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SOURCE
EMISSION
EVALUATION

July 21, 1995

Prepared For:

Am - 55 + 6 95

LOUISIANA-PACIFIC CORPORATION
ORIENTED STRANDBOARD FACILITY
FUEL DRYER E-TUBE STACK
MONTROSE, COLORADO
JUNE 15, 1995

Submitted by:

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

[jwa\c:\w\r\louispac: job #95-097]

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1.0

INTRODUCTION

The purpose of this source emission evaluation was to quantify emissions of particulate and condensible matter at the fuel dryer E-tube exhaust stack at Louisiana-Pacific Corporation's oriented strandboard (OSB) facility located in Montrose, Colorado. This testing was conducted to demonstrate compliance with the Colorado Department of Public Health and Environment permit requirements. Louisiana-Pacific Corporation contracted Am Test-Air Quality, Inc. based in Preston, Washington to conduct these source tests.

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 and 5, and in Title 40 CFR Parts 1-51 (40 CFR 51), Appendix M, Method 202. Methods 1 and 2 were performed to measure the stack gas temperature and velocity for calculating volumetric flow rate. Method 3A was performed to determine the molecular weight of the stack gas based on measurements of the oxygen (O_2) and carbon dioxide (CO_2) concentration in the stack gas. Method 4 was performed to measure the moisture content of the stack gas. Method 5 and Method 202 were performed to quantify particulate and condensible matter emissions. The Colorado Department of Public Health and Environment requires that the condensible particulate matter present in the gas stream be quantified by performing an extraction of the back-half portion of the Method 5 sample train. Three (3) Method 1, 2, 3A, 4 and 5/202 samples were collected at the dryer E-tube stack on June 15, 1995.

Mr. Stanley B. Moye of Am Test-Air Quality, Inc. performed the field sampling and in-field sample recovery. Gravimetric laboratory analysis of the Method 5 samples was performed by Ms. Stacy Akin and Ms. Jeanne M. Thompson of Am Test. Data reduction, quality assurance review and final report preparation were performed by Mr. Kris A. Hansen, Ms. Angela F. Blaisdell, Ms. Jan W. Alden, Ms. Annika M. Woehr and Ms. Cassie B. Heaton of Am Test-Air Quality, Inc. This testing program was coordinated by Ms. Susan Somers and Mr. Keith Seelig of Louisiana-Pacific Corporation who also provided process data. Ms. Susan Busch of the Colorado Department of Public Health and Environment observed the testing. Steve Jaasund of Geoenergy, the control equipment vendor, was also present during the tests.

2.0

SUMMARY OF RESULTS

The following section of this report presents results from the particulate matter testing performed at the dryer E-tube stack. Refer to the Table of Contents to locate specific information for each test. The summary tables in this section contain information obtained from computer printouts for each individual run which are included in Appendix A of this report. Appendix B of this report contains example calculations of results and copies of the original field data sheets. Appendix C of this report contains process data. Appendix D of this report contains miscellaneous supporting information.

The results of the three (3) 60-minute Method 5/202 tests for quantifying particulate and condensible matter emissions at the dryer E-tube stack are summarized in Table 2.0 below, and on the following computer printout titled "Summary of Results - Methods 1, 2, 3A, 4 and 5/202."

Table 2.0. Summary of particulate matter emission test results from samples collected on June 15, 1995 at the dryer E-tube stack at Louisiana-Pacific Corporation's facility in Montrose, Colorado.

Sample Run #	Front-half P.M. Emission Conc. (gr/dscf)	Back-half P.M. Emission Conc. (gr/dscf)	Total P.M. Emission Conc. (gr/dscf)	Total P.M. Emission Rate (lb/hr)
1	0.003	0.008	0.010	3.10
2	0.003	0.006	0.010	2.96
3	0.002	0.012	0.013	3.93
Average	0.003	0.009	0.011	3.33

The front-half, back-half and total particulate matter emission concentrations were calculated in units of grains per dry standard cubic foot (gr/dscf) and milligrams per dry standard cubic meter (mg/dscm). The total particulate matter emission rates were calculated in units of pounds per hour (lb/hr). The particulate matter emission standard for this source is 7.44 lb/hr.

AMTEST
AIR QUALITY, INC.

SUMMARY OF RESULTS - METHODS 1, 2, 3A, 4 AND 5/202
AM TEST - AIR QUALITY, INC.

FILE NAME:	LB607\LPMSUM
CLIENT:	Louisiana-Pacific Corp.
LOCATION:	Montrose, Colorado

DRYER E-TUBE STACK

	RUN #1	RUN #2	RUN #3	AVERAGE
LAB #:	8353	8354	8355	
DATE:	6/15/95	6/15/95	6/15/95	
START TIME:	0910	1050	1227	
STOP TIME:	1012	1152	1330	
SAMPLE LENGTH (minutes):	60.0	60.0	60.0	
VOLUME SAMPLED (cubic feet):	58.062	29.535	59.504	49.034
VOLUME SAMPLED (dry std. cubic feet):	50.232	50.487	49.846	50.188
VOLUME SAMPLED (dry std. cubic meters):	1.423	1.430	1.412	1.422
STACK GAS MOISTURE (percent):	21.06	20.96	22.66	21.56
BAROMETRIC PRESSURE (inches of Hg):	25.10	25.20	25.25	25.18
STATIC PRESSURE (inches of H2O):	1.5	1.4	1.8	1.6
STACK PRESSURE (inches of Hg):	25.21	25.30	25.38	25.30
STACK TEMPERATURE (degrees F.):	136.9	137.3	143.5	139.2
STACK TEMPERATURE (degrees R.):	596.9	597.3	603.5	599.2
CARBON DIOXIDE (percent):	1.5	2.0	1.8	1.8
OXYGEN (percent):	17.1	17.0	17.1	17.1
MOLECULAR WEIGHT (dry, g/g-mole):	28.92	29.00	28.97	28.96
MOLECULAR WEIGHT (wet, g/g-mole):	26.62	26.69	26.49	26.60
AVERAGE VELOCITY HEAD (inches of H2O):	1.356	1.398	1.383	1.379
PITOT TUBE Cp:	0.84	0.84	0.84	
STACK GAS VELOCITY (feet per second):	78.9	79.8	80.0	79.6
STACK DIAMETER (inches):	48.0	48.0	48.0	
STACK AREA (square feet):	12.6	12.6	12.6	
STACK GAS AIRFLOW (dry std. cubic feet per min.):	34988	35571	34634	35064
STACK GAS AIRFLOW (actual cubic feet per min.):	59467	60202	60338	60002
NOZZLE DIAMETER (inches):	0.234	0.234	0.234	
ISOKINETICS (percent):	101	100	101	
FRONT-HALF PARTICULATE EMISSION CONC. (gr/dscf):	0.003	0.003	0.002	0.003
BACK-HALF PARTICULATE EMISSION CONC. (gr/dscf):	0.008	0.006	0.012	0.009
TOTAL PARTICULATE EMISSION CONC. (gr/dscf):	0.010	0.010	0.013	0.011
TOTAL PARTICULATE EMISSION CONC. (mg/dscm):	23.7	22.2	30.3	25.4
TOTAL PARTICULATE MATTER EMISSION RATE (lb/hr):	3.10	2.96	3.93	3.33

3.0
PROJECT OVERVIEW/EXCEPTIONS

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 run. The average percentage isokinetics for each run were within the acceptable limits of 100 ± 10%.

A nitrogen purge to remove sulfates from the condensible matter sample is an option of Method 202. It was not performed since sulfate emissions were not expected from this source. The pH of each back-half sample was measured and the pH ranged between 3.67-3.72. The alternative titration procedure in Section 8.1 of Method 202 was performed for each sample. Gravimetric analysis was performed before and after the titration. No Method 202 corrections were performed since the net particulate matter weights were not significantly different than the initial weights. The pretitration weights were used to calculate the emission results.

4.0

SOURCE OPERATION

Louisiana-Pacific Corporation's Montrose, Colorado facility is an oriented strand board (OSB) manufacturing plant with a rotary dryer. The MEC 60-foot triple pass rotary dryer is equipped with multiclones and a Geoenergy E-tube wet electrostatic precipitator (ESP) to control emissions. Dry wood fines and waferboard trimmings are used to fire a McConnell burner rated at 40 million British thermal units per hour (MMBtu/hr). The burner heats the triple pass rotary dryer which is used to dry wood chips for OSB production. Dryer exhaust gases are controlled by multiclones, followed by an ID fan, a quench duct and a Geoenergy E-tube wet ESP. Process data recorded on the test day was provided by Louisiana-Pacific and is included in the appendices of this report.

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 a pressure measurement device such as an oil-filled inclined manometer, magnehelic gauges, or a Shortridge® Instruments, Inc. 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 evaluated during each test by collecting integrated samples of the stack gas in multilayer bags. The integrated bag samples were analyzed on-site using an electrochemical analyzer to measure the percent (%) O_2 and a Fyrite analyzer to measure the % carbon dioxide (CO_2) in the gas stream. The gas composition data were used to calculate the molecular weight of the stack gas.

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 run on 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 202 design as illustrated in the figure titled "Method 202 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 quartz nozzle and heated quartz probe liner, through a pre-tared front-half quartz filter, and into a Method 202 impinger train for collecting condensible particulate matter. 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^{o} 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^{o} 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.

Prior to arriving at the job site, all sample train components from the first impinger forward were rigorously cleaned and rinsed with dichloromethane (CH_2Cl_2). 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. At the conclusion of the test, the pump was turned off, the probe was removed from the stack, and a post-test leak check was performed according to Method 5 procedures. Following the leak check, the impingers were removed from the sample train. A nitrogen purge to remove sulfates from the sample is an option of Method 202. It was not performed since sulfate emissions were not expected from this source. 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.

Following sample collection, the Method 5 sample trains were transferred to an area free from air disturbances and airborne particulate matter. The filters were transferred to petri dishes labeled with the sample date, client name and run number. Am Test refers to the front-half filter portion of the particulate catch as the "A" section. Care was taken to assure that any loose particulate matter and filter mat were quantitatively transferred to the petri dish. In the laboratory, the filters were placed in an oven and baked at 105° C for two (2) hours, then transferred to a constant humidity desiccator containing silicon dioxide (SiO_2) for at least 24 hours of desiccation prior to obtaining weights. The same weighing procedures were followed to obtain the tare weights for the filters. The tare and final weights were made using an electronic balance set to a time integrating mode with a readability of 0.1 milligrams. The filters were weighed to a constant weight of $\underline{+}0.5$ milligrams. The interval between weighings was at least 6 hours. These weights were recorded in a bound laboratory notebook.

Following each run, the contents of the nozzle, probe liner and prefilter connective glassware were quantitatively transferred to the "B" section storage container labeled with sample date, client name and run number. Several rinses of acetone, with simultaneous loosening of particulate matter using a clean nylon brush, were used for the front-half clean-up. An iodine flask with a female ball joint end was attached to the male ball joint end of the probe to assure that no particulate matter was lost during the rinsing and brushing of the probe. The contents of the iodine flask were quantitatively transferred to the "B" section storage container. In the laboratory, the "B" section acetone rinse was transferred to a tared, graduated 150 milliliter (mL) beaker. The volume of acetone was recorded and the beakers were placed in an evaporation chamber at a temperature of approximately 75-80° F until dry. Note: Some subparts or methods specify alternate "B" section cleanup solvents. The "Sample Train Information Sheet" details any exceptions.

The bubblers and impingers utilized for the condenser section, or "back-half" of the sample train were weighed with a readability of 0.1 grams before and after sampling using an electronic top loading balance. The difference between the initial and final weights of the condenser section constitute the amount of moisture gain during the run.

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 pH of each sample was initially measured and ranged between 3.67-3.72. The alternative titration procedure in Section 8.1 of Method 202 was performed. The dried residue from the water layer for each extracted 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 ± 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 $SO_4^=$ can be calculated based on the known amount of NH_4^+ added and the results may be sulfate corrected, if appropriate. 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 low condensible particulate matter (CPM) emissions, the Method 202 corrections were not performed for this series of tests.

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.

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 ±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
- 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 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 are calculated in accordance with current EPA 40 CFR 60 criteria. Copies of the pertinent equations used to derive the results for this test are included in the appendices of this report. Standard conditions are 29.92 inches of mercury and 68° F.

7.0

METHODOLOGY REFERENCES

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

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

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

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

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                                        METHODS 1, 2, 3A, 4 AND 5/202
                                         AM TEST-AIR QUALITY, INC.

