upgr to e/f 12/13/93

AMTEST AIR QUALITY, INC.

AmTest-Air Quality, Inc.
30545 S.E. 84th St., #5
Preston, WA 98050
Office: (206) 222-7746
FAX: (206) 222-7849

SOURCE

EMISSION

EVALUATION

October 12, 1993

Prepared For:

Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

LAKESIDE INDUSTRIES, INC.
COUNTERFLOW DRUM MIX ASPHALT PLANT
BAGHOUSE STACK
METHOD 5 TESTING
MONROE, WASHINGTON
SEPTEMBER 23, 1993

Submitted by:

Kris A. Hansen
Project Manager

James A. Guenthoer
Sr. Project Engineer

Angela F. Blaisdell
Sr. Technical Writer

Am Test-Air Quality, Inc.
Preston, Washington

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

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1.0
INTRODUCTION

The purpose of this source emission evaluation was to quantify particulate matter emissions at the baghouse exhaust of a counterflow drum mix asphalt plant located at Lakeside Industries, Inc.'s Monroe, Washington facility. The asphalt plant was manufactured by Gencor and is equipped with a Gencor baghouse to control particulate matter emissions prior to exhausting to the atmosphere. Lakeside Industries, Inc. contracted Am Test-Air Quality, Inc. based in Preston, Washington to conduct these source tests. These tests were performed to demonstrate compliance with Puget Sound Area Pollution Control Agency (PSAPCA) notice of construction No. 4813 requirements.

Testing and analysis procedures used for this project are presented in the July 1, 1992 edition of the Environmental Protection Agency (EPA) document Title 40, Code of Federal Regulations, Parts 53-60 (40 CFR 60), Appendix A, Methods 1, 2, 3, 4, and 5, and the Puget Sound Air Pollution Control Agency (PSAPCA) Regulation I. 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). Method 4 was performed to measure the moisture content of the stack gas. Method 5 was performed to quantify particulate and condensible matter emissions. PSAPCA 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 in accordance with PSAPCA Regulation 1 procedures. Three (3) 62.5-

minute Method 1, 2, 3, 4 and 5 samples were collected at the baghouse exhaust on September 23, 1993.

Mr. James A Guenthoer and Mr. E. Ray Lawrence of Am Test-Air Quality, Inc. performed the field sampling. Sample recovery and laboratory analysis of the Method 5 samples was performed by Ms. Wendy A. Linn of Am Test. Data reduction, quality assurance review and final report preparation were performed by Mr. Kris A. Hansen, Ms. Angela F. Blaisdell, Ms. Cassie B. Heaton, Ms. Jan W. Alden, Ms. Amy M. Brotherton and Ms. Linn of Am Test. This testing program was coordinated by Mr. Harold Nickel and Mr. Forest Lane of Lakeside Industries.

2.0

SUMMARY OF RESULTS

The results of the three (3) 62.5-minute Method 5 tests for quantifying particulate and condensible matter emissions at the asphalt plant baghouse exhaust are summarized in Table 2.0 below, and on page 4 in a computer printout titled "Summary of Results - Methods 1, 2, 3A, 4 and 5".

Table 2.0. Summary of particulate matter emission test results from samples collected on September 23, 1993 at the baghouse exhaust at Lakeside Industries, Inc.'s facility in Monroe, Washington.

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	0.011	0.010	0.021	4.33
2	0.014	0.012	0.025	5.38
3	0.008	0.012	0.020	3.92
Average	0.011	0.011	0.022	4.54

The front-half, back-half and total particulate matter emission concentrations in Table 2.0 are presented in units of grains per dry standard cubic foot (gr/dscf). The total particulate matter emission rate is presented in units of pounds per hour (lb/hr). 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 $\pm$ 10%. Computer printouts of the results from the individual Method 5 tests are included in Appendix A of this report. Appendix B of this report contains example calculations of the results, along with copies of original field data sheets.

AMTEST
AIR QUALITY, INC.

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

FILE NAME: S7018\LIM5SUM
CLIENT: LAKESIDE INDUSTRIES, INC.
LOCATION: MONROE, WASHINGTON

	BAGHOUSE STACK			
	RUN #1	RUN #2	RUN #3	AVERAGE
LAB #:	4365	4366	4367	
DATE:	9/23/93	9/23/93	9/23/93	
START TIME:	18:44	20:32	22:42	
STOP TIME:	19:51	22:04	23:52	
SAMPLE LENGTH (minutes):	62.5	62.5	62.5	
VOLUME SAMPLED (cubic feet):	36.178	34.411	34.118	34.902
VOLUME SAMPLED (dry std. cubic feet):	36.746	35.749	35.748	36.081
VOLUME SAMPLED (dry std. cubic meters):	1.041	1.012	1.012	1.022
STACK GAS MOISTURE (percent):	28.82	24.01	28.66	27.16
BAROMETRIC PRESSURE (inches of Hg):	30.10	30.15	30.15	30.13
STATIC PRESSURE (inches of H2O):	-0.16	-0.18	-0.17	-0.17
STACK PRESSURE (inches of Hg):	30.09	30.14	30.14	30.12
STACK TEMPERATURE (degrees F.):	223.2	228.8	236.2	229.4
STACK TEMPERATURE (degrees R.):	683.2	688.8	696.2	689.4
CARBON DIOXIDE (percent):	6.2	6.9	6.4	6.5
OXYGEN (percent):	12.0	11.0	11.7	11.6
MOLECULAR WEIGHT (dry, g/g-mole):	29.47	29.54	29.49	29.50
MOLECULAR WEIGHT (wet, g/g-mole):	26.17	26.77	26.20	26.38
AVERAGE VELOCITY HEAD (inches of H2O):	0.471	0.445	0.427	0.45
PITOT TUBE Cp:	0.84	0.84	0.84	
STACK GAS VELOCITY (feet per second):	45.9	44.2	44.1	44.7
STACK DIAMETER (inches):	48x48	48x48	48x48	
STACK AREA (square feet):	16.00	16.00	16.00	
STACK GAS AIRFLOW (dry std. cubic feet per min.):	24384.5	24917.5	23061.8	24121.3
STACK GAS AIRFLOW (actual cubic feet per min.):	44074.8	42473.0	42317.4	42955.1
NOZZLE DIAMETER (inches):	0.259	0.259	0.259	
ISOKINETICS (percent):	106	100	109	
FRONT-HALF PARTICULATE EMISSION CONC. (gr/dscf):	0.011	0.014	0.008	0.011
BACK-HALF PARTICULATE EMISSION CONC. (gr/dscf):	0.010	0.012	0.012	0.011
TOTAL PARTICULATE EMISSION CONC. (gr/dscf):	0.021	0.025	0.020	0.022
TOTAL PARTICULATE EMISSION CONC. (mg/dscm):	47.4	57.7	45.3	50.1
TOTAL PARTICULATE MATTER EMISSION RATE (lb/hr):	4.33	5.38	3.92	4.54

3.0
SOURCE OPERATION

The Gencor Model Ultraplant 300 (I.D. M5300UDS 7390-92-NA) counterflow drum mix asphalt plant located at Lakeside Industries, Inc.'s facility located at 14800 195th Avenue S.E. in Monroe, Washington was constructed and installed in 1993. Emissions from the asphalt plant are controlled by a Gencor baghouse prior to exhausting to the atmosphere. The plant was fired with propane at a rate of 75%. The baghouse contains 420, 16.25-inch by 192-inch, 14 ounce Nomex bags. The pressure drop across the baghouse averaged 3 inches of water column ("H_2O) on the day of testing. According to plant personnel, the plant operated at an average asphalt production rate of 300 tons per hour (tph), with a gravel moisture content of 5%, gravel containing 6.4% fines and an asphalt discharge temperature of 315° F. A process information sheet, signed in the field by a Lakeside Industries plant operator, is included in Appendix C of this report.

4.0

METHODOLOGY REFERENCES

Sampling procedures specified in the July 1, 1992 edition of the EPA document Title 40, Code of Federal Regulations, Parts 53-60 (40 CFR 60), Appendix A, Methods 1, 2, 3A, 4 and 5 were used for these tests. Sampling and analysis procedures specified in the Puget Sound Air Pollution Control Agency (PSAPCA) "Particulate Source Test Procedures" adopted by the PSAPCA Board of Directors, August 11, 1983, in accordance with section 9.09 of Regulation I, were utilized in conjunction with the EPA Method 5 procedures for "back-half" analysis for extracting condensible matter. Methodology suggested in the EPA Air Pollution Training Institute "Course 450 - Source Sampling For Particulate Pollutants" and quality assurance procedures outlined in the EPA's reference manual titled Quality Assurance Handbook for Air Pollution Measurement Systems, Volume 3, EPA-600/4-77-027b, along with current updates, were used with respect to quality assurance and testing protocol.

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 exhaust stack into a number of equal areas, and then locating a traverse point within each of the equal areas. Method 2 was performed to measure the stack gas velocity using a pitot tube, and the gas temperature using a thermocouple. The S-type pitot tubes were connected with tubing to a magnehelic gauge to obtain velocity measurements. The pitot tube lines were leak-checked and the magnehelic gauge was leveled and zeroed prior to use. Temperatures were measured using calibrated thermocouple probes connected to a digital thermocouple indicator.

Emissions from the baghouse exhaust to the atmosphere through a 48-inch by 48-inch rectangular stack which has five (5) sample ports located at the same elevation along one side. The sample ports are located 33 feet from the nearest upstream flow disturbance, and 3 feet from the nearest downstream flow disturbance. Five (5) velocity and temperature traverses of five (5) points each were performed during each Method 5 test. Each point was sampled for 2.5 minutes for a total sampling time of 62.5 minutes per run. Figure 1 located in Appendix C of this report is a schematic of the stack and the point locations selected. The sample probe was marked with felt pen and heat resistant tape to indicate the proper point location.

5.2 EPA Method 3A - Gas Composition

The stack gas composition was determined using an instrumental analyzer for oxygen (O_2) and using an F_o factor to determine carbon dioxide (CO_2). An Infrared Industries Model 2200 analyzer was used to measure the percent oxygen (O_2). O_2 data were recorded at each traverse point during each Method 5 test period. CO_2 was determined using an F_o factor of 1.44. The gas composition measurements made during each test period 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 which was collected.

5.4 EPA Method 5 - Particulate Matter

The sample train used for particulate matter sampling was an EPA Method 5 design as illustrated in Figure 2 in Appendix C of this report. The stainless steel button hook nozzles used for these tests were measured on-site with inside calipers. A stainless steel probe sheath with a heated stainless steel liner was used to draw gas from the stack. The probe was equipped with S-type 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. A glass filter assembly containing a 110 millimeter Whatman QM-A ultrapure quartz microfibre filter was enclosed in a temperature-controlled heated sample box. The average box temperature was maintained at 248^{o} F $\pm$ 25^{o} F. The nozzle, probe liner, prefilter

connective glassware and filter are often referred to as the "front-half" of the sample train. Following the filter is a condenser section which, by convention, is referred to as the "back-half". The condenser section of the Method 5 sample train consisted of a modified Greenburg-Smith bubbler containing 100 milliliters (mL) of deionized water, an impinger also containing 100 mL of deionized water, an empty bubbler, and a bubbler containing indicating silica gel desiccant. The back-half was maintained at a temperature below 68° F by adding ice to the condenser section during sampling.

The Method 5 sample train was connected to a control box by means of an umbilical cord which contains 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 diaphragm pump which is 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. At the outlet of the dry gas meter is a calibrated orifice which is used to isokinetically control the flow of gas through the metering system. The pitot tubes utilized to measure stack gas velocity are connected to the control box via the umbilical cord. The control box contains a magnehelic gauge which was used for the velocity measurement and for monitoring orifice pressure.

