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Evaluation of Method 5B at an Oil-Fired Boiler

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U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Radiation
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SECTION 1

INTRODUCTION

On June 28, 1979, the U.S. Environmental Protection Agency (EPA) issued an advance notice of proposed rulemaking to develop New Source Performance Standards (NSPS) for fossil-fuel-fired industrial steam generators.* Because these sources can emit significant amounts of condensible sulfates that even the best emission reduction systems are unable to control, particulate emissions measured by Method 5, which is capable of collecting condensible matter, could vary widely as a result of fuel sulfur content or process changes. For this reason, the EPA decided that condensible sulfates should not be included in particulate emission standards or measurements. Therefore, the test program undertaken by EPA to support development of the NSPS had two objectives: 1) to obtain background emission data, and 2) to evaluate sampling and analytical parameters designed to minimize collection of condensible sulfate materials from these sources. Background emission data have been collected at several coal-fired facilities and at one oil-fired facility by use of both the proposed Method 5B (to minimize collection of condensible sulfates) and Method 5.

*44 FR 37632.

PEDCo Environmental, Inc., under contract to the Emission Measurement Branch of the EPA, conducted an atmospheric emission test program from February 7 through February 12, 1983, on the exhaust gases of a 400-MW oil-fired utility boiler. Testing was performed in an effort to determine the precision of proposed Method 5B and to evaluate the effect of sampling and analysis parameters on the collection of condensible sulfates.

All samples were collected by use of a four-train (quad) sampling system stationed at a single point in the exit gas stream. A total of 10 quad train tests were performed during the test series. Paired trains in the quad system consisted of similar sampling methods to allow within-run data comparisons as well as comparisons between different sampling methods.

So that method precision could be estimated, most of the samples were collected at Method 5B sampling conditions [filter and probe heated to 160°C (320°F)], designated as M5B.

Other sampling parameter studies have shown generally that 1) a higher sampling temperature can minimize collection of condensible matter, and 2) even a well-designed, well-constructed, and well-operated probe heating system can have cold spots where the gas temperature is lower than the desired monitored probe temperature. Consequently, several of the quad test runs were conducted with the probe heated to 204°C (400°F) in an effort to raise the temperature of any cold spots in the probe to approximately 160°C (320°F), the desired filter temperature. These samples were designated as M5B-P400.

Probe rinse and filter sample fractions collected by Methods 5B and 5B-P400 were subjected to a series of thermogravimetric analyses to assess sample weight loss as a function of heating temperature between ambient conditions and 316°C (600°F).

In addition, several samples (designated M5BW) were collected and analyzed by use of a modified version of Texas Air Control Board (TACB) Method 5W.* The method incorporates deionized water as the sample recovery solvent and a series of titrimetric and gravimetric analyses to measure water-soluble sulfates and subsequently derive the mass of nonwater-soluble sulfate particulate (particulate matter that does not include any water-soluble sulfates). The method was modified by sampling at 160°C (320°F) and measuring the water-soluble sulfates by ion chromatography (IC). These tests were conducted to determine the suitability of this method for fossil-fuel-fired steam generators. Previous studies[1,2] have confirmed the suitability of Method 5W and the IC analysis modification for use on fluid catalytic cracking unit regenerators at petroleum refineries, which also can emit significant amounts of condensible sulfates.

The filterable portion of each sample train was followed by a modified EPA Method 8 impinger train; this permitted analysis of sulfur dioxide (SO_2) and condensible sulfate [as sulfuric acid (H_2SO_4)] that passed through the particulate filter. Flue gas temperature, moisture content, and composition [oxygen (O_2)

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*Texas Air Control Board - Laboratory Division. Determination of Particulate in Stack Gases Containing Sulfur Dioxide. December 1979.

and carbon dioxide (CO_2)] were measured in conjunction with the emission tests.

Ms. Jenna Sellers, the host plant's representative, recorded process data and provided assistance on site. Mr. Gary McAlister, the EPA Task Manager, and Mr. Andrew Kasprik, the utility company's representative, provided overall project coordination.

This report documents the activities and results of the test program. Section 2 briefly describes the process and operating conditions during the sampling periods. Section 3 describes the sampling site and the sampling and analytical plan. Section 4 presents the test results, which are then discussed in Section 5. Section 6 outlines quality assurance measures and audit results. The appendices contain computer output and example calculations (Appendix A), field data (Appendix B), analytical data (Appendix C), standard sampling and analytical procedures (Appendix D), calibration procedures and results (Appendix E), a quality assurance summary (Appendix F), a list of project participants (Appendix G), and process data (Appendix H).

SECTION 2

PROCESS OPERATION

The source tested in this program is a 400-MW fossil-fuel-fired utility boiler (designated Unit 2) located in the southeastern United States. The pressurized Foster Wheeler boiler, which was placed in service in 1969, generates steam at 17.9 MPa and 541°C (2590 psig and 1005°C). This unit normally fires a mixture of heavy oil and gas, but it was operated on 100 percent oil during the test program. Fly ash removed by the mechanical dust collectors is automatically reinjected into the furnace. Flue gases are exhausted through a 121-m (397-ft) stack. Typical oil burned in the boiler contains 2.4 percent sulfur and 300 to 400 ppm vanadium. No fuel additives are used at this facility.

Table 2-1 summarizes process conditions during the sampling periods. All tests were conducted at essentially the same boiler load (380-MW), as the load did not vary by more than ±5 percent at any time during the sampling periods. A sudden loss of air flow occurred near the beginning of Run 4, but conditions stabilized in about 10 minutes. The condensate blowdown valve was opened during three runs because of high silica concentrations. None of these relatively minor process variations should affect the within-run data comparisons.

TABLE 2-1. PROCESS DATA SUMMARY

Run No.	Date (1983)	Time, 24-h	Gross load, MW		Stack monitor opacity range, %	Oxygen range at east economizer exit, %	Operation
			Range	Average			
1	2/7	0950-1150	Steady	380	21	0.9-1.0	Normal
2	2/7	1410-1610	Steady	380	22-25	0.8-1.1	Normal
3	2/8	0845-1045	Steady	380	18	0.7-0.8	Normal
4	2/8	1230-1430	Steady	380	22-30	0.6-1.2	a
5	2/11	0755-0925	365-378	375	18	0.7	b
6	2/11	1050-1220	Steady	380	24	0.4-0.5	CBD open[c]
7	2/11	1330-1500	Steady	380	20	0.6-0.7	CBD open[c]
8	2/11	1620-1650	Steady	375	18	0.8	Normal
9	2/12	0830-1000	Steady	385	20	0.6-0.7	Normal
10	2/12	1200-1330	Steady	385	20	0.6	Normal

[a] At 1250 hours there was a sudden loss of air flow. Conditions returned to normal in approximately 10 minutes.

[b] At 0820 hours the boiler pressure was decreased slightly and the condensate blowdown was opened because of high silica concentrations.

[c] The condensate blowdown was open because of high silica concentrations; boiler at full pressure.

Testing was not conducted on two days because the unit was operating at reduced load (approximately 200-MW) as a result of a malfunctioning condensate pump.

SECTION 3

SAMPLING AND ANALYTICAL PLAN

All samples were collected with a four-train (quad) sample system stationed at a single point in the exit gas stream. The sample methodology was developed and validated in previous studies.[3] The ability of the four trains to sample simultaneously at essentially the same point in the gas stream (Figure 3-1) reduces the effect of spatial and temporal variations in the velocity and particulate profiles on the sampling results. It also permits a statistically significant number of samples to be taken in a short time. Further, because two of the four trains are identical for every run, within-train precision can be determined while the relationship of the different trains is being compared.

3.1 SAMPLE LOCATION

Testing took place in the east duct of Unit 2, as shown in Figures 3-2 and 3-3. Two existing 7.6-cm (3-in.) diameter ports were located 90 degrees apart in each of the horizontal ducts. A new 15-cm (6-in.) I.D. sampling port for the quad-train samples was installed in the side of the east duct above one of the existing smaller ports. All of the ports were located approximately 3 duct diameters downstream from the mechanical dust

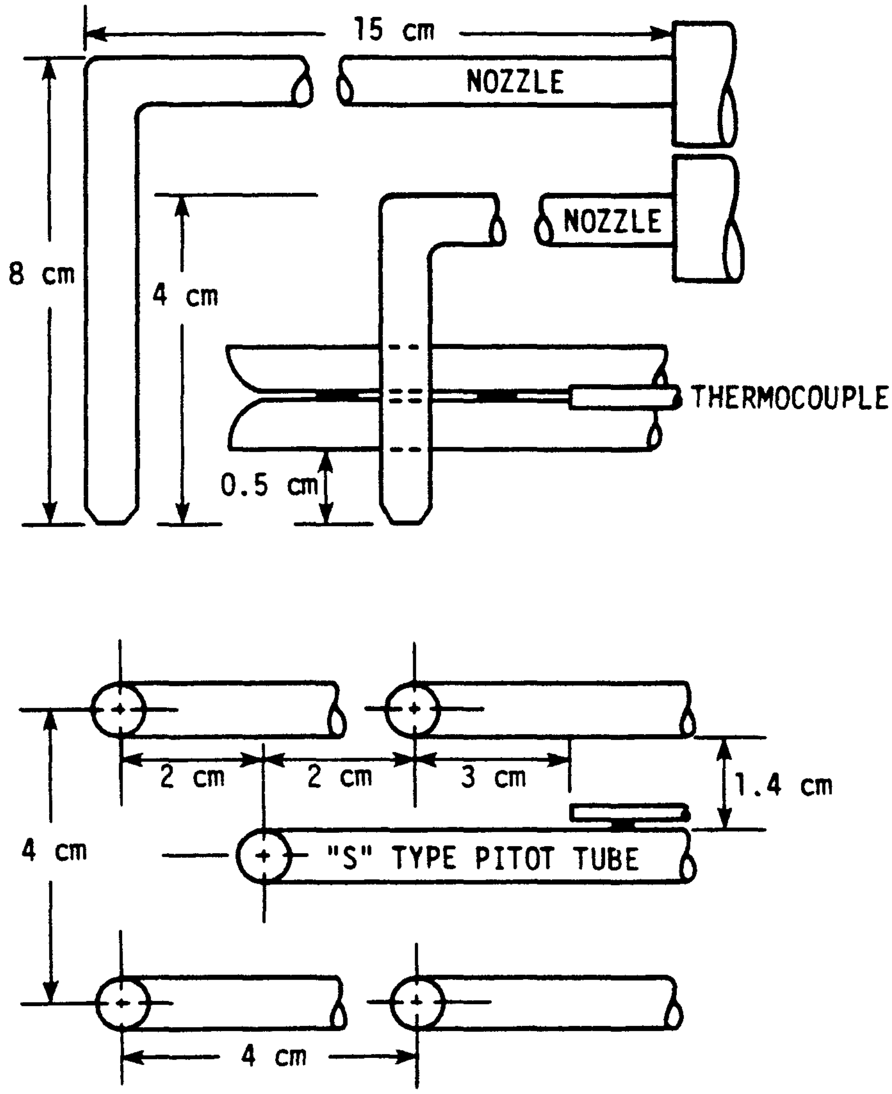


Figure 3-1. Four-train sampling system showing nozzle position.

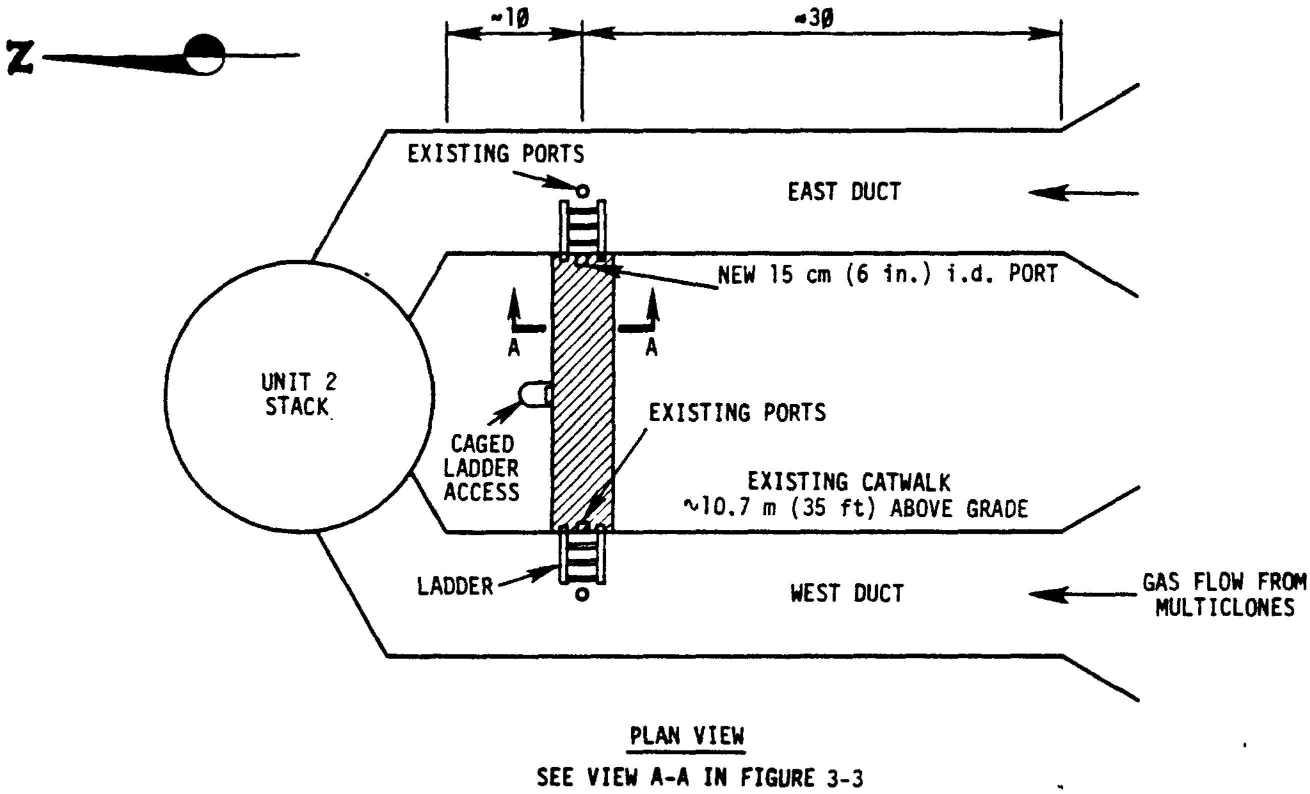
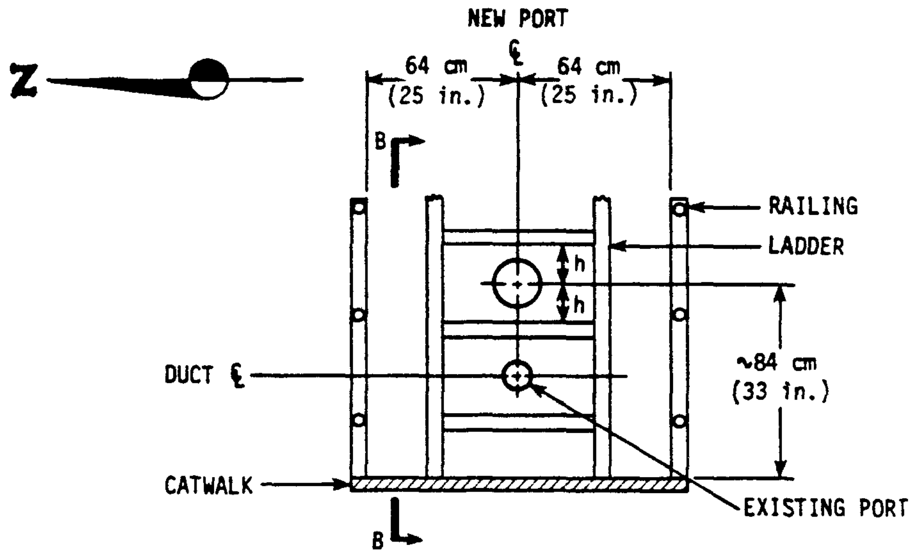
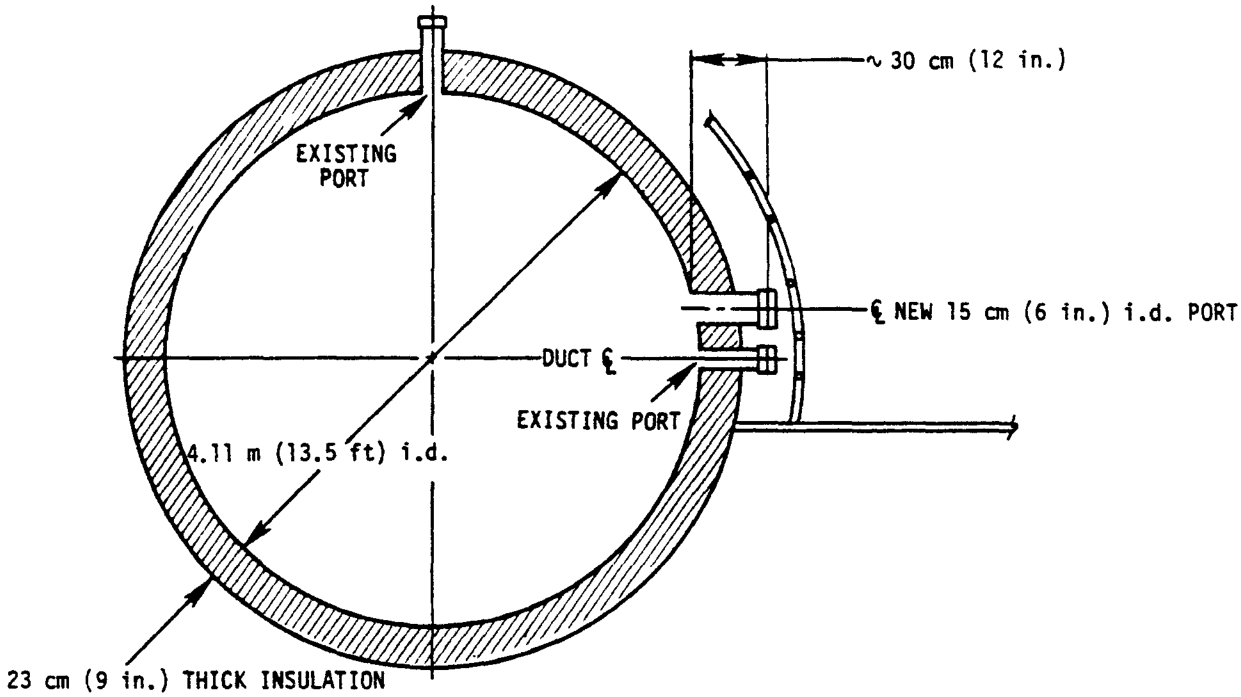


Figure 3-2. Sampling site.



VIEW A-A



SECTION B-B

Figure 3-3. Location of sampling ports in east duct of Unit 2.

collector outlets and 1 duct diameter upstream of a 45-degree bend. Both ducts had an inside diameter of 4.11 m (13.5 ft) surrounded by a 23-cm (9-in.) thick layer of insulation.

3.2 SAMPLE METHODS

The four trains collected flue gas samples simultaneously from a single point in the gas stream. The nozzles of the four-train assembly (Figure 3-1) were positioned 64 cm (25 in.) from the stack wall for each test. The desired sample time was 120 minutes, and readings of stack flue gas and sampling train data were recorded for each train at 10-minute intervals. A single pitot tube and thermocouple located in the four-train nozzle arrangement was used to set isokinetic sample rates for each train. Sample rates were determined by use of programmable calculators. Prior to sampling, the velocity and temperature profile of the general sampling area was established to ensure that all four nozzles could be positioned at points of equal velocity to minimize spatial variations in emissions.

Table 3-1 presents the sample matrix performed during this test series. The particular conditions for each train are described briefly below:

- Method 5B - Designation M5B

  Filterable particulate was collected by use of a probe and filter assembly heated to 160°C (320°F). Acetone was used to rinse all sample train components prior to the filter.

TABLE 3-1. SAMPLE MATRIX

Run No.	Sample Train No.	Sample method[a]: M5B 160°C (320°F)	M5B-P400 160°-204°C (320°-400°F)	M5BW 160°C (320°F)
1	1A			X
	1B			X
	1C	X		
	1D	X		
2	2A	X		
	2B	X		
	2C			X
	2D			X
3	3A	X		
	3B	X		
	3C		X	
	3D		X	
4	4A		X	
	4B		X	
	4C	X		
	4D	X		
5	5A	X		
	5B	X		
	5C	X		
	5D	X		
6	6A	X		
	6B	X		
	6C	X		
	6D	X		

(continued)

TABLE 3-1 (continued)

Run No.	Sample Train No.	Sample method[a] M5B 160°C (320°F)	M5B-P400 160°-204°C (320°-400°F)	M5BW 160°C (320°F)
7	7A			X
	7B	X		
	7C			X
	7D	X		
8	8A	X		
	8B		X	
	8C	X		
	8D		X	
9	9A	X		
	9B	X		
	9C	X		
	9D	X		
10	10A	X		
	10B		X	
	10C	X		
	10D		X	

[a]M5B - Probe and filter heated to 160°C.
M5B-P400 - Probe heated to 204°C; filter heated to 160°C.
M5BW - Probe and filter heated to 160°C; water rinse of nozzle, probe, and front filter holder glassware.

- <u>Modified Method 5B - Designation M5B-P400</u>

  Filterable particulate was collected by use of a probe heated to 204°C (400°F) and a filter assembly heated to 160°C (320°F). Acetone was used to rinse all sample train components prior to the filter.

- <u>Method 5BW - Designation M5BW</u>

  Filterable particulate was collected by use of a probe and filter assembly heated to 160°C (320°F). Deionized, distilled water was used to rinse all sample train components prior to the filter.

The purpose of heating the probe to 204°C while keeping the filter at 160°C was to raise the temperature of any cold spots in the probe to 160°C, and thereby minimize the quantity of condensible sulfates collected.

For each train, the probe and filter temperatures were set at the predetermined level and monitored throughout each test by the use of multiterminal digital indicators with the thermocouples located in the middle of each probe and immediately behind the Method 5 filter frits.

The back half of each sample train represented a modified Method 8 with five impingers. An unheated Method 5 filter assembly was inserted between the second and third impingers to preclude any sulfuric acid mist carryover. The contents of each impinger are listed below:

Impinger	Contents - All Runs
1	Empty
2	200 ml 80% IPA
3	100 ml 10% H_2O_2
4	100 ml 10% H_2O_2
5	400 grams silica gel

All the filters were Whatman Reeve Angel 934AH. The filters used in the Method 5 position were heated to 300°C prior to identification and tare weighing.

The flue gas moisture content of each sample train was determined gravimetrically by weighing each impinger before and after every test. In addition, a flue gas grab sample collected during each test was analyzed for oxygen (O_2) and carbon dioxide (CO_2) by use of an Orsat analyzer, as described in Method 3* of the Federal Register.

3.3 SAMPLE ANALYSIS

Table 3-2 presents the analytical matrix followed for this test program.

Thermogravimetric Analysis

Initially, the filter particulate catch was placed in a tared glass weighing dish, desiccated for 24 hours, and weighed to a constant weight.** The probe rinse fraction was transferred to a tared beaker, allowed to evaporate to dryness at ambient temperature and pressure, desiccated for 24 hours, and weighed to a constant weight. Because previous data have shown that samples containing a significant amount of sulfuric acid may not come to a constant weight, each sample received a maximum of three separate weighings. In any case, the lowest weight achieved was reported as the ambient weight.

*40 CFR 60, Appendix A, Reference Method 3, July 1982.

**Criteria as specified in 40 CFR 60, Appendix A, Reference Method 5, July 1982.

TABLE 3-2. ANALYTICAL MATRIX

Run No.	Sample Train No.	Sample method	Thermogravimetric conditioning: Ambient → 160° → 232° → 316°C	Thermogravimetric conditioning: Ambient → 232° → 316°C	Thermogravimetric conditioning: Ambient → 316°C	Water soluble sulfate determination[b]
1	1A	M5BW				X
	1B	M5BW				X
	1C	M5B	X			
	1D	M5B	X			
2	2A	M5B	X (24)			
	2B	M5B	X (24)			
	2C	M5BW				X
	2D	M5BW				X
3	3A	M5B	X			
	3B	M5B	X			
	3C	M5B-P400	X			
	3D	M5B-P400	X			
4	4A	M5B-P400	X			
	4B	M5B-P400	X			
	4C	M5B	X			
	4D	M5B	X			
5	5A	M5B	X			
	5B	M5B	X			
	5C	M5B	X (24)			
	5D	M5B	X (24)			
6	6A	M5B		X (24)		
	6B	M5B		X (24)		
	6C	M5B		X		
	6D	M5B		X		

(continued)

TABLE 3-2 (continued)

Run No.	Sample Train No.	Sample method	Thermogravimetric conditioning: Ambient → 160° → 232° → 316°C	Ambient → 232° → 316°C	Ambient → 316°C	Water soluble sulfate determination[b]
7	7A	M5BW				X
	7B	M5B		X		
	7C	M5BW				X
	7D	M5B		X		
8	8A	M5B	X (24)			
	8B	M5B-P400	X			
	8C	M5B	X (24)			
	8D	M5B-P400	X			
9	9A	M5B			X (24)	
	9B	M5B			X (24)	
	9C	M5B			X	
	9D	M5B			X	
10	10A	M5B		X		
	10B	M5B-P400		X		
	10C	M5B		X		
	10D	M5B-P400		X		

[a]Thermogravimetric conditioning of probe rinse and filter fractions at indicated temperatures after initial desiccation and ambient weights were obtained. The designation (24) for selected samples indicates a heat period of 24 hours. All other samples were heat-conditioned for 6 hours.

[b]In this procedure, the mass of total water-soluble sulfates in the sample was determined and subtracted from the total sample mass.

Note: All back halves represent a modified Method 8, with analysis for sulfates as sulfuric acid and sulfur dioxide.

After this initial gravimetric analysis at ambient conditions, probe rinse and filter fractions were subjected to the sequence of heat treatments outlined in Table 3-2. The samples were heated in an oven at the specified temperature for either 6 or 24 hours, as indicated. Each sample fraction was cooled and desiccated for 24 hours after removal from the oven and then weighed to the nearest 0.1 mg. Each sample was then desiccated for an additional 3 hours and weighed to the nearest 0.1 mg. The lower weight obtained was reported.

Selected samples received additional heat treatments to evaluate sample stability. For these samples, a heat treatment was repeated at the same time and temperature condition until a stable weight was obtained prior to advancing to the next step of an analytical sequence. For this study, a stable weight was defined as a difference of no more than 5.0 mg or 10 percent of the net sample weight (whichever was greater) between successive treatments at the same conditions. The number of treatments required to achieve a stable weight was recorded for selected sample fractions up to a maximum of three treatments. The lowest weight achieved at a given treatment temperature was reported as the weight for that temperature condition. Filter and acetone blanks were treated in a similar manner as the actual samples.

Water-Soluble Sulfate Analysis

Sample Preparation--

Each sample fraction, including blanks, was handled and analyzed as follows:

Filter - The filter was cut into small pieces and placed in a 125-ml Erlenmeyer flask with a standard taper joint equipped with an air condenser. The shipping container was rinsed into the flask. About 50 ml of distilled water was added and gently refluxed for 6 to 8 hours. The solution was then cooled and diluted to exactly 250 ml with water in a volumetric flask. This was reserved for total soluble sulfate analysis, which is described below.

Probe Rinse - The probe wash was poured into a 250-ml volumetric flask. The sample bottle was rinsed with distilled water and the rinsings were added to the flask. The solution was then diluted to the mark with distilled water (or, if greater than 250 ml, the volume was measured). This solution was reserved for total soluble sulfate analysis, which is described below.

Total Soluble Sulfate Analysis--

A 15-ml aliquot* was drawn from the settled samples (filter and rinse) into separate sample containers with a clean, dry pipet (only solution was transferred, no solids; if necessary, a portion of the sample was centrifuged). The sulfate ion ($SO_4^{=}$) concentration in each aliquot was determined by ion chromatography (IC). A syringe was used to inject 1 ml of the aliquot into the 100-μl sample loop of the IC, thereby flushing the loop with sample. The conductivity response of the sample was compared with the calibration curve to obtain the $SO_4^{=}$ concentration in mg/liter. Dilutions were prepared and reanalyzed if the initial response was out of the linear calibration range (i.e., greater than 15 mg/liter). Blank filter and water samples were prepared and analyzed in the same manner as the actual samples.

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*The pipet is not rinsed. This is a deviation from normal procedures, but is necessary because the volume removed from the volumetric flask is required in the calculations.

Mass Determination--

Filter and Rinse Solution Preparation - The remaining contents of each volumetric flask (235 ml) were poured into separate tared 250-ml beakers, and the flask was rinsed with distilled water to transfer all particulate matter. The filter solution was in Beaker A and the rinse solution was in Beaker B. This solution was evaporated to approximately 100 ml at 105°C and allowed to cool before proceeding with the next analysis.

Filter and Rinse Solution Analysis - Five drops of phenolphthalein indicator were added to all the tared beakers. Concentrated NH_4OH was then added drop by drop until the solution turned pink. The samples were returned to the oven and evaporated to dryness at 105°C, then cooled in a desiccator and weighed to a constant weight. Results were reported to the nearest 0.1 mg. For this method, "constant weight" means a difference of no more than 0.5 mg or 1 percent of the total weight less beaker and/or filter tare, whichever is greater, between two consecutive weighings, with no less than 6 hours of desiccation time between weighings.

Calculations--

Nomenclature--

FP = weight of particulate* on the filter in Beaker A, mg

PRP = weight of probe rinse particulate* in Beaker B, mg

NWSSP = weight of nonwater-soluble sulfate particulate**, mg

AS_f = weight of ammonium sulfate in filter sample, mg

AS_{pr} = weight of AS in probe rinse sample, mg

V_{evap} = volume of solution evaporated in Beaker A (filter) or Beaker B (probe rinse), ml

C_{SO_4} = concentration of sulfate in filter or probe rinse solution aliquots, mg/liter

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*Particulate with H_2SO_4 converted to $(NH_4)_2SO_4$.

**Particulate excluding water-soluble sulfates.

Equations--

$$FP(mg) = \text{gross weight Beaker A - tare weight Beaker A - filter tare weight} \qquad \text{Eq. 1}$$

$$PRP(mg) = \text{Gross weight Beaker B - tare weight Beaker B} \qquad \text{Eq. 2}$$

$$AS(mg) = C_{SO_4}\ (mg/liter) \times V_{evap}\ (ml) \times \frac{liter}{1000\ ml} \times 1.376\ \left(\frac{mg\ AS}{mg\ SO_4}\right) \qquad \text{Eq. 3}$$

Mass of Nonwater-Soluble Sulfate Particulate

The sum of the particulate* collected on the filter (FP) and the particulate* collected in the probe rinse (PRP) is equal to the sum of nonwater-soluble sulfate particulate (NWSSP) and ammonium sulfate (AS) in both samples:

$$FP + PRP = NWSSP + AS_f + AS_{pr} \qquad \text{Eq. 4}$$

The NWSSP can be found by rearranging the equation and substituting appropriate values determined by use of Equations 1, 2, and 3.

$$NWSSP = FP + PRP - AS_f - AS_{pr} \qquad \text{Eq. 5}$$

Sulfuric Acid Mist Analysis

The amount of sulfuric acid that passed through the particulate filter was determined by analyzing the IPA solution recovered in the first two impingers and the backup filter. The volume of the sample solution was recorded, and the pH of the

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*Particulate with H_2SO_4 converted to $(NH_4)_2SO_4$.

sample was determined. The sample volume was diluted to 500 ml with 80 percent IPA. A 100-ml aliquot of this solution was pipetted into a 250-ml Erlenmeyer flask with 2 to 3 drops of thorin indicator and titrated to a pink end point by using 0.0100 N barium perchlorate. If the end point color was not correct, the sample was passed through an ion exchange column and retitrated. A blank was titrated for each sample in the same manner.

Sulfur Dioxide Analysis

The hydrogen peroxide sample solution was diluted to 500 ml with deionized, distilled water. A 20-ml aliquot of this solution was pipetted into a 250-Erlenmeyer flask with 80 ml of 100 percent IPA and 2 to 3 drops of thorin indicator. The solution was then titrated to a pink end point by using 0.0100 N barium perchlorate. A blank was titrated in the same manner.

SECTION 4

SUMMARY OF TEST RESULTS

This section summarizes the results of the field sampling program. These results are presented to allow both within-run and between-run data comparisons, with emphasis on the thermogravimetric and water-soluble sulfate test results.

4.1 SAMPLE DATA

Table 4-1 summarizes pertinent sample data. All tests were conducted at a single point where the stack gas velocity profile was relatively flat. The actual probe and filter temperatures, stack temperature, and moisture content represent average values from each individual sample train. Gas composition data (O_2 and CO_2) are given in percent by volume on a dry basis. The isokinetic criteria defined in Reference Method 5* were met in almost every case, as indicated by the values shown in the far right-hand column. The isokinetic sampling rate for Run 3C reflects an adjustment for the post-test leak rate.

The sampling time for Runs 1 through 4 was 120 minutes; however, the sampling time for subsequent runs was shortened to make up for delays incurred during boiler condensate pump malfunctions. As indicated by the sample catch weights listed in

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*40 CFR 60, Appendix A, July 1982.

TABLE 4-1. SUMMARY OF SAMPLE CONDITIONS

Test No.	Date (1983) and time (24-h)	Train I.D.	Sample[a] type	Sample temperature, °C (°F) Probe Desired	Probe Actual	Filter[b], actual	Metered volume[c] dNm³ (dscf)	Average stack temperature, °C (°F)	Moisture content, %	Average moisture, %	CO_2, %	O_2, %	Isokinetic sampling rate, %
1	2/7 0950-1150	1A	M5BW	160 (320)	162 (324)	161 (322)	1.940 (68.52)	153 (307)	11.3	11.3	13.4	2.4	103
		1B	M5BW	160 (320)	159 (318)	158 (317)	1.924 (67.93)		11.2				104
		1C	M5B	160 (320)	158 (316)	161 (322)	1.820 (64.26)		11.5				99
		1D	M5B	160 (320)	161 (321)	162 (324)	1.831 (64.66)		11.2				104
2	2/7 1410-1610	2A	M5B	160 (320)	160 (319)	163 (325)	1.983 (70.04)	154 (310)	10.6	10.9	13.6	3.0	103
		2B	M5B	160 (320)	162 (324)	161 (322)	1.984 (70.07)		11.0				100
		2C	M5BW	160 (320)	165 (328)	162 (324)	1.715 (60.56)		11.1				100
		2D	M5BW	160 (320)	163 (307)	163 (325)	1.724 (60.88)		11.0				102
3	2/8 0845-1045	3A	M5B	160 (320)	163 (326)	163 (326)	1.911 (67.50)	154 (310)	10.6	10.6	13.7	2.4	102
		3B	M5B	160 (320)	162 (324)	166 (330)	1.891 (66.77)		10.6				102
		3C[d]	M5B-P400	204 (400)	209 (407)	164 (327)	1.588 (56.09)		10.7				86
		3D	M5B-P400	204 (400)	211 (412)	162 (324)	1.813 (64.02)		10.7				104
4	2/8 1230-1430	4A	M5B-P400	204 (400)	209 (408)	167 (332)	1.973 (69.69)	159 (317)	10.7	10.8	13.6	2.3	100
		4B	M5B-P400	204 (400)	211 (412)	163 (325)	2.052 (72.47)		10.7				102
		4C	M5B	160 (320)	164 (327)	163 (325)	1.727 (61.00)		10.8				99
		4D	M5B	160 (320)	161 (321)	160 (319)	1.761 (62.19)		10.8				102
5	2/11 0755-0925	5A	M5B	160 (320)	165 (329)	168 (334)	1.427 (50.39)	151 (304)	11.5	11.6	12.8	3.2	102
		5B	M5B	160 (320)	160 (319)	167 (332)	1.412 (49.88)		11.5				103
		5C	M5B	160 (320)	161 (321)	164 (327)	1.311 (46.32)		11.8				96
		5D	M5B	160 (320)	161 (322)	160 (319)	1.331 (46.99)		11.7				103
6	2/11 1050-1220	6A	M5B	160 (320)	160 (319)	166 (330)	1.423 (50.26)	157 (314)	11.4	11.4	13.6	2.5	102
		6B	M5B	160 (320)	164 (326)	165 (329)	1.396 (49.31)		11.5				97
		6C	M5B	160 (320)	161 (321)	161 (321)	1.211 (42.78)		11.5				97
		6D	M5B	160 (320)	162 (324)	162 (324)	1.238 (43.72)		11.1				100
7	2/11 1330-1500	7A	M5BW	160 (320)	167 (332)	166 (331)	1.411 (49.84)	159 (319)	11.3	11.2	13.4	2.6	101
		7B	M5B	160 (320)	161 (322)	166 (330)	1.396 (49.31)		11.1				102
		7C	M5BW	160 (320)	161 (321)	159 (318)	1.339 (47.29)		11.4				98
		7D	M5B	160 (320)	158 (317)	162 (323)	1.370 (48.40)		11.1				106
8	2/11 1620-1650	8A	M5B	160 (320)	153 (307)	161 (321)	0.866 (30.59)	159 (319)	11.2	11.2	13.3	2.7	99
		8B	M5B-P400	204 (400)	207 (404)	166 (331)	0.829 (29.29)		11.3				98
		8C	M5B	160 (320)	154 (309)	164 (327)	0.856 (30.22)		11.5				98
		8D	M5B-P400	204 (400)	206 (403)	161 (321)	0.792 (27.99)		11.0				95
9	2/12 0830-1000	9A	M5B	160 (320)	168 (335)	159 (318)	1.473 (52.00)	161 (321)	11.2	11.3	13.6	2.5	103
		9B	M5B	160 (320)	165 (328)	166 (331)	1.444 (50.99)		11.1				103
		9C	M5B	160 (320)	161 (322)	160 (320)	1.348 (47.59)		11.6				96
		9D	M5B	160 (320)	163 (326)	163 (326)	1.384 (48.86)		11.4				104
10	2/12 1200-1330	10A	M5B	160 (320)	163 (325)	168 (335)	1.517 (53.59)	163 (326)	12.0	11.9	13.0	3.0	102
		10B	M5B-P400	204 (400)	210 (410)	170 (337)	1.491 (52.64)		11.5				97
		10C	M5B	160 (320)	161 (322)	161 (321)	1.316 (46.48)		12.2				100
		10D	M5B-P400	204 (400)	213 (415)	163 (325)	1.346 (47.52)		12.0				103

[a]M5B - Probe and filter heated to 160°C.
M5BW - Probe and filter heated to 160°C; water rinse of nozzle, probe, and filter holder.
M5B-P400 - Probe heated to 204°C; filter heated to 160°C.

[b]All desired filter temperatures were 160°C.

[c]Sample volume in dry normal cubic meters (dNm³) at 20°C and 760 mmHg and in dry standard cubic feet (dscf) at 68°F and 29.92 in.Hg.

[d]The sample volume, moisture content, and isokinetic sampling rate were adjusted to reflect a post-test leak rate of 0.06 cfm.

Table 4-2, an adequate amount of sample was still collected during the 90-minute runs. This was also true for Run 8, which was conducted with a larger nozzle size but stopped after approximately 30 minutes because the isokinetic sampling rate could not be maintained.

4.2 THERMOGRAVIMETRIC ANALYTICAL RESULTS

Table 4-2 presents the thermogravimetric analytical results. The filterable particulate values represent material collected in the sample probe and on the filter for each sample type (M5B, M5B-P400). All weights are reported in milligrams and sample concentrations in milligrams per dry normal cubic meter (mg/dNm^3).

The constant weight criteria described in Method 5* were achieved within two or three weighings during the ambient weighing on approximately 75 percent of the filter and probe rinse samples; however, the remaining samples did not meet the criteria after three weighings.

As previously noted, several selected samples were heat-conditioned at each temperature for either 6 or 24 hours (as indicated in the table) and then reheated at the same conditions until a stable weight was achieved prior to advancing to the next temperature in the analytical sequence. All samples were heated three times at 316°C (600°F). The stable weight criteria, which were defined as a difference of 5.0 mg or less between consecutive similar heat treatments (or 10 percent of the net sample

*40 CFR 60, Appendix A, July 1982.

TABLE 4-2. SUMMARY OF THERMOGRAVIMETRIC ANALYTICAL RESULTS

Test No.	Train I.D.	Sample type	Filterable particulate following conditioning at indicated temperatures, °C (°F), mg							
			Ambient		160°C (320°F)		232°C (450°F)		316°C (600°F)	
			Probe	Filter	Probe	Filter	Probe	Filter	Probe	Filter
1	1A[a]	M5BW	-	-	-	-	-	-	-	-
	1B[a]	M5BW	-	-	-	-	-	-	-	-
	1C	M5B	125.8	210.9	102.3	181.3	98.1	168.0	62.4	132.4
	1D	M5B	110.2	199.1	95.0	170.6	90.6	160.4	84.1	142.0
2	2A[b]	M5B	161.0	228.7	141.3	196.6	136.4	190.2	41.2	181.0
	2B[b]	M5B	124.9	253.1	103.6	224.1	91.5	212.7	28.4	147.5
	2C[a]	M5BW	-	-	-	-	-	-	-	-
	2D[a]	M5BW	-	-	-	-	-	-	-	-
3	3A	M5B	119.7	237.2	108.7	202.4	103.6	194.6	77.4	173.7
	3B	M5B	149.2	227.4	137.1	195.3	131.6	185.5	81.7	160.0
	3C	M5B-P400	145.1	190.1	134.3	162.5	129.3	154.9	94.9	135.9
	3D	M5B-P400	106.5	244.9	96.4	217.9	93.8	206.5	60.5	185.2
4	4A	M5B-P400	173.6	225.3	165.7	203.4	162.7	195.0	117.3	174.2
	4B	M5B-P400	94.3	303.7	87.0	278.6	84.3	265.6	62.2	214.6
	4C	M5B	158.8	189.8	150.8	169.0	148.6	162.0	133.8	107.3
	4D	M5B	123.2	222.8	117.6	199.9	115.4	190.8	89.6	145.0
5	5A	M5B	75.6	159.9	64.0	137.2	56.4	129.0	39.3	113.3
	5B	M5B	71.1	159.8	58.3	137.7	53.6	129.2	32.4	87.6
	5C[b]	M5B	63.8	155.4	52.9	133.2	47.5	131.0	25.1	78.6
	5D[b]	M5B	64.9	153.0	51.1	132.4	43.8	129.9	20.6	92.7
6	6A[b]	M5B	69.4	159.9	-	-	41.9	140.9	20.3	107.2
	6B[b]	M5B	67.0	149.8	-	-	39.9	128.4	23.9	77.3
	6C	M5B	43.7	125.9	-	-	32.8	102.3	27.1	77.7
	6D	M5B	46.1	140.0	-	-	29.2	115.9	25.7	87.3
7	7A[a]	M5BW	-	-	-	-	-	-	-	-
	7B	M5B	82.7	139.2	-	-	31.6	120.5	21.1	80.5
	7C[a]	M5BW	-	-	-	-	-	-	-	-
	7D	M5B	74.6	140.9	-	-	33.6	119.4	18.9	74.6

(continued)

TABLE 4-2 (continued)

Test No.	Train I.D.	Sample type	Filterable particulate following conditioning at indicated temperatures, °C (°F), mg							
			Ambient		160°C (320°F)		232°C (450°F)		316°C (600°F)	
			Probe	Filter	Probe	Filter	Probe	Filter	Probe	Filter
8	8A[b]	M5B	50.6	106.2	17.9	87.7	14.9	85.3	6.8	44.7
	8B	M5B-P400	23.8	87.7	12.5	75.4	10.3	69.0	6.5	52.6
	8C[b]	M5B	20.6	92.0	12.3	77.5	9.4	75.5	5.2	46.0
	8D	M5B-P400	21.6	83.9	10.5	74.8	8.6	65.6	5.8	49.9
9	9A[b]	M5B	84.9	168.0	-	-	-	-	19.3	98.2
	9B[b]	M5B	94.6	166.6	-	-	-	-	20.4	96.3
	9C	M5B	60.8	143.9	-	-	-	-	43.8	78.3
	9D	M5B	64.7	159.9	-	-	-	-	34.2	85.1
10	10A	M5B	108.8	151.8	-	-	72.8	130.3	50.5	107.3
	10B	M5B-P400	66.9	159.2	-	-	46.6	133.3	24.8	111.2
	10C	M5B	66.6	143.4	-	-	58.9	117.9	32.1	91.4
	10D	M5B-P400	64.8	149.0	-	-	53.1	128.5	24.5	100.2

[a]M5BW samples were analyzed for total water soluble sulfates and particulate mass by modified Texas Air Board procedure described in Section 3 of this report.

[b]Heated for 24 hours, all others heated for 6 hours.

weight, whichever was greater), were achieved in two treatments for selected samples heated at 160°C and 232°C. Several samples heated at 316°C for two treatments appeared to be stable according to the specified criteria, but others had significant weight losses, up to approximately 25 percent (50 mg) in one case. Note that this weight difference occurred between the first and second heat treatments at 316°C, not between two different temperatures. Because of this atypical behavior, all samples were heated a third time at 316°C, even if the stability criteria had been met after two treatments.

Table 4-3 presents the results of individual heatings at 316°C, including the sample weights after the last heating at 232°C as a reference. Approximately 25 percent of the samples did not meet the stability criteria after three heatings at 316°C. In some cases, samples that had met the criteria after two heatings failed to meet it after three heatings. There was no clear advantage to using a 24-h heating interval instead of a 6-h interval, based on the following observation: 14 of the 48 samples heated for 6-h intervals were classified unstable after three heatings at 316°C, and 5 of the 20 samples heated for 24-h intervals also were unstable.

