	25.22	0.9	25.5	31.7
Total Hydrocarbons (THC)	ppm	0.1	-0.3	25.4	24.4	25.4	-0.1	24.9	0.0

PARAMETER	EFFLUENT GAS CONCENTRATION Cgas
Carbon Dioxide (CO2)	10.0 %
Oxygen (O2)	3.3 %
Carbon Monoxide (CO)	1.6 ppm
Sulfur Dioxide (SO2)	0.6 ppm
Nitrogen Oxides (NOx)	31.6 ppm
Total Hydrocarbons (THC)	0.1 ppm

CALIBRATION SUMMARY - GASEOUS EMISSION MONITORS

FILE NAME: DG112\WPG53R1
CLIENT: WP Natural Gas
LOCATION: White City, Oregon
SITE LOCATION: #2 Cleaver Brooks Package Boiler Stack
SAMPLE DATE: May 3, 1995
RUN #: 1 - Methods 3A, 6C, 7E, 10 and 25A
SAMPLE TIMES: 08:11-12:11
LOAD: 100%

PARAMETER	MEASUREMENT UNIT	INITIAL ZERO CHECK	FINAL ZERO CHECK	INITIAL SPAN CHECK	FINAL SPAN CHECK	UPSCALE CAL. GAS VALUE Cma	AVERAGE ZERO BIAS Co	AVERAGE SPAN BIAS Cm	AVERAGE MEASURED CONC. C
Carbon Dioxide (CO2)	%	0.0	0.1	15.0	15.0	15.00	0.1	15.0	10.2
Oxygen (O2)	%	0.0	0.1	5.0	5.1	5.03	0.1	5.1	3.3
Carbon Monoxide (CO)	ppm	0.2	0.6	30.4	30.3	30.1	0.4	30.4	6.3
Sulfur Dioxide (SO2)	ppm	0.1	0.3	89.7	89.3	89.7	0.2	89.5	0.9
Nitrogen Oxides (NOx)	ppm	-0.2	0.4	25.3	25.3	25.22	0.1	25.3	31.1
Total Hydrocarbons (THC)	ppm	0.0	0.1	25.4	25.8	25.4	0.1	25.6	0.0

PARAMETER	EFFLUENT GAS CONCENTRATION Cgas
Carbon Dioxide (CO2)	10.2 %
Oxygen (O2)	3.3 %
Carbon Monoxide (CO)	5.9 ppm
Sulfur Dioxide (SO2)	0.7 ppm
Nitrogen Oxides (NOx)	31.0 ppm
Total Hydrocarbons (THC)	-0.0 ppm

CALIBRATION SUMMARY - GASEOUS EMISSION MONITORS

FILE NAME: DG112\WPG53R2
CLIENT: WP Natural Gas
LOCATION: White City, Oregon
SITE LOCATION: #2 Cleaver Brooks Package Boiler Stack
SAMPLE DATE: May 3, 1995
RUN #: 2 - Methods 3A, 6C, 7E, 10 and 25A
SAMPLE TIMES: 12:39-16:40
LOAD: 100%

PARAMETER	MEASUREMENT UNIT	INITIAL ZERO CHECK	FINAL ZERO CHECK	INITIAL SPAN CHECK	FINAL SPAN CHECK	UPSCALE CAL. GAS VALUE Cma	AVERAGE ZERO BIAS Co	AVERAGE SPAN BIAS Cm	AVERAGE MEASURED CONC. C
Carbon Dioxide (CO2)	%	0.1	0.1	15.0	14.9	15.00	0.1	15.0	10.1
Oxygen (O2)	%	0.1	0.0	5.0	5.0	5.03	0.1	5.0	3.2
Carbon Monoxide (CO)	ppm	0.6	0.4	30.3	29.9	30.1	0.5	30.1	3.4
Sulfur Dioxide (SO2)	ppm	0.3	-0.3	89.3	88.2	89.7	0.0	88.8	0.5
Nitrogen Oxides (NOx)	ppm	0.4	0.7	25.3	25.5	25.22	0.6	25.4	32.1
Total Hydrocarbons (THC)	ppm	0.1	0.1	25.8	26.0	25.4	0.1	25.9	0.0

PARAMETER	EFFLUENT GAS CONCENTRATION Cgas
Carbon Dioxide (CO2)	10.1 %
Oxygen (O2)	3.2 %
Carbon Monoxide (CO)	2.9 ppm
Sulfur Dioxide (SO2)	0.5 ppm
Nitrogen Oxides (NOx)	32.0 ppm
Total Hydrocarbons (THC)	-0.1 ppm

CALIBRATION SUMMARY - GASEOUS EMISSION MONITORS

FILE NAME:	DG112\WPG54R2
CLIENT:	WP Natural Gas
LOCATION:	White City, Oregon
SITE LOCATION:	#2 Cleaver Brooks Package Boiler Stack
SAMPLE DATE:	May 4, 1995
RUN #:	2 - Methods 3A, 6C, 7E, 10 and 25A
SAMPLE TIMES:	12:29-16:07
LOAD:	100%

PARAMETER	MEASUREMENT UNIT	INITIAL ZERO CHECK	FINAL ZERO CHECK	INITIAL SPAN CHECK	FINAL SPAN CHECK	UPSCALE CAL. GAS VALUE Cma	AVERAGE ZERO BIAS Co	AVERAGE SPAN BIAS Cm	AVERAGE MEASURED CONC. C
Carbon Dioxide (CO2)	%	0.0	0.0	15.0	14.9	15.00	0.0	15.0	10.1
Oxygen (O2)	%	0.0	0.0	5.0	5.0	5.03	0.0	5.0	3.0
Carbon Monoxide (CO)	ppm	0.5	0.4	30.2	30.0	30.1	0.5	30.1	3.3
Sulfur Dioxide (SO2)	ppm	0.6	0.9	89.8	90.0	89.7	0.8	89.9	1.3
Nitrogen Oxides (NOx)	ppm	0.5	0.6	25.2	25.6	25.22	0.6	25.4	30.2
Total Hydrocarbons (THC)	ppm	0.0	0.1	25.4	26.2	25.4	0.1	25.8	0.0

PARAMETER	EFFLUENT GAS CONCENTRATION Cgas
Carbon Dioxide (CO2)	10.1 %
Oxygen (O2)	3.0 %
Carbon Monoxide (CO)	2.9 ppm
Sulfur Dioxide (SO2)	0.6 ppm
Nitrogen Oxides (NOx)	30.1 ppm
Total Hydrocarbons (THC)	-0.0 ppm

EMISSION RESULTS
TO-12 TOTAL NON-METHANE ORGANIC CARBON
ETHANE AND METHANE BY GC-FID
AM TEST-AIR QUALITY, INC.

FILE NAME: Y510\WPGASVOC
CLIENT: GRI/WP Natural Gas @ Boise Cascade Corporation
LOCATION: White City, Oregon
SAMPLE LOCATION: #2 Package Boiler

SAMPLE DATE: May 2, 1995 AIRFLOW: 5689 dscf/min
SAMPLE TIME: 1030 FUEL USAGE: 30657.5 scf/hr
LAB NUMBER(S): 854201 STEAM PRODUCTION RATE: 23800 lb/hr

ANALYTE	Run 1 lb/hr	DL Run 1 lb/hr	Run 1 lb/MMscf
Total Non-Methane Organic Carbon	0.026	0.002	0.8412
Ethane	< 0.126	0.126	< 4.116
Methane	< 0.142	0.142	< 4.630

SAMPLE DATE: May 3, 1995 AIRFLOW: 5879 dscf/min
SAMPLE TIME: 0803 FUEL USAGE: 33258.9 scf/hr
LAB NUMBER(S): 854202 STEAM PRODUCTION RATE: 22900 lb/hr

ANALYTE	Run 2 lb/hr	DL Run 2 lb/hr	Run 2 lb/MMscf
Total Non-Methane Organic Carbon	0.028	0.002	0.8278
Ethane	< 0.130	0.130	< 3.920
Methane	< 0.147	0.147	< 4.410

SAMPLE DATE: May 4, 1995 AIRFLOW: 5923 dscf/min
SAMPLE TIME: 0800 FUEL USAGE: 29836.8 scf/hr
LAB NUMBER(S): 854203 STEAM PRODUCTION RATE: 23700 lb/hr

ANALYTE	Run 3 lb/hr	DL Run 3 lb/hr	Run 3 lb/MMscf	AVERAGE RUNS 1-3 lb/hr	AVERAGE RUNS 1-3 lb/MMscf
Total Non-Methane Organic Carbon	0.031	0.002	1.034	0.028	0.9009
Ethane	< 0.131	0.131	< 4.402	< 0.129	< 4.146
Methane	< 0.148	0.148	< 4.953	< 0.145	< 4.664

< DL designates that the compound was not detected, or was found at levels below the practical quantitation limit.
lb/hr = pounds of analyte emitted per hour
lb/MMscf = pounds of analyte emitted per million standard cubic feet of fuel fired

APPENDIX B

Laboratory Analysis Results

CH2M HILL

Engineers
Planners
Economists
Scientists

May 22, 1995

ASE20006.XX

Amtest Air Quality
30545 SE 84th St., Suite 5
Preston, WA 98050

RE: Analytical Data for Boise Cascade-White City
CVO Laboratory Reference No. 8542

Dear Mr. Aaron Porter:

On May 5, 1995, the CH2M HILL Corvallis Applied Sciences Laboratory received three samples with a request for analysis of selected parameters.

The analytical results and associated quality control data are enclosed. Any unusual difficulties encountered during the analysis of your samples are discussed in the case narrative.

Under CH2M HILL policy, your canister sample(s) will be stored for 10 days after reporting. If you have not given us prior instructions for disposal, the canister(s) will be cleaned within 10 days.

The CH2M HILL Applied Sciences Laboratory appreciates your business and looks forward to serving your analytical needs again. If you should have any questions concerning the data, or if you need additional information, please call Ms. Kathy McKinley at (503) 758-0235, extension 3120.

Sincerely,

Lynn White

Lynn White
Senior Data Package Specialist

Enclosures

CLIENT SAMPLE CROSS-REFERENCE

CH2M HILL Applied Science Laboratory Reference No. 8542

CVO Sample ID	Client Sample ID
854201	Run #1 GRI
854202	Run #2 GRI
854203	Run #3 GRI

CASE NARRATIVE
TOTAL NONMETHANE ORGANIC ANALYSIS

Lab Reference No.: 8542

Client/Project: Amtest Air Quality–Boise Cascade-White City

I. Holding Times:
All holding times were met.

II. Analysis:

A. Calibration:
All acceptance criteria were met.

B. Blanks:
All acceptance criteria were met.

C. Duplicate Sample(s):
All acceptance criteria were met.

D. Analytical Exceptions:
None

E. Other:
None

III. Sampling Equipment:
No exceptions.

IV. Documentation Exceptions:
None

V. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signature.

SIGNED: Jodi Bennett DATE: 5-22-95
Jodi Bennett
Supervisor, Air Toxics

CASE NARRATIVE
GC-FID

Lab Reference No.: 8542

Client/Project: Amtest Air Quality–Boise Cascade-White City

I. Holding Times:
All holding times were met.

II. Analysis:

A. Calibration:
All acceptance criteria were met.

B. Blanks:
All acceptance criteria were met.

C. Duplicate Sample(s):
All acceptance criteria were met.

D. Other:
None

III. Documentation Exceptions:
None

IV. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, except for the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designee, as verified by the following signature.

SIGNED: Jodi Bennett DATE: 5-22-95
Jodi Bennett
Supervisor, Air Toxics

Corvallis Applied Sciences Laboratory

Client Information
Project Name: Amtest-Boise Cascade
Project Manager: Aaron Porter
Sampled By: Not given
Client Sample ID: See below
Sampling Date: See chain of custody
Sampling Time: See chain of custody
Type: Grab
Matrix: Air

Lab Information
Date Rec'd: 05/05/95
Lab ID: 8542
Analytical Method: TO-12
Dilution Factor: See below
Report Revision No: 1
Reported By: G. Green
Reviewed By: B. Thompson
Units: µg/m3

Lab ID	Client ID	Dilution Factor	Reporting Limit	Total Non-Methane Organic Carbon Result	Qualifier	Analyzed
854201	Run #1 GRI	2	100	1,210		5/16/95
854202	Run #2 GRI	2	100	1,250		5/16/95
854203	Run #3 GRI	2	100	1,390		5/16/95

J=Estimated value
U=Not detected at specified reporting limits

C:\HPCHEM\2\051795H\854201.D

Corvallis Applied Sciences Laboratory

Client Information		Lab Information	
Project Name:	Amtest-Boise Cascade	Date Rec'd:	05/05/95
Project Manager:	Aaron Porter	Batch ID:	854201
Sampled By:	Not given	Date Analyzed:	5/17/95
Client Sample ID:	Run #1 GRI	Dilution Factor:	1
Sampling Date:	05/03/95	Analysis Method:	GC-FID
Sampling Time:	10:30	Report Revision No.:	0
Type:	Grab	Reported By:	G. Collins
Matrix:	Air	Reviewed By:	J. Bennett
Basis:	As Rec'd.	Units:	µg/m3

Analyte	Reporting Limit	Sample Result	Qualifier
Methane	6660	6660	U
Ethane	5920	5920	U

U=Not detected at specified reporting limits
J=Estimated value

Corvallis Applied Sciences Laboratory

Client Information		**Lab Information**	
Project Name:	Amtest-Boise Cascade	Date Rec'd:	05/05/95
Project Manager:	Aaron Porter	Batch ID:	854202
Sampled By:	Not given	Date Analyzed:	5/17/95
Client Sample ID:	Run #2 GRI	Dilution Factor:	1
Sampling Date:	05/04/95	Analysis Method:	GC-FID
Sampling Time:	8:00	Report Revision No.:	0
Type:	Grab	Reported By:	G. Collins
Matrix:	Air	Reviewed By:	J. Bennett
Basis:	As Rec'd.	Units:	µg/m3

Analyte	Reporting Limit	Sample Result	Qualifier
Methane	6660	6660	U
Ethane	5920	5920	U

U=Not detected at specified reporting limits
J=Estimated value

Corvallis Applied Sciences Laboratory

Client Information		Lab Information	
Project Name:	Amtest-Boise Cascade	Date Rec'd:	05/05/95
Project Manager:	Aaron Porter	Batch ID:	854203
Sampled By:	Not given	Date Analyzed:	5/17/95
Client Sample ID:	Run #3 GRI	Dilution Factor:	1
Sampling Date:	05/05/95	Analysis Method:	GC-FID
Sampling Time:	8:00	Report Revision No.:	0
Type:	Grab	Reported By:	G. Collins
Matrix:	Air	Reviewed By:	J. Bennett
Basis:	As Rec'd.	Units:	μg/m3

Analyte	Reporting Limit	Sample Result	Qualifier
Methane	6660	6660	U
Ethane	5920	5920	U

U=Not detected at specified reporting limits
J=Estimated value

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: ASE20006
Purchase Order #: 95-D47

Project Name: Amtest Air Quality INC.

Company Name/CH2M HILL Office: Boise Cascade - White City

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ]

Report Copy to: Aaron Porter

Requested Completion Date:

Sampling Requirements: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ____

Sample Disposal: Dispose ☐ Return ☐

SHADED AREA-- FOR LAB USE ONLY

Lab 1 #: 842173
Lab 2 #:
Quote #:
Kit Request #:
Project #:
No. of Samples: 3
Page 1 of 1
Login:
LIMS Ver:

LAB TEST CODES

ANALYSES REQUESTED

Date	Time	COMP	GRAB	WATER	SOIL	AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Methane, Ethane	TO-12	REMARKS	LAB 1 ID	LAB 2 ID
5-3	1030		✓			✓	RUN#1GRI	2	✓	✓		1	
5-4	803		✓			✓	RUN#2GRI	2	✓	✓		2	
5-5	800		✓			✓	RUN#3GRI	2	✓	✓		3	

Sampled By & Title (Please sign and print name) — Date/Time

Relinquished By (Please sign and print name): Aaron C. Porter — Date/Time: 1641/5-5-95

Received By (Please sign and print name): Jerri Mattick — Date/Time: 5-5-95 am

Relinquished By (Please sign and print name) — Date/Time

Received By (Please sign and print name) — Date/Time

Relinquished By (Please sign and print name) — Date/Time

Received By (Please sign and print name) — Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other ____

Shipping #

QC Level: 1 2 3 Other: ____

COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Work Authorized By (Please sign and print name)

Remarks: Please ANALYZE only 1 bag for each Run. 2nd bag is backup

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client
REV 3/94 FORM 340

APPENDIX C

Example Calculations & Field Data Sheets

EXAMPLE CALCULATION SHEET
EPA METHODS 1, 2, 3A, 4 AND 5

CLIENT: GRI/WP Natural Gas @ Boise Cascade Corp. LOCATION: White City, OR DATE: 5/3/95

RUN #: 2 LAB #: 8132 SITE LOCATION: #2 Package Boiler

Particulate Matter Emission Concentration - Equation 5-1

Vm_{std} = 17.647°R/"Hg$_{(constant)}$*volume sampled*Yfactor*(P_B + ΔH/13.6)/(460+T_m)

= 17.647°R/"Hg* 193.763 ft³* 1.003 *(28.75 "Hg + (0.433 "H_2O/13.6))/(460 +74.8° F)

= 184.574 dscf

dscm = 184.574 dscf/35.31 ft³/m³

= 5.227 dscm

Substitution of Equation 5-4 into 5-5

W_a = mg/ml blank * ml sample = mg sample due to acetone blank

= 0.1 mg = 0.0015 mg/ml * 80 ml

M_n = (net weight filter catch) + (net weight "B" section) - Wa + Back-half

= 4.1 mg = 0.7 mg + 1.4 mg - 0.1 mg + 2.1 mg

C_s = (0.001 g/mg) * (15.43 grains/gram) * M_n / Vm_{std}

Front-half

C_s = (0.001 g/mg) * (15.43 grains/gram) * 2.0 mg / 184.574 dscf

= 0.0002 gr/dscf (Equation 5-6)

gr/dscf @____% O_2 = ______gr/dscf * (20.9% - ______%O_2)/(20.9% - ______%O_2)
% correction % measured

= NA gr/dscf @ ____% O_2

gr/dscf @___%CO_2 = _______gr/dscf * ______% / ______%CO_2
% correction % measured

= NA gr/dscf @ ____% CO_2

$\frac{lb}{MMscf} = 0.008 \frac{lb}{hr} \times \frac{1\ hr}{33259\ scf} \times \frac{1{,}000{,}000\ scf}{MMsf} = 0.2405 \frac{lb}{MMscf}$ (front-half)

Back-half

C_s = (0.001 g/mg) * (15.43 grains/gram) * 2.1 mg / 184.574 dscf

= 0.0002 gr/dscf (Equation 5-6)

gr/dscf @____% O_2 = ______gr/dscf * (20.9% - ______%O_2)/(20.9% - ______%O_2)
% correction % measured

= NA gr/dscf @ ____% O_2

gr/dscf @___%CO_2 = _______gr/dscf * ______% / ______%CO_2
% correction % measured

= NA gr/dscf @ ____% CO_2

$\frac{lb}{MMscf} = 0.009 \frac{lb}{hr} \times \frac{1\ hr}{33259\ scf} \times \frac{1{,}000{,}000\ scf}{MMscf} = 0.2706 \frac{lb}{MMscf}$ (back-half)

EXAMPLE CALCULATION SHEET (continued)
EPA METHODS 1, 2, 3A, 4 and 5

Total

C_s = (0.001 g/mg) * (15.43 grains/gram) * 4.1 mg / 184.574 dscf

= 0.0003 gr/dscf (Equation 5-6)

gr/dscf @ 3 % O_2 = 0.0003 gr/dscf * (20.9% - 3 % O_2)/(20.9% - 3.3 % O_2)
(% correction) (% measured)

= 0.0003 gr/dscf @ 3 % O_2

gr/dscf @ ___ % CO_2 = ______ gr/dscf * ______ % / ______ % CO_2
(% correction) (% measured)

= NA gr/dscf @ ____ % CO_2

$\frac{lb}{MMscf} = 0.017 \frac{lb}{hr} \times \frac{1 hr}{33259 scf} \times \frac{1,000,000 scf}{MMscf} = 0.5111 \frac{lb}{MMscf}$

mg/dscm = 4.1 mg/ 5.227 dscm

= 0.783 mg/dscm

Particulate Matter Emission Rate

pounds/hour = C_s * dscf/min * 60 min/hr * 1 lb/7000 grains

= 0.0003 gr/dscf * 5879.3 dscf/min * 60 min/hr * 1 lb/7000 grains

= 0.017 lb/hr

tons/year = ______ lb/hr * 24 hr/day * 365 days/yr * 1 ton/2000 lb

= NA tons/yr

Moisture - Equation 5-2 and 5-3

Vw_{std} = 0.04715 ft³/g * 784.1 grams of H_2O collected in impingers

= 36.97 scf

B_{ws} = (36.97 scf)/(36.97 scf + 184.574 dscf)

= 0.1669

% Moisture = 16.69 % = B_{ws} * 100

Molecular weight - Equation 3-2

M_d = 0.440*(10.2 % CO_2)+0.320*(3.3 % O_2)+0.280*(100%- 10.2 % CO_2 - 3.3 % O_2(%CO+% N_2))

= 29.76 g/g-mole (dry)

M_s = M_d * (1-B_{ws}) + 18.0 * B_{ws} = 29.76 g/g-mole * (1 - 0.1669) + 18.0 g/g-mole * 0.1669

= 27.80 g/g-mole (wet)

F_o = (20.9 - 3.3)% O_2/ 10.2 % CO_2 = 1.73

EXAMPLE CALCULATION SHEET (continued)
EPA METHODS 1, 2, 3A, 4 and 5

Stack gas velocity and volumetric flow rate - Equation 2-9 and 2-10

V_S = 85.49 * Cp* $\sqrt{\Delta P * T_s{}^{o} R / (M_s \text{ g/g-mole} * P_s\text{"Hg})}$

= 85.49 * 0.84 * $\sqrt{0.624 * 738.7^{o} R / (27.80 \text{ g/g-mole} * 28.72 \text{"Hg})}$
(278.7° F + 460)° R (28.75 P_B + 0.36 P_s/13.6)

= 54.6 ft/sec (std)

Q_{sd} = 3600 * (1 - B_{ws}) * V_s ft/sec * A_s ft² * ($T_{std}{}^{O}$ R/$T_s{}^{O}$ R) * (P_s"Hg / P_{std}"Hg) / 60 min/hr

= 3600 * (1 - 0.1669) * 54.6 ft/sec * 3.14 ft² * (528° R/738.7 ° R) * (28.72"Hg / 29.92"Hg) / 60
24²*π/4/144
= 5879.3 dscf/min (dry standard cubic feet per minute)

acfm = 54.6 ft/sec * 3.14 ft²* 60 sec/min

= 10284.3 acfm (actual cubic feet per minute)

Isokinetic variation - Equation 5-8

I = 0.09450 * Vm_{std} dscf * $T_s{}^{O}$ R / [P_s"Hg * $V_s$ft/sec * minutes * $A_n$ft² *(1 -B_{ws})]

= 0.09450 * 184.574 dscf * 738.7° R/[28.72"Hg * 54.6 ft/sec * 480 min * 0.0002 ft² *(1 -0.1669)]
(.194 N_{dia}/12/2)²*Pi

= 100 %

All of the above numbered equations are from the 40 CFR 60 and assume English units.
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EXAMPLE CALCULATION SHEET (continued)
EPA METHODS 1, 2, 3A, 4 and 5
BACK-HALF PARTICULATE

"C" Section

(write in final and intial wts for all appropriate impingers for c below)

1071.2 - 643.9 = 427.3
920.5 - 604.9 = 315.6
672.3 - 666.7 = 5.6
555.1 - 553.5 = 1.6
750.1

a 3.8 mg particulate in "C" Section Beaker

b 1284 ml of water in condensers, including rinses

c 750.1 ml condensation in 1st, 2nd and 3rd bubblers (final wt - initial wt, assumes 1g/1ml water density)

d 533.9 ml DI water used in bubblers including rinses = *b - c*

e 0.007 mg/ml blank particulate = 0.2 mg blank / 130 ml blank = 0.0072 (too high)

f 3.7 mg blank particulate = *e * d*

g 900 ml aliquot

h 1.427 correction factor = ~~b/(b-g)~~ b/g

1.7 **mg of "C" particulate** = *a*h - f* = (3.8 mg * 1.427) - 3.7 mg

"Cx" Section

a 0.4 mg particulate in "Cx" Section Beaker = 0.3 mg * 1.427 correction factor (*h*)

b 225 ml CH_2Cl_2 used for sample

c 0.0 mg/ml blank particulate = 0.0 mg blank / 80 ml blank

d 0.0 mg blank particulate = *b * c*

0.4 **mg of "Cx" particulate** = *a - d* = 0.4 mg - 0.0 mg

"D" Section

a ______ mg particulate in "D" Section Beaker

b ______ ml Acetone used for sample

c ______ mg/ml blank particulate (Same as "B" Section)

d ______ mg blank particulate = *b * c*

NA **mg of "D" particulate** = *a - d* = ______ mg - ______ mg

TOTAL BACK-HALF PARTICULATE

\+ 1.7 mg "C" Section Particulate
\+ 0.4 mg "Cx" Section Particulate
\+ NA mg "D" Section Particulate
\+ NA mg Back-half Filter Particulate (If applicable)

= 2.1 **mg Back-half Particulate**

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AMTEST AIR QUALITY, INC.

Example Calculation of Method 5 Post-Test Calibration

Client: GRI/WP Natural Gas @ Boise Cascade

Location: White City, OR

Site Location: #2 Package Boiler

Run #: 2 (0803-1607)

Date: 5/3/95

Calculate Y_{qa} for each test run using the following equation:

$$Y_{qa} = \frac{\theta}{V_m} \sqrt{\frac{0.0319\, T_m}{\Delta H_@ \left(P_b + \Delta \frac{H_{avg}}{13.6}\right)} \frac{29}{M_d}} \left(\sqrt{\Delta H}\right)_{avg}$$

where:

Y_{qa} = dry gas meter calibration check value, dimensionless
θ = total run time, minutes
V_m = total sample volume measured by dry gas meter, dcf
T_m = absolute average dry gas meter temperature, degrees Rankin (^oR)
P_b = barometric pressure, inches Hg
0.0319 = (29.92 " Hg/528 ^oR) $(0.75)^2$

H_{avg} = average orifice meter differential, inches H_2O
H@ = orifice meter calibration coefficient, inches H_2O
M_d = dry molecular weight of stack gas, lb/lb-mole
29 = dry molecular weight of air, lb/lb-mole
13.6 = specific gravity of mercury

Example Calculation:

$$Y_{qa} = \sqrt{\frac{(0.0319 * (\underline{74.8}\ T_m + 460)^oR * 29 \text{ lb/lb-mole}/\underline{29.76}\ M_d)}{\underline{1.666}\ \Delta H@ * (\underline{28.75}\ P_b + (\underline{0.433}\ \Delta H_{avg}/13.6))}}$$

$$* \sqrt{\underline{0.433}\ \Delta H_{avg}} * (\underline{480}\ \theta/\underline{193.763}\ V_m) = \underline{0.960}\ Y_{qa}$$

% Error = ($\underline{0.960}$ Y_{qa} - $\underline{1.003}$ Y)/ $\underline{0.960}$ Y_{qa} * 100% = $\underline{-4.5}$ %*

*Percent (%) error must be less than 5%.

AMTEST AIR QUALITY, INC.

Example Calculation - Fuel Factor

Client GRI/WP Natural Gas @ Boise Cascade

Location White City, OR

Sample Site #2 Package Boiler

Date 4.30.95

Run # 2

H2 : Hydrogen	nC4 : N-Butane
C1 : Methane	C4= : Butene
C2 : Ethane	iC5 : I-Pentane
C2= : Ethylene	nC5 : N-Pentane
C3 : Propane	C6+ : Hexane
C3= : Propylene	N2 : Nitrogen
iC4 : I-Butane	CO2 : Carbon Dioxide

dscf/MMBtu = 528° R/520° R * 30.00"Hg/29.92"Hg * 10^6/100% * { [1.89 ft^3/325 ft^3/MMBtu * ø % H2] +

[8.56 ft^3/1012 ft^3/MMBtu * 95.577 % C1] + [15.23 ft^3/1773 ft^3/MMBtu * 2.889 % C2] +

[14.34 ft^3/1604 ft^3/MMBtu * ø % C2=] + [21.89 ft^3/2523 ft^3/MMBtu * 0.597 % C3] +

[20.01 ft^3/2340 ft^3/MMBtu * ø % C3=] + [28.57 ft^3/3265 ft^3/MMBtu * (0.081 % iC4 + ø % nC4)] +

[26.68 ft^3/3084 ft^3/MMBtu * ø % C4=] + [35.24 ft^3/4014 ft^3/MMBtu * (0.026 % iC5 + ø % nC5)] +

[41.91 ft^3/4748 ft^3/MMBtu * 0.009 % C6+] + [0 * 0.614 % N2] + [0 * 0.050 % CO2] }

= 8546 dscf/MMBtu

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AMTEST
AIR QUALITY, INC.

Example Calculation of Bias Correction

Client: GRI /WP Natural Gas @ Boise Cascade **Location:** White City, OR

Site Location: #2 Package Boiler

Run #: 2B (1239-1640) (labeled run 2 on 5/3/95)

Date: 5/3/95

$$C_{gas} = (C - C_o) * (C_{ma}/(C_m - C_o)$$

where:

C_{gas} = Effluent gas concentration, dry basis, ppm

C = Average gas concentration indicated by analyzer, dry basis, ppm

C_o = Average of initial and final system calibration bias check responses for the zero gas, ppm

C_{ma} = Actual concentration of the upscale calibration gas, ppm

C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas, ppm

= [0.5 ppm - 0.0] * [89.7 /(88.8 - 0.0]

= 0.5 ppm SO_2 (bias corrected)

AMTEST
AIR QUALITY, INC.

Example Calculation of Gaseous Sulfur Dioxide (SO_2) Emissions

Client: GRI/WP Natural Gas @ Boise Cascade Corporation

Location: White City, OR.

Site Location: #2 Package Boiler

Run #: 2B (1239-1640)

Date: 5/3/95

Emission Concentration Results

instrument averaged 0.5 ppm sulfur dioxide (SO_2) during the run

$$0.5 \text{ ppm} * \frac{(20.9 - 3 \text{ \% } O_2)}{(20.9 - 3.2 \text{ \% } O_2)} = 0.5 \text{ ppm } SO_2 \text{ @ } 3 \text{ \% } O_2$$

$$0.5 \text{ ppm} * [1.660 \times 10^{-7}]^1 = 8.3 \times 10^{-8} \text{ lb/dscf } SO_2$$

[1]Conversion factor from 40 CFR 60, Appendix A, Method 19.

Emission Rate Results

$$8.3 \times 10^{-8} \frac{\text{lb}}{\text{dscf}} * 5879.3 \frac{\text{dscf}}{\text{min}} * 60 \frac{\text{min}}{\text{hr}} = 0.029 \text{ lb/hr } SO_2$$

$$\_\_\_\_ \frac{\text{lb}}{\text{hr}} * 24 \frac{\text{hrs}}{\text{day}} * 365 \frac{\text{days}}{\text{yr}} * \frac{1 \text{ ton}}{2000 \text{ lbs}} = \text{NA tons/yr } SO_2$$

$$\frac{\text{lb}}{\text{MMscf}} = 0.029 \frac{\text{lb}}{\text{hr}} SO_2 \times \frac{1 \text{ hr}}{33258.9 \text{ scf (Natural gas)}} \times \frac{1{,}000{,}000 \text{ scf}}{\text{MMscf}} = 0.8803$$

AMTEST
AIR QUALITY, INC.

EXAMPLE CALCULATION OF SULFUR DIOXIDE (SO_2) GASEOUS EMISSION FACTOR

RUN 23

CLIENT GRI/WP Natural Gas @ Boise Cascade Corp.　　LOCATION White City, OR

SAMPLE SITE #2 Package Boiler　　DATE 5/3/95

SULFUR DIOXIDE (SO_2)

instrument averaged 0.5 ppm during the run

ppm x 1.660×10^{-7} = lb/scf SO_2 (from 40 CFR 60, Appendix A, Method 19)

0.5 ppm x 1.660×10^{-7} = 8.3×10^{-8} lb/scf

For Calculations Based on Dry Measurements:

lb/scf x fuel factor[1] x (20.9%/(20.9%- (measured amount) % O_2) = lb/MMBtu
(from 40 CFR 60, Appendix A, Method 19, Eq. 19-1)

8.3×10^{-8} lb/scf x 8270 dscf/MMBtu x (20.9%/(20.9% - 3.2 % O_2) = 0.0008 lb/MMBtu

For Calculations Based on Wet Measurements:

lb/scf x fuel factor[1] x (20.9%/(20.9% x (1 - 0.027) - (measured amount) % O_2) = lb/MMBtu
(from 40 CFR 60, Appendix A, Method 19, Eq. 19-2)

_______ lb/scf x ______ wscf/MMBtu x (20.9%/(20.9% x (1 - 0.027) - ____% O_2) = NA lb/MMBtu

1 Table 19-1-F

TABLE 19-1—F FACTORS FOR VARIOUS FUELS [1]

Fuel type	F_d		F_w		F_c	
	dscm/J	dscf/10⁶ Btu	wscm/J	wscf/10⁶ Btu	scm/J	scf/10⁶ Btu
Coal:						
Anthracite [2]	2.71×10^{-7}	10,100	2.83×10^{-7}	10,540	0.530×10^{-7}	1,970
Bituminous [2]	2.63×10^{-7}	9,780	2.86×10^{-7}	10,640	0.484×10^{-7}	1,800
Lignite	2.65×10^{-7}	9,860	3.21×10^{-7}	11,950	0.513×10^{-7}	1,910
Oil [3]	2.47×10^{-7}	9,190	2.77×10^{-7}	10,320	0.383×10^{-7}	1,420
Gas:						
Natural	2.43×10^{-7}	8,710	2.85×10^{-7}	10,610	0.287×10^{-7}	1,040
Propane	2.34×10^{-7}	8,710	2.74×10^{-7}	10,200	0.321×10^{-7}	1,190
Butane	2.34×10^{-7}	8,710	2.79×10^{-7}	10,390	0.337×10^{-7}	1,250
Wood	2.48×10^{-7}	9,240			0.492×10^{-7}	1,830
Wood Bark	2.58×10^{-7}	9,600			0.516×10^{-7}	1,920
Municipal Solid Waste	2.57×10^{-7}	9,570			0.488×10^{-7}	1,820

[1] Determined at standard conditions: 20 °C (68 °F) and 760 mm Hg (29.92 in. Hg).
[2] As classified according to ASTM D388-77.
[3] Crude, residual, or distillate.

AMTEST AIR QUALITY, INC.

Example Calculation of Gaseous Nitrogen Oxides (NO_x) Emissions

Client: GRI/WP Natural Gas @ Boise Cascade Corporation

Location: White City, OR

Site Location: #2 Package Boiler

Run #: 2B(1239-1640)

Date: 5/3/95

Emission Concentration Results

instrument averaged 32.0 ppm nitrogen oxides (NO_x) during the run

$$32.0 \text{ ppm} * \frac{(20.9 - 3 \text{ \% } O_2)}{(20.9 - 3.2 \text{ \% } O_2)} = 32.4 \text{ ppm } NO_x \text{ @ } 3 \text{ \% } O_2$$

$$32.0 \text{ ppm} * [1.194 \times 10^{-7}]^1 = 3.82 \times 10^{-6} \text{ lb/dscf } NO_x$$

[1]Conversion factor from 40 CFR 60, Appendix A, Method 19.

Emission Rate Results

$$3.82 \times 10^{-6} \frac{\text{lb}}{\text{dscf}} * 5879.3 \frac{\text{dscf}}{\text{min}} * 60 \frac{\text{min}}{\text{hr}} = 1.35 \text{ lb/hr } NO_x$$

$$\_\_\_\_ \frac{\text{lb}}{\text{hr}} * 24 \frac{\text{hrs}}{\text{day}} * 365 \frac{\text{days}}{\text{yr}} * \frac{1 \text{ ton}}{2000 \text{ lbs}} = \text{NA tons/yr } NO_x$$

$$\frac{\text{lb}}{\text{MMscf}} = 1.35 \frac{\text{lb}}{\text{hr}} NO_x \times \frac{1 \text{ hr}}{33258.9 \text{ scf}} \times \frac{1{,}000{,}000 \text{ scf}}{\text{MMscf}} = 40.53 \frac{\text{lb}}{\text{MMscf}}$$

(Natural gas)

AMTEST
AIR QUALITY, INC.

EXAMPLE CALCULATION OF NITROGEN OXIDES (NO_X) GASEOUS EMISSION FACTOR

RUN 2B

CLIENT GRI/WP Natural Gas @ Boise Cascade Corporation
LOCATION White City, OR

SAMPLE SITE #2 Package Boiler
DATE 5·3·95

NITROGEN OXIDES (NO_X)

instrument averaged 32.0 ppm during the run

ppm x 1.194×10^{-7} = lb/scf NO_X (from 40 CFR 60, Appendix A, Method 19)

32.0 ppm x 1.194×10^{-7} = 3.82×10^{-6} lb/scf

For Calculations Based on Dry Measurements:

lb/scf x fuel factor[1] x (20.9%/(20.9%- (measured amount) % O_2) = lb/MMBtu
(from 40 CFR 60, Appendix A, Method 19, Eq. 19-1)

3.82×10^{-6} lb/scf x 8270 dscf/MMBtu x (20.9%/(20.9% - 3.2 % O_2) = 0.0386 lb/MMBtu

For Calculations Based on Wet Measurements:

lb/scf x fuel factor[1] x (20.9%/(20.9% x (1 - 0.027) - (measured amount) % O_2) = lb/MMBtu
(from 40 CFR 60, Appendix A, Method 19, Eq. 19-2)

_______ lb/scf x ______ wscf/MMBtu x (20.9%/(20.9% x (1 - 0.027) - ____% O_2) = NA lb/MMBtu

1 Table 19-1-F

TABLE 19-1—F FACTORS FOR VARIOUS FUELS [1]

Fuel type	F_d dscm/J	F_d dscf/10^6 Btu	F_w wscm/J	F_w wscf/10^6 Btu	F_c scm/J	F_c scf/10^6 Btu
Coal:						
Anthracite [2]	2.71×10^{-7}	10,100	2.83×10^{-7}	10,540	0.530×10^{-7}	1,970
Bituminous [2]	2.63×10^{-7}	9,780	2.86×10^{-7}	10,640	0.484×10^{-7}	1,800
Lignite	2.65×10^{-7}	9,860	3.21×10^{-7}	11,950	0.513×10^{-7}	1,910
Oil [3]	2.47×10^{-7}	9,190	2.77×10^{-7}	10,320	0.383×10^{-7}	1,420
Gas:						
Natural	2.43×10^{-7}	8,710	2.85×10^{-7}	10,610	0.287×10^{-7}	1,040
Propane	2.34×10^{-7}	8,710	2.74×10^{-7}	10,200	0.321×10^{-7}	1,190
Butane	2.34×10^{-7}	8,710	2.79×10^{-7}	10,390	0.337×10^{-7}	1,250
Wood	2.48×10^{-7}	9,240			0.492×10^{-7}	1,830
Wood Bark	2.58×10^{-7}	9,600			0.516×10^{-7}	1,920
Municipal	2.57×10^{-7}	9,570			0.488×10^{-7}	1,820
Solid Waste						

[1] Determined at standard conditions: 20 °C (68 °F) and 760 mm Hg (29.92 in. Hg).
[2] As classified according to ASTM D388-77.
[3] Crude, residual, or distillate.

AMTEST AIR QUALITY, INC.

Example Calculation of Gaseous Carbon Monoxide (CO) Emissions

Client: GRI/WP Natural Gas @ Boise Cascade Corporation

Location: White City, OR

Site Location: #2 Package Boiler

Run #: 2 (1239-1640)

Date: 5/3/95

Emission Concentration Results

instrument averaged 2.9 ppm carbon monoxide (CO) during the run

$$2.9 \text{ ppm} * \frac{(20.9 - 3 \text{ \% } O_2)}{(20.9 - 3.2 \text{ \% } O_2)} = 2.9 \text{ ppm CO @ } 3 \text{ \% } O_2$$

$$2.9 \text{ ppm} * \frac{28.01 \text{ g/g-mole}}{22.414 \text{ L/g-mole}} * \frac{273.15\ ^oK}{293.15\ ^oK} * \frac{1000 \text{ l}}{1 \text{ m}^3} * \frac{1}{10^6 \text{ ppm}} = 3.38 \times 10^{-3} \text{ g/m}^3 \text{ CO}$$

Emission Rate Results

$$3.38 \times 10^{-3} \text{ g/m}^3 * \frac{1 \text{ m}^3}{35.31 \text{ ft}^3} * 5879.3 \frac{\text{dscf}}{\text{min}} * 60 \frac{\text{min}}{\text{hr}} * \frac{1 \text{ lb}}{453.6 \text{ g}} = 0.074 \text{ lb/hr CO}$$

$$\underline{\quad\quad} \frac{\text{lb}}{\text{hr}} * 24 \frac{\text{hrs}}{\text{day}} * 365 \frac{\text{days}}{\text{yr}} * \frac{1 \text{ ton}}{2000 \text{ lbs}} = \text{NA tons/yr CO}$$

$$\frac{\text{lb}}{\text{MMscf}} = 0.074 \frac{\text{lb}}{\text{hr}} \text{ CO} \times \frac{1 \text{ hr}}{33258.9 \text{ scf (Natural gas)}} \times \frac{1{,}000{,}000 \text{ scf}}{\text{MMscf}} = 2.236 \frac{\text{lb}}{\text{MMscf}}$$

AMTEST AIR QUALITY, INC.

Example Calculation of Gaseous Total Hydrocarbon (THC) Emissions

Client: GRI/WP Natural Gas @ Boise Cascade Corp.