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 chosen and isokinetic operating parameters were established utilizing a Hewlett-Packard programmable calculator. The sampling nozzle, probe

and prefilter connective glassware were all cleaned and rinsed prior to use. The sample train was assembled and determined to be leak free following the procedures outlined in Method 5. Before each test, a final check was made to assure that the process was operating at the desired production rate and the desired operating parameters. A final check was made of the sample box and probe heat temperatures. Crushed ice was added to the condenser section. The sample nozzle was positioned in the stack at the first sample point. The sample pump was then turned on and the gas sampling rate was adjusted for isokinetic sampling. Isokinetic sampling proceeded at each of the traverse points. Upon completion of the test, the sample probe was removed from the stack and a post-test leak check was performed according to Method 5 procedures. Care was taken to assure that the nozzle tip did not touch the port nipple.

Following sample collection, the Method 5 sample was 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 they were 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 containing particulate matter were weighed to a constant weight of $\pm$0.5 milligrams. The interval between weighings was at least 6 hours. These weights were recorded in a bound laboratory notebook.

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 following each run. 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. The contents of this "B" section acetone rinse were transferred to a tared, graduated 150 milliliter beaker. The volume of acetone was recorded and the beakers were placed in an evaporation chamber at a temperature of approximately 75-80° F. A tared beaker with 150 milliliters of acetone was handled in an identical fashion to the "B" section samples as a control. The tare and final weights of the beakers were obtained following at least 24 hours of desiccation. The samples and acetone blanks were weighed to a constant weight of $\pm$0.5 milligrams at 6 hour or greater intervals.

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. The contents of the bubblers and impingers were transferred to a 1000 mL graduated cylinder. The bubblers and impingers were rinsed with deionized water into the graduated cylinder and the liquid level was recorded. This liquid was transferred to a separatory funnel and the contents were extracted with three (3) 50 mL portions of dichloromethane (CH_2Cl_2). The organic layer was transferred to a tared 150 mL beaker labeled the "C_x" section and this beaker's contents were

allowed to evaporate to dryness in an evaporation chamber at a temperature of 75-80° F. The water layer was transferred to a tared 150 mL beaker with glass boiling beads labeled the "C" section, and this beaker's contents were heated on a hot plate to boiling until approximately 20 milliliters remained in the beaker. The remaining 20 milliliters in the beaker was evaporated to dryness in an evaporation chamber set at 75-80° F. The bubblers, impingers, and graduated cylinder were given a final rinse with acetone into another tared, graduated beaker ("D" section) and it's contents were allowed to evaporate to dryness in an evaporation chamber at 75-80° F. Sample blanks containing deionized water, dichloromethane, and acetone were analyzed in an identical fashion as the representative "section". All beakers were desiccated for at least 24 hours and weighed to constant weights of $\pm$0.5 milligrams at 6 hour or greater intervals 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 B, C, Cx and D section beakers, minus the acetone, water, and dichloromethane blank concentrations. The particulate matter weights are included on the Method 5 computer printouts which are included in Appendix A of this report, and on the laboratory analysis data sheets in Appendix B of this report.

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 were 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. Procedures were 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 as 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 were 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 meter used to accurately measure sample volumes was

calibrated using a standard laboratory dry gas meter. Calibration data for the dry gas meters used for this project are included in Appendix C of this report. The S-type pitot tubes utilized for velocity determination have been calibrated using Method 2, Section 4.1, and are inspected regularly for wear. The magnehelic gauges used for pressure measurements have been checked against an oil-filled manometer. Pressure sensor calibration data is included in Appendix C of this report. The digital thermocouple indicator used for temperature measurement has a readability of 1 degree Fahrenheit and has been re-certified by the manufacturer. Each thermocouple probe used to monitor temperature is checked periodically at three (3) temperature settings. Thermocouples are checked in the field with ambient air and ice water. Additional calibration information for pressure and temperature recording devices is included in Appendix C of this report. A barometer readable to 0.01 inches of mercury was used in the field to obtain barometric pressure readings.

In the laboratory, ACS grade acetone, dichloromethane, deionized water and filter blanks were carried throughout the gravimetric analysis procedures. The samples were weighed to constant weights of ± 0.5 milligrams following desiccation in a cabinet desiccator. These desiccators contain electronic dehumidifiers which automatically maintain the humidity inside the desiccators. The dehumidifier automatically recharges the internal desiccant every 5.5 hours. An Airguide humidity indicator accurate to $\pm 1\%$ is used to check the humidity inside the 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 was set to a time integrating mode (100,000 readings per minute) with a readability of 0.01 milligrams. The balance was 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 the project, a systems audit was performed, consisting of an on-site qualitative inspection and review of the total measurement system. This inspection was conducted on a daily basis by the Project Leader. During the systems audit, the auditor observed the procedures and techniques of the field team in the following general areas:

- Setting up and leak testing the sampling train
- Isokinetic sampling check of the sampling train
- Final leak check of train
- Sample recovery

Visual inspections of pitot tubes, glassware, and other equipment were 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 relative to samples, collected during each test, were immediately inspected for completeness and placed under the custody of the Project Leader until custody is transferred when the samples are returned to the Air Quality laboratory. Sample

recovery was carried out in a suitable area free from particulate matter contamination.

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 checker. Raw data were entered into the appropriate software package by a "processor", then the entered figures were checked for accuracy by a "checker," different from the "processor". Any mistakes were corrected, and figures were rechecked and signed off by the "checker". In addition, by-hand calculation checks were made to validate the computer output. All data generated by each phase of a laboratory or field sampling program were reviewed by the senior reviewer. The data package was signed off by the senior reviewer prior to releasing the data for report preparation.

7.0
CALCULATION OF RESULTS

The Method 1, 2, 3A, 4 and 5 test results were calculated in accordance with current EPA 40 CFR 60 and Puget Sound Area Pollution Control Agency (PSAPCA) criteria. Copies of the pertinent equations used to derive these results are included in Appendix C of this report. Final result calculations were performed using custom-written spreadsheet programs run on Hewlett-Packard Vectra computer systems. The "by-hand" was performed to check the integrity of the computer programs which were used to reduce the data. A sample "by-hand" calculation was completed for run 2, using a Hewlett Packard 11C calculator, and may be found in Appendix B of this report.

APPENDIX A

Computer Printouts of Results

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

FILE NAME:	S701B\LIM5R1	LAB #:	4365
CLIENT:	LAKESIDE INDUSTRIES	START TIME:	18:44 o'clock
LOCATION:	MONROE, WASHINGTON	STOP TIME:	19:51 o'clock
SAMPLE SITE:	BAGHOUSE STACK	SAMPLE LENGTH:	62.5 minutes
SAMPLE DATE:	SEPTEMBER 23, 1993		
RUN #:	1 - METHOD 5		
OPERATORS:	J. GUENTHOER/R. LAWRENCE		

IMPINGER WEIGHTS

FINAL grams	INITIAL grams	NET grams
894.8	633.5	261.3
679.1	637.8	41.3
544.4	540.7	3.7
755.9	746.7	9.2

TOTAL H2O GAIN:	315.5		
TOTAL VOLUME (SCF):	14.88		
PERCENT MOISTURE:	28.82		
Bws:	0.2882		
PITOT TUBE Cp:	0.84		
NOZZLE DIAMETER:	0.259	inches	
NOZZLE AREA:	0.0004	sq. feet	
STACK DIAMETER:	48x48	inches	
STACK AREA:	16.00	sq. feet	
METER TEMPERATURE:	75.9	degrees F	
BAROMETRIC PRES.:	30.10	inches Hg	
STATIC PRESSURE:	-0.16	inches H2O	
STACK PRESSURE:	30.09	inches Hg	
ORIFICE PRESSURE:	1.094	inches H2O	
METER PRESSURE:	30.18	inches Hg	
INIT. METER VOLUME:	786.358		
FINAL METER VOLUME:	822.536		
VOLUME SAMPLED:	36.178		
STD VOLUME (DSCF):	36.746		
STD VOLUME (DSCM):	1.041		
Y FACTOR:	1.022		
AVERAGE CONC. CO2:	6.2	percent	
AVERAGE CONC. O2:	12.0	percent	
AVERAGE CONC. CO:	NA	ppm	
MOLECULAR WEIGHT:	29.47	g/g-mole-dry	
MOLECULAR WEIGHT:	26.17	g/g-mole-wet	

SAMPLE POINT	VELOCITY " OF H2O	TEMPERATURE °F	SAMPLE POINT	VELOCITY " OF H2O	TEMPERATURE °F
A 1	0.50	203	4	0.50	230
2	0.60	210	5	0.50	228
3	0.70	215	D 1	0.40	228
4	0.70	217	2	0.40	229
5	0.60	219	3	0.45	229
B 1	0.50	223	4	0.45	227
2	0.55	227	5	0.40	225
3	0.65	229	E 1	0.35	220
4	0.65	231	2	0.35	221
5	0.55	232	3	0.30	222
C 1	0.50	234	4	0.30	217
2	0.40	232	5	0.20	200
3	0.50	231			

PERCENT ISOKINETICS:	106 %		
STACK TEMPERATURE:	223.2	degrees F	683.2 degrees R
AVERAGE VELOCITY HEAD:	0.471	" of H20	
STACK GAS VELOCITY:			45.9 ft/second
STACK GAS AIR FLOW:	44074.8	acf/min	24384.5 dscf/min
PARTICULATE EMISSION CONCENTRATION (front-half):			0.011 gr/dscf
PARTICULATE EMISSION CONCENTRATION (back-half):			0.010 gr/dscf
TOTAL PARTICULATE EMISSION CONC. (front & back-half):			0.021 gr/dscf
TOTAL PARTICULATE EMISSION CONCENTRATION:			47.4 mg/dscm
TOTAL PARTICULATE MATTER EMISSION RATE:			4.33 lb/hr

FRONT-HALF PARTICULATE MATTER MASS LOADING

FILTER NUMBER:	#125-556
TARE WEIGHT OF FILTER (grams):	0.8529
FINAL WEIGHT OF FILTER (grams):	0.8676
NET WEIGHT OF PARTICULATE MATTER (grams):	0.0147
BEAKER NUMBER:	#150-059
TARE WEIGHT OF BEAKER (grams):	82.8911
FINAL WEIGHT OF BEAKER (grams):	82.9022
NET WEIGHT OF PARTICULATE MATTER (grams):	0.0111
VOLUME OF ACETONE (milliliters):	180.0
WT./VOL. OF ACETONE BLANK (milligrams/ml):	0.000
NET WEIGHT OF PARTIC. DUE TO ACETONE (grams):	0.0000
TOTAL FRONT-HALF PARTICULATE MATTER (grams):	0.0258

BACK-HALF PARTICULATE MATTER MASS LOADING

"C" SECTION - CONDENSER PARTICULATE	#150-085
TARE WEIGHT OF BEAKER (grams):	67.9027
FINAL WEIGHT OF BEAKER (grams):	67.9209
NET WEIGHT OF PARTIC. MATTER (grams):	0.0182
TOTAL VOLUME OF WATER (milliliters):	721.0
VOLUME OF WATER CONDENSED (milliliters):	306.3
NET VOLUME OF WATER FOR BLANK (milliliters):	414.7
WT./VOL. OF WATER BLANK (milligrams/ml):	0.001
NET WEIGHT OF PARTIC. DUE TO WATER (grams):	0.0004
"Cx" SECTION - HYDROCARBON EXTRACTION	#150-066
TARE WEIGHT OF BEAKER (grams):	66.8804
FINAL WEIGHT OF BEAKER (grams):	66.8831
NET WEIGHT OF PARTIC. MATTER (grams):	0.0027
TOTAL VOLUME OF CH2Cl2 (milliliters):	150.0
WT./VOL. OF CH2Cl2 BLANK (milligrams/ml):	0.002
NET WEIGHT OF PARTIC. DUE TO CH2Cl2 (grams):	0.0003
"D" SECTION - ACETONE RINSE OF CONDENSER	#150-063
TARE WEIGHT OF BEAKER (grams):	66.7723
FINAL WEIGHT OF BEAKER (grams):	66.7756
NET WEIGHT OF PARTIC. MATTER (grams):	0.0033
TOTAL VOLUME OF ACETONE (milliliters):	177.0
WT./VOL. OF ACETONE BLANK (milligrams/ml):	0.000
NET WEIGHT OF PARTIC. DUE TO ACETONE (grams):	0.0000
TOTAL BACK-HALF PARTICULATE MATTER (grams):	0.0235
TOTAL WEIGHT OF PARTICULATE MATTER (grams):	0.0493