Table 4-4 presents a comparison of total filterable particulate concentrations after heat conditioning at the indicated temperatures for the M5B and M5B-P400 samples. For reporting purposes, the results of similar sample types have been grouped together. The average concentration and standard deviation are

TABLE 4-3. NET SAMPLE WEIGHTS AFTER INDIVIDUAL HEAT TREATMENTS AT THE INDICATED TEMPERATURE

Run No.	Sample fraction[a]	Heating interval, h	Weight after last heating at 232°C (450°F), mg	Weight after indicated heating at 316°C (600°F), mg		
				First	Second	Third
1C	PR	6	98.1	82.7	69.9	62.4
1C	F	6	168.0	164.1	136.5	132.4
1D	PR	6	90.6	84.1	86.1	85.4
1D	F	6	160.4	144.1	142.0	142.5
3A	PR	6	103.6	96.2	95.2	77.4
3A	F	6	194.6	185.4	184.0	173.7
3B	PR	6	131.6	113.9	100.1	81.7
3B	F	6	185.5	183.7	176.9	160.0
3C	PR[b]	6	129.3	105.3	97.6	94.9
3C	F	6	154.9	140.7	139.8	135.9
3D	PR[b]	6	93.8	78.5	65.8	60.5
3D	F	6	206.5	197.3	186.9	185.2
4A	PR[b]	6	162.7	160.2	135.3	117.3
4A	F	6	195.0	181.6	175.3	174.2
4B	PR[b]	6	84.3	76.7	71.7	62.2
4B	F	6	265.6	248.2	236.3	214.6
4C	PR	6	148.6	139.4	135.5	133.8
4C	F	6	62.0	129.3	118.3	107.3
4D	PR	6	115.4	100.4	96.7	89.6
4D	F	6	190.8	161.9	148.1	145.0
5A	PR	6	56.4	54.5	45.0	39.3
5A	F	6	129.0	118.7	113.8	113.3
5B	PR	6	53.6	41.2	37.4	32.4
5B	F	6	129.2	89.8	87.6	88.2

(continued)

TABLE 4-3 (continued)

Run No.	Sample fraction[a]	Heating interval, h	Weight after last heating at 232°C (450°F), mg	Weight after indicated heating at 316°C (600°F), mg		
				First	Second	Third
6C	PR	6	32.8	28.9	31.2	27.1
6C	F	6	102.3	99.5	80.8	77.7
6D	PR	6	29.2	27.0	29.1	25.7
6D	F	6	115.9	103.9	97.5	87.3
7B	PR	6	31.6	26.7	24.2	21.1
7B	F	6	120.5	81.6	80.7	80.5
7D	PR	6	33.6	21.1	23.4	18.9
7D	F	6	119.4	83.5	75.1	74.6
8B	PR[b]	6	10.3	7.8	9.9	6.5
8B	F	6	69.0	53.4	52.6	53.7
8D	PR[b]	6	8.6	8.4	9.7	5.8
8D	F	6	65.6	62.4	54.2	49.9
9C	PR	6	c	46.6	44.7	43.8
9C	F	6	c	83.6	78.4	78.3
9D	PR	6	c	45.2	47.1	34.2
9D	F	6	c	90.9	85.3	85.1
10A	PR	6	72.8	58.1	59.7	50.5
10A	F	6	130.3	109.1	107.3	107.4
10B	PR[b]	6	46.6	40.2	28.3	24.8
10B	F	6	133.3	113.4	111.7	111.2
10C	PR	6	58.9	41.0	35.6	32.1
10C	F	6	117.9	96.3	91.4	91.4
10D	PR[b]	6	53.1	35.2	27.7	24.5
10D	F	6	128.5	113.5	100.5	100.2
2A	PR	24	136.1	57.7	51.2	41.2
2A	F	24	190.2	181.7	181.9	181.0
2B	PR	24	91.5	51.0	32.0	28.4
2B	F	24	213.1	201.7	151.8	147.5

(continued)

TABLE 4-3 (continued)

Run No.	Sample fraction[a]	Heating interval, h	Weight after last heating at 232°C (450°F), mg	Weight after indicated heating at 316°C (600°F), mg		
				First	Second	Third
5C	PR	24	47.5	34.7	25.6	25.1
5C	F	24	131.0	85.0	79.8	78.6
5D	PR	24	43.8	24.7	22.5	20.6
5D	F	24	129.9	114.0	105.4	92.7
6A	PR	24	41.9	35.3	34.2	20.3
6A	F	24	142.0	130.1	126.6	107.2
6B	PR	24	39.9	32.4	31.6	23.9
6B	F	24	128.4	81.2	77.3	77.5
8A	PR	24	14.9	7.8	6.8	7.4
8A	F	24	85.3	46.7	44.8	44.7
8C	PR	24	9.4	9.0	5.2	5.3
8C	F	24	75.5	48.7	47.3	46.0
9A	PR	24	c	26.2	20.6	19.3
9A	F	24	c	101.8	98.9	98.2
9B	PR	24	c	30.3	22.0	20.4
9B	F	24	c	99.5	97.2	96.3

[a]PR = Probe rinse; F = Filter.

[b]M5B-P400 run; all others are M5B runs.

[c]Samples were not heated at 232°C.

TABLE 4-4. COMPARISON OF FILTERABLE PARTICULATE CONCENTRATION AFTER HEAT CONDITIONING AT INDICATED TEMPERATURES[a]

Run No.	Sample type	Ambient		160°C		232°C		316°C	
		Total weight, mg	Concen-tration, mg/dNm³	Total weight, mg	Concen-tration, mg/dNm³	Total weight, mg	Concen-tration, mg/dNm³	Total weight, mg	Concen-tration, mg/dNm³
1C	M5B	336.7	185.0	283.6	155.8	266.1	146.2	194.8	107.0
1D	M5B	309.3	168.9	265.6	145.1	251.0	137.0	226.1	123.5
2A[b]	M5B	389.7	196.5	337.9	170.4	326.6	164.7	222.2	112.0
2B[b]	M5B	378.0	190.5	327.7	165.2	304.2	153.3	175.9	88.7
3A	M5B	356.9	186.8	311.1	162.8	298.2	156.0	251.1	131.4
3B	M5B	376.6	199.2	332.4	175.8	317.1	167.7	241.7	127.8
4C	M5B	348.6	201.8	319.8	185.2	310.6	179.8	241.1	139.6
4D	M5B	346.0	196.5	317.5	180.3	306.2	173.9	234.6	133.2
5A	M5B	235.5	165.0	201.2	141.0	185.4	129.9	152.6	106.9
5B	M5B	230.9	163.5	196.0	138.8	182.8	129.5	120.0	85.0
5C[b]	M5B	219.2	167.2	186.1	142.0	178.5	136.2	103.7	79.1
5D[b]	M5B	217.9	163.7	183.5	137.9	173.7	130.5	113.3	85.1
6A[b]	M5B	229.3	161.1	-	-	182.8	128.5	127.5	89.6
6B[b]	M5B	216.8	155.3	-	-	168.3	120.6	101.2	72.5
6C	M5B	169.6	140.0	-	-	135.1	111.6	104.8	86.5
6D	M5B	186.1	150.3	-	-	145.1	117.2	113.0	91.3
7B	M5B	221.9	159.0	-	-	152.1	109.0	101.6	72.8
7D	M5B	215.5	157.3	-	-	153.0	111.7	93.5	68.2
8A[b]	M5B	156.8	181.1	105.6	121.9	100.2	115.7	51.5	59.5
8C[b]	M5B	112.6	131.5	89.8	104.9	84.9	99.2	51.2	59.8
9A[b]	M5B	252.9	171.7	-	-	-	-	117.5	79.8
9B[b]	M5B	261.2	180.9	-	-	-	-	116.7	80.8
9C	M5B	204.7	151.8	-	-	-	-	122.1	90.6
9D	M5B	224.6	162.3	-	-	-	-	119.3	86.2

(continued)

TABLE 4-4 (continued)

Run No.	Sample type	Ambient: Total weight, mg	Ambient: Concentration, mg/dNm^3	160°C: Total weight, mg	160°C: Concentration, mg/dNm^3	232°C: Total weight, mg	232°C: Concentration, mg/dNm^3	316°C: Total weight, mg	316°C: Concentration, mg/dNm^3
10A	M5B	260.6	171.8	-	-	203.1	133.9	157.8	104.0
10C	M5B	210.0	159.6	-	-	176.8	134.4	123.5	93.8
Average			169.9 σ[c] = 18.3 N[d] = 26		151.9 σ = 23.0 N = 14		135.7 σ = 22.3 N = 22		94.4 σ = 22.5 N = 26
3C	M5B-P400	335.2	211.1	296.8	186.9	284.2	179.0	230.8	145.3
3D	M5B-P400	351.4	193.8	314.3	173.4	300.3	165.6	245.7	135.5
4A	M5B-P400	398.9	202.2	369.1	187.1	357.7	181.3	291.5	147.7
4B	M5B-P400	398.0	194.0	365.6	178.2	349.9	170.5	276.8	134.9
8B	M5B-P400	111.5	134.5	87.9	106.0	79.3	95.7	59.1	71.3
8D	M5B-P400	105.5	133.2	85.3	107.7	74.2	93.7	55.7	70.3
10B	M5B-P400	226.1	151.6	-	-	179.9	120.7	136.0	91.2
10D	M5B-P400	213.8	158.8	-	-	181.6	134.9	124.7	92.6
Average			172.4 σ = 31.4 N = 8		156.5 σ = 38.8 N = 6		142.7 σ = 36.4 N = 8		111.1 σ = 33.1 N = 8

[a] Includes both filter and probe rinse fractions.

[b] Heat conditioning intervals for these samples were 24 hours, all others were 6 hours.

[c] Standard deviation with N-1 weighing for sample data.

[d] Number of data points.

given in mg/dNm^3 for all samples of a similar type and temperature. In addition, the number of data points at each temperature condition is shown. Figure 4-1 is a graphical representation of the average data.

Table 4-5 presents the statistical data for each set of grouped runs. Each group represents two runs of the same sample type conducted at the same time, except for run Groups 5, 6, and 9, which represent four similar samples. The M5B data are followed by the M5B-P400 data. Presented for each run group and temperature condition are the mean filterable particulate concentration, the standard deviation with N-1 weighting for sample data, and the relative standard deviation (RSD), which expresses the standard deviation as a percent of the mean concentration.

Table 4-6 summarizes the estimated precision for Methods 5B and 5B-P400 at each conditioning temperature. Method 5B precision data are presented on two bases; the first includes all available data (Runs 1 through 10), and the second includes only data from Runs 3, 4, 8, and 10 to allow a better comparison to within-run M5B-P400 data. The mean filterable concentrations were calculated by averaging grouped run values to weigh two- and four-run groups equally. The mean standard deviations were calculated by averaging standard deviation values for each set of grouped runs (from Table 4-5) to minimize the effect of temporal variation in emissions. In this way, the mean standard deviation of the grouped runs ($\bar{\sigma}$ in Table 4-6) more accurately reflects method precision than does the standard deviation of individual

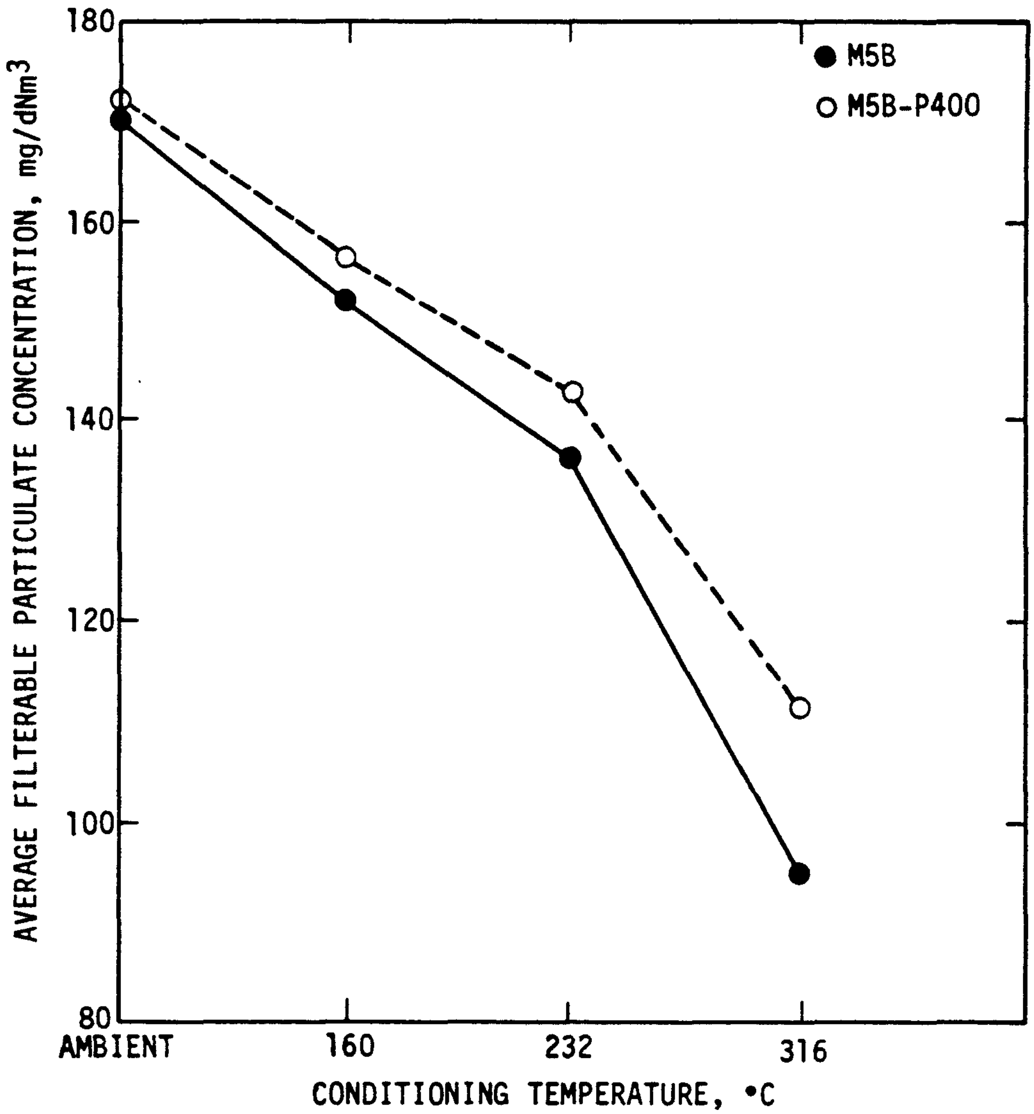

Figure 4-1. Average filterable particulate concentration for similar sample types after conditioning at indicated temperature.

TABLE 4-5. STATISTICAL DATA FOR GROUPED RUNS AFTER CONDITIONING AT INDICATED TEMPERATURES

Run No.	Sample type	Ambient			160°C (320°F)			232°C (450°F)			316°C (600°F)		
		$\bar{x}$,[a] mg/dNm³	σ,[b] mg/dNm³	RSD,[c] %	$\bar{x}$, mg/dNm³	σ, mg/dNm³	RSD, %	$\bar{x}$, mg/dNm³	σ, mg/dNm³	RSD, %	$\bar{x}$, mg/dNm³	σ, mg/dNm³	RSD, %
1-C,D	M5B	177.0	11.4	6.4	150.4	7.6	5.1	141.6	6.5	4.6	115.3	11.6	10
2-A[d],B[d]	M5B	193.5	4.2	2.2	167.8	3.7	2.2	159.0	8.0	5.1	100.4	16.5	16
3-A,B	M5B	193.0	8.8	4.5	169.3	9.2	5.4	161.9	8.2	5.1	129.6	2.5	2.0
4-C,D	M5B	199.2	3.8	1.9	182.7	3.5	1.9	176.9	4.2	2.4	136.4	4.5	3.3
5-A,B, C[d],D[d]	M5B	165.0	1.7	1.0	139.9	1.9	1.4	131.5	3.1	2.4	89.0	12.3	14
6-A[d],B[d] C,D	M5B	151.7	8.9	5.9	-	-	-	119.4	7.1	5.9	85.0	8.6	10
7-B,D	M5B	158.1	1.2	0.7	-	-	-	110.3	1.9	1.7	70.5	3.2	4.5
8-A[d],C[d]	M5B	156.3	35.0	22	113.4	12.0	10.6	107.4	11.7	11	59.6	0.2	0.4
9-A[d],B[d] C,D	M5B	166.7	12.5	7.5	-	-	-	-	-	-	84.3	5.0	6.0
10-A,C	M5B	165.7	8.6	5.2	-	-	-	134.1	0.3	0.2	98.9	7.2	7.3

(continued)

TABLE 4-5 (continued)

Run No.	Sample type	Ambient			160°C (320°F)			232°C (450°F)			316°C (600°F)		
		$\bar{x}$,[a] mg/dNm^3	σ,[b] mg/dNm^3	RSD,[c] %	$\bar{x}$, mg/dNm^3	σ, mg/dNm^3	RSD, %	$\bar{x}$, mg/dNm^3	σ, mg/dNm^3	RSD, %	$\bar{x}$, mg/dNm^3	σ, mg/dNm^3	RSD, %
3-C,D	M5B-P400	202.4	12.2	6.0	180.1	9.6	5.3	172.3	9.4	5.5	140.4	6.9	4.9
4-A,B	M5B-P400	198.1	5.8	2.9	182.6	6.3	3.4	175.9	7.6	4.3	141.3	9.1	6.4
8-B,D	M5B-P400	133.8	0.9	0.7	106.9	1.2	1.1	94.7	1.4	1.5	70.8	0.7	1.0
10-B,D	M5B-P400	155.2	5.1	3.3	-	-	-	127.8	10.1	7.9	91.9	1.0	1.1

[a]Mean filterable concentration.

[b]Within-run standard deviation with N-1 weighting for sample data.

[c]Relative standard deviation is the standard deviation expressed as a percent of the mean concentration.

[d]Samples heated for 24-hour intervals; all others heated 6 hours.

TABLE 4-6. SUMMARY OF PRECISION ESTIMATES AFTER CONDITIONING AT INDICATED TEMPERATURES

Run No.	Sample type	Ambient			160°C (320°F)			232°C (450°F)			316°C (600°F)		
		$\bar{x}$,[a] mg/dNm³	σ,[b] mg/dNm³	$\overline{RSD}$,[c] %	$\bar{x}$, mg/dNm³	σ, mg/dNm³	$\overline{RSD}$, %	$\bar{x}$, mg/dNm³	σ, mg/dNm³	$\overline{RSD}$, %	$\bar{x}$, mg/dNm³	σ, mg/dNm³	$\overline{RSD}$, %
1→10	M5B	172.6	9.6	5.6	153.9	6.3	4.1	138.0	5.7	4.1	96.9	7.2	7.4
		N[d] = 10			N = 6			N = 9			N = 10		
3,4, 8,10	M5B	178.5	14.1	7.9	155.2	8.2	5.3	145.1	6.1	4.2	106.1	3.6	3.4
		N = 4			N = 3			N = 4			N = 4		
3,4 8,10	M5B-P400	172.4	6.0	3.5	156.5	5.7	3.6	142.7	7.1	5.0	111.1	4.4	4.0
		N = 4			N = 3			N = 4			N = 4		

[a]Mean filterable concentration based on grouped run values.

[b]Mean standard deviation of grouped runs ($\frac{\Sigma\sigma_i}{N}$).

[c]Mean relative stanadard deviation (percent) calculated using the mean standard deviation and the mean filterable concentration of grouped runs.

[d]N = number of data points.

run concentrations (σ in Table 4-4). The mean relative standard deviation expresses the mean standard deviation as a percent of the mean concentration. The number of data points included in each calculation is shown for consideration in evaluating the precision estimates.

Table 4-7 presents the relative percent weight loss for the filter samples after conditioning at the indicated temperatures. Percent weight loss was calculated in two ways; 1) by use of the ambient weight as the initial weight basis, and 2) by use of the weight after conditioning at 160°C (320°F) as the initial weight basis. The results of similar sample types have been grouped together. Tables 4-8 and 4-9 present similar data for the probe rinse samples and the total filterable samples, respectively. Figure 4-2 is a graphical representation of the average weight loss data on an ambient weight basis. The graph points out two characteristics of the tabulated data: 1) the most significant weight loss occurred during heating at 316°C (600°F), and 2) the pattern of relative percent weight loss upon heating was similar for all samples.

Because the fuel oil fired during the tests was known to have a relatively high vanadium content (~400 ppm by weight), vanadyl sulfate ($VOSO_4$) was suspected to be one of the components in the particulate matter. A sample of pure vanadyl sulfate was placed in a tared beaker and subjected to a series of heat treatments in the same manner as probe rinse samples. The resultant weight loss data did not follow the same pattern as the samples

TABLE 4-7. RELATIVE PERCENT WEIGHT LOSS FOR FILTER SAMPLES AFTER CONDITIONING AT INDICATED TEMPERATURES

Run No.	Sample type	Net filter weights, mg				Relative weight loss[a], %				
						From ambient to:			From 160°C to:	
		Amb.	160°C	232°C	316°C	160°C	232°C	316°C	232°C	316°C
1C	M5B	210.9	181.3	168.0	132.4	14	20	37	7	27
1D	M5B	199.1	170.6	160.4	142.0	14	19	29	6	17
2A	M5B	228.7	196.6	190.2	181.0	14	17	21	3	8
2B	M5B	253.1	224.1	212.7	147.5	11	16	42	5	34
3A	M5B	237.2	202.4	194.6	173.7	15	18	27	4	14
3B	M5B	227.4	195.3	185.5	160.0	14	18	30	5	18
4C	M5B	189.8	169.0	162.0	107.3	11	15	43	4	37
4D	M5B	222.8	199.9	190.8	145.0	10	14	35	5	27
5A	M5B	159.9	137.2	129.0	113.3	14	19	29	6	17
5B	M5B	159.8	137.7	129.2	87.6	14	19	45	6	36
5C[b]	M5B	155.4	133.2	131.0	78.6	14	16	49	2	41
5D[b]	M5B	153.0	132.4	129.9	92.7	13	15	39	2	30
6A[b]	M5B	159.9	-	140.9	107.2	-	12	33	-	-
6B[b]	M5B	149.8	-	128.4	77.3	-	14	48	-	-
6C	M5B	125.9	-	102.3	77.7	-	19	38	-	-
6D	M5B	140.0	-	115.9	87.3	-	17	38	-	-
7B	M5B	139.2	-	120.5	80.5	-	13	42	-	-
7D	M5B	140.9	-	119.4	74.6	-	15	47	-	-
8A[b]	M5B	106.2	87.7	85.3	44.7	17	20	58	3	49
8C[b]	M5B	92.0	77.5	75.5	46.0	16	18	50	3	41
9A[b]	M5B	168.0	-	-	98.2	-	-	42	-	-
9B[b]	M5B	166.6	-	-	96.3	-	-	42	-	-
9C	M5B	143.9	-	-	78.3	-	-	46	-	-
9D	M5B	159.9	-	-	85.1	-	-	47	-	-

(continued)

TABLE 4-7 (continued)

Run No.	Sample type	Net filter weights, mg				Relative weight loss[a], %				
						From ambient to:			From 160°C to:	
		Amb.	160°C	232°C	316°C	160°C	232°C	316°C	232°C	316°C
10A	M5B	151.8	-	130.3	107.3	-	14	29	-	-
10C	M5B	143.4	-	117.9	91.4	-	18	36	-	-
M5B average		169.0	160.0	142.0	104.0	14	17	39	3	15
3C	M5B-P400	190.1	162.5	154.9	135.9	15	19	29	5	16
3D	M5B-P400	244.9	217.9	206.5	185.2	11	16	24	5	15
4A	M5B-P400	225.3	203.4	195.0	174.2	10	13	23	4	14
4B	M5B-P400	303.7	278.6	265.6	214.6	8	13	29	5	23
8B	M5B-P400	87.7	75.4	69.0	52.6	14	21	40	8	30
8D	M5B-P400	83.9	74.8	65.6	49.9	11	22	41	12	33
10B	M5B-P400	159.2	-	133.3	111.2	-	16	30	-	-
10D	M5B-P400	149.0	-	128.5	100.2	-	14	33	-	-
M5B-P400 average		180.0	169.0	152.0	128.0	11	17	31	5	17

[a]Weight loss, % = $\frac{\text{Weight @ } T_1 - \text{Weight @ } T_2}{\text{Weight @ } T_1} \times 100$; where $T_1 < T_2$.

[b]Heat conditioning intervals for these samples were 24 hours, all others were 6 hours.

TABLE 4-8. RELATIVE PERCENT WEIGHT LOSS FOR PROBE RINSE SAMPLES AFTER CONDITIONING AT INDICATED TEMPERATURES

Run No.	Sample type	Net probe rinse weights, mg				Relative weight loss[a], %				
						From ambient to:			From 160°C to:	
		Amb.	160°C	232°C	316°C	160°C	232°C	316°C	232°C	316°C
1C	M5B	125.8	102.3	98.1	62.4	19	22	50	4	39
1D	M5B	110.2	95.0	90.6	84.1	14	18	24	5	11
2A[b]	M5B	161.0	141.3	136.4	41.2	12	15	74	3	71
2B[b]	M5B	124.9	103.6	91.5	28.4	17	27	77	12	73
3A	M5B	119.7	108.7	103.6	77.4	9	13	35	5	29
3B	M5B	149.2	137.1	131.6	81.7	8	12	45	4	40
4C	M5B	158.8	150.8	148.6	133.8	5	6	16	1	11
4D	M5B	123.2	117.6	115.4	89.6	5	6	27	2	24
5A	M5B	75.6	64.0	56.4	39.3	15	25	48	12	39
5B	M5B	71.1	58.3	53.6	32.4	18	25	54	8	44
5C[b]	M5B	63.8	52.9	47.5	25.1	17	26	61	10	53
5D[b]	M5B	64.9	51.1	43.8	20.6	21	33	68	14	60
6A[b]	M5B	69.4	-	41.9	20.3	-	40	71	-	-
6B[b]	M5B	67.0	-	39.9	23.9	-	40	64	-	-
6C	M5B	43.7	-	32.8	27.1	-	25	38	-	-
6D	M5B	46.1	-	29.2	25.7	-	37	44	-	-
7B	M5B	82.7	-	31.6	21.1	-	62	74	-	-
7D	M5B	74.6	-	33.6	18.9	-	55	75	-	-
8A[b]	M5B	50.6	17.9	14.9	6.8	65	71	87	17	62
8C[b]	M5B	20.6	12.3	9.4	5.2	40	54	75	24	58
9A[b]	M5B	84.9	-	-	19.3	-	-	77	-	-
9B[b]	M5B	94.6	-	-	20.4	-	-	78	-	-
9C	M5B	60.8	-	-	43.8	-	-	28	-	-
9D	M5B	64.7	-	-	34.2	-	-	47	-	-

(continued)

TABLE 4-8 (continued)

Run No.	Sample type	Net probe rinse weights, mg				Relative weight loss[a], %				
						From ambient to:			From 160°C to:	
		Amb.	160°C	232°C	316°C	160°C	232°C	316°C	232°C	316°C
10A	M5B	108.8	-	72.8	50.5	-	33	54	-	-
10C	M5B	66.6	-	58.9	32.1	-	12	52	-	-
M5B average		88	87	67	41	19	30	56	5	24
3C	M5B-P400	145.1	134.3	129.3	94.9	7	11	35	4	29
3D	M5B-P400	106.5	96.4	93.8	60.5	9	12	43	3	37
4A	M5B-P400	173.6	165.7	162.7	117.3	5	6	32	2	29
4B	M5B-P400	94.3	87.0	84.3	62.2	8	11	34	3	29
8B	M5B-P400	23.8	12.5	10.3	6.5	47	57	73	18	48
8D	M5B-P400	21.6	10.5	8.6	5.8	51	60	73	18	45
10B	M5B-P400	66.9	-	46.6	24.8	-	30	63	-	-
10D	M5B-P400	64.8	-	53.1	24.5	-	18	62	-	-
M5B-P400 average		87	84	74	50	21	26	52	6	27

[a]Weight loss, % = $\dfrac{\text{Weight @ } T_1 - \text{Weight @ } T_2}{\text{Weight @ } T_1} \times 100$; where $T_1 < T_2$.

[b]Heat conditioning intervals for these samples were 24 hours, all others were 6 hours.

TABLE 4-9. RELATIVE PERCENT WEIGHT LOSS FOR TOTAL FILTERABLE PARTICULATE SAMPLES AFTER CONDITIONING AT INDICATED TEMPERATURES

Run No.	Sample type	Total net weights, mg				Relative weight loss[a], %				
						From ambient to:			From 160°C to:	
		Amb.	160°C	232°C	316°C	160°C	232°C	316°C	232°C	316°C
1C	M5B	336.7	283.6	266.1	194.8	16	21	42	6	31
1D	M5B	309.3	265.6	251.0	226.1	14	19	27	5	15
2A[b]	M5B	389.7	337.9	326.6	222.2	13	16	43	3	34
2B[b]	M5B	378.0	327.7	304.2	175.9	13	20	53	7	46
3A	M5B	356.9	311.1	298.2	251.1	13	16	30	4	19
3B	M5B	376.6	332.4	317.1	241.7	12	16	36	5	27
4C	M5B	348.6	319.8	310.6	241.1	8	11	31	3	25
4D	M5B	346.0	317.5	306.2	234.6	8	12	32	4	26
5A	M5B	235.5	201.2	185.4	152.6	15	21	35	8	24
5B	M5B	230.9	196.0	182.8	120.0	15	21	48	7	39
5C[d]	M5B	219.2	186.1	178.5	103.7	15	19	53	4	44
5D[b]	M5B	217.9	183.5	173.7	113.3	16	20	48	5	38
6A[b]	M5B	229.3	-	182.8	127.5	-	20	44	-	-
6B[b]	M5B	216.8	-	168.3	101.2	-	22	53	-	-
6C	M5B	169.6	-	135.1	104.8	-	20	38	-	-
6D	M5B	186.1	-	145.1	113.0	-	22	39	-	-
7B	M5B	221.9	-	152.1	101.6	-	31	54	-	-
7D	M5B	215.5	-	153.0	93.5	-	29	57	-	-
8A[b]	M5B	156.8	105.6	100.2	51.5	33	36	67	5	51
8C[b]	M5B	112.6	89.8	84.9	51.2	20	25	55	5	43
9A[b]	M5B	252.9	-	-	117.5	-	-	54	-	-
9B[b]	M5B	261.2	-	-	116.7	-	-	55	-	-
9C	M5B	204.7	-	-	122.1	-	-	40	-	-
9D	M5B	224.6	-	-	119.3	-	-	47	-	-

(continued)

TABLE 4-9 (continued)

Run No.	Sample type	Total net weights, mg				Relative weight loss[a], %				
						From ambient to:			From 160°C to:	
		Amb.	160°C	232°C	316°C	160°C	232°C	316°C	232°C	316°C
10A	M5B	260.6	-	203.1	157.8	-	22	39	-	-
10C	M5B	210.0	-	176.8	123.5	-	16	41	-	-
M5B average		256	247	209	145	15	21	45	3	18
3C	M5B-P400	335.2	296.8	284.2	230.8	11	15	31	4	22
3D	M5B-P400	351.4	314.3	300.3	245.7	11	15	30	4	22
4A	M5B-P400	398.9	369.1	357.7	291.5	7	10	27	3	21
4B	M5B-P400	398.0	365.6	349.9	276.8	8	12	30	4	24
8B	M5B-P400	111.5	87.9	79.3	59.1	21	29	47	10	33
8D	M5B-P400	105.5	85.3	74.2	55.7	19	30	47	13	35
10B	M5B-P400	226.1	-	179.9	136.0	-	20	40	-	-
10D	M5B-P400	213.8	-	181.6	124.7	-	15	42	-	-
M5B-P400 average		268	253	226	178	13	18	37	5	20

[a]Weight loss, % = $\frac{\text{Weight @ } T_1 - \text{Weight @ } T_2}{\text{Weight @ } T_1} \times 100$; where $T_1 < T_2$.

[b]Heat conditioning intervals for these samples were 24 hours, all others were 6 hours.

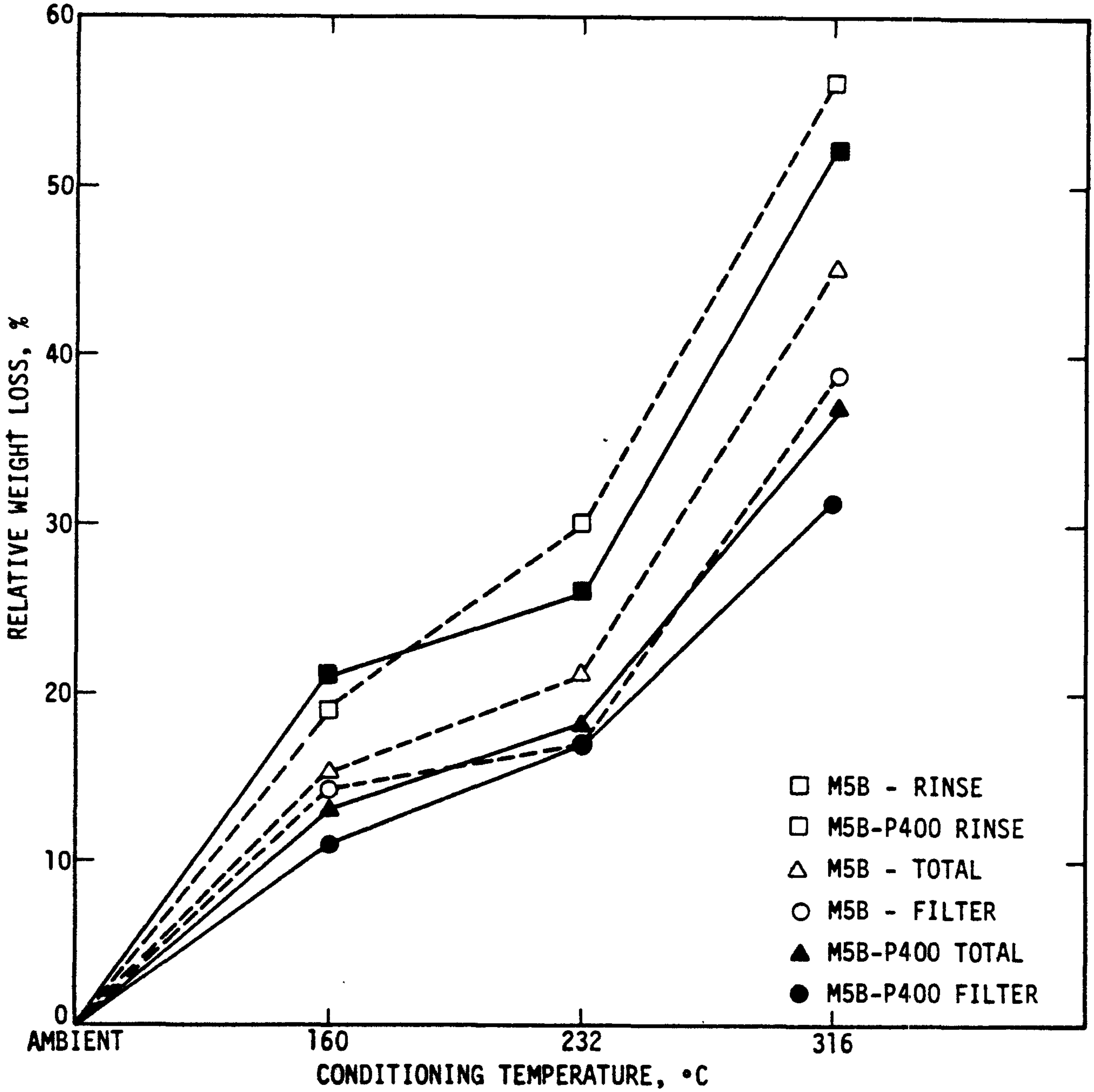

Figure 4-2. Average relative percent weight loss after conditioning at indicated temperatures - ambient weight basis.

in this report, but typified other thermogravimetric analyses that show that the most significant weight loss occurs upon the initial heating at 160°C (320°C).

The filter and probe rinse samples underwent a series of changes in appearance before and during thermogravimetric analysis. Upon recovery in the field, all filters were described as having a green coating. Some filters also had black spots or granular particulate matter. Prior to being desiccated in the laboratory, the filters were described generally as having black specks or black shining spots with a green perimeter. Some filters also had green specks. One filter had a light green glossy surface. During the heatings at 316°C the particulate on the filters turned gradually to a yellow-colored material. The probe rinse samples were basically dark initially, but after heating at 316°C, some of the probe rinse beakers contained some yellow powder along with a black granular particulate matter.

Vanadyl sulfate ($VOSO_4:nH_2O$) is a brillant blue; upon heating at 160°C it turned a dull bluish green; upon heating at 316°C it gradually changed to a greenish yellow.

4.3 WATER-SOLUBLE SULFATE ANALYTICAL DATA

Table 4-10 summarizes the nonwater-soluble sulfate particulate (NWSSP) results of the Method 5BW tests. Since particulate matter cannot be determined gravimetrically in the presence of sulfuric acid because of the inexact amount of water retained by the acid, the method is designed to convert the acid to a nonhygroscopic, nonvolatile product, in this case ammonium sulfate.

TABLE 4-10. SUMMARY OF NONWATER-SOLUBLE SULFATE PARTICULATE RESULTS[a]

Run No.	Weight, mg			Total filterable concentration, mg/dNm³	Statistical data for gaseous runs			Comparison grouped within-runs M5B samples after heating to 316°C	
	Filter	Probe rinse	Total		$\bar{x}$, mg/dNm³	σ, mg/dNm³	RSD, %	Run No.	$\bar{x}$, mg/dNm³
1A	74.5	85.8	160.3	82.6	84.6	2.8	3.3	1C, 1D	115.3
1B	83.9	82.7	166.6	86.6					
2C	94.4	83.5	177.9	103.7	104.4	0.9	0.9	2A, 2B	100.4[b]
2D	98.7	82.3	181.0	105.0					
7A	28.8	53.3	82.1	58.2	60.8	3.7	6.2	7B, 7D	70.5
7C	33.3	51.7	85.0	63.5					
				Average =	83.3			Average =	95.4

[a]NWSSP results of the Method 5BW tests using Texas Air Board procedures modified by the use of ion chromatography to measure water-soluble sulfate concentrations.

[b]The samples for Runs 2A and 2B had a higher relative weight loss than similar samples during the heatings at 316°C.

The acid is measured as water-soluble sulfate and converted to ammonium sulfate. The weight of ammonium sulfate formed is subtracted from the total weight of ammonium sulfate and NWSSP (particulate excluding water-soluble sulfates). Results of within-run Method 5B samples are presented for comparison.

As shown in Table 4-10, the average Method 5BW results were lower than the Method 5B results for samples that had been heated to 316°C (600°F). Method precisions were comparable.

The difference in results between the two methods indicates that the Method 5B samples contain water-soluble sulfates that are not easily volatilized by heating at 316°C. It may be possible to identify any cations associated with the residual sulfate by analyzing water extracts of the samples by ion chromatography. Another approach would consist of heating several samples to a higher temperature to determine additional weight loss and stability.

4.4 METHOD 8 ANALYTICAL RESULTS

Table 4-11 presents the results of back-half analyses for sulfates as H_2SO_4 and SO_2. As expected, the H_2SO_4 data show a higher degree of variability than the SO_2 data, which show a high degree of precision. There is no apparent difference in the H_2SO_4 data between the two methods.

TABLE 4-11. SUMMARY OF BACK-HALF ANALYSES

Test No.	Train I.D.	Sample type	H_2SO_4 [a] mg	H_2SO_4 [a] mg/dNm³	SO_2 [b] mg	SO_2 [b] mg/dNm³
1	1A	M5BW	66.2	34.1	7224	3720
	1B	M5BW	62.6	32.5	7055	3670
	1C	M5B	58.9	32.4	6652	3650
	1D	M5B	58.5	32.0	6467	3530
2	2A	M5B	36.6	18.5	7135	3600
	2B	M5B	29.7	15.0	7678	3870
	2C	M5BW	44.0	25.7	6376	3720
	2D	M5BW	24.2	14.0	6427	3730
3	3A	M5B	49.3	25.8	7124	3730
	3B	M5B	49.3	26.1	7031	3720
	3C	M5B-P400	58.9	37.1	5827	3670
	3D	M5B-P400	53.4	29.4	6797	3750
4	4A	M5B-P400	25.9	13.1	7362	3731
	4B	M5B-P400	24.8	12.1	7678	3740
	4C	M5B	24.8	14.4	6667	3860
	4D	M5B	18.8	10.7	6703	3810
5	5A	M5B	35.5	24.9	5398	3780
	5B	M5B	36.8	26.1	5301	3750
	5C	M5B	28.6	21.8	5008	3820
	5D	M5B	29.8	22.4	5059	3800
6	6A	M5B	38.0	26.7	5278	3710
	6B	M5B	36.5	26.1	5144	3680
	6C	M5B	53.0	43.8	4546	3750
	6D	M5B	24.6	19.9	4518	3650
7	7A	M5BW	52.4	37.1	5087	3610
	7B	M5B	42.6	30.5	5026	3600
	7C	M5BW	47.6	35.5	4800	3580
	7D	M5B	53.6	39.1	4955	3620

(continued)

TABLE 4-11 (continued)

Test No.	Train I.D.	Sample type	H_2SO_4 [a] mg	H_2SO_4 [a] mg/dNm³	SO_2 [b] mg	SO_2 [b] mg/dNm³
8	8A	M5B	31.9	36.8	3037	3510
	8B	M5B-P400	62.8	75.8	2967	3580
	8C	M5B	71.6	83.6	3062	3580
	8D	M5B-P400	46.8	59.1	2763	3490
9	9A	M5B	102.1	69.3	5266	3580
	9B	M5B	84.3	75.8	5198	3580
	9C	M5B	104.1	77.2	4928	3660
	9D	M5B	99.9	72.2	5001	3610
10	10A	M5B	77.5	51.1	5465	3600
	10B	M5B-P400	81.9	54.9	5121	3430
	10C	M5B	92.8	70.5	4834	3670
	10D	M5B-P400	70.7	52.5	4916	3650

[a] Sulfate analysis (as H_2SO_4) per Method 8 (40 CFR 60, Appendix A, July 1, 1981) of IPA impinger contents, back-half filter, and rinse.

[b] SO_2 analysis per Method 8 of peroxide impinger contents and rinse.

SECTION 5

DISCUSSION OF TEST RESULTS

The data both differ and agree with previous studies that characterize condensible sulfate bias of particulate measurements at source emission streams containing sulfur oxides.[2,4,5,6] These studies have shown that sample temperature is a parameter that significantly affects the retention of condensible material in the front half of the standard Method 5 sample train. In this case, condensible matter is defined as probe rinse/filter residue that can be removed by heating. Sulfate species will most likely exist in sources containing sulfur oxides. Water-soluble sulfate can exist in these sources in many different chemical forms. Sulfuric acid (H_2SO_4) is the most common form, but salts of ammonium, sodium, or other cations are also possible. Because exit gas streams from boilers are known to contain sulfur trioxide and sulfur dioxide, sulfuric acid is the most probable form of water-soluble sulfate. Vanadyl sulfate also can be formed during the combustion of high-vanadium residual fuel oils, although the precise effect of this compound on measurements of particulate matter is not completely known.

Data presented in Tables 4-2 and 4-4 show that the use of a higher probe sample temperature did not have a significant effect on the measurement of particulate emissions from this source.

The M5B samples collected at 160°C (320°F) were expected to have a higher particulate catch in the probe rinse than the M5B-P400 samples, which were collected at a probe temperature of 204°C (400°F) and a filter temperature of 160°C; however, this effect was not exhibited. The M5B filterable particulate concentration averaged 170 mg/dNm³ at ambient conditions and compared very well with the M5B-P400 average of 172 mg/dNm³.

Data presented in Table 4-3 show that samples were atypically unstable (according to specified criteria) between heat treatments at the higher temperatures. The variability in weight loss between samples at the same temperature suggests that 316°C may be close to the reaction or decomposition temperature of materials present in the samples.

Effects of analytical temperature are shown graphically in Figure 4-1. The average M5B and M5B-P400 particulate concentrations are similar at each of the three stages of heat conditioning from 160°C (320°F) through 316°C (600°F). The M5B sample concentrations averaged 152, 136, and 94 mg/dNm³ after conditioning at 160°, 232°, and 316°C, respectively. Corresponding results of the M5B-P400 runs at these three temperatures were 156, 143, and 111 mg/dNm³. These data differ from results presented in previous studies in that the most significant sample weight loss normally occurs during the initial heat treatment at 160°C, with subsequent decreasing losses (i.e., the slope of the concentration versus temperature curve becomes flatter). The sample in this study showed a relatively small percent weight loss until they were heated to 316°C, which results in a steeper curve.

An examination of within-run samples (as presented in Table 4-6) shows a closer comparison between the two methods. For Runs 3, 4, 8, and 10, the M5B sample concentrations averaged 155, 145, and 106 mg/dNm^3 after conditioning at 160°, 232°, and 316°C, respectively. Corresponding results of the M5B-P400 runs at these three temperatures were 156, 143, and 111 mg/dNm^3. The apparent increasing difference between the two methods at higher temperatures is probably related to the increasing instability of the samples.

Weight loss data presented in Tables 4-7 through 4-9 and Figure 4-2 show that both probe rinse and filter samples of each method type lost significant percentages of their ambient weights upon heating, although individual samples varied greatly. The M5B and M5B-P400 filter samples had average weight losses of 39 and 31 percent after thermal treatment at 316°C. This close comparison was expected because the sample filtration temperatures were both 160°C. These percentage weight losses correspond to approximately 65 and 52 mg, respectively.

The M5B and M5B-P400 probe rinse samples had average weight losses of 56 and 52 percent after thermal treatment at 316°C. These percentages correspond to approximately 47 and 37 mg, respectively.

The sample weight loss curve shown in Figure 4-2 begins to flatten out between 160°C and 232°C in a manner similar to previous studies. The abrupt departure from expected behavior at a temperature of 316°C supports the possibility of being close to a reaction temperature of components in the particulate matter.

Statistical data for grouped runs in Tables 4-5 and 4-6 show the precision estimates for Methods 5B and M5B-P400. For a given group of two or four runs, the within-run precision generally worsened between the heat treatments at 232° and 316°C, probably as a result of increased instability of the samples. The mean standard deviation for all 10 M5B run groups was 9.6 mg/dNm³ at ambient conditions, which corresponds to a relative standard deviation (RSD) of 5.6 percent. The four M5B-P400 run groups had a mean standard deviation of 6.0 mg/dNm³ and a corresponding RSD of 3.5 percent at ambient conditions.

The mean standard deviation for the six M5B run groups heated to 160°C was 6.3 mg/dNm³, with a corresponding RSD of 4.1 percent, which indicated a slight improvement over results at ambient conditions. For the three M5B-P400 run groups heated to 160°C, the mean standard deviation and RSD were 5.7 mg/dNm³ and 3.6 percent, respectively.

Precision data for the nine M5B run groups heated to 232°C included a mean standard deviation of 5.7 mg/dNm³ and an RSD of 4.1 percent. For the four M5B-P400 run groups, the average standard deviation and RSD were 7.1 mg/dNm³ and 5.0 percent, respectively.

Precision data for the 10 M5B groups heated to 316°C included a mean standard deviation of 7.2 mg/dNm³ and an RSD of 7.4 percent. For the four M5B-P400 samples, the mean standard deviation and RSD were 4.4 mg/dNm³ and 4.0 percent, respectively.

All of these statistical results indicate a high degree of precision for the majority of samples.