Location: White City, OR

Site Location: #2 Package Boiler

Run #: 2B

Date: 5/3/95

Emission Concentration Results

instrument averaged <0.1 ppm, wet THC during the run

$$\frac{<0.1 \text{ ppm, wet}}{(1 - 0.1669 \text{ Bws})} = <0.1 \text{ ppm, dry THC}$$

$$<0.1 \text{ ppm} * \frac{(20.9 - 3 \ \%\ O_2)}{(20.9 - 3.2 \ \%\ O_2)} = <0.1 \text{ ppm THC @ } 3 \ \%\ O_2$$

Emission Rate Results

$$<0.1 \text{ ppm} * \frac{44.09 \text{ g/g-mole}}{22.414 \text{ L/g-mole}} * \frac{273.15\ ^oK}{293.15\ ^oK} * \frac{1 \text{ lb}}{453.6 \text{ g}} * \frac{1000 \text{ L}}{1 \text{ m}^3} * \frac{1 \text{ m}^3}{35.31 \text{ ft}^3} * 60 \frac{\text{min}}{\text{hr}} *$$

$$5879.3 \frac{\text{dscf}}{\text{min}} * \frac{1}{10^6 \text{ ppm}} = <0.005 \text{ lb/hr THC}$$

$$\_\_\_\_ \frac{\text{lb}}{\text{hr}} * 24 \frac{\text{hrs}}{\text{day}} * 365 \frac{\text{days}}{\text{yr}} * \frac{1 \text{ ton}}{2000 \text{ lbs}} = \text{NA tons/yr THC}$$

$$<0.005 \frac{\text{lb}}{\text{hr}} \text{ THC} \times \frac{1 \text{ hr}}{33258.9 \text{ scf}} \times \frac{1{,}000{,}000 \text{ scf}}{\text{MMscf}} = <0.1457 \frac{\text{lb}}{\text{mmscf}}$$

EXAMPLE CALCULATION OF TNMOC RESULTS

Client:	GRI/WP Natural Gas @ Boise Cascade Corp.	Date:	5·3·95
Location:	White City, OR	Lab #:	854202
Site Location:	#2 Package Boiler	Run #:	2

EXAMPLE COMPOUND: Total Non-Methane Organic Carbon (TNMOC)

EMISSION RATE (lb/hr)

$$\frac{\text{lb}}{\text{hr}} = \frac{\text{ug}}{\text{m3}} \times \frac{\text{m3}}{35.31\text{ ft3}} \times \frac{\text{dscf}}{\text{min}} \times \frac{1\text{ lb}}{453600000\text{ ug}} \times \frac{60\text{ min}}{\text{hr}}$$

$$= 1250\,\frac{\text{ug}}{\text{m3}} \times \frac{\text{m3}}{35.31\text{ ft3}} \times 5879.3\,\frac{\text{dscf}}{\text{min}} \times \frac{1\text{ lb}}{453600000\text{ ug}} \times \frac{60\text{ min}}{\text{hr}}$$

$$= 0.028\,\frac{\text{lb}}{\text{hr}}$$

[cbh:c:\excel\byhands\to14bhph.xls]

$$\frac{\text{lb}}{\text{mmscf}} = 0.028\,\frac{\text{lb}}{\text{hr}} \times \frac{1\text{ hr}}{33258.9\text{ scf}} \times \frac{1{,}000{,}000\text{ scf}}{\text{mmscf}} = 0.8278\,\frac{\text{lb}}{\text{mmscf}}$$

(natural gas usage)

STACK SCHEMATIC AND LOCATION OF SAMPLE POINTS

Client: Gas Research Institute

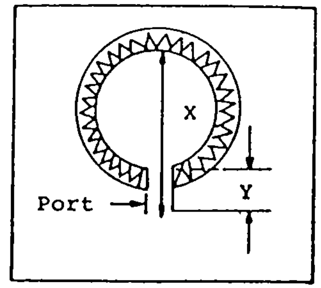
Location: White City, OR

Sampling Location: Boiler #2

Inside of far wall to outside of port (distance, X): 28.0"

Inside of near wall to outside of port (distance, Y): 5.0" - 1.0" inset

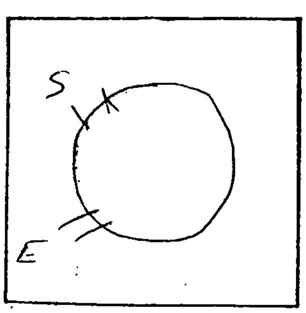
Stack I.D. (distance X - distance Y): 24.0"

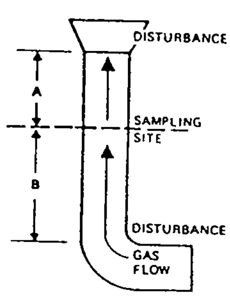


Schematic of Sampling Location

1 Traverse Point #	2 Fractional Percent of Stack I.D.	3 Stack I.D. inches	4 Column 2 x 3	5 Distance Y	6 Traverse Point Location from Outside of Port columns 4 + 5
1	0.021	24.0"	0.5	4.0	4.5
2	0.067		1.6		5.6
3	0.118		2.8		6.8
4	0.177		4.2		8.2
5	0.250		6.0		10.0
6	0.356		8.5		12.5
7	0.644		15.5		19.5
8	0.750		18.0		22.0
9	0.823		19.8		23.8
10	0.882		21.2		25.2
11	0.933		22.4		26.4
12	0.979		23.5		27.5

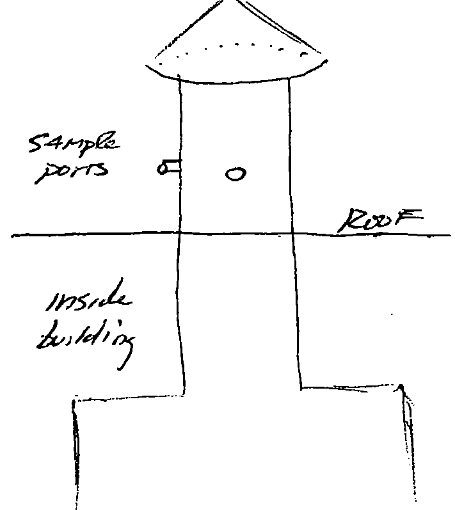
CROSS SECTION





Distance A = 27" *downstream*
Distance B = ≈ 104" *upstream*

STACK, CONTROL DEVICE AND PROCESS FLOW DIAGRAM



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TRAVERSE SAMPLING DATA SHEET

Page ___ of ___ 68

Client Gas Research Institute
Location White City, OR
Sample Site #2 Boiler

Stack Diameter ~~23"~~ 24"
Date 5-2-95
Operators ACP
Run I.D. R-1 M5/202 JBH

QA FORMS COMPLETED
Stack Schematic ✓
Sample Train ✓
Pitot Tube Insp. ✓
Magnehelic Cal. ___
Temp. Probe Cal. ___
Gas Meter Calib. ___

Start Time 1030
Stop Time 1836
Barometric Pressure "Hg 28.70
Static Pres "H_2O −0.35
Production Rate 95% of Steaming rate

EQUIPMENT CHECKS

	Initial/Final
Leak Rate cfm	0.008 / 0.002
Leak Test Vacuum	21 / 5

✓ Pitots, Pre Leak Ck
✓ Pitots, Post Leak Ck
_____ Gas Sampling System
_____ Integrated Bag
M5 Rinse Acetone/H_2O/Other

Filter #25364 Box # 0.1

	Final Wt. gram	Initial Wt. gram	Net Wt. gram
#1 Imp.	1079.7	~~594.9~~ 647.0	432.7
#2 Imp.	894.3	599.6	294.7
#3 Imp.	663.2	~~565.1~~ 652.5	10.7
#4 Imp.	567.2	565.1	2.1
#5 Imp.	-	-	0
#6 S.G.	833.0	799.8	33.2

Total H_2O Volume 773.4 ✓ g

SAMPLING PARAMETERS
RED MANOMETER BOX
% Moisture 16.2
Meter Temp. 68
Stack Temp. 286
Δ H@ 1.666 Y 1.003
Pitot #P195-4B Side # A
Cp 0.84
Nozzle Diameter 0.194 inch
D_1 0.194 D_2 0.194 D_3 0.194
K Factor 0.748, 0.756, 0.761

T 195-4

Sample Point	Elap Time Min.	Dry Gas Meter Reading Cu.Ft.	Pitot Reading Δ P " H_2O	Orifice Setting (Δ H) " H_2O Ideal	Orifice Setting (Δ H) " H_2O Actual	Gas Meter Temp °F In	Gas Meter Temp °F Out	Pump Vac. Gauge " Hg	Filter Box Temp °F	Imp. Exit Temp °F	Stack Temp °F	O_2 %	
E 1	0	581.680	0.58	0.434	0.434	65	63	0	261	60	274		
2	20	589.640	0.58	0.434	0.434	67	64	0	260	50	275		
3	40	597.570	0.57	0.430	0.430	70	66	0	262	49	276		
4	60	605.520	0.57	0.430	0.430	72	68	0	259	49	278		
5	80	613.540	0.55	0.420	0.420	73	69	0	261	51	279		
6	100	621.440	0.48	0.363	0.363	74	70	0	265	50	277		
7	120	628.780	0.67	0.570	0.570	73	69	0	264	48	277		
8	140	637.630	0.69	0.525	0.525	75	70	0	255	50	278		
9	160	646.070	0.68	0.520	0.520	77	72	0	260	53	279		
10	180	654.800	0.67	0.570	0.570	78	73	0	261	53	278		
11	200	663.500	0.65	0.494	0.494	79	74	0	255	56	268		
12	220	672.010	0.64	0.490	0.490	81	76	1	262	51	279		
234 S 1	240	680.432	0.48	0.367	0.367	81	77	1	256	53	275		
2	260	687.800	0.47	0.360	0.360	81	77	1	260	56	274		
3	280	695.282	0.47	0.360	0.360	82	78	1	257	62	274		
4	300	702.450	0.49	0.380	0.380	83	78	1	262	53	277		
5	320	710.240	0.53	0.400	0.400	82	78	1	257	52	277		
6	340	717.865	0.56	0.42	0.42	80	77	1	255	52	278		
7	360	725.781	0.48	0.37	0.37	78	75	1	262	55	278		
8	380	732.780	0.62	0.48	0.48	75	73	1	257	60	275		
9	400	740.555	0.65	0.50	0.45	73	70	1	252	53	276		
10	420	748.540	0.67	0.57	0.46	72	69	2	259	53	277		
11	440	756.450	0.66	0.51	0.45	73	69	2	261	54	276		
1830 12	460	764.240	0.66	0.51	0.45	71	70	2	252	55	277		
END	480	772.149											
		190.469 ✓	52.9 fps		✓0.439	73.8 ✓					276.3 ✓		

Observed by [illegible] Radian Corp 5/2/95

METHOD 5
LABORATORY ANALYSIS

Client GRI/WP Nat. Gas @ BCC Run Number 1

Sample Location #2 Boiler

Date 5-2-95

"A" Section (Filter)

Filter # 125-364

Tare Weight 1.0269 grams
Final Weight 1.0290 grams F ✓
Net Weight 0.0021 grams

"B" Section (Probe Wash)

Beaker # 150-3123
Volume Acetone 180 mls

Tare Weight 64.8088 grams
Final Weight 64.8162 grams F ✓
Net Weight 0.0074 grams

"C" Section (Condenser Particulate - Inorganic Catch)

Beaker # 150-3102
Volume Water 900/1217 mls

$\frac{1217}{900} = 1.352$

Tare Weight 65.1292 grams F
Final Weight 65.1341 grams ✓
Net Weight 0.0049 grams × 1.352
0.0066
pH = 3.21

Combine for Cx

"Cx" Section (Condenser Particulate - Organic Catch)

Beaker # 150-3124
Volume CH_2Cl_2 150 mls

Tare Weight 65.9833 grams
Final Weight 65.9860 grams F ✓
Net Weight 0.0027 grams × 1.352
0.0037

Cx Section
~~"D" Section (Final Acetone Rinse of Impingers)~~

Beaker # 150-3133
Volume ~~Acetone~~ CH_2Cl_2 75 mls

Tare Weight 65.9470 grams F ✓
Final Weight 65.9470 grams
Net Weight 0.0 grams

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TRAVERSE SAMPLING DATA SHEET

Client Gas Research Institute
Location Boise Cascade White City, OR
Sample Site H2 Boiler

Stack Diameter 24.0"
Date 5-3-95
Operators ACP
Run I.D. Run #2 M-5 w/202 BH

EQUIPMENT CHECKS

	Initial/Final
Leak Rate cfm	0.008 / 0.004
Leak Test Vacuum	5 / 5
✓ Pitots, Pre Leak Ck	
___ Pitots, Post Leak Ck	
___ Gas Sampling System	
___ Integrated Bag	
M5 Rinse Acetone/H_2O/Other	

QA FORMS COMPLETED
- Stack Schematic ✓
- Sample Train ✓
- Pitot Tube Insp. ✓
- Magnehelic Cal. ___
- Temp. Probe Cal. ___
- Gas Meter Calib. ___

Filter # 125362 Box # ___

	Final Wt. gram		Initial Wt. gram		Net Wt. gram
#1 Imp.	1071.2	-	643.9	=	427.3
#2 Imp.	920.5	-	604.9	=	315.6
#3 Imp.	672.3	-	666.7	=	5.6
#4 Imp.	555.1	-	553.5	=	1.6
#5 Imp.		-		=	
#6 S.G.	836.1	-	802.1	=	34.0

Total H_2O Volume 784.1 ✓g

Start Time 803
Stop Time 1607
Barometric Pressure "Hg 28.75
Static Pres "H_2O -0.36
Production Rate ___

SAMPLING PARAMETERS

% Moisture 16.7 16.7%
Meter Temp. 66
Stack Temp. 277
Δ H@ 1.666 Y 1.003 T195-4
Pitot # P195-4B Side # A
Cp 0.84
Nozzle Diameter 0.194 inch
D_1 0.194 D_2 0.194 D_3 0.194

K Factor 0.743, 0.756

Sample Point	Elap Time Min.	Dry Gas Meter Reading Cu.Ft.	Pitot Reading Δ P " H_2O	Orifice Setting (Δ H) " H_2O Ideal	Orifice Setting (Δ H) " H_2O Actual	Gas Meter Temp °F In	Gas Meter Temp °F Out	Pump Vac. Gauge " Hg	Filter Box Temp °F	Imp. Exit Temp °F	Stack Temp °F	O_2 %	
E 1	0	773.795	0.61	0.45	~~0.44~~	53	53	0	257	53	274		
2	20	781.820	0.62	0.46	0.43	57	53	0	258	47	280		
3	40	789.675	0.63	0.47	0.44	60	55	0	259	48	281		
4	60	797.610	0.62	0.46	0.43	63	58	0	260	49	279		
5	80	805.475	0.60	0.45	0.40	65	60	0	261	50	279		
6	100	813.240	0.44	0.33	0.30	68	63	0	256	48	280		
7	120	820.105	0.71	0.53	0.48	70	65	0	262	50	278		
8	140	828.485	0.71	0.53	0.48	73	67	0	259	57	278		
9	160	836.870	0.73	0.54	0.50	75	69	0	260	54	279		
10	180	845.531	0.72	0.54	0.49	77	72	0	263	48	279		
11	200	854.120	0.70	0.52	0.49	78	73	1	255	50	280		
12	220	863.342	0.70	0.52	0.49	80	75	1	255	52	280		
1207 S 1	240	871.170	0.52	0.40	0.36	80	76	1	276	59	278		
2	260	878.580	0.52	0.40	0.35	81	77	1	278	51	278		
3	280	886.010	0.52	0.40	0.35	83	78	1	252	55	278		
4	300	893.500	0.65	0.42	0.38	85	80	1	252	55	280		
5	320	901.155	0.59	0.45	0.41	86	81	1	249	54	279		
6	340	909.115	0.58	0.44	0.40	87	82	1	252	56	279		
7	360	917.000	0.54	0.41	0.37	88	84	1	254	52	279		
8	380	924.800	0.62	0.47	0.43	89	84	1	247	55	277		
9	400	932.850	0.70	0.53	0.50	90	85	1	249	56	279		
10	420	941.540	0.71	0.54	0.50	88	84	2	252	54	278		
11	440	950.275	0.70	0.53	0.49	87	83	2	251	58	279		
12	460	958.880	0.70	0.53	0.49	87	83	2	250	59	278		
4.51	480	967.558									-		
		193.763	56.4 fps		0.433	74.8					278.5		

METHOD 5
LABORATORY ANALYSIS

Client GRI /WP Nat. Gas @ BCC Run Number 2

Sample Location #2 Boiler

Date 5-3-95

"A" Section (Filter)

Filter # 125-362

Tare Weight 1.0375 grams
Final Weight 1.0382 grams F ✓
Net Weight 0.0007 grams

"B" Section (Probe Wash)

Beaker # 150-3125
Volume Acetone 80 mls

Tare Weight 64.4072 grams
Final Weight 64.4086 grams F ✓
Net Weight 0.0014 grams

"C" Section (Condenser Particulate - Inorganic Catch)

Beaker # 150-3103
Volume Water 900/1284 mls

$\frac{1284}{900} = 1.427$

Tare Weight 65.4939 grams
Final Weight 65.4977 grams F ✓
Net Weight 0.0038 grams x 1.427
0.0054

pH: 3.26

Combine for Cx

"Cx" Section (Condenser Particulate - Organic Catch)

Beaker # 150-3126
Volume CH_2Cl_2 150 mls

Tare Weight 65.8874 grams
Final Weight 65.8877 grams F ✓
Net Weight 0.0003 grams x 1.427
0.0004

Cx Section

~~"D"~~ Section ~~(Final Acetone Rinse of Impingers)~~

Beaker # 150-3134
Volume ~~Acetone~~ 75 mls
CH_2Cl_2

Tare Weight 65.6546 grams
Final Weight 65.6542 grams F ✓
Net Weight use tare grams x 1.427
= 0.0

8132

Client Gas Research Institute
Location White City, OR
Sample Site #2 BOILER

Stack Diameter 24.0"
Date 5-4-95
Operators ACP
Run I.D. #3 M-5 w/202 BH

EQUIPMENT CHECKS

	Initial/Final
Leak Rate cfm	0.005 / 0.007
Leak Test Vacuum	5 / 5

✓ Pitots, Pre Leak Ck
✓ Pitots, Post Leak Ck
___ Gas Sampling System
___ Integrated Bag
M5 Rinse ~~Acetone/H2O~~/Other

QA FORMS COMPLETED
Stack Schematic ✓
Sample Train ✓
Pitot Tube Insp. ✓
Magnehelic Cal. ___
Temp. Probe Cal. ___
Gas Meter Calib. ___

Filter # 125363 Box # ___

	Final Wt. gram	Initial Wt. gram	Net Wt. gram
#1 Imp.	1078.3	657.3	421.0
#2 Imp.	995.3	698.7	296.6
#3 Imp.	638.8	629.8	9.0
#4 Imp.	530.6	529.6	1.0
#5 Imp.			
#6 S.G.	848.8	817.6	31.2
Total H_2O Volume			758.8 ✓ g

Start Time 8:00
Stop Time 1606
Barometric Pressure "Hg 28.65
Static Pres "H_2O -0.35
Production Rate ___

RED MANOMETER BOX
SAMPLING PARAMETERS

% Moisture 16.7 16.9
Meter Temp. 276
Stack Temp. 60
Δ H@ 1.666 Y 1.003
Pitot # 195-4B Side # A
Cp 0.84
Nozzle Diameter 0.194 inch T195-?
D_1 0.194 D_2 0.194 D_3 0.194

K Factor 0.735

Sample Point	Elap Time Min.	Dry Gas Meter Reading Cu.Ft.	Pitot Reading Δ P " H_2O	Orifice Setting (Δ H) " H_2O Ideal	Actual	Gas Meter Temp °F In	Out	Pump Vac. Gauge " Hg	Filter Box Temp °F	Imp. Exit Temp °F	Stack Temp °F	O_2 %	
E 1	0	967.769	0.64	0.47	0.44	55	55	0	249	48	268		
2	20	975.630	0.64	0.47	0.42	56	54	0	250	43	278		
3	40	983.290	0.63	0.46	0.41	60	55	0	252	44	279		
4	60	990.985	0.64	0.47	0.45	62	57	0	252	45	279		
5	80	998.984	0.63	0.46	0.42	64	59	0	255	46	279		
6	100	1006.782	0.49	0.36	0.33	65	60	0	250	47	279		
7	120	1013.585	0.70	0.51	0.50	67	62	0	254	47	280		
8	140	1021.970	0.74	0.54	0.53	67	62	0	252	48	279		
9	160	1030.684	0.74	0.54	0.53	68	63	0	253	51	281		
10	180	1039.380	0.72	0.53	0.51	68	63	1	254	54	281		
11	200	1047.820	0.71	0.52	0.51	68	64	1	248	49	280		
12	220	1056.320	0.70	0.57	0.50	68	64	1	255	50	280		
1205 S 1	240	1064.860	0.55	0.40	0.39	68	64	1	253	53	279		
2	260	1072.400	0.54	0.40	0.38	68	64	1	243	47	277		
3	280	1079.860	0.55	0.40	0.38	68	64	1	243	49	279		
4	300	1087.350	0.55	0.40	0.38	69	65	1	244	49	279		
5	320	1094.925	0.55	0.40	0.38	70	66	1	243	54	280		
6	340	1102.425	0.50	0.37	0.35	71	67	1	247	50	277		
7	360	1109.675	0.63	0.46	0.46	70	67	1	247	52	273		
8	380	1117.770	0.71	0.52	0.50	70	67	1	245	52	278		
9	400	1126.345	0.70	0.57	0.49	71	67	1	278	49	278		
10	420	1134.857	0.69	0.51	0.49	72	68	1.5	253	51	279		
11	440	1143.245	0.71	0.52	0.50	74	69	2	251	52	281		
12	460	1149.485	0.71								281		
END	480		49a = 2.7%, Ever!										
454.8		181.716 ✓			0.446 ✓ ~~0.45~~	64.9 ✓		BOILER DOWN @ 1557			278.9 ✓		

1300 UP @ 1407
1127 BOILER DOWN 1321
IC CAME UP @ 1521

METHOD 5
LABORATORY ANALYSIS

Client GRI / WP Nat Gas @BCC Run Number 3

Sample Location #2 Boiler

Date 5-3-95

"A" Section (Filter)

Filter # 125-363

Tare Weight 1.0356 grams
Final Weight 1.0358 grams F ✓
Net Weight 0.0002 grams

"B" Section (Probe Wash)

Beaker # 150 - 3127
Volume Acetone 105 mls

Tare Weight 63.6513 grams
Final Weight 63.6526 grams F ✓
Net Weight 0.0013 grams

"C" Section (Condenser Particulate - Inorganic Catch)

Beaker # 150 - 3104
Volume Water 900/1245 mls

$\frac{1245}{900} = 1.383$

Tare Weight 64.8937 grams
Final Weight 64.8990 grams F ✓
Net Weight 0.0053 grams * 1.383
0.0073 pH: 3.23

Combine for Cx

"Cx" Section (Condenser Particulate - Organic Catch)

Beaker # 150 - 3128
Volume CH_2Cl_2 150 mls

Tare Weight 64.4427 grams
Final Weight 64.4440 grams F ✓
Net Weight 0.0013 grams X 1.383
= 0.0018

Cx Section
"~~D~~" Section (Final Acetone Rinse of Impingers)

Beaker # 150 - 3135
Volume ~~Acetone~~ CH_2Cl_2 75 mls

Tare Weight 78.6927 grams
Final Weight 78.6932 grams F ✓
Net Weight 0.0005 grams X 1.383
= 0.0007

8133

W.P. Nat'l Gas

METHOD 5
LABORATORY ANALYSIS

TRIP BLANKS

Acetone Blank

Beaker # 150-3130
Volume Acetone 130 mls

Tare Weight 67.2050 grams
Final Weight 67.2052 grams F ✓
Net Weight 0.0002 grams

0.2mg/130mL = 0.0015 mg/mL

Distilled, Deionized Water Blank

Beaker # 150-3106
Volume Water 236/256 mls

Tare Weight 64.9097 grams
Final Weight 64.9114 grams F ✓
Net Weight 0.0017 grams x 1.0847

$1.7 mg/256 mL \times \frac{256}{236} = 0.0072 mg/m$

use 0.007 mg/mL

Methylene Chloride (CH2Cl2) Blank

Beaker # 150-3132
Volume CH_2Cl_2 80 mls

Tare Weight 66.2588 grams
Final Weight 66.2565 grams F ✓
Net Weight – 0.0023 grams

use 0.0 mg/mL

AT

W.P. Nat'l Gas

FIELD BLANKS

METHOD 5
LABORATORY ANALYSIS

Acetone Blank

Beaker # 150 - 3129 Tare Weight 79.1020 grams
Volume Acetone 83 mls Final Weight 79.1036 grams F
$0.0016 \text{ grams} \times \frac{1000 \text{ g}}{1 \text{ mg}} / 83 \text{ mLs} = 0.0193 \frac{\text{mg}}{\text{mL}}$ Net Weight .00 grams

Distilled, Deionized Water Blank

Beaker # 150 - 3105 Tare Weight 80.7255 grams
Volume Water 539/559 mls Final Weight 80.7280 grams F
$0.0025 \text{ g} \times \frac{1000 \text{ mg}}{\text{g}} / 559 \text{ mLs} =$ Net Weight 0.0025 grams
pH = 5.58

Combine for field blank Ct

Methylene Chloride (CH2Cl2) Blank

Beaker # 150-3131 Tare Weight 65.4489 grams
Volume CH_2Cl_2 150 mls Final Weight 65.4487 grams F
Net Weight -0.0002 grams

Beaker # 150 - 3136
Vol. CH_2Cl_2 75 mls
Tare wt 67.2185
Final wt 67.2169 F
Net wt -0.0016

Filter Blank

Filter # 125-378
(1 of 3 filters)

Tare 1.0353 g
Final 1.0351 g
Net 0.0000 g

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METHOD 202 "C" SECTION

STANDARDIZATION OF NH_4OH

STD : 22.87
22.54 → 22.49
22.44

$N = \frac{(0.1N\ H_2SO_4)(20\,mL)}{22.49 - 0} = 0.0889$

D.I. BLANK
pH 5.91 → 8.74 0.10 mL USE 0

SAMPLE	VOL	VTIT	NTIT	pH INIT.	pH FINAL	BEAKER # 150-
RUN 1 8131	100	.48	0.0889	3.69	7.62	3102
RUN 2 8132	100	.38	0.0889	3.79	7.20	3103
RUN 3 8133	100	.41	0.0889	3.66	7.17	3104
FIELD BLANK	100	1.04	0.0889	5.10	6.91	3105
TRIP BLANK	100	.14	0.0889	4.34	7.24	3106

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FILTER	LAB #	RUN	TARE WEIGHT				
361	7981	1	1.0354 4/13A	$\boxed{1.0357}$ 4/13P			
362	8132	2	1.0375	$\boxed{1.0375}$			
363	8133	3	1.0355	$\boxed{1.0356}$			
364	8131	1	$\boxed{1.0269}$	1.0268			
365	8063	2	1.0413	$\boxed{1.0414}$			
366	8062	1	1.0364	$\boxed{1.0365}$			
367	8066	1	1.0338	$\boxed{1.0341}$			
368	8033	3	1.0371	$\boxed{1.0374}$			
369			1.0350	$\boxed{1.0351}$			
370			1.0362	$\boxed{1.0365}$			
371			1.0312	$\boxed{1.0313}$			
372			1.0443	$\boxed{1.0447}$			
373	8076	1	1.0393	$\boxed{1.0395}$			
374	~~8076~~	~~1~~	1.0397	$\boxed{1.0399}$			
375	8077	2	1.0304	$\boxed{1.0305}$			
376	8078	3	1.0342	$\boxed{1.0345}$			
377	8306	2	$\boxed{1.0327}$	1.0326			
378	Blank		~~1.0347~~	1.0351 4/13A	$\boxed{1.0353}$ 4/13P		
379	Blank		$\boxed{1.0392}$ 4/13A	1.0391			
380	Blank		1.0359	$\boxed{1.0361}$			
381	8305	1	0.6829 4/26A	0.6811 4/27A	0.6823 4/28A	$\boxed{0.6826}$ 5/2A	
382	8179	4	0.6821	0.6813 4/27A	$\boxed{0.6821}$ 4/28A		
383	8178	5	0.6876	0.6870 4/27A	$\boxed{0.6875}$ 4/28A		
384	8177	6	0.7041	0.7034 4/27A	$\boxed{0.7045}$ 4/28A		
385			$\boxed{0.7075}$	0.7072 4/27A			
386			$\boxed{0.6779}$	0.6777 4/27A			
387			0.6803	0.6797 4/27A	$\boxed{0.6808}$ 4/28A		
388			$\boxed{0.6725}$	0.6722 4/27A			
389			0.6645	$\boxed{0.6646}$ 4/27A			
390			$\boxed{0.6701}$	0.6699 4/27A			
391			0.6711	$\boxed{0.6716}$ 4/27A			
392	8307	3	0.6777	0.6785 4/27A	0.6791 4/28A	~~0.68~~ $\boxed{0.6796}$ 5/2A	
393			0.6802	$\boxed{0.6806}$ 4/27A			
394			0.6691	0.6698 4/27A	0.6704 4/28A	0.6710 5/2A	$\boxed{0.6704}$
395			0.6641	0.6648 4/27A	$\boxed{0.6653}$ 4/28A		
396			0.6695	0.6702 4/27A	$\boxed{0.6706}$ 4/28A		

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FILTER	FINAL WEIGHT						CLIENT
361	1.0429 4/24A	1.0427 4/25A				✓	
362	1.0382 5/19A	1.0382 5/19P					WP Nat'l Ge
363	1.0360 5/19A	1.0358 5/19P				✓	W.P. Nat'l Ge
364	1.0290 5/19A	1.0294 5/19P				✓	↓
365	1.3104 5/8A	1.3101 5/8P				✓	
366	1.3549 ↓	1.3529 ↓	1.3511 5/9A	1.3498 5/9P	1.3503 5/10A	✓	
367	1.0893 5/8A	1.0891 5/8P				✓	
368	1.0328 5/2A	1.0324 5/3A				✓	
369							
370							
371							
372							
373	1.0660 5/12A	1.0675 5/12P	1.0662 5/15A	1.0664 5/15P		✓	
374	~~2.0867 5/11A~~	~~2.0864 5/11P~~				✓	
375	1.0410 5/11A	1.0413 5/11P				✓	
376	1.0443 5/11A	1.0441 5/11P				✓	
377	1.7768 6/12A	1.7755 6/12P	1.7766 6/13A			✓	
378	1.0352 5/19A	1.0351 5/19P				✓	W.P. Nat'l G
379	1.0396 5/19A	1.0400 5/19P				✓	↓
380	1.0360 5/19A	1.0354 5/19P				✓	W.P. Nat'l Gas
381	1.6040 6/12A	1.6019 6/12P	1.6020 6/13P				
382	0.7014 5/17A	0.7023 5/17P	0.7022 5/18A			✓	
383	0.7117 5/17A	0.7121 5/17P				✓	
384	~~0.7014 5/17A~~	0.7291 5/17	0.7298 5/17P	0.7300 5/18A		✓	
385							
386							
387							
388							
389							
390							
391							
392	1.3597 6/12A	1.3586 6/12P	1.3626 6/13A	1.3612 6/14A	1.3596 6/14P		
393							
394							
395							
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PROJECT

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WITH/BEADS

BEAKER	LAB	RUN	SEC	mLs	TARE WEIGHT			
3097	8105	17	C	915/835	65.6586 5/17A	65.6601 5/17P	65.6589 5/18A	
3098	8106	18	C	819/839	67.3611 5/17A	67.3619 5/17P ~~65.1609 5/17P~~	67.3607 5/18A	
3099	8085	1	C	335/385	65.1602 5/17A	65.1609 5/17P	65.1603 5/18A	
3100	8086	2	C	300/350	66.5349 5/17A	66.5363 5/17P	66.5349 5/18A	
3101	8087	3	C	315/365	68.3039 5/16A	68.3041 5/16P		
3102	8131	1	C	900/127	65.1289 5/17A	65.1298 5/17P	65.1292 5/18A	
3103	8132	2	C	900/128	65.4934 5/16A	65.4939 5/16P		
3104	8133	3	C	900/245	64.8934 5/16A	64.8937 5/16P		
3105	field Blank		C	539/559	80.7255 5/17A	80.7264 5/17P	80.7252 5/18A	
3106	trip Blank		C	236/256	64.9097 5/17A	64.9103 5/17P	64.9094 5/18A	
3107	8228	1	C	860/880	66.1511 5/18A	66.1508 5/18P		
3108	8229	2	C	780/800	69.9165 5/17A	69.9147 5/17P	69.9143 5/18A	Retared 70.0786 4/2A
3109	Blank		B/D	150	64.7663 5/17A	64.7668 5/17P		
3110	8177	1	B	140	65.3584 5/17A	65.3603 5/17P	65.3599 5/18A	
3111	8178	2	B	120	64.2298 5/17A	64.2312 5/17P	64.2317 5/18A	
3112	8179	3	B	180	65.6928 5/17A	65.6945 5/17P	65.6932 5/18A	
3113	8180	4	B	160	65.6064 5/17A	65.6074 5/17P	65.6079 5/18A	
3114	8181	5	B	145	66.0688 5/17A	66.0697 5/17P	66.0698 5/18A	
3115	8182	6	B	145	64.5585 5/17A	64.5606 5/17P	64.5610 5/18A	
3116	8183	1	B	105	65.0660 5/17A	65.0681 5/17P	65.0665 5/18A	
3117	8184	2	B	115	82.2896 5/17A	82.2904 5/17P	82.2908 5/18A	
3118	Blank		B	140	66.0113 5/17A	66.0124 5/17P	66.0114 5/18A	
3119	8134	1	B	160	67.4024 5/17A	67.4032 5/17P	67.4028 5/18A	
3120	8135	2	B	160	64.1877 5/17A	64.1877 5/17P		
3121	8136	3	B	145	67.3986 5/17A	67.3986 5/17P		
3122	Blank		B	140	64.3862 5/17A	64.3861 5/17P		
3123	8131 8	1	B	180	64.8088 5/17A	64.8083 5/17P		
3124	8131	1	Cx	150 ~~225~~	65.9833 5/17A	65.9828 5/17P		
3125	8132	2	B	80	64.4072 5/17A	64.4072 5/17P		
3126	8132	2	Cx	150 ~~225~~	65.8872 5/17A	65.8874 5/17P		
3127	8133	3	B	105	63.6511 5/17A	63.6513 5/17P		
3128	8133	3	Cx	150 ~~225~~	64.4423 5/17A	64.4427 5/17P		
3129	field Blank		B	83	79.1020 5/17A	79.1020 5/17P		
3130	trip Blank		B	130	67.2050 5/17A	67.2050 5/17P		
3131	field Blank		Cx	75 ~~225~~	65.4489 5/17A	65.4484 5/17P		
3132	trip Blank		Cx	80	66.2564 5/17A	66.2588 5/17P	66.2584 5/18A	

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BEAKER	FINAL WEIGHT						CLIENT
3097	65.6628 5/23A	65.6630 5/23P				/	
3098	67.3641	67.3646				/	
3099	65.6975	65.6361 5/25A	65.6483 5/25P	65.6556 5/26A			
3100	66.5481	66.5485 5/23P				/	
3101	68.3082 5/19A	68.3088 5/24P	68.3087 5/24			/	
3102	65.1334 5/24A	65.1341 5/24P	65.1343 5/25A	After titration M202 65.1337 6/5A	65.1338 6/5P	/	WP Nat'l Q
3103	65.4977	65.4979 5/24P		65.4977 6/5A	65.4977 6/5P	/	
3104	64.8990	64.8997 5/24P	64.8992 5/25A	64.8996 6/5A	64.8994 6/5P	/	
3105	80.7274	80.7280 5/24P	80.7283 5/25A	80.7273 6/5A	80.7271 6/5P	/	
3106	64.9114 5/23A	64.9119 5/23P	64.9128 6/5A	64.9118 6/5P	64.9113 6/6A	/	
3107	66.2335 5/31A	66.2337 6/1A	After titration M202 66.2239 6/6P	66.2240 6/7A		/	
3108	70.1674 5/30A	70.1680 5/30P	70.1678 5/31A	no titration (5 Beads)		/	
3109	64.7665 5/22A	64.7667 5/22P				/	
3110	65.3624 5/22A	65.3622				/	
3111	64.2333 5/22A	64.2337				/	
3112	65.6999 5/22A	65.7001				/	
3113	65.6099 5/22A	65.6103	65.6102 5/23A			/	
3114	66.0715 5/22A	66.0720				/	
3115	64.5607 5/22A	64.5694	64.5681 5/23A	64.5682 5/23P		/	
3116	65.0669 5/22A	65.0673				/	
3117	82.2911 5/22A	82.2976	82.2933 5/23A	82.2908 5/24A		/	
3118	66.0127 5/22A	66.0130				/	
3119	67.4253 5/22A	67.4269	67.4257 5/23A			/	
3120	64.2248 5/22A	64.2250				/	
3121	67.4404 5/22A	67.4406 5/22P				/	
3122	64.3870 5/22A	64.3872				/	
3123	64.8162 5/22A	64.8165				/	WP Nat'l g
3124	65.9860 5/22A	65.9863				/	
3125	64.4086 5/22A	64.4107	64.4089 5/23A			/	
3126	65.8877 5/22A	65.8877				/	
3127	63.6526 5/22A	63.6527				/	
3128	64.4420 5/22A	64.4440	64.4430 5/23A	64.4442 5/23P		/	
3129	79.1028 5/22A	79.1036	79.1040			/	
3130	67.2052 5/22A	67.2057				/	
3131	65.4487 5/22A	65.4492				/	
3132	66.2565 5/22A	66.2567					

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3099 65.6622

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with beads

Beaker	Lab	Run	Sec	mLs	Tare Weight				
3133	8131	1	Cx	75	65.9470 5/17A	65.9465 5/17P			
3134	8132	2	Cx	75	65.6535 5/17A	65.6546 5/17P	65.6544 5/18A		
3135	8133	3	Cx	75	78.6927 5/17A	78.6924 5/17P			
3136	field	blank	Cx	75	67.2185 5/17A	67.2183 5/17P			
3137	8228	1	B	190	65.7313 5/18A	65.7341 5/18P	65.7340 5/19A		
3138	8228	1	Cx	240	65.4827 5/18A	65.4839 5/18P	65.4834 5/19A		
3139	8229	2	B	140	64.4277 5/18A	64.4276 5/18P			
3140	8229	2	Cx	225	64.7727 5/18A	64.7750 5/18P	64.7723 5/19A		
3141	8230	3	B	180	66.7924 5/18A	66.7928 5/18P			
3142	8230	3	Cx	225	80.0098 5/18A	80.0098 5/18P			
3143	8231	1	B	130	66.9944 5/18A	66.9942 5/18P			
3144	8231	1	Cx	240	63.5732 5/18A	63.5732 5/18P			
3145	8230	3	C	820/840	66.4689 5/18A	66.4685 5/18P			
3146	8231	1	C	765/785	~~65.9887 5/18A~~ 66.2110 5/18A	66.2111 5/18P	3147 Retared w/ 3 beads 65.7765		
3147	8232	2	C	720/740	65.9387 5/18A	65.9391 5/18P	65.7782 6/5P	65.7880 6/6A	
3148	8233	3	C	760/780	64.7955 5/18A	64.7955 5/18P			
3149	BLANK		C	350	65.5943 5/18A	65.5941 5/18P			
3150	8257	1	C	435/455	68.3400 5/18A	68.3405 5/18P			
3151	8258	2	C	445/465	64.6786 5/18A	64.6790 5/18P			
3152	8259	3	C	510/530	66.3583 5/18A	66.3581 5/18P			
3153	Blank		C	150	67.5976 5/18A	67.5974 5/18P			
3154	8305	1	C	1900/1052	67.1042 5/18A	67.1043 5/18P			
3155	8306	2	C	802/952	67.1174 5/18A	67.1173 5/18P			
3156	8307	3	C	767/917	82.7308 5/18A	82.7308 5/18P			
3157	8232	~~3~~ 2	B	160	65.0619 5/18A	65.0622 5/18P			
3158	8232	2	Cx	225	65.6426 5/18A	65.6424 5/18P			
3159	8233	3	B	120	66.0784 5/18A	66.0793 5/18P	66.0786 5/19A		
3160	8233	3	Cx	225	67.2997 5/18A	67.2997 5/18P			
3161	BLANK		B	140	64.5175 5/18A	64.5184 5/18P	64.5185 5/19A		
3162	BLANK		Cx	250	65.1343 5/18A	65.1361 5/18P	65.1356 5/19A *		
3163	8257	1	B	175	64.0103 5/18A	64.0108 5/18P			
3164	8257	1	D	70	66.9624 5/18A	66.9640 5/18P	66.9641 5/19A		
3165	8257	1	Cx	150	64.1574 5/18A	64.1538 5/18P	64.1544 5/19A	64.1566 5/19P	64.155:
3166	8258	2	B	225	65.0650 5/18A	65.0655 5/18P			
3167	8258	2	D	64	64.8575 5/18A	64.8580 5/18P			
3168	8258	2	Cx	150	67.4738 5/18A	67.4739 5/18P			

Continued on Page

3147 Retared w/3 beads 65.7749 6/6P 65.7754 6/7A

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Date

BEAKER	FINAL WEIGHT									CLIENT
133	65.9463	5/22A	65.9467	5/22P						WP Mat'l
134	65.6542	5/22A	65.6546							
135	78.6932	5/22A	78.6933							
136	67.2169	5/22A	67.2170							
137	65.7350	5/24P	65.7346	5/25A						
138	65.4846	5/26A	65.4847	5/26P						
139	64.4333	5/24A	64.4338	5/24P						
140	64.7728	5/24P	64.7732	5/25A						
141	66.7979	5/24P	66.7972		66.7979	5/25P				
142	80.0113	5/24P	80.0108							
143	66.9998	5/24A	~~66.~~ 67.0004	5/24P	66.9998	5/23A				
144	63.5766	5/26A	63.5767	5/26P						
145	66.5747	5/31A	66.5747	6/1A	wt. after titration M202 66.5803	6/7A	66.5806	6/7P	66.5804	
146	66.3292	6/1A	66.3297	6/1P	66.3103	6/7A	66.3105	6/8A		
147	65.8223	5/31A	65.8227	6/1A					no titration (3 Beads)	
148	64.9068	6/1A	~~64.9067~~	~~6/1A~~	64.9076	6/1P	64.9072	6/2A	* wt. after titration	
149	65.5953	5/30A	65.5960	5/30P	65.5949	6/1A	after titration M202 65.5959	6/7A	65.5960 6/	
150	68.3474	6/1A	68.3487	6/1P	68.3477	6/2A				
151	64.6822	5/31A	64.6822	6/1A						
152	66.3622	6/1A	66.3632	6/1P	66.3622	6/2A				
153	67.5997	5/26A	67.5985	5/26P	67.5992	5/30A				
154										
155	67.1447	6/15A								
156										
157	65.0662	5/24P	65.0659	5/25A						
158	65.6438	5/26A	65.6441	5/26P						
159	66.0834	5/24A	66.0839	5/24P						
160	67.3014	5/26A	67.3019	5/26P						
161	64.5186	5/24A	64.5190	5/24P						
162	65.1352	5/26A	65.1355	5/26P						
163	64.0232	5/30A	64.0239	5/30P	64.0239	5/31A				
164	66.9649		66.9653							
165	64.1563	5/30A	64.1566							
166	65.0745	5/31A	65.0741	6/1A						
167	64.8587		64.8588							
168	67.4733	5/30A	67.4738	5/30P						

64.8922 6/6P 64.8921 6/7A

Continued on Page

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Signed Date Signed Date

AMTEST AIR QUALITY, INC.

SAMPLE TRAIN INFORMATION

Fill out one sheet per site and per test type.

CLIENT: Gas Research Institute
LOCATION: Boise Cascade, White City Lumber Mill White City, OR
SITE: #2 Cleaver-Brooks Package Boiler
TEST TEAM: DMA, ACP DATE(S): 5-1 – 5-4-95
RUN #'S: R-1, 2 + 3 TYPE: M-5 w/202 Back Half

Probe/Filter Temperature: ✓ 248+25 F ____ 320 F ____ Other
Impinger Temperature: ✓ <68 F ____ Other

THIMBLE: ____ yes ✓ no NOZZLE TYPE: ✓ quartz ____ steel ____ none

PROBE LINER: ✓ quartz ____ glass ____ steel ____ teflon

PROBE TYPE: ✓ regular ____ water-cooled

FRONT-HALF FILTER: ✓ yes ____ no SIZE (mm): ___ 90 ___ 110 ___ 125 ✓ other ____
FRONT-HALF FILTER MEDIA: ____ quartz fiber ____ glass fiber ____ teflon

SUPPORT: ____ steel ✓ glass frit ____ teflon GASKET: ✓ silicon ✓ teflon

BACK-HALF FILTER: ____ yes ✓ no
BACK-HALF FILTER MEDIA: ____ quartz fiber ____ glass fiber ____ telfon ____ tared ____ untared
NOTE: Show the back-half filter location with an arrow on the table below.

CONTENTS	Initial Volume (mL)	Clean-up Solution Used	Bottle Type	Comments
Nozzle/Probe Rinse		Acetone	500ml w.m	
Filter				
#1 D.I.	100	D.I / DCM	1L WM / Glass	
#2 D.I.	100	↓		
#3 D.I.	100	↓		
#4 M.T.	–	↓		
#5 S.G.	–			
#6				
#7				

IF THIS INFORMATION IS NOT ACCURATE FOR ALL RUNS, NOTE ALL EXCEPTIONS.