FILE NAME:   D8805\LPM52021          LAB #:               8353            FRONT-HALF PARTICULATE MATTER MASS LOADING
CLIENT:      Louisiana-Pacific Corp. START TIME:          0910 hours      -----------------------------------------------------------
LOCATION:    Montrose, CO            STOP TIME:           1012 hours      FILTER NUMBER:                                      #90-286
SAMPLE SITE: Dryer E-Tube Stack      SAMPLE LENGTH:       60.0 minutes    TARE WEIGHT OF FILTER (grams):                       0.4339
SAMPLE DATE: June 15,1995                                                 FINAL WEIGHT OF FILTER (grams):                      0.4345
RUN #:       1 - Method 5/202                                             NET WEIGHT OF PARTICULATE MATTER (grams):            0.0006
OPERATORS:   S. MOYE
                                                                          BEAKER NUMBER:                                     #150-3322
          IMPINGER WEIGHTS                                                TARE WEIGHT OF BEAKER (grams):                      79.1047
       FINAL    INITIAL    NET                                            FINAL WEIGHT OF BEAKER (grams):                     79.1129
       grams    grams     grams      PITOT TUBE Cp:       0.84            NET WEIGHT OF PARTICULATE MATTER (grams):            0.0082
       -----    -----     -----      NOZZLE DIAMETER:     0.234 inches    VOLUME OF ACETONE (milliliters):                     185.0
       846.6    636.2     210.4      NOZZLE AREA:        0.0003 sq. feet  WT./VOL. OF ACETONE BLANK (milligrams/ml):           0.000
       685.8    637.9      47.9      STACK DIAMETER:      48.0 inches     NET WEIGHT OF PARTIC. DUE TO ACETONE (grams):        0.0000
       643.5    634.0       9.5      STACK AREA:          12.6 sq. feet
       865.0    848.5      16.5      METER TEMPERATURE:   69.5 degrees F  TOTAL FRONT-HALF PARTICULATE MATTER (grams):         0.0088
TOTAL H2O GAIN:           284.3      BAROMETRIC PRES.:   25.10 inches Hg
TOTAL VOLUME (scf):       13.40      STATIC PRESSURE:     1.50 inches H20 BACK-HALF PARTICULATE MATTER MASS LOADING
PERCENT MOISTURE:         21.06      STACK PRESSURE:     25.21 inches Hg  -----------------------------------------------------------
Bws:                     0.2106      ORIFICE PRESSURE:   2.731 inches H20 "C" SECTION - CONDENSER PARTICULATE                #150-3289
                                     METER PRESSURE:     25.30 inches Hg  TARE WEIGHT OF BEAKER (grams):                      65.5873
INIT. METER VOLUME:     128.243                                           FINAL WEIGHT OF BEAKER (grams):                     65.6036
FINAL METER VOLUME:     186.305      AVERAGE CONC. CO2:    1.5 percent    NET WEIGHT OF PARTIC. MATTER (grams):                0.0163
VOLUME SAMPLED:          58.062      AVERAGE CONC. O2:    17.1 percent    VOLUME OF SAMPLE USED IN EXTRACTION (mL):            698.0
STD VOLUME (dscf):       50.232      AVERAGE CONC. CO:      NA ppm        ADJUSTED NET WEIGHT OF PARTIC. MATTER (grams):       0.0168
STD VOLUME (dscm):        1.423      MOLECULAR WEIGHT:   28.92 g/g-mole-dry TOTAL VOLUME OF WATER (milliliters):               718.0
Y FACTOR:                 1.026      MOLECULAR WEIGHT:   26.62 g/g-mole-wet VOLUME OF WATER CONDENSED (milliliters):           267.8
DELTA H @:                1.890      F FACTOR:            2.53            NET VOLUME OF WATER FOR BLANK (milliliters):         450.2
Y FACTOR CAL. CHECK:      1.016                                           WT./VOL. OF WATER BLANK (milligrams/mL):             0.000
PERCENT ERROR (%):         -1.0                                           NET WEIGHT OF PARTIC. DUE TO WATER (grams):          0.0000
---------------------------------------------------------------------
   SAMPLE     VELOCITY   TEMPERATURE       SAMPLE    VELOCITY   TEMPERATURE   "Cx" SECTION - HYDROCARBON EXTRACTION          #150-3323
   POINT      " OF H2O       °F            POINT     " OF H20       °F        TARE WEIGHT OF BEAKER (grams):                  67.0129
                                                                              FINAL WEIGHT OF BEAKER (grams):                 67.0208
 W  1            1.32        128          N  1          1.15        137       NET WEIGHT OF PARTIC. MATTER (grams):            0.0079
    2            1.28        133             2          1.18        137       ADJUSTED NET WEIGHT OF PARTIC. MATTER (grams):   0.0081
    3            1.25        135             3          1.20        137       TOTAL VOLUME OF CH2Cl2 (milliliters):            225.0
    4            1.20        135             4          1.25        137       WT./VOL. OF CH2Cl2 BLANK (milligrams/ml):        0.000
    5            1.25        135             5          1.30        138       NET WEIGHT OF PARTIC. DUE TO CH2Cl2 (grams):     0.0000
    6            1.18        136             6          1.32        138
    7            1.38        135             7          1.22        138       TOTAL BACK-HALF PARTICULATE MATTER (grams):      0.0249
    8            1.55        136             8          1.38        138       TOTAL WEIGHT OF PARTICULATE MATTER (grams):      0.0337
    9            1.58        135             9          1.42        142
   10            1.60        136            10          1.48        143
   11            1.60        135            11          1.50        143
   12            1.58        135            12          1.48        143
---------------------------------------------------------------------
PERCENT ISOKINETICS:                         101 %
STACK GAS TEMPERATURE:                     136.9 degrees F          596.9 degrees R
AVERAGE VELOCITY HEAD:                     1.356 " of H20
STACK GAS VELOCITY:                                                  78.9 ft/second
STACK GAS AIR FLOW:                      59466.9 acf/min          34987.6 dscf/min
FRONT-HALF PARTICULATE MATTER EMISSION CONCENTRATION:               0.003 gr/dscf
BACK-HALF PARTICULATE MATTER EMISSION CONCENTRATION:                0.008 gr/dscf
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:                    0.010 gr/dscf
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:                     23.7 mg/dscm
TOTAL PARTICULATE MATTER EMISSION RATE:                              3.10 lb/hr
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                                        METHODS 1, 2, 3A, 4 AND 5/202
                                         AM TEST-AIR QUALITY, INC.

FILE NAME:    DB805\LPM52022           LAB #:                 8354              FRONT-HALF PARTICULATE MATTER MASS LOADING
CLIENT:       Louisiana-Pacific Corp.  START TIME:            1050 hours        ----------------------------------------------------------
LOCATION:     Montrose, CO             STOP TIME:             1152 hours        FILTER NUMBER:                                     #90-287
SAMPLE SITE:  Dryer E-Tube Stack       SAMPLE LENGTH:         60.0 minutes      TARE WEIGHT OF FILTER (grams):                      0.4319
SAMPLE DATE:  June 15,1995                                                      FINAL WEIGHT OF FILTER (grams):                     0.4382
RUN #:        2 - Method 5/202                                                  NET WEIGHT OF PARTICULATE MATTER (grams):           0.0063
OPERATORS:    S. MOYE
                                                                                BEAKER NUMBER:                                   #150-3324
                                                                                TARE WEIGHT OF BEAKER (grams):                     65.7494
          IMPINGER WEIGHTS                                                      FINAL WEIGHT OF BEAKER (grams):                    65.7537
       FINAL    INITIAL    NET         PITOT TUBE Cp:            0.84           NET WEIGHT OF PARTICULATE MATTER (grams):           0.0043
       grams    grams      grams       NOZZLE DIAMETER:          0.234 inches   VOLUME OF ACETONE (milliliters):                    170.0
       -----    -----      -----       NOZZLE AREA:             0.0003 sq. feet WT./VOL. OF ACETONE BLANK (milligrams/ml):          0.000
       835.0    627.4      207.6       STACK DIAMETER:           48.0 inches    NET WEIGHT OF PARTIC. DUE TO ACETONE (grams):       0.0000
       713.7    664.6       49.1       STACK AREA:               12.6 sq. feet
       639.4    631.2        8.2       METER TEMPERATURE:        82.4 degrees F TOTAL FRONT-HALF PARTICULATE MATTER (grams):        0.0106
       814.6    795.6       19.0       BAROMETRIC PRES.:        25.20 inches Hg
TOTAL H20 GAIN:            283.9       STATIC PRESSURE:           1.4 inches H20 BACK-HALF PARTICULATE MATTER MASS LOADING
TOTAL VOLUME (scf):        13.39       STACK PRESSURE:          25.30 inches Hg ----------------------------------------------------------
PERCENT MOISTURE:          20.96       ORIFICE PRESSURE:        2.778 inches H20 "C" SECTION - CONDENSER PARTICULATE             #150-3290
Bws:                      0.2096       METER PRESSURE:          25.40 inches Hg TARE WEIGHT OF BEAKER (grams):                     65.5144
                                                                                FINAL WEIGHT OF BEAKER (grams):                    65.5253
INIT. METER VOLUME:      186.691       AVERAGE CONC. CO2:         2.0 percent   NET WEIGHT OF PARTIC. MATTER (grams):               0.0109
FINAL METER VOLUME:      246.226       AVERAGE CONC. O2:         17.0 percent   VOLUME OF SAMPLE USED IN EXTRACTION (mL):           747.0
VOLUME SAMPLED:           59.535       AVERAGE CONC. CO:           NA ppm       ADJUSTED NET WEIGHT OF PARTIC. MATTER (grams):      0.0112
STD VOLUME (dscf):        50.487       MOLECULAR WEIGHT:        29.00 g/g-mole-dry TOTAL VOLUME OF WATER (milliliters):             767.0
STD VOLUME (dscm):         1.430       MOLECULAR WEIGHT:        26.69 g/g-mole-wet VOLUME OF WATER CONDENSED (milliliters):         264.9
Y FACTOR:                  1.026       F FACTOR:                 1.95           NET VOLUME OF WATER FOR BLANK (milliliters):        502.1
DELTA H @:                 1.890                                                WT./VOL. OF WATER BLANK (milligrams/mL):            0.000
Y FACTOR CAL. CHECK:       1.008                                                NET WEIGHT OF PARTIC. DUE TO WATER (grams):         0.0000
PERCENT ERROR (%):          -1.7
-------------------------------------------------------------------------------- "Cx" SECTION - HYDROCARBON EXTRACTION            #150-3325
   SAMPLE     VELOCITY    TEMPERATURE        SAMPLE     VELOCITY    TEMPERATURE TARE WEIGHT OF BEAKER (grams):                    65.2824
   POINT      " OF H20       °F              POINT      " OF H20       °F     FINAL WEIGHT OF BEAKER (grams):                    65.2921
                                                                                NET WEIGHT OF PARTIC. MATTER (grams):               0.0097
 W  1            1.30       137            N  1            1.20       136       ADJUSTED NET WEIGHT OF PARTIC. MATTER (grams):      0.0100
    2            1.30       138               2            1.22       136       TOTAL VOLUME OF CH2Cl2 (milliliters):               225.0
    3            1.38       138               3            1.25       137       WT./VOL. OF CH2Cl2 BLANK (milligrams/ml):           0.000
    4            1.28       138               4            1.28       136       NET WEIGHT OF PARTIC. DUE TO CH2Cl2 (grams):        0.0000
    5            1.28       138               5            1.30       135
    6            1.25       138               6            1.40       140       TOTAL BACK-HALF PARTICULATE MATTER (grams):         0.0212
    7            1.41       138               7            1.18       133       TOTAL WEIGHT OF PARTICULATE MATTER (grams):         0.0318
    8            1.60       137               8            1.35       135
    9            1.68       140               9            1.45       135
   10            1.65       144              10            1.50       134
   11            1.68       143              11            1.52       134
   12            1.70       143              12            1.50       133
--------------------------------------------------------------------------------
PERCENT ISOKINETICS:                   100 %
STACK GAS TEMPERATURE:               137.3 degrees F           597.3 degrees R
AVERAGE VELOCITY HEAD:               1.398 " of H20
STACK GAS VELOCITY:                                             79.8 ft/second
STACK GAS AIR FLOW:                60202.0 acf/min           35571.4 dscf/min
FRONT-HALF PARTICULATE MATTER EMISSION CONCENTRATION:          0.003 gr/dscf
BACK-HALF PARTICULATE MATTER EMISSION CONCENTRATION:           0.006 gr/dscf
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:               0.010 gr/dscf
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:                22.2 mg/dscm
TOTAL PARTICULATE MATTER EMISSION RATE:                         2.96 lb/hr
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                                        METHODS 1, 2, 3A, 4 AND 5/202
                                         AM TEST-AIR QUALITY, INC.