Results of the six M5BW samples and within-run M5B samples presented in Table 4-10 show the disparity between the two methods. The reported nonwater-soluble sulfate particulate (NWSSP) values represent particulate concentrations corrected for water-soluble sulfates determined by ion chromatography (IC). The average NWSSP concentration (83.3 mg/dNm^3) is significantly lower than the average particulate concentration of the within-run M5B samples heated to 316°C (95.4 mg/dNm^3).

A maximum bias of 6 percent (low) could be introduced to the NWSSP value determined by the IC analytical procedure if all of the collected particulate was water-soluble. This is because the aliquot removed for IC analysis is equal to 6 percent of the sample, and the NWSSP result is not corrected for particulate in the aliquot that is water-soluble and nonsulfate. The actual amount of bias is independent of the water-soluble sulfate, but depends on the makeup of the NWSSP. The NWSSP can consist of nonwater-soluble particulate (NWSP) and water-soluble particulate that is not sulfate (WSPNS). Extreme examples of these types of materials would be sand (NWSP) and sodium chloride (WSPNS). If the NWSSP consisted of 75 percent sand and 25 percent salt, the NWSSP results reported from the use of the IC procedure would be biased low by 1.5 percent (6 percent of the WSPNS). For most boiler exhaust gases, the amount of WSPNS in the particulate and the resultant bias to the reported NWSSP should be relatively low.

These NWSSP results indicate that a portion of the water-soluble sulfate initially present in the ambient samples either is not sulfuric acid or it effectively prevents sulfuric acid from being released upon heating to 316°C. It is possible that vanadium present in the fuel oil is responsible for the atypical weight loss results.

As a test for residual sulfates or determination of interfering cations, several of the M5B samples that have been heated to 316°C can be extracted with water for subsequent analysis by IC. Additionally, several of the remaining M5B samples can be heated to 400°C to determine if any additional weight loss is observed.

SECTION 6

QUALITY ASSURANCE

Because the goal of testing is to produce representative emission results, quality assurance is one of the main facets of stack sampling. Quality assurance guidelines provide the detailed procedures and actions necessary for defining and producing acceptable data. Four such documents were used in this test program to ensure the collection of acceptable data and to provide a definition of unacceptable data. These documents are 1) the Source-Specific Test Plan prepared by PEDCo and reviewed by Emission Measurement Branch; 2) the EPA Quality Assurance Handbook Volume III, EPA-600/4-77-027, 3) the PEDCo Environmental Emission Test Quality Assurance Plan, and 4) the PEDCo Environmental Laboratory Quality Assurance Plan. The last two, which are PEDCo's general guideline manuals, define the company's standard operating procedures and are followed by the emission testing groups and the laboratory groups.

Appendix F provides more detail on the quality assurance procedures, such as QA objectives; data reduction; quality control checks; performance and system audits; preventive maintenance; precision, accuracy, and completeness; corrective action; and quality assurance reports to management.

Relative to this specific test program, the following steps were taken to ensure that the testing and analytical procedures produced quality data.

- Calibration of all field sampling equipment. (Appendix E describes calibration guidelines in more detail.)
- Checks on train configuration and calculations.
- Onsite quality assurance checks such as leak checks on the sampling train, pitot tube, and Orsat line, and quality assurance checks of all test equipment prior to use.
- Use of designated analytical equipment and sampling reagents.

Table 6-1 lists the sampling equipment used for quad-train particulate and SO_2 testing as well as the calibration guidelines and limits. In addition to the pre- and post-test calibrations, a field audit was performed on the meter boxes used for the sampling. PEDCo constructed critical orifices for use in this audit. Figures 6-1a through 6-1d show audit runs for each dry gas meter used for testing. Figures 6-2a and 6-2b show thermocouple digital indicator audit runs. Figures 6-3a through 6-3d show thermometer and thermocouple audit data collected during pretest equipment checks.

Between runs, onsite preliminary calculation checks were performed to verify isokinetic sampling rates and to compare moisture contents and other parameters with expected values. These checks were used to ensure that the tests were conducted properly. An example isokinetic calculation sheet is shown in Figure 6-4.

TABLE 6-1. FIELD EQUIPMENT CALIBRATION

Equipment	I.D. No.	Calibrated against	Allowable error	Actual error	Within allowable limits	Comments
Meter boxes	FB-4	Wet test meter	Y ±0.02 Y	0.003	X	Y ±0.05 Y post-test
	FB-5		ΔH @ ±0.15	0.004	X	
	FB-6		(Y ±0.05 Y post-test)	0.003	X	
	FB-7			0.000	X	
Pitot tubes	278	Standard pitot tube	See Appendix E		X	
	379				X	
Digital indicators	124	Millivolt signals	0.5%	0.27%	X	
	125			0.11%	X	
Thermocouples and stack thermometer	178	ASTM-2F or 3F	1.5%	1.0%	X	
	206			1.0%	X	
Orsat analyzer	141	Standard gas	±0.5%	0.3%	X	
Impinger thermometers	447	ASTM-2F or 3F	±2°F	2°F	X	
	448			1.5°F	X	
	449			1.5°F	X	
	450			2.0°F	X	
Balance	M-1	Type S weights	±0.5 g	0.27 g	X	
Barometer	229	NBS traceable barometer	±0.10 in.Hg (0.20 post-test)	0.01 in.Hg	X	
Dry gas thermometers	FB-4	ASTM-2F or 3F	±5°F	1.0°F	X	Inlet and outlet averaged
	FB-5			2.2°F	X	
	FB-6			1.1°F	X	
	FB-7			2.5°F	X	
Probe nozzles	1A	Caliper	Dn ±0.004 in.	0.002	X	
	1B			0.001	X	
	1C			0.001	X	
	1D			0.003	X	
	2A			0.001	X	
	2B			0.001	X	
	2C			0.001	X	
	2D			0.001	X	
	8A			0.002	X	
	8B			0.002	X	
	8C			0.000	X	
	8D			0.002	X	

AUDIT REPORT DRY GAS METER

DATE: 2/6/83 CLIENT: USEPA

BAROMETRIC PRESSURE (P_{bar}): 30.2 in. Hg METER BOX NO. FB 4 TRAIN D

ORIFICE NO. #1 PRETEST γ: 1.030

ORIFICE K FACTOR: 5.200×10^{-4} AUDITOR: PR

Orifice manometer reading ΔH in H_2O	Dry gas meter reading V_i/V_f ft^3	Temperatures			Duration of run $\emptyset$ min
		Ambient T_{ai}/T_{af} °F	Dry gas meter		
			Inlet T_{ii}/T_{if} °F	Outlet T_{oi}/T_{of} °F	
2.30	595.900	69	73	70	13 min 0.57
	606.300	69	74	70	34 sec

Dry gas meter volume V_m ft^3	Average temperatures		$V_{m_{std}}$ ft^3	$V_{m_{act}}$ ft^3	Audit γ	γ deviation %
	Ambient T_a °F	Dry gas meter T_m °F				
10.40	69	72	10.477	10.747	1.026	~~0.0~~ -0.4

$V_{m_{std}}$	$V_{m_{act}}$
$\frac{(17.647)(V_m)(P_{bar} + \Delta H/13.6)}{(T_m + 460)}$	$\frac{(1203)(\emptyset)(K)(P_{bar})}{(T_a + 460)^{1/2}}$
10.477	10.747

Audit γ	γ deviation, %
$\frac{V_{m_{act}}}{V_{m_{std}}}$	$\frac{(\gamma \text{ audit} - \gamma \text{ pre-test})(100\%)}{(\gamma \text{ audit})}$
1.026	-0.4%

Audit γ must be in the range, pre-test $\gamma \pm 0.05\ \gamma$

Figure 6-1a. Audit report dry gas meter.

AUDIT REPORT DRY GAS METER

DATE: 2/6/83 CLIENT: USEPA

BAROMETRIC PRESSURE (P_{bar}): 30.2 in. Hg METER BOX NO. FB-5 TRAIN C

ORIFICE NO. 5 PRETEST γ: 0.983

ORIFICE K FACTOR: 5.412 x 10^-4 AUDITOR: Paul Reinermann

Orifice manometer reading ΔH in H_2O	Dry gas meter reading V_i/V_f ft^3	Temperatures: Ambient T_{ai}/T_{af} °F	Dry gas meter Inlet T_{ii}/T_{if} °F	Dry gas meter Outlet T_{oi}/T_{of} °F	Duration of run Ø min
2.45	026.700	68	77	72	12 min 3.5 sec 0.058
	037.200	68	78	72	

Dry gas meter volume V_m ft^3	Average temperatures: Ambient T_a °F	Average temperatures: Dry gas meter T_m °F	$V_{m_{std}}$ ft^3	$V_{m_{act}}$ ft^3	Audit γ	γ deviation %
10.500	68	75	10.52	10.32	0.981	-0.2%

$V_{m_{std}}$	$V_{m_{act}}$
$\frac{(17.647)(V_m)(P_{bar} + \Delta H/13.6)}{(T_m + 460)}$	$\frac{(1203)(Ø)(K)}{(T_a + 460)^{1/2}}(P_{bar})$
10.52	10.32

Audit γ	γ deviation, %
$\frac{V_{m_{act}}}{V_{m_{std}}}$	$\frac{(\gamma \text{ audit} - \gamma \text{ pre-test})(100\%)}{(\gamma \text{ audit})}$
0.981	-0.2%

Audit γ must be in the range, pre-test γ ±0.05 γ

Figure 6-1b. Audit report dry gas meter.

AUDIT REPORT DRY GAS METER

DATE: ~~2/7~~ 2/6/83	CLIENT: USEPA
BAROMETRIC PRESSURE (P_{bar}): 30.2 in. Hg	METER BOX NO. FB 6 Train B
ORIFICE NO. 3	PRETEST γ: 0.960
ORIFICE K FACTOR: 5.435 x10^{-4}	AUDITOR: [illegible]

Orifice manometer reading ΔH in H_2O	Dry gas meter reading V_i/V_f ft^3	Temperatures: Ambient T_{ai}/T_{af} °F	Temperatures: Dry gas meter Inlet T_{ii}/T_{if} °F	Temperatures: Dry gas meter Outlet T_{oi}/T_{of} °F	Duration of run Ø min
1.42	937.[illegible]	6[illegible]	[illegible]	[illegible]	13.32
	948.400	67	72	65	

Dry gas meter volume V_m ft^3	Average temperatures: Ambient T_a °F	Average temperatures: Dry gas meter T_m °F	$V_{m_{std}}$ ft^3	$V_{m_{act}}$ ft^3	Audit γ	γ deviation %
11.800	67	69	11.94	11.46	0.960	0

$V_{m_{std}}$	$V_{m_{act}}$
$\dfrac{(17.647)(V_m)(P_{bar} + \Delta H/13.6)}{(T_m + 460)}$	$\dfrac{(1203)(Ø)(K)}{(T_a + 460)^{1/2}}\underline{(P_{bar})}$
11.94	11.46

Audit γ	γ deviation, %
$\dfrac{V_{m_{act}}}{V_{m_{std}}}$	$\dfrac{(\gamma\ \text{audit} - \gamma\ \text{pre-test})(100\%)}{(\gamma\ \text{audit})}$
0.960	0

Audit γ must be in the range, pre-test γ ±0.05 γ

Figure 6-1c. Audit report dry gas meter.

AUDIT REPORT DRY GAS METER

DATE: 2/6/83 CLIENT: USEPA

BAROMETRIC PRESSURE (P_{bar}): _____ in. Hg METER BOX NO. FB-7 TRAIN A

ORIFICE NO. 10 PRETEST γ: 1.003

ORIFICE K FACTOR: 4.189 x10⁻⁷ AUDITOR: Paul Reinermann

Orifice manometer reading ΔH in H_2O	Dry gas meter reading V_i/V_f ft^3	Temperatures			Duration of run Ø min
		Ambient T_{ai}/T_{af} °F	Dry gas meter Inlet T_{ii}/T_{if} °F	Dry gas meter Outlet T_{oi}/T_{of} °F	
1.80	411.000	68	76	72	14.70
	422.200	69	77	72	

Dry gas meter volume V_m ft^3	Average temperatures		$V_{m_{std}}$ ft^3	$V_{m_{act}}$ ft^3	Audit γ	γ deviation %
	Ambient T_a °F	Dry gas meter T_m °F				
11.20	68	74	11.23	11.13	0.991	-1.2%

$V_{m_{std}}$	$V_{m_{act}}$
$\frac{(17.647)(\ V_m\ )(P_{bar} + \Delta H/13.6)}{(T_m + 460)}$	$\frac{(1203)(\ Ø\ )(\ K\ )(P_{bar})}{(T_a + 460)^{1/2}}$
11.227	11.13

Audit γ	γ deviation, %
$\frac{V_{m_{act}}}{V_{m_{std}}}$	$\frac{(\gamma \text{ audit} - \gamma \text{ pre-test})(100\%)}{(\gamma \text{ audit})}$
0.991	-1.2%

Audit γ must be in the range, pre-test γ ±0.05 γ

Figure 6-1d. Audit report dry gas meter.

THERMOCOUPLE DIGITAL INDICATOR
AUDIT DATA SHEET

CCS 124

Date 2/6/93 Indicator No. TRAIN C+D ~~[illegible]~~ Operator PR

Test Point No.	Millivolt signal*	Equivalent temperature, °F*	Digital indicator temperature reading, °F	Difference, %
1		32	29	0.6
2		102.2	99.7	0.6
3		451.1	448.2	0.3
4		1127	1127	0.0

AVG = 0.4

ALL SWITCHES OKAY

Percent difference must be less than or equal to 0.5%.

Percent difference:

$$\frac{(\text{Equivalent temperature }°R - \text{Digital indicator temperature reading }°R)(100\%)}{(\text{Equivalent temperature }°R)}$$

Where °R = °F + 460°F

* These values are to be obtained from the calibration data sheet for the calibration device.

Figure 6-2a. Thermocouple digital indicator audit data sheet.

THERMOCOUPLE DIGITAL INDICATOR
AUDIT DATA SHEET

Date 2/6/83 Indicator No. 125 Operator PR
TRAINS A+B

Test Point No.	Millivolt signal*	Equivalent temperature, °F*	Digital indicator temperature reading, °F	Difference, %
1		32	33.2	0.2
2		102.2	102.3	0.0
3		451.1	451.1	0.0
4		1127	1128	0.0

ALL SWITCHES OKAY AVG = 0.0

Percent difference must be less than or equal to 0.5%.

Percent difference:

$$\frac{(\text{Equivalent temperature °R} - \text{Digital indicator temperature reading °R})(100\%)}{(\text{Equivalent temperature °R})}$$

Where °R = °F + 460°F

* These values are to be obtained from the calibration data sheet for the calibration device.

Figure 6-2b. Thermocouple digital indicator audit data sheet.

ON-SITE AUDIT DATA SHEET

Audit Name: FB-7 TRAIN A ~~2/6/83~~ Date: 2/6/83 Auditor: PR

Equipment	Reference	Reference Value	Value Determined	Deviation	Max. Allowable Deviation
Meter box inlet thermo.	ASTM-3F at ambient temp.	68	69	1	5°F
Meter box outlet thermo.	ASTM-3F at ambient temp.	68	68	0	5°F
Impinger #777 thermometer	ASTM-3F at ambient temp.	68	62	6	2°F
Stack #179 thermometer or	ASTM-3F at ambient temp.	96	92	4	7°F
Filter-Probe Thermocouple	ASTM-3F at stack temp.	92	~~97~~ 92	5	See table
Orsat analyzer	% O_2 in ambient air	20.8%			0.7%
Trip balance	IOLM std. weight				0.5 grams
Barometer	Corrected* NWS value				0.20 in. Hg

Reference temp. °F	32-140	141-273	274-406	407-540	541-673	674-760
Max. deviation °F	7	9	11	13	15	17

* Correction factor:

NWS value (in. Hg) - [Altitude (ft)/1000(ft/in. Hg)] + 0.74 in. Hg**

** 0.74 in. Hg is the nominal correction factor for the reference barometer against which the field barometer was calibrated.

If it is not feasible to perform the audit on any piece of equipment, record "N/A" in the space provided for the data.

Figure 6-3a. On-site audit data sheet.

ON-SITE AUDIT DATA SHEET

Audit Name: FB-6 Train B Date: 2/6/83 Auditor: PR

Equipment	Reference	Reference Value	Value Determined	Deviation	Max. Allowable Deviation
Meter box inlet thermo.	ASTM-3F at ambient temp.	68	65	3	5°F
Meter box outlet thermo.	ASTM-3F at ambient temp.	68	66	2	5°F
Impinger #474 thermometer	ASTM-3F at ambient temp.	68	64	4	2°F
Stack #200 thermometer or Thermocouple	ASTM-3F at ambient temp.	88	91	3	7°F
(F. In. Probe)	ASTM-3F at stack temp.	94	97	3	See table
Orsat analyzer	% O_2 in ambient air	20.8%			0.7%
Trip balance	IOLM std. weight				0.5 grams
Barometer	Corrected* NWS value				0.20 in. Hg

Reference temp. °F	32-140	141-273	274-406	407-540	541-673	674-760
Max. deviation °F	7	9	11	13	15	17

* Correction factor:

NWS value (in. Hg) - [Altitude (ft)/1000(ft/in. Hg)] + 0.74 in. Hg**

** 0.74 in. Hg is the nominal correction factor for the reference barometer against which the field barometer was calibrated.

If it is not feasible to perform the audit on any piece of equipment, record "N/A" in the space provided for the data.

Figure 6-3b. On-site audit data sheet.

ON-SITE AUDIT DATA SHEET

Audit Name: FB 5 TREN ~~B~~ C Date: 2/6/83 Auditor: PR

Equipment	Reference	Reference Value	Value Determined	Deviation	Max. Allowable Deviation
Meter box inlet thermo.	ASTM-3F at ambient temp.	68	68	0	5°F
Meter box outlet thermo.	ASTM-3F at ambient temp.	68	69	1	5°F
Impinger #4 thermometer	ASTM-3F at ambient temp.	68	64	4	2°F
Stack thermometer or Thermocouple	ASTM-3F at ambient temp.				7°F
Filter Prem	ASTM-3F at stack temp.	~~94~~ 96	98	4	See table
Orsat analyzer	% O_2 in ambient air	20.8%			0.7%
Trip balance	IOLM std. weight				0.5 grams
Barometer	Corrected* NWS value				0.20 in. Hg

Reference temp. °F	32-140	141-273	274-406	407-540	541-673	674-760
Max. deviation °F	7	9	11	13	15	17

* Correction factor:

NWS value (in. Hg) - [Altitude (ft)/1000(ft/in. Hg)] + 0.74 in. Hg**

** 0.74 in. Hg is the nominal correction factor for the reference barometer against which the field barometer was calibrated.

If it is not feasible to perform the audit on any piece of equipment, record "N/A" in the space provided for the data.

Figure 6-3c. On-site audit data sheet.

ON-SITE AUDIT DATA SHEET

Audit Name: F3 4 TRAIN D Date: 2/6/83 Auditor: PR

Equipment	Reference	Reference Value	Value Determined	Deviation	Max. Allowable Deviation
Meter box inlet thermo.	ASTM-3F at ambient temp.	68	66°F	2	5°F
Meter box outlet thermo.	ASTM-3F at ambient temp.	68	66°F	2	5°F
Impinger #448 thermometer	ASTM-3F at ambient temp.	68	62	6	2°F
Stack thermometer or Thermocouple	ASTM-3F at ambient temp.				7°F
	ASTM-3F at stack temp.	94	94	0	See table
Orsat analyzer	% O_2 in ambient air	20.8%			0.7%
Trip balance	IOLM std. weight				0.5 grams
Barometer	Corrected* NWS value				0.20 in. Hg

Reference temp. °F	32-140	141-273	274-406	407-540	541-673	674-760
Max. deviation °F	7	9	11	13	15	17

* Correction factor:

NWS value (in. Hg) - [Altitude (ft)/1000(ft/in. Hg)] + 0.74 in. Hg**

** 0.74 in. Hg is the nominal correction factor for the reference barometer against which the field barometer was calibrated.

If it is not feasible to perform the audit on any piece of equipment, record "N/A" in the space provided for the data.

Figure 6-3d. On-site audit data sheet.

ISOKINETIC CALCULATION

SITE U.S. EPA TEST NO. 4

		RUN 4A	RUN 4B	RUN 4C	RUN 4
1. Volume of dry gas sampled corrected to standard conditions. Note: V_m must be corrected for leakage if any leakage rates exceed L_a). $V_{m_{std}} = 17.65 \times V_m \times Y \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] =$	V_m, ft^3	67.961	73.029	60.527	58.39
	Y	1.003	0.960	0.983	1.030
	P_{bar}, in.Hg	30.36	30.36	30.36	30.36
	$\overline{\Delta H}$, in.H_2O	1.032	0.952	0.89	0.89
	$\overline{T_m}$, °R	524.5	519.5	525.25	517
	$V_{m_{std}}$, dscf	69.814	72.481	60.83	62.36
. Volume of water vapor at standard conditions, ft^3. $V_{w_{std}} = 0.04707 V_{lc} =$	V_{lc}, g	177.7	184.4	156.3	159.4
	$V_{w_{std}}$, ft^3	8.36	8.68	7.36	7.50
. Moisture content in stack gas. $B_{ws} = \frac{V_{w_{std}}}{V_{m_{std}} + V_{w_{std}}} =$	B_{ws}	0.107	0.107	0.108	0.10
	$1-B_{ws}$	0.893	0.893	.892	.893
. Dry molecular weight of stack gas, lb/lb-mole. $M_d = 0.440\ (\%\ CO_2) + 0.320\ (\%\ O_2) + 0.280\ (\%\ N_2 + \%\ CO) =$	% CO_2	13.6	13.6	13.6	13.6
	% CO_2	2.3	2.3	2.3	2.3
	% N_2 + % CO	84.1	84.1	84.1	84.1
	M_d, lb/lb-mole	30.27	30.27	30.27	30.27
Molecular weight of stack gas. $M_s = M_d\ (1-B_{ws}) + 18\ B_{ws} =$	M_s, lb/lb-mole	29.08	29.08	28.95	28.96
Stack velocity at stack conditions, fps. $V_s = 85.49\ Cp\ \left(avg.\ \sqrt{\Delta P}\right)\sqrt{\frac{T_s}{P_s\ M_s}} =$	P_{static}, in.H_2O	-0.6	-0.6	-0.6	-0.6
	P_s, in.Hg	30.32	30.32	30.32	30.3
	$\overline{T_s}$, °R	777.3	777.3	777.3	777.
	$\overline{\sqrt{\Delta P}}$	0.849	0.849	0.849	0.849
	Cp	0.84	0.84	0.84	0.84
	V_s, fps	57.24	57.24	57.37	57.36
Isokinetic variation $\%\ I = \frac{V_{m_{std}} \times T_s \times 17.32}{V_s \times D_n^2 \times \Theta \times P_s \times (1-B_{ws})}$	Dn, in.	0.224	0.227	.211	.210
	Θ, min.	120	120	120	120
	% I	100.7	101.8	98.8	102..

Figure 6-4. Isokinetic calculations.

As a check on the reliability of the method used to analyze particulate samples, sets of filters that had been preweighed in the lab and acetone blanks were submitted for thermogravimetric analysis in a manner similar to the actual samples. Table 6-2 summarizes the results of blank filter and reagent analyses.

Audit solutions prepared by EPA were used to check the analytical procedures and reagents for SO_2 sampling analysis. Table 6-3 presents the results of this analytical audit. Table 6-4 summarizes the results of SO_2 reagent blank analyses. The audit test and blank analyses show that the analytical techniques were good.

Filter and deionized water blanks were analyzed to check the reliability of the analytical methods used to determine nonwater-soluble sulfate particulate. Table 6-5 presents the results of the blank reagent analyses.

The sampling equipment, reagents, and analytical procedures for this test series were in compliance with all necessary guidelines set forth for accurate test results as described in Volume III of the Quality Assurance Handbook.*

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*Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, EPA-600/4-77-027b, August 1977.

TABLE 6-2. THERMOGRAVIMETRIC REAGENT BLANK ANALYSIS

Sample type	I.D. No.	Initial volume, ml	Net blank weight, mg			
			Ambient	160°C	232°C	316°C
Filter - (Whatman RA 934AH)	CT341	NA	0.2	-0.3	-0.1	0.2
	CT832	NA	0.3	NA	NA	0.3
Acetone	CT881	368	0.6	1.1	0.2	-0.3
Acetone	CT882	372	4.3	NA	NA	0.5

NA = Not applicable

TABLE 6-3. AUDIT REPORT SO_2 ANALYSIS

Plant USEPA **PN Number** 3530-15

Date samples received 2-18-83 **Date analyzed** 3-1-83

Samples analyzed by Craig [illegible]

Reviewed by Julie Bennett **Date of Review** 3-3-83

Sample Number	mg SO_2/dscm Determined	Source of Sample	Accepted Value	% Difference
#1FC5 [illegible] (CT993)	1134 2	T. Wagner	1143.4	-0.6%
#AC93 [illegible] (CT994)	376.5	T. Wagner	381 3	-1.3%

(continued)

TABLE 6-3 (continued)

Plant [illegible] **PN Number** [illegible]

Date samples received [illegible] **Date analyzed** [illegible]

Samples analyzed by [illegible]

Reviewed by [illegible] **Date of Review** [illegible]

Sample Number	mg SO_2/dscm Determined	Source of Sample	Accepted Value	% Difference
[illegible]	1146.7	T. Wagner	[illegible]	[illegible] %
[illegible]	[illegible]7.5	T. Wagner	381.3	+ [illegible] %

TABLE 6-4. SO_2 REAGENT BLANK ANALYSES

Sample type	I.D. No.	Net blank weight, mg as SO_2	Net blank weight, mg as H_2SO_4
80% IPA	CT944	-	<0.3
80% IPA/Filter	CT943	-	<0.2
10% Hydrogen peroxide	CT991	<0.3	-
	CT992	<0.3	-
Water	CT901	<0.3	-
	CT902	<0.2	-

TABLE 6-5. NONWATER-SOLUBLE SULFATE PARTICULATE REAGENT BLANK ANALYSIS

Sample type	I.D. No.	Net weight of particulate plus ammonium sulfate, mg	C_{SO_4},[a] mg/liter	V_{evap}, ml	NWSSP blank weight, mg
Filter	CT889	2.8	1.98	235	2.2
Acetone	CT901	0.8	<1.00	305	0.8
Filter	CT890	1.1	1.91	235	0.5
Acetone	CT902	1.3	<1.00	215	1.3
Filter	CT883	3.6	1.89	235	3.0
Acetone	CT897	3.1	1.55	235	2.6
Filter	CT898	2.8	<1.00	235	2.8
Acetone	CT899	2.7	<1.00	235	2.7
Acetone	CT900	3.1	2.24	235	2.4

[a]A 15-ml aliquot was removed from sample for ion chromatography analysis.

SECTION 7

REFERENCES

1. PEDCo Environmental, Inc. Laboratory Evaluation Report - Analytical Method for Determining the Particulate Weight of EPA Method 5 Exclusive of Water-Soluble Particulate. Method Development and Testing for FCCU Regenerators. EPA Contract No. 68-02-3546, Work Assignment No. 14. October 1982.

2. PEDCo Environmental, Inc. Emission Test Report. Method Development and Testing for FCCU Regenerators. EPA Contract No. 68-02-3546, Work Assignment No. 14. December 1982.

3. Mitchell, W. J., and M. R. Midgett. A Means to Evaluate the Performance of Stationary Source Test Methods. Environmental Science and Technology, 10:85-88, 1976.

4. Oldaker, G. B. Condensibile Particulate and Its Impacts on Particulate Measurements. Draft Report, EPA Contract No. 68-01-4148, Task No. 69. May 1980.

5. Peters, E. T., and J. W. Adams. Sulfur Dioxide Interaction With Filters Used for Method 5 Stack Sampling. In: Workshop Proceedings on Primary Sulfate Emissions From Combustion Sources, Volume I - Measurement Technology. EPA-600/9-78-020a, 1978. pp. 199-202.

6. Cushing, K. W. Particulate Sampling in Process Streams in the Presence of Sulfur Dioxide. In: Workshop Proceedings on Primary Sulfate Emissions From Combustion Sources, Volume I - Measurement Technology. EPA-600/9-78-020a, 1978. pp. 202-227.

APPENDIX A

COMPUTER PRINTOUTS AND EXAMPLE CALCULATIONS

FIELD DATA

PLANT		DATE	02/07/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	1AM5BW
SAMPLE TYPE	PARTIC SO3 SO2	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	PR RA	NOZZLE 1A : I.D.	.223
AMBIENT TEMP.(DEG.F)	63.	ASSUMED MOISTURE	10.0
BAR.PRESS.(IN.HG)	30.06	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	-.60	METER BOX NUMBER	FB7
FILTER NUMBER(S)	3531017	METER HEAD DIFF.	1.72
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.		HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 10.0 IN.HG		
METER CALIB. FACTOR	1.003	K FACTOR	1161.9
READ & RECORD DATA EVERY	10.0 MINUTES		

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	950	436.809									
	10.0	0	442.715	.710	1.08	1.08	305.	63.	62.	4.0	330.	49.
	20.0	0	448.212	.710	1.08	1.08	306.	64.	62.	4.0	319.	49.
	30.0	0	453.974	.710	1.08	1.08	307.	67.	62.	4.5	330.	49.
	40.0	0	459.541	.650	.99	.99	305.	70.	62.	5.0	332.	47.
	50.0	0	464.999	.650	.98	.98	307.	72.	62.	6.0	310.	47.
	60.0	0	471.123	.680	1.03	1.03	308.	72.	62.	6.0	311.	49.
	70.0	0	476.434	.680	1.03	1.03	309.	74.	64.	6.5	319.	48.
	80.0	0	482.099	.680	1.03	1.08	307.	74.	64.	6.5	317.	48.
	90.0	0	487.859	.700	1.06	1.06	309.	74.	65.	7.5	325.	48.
	100.0	0	493.419	.650	.98	.98	308.	74.	65.	8.0	328.	48.
	110.0	0	498.932	.650	.98	.98	308.	73.	66.	8.0	328.	48.
	120.0	1150	504.527	.650	.98	.98	308.	74.	65.	8.5	315.	51.
TOTALS	120.0		67.718									
AVERAGE					1.02	1.03	307.	71.	63.	6.2	322.	48.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS

TEST TEAM LEADER

PR RA

TEST 1AM5BW UNIT 2 EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/07/83	02/07/83
TB	TIME-START	950	950
TF	TIME-FINISH	1150	1150
TT	NET TIME OF TEST, MIN.	120.0	120.0
NP	NET SAMPLING POINTS	12	12
Y	METER CALIBRATION FACTOR	1.003	1.003
DN	SAMPLING NOZZLE DIAMETER	.223 IN	5.7 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	1.03 IN-H2O	26.1 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	67.718 CU-FT	1.918 CU-M
TM	AVERAGE GAS METER TEMP	67.2 F	19.5 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	68.519 SCF	1.940 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	184.9	184.9
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	8.703 SCF	.246 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.27	11.27
FMD	MOLE FRACTION DRY GAS	.887	.887
PCO2	PERCENT CO2 BY VOL., DRY	13.35	13.35
PO2	PERCENT O2 BY VOL., DRY	2.45	2.45
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	84.20	84.20
MD	MOLECULAR WT-DRY STACK GAS	30.23	30.23

MWS	MOLECULAR WT-STACK GAS	28.86		28.86	
PB	BAROMETRIC PRESSURE	30.06	IN-HG	763.52	MM-HG
PSI	STATIC PRES OF STACK GAS	-.60	IN-H2O	-15.24	MM-H2O
PS	STACK PRES, ABS.	30.02	IN-HG	762.40	MM-HG
TS	AVERAGE STACK TEMP	307.	F	153.	C
VS	AVG STACK GAS VELOCITY	55.6	FPS	16.9	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17546932.	SCFH	496877.	SCMH
QS	ACTUAL STACK FLOW RATE	28644928.	ACFH	811139.	ACMH
ISO	PERCENT ISOKINETIC	103.0		103.0	
MN	AMBIENT PARTICULATE MG. EPA 5	100.0		100.0	
CS	AMBIENT PARTICULATE	.0225	GR/DSCF*	51.545	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLF PARTICULATE CALCULATIONS TEST NO.1AM5BW

UNIT 2 EAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

```
VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    67.718 * 1.003 * ( 30.06 + 1.029 / 13.6)
VMSTD = ------------------------------------------------------ =     68.519 DSCF
                          (  67. + 460.)
```

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

```
VWC = .04707 * VLC

VWC = .04707 *  185. =   8.70 SCF
```

PERCENT MOISTURE IN STACK GAS

```
BWO = (100. * VWC) / (VMSTD + VWC)

          100. *   8.70
BWO = -------------------------- = 11.27 PERCENT
            68.519 +   8.70
```

MOLE FRACTION OF DRY STACK GAS

```
FMD = (100. - BWO) / 100.

          100. -  11.3
FMD = ----------------------- =   .887
               100.
```

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

```
MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.35*44/100) + ( 2.4*32/100) + ((84.2+ .0) * 28/100 =   30.23
```

MOLECULAR WEIGHT OF STACK GAS

```
MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.23* (1. -(11.27/100)) + 18. * (11.27/100) =   28.86
```

STACK GAS VELOCITY AT STACK CONDITIONS

```
DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  273.377 / (SQRT( 28.86 * 30.02)  *  12. =   55.59 FPS
```

STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

```
QS = VS * AS * 3600/144

QS =   55.59 * 20612. 3600/144 =   28644928. ACFH
```

STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

```
QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

          17.647 *   28644928. *  30.02 * (1. - (11.27/100))
QSSTD = ---------------------------------------------------- =   17546932. SCFH
                     ( 307. + 460.)
```

PERCENT ISOKINETIC

```
ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 307.+460.))*((0.002669*  185.)+(   67.718*1.003*( 30.06+(   1.029/13.6))/(  67.+460.)))
ISO = ------------------------------------------------------------------------------------------------- = 103.05 PERCENT
                                   120. *     55.59 *   30.02 *  .223 *  .223
```

PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

```
CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    100.0 * 15.43 /    68.519 =       .0225 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/07/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	1BM5BW
SAMPLE TYPE	PART SO4 SO2	PROBE LENGTH & TYPE	6 FT GLASS
OPERATOR	PR RA	NOZZLE 1B : I.D.	.221
AMBIENT TEMP.(DEG.F)	63.	ASSUMED MOISTURE	10.0
BAR.PRESS.(IN.HG)	30.06	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	-.60	METER BOX NUMBER	FB6
FILTER NUMBER(S)	3531016	METER HEAD DIFF.	1.50
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.		HEATER BOX SETTING	320.
LEAKAGE	.012 CFM @ 11.0 IN.HG		
METER CALIB. FACTOR	.960	K FACTOR	977.4

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	950	949.932									
	10.0	0	955.850	.710	.91	.91	305.	59.	60.	1.0	319.	46.
	20.0	0	961.680	.710	.91	.91	306.	59.	60.	1.0	310.	46.
	30.0	0	967.575	.710	.90	.90	307.	62.	60.	1.5	317.	46.
	40.0	0	973.272	.650	.83	.83	305.	64.	60.	1.0	320.	47.
	50.0	0	979.000	.650	.83	.83	307.	66.	60.	5.0	321.	47.
	60.0	0	985.015	.680	.87	.87	308.	67.	60.	6.0	313.	48.
	70.0	0	990.558	.680	.86	.86	309.	68.	60.	6.0	313.	47.
	80.0	0	996.418	.680	.87	.87	307.	68.	61.	6.5	308.	47.
	90.0	0	2.290	.700	.89	.89	309.	68.	60.	7.5	318.	47.
	100.0	0	8.000	.650	.83	.83	308.	68.	60.	7.5	319.	47.
	110.0	0	13.764	.650	.83	.83	308.	68.	60.	8.0	322.	47.
	120.0	1150	19.509	.650	.83	.83	308.	67.	60.	8.0	324.	57.
TOTALS	120.0		69.577									
AVERAGE					.86	.86	307.	65.	60.	4.9	317.	48.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS — TEST TEAM LEADER

?R RA

TEST 18M5BW UNIT 2 EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/07/83	02/07/83
TB	TIME-START	950	950
TF	TIME-FINISH	1150	1150
TT	NET TIME OF TEST, MIN.	120.0	120.0
NP	NET SAMPLING POINTS	12	12
Y	METER CALIBRATION FACTOR	.960	.960
DN	SAMPLING NOZZLE DIAMETER	.221 IN	5.6 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	.86 IN-H2O	21.9 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	69.577 CU-FT	1.970 CU-M
TM	AVERAGE GAS METER TEMP	62.7 F	17.1 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	67.929 SCF	1.924 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	182.1	182.1
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	8.571 SCF	.243 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.20	11.20
FMD	MOLE FRACTION DRY GAS	.888	.888
PCO2	PERCENT CO2 BY VOL., DRY	13.35	13.35
PO2	PERCENT O2 BY VOL., DRY	2.45	2.45
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	84.20	84.20
MD	MOLECULAR WT-DRY STACK GAS	30.23	30.23

MWS	MOLECULAR WT-STACK GAS	28.86		28.86	
PB	BAROMETRIC PRESSURE	30.06	IN-HG	763.52	MM-HG
PSI	STATIC PRES OF STACK GAS	-.60	IN-H2O	-15.24	MM-H2O
PS	STACK PRES, ABS.	30.02	IN-HG	762.40	MM-HG
TS	AVERAGE STACK TEMP	307.	F	153.	C
VS	AVG STACK GAS VELOCITY	55.6	FPS	16.9	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17557520.	SCFH	497176.	SCMH
QS	ACTUAL STACK FLOW RATE	28640920.	ACFH	811025.	ACMH
ISO	PERCENT ISOKINETIC	104.0		104.0	
MN	AMBIENT PARTICULATE MG. EPA 5	100.0		100.0	
CS	AMBIENT PARTICULATE	.0227	GR/DSCF*	51.993	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO.1BM5BW

UNIT 2 EAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

```
VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

         17.647 *    69.577 *   .960 * ( 30.06 +   .863 / 13.6)
VMSTD = -------------------------------------------------------- =     67.929 DSCF
                             (  63. + 460.)
```

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

```
VWC = .04707 * VLC

VWC = .04707 *  182. =   8.57 SCF
```

PERCENT MOISTURE IN STACK GAS

```
BWO = (100. * VWC) / (VMSTD + VWC)

         100. *   8.57
BWO = -------------------------- = 11.20 PERCENT
           67.929 +   8.57
```

MOLE FRACTION OF DRY STACK GAS

```
FMD = (100. - BWO) / 100.

         100. -  11.2
FMD = ----------------------- =   .888
              100.
```

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

```
MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.35*44/100) + ( 2.4*32/100) + ((84.2+ .0) * 28/100 =   30.23
```

MOLECULAR WEIGHT OF STACK GAS

```
MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.23* (1. -(11.20/100)) + 18. * (11.20/100) =   28.86
```

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  273.377 / (SQRT( 28.86 * 30.02)  *  12. =   55.58 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   55.58 * 20612. 3600/144 =   28640920. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

          17.647 *   28640920. *  30.02 * (1. - (11.20/100))
QSSTD = ---------------------------------------------------- =   17557520. SCFH
                      ( 307. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 307.+460.))*((0.002669*  182.)+(   69.577* .960*( 30.06+(    .863/13.6))/(  63.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- = 103.95 PERCENT
                                   120. *     55.58 *   30.02 *  .221 *  .221


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    100.0 * 15.43 /    67.929 =       .0227 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/07/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	1CM5B
SAMPLE TYPE	M-5B	PROBE LENGTH & TYPE	6FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.221
AMBIENT TEMP.(DEG.F)	64.	ASSUMED MOISTURE	10.0
BAR.PRESS.(IN.HG)	30.06	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	-.60	METER BOX NUMBER	FB5
FILTER NUMBER(S)	3531015	METER HEAD DIFF.	1.84
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	206	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 10.0 IN.HG		
METER CALIB. FACTOR	.983	K FACTOR	1174.2

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	950	53.396									
	10.0	1000	59.325	.710	1.09	1.10	305.	62.	62.	5.0	315.	51.
	20.0	1010	64.300	.710	1.09	1.09	306.	62.	62.	5.0	328.	52.
	30.0	1020	69.800	.710	1.09	1.09	307.	67.	62.	5.5	323.	52.
	40.0	1030	74.640	.650	1.00	1.00	305.	72.	63.	6.0	330.	49.
	50.0	1040	80.000	.650	1.00	1.00	307.	74.	64.	6.5	332.	49.
	60.0	1050	85.650	.680	1.04	1.00	308.	75.	64.	7.0	320.	48.
	70.0	1100	91.210	.680	1.04	1.00	309.	76.	65.	7.0	315.	49.
	80.0	1110	96.275	.680	1.04	1.00	307.	76.	66.	7.5	322.	49.
	90.0	1120	102.000	.700	1.07	1.10	309.	78.	66.	8.5	325.	50.
	100.0	1130	106.845	.650	.99	1.00	308.	76.	66.	9.0	317.	49.
	110.0	1140	113.071	.650	.99	1.00	308.	76.	66.	9.5	321.	50.
	120.0	1140	118.356	.650	.99	1.00	308.	77.	66.	9.5	317.	48.
TOTALS	120.0		64.960									
AVERAGE					1.04	1.03	307.	73.	64.	7.2	322.	50.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS

TEST TEAM LEADER

CLARKE

TEST 1CM5B UNIT TWO EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/07/83	02/07/83
TB	TIME-START	950	950
TF	TIME-FINISH	1140	1140
TT	NET TIME OF TEST, MIN.	120.0	120.0
NP	NET SAMPLING POINTS	12	12
Y	METER CALIBRATION FACTOR	.983	.983
DN	SAMPLING NOZZLE DIAMETER	.221 IN	5.6 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	1.03 IN-H2O	26.2 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	64.960 CU-FT	1.839 CU-M
TM	AVERAGE GAS METER TEMP	68.5 F	20.3 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	64.260 SCF	1.820 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	177.0	177.0
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	8.331 SCF	.236 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.48	11.48
FMD	MOLE FRACTION DRY GAS	.885	.885
PCO2	PERCENT CO2 BY VOL., DRY	13.35	13.35
PO2	PERCENT O2 BY VOL., DRY	2.45	2.45
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	84.20	84.20
MD	MOLECULAR WT-DRY STACK GAS	30.23	30.23

MWS	MOLECULAR WT-STACK GAS	28.83		28.83	
PB	BAROMETRIC PRESSURE	30.06	IN-HG	763.52	MM-HG
PSI	STATIC PRES OF STACK GAS	-.60	IN-H2O	-15.24	MM-H2O
PS	STACK PRES, ABS.	30.02	IN-HG	762.40	MM-HG
TS	AVERAGE STACK TEMP	307.	F	153.	C
VS	AVG STACK GAS VELOCITY	55.6	FPS	17.0	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17513744.	SCFH	495937.	SCMH
QS	ACTUAL STACK FLOW RATE	28657476.	ACFH	811494.	ACMH
ISO	PERCENT ISOKINETIC	98.6		98.6	
MN	AMBIENT PARTICULATE MG. EPA 5	336.7		336.7	
CS	AMBIENT PARTICULATE	.0808	GR/DSCF*	185.052	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO. 1CM5B

UNIT TWO EAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

```
VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

             17.647 *    64.960 *   .983 * ( 30.06 + 1.032 / 13.6)
VMSTD = ------------------------------------------------------------- =     64.260 DSCF
                                ( 68. + 460.)
```

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

```
VWC = .04707 * VLC

VWC = .04707 *  177. =   8.33 SCF
```

PERCENT MOISTURE IN STACK GAS

```
BWO = (100. * VWC) / (VMSTD + VWC)

          100. *   8.33
BWO = -------------------------- = 11.48 PERCENT
          64.260 +   8.33
```

MOLE FRACTION OF DRY STACK GAS

```
FMD = (100. - BWO) / 100.