GAS LOG MEASUREMENT DATA

FILE NAME: DG112\WP52#2BS
CLIENT: WP Natural Gas
LOCATION: White City, Oregon
SITE LOCATION: Natural Gas Fired #2 Cleaver Brooks Packaged Boiler Stack
DATE: 5/2/95
LOAD: 95%

TIME	CARBON DIOXIDE (%)	OXYGEN (%)	CARBON MONOXIDE (ppm)	NITROGEN OXIDES (ppm)	SULFUR DIOXIDE (ppm)	TOTAL HYDROCARBONS (ppm)
RUN 1 - 10:30- 14:30						
1030	10.0	3.2	1.2	32.7	2.3	0.0
1031	10.0	3.2	1.2	32.8	2.2	0.0
1032	10.0	3.1	——	33.0	2.1	0.0
1033	10.0	3.1	1.1	33.0	8.5	0.0
1034	10.0	3.2	1.0	——	2.5	0.0
1035	10.0	3.1	1.0	33.1	2.4	0.0
1036	10.1	3.0	1.4	33.0	2.2	0.0
1037	——	3.1	2.2	33.0	2.3	0.0
1038	10.1	3.1	2.4	32.7	2.3	0.0
1039	——	3.3	2.2	32.9	2.0	0.0
1040	13.0	3.2	2.2	33.0	2.3	0.0
1041	10.1	3.1	2.2	33.0	2.2	0.0
1042	10.2	3.1	2.4	32.8	2.3	0.0
1043	10.2	3.1	2.4	32.8	2.2	0.0
1044	10.1	3.2	2.5	33.0	2.4	0.0
1045	10.1	3.2	2.4	33.0	2.2	0.0
1046	10.2	3.0	2.5	33.0	2.1	0.0
1047	10.2	3.1	2.8	32.8	2.1	0.0
1048	10.2	3.1	2.5	32.6	2.2	0.0
1049	10.2	3.1	2.3	32.5	2.2	0.0
1050	10.1	3.2	2.3	32.6	2.0	0.0
1051	10.1	3.2	2.4	32.5	2.1	0.0
1052	10.1	3.2	2.4	26.5	2.0	0.0
1053	10.1	3.2	2.2	32.6	2.0	0.0
1054	10.1	3.2	2.2	32.6	1.9	0.0
1055	10.1	3.2	2.2	32.7	1.9	0.0
1056	10.2	3.1	2.4	32.6	1.9	0.0
1057	10.2	3.1	2.3	32.6	1.9	0.0
1058	10.2	3.1	2.6	32.4	2.0	0.0
1059	10.2	3.0	2.6	32.4	1.9	0.0
1100	10.1	3.2	2.6	32.1	2.1	0.0
1101	10.1	3.2	2.8	32.2	2.0	0.0
1102	10.2	3.1	2.5	32.1	1.9	0.0
1103	10.2	3.1	2.4	32.2	2.0	0.0
1104	10.2	3.1	2.5	32.0	2.0	0.0
1105	10.2	3.1	2.5	32.0	2.0	0.0
1106	10.2	3.1	2.3	32.0	2.0	0.0
1107	10.2	3.1	2.5	32.0	1.8	0.0
1108	10.1	3.2	2.3	32.0	1.9	0.0
1109	10.1	3.1	2.4	32.0	1.7	0.0
1110	10.1	3.2	2.4	32.0	1.6	0.0
1111	10.2	3.1	2.6	31.9	1.7	0.0
1112	10.1	3.1	2.6	31.8	1.6	0.0

1113	10.1	3.2	2.2	31.9	1.8	0.0
1114	10.1	3.2	2.4	31.9	1.6	0.0
1115	10.1	3.2	2.2	32.0	1.6	0.0
1116	10.2	3.0	2.6	31.7	1.7	0.0
1117	10.1	3.1	2.4	31.4	1.7	0.0
1118	10.1	3.2	2.1	31.3	1.6	0.0
1119	10.1	3.1	2.4	31.4	1.4	0.0
1120	10.1	3.2	2.3	31.2	1.7	0.0
1121	10.1	3.2	2.1	31.2	1.5	0.0
1122	10.1	3.3	2.2	31.2	—	0.0
1123	10.1	3.2	2.1	31.0	—	0.0
1124	10.1	3.3	2.1	31.1	1.4	0.0
1125	10.1	3.3	2.2	31.3	1.3	0.0
1126	10.1	3.3	2.2	31.2	1.5	0.0
1127	10.1	3.2	2.2	31.2	1.2	0.0
1128	10.2	3.1	2.4	31.2	1.4	0.0
1129	10.1	3.2	2.3	31.2	1.2	0.0
1130	10.1	3.2	2.3	31.2	1.3	0.0
1131	10.1	3.2	2.2	31.2	1.2	0.0
1132	10.1	3.2	2.1	31.0	1.2	0.0
1133	10.1	3.3	2.1	31.2	1.2	0.0
1134	10.1	3.2	2.3	31.1	1.1	0.0
1135	10.1	3.2	2.1	31.0	1.0	0.0
1136	10.1	3.2	2.1	31.2	1.0	0.0
1137	10.1	3.2	2.1	31.2	0.7	0.0
1138	10.1	3.2	2.2	31.4	0.9	0.0
1139	10.1	3.2	2.1	31.4	0.8	0.0
1140	10.1	3.2	2.1	31.4	1.0	0.0
1141	10.1	3.1	2.2	31.3	1.0	0.0
1142	10.2	3.1	2.2	31.2	—	0.0
1143	10.1	3.2	2.1	31.0	1.1	0.0
1144	10.1	3.2	2.1	31.0	0.9	0.0
1145	10.0	3.3	2.1	31.2	0.9	0.0
1146	10.1	3.3	2.1	31.2	1.1	0.0
1147	10.1	3.2	2.1	31.2	1.0	0.0
1148	10.1	3.2	2.1	31.2	1.1	0.0
1149	10.1	3.3	2.1	31.4	1.0	0.0
1150	10.1	3.2	2.1	31.3	1.1	0.0
1151	10.1	3.1	2.2	31.1	1.0	0.2
1152	10.1	3.1	2.2	30.7	1.2	0.0
1153	10.1	3.2	2.1	30.6	1.0	0.0
1154	10.1	3.2	2.1	30.9	1.0	0.0
1155	—	3.2	2.2	30.8	1.1	0.0
1156	—	3.1	2.2	30.8	1.0	0.0
1157	10.1	3.2	2.1	30.6	1.0	0.0
1158	10.1	3.2	2.1	30.6	0.9	0.0
1159	10.1	3.2	2.0	30.6	1.1	0.0
1200	10.1	3.2	2.1	30.8	1.0	0.0
1201	10.0	3.4	1.8	30.9	1.0	0.0
1202	10.0	3.3	2.0	31.2	1.2	0.0
1203	10.0	3.3	2.2	31.4	1.2	0.0
1204	10.1	3.2	2.2	31.6	1.3	0.0
1205	10.1	3.1	2.1	31.6	1.3	0.0
1206	10.0	3.3	2.1	31.7	1.3	0.0
1207	10.1	3.3	2.1	31.6	1.3	0.0
1208	10.1	3.2	2.1	31.6	1.4	0.0
1209	10.1	3.2	2.1	31.6	1.4	0.0
1210	10.1	3.2	2.2	31.6	1.4	0.0
1211	10.1	3.2	2.0	31.6	1.4	0.0

1212	10.1	3.3	2.1	31.5	1.4	0.0
1213	10.1	3.2	2.1	31.6	1.4	0.0
1214	10.1	3.2	2.1	31.4	1.3	0.0
1215	10.1	3.2	2.1	31.4	1.3	0.0
1216	10.1	3.1	2.1	31.4	1.4	0.0
1217	10.1	3.2	2.2	31.4	1.6	0.0
1218	10.1	3.2	2.1	31.4	1.4	0.0
1219	10.1	3.2	2.1	31.4	1.6	0.0
1220	10.1	3.2	2.1	35.0	1.5	0.0
1221	10.1	3.2	2.2	34.5	1.5	0.0
1222	10.1	3.2	2.2	32.6	1.5	0.0
1223	10.1	3.2	2.2	32.6	1.4	0.0
1224	10.1	3.2	2.1	32.6	1.5	0.0
1225	10.1	3.1	2.2	32.8	1.5	0.0
1226	10.1	3.2	2.2	33.0	1.6	0.0
1227	10.2	3.1	2.1	33.2	1.4	0.0
1228	10.2	3.1	2.3	33.1	1.3	0.0
1229	10.2	3.2	2.1	33.0	1.5	0.0
1230	10.2	3.1	2.2	33.0	1.5	0.0
1231	10.2	3.0	2.0	33.0	1.4	0.0
1232	10.2	3.1	2.3	32.8	1.4	0.0
1233	10.2	3.0	2.2	32.8	1.5	0.0
1234	10.2	3.1	2.2	32.8	1.5	0.0
1235	10.2	3.1	2.1	32.8	1.5	0.0
1236	10.2	3.1	2.1	32.7	1.6	0.0
1237	10.1	3.2	2.2	32.6	1.7	0.0
1238	10.1	3.3	2.2	32.8	1.6	0.0
1239	10.2	3.1	2.2	32.8	1.7	0.0
1240	10.2	3.2	2.2	32.8	1.9	0.0
1241	10.2	3.1	2.2	32.9	1.8	0.0
1242	10.2	3.1	2.2	32.8	1.8	0.0
1243	10.2	3.2	2.3	32.8	1.7	0.0
1244	10.1	3.2	2.2	32.9	1.7	0.0
1245	10.1	3.2	2.2	33.0	1.9	0.0
1246	10.1	3.2	2.1	33.0	1.8	0.0
1247	10.2	3.2	2.4	33.0	1.8	0.0
1248	10.1	3.2	2.2	33.0	1.7	0.0
1249	10.1	3.2	2.3	33.0	1.9	0.0
1250	10.2	3.1	2.2	33.0	1.8	0.0
1251	10.2	3.2	2.2	33.1	1.8	0.0
1252	10.1	3.2	2.2	33.0	1.8	0.0
1253	10.1	3.2	2.1	33.0	1.8	0.0
1254	10.1	3.2	2.2	33.0	1.8	0.0
1255	10.1	3.2	2.2	33.1	1.9	0.0
1256	10.1	3.2	2.2	33.0	1.8	0.0
1257	10.2	3.1	2.1	33.0	2.0	0.0
1258	10.2	3.1	2.3	——	2.0	0.0
1259	10.2	3.1	2.2	32.8	2.0	0.0
1300	10.2	3.1	2.3	32.8	2.1	0.0
1301	10.1	3.2	2.2	32.8	2.0	0.0
1302	10.1	3.2	1.5	32.8	2.2	0.0
1303	10.1	3.2	2.2	32.8	2.0	0.0
1304	10.1	3.2	2.2	32.8	2.0	0.0
1305	10.2	3.1	2.2	32.8	2.1	0.0
1306	10.1	3.2	2.2	32.6	2.0	0.0
1307	10.1	3.2	2.2	32.8	2.0	0.0
1308	10.1	3.2	2.2	32.8	2.1	0.0
1309	10.1	3.3	2.2	32.9	1.9	0.0
1310	10.1	3.2	2.1	33.0	2.1	0.0

1311	10.1	3.2	2.2	33.0	2.1	0.0
1312	10.1	3.2	2.4	32.9	2.0	0.0
1313	10.1	3.2	2.3	33.0	2.1	0.4
1314	10.2	3.1	2.3	32.8	2.1	0.0
1315	10.2	3.1	2.3	32.6	2.1	0.0
1316	10.2	3.1	2.1	32.6	2.1	0.0
1317	10.1	3.2	2.2	32.4	2.0	0.0
1318	10.2	3.2	2.4	32.5	1.9	0.0
1319	10.2	3.1	2.1	32.4	2.0	0.0
1320	10.1	3.3	2.2	32.2	1.8	0.0
1321	10.1	3.3	2.2	32.2	1.9	0.0
1322	10.1	3.3	2.2	32.4	1.8	0.0
1323	10.1	3.3	2.2	32.6	1.8	0.0
1324	10.1	3.2	2.1	32.6	1.9	0.0
1325	10.1	3.2	2.2	32.6	1.7	0.0
1326	10.2	3.1	2.2	32.6	2.0	0.0
1327	10.2	3.1	2.2	32.5	1.7	0.0
1328	10.2	3.1	2.1	32.4	1.8	0.0
1329	10.1	3.2	2.1	32.3	1.9	0.0
1330	10.2	3.1	2.3	32.4	1.8	0.0
1331	10.2	3.1	2.2	32.3	1.8	0.0
1332	10.1	3.2	2.1	32.1	1.9	0.0
1333	10.1	3.2	2.1	32.1	1.9	0.0
1334	10.1	3.2	2.3	32.2	1.8	0.0
1335	10.1	3.2	2.1	32.1	1.7	0.0
1336	10.1	3.2	2.1	32.2	1.8	0.0
1337	10.1	3.2	2.2	32.4	1.9	0.0
1338	10.1	3.2	2.1	32.4	1.7	0.0
1339	10.1	3.3	2.1	32.5	1.8	0.0
1340	10.1	3.2	2.3	32.6	2.0	0.0
1341	10.1	3.2	2.1	32.5	1.9	0.0
1342	10.2	3.1	2.1	32.4	1.8	0.0
1343	10.2	3.1	2.3	26.4	1.7	0.0
1344	10.2	3.1	2.1	32.2	1.9	0.0
1345	——	3.1	2.2	32.4	1.8	0.0
1346	10.2	3.1	2.3	32.4	1.9	0.0
1347	10.2	3.2	2.2	32.2	1.8	0.0
1348	10.1	3.3	2.1	32.3	1.7	0.0
1349	10.1	3.3	1.9	32.4	2.0	0.0
1350	10.1	3.3	2.1	32.2	1.9	0.0
1351	10.1	3.2	2.2	32.3	2.0	0.0
1352	10.1	3.2	2.2	32.3	2.1	0.0
1353	10.2	3.1	2.2	32.2	2.0	0.0
1354	10.1	3.2	2.1	32.0	2.1	0.0
1355	10.1	3.3	2.1	32.0	2.0	0.0
1356	10.1	3.2	2.1	32.3	2.1	0.0
1357	10.2	3.1	2.2	32.4	2.1	0.0
1358	10.2	3.1	2.4	32.4	2.0	0.0
1359	10.2	2.5	2.3	32.4	2.0	0.0
1400	10.2	3.0	2.1	32.4	2.2	0.0
1401	10.2	3.1	2.3	31.9	2.1	0.0
1402	10.1	3.3	2.1	32.2	1.9	0.0
1403	10.1	3.2	2.1	32.3	2.0	0.0
1404	10.1	3.2	2.0	32.2	2.1	0.0
1405	10.1	3.2	2.0	32.4	2.0	0.0
1406	10.2	3.1	1.8	32.6	2.1	0.0
1407	10.2	3.2	2.1	32.4	2.0	0.0
1408	——	3.2	1.9	32.4	1.9	0.0
1409	10.1	3.2	1.8	32.5	2.0	0.0

1410	10.1	3.2	2.0	32.6	2.1	0.0
1411	10.2	3.2	2.0	32.6	2.1	0.0
1412	10.1	3.2	1.9	32.6	2.1	0.4
1413	10.2	3.1	2.1	32.6	2.1	0.0
1414	10.2	3.1	2.7	32.5	2.0	0.0
1415	10.1	3.2	2.1	32.7	2.1	0.0
1416	------	3.1	2.0	32.8	2.1	0.0
1417	10.2	3.1	1.9	32.8	2.1	0.0
1418	10.2	3.1	2.1	32.8	1.9	0.0
1419	10.1	3.2	1.9	32.8	2.1	0.0
1420	10.2	3.2	2.0	32.8	2.2	0.0
1421	10.2	3.2	2.0	32.8	2.1	0.0
1422	10.2	3.2	1.9	32.6	2.3	0.0
1423	10.2	3.1	1.9	32.6	2.2	0.0
1424	10.1	3.2	2.0	32.5	2.0	0.0
1425	10.1	3.3	1.8	32.4	2.1	0.0
1426	10.1	3.3	1.8	32.6	2.3	0.0
1427	10.2	3.1	2.1	32.6	2.2	0.0
1428	10.2	3.1	2.1	32.4	2.2	0.0
1429	10.2	3.1	2.1	32.4	2.3	0.0
1430	10.2	3.1	2.0	32.2	2.2	0.0
AVERAGE RUN 1	10.1	3.2	2.2	32.2	1.8	0.0
	(%)	(%)	(ppm)	(ppm)	(ppm)	(ppm)
	CO2	O2	CO	NOx	SO2	THC

TIME	CARBON DIOXIDE (%)	OXYGEN (%)	CARBON MONOXIDE (ppm)	NITROGEN OXIDES (ppm)	SULFUR DIOXIDE (ppm)	TOTAL HYDROCARBONS (ppm)
RUN 2 - 14:58- 19:58						
1458	10.0	3.2	1.0	31.2	1.1	0.1
1459	10.0	3.3	0.7	31.4	1.0	0.1
1500	10.0	3.1	1.0	31.4	1.2	0.1
1501	10.0	3.2	1.0	31.6	1.1	0.1
1502	10.0	3.2	0.8	31.8	1.4	0.1
1503	10.0	3.2	1.0	31.9	1.2	0.1
1504	10.0	3.2	1.3	31.8	1.2	0.0
1505	10.1	3.2	1.8	31.8	1.3	0.0
1506	10.1	3.2	2.1	31.8	1.2	0.0
1507	10.1	3.2	2.1	32.0	1.2	0.0
1508	10.1	3.3	1.9	32.0	-----	0.0
1509	10.1	3.3	1.9	32.2	-----	0.0
1510	10.2	3.1	2.1	32.0	1.5	0.0
1511	10.1	3.2	1.9	31.8	1.4	0.0
1512	10.1	3.3	2.2	32.1	1.3	0.0
1513	10.1	3.3	1.9	32.2	1.2	0.0
1514	10.1	3.2	2.0	32.2	1.2	0.0
1515	10.1	3.2	2.0	32.4	1.2	0.0
1516	10.2	3.1	2.1	32.1	1.3	0.0
1517	10.2	3.1	2.0	32.1	1.2	0.0
1518	10.2	3.1	2.1	32.2	-----	0.0
1519	10.2	3.1	2.1	32.0	1.4	0.0
1520	10.1	3.2	2.0	32.0	1.2	0.0
1521	10.1	3.3	1.6	32.2	1.3	0.0
1522	10.1	3.2	2.0	32.4	1.4	0.0
1523	10.2	3.1	2.0	32.6	1.4	0.0
1524	10.2	3.1	2.1	32.4	1.4	0.0
1525	10.1	3.2	2.1	32.4	1.3	0.0
1526	10.1	3.2	2.1	32.6	-----	0.0
1527	10.2	3.1	2.0	32.8	-0.2	0.0
1528	10.2	3.1	2.1	32.6	1.4	0.0
1529	10.1	3.2	2.0	32.6	1.3	0.0
1530	10.1	3.2	1.9	32.6	1.4	0.0
1531	10.1	3.2	2.0	32.6	1.3	0.0
1532	10.2	3.1	2.1	32.6	1.4	0.0
1533	10.1	3.2	2.1	32.4	1.4	0.0
1534	10.1	3.2	1.9	32.6	1.4	0.0
1535	10.2	3.1	2.1	32.5	1.4	0.0
1536	10.1	3.2	2.0	32.2	1.2	0.0
1537	10.1	3.2	2.1	32.2	1.3	0.0
1538	10.1	3.2	2.0	32.2	1.2	0.0
1539	10.1	3.3	2.0	32.3	1.5	0.0
1540	10.1	3.2	1.9	32.4	1.3	0.0
1541	10.1	3.2	2.0	32.4	1.2	0.0
1542	10.1	3.3	2.0	32.4	1.4	0.0
1543	10.1	3.3	2.1	32.4	1.4	0.0
1544	10.2	3.1	2.2	32.4	1.4	0.0
1545	10.2	3.1	2.2	32.1	1.3	0.0
1546	10.1	3.1	2.1	32.0	1.3	0.0
1547	10.2	3.1	2.1	32.1	1.5	0.0
1548	10.2	3.2	2.1	31.8	1.6	0.0
1549	10.1	3.2	2.1	32.0	1.4	0.0
1550	10.1	3.2	2.1	32.0	1.2	0.0

1551	10.2	3.1	2.1	32.2	1.4	0.0
1552	10.1	3.2	2.1	32.2	1.4	0.0
1553	10.2	3.1	1.9	32.1	1.3	0.0
1554	10.2	3.1	2.1	31.9	1.4	0.0
1555	10.1	3.2	1.9	31.8	1.3	0.0
1556	10.1	3.2	1.9	32.0	1.3	0.0
1557	10.1	3.2	2.1	32.0	1.3	0.0
1558	10.1	3.2	1.9	32.2	1.4	0.0
1559	10.1	3.2	2.0	32.2	1.5	0.0
1600	10.2	4.5	2.1	32.2	1.4	0.0
1601	10.2	3.1	2.1	32.2	1.4	0.0
1602	10.1	3.2	1.9	32.2	1.5	0.0
1603	10.2	3.1	2.1	32.2	1.5	0.0
1604	10.2	3.1	2.1	32.2	1.7	0.0
1605	10.1	3.1	2.0	32.0	1.5	0.0
1606	10.1	3.2	2.0	32.0	1.4	0.0
1607	10.1	3.2	2.1	32.2	1.6	0.0
1608	10.1	3.2	2.1	32.2	1.5	0.0
1609	10.1	3.2	2.0	32.2	1.5	0.0
1610	10.2	3.1	2.1	32.3	1.5	0.0
1611	10.2	3.1	2.1	32.2	——	0.0
1612	10.1	3.2	2.1	32.2	1.5	0.0
1613	10.2	3.1	1.9	32.1	1.5	0.0
1614	10.2	3.1	2.1	32.0	1.5	0.0
1615	10.1	3.3	-0.7	32.2	1.6	0.0
1616	10.1	3.3	1.8	32.2	1.5	0.0
1617	10.2	3.1	2.1	32.0	1.4	0.0
1618	10.2	3.1	2.1	31.8	1.5	0.0
1619	10.1	3.2	2.1	32.0	1.6	0.0
1620	10.1	3.2	1.8	32.0	1.6	0.0
1621	10.2	3.1	2.1	31.9	1.5	0.0
1622	10.2	3.1	-0.3	31.8	1.5	0.0
1623	10.2	3.1	2.3	31.8	1.4	0.0
1624	10.1	3.2	1.9	31.8	1.5	0.0
1625	10.1	3.1	2.0	31.8	1.5	0.3
1626	10.1	3.2	2.0	31.8	1.6	0.0
1627	10.2	3.1	2.0	31.8	1.6	0.0
1628	10.2	3.1	2.1	31.6	1.5	0.0
1629	10.1	3.2	1.8	31.8	1.5	0.0
1630	10.2	3.1	2.0	31.9	1.7	0.0
1631	10.2	3.1	2.0	31.8	1.5	0.0
1632	10.2	2.6	1.9	31.8	1.5	0.0
1633	10.1	3.2	1.9	31.8	1.5	0.0
1634	10.2	3.1	1.9	31.8	1.5	0.0
1635	10.2	3.1	2.0	31.7	1.6	0.0
1636	10.1	3.2	1.9	31.6	1.5	0.0
1637	10.1	3.3	1.7	31.8	1.7	0.0
1638	10.1	3.2	1.9	32.0	1.6	0.0
1639	10.1	3.2	2.0	32.0	1.5	0.0
1640	10.2	3.1	2.0	32.0	1.3	0.0
1641	10.2	3.1	2.1	32.0	0.7	0.0
1642	10.1	3.2	2.2	32.0	1.5	0.0
1643	10.1	3.3	1.8	32.0	0.3	0.0
1644	10.1	3.2	2.0	32.0	1.5	0.0
1645	10.1	3.2	2.0	32.0	1.6	0.0
1646	10.2	3.1	2.0	31.9	1.5	0.0
1647	10.1	3.2	2.1	31.8	1.6	0.0
1648	10.1	3.3	1.8	31.9	1.5	0.0
1649	10.1	3.2	1.9	32.0	1.6	0.0

1650	10.1	3.2	2.1	31.8	1.6	0.0
1651	10.1	3.2	2.0	31.6	1.6	0.0
1652	10.1	3.2	1.9	31.8	1.4	0.0
1653	10.1	3.1	2.1	31.8	1.5	0.0
1654	10.1	3.2	2.0	31.7	1.3	0.0
1655	10.1	3.2	1.9	31.8	1.4	0.0
1656	10.1	3.2	1.9	31.8	1.3	0.0
1657	10.1	3.2	2.0	31.8	1.3	0.0
1658	10.2	3.1	2.0	31.5	1.2	0.0
1659	10.2	3.2	2.1	31.4	1.2	0.0
1700	10.2	3.3	2.0	31.4	1.3	0.0
1701	10.1	3.3	1.9	31.2	1.3	0.0
1702	10.1	3.4	1.8	31.4	1.4	0.0
1703	10.1	3.4	2.1	31.2	1.2	0.0
1704	10.1	3.4	1.9	31.2	1.3	0.0
1705	10.2	3.3	2.0	31.1	1.4	0.0
1706	10.1	3.4	1.8	31.0	1.2	0.0
1707	10.2	3.3	1.9	31.1	1.1	0.0
1708	——	3.3	2.1	31.0	0.9	0.0
1709	10.1	3.4	1.9	31.0	0.4	0.0
1710	10.1	3.5	1.9	31.3	0.6	0.0
1711	10.2	3.2	2.1	31.2	1.0	0.0
1712	10.2	3.2	2.0	31.0	1.1	0.0
1713	10.2	3.1	1.9	31.0	1.1	0.0
1714	10.2	3.1	1.9	31.0	1.0	0.0
1715	10.1	3.3	1.7	31.0	1.0	0.0
1716	10.1	3.2	1.7	31.0	1.1	0.0
1717	10.1	3.2	1.9	31.0	0.9	0.0
1718	10.1	3.2	1.7	31.0	1.0	0.0
1719	10.1	3.2	1.7	31.0	0.9	0.1
1720	10.1	3.2	1.8	31.0	0.5	0.1
1721	10.1	3.2	1.8	31.0	0.7	0.2
1722	10.1	3.2	1.8	30.9	0.8	0.1
1723	10.1	3.2	1.9	30.8	0.8	0.1
1724	10.1	3.2	1.8	30.8	0.7	0.1
1725	10.1	3.2	1.9	30.8	0.8	0.1
1726	10.1	3.2	1.7	30.8	0.6	0.1
1727	10.1	3.2	1.8	30.8	0.6	0.1
1728	10.1	3.2	1.9	30.8	0.5	0.1
1729	10.1	3.2	1.8	30.8	0.6	0.1
1730	10.1	3.2	1.7	30.9	0.5	0.1
1731	10.2	3.1	1.7	31.0	0.4	0.1
1732	10.1	3.2	1.7	31.0	0.5	0.1
1733	10.1	3.1	1.8	31.0	0.5	0.1
1734	10.1	3.2	1.8	31.0	0.3	0.1
1735	10.1	3.2	1.8	31.0	0.5	0.1
1736	10.1	3.1	1.7	31.0	0.5	0.1
1737	10.2	3.1	1.7	30.9	0.4	0.1
1738	10.1	3.2	1.6	30.8	0.4	0.1
1739	10.1	3.2	1.6	31.0	0.3	0.1
1740	10.1	3.2	1.7	30.8	——	0.1
1741	10.1	3.2	1.7	30.9	——	0.1
1742	10.1	3.2	1.7	31.0	0.5	0.1
1743	10.1	3.2	1.7	30.9	0.5	0.1
1744	10.1	3.2	1.7	31.0	0.4	0.1
1745	10.1	3.2	1.7	31.0	0.3	0.1
1746	10.1	3.2	1.6	31.0	0.5	0.1
1747	10.1	3.1	1.7	30.8	0.4	0.1
1748	10.1	3.2	1.9	30.6	0.5	0.0

1749	10.1	3.2	1.8	30.7	0.4	0.0
1750	10.1	3.2	1.8	30.6	0.4	0.0
1751	10.1	3.1	1.8	30.6	0.5	0.0
1752	10.1	3.1	1.7	30.6	0.6	0.0
1753	10.1	3.2	1.8	30.4	0.5	0.0
1754	10.1	3.2	1.9	30.4	0.5	0.0
1755	10.1	3.2	1.8	30.6	0.5	0.0
1756	10.1	3.2	1.8	30.4	0.6	0.0
1757	10.1	3.2	1.8	30.6	0.6	0.0
1758	10.2	3.1	1.8	30.6	0.6	0.0
1759	10.1	3.2	2.1	30.6	0.3	0.0
1800	10.2	3.1	1.9	30.8	-1.1	0.0
1801	10.1	3.2	1.7	30.8	0.6	0.0
1802	10.1	3.2	1.9	31.0	0.6	0.0
1803	10.1	3.2	1.8	31.2	0.6	0.0
1804	10.1	3.2	2.2	31.4	0.6	0.0
1805	10.1	3.2	2.1	31.3	0.5	0.0
1806	10.1	3.2	1.8	31.0	——	0.0
1807	10.1	3.2	1.8	31.3	0.5	0.0
1808	10.2	3.1	1.9	31.2	0.5	0.0
1809	10.1	3.2	2.0	31.0	0.6	0.0
1810	10.1	3.2	1.8	31.2	0.6	0.0
1811	10.1	3.2	1.8	31.2	0.8	0.0
1812	10.1	3.2	2.0	31.3	0.5	0.0
1813	10.1	3.2	1.8	31.4	0.8	0.0
1814	10.1	3.1	1.9	31.4	0.6	0.0
1815	10.1	3.2	2.2	31.4	0.6	0.0
1816	10.1	3.2	1.9	31.4	0.7	0.0
1817	10.1	3.2	1.6	31.4	0.7	0.0
1818	10.1	3.2	2.1	31.5	0.7	0.0
1819	10.1	3.2	2.2	31.6	0.4	0.0
1820	10.1	3.2	2.0	31.8	-0.1	0.0
1821	10.2	3.1	2.0	31.8	0.6	0.0
1822	10.1	3.2	1.8	31.8	0.9	0.0
1823	10.1	3.2	2.0	31.6	0.7	0.0
1824	10.1	3.2	2.1	31.8	0.6	0.0
1825	10.1	3.2	1.8	31.8	0.9	0.0
1826	10.1	3.2	2.0	31.8	0.7	0.0
1827	10.2	3.1	2.1	31.7	0.7	0.0
1828	10.2	3.1	2.1	31.5	0.7	0.0
1829	10.1	3.2	1.8	31.6	0.7	0.2
1830	10.1	3.3	1.9	31.8	0.8	0.0
1831	10.1	3.2	2.1	31.7	0.7	0.0
1832	10.1	3.1	2.1	31.6	0.7	0.0
1833	10.1	3.1	2.2	31.6	0.7	0.0
1834	10.1	3.2	2.0	31.6	0.8	0.0
1835	10.1	3.2	2.0	31.7	0.5	0.0
1836	10.1	3.3	2.0	31.8	0.2	0.0
1837	10.1	3.3	1.8	31.8	0.5	0.0
1838	10.1	3.2	2.0	32.0	0.8	0.0
1839	10.1	3.1	2.2	31.8	0.7	0.0
1840	10.1	3.1	2.0	31.8	0.7	0.0
1841	10.1	3.3	2.0	32.0	0.7	0.0
1842	10.1	3.3	1.7	32.2	0.7	0.0
1843	10.1	3.2	1.9	32.2	0.7	0.0
1844	10.1	3.2	2.1	32.3	0.8	0.0
1845	10.2	3.1	2.1	32.3	0.8	0.0
1846	10.1	3.2	2.1	32.4	0.9	0.0
1847	10.1	3.2	1.8	32.3	0.7	0.2

1848	10.1	3.2	2.0	32.1	0.7	0.0
1849	10.1	3.3	1.9	32.0	0.8	0.0
1850	10.0	3.3	1.7	32.3	0.8	0.0
1851	10.1	3.3	2.0	32.4	0.9	0.0
1852	10.1	3.3	2.0	32.4	0.8	0.0
1853	10.1	3.3	2.1	32.6	0.9	0.0
1854	10.1	3.2	2.1	32.6	0.9	0.0
1855	10.1	3.1	2.2	32.6	0.9	0.0
1856	10.1	3.2	2.2	26.5	0.9	0.0
1857	10.1	3.2	2.3	31.6	0.9	0.0
1858	10.1	3.2	2.4	——	0.7	0.0
1859	10.1	4.6	2.2	32.4	0.9	0.0
1900	10.0	3.3	2.1	32.2	0.8	0.0
1901	10.0	3.3	2.0	32.3	0.9	0.0
1902	9.8	3.8	1.8	32.3	0.7	0.0
1903	9.4	4.5	1.0	31.8	——	0.0
1904	9.6	4.2	1.1	——	0.8	0.0
1905	9.5	4.2	1.0	25.8	0.7	0.0
1906	9.5	4.3	1.0	31.7	0.8	0.0
1907	9.6	4.1	1.7	31.6	0.7	0.0
1908	9.7	3.9	1.1	31.7	0.7	0.0
1909	9.4	4.5	1.1	32.3	0.8	0.0
1910	9.6	4.2	1.1	32.4	0.8	0.0
1911	9.5	4.3	1.0	32.4	0.8	0.0
1912	9.5	4.4	1.0	26.3	0.9	0.0
1913	9.5	4.3	1.1	32.0	0.8	0.0
1914	9.6	4.1	0.9	31.6	0.6	0.0
1915	9.7	3.9	1.3	31.8	0.5	0.0
1916	9.7	3.9	1.3	32.0	0.6	0.0
1917	9.8	3.8	1.5	32.0	0.7	0.0
1918	9.8	3.8	1.2	31.6	0.6	0.0
1919	9.8	3.8	1.1	32.0	0.8	0.0
1920	9.8	3.8	1.4	32.0	0.8	0.0
1921	9.8	3.8	1.5	19.5	0.9	0.0
1922	9.8	3.7	1.2	32.0	0.7	0.0
1923	9.8	3.8	1.5	32.0	0.9	0.0
1924	9.8	3.8	1.2	32.1	0.6	0.0
1925	9.8	3.8	1.2	32.4	0.6	0.0
1926	9.7	4.0	1.1	32.8	0.8	0.0
1927	9.5	4.2	1.1	32.4	0.8	0.0
1928	9.5	4.3	1.2	32.0	0.7	0.0
1929	9.6	4.1	1.2	31.9	0.6	0.0
1930	9.6	4.1	1.2	——	2.3	0.0
1931	9.7	4.0	1.3	32.1	0.8	0.2
1932	9.8	3.8	1.2	32.2	——	0.0
1933	9.8	3.8	1.1	32.8	0.6	0.0
1934	9.7	3.9	1.2	32.8	0.7	0.0
1935	9.5	4.3	1.1	26.5	0.8	0.0
1936	9.5	4.4	1.1	32.6	0.8	0.0
1937	9.5	4.3	1.8	32.4	0.6	0.0
1938	9.6	4.2	1.5	32.4	0.7	0.0
1939	9.6	4.2	1.6	32.3	0.7	0.0
1940	9.7	3.9	1.3	31.9	0.7	0.0
1941	9.6	4.2	1.0	32.4	0.6	0.0
1942	9.6	4.1	1.1	32.6	0.7	0.0
1943	9.6	4.1	1.2	32.2	0.7	0.0
1944	9.7	3.9	1.2	31.9	0.6	0.0
1945	9.5	4.2	1.0	32.5	0.8	0.0
1946	9.5	4.4	0.8	32.6	0.7	0.0

1947	9.4	4.4	0.8	32.6	——	0.0
1948	9.4	4.4	0.9	32.7	0.7	0.0
1949	9.5	4.2	1.1	32.5	0.7	0.0
1950	9.5	4.2	1.0	32.1	0.7	0.0
1951	9.8	3.7	1.3	32.0	0.8	0.1
1952	10.0	3.4	1.6	32.2	0.8	0.0
1953	10.1	3.2	1.7	32.5	0.9	0.0
1954	10.1	3.2	1.7	32.6	——	0.0
1955	10.1	3.2	1.6	32.7	——	0.0
1956	10.1	3.2	1.8	32.8	0.9	0.2
1957	——	3.2	1.8	32.8	1.0	0.0
1958	9.9	3.6	1.5	32.8	0.9	0.1
AVERAGE RUN 2	10.0	3.3	1.8	31.7	1.0	0.0
	(%)	(%)	(ppm)	(ppm)	(ppm)	(ppm)
	CO2	O2	CO	NOx	SO2	THC

SAMPLING SYSTEM BIAS CHECK

Am Test-Air Quality, Inc.

AMTEST AIR QUALITY, INC.

CLIENT: Gas Research Institute

LOCATION: Boise Cascade, White City Lumber, White City OR

SITE LOCATION: Nat Gas Fired #2 Cleaver-Brooks Package Boiler Stack

DATE: 5-2-95

RUN # 1 CONDITION: 95% Load

START: 10:30
STOP: 14:30
Cal through probe

Parameter 1450	Unit	Initial Zero Check	Final Zero Check	Initial Span Check	Final Span Check	Upscale Cal Gas Value	Analyzer Range	Check One Wet	Check One Dry
Carbon Dioxide (CO2) 1941	%	0.0	0.0	15.0	15.0	15.00	0-25		✓
Oxygen (O2)	%	0.0	0.0	5.0	5.0	5.03	0-25		✓
Carbon Monoxide (CO)	ppm	0.3	0.3	29.6	29.6	30.1	0-500		✓
Sulfur Dioxide (SO2)	ppm	0.3	0.4	90.0	89.7	89.7	0-1000		✓
Nitrogen Oxides (NOx)	ppm	0.0	1.1	25.1	24.8	25.22	0-200		✓
Total Reduced Sulfur (TRS as SO2)	ppm								
Non-Methane Hydrocarbons (NMHC)	ppm								
Total Hydrocarbons (THC)	ppm	0.0	0.1	25.4	26.0	25.4	0-100	✓	

RUN # 2 CONDITION: 95% Load

START: 1458 Start m-5/202 BH
STOP: 1958 @ 1436

Parameter	Unit	Initial Zero Check	Final Zero Check	Initial Span Check	Final Span Check	Upscale Cal Gas Value	Analyzer Range	Check One Wet	Check One Dry
Carbon Dioxide (CO2)	%	0.0	0.0	15.0	15.0	15.00	0-25		✓
Oxygen (O2)	%	0.0	0.0	5.0	5.0	5.03	0-25		✓
Carbon Monoxide (CO)	ppm	0.3	0.2	29.6	29.6	30.1	0-500		✓
Sulfur Dioxide (SO2)	ppm	0.4	0.3	89.7	96.0	89.7	0-1000		✓
Nitrogen Oxides (NOx)	ppm	1.1	0.7	24.8	26.2	25.22	0-200		✓
Total Reduced Sulfur (TRS as SO2)	ppm								
Non-Methane Hydrocarbons (NMHC)	ppm								
Total Hydrocarbons (THC)	ppm	0.1	0.3	25.4	24.4	25.4	0-100	✓	

RUN # CONDITION:

START:
STOP:

Parameter	Unit	Initial Zero Check	Final Zero Check	Initial Span Check	Final Span Check	Upscale Cal Gas Value	Analyzer Range	Check One Wet	Check One Dry
Carbon Dioxide (CO2)	%								
Oxygen (O2)	%								
Carbon Monoxide (CO)	ppm								
Sulfur Dioxide (SO2)	ppm								
Nitrogen Oxides (NOx)	ppm								
Total Reduced Sulfur (TRS as SO2)	ppm								
Non-Methane Hydrocarbons (NMHC)	ppm								
Total Hydrocarbons (THC)	ppm								

GAS LOG MEASUREMENT DATA

FILE NAME: DG112\WP53#2BS
CLIENT: WP Natural Gas
LOCATION: White City, Oregon
SITE LOCATION: Natural Gas Fired #2 Cleaver Brooks Packaged Boiler Stack
DATE: 5/3/95
LOAD: 100%

TIME	CARBON DIOXIDE (%)	OXYGEN (%)	CARBON MONOXIDE (ppm)	NITROGEN OXIDES (ppm)	SULFUR DIOXIDE (ppm)	TOTAL HYDROCARBONS (ppm)
RUN 1 - 08:11- 12:11						
811	9.8	3.1	2.6	30.4	0.7	0.3
812	9.8	3.1	2.3	30.4	0.9	0.1
813	10.1	3.2	4.6	30.5	1.0	0.0
814	10.2	3.2	6.6	30.6	1.2	0.0
815	10.2	3.3	6.5	30.6	1.0	0.0
816	10.2	3.2	6.3	30.7	1.1	0.0
817	10.3	3.2	6.6	30.8	1.3	0.0
818	10.3	3.2	6.8	30.8	1.1	0.0
819	10.3	3.2	6.4	31.0	1.1	0.0
820	10.3	3.2	6.7	30.8	----	0.0
821	10.3	3.2	6.4	31.0	1.1	0.0
822	10.3	3.2	6.2	31.0	1.2	0.0
823	10.2	3.3	5.9	31.2	1.1	0.0
824	10.3	3.2	6.4	31.3	1.0	0.0
825	10.3	3.2	6.3	31.3	1.0	0.0
826	10.3	3.2	6.6	31.3	0.6	0.0
827	10.3	3.3	6.6	31.2	1.2	0.0
828	10.2	3.3	6.2	31.3	1.1	0.0
829	10.3	3.2	6.3	31.2	1.1	0.0
830	10.2	3.2	6.2	31.1	1.2	0.0
831	10.3	3.2	6.3	31.1	1.1	0.0
832	10.3	3.3	6.2	31.2	0.8	0.0
833	10.3	3.1	6.5	31.3	1.1	0.0
834	10.3	3.2	6.5	31.2	0.9	0.0
835	10.3	3.2	6.3	31.3	1.0	0.0
836	10.3	3.2	6.8	31.2	0.9	0.0
837	10.2	3.3	6.4	31.2	0.9	0.0
838	10.3	3.3	6.4	31.3	0.9	0.0
839	10.3	3.3	6.2	31.4	0.9	0.0
840	10.3	3.1	6.7	31.4	1.0	0.0
841	10.3	3.2	6.6	31.4	1.0	0.0
842	10.3	3.1	6.6	31.4	1.0	0.0
843	10.3	3.1	7.1	31.3	1.0	0.0
844	10.2	3.3	6.7	31.3	1.1	0.0
845	10.3	3.2	6.4	31.5	1.0	0.0
846	10.3	3.3	6.6	31.4	1.3	0.0
847	10.3	3.2	6.3	31.6	1.2	0.0
848	10.2	3.2	6.3	31.6	1.1	0.0
849	10.3	3.2	6.5	31.5	1.0	0.0
850	10.3	3.3	6.5	31.5	1.0	0.0
851	10.2	3.3	6.2	31.6	0.9	0.0
852	10.3	3.2	6.4	31.5	0.9	0.0
853	10.2	3.3	6.8	31.4	0.9	0.0

854	10.3	3.2	6.5	31.5	1.1	0.0
855	10.3	3.2	6.8	31.5	0.9	0.0
856	10.3	3.1	7.1	31.5	1.1	0.0
857	10.3	3.2	6.8	31.3	0.9	0.0
858	10.2	3.3	6.1	31.5	1.0	0.0
859	10.3	3.2	6.8	31.4	1.0	0.0
900	10.3	3.2	7.2	31.4	1.1	0.0
901	10.3	3.2	6.3	31.3	0.9	0.0
902	10.3	3.1	6.8	31.2	0.8	0.0
903	10.3	3.2	6.2	31.2	0.9	0.0
904	10.2	3.3	6.4	31.2	0.9	0.0
905	10.3	3.2	6.4	31.1	0.9	0.0
906	10.3	3.3	6.6	31.2	0.9	0.0
907	10.3	3.3	6.2	31.2	-0.1	0.0
908	10.3	3.2	6.5	31.1	0.6	0.0
909	10.3	3.2	6.3	31.0	0.8	0.0
910	10.3	3.2	6.8	30.9	0.9	0.0
911	10.3	3.2	6.5	31.0	0.8	0.0
912	10.3	3.2	6.3	31.0	1.0	0.0
913	10.3	3.2	6.7	31.2	0.9	0.0
914	10.3	3.2	6.3	31.2	1.0	0.0
915	10.3	3.2	6.3	31.4	1.0	0.0
916	10.3	3.2	6.8	31.4	0.9	0.0
917	10.2	3.3	6.2	31.3	0.9	0.0
918	10.3	3.2	6.2	31.5	1.0	0.0
919	10.3	3.2	6.4	31.6	1.0	0.0
920	10.3	3.3	6.3	31.7	1.1	0.0
921	10.3	3.2	6.9	31.6	1.2	0.0
922	10.3	3.2	6.6	31.6	1.1	0.0
923	10.3	3.2	6.1	31.8	1.2	0.0
924	10.3	3.2	6.4	31.8	1.1	0.0
925	10.3	3.2	6.4	31.8	1.1	0.0
926	10.3	3.2	6.8	31.7	1.2	0.0
927	10.3	3.2	6.5	31.7	1.3	0.0
928	10.3	3.2	6.6	31.6	1.2	0.0
929	10.3	3.2	6.4	31.7	1.3	0.0
930	10.3	3.2	6.9	31.6	1.1	0.0
931	10.3	3.1	6.7	31.7	1.3	0.0
932	10.3	3.1	6.9	31.8	1.3	0.0
933	10.3	3.1	6.9	31.7	1.1	0.0
934	10.3	3.2	6.6	31.7	1.3	0.0
935	10.3	3.2	6.2	31.6	1.2	0.0
936	10.2	3.3	5.9	31.8	1.2	0.0
937	10.3	3.2	6.2	31.8	1.2	0.0
938	10.3	3.2	6.1	31.8	1.2	0.0
939	10.3	3.1	6.7	31.6	1.1	0.0
940	10.2	3.3	6.1	31.7	1.2	0.0
941	10.2	3.3	6.0	31.7	1.1	0.0
942	10.3	3.2	6.3	31.7	1.1	0.0
943	10.3	3.2	6.7	31.6	1.2	0.0
944	10.3	3.2	6.4	31.5	1.2	0.0
945	10.3	3.3	6.1	31.5	1.2	0.0
946	10.3	3.3	5.8	31.7	1.2	0.0
947	10.2	3.4	5.9	31.6	1.1	0.0
948	10.2	3.3	6.0	31.3	0.4	0.0
949	10.2	3.4	6.1	31.2	1.0	0.0
950	10.2	3.4	6.4	31.0	1.0	0.0
951	10.2	3.4	6.3	31.0	0.9	0.0
952	10.2	3.4	6.1	31.1	1.1	0.0

953	10.2	3.4	6.3	31.4	1.0	0.0
954	10.2	3.3	6.4	31.4	1.0	0.0
955	10.2	3.4	6.4	31.2	1.0	0.0
956	10.2	3.4	6.5	31.1	1.1	0.0
957	10.2	3.5	6.3	31.2	1.1	0.0
958	10.2	3.5	6.2	31.2	1.2	0.0
959	10.2	3.4	6.7	31.1	1.2	0.0
1000	10.2	3.4	6.4	31.0	1.3	0.0
1001	10.1	3.5	6.1	31.1	1.0	0.0
1002	10.1	3.6	6.0	31.2	1.2	0.0
1003	10.2	3.4	6.1	31.1	1.3	0.0
1004	10.2	3.4	6.5	31.1	1.2	0.0
1005	10.2	3.4	6.2	31.2	1.0	0.0
1006	10.2	3.4	6.3	31.1	1.2	0.0
1007	10.1	3.5	6.1	31.0	1.2	0.0
1008	10.1	3.4	6.7	31.1	1.0	0.0
1009	10.2	3.4	6.4	31.3	1.1	0.0
1010	10.2	3.4	6.5	31.2	1.2	0.0
1011	10.2	2.6	6.5	31.1	1.1	0.0
1012	10.3	3.3	7.3	31.1	1.2	0.0
1013	10.2	3.3	7.1	31.0	1.1	0.0
1014	10.2	3.4	6.5	30.6	1.1	0.0
1015	10.2	3.4	6.0	30.1	1.2	0.0
1016	10.2	3.4	6.2	29.9	0.9	0.0
1017	10.1	3.5	6.2	29.7	0.9	0.0
1018	10.1	3.5	6.0	29.6	0.6	0.0
1019	10.1	3.5	5.7	29.8	0.9	0.0
1020	10.1	3.5	5.8	30.0	1.1	0.0
1021	10.2	3.4	6.4	29.9	1.1	0.0
1022	10.2	3.4	6.3	30.0	1.0	0.0
1023	10.2	3.4	7.0	29.9	1.1	0.0
1024	10.2	3.4	6.4	29.8	0.9	0.0
1025	10.2	3.4	6.3	29.8	1.0	0.0
1026	10.2	3.4	6.2	29.7	0.8	0.0
1027	10.2	3.5	6.0	29.7	-0.1	0.0
1028	10.2	3.4	5.9	29.9	0.9	0.0
1029	10.1	3.5	6.0	29.8	0.8	0.0
1030	10.2	3.3	6.2	30.1	1.0	0.0
1031	10.2	3.4	6.5	30.0	0.8	0.0
1032	10.2	3.3	6.6	30.1	0.8	0.0
1033	10.2	3.4	6.4	30.0	0.9	0.0
1034	10.2	3.4	6.2	30.0	0.7	0.0
1035	10.1	3.5	6.0	30.1	0.8	0.0
1036	10.2	3.5	6.0	30.3	0.7	0.0
1037	10.2	3.4	6.2	30.3	0.8	0.0
1038	10.2	3.3	6.4	30.3	0.7	0.0
1039	10.2	3.3	6.6	30.3	0.6	0.0
1040	10.1	3.6	6.1	30.2	0.5	0.0
1041	10.1	3.5	5.7	30.6	0.5	0.0
1042	10.1	3.5	6.0	30.5	0.4	0.0
1043	10.2	3.4	6.0	30.7	0.6	0.0
1044	10.2	3.4	6.5	30.7	0.5	0.0
1045	10.2	3.4	6.7	30.7	0.5	0.0
1046	10.2	3.4	6.1	30.7	0.4	0.0
1047	10.1	3.5	6.1	30.7	0.3	0.0
1048	10.1	3.5	6.0	30.6	0.3	0.0
1049	10.2	3.4	6.1	30.7	0.6	0.0
1050	10.2	3.4	6.4	30.7	0.5	0.0
1051	10.1	3.4	6.5	30.8	0.5	0.0

1052	10.2	3.3	6.8	30.8	0.4	0.0
1053	10.2	3.3	6.5	30.7	0.3	0.0
1054	10.2	3.3	6.4	30.7	0.3	0.0
1055	10.2	3.4	6.5	30.6	0.3	0.0
1056	10.2	3.4	5.9	30.8	0.3	0.0
1057	10.2	3.3	6.3	30.7	0.3	0.0
1058	10.2	3.4	6.4	30.6	0.5	0.0
1059	10.1	3.4	6.4	30.7	0.4	0.0
1100	10.1	3.4	5.8	30.6	0.3	0.0
1101	10.1	3.4	6.2	30.5	0.4	0.0
1102	10.2	3.4	6.3	30.6	0.5	0.0
1103	10.2	3.4	6.3	30.4	0.4	0.0
1104	10.2	3.4	6.2	30.4	0.3	0.0
1105	10.2	3.4	6.6	30.5	0.4	0.0
1106	10.2	3.4	6.4	30.5	0.2	0.0
1107	10.2	3.3	7.3	30.6	0.3	0.0
1108	10.2	3.3	6.9	30.5	0.1	0.0
1109	10.2	3.4	6.6	30.5	0.2	0.0
1110	10.2	3.4	6.4	30.6	0.3	0.0
1111	10.2	3.3	6.4	30.6	0.2	0.0
1112	10.2	3.4	6.4	30.4	0.2	0.0
1113	10.1	3.6	5.5	30.6	0.3	0.0
1114	10.1	3.5	5.7	30.8	0.4	0.0
1115	10.1	3.4	6.2	30.9	0.5	0.0
1116	10.1	3.4	6.1	31.0	0.5	0.0
1117	10.1	3.4	6.2	31.0	0.4	0.0
1118	10.2	3.3	6.5	31.2	0.5	0.0
1119	10.2	3.3	6.8	31.3	0.4	0.0
1120	10.2	3.4	6.6	31.3	0.5	0.0
1121	10.2	3.3	6.8	31.3	0.6	0.0
1122	10.2	3.4	6.3	31.0	0.5	0.0
1123	10.2	3.3	6.2	31.1	0.6	0.0
1124	10.2	3.4	6.3	31.1	0.7	0.0
1125	10.2	3.4	6.8	31.3	0.7	0.0
1126	10.2	3.3	6.5	31.4	-1.1	0.0
1127	10.2	3.4	6.1	31.2	0.7	0.0
1128	10.1	3.4	6.2	31.3	0.7	0.0
1129	10.1	3.4	6.1	31.3	0.7	0.0
1130	10.2	3.3	6.4	31.5	0.8	0.0
1131	10.2	3.4	6.7	31.4	0.6	0.0
1132	10.2	3.4	6.4	31.5	0.9	0.0
1133	10.2	3.4	6.2	31.5	0.8	0.0
1134	10.2	3.4	6.4	31.7	0.7	0.0
1135	10.2	3.3	7.1	31.8	1.0	0.0
1136	10.2	3.3	7.4	31.7	0.9	0.0
1137	10.2	3.4	6.9	31.7	0.9	0.0
1138	10.2	3.3	6.4	31.7	1.0	0.0
1139	10.2	3.3	6.3	31.5	0.7	0.0
1140	10.2	3.3	6.6	31.5	0.8	0.0
1141	10.2	3.4	6.5	31.3	1.0	0.0
1142	10.2	3.3	6.3	31.4	1.0	0.0
1143	10.1	3.4	6.2	31.3	0.9	0.0
1144	10.2	3.3	6.3	31.4	1.0	0.0
1145	10.2	3.3	6.6	31.4	0.9	0.0
1146	10.2	3.3	6.4	31.6	——	0.0
1147	10.2	3.3	6.5	31.6	0.9	0.0
1148	10.2	3.3	6.5	31.5	0.9	0.0
1149	10.2	3.2	6.8	31.4	0.9	0.0
1150	10.2	3.4	6.2	31.4	6.9	0.0