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

FILE NAME:	S701B\LIM5R2	LAB #:	4366
CLIENT:	LAKESIDE INDUSTRIES	START TIME:	20:32 o'clock
LOCATION:	MONROE, WASHINGTON	STOP TIME:	22:04 o'clock
SAMPLE SITE:	BAGHOUSE STACK	SAMPLE LENGTH:	62.5 minutes
SAMPLE DATE:	SEPTEMBER 23, 1993		
RUN #:	2 - METHOD 5		
OPERATORS:	J. GUENTHOER/R. LAWRENCE		

IMPINGER WEIGHTS

FINAL grams	INITIAL grams	NET grams
922.5	636.3	286.2
674.4	632.0	42.4
540.4	638.0	-97.6
832.2	823.6	8.6

TOTAL H2O GAIN:	239.6	PITOT TUBE Cp:	0.84
TOTAL VOLUME (SCF):	11.30	NOZZLE DIAMETER:	0.259 inches
PERCENT MOISTURE:	24.01	NOZZLE AREA:	0.0004 sq. feet
Bws:	0.2401	STACK DIAMETER:	48x48 inches
		STACK AREA:	16.00 sq. feet
		METER TEMPERATURE:	64.7 degrees F
		BAROMETRIC PRES.:	30.15 inches Hg
		STATIC PRESSURE:	-0.18 inches H2O
		STACK PRESSURE:	30.14 inches Hg
		ORIFICE PRESSURE:	1.014 inches H2O
		METER PRESSURE:	30.22 inches Hg
INIT. METER VOLUME:	822.902		
FINAL METER VOLUME:	857.313		
VOLUME SAMPLED:	34.411	AVERAGE CONC. CO2:	6.9 percent
STD VOLUME (DSCF):	35.749	AVERAGE CONC. O2:	11.0 percent
STD VOLUME (DSCM):	1.012	AVERAGE CONC. CO:	NA ppm
Y FACTOR:	1.022	MOLECULAR WEIGHT:	29.54 g/g-mole-dry
		MOLECULAR WEIGHT:	26.77 g/g-mole-wet

SAMPLE POINT	VELOCITY " OF H2O	TEMPERATURE °F	SAMPLE POINT	VELOCITY " OF H2O	TEMPERATURE °F
E 1	0.25	197	4	0.50	237
2	0.30	199	5	0.50	235
3	0.30	206	B 1	0.45	236
4	0.30	212	2	0.45	235
5	0.25	195	3	0.55	234
D 1	0.45	233	4	0.60	233
2	0.30	235	5	0.60	232
3	0.35	240	A 1	0.55	230
4	0.40	243	2	0.55	231
5	0.40	244	3	0.65	232
C 1	0.40	241	4	0.70	232
2	0.40	239	5	0.65	232
3	0.50	238			

PERCENT ISOKINETICS:	100 %		
STACK TEMPERATURE:	228.8 degrees F	688.8	degrees R
AVERAGE VELOCITY HEAD:	0.445 " of H20		
STACK GAS VELOCITY:		44.2	ft/second
STACK GAS AIR FLOW:	42473.0 acf/min	24917.5	dscf/min
PARTICULATE EMISSION CONCENTRATION (front-half):		0.014	gr/dscf
PARTICULATE EMISSION CONCENTRATION (back-half):		0.012	gr/dscf
TOTAL PARTICULATE EMISSION CONC. (front & back-half):		0.025	gr/dscf
TOTAL PARTICULATE EMISSION CONCENTRATION:		57.7	mg/dscm
TOTAL PARTICULATE MATTER EMISSION RATE:		5.38	lb/hr

FRONT-HALF PARTICULATE MATTER MASS LOADING

FILTER NUMBER:	#125-557
TARE WEIGHT OF FILTER (grams):	0.8362
FINAL WEIGHT OF FILTER (grams):	0.8590
NET WEIGHT OF PARTICULATE MATTER (grams):	0.0228
BEAKER NUMBER:	#150-060
TARE WEIGHT OF BEAKER (grams):	65.9340
FINAL WEIGHT OF BEAKER (grams):	65.9429
NET WEIGHT OF PARTICULATE MATTER (grams):	0.0089
VOLUME OF ACETONE (milliliters):	175.0
WT./VOL. OF ACETONE BLANK (milligrams/ml):	0.000
NET WEIGHT OF PARTIC. DUE TO ACETONE (grams):	0.0000
TOTAL FRONT-HALF PARTICULATE MATTER (grams):	0.0317

BACK-HALF PARTICULATE MATTER MASS LOADING

"C" SECTION - CONDENSER PARTICULATE	#150-086
TARE WEIGHT OF BEAKER (grams):	80.7764
FINAL WEIGHT OF BEAKER (grams):	80.7996
NET WEIGHT OF PARTIC. MATTER (grams):	0.0232
TOTAL VOLUME OF WATER (milliliters):	740.0
VOLUME OF WATER CONDENSED (milliliters):	231.0
NET VOLUME OF WATER FOR BLANK (milliliters):	509.0
WT./VOL. OF WATER BLANK (milligrams/ml):	0.001
NET WEIGHT OF PARTIC. DUE TO WATER (grams):	0.0005
"Cx" SECTION - HYDROCARBON EXTRACTION	#150-067
TARE WEIGHT OF BEAKER (grams):	67.5686
FINAL WEIGHT OF BEAKER (grams):	67.5702
NET WEIGHT OF PARTIC. MATTER (grams):	0.0016
TOTAL VOLUME OF CH2Cl2 (milliliters):	150.0
WT./VOL. OF CH2Cl2 BLANK (milligrams/ml):	0.002
NET WEIGHT OF PARTIC. DUE TO CH2Cl2 (grams):	0.0003
"D" SECTION - ACETONE RINSE OF CONDENSER	#150-064
TARE WEIGHT OF BEAKER (grams):	65.8734
FINAL WEIGHT OF BEAKER (grams):	65.8761
NET WEIGHT OF PARTIC. MATTER (grams):	0.0027
TOTAL VOLUME OF ACETONE (milliliters):	142.0
WT./VOL. OF ACETONE BLANK (milligrams/ml):	0.000
NET WEIGHT OF PARTIC. DUE TO ACETONE (grams):	0.0000
TOTAL BACK-HALF PARTICULATE MATTER (grams):	0.0267
TOTAL WEIGHT OF PARTICULATE MATTER (grams):	0.0584

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

FILE NAME:	S701B\LIM5R3	LAB #:	4367
CLIENT:	LAKESIDE INDUSTRIES	START TIME:	22:42 o'clock
LOCATION:	MONROE, WASHINGTON	STOP TIME:	23:52 o'clock
SAMPLE SITE:	BAGHOUSE STACK	SAMPLE LENGTH:	62.5 minutes
SAMPLE DATE:	SEPTEMBER 23, 1993		
RUN #:	3 - METHOD 5		
OPERATORS:	J. GUENTHOER/R. LAWRENCE		

IMPINGER WEIGHTS

FINAL grams	INITIAL grams	NET grams
879.5	631.5	248.0
682.7	637.8	44.9
546.4	543.5	2.9
752.4	743.6	8.8

TOTAL H2O GAIN:	304.6	PITOT TUBE Cp:	0.84
TOTAL VOLUME (SCF):	14.36	NOZZLE DIAMETER:	0.259 inches
PERCENT MOISTURE:	28.66	NOZZLE AREA:	0.0004 sq. feet
Bws:	0.2866	STACK DIAMETER:	48x48 inches
		STACK AREA:	16.00 sq. feet
INIT. METER VOLUME:	857.655	METER TEMPERATURE:	60.2 degrees F
FINAL METER VOLUME:	891.773	BAROMETRIC PRES.:	30.15 inches Hg
VOLUME SAMPLED:	34.118	STATIC PRESSURE:	-0.17 inches H2O
STD VOLUME (DSCF):	35.748	STACK PRESSURE:	30.14 inches Hg
STD VOLUME (DSCM):	1.012	ORIFICE PRESSURE:	0.971 inches H2O
Y FACTOR:	1.022	METER PRESSURE:	30.22 inches Hg
		AVERAGE CONC. CO2:	6.4 percent
		AVERAGE CONC. O2:	11.7 percent
		AVERAGE CONC. CO:	NA ppm
		MOLECULAR WEIGHT:	29.49 g/g-mole-dry
		MOLECULAR WEIGHT:	26.20 g/g-mole-wet

SAMPLE POINT	VELOCITY " OF H2O	TEMPERATURE °F	SAMPLE POINT	VELOCITY " OF H2O	TEMPERATURE °F
A 1	0.50	233	4	0.50	241
2	0.50	233	5	0.45	240
3	0.60	234	D 1	0.35	239
4	0.60	234	2	0.35	239
5	0.60	233	3	0.40	240
B 1	0.45	234	4	0.40	239
2	0.45	235	5	0.35	236
3	0.50	236	E 1	0.30	234
4	0.60	236	2	0.30	235
5	0.60	234	3	0.35	237
C 1	0.35	234	4	0.30	237
2	0.35	237	5	0.25	235
3	0.45	240			

PERCENT ISOKINETICS:	109 %	
STACK TEMPERATURE:	236.2 degrees F	696.2 degrees R
AVERAGE VELOCITY HEAD:	0.427 " of H20	
STACK GAS VELOCITY:		44.1 ft/second
STACK GAS AIR FLOW:	42317.4 acf/min	23061.8 dscf/min
PARTICULATE EMISSION CONCENTRATION (front-half):		0.008 gr/dscf
PARTICULATE EMISSION CONCENTRATION (back-half):		0.012 gr/dscf
TOTAL PARTICULATE EMISSION CONC. (front & back-half):		0.020 gr/dscf
TOTAL PARTICULATE EMISSION CONCENTRATION:		45.3 mg/dscm
TOTAL PARTICULATE MATTER EMISSION RATE:		3.92 lb/hr

FRONT-HALF PARTICULATE MATTER MASS LOADING

FILTER NUMBER:	#125-558
TARE WEIGHT OF FILTER (grams):	0.8448
FINAL WEIGHT OF FILTER (grams):	0.8577
NET WEIGHT OF PARTICULATE MATTER (grams):	0.0129
BEAKER NUMBER:	#150-061
TARE WEIGHT OF BEAKER (grams):	66.8717
FINAL WEIGHT OF BEAKER (grams):	66.8774
NET WEIGHT OF PARTICULATE MATTER (grams):	0.0057
VOLUME OF ACETONE (milliliters):	200.0
WT./VOL. OF ACETONE BLANK (milligrams/ml):	0.000
NET WEIGHT OF PARTIC. DUE TO ACETONE (grams):	0.0000
TOTAL FRONT-HALF PARTICULATE MATTER (grams):	0.0186

BACK-HALF PARTICULATE MATTER MASS LOADING

"C" SECTION - CONDENSER PARTICULATE	#150-087
TARE WEIGHT OF BEAKER (grams):	64.7273
FINAL WEIGHT OF BEAKER (grams):	64.7487
NET WEIGHT OF PARTIC. MATTER (grams):	0.0214
TOTAL VOLUME OF WATER (milliliters):	685.0
VOLUME OF WATER CONDENSED (milliliters):	295.8
NET VOLUME OF WATER FOR BLANK (milliliters):	389.2
WT./VOL. OF WATER BLANK (milligrams/ml):	0.001
NET WEIGHT OF PARTIC. DUE TO WATER (grams):	0.0004
"Cx" SECTION - HYDROCARBON EXTRACTION	#150-068
TARE WEIGHT OF BEAKER (grams):	66.4955
FINAL WEIGHT OF BEAKER (grams):	66.4995
NET WEIGHT OF PARTIC. MATTER (grams):	0.0040
TOTAL VOLUME OF CH2Cl2 (milliliters):	150.0
WT./VOL. OF CH2Cl2 BLANK (milligrams/ml):	0.002
NET WEIGHT OF PARTIC. DUE TO CH2Cl2 (grams):	0.0003
"D" SECTION - ACETONE RINSE OF CONDENSER	#150-065
TARE WEIGHT OF BEAKER (grams):	67.2140
FINAL WEIGHT OF BEAKER (grams):	67.2166
NET WEIGHT OF PARTIC. MATTER (grams):	0.0026
TOTAL VOLUME OF ACETONE (milliliters):	170.0
WT./VOL. OF ACETONE BLANK (milligrams/ml):	0.000
NET WEIGHT OF PARTIC. DUE TO ACETONE (grams):	0.0000
TOTAL BACK-HALF PARTICULATE MATTER (grams):	0.0273
TOTAL WEIGHT OF PARTICULATE MATTER (grams):	0.0459