          100. -  11.5
FMD = ---------------------- =   .885
             100.
```

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

```
MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.35*44/100) + ( 2.4*32/100) + ((84.2+ .0) * 28/100 =   30.23
```

MOLECULAR WEIGHT OF STACK GAS

```
MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.23* (1. -(11.48/100)) + 18. * (11.48/100) =   28.83
```

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  273.377 / (SQRT( 28.83 * 30.02)  *  12. =   55.61 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   55.61 * 20612. 3600/144 =   28657476. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

           17.647 *   28657476. *  30.02 * (1. - (11.48/100))
QSSTD = ----------------------------------------------------- =   17513744. SCFH
                      ( 307. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 307.+460.))*((0.002669*  177.)+(   64.960* .983*( 30.06+(   1.032/13.6))/(  68.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- =  98.59 PERCENT
                                          120. *     55.61 *   30.02 *  .221 *  .221


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    336.7 * 15.43 /    64.260 =       .0808 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/07/83
SAMPLING LOCATION	UNIT TWO FAST	RUN NUMBER	1DM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.215
AMBIENT TEMP.(DEG.F)	64.	ASSUMED MOISTURE	10.0
BAR.PRESS.(IN.HG)	30.06	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	-.60	METER BOX NUMBER	FB4
FILTER NUMBER(S)	3531014	METER HEAD DIFF.	1.88
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	206	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 8.0 IN.HG		
METER CALIB. FACTOR	1.030	K FACTOR	1174.2
READ & RECORD DATA EVERY	10.0 MINUTES		

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	950	622.701									
	10.0	1000	629.125	.710	1.09	1.10	305.	58.	60.	2.0	307.	49.
	20.0	1010	633.433	.710	1.09	1.10	306.	60.	59.	2.5	334.	50.
	30.0	1020	638.490	.710	1.09	1.09	307.	62.	59.	3.0	304.	50.
	40.0	1030	643.625	.650	1.00	1.00	305.	65.	60.	3.5	341.	48.
	50.0	1040	648.656	.650	1.00	1.00	307.	68.	60.	3.5	315.	48.
	60.0	1050	654.150	.680	1.04	1.00	308.	68.	60.	4.0	317.	48.
	70.0	1100	659.210	.680	1.04	1.00	309.	68.	62.	4.5	328.	49.
	80.0	1110	663.750	.680	1.04	1.00	307.	68.	62.	5.0	334.	51.
	90.0	1120	669.100	.700	1.07	1.10	309.	68.	62.	6.0	319.	50.
	100.0	1130	674.125	.650	.99	1.00	308.	67.	62.	6.5	319.	49.
	110.0	1140	679.815	.650	.99	1.00	308.	67.	62.	6.5	332.	48.
	120.0	1150	684.453	.650	.99	1.00	308.	66.	61.	7.0	336.	48.
TOTALS	120.0		61.752									
AVERAGE					1.04	1.03	307.	65.	61.	4.5	324.	49.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS

TEST TEAM LEADER

CLARKE

TEST 1DM58 UNIT TWO EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/07/83	02/07/83
TB	TIME-START	950	950
TF	TIME-FINISH	1150	1150
TT	NET TIME OF TEST, MIN.	120.0	120.0
NP	NET SAMPLING POINTS	12	12
Y	METER CALIBRATION FACTOR	1.030	1.030
DN	SAMPLING NOZZLE DIAMETER	.215 IN	5.5 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	1.03 IN-H2O	26.2 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	61.752 CU-FT	1.749 CU-M
TM	AVERAGE GAS METER TEMP	63.1 F	17.3 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	64.665 SCF	1.831 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	172.9	172.9
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	8.138 SCF	.230 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.18	11.18
FMD	MOLE FRACTION DRY GAS	.888	.888
PCO2	PERCENT CO2 BY VOL., DRY	13.35	13.35
PO2	PERCENT O2 BY VOL., DRY	2.45	2.45
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	84.20	84.20
MD	MOLECULAR WT-DRY STACK GAS	30.23	30.23

MWS	MOLECULAR WT-STACK GAS	28.87		28.87	
PB	BAROMETRIC PRESSURE	30.06	IN-HG	763.52	MM-HG
PSI	STATIC PRES OF STACK GAS	-.60	IN-H2O	-15.24	MM-H2O
PS	STACK PRES, ABS.	30.02	IN-HG	762.40	MM-HG
TS	AVERAGE STACK TEMP	307.	F	153.	C
VS	AVG STACK GAS VELOCITY	55.6	FPS	16.9	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17561684.	SCFH	497294.	SCMH
QS	ACTUAL STACK FLOW RATE	28639348.	ACFH	810981.	ACMH
ISO	PERCENT ISOKINETIC	104.5		104.5	
MN	AMBIENT PARTICULATE MG. EPA 5	309.3		309.3	
CS	AMBIENT PARTICULATE	.0738	GR/DSCF*	168.928	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLF PARTICULATF CALCULATIONS TEST NO. 1DM5R

UNIT TWO EAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

$$VMSTD = \frac{17.647 * 61.752 * 1.030 * (30.06 + 1.033 / 13.6)}{(63. + 460.)} = 64.665 \text{ DSCF}$$

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 * 173. = 8.14 SCF

PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

$$BWO = \frac{100. * 8.14}{64.665 + 8.14} = 11.18 \text{ PERCENT}$$

MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

$$FMD = \frac{100. - 11.2}{100.} = .888$$

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.35*44/100) + (2.4*32/100) + ((84.2+ .0) * 28/100 = 30.23

MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS = 30.23* (1. -(11.18/100)) + 18. * (11.18/100) = 28.87

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  273.377 / (SQRT( 28.87 * 30.02)  *  12. =   55.58 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   55.58 * 20612. 3600/144 =   28639348. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

           17.647 *   28639348. *  30.02 * (1. - (11.18/100))
QSSTD = ---------------------------------------------------- =   17561684. SCFH
                      ( 307. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

        (305.58*( 307.+460.))*((0.002669*  173.)+(   61.752*1.030*( 30.06+(   1.033/13.6))/(  63.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- = 104.54 PERCENT
                                           120. *     55.58 *   30.02 *  .215 *  .215


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    309.3 * 15.43 /    64.665 =       .0738 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/07/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	2AM5B
SAMPLE TYPE	M5B SO4 SO2	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	PR RA	NOZZLE 2A : I.D.	.224
AMBIENT TEMP.(DEG.F)	65.	ASSUMED MOISTURE	10.0
BAR.PRESS.(IN.HG)	30.07	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	-.60	METER BOX NUMBER	FB
FILTER NUMBER(S)	3531013	METER HEAD DIFF.	1.72
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 10.0 IN.HG		
METER CALIB. FACTOR	1.003	K FACTOR	1182.9
READ & RECORD DATA EVERY	10.0 MINUTES		

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	1410	504.942									
	10.0	0	510.863	.700	1.08	1.08	305.	64.	63.	4.5	325.	48.
	20.0	0	516.599	.700	1.08	1.08	309.	66.	64.	4.5	303.	48.
	30.0	0	522.411	.700	1.08	1.08	309.	70.	64.	5.0	325.	48.
	40.0	0	528.144	.680	1.04	1.04	310.	73.	65.	5.5	330.	53.
	50.0	0	533.875	.680	1.04	1.04	310.	75.	66.	6.0	326.	53.
	60.0	0	539.638	.680	1.04	1.04	309.	76.	67.	6.5	332.	52.
	70.0	0	545.535	.710	1.09	1.09	310.	76.	67.	7.0	333.	52.
	80.0	0	551.392	.710	1.09	1.09	311.	77.	68.	7.5	320.	62.
	90.0	0	557.213	.710	1.09	1.09	311.	78.	68.	7.5	333.	62.
	100.0	0	563.067	.700	1.08	1.08	310.	79.	69.	8.0	320.	52.
	110.0	0	568.934	.700	1.08	1.08	311.	80.	70.	8.5	330.	53.
	120.0	0	574.595	.650	1.00	1.00	310.	82.	70.	8.5	324.	62.
TOTALS	120.0		69.653									
AVERAGE					1.07	1.07	310.	75.	67.	6.6	325.	54.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS | TEST TEAM LEADER: PR RA

TEST 2AM5B UNIT 2 EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/07/83	02/07/83
TB	TIME-START	1410	1410
TF	TIME-FINISH	0	0
TT	NET TIME OF TEST, MIN.	120.0	120.0
NP	NET SAMPLING POINTS	12	12
Y	METER CALIBRATION FACTOR	1.003	1.003
DN	SAMPLING NOZZLE DIAMETER	.224 IN	5.7 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	1.07 IN-H2O	27.1 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	69.653 CU-FT	1.972 CU-M
TM	AVERAGE GAS METER TEMP	70.7 F	21.5 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	70.036 SCF	1.983 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	176.8	176.8
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	8.322 SCF	.236 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	10.62	10.62
FMD	MOLE FRACTION DRY GAS	.894	.894
PCO2	PERCENT CO2 BY VOL., DRY	13.60	13.60
PO2	PERCENT O2 BY VOL., DRY	2.95	2.95
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	83.45	83.45
MD	MOLECULAR WT-DRY STACK GAS	30.29	30.29

MWS	MOLECULAR WT-STACK GAS	28.99		28.99	
PB	BAROMETRIC PRESSURE	30.07	IN-HG	763.78	MM-HG
PSI	STATIC PRES OF STACK GAS	-.60	IN-H2O	-15.24	MM-H2O
PS	STACK PRES, ABS.	30.03	IN-HG	762.66	MM-HG
TS	AVERAGE STACK TEMP	310.	F	154.	C
VS	AVG STACK GAS VELOCITY	56.2	FPS	17.1	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17828276.	SCFH	504843.	SCMH
QS	ACTUAL STACK FLOW RATE	28970800.	ACFH	820366.	ACMH
ISO	PERCENT ISOKINETIC	102.7		102.7	
MN	AMBIENT PARTICULATE MG. EPA 5	389.7		389.7	
CS	AMBIENT PARTICULATE	.0859	GR/DSCF*	196.520	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO. 2AM5B

UNIT 2 EAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

```
        17.647 *    69.653 * 1.003 * ( 30.07 + 1.066 / 13.6)
VMSTD = --------------------------------------------------------- =     70.036 DSCF
                          (  71. + 460.)
```

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 * 177. =   8.32 SCF

PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

```
      100. *    8.32
BWO = -------------------------- = 10.62 PERCENT
         70.036 +   8.32
```

MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

```
      100. -  10.6
FMD = ----------------------- =   .894
           100.
```

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.60*44/100) + (2.9*32/100) + ((83.4+ .0) * 28/100 =   30.29

MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS = 30.29* (1. -(10.62/100)) + 18. * (10.62/100) =   28.99

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  277.170 / (SQRT( 28.99 * 30.03)  *  12. =   56.22 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   56.22 * 20612. 3600/144 =   28970800. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

          17.647 *   28970800. *  30.03 * (1. - (10.62/100))
QSSTD = ----------------------------------------------------- =   17828276. SCFH
                    ( 310. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 310.+460.))*((0.002669*  177.)+(   69.653*1.003*( 30.07+(   1.066/13.6))/(  71.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- = 102.74 PERCENT
                                 120. *     56.22 *   30.03 *  .224 *  .224


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    389.7 * 15.43 /    70.036 =       .0859 GR/DSCF
```

FIELD DATA

PLANT
SAMPLING LOCATION UNIT 2 EAST

SAMPLE TYPE PM5B SO4 SO2
OPERATOR PR RA
AMBIENT TEMP.(DEG.F) 65.
BAR.PRESS.(IN.HG) 30.07
STATIC PRESS.(IN.H2O) -.60
FILTER NUMBER(S) 3531017
STACK INSIDE DIM.(IN) 162.00 .00
PITOT TUBE COEFF. .84
THERM. NO. 117
LEAKAGE .020 CFM @ 13.0 IN.HG
METER CALIB. FACTOR .960
READ & RECORD DATA EVERY 10.0 MINUTES

DATE 02/07/83
RUN NUMBER 2BM5B

PROBE LENGTH & TYPE 6 FT GLASS
NOZZLE : I.D. .227
ASSUMED MOISTURE 10.0
SAMPLE BOX NUMBER
METER BOX NUMBER FB6
METER HEAD DIFF. 1.50

PROBE HEATER SETTING 320.
HEATER BOX SETTING 320.

K FACTOR 1088.0

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	1410	19.804									
	10.0	0	26.053	.700	1.00	1.00	305.	59.	59.	4.5	331.	48.
	20.0	0	32.238	.700	.99	.99	309.	60.	59.	5.0	320.	48.
	30.0	0	38.421	.700	.99	.99	309.	65.	60.	5.5	324.	48.
	40.0	0	44.544	.680	.96	.96	310.	68.	60.	6.0	317.	49.
	50.0	0	50.624	.680	.96	.96	310.	69.	60.	6.0	331.	49.
	60.0	0	56.790	.680	.96	.96	310.	70.	62.	7.0	315.	53.
	70.0	0	63.104	.710	1.00	1.00	310.	70.	62.	8.0	325.	53.
	80.0	0	69.366	.710	1.00	1.00	311.	70.	62.	8.0	316.	59.
	90.0	0	75.637	.710	1.00	1.00	311.	70.	63.	8.5	325.	59.
	100.0	0	81.936	.700	.99	.99	310.	71.	64.	9.0	318.	53.
	110.0	0	88.211	.700	.99	.99	311.	72.	64.	10.0	322.	53.
	120.0	0	94.225	.650	.92	.92	310.	72.	65.	9.5	319.	59.
TOTALS	120.0		72.021									
AVERAGE					.98	.98	310.	68.	62.	7.3	322.	53.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS — TEST TEAM LEADER: PR RA

TEST 28M5B UNIT 2 EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/07/83	02/07/83
TB	TIME-START	1410	1410
TF	TIME-FINISH	0	0
TT	NET TIME OF TEST, MIN.	120.0	120.0
NP	NET SAMPLING POINTS	12	12
Y	METER CALIBRATION FACTOR	.960	.960
DN	SAMPLING NOZZLE DIAMETER	.227 IN	5.8 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	.98 IN-H2O	24.9 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	72.021 CU-FT	2.039 CU-M
TM	AVERAGE GAS METER TEMP	64.8 F	18.2 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	70.073 SCF	1.984 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	183.8	183.8
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	8.651 SCF	.245 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	10.99	10.99
FMD	MOLE FRACTION DRY GAS	.890	.890
PCO2	PERCENT CO2 BY VOL., DRY	13.60	13.60
PO2	PERCENT O2 BY VOL., DRY	2.95	2.95
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	83.45	83.45
MD	MOLECULAR WT-DRY STACK GAS	30.29	30.29

MWS	MOLECULAR WT-STACK GAS	28.94		28.94	
PB	BAROMETRIC PRESSURE	30.07	IN-HG	763.78	MM-HG
PSI	STATIC PRES OF STACK GAS	-.60	IN-H2O	-15.24	MM-H2O
PS	STACK PRES, ABS.	30.03	IN-HG	762.66	MM-HG
TS	AVERAGE STACK TEMP	310.	F	154.	C
VS	AVG STACK GAS VELOCITY	56.3	FPS	17.2	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17767612.	SCFH	503126.	SCMH
QS	ACTUAL STACK FLOW RATE	28995052.	ACFH	821053.	ACMH
ISO	PERCENT ISOKINETIC	100.4		100.4	
MN	AMBIENT PARTICULATE MG. EPA 5	378.0		378.0	
CS	AMBIENT PARTICULATE	.0832	GR/DSCF*	190.517	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO. 2BM5B

UNIT 2 EAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

```
VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    72.021 *  .960 * ( 30.07 +  .980 / 13.6)
VMSTD = ------------------------------------------------------ =     70.073 DSCF
                           (  65. + 460.)
```

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

```
VWC = .04707 * VLC

VWC = .04707 *  184. =   8.65 SCF
```

PERCENT MOISTURE IN STACK GAS

```
BWO = (100. * VWC) / (VMSTD + VWC)

        100. *   8.65
BWO = -------------------------- = 10.99 PERCENT
          70.073 +   8.65
```

MOLE FRACTION OF DRY STACK GAS

```
FMD = (100. - BWO) / 100.

        100. -  11.0
FMD = ----------------------- =   .890
             100.
```

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

```
MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.60*44/100) + ( 2.9*32/100) + ((83.4+ .0) * 28/100 =   30.29
```

MOLECULAR WEIGHT OF STACK GAS

```
MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.29* (1. -(10.99/100)) + 18. * (10.99/100) =   28.94
```

STACK GAS VELOCITY AT STACK CONDITIONS

```
DELP = SUM. OF THE SORT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  277.185 / (SQRT( 28.94 * 30.03)  *  12. =   56.27 FPS
```

STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

```
QS = VS * AS * 3600/144

QS =   56.27 * 20612. 3600/144 =   28995052. ACFH
```

STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

```
QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

          17.647 *   28995052. *  30.03 * (1. - (10.99/100))
QSSTD = ----------------------------------------------------- =   17767612. SCFH
                     ( 310. + 460.)
```

PERCENT ISOKINETIC

```
ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 310.+460.))*((0.002669*  184.)+(   72.021* .960*( 30.07+(    .980/13.6))/(  65.+460.)))
ISO = ------------------------------------------------------------------------------------------------ = 100.44 PERCENT
                                    120. *     56.27 *   30.03 *  .227 *  .227
```

PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

```
CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    378.0 * 15.43 /    70.073 =       .0832 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/07/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	2CM5BW
SAMPLE TYPE	M5BW	PROBE LENGTH & TYPE	6 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.211
AMBIENT TEMP.(DEG.F)	58.	ASSUMED MOISTURE	10.0
BAR.PRESS.(IN.HG)	30.07	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	-.60	METER BOX NUMBER	FB5
FILTER NUMBER(S)	3531070	METER HEAD DIFF.	1.84
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.001 CFM @ 7.0 IN.HG		
METER CALIB. FACTOR	.983	K FACTOR	992.4

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	1410	118.570									
	10.0	1420	123.900	.700	.91	.91	305.	62.	62.	4.0	316.	50.
	20.0	1430	128.975	.700	.90	.90	309.	64.	62.	4.0	331.	48.
	30.0	1440	134.150	.700	.90	.90	309.	69.	63.	4.0	320.	48.
	40.0	1450	139.000	.680	.88	.88	310.	73.	64.	4.5	317.	52.
	50.0	1500	144.404	.680	.88	.88	310.	75.	65.	4.5	328.	54.
	60.0	1510	149.194	.680	.88	.88	309.	77.	68.	5.0	321.	58.
	70.0	1520	154.525	.710	.92	.92	310.	78.	67.	5.5	324.	56.
	80.0	1530	159.500	.710	.92	.92	311.	78.	68.	5.5	329.	60.
	90.0	1540	164.810	.710	.92	.92	311.	78.	68.	6.0	322.	62.
	100.0	1550	169.750	.700	.90	.90	310.	80.	69.	6.0	328.	51.
	110.0	1600	174.495	.700	.90	.90	311.	80.	70.	6.5	326.	51.
	120.0	1610	180.021	.650	.84	.84	310.	80.	70.	6.5	329.	60.
TOTALS	120.0		61.451									
AVERAGE					.90	.90	310.	75.	66.	5.2	324.	54.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS TEST TEAM LEADER

CLARKE

TEST 2CM5BW UNIT TWO EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/07/83	02/07/83
TB	TIME-START	1410	1410
TF	TIME-FINISH	1610	1610
TT	NET TIME OF TEST, MIN.	120.0	120.0
NP	NET SAMPLING POINTS	12	12
Y	METER CALIBRATION FACTOR	.983	.983
DN	SAMPLING NOZZLE DIAMETER	.211 IN	5.4 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	.90 IN-H2O	22.8 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	61.451 CU-FT	1.740 CU-M
TM	AVERAGE GAS METER TEMP	70.4 F	21.3 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	60.565 SCF	1.715 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	160.1	160.1
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	7.536 SCF	.213 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.07	11.07
FMD	MOLE FRACTION DRY GAS	.889	.889
PCO2	PERCENT CO2 BY VOL., DRY	13.60	13.60
PO2	PERCENT O2 BY VOL., DRY	2.95	2.95
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	83.45	83.45
MD	MOLECULAR WT-DRY STACK GAS	30.29	30.29

MWS	MOLECULAR WT-STACK GAS	28.93		28.93	
PB	BAROMETRIC PRESSURE	30.07	IN-HG	763.78	MM-HG
PSI	STATIC PRES OF STACK GAS	-.60	IN-H2O	-15.24	MM-H2O
PS	STACK PRES, ABS.	30.03	IN-HG	762.66	MM-HG
TS	AVERAGE STACK TEMP	310.	F	154.	C
VS	AVG STACK GAS VELOCITY	56.3	FPS	17.2	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17756224.	SCFH	502803.	SCMH
QS	ACTUAL STACK FLOW RATE	28998200.	ACFH	821142.	ACMH
ISO	PERCENT ISOKINETIC	100.5		100.5	
MN	AMBIENT PARTICULATE MG. EPA 5	100.0		100.0	
CS	AMBIENT PARTICULATE	.0255	GR/DSCF*	58.314	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO.2CM5BW

UNIT TWO EAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

$$VMSTD = \frac{17.647 * 61.451 * .983 * (30.07 + .896 / 13.6)}{(70. + 460.)} = 60.565 \text{ DSCF}$$

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 * 160. = 7.54 SCF

PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

$$BWO = \frac{100. * 7.54}{60.565 + 7.54} = 11.07 \text{ PERCENT}$$

MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

$$FMD = \frac{100. - 11.1}{100.} = .889$$

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.60*44/100) + (2.9*32/100) + ((83.4+ .0) * 28/100 = 30.29

MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS = 30.29* (1. -(11.07/100)) + 18. * (11.07/100) = 28.93

STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 * .84 * 277.170 / (SQRT(28.93 * 30.03) * 12. = 56.27 FPS

STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS = 56.27 * 20612. 3600/144 = 28998200. ACFH

STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

```
           17.647 *   28998200. *  30.03 * (1. - (11.07/100))
QSSTD = ------------------------------------------------------ =   17756224. SCFH
                        ( 310. + 460.)
```

PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

```
      (305.58*( 310.+460.))*((0.002669*  160.)+(    61.451* .983*( 30.07+(     .896/13.6))/(  70.+460.)))
ISO = --------------------------------------------------------------------------------------------------- = 100.54 PERCENT
                                         120. *      56.27 *    30.03 *  .211 *  .211
```

PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 * 100.0 * 15.43 / 60.565 = .0255 GR/DSCF

FIELD DATA

PLANT		DATE	02/07/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	2DM5BW
SAMPLE TYPE	M5BW	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.210
AMBIENT TEMP.(DEG.F)	58.	ASSUMED MOISTURE	10.0
BAR.PRESS.(IN.HG)	30.07	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	-.60	METER BOX NUMBER	FB4
FILTER NUMBER(S)	3531069	METER HEAD DIFF.	1.88
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.002 CFM @ 9.0 IN.HG		
METER CALIB. FACTOR	1.030	K FACTOR	992.4
READ & RECORD DATA EVERY	10.0 MINUTES		

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	1410	684.704									
	10.0	1420	689.725	.700	.91	.90	305.	62.	61.	5.0	317.	49.
	20.0	1430	694.200	.700	.90	.90	309.	63.	61.	5.0	327.	49.
	30.0	1440	699.800	.700	.90	.90	309.	65.	61.	5.0	312.	48.
	40.0	1450	704.174	.680	.88	.88	310.	68.	62.	5.5	312.	53.
	50.0	1500	709.097	.680	.88	.88	310.	69.	62.	6.0	331.	57.
	60.0	1510	713.445	.680	.88	.88	309.	70.	64.	6.5	317.	60.
	70.0	1520	718.999	.710	.92	.92	310.	70.	64.	7.0	313.	61.
	80.0	1530	723.430	.710	.92	.92	311.	70.	64.	7.5	330.	62.
	90.0	1540	728.811	.710	.92	.92	311.	70.	64.	8.0	326.	60.
	100.0	1550	733.525	.700	.90	.90	310.	71.	66.	8.5	333.	55.
	110.0	1600	737.990	.700	.90	.90	311.	71.	65.	9.0	342.	54.
	120.0	1610	743.154	.650	.84	.84	310.	72.	66.	9.0	335.	64.
TOTALS	120.0		58.450									
AVERAGE					.90	.89	310.	68.	63.	6.8	325.	56.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS TEST TEAM LEADER

CLARKE

TEST 2DM5BW UNIT TWO EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/07/83	02/07/83
TB	TIME-START	1410	1410
TF	TIME-FINISH	1610	1610
TT	NET TIME OF TEST, MIN.	120.0	120.0
NP	NET SAMPLING POINTS	12	12
Y	METER CALIBRATION FACTOR	1.030	1.030
DN	SAMPLING NOZZLE DIAMETER	.210 IN	5.3 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	.89 IN-H2O	22.7 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	58.450 CU-FT	1.655 CU-M
TM	AVERAGE GAS METER TEMP	65.9 F	18.8 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	60.883 SCF	1.724 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	160.0	160.0
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	7.531 SCF	.213 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.01	11.01
FMD	MOLE FRACTION DRY GAS	.890	.890
PCO2	PERCENT CO2 BY VOL., DRY	13.60	13.60
PO2	PERCENT O2 BY VOL., DRY	2.95	2.95
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	83.45	83.45
MD	MOLECULAR WT-DRY STACK GAS	30.29	30.29

MWS	MOLECULAR WT-STACK GAS	28.94		28.94	
PB	BAROMETRIC PRESSURE	30.07	IN-HG	763.78	MM-HG
PSI	STATIC PRES OF STACK GAS	-.60	IN-H2O	-15.24	MM-H2O
PS	STACK PRES, ABS.	30.03	IN-HG	762.66	MM-HG
TS	AVERAGE STACK TEMP	310.	F	154.	C
VS	AVG STACK GAS VELOCITY	56.3	FPS	17.2	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17765544.	SCFH	503067.	SCMH
QS	ACTUAL STACK FLOW RATE	28994660.	ACFH	821042.	ACMH
ISO	PERCENT ISOKINETIC	102.0		102.0	
MN	AMBIENT PARTICULATE MG. EPA 5	100.0		100.0	
CS	AMBIENT PARTICULATE	.0253	GR/DSCF*	58.010	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

```
EXAMPLF PARTICULATF CALCULATIONS TEST NO.2DM5BW

     UNIT TWO EAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    58.450 * 1.030 * ( 30.07 +  .895 / 13.6)
VMSTD = -----------------------------------------------------  =     60.883 DSCF
                           (  66. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  160. =   7.53 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

          100. *   7.53
BWO = -------------------------- = 11.01 PERCENT
            60.883 +   7.53


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

          100. -  11.0
FMD = ----------------------- =   .890
                100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.60*44/100) + ( 2.9*32/100) + ((83.4+ .0) * 28/100 =   30.29


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.29* (1. -(11.01/100)) + 18. * (11.01/100) =   28.94
```

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  277.170 / (SQRT( 28.94 * 30.03)  *  12. =   56.27 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   56.27 * 20612. 3600/144 =   28994660. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

           17.647 *   28994660. *  30.03 * (1. - (11.01/100))
QSSTD = ---------------------------------------------------- =   17765544. SCFH
                       ( 310. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 310.+460.))*((0.002669*  160.)+(   58.450*1.030*( 30.07+(    .895/13.6))/(  66.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- = 101.98 PERCENT
                                  120. *     56.27 *   30.03 *  .210 *  .210


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    100.0 * 15.43 /    60.883 =       .0253 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/08/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	3AM5B
SAMPLE TYPE	PART SO3 SO4	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	PR RA JP	NOZZLE 1A : I.D.	.223
AMBIENT TEMP.(DEG.F)	45.	ASSUMED MOISTURE	11.1
BAR.PRESS.(IN.HG)	30.34	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	-.60	METER BOX NUMBER	FB4
FILTER NUMBER(S)	3531010	METER HEAD DIFF.	1.72
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	206	HEATER BOX SETTING	320.
LEAKAGE	.010 CFM @ 9.0 IN.HG		
METER CALIB. FACTOR	1.003	K FACTOR	1093.5

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	845	574.939									
	10.0	0	580.299	.650	.93	.93	303.	46.	45.	3.5	321.	43.
	20.0	0	585.673	.650	.93	.93	306.	48.	45.	4.0	324.	43.
	30.0	0	590.978	.650	.93	.93	308.	53.	46.	4.5	334.	45.
	40.0	0	596.377	.670	.95	.95	307.	56.	46.	5.0	316.	45.
	50.0	0	601.740	.670	.95	.95	309.	60.	48.	5.0	322.	45.
	60.0	0	607.148	.670	.95	.95	310.	62.	50.	5.5	336.	46.
	70.0	0	612.600	.680	.97	.97	310.	63.	51.	6.0	330.	37.
	80.0	0	617.950	.650	.92	.92	311.	64.	52.	6.5	327.	38.
	90.0	0	623.286	.650	.92	.92	311.	65.	53.	7.0	318.	39.
	100.0	0	628.650	.650	.92	.92	312.	66.	54.	7.0	330.	40.
	110.0	0	634.100	.680	.96	.96	313.	66.	55.	7.5	319.	40.
	120.0	1045	639.502	.680	.96	.96	314.	66.	56.	8.0	339.	45.
TOTALS	120.0		64.563									
AVERAGE					.94	.94	310.	60.	50.	5.8	326.	42.

PARTICULATE FIFLD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS　　　　TEST TEAM LEADER

PR RA JP

TEST 3AM5B　　UNIT 2 FAST

		ENGLISH UNITS		METRIC UNITS	
TEST DATE		02/08/83		02/08/83	
TB	TIME-START	845		845	
TF	TIME-FINISH	1045		1045	
TT	NET TIME OF TEST, MIN.	120.0		120.0	
NP	NET SAMPLING POINTS	12		12	
Y	METER CALIBRATION FACTOR	1.003		1.003	
DN	SAMPLING NOZZLE DIAMETER	.223	IN	5.7	MM
CP	PITOT TUBE COEFFICIENT	.84		.84	
PM	AVERAGE ORIFICE PRESSURE DROP	.94	IN-H2O	23.9	MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	64.563	CU-FT	1.828	CU-M
TM	AVERAGE GAS METFR TEMP	54.8	F	12.7	C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	67.498	SCF	1.911	SCM
VLC	TOTAL H2O COLLECTFD IN IMPINGERS AND SILICA GEL,ML.	170.4		170.4	
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	8.021	SCF	.227	SCM
BWO	PERCENT MOISTURF BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	10.62		10.62	
FMD	MOLE FRACTION DRY GAS	.894		.894	
PCO2	PERCENT CO2 BY VOL., DRY	13.70		13.70	
PO2	PERCENT O2 BY VOL., DRY	2.35		2.35	
PCO	PERCENT CO BY VOL., DRY	.00		.00	
PN2	PERCENT N2 BY VOL., DRY	83.95		83.95	
MD	MOLECULAR WT-DRY STACK GAS	30.29		30.29	

MWS	MOLECULAR WT-STACK GAS	28.98		28.98	
PB	BAROMETRIC PRESSURE	30.34	IN-HG	770.64	MM-HG
PSI	STATIC PRES OF STACK GAS	-.60	IN-H2O	-15.24	MM-H2O
PS	STACK PRES, ABS.	30.30	IN-HG	769.52	MM-HG
TS	AVERAGE STACK TEMP	310.	F	154.	C
VS	AVG STACK GAS VELOCITY	54.7	FPS	16.7	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17509204.	SCFH	495808.	SCMH
QS	ACTUAL STACK FLOW RATE	28195776.	ACFH	798420.	ACMH
ISO	PERCENT ISOKINETIC	101.7		101.7	
MN	AMBIENT PARTICULATE MG. EPA 5	356.9		356.9	
CS	AMBIENT PARTICULATE	.0816	GR/DSCF*	186.744	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

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EXAMPLE PARTICULATF CALCULATIONS TEST NO. 3AM5B

     UNIT 2 EAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    64.563 * 1.003 * ( 30.34 +  .941 / 13.6)
VMSTD = ----------------------------------------------------- =     67.498 DSCF
                         (  55. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  170. =   8.02 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

          100. *   8.02
BWO = -------------------------- = 10.62 PERCENT
            67.498 +   8.02


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

          100. -  10.6
FMD = ----------------------- =   .894
               100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.70*44/100) + ( 2.3*32/100) + ((83.9+ .0) * 28/100 =   30.29


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.29* (1. -(10.62/100)) + 18. * (10.62/100) =   28.98
```

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  270.932 / (SQRT( 28.98 * 30.30)  *  12. =   54.72 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   54.72 * 20612. 3600/144 =   28195776. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

            17.647 *    28195776. *  30.30 * (1. - (10.62/100))
QSSTD = --------------------------------------------------- =   17509204. SCFH
                        ( 310. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 310.+460.))*((0.002669*  170.)+(   64.563*1.003*( 30.34+(    .941/13.6))/(  55.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- = 101.73 PERCENT
                                    120. *     54.72 *   30.30 *  .223 *  .223


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    356.9 * 15.43 /    67.498 =       .0816 GR/DSCF
```

FIELD DATA

PLANT -
SAMPLING LOCATION UNIT 2 EAST

SAMPLE TYPE PART SO3 SO2
OPERATOR PR RA JP
AMBIENT TEMP.(DEG.F) 45.
BAR.PRESS.(IN.HG) 30.34
STATIC PRESS.(IN.H2O) -.60
FILTER NUMBER(S) 3531009
STACK INSIDE DIM.(IN) 162.00 .00
PITOT TUBE COEFF. .84
THERM. NO.
LEAKAGE .013 CFM @ 9.5 IN.HG
METER CALIB. FACTOR .960
READ & RECORD DATA EVERY 10.0 MINUTES

DATE 02/08/83
RUN NUMBER 3BM5B

PROBE LENGTH & TYPE 6 FT GLASS
NOZZLE 1B : I.D. .221
ASSUMED MOISTURE 11.1
SAMPLE BOX NUMBER
METER BOX NUMBER FB6
METER HEAD DIFF. 1.50

PROBE HEATER SETTING 320.
HEATER BOX SETTING 320.

K FACTOR 919.9

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	845	94.740									
	10.0	0	100.161	.650	.78	.78	303.	40.	42.	3.5	321.	43.
	20.0	0	105.596	.650	.78	.78	306.	42.	43.	3.5	328.	43.
	30.0	0	111.008	.650	.78	.78	308.	46.	43.	4.0	328.	45.
	40.0	0	116.514	.670	.80	.80	307.	51.	43.	4.5	329.	45.
	50.0	0	122.076	.670	.80	.80	309.	54.	44.	5.0	326.	45.
	60.0	0	127.593	.670	.80	.80	310.	56.	45.	5.5	332.	46.
	70.0	0	133.181	.680	.81	.81	310.	57.	46.	6.0	335.	39.
	80.0	0	138.664	.650	.77	.77	311.	57.	46.	6.0	339.	39.
	90.0	0	144.100	.650	.77	.77	311.	58.	48.	6.5	331.	40.
	100.0	0	149.581	.650	.77	.77	312.	59.	49.	7.0	337.	40.
	110.0	0	155.196	.680	.81	.68	312.	59.	50.	7.0	321.	40.
	120.0	1045	160.804	.680	.81	.81	314.	60.	50.	7.5	335.	43.
TOTALS	120.0		66.064									
AVERAGE					.79	.78	309.	53.	46.	5.5	330.	42.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS   TEST TEAM LEADER

PR RA JP

TEST 3BM5B   UNIT 2 EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/08/83	02/08/83
TB	TIME-START	845	845
TF	TIME-FINISH	1045	1045
TT	NET TIME OF TEST, MIN.	120.0	120.0
NP	NET SAMPLING POINTS	12	12
Y	METER CALIBRATION FACTOR	.960	.960
DN	SAMPLING NOZZLE DIAMETER	.221 IN	5.6 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	.78 IN-H2O	19.8 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	66.064 CU-FT	1.871 CU-M
TM	AVERAGE GAS METER TEMP	49.5 F	9.7 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	66.772 SCF	1.891 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	168.8	168.8
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	7.945 SCF	.225 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	10.63	10.63
FMD	MOLE FRACTION DRY GAS	.894	.894
PCO2	PERCENT CO2 BY VOL., DRY	13.70	13.70
PO2	PERCENT O2 BY VOL., DRY	2.35	2.35
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	83.95	83.95
MD	MOLECULAR WT-DRY STACK GAS	30.29	30.29

MWS	MOLECULAR WT-STACK GAS	28.98		28.98	
PB	BAROMETRIC PRESSURE	30.34	IN-HG	770.64	MM-HG
PSI	STATIC PRES OF STACK GAS	-.60	IN-H2O	-15.24	MM-H2O
PS	STACK PRES, ABS.	30.30	IN-HG	769.52	MM-HG
TS	AVERAGE STACK TEMP	309.	F	154.	C
VS	AVG STACK GAS VELOCITY	54.7	FPS	16.7	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17508064.	SCFH	495776.	SCMH
QS	ACTUAL STACK FLOW RATE	28195020.	ACFH	798398.	ACMH
ISO	PERCENT ISOKINETIC	102.5		102.5	
MN	AMBIENT PARTICULATE MG. EPA 5	376.6		376.6	
CS	AMBIENT PARTICULATE	.0870	GR/DSCF*	199.195	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO. 3BM5B

UNIT 2 EAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

```
         17.647 *    66.064 *  .960 * ( 30.34 +  .779 / 13.6)
VMSTD = ------------------------------------------------------ =     66.772 DSCF
                          (  50. + 460.)
```

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 * 169. =   7.95 SCF

PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

```
       100. *   7.95
BWO = -------------------------- = 10.63 PERCENT
         66.772 +   7.95
```

MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

```
       100. -  10.6
FMD = ---------------------- =   .894
            100.
```

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.70*44/100) + (2.3*32/100) + ((83.9+ .0) * 28/100 =   30.29

MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS = 30.29* (1. -(10.63/100)) + 18. * (10.63/100) =   28.98

STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 * .84 * 270.917 / (SQRT(28.98 * 30.30) * 12. = 54.72 FPS

STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS = 54.72 * 20612. 3600/144 = 28195020. ACFH

STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

```
           17.647 *   28195020. *  30.30 * (1. - (10.63/100))
QSSTD = -------------------------------------------------------- =   17508064. SCFH
                    ( 309. + 460.)
```

PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

```
      (305.58*( 309.+460.))*((0.002669*  169.)+(   66.064* .960*( 30.34+(    .779/13.6))/(  50.+460.)))
ISO = ------------------------------------------------------------------------------------------------ = 102.47 PERCENT
                                  120. *     54.72 *   30.30 *  .221 *  .221
```

PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 * 376.6 * 15.43 / 66.772 = .0870 GR/DSCF

FIELD DATA

PLANT		DATE	02/08/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	3CM5BP
SAMPLE TYPE	M5BP400	PROBE LENGTH & TYPE	6 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.221
AMBIENT TEMP.(DEG.F)	45.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.34	SAMPLE BOX NUMBER	QAC
STATIC PRESS.(IN.H2O)	-.60	METER BOX NUMBER	FB5
FILTER NUMBER(S)	3531008	METER HEAD DIFF.	1.84
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	400.
THERM. NO.	206	HEATER BOX SETTING	320.
LEAKAGE	.060 CFM @ 7.0 IN.HG		
METER CALIB. FACTOR	.983	K FACTOR	1089.1

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	DRY GAS METER TEMP (DEG.F) OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	845	180.494									
	10.0	855	185.825	.650	.95	.93	303.	44.	46.	4.5	314.	42.
	20.0	905	190.865	.650	.92	.92	306.	47.	46.	5.0	320.	44.
	30.0	915	195.995	.650	.92	.92	308.	53.	46.	5.5	329.	46.
	40.0	925	201.050	.670	.95	.95	307.	58.	48.	5.0	323.	45.
	50.0	935	206.245	.670	.95	.95	309.	62.	50.	5.5	333.	46.
	60.0	945	211.499	.670	.95	.95	310.	64.	51.	6.0	330.	44.
	70.0	955	216.595	.680	.96	.96	310.	64.	52.	6.0	325.	42.
	80.0	1005	221.715	.650	.92	.92	311.	65.	54.	6.5	335.	38.
	90.0	1015	226.891	.650	.92	.92	311.	66.	54.	6.5	335.	39.
	100.0	1025	232.150	.650	.92	.92	312.	67.	55.	6.5	330.	40.
	110.0	1035	237.277	.680	.96	.96	313.	68.	56.	7.0	317.	41.
	120.0	1045	242.544	.680	.96	.96	314.	68.	56.	7.0	328.	44.
TOTALS	120.0		54.850									
AVERAGE					.94	.94	310.	61.	51.	5.9	327.	43.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS   TEST TEAM LEADER

CLARKE

TEST 3CM58P   UNIT TWO EAST

		ENGLISH UNITS		METRIC UNITS	
TEST DATE		02/08/83		02/08/83	
TB	TIME-START	845		845	
TF	TIME-FINISH	1045		1045	
TT	NET TIME OF TEST, MIN.	120.0		120.0	
NP	NET SAMPLING POINTS	12		12	
Y	METER CALIBRATION FACTOR	.983		.983	
DN	SAMPLING NOZZLE DIAMETER	.221	IN	5.6	MM
CP	PITOT TUBE COEFFICIENT	.84		.84	
PM	AVERAGE ORIFICE PRESSURE DROP	.94	IN-H2O	23.8	MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	54.850	CU-FT	1.553	CU-M
TM	AVERAGE GAS METER TEMP	55.8	F	13.2	C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	56.091	SCF	1.588	SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	143.4		143.4	
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	6.750	SCF	.191	SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	10.74		10.74	
FMD	MOLE FRACTION DRY GAS	.893		.893	
PCO2	PERCENT CO2 BY VOL., DRY	13.70		13.70	
PO2	PERCENT O2 BY VOL., DRY	2.35		2.35	
PCO	PERCENT CO BY VOL., DRY	.00		.00	
PN2	PERCENT N2 BY VOL., DRY	83.95		83.95	
MD	MOLECULAR WT-DRY STACK GAS	30.29		30.29	

MWS	MOLECULAR WT-STACK GAS	28.97		28.97	
PB	BAROMETRIC PRFSSURE	30.34	IN-HG	770.64	MM-HG
PSI	STATIC PRFS OF STACK GAS	-.60	IN-H20	-15.24	MM-H20
PS	STACK PRES, ARS.	30.30	IN-HG	769.52	MM-HG
TS	AVERAGE STACK TEMP	310.	F	154.	C
VS	AVG STACK GAS VFLOCITY	54.7	FPS	16.7	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17490092.	SCFH	495267.	SCMH
QS	ACTUAL STACK FLOW RATE	28202980.	ACFH	798624.	ACMH
ISO	PERCENT ISOKINETIC	86.2		86.2	
MN	AMBIENT PARTICULATE MG. EPA 5	335.2		335.2	
CS	AMBIENT PARTICULATE	.0922	GR/DSCF*	211.060	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATF CALCULATIONS TFST NO.3CM5BP

UNIT TWO FAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

$$VMSTD = \frac{17.647 * 54.850 * .983 * (30.34 + .938 / 13.6)}{(56. + 460.)} = 56.091 \text{ DSCF}$$

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 * 143. = 6.75 SCF

PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

$$BWO = \frac{100. * 6.75}{56.091 + 6.75} = 10.74 \text{ PERCENT}$$

MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

$$FMD = \frac{100. - 10.7}{100.} = .893$$

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.70*44/100) + (2.3*32/100) + ((83.9+ .0) * 28/100 = 30.29

MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS = 30.29* (1. -(10.74/100)) + 18. * (10.74/100) = 28.97

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  270.932 / (SQRT( 28.97 * 30.30)  *  12. =   54.73 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   54.73 * 20612. 3600/144 =   28202980. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

         17.647 *   28202980. *  30.30 * (1. - (10.74/100))
QSSTD = ------------------------------------------------ =   17490092. SCFH
                    ( 310. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 310.+460.))*((0.002669*  143.)+(   54.850* .983*( 30.34+(    .938/13.6))/(  56.+460.)))
ISO = ------------------------------------------------------------------------------------------------ =  86.17 PERCENT
                                  120. *     54.73 *   30.30 *  .221 *  .221


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    335.2 * 15.43 /    56.091 =       .0922 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/08/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	3DM5BP
SAMPLE TYPE	M5BP400	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.215
AMBIENT TEMP.(DEG.F)	45.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.34	SAMPLE BOX NUMBER	QAD
STATIC PRESS.(IN.H2O)	-.60	METER BOX NUMBER	FB4
FILTER NUMBER(S)	3531004	METER HEAD DIFF.	1.88
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	400.
THERM. NO.		HEATER BOX SETTING	320.
LEAKAGE	.002 CFM @ 6.0 IN.HG		
METER CALIB. FACTOR	1.030	K FACTOR	1089.1
READ & RECORD DATA EVERY 10.0 MINUTES			

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	845	743.598									
	10.0	855	748.454	.650	.93	.93	303.	42.	42.	2.0	314.	42.
	20.0	905	753.323	.650	.92	.92	306.	44.	42.	2.5	333.	42.
	30.0	915	758.195	.650	.92	.92	308.	49.	43.	2.5	311.	40.
	40.0	925	763.125	.670	.95	.95	307.	53.	44.	3.0	326.	44.
	50.0	935	768.125	.670	.95	.95	309.	56.	47.	3.5	334.	46.
	60.0	945	773.186	.670	.95	.95	310.	56.	47.	4.0	320.	42.
	70.0	955	777.999	.680	.96	.96	310.	57.	48.	4.5	319.	40.
	80.0	1005	782.935	.650	.92	.92	311.	57.	49.	4.5	336.	36.
	90.0	1015	787.855	.650	.92	.92	311.	58.	50.	5.0	313.	38.
	100.0	1025	792.690	.650	.92	.92	312.	58.	51.	5.0	328.	36.
	110.0	1035	797.725	.680	.96	.96	313.	59.	51.	5.5	329.	38.
	120.0	1045	802.746	.680	.96	.96	314.	60.	52.	6.0	319.	43.
TOTALS	120.0		59.148									
AVERAGE					.94	.94	310.	54.	47.	4.0	324.	41.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS

TEST TEAM LEADER

CLARKE

TEST 3DM5BP   UNIT TWO EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/08/83	02/08/83
TB	TIME-START	845	845
TF	TIME-FINISH	1045	1045
TT	NET TIME OF TEST, MIN.	120.0	120.0
NP	NET SAMPLING POINTS	12	12
Y	METER CALIBRATION FACTOR	1.030	1.030
DN	SAMPLING NOZZLE DIAMETER	.215 IN	5.5 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	.94 IN-H2O	23.8 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	59.148 CU-FT	1.675 CU-M
TM	AVERAGE GAS METER TEMP	50.6 F	10.3 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	64.025 SCF	1.813 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	163.5	163.5
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	7.696 SCF	.218 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	10.73	10.73
FMD	MOLE FRACTION DRY GAS	.893	.893
PCO2	PERCENT CO2 BY VOL., DRY	13.70	13.70
PO2	PERCENT O2 BY VOL., DRY	2.35	2.35
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	83.95	83.95
MD	MOLECULAR WT-DRY STACK GAS	30.29	30.29

MWS	MOLECULAR WT-STACK GAS	28.97		28.97	
PB	BAROMETRIC PRESSURE	30.34	IN-HG	770.64	MM-HG
PSI	STATIC PRES OF STACK GAS	-.60	IN-H2O	-15.24	MM-H2O
PS	STACK PRES, ABS.	30.30	IN-HG	769.52	MM-HG
TS	AVERAGE STACK TEMP	310.	F	154.	C
VS	AVG STACK GAS VELOCITY	54.7	FPS	16.7	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17491792.	SCFH	495315.	SCMH
QS	ACTUAL STACK FLOW RATE	28202336.	ACFH	798606.	ACMH
ISO	PERCENT ISOKINETIC	103.9		103.9	
MN	AMBIENT PARTICULATE MG. EPA 5	351.4		351.4	
CS	AMBIENT PARTICULATE	.0847	GR/DSCF*	193.842	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

```
     EXAMPLE PARTICULATE CALCULATIONS TEST NO.3DM5BP

          UNIT TWO EAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

           17.647 *    59.148 * 1.030 * ( 30.34 +  .938 / 13.6)
VMSTD = ------------------------------------------------------------- =     64.025 DSCF
                              (  51. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  164. =   7.70 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

        100. *   7.70
BWO = ---------------------------- = 10.73 PERCENT
          64.025 +   7.70


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

        100. -  10.7
FMD = ------------------------ =   .893
             100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.70*44/100) + ( 2.3*32/100) + ((83.9+ .0) * 28/100 =   30.29


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.29* (1. -(10.73/100)) + 18. * (10.73/100) =   28.97
```

STACK GAS VELOCITY AT STACK CONDITIONS

```
DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  270.932 / (SQRT( 28.97 * 30.30)  *  12. =   54.73 FPS
```

STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

```
QS = VS * AS * 3600/144

QS =   54.73 * 20612. 3600/144 =   28202336. ACFH
```

STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

```
QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

           17.647 *   28202336. *  30.30 * (1. - (10.73/100))
QSSTD = ---------------------------------------------------- =   17491792. SCFH
                       ( 310. + 460.)
```

PERCENT ISOKINETIC

```
ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 310.+460.))*((0.002669*  164.)+(   59.148*1.030*( 30.34+(    .938/13.6))/(  51.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- = 103.91 PERCENT
                                  120. *     54.73 *    30.30 *  .215 *  .215
```

PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

```
CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    351.4 * 15.43 /    64.025 =       .0847 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/08/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	4AM5BP
SAMPLE TYPE	PART SO3 SO4	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	PR RA JP	NOZZLE 2A : I.D.	.224
AMBIENT TEMP.(DEG.F)	50.	ASSUMED MOISTURE	11.1
BAR.PRESS.(IN.HG)	30.36	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	-.60	METER BOX NUMBER	FB4
FILTER NUMBER(S)	3530458	METER HEAD DIFF.	1.72
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	400.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 9.0 IN.HG		
METER CALIB. FACTOR	1.003	K FACTOR	1112.4
READ & RECORD DATA EVERY 10.0 MINUTES			