1151	10.2	3.4	6.0	31.5	0.8	0.0
1152	10.1	3.4	5.8	31.4	0.8	0.0
1153	10.2	3.3	6.6	31.3	0.8	0.0
1154	10.2	3.3	6.8	31.2	0.6	0.0
1155	10.1	3.4	6.2	31.3	0.6	0.0
1156	10.2	3.3	6.2	31.3	0.6	0.0
1157	10.2	3.3	6.7	31.3	-0.3	0.0
1158	10.1	3.4	6.0	31.2	0.4	0.0
1159	10.2	3.4	6.3	31.5	0.5	0.0
1200	10.2	3.2	6.6	31.5	0.4	0.0
1201	10.2	3.2	6.4	31.5	0.4	0.0
1202	10.2	3.3	6.4	31.4	0.6	0.0
1203	10.2	3.3	6.3	31.3	0.4	0.0
1204	10.2	3.2	6.4	31.2	0.5	0.0
1205	10.2	3.3	5.8	31.1	0.6	0.0
1206	10.2	3.4	5.8	31.1	0.7	0.0
1207	10.1	3.4	5.7	31.1	0.6	0.0
1208	10.1	3.4	5.7	31.3	0.7	0.0
1209	10.2	3.4	6.1	31.5	0.5	0.0
1210	10.1	3.4	5.8	31.6	0.6	0.0
1211	10.1	3.4	6.0	31.8	0.7	0.0
AVERAGE RUN 1	10.2	3.3	6.3	31.1	0.9	0.0
	(%)	(%)	(ppm)	(ppm)	(ppm)	(ppm)
	CO2	O2	CO	NOx	SO2	THC

TIME	CARBON DIOXIDE (%)	OXYGEN (%)	CARBON MONOXIDE (ppm)	NITROGEN OXIDES (ppm)	SULFUR DIOXIDE (ppm)	TOTAL HYDROCARBONS (ppm)
RUN 2 - 12:39- 16:40						
1239	10.0	3.2	2.5	32.3	0.5	0.0
1240	10.0	3.2	2.4	32.4	0.6	0.0
1241	10.0	3.2	2.5	32.3	0.7	0.0
1242	9.9	3.3	2.4	32.3	0.8	0.0
1243	9.9	3.3	2.1	32.4	0.9	0.0
1244	9.9	3.3	2.7	32.6	1.0	0.0
1245	9.9	3.2	2.3	32.5	1.1	0.0
1246	10.0	3.2	2.7	32.6	1.1	0.0
1247	10.0	3.1	3.0	32.6	1.2	0.0
1248	10.0	3.1	2.9	32.5	1.3	0.0
1249	10.1	3.2	2.9	32.7	1.2	0.0
1250	10.1	3.1	3.7	32.5	1.1	0.0
1251	10.1	3.1	4.2	32.2	0.5	0.0
1252	10.1	3.2	3.4	32.3	1.0	0.0
1253	10.1	3.2	4.0	32.1	1.0	0.0
1254	10.0	3.4	3.1	32.1	1.2	0.0
1255	10.0	3.3	3.1	32.3	0.9	0.0
1256	10.1	3.2	3.4	32.3	1.0	0.0
1257	10.1	3.2	3.2	32.3	1.0	0.0
1258	10.0	3.3	3.1	32.3	1.1	0.0
1259	10.1	3.2	3.7	32.3	1.2	0.0
1300	10.1	3.2	3.6	32.2	1.1	0.0
1301	10.1	3.2	3.5	32.2	1.1	0.0
1302	10.1	3.1	3.8	32.1	1.1	0.0
1303	10.1	3.3	3.7	32.2	0.9	0.0
1304	10.0	3.4	2.9	32.4	0.6	0.0
1305	10.1	3.3	3.6	32.5	0.8	0.0
1306	10.1	3.3	4.0	32.3	0.9	0.0
1307	10.1	3.3	3.2	32.4	0.9	0.0
1308	10.1	3.2	3.6	32.5	0.9	0.0
1309	10.1	3.1	3.9	32.3	0.8	0.0
1310	10.1	3.3	3.3	32.4	1.0	0.0
1311	10.1	3.3	3.2	32.5	0.8	0.0
1312	10.1	3.3	3.5	32.6	0.8	0.0
1313	10.1	3.1	3.8	32.4	0.9	0.0
1314	10.1	3.2	3.9	32.2	1.0	0.0
1315	10.0	3.3	3.4	32.1	0.9	0.0
1316	10.1	3.2	3.1	32.3	1.0	0.0
1317	10.2	3.1	3.6	32.1	1.0	0.0
1318	10.0	3.3	3.2	31.8	0.8	0.0
1319	10.1	3.3	3.3	32.2	0.7	0.0
1320	10.0	3.3	3.0	32.3	0.8	0.0
1321	10.1	3.3	3.2	32.6	0.9	0.0
1322	10.1	3.2	3.3	32.6	1.0	0.0
1323	10.0	3.3	3.6	32.9	1.0	0.0
1324	10.1	3.2	3.5	32.8	0.9	0.0
1325	10.1	3.3	3.7	32.9	1.1	0.0
1326	10.1	3.3	3.6	32.9	1.0	0.0
1327	10.1	3.2	3.9	32.6	0.9	0.0
1328	10.1	3.2	3.8	32.5	1.0	0.0
1329	10.1	3.2	3.8	32.6	1.2	0.0
1330	10.1	3.2	3.9	32.6	0.9	0.0
1331	10.1	3.1	3.6	26.0	0.9	0.0

1332	10.0	3.3	3.6	32.3	1.0	0.0
1333	10.0	3.4	2.8	32.7	1.0	0.0
1334	10.0	3.3	3.2	32.9	1.0	0.0
1335	10.1	3.2	3.7	32.8	0.9	0.0
1336	10.1	3.2	3.5	32.8	0.9	0.0
1337	10.1	3.2	3.8	32.7	0.9	0.0
1338	10.1	3.2	3.6	32.6	1.0	0.0
1339	10.1	3.2	3.2	32.5	1.0	0.0
1340	10.1	3.2	3.3	32.5	1.0	0.0
1341	10.1	3.3	3.2	32.5	1.1	0.0
1342	10.1	3.2	3.2	32.6	1.0	0.0
1343	10.1	3.2	3.5	32.7	1.0	0.0
1344	10.1	3.2	3.6	32.7	0.9	0.0
1345	10.2	3.0	4.1	32.5	0.9	0.0
1346	10.1	3.2	3.6	32.3	1.0	0.0
1347	10.0	3.4	3.2	32.3	1.0	0.0
1348	10.0	3.3	3.2	32.5	0.9	0.0
1349	10.1	3.2	3.2	32.3	0.9	0.0
1350	10.1	3.1	3.3	32.2	1.0	0.0
1351	10.0	3.3	3.2	32.0	1.1	0.0
1352	10.0	3.3	3.2	32.2	1.0	0.0
1353	10.1	3.3	3.1	32.5	1.1	0.0
1354	10.1	3.2	3.3	32.4	1.0	0.0
1355	10.1	3.2	3.5	32.3	1.0	0.0
1356	10.1	3.3	3.4	32.3	0.9	0.0
1357	10.1	3.1	3.7	32.3	1.0	0.0
1358	10.1	3.2	3.7	31.8	1.1	0.0
1359	10.1	3.2	3.3	32.0	1.1	0.0
1400	10.1	3.3	3.0	32.1	1.0	0.0
1401	10.0	3.4	2.8	32.2	0.8	0.0
1402	10.1	3.2	3.1	32.5	0.9	0.0
1403	10.1	3.2	3.6	32.5	1.1	0.0
1404	10.2	3.0	4.6	32.1	1.0	0.0
1405	10.0	3.3	3.3	32.2	1.2	0.0
1406	10.0	3.3	3.0	32.6	1.1	0.0
1407	10.1	3.2	3.4	32.4	1.1	0.0
1408	10.1	3.2	3.3	32.3	1.1	0.0
1409	10.1	3.2	3.2	32.6	1.1	0.0
1410	10.1	3.2	3.4	32.6	1.2	0.0
1411	10.1	3.2	3.4	32.5	-0.5	0.0
1412	10.1	3.2	3.5	32.7	1.0	0.0
1413	10.1	3.1	3.7	32.5	0.7	0.0
1414	10.1	3.2	3.4	32.6	1.0	0.0
1415	10.1	3.3	3.4	32.7	0.9	0.0
1416	10.1	3.2	3.3	32.7	1.0	0.0
1417	10.1	3.2	3.4	32.6	0.9	0.0
1418	10.1	3.2	3.3	32.6	0.9	0.0
1419	10.1	3.2	3.3	32.6	1.0	0.0
1420	10.1	3.3	2.2	32.3	0.7	0.0
1421	10.1	3.2	3.5	32.5	0.9	0.0
1422	10.1	3.2	3.8	32.2	0.8	0.0
1423	10.1	3.1	3.7	32.0	1.0	0.0
1424	10.1	3.1	3.4	32.1	0.9	0.0
1425	10.1	3.1	3.4	31.8	1.0	0.0
1426	10.1	3.3	3.2	31.8	1.0	0.0
1427	10.0	3.3	2.8	32.0	0.9	0.0
1428	10.0	3.3	3.2	32.2	0.9	0.0
1429	10.1	3.2	3.3	32.2	0.9	0.0
1430	10.0	3.3	3.4	32.2	0.8	0.0

1431	10.1	3.2	3.6	32.4	0.7	0.0
1432	10.1	3.2	3.7	32.3	0.4	0.0
1433	10.1	3.2	3.5	32.2	0.8	0.0
1434	10.1	3.1	3.6	32.3	0.8	0.0
1435	10.1	3.2	4.0	32.3	0.9	0.0
1436	10.1	3.3	3.3	32.3	0.8	0.0
1437	10.1	3.2	3.4	32.2	0.8	0.0
1438	10.1	3.2	3.5	32.1	0.8	0.0
1439	10.1	3.1	3.5	32.2	1.0	0.0
1440	10.1	3.2	3.7	32.1	0.9	0.0
1441	10.1	3.2	3.1	32.3	0.7	0.0
1442	10.1	3.2	4.2	32.2	0.8	0.0
1443	10.1	3.2	3.5	32.3	0.9	0.0
1444	10.1	3.2	3.3	32.2	0.8	0.0
1445	10.1	3.2	3.0	31.9	0.7	0.0
1446	10.1	3.2	3.2	31.9	0.8	0.0
1447	10.1	3.2	3.3	32.1	0.9	0.0
1448	10.1	3.2	3.5	32.2	0.8	0.0
1449	10.1	3.2	3.4	32.4	0.8	0.0
1450	10.1	3.2	3.5	32.4	0.7	0.0
1451	10.1	3.2	3.3	32.5	-0.5	0.0
1452	10.2	3.1	3.8	32.4	0.7	0.0
1453	10.1	3.2	3.9	32.3	0.7	0.0
1454	10.1	3.1	3.7	32.6	0.8	0.0
1455	10.1	3.2	3.5	32.4	0.7	0.0
1456	10.1	3.1	3.4	32.5	0.8	0.0
1457	10.1	3.2	3.4	32.3	0.7	0.0
1458	10.1	3.2	3.6	32.2	0.7	0.0
1459	10.1	3.1	3.7	32.2	0.7	0.0
1500	10.2	3.1	3.8	31.9	0.9	0.0
1501	10.0	3.3	3.3	31.8	0.8	0.0
1502	10.1	3.2	3.1	32.1	0.9	0.0
1503	10.1	3.2	2.9	32.1	0.8	0.0
1504	10.1	3.2	3.3	32.1	0.8	0.0
1505	10.1	3.1	3.6	32.2	0.7	0.0
1506	10.1	3.1	3.9	31.8	0.6	0.0
1507	10.2	3.1	4.2	31.7	0.4	0.0
1508	10.1	3.2	3.0	31.8	0.7	0.0
1509	10.1	3.1	3.4	31.9	0.8	0.0
1510	10.1	3.1	3.6	31.6	0.6	0.0
1511	10.1	3.1	4.0	31.5	-1.3	0.0
1512	10.1	3.2	3.6	31.5	0.7	0.0
1513	10.1	3.2	3.0	31.9	0.8	0.0
1514	10.1	3.2	2.9	31.9	0.7	0.0
1515	10.1	3.1	3.3	31.9	0.7	0.0
1516	10.1	3.1	4.0	31.8	0.6	0.0
1517	10.1	3.1	3.9	32.0	0.6	0.0
1518	10.1	3.1	3.7	32.0	0.7	0.0
1519	10.1	3.2	3.4	32.0	0.7	0.0
1520	10.1	3.2	3.5	32.0	0.7	0.0
1521	10.1	3.1	3.2	31.9	0.6	0.0
1522	10.1	3.1	3.5	31.8	0.5	0.0
1523	10.2	3.0	4.2	31.7	0.3	0.0
1524	10.1	3.2	3.7	31.5	0.4	0.0
1525	10.1	3.2	3.1	31.8	0.3	0.0
1526	10.1	3.2	3.2	31.9	0.3	0.0
1527	10.1	3.2	3.2	31.8	0.5	0.0
1528	10.1	3.1	3.6	31.9	0.3	0.0
1529	10.1	3.1	3.7	31.9	0.4	0.0

1530	10.1	3.1	3.8	31.8	-0.5	0.0
1531	10.2	3.0	3.7	31.6	0.2	0.0
1532	10.1	3.1	3.8	31.4	0.2	0.0
1533	10.1	3.1	3.6	31.6	0.0	0.0
1534	10.1	3.1	3.4	31.5	0.1	0.0
1535	10.1	3.1	3.5	31.8	0.1	0.0
1536	10.1	3.1	3.4	31.8	0.2	0.0
1537	10.1	3.0	3.7	31.7	0.2	0.0
1538	10.1	3.1	3.7	31.6	0.1	0.0
1539	10.1	3.1	4.3	31.7	0.2	0.0
1540	10.0	3.2	3.3	31.7	-0.1	0.0
1541	10.0	3.2	3.2	31.8	0.2	0.0
1542	10.0	3.2	3.2	31.9	0.0	0.0
1543	10.0	3.2	3.3	31.9	-0.1	0.0
1544	10.1	3.2	3.5	32.0	-0.2	0.0
1545	10.1	3.2	3.3	32.0	-0.2	0.0
1546	10.1	3.1	3.7	31.9	-0.2	0.0
1547	10.1	3.1	3.9	31.8	-0.3	0.0
1548	10.0	3.2	3.5	31.7	-0.2	0.0
1549	10.1	3.2	3.4	32.0	-0.2	0.0
1550	10.1	3.2	3.6	32.0	-0.5	0.0
1551	10.1	3.1	3.8	32.0	-0.8	0.0
1552	10.1	3.1	3.9	31.9	-1.0	0.0
1553	10.1	3.1	3.8	31.9	-0.2	0.0
1554	10.1	3.1	3.9	31.8	-0.3	0.0
1555	10.0	3.2	3.3	31.8	-0.2	0.0
1556	10.1	3.1	3.3	31.8	-0.1	0.0
1557	10.1	3.2	3.3	31.7	-0.3	0.0
1558	10.1	3.1	3.7	31.7	-0.2	0.0
1559	10.1	3.1	3.6	31.3	-0.1	0.0
1600	10.1	3.2	3.0	31.4	-0.2	0.0
1601	10.1	3.1	3.3	31.6	-0.1	0.0
1602	10.1	3.1	3.4	31.3	-0.2	0.0
1603	10.1	3.1	3.4	31.3	-0.1	0.0
1604	10.1	3.2	3.2	31.5	-0.1	0.0
1605	10.1	3.1	3.2	31.5	-0.2	0.0
1606	10.1	3.1	3.2	31.6	-0.1	0.0
1607	10.1	3.1	3.3	31.4	0.0	0.0
1608	10.1	3.2	3.1	31.6	0.0	0.0
1609	10.0	3.2	2.9	31.8	-0.1	0.0
1610	10.2	3.0	4.0	31.5	-0.9	0.0
1611	10.1	3.1	3.7	31.2	-0.6	0.0
1612	10.1	3.1	3.2	31.4	-0.7	0.0
1613	10.1	3.2	3.1	31.6	-0.3	0.0
1614	10.1	3.1	3.3	31.6	-0.3	0.0
1615	10.0	3.2	3.1	31.5	-0.4	0.0
1616	10.1	3.1	3.1	31.7	-0.3	0.0
1617	10.0	3.2	2.8	31.7	-0.3	0.0
1618	10.0	3.2	2.8	32.0	-0.4	0.0
1619	10.0	3.2	3.1	31.8	-0.3	0.0
1620	10.1	3.1	3.3	31.6	-0.2	0.0
1621	10.1	3.2	3.3	31.7	-0.2	0.0
1622	10.1	3.2	3.1	31.6	-0.3	0.0
1623	10.1	3.2	3.0	31.5	-0.3	0.0
1624	10.0	3.2	3.1	31.6	-0.2	0.0
1625	10.0	3.2	2.8	31.8	-0.1	0.0
1626	10.1	3.2	3.0	31.9	-0.3	0.0
1627	10.0	3.2	2.9	32.0	-0.2	0.0
1628	10.1	3.1	3.5	32.0	-0.2	0.0

1629	10.1	3.2	3.5	31.8	-0.2	0.0
1630	10.1	3.2	3.3	32.1	-0.1	0.0
1631	10.0	3.2	3.3	32.2	-0.1	0.0
1632	10.1	3.2	3.1	32.3	-0.1	0.0
1633	10.1	3.2	3.3	32.3	-0.2	0.0
1634	10.1	3.1	3.6	32.1	-0.1	0.0
1635	10.1	3.1	3.9	32.0	-0.1	0.0
1636	10.1	3.1	3.3	31.9	-0.2	0.0
1637	10.1	3.1	3.5	32.0	0.0	0.0
1638	10.1	3.1	3.4	32.2	-0.1	0.0
1639	10.1	3.0	4.0	32.1	-0.1	0.0
1640	10.1	3.2	3.2	31.9	0.0	0.0
AVERAGE RUN 2	10.1	3.2	3.4	32.1	0.5	0.0
	(%)	(%)	(ppm)	(ppm)	(ppm)	(ppm)
	CO2	O2	CO	NOx	SO2	THC

SAMPLING SYSTEM BIAS CHECK

Am Test-Air Quality, Inc.

AMTEST AIR QUALITY, INC.

CLIENT: Gas Research Institute
LOCATION: Boise Cascade, White City, OR
SITE LOCATION: Nat Gas Fired #2 Cleaver-Brooks Package Boiler Stack
DATE: 5-3-95

RUN # 1 0803 Start M-5 CONDITION: 100% load

START: 0811
STOP: 1211

Cal through Probe

1220 1711

Parameter	Unit	Initial Zero Check	Final Zero Check	Initial Span Check	Final Span Check	Upscale Cal Gas Value	Analyzer Range	Check One: Wet	Check One: Dry
Carbon Dioxide (CO2)	%	0.0	0.1	15.0	15.0	15.00	0-25		✓
Oxygen (O2)	%	0.0	0.1	5.0	5.1	5.03	0-25		✓
Carbon Monoxide (CO)	ppm	0.2	0.6	30.4	30.3	30.1	0-100		✓
Sulfur Dioxide (SO2)	ppm	0.1	0.3	89.7	89.3	89.7	0-1000		✓
Nitrogen Oxides (NOx)	ppm	-0.2	0.4	25.3	25.3	25.22	0-100		✓
Total Reduced Sulfur (TRS as SO2)	ppm								
Non-Methane Hydrocarbons (NMHC)	ppm								
Total Hydrocarbons (THC)	ppm	0.0	0.1	25.4	25.8	25.4	0-100	✓	

RUN # 2 CONDITION: 100% Load

START: 1239
STOP: 1640

Parameter	Unit	Initial Zero Check	Final Zero Check	Initial Span Check	Final Span Check	Upscale Cal Gas Value	Analyzer Range	Check One: Wet	Check One: Dry
Carbon Dioxide (CO2)	%	0.1	0.1	15.0	14.9	15.00	0-25		✓
Oxygen (O2)	%	0.1	0.0	5.0	5.0	5.03	0-25		✓
Carbon Monoxide (CO)	ppm	0.6	0.4	30.3	29.9	30.1	0-100		✓
Sulfur Dioxide (SO2)	ppm	0.3	-0.3	89.3	88.2	89.7	0-1000		✓
Nitrogen Oxides (NOx)	ppm	0.4	0.7	25.3	25.5	25.22	0-100		✓
Total Reduced Sulfur (TRS as SO2)	ppm								
Non-Methane Hydrocarbons (NMHC)	ppm								
Total Hydrocarbons (THC)	ppm	0.1	0.1	25.8	26.6	25.4	0-100	✓	

RUN # ______ CONDITION: ______

START: ______
STOP: ______

Parameter	Unit	Initial Zero Check	Final Zero Check	Initial Span Check	Final Span Check	Upscale Cal Gas Value	Analyzer Range	Check One: Wet	Check One: Dry
Carbon Dioxide (CO2)	%								
Oxygen (O2)	%								
Carbon Monoxide (CO)	ppm								
Sulfur Dioxide (SO2)	ppm								
Nitrogen Oxides (NOx)	ppm								
Total Reduced Sulfur (TRS as SO2)	ppm								
Non-Methane Hydrocarbons (NMHC)	ppm								
Total Hydrocarbons (THC)	ppm								

[jaa\c\excel\biaschk]

GAS LOG MEASUREMENT DATA

FILE NAME: DG112\WPNG#2BS
CLIENT: WP Natural Gas
LOCATION: White City, Oregon
SITE LOCATION: Natural Gas Fired #2 Cleaver Brooks Packaged Boiler Stack
DATE: 5/4/95
LOAD: 100%

TIME	CARBON DIOXIDE (%)	OXYGEN (%)	CARBON MONOXIDE (ppm)	NITROGEN OXIDES (ppm)	SULFUR DIOXIDE (ppm)	TOTAL HYDROCARBONS (ppm)
RUN 1 - 08:00- 12:00						
800	10.1	2.9	4.2	31.5	1.4	0.0
801	10.1	2.9	3.7	31.7	1.6	0.0
802	10.1	2.9	3.6	31.7	1.7	0.0
803	10.1	2.9	4.4	31.7	1.6	0.0
804	10.1	2.9	3.6	31.6	1.5	0.0
805	10.1	3.0	3.5	31.7	1.5	0.0
806	10.2	3.0	4.1	31.7	1.4	0.0
807	10.2	3.0	2.9	31.5	1.6	0.0
808	10.2	3.0	4.0	31.4	1.8	0.0
809	10.2	2.9	3.8	31.6	1.7	0.0
810	10.2	3.0	4.6	31.6	1.7	0.0
811	10.2	2.9	4.0	31.6	1.7	0.0
812	10.2	2.9	4.2	31.5	1.7	0.0
813	10.2	2.9	3.9	31.5	1.6	0.0
814	10.2	2.9	4.1	31.5	1.8	0.0
815	10.2	3.0	3.9	31.4	1.7	0.0
816	10.2	3.0	3.6	31.3	1.8	0.0
817	10.1	3.1	3.3	31.3	1.7	0.0
818	10.2	2.9	4.0	31.3	1.7	0.0
819	10.2	3.0	3.7	31.2	1.7	0.0
820	10.2	3.0	3.6	31.2	1.7	0.0
821	10.1	3.1	3.4	31.3	1.8	0.0
822	10.2	3.0	3.6	31.3	1.8	0.0
823	10.1	3.1	3.6	31.3	1.7	0.0
824	10.2	3.0	3.6	31.4	1.7	0.0
825	10.2	2.9	4.0	31.3	1.8	0.0
826	10.2	2.9	4.0	31.2	1.7	0.0
827	10.2	2.9	4.8	31.1	1.8	0.0
828	10.1	3.1	3.8	31.3	1.8	0.0
829	10.2	3.0	3.5	31.4	1.7	0.0
830	10.2	2.9	4.4	31.3	1.7	0.0
831	10.2	3.0	3.9	31.4	1.7	0.0
832	10.2	2.9	4.0	31.4	1.9	0.0
833	10.2	3.0	4.7	31.2	1.7	0.0
834	10.2	3.0	3.6	31.2	1.8	0.0
835	10.2	3.0	3.8	31.3	1.8	0.0
836	10.2	3.0	3.7	31.3	1.7	0.0
837	10.2	3.0	3.6	31.3	1.9	0.0
838	10.2	3.0	3.8	31.2	1.8	0.0
839	10.2	3.0	3.6	31.2	1.9	0.0
840	10.1	3.1	3.8	31.1	1.9	0.0
841	10.2	3.0	4.2	31.1	1.9	0.0

842	10.2	3.0	4.0	31.0	1.9	0.0
843	10.2	3.0	4.3	31.0	1.6	0.0
844	10.2	3.0	3.9	31.1	1.4	0.0
845	10.1	3.0	3.8	31.2	1.8	0.0
846	10.1	3.0	3.3	31.2	1.7	0.0
847	10.2	3.0	4.2	31.2	1.7	0.0
848	10.2	3.0	3.8	31.2	1.7	0.0
849	10.2	3.0	4.1	31.3	1.7	0.0
850	10.2	3.0	3.8	31.3	1.8	0.0
851	10.2	3.0	3.6	31.3	1.9	0.0
852	10.2	2.9	4.1	31.3	1.8	0.0
853	10.2	3.0	3.8	31.3	1.8	0.0
854	10.1	3.0	2.8	31.4	1.8	0.0
855	10.1	3.1	2.9	31.5	2.0	0.0
856	10.2	2.9	3.5	31.5	1.8	0.0
857	10.2	2.9	3.1	31.5	1.9	0.0
858	10.2	2.9	3.9	31.5	1.7	0.0
859	10.1	3.0	3.0	31.4	1.8	0.0
900	10.2	2.9	3.9	31.6	1.8	0.0
901	10.1	3.0	3.1	31.4	1.9	0.0
902	10.2	2.9	2.6	31.5	1.7	0.0
903	10.2	3.0	2.7	31.4	1.7	0.0
904	10.1	3.0	2.8	31.4	1.0	0.0
905	10.1	3.0	2.7	31.3	1.7	0.0
906	10.2	2.9	2.6	31.3	1.8	0.0
907	10.1	3.1	2.7	31.2	1.7	0.0
908	10.1	2.9	2.6	31.3	1.9	0.0
909	10.2	2.9	3.8	31.2	1.8	0.0
910	10.2	3.0	3.0	31.1	1.8	0.0
911	10.1	3.0	2.7	31.2	1.9	0.0
912	10.1	3.0	2.7	31.2	2.0	0.0
913	10.1	3.0	2.7	31.2	1.8	0.0
914	10.2	2.9	2.8	31.1	1.8	0.0
915	10.2	2.9	2.9	31.0	1.7	0.0
916	10.1	3.0	3.0	30.9	1.8	0.0
917	10.2	2.9	2.9	30.6	1.7	0.0
918	10.2	2.9	3.4	30.7	1.9	0.0
919	10.2	2.9	3.4	30.6	1.9	0.0
920	10.2	3.0	3.0	30.5	1.8	0.0
921	10.2	3.0	2.6	30.5	1.8	0.0
922	10.1	3.1	2.2	30.5	1.8	0.0
923	10.2	2.9	3.3	30.6	1.8	0.0
924	10.2	3.0	3.0	30.3	1.6	0.0
925	10.2	3.0	2.6	30.4	1.8	0.0
926	10.1	3.0	3.3	30.6	2.0	0.0
927	10.2	2.9	3.2	30.5	1.9	0.0
928	10.2	2.9	2.8	30.5	2.0	0.0
929	10.2	2.9	4.2	30.4	1.8	0.0
930	10.1	3.0	3.2	30.4	1.8	0.0
931	10.2	3.0	3.0	30.3	1.9	0.0
932	10.1	3.0	3.5	30.0	1.7	0.0
933	10.2	2.9	3.4	29.9	1.8	0.0
934	10.2	2.9	3.4	29.9	1.8	0.0
935	10.1	3.0	2.7	29.8	1.8	0.0
936	10.2	2.9	3.0	29.8	1.7	0.0
937	10.2	2.9	3.1	29.8	1.8	0.0
938	10.2	2.9	3.7	29.7	1.8	0.0
939	10.2	2.9	2.2	29.8	1.8	0.0
940	10.2	2.9	3.6	29.8	1.7	0.0

941	10.1	3.0	2.8	29.8	1.8	0.0
942	10.2	2.9	2.8	30.0	1.9	0.0
943	10.2	2.9	3.7	29.9	1.8	0.0
944	10.2	3.0	3.2	30.0	0.4	0.0
945	10.2	3.0	3.5	30.3	1.8	0.0
946	10.1	3.0	2.6	30.5	1.8	0.0
947	10.1	3.0	2.7	30.6	1.9	0.0
948	10.2	2.9	2.7	30.6	1.8	0.0
949	10.1	3.0	8.9	30.7	1.9	0.0
950	10.2	2.9	3.6	30.8	1.8	0.0
951	10.2	2.9	3.5	30.7	1.9	0.0
952	10.1	3.0	3.5	30.7	1.8	0.0
953	10.1	3.0	2.7	30.8	1.9	0.0
954	10.2	2.9	3.2	30.7	1.8	0.0
955	10.2	2.9	3.1	30.6	1.9	0.0
956	10.1	3.0	3.0	30.6	1.7	0.0
957	10.1	3.0	2.6	30.7	1.9	0.0
958	10.2	2.9	4.7	30.6	1.9	0.0
959	10.2	2.9	3.8	30.7	1.8	0.0
1000	10.2	2.9	3.2	30.9	1.3	0.0
1001	10.2	2.9	3.2	31.0	1.1	0.0
1002	10.2	2.9	3.7	30.9	1.8	0.0
1003	10.2	2.9	3.7	31.0	1.6	0.0
1004	10.2	2.9	3.7	30.9	1.0	0.0
1005	10.2	2.9	3.3	31.0	1.8	0.0
1006	10.1	3.0	2.6	31.1	1.9	0.0
1007	10.1	3.0	2.7	31.2	1.8	0.0
1008	10.1	3.0	2.7	31.2	1.9	0.0
1009	10.2	3.0	2.6	31.1	1.7	0.0
1010	10.1	3.0	3.0	31.0	1.9	0.0
1011	10.2	2.9	3.4	31.3	1.7	0.0
1012	10.2	2.9	4.1	31.2	1.7	0.0
1013	10.2	2.9	3.9	31.2	1.8	0.0
1014	10.2	3.0	2.9	31.3	1.9	0.0
1015	10.1	3.0	2.6	31.1	1.9	0.0
1016	10.2	2.9	3.2	31.1	1.9	0.0
1017	10.2	2.9	2.9	31.1	1.7	0.0
1018	10.2	3.0	2.9	31.1	1.9	0.0
1019	10.2	2.9	3.2	31.1	1.8	0.0
1020	10.2	2.8	3.7	31.2	2.0	0.0
1021	10.2	2.9	3.4	31.2	2.0	0.0
1022	10.2	2.9	3.1	31.3	1.9	0.0
1023	10.2	2.9	3.4	31.2	1.9	0.0
1024	10.2	2.9	2.7	31.2	1.8	0.0
1025	——	2.9	3.3	31.2	1.9	0.0
1026	10.2	2.9	3.8	31.3	2.0	0.0
1027	10.2	2.9	3.3	31.2	1.8	0.0
1028	10.2	2.9	3.2	31.2	1.9	0.0
1029	10.2	2.9	3.0	31.3	1.9	0.0
1030	10.2	2.9	3.5	31.3	1.9	0.0
1031	10.2	2.8	4.1	31.3	2.0	0.0
1032	10.2	2.9	4.0	31.2	1.9	0.0
1033	10.2	2.9	3.4	31.4	1.9	0.0
1034	10.2	2.9	3.6	31.6	1.9	0.0
1035	10.2	2.9	4.3	31.4	1.8	0.0
1036	10.2	2.9	3.5	31.3	1.9	0.0
1037	10.1	3.1	3.3	31.5	1.4	0.0
1038	10.2	3.0	4.1	31.5	1.8	0.0
1039	10.2	3.0	2.8	31.6	2.0	0.0

1040	10.2	2.9	2.9	31.6	1.7	0.0
1041	10.2	3.0	3.2	31.6	1.9	0.0
1042	10.1	3.0	2.7	31.8	2.0	0.0
1043	10.2	2.9	3.7	31.9	1.8	0.0
1044	10.2	2.9	3.3	31.9	1.9	0.0
1045	10.2	2.8	4.7	31.7	1.2	0.0
1046	10.2	3.0	3.8	31.6	2.0	0.0
1047	10.1	3.1	3.0	31.4	1.8	0.0
1048	10.2	3.0	2.6	31.5	2.0	0.0
1049	10.2	2.9	3.0	31.5	2.0	0.0
1050	10.2	2.9	3.2	31.6	1.8	0.0
1051	10.2	3.0	3.1	31.4	1.9	0.0
1052	10.2	3.0	2.4	31.5	2.0	0.0
1053	10.2	3.0	2.9	31.4	1.8	0.0
1054	10.2	3.0	3.3	31.5	1.8	0.0
1055	10.2	2.9	2.9	31.5	1.8	0.0
1056	10.2	2.9	3.3	31.4	1.9	0.0
1057	10.2	2.8	4.4	31.5	1.9	0.0
1058	10.2	3.0	3.8	31.6	1.8	0.0
1059	10.2	2.9	3.3	31.9	1.7	0.0
1100	10.2	2.8	3.7	32.0	1.9	0.0
1101	10.2	2.9	3.3	31.9	1.8	0.0
1102	10.2	3.0	3.7	31.9	1.6	0.0
1103	10.2	3.0	2.8	32.0	1.5	0.0
1104	10.2	3.0	3.1	32.1	1.3	0.0
1105	10.2	3.0	3.1	32.2	1.5	0.0
1106	10.2	3.0	2.9	32.3	1.4	0.0
1107	10.2	2.9	3.7	32.4	1.6	0.0
1108	10.2	3.0	3.5	32.3	1.6	0.0
1109	10.2	3.0	2.7	32.4	1.4	0.0
1110	10.2	2.9	3.1	32.6	1.5	0.0
1111	10.2	2.9	3.4	32.6	1.4	0.0
1112	10.2	2.9	3.2	32.5	1.5	0.0
1113	10.2	2.9	3.3	32.7	1.3	0.0
1114	10.2	2.9	3.5	32.7	1.3	0.0
1115	10.2	3.0	3.0	32.9	1.4	0.0
1116	10.2	2.9	3.6	33.0	1.4	0.0
1117	10.1	3.1	3.3	32.6	1.3	0.0
1118	10.1	3.1	2.3	33.0	1.4	0.0
1119	10.1	3.0	2.7	33.0	1.2	0.0
1120	10.2	2.9	3.2	33.0	1.3	0.0
1121	10.2	2.9	3.8	32.9	1.3	0.0
1122	10.2	3.0	3.6	33.0	1.4	0.0
1123	10.2	3.0	3.0	33.0	1.1	0.0
1124	10.2	3.0	3.1	32.8	1.4	0.0
1125	10.2	3.0	2.8	33.0	1.2	0.0
1126	10.2	3.0	3.4	33.0	1.3	0.0
1127	10.2	3.0	2.8	33.0	1.2	0.0
1128	10.2	3.0	3.2	33.0	1.3	0.0
1129	10.2	3.0	3.0	33.1	1.3	0.0
1130	10.2	3.0	3.2	33.0	1.4	0.0
1131	10.2	3.0	3.5	33.1	1.2	0.0
1132	10.2	2.9	4.0	33.1	1.4	0.0
1133	10.2	2.9	4.0	33.0	1.3	0.0
1134	10.2	2.9	4.1	33.3	1.4	0.0
1135	10.2	3.0	3.6	33.3	1.2	0.0
1136	10.2	2.9	3.9	33.4	1.3	0.0
1137	10.2	2.9	3.1	33.5	1.3	0.0
1138	10.2	3.0	3.1	33.6	1.3	0.0

1139	10.2	3.0	3.2	33.6	1.4	0.0
1140	10.2	3.0	2.9	33.7	1.4	0.0
1141	10.2	3.0	3.2	33.7	1.5	0.0
1142	10.2	2.9	3.4	33.8	1.5	0.0
1143	10.2	2.9	4.0	33.7	1.5	0.0
1144	10.2	3.0	3.5	33.5	1.2	0.0
1145	10.2	3.0	2.9	33.6	1.5	0.0
1146	10.2	2.9	3.8	33.6	1.6	0.0
1147	10.2	3.0	3.5	33.6	1.4	0.0
1148	10.2	3.0	3.4	33.6	1.6	0.0
1149	10.2	2.9	2.8	33.6	1.6	0.0
1150	10.2	3.0	2.8	33.7	1.5	0.0
1151	10.1	3.1	3.1	33.7	1.6	0.0
1152	10.1	3.0	2.5	33.7	1.6	0.0
1153	10.2	3.0	2.8	33.7	1.6	0.0
1154	10.2	3.0	3.7	33.6	1.7	0.0
1155	10.2	3.0	3.6	33.6	1.6	0.0
1156	10.2	2.9	3.5	33.6	1.7	0.0
1157	10.2	2.9	4.1	33.6	1.6	0.0
1158	10.2	3.0	3.2	33.5	1.7	0.0
1159	10.2	3.0	3.2	33.6	1.5	0.0
1200	10.2	3.0	3.1	33.6	1.5	0.0
AVERAGE RUN 1	10.2	3.0	3.4	31.6	1.7	0.0
	(%)	(%)	(ppm)	(ppm)	(ppm)	(ppm)
	CO2	O2	CO	NOx	SO2	THC

1106	10.2	3.0	2.9	32.3	1.4	0.0
1107	10.2	2.9	3.7	32.4	1.6	0.0
1108	10.2	3.0	3.5	32.3	1.6	0.0
1109	10.2	3.0	2.7	32.4	1.4	0.0
1110	10.2	2.9	3.1	32.6	1.5	0.0
1111	10.2	2.9	3.4	32.6	1.4	0.0
1112	10.2	2.9	3.2	32.5	1.5	0.0
1113	10.2	2.9	3.3	32.7	1.3	0.0
1114	10.2	2.9	3.5	32.7	1.3	0.0
1115	10.2	3.0	3.0	32.9	1.4	0.0
1116	10.2	2.9	3.6	33.0	1.4	0.0
1117	10.1	3.1	3.3	32.6	1.3	0.0
1118	10.1	3.1	2.3	33.0	1.4	0.0
1119	10.1	3.0	2.7	33.0	1.2	0.0
1120	10.2	2.9	3.2	33.0	1.3	0.0
1121	10.2	2.9	3.8	32.9	1.3	0.0
1122	10.2	3.0	3.6	33.0	1.4	0.0
1123	10.2	3.0	3.0	33.0	1.1	0.0
1124	10.2	3.0	3.1	32.8	1.4	0.0
1125	10.2	3.0	2.8	33.0	1.2	0.0
1126	10.2	3.0	3.4	33.0	1.3	0.0
1127	10.2	3.0	2.8	33.0	1.2	0.0
1128	10.2	3.0	3.2	33.0	1.3	0.0
1129	10.2	3.0	3.0	33.1	1.3	0.0
1130	10.2	3.0	3.2	33.0	1.4	0.0
1131	10.2	3.0	3.5	33.1	1.2	0.0
1132	10.2	2.9	4.0	33.1	1.4	0.0
1133	10.2	2.9	4.0	33.0	1.3	0.0
1134	10.2	2.9	4.1	33.3	1.4	0.0
1135	10.2	3.0	3.6	33.3	1.2	0.0
1136	10.2	2.9	3.9	33.4	1.3	0.0
1137	10.2	2.9	3.1	33.5	1.3	0.0
1138	10.2	3.0	3.1	33.6	1.3	0.0
1139	10.2	3.0	3.2	33.6	1.4	0.0
1140	10.2	3.0	2.9	33.7	1.4	0.0
1141	10.2	3.0	3.2	33.7	1.5	0.0
1142	10.2	2.9	3.4	33.8	1.5	0.0
1143	10.2	2.9	4.0	33.7	1.5	0.0
1144	10.2	3.0	3.5	33.5	1.2	0.0
1145	10.2	3.0	2.9	33.6	1.5	0.0
1146	10.2	2.9	3.8	33.6	1.6	0.0
1147	10.2	3.0	3.5	33.6	1.4	0.0
1148	10.2	3.0	3.4	33.6	1.6	0.0
1149	10.2	2.9	2.8	33.6	1.6	0.0
1150	10.2	3.0	2.8	33.7	1.5	0.0
1151	10.1	3.1	3.1	33.7	1.6	0.0
1152	10.1	3.0	2.5	33.7	1.6	0.0
1153	10.2	3.0	2.8	33.7	1.6	0.0
1154	10.2	3.0	3.7	33.6	1.7	0.0
1155	10.2	3.0	3.6	33.6	1.6	0.0
1156	10.2	2.9	3.5	33.6	1.7	0.0
1157	10.2	2.9	4.1	33.6	1.6	0.0
1158	10.2	3.0	3.2	33.5	1.7	0.0
1159	10.2	3.0	3.2	33.6	1.5	0.0
1200	10.2	3.0	3.1	33.6	1.5	0.0
AVERAGE RUN 1	10.2	3.0	3.3	31.6	1.7	0.0
	(%)	(%)	(ppm)	(ppm)	(ppm)	(ppm)
	CO_2	O_2	CO	NO_x	SO_2	THC

WPNG#2BS.XLS

TIME	CARBON DIOXIDE (%)	OXYGEN (%)	CARBON MONOXIDE (ppm)	NITROGEN OXIDES (ppm)	SULFUR DIOXIDE (ppm)	TOTAL HYDROCARBONS (ppm)
RUN 2 - 12:29- 15:57						
1229	10.0	3.0	2.6	29.6	0.9	0.0
1230	10.1	3.0	2.7	29.6	1.2	0.0
1231	10.1	3.0	2.7	29.6	1.2	0.0
1232	10.0	3.1	2.5	29.6	1.3	0.0
1233	10.1	3.0	3.2	29.6	1.3	0.0
1234	10.1	3.0	5.0	29.6	1.3	0.0
1235	10.1	3.0	3.1	29.7	1.2	0.0
1236	10.1	2.9	3.4	29.8	1.4	0.0
1237	10.1	3.1	2.4	29.9	3.0	0.0
1238	10.1	3.1	2.2	30.0	1.4	0.0
1239	10.1	3.1	2.2	30.1	1.4	0.0
1240	10.1	3.0	2.9	30.1	1.3	0.0
1241	10.0	3.1	2.2	30.0	1.3	0.0
1242	10.1	3.0	2.7	30.0	1.4	0.0
1243	10.1	3.0	2.3	30.1	1.4	0.0
1244	10.1	3.0	2.5	30.1	1.4	0.0
1245	10.1	3.0	2.6	30.1	1.2	0.0
1246	10.2	3.0	4.3	30.2	1.3	0.0
1247	10.2	3.0	3.7	30.1	1.4	0.0
1248	10.2	3.0	3.6	30.2	1.3	0.0
1249	10.2	3.0	3.7	30.1	1.2	0.0
1250	10.1	3.1	3.5	30.2	1.4	0.0
1251	10.1	3.1	3.0	30.3	1.4	0.0
1252	-----	3.1	3.1	30.2	1.4	0.0
1253	10.1	3.1	3.4	30.2	1.4	0.0
1254	10.1	3.1	3.5	30.2	1.2	0.0
1255	10.1	3.1	3.0	30.2	1.5	0.0
1256	10.2	3.0	3.5	30.2	1.4	0.0
1257	10.2	3.0	3.7	30.2	1.4	0.0
1258	10.2	3.0	3.7	30.3	1.5	0.0
1259	10.2	3.1	3.5	30.2	1.5	0.0
1300	10.2	3.0	3.7	30.2	1.3	0.0
1301	10.1	3.1	3.4	30.1	1.3	0.0
1302	10.2	3.0	3.1	30.2	1.2	0.0
1303	10.1	3.1	3.8	30.3	1.2	0.0
1304	10.1	3.1	3.1	30.3	1.3	0.0
1305	10.1	3.1	3.0	30.3	1.4	0.0
1306	10.1	3.1	3.0	30.4	1.4	0.0
1307	10.2	3.0	3.7	30.4	1.5	0.0
1308	10.2	3.1	3.2	30.5	1.3	0.0
1309	10.1	3.1	3.2	30.6	1.2	0.0
1310	10.2	3.0	3.2	30.6	1.3	0.0
1311	10.1	3.1	3.6	30.6	1.3	0.0
1312	10.1	3.1	3.0	30.6	1.4	0.0
1313	10.1	3.1	2.8	30.5	1.5	0.0
1314	10.1	3.1	3.1	30.3	1.3	0.0
1315	10.1	3.2	2.9	30.4	1.4	0.0
1316	10.1	3.1	3.0	30.5	1.0	0.0
1317	10.1	3.1	2.8	30.4	1.3	0.0
1318	10.1	3.1	3.1	30.5	1.3	0.0
1319	10.1	3.1	3.5	30.3	1.4	0.0
1320	10.1	3.1	3.3	30.4	1.5	0.0

1321	10.1	3.1	2.8	30.5	1.2	0.0
1322	10.1	3.1	3.0	30.5	1.4	0.0
1323	10.1	3.1	3.1	30.3	1.4	0.0
1324	10.1	3.0	3.2	30.4	1.4	0.0
1325	10.2	3.0	3.5	30.5	1.4	0.0
1326	10.1	3.1	2.9	30.5	1.4	0.0
1327	10.1	3.1	3.0	30.5	1.5	0.0
1328	10.2	3.1	3.0	30.5	1.3	0.0
1329	10.1	3.1	3.0	30.5	1.5	0.0
1330	10.1	3.1	3.1	30.5	1.4	0.0
1331	10.1	3.0	3.3	30.5	1.4	0.0
1332	10.1	3.1	2.9	30.6	1.4	0.1
1333	10.2	3.0	3.8	30.5	1.4	0.1
1334	10.2	3.0	3.5	30.5	1.6	0.0
1335	10.1	3.1	2.9	30.4	1.5	0.0
1336	10.1	3.1	3.2	30.6	1.2	0.1
1337	——	3.1	3.1	30.6	1.2	0.0
1338	10.1	3.1	3.1	30.7	1.5	0.0
1339	10.1	3.1	3.3	30.7	1.3	0.0
1340	10.2	3.1	3.6	30.6	0.8	0.0
1341	10.1	3.1	3.2	30.6	1.4	0.0
1342	10.1	3.1	3.0	30.6	1.3	0.0
1343	10.2	3.0	3.1	30.6	1.3	0.0
1344	10.1	3.1	3.1	30.7	1.4	0.0
1345	10.1	3.1	2.7	30.6	1.3	0.0
1346	10.1	3.1	3.3	25.0	1.3	0.0
1347	10.1	3.1	3.2	30.5	1.2	0.0
1348	10.1	3.0	3.4	30.5	1.2	0.0
1349	10.1	3.1	3.5	30.5	1.3	0.0
1350	10.1	3.1	3.0	30.4	1.2	0.0
1351	10.1	3.1	3.4	30.5	1.3	0.0
1352	10.1	3.1	3.0	30.6	1.3	0.0
1353	10.2	3.0	3.2	30.5	1.3	0.0
1354	10.2	3.0	3.8	30.5	1.2	0.1
1355	10.2	3.0	3.5	30.4	1.2	0.0
1356	——	——	——	——	——	——
1357	——	——	——	——	——	——
1358	——	——	——	——	——	——
1359	——	——	——	——	——	——
1400	——	——	——	——	——	——
1401	——	——	——	——	——	——
1402	——	——	——	——	——	——
1403	——	——	——	——	——	——
1404	——	——	——	——	——	——
1405	10.1	3.1	2.9	29.6	0.8	0.1
1406	10.1	3.0	3.5	29.8	1.0	0.1
1407	10.1	3.0	3.7	29.8	0.9	0.1
1408	10.2	3.0	3.7	30.1	1.2	0.1
1409	10.1	3.1	3.6	30.2	1.1	0.1
1410	10.1	3.1	3.1	30.2	1.3	0.1
1411	10.1	3.1	2.6	30.2	1.2	0.1
1412	10.1	3.2	2.6	30.1	1.2	0.1
1413	10.1	3.2	2.8	30.1	0.8	0.1
1414	10.1	3.1	3.3	30.3	1.1	0.1
1415	10.1	3.1	3.1	30.3	1.2	0.1
1416	10.1	3.1	3.0	30.3	1.4	0.1
1417	10.1	3.0	3.6	30.2	1.2	0.1
1418	10.1	3.1	2.9	30.3	1.1	0.1
1419	10.1	3.1	2.8	30.3	1.4	0.1