APPENDIX B

Example Calculations and Field Data Sheets

SAMPLE CALCULATION SHEET
METHODS 1, 2, 3A, 4 AND 5

CLIENT: Lakeside Industries — DATE OF TEST: 9/23/93

LOCATION: Monroe Washington Baghouse Stack — RUN #: 2 - Lab #4366

Particulate Matter Emission Concentration - Equation 5-1

Vm_{std} =
17.647°R/"Hg* 34.411 ft^3* 1.022 *(30.15 "Hg + (1.014 "H_2O/13.6))/(460 + 64.7 °F)

= 35.749 dscf

dscm = 35.749 dscf/35.31 ft^3/m^3

= 1.012 dscm

Substitution of Equation 5-4 into 5-5

W_a = 0.0 mg * 175 ml / 175 ml

= 0.0 mg

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

= 58.4 mg = 22.9 mg + 8.9 mg - 0.0 mg + 26.7 mg

C_s= (0.001 g/mg) * (15.43 grains/gram) * 58.4 mg / 35.749 dscf

= 0.025 gr/dscf (Equation 5-6)

gr/dscf @7% O_2 = _____ gr/dscf * (20.9% - 7%O_2)/(20.9% - _____ %O_2)

= N/A gr/dscf @ 7% O_2

gr/dscf @ 12% CO_2 = _____ gr/dscf * 12% / _____ %CO_2

= N/A gr/dscf @ 12% CO_2

mg/dscm = 58.1 mg/ 1.012 dscm

= 57.7 mg/dscm

Particulate Matter Emission Rate

pounds/hour = 0.025 gr/dscf * 24917.5 dscf/min * 60 min/hr * 1 lb/7000 grains

= 5.38 lb/hr

Moisture - Equation 5-2 and 5-3

Vw_{std} = 0.04715 ft^3/g * 239.6 grams of H_2O collected in impingers

= 11.30 scf

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

B_{ws} = (11.30 scf)/(11.30 scf + 35.749 dscf)

= 0.2401

%Moisture = 0.2401 * 100

= 24.01 %

Molecular weight - Equation 3-2

M_d = 0.440 * (6.9 $\%CO_2$) + 0.320 * (11.0 $\%O_2$) + 0.280 * (82.1 % CO + $\%N_2$)
(100-6.9-11.0)

M_d = 29.54 g/g-mole (dry)

M_s = 29.54 g/g-mole * (1 - 0.2401) + 18.0g/g-mole * 0.2401

M_s = 26.77 g/g-mole (wet)

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

V_s = 85.49 * 0.84 * $\sqrt{0.445 * 688.8}$ ° R / 26.77 g/g-mole / 30.14 "Hg

V_s = 44.2 ft/sec

Q_{sd} = 3600 * (1 - 0.2401) * 44.2 ft/sec * 16.00 ft^2 * (528 ° R/ 688.8 ° R) *
(30.14 "Hg/ 29.92 "Hg)

= 1495650 dscf/hr / 60 min/hr

= 24917.5 dscf/min (dry standard cubic feet per minute)

acfm = 44.2 ft/sec * 16.00 ft^2* 60 sec/min

= 42473.0 acfm (actual cubic feet per minute)

Isokinetic variation - Equation 5-8

I = 0.09450 * 35.749 dscf * 688.8 ° R/(30.14 "Hg * 44.2 ft/sec * 62.5 min *
0.0004 ft^2 *(1 - 0.2401))

I = 100 %

All of the above numbered equations are from the 40 CFR 60 and assume English units.

SAMPLE CALCULATION SHEET (2)

Backhalf particulate

"C" Section

23.2 mg particulate in "C" Section beaker

340 ml of water in condensers, including rinses

231.0 ml of condensation in 1st, 2nd and 3rd bubblers (final weight - initial weight, assumes 1g/1ml water density)

500.0 ml of deionized, distilled water used in bubblers including rinses

0.001 mg/ml blank partic. = (0.7 mg H2O blank / 700 ml H2O)

0.5 mg of blank particulate

= 22.7 mg of "C" partic. = 23.2 mg of partic. in "C" - 0.5 mg of blank

"Cx" Section

1.6 mg of particulate in "Cx" Section beaker

0.002 mg/ml of blank partic. = (0.3 mg CH2Cl2 blank / 150 ml CH2Cl2)

0.3 mg of blank particulate = (150 ml * 0.002 mg/ml)

= 1.3 mg of "Cx" partic = 1.6 mg of partic in "Cx" - 0.3 mg of blank

"D" Section

2.7 mg of particulate in "D" Section beaker

0.0 mg/ml of blank particulate (same as "B" Section)

0.0 mg of blank particulate = (1700 ml * 0.0 mg/ml)

= 2.7 mg of "D" partic. = 2.7 mg of partic. in "D" - 0.0 mg of blank

Total Backhalf Particulate

+ 22.7 mg of "C" Section particulate

+ 1.3 mg of "Cx" Section particulate

+ 2.7 mg of "D" Section particulate

+ NA mg of Backhalf filter (if applicable)

= 26.7 mg of Backhalf particulate

STACK SCHEMATIC AND LOCATION OF SAMPLE POINTS

Client Lakeside Industries

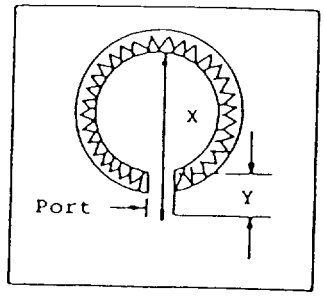
Location Monroe, WA

Sampling Location Concor Asphalt Plant Baghouse Exhaust

Inside of far wall to outside of port (distance, X) 51"

Inside of near wall to outside of port (distance, Y) 3"

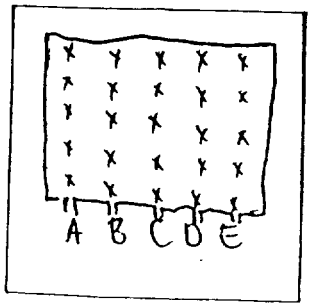
Stack I.D. (distance X - distance Y) 48.0" X 48.0" Rectangular

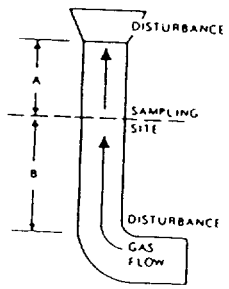


Schematic of Sampling Location

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	10%	48.0"	4.8"	3.0"	7.8"
2	30%		14.4"		17.4"
3	50%		24.0"		27.0"
4	70%		33.6"		36.6"
5	90%		43.2"		46.2"
6					
7					
8					
9					
10					
11					
12					

CROSS SECTION

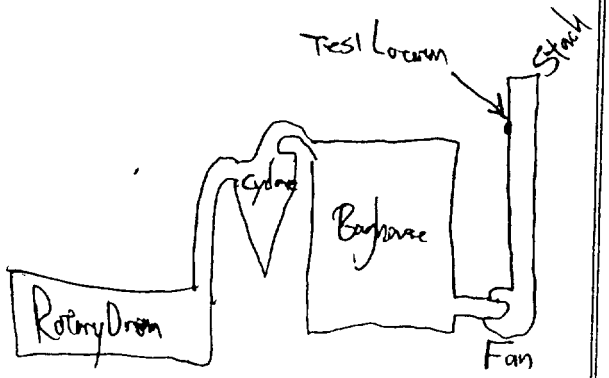




Distance A = 34" downstream

Distance B = 33" upstream

STACK, CONTROL DEVICE AND PROCESS FLOW DIAGRAM



4365

TRAVERSE SAMPLING DATA SHEET

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Client LAKESIDE IND.
Location MONROE WA
Sample Site GENCOR PLANT B/H STACK
Stack Diameter 48 x 48
Date 9-23-93
Operators JAG - ERC
Run I.D. 1-MS/BH

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

Filter # ___ Box # O-1

Start Time 1844
Stop Time 1951
Barometric Pressure "Hg 30.10
Static Pres "H_2O -.16
Production Rate ___

ORANGE MS

EQUIPMENT CHECKS

	Initial/Final
Leak Rate cfm	.01/.02
Leak Test Vacuum	15/18
___ Pitots, Pre Leak Ck	
___ Pitots, Post Leak Ck	
___ Gas Sampling System	
___ Integrated Bag	
TSA Thermocouples @ ___ °F	

	Final Wt. gram	Initial Wt. gram	Net Wt. gram
#1 Imp.	894.8	633.5	___
#2 Imp.	679.1	637.8	___
#3 Imp.	544.4	540.7	___
#4 Imp.	___	___	___
#5 Imp.	___	___	___
#6 S.G.	755.9	746.7	___

Total H_2O Volume 315.5 ✓ g

SAMPLING PARAMETERS

% Moisture 26
Meter Temp. 80
Stack Temp. 250
ΔH@ 1.78 Y 1.022
Pitot # DSG Side # A
Cp .84
Nozzle Diameter .259 inch
D_1 .259 D_2 .259 D_3 .260

K Factor ___

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 %
A 1	0	786.358	.50	1.19	1.19	78	79	1	273	56	203	12.1
2			.60	1.43	1.43	77	79	1	270	57	210	11.5
3	5		.70	1.67	1.67	77	79	1	268	50	215	12.3
4			.70	1.67	1.67	77	78	1	270	49	217	12.2
5	10		.60	1.43	1.43	77	78	1	273	50	219	12.2
B 1		794.827	.50	1.19	1.19	77	78	1	272	54	223	11.9
2	15		.55	1.31	1.31	77	77	1	272	53	227	11.9
3			.65	1.55	1.55	77	77	1	272	53	229	11.8
4	20		.65	1.41	1.41	77	77	1	270	53	231	11.8
5			.55	1.20	1.20	77	76	1	272	55	232	11.7
C 1	25	802.853	.50	1.09	1.09	77	76	1	272	58	234	12.3
2			.40	.87	.87	76	76	1	273	55	232	12.3
3	30		.50	1.09	1.09	76	76	1	272	53	231	12.0
4			.50	1.09	1.09	76	76	1	272	54	230	12.0
5	35		.50	1.09	1.09	76	75	1	271	53	228	12.0
D 1		810.005	.40	.87	.87	76	75	1	273	54	228	12.0
2	40		.40	.87	.87	76	75	1	273	52	229	12.0
3			.45	.98	.98	75	74	1	269	52	229	11.9
4	45		.45	.98	.98	75	74	1	272	49	227	12.0
5			.40	.92	.92	75	74	1	270	49	225	12.1
E 1	50	816.877	.35	.80	.80	75	74	1	268	57	220	12.0
2			.35	.80	.80	74	73	1	273	49	221	11.6
3	55		.30	.69	.69	74	73	1	272	50	222	11.6
4			.30	.69	.69	74	73	1	270	50	217	11.8
5	60		.20	.46	.46	74	73	1	271	50	200	12.0
	62.5	822.536	$\sqrt{(\Delta P)^2}$		ΔH		Tm				Ts	
		36.179 ✓			1.094 ✓		75.9 ✓				223.2 ✓	12.0 ✓

f_o = 1.44
CO_2 = 6.2 %

METHOD 5
LABORATORY ANALYSIS

Client LAKESIDE IND. MONROE Run Number 1

Sample Location GENCOR PLANT BAGHOUSE STACK

Date 9/23/93

"A" Section (Filter)