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	DRY GAS METER TEMP (DEG.F) OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	1230	639.710									
	10.0	0	645.416	.720	1.03	1.03	314.	58.	56.	4.5	347.	50.
	20.0	0	651.047	.720	1.03	1.03	317.	60.	56.	4.5	318.	50.
	30.0	0	656.673	.720	1.03	1.03	318.	64.	57.	5.0	340.	51.
	40.0	0	662.447	.750	1.07	1.07	318.	68.	58.	5.5	327.	51.
	50.0	0	668.169	.750	1.07	1.07	317.	70.	60.	6.0	333.	51.
	60.0	0	673.838	.720	1.03	1.03	317.	71.	60.	6.0	341.	50.
	70.0	0	679.434	.720	1.03	1.03	317.	72.	61.	6.5	327.	50.
	80.0	0	685.020	.700	1.00	1.00	318.	73.	62.	6.5	338.	52.
	90.0	0	690.611	.700	1.00	1.00	318.	75.	63.	7.0	335.	52.
	100.0	0	696.309	.720	1.03	1.03	317.	76.	64.	7.5	335.	51.
	110.0	0	701.964	.720	1.03	1.03	318.	76.	65.	8.0	317.	51.
	120.0	1430	707.671	.720	1.03	1.03	319.	77.	66.	8.0	330.	51.
TOTALS	120.0		67.961									
AVERAGE					1.03	1.03	317.	70.	61.	6.3	332.	51.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS

TEST TEAM LEADER

PR RA JP

TEST 4AM5BP UNIT 2 EAST

		ENGLISH UNITS		METRIC UNITS	
TEST DATE		02/08/83		02/08/83	
TB	TIME-START	1230		1230	
TF	TIME-FINISH	1430		1430	
TT	NET TIME OF TEST, MIN.	120.0		120.0	
NP	NET SAMPLING POINTS	12		12	
Y	METER CALIBRATION FACTOR	1.003		1.003	
DN	SAMPLING NOZZLE DIAMETER	.224	IN	5.7	MM
CP	PITOT TUBE COEFFICIENT	.84		.84	
PM	AVERAGE ORIFICE PRESSURE DROP	1.03	IN-H2O	26.2	MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	67.961	CU-FT	1.924	CU-M
TM	AVERAGE GAS METER TEMP	65.3	F	18.5	C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	69.692	SCF	1.973	SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	177.7		177.7	
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	8.364	SCF	.237	SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	10.72		10.72	
FMD	MOLE FRACTION DRY GAS	.893		.893	
PCO2	PERCENT CO2 BY VOL., DRY	13.60		13.60	
PO2	PERCENT O2 BY VOL., DRY	2.30		2.30	
PCO	PERCENT CO BY VOL., DRY	.00		.00	
PN2	PERCENT N2 BY VOL., DRY	84.10		84.10	
MD	MOLECULAR WT-DRY STACK GAS	30.27		30.27	

MWS	MOLECULAR WT-STACK GAS	28.95		28.95	
PB	BAROMETRIC PRESSURE	30.36	IN-HG	771.14	MM-HG
PSI	STATIC PRES OF STACK GAS	-.60	IN-H2O	-15.24	MM-H2O
PS	STACK PRES, ABS.	30.32	IN-HG	770.02	MM-HG
TS	AVERAGE STACK TEMP	317.	F	159.	C
VS	AVG STACK GAS VELOCITY	57.4	FPS	17.5	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	18177220.	SCFH	514724.	SCMH
QS	ACTUAL STACK FLOW RATE	29581420.	ACFH	837657.	ACMH
ISO	PERCENT ISOKINETIC	100.3		100.3	
MN	AMBIENT PARTICULATE MG. EPA 5	398.9		398.9	
CS	AMBIENT PARTICULATE	.0883	GR/DSCF*	202.151	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO.4AM5BP

UNIT 2 EAST

```
VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    67.961 * 1.003 * ( 30.36 + 1.032 / 13.6)
VMSTD = -------------------------------------------------------- =      69.692 DSCF
                          (  65. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  178. =   8.36 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

        100. *   8.36
BWO = -------------------------- = 10.72 PERCENT
          69.692 +   8.36


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

        100. -  10.7
FMD = ----------------------- =   .893
             100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.60*44/100) + ( 2.3*32/100) + ((84.1+ .0) * 28/100 =   30.27


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.27* (1. -(10.72/100)) + 18. * (10.72/100) =   28.95
```

STACK GAS VELOCITY AT STACK CONDITIONS

```
DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  284.204 / (SQRT( 28.95 * 30.32)  *  12. =   57.41 FPS
```

STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

```
QS = VS * AS * 3600/144

QS =   57.41 * 20612. 3600/144 =   29581420. ACFH
```

STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

```
QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

          17.647 *   29581420. *  30.32 * (1. - (10.72/100))
QSSTD = ---------------------------------------------------- =   18177220. SCFH
                     ( 317. + 460.)
```

PERCENT ISOKINETIC

```
ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 317.+460.))*((0.002669*  178.)+(   67.961*1.003*( 30.36+(   1.032/13.6))/(  65.+460.)))
ISO = ------------------------------------------------------------------------------------------------ = 100.27 PERCENT
                                   120. *     57.41 *   30.32 *  .224 *  .224
```

PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

```
CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    398.9 * 15.43 /    69.692 =       .0883 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/08/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	4BM5BP
SAMPLE TYPE	PART SO3 SO4	PROBE LENGTH & TYPE	6 FT GLASS
OPERATOR	PR RA JP	NOZZLE 28 : I.D.	.227
AMBIENT TEMP.(DEG.F)	50.	ASSUMED MOISTURE	11.1
BAR.PRESS.(IN.HG)	30.36	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	-.60	METER BOX NUMBER	FB6
FILTER NUMBER(S)	0002530	METER HEAD DIFF.	1.50
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	400.
THERM. NO.		HEATER BOX SETTING	320.
LEAKAGE	.005 CFM @ 10.5 IN.HG		
METER CALIB. FACTOR	.960	K FACTOR	1023.1

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	DRY GAS METER TEMP (DEG.F) OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	1230	162.434									
	10.0	0	168.474	.720	.95	.95	314.	52.	52.	4.5	320.	48.
	20.0	0	174.553	.720	.95	.95	317.	52.	52.	4.5	324.	48.
	30.0	0	180.584	.720	.95	.95	318.	58.	52.	5.0	323.	50.
	40.0	0	186.800	.750	.99	.99	318.	61.	52.	5.5	322.	50.
	50.0	0	192.990	.750	.99	.99	317.	64.	54.	6.0	322.	51.
	60.0	0	199.064	.720	.95	.95	317.	65.	56.	6.5	324.	50.
	70.0	0	205.137	.720	.95	.95	317.	66.	56.	6.5	327.	50.
	80.0	0	211.094	.700	.92	.92	318.	66.	58.	7.0	328.	50.
	90.0	0	217.103	.700	.92	.92	318.	67.	59.	7.5	330.	51.
	100.0	0	223.214	.720	.95	.95	317.	68.	60.	7.5	323.	50.
	110.0	0	229.300	.720	.95	.95	318.	69.	60.	8.0	327.	50.
	120.0	1430	235.462	.720	.95	.95	319.	69.	60.	8.5	324.	50.
TOTALS	120.0		73.028									
AVERAGE					.95	.95	317.	63.	56.	6.4	325.	50.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS   TEST TEAM LEADER

PR RA JP

TEST 48M5RP   UNIT 2 EAST

		ENGLISH UNITS		METRIC UNITS	
TEST DATE		02/08/83		02/08/83	
TB	TIME-START	1230		1230	
TF	TIME-FINISH	1430		1430	
TT	NET TIME OF TEST, MIN.	120.0		120.0	
NP	NET SAMPLING POINTS	12		12	
Y	METER CALIBRATION FACTOR	.960		.960	
DN	SAMPLING NOZZLE DIAMETER	.227	IN	5.8	MM
CP	PITOT TUBE COEFFICIENT	.84		.84	
PM	AVERAGE ORIFICE PRESSURE DROP	.95	IN-H2O	24.2	MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	73.028	CU-FT	2.068	CU-M
TM	AVERAGE GAS METER TEMP	59.5	F	15.3	C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	72.468	SCF	2.052	SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	184.4		184.4	
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	8.680	SCF	.246	SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	10.70		10.70	
FMD	MOLE FRACTION DRY GAS	.893		.893	
PCO2	PERCENT CO2 BY VOL., DRY	13.60		13.60	
PO2	PERCENT O2 BY VOL., DRY	2.30		2.30	
PCO	PERCENT CO BY VOL., DRY	.00		.00	
PN2	PERCENT N2 BY VOL., DRY	84.10		84.10	
MD	MOLECULAR WT-DRY STACK GAS	30.27		30.27	

MWS	MOLECULAR WT-STACK GAS	28.96		28.96	
PB	BAROMETRIC PRESSURE	30.36	IN-HG	771.14	MM-HG
PSI	STATIC PRES OF STACK GAS	-.60	IN-H2O	-15.24	MM-H2O
PS	STACK PRES, ABS.	30.32	IN-HG	770.02	MM-HG
TS	AVERAGE STACK TEMP	317.	F	159.	C
VS	AVG STACK GAS VELOCITY	57.4	FPS	17.5	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	18180460.	SCFH	514816.	SCMH
QS	ACTUAL STACK FLOW RATE	29580184.	ACFH	837622.	ACMH
ISO	PERCENT ISOKINETIC	101.5		101.5	
MN	AMBIENT PARTICULATE MG. EPA 5	398.0		398.0	
CS	AMBIENT PARTICULATE	.0847	GR/DSCF*	193.968	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

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      EXAMPLE PARTICULATE CALCULATIONS TEST NO.4BM5BP

           UNIT 2 EAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    73.028 *  .960 * ( 30.36 +  .952 / 13.6)
VMSTD = ------------------------------------------------------ =     72.468 DSCF
                           (  60. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  184. =   8.68 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

          100. *   8.68
BWO = -------------------------- = 10.70 PERCENT
            72.468 +   8.68


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

          100. -  10.7
FMD = ----------------------- =   .893
               100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.60*44/100) + ( 2.3*32/100) + ((84.1+ .0) * 28/100 =   30.27


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.27* (1. -(10.70/100)) + 18. * (10.70/100) =   28.96
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STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  284.204 / (SQRT( 28.96 * 30.32)  *  12. =   57.40 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   57.40 * 20612. 3600/144 =   29580184. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

          17.647 *   29580184. *  30.32 * (1. - (10.70/100))
QSSTD = ---------------------------------------------------- =   18180460. SCFH
                       ( 317. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

        (305.58*( 317.+460.))*((0.002669*  184.)+(   73.028* .960*( 30.36+(    .952/13.6))/(  60.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- = 101.51 PERCENT
                                    120. *     57.40 *   30.32 *  .227 *  .227


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    398.0 * 15.43 /    72.468 =       .0847 GR/DSCF
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FIELD DATA

PLANT		DATE	02/08/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	4CM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	6 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.211
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.36	SAMPLE BOX NUMBER	OAR
STATIC PRESS.(IN.H2O)	-.60	METER BOX NUMBER	
FILTER NUMBER(S)	3531066	METER HEAD DIFF.	1.84
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 7.0 IN.HG		
METER CALIB. FACTOR	.983	K FACTOR	957.5
READ & RECORD DATA EVERY 10.0 MINUTES			

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	DRY GAS METER TEMP (DEG.F) OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	1230	244.025									
	10.0	1240	249.129	.720	.89	.89	314.	57.	56.	4.0	331.	55.
	20.0	1250	254.111	.720	.89	.89	317.	58.	56.	4.0	316.	56.
	30.0	1300	259.195	.720	.89	.89	318.	64.	57.	4.0	324.	58.
	40.0	1310	264.300	.750	.92	.92	318.	68.	58.	4.5	326.	58.
	50.0	1320	269.444	.750	.92	.92	317.	70.	59.	4.5	325.	56.
	60.0	1330	274.500	.720	.89	.89	317.	72.	60.	5.0	326.	54.
	70.0	1340	279.525	.720	.89	.89	317.	73.	62.	5.0	324.	50.
	80.0	1350	284.465	.700	.86	.86	318.	74.	62.	5.0	325.	50.
	90.0	1400	289.425	.700	.86	.86	318.	74.	64.	5.5	324.	52.
	100.0	1410	294.504	.720	.89	.89	317.	75.	65.	6.0	323.	52.
	110.0	1420	299.622	.720	.89	.89	318.	75.	65.	6.0	326.	54.
	120.0	1430	304.732	.720	.89	.89	319.	76.	66.	6.5	328.	56.
TOTALS	120.0		60.707									
AVERAGE					.89	.89	317.	70.	61.	5.0	325.	54.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS TEST TEAM LEADER

CLARKE

TEST 4CM5B UNIT TWO EAST

		ENGLISH UNITS		METRIC UNITS	
TEST DATE		02/08/83		02/08/83	
TB	TIME-START	1230		1230	
TF	TIME-FINISH	1430		1430	
TT	NET TIME OF TEST, MIN.	120.0		120.0	
NP	NET SAMPLING POINTS	12		12	
Y	METER CALIBRATION FACTOR	.983		.983	
DN	SAMPLING NOZZLE DIAMETER	.211	IN	5.4	MM
CP	PITOT TUBE COEFFICIENT	.84		.84	
PM	AVERAGE ORIFICE PRESSURE DROP	.89	IN-H2O	22.6	MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	60.707	CU-FT	1.719	CU-M
TM	AVERAGE GAS METER TEMP	65.3	F	18.5	C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	61.001	SCF	1.727	SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	156.3		156.3	
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	7.357	SCF	.208	SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	10.76		10.76	
FMD	MOLE FRACTION DRY GAS	.892		.892	
PCO2	PERCENT CO2 BY VOL., DRY	13.60		13.60	
PO2	PERCENT O2 BY VOL., DRY	2.30		2.30	
PCO	PERCENT CO BY VOL., DRY	.00		.00	
PN2	PERCENT N2 BY VOL., DRY	84.10		84.10	
MD	MOLECULAR WT-DRY STACK GAS	30.27		30.27	

MWS	MOLECULAR WT-STACK GAS	28.95		28.95	
PB	BAROMETRIC PRESSURE	30.36	IN-HG	771.14	MM-HG
PSI	STATIC PRES OF STACK GAS	-.60	IN-H2O	-15.24	MM-H2O
PS	STACK PRES, ABS.	30.32	IN-HG	770.02	MM-HG
TS	AVERAGE STACK TEMP	317.	F	159.	C
VS	AVG STACK GAS VELOCITY	57.4	FPS	17.5	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	18169492.	SCFH	514506.	SCMH
QS	ACTUAL STACK FLOW RATE	29584348.	ACFH	837740.	ACMH
ISO	PERCENT ISOKINETIC	99.0		99.0	
MN	AMBIENT PARTICULATE MG. EPA 5	348.6		348.6	
CS	AMBIENT PARTICULATE	.0882	GR/DSCF*	201.831	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

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      EXAMPLE PARTICULATE CALCULATIONS TEST NO. 4CM5B

           UNIT TWO EAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    60.707 *  .983 * ( 30.36 +  .890 / 13.6)
VMSTD = ------------------------------------------------------ =     61.001 DSCF
                             (  65. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  156. =   7.36 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

          100. *   7.36
BWO = -------------------------- = 10.76 PERCENT
            61.001 +   7.36


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

          100. -  10.8
FMD = ----------------------- =   .892
               100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.60*44/100) + ( 2.3*32/100) + ((84.1+ .0) * 28/100 =   30.27


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.27* (1. -(10.76/100)) + 18. * (10.76/100) =   28.95
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STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  284.204 / (SQRT( 28.95 * 30.32)  *  12. =   57.41 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   57.41 * 20612. 3600/144 =   29584348. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

          17.647 *   29584348. *  30.32 * (1. - (10.76/100))
QSSTD = ---------------------------------------------------- =   18169492. SCFH
                    ( 317. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 317.+460.))*((0.002669*  156.)+(   60.707* .983*( 30.36+(    .890/13.6))/(  65.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- =  98.96 PERCENT
                                    120. *     57.41 *   30.32 *  .211 *  .211


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    348.6 * 15.43 /    61.001 =       .0882 GR/DSCF
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FIELD DATA

PLANT		DATE	02/08/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	4DM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.210
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.36	SAMPLE BOX NUMBER	QAD
STATIC PRESS.(IN.H2O)	-.60	METER BOX NUMBER	
FILTER NUMBER(S)	3531068	METER HEAD DIFF.	1.88
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.001 CFM @ 9.0 IN.HG		
METER CALIB. FACTOR	1.030	K FACTOR	957.5
READ & RECORD DATA EVERY	10.0 MINUTES		

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	1230	802.979									
	10.0	1240	807.867	.720	.89	.89	314.	54.	54.	4.5	327.	58.
	20.0	1250	812.715	.720	.89	.89	317.	55.	54.	5.0	317.	58.
	30.0	1300	817.535	.720	.89	.89	318.	58.	54.	5.0	312.	60.
	40.0	1310	822.475	.750	.92	.92	318.	60.	54.	6.0	322.	58.
	50.0	1320	827.385	.750	.92	.92	317.	62.	56.	6.0	325.	56.
	60.0	1330	832.265	.720	.89	.89	317.	63.	56.	6.5	312.	52.
	70.0	1340	837.110	.720	.89	.89	317.	63.	57.	7.0	309.	52.
	80.0	1350	841.925	.700	.86	.86	318.	64.	58.	7.0	320.	50.
	90.0	1400	846.725	.700	.86	.86	318.	65.	58.	7.5	326.	52.
	100.0	1410	851.621	.720	.89	.89	317.	66.	60.	8.0	310.	54.
	110.0	1420	856.475	.720	.89	.89	318.	66.	60.	8.5	318.	50.
	120.0	1430	861.373	.720	.89	.89	319.	66.	60.	9.0	327.	51.
TOTALS	120.0		58.394									
AVERAGE					.89	.89	317.	62.	57.	6.7	319.	54.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS — TEST TEAM LEADER

CLARKE

TEST 4DM5B UNIT TWO EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/08/83	02/08/83
TB	TIME-START	1230	1230
TF	TIME-FINISH	1430	1430
TT	NET TIME OF TEST, MIN.	120.0	120.0
NP	NET SAMPLING POINTS	12	12
Y	METER CALIBRATION FACTOR	1.030	1.030
DN	SAMPLING NOZZLE DIAMETER	.210 IN	5.3 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	.89 IN-H2O	22.6 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	58.394 CU-FT	1.654 CU-M
TM	AVERAGE GAS METER TEMP	59.3 F	15.2 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	62.187 SCF	1.761 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	159.4	159.4
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	7.503 SCF	.212 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	10.77	10.77
FMD	MOLE FRACTION DRY GAS	.892	.892
PCO2	PERCENT CO2 BY VOL., DRY	13.60	13.60
PO2	PERCENT O2 BY VOL., DRY	2.30	2.30
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	84.10	84.10
MD	MOLECULAR WT-DRY STACK GAS	30.27	30.27

MWS	MOLECULAR WT-STACK GAS	28.95		28.95	
PB	BAROMETRIC PRESSURE	30.36	IN-HG	771.14	MM-HG
PSI	STATIC PRES OF STACK GAS	-.60	IN-H2O	-15.24	MM-H2O
PS	STACK PRES, ABS.	30.32	IN-HG	770.02	MM-HG
TS	AVERAGE STACK TEMP	317.	F	159.	C
VS	AVG STACK GAS VELOCITY	57.4	FPS	17.5	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	18168904.	SCFH	514489.	SCMH
QS	ACTUAL STACK FLOW RATE	29584568.	ACFH	837746.	ACMH
ISO	PERCENT ISOKINETIC	101.9		101.9	
MN	AMBIENT PARTICULATE MG, EPA 5	346.0		346.0	
CS	AMBIENT PARTICULATE	.0858	GR/DSCF*	196.503	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

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EXAMPLE PARTICULATE CALCULATIONS TEST NO. 4DM5B

     UNIT TWO EAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *     58.394 * 1.030 * ( 30.36 +  .890 / 13.6)
VMSTD = ------------------------------------------------------- =      62.187 DSCF
                                 (  59. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  159. =   7.50 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

           100. *   7.50
BWO = -------------------------- = 10.77 PERCENT
              62.187 +   7.50


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

           100. -  10.8
FMD = ----------------------- =   .892
                100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.60*44/100) + ( 2.3*32/100) + ((84.1+ .0) * 28/100 =   30.27


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.27* (1. -(10.77/100)) + 18. * (10.77/100) =   28.95
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STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  284.204 / (SQRT( 28.95 * 30.32)  *  12. =   57.41 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   57.41 * 20612. 3600/144 =   29584568. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

           17.647 *   29584568. *  30.32 * (1. - (10.77/100))
QSSTD = ---------------------------------------------------- =   18168904. SCFH
                      ( 317. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

      (305.58*( 317.+460.))*((0.002669*  159.)+(   58.394*1.030*( 30.36+(    .890/13.6))/(  59.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- = 101.85 PERCENT
                                    120. *     57.41 *   30.32 *  .210 *  .210


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    346.0 * 15.43 /    62.187 =       .0858 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/11/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	5AM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	PR RA	NOZZLE 1A : I.D.	.223
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.05	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	-.80	METER BOX NUMBER	F84
FILTER NUMBER(S)	3531067	METER HEAD DIFF.	1.72
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	206	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 7.0 IN.HG		
METER CALIB. FACTOR	1.003	K FACTOR	1116.0

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	755	708.102									
	10.0	805	713.796	.700	1.03	1.03	301.	63.	62.	4.0	327.	52.
	20.0	815	719.262	.650	.95	.95	303.	64.	62.	4.0	341.	52.
	30.0	825	724.692	.650	.95	.95	305.	68.	62.	4.0	377.	53.
	40.0	835	730.183	.650	.95	.95	305.	70.	62.	5.0	321.	53.
	50.0	845	735.892	.700	1.02	1.02	305.	73.	63.	5.5	330.	54.
	60.0	855	741.423	.650	.95	.95	304.	75.	64.	5.5	331.	54.
	70.0	905	746.950	.650	.95	.95	305.	77.	65.	6.0	330.	52.
	80.0	915	752.500	.650	.95	.95	304.	78.	66.	6.0	323.	52.
	90.0	925	757.988	.650	.95	.95	307.	79.	68.	6.5	324.	52.
TOTALS	90.0		49.886									
AVERAGE					.97	.97	304.	72.	64.	5.2	334.	53.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS   TEST TEAM LEADER

PR RA

TEST 5AM5B   UNIT 2 FAST

		ENGLISH UNITS		METRIC UNITS	
TEST DATE		02/11/83		02/11/83	
TB	TIME-START	755		755	
TF	TIME-FINISH	925		925	
TT	NET TIME OF TEST, MIN.	90.0		90.0	
NP	NET SAMPLING POINTS	9		9	
Y	METER CALIBRATION FACTOR	1.003		1.003	
DN	SAMPLING NOZZLE DIAMETER	.223	IN	5.7	MM
CP	PITOT TUBE COEFFICIENT	.84		.84	
PM	AVERAGE ORIFICE PRESSURE DROP	.97	IN-H2O	24.6	MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	49.886	CU-FT	1.413	CU-M
TM	AVERAGE GAS METER TEMP	67.8	F	19.9	C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	50.388	SCF	1.427	SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	138.6		138.6	
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	6.524	SCF	.185	SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.46		11.46	
FMD	MOLE FRACTION DRY GAS	.885		.885	
PCO2	PERCENT CO2 BY VOL., DRY	12.80		12.80	
PO2	PERCENT O2 BY VOL., DRY	3.25		3.25	
PCO	PERCENT CO BY VOL., DRY	.00		.00	
PN2	PERCENT N2 BY VOL., DRY	83.95		83.95	
MD	MOLECULAR WT-DRY STACK GAS	30.18		30.18	

MWS	MOLECULAR WT-STACK GAS	28.78		28.78	
PB	BAROMETRIC PRESSURE	30.05	IN-HG	763.27	MM-HG
PSI	STATIC PRES OF STACK GAS	-.80	IN-H2O	-20.32	MM-H2O
PS	STACK PRES, ABS.	29.99	IN-HG	761.78	MM-HG
TS	AVERAGE STACK TEMP	304.	F	151.	C
VS	AVG STACK GAS VELOCITY	54.9	FPS	16.7	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17355016.	SCFH	491442.	SCMH
QS	ACTUAL STACK FLOW RATE	28308684.	ACFH	801617.	ACMH
ISO	PERCENT ISOKINETIC	102.2		102.2	
MN	AMBIENT PARTICULATE MG. EPA 5	235.5		235.5	
CS	AMBIENT PARTICULATE	.0721	GR/DSCF*	165.067	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO. 5AM5B

UNIT 2 EAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

```
VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    49.886 * 1.003 * ( 30.05 +  .967 / 13.6)
VMSTD = ---------------------------------------------------------- =     50.388 DSCF
                               (  68. + 460.)
```

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

```
VWC = .04707 * VLC

VWC = .04707 *  139. =   6.52 SCF
```

PERCENT MOISTURE IN STACK GAS

```
BWO = (100. * VWC) / (VMSTD + VWC)

        100. *    6.52
BWO = -------------------------- = 11.46 PERCENT
         50.388 +   6.52
```

MOLE FRACTION OF DRY STACK GAS

```
FMD = (100. - BWO) / 100.

        100. -  11.5
FMD = ----------------------- =   .885
            100.
```

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

```
MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (12.80*44/100) + ( 3.3*32/100) + ((83.9+ .0) * 28/100 =   30.18
```

MOLECULAR WEIGHT OF STACK GAS

```
MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.18* (1. -(11.46/100)) + 18. * (11.46/100) =   28.78
```

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *   .84 *  202.286 / (SQRT( 28.78 * 29.99)   *    9. =    54.94 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =    54.94 * 20612. 3600/144 =   28308684. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

               17.647 *    28308684. *  29.99 * (1. - (11.46/100))
QSSTD = ---------------------------------------------------- =   17355016. SCFH
                           ( 304. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 304.+460.))*((0.002669*  139.)+(   49.886*1.003*( 30.05+(    .967/13.6))/(  68.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- = 102.16 PERCENT
                                  90. *     54.94 *   29.99 *  .223 *  .223


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    235.5 * 15.43 /    50.388 =       .0721 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/11/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	5BM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	6 FT GLASS
OPERATOR	PR RA JP	NOZZLE 1B : I.D.	.221
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.05	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	-.80	METER BOX NUMBER	F86
FILTER NUMBER(S)	3531013	METER HEAD DIFF.	1.50
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	206	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 8.5 IN.HG		
METER CALIB. FACTOR	.960	K FACTOR	938.8

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	755	236.455									
	10.0	805	242.410	.700	.86	.86	301.	56.	58.	4.0	322.	52.
	20.0	815	247.969	.650	.80	.80	303.	57.	58.	3.5	340.	52.
	30.0	825	253.558	.650	.80	.80	305.	62.	58.	4.0	332.	52.
	40.0	835	259.176	.650	.80	.80	305.	65.	59.	4.0	336.	53.
	50.0	845	265.000	.700	.86	.86	305.	67.	59.	4.0	337.	53.
	60.0	855	270.627	.650	.80	.80	304.	69.	60.	4.0	329.	55.
	70.0	905	276.234	.650	.80	.80	305.	70.	61.	5.5	333.	50.
	80.0	915	281.856	.650	.80	.80	304.	71.	62.	6.0	329.	50.
	90.0	925	287.555	.650	.80	.80	307.	72.	63.	6.0	327.	51.
TOTALS	90.0		51.100									
AVERAGE					.81	.81	304.	65.	60.	4.6	332.	52.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS

TEST TEAM LEADER

PR RA JP

TEST 5BM5B UNIT 2 EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/11/83	02/11/83
TB	TIME-START	755	755
TF	TIME-FINISH	925	925
TT	NET TIME OF TEST, MIN.	90.0	90.0
NP	NET SAMPLING POINTS	9	9
Y	METER CALIBRATION FACTOR	.960	.960
DN	SAMPLING NOZZLE DIAMETER	.221 IN	5.6 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	.81 IN-H2O	20.7 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	51.100 CU-FT	1.447 CU-M
TM	AVERAGE GAS METER TEMP	62.6 F	17.0 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	49.876 SCF	1.412 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	137.2	137.2
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	6.458 SCF	.183 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.46	11.46
FMD	MOLE FRACTION DRY GAS	.885	.885
PCO2	PERCENT CO2 BY VOL., DRY	12.80	12.80
PO2	PERCENT O2 BY VOL., DRY	3.25	3.25
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	83.95	83.95
MD	MOLECULAR WT-DRY STACK GAS	30.18	30.18

MWS	MOLECULAR WT-STACK GAS	28.78		28.78	
PB	BAROMETRIC PRESSURE	30.05	IN-HG	763.27	MM-HG
PSI	STATIC PRES OF STACK GAS	-.80	IN-H2O	-20.32	MM-H2O
PS	STACK PRES, ABS.	29.99	IN-HG	761.78	MM-HG
TS	AVERAGE STACK TEMP	304.	F	151.	C
VS	AVG STACK GAS VELOCITY	54.9	FPS	16.7	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17354928.	SCFH	491440.	SCMH
QS	ACTUAL STACK FLOW RATE	28308716.	ACFH	801618.	ACMH
ISO	PERCENT ISOKINETIC	103.0		103.0	
MN	AMBIENT PARTICULATE MG. EPA 5	230.9		230.9	
CS	AMBIENT PARTICULATE	.0714	GR/DSCF*	163.503	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO. 5BM5B

UNIT 2 EAST

```
VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    51.100 *  .960 * ( 30.05 +  .813 / 13.6)
VMSTD = ------------------------------------------------------ =     49.876 DSCF
                            (  63. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  137. =   6.46 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

          100. *   6.46
BWO = -------------------------- = 11.46 PERCENT
            49.876 +   6.46


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

          100. -  11.5
FMD = ----------------------- =   .885
               100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (12.80*44/100) + ( 3.3*32/100) + ((83.9+ .0) * 28/100 =   30.18


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.18* (1. -(11.46/100)) + 18. * (11.46/100) =   28.78
```

STACK GAS VELOCITY AT STACK CONDITIONS

```
DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *   .84 *  202.286 / (SQRT( 28.78 * 29.99)  *    9. =    54.94 FPS
```

STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

```
QS = VS * AS * 3600/144

QS =   54.94 * 20612. 3600/144 =   28308716. ACFH
```

STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

```
QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

           17.647 *   28308716. *  29.99 * (1. - (11.46/100))
QSSTD = ---------------------------------------------------- =   17354928. SCFH
                       ( 304. + 460.)
```

PERCENT ISOKINETIC

```
ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 304.+460.))*((0.002669*  137.)+(   51.100* .960*( 30.05+(    .813/13.6))/(  63.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- = 102.96 PERCENT
                                        90. *     54.94 *   29.99 *  .221 *  .221
```

PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

```
CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    230.9 * 15.43 /    49.876 =       .0714 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/11/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	5CM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	6 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.221
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.05	SAMPLE BOX NUMBER	UAC
STATIC PRESS.(IN.H2O)	-.80	METER BOX NUMBER	FB5
FILTER NUMBER(S)	3531124	METER HEAD DIFF.	1.84
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	206	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 11.0 IN.HG		
METER CALIB. FACTOR	.983	K FACTOR	1070.1

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	755	306.333									
	10.0	805	311.845	.700	.98	.98	301.	62.	62.	5.0	327.	56.
	20.0	815	317.000	.650	.91	.91	303.	64.	62.	4.5	324.	54.
	30.0	825	322.180	.650	.91	.91	303.	70.	62.	5.0	322.	52.
	40.0	835	327.245	.650	.91	.91	303.	74.	63.	5.5	326.	54.
	50.0	845	332.630	.700	.98	.98	305.	77.	64.	6.0	329.	50.
	60.0	855	337.737	.650	.91	.91	304.	79.	69.	6.5	336.	50.
	70.0	905	342.945	.650	.91	.91	305.	80.	67.	6.5	336.	52.
	80.0	915	348.190	.650	.91	.91	304.	80.	68.	7.0	332.	50.
	90.0	925	353.282	.650	.91	.91	307.	81.	69.	7.0	312.	48.
TOTALS	90.0		46.949									
AVERAGE					.93	.93	304.	74.	65.	5.9	327.	52.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS   TEST TEAM LEADER

CLARKE

TEST   5CM5B   UNIT TWO FAST

		ENGLISH UNITS		METRIC UNITS	
TEST DATE		02/11/83		02/11/83	
TB	TIME-START	755		755	
TF	TIME-FINISH	925		925	
TT	NET TIME OF TEST, MIN.	90.0		90.0	
NP	NET SAMPLING POINTS	9		9	
Y	METER CALIBRATION FACTOR	.983		.983	
DN	SAMPLING NOZZLE DIAMETER	.221	IN	5.6	MM
CP	PITOT TUBE COEFFICIENT	.84		.84	
PM	AVERAGE ORIFICE PRESSURE DROP	.93	IN-H2O	23.5	MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	46.949	CU-FT	1.329	CU-M
TM	AVERAGE GAS METER TEMP	69.6	F	20.9	C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	46.315	SCF	1.311	SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	131.6		131.6	
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	6.194	SCF	.175	SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.80		11.80	
FMD	MOLE FRACTION DRY GAS	.882		.882	
PCO2	PERCENT CO2 BY VOL., DRY	12.80		12.80	
PO2	PERCENT O2 BY VOL., DRY	3.25		3.25	
PCO	PERCENT CO BY VOL., DRY	.00		.00	
PN2	PERCENT N2 BY VOL., DRY	83.95		83.95	
MD	MOLECULAR WT-DRY STACK GAS	30.18		30.18	

MWS	MOLECULAR WT-STACK GAS	28.74		28.74	
PB	BAROMETRIC PRESSURE	30.05	IN-HG	763.27	MM-HG
PSI	STATIC PRES OF STACK GAS	-.80	IN-H2O	-20.32	MM-H2O
PS	STACK PRES, ABS.	29.99	IN-HG	761.78	MM-HG
TS	AVERAGE STACK TEMP	304.	F	151.	C
VS	AVG STACK GAS VELOCITY	55.0	FPS	16.8	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17306912.	SCFH	490080.	SCMH
QS	ACTUAL STACK FLOW RATE	28320512.	ACFH	801952.	ACMH
ISO	PERCENT ISOKINETIC	95.9		95.9	
MN	AMBIENT PARTICULATE MG. EPA 5	219.2		219.2	
CS	AMBIENT PARTICULATE	.0730	GR/DSCF*	167.153	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

```
EXAMPLE PARTICULATE CALCULATIONS TEST NO. 5CM5B

     UNIT TWO EAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    46.949 *  .983 * ( 30.05 +  .926 / 13.6)
VMSTD = ------------------------------------------------------ =      46.315 DSCF
                           (  70. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  132. =   6.19 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

          100. *   6.19
BWO = -------------------------- = 11.80 PERCENT
            46.315 +   6.19


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

          100. -  11.8
FMD = ----------------------- =   .882
               100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (12.80*44/100) + ( 3.3*32/100) + ((83.9+ .0) * 28/100 =   30.18


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.18* (1. -(11.80/100)) + 18. * (11.80/100) =   28.74
```

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  202.227 / (SQRT( 28.74 * 29.99)  *   9. =   54.96 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   54.96 * 20612. 3600/144 =   28320512. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

          17.647 *   28320512. *  29.99 * (1. - (11.80/100))
QSSTD = -------------------------------------------------- =   17306912. SCFH
                    ( 304. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 304.+460.))*((0.002669*  132.)+(   46.949* .983*( 30.05+(    .926/13.6))/(  70.+460.)))
ISO = ---------------------------------------------------------------------------------------------- =  95.87 PERCENT
                                   90. *     54.96 *   29.99 *  .221 *  .221


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    219.2 * 15.43 /    46.315 =       .0730 GR/DSCF
```

FIELD DATA

PLANT.		DATE	02/11/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	5DM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.215
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.05	SAMPLE BOX NUMBER	QAD
STATIC PRESS.(IN.H2O)	-.80	METER BOX NUMBER	FB4
FILTER NUMBER(S)	3531123	METER HEAD DIFF.	1.88
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	206	HEATER BOX SETTING	320.
LEAKAGE	.010 CFM @ 8.0 IN.HG		
METER CALIB. FACTOR	1.030	K FACTOR	1070.1
READ & RECORD DATA EVERY	10.0 MINUTES		

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	755	863.797									
	10.0	805	868.940	.700	.98	.98	301.	58.	58.	2.5	311.	52.
	20.0	815	874.125	.650	.91	.91	303.	60.	58.	2.5	317.	52.
	30.0	825	878.910	.650	.91	.91	305.	66.	62.	3.0	322.	50.
	40.0	835	883.833	.650	.91	.91	305.	68.	60.	3.0	325.	50.
	50.0	845	889.000	.700	.98	.98	305.	70.	62.	3.5	321.	48.
	60.0	855	893.845	.650	.91	.91	304.	71.	62.	4.0	315.	52.
	70.0	905	898.939	.650	.91	.91	305.	72.	64.	4.0	319.	50.
	80.0	915	903.900	.650	.91	.91	304.	73.	66.	4.5	325.	52.
	90.0	925	908.861	.650	.91	.91	307.	74.	66.	5.0	314.	50.
TOTALS	90.0		45.064									
AVERAGE					.93	.93	304.	68.	62.	3.6	319.	51.

PARTICULATF FIFLD DATA & RFSULTS TABULATION

PLANT- NAME AND ADDRESS TEST TEAM LEADER

CLARKF

TEST 5DM5B UNIT TWO FAST

		ENGLISH UNITS		METRIC UNITS	
TEST DATE		02/11/83		02/11/83	
TB	TIME-START	755		755	
TF	TIME-FINISH	925		925	
TT	NFT TIME OF TFST, MIN.	90.0		90.0	
NP	NFT SAMPLING POINTS	9		9	
Y	METER CALIBRATION FACTOR	1.030		1.030	
DN	SAMPLING NOZZLE DIAMETER	.215	IN	5.5	MM
CP	PITOT TUBE COFFFICIENT	.84		.84	
PM	AVERAGE ORIFICE PRESSURE DROP	.93	IN-H2O	23.5	MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	45.064	CU-FT	1.276	CU-M
TM	AVERAGE GAS MFTER TEMP	65.0	F	18.3	C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	46.990	SCF	1.331	SCM
VLC	TOTAL H2O COLLECTFD IN IMPINGERS AND SILICA GEL,ML.	132.8		132.8	
VWC	VOLUME OF WATFR VAPOR AT STANDARD CONDITIONS*	6.251	SCF	.177	SCM
BWO	PFRCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.74		11.74	
FMD	MOLE FRACTION DRY GAS	.883		.883	
PCO2	PFRCENT CO2 BY VOL., DRY	12.80		12.80	
PO2	PERCENT O2 BY VOL., DRY	3.25		3.25	
PCO	PFRCENT CO BY VOL., DRY	.00		.00	
PN2	PFRCENT N2 BY VOL., DRY	83.95		83.95	
MD	MOLECULAR WT-DRY STACK GAS	30.18		30.18	

MWS	MOLECULAR WT-STACK GAS	28.75		28.75	
PB	BAROMETRIC PRESSURE	30.05	IN-HG	763.27	MM-HG
PSI	STATIC PRES OF STACK GAS	-.80	IN-H2O	-20.32	MM-H2O
PS	STACK PRES, ABS.	29.99	IN-HG	761.78	MM-HG
TS	AVERAGE STACK TEMP	304.	F	151.	C
VS	AVG STACK GAS VELOCITY	55.0	FPS	16.8	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17310776.	SCFH	490189.	SCMH
QS	ACTUAL STACK FLOW RATE	28325324.	ACFH	802088.	ACMH
ISO	PERCENT ISOKINETIC	102.8		102.8	
MN	AMBIENT PARTICULATE MG. EPA 5	217.9		217.9	
CS	AMBIENT PARTICULATE	.0716	GR/DSCF*	163.775	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO. 5DM5B

UNIT TWO EAST

```
VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

           17.647 *    45.064 * 1.030 * ( 30.05 +   .926 / 13.6)
VMSTD = ------------------------------------------------------ =      46.990 DSCF
                              (  65. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  133. =   6.25 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

           100. *   6.25
BWO = -------------------------- = 11.74 PERCENT
             46.990 +   6.25


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

           100. -  11.7
FMD = ----------------------- =   .883
                100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (12.80*44/100) + ( 3.3*32/100) + ((83.9+ .0) * 28/100 =   30.18


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.18* (1. -(11.74/100)) + 18. * (11.74/100) =   28.75
```

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  202.286 / (SQRT( 28.75 * 29.99)  *   9. =   54.97 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   54.97 * 20612. 3600/144 =   28325324. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

           17.647 *   28325324. *  29.99 * (1. - (11.74/100))
QSSTD = --------------------------------------------------- =   17310776. SCFH
                      ( 304. + 460.)


PERCENT ISOKINFTIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 304.+460.))*((0.002669*  133.)+(   45.064*1.030*( 30.05+(    .926/13.6))/(  65.+460.)))
ISO = ------------------------------------------------------------------------------------------------- = 102.75 PERCENT
                                    90. *     54.97 *   29.99 *  .215 *  .215


PARTICULATF LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    217.9 * 15.43 /    46.990 =       .0716 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/11/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	6AM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	PR RA JP	NOZZLE 2A : I.D.	.224
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.10	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	.25	METER BOX NUMBER	FB4
FILTER NUMBER(S)	3531061	METER HEAD DIFF.	1.72
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 8.0 IN.HG		
METER CALIB. FACTOR	1.003	K FACTOR	1139.1
READ & RECORD DATA EVERY 10.0 MINUTES			

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	1050	758.131									
	10.0	1100	763.876	.700	1.03	1.03	311.	70.	68.	4.5	315.	66.
	20.0	1110	769.397	.650	.96	.96	313.	71.	68.	4.5	328.	60.
	30.0	1120	774.920	.650	.96	.96	313.	75.	68.	5.0	346.	60.
	40.0	1130	780.453	.650	.96	.96	315.	78.	69.	5.5	316.	60.
	50.0	1140	786.057	.670	.98	.98	316.	80.	70.	6.0	329.	60.
	60.0	1150	791.653	.670	.98	.98	314.	81.	71.	6.5	321.	60.
	70.0	1200	797.273	.670	.98	.98	316.	82.	72.	7.0	336.	59.
	80.0	1210	802.831	.650	.96	.96	315.	82.	72.	7.0	338.	62.
	90.0	1220	808.399	.650	.96	.96	317.	84.	73.	7.5	338.	62.
TOTALS	90.0		50.268									
AVERAGE					.97	.97	314.	78.	70.	5.9	330.	61.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS　　　　　　TEST TEAM LEADER

PR RA JP

TEST 6AM5B　　UNIT 2 EAST

			ENGLISH UNITS		METRIC UNITS	
TEST DATE		02/11/83		02/11/83	
TB	TIME-START	1050		1050	
TF	TIME-FINISH	1220		1220	
TT	NET TIME OF TEST, MIN.	90.0		90.0	
NP	NET SAMPLING POINTS	9		9	
Y	METER CALIBRATION FACTOR	1.003		1.003	
DN	SAMPLING NOZZLE DIAMETER	.224	IN	5.7	MM
CP	PITOT TUBE COEFFICIENT	.84		.84	
PM	AVERAGE ORIFICE PRESSURE DROP	.97	IN-H2O	24.8	MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	50.268	CU-FT	1.423	CU-M
TM	AVERAGE GAS METER TEMP	74.1	F	23.4	C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	50.261	SCF	1.423	SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	137.6		137.6	
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	6.477	SCF	.183	SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.42		11.42	
FMD	MOLE FRACTION DRY GAS	.886		.886	
PCO2	PERCENT CO2 BY VOL., DRY	13.60		13.60	
PO2	PERCENT O2 BY VOL., DRY	2.50		2.50	
PCO	PERCENT CO BY VOL., DRY	.00		.00	
PN2	PERCENT N2 BY VOL., DRY	83.90		83.90	
MD	MOLECULAR WT-DRY STACK GAS	30.28		30.28	

MWS	MOLECULAR WT-STACK GAS	28.87		28.87	
PB	BAROMETRIC PRESSURE	30.10	IN-HG	764.54	MM-HG
PSI	STATIC PRES OF STACK GAS	.25	IN-H2O	6.35	MM-H2O
PS	STACK PRES, ABS.	30.12	IN-HG	765.01	MM-HG
TS	AVERAGE STACK TEMP	314.	F	157.	C
VS	AVG STACK GAS VELOCITY	55.1	FPS	16.8	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17274784.	SCFH	489170.	SCMH
QS	ACTUAL STACK FLOW RATE	28414632.	ACFH	804617.	ACMH
ISO	PERCENT ISOKINETIC	101.5		101.5	
MN	AMBIENT PARTICULATE MG. EPA 5	229.3		229.3	
CS	AMBIENT PARTICULATE	.0704	GR/DSCF*	161.127	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO. 6AMSB

UNIT 2 EAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

```
         17.647 *    50.268 * 1.003 * ( 30.10 +  .974 / 13.6)
VMSTD = ------------------------------------------------------ =     50.261 DSCF
                        (  74. + 460.)
```

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 * 138. =   6.48 SCF

PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

```
        100. *    6.48
BWO = -------------------------- = 11.42 PERCENT
          50.261 +   6.48
```

MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