1420	10.1	3.0	3.2	30.3	1.4	0.1
1421	10.1	3.0	3.1	30.3	1.4	0.1
1422	10.1	3.1	3.0	30.4	1.3	0.1
1423	10.1	3.1	3.6	30.4	1.6	0.1
1424	10.1	3.0	2.7	30.6	1.3	0.1
1425	10.1	3.1	3.1	30.5	1.5	0.0
1426	10.1	3.1	2.9	30.5	1.5	0.0
1427	10.1	3.0	3.4	30.5	1.4	0.0
1428	10.1	3.1	2.9	30.5	1.4	0.0
1429	10.2	3.0	3.0	30.5	1.5	0.0
1430	10.1	3.1	2.7	30.4	1.5	0.0
1431	10.2	3.0	2.9	30.4	1.4	0.0
1432	10.2	3.0	3.0	30.4	1.5	0.0
1433	10.3	2.8	4.4	30.4	1.6	0.0
1434	10.2	2.9	4.3	30.2	1.6	0.0
1435	10.2	3.0	3.5	30.4	1.5	0.0
1436	10.2	3.0	3.6	30.3	1.5	0.0
1437	10.1	3.0	3.1	30.3	1.5	0.0
1438	10.1	3.0	2.9	30.3	1.5	0.0
1439	10.2	3.0	3.1	30.3	1.5	0.0
1440	10.2	2.9	3.6	30.2	1.5	0.0
1441	10.2	3.0	3.6	30.1	1.5	0.0
1442	10.2	2.9	3.5	30.2	1.6	0.0
1443	10.2	2.9	4.1	30.1	1.6	0.0
1444	10.2	2.9	4.1	30.0	1.5	0.0
1445	10.2	2.9	3.2	30.1	1.5	0.0
1446	10.2	2.9	3.2	30.0	1.5	0.0
1447	10.2	3.0	3.0	30.1	1.6	0.0
1448	10.2	2.9	3.1	30.2	1.4	0.0
1449	10.2	2.9	3.3	30.2	1.7	0.0
1450	10.2	3.0	3.4	30.1	1.4	0.0
1451	10.2	3.0	3.0	30.2	1.7	0.0
1452	10.2	3.0	3.3	30.0	1.5	0.0
1453	10.2	3.0	3.4	30.1	1.5	0.0
1454	10.2	3.0	3.5	30.2	1.5	0.0
1455	10.2	3.1	3.3	30.3	1.4	0.0
1456	10.2	3.2	2.7	30.4	1.5	0.0
1457	10.2	3.1	3.3	30.3	1.5	0.0
1458	10.2	3.1	3.5	30.4	1.7	0.0
1459	10.2	3.1	3.3	30.4	1.5	0.0
1500	10.2	3.1	3.4	30.3	1.5	0.0
1501	10.2	3.2	3.3	30.3	1.5	0.0
1502	10.2	3.1	3.3	30.3	1.4	0.0
1503	10.2	3.0	3.7	30.2	1.5	0.0
1504	10.2	3.2	3.1	30.3	1.6	0.3
1505	10.2	3.1	3.6	30.5	1.4	0.0
1506	10.2	3.1	3.4	30.6	1.5	0.0
1507	10.1	3.2	3.2	30.6	1.3	0.0
1508	10.2	3.1	3.3	30.8	1.3	0.0
1509	10.2	3.1	3.6	30.7	1.3	0.0
1510	10.1	3.1	3.4	30.6	1.2	0.0
1511	10.2	3.0	3.1	30.7	1.4	0.0
1512	10.2	3.1	3.5	30.6	1.2	0.0
1513	10.2	3.1	3.6	30.6	1.3	0.0
1514	10.1	3.2	3.0	30.6	1.3	0.0
1515	10.1	3.3	2.6	30.7	1.5	0.0
1516	10.1	3.2	2.8	30.6	1.4	0.0
1517	10.2	3.1	3.8	30.5	1.3	0.0
1518	10.1	3.0	3.0	30.3	1.3	0.0

1519	10.2	3.0	3.2	30.3	1.3	0.0
1520	10.1	3.0	3.1	30.3	1.2	0.2
1521	10.1	3.1	2.8	30.4	1.5	0.0
1522	10.2	2.9	2.8	30.4	1.3	0.0
1523	10.2	2.9	3.3	30.4	1.4	0.0
1524	10.2	2.9	3.7	30.3	1.4	0.0
1525	10.2	2.9	3.5	30.2	1.3	0.0
1526	10.2	3.0	3.4	30.2	1.3	0.0
1527	10.1	3.0	3.0	30.2	1.3	0.0
1528	10.2	3.0	2.8	30.3	1.2	0.0
1529	10.1	3.1	3.0	30.3	1.2	0.0
1530	10.1	3.1	2.8	30.4	1.2	0.0
1531	10.1	3.0	2.9	30.6	1.3	0.0
1532	10.1	3.0	3.0	30.4	1.2	0.0
1533	10.1	3.0	2.9	30.4	0.9	——
1534	——	——	——	——	——	——
1535	——	——	——	——	——	——
1536	——	——	——	——	——	——
1537	——	——	——	——	——	——
1538	——	——	——	——	——	——
1539	——	——	——	——	——	——
1540	——	——	——	——	——	——
1541	——	——	——	——	——	——
1542	——	——	——	——	——	——
1543	——	——	——	——	——	——
1544	——	——	——	——	——	——
1545	——	——	——	——	——	——
1546	——	——	——	——	——	——
1547	——	——	——	——	——	——
1548	10.0	3.1	2.7	28.4	0.6	0.1
1549	10.1	2.9	4.1	28.5	0.9	0.1
1550	10.1	2.9	5.0	28.7	0.7	0.1
1551	10.2	2.8	5.6	28.9	0.9	0.1
1552	10.1	2.9	4.7	29.3	0.9	0.1
1553	10.2	2.8	5.0	29.5	0.9	0.1
1554	10.2	2.9	4.3	29.7	0.4	0.1
1555	10.2	2.9	4.2	30.0	0.7	0.1
1556	10.1	2.9	3.4	30.0	0.9	0.0
1557	10.1	2.9	3.9	30.0	——	0.0
AVERAGE RUN 2	10.1	3.0	3.3	30.2	1.3	0.0
	(%)	(%)	(ppm)	(ppm)	(ppm)	(ppm)
	CO2	O2	CO	NOx	SO2	THC

117

SAMPLING SYSTEM BIAS CHECK

Am Test-Air Quality, Inc.

AMTEST AIR QUALITY, INC.

CLIENT: Gas Research Institute
LOCATION: Boise Cascade, White City, OR
SITE LOCATION: Nat Gas Fired #2 Cleaver Brooks Packaged Boiler Stack
DATE: 5-4-95

RUN # 1 CONDITION: 100% load

START: 0800
STOP: 1200 1235

Parameter	Unit	Initial Zero Check	Final Zero Check	Initial Span Check	Final Span Check	Upscale Cal Gas Value	Analyzer Range	Check One: Wet	Check One: Dry
Carbon Dioxide (CO2)	%	0.0	0.0	15.0	15.00	15.00	0-25		✓
Oxygen (O2)	%	0.0	0.0	5.0	5.0	5.03	0-25		✓
Carbon Monoxide (CO)	ppm	0.1	0.5	29.8	30.2	30.1	0-100		✓
Sulfur Dioxide (SO2)	ppm	0.3	0.6	89.7	89.8	89.7	0-1000		✓
Nitrogen Oxides (NOx)	ppm	0.0	0.9	25.1	27.1	25.22	0-100		✓
Total Reduced Sulfur (TRS as SO2)	ppm								
Non-Methane Hydrocarbons (NMHC)	ppm								
Total Hydrocarbons (THC)	ppm	0.0	0.0	25.4	26.3	25.4	0-100	✓	

RUN # 2 Boiler Down at 1358 CONDITION:

START: 1229 Low water trip
STOP: 1607 15:33 Boiler down
Low water trip 16:00
Low water trip 16:07
Terminated test at this time

Parameter	Unit	Initial Zero Check	Final Zero Check	Initial Span Check	Final Span Check	Upscale Cal Gas Value	Analyzer Range	Check One: Wet	Check One: Dry
Carbon Dioxide (CO2)	%	0.0	0.0	15.0	14.9	15.00	0-25		✓
Oxygen (O2)	%	0.0	0.6	5.0	5.0	5.03	0-25		✓
Carbon Monoxide (CO)	ppm	0.5	0.4	30.2	30.0	30.1	0-100		✓
Sulfur Dioxide (SO2)	ppm	0.6	0.9	89.8	90.0	89.7	0-1000		✓
Nitrogen Oxides (NOx)	ppm	0.5	0.6	25.2	25.6	25.22	0-100		✓
Total Reduced Sulfur (TRS as SO2)	ppm								
Non-Methane Hydrocarbons (NMHC)	ppm								
Total Hydrocarbons (THC)	ppm	0.0	0.1	25.4	26.2	25.4	0-100	✓	

RUN # CONDITION:

START:
STOP:

Parameter	Unit	Initial Zero Check	Final Zero Check	Initial Span Check	Final Span Check	Upscale Cal Gas Value	Analyzer Range	Check One: Wet	Check One: Dry
Carbon Dioxide (CO2)	%								
Oxygen (O2)	%								
Carbon Monoxide (CO)	ppm								
Sulfur Dioxide (SO2)	ppm								
Nitrogen Oxides (NOx)	ppm								
Total Reduced Sulfur (TRS as SO2)	ppm								
Non-Methane Hydrocarbons (NMHC)	ppm								
Total Hydrocarbons (THC)	ppm								

[jaa\c\excel\biaschk]

AMTEST
AIR QUALITY, INC.

ANALYZER LINEARITY CHECKS
Am Test-Air Quality, Inc.

KCf

CLIENT: Gas Research Institute

Om Albert

LOCATION: Boise Cascade, Medford -

SITE LOCATION: White City, OR Boiler #2 (Cleaver Brooks

DATE: 5-1-95

GRI5-1.DAQ

Type of Analyzer
Gas NOx

Make: TECO
Model #: 42H

Range	% (check one)	ppm (check one)	TIME (hours)		Calibration Gas	Analyzer Response	Time (minutes)	Absolute Difference	Percent of Span
0-200			2040						
				High	89.8	89.6	2.0		
				Mid-High					
				Mid	25.22	24.8			
				Mid Low					
				Low	Zero	0.0			

Type of Analyzer
Gas SO_2

Make: Western Research
Model #: 721-AT

Range	% (check one)	ppm (check one)	TIME (hours)		Calibration Gas	Analyzer Response	Time (minutes)	Absolute Difference	Percent of Span
0-1000		✓	2040						
				High	212	213.3	2.5		
				Mid-High					
				Mid	89.7	~~90.2~~ 87.1 Dmd			
				Mid Low					
				Low	Zero	0.0			

Type of Analyzer
Gas THC

Make: TECO
Model #: 51

Range	% (check one)	ppm (check one)	TIME (hours)		Calibration Gas	Analyzer Response	Time (minutes)	Absolute Difference	Percent of Span
0-100		✓	2100						
				High	90.0	90.3	1.0		
				Mid-High	50.2	49.7			
				Mid					
				Mid Low	25.4	25.3			
				Low	Zero	0.0			

AMTEST
AIR QUALITY, INC.

KA

ANALYZER LINEARITY CHECKS

Am Test-Air Quality, Inc.

CLIENT: Gas Research Institute

LOCATION: Boise Cascade, Medford –

SITE LOCATION: White City, OR Boiler #2 (Cleaver Brooks)

DATE: 5-1-95

GR15-1.DAQ

Type of Analyzer Gas CO_2 Range 0-25 (check one) % ✓ ppm TIME (hours) 19:20pm

Make: Servomex

Model #: 1410B

	Calibration Gas	Analyzer Response	Time (minutes)	Absolute Difference	Percent of Span
High			1.5		
Mid-High	15.0	15.0			
Mid	11.9	12.0			
Mid Low					
Low	Zero	0.0			

Type of Analyzer Gas O_2 Range 0-25 (check one) % ✓ ppm TIME (hours) 1920

Make: Servomex

Model #: 1420B

	Calibration Gas	Analyzer Response	Time (minutes)	Absolute Difference	Percent of Span
High	20.9	20.8	1.5		
Mid-High	9.94	10.1			
Mid	5.03	5.0			
Mid Low					
Low	Zero	0.0			

Type of Analyzer Gas CO Range 0-500 (check one) % ppm ✓ TIME (hours) 1920

Make: TECO

Model #: 48

	Calibration Gas	Analyzer Response	Time (minutes)	Absolute Difference	Percent of Span
High			1.5		
Mid-High	150.2	150.2			
Mid	60.8	60.3			
Mid Low	30.1	30.1			
Low	Zero	0.2			

GR 1
5-1-95

AMTEST
AIR QUALITY, INC

CONTINUOUS ANALYZERS CHECKLIST

Oxygen (O_2)

Infrared Industries Model 2200 O_2 Analyzer ____

Servomex Model 1420B O_2 Analyzer ____

Western Research Model 721ATM Analyzer with Servomex 1155 O_2 Transducer ____

Carbon Dioxide (CO_2)

Infrared Industries Model 702D CO_2 Analyzer ____

Automated Custom Systems Model 3300 CO_2 Analyzer ____

Servomex Model 1410B Infrared CO_2 Analyzer ____

Carbon Monoxide (CO)

Automated Custom Systems Model 3300 CO Analyzer ____

Thermo Environmental Instruments Model 48 CO Analyzer ____

Sulfur Dioxide (SO_2)

Monitor Labs Model 8850 SO_2 Analyzer ____

Sampling Technologies, Inc./Am Test SO_2 Dilution Module ____

Western Research Model 721AT SO_2 Analyzer ____

Western Research Model 721ATM SO_2 Analyzer ____

Nitrogen Oxides (NO_x)

Monitor Labs Model 8840 NO_x Analyzer ____

Monitor Labs Model 8730 NO_x Dilution Module ____

Thermo Environmental Instruments Model 10S NO_x Analyzer ____

Thermo Environmental Instruments Model 42H NO_x Analyzer ____

Hydrocarbons (HC)

Byron Model 301 HC Analyzer ____

Infrared Industries Model 702D HC Analyzer ____

Infrared Industries Model 703 HC Analyzer ____

Compur Flame Ionization Detector (FID) THC Analyzer ____

Thermo Environmental Instruments Model 51 THC Analyzer ____

AMTEST
AIR QUALITY, INC

CONTINUOUS ANALYZERS CHECKLIST

Data Acquisition

Odessa Engineering	______
Hewlett Packard w/Compaq Portable	______
Yokogawa Model HR2400 Hybrid Chart Recorder	______
Yokogawa Model HR2400 w/Compaq Portable	✓
Yokogawa Model UR1000 w/Compaq Portable	______
Manually Recorded	______

GRI 5-1-95

Rev 3/16/95

GAS CYLINDER CHECKLIST

TEST #	CYLINDER #	GAS CONCENTRATIONS	EXP. DATE
		Carbon Dioxide, Oxygen	
____	CC-19319	6.03% O_2	2/97
		Carbon Dioxide, Oxygen	
____	CC-12424	4.01% CO_2, 13.92% O_2	
____	CC-19669	9.03% CO_2, 13.99% O_2	1/98
____	LL-10577	11.8% CO_2, 9.95% O_2	---
		Carbon Dioxide, Oxygen, Carbon Monoxide	
____	CC-6973	59.3 ppm CO, 8.17% CO_2, 15.20% O_2	---
____	CC-61672	150.1 ppm CO, 15.01% CO_2, 5.03% O_2	---
✓	CC-18534	150.2 ppm CO, 15.00% CO_2, 5.03% O_2	---
____	CC-125	296 ppm CO, 6.05% CO_2, 15.02% O_2	---
____	CC-66323	297 ppm CO, 5.98% CO_2, 15.01% O_2	---
____	CC-48487	297 ppm CO, 5.99% CO_2, 15.07% O_2	---
____	CC-66215	299.8 ppm CO, 6.00% CO_2, 15.00% O_2	---
____	CC-82571	299.9 ppm CO, 6.00% CO_2, 15.00% O_2	---
____	CC-89217	301.5 ppm CO, 5.98% CO_2, 14.98% O_2	---
____	CC-12009	302 ppm CO, 6.00% CO_2, 15.03% O_2	---
____	CC-2895	556 ppm CO, 11.06% CO_2, 9.28% O_2	---
✓	CC-74240	593 ppm CO, 11.90% CO_2, 9.94% O_2	---
____	CC-12087	593 ppm CO, 11.92% CO_2, 9.97% O_2	---
____	CC-14137	594 ppm CO, 11.94% CO_2, 9.98% O_2	---
____	CC-20649	594 ppm CO, 11.97% CO_2, 10.00% O_2	---
____	CC-7284	597 ppm CO, 11.99% CO_2, 10.00% O_2	---
____	CC-14485	597 ppm CO, 12.00% CO_2, 9.99% O_2	---
____	CC-15362	598 ppm CO, 12.01% CO_2, 10.03% O_2	---
____	CC-6007	599 ppm CO, 11.96% CO_2, 10.01% O_2	---
____	CC-58965	1798 ppm CO, 24.03% CO_2, 5.00% O_2	---
		Sulfur Dioxide, Oxygen	
____	CC-61393	49.0 ppm SO_2, 15.0% O_2	11/93
____	CC-61497	89.0 ppm SO_2, 15.0% O_2	5/95
____	CC-5966	148 ppm SO_2, 5.04% O_2	8/95
____	CC-14717	992.9 ppm SO_2	6/95
____	CC-27286	321.8 ppm SO_2, 10.05% O_2	8/96

Rev 3/16/95

GAS CYLINDER CHECKLIST

TEST #	CYLINDER #	GAS CONCENTRATIONS	EXP. DATE
		Sulfur Dioxide, Nitrogen Oxides	
	CC-31967	49.4 ppm SO_2, 50.0 ppm NO_x	12/96
	CC-20494	50.3 ppm SO_2, 51.8 ppm NO_x	7/96
	CC-26785	50.4 ppm SO_2, 52.0 ppm NO_x	7/96
	CC-10646	50.6 ppm SO_2, 49.2 ppm NO_x	4/94
	CC-10652	50.7 ppm SO_2, 49.0 ppm NO_x	4/94
	CC-7020	86.4 ppm SO_2, 89.9 ppm NO_x	8/96
	CC-72894	89.5 ppm SO_2, 89.8ppm NO_x	12/96
	CC-61958	89.7 ppm SO_2, 89.8 ppm NO_x	12/96
	CC-26792	89.9 ppm SO_2, 93.9 ppm NO_x	7/96
	CC-20482	183.1 ppm SO_2, 195.6 ppm NO_x	7/96
	CC-18144	191.3 ppm SO_2, 193.9 ppm NO_x	11/96
	CC-59262	196.1 ppm SO_2, 200.1 ppm NO_x	12/96
	CC-4623	212 ppm SO_2, 236 ppm NO_x	10/95
	CC-5812	460 ppm SO_2, 470 ppm NO_x	7/95
	CC-4486	865 ppm SO_2, 893 ppm NO_x	10/95
	CC-3735	932.1 ppm SO_2, 912.7 ppm NO_x	12/94
		Nitrogen Oxides	
	CC-14913	4.86 ppm NO_x	3/96
	CC-82961	10.6 ppm NO_x	3/96
	CC-97675	13.1 ppm NO_x	7/95
	CC-107849	24.2 ppm NO_x	5/95
	CC-94990	25.22 ~~25.4~~ ppm NO_x	1/97
	CC-1560	49.3 ppm NO_x	5/95
	CC-1600	82.3 ppm NO_x	5/95
	CC-18322	114.9 ppm NO_x	3/96
	CC-14479	3011 ppm NO_x	6/95
		Carbon Monoxide	
	CC-26883	30.1 ppm CO	12/97
	CC-16544	30.3 ppm CO	7/96
	CC-4239	30.5 ppm CO	12/97
	CC-72592	58.4 ppm CO	—
	CC-97420	60.8 ppm CO	12/97
	CC-39011	61.6 ppm CO	12/97

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Rev 3/16/95

GAS CYLINDER CHECKLIST

TEST #	CYLINDER #	GAS CONCENTRATIONS	EXP. DATE
		Carbon Monoxide (continued)	
____	CC-14269	63.7 ppm CO	6/95
____	CC-64521	905 ppm CO	---
____	CC-90717	912 ppm CO	6/96
____	CC-3738	2992 ppm CO	---
____	CC-1607	9080 ppm CO (0.908%)	6/95
____	CC-25720	6000 ppm CO	---
		Carbon Monoxide, Oxygen	
____	CC-87523	121 ppm CO, 10.1% O_2	---
____	CC-17765	11.8 ppm CO, 14.2% O_2	---
		Carbon Monoxide, Carbon Dioxide	
____	CC-61491	84.0 ppm CO, 9.86% CO_2	---
		Sulfur Dioxide, Nitrogen Oxides, Carbon Monoxide	
____	CC-6875	109 ppm SO_2, 276 ppm NO_x, 274 ppm CO	8/95
____	CC-5936	49.6 ppm SO_2, 123.9 ppm NO_x, 125 ppm CO	8/96
		Sulfur Dioxide, Carbon Dioxide, Carbon Monoxide	
____	CC-5653	201 ppm SO_2, 9.85% CO_2, 476 ppm CO	
		Methane, Propane	
____	CC-66450	8.17 ppm Propane	7/97
✓	CC-26790	25.4 ppm Propane	7/97
____	CC-26845	25.5 ppm Propane	7/97
____	CC-14274	29.7 ppm Propane	5/95
____	CC-59497	31.8 ppm Propane	9/96
____	CC-59457	31.8 ppm Propane	9/96
____	CC-26826	45.3 ppm Propane	7/97
____	CC-18250	50.0 ppm Propane	---
____	CC-19253	50.4 ppm Propane	9/96
____	CC-17649	72.9 ppm Propane, 73.7 ppm Methane	
____	CC-93822	90.2 ppm Propane	9/96
____	CC-26828	90.9 ppm Propane	7/97
____	CC-48931	179.9 ppm Propane	6/95
____	CC-15033	4999 ppm Propane	6/95
____	CC-91743	3.07% Propane	---
____	CC-69475	5.00% Propane	---
____	CC-77479	9.00% Propane	---
____	A021559	49.07% Methane	---
✓	CC-40369	90.0 Propane	3/98
✓	CC-40323	50.2 Propane	3/98

APPENDIX D

WP Natural Gas Process Data

AMTEST
AIR QUALITY, INC.

SOURCE AND PROCESS INFORMATION

CLIENT: Gas Research Institute

LOCATION: Testing at Boise Cascade, White City Lumber, White City, OR

SAMPLE SITE: #2 Cleaver-Brooks Package Boiler (Nat. Gas Fired)

TEST DATE: 5-2 — 5-4-95

CLIENT CONTACT: Chuck Gates, WP natural gas & Bob Morris, P.E. Boise Cascade Region Engineer

OPERATION PERSONNEL: Greg Egan - Superintendent, Tom Willis maintenance Boiler opr.

AGENCY REPRESENTATIVE: Kenan Smith, Field Rep. ODEQ, Mark Ludwiczak, Staff Engineer Radian Corp - EPA Rep.

AM TEST-AIR QUALITY PERSONNEL: DM Albertson, Aaron Porter

TYPE OF PROCESS: Process Steam for Dry Kilns

EQUIPMENT MANUFACTURER: Cleaver-Brooks CB Packaged Boiler

MODEL: CB 1 700-800 CONSTRUCTED/INSTALLED: 6/28/94

IDENTIFICATION NO.: Ser # L-93181 Boiler #2 DATE LAST TESTED: April 1995 - Setup Burner - Cdetuff? industries

PROCESS RATE: ~22,800 lbs/hr sat. steam at 106 psi

FUEL FIRING RATE: max Input 33,476,000 MMBtu/hr TYPE OF FUEL: Natural Gas

TYPE OF EMISSION CONTROL DEVICE: None

EQUIPMENT MANUFACTURER:

PURPOSE OF TESTING: To establish new particulate and condensable values for LO-Nox Nat Gas Fired Boilers

EMISSION STANDARD (in units): NA

PROCESS DESCRIPTION:

Small package boiler exhausting thru an economizer and out a 24" stack at roof level. Boiler delivers steam to a common header served by two identical boilers

PROCESS SHUTDOWNS/PROBLEMS:

DM Albertson

AUTHORIZED SIGNATURE

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	BTU	Gravity	CO_2	N_2	Methane	Ethane	Propane	I-Butane
ase Time	Soft Pt 11	Soft Pt 11	Soft Pt 11	Soft Pt 11	Soft Pt 11	Soft Pt 11	Soft Pt 11	Soft Pt 11
-D,H:MIN	DATA1 ,AVG	DATA2 ,AVG	DATA3 ,AVG	DATA4 ,AVG	DATA5 ,AVG	DATA6 ,AVG	DATA7 ,AVG	DATA8 ,AVG
-30,9:0	1045.346	.5819037	.0504140	.6144239	95.57658	2.888873	.5967078	.0814986
-29,9:0	1044.849	.5815175	.0498131	.6088601	95.62471	2.874834	.5733136	.0801703
-28,9:0	1043.762	.5810677	.0521432	.6287059	95.67704	2.823982	.5609187	.0767860
-27,9:0	1045.089	.5818702	.0520290	.6239954	95.58300	2.866700	.6090511	.0794993
-26,9:0	1044.389	.5823482	.0960988	.6440281	95.57643	2.758136	.6568417	.0803184
-25,9:0	1043.692	.5820887	.1024559	.6518468	95.61073	2.731436	.6361966	.0797373
-24,9:0	1044.080	.5825908	.1217911	.6466109	95.51711	2.822260	.6290190	.0788457
-23,9:0	1043.356	.5823902	.1269935	.6642020	95.56060	2.750318	.6332205	.0798242
-22,9:0	1044.026	.5830812	.1619504	.6360025	95.43508	2.883082	.6272114	.0780041
-21,9:0	1045.965	.5836924	.1326036	.6213048	95.33834	2.976239	.6696842	.0798588

	Pentanes	Hexanes
ase Time	Soft Pt 11	Soft Pt 11
-D,H:MIN	DATA11,AVG	DATA12,AVG
-30,9:0	.0255390	.0086897
-29,9:0	.0253798	.0084420
-28,9:0	.0241565	.0089101
-27,9:0	.0248974	.0090713
-26,9:0	.0252886	.0089721
-25,9:0	.0254399	.0091511
-24,9:0	.0254615	.0088010
-23,9:0	.0246321	.0083522
-22,9:0	.0237015	.0085162
-21,9:0	.0242100	.0083168

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~Butane	N-Butane	Pentanes
t Pt 11	Soft Pt 11	Soft Pt 11
'A8 ,AVG	DATA9 ,AVG	DATA10,AVG
14986	.1311292	.0255390
01703	.1287558	.0253799
67860	.1220102	.0241565
94993	.1266086	.0248974
03184	.1275589	.0252885
97373	.1260695	.0254398
88457	.1246463	.0254614
98242	.1265060	.0246321
80041	.1224478	.0237015
98588	.1253909	.0242100

BOISE CASCADE TEST
Nº 2 BOILER @ 95%

START OF TEST — METER READS

TIME	C.R. READ	UNC. READ	PRESS FACTOR	MTR. SPLT
10:30A	146057 ~~146045~~	31620 MCF	4.912	29472 SCFH
11:30A	146088	31626 MCF	4.925	29550 SCFH
12:30P	146118	31632 MCF	4.894	29364 SCFH
1:30P	146148	31638 MCF	4.975	29850 SCFH
2:30P	146178	31644 MCF	4.941	29646 SCFH
3:30P	146209	31650770 SCFH	4.928	33362 SCFH
4:30P	146238	31656850 SCFH	4.897	29774 SCFH
5:30P	146268	31662970	4.905	30019 SCFH
6:30P	146298	31669070	4.871	29713 SCFH
6:38P	146302	31669880	4.924	3988 SCFH
END OF TEST				
TOTALS	245 MCF	49,880 SCFH UNC	AVER. 4.917	245,260 SCF

31669880
− 31620000
49880 SCFH UNC
× 4.917 AVER FACTOR
245260 STD CUBIC FEET CORRECTED

245,260 SCF USED DURING 8 HR TEST

$$\frac{245,260 \text{ scf}}{8 \text{ hr}} = 30,657.5 \frac{\text{scf}}{\text{hr}}$$

BOISE CASCADE TEST
No 2 BOILER @ 100%

START OF TEST — METER READS

TIME	COR. READ	UNC READ	PRESS FACTOR	
8:01 A	146711	31755400	4.732	
9:00 A	146741	31761670	4.792	30,046 SCFH
0:00 A	146772	31768080	4.807	30,812 SCFH
:00 A	146802	31774430	4.844	30,759 SCFH
2:00 P	146833	31780810	4.855	30,975 SCFH
:00 P	146864	31787150	4.867	30,857 SCFH
:00 P	146894	31793470	4.869	30,772 SCFH
3:00 P	146925	31799750	4.913	30,854 SCFH
:00 P	146956	31806030	4.913	30,854 SCFH
:40 P	146976	31810260	4.911	20,774 SCFH
END OF TEST				
TOTALS	265 MCF	54,860 STCFH	AVER. 4.850	266,071 SCF

31810260
− 31755400
54860 SCFH UNC
X 4.850 AVER. FACTOR
266,071 STD CUBIC FEET ~~I~~. COR

~~266~~ 266,071 SCF USED DURING 8 HR TEST

$$\frac{266{,}071 \text{ scf}}{8 \text{ hr}} = 33258.9$$

BOISE CASCADE TEST
NO 2 BOILER @ 100%

START OF TEST

TIME	METER READS COR READ	UNC READ	PRESSURE FACTOR	MANUAL COR.
8:00 A	147269	31869240	4.688	
9:00 A	147300	31875870	4.728	31,346 SCFH
10:00A	147331	31882480	4.633	30,624 SCFH
11:00 A	147362	31889170	4.507	30,152 SCFH
12:00 P	147393	31895980	4.546	30,958 SCFH
1:00 P	147423	31902720	4.604	31,031 SCFH
1:57 P	147451	31908640	~~5.054~~	BOILER DOWN
2:00 P	147452	31908770	4.775	28,889 SCFH
3:00 P	147482	31915260	4.732	30,711 SCFH
3:32 P	147498	31918560	~~5.038~~	BOILER DOWN
4:00 P	147505	31919980	~~5.110~~	BOILER DOWN
4:04 P	147507	31920440	~~5.026~~	BOILER DOWN
4:07 P	147508	31920550	~~5.046~~	BOILER DOWN
END OF TEST				
TOTALS	239 MCF	51,310 SCFH UNC	AVER FACTOR 4.652	238,694 SCFH

31920550
\- 31869240

51,310 SCFH UNC
X 4.652 AVER FACTOR

238,694 STD CUBIC FEET CORRECTED

238,694 SCF USED DURING TEST

$\frac{238{,}694 \text{ scf}}{8 \text{ hr}} = 29836.8 \frac{\text{scf}}{\text{hr}}$

07/19/95

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White City Boiler Source Test

Steam Flow Calculation

Time	Steam Flow (#/hr)		
	05/02/95	05/03/95	05/04/95
08:00 AM		22,500	26,000
08:15 AM		21,500	26,000
08:30 AM		23,500	25,000
08:45 AM		25,000	23,000
09:00 AM		24,000	26,500
09:15 AM		24,000	24,000
09:30 AM		23,000	24,500
09:45 AM		23,000	24,000
10:00 AM		24,000	22,500
10:15 AM		24,500	24,500
10:30 AM	24,500	24,500	25,000
10:45 AM	23,500	24,000	25,000
11:00 AM	24,000	24,500	23,500
11:15 AM	23,500	23,500	23,000
11:30 AM	24,000	25,000	25,000
11:45 AM	23,500	23,000	22,000
12:00 PM	23,000	24,500	25,000
12:15 PM	24,000	23,500	25,000
12:30 PM	23,500	23,000	23,000
12:45 PM	25,000	23,500	21,000
01:00 PM	23,000	23,000	23,000
01:15 PM	23,500	23,500	24,500
01:30 PM	24,500	22,000	23,000
01:45 PM	24,000	25,000	25,000
02:00 PM	26,000	24,000	17,000
02:15 PM	23,500	25,100	23,500
02:30 PM	24,000	24,000	24,500
02:45 PM	24,000	21,000	24,000
03:00 PM	23,500	24,000	26,000
03:15 PM	23,000	23,000	25,000
03:30 PM	23,500	22,000	22,500
03:45 PM	23,500	24,000	13,000
04:00 PM	24,000	23,500	15,000
04:15 PM	24,000	24,000	26,000
04:30 PM	24,000	24,000	15,500
04:45 PM	23,000	25,500	20,000
05:00 PM	24,500	23,500	17,000
05:15 PM	23,500		
05:30 PM	24,000		
05:45 PM	23,500		
06:00 PM	24,000		
06:15 PM	23,500		
06:30 PM	24,500		
Average Steam Flow	23,848	23,651	22,919
Average Steam Flow rounded to nearest 100 #/hr	**23,800**	**23,700**	**22,900**

WCTEST.WK4

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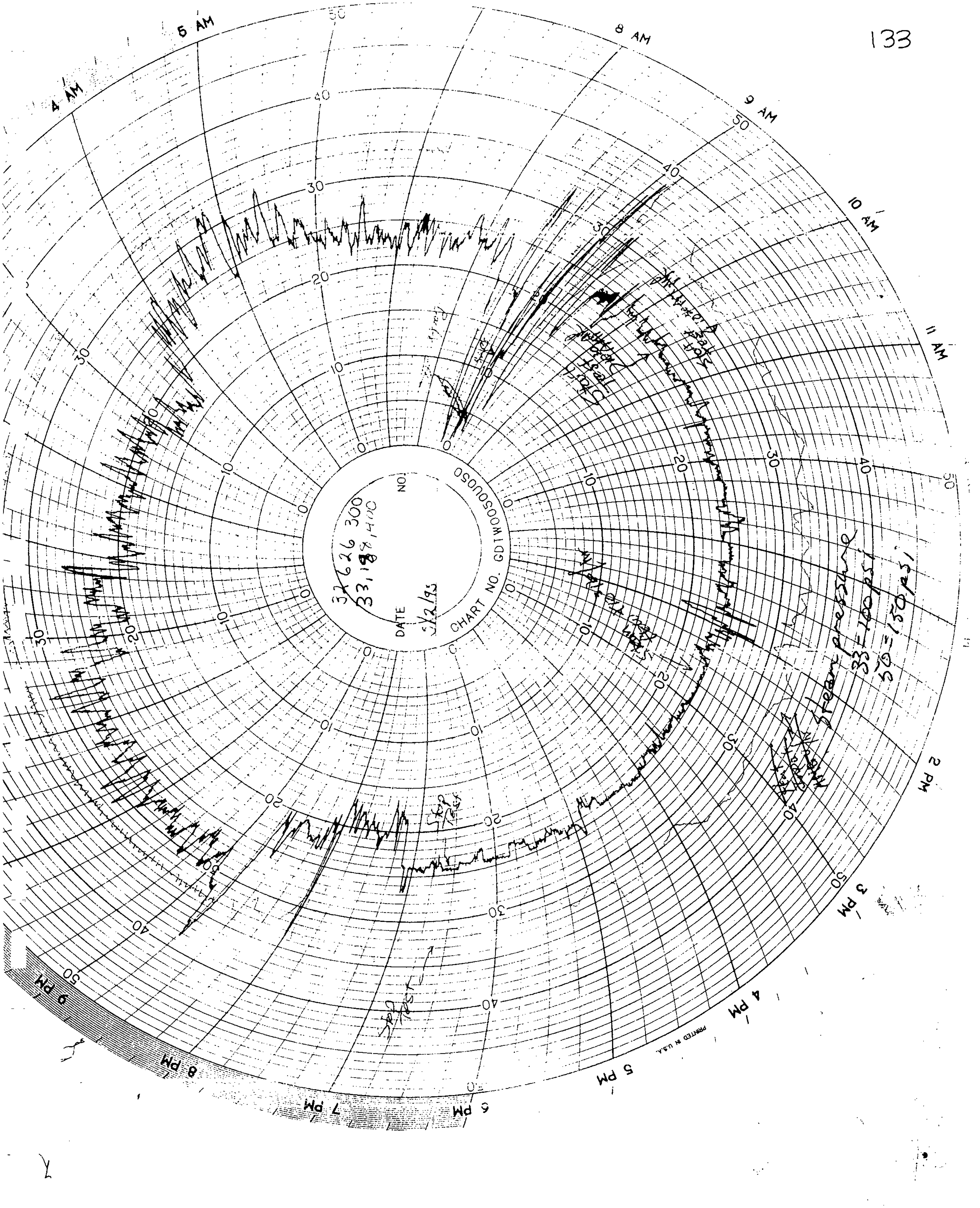
Co. | Co.
Dept. | Phone #
Fax # 206-222-7849 | Fax #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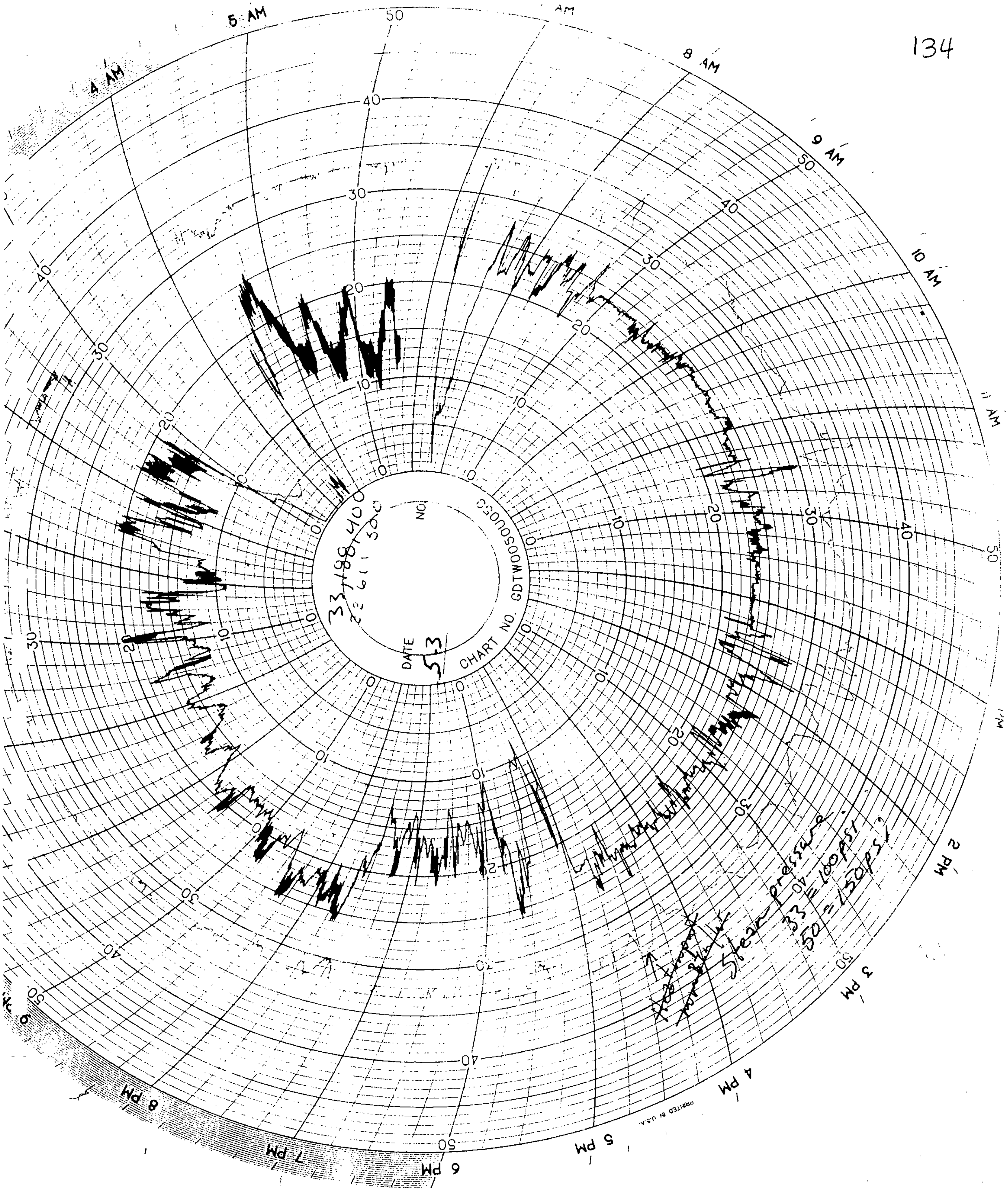
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50 = 150 psi
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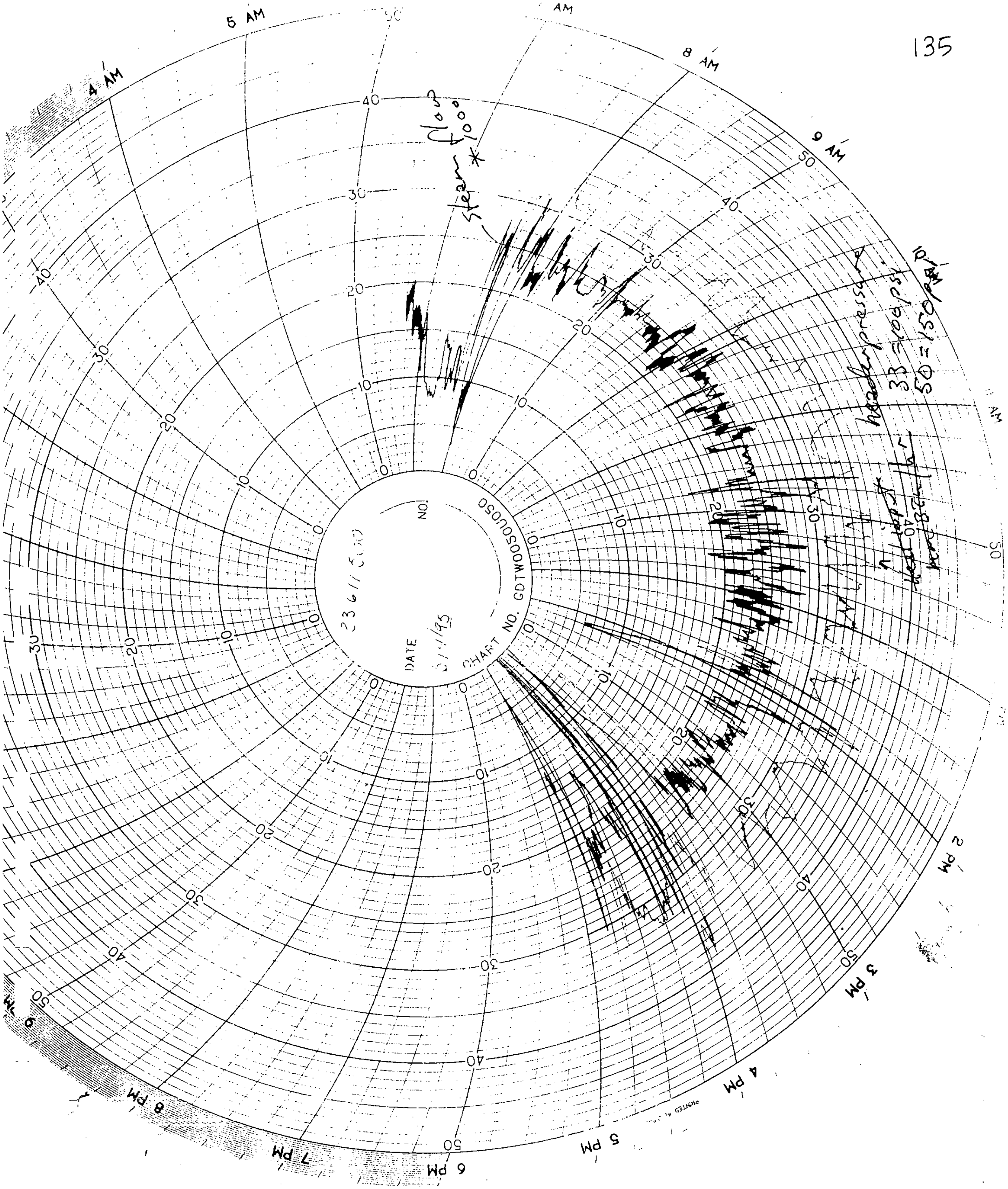
4 AM
5 AM
8 AM
9 AM
10 AM
2 PM
3 PM
4 PM
5 PM
6 PM
7 PM
8 PM
DATE
CHART NO. GDTW0050U050
NO.
Steam flow 1000 *
head pressure
33 = 100 psi
50 = 150 psi

APPENDIX E

Miscellaneous Supporting Information

<u>**CROSS SECTIONAL AREA**</u>

Traverse Point	Distance (inches)
1	0.5
2	1.6
3	2.8
4	4.2
5	6.0
6	8.5
7	15.5
8	18.0
9	19.8
10	21.2
11	22.4
12	23.5

<u>**STACK DIMENSIONS**</u>

24 inch diameter circular stack

2 ports at 90 degrees

A = 27 inches downstream

B = ~104 inches upstream

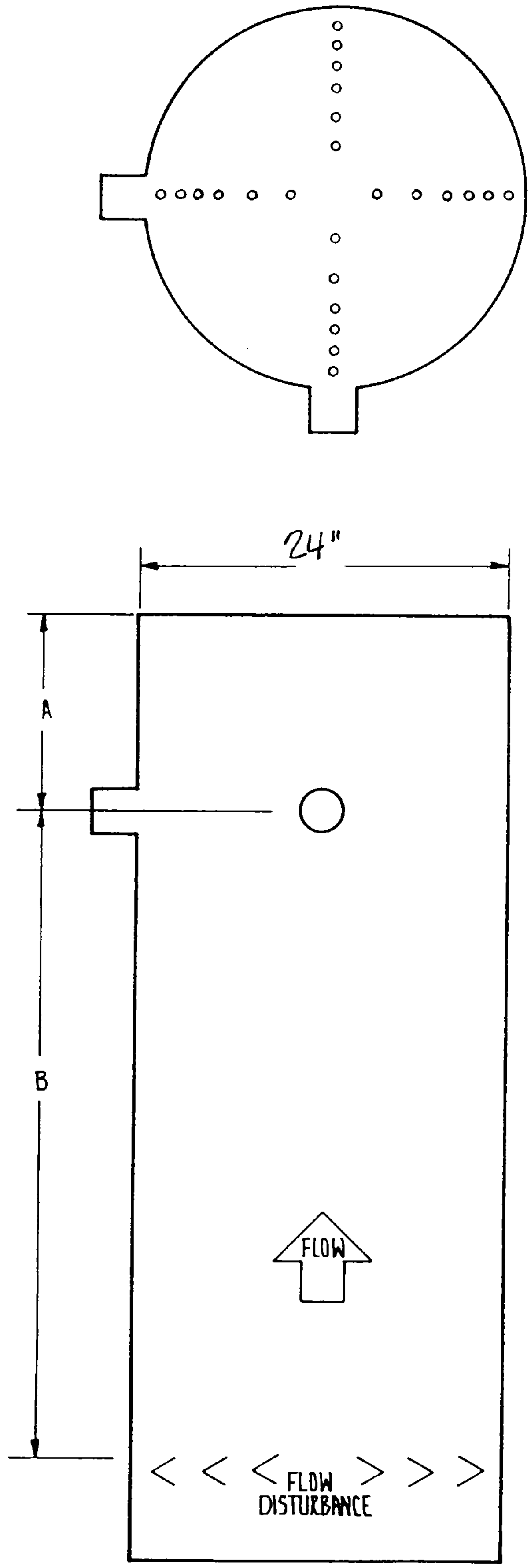

Figure 1. Location of sampling ports and traverse points.