Filter # 125.556

Tare Weight 0.8529 grams
Final Weight 0.8676 grams
Net Weight 0.0147 grams

"B" Section (Probe Wash)

Beaker # 150-059

Volume Acetone 180 mls

Tare Weight 82.8911 grams
Final Weight 82.9022 grams
Net Weight 0.0111 grams

"C" Section (Condenser Particulate - Inorganic Catch)

Beaker # 150-085

Volume Water 721 mls

Tare Weight 67.9027 grams
Final Weight 67.9209 grams
Net Weight 0.0182 grams

BLANK # 150-059 T 67.5816
F 69.9823
N) 0.0007 = 0.001 mg/ml

"Cx" Section (Condenser Particulate - Organic Catch)

Beaker # 150-066

Volume CH_2Cl_2 150 mls

Tare Weight 66.5804 grams
Final Weight 66.8831 grams
Net Weight 0.0027 grams

BLANK # 150-067 T 67.4770
F 67.7513
N) 0.0003 => 0.002 mg/ml

"D" Section (Final Acetone Rinse of Impingers)

Beaker # 150-063

Volume Acetone 177 mls

Tare Weight 66.7723 grams
Final Weight 66.7756 grams
Net Weight 0.0033 grams

ACETONE BLANK # 150-062 T 66.6508
F 66.6508
N) 0.0000 => 0.000 mg/ml

4365

4366

TRAVERSE SAMPLING DATA SHEET

Page ___ of 29

Client LaBarge Ind.
Location Monroe, WA
Sample Site Before Stack
Stack Diameter 48x48
Date 9-23-93
Operators JAE - GAL
Run I.D. 2-MM/BH

EQUIPMENT CHECKS

	Initial/Final
Leak Rate cfm	.01 / .001
Leak Test Vacuum	18 / 18
✓ Pitots, Pre Leak Ck	
✓ Pitots, Post Leak Ck	
✓ Gas Sampling System	
✓ Integrated Bag	
Thermocouples @ ___ °F	

QA FORMS COMPLETED

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

Filter # ___ Box # O-2

	Final Wt. gram	Initial Wt. gram	Net Wt. gram
#1 Imp.	922.5	636.3	
#2 Imp.	674.4	632.0	
#3 Imp.	540.4	638.0	
#4 Imp.			
#5 Imp.			
#6 S.G.	832.2	823.6	

Total H_2O Volume 239.6 ✓ g

Start Time 2032
Stop Time 2104
Barometric Pressure "Hg 30.15
Static Pres "H_2O -.18
Production Rate

SAMPLING PARAMETERS

% Moisture
Meter Temp.
Stack Temp.
ΔH@ 1.70 Y 1.022
Pitot # ___ Side # ___
Cp .84
Nozzle Diameter .259 inch
D_1 ___ D_2 ___ D_3 ___
K Factor

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 %	
E	1	0	882.902	.25	.63	.63	68	68	1	267	57	197	11.6	
	2			.30	.75	.75	68	68	1	266	50	199	11.3	
	3	5		.30	.75	.75	67	68	1	268	50	206	11.0	
	4			.30	.75	.75	68	68	1	271	51	212	10.8	
	5	10		.25	.63	.63	67	67	1	271	51	195	10.7	
D	1		878.661	.35	1.02	1.02	67	67	1	273	52	233	11.1	ΔH=
	2	15		.30	.75	.75	65	65	1	273	52	235	11.0	.68
	3			.35	.79	.79	64	65	1	267	50	240	11.0	
	4	20		.40	.90	.90	64	64	1	271	50	243	10.8	
	5			.40	.90	.90	64	64	1	273	50	244	11.0	
C	1	25	834.990	.40	.90	.90	64	64	1	274	51	241	11.0	
	2			.40	.90	.90	64	64	1	273	50	239	10.9	
	3	30		.50	1.06	1.06	64	64	1	272	48	238	11.0	
	4			.50	1.06	1.06	64	64	1	273	49	237	10.9	
	5	35		.50	1.06	1.06	64	63	1	273	50	235	10.8	
B	1		841.855	.45	.95	.95	64	63	1	273	52	236	10.8	
	2	40		.45	.95	.95	64	63	1	273	51	235	11.0	
	3			.55	1.16	1.16	64	63	1	273	50	234	11.0	
	4	45		.60	1.27	1.27	64	63	1	273	49	233	11.0	
	5			.60	1.27	1.27	64	63	1	270	50	232	11.0	
A	1	50	849.211	.55	1.24	1.24	64	63	1	273	52	230	10.9	
	2			.55	1.24	1.24	64	62	1	270	51	231	10.9	
	3	55		.65	1.46	1.46	64	62	1.1	273	51	232	10.8	
	4			.70	1.58	1.58	65	62	1.1	273	51	232	10.9	
	5	60		.65	1.46	1.46	65	62	1.1	272	52	232	10.9	
		62.5	854.313	$\sqrt{(\Delta P)^2}$		ΔH 1.014 ✓		T_m 64.7 ✓				T_s 233.2 ✓	11.0 ✓	

CO₂ 6.0

METHOD 5
LABORATORY ANALYSIS

Client LAKESIDE IND MONROE Run Number 2

Sample Location BAGHOUSE STACK

Date 9/23/93

"A" Section (Filter)

Filter # 125-557 Tare Weight 0.8362 grams
Final Weight 0.8590 grams
Net Weight 0.0228 grams

"B" Section (Probe Wash)

Beaker # 150-060 Tare Weight 65.9340 grams
Volume Acetone 175 mls Final Weight 65.9429 grams
Net Weight 0.0089 grams

"C" Section (Condenser Particulate - Inorganic Catch)

Beaker # 150-086 Tare Weight 80.7764 grams
Volume Water 740 mls Final Weight 80.7996 grams
Net Weight 0.0232 grams

"Cx" Section (Condenser Particulate - Organic Catch)

Beaker # 150-067 Tare Weight 67.5686 grams
Volume CH_2Cl_2 150 mls Final Weight 67.5702 grams
Net Weight 0.0016 grams

"D" Section (Final Acetone Rinse of Impingers)

Beaker # 150-064 Tare Weight 65.8738 grams
Volume Acetone 142 mls Final Weight 65.8761 grams
Net Weight 0.0027 grams

4367

TRAVERSE SAMPLING DATA SHEET

Client Lakeside Ind.
Location Monroe, WA
Sample Site B/H Stack
Stack Diameter 48 x 48
Date 9-23-93
Operators JTE - OIC
Run I.D. 3-MS/BH

EQUIPMENT CHECKS

	Initial	Final
Leak Rate cfm	.01	.03
Leak Test Vacuum	15	15

✓ Pitots, Pre Leak Ck
✓ Pitots, Post Leak Ck
✓ Gas Sampling System
✓ Integrated Bag
___ Thermocouples @ ___ °F

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

Filter # ___ Box # 0-3

	Final Wt. gram	Initial Wt. gram	Net Wt. gram
#1 Imp.	879.5	631.5	___
#2 Imp.	682.7	637.8	___
#3 Imp.	546.4	543.5	___
#4 Imp.	___	___	___
#5 Imp.	___	___	___
#6 S.G.	752.4	743.6	___

Total H_2O Volume 304.6 ✓ g

Start Time 7242
Stop Time 7352
Barometric Pressure "Hg 30.15
Static Pres "H_2O -.17
Production Rate ___

SAMPLING PARAMETERS

% Moisture ___
Meter Temp. ___
Stack Temp. ___
ΔH@ 1.73 Y 1.022
Pitot # ___ Side # ___
Cp .84
Nozzle Diameter .259 inch
D_1 ___ D_2 ___ D_3 ___
K Factor ___

Sample Point		Elap Time Min.	Dry Gas Meter Reading Cu.Ft.	Pitot Reading Δ P " H_2O	Orifice Setting (Δ H) " H_2O Ideal	Orifice Setting (Δ H) " H_2O Actual	Gas Meter Temp °F In	Gas Meter Temp °F Out	Pump Vac. Gauge " Hg	Filter Box Temp °F	Imp. Exit Temp °F	Stack Temp °F	O_2 %
A	1	0	857.655	.50	1.12	1.12	60	60	1	269	57	233	11.3
	2			.50	1.12	1.12	60	60	1	270	50	233	11.3
	3	5		.60	1.34	1.34	61	60	1	271	46	234	12.1
	4			.60	1.34	1.34	61	60	1	267	45	234	12.2
	5	10		.60	1.34	1.34	61	60	1	270	45	233	12.2
B	1		865.431	.45	1.01	1.01	61	60	1	273	48	234	12.6
	2	15		.45	1.01	1.01	61	60	1	273	47	235	12.0
	3			.50	1.12	1.12	61	60	1	271	47	236	11.6
	4	20		.60	1.34	1.34	62	59	1	271	47	236	12.0
	5			.60	1.34	1.34	62	59	1	272	46	234	12.0
C	1	25	872.973	.35	.78	.78	61	59	1	272	49	234	12.0
	2			.35	.78	.78	61	59	1	273	47	237	11.7
	3	30		.45	1.01	1.01	61	59	1	273	47	240	11.7
	4			.50	1.12	1.12	62	59	1	272	46	241	11.6
	5	35		.45	1.01	1.01	62	59	1	270	47	240	11.5
D	1		879.753	.35	.78	.78	61	59	1	270	48	239	11.6
	2	40		.35	.78	.78	61	59	1	273	48	239	12.0
	3			.40	.90	.90	62	59	1	271	48	240	11.7
	4	45		.40	.90	.90	62	59	1	272	47	239	11.6
	5			.35	.78	.78	62	59	1	273	47	236	11.6
E	1	50	886.080	.30	.67	.67	61	58	1	273	48	234	11.4
	2			.30	.67	.67	61	59	1	273	48	235	11.6
	3	55		.35	.78	.78	61	59	1	272	48	237	11.4
	4			.30	.67	.67	61	59	1	271	48	237	11.4
	5	60		.25	.56	.56	61	59	1	271	48	235	11.3
		60.5	891.773	$\sqrt{(\Delta P)^2}$		ΔH	T_m					T_s	

0.771 ✓ 60.2 ✓ 236.2 ✓ 11.7 ✓ CO = 6.4

METHOD 5
LABORATORY ANALYSIS

Client LAKESIDE IND, MONROE Run Number 3

Sample Location BAGHOUSE STACK

Date 9/23/93

"A" Section (Filter)

Filter # 125-558 Tare Weight 0.8448 grams
Final Weight 0.8577 grams
Net Weight 0.0129 grams

"B" Section (Probe Wash)

Beaker # 150-061 Tare Weight 66.8717 grams
Volume Acetone 200 mls Final Weight 66.8774 grams
Net Weight 0.0057 grams

"C" Section (Condenser Particulate - Inorganic Catch)

Beaker # 150-087 Tare Weight 64.7273 grams
Volume Water 685 mls Final Weight 64.7487 grams
Net Weight 0.0214 grams

"Cx" Section (Condenser Particulate - Organic Catch)

Beaker # 150-068 Tare Weight 66.4955 grams
Volume CH_2Cl_2 150 mls Final Weight 66.4995 grams
Net Weight 0.0040 grams

"D" Section (Final Acetone Rinse of Impingers)

Beaker # 150-065 Tare Weight 67.2140 grams
Volume Acetone 170 mls Final Weight 67.2166 grams
Net Weight 0.0026 grams

SAMPLE TRAIN INFORMATION

Fill Out One Sheet Per Site and Per Test Type

Client: LAKESIDE INDUSTRIES

Location: MONROE, WA

Site: GEORGIA DRUM MFG B/H STACK

Date(s): 9-23-93

Test Team: JMC - ETC

Run Numbers: 1, 2, 3 Type: METHOD 5 w/ BH

If this information is not accurate for all runs, note all exceptions:

9 M3)

Thimble: ___yes ✓no **Nozzle type:** ___quartz ✓steel

Probe liner: ___quartz ___glass ✓steel ___teflon

Probe type: ✓regular ___water-cooled

Front-half filter: ✓yes ___no **Size (mm):** __90 __110 ✓125

Support: ___steel ✓glass frit ___teflon

Gasket: ✓silicon ✓teflon

Filter media: ✓quartz fiber ___glass fiber ___teflon

Impinger Train Solutions/Quantity of Solution Charged			
#1	100 ml	D.I H_2O	BUBBLER
#2	100 ml	D.I H_2O	Impinger
#3	M.T		BUBBLER
#4	S.G		BUBBLER
#5			
#6			

Note: Show the back-half filter location with an arrow

Back-half filter type: __quartz fiber __glass fiber __teflon
___tared ___untared

APPENDIX C

Supporting Information

SOURCE TEST OBSERVATION CHECKLIST
ASPHALT PLANTS WITH BAGHOUSE

AMTEST AIR QUALITY, INC.