```
        100. -  11.4
FMD = ----------------------- =   .886
             100.
```

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.60*44/100) + (2.5*32/100) + ((83.9+ .0) * 28/100 =   30.28

MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS = 30.28* (1. -(11.42/100)) + 18. * (11.42/100) =   28.87

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  203.800 / (SQRT( 28.87 * 30.12)  *   9. =   55.14 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   55.14 * 20612. 3600/144 =   28414632. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

         17.647 *   28414632. *  30.12 * (1. - (11.42/100))
QSSTD = ----------------------------------------------------- =   17274784. SCFH
                     ( 314. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

      (305.58*( 314.+460.))*((0.002669*  138.)+(   50.268*1.003*( 30.10+(    .974/13.6)))/(  74.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- = 101.46 PERCENT
                                      90. *     55.14 *   30.12 *  .224 *  .224


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    229.3 * 15.43 /    50.261 =       .0704 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/11/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	68M5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	6 FT GLASS
OPERATOR	PR RA JP	NOZZLE : I.D.	.227
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.10	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	.25	METER BOX NUMBER	
FILTER NUMBER(S)	3531062	METER HEAD DIFF.	1.50
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 8.5 IN.HG		
METER CALIB. FACTOR	.960	K FACTOR	941.3

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	DRY GAS METER TEMP (DEG.F) OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	1050	287.808									
	10.0	1100	293.165	.700	.85	.85	311.	63.	63.	4.0	319.	60.
	20.0	1110	299.214	.650	.79	.79	313.	64.	63.	4.0	335.	56.
	30.0	1120	304.890	.650	.79	.79	313.	68.	64.	4.5	332.	56.
	40.0	1130	310.472	.650	.79	.79	315.	72.	64.	4.5	319.	56.
	50.0	1140	316.167	.670	.81	.81	316.	74.	66.	5.0	329.	58.
	60.0	1150	321.872	.670	.81	.81	314.	75.	67.	6.0	332.	58.
	70.0	1200	327.592	.670	.81	.81	316.	76.	68.	6.0	326.	58.
	80.0	1210	333.200	.650	.79	.79	315.	77.	69.	6.5	330.	60.
	90.0	1220	338.850	.650	.79	.79	317.	77.	69.	7.0	336.	60.
TOTALS	90.0		51.042									
AVERAGE					.80	.80	314.	72.	66.	5.3	329.	58.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS

TEST TEAM LEADER

PR RA JP

TEST 68M5B UNIT 2 EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/11/83	02/11/83
TB	TIME-START	1050	1050
TF	TIME-FINISH	1220	1220
TT	NET TIME OF TEST, MIN.	90.0	90.0
NP	NET SAMPLING POINTS	9	9
Y	METER CALIBRATION FACTOR	.960	.960
DN	SAMPLING NOZZLE DIAMETER	.227 IN	5.8 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	.80 IN-H2O	20.4 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	51.042 CU-FT	1.445 CU-M
TM	AVERAGE GAS METER TEMP	68.8 F	20.5 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	49.314 SCF	1.396 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	136.3	136.3
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	6.416 SCF	.182 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.51	11.51
FMD	MOLE FRACTION DRY GAS	.885	.885
PCO2	PERCENT CO2 BY VOL., DRY	13.60	13.60
PO2	PERCENT O2 BY VOL., DRY	2.50	2.50
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	83.90	83.90
MD	MOLECULAR WT-DRY STACK GAS	30.28	30.28

MWS	MOLECULAR WT-STACK GAS	28.86		28.86	
PB	BAROMETRIC PRESSURE	30.10	IN-HG	764.54	MM-HG
PSI	STATIC PRES OF STACK GAS	.25	IN-H2O	6.35	MM-H2O
PS	STACK PRES, ABS.	30.12	IN-HG	765.01	MM-HG
TS	AVERAGE STACK TEMP	314.	F	157.	C
VS	AVG STACK GAS VELOCITY	55.2	FPS	16.8	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17259472.	SCFH	488737.	SCMH
QS	ACTUAL STACK FLOW RATE	28420484.	ACFH	804783.	ACMH
ISO	PERCENT ISOKINETIC	97.0		97.0	
MN	AMBIENT PARTICULATE MG, EPA 5	216.8		216.8	
CS	AMBIENT PARTICULATE	.0678	GR/DSCF*	155.269	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO. 6BM5B

UNIT 2 EAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

$$VMSTD = \frac{17.647 * 51.042 * .960 * (30.10 + .803 / 13.6)}{(69. + 460.)} = 49.314 \text{ DSCF}$$

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 * 136. = 6.42 SCF

PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

$$BWO = \frac{100. * 6.42}{49.314 + 6.42} = 11.51 \text{ PERCENT}$$

MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

$$FMD = \frac{100. - 11.5}{100.} = .885$$

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.60*44/100) + (2.5*32/100) + ((83.9+ .0) * 28/100 = 30.28

MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS = 30.28* (1. -(11.51/100)) + 18. * (11.51/100) = 28.86

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  203.800 / (SQRT( 28.86 * 30.12)  *   9. =   55.15 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   55.15 * 20612. 3600/144 =   28420484. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

          17.647 *   28420484. *  30.12 * (1. - (11.51/100))
QSSTD = -------------------------------------------------- =   17259472. SCFH
                      ( 314. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 314.+460.))*((0.002669*  136.)+(   51.042* .960*( 30.10+(    .803/13.6))/(  69.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- =  97.02 PERCENT
                                     90. *     55.15 *   30.12 *  .227 *  .227


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    216.8 * 15.43 /    49.314 =       .0678 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/11/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	6CM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	6 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.211
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.10	SAMPLE BOX NUMBER	OAC
STATIC PRESS.(IN.H2O)	.25	METER BOX NUMBER	FB5
FILTER NUMBER(S)	3531108	METER HEAD DIFF.	1.84
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ .6 IN.HG		
METER CALIB. FACTOR	.983	K FACTOR	937.4

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	1050	353.557									
	10.0	1100	358.565	.700	.85	.85	311.	68.	68.	3.5	313.	59.
	20.0	1110	363.343	.650	.79	.79	313.	70.	68.	3.5	320.	58.
	30.0	1120	368.650	.650	.79	.79	313.	74.	69.	4.0	319.	57.
	40.0	1130	373.500	.650	.79	.79	315.	80.	70.	4.0	322.	60.
	50.0	1140	378.300	.670	.81	.81	316.	82.	71.	4.5	316.	60.
	60.0	1150	382.780	.670	.81	.81	314.	84.	72.	4.5	326.	59.
	70.0	1200	387.625	.670	.81	.81	316.	84.	73.	5.0	323.	57.
	80.0	1210	392.655	.650	.79	.79	315.	85.	74.	5.0	327.	60.
	90.0	1220	397.318	.650	.78	.78	317.	86.	75.	5.5	326.	60.
TOTALS	90.0		43.761									
AVERAGE					.80	.80	314.	79.	71.	4.4	321.	59.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS   TEST TEAM LEADER

CLARKE

TEST 6CM5B   UNIT TWO FAST

		ENGLISH UNITS		METRIC UNITS	
TEST DATE		02/11/83		02/11/83	
TB	TIME-START	1050		1050	
TF	TIME-FINISH	1220		1220	
TT	NET TIME OF TEST, MIN.	90.0		90.0	
NP	NET SAMPLING POINTS	9		9	
Y	METER CALIBRATION FACTOR	.983		.983	
DN	SAMPLING NOZZLE DIAMETER	.211	IN	5.4	MM
CP	PITOT TUBE COEFFICIENT	.84		.84	
PM	AVERAGE ORIFICE PRESSURE DROP	.80	IN-H2O	20.4	MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	43.761	CU-FT	1.239	CU-M
TM	AVERAGE GAS METER TEMP	75.2	F	24.0	C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	42.780	SCF	1.211	SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	117.7		117.7	
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	5.540	SCF	.157	SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.47		11.47	
FMD	MOLE FRACTION DRY GAS	.885		.885	
PCO2	PERCENT CO2 BY VOL., DRY	13.60		13.60	
PO2	PERCENT O2 BY VOL., DRY	2.50		2.50	
PCO	PERCENT CO BY VOL., DRY	.00		.00	
PN2	PERCENT N2 BY VOL., DRY	83.90		83.90	
MD	MOLECULAR WT-DRY STACK GAS	30.28		30.28	

MWS	MOLECULAR WT-STACK GAS	28.87		28.87	
PB	BAROMETRIC PRESSURE	30.10	IN-HG	764.54	MM-HG
PSI	STATIC PRES OF STACK GAS	.25	IN-H2O	6.35	MM-H2O
PS	STACK PRES, ABS.	30.12	IN-HG	765.01	MM-HG
TS	AVERAGE STACK TEMP	314.	F	157.	C
VS	AVG STACK GAS VELOCITY	55.1	FPS	16.8	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17266852.	SCFH	488945.	SCMH
QS	ACTUAL STACK FLOW RATE	28417676.	ACFH	804703.	ACMH
ISO	PERCENT ISOKINETIC	97.4		97.4	
MN	AMBIENT PARTICULATE MG. EPA 5	169.6		169.6	
CS	AMBIENT PARTICULATE	.0612	GR/DSCF*	140.017	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO. 6CM5B

UNIT TWO EAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

```
VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    43.761 *  .983 * ( 30.10 +  .802 / 13.6)
VMSTD = -------------------------------------------------------- =     42.780 DSCF
                             (  75. + 460.)
```

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

```
VWC = .04707 * VLC

VWC = .04707 *  118. =   5.54 SCF
```

PERCENT MOISTURE IN STACK GAS

```
BWO = (100. * VWC) / (VMSTD + VWC)

          100. *    5.54
BWO = -------------------------- = 11.47 PERCENT
            42.780 +   5.54
```

MOLE FRACTION OF DRY STACK GAS

```
FMD = (100. - BWO) / 100.

          100. -  11.5
FMD = ----------------------- =   .885
               100.
```

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

```
MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.60*44/100) + ( 2.5*32/100) + ((83.9+ .0) * 28/100 =   30.28
```

MOLECULAR WEIGHT OF STACK GAS

```
MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.28* (1. -(11.47/100)) + 18. * (11.47/100) =   28.87
```

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  203.800 / (SQRT( 28.87 * 30.12)  *   9. =   55.15 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   55.15 * 20612. 3600/144 =   28417676. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

          17.647 *   28417676. *  30.12 * (1. - (11.47/100))
QSSTD = --------------------------------------------------- =   17266852. SCFH
                    ( 314. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 314.+460.))*((0.002669*  118.)+(   43.761* .983*( 30.10+(    .802/13.6))/(  75.+460.)))
ISO = ------------------------------------------------------------------------------------------------ =  97.37 PERCENT
                                   90. *     55.15 *   30.12 *  .211 *  .211


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    169.6 * 15.43 /    42.780 =       .0612 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/11/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	6DM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.210
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.10	SAMPLE BOX NUMBER	UAD
STATIC PRESS.(IN.H2O)	.25	METER BOX NUMBER	FB4
FILTER NUMBER(S)	3531090	METER HEAD DIFF.	1.88
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.015 CFM @ 7.0 IN.HG		
METER CALIB. FACTOR	1.030	K FACTOR	937.4

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	1050	909.442									
	10.0	1100	914.580	.700	.85	.85	311.	66.	65.	5.0	312.	62.
	20.0	1110	919.185	.650	.79	.79	313.	68.	66.	4.5	328.	60.
	30.0	1120	924.225	.650	.79	.79	313.	71.	66.	5.0	332.	58.
	40.0	1130	928.600	.650	.79	.79	315.	74.	68.	5.5	333.	61.
	50.0	1140	933.490	.670	.81	.81	316.	76.	69.	5.5	326.	60.
	60.0	1150	937.937	.670	.81	.81	314.	77.	70.	6.0	326.	59.
	70.0	1200	942.445	.670	.81	.81	316.	78.	71.	6.5	309.	58.
	80.0	1210	947.200	.650	.79	.79	315.	78.	71.	7.0	321.	59.
	90.0	1220	951.818	.650	.78	.78	317.	78.	72.	7.0	331.	60.
TOTALS	90.0		42.376									
AVERAGE					.80	.80	314.	74.	69.	5.8	324.	60.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS

TEST TEAM LEADER

CLARKE

TEST 6DM5B UNIT TWO EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/11/83	02/11/83
TB	TIME-START	1050	1050
TF	TIME-FINISH	1220	1220
TT	NET TIME OF TEST, MIN.	90.0	90.0
NP	NET SAMPLING POINTS	9	9
Y	METER CALIBRATION FACTOR	1.030	1.030
DN	SAMPLING NOZZLE DIAMETER	.210 IN	5.3 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	.80 IN-H2O	20.4 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	42.376 CU-FT	1.200 CU-M
TM	AVERAGE GAS METER TEMP	71.3 F	21.9 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	43.720 SCF	1.238 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	116.2	116.2
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	5.470 SCF	.155 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.12	11.12
FMD	MOLE FRACTION DRY GAS	.889	.889
PCO2	PERCENT CO2 BY VOL., DRY	13.60	13.60
PO2	PERCENT O2 BY VOL., DRY	2.50	2.50
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	83.90	83.90
MD	MOLECULAR WT-DRY STACK GAS	30.28	30.28

MWS	MOLECULAR WT-STACK GAS	28.91		28.91	
PB	BAROMETRIC PRFSSURE	30.10	IN-HG	764.54	MM-HG
PSI	STATIC PRES OF STACK GAS	.25	IN-H2O	6.35	MM-H2O
PS	STACK PRES, ABS.	30.12	IN-HG	765.01	MM-HG
TS	AVERAGE STACK TEMP	314.	F	157.	C
VS	AVG STACK GAS VELOCITY	55.1	FPS	16.8	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17321612.	SCFH	490496.	SCMH
QS	ACTUAL STACK FLOW RATE	28396772.	ACFH	804111.	ACMH
ISO	PERCENT ISOKINETIC	100.1		100.1	
MN	AMBIENT PARTICULATE MG. EPA 5	186.1		186.1	
CS	AMBIENT PARTICULATE	.0657	GR/DSCF*	150.336	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO. 6DM5B

UNIT TWO EAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

$$VMSTD = \frac{17.647 * 42.376 * 1.030 * (30.10 + .802 / 13.6)}{(71. + 460.)} = 43.720 \text{ DSCF}$$

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 * 116. = 5.47 SCF

PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

$$BWO = \frac{100. * 5.47}{43.720 + 5.47} = 11.12 \text{ PERCENT}$$

MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

$$FMD = \frac{100. - 11.1}{100.} = .889$$

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.60*44/100) + (2.5*32/100) + ((83.9+ .0) * 28/100 = 30.28

MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS = 30.28* (1. -(11.12/100)) + 18. * (11.12/100) = 28.91

A-120

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  203.800 / (SQRT( 28.91 * 30.12)  *   9. =   55.11 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   55.11 * 20612. 3600/144 =   28396772. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

          17.647 *   28396772. *  30.12 * (1. - (11.12/100))
QSSTD = --------------------------------------------------- =   17321612. SCFH
                    ( 314. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

      (305.58*( 314.+460.))*((0.002669*  116.)+(   42.376*1.030*( 30.10+(    .802/13.6))/(  71.+460.)))
ISO = ------------------------------------------------------------------------------------------------- = 100.14 PERCENT
                                  90. *     55.11 *    30.12 *  .210 *  .210


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    186.1 * 15.43 /    43.720 =       .0657 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/11/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	7AM5BW
SAMPLE TYPE	M5BW	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	PR RA JP	NOZZLE : I.D.	.223
AMBIENT TEMP.(DEG.F)	65.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.11	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	.20	METER BOX NUMBER	FB4
FILTER NUMBER(S)	35310125	METER HEAD DIFF.	1.72
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	206	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 8.0 IN.HG		
METER CALIB. FACTOR	1.003	K FACTOR	1129.5

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	1330	808.703									
	10.0	1340	814.370	.670	.98	.98	315.	76.	74.	4.0	325.	59.
	20.0	1350	819.924	.650	.94	.94	317.	79.	75.	4.0	343.	60.
	30.0	1400	825.527	.670	.98	.98	318.	80.	75.	4.0	330.	56.
	40.0	1410	831.125	.670	.98	.98	318.	83.	75.	4.5	318.	57.
	50.0	1420	836.570	.640	.93	.93	318.	86.	78.	5.0	332.	58.
	60.0	1430	842.295	.700	1.01	1.01	320.	87.	77.	6.0	323.	60.
	70.0	1440	847.913	.670	.97	.97	320.	88.	77.	6.0	327.	58.
	80.0	1450	853.352	.670	.97	.97	321.	88.	78.	6.5	338.	58.
	90.0	1500	859.095	.670	.97	.97	321.	88.	79.	7.0	339.	59.
TOTALS	90.0		50.392									
AVERAGE					.97	.97	319.	84.	76.	5.2	331.	58.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS — TEST TEAM LEADER

PR RA JP

TEST 7AM58W UNIT 2 EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/11/83	02/11/83
TB	TIME-START	1330	1330
TF	TIME-FINISH	1500	1500
TT	NET TIME OF TEST, MIN.	90.0	90.0
NP	NET SAMPLING POINTS	9	9
Y	METER CALIBRATION FACTOR	1.003	1.003
DN	SAMPLING NOZZLE DIAMETER	.223 IN	5.7 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	.97 IN-H2O	24.6 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	50.392 CU-FT	1.427 CU-M
TM	AVERAGE GAS METER TEMP	80.2 F	26.8 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	49.836 SCF	1.411 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	134.9	134.9
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	6.350 SCF	.180 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.30	11.30
FMD	MOLE FRACTION DRY GAS	.887	.887
PCO2	PERCENT CO2 BY VOL., DRY	13.40	13.40
PO2	PERCENT O2 BY VOL., DRY	2.60	2.60
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	84.00	84.00
MD	MOLECULAR WT-DRY STACK GAS	30.25	30.25

MWS	MOLECULAR WT-STACK GAS	28.86		28.86	
PB	BAROMETRIC PRESSURE	30.11	IN-HG	764.79	MM-HG
PSI	STATIC PRES OF STACK GAS	.20	IN-H2O	5.08	MM-H2O
PS	STACK PRES, ABS.	30.12	IN-HG	765.17	MM-HG
TS	AVERAGE STACK TEMP	319.	F	159.	C
VS	AVG STACK GAS VELOCITY	55.5	FPS	16.9	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17327652.	SCFH	490667.	SCMH
QS	ACTUAL STACK FLOW RATE	28614128.	ACFH	810266.	ACMH
ISO	PERCENT ISOKINETIC	101.2		101.2	
MN	AMBIENT PARTICULATE MG. EPA 5	100.0		100.0	
CS	AMBIENT PARTICULATE	.0310	GR/DSCF*	70.868	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO.7AM5HW

UNIT 2 EAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

```
VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

         17.647 *    50.392 * 1.003 * ( 30.11 +  .970 / 13.6)
VMSTD = ------------------------------------------------------- =     49.836 DSCF
                                 (  80. + 460.)
```

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

```
VWC = .04707 * VLC

VWC = .04707 *  135. =   6.35 SCF
```

PERCENT MOISTURE IN STACK GAS

```
BWO = (100. * VWC) / (VMSTD + VWC)

        100. *   6.35
BWO = -------------------------- = 11.30 PERCENT
          49.836 +   6.35
```

MOLE FRACTION OF DRY STACK GAS

```
FMD = (100. - BWO) / 100.

        100. -  11.3
FMD = ----------------------- =   .887
             100.
```

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

```
MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.40*44/100) + ( 2.6*32/100) + ((84.0+ .0) * 28/100 =   30.25
```

MOLECULAR WEIGHT OF STACK GAS

```
MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.25* (1. -(11.30/100)) + 18. * (11.30/100) =   28.86
```

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  205.214 / (SQRT( 28.86 * 30.12)  *   9. =   55.53 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   55.53 * 20612. 3600/144 =   28614128. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

           17.647 *   28614128. *  30.12 * (1. - (11.30/100))
QSSTD = ---------------------------------------------------- =   17327652. SCFH
                       ( 319. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

        (305.58*( 319.+460.))*((0.002669*  135.)+(   50.392*1.003*( 30.11+(    .970/13.6))/(  80.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- = 101.20 PERCENT
                                   90. *     55.53 *    30.12 *  .223 *  .223


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    100.0 * 15.43 /    49.836 =      .0310 GR/DSCF
```

FIELD DATA

PLANT	-	DATE	02/11/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	7BM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	6 FT GLASS
OPERATOR	PR RA JP	NOZZLE : I.D.	.221
AMBIENT TEMP.(DEG.F)	65.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.11	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	.20	METER BOX NUMBER	FB6
FILTER NUMBER(S)	35310072	METER HEAD DIFF.	1.50
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	206	HEATER BOX SETTING	320.
LEAKAGE	.015 CFM @ 8.5 IN.HG		
METER CALIB. FACTOR	.960	K FACTOR	950.2
READ & RECORD DATA EVERY 10.0 MINUTES			

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	DRY GAS METER TEMP (DEG.F) OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	1330	339.104									
	10.0	1340	344.847	.670	.82	.82	315.	69.	70.	4.0	304.	58.
	20.0	1350	350.452	.650	.79	.79	317.	70.	70.	3.5	341.	59.
	30.0	1400	356.187	.670	.82	.82	318.	73.	70.	4.0	339.	61.
	40.0	1410	361.878	.670	.82	.82	318.	76.	70.	4.5	330.	61.
	50.0	1420	367.536	.640	.78	.78	318.	78.	71.	4.5	327.	61.
	60.0	1430	373.376	.700	.85	.85	320.	79.	71.	6.0	325.	61.
	70.0	1440	379.100	.670	.82	.82	320.	80.	72.	5.5	337.	60.
	80.0	1450	384.671	.670	.82	.82	321.	80.	73.	6.0	336.	60.
	90.0	1500	390.580	.670	.82	.82	321.	80.	73.	6.5	329.	60.
TOTALS	90.0		51.476									
AVERAGE					.82	.82	319.	76.	71.	4.9	330.	60.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS

TEST TEAM LEADER

PR RA JP

TEST 7RM5B UNIT 2 EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/11/83	02/11/83
TB	TIME-START	1330	1330
TF	TIME-FINISH	1500	1500
TT	NET TIME OF TEST, MIN.	90.0	90.0
NP	NET SAMPLING POINTS	9	9
Y	METER CALIBRATION FACTOR	.960	.960
DN	SAMPLING NOZZLE DIAMETER	.221 IN	5.6 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	.82 IN-H2O	20.7 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	51.476 CU-FT	1.458 CU-M
TM	AVERAGE GAS METER TEMP	73.6 F	23.1 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	49.306 SCF	1.396 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	130.7	130.7
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	6.152 SCF	.174 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.09	11.09
FMD	MOLE FRACTION DRY GAS	.889	.889
PCO2	PERCENT CO2 BY VOL., DRY	13.40	13.40
PO2	PERCENT O2 BY VOL., DRY	2.60	2.60
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	84.00	84.00
MD	MOLECULAR WT-DRY STACK GAS	30.25	30.25

MWS	MOLECULAR WT-STACK GAS	28.89		28.89	
PB	BAROMETRIC PRESSURE	30.11	IN-HG	764.79	MM-HG
PSI	STATIC PRES OF STACK GAS	.20	IN-H2O	5.08	MM-H2O
PS	STACK PRES, ABS.	30.12	IN-HG	765.17	MM-HG
TS	AVERAGE STACK TEMP	319.	F	159.	C
VS	AVG STACK GAS VELOCITY	55.5	FPS	16.9	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17360644.	SCFH	491601.	SCMH
QS	ACTUAL STACK FLOW RATE	28601504.	ACFH	809909.	ACMH
ISO	PERCENT ISOKINETIC	101.7		101.7	
MN	AMBIENT PARTICULATE MG. EPA 5	221.9		221.9	
CS	AMBIENT PARTICULATE	.0694	GR/DSCF*	158.948	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

```
      EXAMPLE PARTICULATE CALCULATIONS TEST NO. 7BM5B

           UNIT 2 EAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    51.476 *  .960 * ( 30.11 +  .816 / 13.6)
VMSTD = ------------------------------------------------------- =     49.306 DSCF
                            (  74. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  131. =   6.15 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

          100. *   6.15
BWO = -------------------------- = 11.09 PERCENT
            49.306 +   6.15


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

          100. -  11.1
FMD = ----------------------- =   .889
               100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.40*44/100) + ( 2.6*32/100) + ((84.0+ .0) * 28/100 =   30.25


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.25* (1. -(11.09/100)) + 18. * (11.09/100) =   28.89
```

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  205.214 / (SQRT( 28.89 * 30.12)  *   9. =   55.50 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   55.50 * 20612. 3600/144 =   28601504. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

            17.647 *   28601504. *  30.12 * (1. - (11.09/100))
QSSTD = ---------------------------------------------------- =   17360644. SCFH
                         ( 319. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 319.+460.))*((0.002669*  131.)+(    51.476* .960*( 30.11+(     .816/13.6))/(  74.+460.)))
ISO = ------------------------------------------------------------------------------------------------- = 101.75 PERCENT
                                     90. *      55.50 *   30.12 *   .221 *   .221


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    221.9 * 15.43 /    49.306 =       .0694 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/11/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	7CM5BW
SAMPLE TYPE	M5BW	PROBE LENGTH & TYPE	6 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.221
AMBIENT TEMP.(DEG.F)	65.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.11	SAMPLE BOX NUMBER	0AC
STATIC PRESS.(IN.H2O)	.20	METER BOX NUMBER	FB5
FILTER NUMBER(S)	3531132	METER HEAD DIFF.	1.84
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	206	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 7.0 IN.HG		
METER CALIB. FACTOR	.983	K FACTOR	1156.2
READ & RECORD DATA EVERY	10.0 MINUTES		

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	1330	397.594									
	10.0	1340	403.390	.670	1.00	1.00	315.	75.	74.	5.0	306.	58.
	20.0	1350	408.675	.650	.97	.97	317.	76.	74.	4.5	335.	60.
	30.0	1400	414.075	.670	1.00	1.00	318.	80.	74.	5.0	318.	58.
	40.0	1410	419.444	.670	1.00	1.00	318.	84.	74.	5.5	322.	54.
	50.0	1420	424.696	.640	.95	.95	318.	88.	75.	5.5	315.	56.
	60.0	1430	430.185	.700	1.04	1.04	320.	88.	76.	6.0	314.	58.
	70.0	1440	435.555	.670	.99	.99	320.	89.	78.	6.5	318.	60.
	80.0	1450	440.981	.670	.99	.99	321.	90.	78.	7.0	317.	62.
	90.0	1500	446.378	.670	.99	.99	321.	90.	80.	7.0	317.	62.
TOTALS	90.0		48.784									
AVERAGE					.99	.99	319.	84.	76.	5.8	318.	59.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS | TEST TEAM LEADER

CLARKE

TEST 7CM5BW UNIT TWO EAST

		ENGLISH UNITS		METRIC UNITS	
TEST DATE		02/11/83		02/11/83	
TB	TIME-START	1330		1330	
TF	TIME-FINISH	1500		1500	
TT	NET TIME OF TEST, MIN.	90.0		90.0	
NP	NET SAMPLING POINTS	9		9	
Y	METER CALIBRATION FACTOR	.983		.983	
DN	SAMPLING NOZZLE DIAMETER	.221	IN	5.6	MM
CP	PITOT TUBE COEFFICIENT	.84		.84	
PM	AVERAGE ORIFICE PRESSURE DROP	.99	IN-H2O	25.2	MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	48.784	CU-FT	1.381	CU-M
TM	AVERAGE GAS METER TEMP	80.2	F	26.8	C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	47.286	SCF	1.339	SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	128.9		128.9	
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	6.067	SCF	.172	SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.37		11.37	
FMD	MOLE FRACTION DRY GAS	.886		.886	
PCO2	PERCENT CO2 BY VOL., DRY	13.40		13.40	
PO2	PERCENT O2 BY VOL., DRY	2.60		2.60	
PCO	PERCENT CO BY VOL., DRY	.00		.00	
PN2	PERCENT N2 BY VOL., DRY	84.00		84.00	
MD	MOLECULAR WT-DRY STACK GAS	30.25		30.25	

MWS	MOLECULAR WT-STACK GAS	28.86		28.86	
PB	BAROMETRIC PRESSURE	30.11	IN-HG	764.79	MM-HG
PSI	STATIC PRES OF STACK GAS	.20	IN-H2O	5.08	MM-H2O
PS	STACK PRES, ABS.	30.12	IN-HG	765.17	MM-HG
TS	AVERAGE STACK TEMP	319.	F	159.	C
VS	AVG STACK GAS VELOCITY	55.5	FPS	16.9	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17316460.	SCFH	490350.	SCMH
QS	ACTUAL STACK FLOW RATE	28618416.	ACFH	810388.	ACMH
ISO	PERCENT ISOKINETIC	97.8		97.8	
MN	AMBIENT PARTICULATE MG. EPA 5	100.0		100.0	
CS	AMBIENT PARTICULATE	.0326	GR/DSCF*	74.689	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

```
      EXAMPLE PARTICULATE CALCULATIONS TEST NO.7CM5BW

           UNIT TWO EAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    48.784 *   .983 * ( 30.11 +   .992 / 13.6)
VMSTD = ------------------------------------------------------- =      47.286 DSCF
                           (  80. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  129. =   6.07 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

        100. *   6.07
BWO = -------------------------- = 11.37 PERCENT
          47.286 +   6.07


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

        100. -  11.4
FMD = ----------------------- =   .886
             100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.40*44/100) + ( 2.6*32/100) + ((84.0+ .0) * 28/100 =   30.25


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.25* (1. -(11.37/100)) + 18. * (11.37/100) =   28.86
```

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  205.214 / (SQRT( 28.86 * 30.12)  *   9. =   55.54 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   55.54 * 20612. 3600/144 =   28618416. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

           17.647 *   28618416. *  30.12 * (1. - (11.37/100))
QSSTD = ---------------------------------------------------- =   17316460. SCFH
                      ( 319. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 319.+460.))*((0.002669*  129.)+(   48.784* .983*( 30.11+(    .992/13.6))/(  80.+460.)))
ISO = ------------------------------------------------------------------------------------------------- =  97.83 PERCENT
                                   90. *     55.54 *   30.12 *  .221 *  .221


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    100.0 * 15.43 /    47.286 =       .0326 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/11/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	7DM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.215
AMBIENT TEMP.(DEG.F)	65.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.11	SAMPLE BOX NUMBER	QAD
STATIC PRESS.(IN.H2O)	.20	METER BOX NUMBER	FB4
FILTER NUMBER(S)	3531131	METER HEAD DIFF.	1.88
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	206	HEATER BOX SETTING	320.
LEAKAGE	.001 CFM @ 6.0 IN.HG		
METER CALIB. FACTOR	1.030	K FACTOR	1156.2
READ & RECORD DATA EVERY	10.0 MINUTES		

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	DRY GAS METER TEMP (DEG.F) OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	1330	952.183									
	10.0	1340	957.870	.670	1.00	1.00	315.	72.	70.	3.0	329.	58.
	20.0	1350	962.962	.650	.97	.97	317.	72.	70.	3.5	317.	54.
	30.0	1400	968.125	.670	1.00	1.00	318.	75.	71.	3.0	322.	52.
	40.0	1410	973.353	.670	1.00	1.00	318.	78.	72.	3.0	317.	50.
	50.0	1420	978.444	.640	.95	.95	318.	80.	72.	3.5	306.	54.
	60.0	1430	983.737	.700	1.04	1.04	320.	81.	74.	4.0	324.	60.
	70.0	1440	988.898	.670	.99	.99	320.	82.	74.	4.5	337.	61.
	80.0	1450	994.170	.670	.99	.99	321.	82.	74.	5.0	329.	60.
	90.0	1500	999.409	.670	.99	.99	321.	82.	75.	5.0	322.	62.
TOTALS	90.0		47.226									
AVERAGE					.99	.99	319.	78.	72.	3.8	323.	57.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS TEST TEAM LEADER

CLARKE

TEST 7DM5B UNIT TWO EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/11/83	02/11/83
TB	TIME-START	1330	1330
TF	TIME-FINISH	1500	1500
TT	NET TIME OF TEST, MIN.	90.0	90.0
NP	NET SAMPLING POINTS	9	9
Y	METER CALIBRATION FACTOR	1.030	1.030
DN	SAMPLING NOZZLE DIAMETER	.215 IN	5.5 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	.99 IN-H2O	25.2 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	47.226 CU-FT	1.337 CU-M
TM	AVERAGE GAS METER TEMP	75.3 F	24.1 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	48.398 SCF	1.370 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	128.5	128.5
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	6.048 SCF	.171 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.11	11.11
FMD	MOLE FRACTION DRY GAS	.889	.889
PCO2	PERCENT CO2 BY VOL., DRY	13.40	13.40
PO2	PERCENT O2 BY VOL., DRY	2.60	2.60
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	84.00	84.00
MD	MOLECULAR WT-DRY STACK GAS	30.25	30.25

MWS	MOLECULAR WT-STACK GAS	28.89		28.89	
PB	BAROMETRIC PRESSURE	30.11	IN-HG	764.79	MM-HG
PSI	STATIC PRES OF STACK GAS	.20	IN-H2O	5.08	MM-H2O
PS	STACK PRES, ABS.	30.12	IN-HG	765.17	MM-HG
TS	AVERAGE STACK TEMP	319.	F	159.	C
VS	AVG STACK GAS VELOCITY	55.5	FPS	16.9	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17358136.	SCFH	491530.	SCMH
QS	ACTUAL STACK FLOW RATE	28602468.	ACFH	809936.	ACMH
ISO	PERCENT ISOKINETIC	105.5		105.5	
MN	AMBIENT PARTICULATE MG. EPA 5	215.5		215.5	
CS	AMBIENT PARTICULATE	.0687	GR/DSCF*	157.259	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

```
      EXAMPLE PARTICULATE CALCULATIONS TEST NO. 7DM5B

           UNIT TWO EAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    47.226 * 1.030 * ( 30.11 +  .992 / 13.6)
VMSTD = ------------------------------------------------------ =     48.398 DSCF
                           (  75. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  129. =   6.05 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

        100. *   6.05
BWO = -------------------------- = 11.11 PERCENT
          48.398 +   6.05


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

        100. -  11.1
FMD = ----------------------- =   .889
               100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.40*44/100) + ( 2.6*32/100) + ((84.0+ .0) * 28/100 =   30.25


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.25* (1. -(11.11/100)) + 18. * (11.11/100) =   28.89
```

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  205.214 / (SQRT( 28.89 * 30.12)  *   9. =   55.51 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   55.51 * 20612. 3600/144 =   28602468. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

           17.647 *   28602468. *  30.12 * (1. - (11.11/100))
QSSTD = ----------------------------------------------------- =   17358136. SCFH
                          ( 319. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

        (305.58*( 319.+460.))*((0.002669*  129.)+(   47.226*1.030*( 30.11+(    .992/13.6))/(  75.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- = 105.54 PERCENT
                                       90. *     55.51 *   30.12 *  .215 *  .215


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    215.5 * 15.43 /    48.398 =       .0687 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/11/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	8AM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	PR RA JP	NOZZLE : I.D.	.305
AMBIENT TEMP.(DEG.F)	70.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.08	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	.02	METER BOX NUMBER	FB4
FILTER NUMBER(S)		METER HEAD DIFF.	1.72
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 17.0 IN.HG		
METER CALIB. FACTOR	1.003	K FACTOR	3986.7
READ & RECORD DATA EVERY	10.0 MINUTES		

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	1620	860.601									
	10.0	0	871.024	.650	3.33	3.33	319.	76.	75.	9.0	311.	60.
	20.0	0	880.863	.620	3.18	3.18	318.	76.	74.	8.5	333.	62.
	30.0	0	890.491	.590	3.02	3.02	320.	79.	74.	9.0	319.	56.
	30.7	1650	891.157	.740	3.79	3.35	318.	81.	73.	15.0	320.	56.
TOTALS	30.7		30.556									
AVERAGE					3.33	3.22	319.	78.	74.	10.4	321.	59.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS

TEST TEAM LEADER

PR RA JP

TEST 8AM5B UNIT 2 EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/11/83	02/11/83
TB	TIME-START	1620	1620
TF	TIME-FINISH	1650	1650
TT	NET TIME OF TEST, MIN.	30.7	30.7
NP	NET SAMPLING POINTS	4	4
Y	METER CALIBRATION FACTOR	1.003	1.003
DN	SAMPLING NOZZLE DIAMETER	.305 IN	7.7 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	3.22 IN-H2O	81.8 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	30.556 CU-FT	.865 CU-M
TM	AVERAGE GAS METER TEMP	76.0 F	24.4 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	30.591 SCF	.866 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	81.6	81.6
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	3.841 SCF	.109 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.16	11.16
FMD	MOLE FRACTION DRY GAS	.888	.888
PCO2	PERCENT CO2 BY VOL., DRY	13.30	13.30
PO2	PERCENT O2 BY VOL., DRY	2.70	2.70
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	84.00	84.00
MD	MOLECULAR WT-DRY STACK GAS	30.24	30.24

MWS	MOLECULAR WT-STACK GAS	28.87		28.87	
PB	BAROMETRIC PRESSURE	30.08	IN-HG	764.03	MM-HG
PSI	STATIC PRES OF STACK GAS	.02	IN-H2O	.51	MM-H2O
PS	STACK PRES, ABS.	30.08	IN-HG	764.07	MM-HG
TS	AVERAGE STACK TEMP	319.	F	159.	C
VS	AVG STACK GAS VELOCITY	54.8	FPS	16.7	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17093528.	SCFH	484037.	SCMH
QS	ACTUAL STACK FLOW RATE	28224616.	ACFH	799237.	ACMH
ISO	PERCENT ISOKINETIC	98.7		98.7	
MN	AMBIENT PARTICULATE MG. EPA 5	156.8		156.8	
CS	AMBIENT PARTICULATE	.0791	GR/DSCF*	181.031	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO. 8AM5B

UNIT 2 EAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

```
                17.647 *     30.556 * 1.003 * ( 30.08 + 3.220 / 13.6)
VMSTD = -----------------------------------------------------------------  =     30.591 DSCF
                                 (  76. + 460.)
```

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *   82. =   3.84 SCF

PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

```
          100. *    3.84
BWO = -------------------------- = 11.16 PERCENT
            30.591 +    3.84
```

MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

```
          100. -  11.2
FMD = ----------------------- =   .888
                100.
```

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.30*44/100) + (2.7*32/100) + ((84.0+ .0) * 28/100 =   30.24

MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS = 30.24* (1. -(11.16/100)) + 18. * (11.16/100) =   28.87

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *   89.911 / (SQRT( 28.87 * 30.08)  *   4. =   54.77 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   54.77 * 20612. 3600/144 =   28224616. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

          17.647 *   28224616. *  30.08 * (1. - (11.16/100))
QSSTD = ---------------------------------------------------- =   17093528. SCFH
                      ( 319. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 319.+460.))*((0.002669*   82.)+(   30.556*1.003*( 30.08+(   3.220/13.6))/(  76.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- =  98.68 PERCENT
                                 31. *     54.77 *   30.08 *  .305 *  .305


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    156.8 * 15.43 /    30.591 =       .0791 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/11/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	8BM5BP
SAMPLE TYPE	M5B P400	PROBE LENGTH & TYPE	6 FT GLASS
OPERATOR	PR RA JP	NOZZLE : I.D.	.307
AMBIENT TEMP.(DEG.F)	20.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.08	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	.02	METER BOX NUMBER	FB6
FILTER NUMBER(S)		METER HEAD DIFF.	1.50
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	400.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.013 CFM @ 23.0 IN.HG		
METER CALIB. FACTOR	.960	K FACTOR	3568.9
READ & RECORD DATA EVERY 10.0 MINUTES			

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	1620	390.904									
	10.0	0	401.501	.650	2.98	2.98	319.	69.	71.	12.5	322.	60.
	20.0	0	411.562	.620	2.84	2.75	318.	69.	70.	13.5	350.	60.
	30.0	1650	421.136	.590	2.75	2.50	320.	69.	69.	14.0	320.	60.
TOTALS	30.0		30.232									
AVERAGE					2.86	2.74	319.	69.	70.	13.3	331.	60.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS | TEST TEAM LEADER

PR RA JP

TEST 8BM5BP | UNIT 2 EAST

		ENGLISH UNITS		METRIC UNITS	
TEST DATE		02/11/83		02/11/83	
TB	TIME-START	1620		1620	
TF	TIME-FINISH	1650		1650	
TT	NET TIME OF TEST, MIN.	30.0		30.0	
NP	NET SAMPLING POINTS	3		3	
Y	METER CALIBRATION FACTOR	.960		.960	
DN	SAMPLING NOZZLE DIAMETER	.307	IN	7.8	MM
CP	PITOT TUBE COEFFICIENT	.84		.84	
PM	AVERAGE ORIFICE PRESSURE DROP	2.74	IN-H2O	69.7	MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	30.232	CU-FT	.856	CU-M
TM	AVERAGE GAS METER TEMP	69.5	F	20.8	C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	29.290	SCF	.829	SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	79.5		79.5	
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	3.742	SCF	.106	SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.33		11.33	
FMD	MOLE FRACTION DRY GAS	.887		.887	
PCO2	PERCENT CO2 BY VOL., DRY	13.30		13.30	
PO2	PERCENT O2 BY VOL., DRY	2.70		2.70	
PCO	PERCENT CO BY VOL., DRY	.00		.00	
PN2	PERCENT N2 BY VOL., DRY	84.00		84.00	
MD	MOLECULAR WT-DRY STACK GAS	30.24		30.24	

MWS	MOLECULAR WT-STACK GAS	28.85		28.85	
PB	BAROMETRIC PRESSURE	30.08	IN-HG	764.03	MM-HG
PSI	STATIC PRES OF STACK GAS	.02	IN-H2O	.51	MM-H2O
PS	STACK PRES, ABS.	30.08	IN-HG	764.07	MM-HG
TS	AVERAGE STACK TEMP	319.	F	159.	C
VS	AVG STACK GAS VELOCITY	53.6	FPS	16.3	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	16677352.	SCFH	472253.	SCMH
QS	ACTUAL STACK FLOW RATE	27600084.	ACFH	781552.	ACMH
ISO	PERCENT ISOKINETIC	97.8		97.8	
MN	AMBIENT PARTICULATE MG. EPA 5	111.5		111.5	
CS	AMBIENT PARTICULATE	.0587	GR/DSCF*	134.445	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO.88M58P

UNIT 2 EAST

```
VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

         17.647 *    30.232 *  .960 * ( 30.08 + 2.743 / 13.6)
VMSTD = ------------------------------------------------------ =     29.290 DSCF
                           (  70. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *   80. =   3.74 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

        100. *   3.74
BWO = -------------------------- = 11.33 PERCENT
          29.290 +   3.74


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

        100. -  11.3
FMD = ---------------------- =   .887
             100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.30*44/100) + ( 2.7*32/100) + ((84.0+ .0) * 28/100 =   30.24


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.24* (1. -(11.33/100)) + 18. * (11.33/100) =   28.85
```

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *   65.917 / (SQRT( 28.85 * 30.08)  *   3. =   53.56 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   53.56 * 20612. 3600/144 =   27600084. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

           17.647 *   27600084. *  30.08 * (1. - (11.33/100))
QSSTD = --------------------------------------------------- =   16677352. SCFH
                        ( 319. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 319.+460.))*((0.002669*   80.)+(   30.232* .960*( 30.08+(   2.743/13.6))/(  70.+460.)))
ISO = ------------------------------------------------------------------------------------------------ =  97.82 PERCENT
                                   30. *      53.56 *   30.08 *  .307 *  .307


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    111.5 * 15.43 /    29.290 =       .0587 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/11/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	8CM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	6 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.305
AMBIENT TEMP.(DEG.F)	70.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.08	SAMPLE BOX NUMBER	QAC
STATIC PRESS.(IN.H2O)	.02	METER BOX NUMBER	FB5
FILTER NUMBER(S)		METER HEAD DIFF.	1.84
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.001 CFM @ 13.0 IN.HG		
METER CALIB. FACTOR	.983	K FACTOR	4473.6

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	1620	446.569									
	10.0	1630	457.000	.650	3.73	3.73	319.	74.	75.	8.0	340.	62.
	20.0	1640	467.350	.620	3.57	3.57	318.	76.	74.	9.0	332.	58.
	30.0	1650	477.100	.590	3.38	3.38	320.	79.	74.	10.5	305.	58.
	30.8	1651	477.329	.740	4.26	4.26	318.	81.	74.	12.5	329.	50.
TOTALS	30.8		30.760									
AVERAGE					3.74	3.74	319.	78.	74.	10.0	327.	57.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS — TEST TEAM LEADER: CLARKE

TEST 8CM5B UNIT TWO EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/11/83	02/11/83
TB	TIME-START	1620	1620
TF	TIME-FINISH	1651	1651
TT	NET TIME OF TEST, MIN.	30.8	30.8
NP	NET SAMPLING POINTS	4	4
Y	METER CALIBRATION FACTOR	.983	.983
DN	SAMPLING NOZZLE DIAMETER	.305 IN	7.7 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	3.74 IN-H2O	94.9 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	30.760 CU-FT	.871 CU-M
TM	AVERAGE GAS METER TEMP	75.9 F	24.4 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	30.225 SCF	.856 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	83.6	83.6
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	3.935 SCF	.111 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.52	11.52
FMD	MOLE FRACTION DRY GAS	.885	.885
PCO2	PERCENT CO2 BY VOL., DRY	13.30	13.30
PO2	PERCENT O2 BY VOL., DRY	2.70	2.70
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	84.00	84.00
MD	MOLECULAR WT-DRY STACK GAS	30.24	30.24

MWS	MOLECULAR WT-STACK GAS	28.83		28.83	
PB	BAROMETRIC PRESSURE	30.08	IN-HG	764.03	MM-HG
PSI	STATIC PRES OF STACK GAS	.02	IN-H2O	.51	MM-H2O
PS	STACK PRES, ABS.	30.08	IN-HG	764.07	MM-HG
TS	AVERAGE STACK TEMP	319.	F	159.	C
VS	AVG STACK GAS VELOCITY	54.8	FPS	16.7	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17036632.	SCFH	482426.	SCMH
QS	ACTUAL STACK FLOW RATE	28246420.	ACFH	799854.	ACMH
ISO	PERCENT ISOKINETIC	97.5		97.5	
MN	AMBIENT PARTICULATE MG. EPA 5	112.6		112.6	
CS	AMBIENT PARTICULATE	.0575	GR/DSCF*	131.571	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

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EXAMPLE PARTICULATE CALCULATIONS TEST NO. 8CM5B

     UNIT TWO EAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    30.760 *  .983 * ( 30.08 + 3.735 / 13.6)
VMSTD = ----------------------------------------------------- =     30.225 DSCF
                            (  76. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *   84. =   3.94 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

        100. *   3.94
BWO = -------------------------- = 11.52 PERCENT
          30.225 +   3.94


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

        100. -  11.5
FMD = ----------------------- =   .885
            100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.30*44/100) + ( 2.7*32/100) + ((84.0+ .0) * 28/100 =   30.24


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.24* (1. -(11.52/100)) + 18. * (11.52/100) =   28.83
```

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *   .84 *   89.911 / (SQRT( 28.83 * 30.08)   *    4. =    54.82 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   54.82 * 20612. 3600/144 =   28246420. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

            17.647 *   28246420. *  30.08 * (1. - (11.52/100))
QSSTD = ---------------------------------------------------- =   17036632. SCFH
                        ( 319. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 319.+460.))*((0.002669*   84.)+(   30.760* .983*( 30.08+(   3.735/13.6))/(  76.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- =  97.51 PERCENT
                                  31. *     54.82 *   30.08 *  .305 *  .305


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    112.6 * 15.43 /    30.225 =       .0575 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/11/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	8DM5BP
SAMPLE TYPE	M5B-P400	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.304
AMBIENT TEMP.(DEG.F)	70.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.08	SAMPLE BOX NUMBER	UAD
STATIC PRESS.(IN.H2O)	.02	METER BOX NUMBER	FB4
FILTER NUMBER(S)		METER HEAD DIFF.	1.88
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	400.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.016 CFM @ 18.0 IN.HG		
METER CALIB. FACTOR	1.030	K FACTOR	4473.6

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	DRY GAS METER TEMP (DEG.F) OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	1620	999.812									
	10.0	1630	9.222	.650	3.73	3.73	319.	70.	70.	13.0	331.	62.
	20.0	1640	18.500	.620	3.57	3.30	318.	70.	70.	16.5	337.	64.
	30.0	1650	26.727	.590	3.38	2.70	320.	71.	69.	17.0	295.	64.
TOTALS	30.0		26.915									
AVERAGE					3.56	3.24	319.	70.	70.	15.5	321.	63.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS | TEST TEAM LEADER

CLARKE

TEST 8DM58P UNIT TWO EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/11/83	02/11/83
TB	TIME-START	1620	1620
TF	TIME-FINISH	1650	1650
TT	NET TIME OF TEST, MIN.	30.0	30.0
NP	NET SAMPLING POINTS	3	3
Y	METER CALIBRATION FACTOR	1.030	1.030
DN	SAMPLING NOZZLE DIAMETER	.304 IN	7.7 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	3.24 IN-H2O	82.4 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	26.915 CU-FT	.762 CU-M
TM	AVERAGE GAS METER TEMP	70.0 F	21.1 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	27.986 SCF	.792 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	73.3	73.3
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	3.450 SCF	.098 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	10.98	10.98
FMD	MOLE FRACTION DRY GAS	.890	.890
PCO2	PERCENT CO2 BY VOL., DRY	13.30	13.30
PO2	PERCENT O2 BY VOL., DRY	2.70	2.70
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	84.00	84.00
MD	MOLECULAR WT-DRY STACK GAS	30.24	30.24

MWS	MOLECULAR WT-STACK GAS	28.89		28.89	
PB	BAROMETRIC PRESSURE	30.08	IN-HG	764.03	MM-HG
PSI	STATIC PRES OF STACK GAS	.02	IN-H2O	.51	MM-H2O
PS	STACK PRES, ABS.	30.08	IN-HG	764.07	MM-HG
TS	AVERAGE STACK TEMP	319.	F	159.	C
VS	AVG STACK GAS VELOCITY	53.5	FPS	16.3	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	16731224.	SCFH	473778.	SCMH
QS	ACTUAL STACK FLOW RATE	27579440.	ACFH	780967.	ACMH
ISO	PERCENT ISOKINETIC	95.0		95.0	
MN	AMBIENT PARTICULATE MG. EPA 5	105.5		105.5	
CS	AMBIENT PARTICULATE	.0582	GR/DSCF*	133.141	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

EXAMPLE PARTICULATE CALCULATIONS TEST NO.8DM5HP

UNIT TWO EAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

```
VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

         17.647 *    26.915 * 1.030 * ( 30.08 + 3.243 / 13.6)
VMSTD = ------------------------------------------------------ =     27.986 DSCF
                          (  70. + 460.)
```

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

```
VWC = .04707 * VLC

VWC = .04707 *   73. =   3.45 SCF
```

PERCENT MOISTURE IN STACK GAS

```
BWO = (100. * VWC) / (VMSTD + VWC)

        100. *   3.45
BWO = -------------------------- = 10.98 PERCENT
          27.986 +   3.45
```

MOLE FRACTION OF DRY STACK GAS

```
FMD = (100. - BWO) / 100.