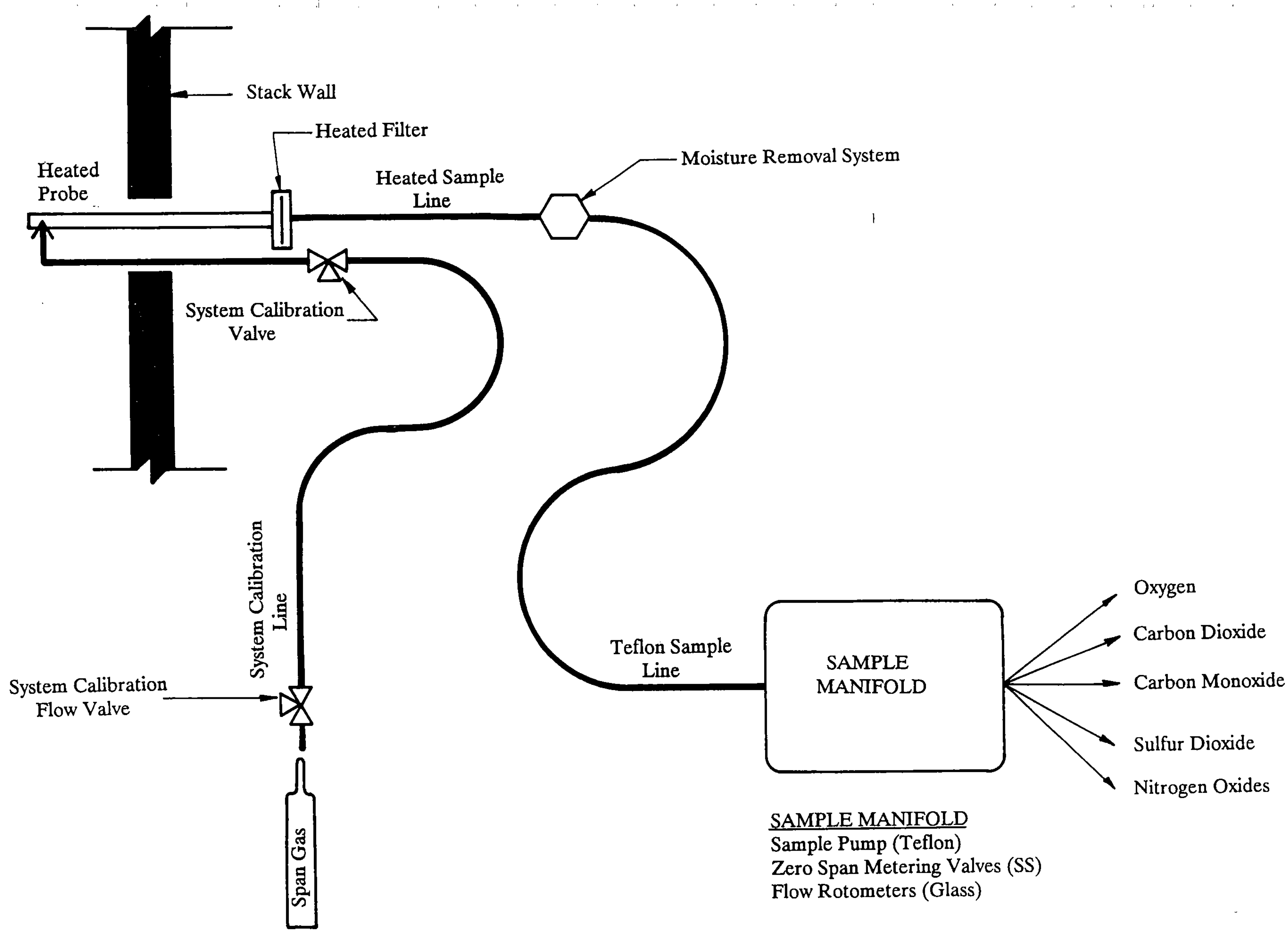

Figure 2. EPA Method 3A, 6C, 7E and 10 Sample Train

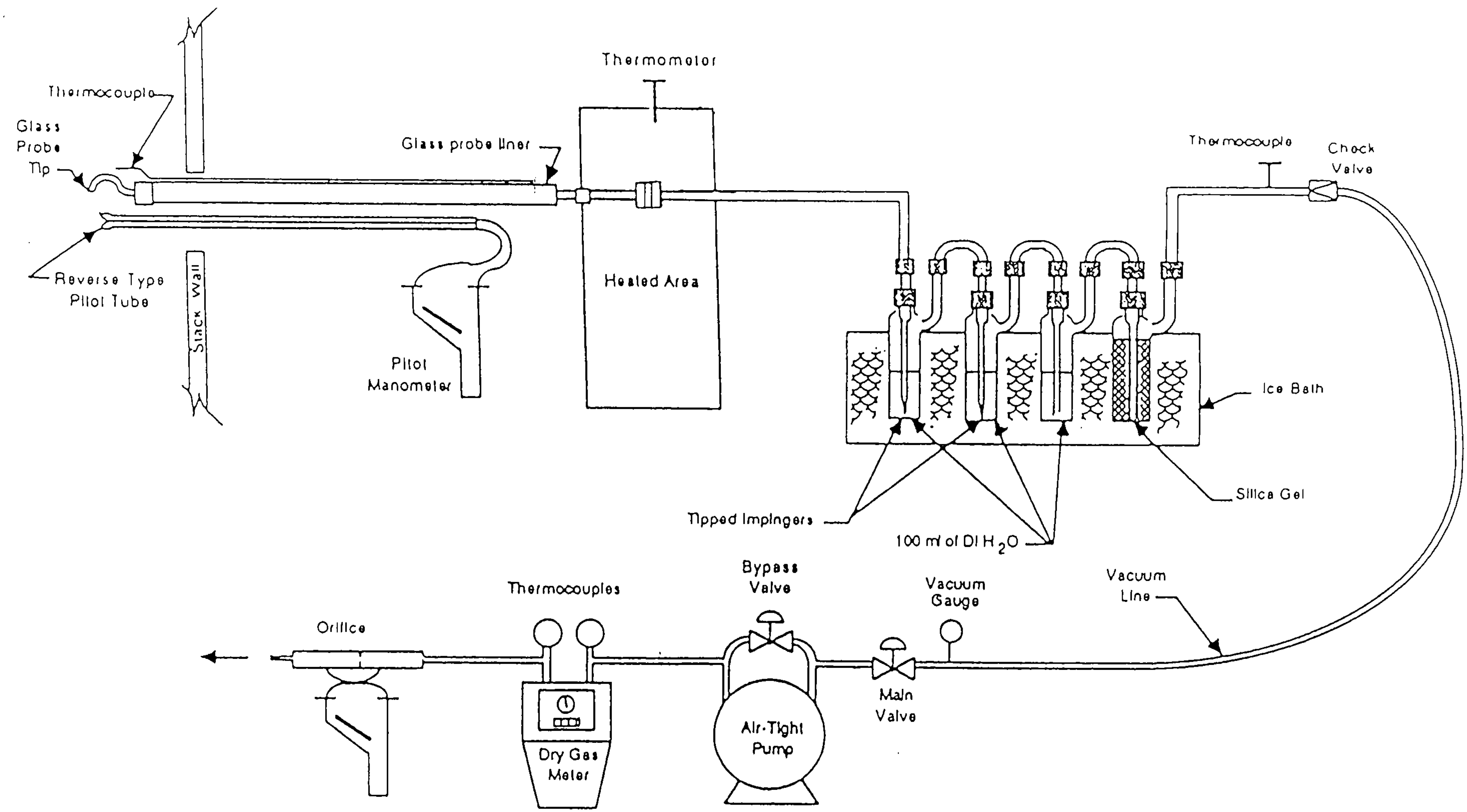

Figure: 3 EPA Method 5/202 Sample Train

METHOD 1 - LOCATION OF TRAVERSE POINTS

Circular Stacks

TRAVERSE POINT	DISTANCE, % of diameter
1	4.4
2	14.7
3	29.5
4	70.5
5	85.3
6	95.6

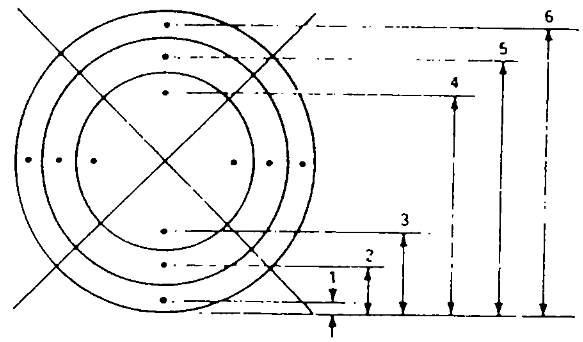

Figure 1-3. Example showing circular stack cross section divided into 12 equal areas, with location of traverse points indicated.

TABLE 1-2. LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

[Percent of stack diameter from inside wall to traverse point]

Traverse point number on a diameter	Number of traverse points on a diameter—											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	65.4	80.6
18									98.6	93.3	88.4	83.9

Rectangular Stacks

For a rectangular cross section, an equivalent diameter (D_e) shall be calculated from the following equation, to determine the upstream and downstream distances:

$$D_e = \frac{2LW}{(L+W)}$$

where L=length and W=width.

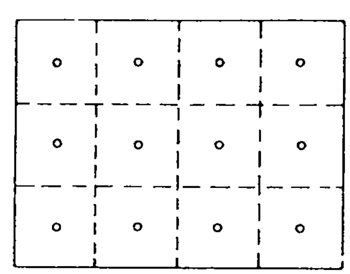

Figure 1-4. Example showing rectangular stack cross section divided into 12 equal areas, with a traverse point at centroid of each area.

METHOD 1 - MINIMUM NUMBER OF TRAVERSE POINTS

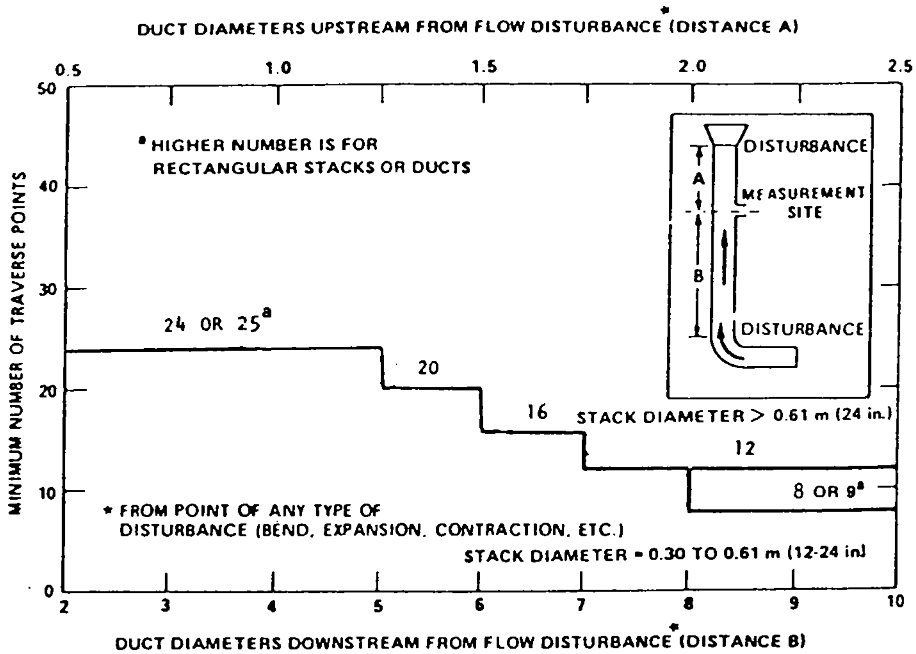

Figure 1-1. Minimum number of traverse points for particulate traverses.

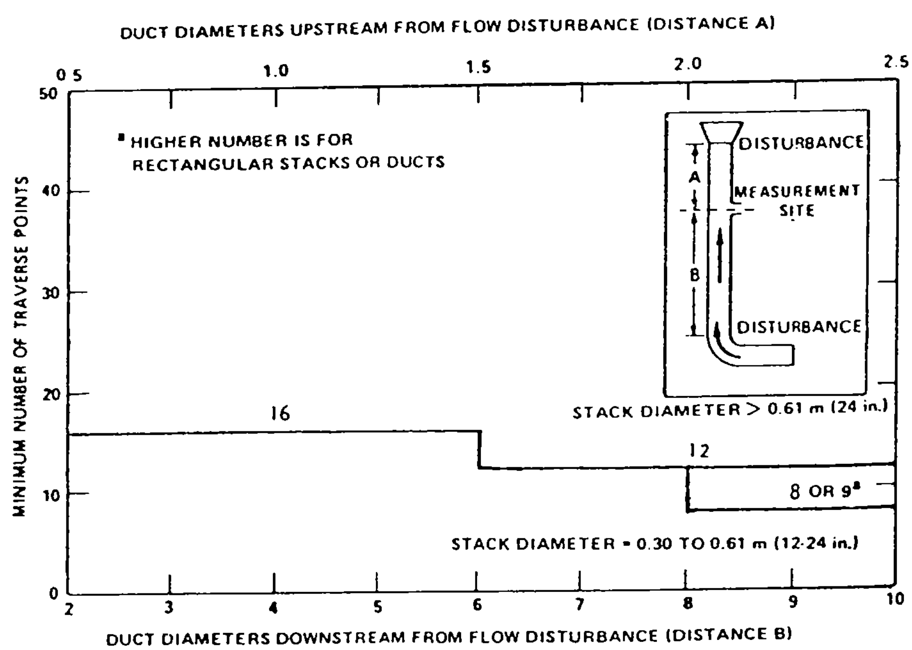

Figure 1-2. Minimum number of traverse points for velocity (nonparticulate) traverses.

METHOD 2 - STACK GAS VELOCITY AND VOLUMETRIC FLOW CALCULATIONS

5.1 Nomenclature.

A=Cross-sectional area of stack, m^2 (ft^2).
B_{ws}=Water vapor in the gas stream (from Method 5 or Reference Method 4), proportion by volume.
C_p=Pitot tube coefficient, dimensionless.
K_p=Pitot tube constant,

$$34.97 \frac{m}{sec}\left[\frac{(g/g\text{-mole})(mm\ Hg)}{(°K)(mm\ H_2O)}\right]^{1/2}$$

for the metric system and

$$85.49 \frac{ft}{sec}\left[\frac{(lb/lb\text{-mole})(in.\ Hg)}{(°R)(in.\ H_2O)}\right]^{1/2}$$

for the English system.
M_d=Molecular weight of stack gas, dry basis (see Section 3.6) g/g-mole (lb/lb-mole).
M_s=Molecular weight of stack gas, wet basis, g/g-mole (lb/lb-mole).
$=M_d\,(1-B_{ws})+18.0\,B_{ws}$

Eq. 2-5

P_{bar}=Barometric pressure at measurement site, mm Hg (in. Hg).
P_g=Stack static pressure, mm Hg (in. Hg).
P_s=Absolute stack gas pressure, mm Hg (in. Hg).
$=P_{bar}+P_g$ Eq. 2-6

Eq. 2-6

P_{std}=Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
Q_{sd}=Dry volumetric stack gas flow rate corrected to standard conditions, dscm/hr (dscf/hr).
t_s=Stack temperature, °C (°F).
T_s=Absolute stack temperature, °K, (°R).
$=273+t_s$ for metric.

Eq. 2-7

$=460+t_s$ for English.

Eq. 2-8

T_{std}=Standard absolute temperature, 293 °K (528° R).
v_s=Average stack gas velocity, m/sec (ft/sec).
Δ_p=Velocity head of stack gas, mm H_2O (in. H_2O).
3,600=Conversion factor, sec/hr.
18.0=Molecular weight of water, g/g-mole (lb/lb-mole).

5.2 Average Stack Gas Velocity.

$$v_s=K_pC_p(\sqrt{\Delta p})_{avg}\sqrt{\frac{T_{s(avg)}}{P_sM_s}}$$

Equation 2–9

5.3 Average Stack Gas Dry Volumetric Flow Rate.

$$Q_{sd}=3{,}600(1-B_{ws})v_sA\left(\frac{T_{std}}{T_{s\,(avg)}}\right)\left(\frac{P_s}{P_{std}}\right)$$

Eq. 2-10

METHOD 3 - MOLECULAR WEIGHT AND EXCESS AIR CALCULATIONS

6.1 Nomenclature.

M_d=Dry molecular weight, g/g-mole (lb/lb-mole).
%EA=Percent excess air.
$\%CO_2$=Percent CO_2 by volume (dry basis).
$\%O_2$=Percent O_2 by volume (dry basis).
%CO=Percent CO by volume (dry basis).
$\%N_2$=Percent N_2 by volume (dry basis).
0.264=Ratio of O_2 to N_2 in air, v/v.
0.280=Molecular weight of N_2 or CO, divided by 100.
0.320=Molecular weight of O_2 divided by 100.
0.440=Molecular weight of CO_2 divided by 100.

6.2 Percent Excess Air. Calculate the percent excess air (if applicable), by substituting the appropriate values of percent O_2, CO, and N_2 (obtained from Section 4.1.3 or 4.2.4) into Equation 3-1.

$$\%\,EA=\frac{\%O_2-0.5\%\,CO}{0.264\%\,N_2(\%O_2-0.5\%\,CO)}\times 100$$

Eq. 3-1

NOTE: The equation above assumes that ambient air is used as the source of O_2 and that the fuel does not contain appreciable amounts of N_2 (as do coke oven or blast furnace gases). For those cases when appreciable amounts of N_2 are present (coal, oil, and natural gas do not contain appreciable amounts of N_2) or when oxygen enrichment is used, alternate methods, subject to approval of the Administrator, are required.

6.3 Dry Molecular Weight. Use Equation 3-2 to calculate the dry molecular weight of the stack gas

$$M_d=0.440(\%CO_2)+0.320(\%O_2)+0.280(\%N_2+\%CO)$$

Eq. 3-2

METHOD 4 - STACK GAS MOISTURE CALCULATIONS

2.3.1 Nomenclature.

B_{ws}=Proportion of water vapor, by volume, in the gas stream.

M_w=Molecular weight of water, 18.0 g/g-mole (18.0 lb/lb-mole).

P_m=Absolute pressure (for this method, same as barometric pressure) at the dry gas meter, mm Hg (in. Hg).

P_{std}=Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R=Ideal gas constant, 0.06236 (mm Hg) (m³)/(g-mole) (°K) for metric units and 21.85 (in. Hg) (ft³)/(lb-mole) (°R) for English units.

T_m=Absolute temperature at meter, °K (°R).

T_{std}=Standard absolute temperature, 293° K (528°R).

V_m=Dry gas volume measured by dry gas meter, dcm (dcf).

ΔV_m=Incremental dry gas volume measured by dry gas meter at each traverse point, dcm (dcf).

$V_{m(std)}$=Dry gas volume measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{wc(std)}$=Volume of water vapor condensed corrected to standard conditions, scm (scf).

$V_{wsg(std)}$=Volume of water vapor collected in silica gel corrected to standard conditions, scm (scf).

V_f=Final volume of condenser water, ml.

V_i=Initial volume, if any, of condenser water, ml.

W_f=Final weight of silica gel or silica gel plus impinger, g.

W_i=Initial weight of silica gel or silica gel plus impinger, g.

Y=Dry gas meter calibration factor.

ρ_w=Density of water, 0.9982 g/ml (0.002201 lb/ml).

2.3.2 Volume of Water Vapor Condensed.

$$V_{wc(std)} = \frac{(V_f - V_i)\rho_w R T_{std}}{P_{std} M_w}$$

$$= K_1 (V_f - V_i)$$

Eq. 4-1

K_1=0.001333 m³/ml for metric units
=0.04707 ft³/ml for English units

2.3.3 Volume of Water Vapor Collected in Silica Gel.

$$V_{wsg(std)} = \frac{(W_f - W_i) R T_{std}}{P_{std} M_w}$$

$$= K_2 (W_f - W_i)$$

Eq. 4-2

Where:

K_2=0.001335 m³/g for metric units
=0.04715 ft³/g for English units

2.3.4 Sample Gas Volume.

$$V_{m(std)} = V_m Y \frac{(P_m)(T_{std})}{(P_{std})(T_m)}$$

$$= K_3 Y \frac{V_m P_m}{T_m}$$

Eq. 4-3

Where:

K_3=0.3858 °K/mm Hg for metric units
=17.64 °R/in. Hg for English units

NOTE: If the post-test leak rate (Section 2.2.6) exceeds the allowable rate, correct the value of V_m in Equation 4-3, as described in Section 6.3 of Method 5.

2.3.5 Moisture Content.

$$B_{ws} = \frac{V_{wc(std)} + V_{wsg(std)}}{V_{wc(std)} + V_{wsg(std)} + V_{m(std)}}$$

Eq. 4-4

NOTE: In saturated or moisture droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one using a value based upon the saturated conditions (see Section 1.2), and another based upon the results of the impinger analysis. The lower of these two values of B_{ws} shall be considered correct.

METHOD 5 - PARTICULATE EMISSION CALCULATIONS - (1)

6.1 Nomenclature.

A_n = Cross-sectional area of nozzle, m^2 (ft^2).

B_{ws} = Water vapor in the gas stream, proportion by volume.

C_a = Acetone blank residue concentration, mg/g.

c_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).

I = Percent of isokinetic sampling.

L_a = Maximum acceptable leakage rate for either a pretest leak check or for a leak check following a component change; equal to 0.0057 m^3/min (0.02 cfm) or 4 percent of the average sampling rate, whichever is less.

L_i = Individual leakage rate observed during the leak check conducted prior to the "i^{th}" component change (i=1, 2, 3....n), m^3/min (cfm).

L_p = Leakage rate observed during the post-test leak check, m^3/min (cfm).

m_a = Mass of residue of acetone after evaporation, mg.

m_n = Total amount of particulate matter collected, mg.

M_w = Molecular weight of water, 18.0 g/g-mole (18.0lb/lb-mole).

P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).

P_s = Absolute stack gas pressure, mm Hg (in. Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R = Ideal gas constant, 0.06236 mm Hg-m^3/°K-g-mole (21.85 in. Hg-ft^3/°R-lb-mole).

T_m = Absolute average dry gas meter temperature (see Figure 5-2), °K (°R).

T_s = Absolute average stack gas temperature (see Figure 5-2), °K (°R).

T_{std} = Standard absolute temperature, 293° K (528° R).

V_a = Volume of acetone blank, ml.

V_{aw} = Volume of acetone used in wash, ml.

V_{lc} = Total volume of liquid collected in impingers and silica gel (see Figure 5-3), ml.

V_m = Volume of gas sample as measured by dry gas meter, dcm (dscf).

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{w(std)}$ = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).

v_s = Stack gas velocity, calculated by Method 2, Equation 2-9, using data obtained from Method 5, m/sec (ft/sec).

W_a = Weight of residue in acetone wash, mg.

Y = Dry gas meter calibration factor.

ΔH = Average pressure differential across the orifice meter (see Figure 5-2), mm H_2O (in. H_2O).

ρ_a = Density of acetone, mg/ml (see label on bottle).

ρ_w = Density of water, 0.9982 g/ml (0.002201 lb/ml).

θ = Total sampling time, min.

θ_1 = Sampling time interval, from the beginning of a run until the first component change, min.

θ_i = Sampling time interval, between two successive component changes, beginning with the interval between the first and second changes, min.

θ_p = Sampling time interval, from the final (n^{th}) component change until the end of the sampling run, min.

13.6 = Specific gravity of mercury.

60 = Sec/min.

100 = Conversion to percent.

6.2 Average Dry Gas Meter Temperature and Average Orifice Pressure Drop. See data sheet (Figure 5-2).

6.3 Dry Gas Volume. Correct the sample volume measured by the dry gas meter to standard conditions (20° C, 760 mm Hg or 68° F, 29.92 in. Hg) by using Equation 5-1.

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

$$= K_1 V_m Y \frac{P_{bar} + (\Delta H/13.6)}{T_m}$$

Equation 5-1

Where:

K_1 = 0.3858 °K/mm Hg for metric units
= 17.64 °R/in. Hg for English units

NOTE: Equation 5-1 can be used as written unless the leakage rate observed during any of the mandatory leak checks (i.e., the post-test leak check or leak checks conducted prior to component changes) exceeds L_a. If L_p or $_i$ exceeds L_a, Equation 5-1 must be modified as follows:

(a) Case I. No component changes made during sampling run. In this case, replace V_m in Equation 5-1 with the expression:

$$[V_m - (L_p - L_a)\theta]$$

(b) Case II. One or more component changes made during the sampling run. In this case, replace V_m in Equation 5-1 by the expression:

$$\left[V_m - (L_1 - L_a)\theta_1 - \sum_{i=2}^{n} (L_i - L_a)\theta_i - (L_p - L_a)\theta_p\right]$$

and substitute only for those leakage rates (L_i or L_p) which exceed L_a.

6.4 Volume of Water Vapor.

METHOD 5 - PARTICULATE EMISSION CALCULATIONS - (2)

Equation 5-2

$$V_{w(std)} = V_{1c}\left(\frac{\rho_w}{M_w}\right)\left(\frac{RT_{std}}{P_{std}}\right) = K_2 V_{1c}$$

Where:

K_2 = 0.001333 m³/ml for metric units
= 0.04707 ft³/ml for English units.

6.5 Moisture Content.

$$B_{ws} = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)}}$$

Eq. 5-3

NOTE: In saturated or water droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one from the impinger analysis (Equation 5-3), and a second from the assumption of saturated conditions. The lower of the two values of B_w shall be considered correct. The procedure for determining the moisture content based upon assumption of saturated conditions is given in the Note of Section 1.2 of Method 4. For the purposes of this method, the average stack gas temperature from Figure 5-2 may be used to make this determination, provided that the accuracy of the in-stack temperature sensor is ±1° C (2° F).

6.6 Acetone Blank Concentration.

$$C_a = \frac{m_a}{V_a \rho_a} \qquad \text{Eq. 5-4}$$

6.7 Acetone Wash Blank.

$$W_a = C_a V_{aw} \rho_a \qquad \text{Eq. 5-5}$$

6.8 Total Particulate Weight. Determine the total particulate catch from the sum of the weights obtained from Containers 1 and 2 less the acetone blank (see Figure 5-3).

NOTE: Refer to Section 4.1.5 to assist in calculation of results involving two or more filter assemblies or two or more sampling trains.

6.9 Particulate Concentration.

$$c_s = (0.001\ g/mg)\,(m_n / V_{m(std)})$$

Eq. 5-6

6.10 Conversion Factors:

From	To	Multiply by
scf	m³	0.02832.
g/ft³	gr/ft³	15.43.
g/ft³	lb/ft³	2.205 × 10⁻³
g/ft³	g/m³	35.31.

6.11 Isokinetic Variation.

6.11.1 Calculation From Raw Data.

$$I = \frac{100\ T_s[K_3 V_{1c} + (P_m/T_m)(P_{bar} + \Delta H/13.6)]}{60 \theta v_s P_s A_n}$$

Eq. 5-7

Where:

K_3 = 0.003454 mm Hg − m³/ml − °K for metric units.
= 0.002669 in. Hg − ft³/ml − °R for English units.

6.11.2 Calculation From Intermediate Values.

$$I = \frac{T_s V_{m(std)} P_{std}\, 100}{T_{std} v_s \theta A_n P_s 60 (1 - B_{ws})}$$

$$= K_4 \frac{T_s V_{m(std)}}{P_s V_s A_n \theta (1 - B_{ws})}$$

Equation 5-8

where:

K_4 = 4.320 for metric units
= 0.09450 for English units.

6.12 Acceptable Results. If 90 percent < I < 110 percent, the results are acceptable. If the particulate results are low in comparison to the standard, and I is over 110 percent or less than 90 percent, the Administrator may accept the results.

NOMENCLATURE
METHOD 5 CALCULATIONS

Vm_{std} = Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

Y = Dry gas meter calibration factor

P_b = Barometric pressure at the sampling site, mm Hg (in. Hg)

H = Average pressure differential across the orifice meter, mm H_2O (in. H_2O)

T_m = Absolute average dry gas meter temperature, ° K (° R)

dscm = Dry standard cubic meters

dscf = Dry standard cubic feet

W_a = Weight of residue in acetone wash

M_a = Mass of residue of acetone after evaporation, mg

C_a = Acetone blank residue concentration, mg/g

V_a = Volume of acetone blank

V_{aw} = Volume of acetone used in wash, ml

M_n = Total amount of particulate matter collected, mg

C_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, mg/dscm (gr/dscf)

gr/dscf = grains per dry standard cubic foot

Vw_{std} = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf)

B_{ws} = Water vapor in the gas stream, proportion by volume

M_d = Molecular weight of stack gas, g/g-mole on dry basis

M_s = Molecular weight of stack gas, g/g-mole on wet basis

V_s = Stack gas velocity, calculated by Method 2, Equation 2-9, using data obtained from Method 5, m/sec (ft/sec)

C_p = Pitot tube coefficient, dimensionless

Δ_p = Velocity head of stack gas, mm H_2O (in. H_2O)

P_s = Absolute stack gas pressure, mm Hg (in. Hg)

NOMENCLATURE (continued)
METHOD 5 CALCULATIONS

Q_{std} = Dry volumetric stack gas flow rate corrected to standard conditions, dscm/hr (dscf/hr)

dscf/min = dry standard cubic feet per minute (also identified as dcfm or scfm)

acfm = actual cubic feet per minute

I = Percent of isokinetic sampling

A_n = Cross-sectional area of nozzle, m^2 (ft^2)

AMTEST
AIR QUALITY, INC.

DRY GAS METER CALIBRATION
AM TEST - AIR QUALITY, INC.

FILE NAME: RED7-94
METER BOX #: RED MANOMETER
CALIBRATION DATE: 7-11-94
METHOD OF CALIB.: STANDARD DRY GAS METER (Method 5 Section 7.1)

TOTAL TIME min	DELTA H "H2O	METER VOL V1 cf	METER VOL V2 cf	TEMP IN deg F	TEMP OUT deg F	BARO. PRES. "Hg	STD DGM V1	STD DGM V2	ST.DGM TEMP IN deg F	ST.DGM TEMP OUT deg F	ST.DGM Yds FACTOR	Y FACTOR	DELTA H@
15.50	0.5	758.216	764.689	67.0	66.0	29.74	354.927	361.406	67.0	67.0	1.001	0.9997	1.607
15.00	1.0	765.799	774.594	70.0	68.0	29.74	362.517	371.309	68.0	68.0	1.001	1.0001	1.635
15.00	1.5	775.367	785.934	70.0	73.0	29.74	372.094	382.665	69.0	69.0	1.001	1.0024	1.687
13.00	2.0	786.526	797.104	76.0	72.0	29.74	383.257	393.847	69.0	70.0	1.001	1.0057	1.690
8.00	2.5	797.586	804.916	78.0	73.0	29.74	394.329	401.664	70.0	70.0	1.001	1.0059	1.667
6.00	3.0	805.612	811.557	79.0	74.0	29.74	402.364	408.325	71.0	71.0	1.001	1.0066	1.707
AVERAGE												1.003	1.666

[redacted] TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 6-21-93 Thermocouple Indicator # Red Man

Ambient Temperature 65 °F Barometric Pressure 29.4 in Hg

THERMOCOUPLE # OR REFERENCE	REFERENCE THERMOMETER TEMPERATURE °F	THERMOCOUPLE TEMPERATURE °F	TEMPERATURE DIFFERENCE °F	%
Red Marometer				
Meter in	33.	34	1	0.2%
	211	213	2	0.3%
Meter out	33	33	0	0.0%
	211	214	3	0.5%

$$\frac{(\text{ref temp, °F} + 460) - (\text{test therm. temp, °F} + 460)}{(\text{ref temp, °F} + 460)} * 100 \leq 1.5\%$$

For information only

AMTEST
AIR QUALITY, INC.

DRY GAS METER CALIBRATION
AM TEST - AIR QUALITY, INC.

PRE
~~POST~~-TEST CALIBRATION

FILE NAME: POST1-95
METER BOX #: RED MANOMETER
CALIBRATION DATE: 1-26-95
METHOD OF CALIB.: STANDARD DRY GAS METER (Method 5 Section 7.1)

TOTAL TIME min	DELTA H "H2O	METER VOL V1 cf	METER VOL V2 cf	TEMP IN deg F	TEMP OUT deg F	BARO. PRES. "Hg	STD DGM V1	STD DGM V2	ST.DGM TEMP IN deg F	ST.DGM TEMP OUT deg F	ST.DGM Yds FACTOR	Y FACTOR	DELTA H@
10.0	1.5	923.437	930.570	63.0	60.0	29.47	129.622	136.748	63.0	61.0	1.001	0.9953	1.662
10.0	1.5	930.570	937.669	64.0	61.0	29.47	136.748	143.822	63.0	63.0	1.001	0.9928	1.689
10.0	1.5	937.669	944.748	66.0	61.0	29.47	143.822	150.875	64.0	63.0	1.001	0.9936	1.703
AVERAGE												0.994	1.685

AMTEST
AIR QUALITY, INC.

DRY GAS METER CALIBRATION
AM TEST - AIR QUALITY, INC.

Post-Test Calibration

FILE NAME: REMAN595.WK1
METER BOX #: Red Manometer
CALIBRATION DATE: 5-30-95
METHOD OF CALIB.: STANDARD DRY GAS METER (Method 5 Section 7.1)

TOTAL TIME min	DELTA H "H2O	METER VOL V1 cf	METER VOL V2 cf	TEMP IN deg F	TEMP OUT deg F	BARO. PRES. "Hg	STD DGM V1	STD DGM V2	ST.DGM TEMP IN deg F	ST.DGM TEMP OUT deg F	ST.DGM Yds FACTOR	Y FACTOR	DELTA H@
17.0	0.5	152.540	159.779	73.0	71.0	29.66	591.850	598.934	68.0	68.0	1.001	0.9858	1.613
10.0	1.0	160.000	165.985	75.0	71.0	29.66	599.160	605.050	69.0	69.0	1.001	0.9901	1.620
10.0	1.5	166.263	173.405	77.0	72.0	29.66	605.325	612.369	70.0	69.0	1.001	0.9929	1.699
10.0	2.0	173.605	181.880	79.0	73.0	29.66	612.568	620.745	71.0	70.0	1.001	0.9945	1.685
10.0	2.5	182.211	191.529	82.0	74.0	29.66	621.071	630.287	71.0	70.0	1.001	0.9979	1.655
10.0	3.0	191.785	202.046	84.0	76.0	29.66	630.542	640.695	71.0	71.0	1.001	0.9998	1.633
AVERAGE												0.993	1.651

AMTEST
AIR QUALITY, INC.

STANDARD DRY GAS METER CALIBRATION DATA SUMMARY
AMTEST AIR QUALITY, INC.

PERFROMED BY HOMER R. DULIN CO.

Cal. DGM Ind, SCFH	Primary Standard SCFH	Yds
13.5	13.8	1.022
25.7	25.8	1.004
35.9	35.7	0.994
46.5	46.2	0.994
55.9	55.9	1.000
66.8	66.6	0.997
85.5	84.8	0.992
88.8	88.5	0.997
99.9	100.1	1.002
108.6	108.9	1.003
113.3	113.5	1.002
	AVG. Yds =	1.001

HOMER R. DULIN CO.

729 EAST WILLOW STREET
LONG BEACH, CALIFORNIA 90806

(310) 424-8533 (213) 636-4096 FAX (310) 426-7707

CERT. NO. 4-304-4

CALIBRATION CERTIFICATION

SUBMITTED BY: KRIS A. HANSEN CO.

FLOWMETER SERIAL No. 0302

MANUFACTURER EQUIMETER MFG. SERIAL No. 27688

TUBE No. FLOAT No.

MODEL NO.: T-110

REMARKS: CALIBRATED IN CFH AIR @ 14.7 PSIA & 70 DEG F.

ACCURACY: SEE DATA

INDICATED		ACTUAL	
CFH		CFH	
113.3		113.5	
108.6		108.9	
99.9		100.1	
88.8		88.5	
85.5		84.8	
66.8		66.6	
55.9		55.9	
46.5		46.2	
35.9		35.7	
25.7		25.8	
13.5		13.8	

Flowmeter Certified with HOMER R. DULIN CO.

Equipment No. 12400 Accuracy 0.2% Calib. Due 5-28-94

Procedure No. 101G

NIST Cert. No. 821/249576-92

Our standards are certified by or are traceable to the National Institute of Standards and Technology and comply with MIL-STD-45662A.

P.O. No. 06330 Shipper No.

4-18-94 — CALIBRATION DATE

4-18-95 — RECALIBRATION DATE

B. Richardson — CALIBRATION TECHNICIAN
B.RICHARDSON

EMISSION MEASUREMENT TECHNICAL INFORMATION CENTER
GUIDELINE DOCUMENT

Alternative Method 5 Post-Test Calibration

INTRODUCTION AND BACKGROUND

EPA Method 5 requires the calibration of the metering system after each field use. Because the post-test calibration requires the use of a spirometer or wet test meter, the calibration is often conducted in the laboratory. However, a field calibration procedure is highly desirable for two reasons: (1) it eliminates questions about the possibility of the damage to the metering system occurring during transport and (2) it eliminates travel costs for a retest if the metering system fails the post-test calibration.

The alternative post-test calibration procedure described below is based on the principles of the optional pretest orifice meter coefficient check in Section 4.4.1 of Method 5. Since the orifice meter coefficient check will not detect leakages between the inlet of the metering system and the dry gas meter, the alternative procedure includes two additional steps: (1) a leak check from either the inlet of the sampling train or the inlet of the metering system and (2) a leak check of that portion of the sampling train from the pump to the orifice meter.

PROCEDURE

The alternative to the post-test calibration in Section 5.3.2 of Method 5 is as follows:

After each test run, do the following:

1. Ensure that the metering system has passed the post-test leak-check. If not, conduct a leak-check of the metering system from its inlet.

2. Conduct the leak-check of that portion of the train from the pump to the orifice meter as described in Section 5.6 of Method 5.

3. Calculate Y_{qa} for each test run using the following equation:

$$Y_{qa}=\frac{\theta}{V_m}\sqrt{\frac{0.0319\,T_m}{\Delta H_{@}\left(P_b+\Delta\frac{H_{avg}}{13.6}\right)}\,\frac{29}{M_d}}\;\left(\sqrt{\Delta H}\right)_{avg}$$

Prepared by Michael K. Ciolek, EMB
Technical Support Division, OAQPS

EMTIC GD-26
June 21, 1994

where:

Y_{qa} = dry gas meter calibration check value, dimensionless.
θ = total run time, min.
V_m = total sample volume measured by dry gas meter, dcf.
T_m = absolute average dry gas meter temp., oR.
P_b = barometric pressure, in. Hg.
0.0319 = $(29.92/528)(0.75)^2$ (in. Hg/o/R) cfm^2.

ΔH_{avg} = average orifice meter differential, in. H_2O.
$\Delta H@$ = orifice meter calibration coefficient, in. H_2O.
M_d = dry molecular weight of stack gas, lb/lb-mole.
29 = dry molecular weight of air, lb/lb-mole.
13.6 = specific gravity of mercury.

After each test run series, do the following:

4. Average the three or more Y_{qa}'s obtained from the test run series and compare this average Y_{qa} with the dry gas meter calibration factor, Y. The average Y_{qa} must be within 5 percent of Y.

5. If the average Y_{qa} does not meet the ± 5 percent criterion, recalibrate the meter over the full range of orifice settings, as detailed in Section 5.3.1 of Method 5. Then follow the procedure in Section 5.3.3 of Method 5.

REFERENCE

Roger T. Shigehara, P.G. Royals, and E.W. Steward, "Alternative Method 5 Post-Test Calibration", Entropy, Inc, contained in the EMTIC TSAR Library.

TYPE S PITOT TUBE INSPECTION DATA FORM

Date 7-14-95 ACP Pitot Tube # P195-4B

Client GRI / WP Natural Gas @ Boise Cascade

Location White City, OR

Site(s) # 2 Package Boiler

Test Date(s) May 2-4, 1995

Pitot tube assembly level? ✓ yes ____ no

Pitot tube openings damaged? ____ yes (explain below) ✓ no

α_1 = 1.0 ° (<10°), α_2 = 1.5 ° (<10°), β_1 = 0.5 ° (<5°),
β_2 = 1.0 ° (<5°)

γ = 0.5 °, θ = 1.0 °, A = 1.09 cm (in.)

$z = A \sin \gamma$ = 0.001 cm (in.); <0.32 cm (<1/8 in.). 0.125

$w = A \sin \theta$ = 0.019 cm (in.); <.08 cm (<1/32 in.) 0.03125

P_A 0.549 cm (in.) P_b 0.555 cm (in.)

D_t = 0.375 cm (in.)

Comments:

PA is within 1.05 - 1.50 x Dt $1.05 D_t < P_A < 1.50 D_t$

PB is within 1.05 - 1.50 x Dt $1.05 D_t < P_B < 1.50 D_t$

Calibration required? ____ yes* ✓ no

*If yes, tag and take out of service until repaired.

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 06-22-95 JSH Thermocouple Indicator : FLUKE 52 K/J THERMOMETER

Ambient Temperature 73 °F Barometric Pressure 29.75 in Hg

T 195-4B THERMOCOUPLE # OR REFERENCE	REFERENCE THERMOMETER TEMPERATURE °F	THERMOCOUPLE TEMPERATURE °F	TEMPERATURE DIFFERENCE °F	%
BOILING OIL	340.0	333.8	6.2	1.0%
	334.0	327.4	6.6	1.0%
	332.0	325.4	6.6	1.0%
BOILING	208.8	208.8	0.0	0%
WATER	210.5	210.2	0.3	0.04%
	210.5	210.2 ~~209.~~	0.3	0.04%
ICE WATER	~~41.8~~ 40.5	42.2	1.7	0.34%
	39.5	41.2	1.7	0.34%
	38.5	40.2	1.7	0.34%

$$\frac{(\text{ref temp, °F} + 460) - (\text{test therm. temp, °F} + 460)}{(\text{ref temp, °F} + 460)} \cdot 100 \leq 1.5\%$$

SECTION 1. DESCRIPTION

1.1 General

The Servomex 1400B series of gas analysers comprises two base units, the 1410B analyser using dual wavelength, single beam infrared technique and the 1420B/1421B oxygen analysers using paramagnetic technology. This manual describes the 1420B oxygen analyser.

The 1400B series may be fitted into a twin unit 19" rack mounted case, a bench top case or a single unit case for flush panel mounting.

The 1420B has voltage and current outputs, multiple ranges, oxygen level alarms, flow alarm and remote range indication.

A version of the analyser is available for oxygen purity measurements.

Included with the analyser are the following accessories:

Fuses	2531-0526
Filters	2377-3608
'D' connectors	2535-7127 (plug)
	2535-7374 (socket)
'D' connector hoods	2535-7088
Manual	01420001B
IEC Power connector	2533-1437

A 3 1/2 digit green LED indicates the oxygen content to 0.1% resolution.

WARNING

This analyser is not suitable for use in hazardous areas or for measuring flammable sample gases.

1.2 Principles of Operation

The 1420B oxygen analyser measures the paramagnetic susceptibility of the sample gas by means of a magneto-dynamic type measuring cell.

Oxygen is virtually unique in being a paramagnetic gas, this means that it is attracted into a magnetic field. In the Servomex measuring cell the oxygen concentration is detected by means of a dumb-bell mounted on a torque suspension in a strong, non-linear magnetic field. The higher the concentration of oxygen the greater this dumb-bell is deflected from its rest position. This deflection is detected by an optical system and twin photo-cells connected to an amplifier. Around the dumb-bell is a coil of wire. A current is passed through this coil to return the dumb-bell to its original position. The current is measured and is proportional to the oxygen concentration.

1.3 Sampling System

The sampling system of the analyser includes a combination filter/automatic flow control device, designed to keep a constant flow of sample gas through the measuring cell for varying input pressures and to prevent the entrance of particulate matter into the measuring cell. Excess flow is vented to the by-pass.

An optional back pressure regulator is available for high oxygen concentrations to reduce the errors which would occur due to changes in barometric pressure.