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CLIENT: LAKESIDE INDUSTRIES

LOCATION: MONROE, WA

SAMPLE SITE: BAGHOUSE STACK

TEST DATE: 9-23-93

TYPE OF PLANT: Counter Flow Drum mix

EQUIPMENT MANUFACTURER: GENCOR

MODEL: Ultraplant 300 CONSTRUCTED/INSTALLED: 6/93

IDENTIFICATION NO.: M5300405 7390-92-NA DATE LAST TESTED: 7-26-93

PROCESS RATE: 300 TPH 20% RAP DISCHARGE TEMP °F: 315

FUEL FIRING RATE: 75% TYPE OF FUEL: Propane

A/C INJECTION LOCATION: Drum (mix Chamber)

FINES IN GRAVEL (-200 mesh): 6.4%

GRAVEL MOISTURE: 5% % ASPHALT TYPE: AR 4000

DENSITY 8.527 lb/gal FLASHPOINT °F

TYPE OF EMISSION CONTROL DEVICE: BAGHOUSE

EQUIPMENT MANUFACTURER: GENCOR MODEL: BH-110

IDENTIFICATION NO.: BH110-7389-92-NA

BAG MATERIAL: 14oz nomex NO. OF BAGS: 420

BAG SIZE: 6¼" x 16' DATE BAGS LAST CHANGED: —

TYPE OF BAG CLEANING: Pulse Jet

BAGHOUSE PRESSURE ΔP = 3 " H_2O (OR PRESSURE DROP ACROSS BAGHOUSE)

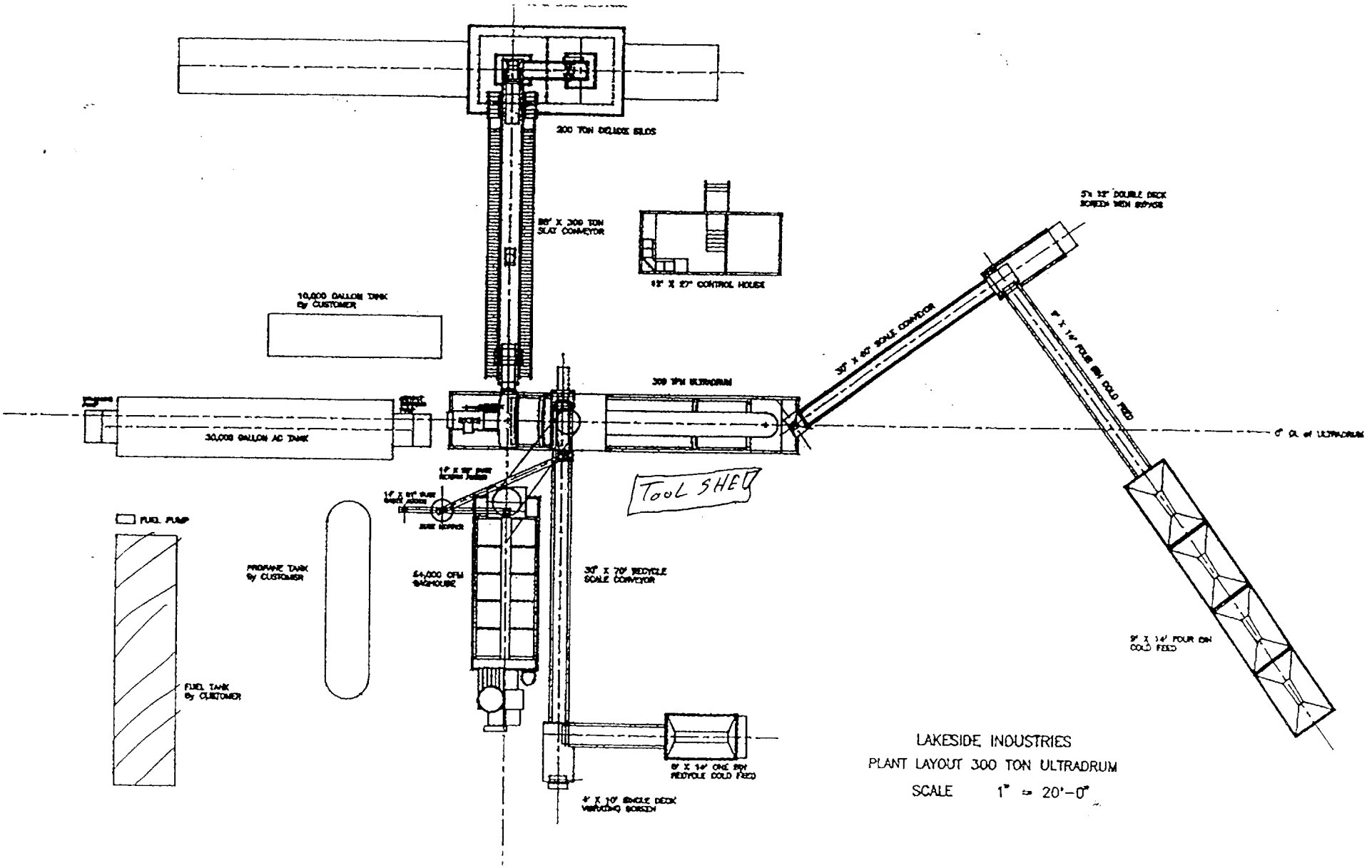
CLEANING CYCLE DURATION: 20 psi/in.

DISPOSITION OF COLLECTED DUST: returned to mix

ADDITIONAL INFORMATION:

SKETCH OF SYSTEM:

AUTHORIZED SIGNATURE



LAKESIDE INDUSTRIES

PLANT LAYOUT 300 TON ULTRADRUM

SCALE 1" = 20'-0"

CROSS SECTIONAL AREA

Traverse Point	Distance (inches)
1	4.8
2	14.4
3	24.0
4	33.6
5	43.2

Port	Distance (inches)
A	4.8
B	14.4
C	24.0
D	33.6
E	43.2

STACK DIMENSIONS

48-inch x 48-inch rectangular stack

5 ports located along one side

A = 3 feet downstream

B = 33 feet upstream

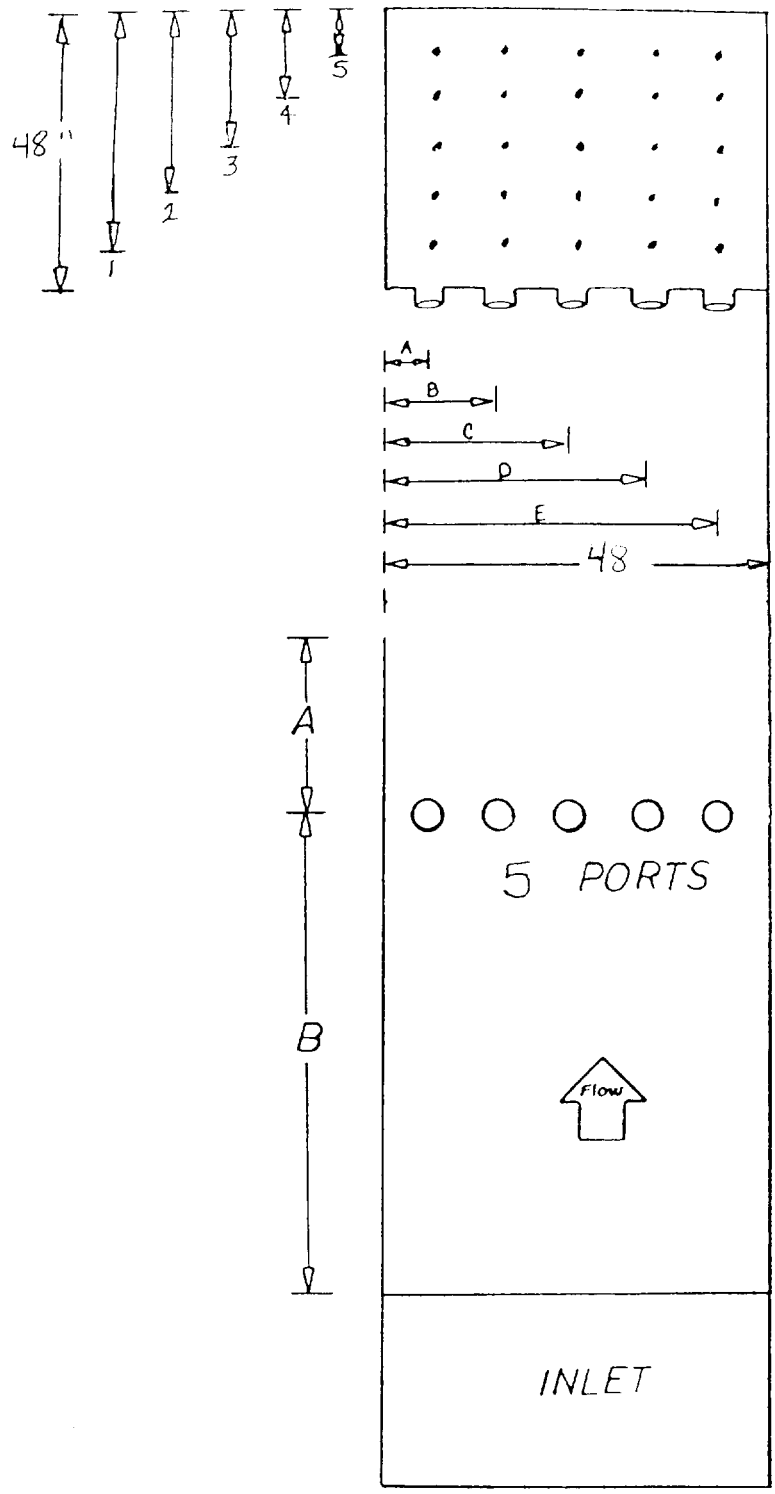


Figure 1. Location of sampling ports and traverse points.