FILE NAME:   DB805\LPM52023              LAB #:               8355                FRONT-HALF PARTICULATE MATTER MASS LOADING
CLIENT:      Louisiana-Pacific Corp.     START TIME:          1227 hours          ---------------------------------------------------------
LOCATION:    Montrose, CO                STOP TIME:           1330 hours          FILTER NUMBER:                                    #90-255
SAMPLE SITE: Dryer E-Tube Stack          SAMPLE LENGTH:       60.0 minutes        TARE WEIGHT OF FILTER (grams):                     0.3951
SAMPLE DATE: June 15,1995                                                         FINAL WEIGHT OF FILTER (grams):                    0.3958
RUN #:       3 - Method 5/202                                                     NET WEIGHT OF PARTICULATE MATTER (grams):          0.0007
OPERATORS:   S. MOYE
                                                                                  BEAKER NUMBER:                                   #150-3326
                                                                                  TARE WEIGHT OF BEAKER (grams):                    65.0005
        IMPINGER WEIGHTS                                                          FINAL WEIGHT OF BEAKER (grams):                   65.0047
     FINAL   INITIAL    NET              PITOT TUBE Cp:          0.84             NET WEIGHT OF PARTICULATE MATTER (grams):          0.0042
     grams    grams    grams             NOZZLE DIAMETER:        0.234 inches     VOLUME OF ACETONE (milliliters):                   165.0
     -----    -----    -----             NOZZLE AREA:           0.0003 sq. feet   WT./VOL. OF ACETONE BLANK (milligrams/ml):         0.000
     855.2    640.7    214.5             STACK DIAMETER:         48.0 inches      NET WEIGHT OF PARTIC. DUE TO ACETONE (grams):      0.0000
     752.1    685.3     66.8             STACK AREA:             12.6 sq. feet
     651.6    642.9      8.7             METER TEMPERATURE:      90.1 degrees F   TOTAL FRONT-HALF PARTICULATE MATTER (grams):       0.0049
     802.6    782.8     19.8             BAROMETRIC PRES.:      25.25 inches Hg
TOTAL H2O GAIN:        309.8             STATIC PRESSURE:         1.8 inches H2O  BACK-HALF PARTICULATE MATTER MASS LOADING
TOTAL VOLUME (scf):    14.61             STACK PRESSURE:        25.38 inches Hg   ---------------------------------------------------------
PERCENT MOISTURE:      22.66             ORIFICE PRESSURE:      2.735 inches H2O  "C" SECTION - CONDENSER PARTICULATE              #150-3291
Bws:                  0.2266             METER PRESSURE:        25.45 inches Hg   TARE WEIGHT OF BEAKER (grams):                    65.0415
                                                                                  FINAL WEIGHT OF BEAKER (grams):                   65.0650
INIT. METER VOLUME:   246.756            AVERAGE CONC. CO2:       1.8 percent     NET WEIGHT OF PARTIC. MATTER (grams):              0.0235
FINAL METER VOLUME:   306.260            AVERAGE CONC. O2:       17.1 percent     VOLUME OF SAMPLE USED IN EXTRACTION (mL):          733.0
VOLUME SAMPLED:        59.504            AVERAGE CONC. CO:         NA ppm         ADJUSTED NET WEIGHT OF PARTIC. MATTER (grams):     0.0241
STD VOLUME (dscf):     49.846            MOLECULAR WEIGHT:      28.97 g/g-mole-dry TOTAL VOLUME OF WATER (milliliters):              753.0
STD VOLUME (dscm):      1.412            MOLECULAR WEIGHT:      26.49 g/g-mole-wet VOLUME OF WATER CONDENSED (milliliters):          290.0
Y FACTOR:               1.026            F FACTOR:               2.11             NET VOLUME OF WATER FOR BLANK (milliliters):       463.0
DELTA H @:              1.890                                                     WT./VOL. OF WATER BLANK (milligrams/mL):           0.000
Y FACTOR CAL. CHECK:    1.008                                                     NET WEIGHT OF PARTIC. DUE TO WATER (grams):        0.0000
PERCENT ERROR (%):       -1.8
------------------------------------------------------------------------------    "Cx" SECTION - HYDROCARBON EXTRACTION            #150-3327
  SAMPLE    VELOCITY   TEMPERATURE          SAMPLE   VELOCITY   TEMPERATURE       TARE WEIGHT OF BEAKER (grams):                    64.5639
  POINT     " OF H2O       °F               POINT    " OF H2O       °F            FINAL WEIGHT OF BEAKER (grams):                   64.5773
                                                                                  NET WEIGHT OF PARTIC. MATTER (grams):              0.0134
 W  1         1.30        142              N  1        1.20        139            ADJUSTED NET WEIGHT OF PARTIC. MATTER (grams):     0.0138
    2         1.32        140                 2        1.18        140            TOTAL VOLUME OF CH2Cl2 (milliliters):              225.0
    3         1.38        144                 3        1.22        139            WT./VOL. OF CH2Cl2 BLANK (milligrams/ml):          0.000
    4         1.35        146                 4        1.24        141            NET WEIGHT OF PARTIC. DUE TO CH2Cl2 (grams):       0.0000
    5         1.28        146                 5        1.32        140
    6         1.18        146                 6        1.38        139            TOTAL BACK-HALF PARTICULATE MATTER (grams):        0.0379
    7         1.40        147                 7        1.32        139            TOTAL WEIGHT OF PARTICULATE MATTER (grams):        0.0428
    8         1.61        147                 8        1.20        140
    9         1.64        147                 9        1.40        144
   10         1.68        147                10        1.41        147
   11         1.65        142                11        1.50        148
   12         1.70        146                12        1.45        148
------------------------------------------------------------------------------
PERCENT ISOKINETICS:                       101 %
STACK GAS TEMPERATURE:                   143.5 degrees F       603.5 degrees R
AVERAGE VELOCITY HEAD:                   1.383 " of H2O
STACK GAS VELOCITY:                                             80.0 ft/second
STACK GAS AIR FLOW:                    60338.3 acf/min       34634.3 dscf/min
FRONT-HALF PARTICULATE MATTER EMISSION CONCENTRATION:          0.002 gr/dscf
BACK-HALF PARTICULATE MATTER EMISSION CONCENTRATION:           0.012 gr/dscf
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:               0.013 gr/dscf
TOTAL PARTICULATE MATTER EMISSION CONCENTRATION:                30.3 mg/dscm
TOTAL PARTICULATE MATTER EMISSION RATE:                         3.93 lb/hr
```

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

CLIENT: Louisiana-Pacific Corp. LOCATION: Montrose, CO DATE: 6/15/95

RUN #: 2 LAB #: 8354 SITE LOCATION: Dryer E-Tube Stack

Particulate Matter Emission Concentration - Equation 5-1

Vm_{std} = 17.647°R/"$Hg_{(constant)}$*volume sampled*Y_{factor}*(P_B + ΔH/13.6)/(460+T_m)

= 17.647°R/"Hg* 59.535 ft^3* 1.026*(25.20"Hg + (2.778"H_2O/13.6))/(460 +82.4° F)

= 50.487 dscf

dscm = 50.487 dscf/35.31 ft^3/m^3

= 1.430 dscm

Substitution of Equation 5-4 into 5-5

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

= 0.0 mg = 0.0 mg/ml * 170.0 ml

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

= 31.8 mg = 6.3 mg + 4.3 mg - 0.0 mg + 21.2 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) * 10.6 mg / 50.487 dscf

= 0.003 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

Back-half

C_s = (0.001 g/mg) * (15.43 grains/gram) * 21.2 mg / 50.487 dscf

= 0.006 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

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

Total

C_S = (0.001 g/mg) * (15.43 grains/gram) * 31.8 mg / 50.487 dscf

= 0.010 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

mg/dscm = 31.8 mg/ 1.430 dscm

= 22.2 mg/dscm

Particulate Matter Emission Rate

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

= 0.010 gr/dscf * 35571.4 dscf/min * 60 min/hr * 1 lb/7000 grains

= 2.96 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 ft^3/g * 283.9 grams of H_2O collected in impingers

= 13.39 scf

B_{WS} = (13.39 scf)/(13.39 scf + 50.487 dscf)

= 0.2096

% Moisture = 20.96 % = B_{WS} * 100

Molecular weight - Equation 3-2

M_d = 0.440*(2.0 %CO_2)+0.320*(17.0 %O_2)+0.280*(100%- 2.0 %CO_2- 17.0 %O_2(%CO+%N_2))

= 29.00 g/g-mole (dry)

M_s = M_d * (1-B_{WS}) + 18.0 * B_{WS} = 29.00 g/g-mole * (1 - 0.2096) + 18.0 g/g-mole * 0.2096

= 26.69 g/g-mole (wet)

F_o = (20.9 - 17.0)%O_2/ 2.0 %CO_2 = 1.95

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* $\sqrt{\Delta P * T_s{}^{\circ} R / (M_s \text{ g/g-mole} * P_s \text{"Hg})}$

= 85.49 * 0.84 * $\sqrt{1.398 * 597.3^{\circ} R / (26.69 \text{ g/g-mole} * 25.30 \text{"Hg})}$

(137.3 °F + 460)° R (25.20 P_B + 1.4 P_s/13.6)

= 79.8 ft/sec (std)

Q_{sd} = 3600 * (1 - B_{ws}) * V_s ft/sec * A_s ft^2 * ($T_{std}{}^{\circ}$ R/$T_s{}^{\circ}$ R) * (P_s"Hg / P_{std}"Hg) / 60 min/hr

= 3600 * (1 - 0.2096) * 79.8 ft/sec * 12.6 ft^2 * (528° R/597.3° R) * (25.30"Hg / 29.92"Hg) / 60

= 35,571.4 dscf/min (dry standard cubic feet per minute)