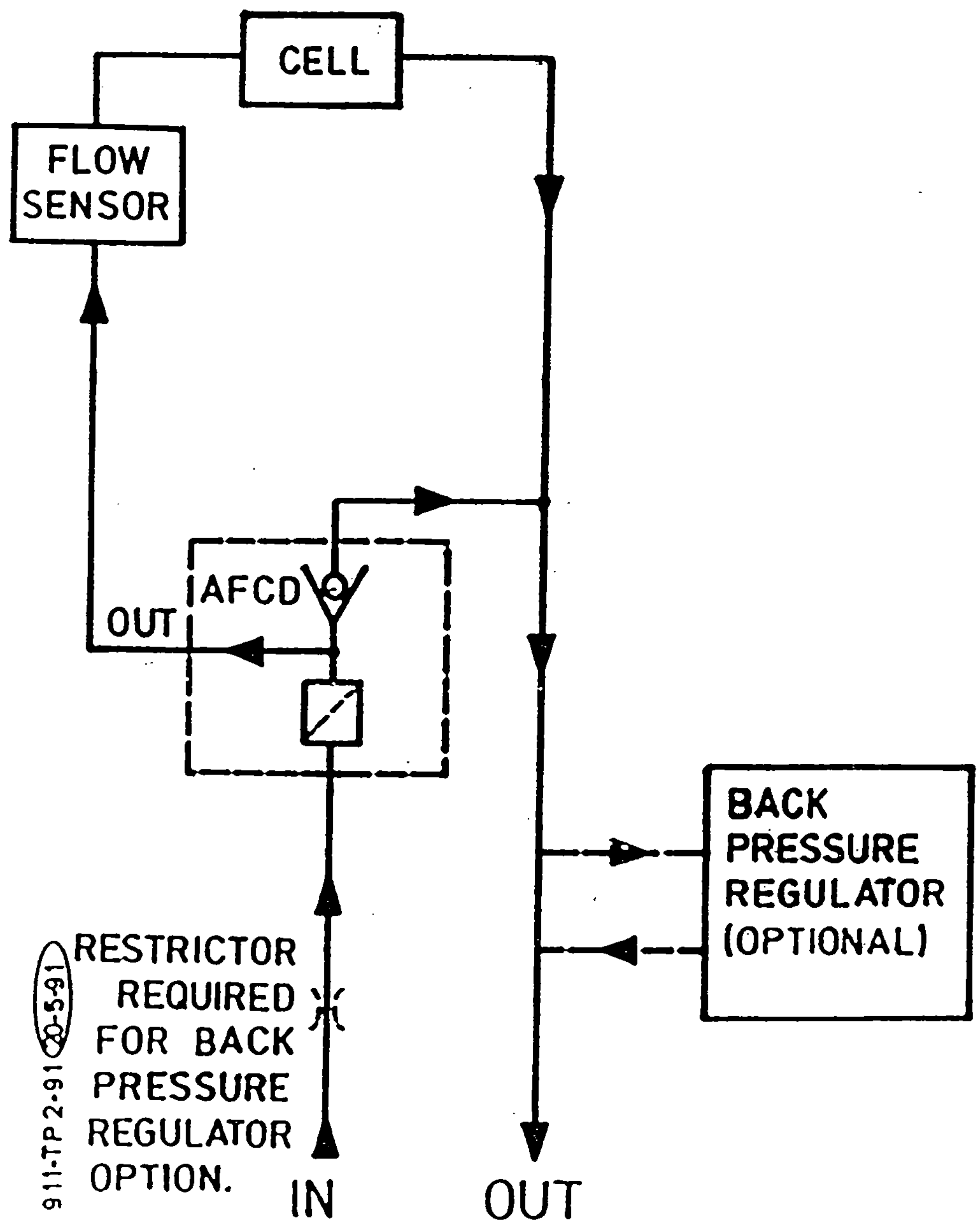

Figure 1.1 Schematic of Sampling System

1.4 Use With Toxic or Flammable Gases

1.4.1 Toxic Gases

If the analyser is used with sample gases which may be toxic, asphyxiant or otherwise harmful to health then adequate precautions should be taken to ensure safe installation and operation.

These precautions could, for example, include ensuring good quality sample piping to reduce the possibility of leaks, regular leak checking of the analyser and sample piping, minimum sample pressure, adequate ventilation of enclosed spaces and the possibility of monitoring for toxic levels.

The analyser vent should be piped to a well ventilated area.

1.4.2 Flammable Gases

WARNING

This analyser is not suitable for use in hazardous areas or for measuring flammable sample gases.

Consult Servomex for details of analysers which may be more suitable for measuring sample gases which can be toxic or flammable.

1.5 Specification

Performance Specification (typical)

Repeatability:	Better than ±0.1% O_2 under constant conditions (measured at the IV electrical output).
Temperature coefficient:	±0.005% O_2 ±0.04% of reading(on display) per °C change from calibration temperature.
Response Time:	Less than 15 seconds to 90%. At point when flow alarm is triggered the response time will be approximately 50 seconds

Outputs

Display:	3 1/2 digit LED reading 0.0 to 100.0% oxygen with overrange capability.
Output:	4-20mA (isolated), maximum load 600 ohms. Isolation 110V ac. 0-1V (unisolated), minimum load 1000 ohms for range selected.

Alarm outputs:

Oxygen level:	2 oxygen level alarms, SPCO relay contacts rated at 1A/110V AC or 1A/28V DC, non-inductive. Can be configured to high or low. Independent of range.
Flow fail:	SPCO relay contacts rated at 1A/110V AC or 1A 28V DC, non-inductive.
Local alarm:	Red LED lamps flash when alarm active.

Sample requirements

Condition:	Clean, dry gas with dew point 5°C below ambient temperature.
Inlet pressure: (Standard)	3.5 to 70kPa (0.5 to 10psig). Inlet pressure changes within this range will change the reading by less than 0.1% O_2.
(With back-pressure regulator)	17kPa to 35kPa (2.5 to 5 psig). Pressure values will be increased by 1 psig for every 2000ft(10Pa per 1000m) altitude above sea level.
Flowrate:	1 to 6 litres/minute approximately depending on sample pressure. Version with back pressure regulator: 1 - 2 litres/min
Filtering:	0.6 micron replaceable filter integral to the automatic flow control device.
Materials exposed to the sample:	Stainless steel, Pyrex glass, brass, platinum, epoxy resin, Viton, nylon, neoprene, polypropylene and glass fibre filter.
Gas connection:	6.4mm (1/4") OD tube.

Physical Characteristics

Case:	Steel and aluminium finished in epoxy powder paint.
Case classification:	IP 20 (IEC 529) when fitted into the Servomex 1400 series 19 inch case.

Dimensions:	See Figure 2.1.
Weight:	5Kg (11lb) approximately.

Electrical

AC Supply:	88 to 264V, 47 to 440Hz.
Power required:	50VA.

Environmental Limits

Operating ambient temperature:	0 to +45°C (32 to 113°F) 0 to 40°C (32 to 104°F), when fitted in bench top case.
Storage temperature range:	-20 to +70°C (-4 to 158°F)
Relative humidity:	0-85%, non-condensing.
Sunlight:	Protect from direct sunlight which may cause the interior of the analyser to overheat.
Vibration:	Protect the analyser from excessive vibration.
EMC:	Complies with EN 50022(1987) CLASS A for conducted interference and radiated electric field.

1.6 Product Identification

A label is fitted to the rear panel giving the model and serial numbers. It is of the form 1420/B701/NNNN where NNNN is the serial number

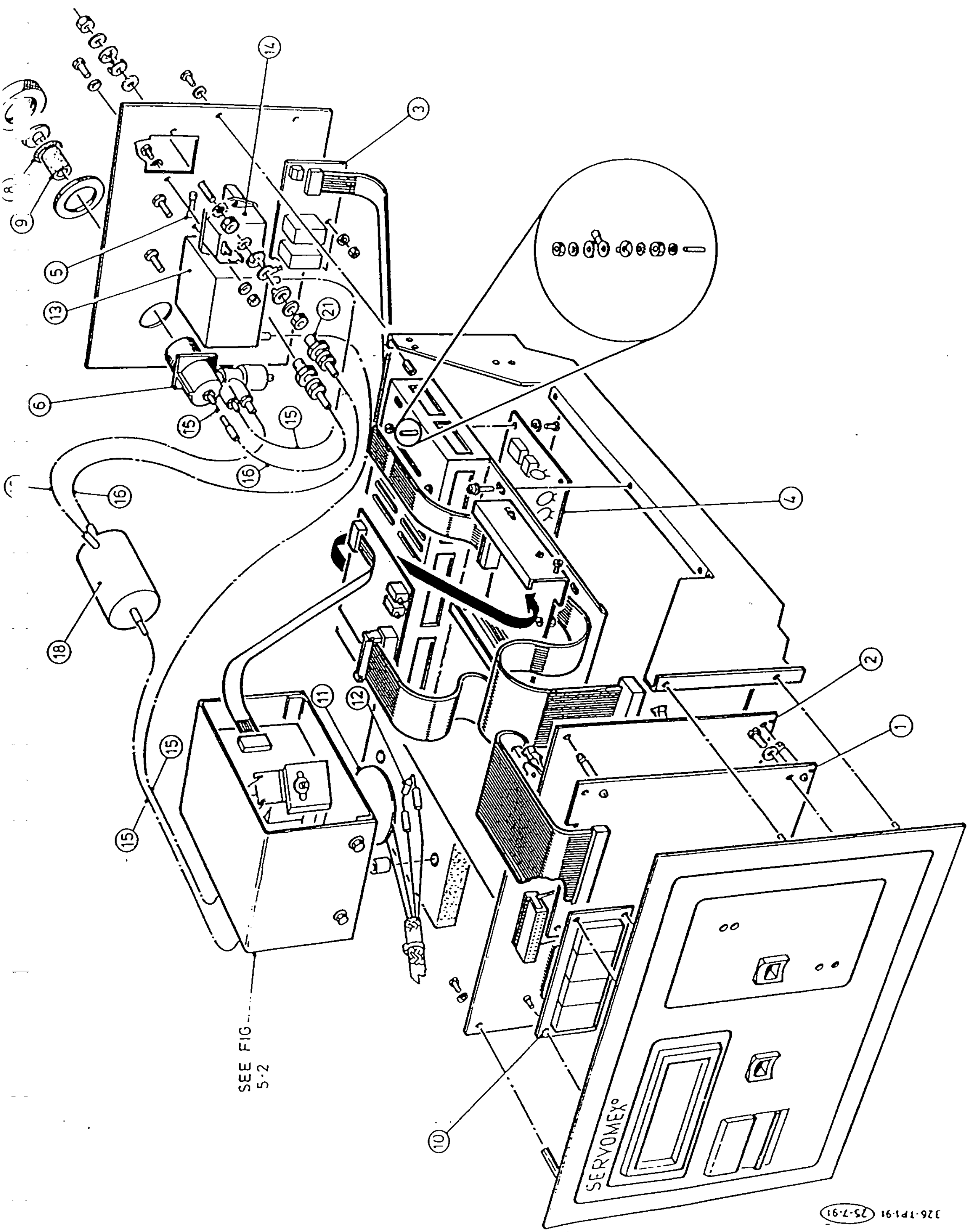

Figure 5.1 Exploded View 1420B Oxygen Analyser

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Servomex

1410B
Infrared Analyser
Instruction Manual

Ref : 01410/001B/0
Order as part No. 01410001B

Certificate No.________Q5166
ISO 9001 (1987)
EN 29001 (1987)
BS 5750 Part 1 (1987)

CUSTOMISED CIRCUIT VARIABLES

The 1400 display pcb (01410902/0) on this instrument is fitted with ~~standard~~/special resistor values and switch settings, as follows :-

Resistors		Special Switch 1 Settings	
R8	~~8K0/~~	1/1	ON
R9	9K0	1/2	ON
R10	~~1K0/~~	1/3	OFF
R11	500R	1/4	ON
R12	500R	1/5	ON
R13	500R	1/6	ON
R14	500R	1/7	ON
R15	500R	1/8	ON

Standard Switch 1 settings are listed on Page 18 of the manual.

Section 1. Description and Specification.

1.1 General

This manual describes the Servomex 1410 infra-red gas analyser.

The 1410 is supplied for packaging into a 19 inch rack , 4U high, case. A suitable case is available from Servomex, part number 00022905.

If the 1410 is not fitted into a suitable protective case by Servomex (eg. when the 1410 is supplied as an OEM chassis) it is then the responsibility of the user to ensure that suitable precautions are taken so that the level of protection is adequate for the intended environment.

A 3 1/2 digit LED display indicates the gas concentration

The analyser has built-in alarms for flow failure, instrument fault and high concentration level. These alarms have indicating LED's on the front panel. An alarm relay is fitted inside the unit and can be selected by the user to operate on any one of these alarm conditions.

A switch on the analyser's front panel selects the measurement range. Pins on the rear of the analyser allow connection of a remote range change switch which, if connected, overrides the front panel switch.

WARNING

This analyser is not suitable for use in hazardous areas or for measuring hazardous gas mixtures

1.2 Specification

Principle:	Infra-red. Single beam dual wavelength.
Accuracy:	Subject to available standards or gas mixtures. Typically better than +/- 2% FSD.
Linearity:	Better than +/- 1% FSD.
Repeatability:	Better than +/- 1% FSD
Zero drift:	Less than 2% FSD per week
Effect of sample cell contamination:	Less than 1% FSD for 50% cell window obscuration, due to broad band contamination.
Temperature coefficient:	Zero - less than 0.2% FSD per deg C Span - less than 0.4% of reading per deg C (includes gas law effect).

Sample pressure coefficient:	Less than 0.15% of reading per mbar
Response time:	Typically 30 seconds to 90%.
Electrical output:	0 to 1V, isolated, min load 1K and 4 to 20mA, isolated, max load impedance 500R. Note that the current and voltage outputs are not isolated from each other.
Operating ambient temperature:	0 to 40 deg C (32 to 104 deg F).
Relative humidity:	5 to 85% non-condensing.
Storage temperature:	-20 to +70 deg C (-4 to 158 deg F).
Storage relative humidity:	80% RH maximum.
AC supply;	120 or 240V AC, +/-10%, 45/65Hz. Max load 30VA.

Alarms

Instrument/level/ flow alarm:	This alarm can be configured to operate in different ways:- 1. As a concentration alarm only 2. As an instrument fault alarm only 3. As a flow alarm 4 sets of changeover relay contacts rated at 3A/120V, 1A/240V AC or 1A/28V DC. Relay de-energises on alarm or power failure. See section 2.3.1 for details of how to configure these alarms.
Additional Gas Concentration Alarm:	Change over relay contacts rated at 1A/28V AC or DC . Relay de-energises on high concentration or power fail.

Sample Requirements

Pressure:	0.9 to 1.1 bar absolute.
Flowrate:	Typically 100ml/min to 1 litre/min.
Materials in contact with the sample:	Stainless steel, Viton, sapphire/CaF2, UPVC, as standard.
Gas connection:	6.4mm (1/4in) OD tube, suitable for push-on tubing or 1/4 inch compression fittings.

Section 4. Principles Of Operation And Product Description

4.1 Description Of The 1410

The 1410 analyser comprises two major assemblies:-

1. 12X1 infrared bench (see appendices A-D)
2. Front panel assembly (see figure 4.1)

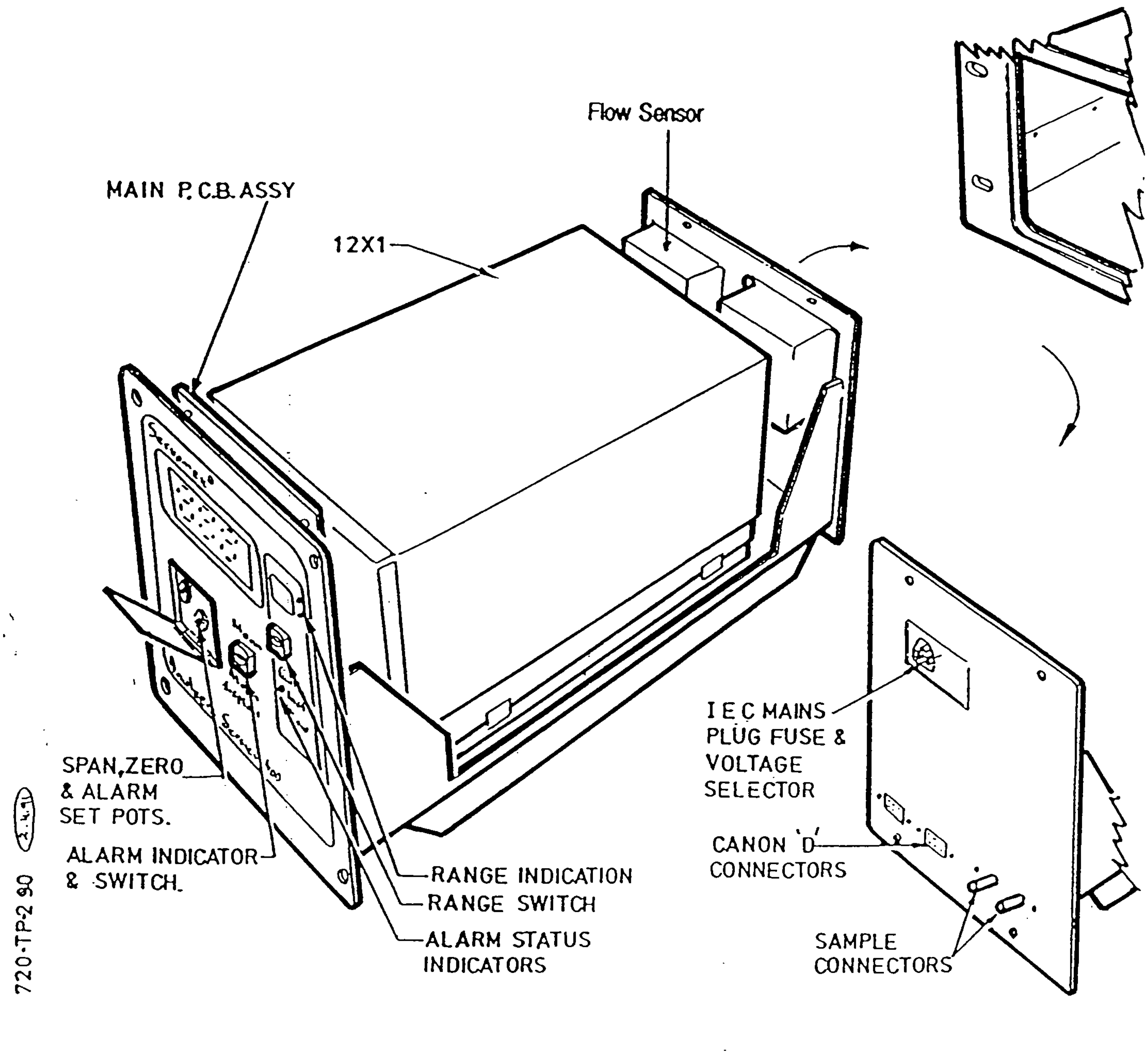

Figure 4.1 General Construction

SO_2 Analyzer

Continuous Emission Monitoring

Benefits and Features

- EPA certifiable.
- Wide dynamic "dual range" capability.
- Single point calibration.
- Seven user selectable outputs.
- Portability.
- Reduced maintenance.
- Start-up time — 5 minutes.

Specifications

- Accuracy — typically ±0.5% of full-scale.
- Electronic Response −90% in less than three seconds.
- Stability (zero drift) — better than ±0.5% of full-scale in 24 hours.
- Sensitivity — better than ±0.5% of full-scale.
- Zero and span check (manual) — recommended frequency once per 24 hours or per EPA requirements.
- Electrical requirements — approximately 50 watts, 120 ±10% 50-60 Hz or 220 V ±10% 50 hz.
- Weight — 27 lbs.
- Output signals: field selectable 0-100 mV, 200 mV, 500 mV, 1.00V, 2.00V, 5.00V or 10.00V — two of which are available simultaneously for each range. Isolated 4-20 mA output available.
- Area Classification — General Purpose.
- Sample gas flow rate — non critical 1-2 litres/min (2-5 SCF/H).
- Permissible ambient operating temperature 15-35°C (59-95°F).
- Temperature stability: 0.25 percent per °C (15-35°C).
- Non condensing operating conditions.

Western Research
Division of
Bow Valley Resource Services Ltd.

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FAX: (303) 751-8994

Representatives In: Europe, Middle East, South America, Asia and Pacific Rim

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Designed by Douglas Mitchell Design Ltd

721AT2 ANALYZER DATA

S/N 90 -721AT2 -7722

CUSTOMER: AMTEST INC

LOCATION: WASH.

P.O. #: 0976

CALIBRATION

CELL LENGTH 35.0 cm

CALIBRATION PRESSURE 760 mm Hg

CALIBRATION TEMP. 25 ^{0}C + 273 = 298 ^{0}K

MOLAR ABSORBTIVITY CONSTANT "k" 258

ELECTRONIC SPAN VALUE 809 ppm

SCALING RATIO 2mV /ppm

	RANGE 1	RANGE 2
FULL SCALE	200 ppm	2000 ppm
LOW OUTPUT	0.1 VDC	0.1 VDC
HIGH OUTPUT	1.0 VDC	1.0 VDC
V/I	- mA	- mA

LAMP TYPE SMG15MB

PMT TYPE R423HA

MEASURING PMT S/N 1A0361

REFERENCE PMT S/N YC6031

MEASURING FILTER WAVELENGTH 285 nM S/N 89-12

REFERENCE FILTER WAVELENGTH 585 nM S/N 90-04

46-01/89-721AT2-0494C

PRIMARY OUTPUT CARD

TJ1 (DPM)	0.00	Vdc
TJ2 (AGC1)	3.49	Vdc
TJ3 (AGC2)	3.56	Vdc
TJ4 (I_{avg})	4.00	Vdc
TJ5 (M1)	9.00	Vdc
TJ6 (M2)	7.98	Vdc
TJ7 (M1B)	4.51	Vdc
TJ8 (M2B)	4.50	Vdc
TJ9 (OPACITY)	0.00	Vdc

JUMPERS

JH1 A B C
JH2 A B C D
JH3 A B C D
JH4 A B C D

SWITCHES

SW1-1 OP CAL
SW1-2 ZERO SPAN

SECONDARY OUTPUT CARD

JUMPERS

JH1 A B C D
JH2 A B C D
JH3 1 2 3 4 5 6 7 8
JH4 1 2 3 4 5 6 7 8
JH5 1 2 3 4 5 6 7 8
JH6 1 2 3 4 5 6 7 8

HARD WIRED JUMPERS

JW1 JW6
JW2 JW7
JW3 JW8
JW4 JW9
JW5 JW10

721AT2 ANALYZER DATA

LAMP POWER SUPPLY

TEST POINTS

TP1	10.15 Vdc (OC1)	
TP2	10.15 Vdc (OC2)	
TP3 (Scope Measurement)		
Base	0.50 Vdc	
Measuring Pulse	8.80 Vdc	
Reference Pulse	2.60 Vdc	
TJ1 I_{avg}	4.00 Vdc	
LAMP VOLTAGE	150.1	Measured Across TB2 Terminals

JUMPERS

JH1 1 3

JH2 1 3

JH3 1 3

DETECTOR CARD

TEST JACKS

TJ1 (AGC1)	3.49 Vdc
TJ2 (AGC2)	3.56 Vdc
TJ3 (R1)	8.03 Vdc
TJ4 (R2)	8.05 Vdc
TJ5 (M1)	9.00 Vdc
TJ6 (M2)	7.98 Vdc

TEST POINTS

TP1 (RSIG1)	-0.80 Vdc
TP2 (RSIG2)	-0.80 Vdc
TP3 (MSIG1)	-0.90 Vdc
TP4 (MSIG2)	-0.80 Vdc
TP5 (PMTSIG1)	-1.71 Vdc
TP6 (PMTSIG2)	-1.61 Vdc

SWITCHES

SW1-1	AUTO	MANUAL
SW1-2	AUTO	MANUAL
SW1-3	ON	OFF
SW1-4	ON	OFF

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INSTRUCTION MANUAL

MODEL 42

CHEMILUMINESCENCE NO-NO_2-NO_X ANALYZER

DESIGNATED REFERENCE METHOD NUMBER
RFNA - 1289 - 074

THERMO ENVIRONMENTAL INSTRUMENTS INC.
8 WEST FORGE PARKWAY
FRANKLIN, MA 02038
TEL: (508) 520-0430
FAX: (508) 520-1460

P/N 7687

This Manual Issued For:

Serial No. ______________

Program ______________

Options ______________

Date ______________

Revised
2/12/92

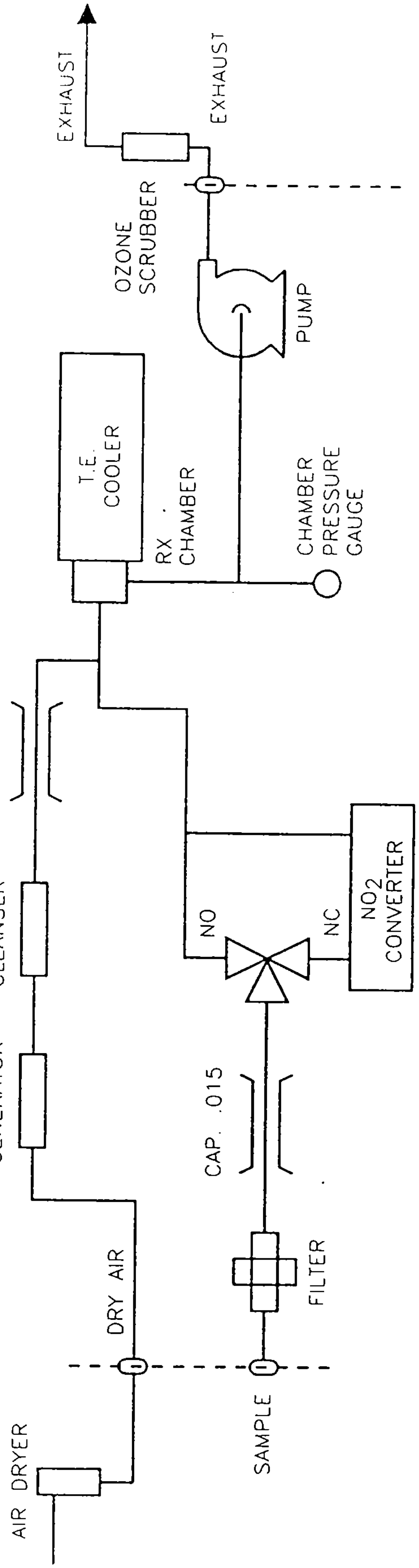

Figure I-2
Flow Schematic of Model 42

C. SPECIFICATIONS

Ranges	0-10, 20, 50, 100, 200 500, 1000, 2000, 5000 PPM
Noise	25 PPB
Detection Limit	50 PPB
Zero Drift (24 hour)	50 PPB
Span Drift (24 hour)	+/- 1% Full Scale
Rise, Fall times (0-90%)	2.5 seconds NO 5.0 seconds NO_x
Linearity	+/- 1% Full Scale
Sample Flow Rate	25 cc/min.
Vacuum	28.5" HG
Power Requirements	500 Watts 115 ± 10 Volts 220 ± 20 Volts 50/60 HZ
Physical Dimensions	17" W x [illegible] 3/4" H x 23" D
Weight	70 lbs. (including external pump)
Outputs	NO, NO_2, NO_x Selectable Voltage 4-20 ma

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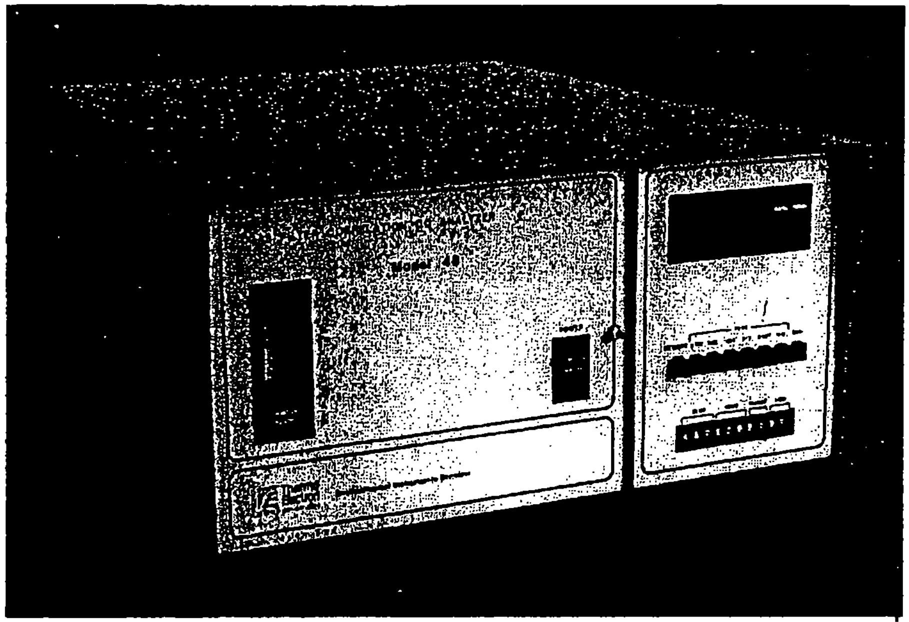
TE Thermo Environmental Instruments Inc.

Gas Filter Correlation CO Analyzer

Model 48

For Continuous Ambient Air Monitoring



Thermo Electron's Microprocessor Based Model 48 Ambient CO Analyzer provides unequaled ease of operation, reliability, precision and specificity. The unique Gas Filter Correlation principle of operation offers the significant advantages of unequaled specificity and sensitivity and increased resistance to shock and vibration.

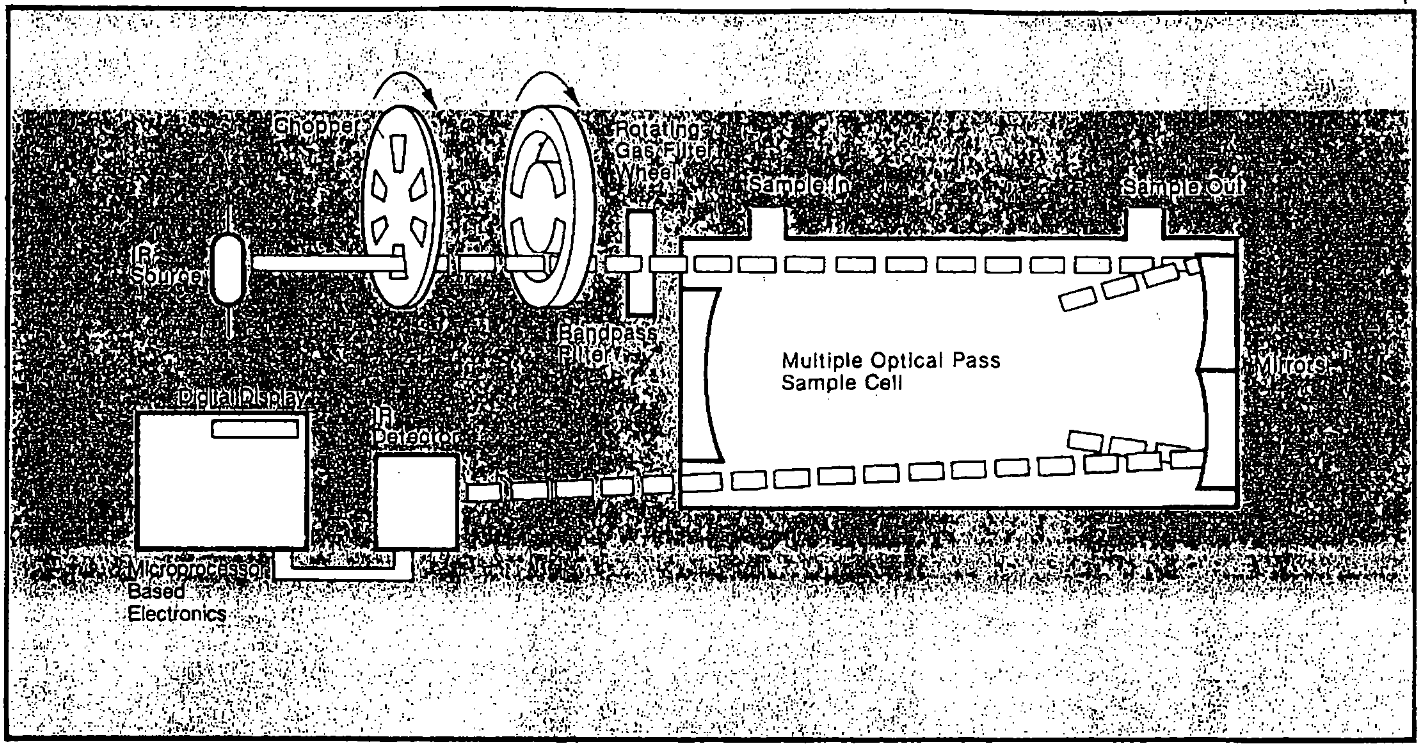
Key Features

- Microprocessor Based
- Automatic pressure and temperature correction
- Dual fully independent outputs standard
- Hourly average output standard
- Lower ranges, wide dynamic range (suitable for both ambient and source)
- Highly specific to CO
- Long term zero and span stability
- Vibration and shock resistant
- Powerful diagnostics made possible by microprocessor
- Linear through all ranges
- Unaffected by changes in flow
- Self-aligning optics
- U.S.A.—EPA reference method RFCA-0981-054, range 0-50ppm time constant — 30 seconds

Model 48 Specifications

Ranges	0-1, 0-2, 0-5, 0-10, 0-20, 0-50*, 0-100, 0-200, 0-500, 0-1000 ppm
Zero Noise	0.05 ppm RMS — With time constant = 30 seconds
Minimum Detectable Limit	0.10 ppm
Zero Drift, 24 Hours	± 0.2 ppm
Span Drift, 24 hours	± 1% Full Scale
Rise/Fall Times (0-95%) (at 1 ~~ppm~~ flow, 30 second integration time)	I minute
Precision	± 0.1 ppm
Linearity	± 1%
Flow Rate	1 lpm standard
Rejection Ratio	Negligible interference from water and CO_2
Operating Temperature	Performance specifications maintained over the range 15–35° C (may be operated safely over the range 5–45° C)
Power Requirements	100 Watts; 105–125 VAC, 60Hz; 220-240VAC 50Hz
Physical Dimensions	17" wide × 8¾" high × 23" deep
Weight	45 lbs.
Dual Outputs (standard)	Selectable to 0-10mV, 0-100mV 0-1V, 0-5V, 0-10V; digital display; 1 hour integrated value. Other outputs available upon request (4-20ma, IEEE488)

* See Federal Register, Tuesday, February 18, 1975, Volume 40, Number 33, Part II for definitions and Federal specifications. Performance specifications over 15-35°C range.



Principle of Operation

The basic components of a Gas Correlation System are illustrated in the above diagram. Radiation from an Infrared source is chopped and then passed through a gas filter which alternates between CO and N_2 due to Rotation of the filter wheel. The radiation then passes through a narrow bandpass filter and a multiple optical pass sample cell where absorption by the sample gas occurs. The IR radiation exits the sample cell and falls on a solid state IR detector.

The CO gas filter acts to produce a reference beam which cannot be further affected by CO in the sample chamber. The N_2 side of the filter wheel is transparent to IR radiation and therefore produces a measure beam which *can* be absorbed by CO. The chopped detector signal is modulated by the alternation between the two gas filters with an amplitude proportional to the concentration of CO in the sample chamber. Other gases do not cause modulation of the detector signal since they absorb the reference and measure beams equally. Thus, the Gas Filter Correlation System responds solely to CO.

Options

48-001 — Particulate Filter

48-002 — Rack Mounts

48-003 — Remote activation of zero and span solenoids.

Thermo Environmental Instruments Inc.

8 West Forge Parkway
Franklin, MA 02038

(508) 520-0430
Telex: 200205 THEMO UR

FAX: (508) 520-1460

Printed in U.S.A 10/89 5M

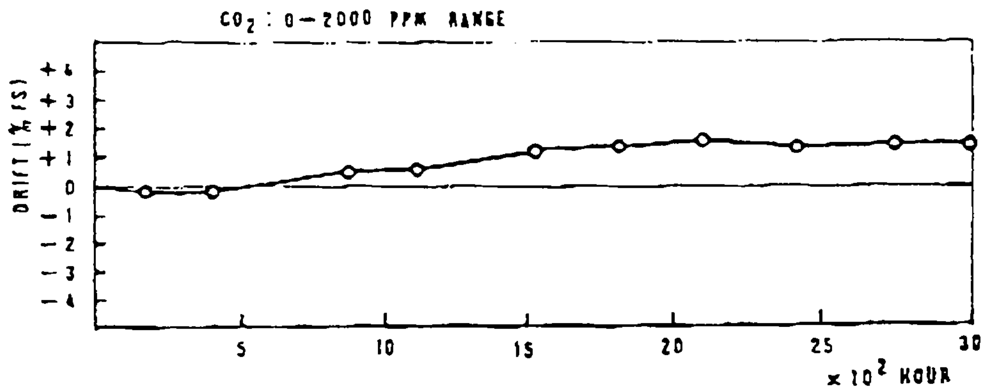
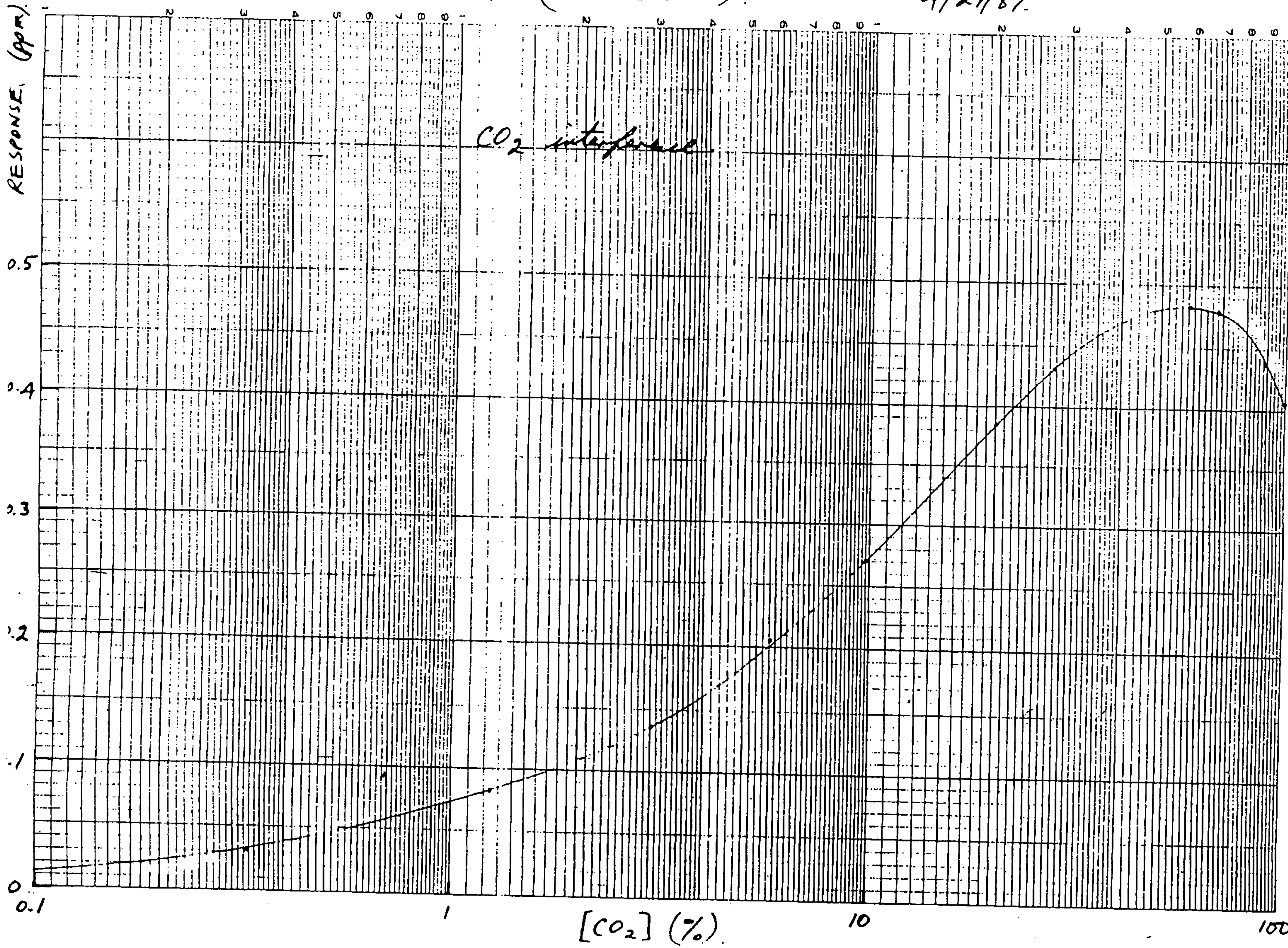


FIGURE 9 ZERO DRIFT

INTERFERENT COMP. / RANGE	CO 1000 PPM	CO_2 20%	SO_2 1000 PPM	H_2O 25°C SAT.
CO : 0—1000 PPM	———	0.02 %FS	≃ 0	−0.5 %FS
CO_2 : 0—400 PPM	0.12 %FS	———	≃ 0	−0.5 %FS

TABLE 1 . INTERFERENCE

MODEL 48 (Baseline unit). 4/29/87



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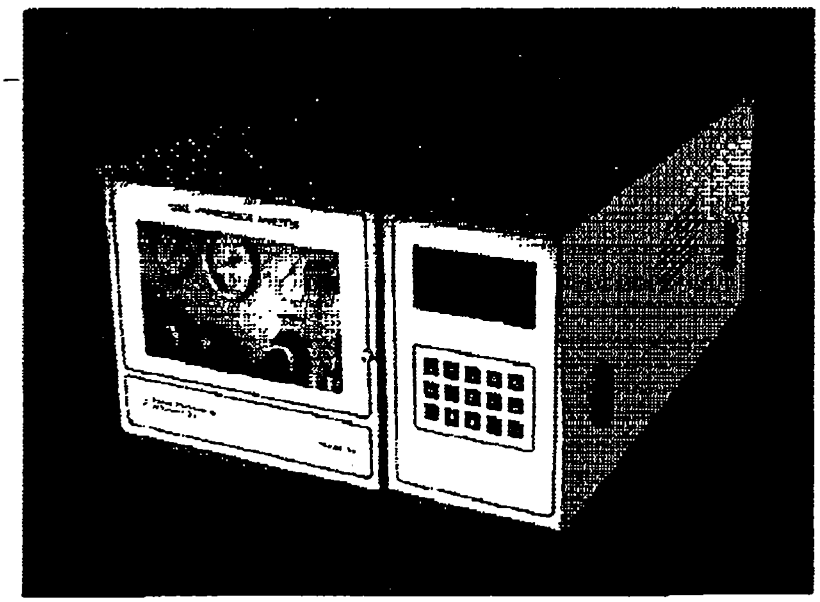
MODEL 51

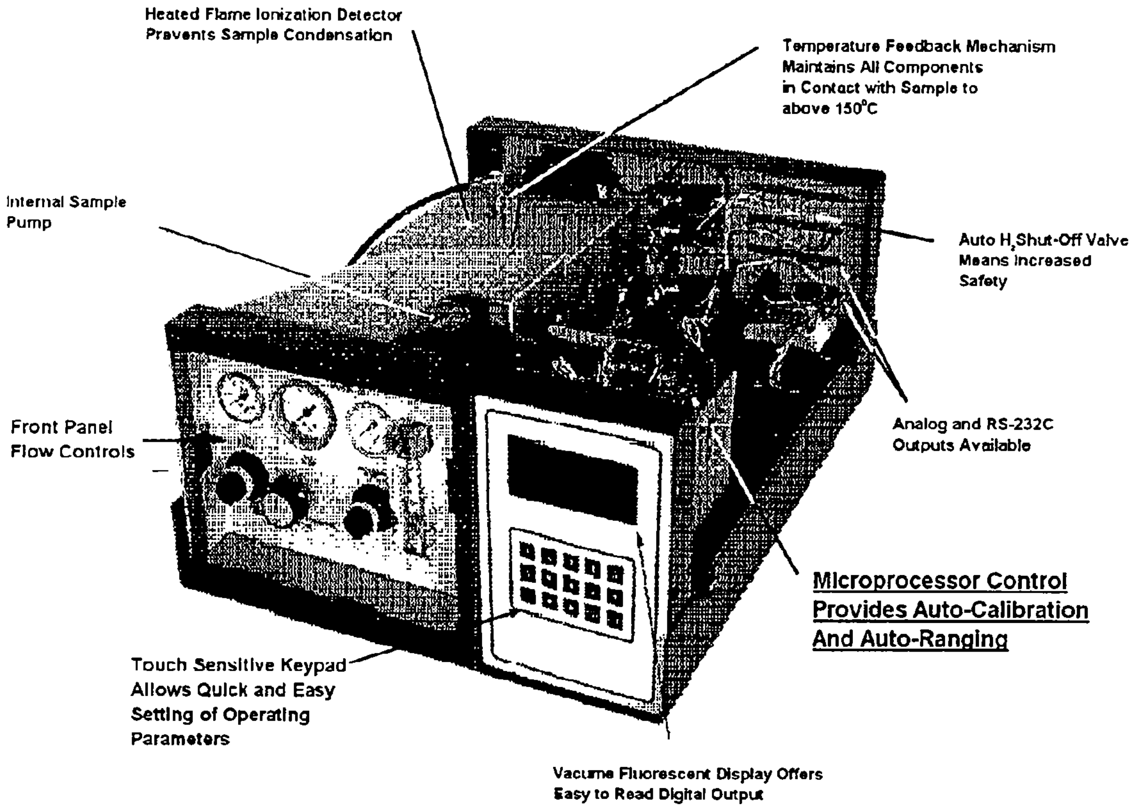
HEATED TOTAL HYDROCARBON ANALYZER



Ideally Suited For Applications In:

- EPA Method 25A Compliance Monitoring
- Continuous Emission Monitoring (CEM) of Source Hydrocarbons
- Carbon Bed Breakthrough Detection
- Fenceline (Perimeter) Monitoring
- Industrial Hygiene Monitoring

KEY DESIGN FEATURES



POWERFUL YET SIMPLE

The microprocessor based design provides capabilities not available in conventional analog based FID analyzers, including, system diagnostics (check-out) upon power-up, bidirectional RS-232 communications, and auto-ranging over the entire 0–10,000 ppm concentration range.

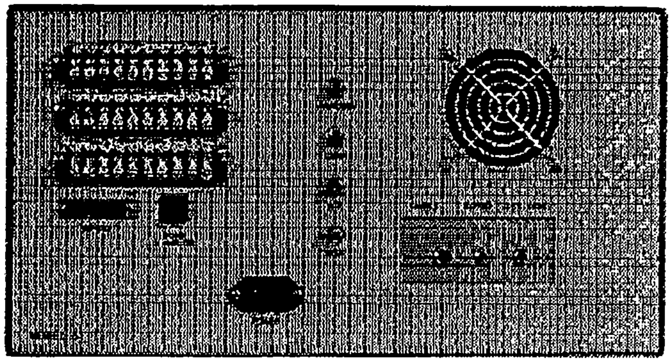
However, Thermo Environmental Instrument engineers were careful not to sacrifice simplicity and ease-of-use at the cost of these powerful features. The Model 51 design focuses on ease-of-operation to reduce personnel attention.

For example, the analyzer can perform automatic calibration routines at user prescribed time intervals. This eliminates the need for periodic, time-consuming manual calibration operations. Additionally, an auto-ignition routine is provided for the hydrogen flame. This eliminates manual ignition procedures and minimizes unnecessary downtime due to unknown flame-out conditions.

The highly visible Vacuum Fluorescent Display (VFD) provides continuous display of current sample concentration (ppm), as well as, high, low, and average concentration readings. Service (Fault) reports are readily available for operator diagnosis.