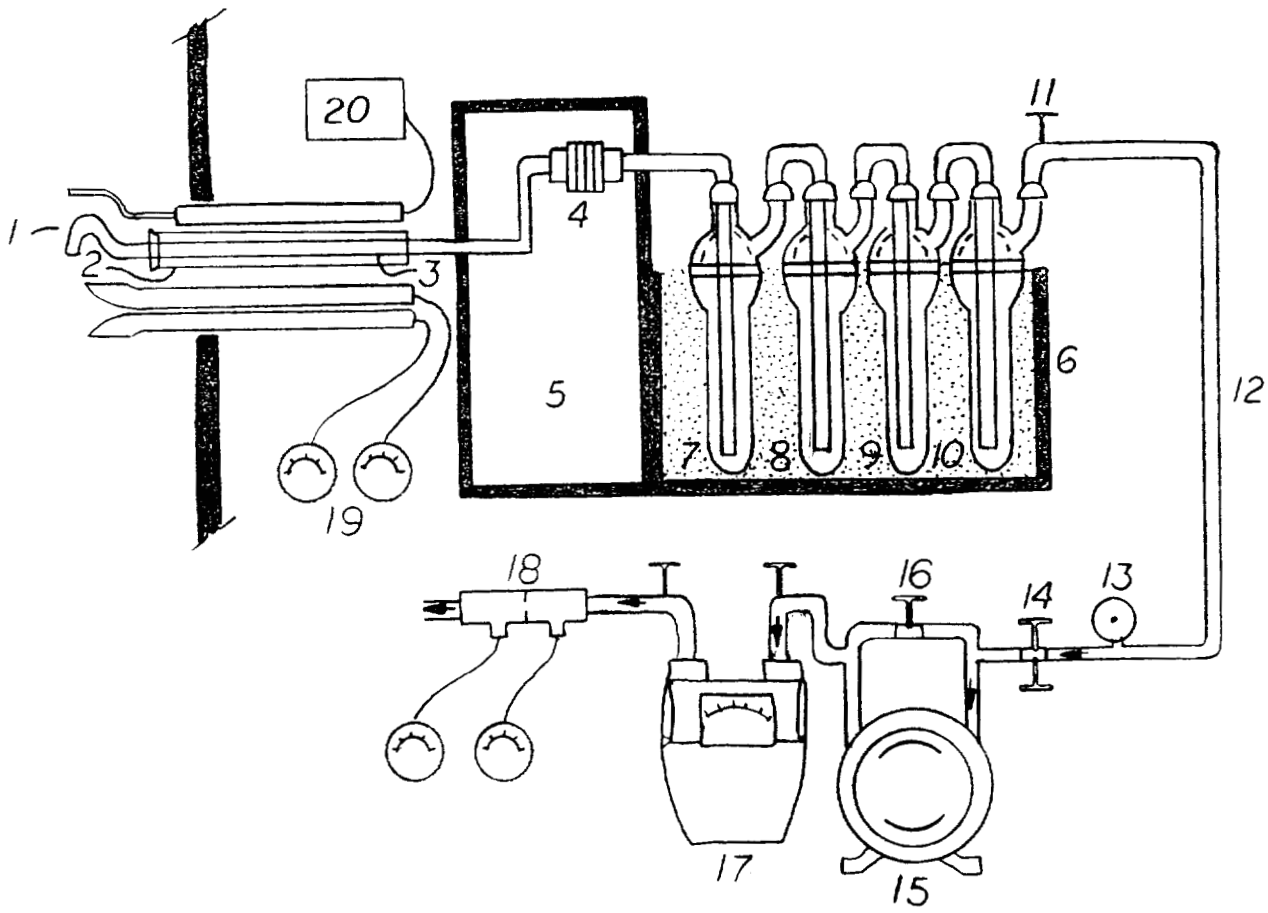


Figure 2. Method 5 Sample Train.

1. Sampling nozzle
2. Sampling probe sheath
3. Heated sample probe liner
4. Out of stack filter assembly
5. Heated filter compartment maintained at 248°F ± 25°F (or temperature specified in 40 CFR subpart)
6. Impinger case - contains ice during sampling
7. First impinger containing 100 ml H_2O
8. Modified Greenburg-Smith impinger containing 100 ml H_2O
9. Third impinger - empty
10. Fourth impinger containing indicating silica gel desiccant
11. Impinger exit gas temperature sensor
12. Umbilical cord - vacuum line
13. Vacuum gauge
14. Fine and coarse adjustment valves
15. Leak free pump
16. By-pass valve
17. Dry gas meter with inlet and outlet temperature sensors
18. Orifice meter with magnehelic gauges
19. S-type pitot tube with magnehelic gauges
20. Fluke multi-channel digital thermocouple indicator

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

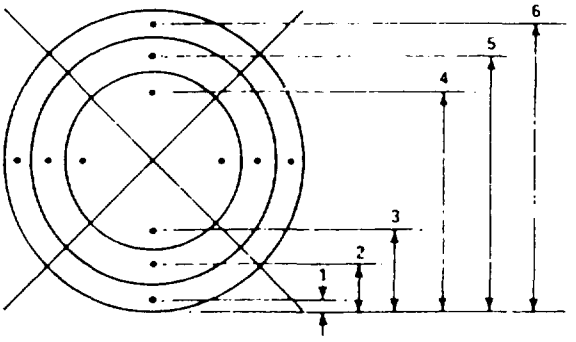


Figure 1-3. Example showing circular stack cross section divided into 12 equal areas, with location of traverse points indicated.

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	85.4	80.6
18									98.6	93.3	88.4	83.9

Rectangular Stacks

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

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

where L=length and W=width.

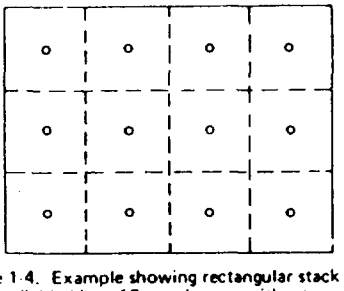


Figure 1-4. Example showing rectangular stack cross section divided into 12 equal areas, with a traverse point at centroid of each area.

METHOD 1 - MINIMUM NUMBER OF TRAVERSE POINTS

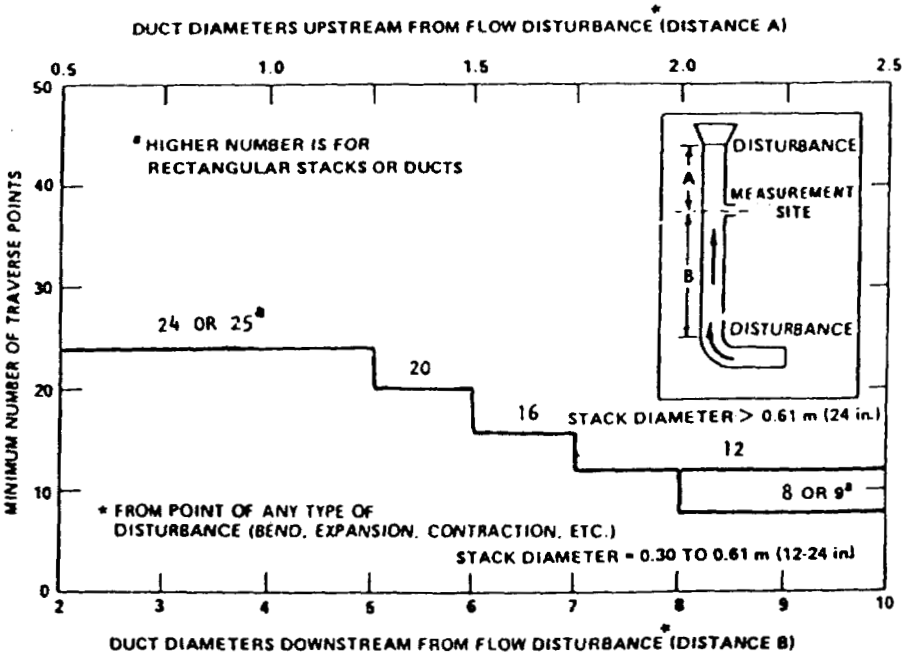


Figure 1-1. Minimum number of traverse points for particulate traverses.

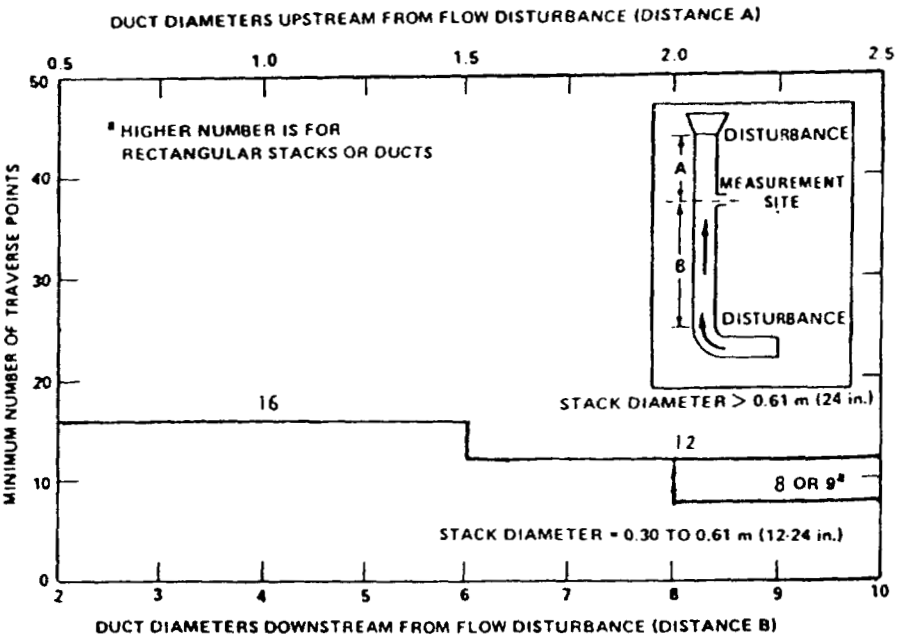


Figure 1-2. Minimum number of traverse points for velocity (nonparticulate) traverses.

METHOD 2 - STACK GAS VELOCITY AND VOLUMETRIC FLOW CALCULATIONS

5.1 Nomenclature.

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

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

for the metric system and

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

for the English system.

M_d = Molecular weight of stack gas, dry basis (see Section 3.6) g/g-mole (lb/lb-mole).
M_s = Molecular weight of stack gas, wet basis, g/g-mole (lb/lb-mole).

$$= M_d(1 - B_{ws}) + 18.0\ B_{ws} \qquad \text{Eq. 2-5}$$

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).

$$= P_{bar} + P_g \qquad \text{Eq. 2-6}$$

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).

$$= 273 + t_s \text{ for metric.} \qquad \text{Eq. 2-7}$$

$$= 460 + t_s \text{ for English.} \qquad \text{Eq. 2-8}$$

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

5.2 Average Stack Gas Velocity.

$$v_s = K_p C_p (\sqrt{\Delta p})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}} \qquad \text{Equation 2-9}$$

5.3 Average Stack Gas Dry Volumetric Flow Rate.

$$Q_{sd} = 3{,}600(1 - B_{ws}) v_s A \left(\frac{T_{std}}{T_{s\ (avg)}}\right)\left(\frac{P_s}{P_{std}}\right) \qquad \text{Eq. 2-10}$$

METHOD 3 - MOLECULAR WEIGHT AND EXCESS AIR CALCULATIONS

6.1 Nomenclature.

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

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

$$\%\ EA = \frac{\%O_2 - 0.5\%\ CO}{0.264\%\ N_2(\%O_2 - 0.5\%\ CO)} \times 100 \qquad \text{Eq. 3-1}$$

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

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

$$M_d = 0.440(\%CO_2) + 0.320(\%O_2) + 0.280(\%N_2 + \%CO) \qquad \text{Eq. 3-2}$$

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) (m^3)/(g-mole) (°K) for metric units and 21.85 (in. Hg) (ft^3)/(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 m^3/ml for metric units
= 0.04707 ft^3/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 m^3/g for metric units
= 0.04715 ft^3/g for English units

2.3.4 Sample Gas Volume.

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

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

Eq. 4-3

Where:

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

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

2.3.5 Moisture Content.

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

Eq. 4-4

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

METHOD 5 - PARTICULATE EMISSION CALCULATIONS - (1)

6.1 Nomenclature.

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

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

C_a = Acetone blank residue concentration, mg/g.

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

I = Percent of isokinetic sampling.

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

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

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

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

m_n = Total amount of particulate matter collected, mg.

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

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

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

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

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

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

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

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

V_a = Volume of acetone blank, ml.

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

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

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

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

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

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

W_a = Weight of residue in acetone wash, mg.

Y = Dry gas meter calibration factor.

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

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

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

θ = Total sampling time, min.

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

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

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

13.6 = Specific gravity of mercury.

60 = Sec/min.

100 = Conversion to percent.

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

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

$$V_{m(std)} = V_m Y \left(\frac{T_{std}}{T_m}\right)\left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{P_{std}}\right] = K_1 V_m Y \frac{P_{bar} + (\Delta H/13.6)}{T_m}$$

Equation 5-1

Where:

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

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

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

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

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

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

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

6.4 Volume of Water Vapor.

METHOD 5 - PARTICULATE EMISSION CALCULATIONS - (2)

Equation 5-2

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

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.

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

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

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

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

NOMENCLATURE (continued)
METHOD 5 CALCULATIONS

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

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

acfm = actual cubic feet per minute

I = Percent of isokinetic sampling

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

AMTEST
AIR QUALITY, INC.