acfm = 79.8 ft/sec * 12.6 ft^2* 60 sec/min

= 60,202.0 acfm (actual cubic feet per minute)

Isokinetic variation - Equation 5-8

I = 0.09450 * Vm_{std} dscf * $T_s{}^{\circ}$ R / [P_s"Hg * $V_s$ft/sec * minutes * $A_n$$ft^2$ *(1 -B_{ws})]

= 0.09450 * 50.487 dscf * 597.3° R/[25.30"Hg * 79.8 ft/sec * 60.0 min * 0.0003 ft^2 *(1 -.2096)]

(.234 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)

Final wt.	-	Initial Wt	=	Net wt.
835.0		627.4	=	207.6
713.7		664.6	=	49.1
639.4		631.2	=	8.2
				264.9

a 10.9 mg particulate in "C" Section Beaker

b 767 ml of water in condensers, including rinses

c 264.9 ml condensation in 1st, 2nd and 3rd bubblers (final wt - initial wt, assumes 1g/1ml water density)

d 502.1 ml DI water used in bubblers including rinses = $b - c$

e 0.0 mg/ml blank particulate = 0.0 mg blank / 240 ml blank

f 0.0 mg blank particulate = $e * d$

g 20 ml aliquot

h 1.027 correction factor = $b/(b-g)$

11.2 **mg of "C" particulate** = $a*h - f$ = (10.9 mg * 1.027) - 0.0 mg

"Cx" Section

a 9.96 mg particulate in "Cx" Section Beaker = 9.7 mg * 1.027 correction factor (h)

b 225.0 ml CH_2Cl_2 used for sample

c 0.0 mg/ml blank particulate = 0.0 mg blank / 150 ml blank

d 0.0 mg blank particulate = $b * c$

9.96 **mg of "Cx" particulate** = $a - d$ = 9.96 mg - 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

\+ 11.2 mg "C" Section Particulate

\+ 9.96 mg "Cx" Section Particulate

\+ NA mg "D" Section Particulate

\+ NA mg Back-half Filter Particulate (If applicable)

= 21.2 **mg Back-half Particulate**

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Example Calculation of Method 5 Post-Test Calibration

Client: Louisiana-Pacific Corp.

Location: Montrose, Colorado

Site Location: Dryer E-Tube Stack

Run #: 2

Date: 6/15/95

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

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

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 (°R)
P_b = barometric pressure, inches Hg
0.0319 = (29.92 " Hg/528 °R) $(0.75)^2$

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:

$$Y_{qa} = \sqrt{\frac{(0.0319 * (\underline{82.4}\,T_m + 460)^{o}R * 29\text{ lb/lb-mole}/\underline{29.00}\,M_d)}{\underline{1.890}\,\Delta H@ * (\underline{25.20}\,P_b + (\underline{2.778}\,\Delta H_{avg}/13.6))}}$$

$$* \sqrt{\underline{2.778}\,\Delta H_{avg}} * (\underline{60}\;\theta/\underline{59.535}\,V_m) = \underline{1.008}\,Y_{qa}$$

% Error = ($\underline{1.008}\,Y_{qa}$ - $\underline{1.026}$ Y)/ $\underline{1.008}\,Y_{qa}$ * 100% = $\underline{-1.7}$ %*

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

STACK SCHEMATIC AND LOCATION OF SAMPLE POINTS

Client L.P. Montrose

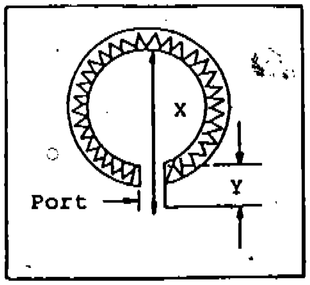
Location Montrose, CO

Sampling Location Dryer E-tube stack

Inside of far wall to outside of port (distance, X) 54"

Inside of near wall to outside of port (distance, Y) 6"

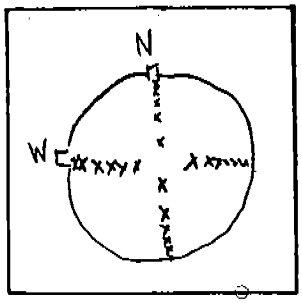
Stack I.D. (distance X - distance Y) 48" Ø

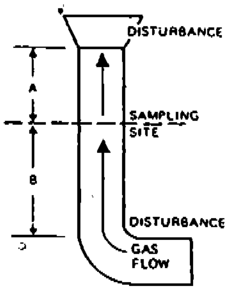


Schematic of Sampling Location

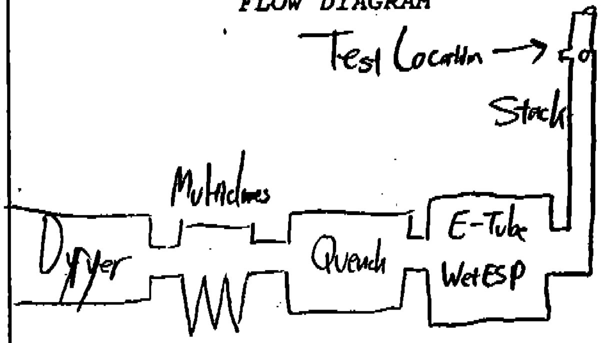
1 Traverse Point #	2 Fractional Percent of Stack I.D.	3 Stack I.D. inches	4 Column 2 x 3	5 Distance Y	6 Traverse Point Location from Outside of Port columns 4 + 5
1	.021	48.0"	1.0"	6.0"	7.0"
2	.067		3.2		9.2
3	.118		5.7		11.7
4	.177		8.5		14.5
5	.250		12.0		18.0
6	.356		17.1		23.1
7	.644		30.9		36.9
8	.750		36.0		42.0
9	.823		39.5		45.5
10	.882		42.3		48.3
11	.933		44.8		50.8
12	.979		47.0		53.0

CROSS SECTION





STACK, CONTROL DEVICE AND PROCESS FLOW DIAGRAM



Distance A = ~40 ft *downstream*

Distance B = 14 ft *upstream*

8353

TRAVERSE SAMPLING DATA SHEET

Page ___ of 31

Client Louisiana Pacific
Location Montrose, Co
Sample Site E-Tube STACK
Stack Diameter ' 48"
Date 6-15-95
Operators SBM
Run I.D. Method 5/202 R.1

EQUIPMENT CHECKS

Initial/Final
Leak Rate cfm 0.002/0.002
Leak Test Vacuum 12/12"
✓ 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 # 90-286 Box # 6.1

	Final Wt. gram		Initial Wt. gram		Net Wt. gram
#1 Imp.	846.6		636.2	=	210.4
#2 Imp.	685.8	-	637.9	=	47.9
#3 Imp.	643.5	-	634.0	=	9.5
#4 Imp.			~~536.6~~	=	
#5 Imp.	865.0	-	848.5	=	16.5
#6 S.G.		-	[illegible]	=	

Total H_2O Volume 284.3 ✓ g

Start Time 0910
Stop Time 1012
Barometric Pressure "Hg 25.10
Static Pres "H_2O +0.50
Production Rate –

KAH BOX

SAMPLING PARAMETERS

% Moisture 22%
Meter Temp. 70°
Stack Temp. 130°
ΔH@ 1.890 Y 1.026
Pitot # P195-5B Side # A
Cp 0.84 / TC-T195-5B
Nozzle Diameter 0.234 inch
D_1 0.233 D_2 0.234 D_3 0.235
K Factor 2.007

Sample Point	Elap Time Min.	Dry Gas Meter Reading Cu. Ft.	Pitot Reading ΔP " H_2O	Orifice Setting (ΔH) " H_2O Ideal	Orifice Setting (ΔH) " 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 %	
W 1	0	128.243	1.32	2.65	2.65	66	66	5	258	55	129		
2			1.28	2.57	2.57	68	68	5	262	60	133		
3	5		1.25	2.51	2.51	68	68	5	260	57	135		
4			1.20	2.41	2.41	69	68	5	259	56	135		
5	10	137.32	1.25	2.51	2.51	69	69	4	259	55	135		
6			1.18	2.37	2.37	69	68	4	260	54	136		
7	15	141.83	1.38	2.77	2.77	69	68	4	257	54	135		
8			1.55	3.11	3.11	70	68	5	255	55	136		
9	20	146.92	1.58	3.17	3.17	70	68	5½	256	54	135		
10			1.60	3.21	3.21	70	68	5½	253	57	136		
11	25	152.23	1.60	3.21	3.21	70	68	5½	248	54	135		
12			1.58	3.17	3.17	70	68	5½	253	55	135		
N 1	30	157.538	1.15	2.31	2.31	70	69	4	270	61	137		
2			1.18	2.37	2.37	70	69	4	259	56	137		
3	35	161.91	1.20	2.41	2.41	70	69	4	255	54	137		
4			1.25	2.51	2.51	71	69	4	259	53	137		
5	40	166.50	1.30	2.61	2.61	71	69	5	259	53	138		
6			1.32	2.65	2.65	71	69	5	256	54	138		
7	45	171.23	1.22	2.45	2.45	72	69	5	257	55	138		
8			1.38	2.77	2.77	72	69	5	258	54	138		
9	50	176.03	1.42	2.85	2.85	73	70	5	260	54	142		
10			1.48	2.97	2.97	73	70	5	252	55	143		
11	55	181.12	1.50	3.01	3.01	74	70	6	259	56	143		
12			1.48	2.97	2.97	74	71	6	256	56	143		
	60	186.305											
✓ chk		58.062 ✓	1.266	2.8	2.731 ✓	69.5					136.9 ✓		

METHOD 5
LABORATORY ANALYSIS

Client LOUISIANA PACIFIC Run Number 1

Sample Location DRYER F-TUBE STACK

Date 6/15

"A" Section (Filter)

Filter # 90-286

Tare Weight 0.4339 grams ✓

Final Weight 0.4346 grams ✓

Net Weight 0.0006 grams

"B" Section (Probe Wash)

Beaker # 150-3322

Volume Acetone 185 mls

Tare Weight 79.1047 grams ✓

Final Weight 79.1129 grams ✓

Net Weight 0.0082 grams

"C" Section (Condenser Particulate - Inorganic Catch)

pH: 3.72

Beaker # 150-3289

Volume Water 698/718 mls

$\frac{718}{698} = 1.029$

Tare Weight 65.5873 grams ✓

Final Weight 65.6036 grams ✓

Net Weight 0.0163 grams x1.029

0.0168

"Cx" Section (Condenser Particulate - Organic Catch)

Beaker # 150-3323

Volume CH_2Cl_2 225 mls

Tare Weight 67.0129 grams ✓

Final Weight 67.0208 grams ✓

Net Weight 0.0079 grams x1.029

0.0081

"D" Section (Final Acetone Rinse of Impingers)

Beaker # ____________

Volume Acetone ________ mls

Tare Weight ________ grams

Final Weight ________ grams

Net Weight ________ grams

8353

8354

TRAVERSE SAMPLING DATA SHEET

Page ___ of 33

Client Louisiana Pacific
Location Montrose, CO
Sample Site E-Tube STACK
Stack Diameter 48
Date 6-15-95
Operators Moye
Run I.D. Method 5/202 R.2

EQUIPMENT CHECKS

	Initial/Final
Leak Rate cfm	0.001 / 0.001
Leak Test Vacuum	15 / 14"

✓ 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 # 90-287 Box # G-2

	Final Wt. gram	Initial Wt. gram	Net Wt. gram
#1 Imp.	835.0	627.4	207.6
#2 Imp.	713.7	664.6	49.1
#3 Imp.	639.4	631.2	8.2
#4 Imp.		[redacted]	
#5 Imp.	814.6	795.6	19.0
#6 S.G.		~~797.3~~	

Total H_2O Volume 283.9 ✓ g

Start Time 1050
Stop Time 1152
Barometric Pressure "Hg 25.20
Static Pres "H_2O +1.4"
Production Rate ___

KAH meter Box

SAMPLING PARAMETERS

% Moisture 22
Meter Temp. 78
Stack Temp. 145
Δ H@ 1.890 Y 1.026
Pitot # P195-5D Side # A
Cp 0.84 / TC - T195-5D
Nozzle Diameter 0.234 inch
D_1 ___ D_2 ___ D_3 ___

K Factor 1.971

Sample Point	Elap Time Min.	Dry Gas Meter Reading Cu.Ft.	Pitot Reading Δ P " H_2O	Orifice Setting (Δ H) " H_2O		Gas Meter Temp °F		Pump Vac. Gauge " Hg	Filter Box Temp °F	Imp. Exit Temp °F	Stack Temp °F	O_2 %	
				Ideal	Actual	In	Out						
W 1	0	186.69	1.30	2.56	2.56	79	78	4	255	64	137		
2			1.30	2.56	2.56	79	78	4	251	64	138		
3	5	191.36	1.38	2.74	2.74	80	78	4	257	64	138		
4			1.28	2.54	2.54	80	79	4	253	63	138		
5	10	196.13	1.28	2.54	2.54	80	79	4	256	64	138		
6			1.25	2.48	2.48	81	79	4	257	66	138		
7	15	209.92	1.41	2.80	2.80	81	79	5	266	64	138		
8			1.60	3.18	3.18	82	80	5	266	65	137		
9	20	~~205.~~	1.68	3.34	3.34	82	80	5	251	68	140		
10			1.65	3.28	3.28	83	81	5	261	67	144		
11	25	211.53	1.68	3.34	3.34	83	81	5	262	64	143		
12			1.70	3.40	3.40	84	81	6	261	67	143		
N 1	30	216.930	1.20	2.40	2.40	84	82	4	255	64	136		
2			1.22	2.44	2.44	84	82	4	261	64	136		
3	35	221.39	1.25	2.50	2.50	85	82	4	265	64	137		
4			1.28	2.56	2.56	85	83	4½	264	65	136		
5	40	226.14	1.30	2.60	2.60	85	83	5	264	60	135		
6			1.40	2.80	2.80	86	83	5	260	57	140		
7	45	230.99	1.18	2.36	2.36	86	83	5	260	58	133		
8			1.35	2.70	2.70	86	84	5	255	56	135		
9	50	235.75	1.45	2.90	2.90	87	84	5	262	58	135		
10			1.50	3.00	3.00	87	84	5	257	59	134		
11	55	241.02	1.52	3.04	3.04	87	85	6	254	60	134		