Flexible Communications

- Analog Output (0 – 10V Full Scale) Standard: 4-20 mA option available
- Bidirectional RS-232 Communications Standard
- 3 Amp contact closure provides mechanism for external alarm activation
- Drivers (110 VDC) offer activation of external solenoids for calibration of entire sampling system
- Remote instrument calibration made available via Control Lines
- Driver circuit for initiation of stack probe purge air (blow back) functionality



Specifications

Measurement:

Technique:	Flame Ionization Detection (FID) of most organic vapors
Ranges:	Vacuum Fluorescent Display (VFD) – Auto Ranging Over 0 – 10,000 ppm concentration range 0 – 100 ppm (resolution to 0.1 ppm) 0 – 1,000 ppm (resolution to 1.0 ppm) 0 – 10,000 ppm (resolution to 1.0 ppm)
Minimum Detectable:	0.1 ppm methane in air matrix
Sensitivity:	0.1 ppm methane on 0 – 100 ppm range
System Time Constant:	1.0 seconds at 3 LPM sample flow
Sampling Rate:	2.0 LPM
Detector Sample Flow Rate:	30 ml/min
Sample Conditioning:	Changeable micron filter in heated zone

Power Requirements: 115/220 VAC, 60/50 HZ

Controls, Panel:

Readout:	4 (four) line alphanumeric display 20 (twenty) character length
Keypad:	15 segment pad with audible and tactile feedback

Gases:

Combustion Air:	130 ml/min at 30 psig
Fuel:	25 ml/min at 30 psig
Span Gas:	Same as Sample Flow; flow controlled via metal frit restrictor
Zero Air:	Same as Sample Flow; flow controlled via metal frit restrictor

Physical Dimensions:

Case Size:	HWD 9.2 x 16.9 x 22 inches
Weight.	51 lbs.

Communications:
- 25 pin RS-232 port
- 0 – 1, 5, 10V Analog Signal (Selectable)
- 4 – 20 mA Output (optional)

For Price and Delivery Information, Contact:

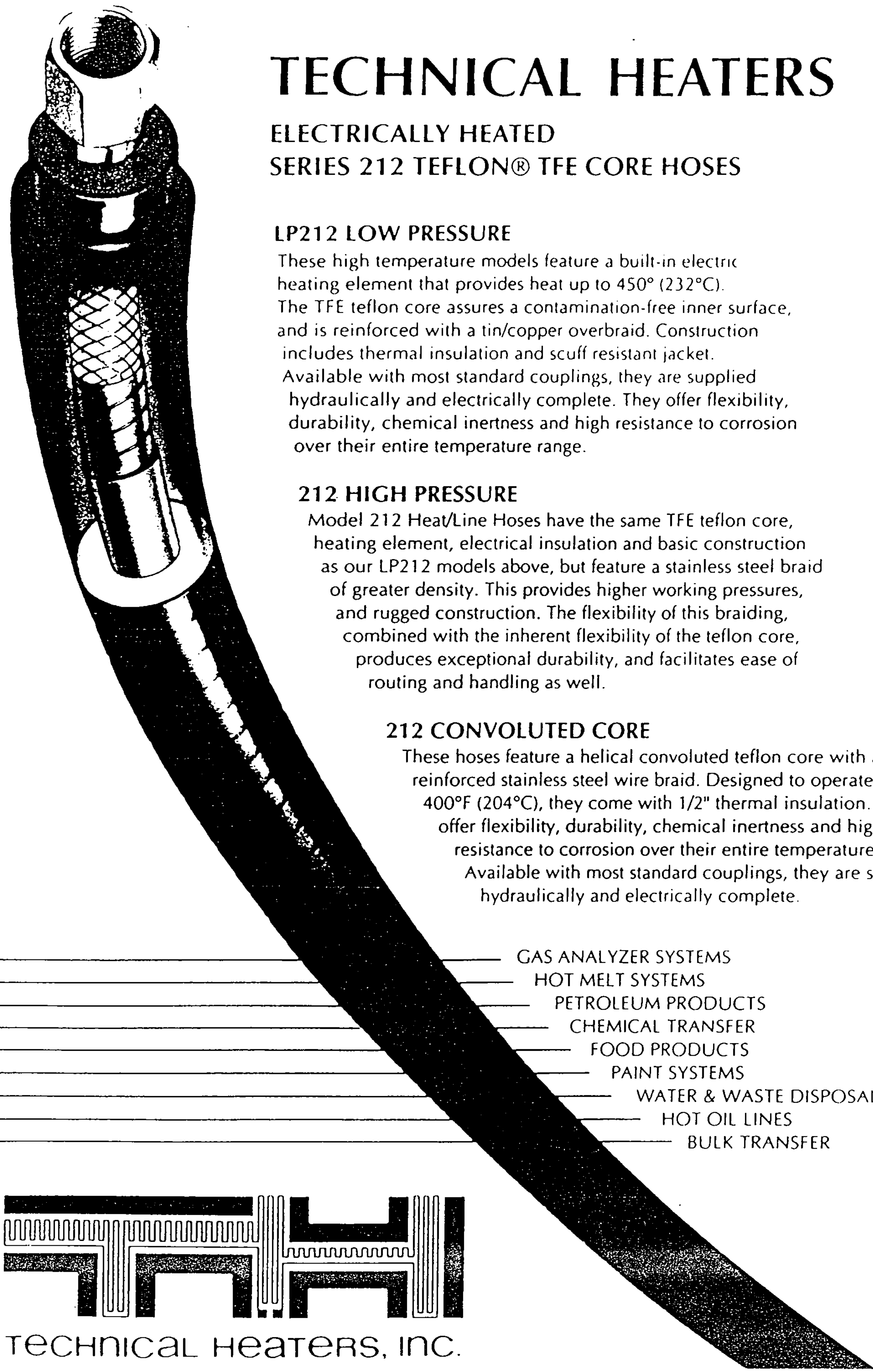
TE Thermo Environmental Instruments Inc.

Thermo Electron (U.K.) Ltd., Analytical Division, 830 Birchwood Blvd., Warrington, Cheshire, WA3 7QZ, ENGLAND / Telephone: 0925 / 81 36 00
Thermo Instrument Systems GMBH, Martenerstrasse 539, 4600 Dortmund 70, WEST GERMANY / Telephone: 231 / 6170 78
Thermo Instrument Systems BV, Heerbaan 220, 4817 Breda, HOLLAND / Telephone: 76 / 713717

8 West Forge Parkway
Franklin, MA 02038

(508) 520-0430
Telex: 200205 THEMO UR

FAX: (508) 520-1460



TECHNICAL HEATERS

ELECTRICALLY HEATED
SERIES 212 TEFLON® TFE CORE HOSES

LP212 LOW PRESSURE

These high temperature models feature a built-in electric heating element that provides heat up to 450° (232°C). The TFE teflon core assures a contamination-free inner surface, and is reinforced with a tin/copper overbraid. Construction includes thermal insulation and scuff resistant jacket. Available with most standard couplings, they are supplied hydraulically and electrically complete. They offer flexibility, durability, chemical inertness and high resistance to corrosion over their entire temperature range.

212 HIGH PRESSURE

Model 212 Heat/Line Hoses have the same TFE teflon core, heating element, electrical insulation and basic construction as our LP212 models above, but feature a stainless steel braid of greater density. This provides higher working pressures, and rugged construction. The flexibility of this braiding, combined with the inherent flexibility of the teflon core, produces exceptional durability, and facilitates ease of routing and handling as well.

212 CONVOLUTED CORE

These hoses feature a helical convoluted teflon core with a reinforced stainless steel wire braid. Designed to operate up to 400°F (204°C), they come with 1/2" thermal insulation. They offer flexibility, durability, chemical inertness and high resistance to corrosion over their entire temperature range. Available with most standard couplings, they are supplied hydraulically and electrically complete.

GAS ANALYZER SYSTEMS
HOT MELT SYSTEMS
PETROLEUM PRODUCTS
CHEMICAL TRANSFER
FOOD PRODUCTS
PAINT SYSTEMS
WATER & WASTE DISPOSAL
HOT OIL LINES
BULK TRANSFER

TECHNICAL HEATERS, INC.

® DuPont Trademark

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CERTIFICATE OF ANALYSIS – EPA PROTOCOL GAS MIX

CUSTOMER: General Welding Supply
TEST #: 32976
CERTIFICATION DATE: 10/20/93
CYLINDER #: CC4623
EXPIRATION DATE: 10/20/95
CYLINDER PRESSURE: 2000 PSI
REFERENCE #: 583779
LABORATORY: Special Gas ; Chatt, TN

ACTUAL MIXTURE COMPONENTS	ACTUAL MIXTURE CONCENTRATION	AIRCO INTERMEDIATE STANDARD	
		CYLINDER #	CONCENTRATION
SULFUR DIOXIDE	212 ppm	CC70209	491 PPM
NITRIC OXIDE	235 ppm	CC93818	515 PPM

BALANCE GAS: NITROGEN

COMPONENT 1 GAS ANALYSIS PROCEDURE NDIR
MAKE: ROSEMOUNT MODEL: 880A SERIAL: 20000541
LAST MULTIPOINT CALIBRATION DATE: 08/19/93

COMPONENT 1 GAS ANALYSIS PROCEDURE CHEMILUMINESCENT
MAKE: HORIBA MODEL: CLA-22A SERIAL: 592234122
LAST MULTIPOINT CALIBRATION DATE: 08/27/93

R = REFERENCE STANDARD Z = ZERO GAS S = SAMPLE GAS

1ST COMPONENT SULFUR DIOXIDE

1ST ANALYSIS: DATE: 09/26/93 ANALYST: BRAD PREWITT

1) Z	2.4	R	479.6	S	207.0	CONC (1)	212 PPM
2) R	483.0	Z	2.8	S	208.7	CONC (2)	212 PPM
3) R	483.6	S	207.1	Z	2.9	CONC (3)	210 PPM
						AVE CONC.	211 PPM

2ND ANALYSIS: DATE: 10/05/93 ANALYST: JOE STANLEY

1) Z	0	R	491	S	214	CONC (1)	214 PPM
2) R	490	Z	0	S	213	CONC (2)	213 PPM
3) R	490	S	213	Z	1	CONC (3)	213 PPM
						AVE CONC.	213 PPM

2ND COMPONENT NITRIC OXIDE

2ND ANALYSIS: DATE: 10/13/93 ANALYST: RANDY VINSON

1) Z	0.000	R	0.730	S	0.331	CONC (1)	234 PPM
2) R	0.731	Z	0.001	S	0.330	CONC (2)	232 PPM
3) R	0.726	S	0.332	Z	0.001	CONC (3)	236 PPM
						AVE CONC.	234 PPM

2ND ANALYSIS: DATE: 10/20/93 ANALYST: JOE STANLEY

1) Z	.002	R	.702	S	.323	CONC (1)	237 PPM
2) R	.702	Z	.002	S	.322	CONC (2)	236 PPM
3) R	.705	S	.323	Z	.001	CONC (3)	236 PPM
						AVE CONC.	236 PPM

THIS CALIBRATION STANDARD HAS BEEN CERTIFIED VERSUS EPA TRACEABILITY PROTOCOL NO. 1, PROCEDURE G1, AND ANALYSES PERFORMED PER SECTION 3.0.4.

CERTIFIED CONCENTRATION: SO2 212 PPM/ NO 235 PPM/ NOX 236 PPM/ N2 BALANCE

ANALYST Joe Stanley APPROVED BY: [signature]
LABORATORY MANAGER

BOC GASES
An operating unit of The BOC Group, Inc.

Union Landing & River Roads
P.O. Drawer No. 272
Riverton
New Jersey 08077
Telephone: Marketing; 609-829-7878
Prod. & Admin.; 609-829-7914
International; 609-829-7917

663680

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ANALYTICAL REPORT

To: General Welding Supply
3623 East Marginal Way, S
Seattle, WA 98124

Date Reported: 11-29-94
Test Number: 4C890
Fill Date: 11-22-94

Material Submitted: 150ppm CO,5%O2,15%CO2/N2

Specification Number:

Method of Analysis: Non-Dispersive Infrared Analyzer, Percent Oxygen Analyzer

Result of Investigation: Cylinder No. CC-18534

Component	Specification	Concentration
*Carbon Monoxide	150 ppm	150.2 ppm
**Oxygen	5%	5.03%
**Carbon Dioxide	15%	15.00%
Nitrogen	Balance	Balance

* Primary Standard Analytical Accuracy +/- 2.0% Relative
** Primary Standard Analytical Accuracy +/- 0.02% Absolute

By [signature]
Authorized Signature

FORM NO. 037-002

AIRCO

Certification of Analysis - EPA Protocol Gas
Performed According to Section 3.0.4

To: General Welding-Hansen

Expiration Date: 07/19/97
Customer P.O.: 323371/K.Hansen
Balance Gas: Nitrogen
CAS 7727-37-9

Certified Per Traceablity — Procedure # G1
Certified Accuracy 1% NIST — Protocol # 1

Test Number: 43086
Cylinder Number: CC-26790
Fill Date: 07/12/94
Cylinder Pressure: 2000 PSIG
Certification Date: 07/19/94
Location: Riverton, N.J.

Component	Certified Concentration	SRM No.	SRM Conc.	Cylinder Number	Serial Number	Analytical Procedure	Make	Model	Calibration Date
Propane	25.4 ppm	1667b	47.3 ppm	FF26970	3022A29265	Gas Chromatography	Hewlett-Pack	5890	05/02/94

Analytical Information — CAS 74-98-6

First Analysis — Analyst: A. Lattanze — Date: 07/19/94

Zero Gas	Reference Gas	Sample Gas	-- Concentration
000000	117613	63342	25.5 ppm
000000	118138	63421	25.4 ppm
000000	118663	63502	25.3 ppm
		Average-	25.4 ppm

Second Analysis — Analyst: A. Lattanze — Date: 07/19/94

Zero Gas	Reference Gas	Sample Gas	-- Concentration
000000	117647	63434	25.5 ppm
000000	118083	63392	25.4 ppm
000000	118519	63349	25.3 ppm
		Average-	25.4 ppm

This Calibration Standard has been Certified versus EPA Traceability Protocol # 1, Procedure G1, and Analysis performed per section 3.0.4
Certified Concentration: Balance = Nitrogen, Propane=25.4 ppm

APPROVED BY J. Lena
Laboratory Manager

EPA PROTOCOL

186

AIRCO

To: General Welding Supply

Expiration Date: 12/17/97
Customer P.O.: 397390
Balance Gas: Nitrogen
CAS 7727-37-9

Certification of Analysis - EPA Protocol Gas
Performed According to Section 3.0.4

Certified Per Traceablity Procedure # G1
Certified Accuracy 1% NIST Protocol # 1

Test Number: 4D318
Cylinder Number: CC-26883
Fill Date: 12/06/94
Cylinder Pressure: 2000 PSIG
Certification Date: 12/17/94
Location: Riverton, N.J.

Component	Certified Concentration	GMIS No.	GMIS Conc.	Cylinder Number	Analytical Information Serial Number	Analytical Procedure	Make	Model	CAS 630-08-0 Calibration Date
Carbon Monoxide	30.1 ppm	GMIS	50.3 ppm	CC-93519	48-46045-275	Non-dispersive Infrared	Thermo Envir	48	11/23/94

First Analysis Analyst: M. McAveety Date: 12/10/94

Zero Gas	Reference Gas	Sample Gas	-- Concentration
0000	4956	2970	30.1 ppm
0000	4949	2962	30.1 ppm
0000	4947	2966	30.2 ppm
		Average-	30.1 ppm

Second Analysis Analyst: M. McAveety Date: 12/17/94

Zero Gas	Reference Gas	Sample Gas	-- Concentration
0000	4970	2972	30.1 ppm
0000	4960	2972	30.1 ppm
0000	4962	2970	30.1 ppm
		Average-	30.1 ppm

This Calibration Standard has been Certified versus EPA Traceability Protocol # 1, Procedure G1, and Analysis performed per section 3.0.4
Certified Concentration: Balance = Nitrogen, Carbon Monoxide=30.1 ppm

APPROVED BY [signature]
Laboratory Manager

187

AIRCO

To: General Welding Supply

Expiration Date: 03/21/98
Customer P.O.: 449877/K.HANSEN
Balance Gas: Nitrogen
CAS 7727-37-9

Certification of Analysis - EPA Protocol Gas Performed According to Section 3.0.4

Certified Per Traceablity Procedure # G1
Certified Accuracy 1% NIST Protocol # 1

Test Number: 686881
Cylinder Number: CC40323
Fill Date: 03/16/95
Cylinder Pressure: 2000 PSIG
Certification Date: 03/21/95
Location: Royal Oak, M.I.

CAS 74-98-6

Component	Certified Concentration	SRM No.	SRM Conc.	Cylinder Number	Serial Number	Analytical Procedure	Make	Model	Calibration Date
Propane	50.2 ppm	2643a	99.1 ppm	SX20443	RAPID 4189	Flame Ionization Detector	Beckman	400	03/08/95

First Analysis Analyst: M. Kelley Date: 03/21/95

Zero Gas	Reference Gas	Sample Gas	-- Concentration
00.0	99.1	50.2	50.2 ppm
00.0	99.1	50.1	50.1 ppm
00.0	99.1	50.2	50.2 ppm
		Average-	50.2 ppm

Second Analysis Analyst: M. Kelley Date: 03/21/95

Zero Gas	Reference Gas	Sample Gas	-- Concentration
00.0	99.1	50.2	50.2 ppm
00.0	99.1	50.2	50.2 ppm
00.0	99.1	50.2	50.2 ppm
		Average-	50.2 ppm

This Calibration Standard has been Certified versus EPA Traceability Protocol # 1, Procedure G1, and Analysis performed per section 3.0.4
Certified Concentration: Balance = Nitrogen, Propane=50.2 ppm

APPROVED BY M. Kelley
Laboratory Manager

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AIRCO

To: General Welding Supply

Expiration Date: 03/21/98
Customer P.O.: 449877/K.HANSEN
Balance Gas: Nitrogen
CAS 7727-37-9

Certification of Analysis - EPA Protocol Gas
Performed According to Section 3.0.4

Certified Per Traceablity Procedure # G1
Certified Accuracy 1% NIST Protocol # 1

Test Number: 686881
Cylinder Number: CC40367
Fill Date: 03/16/95
Cylinder Pressure: 2000 PSIG
Certification Date: 03/21/95
Location: Royal Oak, M.I.

Component	Certified Concentration	SRM No.	SRM Conc.	Cylinder Number	Serial Number	Analytical Procedure	Make	Model	Calibration Date
Propane	50.2 ppm	2643a	99.1 ppm	SX20443	RAPID 4189	Flame Ionization Detector	Beckman	400	03/08/95

Analytical Information — CAS 74-98-6

First Analysis — Analyst: M. Kelley — Date: 03/21/95

Zero Gas	Reference Gas	Sample Gas	-- Concentration
00.0	99.1	50.1	50.1 ppm
00.0	99.1	50.1	50.1 ppm
00.0	99.1	50.2	50.2 ppm
		Average-	50.1 ppm

Second Analysis — Analyst: M. Kelley — Date: 03/21/95

Zero Gas	Reference Gas	Sample Gas	-- Concentration
00.0	99.1	50.2	50.2 ppm
00.0	99.1	50.2	50.2 ppm
00.0	99.1	50.2	50.2 ppm
		Average-	50.2 ppm

This Calibration Standard has been Certified versus EPA Traceability Protocol # 1, Procedure G1, and Analysis performed per section 3.0.4
Certified Concentration: Balance = Nitrogen, Propane=50.2 ppm

APPROVED BY M. Kelley
Laboratory Manager

189

AIRCO

To: General Welding Supply

Expiration Date: 12/20/96
Customer P.O.: 397390
Balance Gas: Nitrogen
CAS 7727-37-9

Certification of Analysis - EPA Protocol Gas
Performed According to Section 3.0.4

Certified Per Traceablity   Procedure # G1
Certified Accuracy 1% NIST   Protocol # 1

Test Number: 4D315
Cylinder Number: CC-61958
Fill Date: 12/07/94
Cylinder Pressure: 2000 PSIG
Certification Date: 12/20/94
Location: Riverton, N.J.

Component	Certified Concentration	GMIS No.	GMIS Conc.	Cylinder Number	Serial Number	Analytical Procedure	Make	Model	Calibration Date
					Analytical Information				CAS 7446-09-5
Sulfur Dioxide	89.7 ppm	GMIS	102.3 ppm	CC-10444	93-721m-7998-3	Non-dispersive Ultraviolet	Bovar	721m	11/23/94

First Analysis   Analyst: M. McAveety   Date: 12/13/94

Zero Gas	Reference Gas	Sample Gas	-- Concentration
0000	1015	891	89.8 ppm
0000	1015	891	89.8 ppm
0000	1015	891	89.8 ppm
		Average-	89.8 ppm

Second Analysis   Analyst: M. McAveety   Date: 12/20/94

Zero Gas	Reference Gas	Sample Gas	-- Concentration
0000	1004	881	89.8 ppm
0000	1007	880	89.4 ppm
0000	1006	881	89.6 ppm
		Average-	89.6 ppm

Component	Certified Concentration	GMIS No.	GMIS Conc.	Cylinder Number	Serial Number	Analytical Procedure	Make	Model	Calibration Date
					Analytical Information				CAS 10102-43-9
Nitric Oxide	89.8 ppm	GMIS	83.9 ppm	CC-22429	42H-46156-275K	Chemiluminescence	TECO	42H	11/23/94

First Analysis   Analyst: M. McAveety   Date: 12/13/94

Zero Gas	Reference Gas	Sample Gas	-- Concentration
000	834	895	90.0 ppm
000	834	895	90.0 ppm
000	834	895	90.0 ppm
		Average-	90.0 ppm

Second Analysis   Analyst: M. McAveety   Date: 12/20/94

Zero Gas	Reference Gas	Sample Gas	-- Concentration
000	841	898	89.6 ppm
000	842	899	89.6 ppm
000	841	898	89.6 ppm
		Average-	89.6 ppm

This Calibration Standard has been Certified versus EPA Traceability Protocol # 1, Procedure G1, and Analysis performed per section 3.0.4
Certified Concentration: Balance = Nitrogen, Sulfur Dioxide=89.7 ppm, Nitric Oxide=89.8 ppm
NOx = 89.8 ppm

APPROVED BY J. Long
Laboratory Manager

EPA

190

BOC GASES
An operating unit of The BOC Group, Inc

Union Landing & River Roads
P.O. Drawer No. 272
Riverton
New Jersey 08077
Telephone: Marketing; 609-829-7878
Prod. & Admin.; 609-829-7914
International; 609-829-7917

663680

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ANALYTICAL REPORT

To: General Welding Supply
3623 E. Marginal Way So.
Seattle, WA 98134

Date Reported: 12-12-94
Test Number: 4C889
Fill Date: 11-23-94

Material Submitted: 600ppm CO,10%O2,12%CO2/N2

Specification Number: Primary Standard

Method of Analysis: Non-Dispersive Infrared Analyzer, Percent Oxygen Analyzer

Result of Investigation: Cylinder No. CC-74240

Component	Specification	Concentration
* Carbon Monoxide	600 ppm	593 ppm
** Oxygen	10%	9.94%
** Carbon Dioxide	12%	11.90%
Nitrogen	Balance	Balance

* Primary Standard Analytical Accuracy +/- 2.0% Relative
** Primary Standard Analytical Accuracy +/- 0.02% Absolute

By JLong
Authorized Signature

FORM NO. 037-002

AIRCO

To: General Welding Supply

Expiration Date: 01/26/97
Customer P.O.: 415353 K.HANSEN
Balance Gas: Nitrogen
CAS 7727-37-9

Certification of Analysis - EPA Protocol Gas
Performed According to Section 3.0.4

Certified Per Traceablity Procedure # G1
Certified Accuracy 1% NIST Protocol # 1

Test Number: 673622
Cylinder Number: CC94990
Fill Date: 01/11/95
Cylinder Pressure: 2000 PSIG
Certification Date: 01/26/95
Location: Royal Oak, M.I.

CAS 10102-43-9

Component	Certified Concentration	SRM No.	SRM Conc.	Cylinder Number	Serial Number	Analytical Procedure	Make	Model	Calibration Date
Nitric Oxide	25.22 ppm	2629a	19.40 ppm	CLM003287	611818	Chemiluminescence	Beckman	951a	01/18/95

First Analysis — Analyst: L. Cosey — Date: 01/18/95

Zero Gas	Reference Gas	Sample Gas	-- Concentration
-00.3	70.2	91.2	25.18 ppm
-00.3	70.3	91.2	25.14 ppm
-00.3	70.0	91.0	25.20 ppm
		Average-	25.17 ppm

Second Analysis — Analyst: L. Cosey — Date: 01/26/95

Zero Gas	Reference Gas	Sample Gas	-- Concentration
00.0	70.9	92.1	25.20 ppm
00.0	70.8	92.6	25.37 ppm
00.4	71.3	92.6	25.28 ppm
		Average-	25.28 ppm

This Calibration Standard has been Certified versus EPA Traceability Protocol # 1, Procedure G1, and Analysis performed per section 3.0.4
Certified Concentration: Balance = Nitrogen, Nitric Oxide = 25.22 ppm
NOX=25.40PPM

APPROVED BY M. Kelley
Laboratory Manager

EPA PROTOCOL

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AIRCO

Certification of Analysis - EPA Protocol Gas Performed According to Section 3.0.4

To: General Welding Supply

Expiration Date: 12/17/97
Customer P.O.: 397390
Balance Gas: Nitrogen
CAS 7727-37-9

Certified Per Traceablity Procedure # G1
Certified Accuracy 1% NIST Protocol # 1

Test Number: 4D317
Cylinder Number: CC-97420
Fill Date: 12/06/94
Cylinder Pressure: 2000 PSIG
Certification Date: 12/17/94
Location: Riverton, N.J.

CAS 630-08-0

Component	Certified Concentration	GMIS No.	GMIS Conc.	Cylinder Number	Serial Number	Analytical Procedure	Make	Model	Calibration Date
					Analytical Information				
Carbon Monoxide	60.8 ppm	GMIS	50.3 ppm	CC-93519	48-46045-275	Non-dispersive Infrared	Thermo Envir	48	11/23/94

First Analysis — Analyst: M. McAveety — Date: 12/10/94

Zero Gas	Reference Gas	Sample Gas	-- Concentration
0000	4956	5977	60.7 ppm
0000	4949	5996	60.9 ppm
0000	4947	5988	60.9 ppm
		Average-	60.8 ppm

Second Analysis — Analyst: M. McAveety — Date: 12/17/94

Zero Gas	Reference Gas	Sample Gas	-- Concentration
0000	4970	5990	60.6 ppm
0000	4960	6008	60.9 ppm
0000	4962	5986	60.7 ppm
		Average-	60.7 ppm

This Calibration Standard has been Certified versus EPA Traceability Protocol # 1, Procedure G1, and Analysis performed per section 3.0.4
Certified Concentration: Balance = Nitrogen, Carbon Monoxide=60.8 ppm

APPROVED BY J Long
Laboratory Manager

EPA PROTO

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A410-03

AMTEST
AIR QUALITY, INC.

RESUME OF
DOUGLAS M. ALBERTSON

SENIOR AIR QUALITY SPECIALIST

EDUCATION

- B.A., Bioscience, California State University at Stanislaus, 1971
- Professional training courses and specialty conferences

PROFESSIONAL MEMBERSHIPS

- Air and Waste Management Association (AWMA)
- Pacific Northwest International Section of AWMA (PNWIS)

PROFESSIONAL EXPERIENCE

Mr. Albertson has worked with Am Test-Air Quality Inc. for the past year. He has over 20 years experience in environmental research, including process modification, equipment design, permitting, analytical testing, and plant start-up. Mr. Albertson manages Am Test-Air Quality's Coeur d'Alene, Idaho office. He has had extensive experience in all aspects of source testing, project management and technical review of emission reports.

From 1972 to 1982, Mr. Albertson was the co-founder of Chemecology Corporation, an analytical laboratory which specialized in all facets of environmental testing. He was responsible for the identification and solution of environmental problems on combustion sources fired with coal, crude oil, natural gas and a wide variety of biomass. Mr. Albertson organized research projects and managed data collection teams throughout the United States, Europe and Japan.

From 1983 to 1993, Mr. Albertson was employed by Energy Products, Inc. of Coeur d'Alene, Idaho, as an Environmental and Special Projects Manager. His responsibilities included development of equipment and procedures to analyze and minimize emissions from full scale combustors and gasifiers fired with conventional and experimental fuels. In this position, Mr. Albertson derived full scale operating conditions and process flow for full scale facilities based on mass/energy balance from pilot research, developed emissions factors and projections to be used for environmental permit operations, and provided technical support for marketing, sales and engineering staff. He designed, built and operated a continuous emission monitoring system (CEMS) for monitoring process emissions. Mr. Albertson authored over 30 research reports in fluid bed combustion and gasification. In the 10 years Mr. Albertson was employed at EPI, several of his reports were published in national publications. A sample of Mr. Albertson's technical papers follows:

"Emissions From Fluid Bed Combustion of High Ash Cotton Stalks", IGT Conference, New Orleans, Louisiana, February 1988.

"Design Characteristics of a 12 MW AFB Power Station Firing Agricultural Wastes", American Society of Mechanical Engineers, San Francisco, California, April 1989.

"Modifications to Fluid Bed Boiler Design Based on NO_x Reduction Experience", American Society of Mechanical Engineers, Dallas, Texas, October 1989

AMTEST
AIR QUALITY, INC.

RESUME OF
AARON C. PORTER

AIR QUALITY SPECIALIST

EDUCATION

- B.S. in Biology, Oregon State University
  Minor in Environmental Health, 1992
- Washington State Department of Ecology Plume Evaluation Training, 1992.
- Graseby/Anderson Stack Sampling and Particle Sizing Seminar, December 1992

PROFESSIONAL MEMBERSHIPS

- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

Mr. Porter was recently hired by Am Test-Air Quality, Inc. (August 1994). He conducts source emission testing and activities related to source emission testing, including field sampling, test equipment maintenance and calibration, test planning and preparation, and data reduction and evaluation. In the laboratory and office, he performs test equipment trouble-shooting, maintenance, fabrication, and calibration. He helps keep the Air Quality shop and mobile laboratories organized and stocked with the necessary sampling supplies and parts.

Mr. Porter is experienced at performing the following test methods: EPA Methods 1, 2, 3A, 4, 5, 8, 12, 13B, 17, 23, 26A, 29 (multiple metals sampling), 101A, semi-volatile organic compound sampling (including dioxins and furans), volatile organic compound testing by TO-14, particle size distribution, continuous emission monitoring systems certifications, and other miscellaneous EPA methodology.

Prior to his position with Am Test, Mr. Porter was an air quality and laboratory technician for Vanalco Inc. in Vancouver, Washington for 2 years. He performed periodic source testing of plant emissions, vegetation sampling, and reviewed meteorological data, as well as oversaw quality assurance and quality control programs and prepared monthly emission reports. Prior to his position at Vanalco, Aaron worked as an intern for 2 summers at Boise Cascade's Wallula, Washington mill performing monthly source tests on eight stacks, operating a met station, collecting well water and pond samples and testing pulp.

AMTEST
AIR QUALITY, INC.

RESUME OF JUDITH A. AASLAND

SENIOR TECHNICAL WRITER

EDUCATION

- Coursework partially completed towards B.S., Business Administration Washington State University, 1982-1984
- Continuous Emission Monitoring System (CEMS) Workshop, taught by Dr. James Jahnke, April 1993.
- Enhanced Monitoring Workshop, May 1994

PROFESSIONAL EXPERIENCE

Ms. Aasland has worked for Am Test-Air Quality, Inc. for the past 4 years and has had 7 years of experience in providing administrative support in the environmental industry. In the office, Ms. Aasland assists with project coordination, performs data reduction, data review and report preparation for the senior reviewers. She also assists in word processing of proposals and test plans and performs numerous administrative duties to keep the air quality office organized and operating efficiently.

Prior to joining Am Test-Air Quality, Inc., Ms. Aasland was an Office Manager for Am Test, Inc.'s Redmond laboratory for 3 years. In this position, Ms. Aasland coordinated office support personnel in report and invoice generation and provided administrative support services to the General Manager.

Prior to her employment at Am Test, Ms. Aasland worked for several small businesspersons as an Office Manager for 3 years. In this position, Ms. Aasland provided word processing, full-charge bookkeeping and personnel support services for each businessperson.

AMTEST
AIR QUALITY, INC.

RESUME OF
STACY AKIN

PROJECT ASSISTANT/TECHNICAL WRITER

EDUCATION

- B.S., Marine Biology, Roger Williams University, Bristol, Rhode Island, 1992

PROFESSIONAL EXPERIENCE

Ms. Akin began her employment with Am Test-Air Quality, Inc. in September 1993. She is responsible for pre-field preparation for air quality projects and preparation of sample trains, glassware, labware and sampling hardware to be used on each specific project. In the field, Ms. Akin has acted as a Project Assistant, assisting the Project Manager, Project Engineer, or Project Leader in setting up the equipment at each sample site, performing tests and recording data, recovering the samples after each test, performing any in-field analysis, and in demobilizing. When working in the field, she is responsible for properly labeling and identifying each sample, and initiating chain-of-custody procedures.

In the laboratory, Ms. Akin is experienced in gravimetric analysis of particulate matter samples and particle size distribution samples. She assists in preparation and analysis of samples for quantifying sulfur oxides, reduced sulfur compounds, toxic metals (including hexavalent chromium), semi-volatile compounds (including dioxins and furans), and volatile organic compounds.

In the office, Ms. Akin reduces the field data and inputs values into data reduction programs and performs by-hand calculations to verify computer program integrity.

Prior to her employment with Am Test, Ms. Akin worked in a large ophthalmology clinic as a receptionist and assistant bookkeeper. Her responsibilities included daily record keeping for the optical shop as well as monthly patient and insurance billings.

AMTEST
AIR QUALITY, INC.

RESUME OF
ANNIKA M. WOEHR

PROJECT ASSISTANT/TECHNICAL WRITER

EDUCATION

- B.S., Biology, Florida Atlantic University, Boca Raton, Florida, 1992, emphasis in Marine Biology

PROFESSIONAL EXPERIENCE

Ms. Woehr began her employment with Am Test-Air Quality, Inc. in June 1994. She has been responsible for pre-field preparation for air quality projects and preparation of sample trains, glassware, labware and sampling hardware to be used on each specific project. In the field, Ms. Woehr has acted as a Project Assistant, assisting the Project Manager, Project Engineer, or Project Leader in setting up the equipment at each sample site, performing tests and recording data, recovering the samples after each test, performing any in-field analysis, and in demobilizing. When working in the field, she is responsible for properly labeling and identifying each sample, and initiating chain-of-custody procedures.

In the laboratory, Ms. Woehr is experienced in gravimetric analysis of particulate matter samples and particle size distribution samples. She assists in preparation and analysis of samples for quantifying sulfur oxides, reduced sulfur compounds, toxic metals (including hexavalent chromium), semi-volatile compounds (including dioxins and furans), and volatile organic compounds.

In the office, Ms. Woehr reduces the field data and inputs values into data reduction programs and performs by-hand calculations to verify computer program integrity.

Prior to joining Am Test, Annika worked through an employment agency for a coastal management firm restoring and building up sand dunes on beaches in Florida using native and endangered plants. She worked as a teacher assistant, office assistant, research assistant while attending Florida Atlantic University. One project involved maintaining sea turtle tanks in a laboratory. She also spent a summer working as a secretary in Geneva, Switzerland.

AMTEST
AIR QUALITY, INC.

RESUME OF
JEANNE THOMPSON

CHEMIST

EDUCATION

- B.S., Environmental Science, Minor in Chemistry, Huxley College of Environmental Science, Western Washington University, Bellingham, Washington, 1994

PROFESSIONAL EXPERIENCE

Ms. Thompson began her employment with Am Test-Air Quality, Inc. in January of 1995. She is responsible for pre-field preparation for air quality projects and preparation of sample trains, glassware, labware and sampling hardware to be used on each specific project. In the field, Ms. Thompson has acted as a Project Assistant, assisting the Project Manager, Project Engineer, or Project Leader in setting up the equipment at each sample site, performing tests and recording data, recovering the samples after each test, performing any in-field analysis, and in demobilizing. When working in the field, she is responsible for properly labeling and identifying each sample, and initiating chain-of-custody procedures.

In the laboratory, Ms. Thompson is experienced in gravimetric analysis of particulate matter samples and particle size distribution samples. She assists in preparation and analysis of samples for quantifying sulfur oxides, reduced sulfur compounds, toxic metals (including hexavalent chromium), semi-volatile compounds (including dioxins and furans), and volatile organic compounds. Ms. Thompson is also experienced in utilizing titration techniques to quantify emissions of chlorine, chlorine dioxide and hydrogen sulfide.

In the office, Ms. Thompson reduces the field data and inputs values into data reduction programs and performs by-hand calculations to verify computer program integrity.

Prior to accepting a position at Am Test, Ms. Thompson worked through an employment agency, Lab Temps of Bellevue, Washington. She interned as a Water Quality Intern in 1994 for the Washington State University (WSU) Extension and Research Station in Long Beach, Washington. In this position Ms. Thompson sampled and tested numerous water quality parameters on irrigation ponds. She also developed a method to flocculate organic material and lower the iron content of the water column. In 1993, Ms. Thompson interned as a Laboratory Assistant for Western Washington University's (WWU) chemistry department. In this position, Ms. Thompson assisted the professor with the organic chemistry lab and classroom. In 1991, Ms. Thompson was employed by ICOS Corporation in Bothell, Washington as a Lab Technician. Her responsibilities in this position included the preparation of growth media and chemical reagents for biotech labs using sterile method as well as the cleaning, sterilization, stocking and inventory maintenance for all labs.

AMTEST
AIR QUALITY, INC.

RESUME OF
SARA E. PRESCOTT

TECHNICAL WRITER

EDUCATION

- B.S., Biology, California State University, Los Angeles, California, 1992
- M.S., Environmental Science, Western Washington University, Bellingham, Washington, in progress

PROFESSIONAL MEMBERSHIPS

- Air and Waste Management Association (A&WMA)
- Pacific Northwest International Section of A&WMA (PNWIS)
- American Society of Limnology and Oceanography (ASLO)

PROFESSIONAL EXPERIENCE

Ms. Prescott began her employment with Am Test-Air Quality, Inc. in January 1995. In the office, Ms. Prescott reduces field data and inputs values into data reduction programs and performs by-hand calculations to verify computer program integrity. She will also be trained to perform technical writing of source test reports.

In the laboratory, Ms. Prescott is experienced in gravimetric analysis of particulate matter samples and particle size distribution samples and solvent extractions.

At the present time Ms. Prescott is continuing research on her Master's thesis on the life cycle of *Cancer magister* (Dungeness Crab) and the effects of anthropogenic hydrocarbons on early life stages. She presented her hydrocarbon research on the Dungeness crab at the 1994 ASLO annual meeting. Prior to her employment with Am Test, Ms. Prescott interned at the Puget Sound Air Pollution Control Agency (PSAPCA) to develop a compendium of air quality research in the Puget Sound area. At PSAPCA she also collected and compiled data on yardwaste and garbage burning to obtain data for PM_{10} and CO emissions inventories. In 1994, Ms. Prescott worked as the bacteriologist for Dean's Frozen Foods in Bellingham, Washington. In 1992 and 1993, Ms. Prescott worked as a research assistant and teacher's assistant at the Shannon Point Marine Center in Anacortes, Washington. In 1992, Ms. Prescott also served as a consultant to the City of Anacortes. In 1990 and 1991, Ms. Prescott research assistant at the University of Washington Marine Science Laboratory in Friday Harbor, Washington and the University of Southern California Marine Center on Catalina Island. Earlier biomedical research (1988-1990) resulted in publication in the scientific community.

AMTEST
AIR QUALITY, INC.

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Office: (206) 222-7746
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AM TEST-AIR QUALITY, INC.
CAPABILITIES

Am Test-Air Quality, Inc. is an independent company providing comprehensive air pollution testing services to industry and government. Am Test, Inc.'s Air Quality Division was developed in 1982 by Mr. Kris A. Hansen. On January 1, 1991, the Air Quality Division incorporated as a separate company named Am Test-Air Quality, Inc. Am Test-Air Quality's main office and laboratory facility is located in Preston, Washington. The Preston office employs a staff of 20 qualified, experienced engineers, chemists and scientists. In January 1993, Am Test-Air Quality, Inc. opened a branch office, Am Test Alaska in Anchorage, Alaska in order to better serve our many Alaskan clients. One aspect of the testing services provided by Am Test-Air Quality, Inc., which we feel is unsurpassed by other testing firms, is the quality and experience of our personnel. We utilize highly experienced, motivated personnel on all projects. We believe that the success of a project is dependent on the use of state-of-the-art equipment and experienced, knowledgeable personnel. We have performed source testing projects of all different sizes and difficulty levels. Typically, we dispatch test teams of one to ten individuals. On all projects, our attention to detail remains extremely high.

Am Test-Air Quality, Inc. performs source testing projects at all types of facilities throughout the United States and Canada. Some of the types of facilities tested include:

- Oil and Gas Refineries
- Pulp and Paper Mills
- Gas, Oil, Wood, Coal and Nuclear-Fired Power Plants
- Chemical Plants
- Aluminum Reduction Facilities
- Wood Products Industries
- Smelters
- Cement Kilns
- Hazardous Waste Incinerators
- Municipal and Medical Waste Combustors
- Landfill Gas Flares
- Wastewater and Sewage Treatment Facilities
- Coating and Finishing Facilities
- Manufacturers
- Superfund Clean-Up Sites
- Asphalt Plants

AMTEST
AIR QUALITY, INC.

CONTINUOUS EMISSION MONITORING SYSTEMS AND INSTRUMENTAL TESTING SERVICES

Am Test-Air Quality, Inc. has two (2) complete continuous emission monitor (CEM) instrument vans and a separate set of instruments which can be shipped to remote locations. We maintain an inventory of approximately 80 EPA Protocol 1 (or best available grade) certified calibration gas mixtures to tailor calibrations gases to each source. Each mobile laboratory is equipped with:

- O_2, CO_2, SO_2, NO_x, and CO analyzers
- Total hydrocarbon (THC) and non-methane hydrocarbon (NMHC) analyzers
- PC-based data acquisition systems for collecting and reducing data to provide on-site results
- Cylinder racks for calibration gases
- Heated or unheated Teflon sample transport lines
- Sample extraction systems, including sample probes, fine particulate filters, moisture removal systems, and Teflon lined sample pumps
- Laboratory bench space which can be equipped with analytical balances, wet chemical analysis equipment and instrumental methods, including gas chromatography

Am Test-Air Quality, Inc.'s mobile laboratories are used to perform New Source Performance Standards (NSPS) testing and to conduct continuous emission monitoring system (CEMS) performance specification testing and audits. We provide a variety of CEMS services, including:

- Performance Specification Tests (PST)
- Relative Accuracy Test Audits (RATA)
- Relative Accuracy Audits (RAA)
- Cylinder Gas Audits (CGA)
- Quality Assurance Plans (QAP)

In addition, Am Test-Air Quality, Inc.'s senior level staff are extremely knowledgeable in the field of CEMS and can assist in monitor selection, calibration gas selection, stratification testing to locate CEMS probes, sampling system troubleshooting, and act as a liaison with the regulatory agency.

AMTEST
AIR QUALITY, INC.

MANUAL EMISSIONS TESTING SERVICES

Am Test-Air Quality, Inc. performs all recognized EPA source test methods for many types of industries. We also perform NIOSH methods, BIF Regulation methods, SW-846 methods, toxic organic (TO) methods and are experienced at developing test methods for specialized applications where published methods do not exist. Am Test personnel keep current on new method development by attending training courses and utilizing the EMTIC bulletin board system (BBS). A partial list of pollutants measured using manual test methods follows:

- Particulate Matter
- Particle Size Distribution
- Sulfur Oxides
- Nitrogen Oxides
- Opacity Measurement
- Carbon Monoxide and Fixed Gases
- Hydrogen Sulfide
- Multi-Metals
  - Hexavalent Chromium
  - ICP Metals
  - Low-Level Mercury
- Particulate and Gaseous Fluoride
- Total Reduced Sulfur Compounds
- Volatile Organic Compounds
  - 8240 list of VOCs
  - Alcohols and Acetates
  - BTEX
  - Formaldehyde/Aldehydes
- Semi-Volatile Organic Compounds
  - Dioxin and Furan Isomers
  - PAHs
  - BNAs
  - PCBs
  - Pesticides and Herbicides
- Acid Gases
  - Hydrochloric Acid
  - Hydrofluoric Acid
  - Nitric Acid
  - Sulfuric Acid
- Chlorine, Chlorine Dioxide and Chloroform
- Ammonia and Urea
- Radionucleides
- Hazardous Air Pollutants (HAPs)

AMTEST AIR QUALITY, INC.

Examples of the types of projects Am Test-Air Quality, Inc. becomes involved in include:

- Regulatory compliance with NSPS, MACT, BIF requirements
- Continuous emission monitoring system (CEMS) certifications
- Enhanced monitor certifications (CEMS, CRMS, CPMS)
- Emission inventories for MACT, NESHAP, SARA Title III and SIP determinations
- Air pollution control equipment warranty/guarantee/design testing
- Combustion or control device optimization
- Air toxics studies for hazardous air pollutants (HAPs)
- Particle size distribution studies (PM_{10})
- Soil remediation unit evaluations
- Vapor recovery system efficiency evaluations
- Destruction/capture efficiency studies
- Ammonia slip evaluations
- Pilot plant or engineering-scale trial burns
- Hands-on stack sampling training workshops
- Industry-agency liaison

AM TEST LABORATORY

AmTest, Inc. is a full service analytical testing laboratory located in Redmond, Washington. It was organized to provide the highest caliber laboratory testing of environmental and industrial samples. Experienced environmental chemists and microbiologists have the best available equipment at their disposal. Experienced personnel, top-notch instrumentation, and a personal interest in your testing requirements assures:

- **Quick turnaround time for sample analysis**
- **Maximum quality control on projects**
- **Direct dialogue with the analytical staff**
- **Reasonable rates**

AmTest's laboratory is departmentalized into the following disciplines:

AIR QUALITY	**Source and Ambient Testing**
ENVIRONMENTAL	**Water, Wastes, Tissue, Vegetation**
INDUSTRIAL	**Food, Materials Testing, Industrial Hygiene, Special Projects**
OIL AND FUELS	**Lubricating Oil, Fuel Analysis, Hydraulics, Contamination Analysis**
TRACE ORGANICS	**PCB's, Pesticides, Hazardous Wastes, Priority Pollutants**
MICROBIOLOGY	**Water, Wells, Food, Product Evaluation**

AmTest's laboratory utilizes the following instrumentation:

Finnigan Incos 50 GC/MS	Atomic Absorption Spectrometer-Flame
Jarrell Ash ICP Plasma Emission Spectrometer	Atomic Absorption Spectrometer-Graphite Furnace
Gas Chromatographs: FID, EC, TC, N_2, P	Atomic Absorption Spectrometer-Hydride Generation
Jarrell Ash Arc, Spark Emission Spectrometer	UV/Visible Spectrometer
Xertex TOX Analyzer	Infrared Spectrometer
Source Test Equipment-EPA Approved	High Performance Liquid Chromatograph

AmTest is one laboratory in a group of laboratories serving the West. Other facilities include:

AmTest, Inc., Portland, Oregon
AmTest of Arizona, Phoenix, Arizona
Can Test Ltd., Vancouver, B.C.
Loring Laboratories, Calgary, Alberta
Metropolitan Clinical Laboratories, Ltd., Vancouver, B.C.

Phone Mr. Shawn Moore, General Manager or Mr. Mark Fugiel, Technical Director, at (206)885-1664 for more details or a price quotation.