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

FILE NAME: OR-9-93
METER BOX #: Orange JAG
CALIBRATION DATE: 9-8-93
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@
15.000	0.5	92.100	97.965	71.5	68.0	29.70	647.008	652.923	67.0	66.5	1.001	1.0140	1.800
27.000	1.0	98.518	113.648	71.5	69.0	29.70	653.483	668.846	67.5	67.5	1.001	1.0192	1.731
23.000	2.0	114.503	132.580	73.5	69.5	29.70	669.722	688.201	68.5	68.5	1.001	1.0240	1.741
22.000	3.0	133.979	154.717	76.5	71.5	29.70	689.621	710.858	69.5	69.5	1.001	1.0262	1.809
23.000	4.0	155.012	179.953	79.5	73.0	29.70	711.163	736.754	70.5	70.5	1.001	1.0280	1.817
AVERAGE												1.022	1.780

AMTEST
AIR QUALITY, INC.

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

Run #	CAL. DGM IND. SCFM	PRIMARY STANDARD	Y std.	DEVIATION
1	0.249	0.250	1.004	0.001
2	0.349	0.350	1.003	0.001
3	0.448	0.450	1.004	0.002
4	0.498	0.500	1.004	0.002
5	0.598	0.600	1.003	0.002
6	0.799	0.800	1.001	0.001
7	0.900	0.900	1.000	0.000
8	1.001	1.000	0.999	-0.001
9	1.150	1.150	1.000	0.000
10	1.302	1.300	0.998	-0.002
11	1.506	1.500	0.996	-0.006
		AVG Y std. =	1.001	

DATE: 1/15/93
FILE NAME: STD-GASM

DICK MUNNS COMPANY

Liquid and Gas - Flowmeter Calibration Service
10571 Calle Lee - 133 • Los Alamitos, California 90720
Telephone (213) 596-1559 • Telefax (714) 827-0823

CERTIFICATE OF CALIBRATION

Client Name:	KRIS A HANSEN CO	Calibration Date:	01-05-1993
Reference Number:	955	Calibration Due:	01-05-1994
Instrument Manufacturer:	QUIMETER	Calibration Fluid:	AIR 14.7 PSIA 70F
Instrument Description:	DRY GAS METER	Test Unit(s):	A3
Model Number:	T-110	NIST Traceability Per:	M-0122
Serial Number:	27688	Ambient Conditions:	54% RH
Rated Accuracy:	+/- .5%	Data File:	93KRQU7688
Accuracy Given:	AS RECEIVED		

	IND.SCFM	ACT.SCFM
1	0.249	0.250
2	0.349	0.350
3	0.448	0.450
4	0.498	0.500
5	0.598	0.600
6	0.799	0.800
7	0.900	0.900
8	1.001	1.000
9	1.150	1.150
10	1.302	1.300
11	1.506	1.500

Remarks:

All instruments used in the performance of the above calibration have direct traceability to the National Institute of Standards and Technology (NIST). Calibration has been performed in accordance with MIL-STD-45662A.

Calibration Performed By:

RA

Approved By:

R.MUNNS

DATA FILE NAME: N7688

CLIENT NAME: KRIS A. HANSEN CO
REFERENCE NUMBER / P.O.: 955
INSTRUMENT MANUFACTURER: KRIS A. HANSEN CO
INSTRUMENT DESCRIPTION: DRY GAS METER
MODEL NUMBER: T110
SERIAL NUMBER: 27688
RATED ACCURACY: +/- .5%
ACCURACY GIVEN: AS RECEIVED
CALIBRATION DATE: 01-05-1993
CALIBRATION DUE: 01-05-1994
CALIBRATION FLUID: AIR 14.7 PSIA 70F
TEST UNITS:
NIST TRACEABILITY PER:
AMBIENT CONDITIONS:
CALIBRATION BY:
APPROVED BY: R.MUNNS
X-UNITS, Y-UNITS: IND.SCFM, ACT.SCFM

IND.SCFM	ACT.SCFM	K = ACT.SCFM/IND.SCFM	
0.25000	0.25100	1.00398	*
0.27000	0.27092	1.00339	
0.29000	0.29088	1.00302	
0.31000	0.31088	1.00284	
0.33000	0.33092	1.00279	*
0.35000	0.35101	1.00287	
0.37000	0.37117	1.00316	
0.39000	0.39141	1.00362	
0.41000	0.41167	1.00407	
0.43000	0.43189	1.00439	
0.45000	0.45201	1.00446	*
0.47000	0.47202	1.00431	
0.49000	0.49200	1.00409	
0.51000	0.51200	1.00393	
0.53000	0.53201	1.00380	
0.55000	0.55202	1.00368	
0.57000	0.57202	1.00355	
0.59000	0.59201	1.00341	
0.61000	0.61198	1.00324	
0.63000	0.63193	1.00306	
0.65000	0.65187	1.00288	
0.67000	0.67179	1.00268	
0.69000	0.69171	1.00247	
0.71000	0.71161	1.00226	
0.73000	0.73149	1.00204	
0.75000	0.75137	1.00182	
0.77000	0.77123	1.00159	
0.79000	0.79107	1.00136	
0.81000	0.81091	1.00112	
0.83000	0.83072	1.00086	
0.85000	0.85052	1.00061	
0.87000	0.87031	1.00035	
0.89000	0.89010	1.00011	
0.91000	0.90989	0.99988	
0.93000	0.92966	0.99964	
0.95000	0.94942	0.99939	
0.97000	0.96921	0.99918	
0.99000	0.98905	0.99904	
1.01000	1.00899	0.99900	*
1.03000	1.02905	0.99908	
1.05000	1.04922	0.99925	

1.07000	1.06943	0.99947
1.09000	1.08967	0.99969
1.11000	1.10986	0.99988
1.13000	1.12999	0.99999
1.15000	1.15000	1.00000 *
1.17000	1.16989	0.99991
1.19000	1.18971	0.99976
1.21000	1.20947	0.99956
1.23000	1.22918	0.99934
1.25000	1.24886	0.99909
1.27000	1.26853	0.99884
1.29000	1.28819	0.99860
1.31000	1.30787	0.99838
1.33000	1.32754	0.99815
1.35000	1.34719	0.99792
1.37000	1.36683	0.99769
1.39000	1.38646	0.99745
1.41000	1.40607	0.99721
1.43000	1.42567	0.99697
1.45000	1.44525	0.99672
1.47000	1.46482	0.99647
1.49000	1.48437	0.99622

* INDICATES LOCAL K-FACTOR MINIMUM / MAXIMUM

~~STACK~~ TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 1-29-93 Thermocouple Indicator # Fluke 51AG Orange

Ambient Temperature 65 °F Barometric Pressure 29.90 in Hg

THERMOCOUPLE # OR REFERENCE	REFERENCE THERMOMETER TEMPERATURE °F	THERMOCOUPLE TEMPERATURE °F	TEMPERATURE DIFFERENCE °F	TEMPERATURE DIFFERENCE %
Orange	M5 Meter	TC		
Meter-in	32	32	0.0	0.0%
	212	212	0.0	0.0%
Meter out	32	32	0.0	0.0%
	212	211	1.0	0.15%

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

PRESSURE SENSOR CALIBRATION DATA FORM

Date 1-29-93 Control Box # Orange (JAG)

Ambient Temperature 65 °F Barometric Pressure 29.9 in Hg

	MAGNEHELIC GUAGE #	REFERENCE MANOMETER READING Inches H_2O	MAGNEHELIC GUAGE READING Inches H_2O	PRESSURE DIFFERENCE Inches H_2O	%
High	0"-15"	2.4	2.4	0	0.0%
		4.8	4.8	0	0.0%
		7.2	7.2	0	0.0%
		10.0	10.0	0	0.0%
Low	0"-15"	2.4	2.4	0	0.0%
		4.8	4.8	0	0.0%
		7.2	7.2	0	0.0%
		10.0	10.0	0	0.0%
High	0"-6"	1.2	1.2	0	0.0%
		2.4	2.4	0	0.0%
		3.6	3.7	0.1	
		4.8	5.0	0.2	
Low	0"-6"	1.2	1.2	0.	0.0%
		2.4	2.4	0	0.0%
		3.6	3.7	0.1	2.8%
		4.8	5.0	0.2	4.2%

$$\frac{\text{(ref pres. "H}_2O - \text{test pres. "H}_2O)}{\text{(ref pres. "H}_2O)} * 100 \leq 5\%$$

PRESSURE SENSOR CALIBRATION DATA FORM

Date 1-29-93 Control Box # ORange(JAG)

Ambient Temperature 65 °F Barometric Pressure 29.9 in Hg

	MAGNEHELIC GUAGE #	REFERENCE MANOMETER READING Inches H_2O	MAGNEHELIC GUAGE READING Inches H_2O	PRESSURE DIFFERENCE Inches H_2O	PRESSURE DIFFERENCE %
high	0"-4"	0.8	0.8	0.0	0.0%
		1.6	1.6	0.0	0.0%
		2.4	2.4	0	0.0%
		3.2	3.2	0	0.0%
Low	0"-4"	0.8	0.8	0	0.0%
		1.6	1.6	0	0.0%
		2.4	2.4	0	0.0%
		3.2	3.2	0	0.0%
High	0"-2"	0.4	0.42	0.02	5.0%
		0.8	0.83	0.03	3.7%
		1.2	1.25	0.05	4.2%
		1.6	1.66	0.06	3.8%
Low	0-2"	0.4	0.42	0.02	5.0%
		0.8	0.83	0.03	3.7%
		1.2	1.25	0.05	4.2%
		1.6	1.66	0.06	3.8%

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

PRESSURE SENSOR CALIBRATION DATA FORM

Date 1-29-93 Control Box # Orange (JAG)

Ambient Temperature 65 °F Barometric Pressure 29.90 in Hg

	MAGNEHELIC GUAGE #	REFERENCE MANOMETER READING Inches H_2O	MAGNEHELIC GUAGE READING Inches H_2O	PRESSURE DIFFERENCE Inches H_2O	PRESSURE DIFFERENCE %
High	0"-1"	0.20	0.21	0.01	5.0%
		0.40	0.40	0.00	0.0%
		0.60	0.60	0.00	0.0%
		0.80	0.81	0.01	1.25%
Low	0"-1"	0.20	0.20	0.00	0.0%
		0.40	0.40	0.00	0.0%
		0.60	0.61	0.01	1.7%
		0.80	0.82	0.02	2.5%
High	0-0.25	0.05	0.50	0.00	0.0%
		0.10	0.10	0.00	0.0%
		0.15	0.15	0.00	0.0%
		0.20	0.20	0.00	0.0%
Low	0"-0.25"	0.05	0.05	0.00	0.0%
		0.10	0.10	0.00	0.0%
		0.15	0.15	0.00	0.0%
		0.20	0.20	0.00	0.0%

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

TYPE S PITOT TUBE INSPECTION DATA FORM

Date 8-6-93 Pitot Tube # P5 G

Client Lakeside Industries

Location Monroe, WA

Site(s) Baghouse Stack

Test Date(s) 9/23/93

Pitot tube assembly level? ✓ yes _____ no

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

α_1 = 2½ ° (<10°), α_2 = 1 ° (<10°), β_1 = 0 ° (<5°),

β_2 = 1 ° (<5°)

γ = .5 °, θ = 1.5 °, A = .96 cm (in.)

z = A sin γ = .008 cm (in.); <0.32 cm (<1/8 in.),

w = A sin θ = .025 cm (in.); <.08 cm (<1/32 in.)

P_A .473 cm (in.) P_b .48 cm (in.)

D_t = .375 cm (in.)

Comments:

_____

_____

_____

Calibration required? _____ yes* _____ no

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

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 5-4-93 Thermocouple Indicator # Blue Controler

Ambient Temperature 65 °F Barometric Pressure 29.5 in Hg

THERMOCOUPLE # OR REFERENCE	REFERENCE THERMOMETER TEMPERATURE °F	THERMOCOUPLE TEMPERATURE °F	TEMPERATURE DIFFERENCE °F	TEMPERATURE DIFFERENCE %
T5A	32	32	0°F	0.0%
	212	210	2°F	0.30%
	334	331	3°F	0.40%

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

NP