12			1.50	3.00	3.00	88	85	5½	256	61	133		
	60	246.226											
		59.535 ✓			✓2.778	82.4 ✓					137.3 ✓		

METHOD 5
LABORATORY ANALYSIS

Client LOUISIANA PACIFIC Run Number 2

Sample Location DRYER E-TUBE STACK

Date 6/15/95

"A" Section (Filter)

Filter # 90-287

Tare Weight 0.4319 grams ✓

Final Weight 0.4382 grams ✓

Net Weight 0.0063 grams

"B" Section (Probe Wash)

Beaker # 150-3324

Volume Acetone 170 mls

Tare Weight 65.7494 grams ✓

Final Weight 65.7537 grams ✓

Net Weight 0.0043 grams

"C" Section (Condenser Particulate - Inorganic Catch)

pH: 3.71

Beaker # 150-3290

Volume Water 747/767 mls

$\frac{767}{747} = 1.027$

Tare Weight 65.5144 grams ✓

Final Weight 65.5253 grams ✓

Net Weight 0.0109 grams ×1.027

0.0112

"Cx" Section (Condenser Particulate - Organic Catch)

Beaker # 150-3325

Volume CH_2Cl_2 225 mls

Tare Weight 65.2824 grams ✓

Final Weight 65.2921 grams ✓

Net Weight 0.0097 grams ×1.027

0.0100

"D" Section (Final Acetone Rinse of Impingers)

Beaker # ______

Volume Acetone ______ mls

Tare Weight ______ grams

Final Weight ______ grams

Net Weight ______ grams

8355

TRAVERSE SAMPLING DATA SHEET

Page ___ of 35

Client Louisiana Pacific
Location Montrose, Co
Sample Site E-Tube STACK
Stack Diameter 48"
Date 6-19-95
Operators SBW
Run I.D. Method 5/202 R-3

EQUIPMENT CHECKS

Leak Rate cfm (Initial/Final) 0.001 / 0.001
Leak Test Vacuum 14 / 14"
✓ 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 # 90-255 Box # G-3

	Final Wt. gram	Initial Wt. gram	Net Wt. gram
#1 Imp.	855.2	640.7	214.5
#2 Imp.	752.1	685.3	66.8
#3 Imp.	651.6	642.9	8.7
#4 Imp.		~~[illegible]~~	
#5 Imp.	802.6	782.8	19.8
#6 S.G.		~~[illegible]~~	/

Total H₂O Volume 309.8 g

Start Time 1227
Stop Time 1330
Barometric Pressure "Hg 25.25
Static Pres "H₂O 1.8"
Production Rate ___
ICAH Box

SAMPLING PARAMETERS

% Moisture 22
Meter Temp. 92
Stack Temp. 140
ΔH@ 1.890 Y 1.026
Pitot # P195-5B Side # A
Cp 0.84 / TC T-195-5B
Nozzle Diameter 0.234 inch
D₁ ___ D₂ ___ D₃ ___
K Factor 1.966

Sample Point	Elap Time Min.	Dry Gas Meter Reading Cu.Ft.	Pitot Reading ΔP " H₂O	Orifice Setting (ΔH) " H₂O Ideal	Orifice Setting (ΔH) " H₂O 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	O₂ %	
W 1	0	246.256	1.30	2.58	2.58	88	88	2	257	66	142		
2			1.32	2.62	2.62	84	88	2	253	60	140		
3	5	251.54	1.38	2.74	2.74	89	88	2	253	58	144		
4			1.35	2.68	2.68	89	88	2	252	60	146		
5	10	256.44	1.28	2.54	2.54	90	88	2	256	61	146		
6			1.18	2.32	2.32	90	88	2	255	64	146		
7	15	261.03	1.40	2.75	2.75	91	88	3	260	62	147		
8			1.61	3.17	3.17	91	89	3	256	61	147		
9	20	266.25	1.64	3.23	3.23	91	89	3	261	61	147		
10			1.68	3.30	3.30	92	89	3	256	61	147		
11	25	271.77	1.65	3.24	3.24	92	90	3	255	61	142		
12			1.70	3.34	3.34	92	90	3	256	61	146		
N 1	30	277.26	1.20	2.36	2.36	92	90	2	257	64	139		
2			1.18	2.32	2.32	92	90	2	258	63	140		
3	35	281.78	1.22	2.40	2.40	92	90	2	256	61	139		
4			1.24	2.44	2.44	92	90	2	256	62	141		
5	40	286.44	1.32	2.60	2.60	91	90	2	258	61	140		
6			1.38	2.71	2.71	91	90	2	257	61	139		
7	45	291.31	1.32	2.60	2.60	91	90	2	256	59	139		
8			1.20	2.36	2.36	91	90	2	255	59	140		
9	50	295.99	1.40	2.75	2.75	91	90	2	258	60	144		
10			1.41	2.79	2.79	91	90	2	250	60	147		
11	55	301.04	1.50	2.95	2.95	91	90	2	250	60	148		
12			1.45	2.86	2.85	91	90	3	252	59	148		
	60	306.260			↑								
Total		59.504	1.383	2.739	2.735	90.1					143.5		

3.0" →

METHOD 5
LABORATORY ANALYSIS

Client LOUISIANA PACIFIC Run Number 3

Sample Location DRYER E-TUBE STACK

Date 6/15/95

"A" Section (Filter)

Filter # 90-255

Tare Weight 0.3951 grams ✓

Final Weight 0.3958 grams ✓

Net Weight 0.0007 grams

"B" Section (Probe Wash)

Beaker # 150-3326

Volume Acetone 165 mls

Tare Weight 65.0005 grams ✓

Final Weight 65.0047 grams ✓

Net Weight 0.0042 grams

"C" Section (Condenser Particulate - Inorganic Catch) pH: 3.67

Beaker # 150- 3291

Volume Water 733/753 mls

$\frac{753}{733} = 1.027$

Tare Weight 65.0415 grams ✓

Final Weight 65.0650 grams ✓

Net Weight 0.0235 grams x 1.027

0.0241

"Cx" Section (Condenser Particulate - Organic Catch)

Beaker # 150-3327

Volume CH_2Cl_2 225 mls

Tare Weight 64.5639 grams ✓

Final Weight 64.5773 grams ✓

Net Weight 0.0134 grams x 1.027

0.0138

"D" Section (Final Acetone Rinse of Impingers)

Beaker #

Volume Acetone mls

Tare Weight grams

Final Weight grams

Net Weight grams

8355

L.P. MONTROSE

METHOD 5
LABORATORY ANALYSIS

Acetone Blank

Beaker # 150·3328
Volume Acetone 140 mls

Tare Weight 64.9051 grams ✓
Final Weight 64.9051 grams ✓
Net Weight 0.0000 grams

$\frac{0.0\,mg}{140\,mL} = 0.0\,\frac{mg}{mL}$

Distilled, Deionized Water Blank

Beaker # 150 - 3292
Volume Water 250 mls

Tare Weight 65.4285 grams ✓
Final Weight 65.4271 grams ✓
Net Weight -0.0014 grams
use 0

Methylene Chloride (CH2Cl2) Blank

Beaker # 150·3329
Volume CH_2Cl_2 150 mls

Tare Weight 64.9720 grams ✓
Final Weight 64.9707 grams ✓
Net Weight -0.0013 grams
use 0

AMTEST
AIR QUALITY, INC.

SAMPLE TRAIN INFORMATION

Fill out one sheet per site and per test type.

CLIENT: Louisiana Pacific
LOCATION: Montrose Co
SITE: Dryer E-Tube stack
TEST TEAM: SBM DATE(S):
RUN #'S: 3 (1 Hr) TYPE: Method 5/202

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		—	petri dish	
#1 D.I.	100	D.I. / DCM	1L WM / 250mL GLASS	TAKE pH of D.I.
#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.

DIDNT DO N_2 PURGE

[jaa\c\excel\sampltrn.xls] 1/27/94

AMTEST
AIR QUALITY, INC.

Page 1 of 1

GAS BAG SAMPLE DATA SHEET

CLIENT: C.P

LOCATION: ~~Dryer F-Tube~~ Montrose Co.

SAMPLE SITE: Dryer F-Tube

DATE: 6-15-95

NUMBER/TYPE OF TESTS: O2 NUMBER OF BAGS: 3

SAMPLED BY: SBM

SUBMITTED BY: SBM

ANALYZED BY: SBM DATE: 6-15-95

BAG NUMBER/IDENTIFICATION	CO_2 %	O_2 %	CO ppm	F_o	NOTES
R1 Bag 1	1.5	17.1	~~[illegible]~~		
R2 Bag 1	2.0	17.0			
R3 Bag 1	1.8	17.1			

CO_2 ANALYZER: Fyrite CALIBRATION GAS: NA

O_2 ANALYZER: IR 2200 CALIBRATION GAS: 10.0%

CO ANALYZER: CALIBRATION GAS:

PROJECT L.P. MONTROSE

M202

STANDARDIZATION OF NH_4OH

STD: 26.70
28.15
28.98
29.34
29.57
29.32

29.33

$N = \frac{(0.1N\ H_2SO_4)(10mL)}{29.33 - 0} = 0.0341\ N$

STD: 9.48, 9.40, 9.38 $N = \frac{(0.001N)(10mL)}{9.43 - 0}$

				pH		
SAMPLE	VOL	VTIT	NTIT	INITIAL	FINAL	BEAKER #
RUN 1 8353	95	0.45	0.0341	4.75	7.14	150-3289
RUN 2 8354	95	0.27	0.0060	6.49	7.05	150-3290
RUN 3 8355	95	1.83	0.0060	4.55	6.97	150-3291
BLANK	95			7.02		150-3292

∅

STD 16.56
1658
16.57

$\frac{(0.01)(10)}{16.57 - 0} = 0.0060$

Continued on Page

Louisiana-Pacific Corporation
Northern Division
Rt. 8, Box 8263
Hayward, Wisconsin 54843
(715) 634-3454

LETTER OF TRANSMITTAL

42

Date: 7/6/95
Attention: Jan Alden
Re: Montrose June 15, Test

TO Am Test - Air Quality, Inc.
30545 SE 84th Street #5
Preston, WA 98050

WE ARE SENDING YOU

☒ Attached ☐ Under separate cover via ______ the following items:

☐ Shop Drwgs. ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of Letter ☐ Change Order ☐ 3.5" disk ☐

COPIES	REV.	NO.	DESCRIPTION
1			Process Data for Final Report 11 Pages
			For Final Report

THESE ARE TRANSMITTED as Checked Below:

☐ For Approval
☒ For Your Use
☐ As Requested
☐ For Review & Comment
☐ FOR BIDS DUE ______

☐ Approved as Submitted
☐ Approved as Noted
☐ Returned for Corrections
☐ Resubmit ____ Copies for Approval

☐ Submit ____ Copies for Distribution
☐ Return ____ Corrected Prints
☐ For Your Information
☐

REMARKS:

Copy To: File,

Signed: Sue Somers / Sue Somers / D.B.

MONTROSE TESTING 6-15-95
PROCESS DATA

CONTENTS PAGE

MONTROSE DRYER TESTING 6-15-95, Pm

MONTROSE TESTING 6-15-95

TEST SCHEDULE

MONTROSE TESTING 6-15-95

DATE	POLLUTANT	RUN #1	RUN #2	RUN #3
7-18	PM	0910-1012	1050-1152	1227-1330

PROCESS DATA SUMMARY

MONTROSE TESTING 6-15-95

11.07 =Plant production rate in TONS per HOUR
1.62 =estimated TONS of dry fuel burned based on fuel measurement
26637 =LB per HOUR of furnish produced by the dryer
1088 =average dryer inlet temperature in deg. f.
37.7% =moisture content of incoming wood
5.7% =moisture content of wood after drying

MONTROSE TESTING 6-15-95 PM testing

DATA TIME: START= 09:00 END= 13:30 HOURS= 4.50

TOTAL HOURS = 4.50

BOARD WEIGHTS - LBS

weight of approximately every 25th untrimmed board

215	189	192
181	191	193
190	199	
193	195	
191	200	
192	188	
193	192	
194	190	
192	191	
187	187	

192.5 lb = average untrimmed mat weight

175.37 lb = average finished board weight (untrimmed mat weight-weight of trim)

8.9% = TRIM

PLANT PRODUCTION RATE

4.50 =hours during testing
71 =pressloads
568 =No. of (8' X 16') boards produced (no. of pressloads x 8 boards per load)
99610 =Lbs. finished product (no. of boards x weight of finished board)
22136 =Lbs. finished product produced per hour (lbs. of finished product / testing hours)
11.07 =Tons finished product per hour (lbs. of finished product per hour / 2000 lb)

DRYER PRODUCTION RATE:

26637 = lbs of dryer production per hour (lb. of finished product / (1-%trim + % fines))
8.0% =%FINES
8.9% =%TRIM
1088 =average dryer inlet temperature
37.7% =moisture content of incoming wood
5.7% =moisture content of wood after drying

DRYER FUEL BURNING RATE

4.504 =fuel calibration on lbs. per count