        100. -  11.0
FMD = ---------------------- =   .890
              100.
```

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

```
MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.30*44/100) + ( 2.7*32/100) + ((84.0+ .0) * 28/100 =   30.24
```

MOLECULAR WEIGHT OF STACK GAS

```
MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.24* (1. -(10.98/100)) + 18. * (10.98/100) =   28.89
```

STACK GAS VELOCITY AT STACK CONDITIONS

```
DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *   65.917 / (SQRT( 28.89 * 30.08)  *   3. =   53.52 FPS
```

STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

```
QS = VS * AS * 3600/144

QS =   53.52 * 20612. 3600/144 =   27579440. ACFH
```

STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

```
QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

          17.647 *   27579440. *  30.08 * (1. - (10.98/100))
QSSTD = ---------------------------------------------------- =   16731224. SCFH
                     ( 319. + 460.)
```

PERCENT ISOKINETIC

```
ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 319.+460.))*((0.002669*   73.)+(   26.915*1.030*( 30.08+(   3.243/13.6))/(  70.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- =  95.01 PERCENT
                                    30. *     53.52 *   30.08 *  .304 *  .304
```

PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

```
CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    105.5 * 15.43 /    27.986 =       .0582 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/12/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	9AM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	PR RA JP	NOZZLE : I.D.	.223
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.27	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	-.40	METER BOX NUMBER	FB4
FILTER NUMBER(S)	3531106	METER HEAD DIFF.	1.72
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	206	HEATER BOX SETTING	320.
LEAKAGE	.002 CFM @ 9.0 IN.HG		
METER CALIB. FACTOR	1.003	K FACTOR	1126.6
READ & RECORD DATA EVERY 10.0 MINUTES			

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	830	891.537									
	10.0	840	897.300	.720	1.05	1.05	313.	63.	62.	4.0	320.	49.
	20.0	850	902.930	.690	1.00	1.00	319.	64.	62.	4.0	334.	49.
	30.0	900	908.540	.690	1.00	1.00	321.	67.	62.	4.5	338.	49.
	40.0	910	914.173	.690	1.00	1.00	321.	70.	63.	5.0	334.	50.
	50.0	920	919.851	.690	1.00	1.00	322.	72.	63.	5.5	315.	50.
	60.0	930	925.513	.700	1.01	1.01	323.	74.	64.	6.0	314.	51.
	70.0	940	931.174	.700	1.01	1.01	324.	76.	65.	7.0	307.	53.
	80.0	950	936.885	.710	1.02	1.02	324.	76.	66.	7.5	305.	55.
	90.0	1000	942.595	.710	1.02	1.02	324.	77.	66.	8.0	295.	55.
TOTALS	90.0		51.058									
AVERAGE					1.01	1.01	321.	71.	64.	5.7	318.	51.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS

TEST TEAM LEADER

PR RA JP

TEST 9AM5B UNIT 2 EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/12/83	02/12/83
TB	TIME-START	830	830
TF	TIME-FINISH	1000	1000
TT	NET TIME OF TEST, MIN.	90.0	90.0
NP	NET SAMPLING POINTS	9	9
Y	METER CALIBRATION FACTOR	1.003	1.003
DN	SAMPLING NOZZLE DIAMETER	.223 IN	5.7 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	1.01 IN-H2O	25.7 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	51.058 CU-FT	1.446 CU-M
TM	AVERAGE GAS METER TEMP	67.3 F	19.6 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	52.003 SCF	1.473 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	139.7	139.7
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	6.576 SCF	.186 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.23	11.23
FMD	MOLE FRACTION DRY GAS	.888	.888
PCO2	PERCENT CO2 BY VOL., DRY	13.60	13.60
PO2	PERCENT O2 BY VOL., DRY	2.50	2.50
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	83.90	83.90
MD	MOLECULAR WT-DRY STACK GAS	30.28	30.28

MWS	MOLECULAR WT-STACK GAS	28.90		28.90	
PB	BAROMETRIC PRESSURE	30.27	IN-HG	768.86	MM-HG
PSI	STATIC PRES OF STACK GAS	-.40	IN-H2O	-10.16	MM-H2O
PS	STACK PRES, ABS.	30.24	IN-HG	768.11	MM-HG
TS	AVERAGE STACK TEMP	321.	F	161.	C
VS	AVG STACK GAS VELOCITY	56.8	FPS	17.3	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17750968.	SCFH	502654.	SCMH
QS	ACTUAL STACK FLOW RATE	29271616.	ACFH	828884.	ACMH
ISO	PERCENT ISOKINETIC	103.1		103.1	
MN	AMBIENT PARTICULATE MG. EPA 5	252.9		252.9	
CS	AMBIENT PARTICULATE	.0750	GR/DSCF*	171.757	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

```
      EXAMPLE PARTICULATE CALCULATIONS TEST NO. 9AM5B

           UNIT 2 EAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    51.058 * 1.003 * ( 30.27 + 1.012 / 13.6)
VMSTD = ------------------------------------------------------ =      52.003 DSCF
                           (  67. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  140. =   6.58 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

          100. *   6.58
BWO = -------------------------- = 11.23 PERCENT
            52.003 +   6.58


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

          100. -  11.2
FMD = ----------------------- =   .888
               100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.60*44/100) + ( 2.5*32/100) + ((83.9+ .0) * 28/100 =   30.28


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.28* (1. -(11.23/100)) + 18. * (11.23/100) =   28.90
```

STACK GAS VELOCITY AT STACK CONDITIONS

```
DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  210.457 / (SQRT( 28.90 * 30.24)  *   9. =   56.81 FPS
```

STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

```
QS = VS * AS * 3600/144

QS =   56.81 * 20612. 3600/144 =   29271616. ACFH
```

STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

```
QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

           17.647 *   29271616. *  30.24 * (1. - (11.23/100))
QSSTD = --------------------------------------------------- =   17750968. SCFH
                      ( 321. + 460.)
```

PERCENT ISOKINETIC

```
ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 321.+460.))*((0.002669*  140.)+(   51.058*1.003*( 30.27+(   1.012/13.6))/(  67.+460.)))
ISO = ------------------------------------------------------------------------------------------------- = 103.08 PERCENT
                                    90. *     56.81 *   30.24 *  .223 *  .223
```

PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

```
CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    252.9 * 15.43 /    52.003 =       .0750 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/12/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	9BM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	6 FT GLASS
OPERATOR	PR RA JP	NOZZLE : I.D.	.221
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.27	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	-.40	METER BOX NUMBER	FB6
FILTER NUMBER(S)	3531105	METER HEAD DIFF.	1.50
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	206	HEATER BOX SETTING	320.
LEAKAGE	.012 CFM @ 8.5 IN.HG		
METER CALIB. FACTOR	.960	K FACTOR	947.8

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	DRY GAS METER TEMP (DEG.F) OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	830	421.579									
	10.0	840	427.397	.720	.88	.88	313.	57.	59.	4.0	322.	48.
	20.0	850	433.125	.690	.84	.84	319.	59.	59.	4.0	330.	48.
	30.0	900	438.857	.690	.84	.84	321.	62.	59.	4.5	327.	49.
	40.0	910	444.600	.690	.84	.84	321.	66.	60.	4.5	328.	50.
	50.0	920	450.337	.690	.84	.84	322.	68.	60.	5.0	334.	50.
	60.0	930	456.100	.700	.85	.85	323.	70.	61.	6.0	334.	50.
	70.0	940	461.983	.700	.85	.85	323.	70.	62.	6.5	336.	51.
	80.0	950	467.683	.710	.86	.86	324.	71.	62.	7.5	338.	52.
	90.0	1000	473.504	.710	.86	.86	324.	71.	64.	7.5	332.	52.
TOTALS	90.0		51.925									
AVERAGE					.85	.85	321.	66.	61.	5.5	331.	50.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS   TEST TEAM LEADER

PR RA JP

TEST 9BM5B   UNIT 2 EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/12/83	02/12/83
TB	TIME-START	830	830
TF	TIME-FINISH	1000	1000
TT	NET TIME OF TEST, MIN.	90.0	90.0
NP	NET SAMPLING POINTS	9	9
Y	METER CALIBRATION FACTOR	.960	.960
DN	SAMPLING NOZZLE DIAMETER	.221 IN	5.6 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	.85 IN-H2O	21.6 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	51.925 CU-FT	1.470 CU-M
TM	AVERAGE GAS METER TEMP	63.3 F	17.4 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	50.986 SCF	1.444 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	135.4	135.4
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	6.373 SCF	.180 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.11	11.11
FMD	MOLE FRACTION DRY GAS	.889	.889
PCO2	PERCENT CO2 BY VOL., DRY	13.60	13.60
PO2	PERCENT O2 BY VOL., DRY	2.50	2.50
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	83.90	83.90
MD	MOLECULAR WT-DRY STACK GAS	30.28	30.28

MWS	MOLECULAR WT-STACK GAS	28.91		28.91	
PB	BAROMETRIC PRESSURE	30.27	IN-HG	768.86	MM-HG
PSI	STATIC PRES OF STACK GAS	-.40	IN-H2O	-10.16	MM-H2O
PS	STACK PRES, ABS.	30.24	IN-HG	768.11	MM-HG
TS	AVERAGE STACK TEMP	321.	F	161.	C
VS	AVG STACK GAS VELOCITY	56.8	FPS	17.3	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17770760.	SCFH	503215.	SCMH
QS	ACTUAL STACK FLOW RATE	29262440.	ACFH	828625.	ACMH
ISO	PERCENT ISOKINETIC	102.8		102.8	
MN	AMBIENT PARTICULATE MG. EPA 5	261.2		261.2	
CS	AMBIENT PARTICULATE	.0790	GR/DSCF*	180.933	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

```
     EXAMPLE PARTICULATE CALCULATIONS TEST NO. 9BM5B

          UNIT 2 EAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    51.925 *  .960 * ( 30.27 +  .851 / 13.6)
VMSTD = ------------------------------------------------------ =     50.986 DSCF
                             (  63. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  135. =   6.37 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

          100. *   6.37
BWO = -------------------------- = 11.11 PERCENT
            50.986 +   6.37


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

          100. -  11.1
FMD = ----------------------- =   .889
               100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.60*44/100) + ( 2.5*32/100) + ((83.9+ .0) * 28/100 =   30.28


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.28* (1. -(11.11/100)) + 18. * (11.11/100) =   28.91
```

STACK GAS VELOCITY AT STACK CONDITIONS

```
DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  210.442 / (SQRT( 28.91 * 30.24)  *   9. =   56.79 FPS
```

STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

```
QS = VS * AS * 3600/144

QS =   56.79 * 20612. 3600/144 =   29262440. ACFH
```

STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

```
QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

          17.647 *   29262440. *   30.24 * (1. - (11.11/100))
QSSTD = ---------------------------------------------------- =   17770760. SCFH
                      ( 321. + 460.)
```


PERCENT ISOKINETIC

```
ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 321.+460.))*((0.002669*  135.)+(   51.925* .960*( 30.27+(    .851/13.6))/(  63.+460.)))
ISO = ------------------------------------------------------------------------------------------------- = 102.79 PERCENT
                                   90. *     56.79 *    30.24 *   .221 *   .221
```

PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

```
CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    261.2 * 15.43 /    50.986 =       .0790 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/12/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	9CM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	6 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.221
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.27	SAMPLE BOX NUMBER	QAC
STATIC PRESS.(IN.H2O)	-.40	METER BOX NUMBER	FB5
FILTER NUMBER(S)	3531104	METER HEAD DIFF.	1.84
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	206	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 8.0 IN.HG		
METER CALIB. FACTOR	.983	K FACTOR	1134.0
READ & RECORD DATA EVERY 10.0 MINUTES			

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	830	477.734									
	10.0	840	482.700	.720	1.06	1.06	313.	65.	64.	4.5	328.	53.
	20.0	850	488.160	.690	1.00	1.00	319.	66.	64.	5.5	317.	54.
	30.0	900	493.440	.690	1.00	1.00	321.	70.	60.	5.5	317.	53.
	40.0	910	498.775	.690	1.00	1.00	321.	76.	66.	6.0	321.	50.
	50.0	920	504.110	.690	1.00	1.00	322.	78.	66.	6.5	322.	50.
	60.0	930	509.666	.700	1.01	1.01	323.	81.	69.	7.0	317.	52.
	70.0	940	515.015	.700	1.01	1.01	324.	82.	70.	7.5	322.	54.
	80.0	950	520.480	.710	1.03	1.03	324.	84.	71.	8.0	320.	54.
	90.0	1000	525.793	.710	1.03	1.03	324.	85.	72.	8.0	317.	54.
TOTALS	90.0		48.059									
AVERAGE					1.02	1.02	321.	76.	67.	6.5	320.	53.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS	TEST TEAM LEADER
.	CLARKE

TEST 9CM5B UNIT TWO FAST

		ENGLISH UNITS		METRIC UNITS	
TEST DATE		02/12/83		02/12/83	
TB	TIME-START	830		830	
TF	TIME-FINISH	1000		1000	
TT	NET TIME OF TEST, MIN.	90.0		90.0	
NP	NET SAMPLING POINTS	9		9	
Y	METER CALIBRATION FACTOR	.983		.983	
DN	SAMPLING NOZZLE DIAMETER	.221	IN	5.6	MM
CP	PITOT TUBE COEFFICIENT	.84		.84	
PM	AVERAGE ORIFICE PRESSURE DROP	1.02	IN-H2O	25.8	MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	48.059	CU-FT	1.361	CU-M
TM	AVERAGE GAS METER TEMP	71.6	F	22.0	C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	47.587	SCF	1.348	SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	133.1		133.1	
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	6.265	SCF	.177	SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.63		11.63	
FMD	MOLE FRACTION DRY GAS	.884		.884	
PCO2	PERCENT CO2 BY VOL., DRY	13.60		13.60	
PO2	PERCENT O2 BY VOL., DRY	2.50		2.50	
PCO	PERCENT CO BY VOL., DRY	.00		.00	
PN2	PERCENT N2 BY VOL., DRY	83.90		83.90	
MD	MOLECULAR WT-DRY STACK GAS	30.28		30.28	

MWS	MOLECULAR WT-STACK GAS	28.85		28.85	
PB	BAROMETRIC PRESSURE	30.27	IN-HG	768.86	MM-HG
PSI	STATIC PRES OF STACK GAS	-.40	IN-H2O	-10.16	MM-H2O
PS	STACK PRES, ABS.	30.24	IN-HG	768.11	MM-HG
TS	AVERAGE STACK TEMP	321.	F	161.	C
VS	AVG STACK GAS VELOCITY	56.9	FPS	17.3	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17684652.	SCFH	500776.	SCMH
QS	ACTUAL STACK FLOW RATE	29297040.	ACFH	829604.	ACMH
ISO	PERCENT ISOKINETIC	96.4		96.4	
MN	AMBIENT PARTICULATE MG. EPA 5	204.7		204.7	
CS	AMBIENT PARTICULATE	.0664	GR/DSCF*	151.924	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

```
      EXAMPLE PARTICULATE CALCULATIONS TEST NO. 9CM5B

           UNIT TWO FAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

           17.647 *    48.059 *   .983 * ( 30.27 + 1.016 / 13.6)
VMSTD = ------------------------------------------------------ =      47.587 DSCF
                                  (  72. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  133. =   6.27 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

          100. *   6.27
BWO = ------------------------- = 11.63 PERCENT
            47.587 +   6.27


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

          100. -  11.6
FMD = ---------------------- =   .884
               100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.60*44/100) + ( 2.5*32/100) + ((83.9+ .0) * 28/100 =   30.28


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.28* (1. -(11.63/100)) + 18. * (11.63/100) =   28.85
```

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  210.457 / (SQRT( 28.85 * 30.24)  *   9. =   56.85 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   56.85 * 20612. 3600/144 =   29297040. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

           17.647 *   29297040. *  30.24 * (1. - (11.63/100))
QSSTD = ----------------------------------------------------- =   17684652. SCFH
                      ( 321. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 321.+460.))*((0.002669*  133.)+(   48.059* .983*( 30.27+(   1.016/13.6))/(  72.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- =  96.40 PERCENT
                                90. *     56.85 *    30.24 *   .221 *   .221


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    204.7 * 15.43 /    47.587 =       .0664 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/12/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	9DM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.215
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.27	SAMPLE BOX NUMBER	DAD
STATIC PRESS.(IN.H2O)	-.40	METER BOX NUMBER	FB4
FILTER NUMBER(S)	3531103	METER HEAD DIFF.	1.88
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	206	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 5.0 IN.HG		
METER CALIB. FACTOR	1.030	K FACTOR	1134.0

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) DESIRED	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O) ACTUAL	STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F) INLET	DRY GAS METER TEMP (DEG.F) OUTLET	PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
INIT	0	830	27.215									
	10.0	840	31.819	.720	1.06	1.06	313.	59.	59.	3.0	320.	54.
	20.0	850	37.300	.690	1.00	1.00	319.	60.	60.	3.0	331.	53.
	30.0	900	42.380	.690	1.00	1.00	321.	64.	60.	3.0	325.	52.
	40.0	910	47.620	.690	1.00	1.00	321.	68.	60.	3.5	327.	50.
	50.0	920	52.815	.690	1.00	1.00	322.	70.	62.	4.0	321.	50.
	60.0	930	58.138	.700	1.01	1.01	323.	73.	63.	4.5	318.	48.
	70.0	940	63.425	.700	1.01	1.01	324.	74.	64.	4.5	322.	48.
	80.0	950	68.560	.710	1.03	1.03	324.	74.	65.	5.0	330.	52.
	90.0	1000	73.756	.710	1.03	1.03	324.	75.	66.	5.0	336.	56.
TOTALS	90.0		46.541									
AVERAGE					1.02	1.02	321.	69.	62.	3.9	326.	51.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS

TEST TEAM LEADER

CLARKE

TEST 9DM58 UNIT TWO EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/12/83	02/12/83
TB	TIME-START	830	830
TF	TIME-FINISH	1000	1000
TT	NET TIME OF TEST, MIN.	90.0	90.0
NP	NET SAMPLING POINTS	9	9
Y	METER CALIBRATION FACTOR	1.030	1.030
DN	SAMPLING NOZZLE DIAMETER	.215 IN	5.5 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	1.02 IN-H2O	25.8 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	46.541 CU-FT	1.318 CU-M
TM	AVERAGE GAS METER TEMP	65.3 F	18.5 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	48.864 SCF	1.384 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	133.5	133.5
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	6.284 SCF	.178 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.39	11.39
FMD	MOLE FRACTION DRY GAS	.886	.886
PCO2	PERCENT CO2 BY VOL., DRY	13.60	13.60
PO2	PERCENT O2 BY VOL., DRY	2.50	2.50
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	83.90	83.90
MD	MOLECULAR WT-DRY STACK GAS	30.28	30.28

MWS	MOLECULAR WT-STACK GAS	28.88		28.88	
PB	BAROMETRIC PRESSURE	30.27	IN-HG	768.86	MM-HG
PSI	STATIC PRES OF STACK GAS	-.40	IN-H2O	-10.16	MM-H2O
PS	STACK PRES, ABS.	30.24	IN-HG	768.11	MM-HG
TS	AVERAGE STACK TEMP	321.	F	161.	C
VS	AVG STACK GAS VELOCITY	56.8	FPS	17.3	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	17723520.	SCFH	501877.	SCMH
QS	ACTUAL STACK FLOW RATE	29282136.	ACFH	829182.	ACMH
ISO	PERCENT ISOKINETIC	104.4		104.4	
MN	AMBIENT PARTICULATE MG. EPA 5	224.6		224.6	
CS	AMBIENT PARTICULATE	.0709	GR/DSCF*	162.335	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

```
     EXAMPLE PARTICULATE CALCULATIONS TEST NO. 9DM5B

          UNIT TWO EAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

          17.647 *    46.541 * 1.030 * ( 30.27 + 1.016 / 13.6)
VMSTD = ------------------------------------------------------- =     48.864 DSCF
                            (  65. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  134. =   6.28 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

          100. *   6.28
BWO = -------------------------- = 11.39 PERCENT
            48.864 +   6.28


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

          100. -  11.4
FMD = ----------------------- =   .886
               100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.60*44/100) + ( 2.5*32/100) + ((83.9+ .0) * 28/100 =   30.28


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.28* (1. -(11.39/100)) + 18. * (11.39/100) =   28.88
```

```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  210.457 / (SQRT( 28.88 * 30.24)  *   9. =   56.83 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   56.83 * 20612. 3600/144 =   29282136. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

          17.647 *   29282136. *  30.24 * (1. - (11.39/100))
QSSTD = ------------------------------------------------------ =   17723520. SCFH
                      ( 321. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

        (305.58*( 321.+460.))*((0.002669*  134.)+(   46.541*1.030*( 30.27+(   1.016/13.6))/(  65.+460.)))
ISO = -------------------------------------------------------------------------------------------------- = 104.36 PERCENT
                                       90. *     56.83 *   30.24 *  .215 *  .215


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    224.6 * 15.43 /    48.864 =       .0709 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/12/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	10AM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	PR RA JP	NOZZLE : I.D.	.224
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.27	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	-.40	METER BOX NUMBER	FB4
FILTER NUMBER(S)	3531028	METER HEAD DIFF.	1.72
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 8.5 IN.HG		
METER CALIB. FACTOR	1.003	K FACTOR	1141.5
READ & RECORD DATA EVERY	10.0 MINUTES		

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	1200	942.801									
	10.0	1210	949.150	.850	1.24	1.24	325.	67.	65.	5.0	342.	50.
	20.0	1220	955.100	.770	1.12	1.12	326.	69.	65.	5.0	327.	50.
	30.0	1230	961.038	.770	1.12	1.12	326.	72.	65.	5.5	340.	50.
	40.0	1240	966.760	.750	1.09	1.09	326.	77.	66.	6.0	331.	51.
	50.0	1250	972.650	.750	1.09	1.09	325.	81.	67.	6.0	336.	51.
	60.0	1300	978.444	.730	1.06	1.06	326.	81.	69.	7.0	337.	53.
	70.0	1310	984.250	.730	1.06	1.06	327.	81.	69.	7.5	326.	53.
	80.0	1320	990.061	.730	1.06	1.06	327.	81.	70.	8.0	337.	54.
	90.0	1330	995.879	.730	1.06	1.06	328.	82.	71.	8.5	327.	54.
TOTALS	90.0		53.078									
AVERAGE					1.10	1.10	326.	77.	67.	6.5	334.	52.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS　　　　TEST TEAM LEADER

PR RA JP

TEST 10AM5B　　UNIT 2 EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/12/83	02/12/83
TB	TIME-START	1200	1200
TF	TIME-FINISH	1330	1330
TT	NET TIME OF TEST, MIN.	90.0	90.0
NP	NET SAMPLING POINTS	9	9
Y	METER CALIBRATION FACTOR	1.003	1.003
DN	SAMPLING NOZZLE DIAMETER	.224 IN	5.7 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	1.10 IN-H2O	27.9 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	53.078 CU-FT	1.503 CU-M
TM	AVERAGE GAS METER TEMP	72.1 F	22.3 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	53.587 SCF	1.517 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	154.9	154.9
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	7.291 SCF	.206 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.98	11.98
FMD	MOLE FRACTION DRY GAS	.880	.880
PCO2	PERCENT CO2 BY VOL., DRY	13.00	13.00
PO2	PERCENT O2 BY VOL., DRY	3.00	3.00
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	84.00	84.00
MD	MOLECULAR WT-DRY STACK GAS	30.20	30.20

MWS	MOLECULAR WT-STACK GAS	28.74		28.74	
PB	BAROMETRIC PRESSURE	30.27	IN-HG	768.86	MM-HG
PSI	STATIC PRES OF STACK GAS	-.40	IN-H2O	-10.16	MM-H2O
PS	STACK PRES, ABS.	30.24	IN-HG	768.11	MM-HG
TS	AVERAGE STACK TEMP	326.	F	163.	C
VS	AVG STACK GAS VELOCITY	59.4	FPS	18.1	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	18286776.	SCFH	517827.	SCMH
QS	ACTUAL STACK FLOW RATE	30607220.	ACFH	866705.	ACMH
ISO	PERCENT ISOKINETIC	102.2		102.2	
MN	AMBIENT PARTICULATE MG. EPA 5	260.6		260.6	
CS	AMBIENT PARTICULATE	.0750	GR/DSCF*	171.757	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

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EXAMPLE PARTICULATE CALCULATIONS TEST NO.10AMSB

     UNIT 2 EAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

            17.647 *     53.078 * 1.003 * ( 30.27 + 1.100 / 13.6)
VMSTD = ---------------------------------------------------------- =     53.587 DSCF
                              (  72. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  155. =   7.29 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

          100. *    7.29
BWO = -------------------------- = 11.98 PERCENT
            53.587 +    7.29


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

          100. -  12.0
FMD = ----------------------- =   .880
               100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.00*44/100) + ( 3.0*32/100) + ((84.0+ .0) * 28/100 =   30.20


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.20* (1. -(11.98/100)) + 18. * (11.98/100) =   28.74
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```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  219.453 / (SQRT( 28.74 * 30.24)  *   9. =   59.40 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   59.40 * 20612. 3600/144 =   30607220. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

          17.647 *   30607220. *  30.24 * (1. - (11.98/100))
QSSTD = ---------------------------------------------------- =   18286776. SCFH
                    ( 326. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

       (305.58*( 326.+460.))*((0.002669*  155.)+(   53.078*1.003*( 30.27+(   1.100/13.6))/(  72.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- = 102.19 PERCENT
                                    90. *     59.40 *   30.24 *  .224 *  .224


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    260.6 * 15.43 /    53.587 =       .0750 GR/DSCF
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FIELD DATA

PLANT		DATE	02/12/83
SAMPLING LOCATION	UNIT 2 EAST	RUN NUMBER	10BM5P
SAMPLE TYPE	M5B P400	PROBE LENGTH & TYPE	6 FT GLASS
OPERATOR	PR RA JP	NOZZLE : I.D.	.227
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.27	SAMPLE BOX NUMBER	
STATIC PRESS.(IN.H2O)	-.40	METER BOX NUMBER	FB6
FILTER NUMBER(S)	3531027	METER HEAD DIFF.	1.50
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	400.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.055 CFM @ 12.0 IN.HG		
METER CALIB. FACTOR	.960	K FACTOR	948.6
READ & RECORD DATA EVERY 10.0 MINUTES			

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	1200	473.751									
	10.0	1210	480.096	.850	1.03	1.03	325.	61.	62.	4.0	331.	50.
	20.0	1220	486.187	.770	.93	.93	326.	62.	63.	4.0	345.	50.
	30.0	1230	492.168	.770	.93	.93	326.	66.	63.	4.0	342.	52.
	40.0	1240	498.125	.750	.90	.90	326.	70.	63.	4.0	334.	52.
	50.0	1250	504.061	.750	.90	.90	325.	73.	64.	4.5	335.	53.
	60.0	1300	509.993	.730	.88	.88	326.	74.	65.	4.5	334.	53.
	70.0	1310	515.870	.730	.88	.88	327.	74.	65.	4.5	338.	54.
	80.0	1320	521.792	.730	.88	.88	327.	74.	66.	4.5	339.	55.
	90.0	1330	527.726	.730	.88	.88	328.	74.	66.	6.5	339.	57.
TOTALS	90.0		53.975									
AVERAGE					.91	.91	326.	70.	64.	4.5	337.	53.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS

TEST TEAM LEADER

PR RA JP

TEST 10BM5P   UNIT 2 EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/12/83	02/12/83
TB	TIME-START	1200	1200
TF	TIME-FINISH	1330	1330
TT	NET TIME OF TEST, MIN.	90.0	90.0
NP	NET SAMPLING POINTS	9	9
Y	METER CALIBRATION FACTOR	.960	.960
DN	SAMPLING NOZZLE DIAMETER	.227 IN	5.8 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	.91 IN-H2O	23.2 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	53.975 CU-FT	1.528 CU-M
TM	AVERAGE GAS METER TEMP	66.9 F	19.4 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	52.643 SCF	1.491 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	145.6	145.6
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	6.853 SCF	.194 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.52	11.52
FMD	MOLE FRACTION DRY GAS	.885	.885
PCO2	PERCENT CO2 BY VOL., DRY	13.00	13.00
PO2	PERCENT O2 BY VOL., DRY	3.00	3.00
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	84.00	84.00
MD	MOLECULAR WT-DRY STACK GAS	30.20	30.20

MWS	MOLECULAR WT-STACK GAS	28.79		28.79	
PB	BAROMETRIC PRESSURE	30.27	IN-HG	768.86	MM-HG
PSI	STATIC PRES OF STACK GAS	-.40	IN-H2O	-10.16	MM-H2O
PS	STACK PRES, ABS.	30.24	IN-HG	768.11	MM-HG
TS	AVERAGE STACK TEMP	326.	F	163.	C
VS	AVG STACK GAS VELOCITY	59.3	FPS	18.1	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	18364048.	SCFH	520015.	SCMH
QS	ACTUAL STACK FLOW RATE	30577524.	ACFH	865864.	ACMH
ISO	PERCENT ISOKINETIC	97.3		97.3	
MN	AMBIENT PARTICULATE MG. EPA 5	226.1		226.1	
CS	AMBIENT PARTICULATE	.0663	GR/DSCF*	151.688	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

```
EXAMPLE PARTICULATE CALCULATIONS TEST NO.10BM5P

     UNIT 2 EAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

         17.647 *    53.975 *  .960 * ( 30.27 +  .912 / 13.6)
VMSTD = ----------------------------------------------------- =     52.643 DSCF
                         (  67. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  146. =   6.85 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

         100. *   6.85
BWO = -------------------------- = 11.52 PERCENT
           52.643 +   6.85


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

         100. -  11.5
FMD = ---------------------- =   .885
              100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.00*44/100) + ( 3.0*32/100) + ((84.0+ .0) * 28/100 =   30.20


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.20* (1. -(11.52/100)) + 18. * (11.52/100) =   28.79
```

STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 * .84 * 219.453 / (SQRT(28.79 * 30.24) * 9. = 59.34 FPS

STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS = 59.34 * 20612. 3600/144 = 30577524. ACFH

STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

```
           17.647 *   30577524. *  30.24 * (1. - (11.52/100))
QSSTD = --------------------------------------------------- =   18364048. SCFH
                      ( 326. + 460.)
```

PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

```
        (305.58*( 326.+460.))*((0.002669*  146.)+(   53.975* .960*( 30.27+(    .912/13.6))/(  67.+460.)))
ISO = ------------------------------------------------------------------------------------------------ =  97.34 PERCENT
                                     90. *     59.34 *   30.24 *  .227 *  .227
```

PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *   226.1 * 15.43 /   52.643 =   .0663 GR/DSCF

FIELD DATA

PLANT		DATE	02/12/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	10CM5B
SAMPLE TYPE	M5B	PROBE LENGTH & TYPE	6 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.211
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.27	SAMPLE BOX NUMBER	0AC
STATIC PRESS.(IN.H2O)	-.40	METER BOX NUMBER	FB5
FILTER NUMBER(S)	3531089	METER HEAD DIFF.	1.84
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	320.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.000 CFM @ 6.0 IN.HG		
METER CALIB. FACTOR	.983	K FACTOR	994.9

READ & RECORD DATA EVERY 10.0 MINUTES

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	1200	526.000									
	10.0	1210	531.595	.850	1.08	1.08	325.	60.	68.	4.0	317.	50.
	20.0	1220	536.820	.770	.98	.98	326.	68.	68.	4.0	337.	48.
	30.0	1230	542.160	.770	.98	.98	326.	72.	68.	4.5	314.	48.
	40.0	1240	547.370	.750	.95	.95	328.	78.	68.	4.5	317.	50.
	50.0	1250	552.600	.750	.95	.95	325.	82.	70.	5.0	319.	54.
	60.0	1300	557.810	.730	.92	.92	326.	84.	71.	5.0	319.	52.
	70.0	1310	562.989	.730	.92	.92	327.	85.	72.	5.5	321.	56.
	80.0	1320	567.925	.730	.92	.92	327.	86.	72.	6.0	322.	58.
	90.0	1330	573.155	.730	.92	.92	328.	86.	73.	6.0	323.	60.
TOTALS	90.0		47.155									
AVERAGE					.96	.96	326.	78.	70.	4.9	321.	53.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS   TEST TEAM LEADER

CLARKE

TEST 10CM5B   UNIT TWO EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/12/83	02/12/83
TB	TIME-START	1200	1200
TF	TIME-FINISH	1330	1330
TT	NET TIME OF TEST, MIN.	90.0	90.0
NP	NET SAMPLING POINTS	9	9
Y	METER CALIBRATION FACTOR	.983	.983
DN	SAMPLING NOZZLE DIAMETER	.211 IN	5.4 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	.96 IN-H2O	24.3 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	47.155 CU-FT	1.335 CU-M
TM	AVERAGE GAS METER TEMP	73.9 F	23.3 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	46.481 SCF	1.316 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	137.4	137.4
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	6.467 SCF	.183 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	12.21	12.21
FMD	MOLE FRACTION DRY GAS	.878	.878
PCO2	PERCENT CO2 BY VOL., DRY	13.00	13.00
PO2	PERCENT O2 BY VOL., DRY	3.00	3.00
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	84.00	84.00
MD	MOLECULAR WT-DRY STACK GAS	30.20	30.20

MWS	MOLECULAR WT-STACK GAS	28.71		28.71	
PB	BAROMETRIC PRESSURE	30.27	IN-HG	768.86	MM-HG
PSI	STATIC PRES OF STACK GAS	-.40	IN-H2O	-10.16	MM-H2O
PS	STACK PRES, ABS.	30.24	IN-HG	768.11	MM-HG
TS	AVERAGE STACK TEMP	326.	F	164.	C
VS	AVG STACK GAS VELOCITY	59.4	FPS	18.1	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	18244000.	SCFH	516615.	SCMH
QS	ACTUAL STACK FLOW RATE	30626964.	ACFH	867264.	ACMH
ISO	PERCENT ISOKINETIC	100.1		100.1	
MN	AMBIENT PARTICULATE MG. EPA 5	210.0		210.0	
CS	AMBIENT PARTICULATE	.0697	GR/DSCF*	159.564	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

```
      EXAMPLE PARTICULATE CALCULATIONS TEST NO.10CM5B

           UNIT TWO EAST


VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

             17.647 *    47.155 *  .983 * ( 30.27 +  .958 / 13.6)
VMSTD = ------------------------------------------------------------ =     46.481 DSCF
                                  (  74. + 460.)


VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 *  137. =   6.47 SCF


PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

           100. *   6.47
BWO = ------------------------- = 12.21 PERCENT
             46.481 +   6.47


MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

           100. -  12.2
FMD = ---------------------- =   .878
                100.


AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.00*44/100) + ( 3.0*32/100) + ((84.0+ .0) * 28/100 =   30.20


MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS =  30.20* (1. -(12.21/100)) + 18. * (12.21/100) =   28.71
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```
STACK GAS VELOCITY AT STACK CONDITIONS

DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  219.484 / (SQRT( 28.71 * 30.24)  *   9. =   59.44 FPS


STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

QS = VS * AS * 3600/144

QS =   59.44 * 20612. 3600/144 =   30626984. ACFH


STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

            17.647 *   30626984. *  30.24 * (1. - (12.21/100))
QSSTD = --------------------------------------------------- =   18244000. SCFH
                      ( 326. + 460.)


PERCENT ISOKINETIC

ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

        (305.58*( 326.+460.))*((0.002669*  137.)+(   47.155* .983*( 30.27+(    .958/13.6))/(  74.+460.)))
ISO = ----------------------------------------------------------------------------------------------- = 100.13 PERCENT
                                     90. *     59.44 *   30.24 *  .211 *  .211


PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    210.0 * 15.43 /    46.481 =      .0697 GR/DSCF
```

FIELD DATA

PLANT		DATE	02/12/83
SAMPLING LOCATION	UNIT TWO EAST	RUN NUMBER	10DM5P
SAMPLE TYPE	M5B P400	PROBE LENGTH & TYPE	5 FT GLASS
OPERATOR	CLARKE	NOZZLE : I.D.	.210
AMBIENT TEMP.(DEG.F)	60.	ASSUMED MOISTURE	11.0
BAR.PRESS.(IN.HG)	30.27	SAMPLE BOX NUMBER	QAD
STATIC PRESS.(IN.H2O)	-.40	METER BOX NUMBER	FB4
FILTER NUMBER(S)	3531088	METER HEAD DIFF.	1.88
STACK INSIDE DIM.(IN)	162.00 .00		
PITOT TUBE COEFF.	.84	PROBE HEATER SETTING	400.
THERM. NO.	178	HEATER BOX SETTING	320.
LEAKAGE	.010 CFM @ 9.0 IN.HG		
METER CALIB. FACTOR	1.030	K FACTOR	994.9
READ & RECORD DATA EVERY	10.0 MINUTES		

TRAVERSE POINT NO.	SAMPLE TIME (MIN.)	CLOCK TIME (24-HR CLOCK)	GAS METER READING (CU.FT.)	VELOCITY HEAD (IN.H2O)	ORIFICE PRESSURE DIFFERENTIAL (IN.H2O)		STACK TEMP (DEG.F)	DRY GAS METER TEMP (DEG.F)		PUMP VACUUM (IN.HG)	SAMPLE BOX TEMP (DEG.F)	IMPINGER TEMP (DEG.F)
					DESIRED	ACTUAL		INLET	OUTLET			
INIT	0	1200	74.879									
	10.0	1210	80.200	.850	1.08	1.08	325.	64.	63.	5.0	342.	48.
	20.0	1220	85.290	.770	.98	.98	326.	66.	64.	5.5	326.	48.
	30.0	1230	90.428	.770	.98	.98	326.	68.	64.	6.0	329.	50.
	40.0	1240	95.500	.750	.95	.95	328.	72.	65.	6.8	330.	52.
	50.0	1250	100.600	.750	.95	.95	325.	74.	66.	7.0	321.	54.
	60.0	1300	105.525	.730	.92	.92	326.	75.	67.	7.5	324.	52.
	70.0	1310	110.500	.730	.92	.92	327.	76.	68.	8.0	309.	56.
	80.0	1320	115.580	.730	.92	.92	327.	76.	68.	8.5	320.	58.
	90.0	1330	120.457	.730	.92	.92	328.	76.	68.	9.0	326.	60.
TOTALS	90.0		45.578									
AVERAGE					.96	.96	326.	72.	66.	7.0	325.	53.

PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT- NAME AND ADDRESS — TEST TEAM LEADER

CLARKE

TEST 10DM5P   UNIT TWO EAST

		ENGLISH UNITS	METRIC UNITS
TEST DATE		02/12/83	02/12/83
TB	TIME-START	1200	1200
TF	TIME-FINISH	1330	1330
TT	NET TIME OF TEST, MIN.	90.0	90.0
NP	NET SAMPLING POINTS	9	9
Y	METER CALIBRATION FACTOR	1.030	1.030
DN	SAMPLING NOZZLE DIAMETER	.210 IN	5.3 MM
CP	PITOT TUBE COEFFICIENT	.84	.84
PM	AVERAGE ORIFICE PRESSURE DROP	.96 IN-H2O	24.3 MM-H2O
VM	VOLUME OF DRY GAS SAMPLED AT METER CONDITIONS	45.578 CU-FT	1.291 CU-M
TM	AVERAGE GAS METER TEMP	68.9 F	20.5 C
VMSTD	VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS*	47.525 SCF	1.346 SCM
VLC	TOTAL H2O COLLECTED IN IMPINGERS AND SILICA GEL,ML.	137.5	137.5
VWC	VOLUME OF WATER VAPOR AT STANDARD CONDITIONS*	6.472 SCF	.183 SCM
BWO	PERCENT MOISTURE BY VOLUME (CHECK AGAINST SATURATION POINT HAS BEEN MADE.)	11.99	11.99
FMD	MOLE FRACTION DRY GAS	.880	.880
PCO2	PERCENT CO2 BY VOL., DRY	13.00	13.00
PO2	PERCENT O2 BY VOL., DRY	3.00	3.00
PCO	PERCENT CO BY VOL., DRY	.00	.00
PN2	PERCENT N2 BY VOL., DRY	84.00	84.00
MD	MOLECULAR WT-DRY STACK GAS	30.20	30.20

MWS	MOLECULAR WT-STACK GAS	28.74		28.74	
PB	BAROMETRIC PRESSURE	30.27	IN-HG	768.86	MM-HG
PSI	STATIC PRES OF STACK GAS	-.40	IN-H2O	-10.16	MM-H2O
PS	STACK PRES, ABS.	30.24	IN-HG	768.11	MM-HG
TS	AVERAGE STACK TEMP	326.	F	164.	C
VS	AVG STACK GAS VELOCITY	59.4	FPS	18.1	MPS
AS	STACK AREA	20612.	SQ-IN	13.298	SQ-M
QSSTD	STACK FLOW RATE, DRY*	18282604.	SCFH	517709.	SCMH
QS	ACTUAL STACK FLOW RATE	30612136.	ACFH	866844.	ACMH
ISO	PERCENT ISOKINETIC	103.1		103.1	
MN	AMBIENT PARTICULATE MG. EPA 5	213.8		213.8	
CS	AMBIENT PARTICULATE	.0694	GR/DSCF*	158.885	MG/DSCM

* 68 DEG F, 29.92 IN.HG.

FXAMPLE PARTICULATF CALCULATIONS TFST NO.10DMSP

UNIT TWO FAST

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

VMSTD = (17.647 * VM * Y * (PB + PM / 13.6)) / (TM + 460.)

$$VMSTD = \frac{17.647 * 45.578 * 1.030 * (30.27 + .958 / 13.6)}{(69. + 460.)} = 47.525 \text{ DSCF}$$

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

VWC = .04707 * VLC

VWC = .04707 * 138. = 6.47 SCF

PERCENT MOISTURE IN STACK GAS

BWO = (100. * VWC) / (VMSTD + VWC)

$$BWO = \frac{100. * 6.47}{47.525 + 6.47} = 11.99 \text{ PERCENT}$$

MOLE FRACTION OF DRY STACK GAS

FMD = (100. - BWO) / 100.

$$FMD = \frac{100. - 12.0}{100.} = .880$$

AVERAGE MOLECULAR WEIGHT OF DRY STACK GAS

MD = (PCO2 * .44) + (PO2 * .32) + (PN2 + PCO) * .28

MD = (13.00*44/100) + (3.0*32/100) + ((84.0+ .0) * 28/100 = 30.20

MOLECULAR WEIGHT OF STACK GAS

MWS = MD * (1. - (BWO/100)) + 18. * (BWO/100)

MWS = 30.20* (1. -(11.99/100)) + 18. * (11.99/100) = 28.74

STACK GAS VELOCITY AT STACK CONDITIONS

```
DELP = SUM. OF THE SQRT(VH * (TS + 460.))

VS = 85.49 * CP * DELP / (SQRT(MWS * PS) * PNTS)

VS = 85.49 *  .84 *  219.484 / (SQRT( 28.74 * 30.24)  *   9. =   59.41 FPS
```

STACK GAS VOLUMETRIC FLOW AT STACK CONDITIONS

```
QS = VS * AS * 3600/144

QS =   59.41 * 20612. 3600/144 =   30612136. ACFH
```

STACK GAS VOLUMETRIC FLOW AT STANDARD CONDITIONS

```
QSSTD = 17.647 * QS * PS * (1. - (BWO/100)) / (TS + 460.)