3227 =total counts during testing
4.50 =hours during testing
14534 =total lbs. of fuel burned during testing (calibration x total counts)
3230 =lbs of fuel burned per hour (total lbs fuel burned / testing hours)
1.62 = Tons of fuel burned per hour (lbs of fuel burned per hour / 2000 lbs.)
8600 =estimated BTU content per lb. of wood fuel
27.8 =estimated mmbtu input per hour (BTU content per lb. x lb. per hour)

46

DAILY INVENTORY SHEET

DATE 6-15-95

MTD 6425367

SHIFT 1	SHIFT 2	DAILY TOTAL 344920
***	***	

0	3/8	0	38.70	0	3/8	0
133	7/16	158895	38.82	39	7/16	46593
0	15/32	0	39.60	0	15/32	0
5	19/32 SE	8106	39.49	81	19/32 SE	131325
0	19/32 TG	0	39.76	0	19/32 TG	0
0	23/32 SE	0	37.07	0	23/32 SE	0
0	23/32 TG	0	37.60	0	23/32 TG	0
0	7/8 TG	0	37.20	0	7/8 TG	0
0	1 TG	0	36.50	0	1 TG	0
0	1-1/8 TG	0	36.50	0	1-1/8 TG	0
	TOTAL	167002			TOTAL	177919

MDI RESIN			COST			
DAY B/4	46907		.6912	INSIDE	3.29	28692
+INCOMING	0					
TODAY	43281					
USAGE	3626					
DAILY COST	7.27	1.91%				
				OUTSIDE	1.67	14589
MONTH USE	76679					
MONTH COST	8.25	2.20%				

PHENOLIC			COST			
DAY B/4	218144	0.2428	52858	SOUTH	5.04	34624
+INCOMING	0		.2342			
TODAY	206238			NORTH	13.75	78313
USAGE	11906					
DAILY COST	8.08	2.98%		WEST	12.83	85474
MONTH USE	274070			DAY	3.42	5211
MONTH COST	10.06	3.73%				

WAX			COST			
DAY B/4	105668		.232	TANK	18.17	102399
+INCOMING	0					
TODAY	102399					
USAGE	3269					
DAILY COST	2.20	0.78%				
MONTH USE	77974					
MONTH COST	2.82	1.01%				

# OF BRDS USED FOR 1 TESTS	2 7/16 2 19/32se	LBS. PROD DAILY	421351
		LBS. PROD MTD	7743154
		PH % TOTAL #'S	1.64
MDI % TOTAL #'S	0.86	DENSITY:	39.1
MDI % MTD	0.99	TOTAL	732.7
LPH % MTD	2.05	DAY#	19
		MTD DENSITY	38.6

9

DRYER DATA SHEET

DATE 6-15-95 ~~31 MAY 1995~~

BY Mike Kennedy

PLANT MONTROSE, COLORADO

READINGS EVERY 10 MIN.

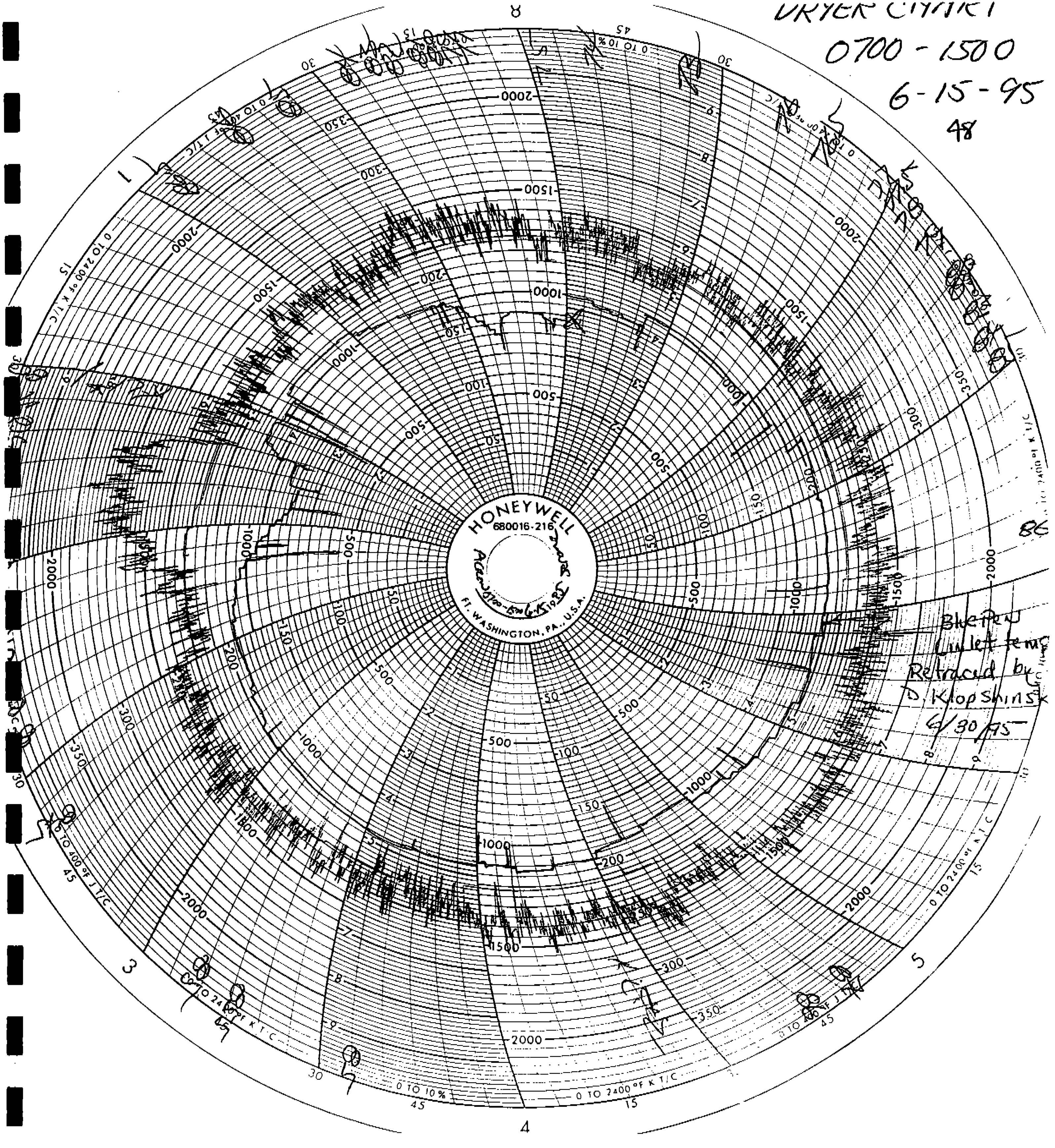
FUEL CALIBRATION: 4.504 lb Dry weight.

WET dry

TIME	OUTLET SET POINT	FEED RATE	DRYER INLET TEMP	DRYER OUTLET TEMP	FUEL COUNT	WET BIN LEVEL	DRY BIN LEVEL		EVERY HOUR FLAKE MOISTURE	
							SUR.	CORE	IN	OUT
0830	234.0	800	1081	233.3	696433	3/8	1/2	1/2		
0840	242.0	50.0	981	240.7	696511	3/8	- 1/2	1/2		
0850	246.1	50.0	849	244.2	696581	3/8	- 1/2	- 1/2		
0900	244.0	70.0	932	244.8	696690	3/8	- 1/2	- 1/2		901-6.2
0910	242.0	80.0	1028	242.7	696791	3/8	- 1/2	1/2		
0920	240.0	83.0	1097	239.6	696902	3/8	- 1/2	1/2	33	930
0940	234.5	84.5	1131	234.8	697209	3/8	3/8	3/8		
0950	234.5	84.5	1151	234.5	697280	3/8	3/8	3/8		
1000	234.5	84.5	1135	234.5	697404	3/8	3/8	3/8		5.6
1010	234.0	85.0	1090	233.9	697511	3/8	+3/8	+3/8		
1020	232.7	85.5	1136	232.2	697649	3/8	3/8	3/8		
1030	231.5	85.0	1119	231.2	697793	3/8	- 1/2	- 1/2	37.5	
1040	231.1	85.0	1144	231.5	697890	3/8	- 1/2	1/2		
1050	231.5	85.0	1147	231.9	697990	3/8	1/2	1/2		
1100	230.0	86.0	1125	229.9	698131	3/8	1/2	1/2		5.5
1110	232.0	85.0	1159	230.6	698257	3/8	1/2	1/2		
1120	230.6	85.0	1136	231.2	698356	1/2	1/2	1/2	41.9	
1130	231.0	85.0	1089	231.2	698468	1/2	1/2	1/2		
1140	231.0	850	1088	231.9	698565	3/8	1/2	1/2		
1150	231.0	87.0	1046	233.5	698666	3/8	1/2	1/2		5.8
1200	231.0	87.0	1088	230.1	698808	3/8	1/2	1/2		
1210	231.0	87.0	1111	230.8	698911	3/8	1/2	1/2		
1220	231.8	87.0	1150	232.8	699025	3/8	1/2	1/2	39.2	
1230	232.3	87.0	1166	231.6	699147	3/8	1/2	1/2		
1240	233.0	87.0	1183	234.6	699326	3/8	+1/2	+1/2		
1250	233.0	87.0	1187	233.1	699400	1/2	1/2+	1/2+		
1300	233.0	87.0	1191	231.7	699512	1/2	1/2+	1/2+		5.6
1310	233.0	86.0	1198	234.3	699650	1/2+	1/2+	1/2+		
1320	233.0	86.0	1184	233.1	699774	1/2	1/2+	1/2+	36.7	
1330	233.0	84.0	1198	233.6	699917	1/2	1/2	1/2		

5

DRYER CHART
0700 - 1500
6-15-95
48

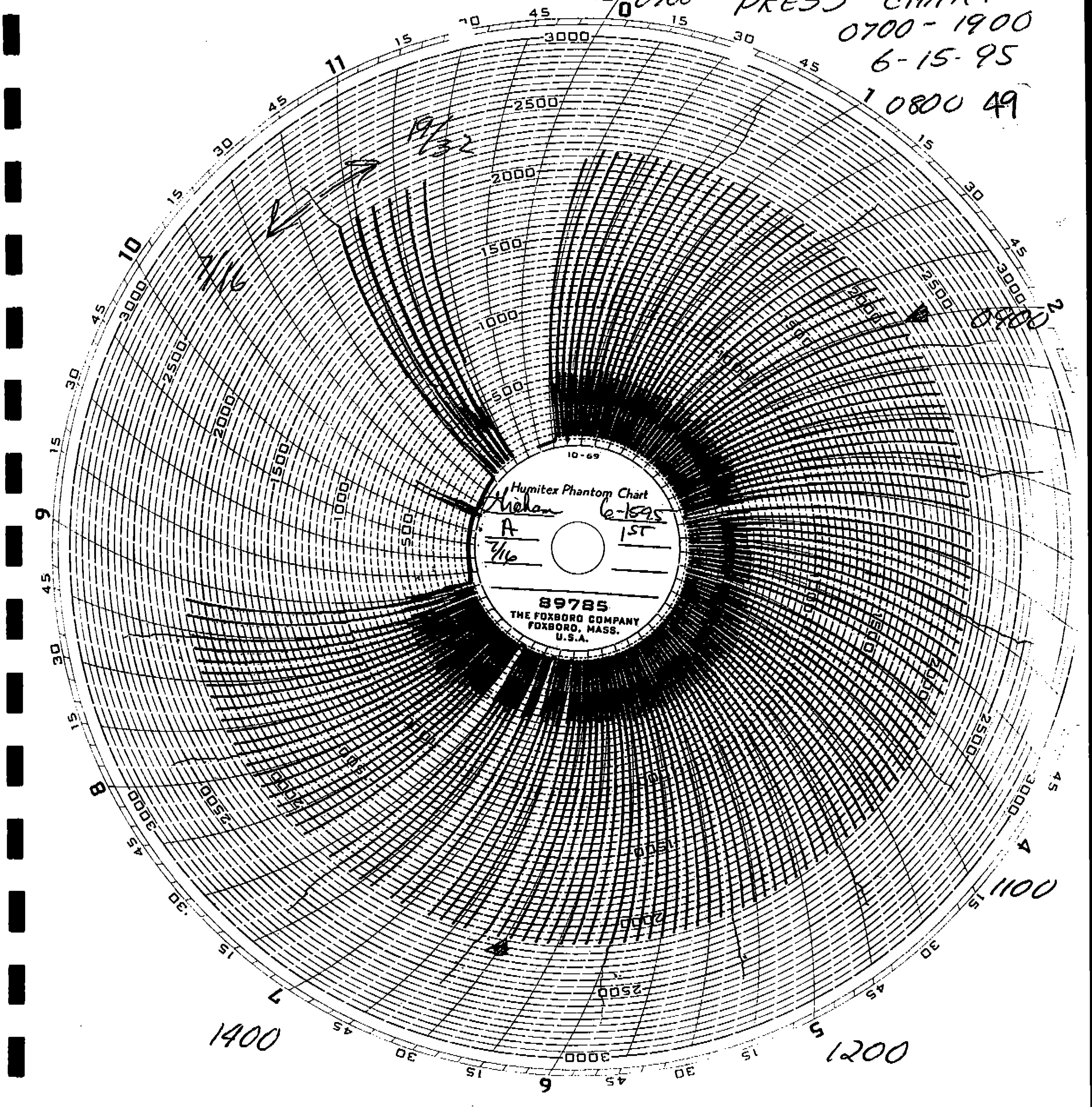


Blue Pen
Inlet temp
Retraced by
D Klopshinsk
6/30/95

Montrose Dryer Chart 6/15/95

6

PRESS CHART
0700 - 1900
6-15-95



1 0800 49

0900

1100

1200

1300

1400

PRESSLOADS 0900-1330
= 71

7

PRESS REPORT 50

MONTROSE, COLORADO

OPERATOR Graham SHIFT 1st CREW A DATE 6-15-95

Thumbwheel setting

Thickness 7/16

Surface______ Core______ Resin______

Flowmeter

Press Temp 200°

Pressloads 7/16 125-133 19/32 125-5 T. 138

Total Footage 167,001

Total Downtime minutes 180

Surface______lb Core______lb

Highest Board Wt______

Lowest Board Wt______

Former Setting

TSL________Core________BSL________

Dry Bin Thumbwheel Setting

Core________Surface________

	Downtime		Downtime (mins.)				REASON FOR DOWNTIME
	From	To	M	E	O	QC	
15	7:00	7:15			15		Changing Dry Bins
18	10:05	10:08	3				Dropp H.B. @ #6 T.O.
19	10:08	10:09		1			Press Not Loading
21	10:56	10:58	2				Dropped H.B. @ #6 T.O.
23	1:41	1:43	2				Dropped H.B. @ #6 T.O
25	1:58	1:60	2				" "
27	2:02	2:04		2			unloader Not unloading
28	2:12	2:13	1				No Mat @ Hop Pulling H.B.
29	2:14	2:15				1	Viewing forming
31	2:33	2:35	2				Dropped H. B. @ #6 T.O.
34	2:35	2:38		3			Trip on Core Former Rack [illegible]
35	3:50	3:51	1				Dropped H.B. @ # 8
36	3:56	3:57		1			FLT #7 Limit Not making
38	3:59	4:01	2				Unit stuck in stacker
39	4:03	4:04	1				F.C.O.S. Missed a Cut
178	4:05	6:24	139				F.C.O.S. Problems / Power Outage
180	6:26	6:28		2			Press Not Loading

Downtime Code: M – Mechanical E – Electrical O – Operator

8

6-15-95

51

READINGS EVERY 10 MIN.

E-TUBE DATA SHEET

DATE ~~31 MAY 1995~~

BY Mike Kennedy

PLANT: MONTROSE, COLORADO

TIME	QUENCH CHAMBER TEMP	SOUTH TR SET KV	MA	SPARK RATE	NORTH TR SET KV	MA	SPARK RATE	INDICATE TIME FLUSH CYCLE
0835	215.6 121.7	52	180	27.3	53	180	27.9	7
0845	216.2 120.1	52	180	27.6	53	190	27.7	/
0855	217.6 122.6	52	170	28.2	54	190	27.8	0901
0905	219.9 126.4	46	90	28.1	52	160	28.0	
0915	220.6 130.1	49	100	27.7	54	170	27.9	
0925	218.8 131.0	50	110	27.9	52	150	27.6	
0935	215.7 132.4	50	100	28.0	52	140	28.0	
0945	215.6 132.4	50	120	27.9	52	140	27.8	
0955	215.4 131.8	50	130	27.9	53	150	27.8	
1005	215.9 131.2	51	130	27.9	54	180	27.7	
1015	216.5 131.4	50	120	27.7	52	170	27.8	
1025	215.5 131.3	46	100	28.0	46	100	28.9	N 1027
1035	216.3 132.6	50	100	27.7	52	160	27.7	
1045	215.8 131.8	50	110	27.7	52	170	27.6	
1055	214.8 132.0	51	130	27.7	54	180	28.3	
1105	216.1 132.4	50	130	27.9	53	170	27.5	
1115	214.4 132.7	52	140	27.9	54	180	27.6	
1125	215.4 131.6	52	150	27.7	54	190	27.9	
1135	216.1 131.0	40	50	28.8	51	170	28.0	S
1145	216.4 130.1	50	100	26.7	54	190	27.8	
1155	216.7 129.8	52	120	27.4	53	180	27.9	
1205	216.0 130.8	52	120	27.9	53	180	27.7	
1215	216.0 132.8	52	140	27.8	52	160	27.8	
1225	216.4 133.9	52	140	27.7	53	160	27.9	
1235	217.4 134.1	53	140	27.8	54	190	27.8	
1245	218.4 133.8	52	140	27.9	53	180	27.8	
1255	218.2 133.8	52	130	27.7	52	190	27.8	
1305	217.4 135.1	51	120	27.8	52	170	27.8	
1325	218.5 134.3	52	130	27.7	52	170	28.0	
1335	218.5 134.2	52	140	27.8	51	160	28.0	

READINGS EVERY 10 MIN.

E-TUBE DATA SHEET

DATE ~~15 JUNE 1995~~

PLANT: MONTROSE, COLORADO

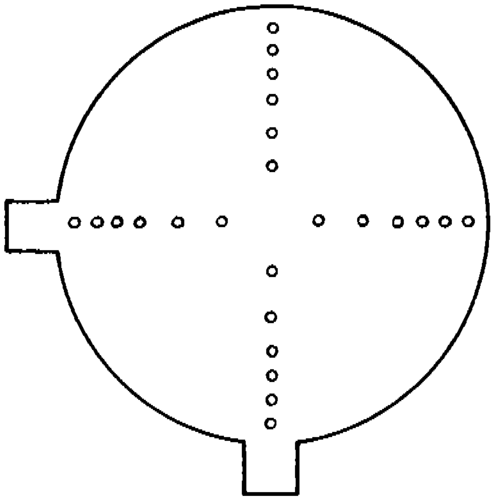
BY

6-15-95

TIME	QUENCH CHAMBER TEMP	SOUTH TR SET KV	SOUTH TR SET MA	SOUTH TR SET SPARK RATE	NORTH TR SET KV	NORTH TR SET MA	NORTH TR SET SPARK RATE	INDICATE TIME FLUSH CYCLE
	218.4 132.5	51	140	27.9	50	160	27.9	

CROSS SECTIONAL AREA

Traverse Point	Distance (inches)
1	1.0
2	3.2
3	5.7
4	8.5
5	12.0
6	17.1
7	30.9
8	36.0
9	39.5
10	42.3
11	44.8
12	47.0



STACK DIMENSIONS

48-inch diameter circular stack

2 ports

A = 40 feet downstream

B = 14 feet upstream

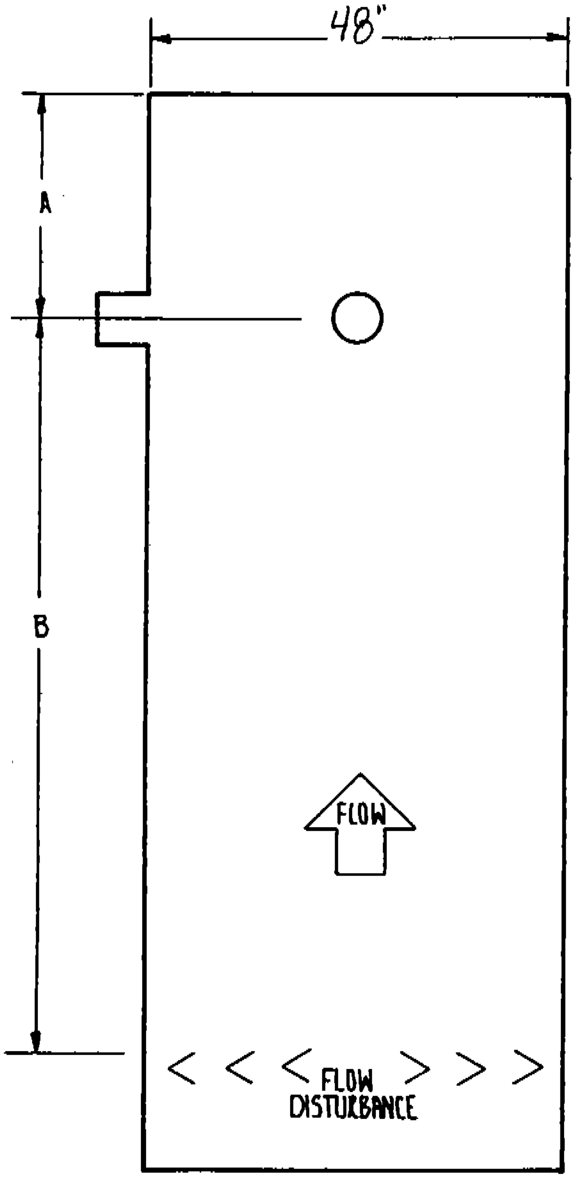


Figure 1. Location of Sampling Ports and Traverse Points

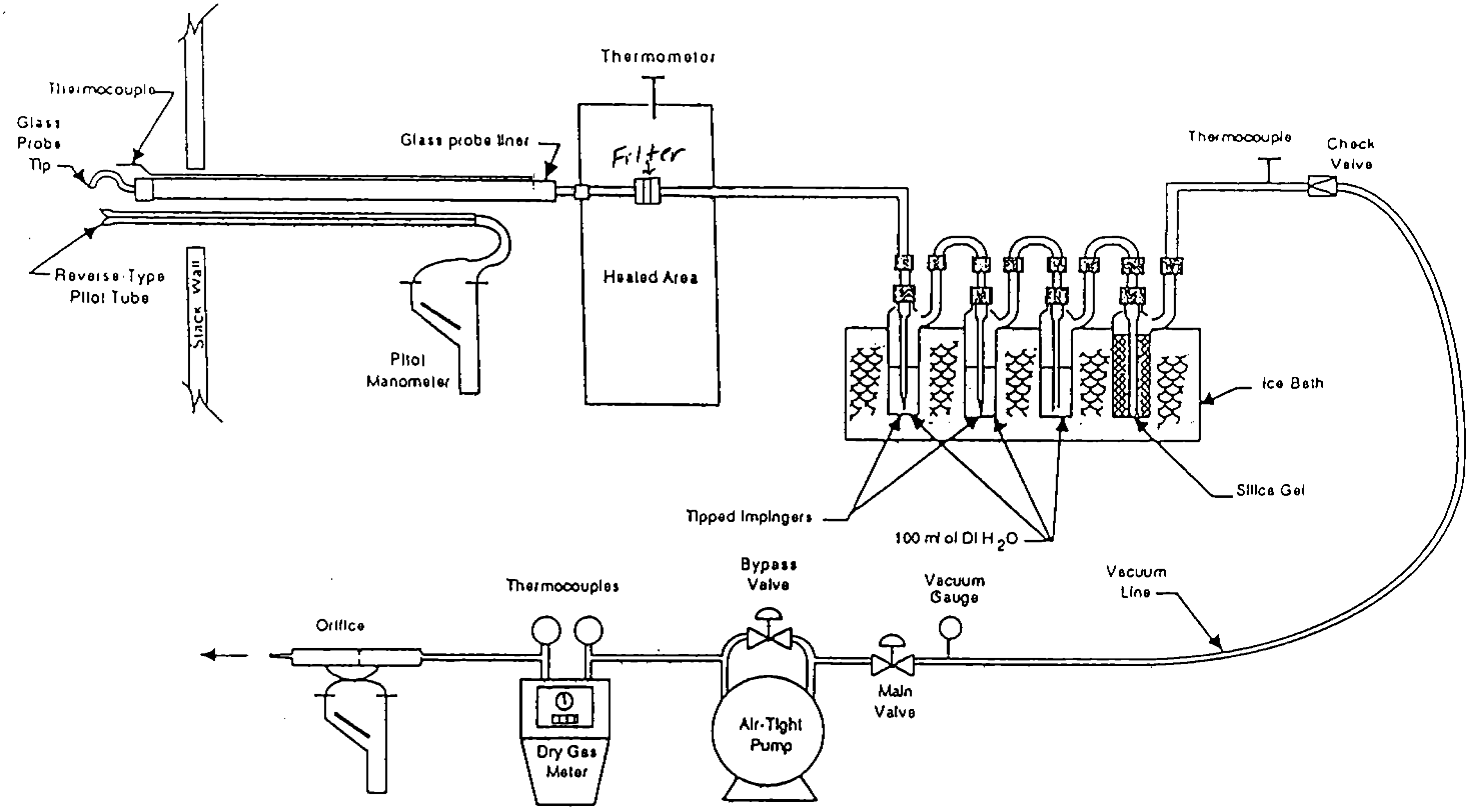


Figure: 2 EPA Method 5/202 Sample Train

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

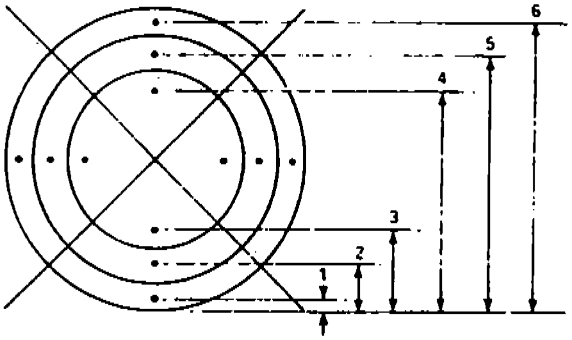


Figure 1-3. Example showing circular stack cross section divided into 12 equal areas, with location of traverse points indicated.

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.

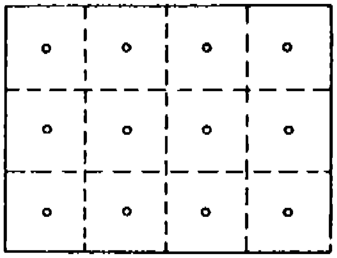


Figure 1-4. Example showing rectangular stack cross section divided into 12 equal areas, with a traverse point at centroid of each area.

METHOD 1 - MINIMUM NUMBER OF TRAVERSE POINTS

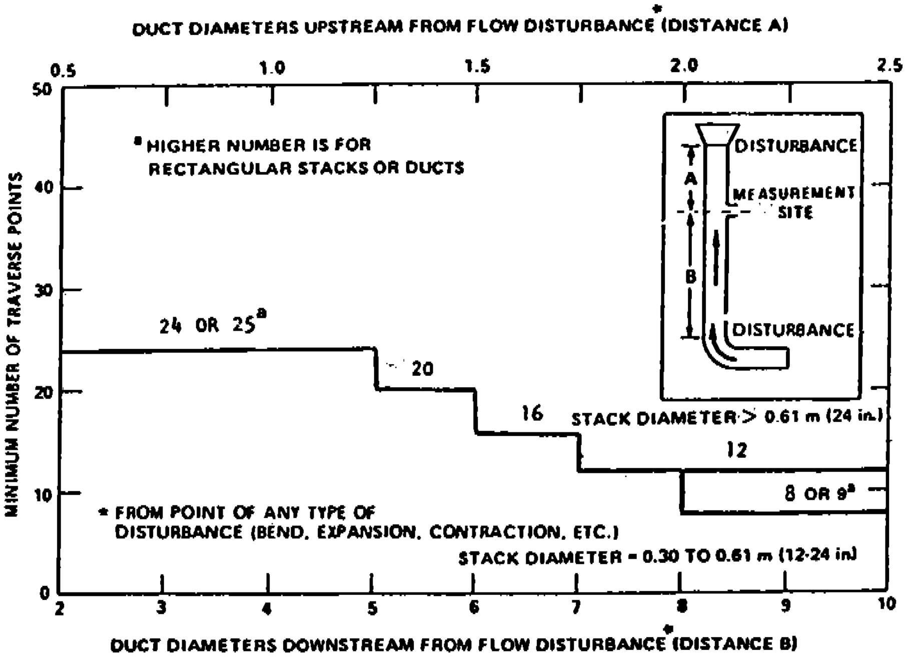


Figure 1-1. Minimum number of traverse points for particulate traverses.

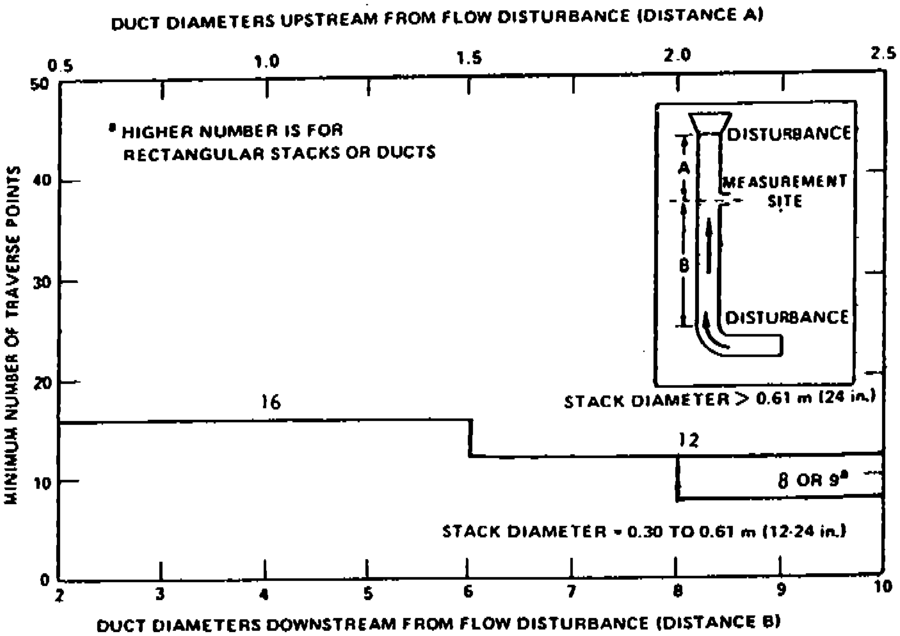


Figure 1-2. Minimum number of traverse points for velocity (nonparticulate) traverses.

METHOD 2 - STACK GAS VELOCITY AND VOLUMETRIC FLOW CALCULATIONS

5.1 Nomenclature.

A=Cross-sectional area of stack, m² (ft²).

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,

$$34.97\ \frac{\text{m}}{\text{sec}}\left[\frac{(g/g\text{-mole})(\text{mm Hg})}{(^\circ\text{K})(\text{mm H}_2\text{O})}\right]^{1/2}$$

for the metric system and

$$85.49\ \frac{\text{ft}}{\text{sec}}\left[\frac{(\text{lb/lb-mole})(\text{in. Hg})}{(^\circ\text{R})(\text{in. H}_2\text{O})}\right]^{1/2}$$

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).

Δp=Velocity head of stack gas, mm H₂O (in. H₂O).

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.

%CO₂=Percent CO₂ by volume (dry basis).

%O₂=Percent O₂ by volume (dry basis).

%CO=Percent CO by volume (dry basis).

%N₂=Percent N₂ by volume (dry basis).

0.264=Ratio of O₂ to N₂ in air, v/v.

0.280=Molecular weight of N₂ or CO, divided by 100.

0.320=Molecular weight of O₂ divided by 100.

0.440=Molecular weight of CO₂ divided by 100.

6.2 Percent Excess Air. Calculate the percent excess air (if applicable), by substituting the appropriate values of percent O₂, CO, and N₂ (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 O₂ and that the fuel does not contain appreciable amounts of N₂ (as do coke oven or blast furnace gases). For those cases when appreciable amounts of N₂ are present (coal, oil, and natural gas do not contain appreciable amounts of N₂) 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.

60

METHOD 5 - PARTICULATE EMISSION CALCULATIONS - (1)

6.1 Nomenclature.

A_n = Cross-sectional area of nozzle, m² (ft²).
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 m³/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), m³/min (cfm).
L_p = Leakage rate observed during the post-test leak check, m³/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-m³/°K-g-mole (21.85 in. Hg-ft³/°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 H₂O (in. H₂O).
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;
K₁ = 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 , 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:

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

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

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

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.

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

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

Δp = 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: BKAH595.WK1
METER BOX #: Blue KAH
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@
15.5	0.5	116.745	122.440	73.0	70.0	29.57	921.910	927.825	68.0	68.0	1.001	1.0453	1.932
10.5	1.0	122.440	128.003	75.0	71.0	29.57	927.825	933.596	69.0	68.0	1.001	1.0447	1.863
10.0	1.5	83.667	90.020	72.0	68.0	29.57	888.346	894.864	68.0	67.0	1.001	1.0280	1.991
10.0	2.0	90.204	98.035	74.0	69.0	29.57	895.155	903.015	68.0	68.0	1.001	1.0064	1.825
10.0	2.5	98.243	106.790	75.0	69.0	29.57	903.222	911.865	71.0	68.0	1.001	1.0107	1.898
10.0	3.0	107.316	116.745	77.0	70.0	29.57	912.305	921.910	68.0	68.0	1.001	1.0227	1.830
AVERAGE												1.026	1.890

PRESSURE SENSOR CALIBRATION DATA FORM

Date 11-8-94 ACP Control Box # Blue KAH Box

Ambient Temperature 81 °F Barometric Pressure 29.27 in Hg

	MAGNEHELIC GUAGE #	REFERENCE MANOMETER READING Inches H_2O	MAGNEHELIC GUAGE READING Inches H_2O	PRESSURE DIFFERENCE Inches H_2O	%
	BLUE KAH	M5 BOX			
HIGH	0-1	0.78	0.78	0	0
		0.58	0.58	0	0
		0.39	0.40	0.01	2.6
		0.21	0.21	0	0
LOW	0-1	0.795	0.80	0.005	0.6
		0.595	0.60	0.005	0.8
		0.39	0.39	0	0
		0.20	0.20	0	0
HIGH	0-4	0.79	0.80	0.01	1.3
		1.30	1.35	0.05	3.8
		2.40	2.45	0.05	2.1
		3.10	3.20	0.10	3.2
LOW	0-4	0.80	0.80	0	0
		1.30	1.30	0	0
		2.40	2.40	0	0
		3.30	3.40	0.1	3

$$\frac{(\text{ref pres. " } H_2O - \text{test pres. " } H_2O))}{(\text{ref pres. "} H_2O)} \bullet 100 \leq 5\%$$

PRESSURE SENSOR CALIBRATION DATA FORM

Date 11-8-94 Control Box # BLUE KAH BOX

Ambient Temperature 81 °F Barometric Pressure 29.27 in Hg

	MAGNEHELIC GUAGE #	REFERENCE MANOMETER READING Inches H_2O	MAGNEHELIC GUAGE READING Inches H_2O	PRESSURE DIFFERENCE Inches H_2O	PRESSURE DIFFERENCE %
	BLUE KAH M5 BOX				
HIGH	0-2	0.34	0.35	0.01	2.9
		0.79	0.80	0.01	1.3
		1.20	1.20	0	0
		1.90	1.85	0.05	2.6
LOW	0-2	0.34	0.35	0.01	2.9
		0.70	0.70	0	0
		1.10	1.10	0	0
		2.0	1.90	0.10	5
HIGH	0-5	1.10	1.10	0	0
		2.0	1.90	0.10	5
		2.9	2.9	0	0
		4.1	4.0	0.10	2.4
LOW	0-5	1.10	1.10	0	0
		2.10	2.00	0.10	4.8
		3.10	3.05	0.05	1.6
		3.90	3.75	0.15	3.8

$$\frac{(\text{ref pres. " } H_2O - \text{test pres. " } H_2O))}{(\text{ref pres. "} H_2O)} \cdot 100 \leq 5\%$$

[redacted] TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 11-9-94 AEP Thermocouple Indicator # BLUE KAH BOX

Ambient Temperature 65 °F Barometric Pressure 29.19 in Hg

THERMOCOUPLE # OR REFERENCE	REFERENCE THERMOMETER TEMPERATURE °F	THERMOCOUPLE TEMPERATURE °F	TEMPERATURE DIFFERENCE	
			°F	%
Meter in	33 °F	33 °F	0	0
	210 °F	211 °F	1	0.15
	ambient – 72.5 °F	72 °F	0.5	0.09
METER OUT	34 °F	33 °F	1	0.20
	211 °F	212 °F	1	0.15
	Ambient – 75.5 °F	75 °F	0.5	0.09

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

AMTEST
AIR QUALITY, INC.

#1

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.

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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 4-1-95 Pitot Tube # 01955B

Client Louisiana-Pacific Corporation

Location Montrose, Colorado

Site(s) Dryer E-tube stack

Test Date(s) 6/15/95

Pitot tube assembly level? ✓ yes ____ no

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

α_1 = 0 ° (<10°), α_2 = 0 ° (<10°), β_1 = 0 ° (<5°),

β_2 = 1 ° (<5°)

Y = 1 °, θ = 2 °, A = 1.088 cm (in.)

$z = A \sin Y$ = 0 cm (in.); <0.32 cm (<1/8 in.),

$w = A \sin \theta$ = 0 cm (in.); <.08 cm (<1/32 in.)

P_A .577 cm (in.) P_b .519 cm (in.)

D_t = .378 cm (in.)

Comments:

Calibration required? ____ yes* ✓ no

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

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 4-1-95 Thermocouple Indicator # T195-5-3

Ambient Temperature 75 °F Barometric Pressure 29.75 in Hg

THERMOCOUPLE # OR REFERENCE	REFERENCE THERMOMETER TEMPERATURE °F	THERMOCOUPLE TEMPERATURE °F	TEMPERATURE DIFFERENCE	
			°F	%
Ice H20 1	38	38	0	0
2	38	37	1	0.002
3	36	36	0	0
Boilin H20 1	193	195	2	0.003
2	198	198	0	0
3	200	201	1	0.002
Boilin oil 1	290	289	1	0.002
2	305	302	3	0.004
3	312	309	3	0.004

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

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RESUME OF
KRIS A. HANSEN

PRESIDENT
AM TEST-AIR QUALITY, INC.
AM TEST ALASKA

EDUCATION

- B.S., Chemistry, Central Washington University, 1973
- Coursework and 2.5 years research completed towards M.S., Chemistry, Central Washington University
- Several workshops, courses and conferences annually, including a Continuous Emission Monitoring System (CEMS) Workshop, taught by Dr. James Jahnke in October 1992, an Advanced Emission Measurement Workshop in July 1993, a Title III MACT Workshop in 1994, a Title V Operating Permits Workshop in 1994 and Enhanced Monitoring Workshops in 1993 and 1994.

PROFESSIONAL MEMBERSHIPS

- Air and Waste Management Association (AWMA)
- Pacific Northwest International Section of AWMA (PNWIS)
- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

Am Test-Air Quality, Inc. was formed under the direction of Mr. Hansen in 1982. This company conducts full-service source testing activities. Mr. Hansen keeps current on recent developments in EPA methodology and has developed sampling and analysis techniques for many sources for which EPA guidelines are not available. He has worked at numerous types of industrial facilities, including oil and gas refineries, gas, oil and coal-fired power plants, nuclear plants, aluminum plants, wood products industries, smelters, incinerators, and other industrial sources throughout the United States and internationally. Mr. Hansen manages an experienced field testing and laboratory analysis staff. Mr. Hansen manages all phases of project development, including cost estimation, scheduling, sample collection, analysis and report preparation. He also manages all other aspects of the business, including business development and personnel issues.

Prior to joining Am Test, Inc., Mr. Hansen's professional experience included 4.5 years as the Manager of Laboratory services and a Project Leader for an environmental consulting firm which specialized in air quality studies, and 2 years as a laboratory instructor while attending graduate school at Central Washington University, where his research emphasis was in gas chemistry. Mr. Hansen has 18 years of professional experience.

Mr. Hansen has assisted in the instruction of the EPA 450 "Source Sampling for Particulate Pollutants" and the EPA 468 "Source Sampling and Analysis of Gaseous Pollutants" courses offered yearly by the EPA in cooperation with the University of Washington. Students are represented by industry and governmental agency personnel from across the U.S. and other nations. Mr. Hansen was the recipient of the 1987 PNWIS/APCA "Hardhat Award" which was presented in recognition of his contributions to the advancement of source sampling technology in the Pacific Northwest.

[afb\c\bp\res-kah, 8/25/94]

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RESUME OF
ANGELA F. BLAISDELL

VICE PRESIDENT/SR. TECHNICAL WRITER

EDUCATION

- B.S., Marine Resources, Western Washington University, Bellingham, Washington, 1980
- Minors in Chemistry and Biology
- Several workshops, courses and conferences annually, including a Continuous Emission Monitoring System (CEMS) Workshop, taught by Dr. James Jahnke in October 1992 and April 1993, a Title V Operating Permits Workshop in May 1993, an Advanced Emission Measurement Workshop in July 1993, a Title III MACT Workshop in 1994 and Enhanced Monitoring Workshops in 1993 and 1994.

PROFESSIONAL MEMBERSHIPS

- Air and Waste Management Association (A&WMA)
- Pacific Northwest International Section of A&WMA (PNWIS)
- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

Ms. Blaisdell has worked with Am Test-Air Quality, Inc. for the past 10 years and has had 14 years of professional experience in the field of air quality. She helps manage all aspects of source test projects, including initial client contact, scope of work preparation, scheduling, pre-test coordination, implementation of quality assurance programs for field sampling, analysis, data reduction, final data review and report preparation and review. She reviews current literature for each test method and incorporates the methodology into our testing and reporting protocol. Ms. Blaisdell recently assisted in the instruction of the EPA-APTI 464L "Continuous Emission Monitoring" course, the EPA 450 "Source Sampling for Particulate Pollutants" course and the EPA 502 Course "Hazardous Waste Incineration" offered by the EPA's Air Pollution Training Institute in cooperation with the University of Washington. She was the General Chair of the 1994 PNWIS Spring Specialty Conference on Enhanced Monitoring, and was a speaker at the 1990 and 1991 PNWIS annual meetings on the subject of continuous emission monitoring systems (CEMS). Angela is the current Treasurer and past secretary/treasurer for the Pacific Northwest International Section (PNWIS) of the Air and Waste Management Association (A&WMA) and is the past Chair for the Puget Sound Chapter of PNWIS. Ms. Blaisdell was the recipient of the 1991 PNWIS/A&WMA "Labcoat Award" which is presented each year to an individual to recognize his contribution to the advancement of source sampling methodology in the Pacific Northwest.

Prior to joining Am Test, Ms. Blaisdell acted as a Project Leader and Office Manager for an environmental engineering consulting firm in the Seattle area for 2 years. Experience with that firm involved sample collection, analysis and report preparation for source and ambient air, water and industrial hygiene studies. Ms. Blaisdell also worked on various research projects in the Chemistry department while attending Western Washington University.

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RESUME OF
STANLEY B. MOYE

SENIOR AIR QUALITY SPECIALIST/CHEMIST

EDUCATION

- Coursework completed towards B.S., Mathematics, Chemistry Central Washington University
- EPA 450 "Source Sampling for Particulate Pollutants Course", August 1992.
- Continuous Emission Monitoring System (CEMS) Workshop, taught by Dr. James Jahnke, April 1993.

PROFESSIONAL EXPERIENCE

Mr. Moye began his employment with Am Test-Air Quality, Inc. in August 1992. He conducts source testing and activities related to emission testing, including preparing and packing the sampling equipment for mobilization to the test site, field sampling, test equipment maintenance, troubleshooting and calibration, and pre-test planning and preparation. He has performed EPA Methods 1, 2, 3A, 4, 5, 6, 6C, 7, 7E, 8, 10, 11, 12, 13A, 16A, 17, 20, 23, 25A, 26, 26A, 29, 101A, 201A for PM_{10}, and 202. He is familiar with several toxic organic (TO) methods and solid waste (SW-846) methods to quantify hazardous air pollutants (HAPs). In the field, Mr. Moye sets up the equipment at each sample site, performs the tests, turns over samples between each run, analyzes samples and assists in demobilization. In the laboratory and office, he performs test equipment trouble-shooting, maintenance, fabrication, and calibration.

Prior to joining Am Test, Mr. Moye worked as a Source Tester/Lab Technician for Simpson Tacoma Kraft in Tacoma, Washington for 15 years. In this position, Mr. Moye maintained the in-house continuous emission monitoring system (CEMS), performed particulate matter and total reduced sulfur testing, sample recovery and analysis as well as data reduction and report generation. Mr. Moye conducted testing with respect to wet and dry Kraft recovery precipitators and hog fuel boiler precipitators, and performed quality assurance procedures of ITT Barton total reduced sulfur instruments as well as the maintenance and repair of NCG system. Mr. Moye performed vessel Enkly tests for oxygen, sulfur dioxide, hydrogen sulfide, carbon monoxide, carbon dioxide and Exptor.

RESUME OF
JAN W. ALDEN

SENIOR TECHNICAL WRITER

EDUCATION

- B.S., Marine Resources, Western Washington University, Bellingham, Washington, 1980
- Minor in Biology
- Continuous Emission Monitoring System (CEMS) Workshop, taught by Dr. James Jahnke, April 1993.
- Enhanced Monitoring Workshop, May 1994.

PROFESSIONAL MEMBERSHIPS

- Pacific Northwest International Section of A&WMA (PNWIS)
- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

Ms. Alden has been with Am Test-Air Quality, Inc. for nearly 8 years. Currently, she performs technical writing of reports and word processing of proposals, test plans, and reports for the Vice President to review. She develops new computerized data reduction programs for field and laboratory analysis data, performs quality assurance review of the data input and performs by-hand calculations to verify computer program integrity. Ms. Alden assists in training new personnel and also performs many administrative duties to keep the air quality office organized and operating efficiently.

Ms. Alden was formerly 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. Alden has acted as a Project Assistant, assisting the Project Manager, Project Engineer, or Project Leader in handling and setting up the equipment at each sample site, running the control box and recording data, sample recovery, in-field analysis, data reduction, and demobilization. She was responsible for properly labeling and identifying each sample, and initiating chain-of-custody procedures.

In the laboratory, Ms. Alden is experienced in gravimetric analysis of particulate matter samples, particle size distribution samples, wet chemical titrametric analysis and glassware preparation for organics and metals testing. She supervises the preparation and analysis of samples for quantifying sulfur oxides, nitrogen oxides, hydrogen sulfide, lead, toxic metals (including hexavalent chromium), semi-volatile compounds (including dioxins and furans), and volatile organic compounds.

RESUME OF
CASSIE B. HEATON

PROJECT ENGINEER/CHEMIST

EDUCATION

- B.A. in Chemistry, BSc in Chemical Engineering
  University of Colorado, Boulder, Colorado, 1990
- Engineer-in-Training; State of Colorado
- EPA 450 "Source Sampling for Particulate Pollutants Course", August 1992.

PROFESSIONAL EXPERIENCE

Ms. Heaton began her employment with Am Test-Air Quality, Inc. in January 1992. She performs technical writing of reports and word processing of proposals, test plans, and reports for the Senior Technical Writers to review. She performs data processing of field and laboratory analysis data using computerized data reduction programs, and performs by-hand calculations to verify computer program integrity. She also develops new computerized data reduction programs for field and laboratory analysis data and reviews other staff members data for accuracy.

Ms. Heaton is also experienced preparing and packing sampling equipment for mobilization to the test sites, and in assisting the Project Leaders to collect samples. She has assisted in handling and setting up the equipment at each sample site, running the control box and recording data, sample recovery, in-field analysis, data reduction, and demobilization.

In the laboratory, Ms. Heaton is experienced with gravimetric analysis of particulate matter samples and particle size distribution samples, wet chemical titrametric analysis and glassware preparation for organics and metals testing. She assists in preparation and analysis of samples for quantifying sulfur oxides, nitrogen oxides, hydrogen sulfide, toxic metals (including hexavalent chromium), semi-volatile compounds (including dioxins and furans), and volatile organic compounds.

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.

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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.

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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.

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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

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

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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.

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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

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
Jarrell Ash ICP Plasma Emission Spectrometer
Gas Chromatographs: FID, EC, TC, N_2, P
Jarrell Ash Arc, Spark Emission Spectrometer
Xertex TOX Analyzer
Source Test Equipment-EPA Approved
Atomic Absorption Spectrometer-Flame
Atomic Absorption Spectrometer-Graphite Furnace
Atomic Absorption Spectrometer-Hydride Generation
UV/Visible Spectrometer
Infrared Spectrometer
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.