             17.647 *   30612136. *  30.24 * (1. - (11.99/100))
QSSTD = ---------------------------------------------------- =   18282604. SCFH
                         ( 326. + 460.)
```

PERCENT ISOKINETIC

```
ISO = (305.58*(TS+460.))*((0.002669*VLC)+(VM*Y*(PB+(PM/13.6))/(TM+460.)))/(TT*VS*PS*DN*DN)

        (305.58*( 326.+460.))*((0.002669*  138.)+(   45.578*1.030*( 30.27+(    .958/13.6))/(  69.+460.)))
ISO = ---------------------------------------------------------------------------------------------------- = 103.14 PERCENT
                                      90. *     59.41 *   30.24 *  .210 *  .210
```

PARTICULATE LOADING -- EPA METHOD 5 (AT STANDARD CONDITIONS)

```
CS = 0.001 * MN * 15.43 / VMSTD

CS = 0.001 *    213.8 * 15.43 /    47.525 =       .0694 GR/DSCF
```

```
END OF PROGRAM
:EOJ
CPU SEC. = 109.  ELAPSED MIN. = 3.  FRI, MAR 18, 1983, 12:27 PM
```

APPENDIX B

FIELD DATA

GAS VELOCITY AND VOLUME DATA

PLANT AND CITY	RUN DATE
1.	2/16/83

SAMPLING LOCATION	CLOCK TIME
Unit 2	1045

RUN NUMBER	OPERATOR	AMB. TEMP. (°F)	BAR. PRESS (in. Hg)	STATIC PRESS (in. H_2O)
2. V-1	PR PC RA	68	30.20	-.50

MOLECULAR WT.	STACK INSIDE DIMENSION (in.) DIAM OR SIDE 1	SIDE 2	PITOT TUBE Cp	MOISTURE %
~~29~~ ~~30.27~~ 29.00	162		0.84	

PT - 278
TC - 178
DI - 125

FIELD DATA

TRAVERSE POINT NUMBER	POSITION (in.)	VELOCITY HEAD (Δp_s), in.H_2O	STACK TEMP, °F
1	1	~~0.5~~ 0.63	304
2	4	0.73	304
3	7	0.66	304
4	10	0.71	304
5	13	0.74	304
6	16	0.66	305
7	19	0.77	304
8	22	0.65	306
9	25	0.80	308
10	28	0.69	306
11	31	0.72	305
12	34	0.77	306

$\overline{\Delta P} = 0.71$

$\overline{\sqrt{\Delta P}} = 0.842$

$\bar{T} = 305°F = 765°R$

$V_s = 85.49\,(0.842)(0.84)\sqrt{\frac{T_s}{P_s\,M_s}}$ $\sqrt{\frac{765}{30.12\,(29)}}$

$V_s = 56.6$ ft/s

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/7/83	UNIT 2 EAST	PARTIC SP3 SP2

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE C_p	THERM NO.	PAGE
1AMSBV	PR RA	63	30.16	-.60	~~825-3101~~ 353.1917	162	0.84		10F1

PT-379
TC-206
DI-125

PROBE LENGTH AND TYPE	NOZZLE I.D	NOZZLE NO.	H_2O, (%)	SAMPLE BOX NO	METER BOX NO.	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5 FT GLASS	.223	1A	10.0		FB7	1.72	1.003	10	.0009	~~1156~~ 1161.9		320	320		10

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in.H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in.Hg	SAMPLE BOX TEMPERATURE °F F	SAMPLE BOX TEMPERATURE °F P	IMPINGER TEMPERATURE °F
	0	950	436.809										
	10.		442.715	0.71	1.08	1.08	305	63	62	4.0	330	337	49
	20.		449.212	0.71	1.09	1.08	306	64	62	4.0	319	331	49
	30.		453.974	0.71	1.08	1.08	307	67	62	4.5	330	306	49
	40.		459.541	0.65	0.99	0.99	305	70	62	5.0	332	326	47
	50.		464.999	0.65	0.98	0.98	307	72	62	6.0	310	330	47
	60.		471.123	0.68	1.03	1.03	308	72	62	6.0	311	~~363~~ 326	49
	70.		476.434	0.68	1.03	1.03	309	74	64	6.5	319	326	48
	80.		482.099	0.68	1.03	1.08	307	74	64	6.5	317	321	48
	90.		487.859	0.70	1.06	1.06	309	74	65	7.5	325	327	48
	100.		493.419	0.65	0.98	0.98	308	74	65	8.0	329	319	48
	110.		498.932	0.65	0.98	0.98	308	73	66	8.0	329	323	48
	120.	1150	504.527	0.65	0.98	0.98	308	74	65	8.5	315	316	51

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/17/83	PMT 2 EAST	PART. PASP2

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
1BM58W	PR RA	63	30.96	-.60	3531016	162	0.84		1 OF 1

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER ΔH@	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6 FT GLASS	.221	11B	10		FB6	1.59	0.960	10	.0012	9.774		320	329		10

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F F	SAMPLE BOX TEMPERATURE °F P	IMPINGER TEMPERATURE °F
	0	950	949.932										
	10.		955.850	0.71	0.91	0.91	305	59	60	1.0	319	298	46
	20.		961.680	0.71	0.91	0.91	306	59	60	1.0	310	318	46
	30.		967.575	0.71	0.90	0.90	307	62	60	1.5	317	317	46
	40.		473.272	0.65	0.83	0.83	305	64	60	1.0	320	322	47
	50.		979.000	0.65	0.83	0.83	307	66	60	5.0	321	323	47
	60.		985.015	0.68	0.87	0.87	308	67	60	6.0	313	320	48
	70.		990.558	0.68	0.86	0.86	309	68	60	6.0	313	320	47
	80.		996.419	0.69	0.87	0.87	307	68	61	6.5	308	318	47
	90.		002.290	0.70	0.89	0.89	309	68	60	7.5	319	321	47
	100.		008.000	0.65	0.83	0.83	308	68	60	7.5	319	317	47
	110.		013.764	0.65	0.83	0.83	308	68	60	8.0	322	324	47
	120.	1150	019.509	0.65	0.83	0.83	308	67	60	9.0	324	322	51

EMISSION TESTING FIELD DATA

1-C

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	6/7/83	UNIT 5 #9 EAST	M-5B

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
1C-M5B	CLARK	64	30.16	-.96	353/915	166	.84	206	1 OF 1

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER ΔH@	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6FT GLASS	.221		10		FB5	1.84	.988	10	.009	1.1742		329	320		10

Pretest @ 15" OK

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in.H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in.Hg	SAMPLE BOX TEMPERATURE °F FLTR	SAMPLE BOX TEMPERATURE °F PRBE	IMPINGER TEMPERATURE °F
	0	9:50	53.396										
	10.	10:00	59.325	.71	1.09	1.1	305	62	62	5.0	315	308	51
	20.	10:10	64.300	.71	1.09	1.09	306	62	62	5.0	328	323	52
	30.	10:20	69.800	.71	1.09	1.09	307	67	62	5.5	323	243	52 *
	40.	10:30	74.640	.65	1.0	1.0	305	72	63	6.0	330	329	49
	50.	10:40	80.000	.65	1.0	1.0	307	74	64	6.5	332	320	49
	60.	10:50	85.650	.68	1.04	1.0	308	75	64	7.0	320	318	48
	70.	11:00	91.210	.68	1.04	1.0	309	76	65	7.0	315	322	49
	80.	11:10	96.275	.68	1.04	1.0	307	76	66	7.5	322	323	49
	90.	11:20	102.000	.70	1.07	1.1	309	78	66	8.5	325	327	50
	100.	11:30	106.845	.65	.99	1.0	308	76	66	9.0	317	332	49
	110.	11:40	113.071	.65	.99	1.0	308	76	66	9.5	321	330	50
	120.	11:40	118.356	.65	.99	1.0	308	77	66	9.5	317	319	48

* PROBE HEAT SHORTED OUT
Back at [illegible] @ 10:14

B-5

1-D

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/07/83	UNIT TWO EAST	M5B

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
1-M5B	CLARKE	64	29.96	-0.6	3531014	162	.84	20	1 OF 1

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER ΔH@	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5 FT GLASS	~~.219~~ .215		10	D	FB4	1.88	1.030	8.0	.009	1.1792		320	349		10

Probe test @ 15" ok

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F FLTR	SAMPLE BOX TEMPERATURE °F PRBE	IMPINGER TEMPERATURE °F
	0	9:50	622.701										
	10.	10:00	629.125	.71	1.09	1.1	305	68	60	2.0	307	304	49
	20.	10:10	633.433	.71	1.09	1.1	306	60	59	2.5	334	320	50
	30.	10:20	638.490	.71	1.09	1.09	307	62	59	3.0	304	306	50
	40.	10:30	643.625	.65	1.0	1.0	305	65	60	3.5	341	325	48
	50.	10:40	648.656	.65	1.0	1.0	307	68	60	3.5	315	320	48
	60.	10:50	654.150	.68	1.04	1.0	308	68	60	4.0	317	321	48
	70.	11:00	659.210	.68	1.04	1.0	309	68	62	4.5	328	326	49
	80.	11:10	663.750	.68	1.04	1.0	307	68	62	5.0	334	324	51
	90.	11:20	669.100	.70	1.07	1.0	309	68	62	6.0	319	328	50
	100.	11:30	674.125	.65	0.99	1.0	308	67	62	6.5	319	327	49
	110.	11:40	679.815	.65	0.99	1.0	308	67	62	6.5	332	332	48
	120.	11:50	684.953	.65	0.99	1.0	308	66	61	7.0	336	319	48

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/7/83

Sample location Boiler #2 Recovery date 2/7/83

Run number 1A M5BW Recovered by DO/DS

Particulate sample type ___ M5 ___ M5-320 ___ M5-450 ✓ M5W-320

Particulate filter number 3531017 ✓

Particulate filter sample I.D. 4313 B ✓

Probe rinse H_2O I.D. 4313A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half between imp #2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	632.3 g	629.6 g	620.0 g	616.8 g	872.6 g
Initial wt	502.1 g	669.3 g	589.9 g	597.0 g	828.1 g
Net wt	130.2 g	-39.7 g	30.1 g	19.8 g	44.5 g

Total moisture 184.9 g   80 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4313 A ✓

IPA IMP. CONTAINER I.D. 4314 A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4315 A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4303 A ✓	✓
H_2O_2	4302 A ✓	✓
H_2O	4304 A ✓	✓
Acetone	4301 A n/a	✓

Samples stored and locked ______

Remarks Filter Blank #3531026 ✓ I.D. 4301B ✓

PROBE RINSE BLANK - CONT. NO. 4305 A ✓

RINSE - H_2O

LABORATORY CUSTODY

Received by Doris White Date 15 Feb 1983

Remarks Reg # 4061

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/7/83

Sample location Boiler #2 Recovery date 2/7/83

Run number 1BM5BW Recovered by DO/DS

Particulate sample type ___ M5 ___ M5-320 ___ M5-450 ✓ M5W-320

Particulate filter number 3531016 ✓

Particulate filter sample I.D. 4316 B ✓

Probe rinse H_2O I.D. 4316 A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half between Imp. #2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	634.6 g	622.7 g	634.9 g	624.5 g	857.3 g
Initial wt	503.9 g	664.9 g	603.6 g	603.3 g	816.2 g
Net wt	130.7 g	-42.2 g	31.3 g	21.2 g	41.1 g

Total moisture 182.1 g 90 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4316 A ✓

IPA IMP. CONTAINER I.D. 4317 A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4318 A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4303 A ✓	✓
H_2O_2	4302 A ✓	✓
H_2O	4304 A ✓	✓
Acetone	4301 A NP	✓

Samples stored and locked ______

Remarks Filter blank #3531026, ID. 4301B ✓

PROBE RINSE BLANK - CONT ID 4306 A ✓

RINSE H2O

LABORATORY CUSTODY

Received by [signature] Date 15-Feb-1983

Remarks reg. #4061

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/7/83
Sample location Boiler No. 7 Recovery date 2/7/83
Run number 1CM5B Recovered by DO/DS
Particulate sample type ____ M5 ✓ M5-320 ____ M5-450 ____ M5W
Particulate filter number 3531015 ✓
Particulate filter sample I.D. 4319 B ✓
Probe rinse Acetone I.D. 4319 A ✓
Purge train 20 min (check when completed) ✓
Location of filter in back half between imp #2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	604.5 g	631.7 g	569.1 g	629.2 g	888.9 g
Initial wt	481.4 g	666.3 g	537.8 g	609.3 g	851.6 g
Net wt	123.1 g	-34.6 g	31.3 g	19.9 g	37.3 g

Total moisture 177.0 g 90 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4319A ✓
IPA IMP. CONTAINER I.D. 4320 A ✓ LIQUID LEVEL MARKED ✓
H_2O_2 IMP. CONTAINER I.D. 4321A ✓ LIQUID LEVEL MARKED ✓
BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4303A ✓	✓
H_2O_2	4302A ✓	✓
H_2O	4304A ✓	✓
Acetone	4301A ✓	✓

Samples stored and locked ______
Remarks Filter blank #3531026 ✓ ID. 4301B ✓
PROBE RINSE BLANK - CONT I.D. 4307 A ✓
RINSE - ACETONE

LABORATORY CUSTODY

Received by Dennis Dahle Date 15-Feb-1983
Remarks Reg. #406

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/7/83
Sample location Boiler No. 2 Recovery date 2/7/83
Run number 1DM5B Recovered by JO/DS
Particulate sample type ____ M5 ✓ M5-320 ____ M5-450 ____ M5W
Particulate filter number 3531014 ✓
Particulate filter sample I.D. 4322 B ✓
Probe rinse Acetone I.D. 4322 A ✓
Purge train 20 min (check when completed) ✓
Location of filter in back half between imp #2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	616.9 g	631.2 g	630.3 g	616.5 g	869.7 g
Initial wt	495.1 g	667.9 g	597.4 g	598.2 g	833.1 g
Net wt	121.8 g	-36.7 g	32.9 g	18.3 g	36.6 g

Total moisture 172.9 g   80 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4322A ✓
IPA IMP. CONTAINER I.D. 4323A ✓ LIQUID LEVEL MARKED ✓
H_2O_2 IMP. CONTAINER I.D. 4324A ✓ LIQUID LEVEL MARKED ✓
BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4303A ✓	✓
H_2O_2	4302A ✓	✓
H_2O	4304A ✓	✓
Acetone	4301A ✓	✓

Samples stored and locked ______
Remarks Filter blank #3531026, I.D 4381B ✓
PROBE RINSE BLANK - CONT. I.D. 4308A ✓
RINSE - ACETONE

LABORATORY CUSTODY

Received by [illegible signature] Date 15-Feb-1983
Remarks Log # 4661

DRY MOLECULAR WEIGHT DETERMINATION

PLANT [illegible]

DATE 2·7·83 TEST NO 1-ABCD

SAMPLING TIME (24-hr CLOCK) 1145

SAMPLING LOCATION Boiler #2

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) BAG

ANALYTICAL METHOD ORSAT

AMBIENT TEMPERATURE 70

OPERATOR [illegible]

ORSAT LEAK CHECKED ✓

COMMENTS:

GAS \ RUN	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	13.4	13.4	13.3	13.3			13.35	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	15.8	2.4	15.8	2.5			2.45	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)							84.2	28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/27/83	UNIT 2 EAST	M5B SPH SP2

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
2AM5B	PR RA	65	30.07	-.60	3531913	162	.84	78	10 F

PT - 278
TC - 178
DI - 125

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER Δ H @	METER CAL. FACTOR γ	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5 FT GLASS	.224	2A	10		FB	1.72	1.003	10	0.009	[illegible]		320	320		10

1182.9

LEAK CHECKS Pitot - good
Orsat - good

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F F	SAMPLE BOX TEMPERATURE °F P	IMPINGER TEMPERATURE °F
	0	1410	504.942										
	10.		510.863	0.70	1.09	1.08	305	64	63	4.5	325	306	48
	20.		516.599	0.70	1.08	1.08	309	66	64	4.5	303	322	48
	30.		522.411	0.70	1.08	1.08	309	70	64	5.0	325	320	48
	40.		528.144	0.68	1.04	1.04	310	73	65	5.5	330	317	53
	50.		533.875	0.68	1.04	1.04	310	75	66	6.0	326	317	53
	60.		539.638	0.68	1.04	1.04	309	76	67	6.5	332	319	52
	70.		545.3535	0.71	1.09	1.09	310	76	67	7.0	333	323	52
	80.		551.342	0.71	1.09	1.09	311	77	68	7.5	320	312	62
	90.		557.213	0.71	1.09	1.09	311	78	68	7.5	333	322	62
	100.		563.067	0.70	1.08	1.08	310	79	69	8.0	320	323	52
	110.		568.934	0.70	1.08	1.08	311	80	70	8.5	330	320	53
	120.		574.595	0.65	1.00		310	82	70	8.5	324	321	62

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/2/93	UNIT 2 EAST	PM5B SO4 SO2

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
2-PM5B	PR RA	65	30.07	-1.60	3531-0117	162	.84	17	1 OF 1

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER ΔH @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. Δp	RECORD DATA MINS
6 FT [illegible]	.227		10		FB6	1.50	0.960	13	.020	10880		320	320		10

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F F	SAMPLE BOX TEMPERATURE °F P	IMPINGER TEMPERATURE °F
	0	1410	019.804										
	10.		026.053	0.70	1.00	1.00	305	59	59	4.5	331	321	48
	20.		032.238	0.70	0.99	0.99	309	60	59	5.0	320	339	48
	30.		038.421	0.70	0.99	0.99	309	65	60	5.5	324	321	48
	40.		044.544	0.68	0.96	0.96	310	68	60	6.0	317	308	49
	50.		050.624	0.68	0.96	0.96	310	69	60	6.0	331	320	49
	60.		056.790	0.68	0.96	0.96	310	70	62	7.0	315	335	53
	70.		063.104	0.71	1.00	1.00	310	70	62	8.0	325	350	53
	80.		069.366	0.71	1.00	1.00	311	70	62	8.0	316	321	59
	90.		075.637	0.71	1.00	1.00	311	70	63	8.5	325	321	57
	100.		081.436	0.70	0.99	0.99	310	71	64	9.0	318	313	53
	110.		088.211	0.70	0.99	0.99	311	72	64	10.0	322	~~363~~ 324	53
	120.		094.225	0.65	0.92	0.92	310	72	65	9.5	319	308	59

EMISSION TESTING FIELD DATA

2C.

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	02/17/83	UNIT TWO TREV	MSBW

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
2C MSBW	CLARKE	58	29.07	-.06	363107A	162	.84	178	1 OF 1

Pitot 278

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER ΔH@	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6 FT GLASS	.311		10		FB5	1.84	.9983	7.0	.001	.9924		320	320		10

Pitot 15" OK

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F FLTR	PRBE	IMPINGER TEMPERATURE °F
	0	14:10	118.570										
	10.0	14:20	123.900	.7	.91	.91	305	62	62	4.0	316	320	50
	20.0	14:30	128.975	.7	.9	.9	309	69	62	4.0	331	323	48
	30.0	14:40	134.150	.7	.9	.9	309	69	63	4.0	320	317	48
	40.0	14:50	139.000	.68	.88	.88	310	73	64	4.5	317	302	52
	50.0	15:00	144.404	.68	.88	.88	310	75	65	4.5	328	334	54
	60.0	15:10	149.194	.68	.88	.88	309	77	68	5.0	321	329	58
	70.0	15:20	154.525	.71	.92	.92	310	78	67	5.5	324	349	56
	80.0	15:30	159.500	.71	.92	.92	311	78	68	5.5	329	327	60
	90.	15:40	164.810	.71	.92	.92	311	78	68	6.0	322	342	62
	100.	15:50	169.750	.7	.9	.9	310	80	69	6.0	328	330	57
	110.	16:00	174.495	.7	.9	.9	311	80	70	6.5	326	334	57
	120.	16:10	180.021	.65	.84	.84	310	80	70	6.5	329	333	60

2-D

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	02/07/83	UNIT TWO EAST	M5BW

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
2DM5BW	CLARKE	58	30.17	-.66	353/1068	164	.84	70	1 OF 1

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER ΔH@	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5 FT GLASS	.249		10		FC4	1.88	1.03	10	.002	1.624		320	320		10

Pretest is ok

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F MTR	PRBE	IMPINGER TEMPERATURE °F
	0	14:10	684.704										
	10.	14:20	689.725	.7	.91	.9	305	62	61	5.0	317	298	49
	20.	14:30	694.200	.7	.9	.9	309	63	61	5.0	327	309	49
	30.	14:40	699.800	.7	.9	.9	309	65	61	5.0	312	305	48
	40.	14:50	704.174	.68	.88	.88	310	68	62	5.5	312	297	53
	50.	15:00	709.097	.68	.88	.88	310	69	62	6.0	331	302	57
	60.0	15:10	713.445	.68	.88	.88	309	70	64	6.5	317	308	60
	70.0	15:20	718.999	.71	.92	.92	310	70	64	7.0	313	318	61
	80.0	15:30	723.430	.71	.92	.92	311	70	64	7.5	330	306	62
	90.	15:40	728.811	.71	.92	.92	311	70	64	8.0	326	307	60
	100.	15:50	733.525	.70	.9	.9	310	71	66	8.5	333	309	55
	110.	16:00	737.990	.7	.9	.9	311	71	65	9.0	342	314	54
	120.	16:10	743.154	.65	.89	.89	310	72	66	9.0	335	303	64

1 ✓

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/7/83

Sample location Boiler No. 2 Recovery date 2/7+8/83

Run number 2AM5B Recovered by DO/DS

Particulate sample type ____ M5 ✓ M5-320 ____ M5-450 ____ M5W

Particulate filter number 3531018 ✓

Particulate filter sample I.D. 4325 B ✓

Probe rinse Acetone I.D. 4325 A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	614.8 g	624.7 g	648.4 g	614.6 g	874.9 g
Initial wt	492.3 g	669.6 g	613.4 g	594.4 g	830.9 g
Net wt	122.5 g	-44.9 g	35.0 g	20.2 g	44.0 g

Total moisture 176.8 g 90 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4325 A ✓

IPA IMP. CONTAINER I.D. 4326 A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4327 A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4303 A ✓	✓
H_2O_2	4302 A ✓	✓
H_2O	4304 A ✓	✓
Acetone	4301 A ✓	✓

Samples stored and locked ______

Remarks Filter blank # 3531026, ID. 4301B ✓

PROBE RINSE BLANK - CONT ID 4309 A ✓

RINSE - ACETONE

LABORATORY CUSTODY

Received by Alanis White Date 15-Feb-1983

Remarks NEG # 4061

Filter A - green coat, heavy

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/7/83
Sample location Boiler #1 Recovery date 2/7-8/83
Run number 2BM5B Recovered by DO/DS
Particulate sample type ____ M5 ✓ M5-320 ____ M5-450 ____ M5W
Particulate filter number 3531071 ✓
Particulate filter sample I.D. 4328 B ✓
Probe rinse Acetone I.D. 4328 A ✓
Purge train 20 min (check when completed) ✓
Location of filter in back half bet. imp 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	623.2 g	610.2 g	626.2 g	634.9 g	877.3 g
Initial wt	487.7 g	665.0 g	589.7 g	614.6 g	831.0 g
Net wt	135.5 g	-54.8 g	36.5 g	20.3 g	46.3 g

Total moisture 183.8 g 95 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4328 A ✓
IPA IMP. CONTAINER I.D. 4329 A ✓ LIQUID LEVEL MARKED ✓
H_2O_2 IMP. CONTAINER I.D. 4330 A ✓ LIQUID LEVEL MARKED ✓
BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED
IPA 4303A ✓ ✓
H_2O_2 4302A ✓ ✓
H_2O 4304A ✓ ✓
Acetone 4301A ✓ ✓

Samples stored and locked
Remarks Filter blank #3531026 ✓, I.D. 4301B
PROBE RINSE BLANK - CONT ID - 4310A ✓
RINSE - ACETONE

LABORATORY CUSTODY

Received by Lonie White Date 15 Feb. 1983
Remarks log #4061

Filter - green coat w/ black powder/granules (a lot), heavy
1st. imp H_2O - cloudy

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant [illegible] Sample date 2/7/83

Sample location Boiler No. 2 Recovery date 2/7+8/83

Run number 2CM5BW Recovered by DO/DS

Particulate sample type ______ M5 ______ M5-320 ______ M5-450 ✓ M5W-320

Particulate filter number 3531070 ✓

Particulate filter sample I.D. 4331B ✓

Probe rinse H_2O* I.D. 4331A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	597.5 g	623.2 g	637.6 g	609.1 g	867.4 g
Initial wt	483.3 g	670.2 g	604.2 g	589.1 g	827.9 g
Net wt	114.2 g	-47.0 g	33.4 g	20.0 g	39.5 g

Total moisture 160.1 g   80 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4331A ✓

IPA IMP. CONTAINER I.D. 4332A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4333A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	Container I.D.	Liquid level marked
IPA	4303A ✓	✓
H_2O_2	4302A ✓	✓
H_2O	4304A ✓	✓
Acetone	4301A ✓	✓

Samples stored and locked

Remarks Filter blank #3531026, I.D. 4301B

PROBE RINSE BLANK - CONT. I.D. - 4311A ✓

RINSE - H_2O

LABORATORY CUSTODY

Received by [signature] Date 15-Feb-1982

Remarks Key # 4061

Filter - green coat, heavy

* Approx 20 ml acetone in probe rinse

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/7/83

Sample location Boiler #2 Recovery date 2/7+8/83

Run number 2DM5BW Recovered by DO/DS

Particulate sample type ___ M5 ___ M5-320 ___ M5-450 ✓ M5W-320

Particulate filter number 3531069 ✓

Particulate filter sample I.D. 4334 B ✓

Probe rinse H_2O I.D. 4334A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	571.1 g	615.9 g	572.5 g	645.9 g	871.5 g
Initial wt	465.0 g	659.2 g	541.1 g	621.5 g	830.1 g
Net wt	106.1 g	-43.3 g	31.4 g	24.4 g	41.4 g

Total moisture 160.0 g 90 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4334 A ✓

IPA IMP. CONTAINER I.D. 4335 A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4336 A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4303 A ✓	✓
H_2O_2	4302 A ✓	✓
H_2O	4304 A ✓	✓
Acetone	4301 A N/A	✓

Samples stored and locked ______

Remarks Filter blank # 3530026, I.D 4301 B ✓

PROBE RINSE BLANK - CONT. ID 4312 A ✓

RINSE - H_2O

LABORATORY CUSTODY

Received by Louis White Date 15 Feb 1983

Remarks pkg # 4CG1

Filter - green coat, heavy

DRY MOLECULAR WEIGHT DETERMINATION

PLANT ______
DATE 2·7·83 TEST NO 2 - ABCD
SAMPLING TIME (24-hr CLOCK) ______
SAMPLING LOCATION Boiler #2
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) BAG
ANALYTICAL METHOD ORSAT
AMBIENT TEMPERATURE ______
OPERATOR ______
ORSAT LEAK CHECKED ✓

COMMENTS: Grab Sample @ 1600

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	13.6	13.6	13.6	13.6			13.6	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	16.6	3.0	16.5	2.9			2.95	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/8/83	UNIT 2 EAST	PART 503 504

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
3AM5B	PR RA ~~AB~~ JP	45	30.34	-.60	3531949	162	.84	206	4 OF 4

~~PT-206~~
PT-379
DI-125
OP-999

PROBE LENGTH AND TYPE	NOZZLE I.D	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER ΔH @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5 FT GLASS	.223	1A	11		FB4	1.72	1.003	9.0	0.019	1.0935		320	320		10.0

orsat good - no leaks
pitot good no leaks

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F F	SAMPLE BOX TEMPERATURE °F P	IMPINGER TEMPERATURE °F
	0	845	574.939										
	10.		580.299	0.65	0.93	0.93	303	46	45	3.5	321	344	43
	20.		585.673	0.65	0.93	0.93	306	48	45	4.0	324	329	43
	30.		590.978	0.65	0.93	0.93	308	53	46	4.5	334	334	45
	40.		596.377	0.67	0.95	0.95	307	56	46	5.0	316	322	45
	50.		601.740	0.67	0.95	0.95	309	60	48	5.0	322	327	45
	60.		607.148	0.67	0.95	0.95	310	62	50	5.5	336	322	46
	70.		612.600	0.68	0.97	0.97	310	63	51	6.0	330	320	37
	80.		617.950	0.65	0.92	0.92	311	64	52	6.5	327	331	38
	90.		623.286	0.65	0.92	0.92	311	65	53	7.0	318	323	39
	100.		628.650	0.65	0.92	0.92	312	66	54	7.0	330	323	40
	110.		634.100	0.68	0.96	0.96	313	66	55	7.5	319	319	40
	120.	1045	639.502	0.68	0.96	0.96	314	66	56	8.0	337	323	45

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/8/83	UNIT 2 EAST	PART 503 802

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
3BM5B	RR RA JP	45	3034	-60	3531909	162	084		10F1

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO.	METER BOX NO.	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6 FT GLASS	0221	19	11N		FB6	159	0960	15	0013	919		320	329		10

Leak check pitot tube good
orsat - good

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F F	P	IMPINGER TEMPERATURE °F
	0	845	094.740										
	10.		100.161	0.65	0.78	0.78	303	40	42	3.5	321	323	43
	20.		105.596	0.65	0.78	0.78	306	42	43	3.5	328	329	43
	30.		111.008	0.65	0.78	0.78	308	46	43	4.0	328	322	45
	40.		116.514	0.67	0.80	0.80	307	51	43	4.5	329	321	45
	50.		122.076	0.67	0.80	0.80	309	54	44	5.0	326	328	45
	60.		127.593	0.67	0.80	0.80	310	56	45	5.5	332	320	46
	70.		133.181	0.68	0.81	0.81	310	57	46	6.0	335	318	39
	80.		138.664	0.65	0.77	0.77	311	57	46	6.0	339	339	39
	90.		144.100	0.65	0.77	0.77	311	58	48	6.5	331	313	40
	100.		149.581	0.65	0.77	0.77	312	59	49	7.0	337	339	40
	110.		155.196	0.68	0.81	0.68	313	59	50	7.0	321	320	40
	120.	1045	160.804	0.68	0.81	0.81	314	60	50	7.5	335	318	43

EMISSION TESTING FIELD DATA

3 C

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	02/08/83	441 T49 GAST	M5BA400

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
5CM5BA	KILBRIDE	15	30.39	-.96	3531008	162	.84	206	1 0 F 1

Pitot 379

0.1?999

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER ΔH @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6 FT GLASS	0.221		11	QAC	FB5	1.84	0.983	20	.060	1.0891		400	529		10

Pitot @ 26" ok

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F FLTR	PRBE	IMPINGER TEMPERATURE °F
	0	8:45	180.494										
	10.0	8:55	185.825	.65	0.93	.93	303	44	46	4.5	314	385	42
	20.0	9:05	190.865	.65	.92	.92	306	47	46	5.0	320	405	44
	30.0	9:15	195.995	.65	.92	.92	308	53	46	5.5	329	397	46
	40.0	9:25	201.050	.67	.95	.95	307	58	48	5.0	323	407	45
	50.0	9:35	206.245	.67	.95	.95	309	62	50	5.5	333	407	46
	60.0	9:45	211.499	.67	.95	.95	310	69	51	6.0	330	411	44
	70.0	9:55	216.595	.68	.96	.96	310	64	52	6.0	325	418	42
	80.0	10:05	221.715	.65	.92	.92	311	65	54	6.5	335	425	38
	90.0	10:15	226.891	.65	.92	.92	311	66	54	6.5	335	395	39
	100.0	10:25	232.150	.65	.92	.92	312	67	55	6.5	330	422	40
	110.0	10:35	237.277	.68	.96	.96	313	68	56	7.0	317	406	41
	120.0	10:45	242.544	.68	.96	.96	314	68	56	7.0	328	403	44

62.05

T... 554

3 P

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	02/08/83	UNIT TWO EAST	M5BP400

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
3D1/5BP	CLARK	45	30.34	-.6	353/1OPA	162	.84		1 OF 1

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O, (%)	SAMPLE BOX NO	METER BOX NO.	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5 FT GLASS	215		1.1	QAD	FB4	1.88	1.030	60	.002	1.891		400	320		10

Preleak@17"OK

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F FLTR	PRBE	IMPINGER TEMPERATURE °F
	0	8:45	743.598										
	10.0	8:55	748.454	.65	.93	.93	303	42	42	2.0	319	396	42
	20.0	9:05	753.323	.65	.92	.92	306	44	42	2.5	333	415	42
	30.0	9:15	758.195	.65	.92	.92	308	49	43	2.5	311	399	40
	40.0	9:25	763.125	.67	.95	.95	307	53	44	3.0	326	411	44
	50.0	9:35	768.125	.67	.95	.95	309	56	47	3.5	334	428	46
	60.0	9:45	773.186	.67	.95	.95	310	56	47	4.0	320	419	42
	70.0	9:55	777.999	.68	.96	.96	310	57	48	4.5	319	409	40
	80.0	10:05	782.935	.65	.92	.92	311	57	49	4.5	336	419	36
	90.0	10:15	787.855	.65	.92	.92	311	58	50	5.0	313	400	38
	100.0	10:25	792.690	.65	.92	.92	312	58	51	5.0	328	431	36
	110.0	10:35	797.725	.68	.96	.96	313	59	51	5.5	329	405	38
	120.0	10:45	802.746	.68	.96	.96	314	60	52	6.0	319	409	43

59.148 $\overline{\Delta H}$ = .938 T_m: 50.6

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______________________ Sample date 2/8/83

Sample location Boiler #2 Recovery date 2/8/83

Run number 3AM5B Recovered by DO, DA

Particulate sample type ____ M5 ✓ M5-320 ____ M5-450 ____ M5W

Particulate filter number 3531010 ✓

Particulate filter sample I.D. 4338B ✓

Probe rinse Acetone I.D. 4338A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half between imp's 2+3.

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	626.5 g	642.7 g	630.6 g	608.7 g	835.5 g
Initial wt	505.7 g	676.0 g	600.0 g	591.6 g	800.3 g
Net wt	120.8 g	-33.3 g	30.6 g	17.1 g	35.2 g

Total moisture 170.4 g 15 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4338A ✓

IPA IMP. CONTAINER I.D. 4339A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4340A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4303 A ✓	✓
H_2O_2	4302 A ✓	✓
H_2O	4304 A ✓	✓
Acetone	4301 A ✓	✓

Samples stored and locked ______________________

Remarks ______________________

LABORATORY CUSTODY

Received by Lonis White Date 15 Feb 1983

Remarks Reg. # 4061

Filter - green coat, heavy

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______________________ Sample date 2/8/83

Sample location Boiler #2 Recovery date 2/8/83

Run number 3B M5 B Recovered by DJ, DO

Particulate sample type ____ M5 ✓ M5-320 ____ M5-450 ____ M5W

Particulate filter number 3531009 ✓

Particulate filter sample I.D. ~~4331 B~~ 4341 B ✓

Probe rinse Acetone I.D. 4341 A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half Between imp's 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	630.4 g	630.8 g	634.2 g	622.7 g	856.4 g
Initial wt	506.9 g	671.2 g	604.2 g	602.7 g	820.7 g
Net wt	123.5 g	-40.4 g	30.0 g	20.0 g	35.7 g

Total moisture 168.8 g 85 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4341 A ✓

IPA IMP. CONTAINER I.D. 4342 A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4343 A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4303 A	✓
H_2O_2	4302 A ✓	✓
H_2O	4304 A ✓	✓
Acetone	4301 A ✓	✓

Samples stored and locked ______________________

Remarks ______________________

LABORATORY CUSTODY

Received by Dennis White Date 15 Feb. 1983

Remarks Reg. # 4661

Filter - green coat, heavy

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/8/83

Sample location Boiler #2 Recovery date 2/8/83

Run number 3CM5B-D400 Recovered by DB/DS

Particulate sample type ____ M5 ✓ M5-320 P400 ~~M5-450~~ ____ M5W

Particulate filter number 353100P ✓

Particulate filter sample I.D. 4344B ✓

Probe rinse Acetone I.D. 4344A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half between imp's 2+3.

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	590.0 g	641.8 g	563.7 g	624.2 g	881.4 g
Initial wt	483.4 g	667.1 g	545.1 g	610.5 g	851.6 g
Net wt	106.6 g	-25.3 g	18.6 g	13.7 g	29.8 g

Total moisture 143.4 g 55 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4344A ✓

IPA IMP. CONTAINER I.D. 4345A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4346A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4303A ✓	✓
H_2O_2	4302A ✓	✓
H_2O	4304A ✓	✓
Acetone	4301A ✓	✓

Samples stored and locked ______

Remarks ______

LABORATORY CUSTODY

Received by Doris Inhete Date 15-Feb. 1983

Remarks Reg # 4061

Filter - green coat, heavy

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/8/83

Sample location Boiler #2 Recovery date 2/8/83

Run number 3DM5B-P400 Recovered by DO/DS

Particulate sample type ____ M5 ✓ M5-320 P400 ~~M5-450~~ ____ M5W

Particulate filter number 3831007 ✓

Particulate filter sample I.D. 4347B ✓

Probe rinse Acetone I.D. 4347A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half between imp's 2+3.

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	613.3 g	639.0 g	626.4 g	622.8 g	886.7 g
Initial wt	497.6 g	672.8 g	594.6 g	604.6 g	855.1 g
Net wt	115.7 g	-33.8 g	31.8 g	18.2 g	31.6 g

Total moisture 163.5 g 60 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4347A ✓

IPA IMP. CONTAINER I.D. 4348A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4349A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4303A ✓	✓
H_2O_2	4302A ✓	✓
H_2O	4304A ✓	✓
Acetone	4301A ✓	✓

Samples stored and locked ______

Remarks ______

LABORATORY CUSTODY

Received by Doris White Date 15 Feb. 1983

Remarks Reg #4061

Filter - green coat w/ black, heavy

DRY MOLECULAR WEIGHT DETERMINATION

PLANT ______
DATE 2.8.83 TEST NO. 3
SAMPLING TIME (24-hr CLOCK) 1040
SAMPLING LOCATION Boiler #2
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Bag
ANALYTICAL METHOD ORSAT
AMBIENT TEMPERATURE 60
OPERATOR D. Scheffel
ORSAT LEAK CHECKED ✓

COMMENTS:

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	13.6	13.6	13.8	13.8			13.7	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	16.0	2.4	16.1	2.3			2.35	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
P	2/8/83	UNIT 2 EAST	P400 PART 503 504

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
4AMSBP	PR RA JR	50	3036	-60	353P458	162	084	178	10F1

PT-278
DI-125
OP-948

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5 FT GLASS	0224	2A	111		FB4	172	1003	9	00.00	1124		400	320		10.0

pitot tube no leaks
orsat no leaks

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in.H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in.Hg	SAMPLE BOX TEMPERATURE °F F	P	IMPINGER TEMPERATURE °F
	0	1230	639.710										
	10		645.416	0.72	1.03	1.03	314	58	56	4.5	347	398	~~34~~ 50
	20		651.047	0.72	1.03	1.03	317	60	56	4.5	318	401	50
	30		656.673	0.72	1.03	1.03	318	64	57	5.0	340	409	51
	40		662.447	0.75	1.07	1.07	318	68	58	5.5	327	407	51
	50		668.169	0.75	1.07	1.07	317	70	60	6.0	333	406	51
	60		673.838	0.72	1.03	1.03	317	71	60	6.0	341	408	50
	70		679.434	0.72	1.03	1.03	317	72	61	6.5	327	413	50
	80		685.020	0.70	1.00	1.00	318	73	62	6.5	338	409	52
	90		690.611	0.70	1.00	1.00	318	75	63	7.0	335	408	52
	100		696.309	0.72	1.03	1.03	317	76	64	7.5	335	410	57
	110		701.964	0.72	1.03	1.03	318	76	65	8.0	317	411	51
	120	1430	707.671	0.72	1.03	1.03	319	77	66	8.0	330	400	51

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/8/83	UNIT 2 EAST	P400 PART 503 504

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
4BM5BP	PR RA JP	50	30.36	-.60	00253P	162	0.84		0 F

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER ΔH@	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6 FT GLASS	0.227	2B	11 N		FB6	1.59	0.969	10	0.005	1.0231		400	320		Y0

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F F	P	IMPINGER TEMPERATURE °F
	0	1230	162.434										
	10.		168.474	0.72	0.95	0.95	314	52	52	4.5	320	409	~~34~~ 48
	20.		174.553	0.72	0.95	0.95	317	52	52	4.5	324	420	48
	30.		180.584	0.72	0.95	0.95	318	58	52	5.0	323	402	50
	40.		186.800	0.~~72~~75	0.99	0.99	318	61	52	5.5	322	404	50
	50.		192.990	0.75	0.99	0.99	317	64	54	6.0	322	402	51
	60.		199.064	0.72	0.95	0.95	317	65	56	6.5	324	407	50
	70.		205.137	0.72	0.95	0.95	317	66	56	6.5	327	407	50
	80.		211.094	0.70	0.92	0.92	318	66	58	7.0	328	417	50
	90.		217.103	0.70	0.92	0.92	318	67	59	7.5	330	419	51
	100.		223.214	0.72	0.95	0.95	317	68	60	7.5	323	420	50
	110.		229.300	0.72	0.95	0.95	318	69	60	8.0	327	418	50
	120.	1430	235.462	0.72	0.95	0.95	319	69	60	8.5	324	414	50

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EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	02/08/83	UNIT T44 EAST	M5B

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
4C-M5B	CLARKE	60	30.36	-.06	353,066	162		.84	178	1 OF 1

Pitot 278

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6 FT GLASS	~~.249~~ .211 pm		11	GAR		1.8A	.9923	10	.020	9.575		320	320		10

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F FLTR	PRBE	IMPINGER TEMPERATURE °F
	0	12:30	244.025										
	10.0	12:40	249.129	.72	.89	.89	314	57	56	4.0	331	346	55
	20.0	12:50	254.111	.72	.89	.89	317	58	56	4.0	316	295	56
	30.0	13:00	259.195	.72	.89	.89	318	64	57	4.0	324	328	58
	40.0	13:10	264.300	.75	.92	.92	318	68	58	4.5	326	335	58
	50.0	13:20	269.444	.75	.92	.92	317	70	59	4.5	325	323	56
	60.0	13:30	274.500	.72	.89	.89	317	72	60	5.0	326	327	54
	70.0	13:40	279.525	.72	.89	.89	317	73	62	5.0	324	330	50
	80.0	13:50	284.465	.70	.86	.86	318	74	62	5.0	325	328	50
	90.0	14:00	289.425	.70	.86	.86	318	74	64	5.5	324	330	52
	100.0	14:10	294.504	.72	.89	.89	317	75	65	6.0	323	330	52
	110.0	14:20	299.622	.72	.89	.89	318	75	65	6.0	326	330	54
	120.0	14:30	304.732	.72	.89	.89	319	76	66	6.5	328	322	56
	60.527					.89		65.25					

P-12

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	02/08/83	WHITING EAST	M5B

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
4D-M5B	CLARKE	60	30.36	-.06	358 1068	162	.84	78	1 OF 1

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5 FT GLASS	.211		11	QUAD		1.88	1.030	10	.001	1.575		320	320		10

.210 /m

PRETEST @ 16" OK

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F		IMPINGER TEMPERATURE °F
	0	12:30	802.979										
	10.0	12:40	807.867	.72	.89	.89	314	54	54	4.5	327	316	58
	20.0	12:50	812.715	.72	.89	.89	317	55	54	5.0	317	312	58
B-3	30.0	13:00	817.535	.72	.89	.89	318	58	54	5.0	312	328	60
	40.0	13:10	822.475	.75	.92	.22	318	60	57	6.0	322	312	58
	50.0	13:20	827.385	.75	.92	.72	317	62	56	6.0	325	323	56
	60.0	13:30	832.265	.72	.89	.89	317	63	56	6.5	312	326	52
	70.0	13:40	837.110	.72	.89	.89	317	63	57	7.0	309	317	52
	80.0	13:50	841.925	.70	.86	.86	318	64	58	7.0	320	322	50
	90.0	14:00	846.725	.70	.86	.86	318	65	58	7.5	326	327	52
	100.0	14:10	851.621	.72	.89	.89	317	66	60	8.0	310	329	54
	110.0	14:20	856.475	.72	.89	.89	318	66	60	8.5	318	320	50
	120.0	14:30	861.373	.72	.89	.89	319	66	60	9.0	327	316	57

56.398 57.

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______________________ Sample date 2/8/83

Sample location Boiler #2 Recovery date 2/8+9/83

Run number 4 AM5B P400 Recovered by DB/DS

Particulate sample type ____ M5 ✓ M5-320 P400 ~~M5-450~~ ____ M5W

Particulate filter number 3530458 - 3530458 ✓

Particulate filter sample I.D. 4352 B ✓

Probe rinse Acetone I.D. 4352 A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half between imp's 2+3.

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	619.5 g	634.6 g	644.7 g	615.8 g	867.1 g
Initial wt	494.3 g	672.0 g	612.3 g	596.8 g	828.6 g
Net wt	125.2 g	-37.4 g	32.4 g	19.0 g	38.5 g

Total moisture 177.7 g 40 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4352 A ✓

IPA IMP. CONTAINER I.D. 4353 A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4354A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4303 A ✓	✓
H_2O_2	4302 A ✓	✓
H_2O	4304 A ✓	✓
Acetone	4301 A ✓	✓

Samples stored and locked ______________________

Remarks ______________________

LABORATORY CUSTODY

Received by Sonia White Date 15-Feb-1983

Remarks reg #4061

Filter - green coat, heavy

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/8/83

Sample location Boiler #2. Recovery date 2/8/~~/~~10/83

Run number 4B M5B·P400 Recovered by DB/DS

Particulate sample type ___ M5 ✓ M5-320 P400 ~~M5-450~~ ___ M5W

Particulate filter number 0002530 ✓

Particulate filter sample I.D. 4355B ✓

Probe rinse Acetone I.D. 4355A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half between imp's 2+3.

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	620.4 g	622.4 g	621.5 g	646.7 g	864.9 g
Initial wt	490.5 g	671.3 g	584.7 g	624.5 g	820.5 g
Net wt	129.9 g	-48.9 g	36.8 g	22.2 g	44.4 g

Total moisture 184.4 g 50 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4355A ✓

IPA IMP. CONTAINER I.D. 4356A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4357A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4303A ✓	✓
H_2O_2	4302A ✓	✓
H_2O	4304A ✓	✓
Acetone	4301A ✓	✓

Samples stored and locked ______

Remarks ______

LABORATORY CUSTODY

Received by Diane White Date 15 Feb 1983

Remarks Acq # 4061

Lt green coat, heavy, w/ black mostly around edge

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/8/83

Sample location Boiler #2 Recovery date 2/8+10/83

Run number 4C M5B Recovered by DO/DS

Particulate sample type ___ M5 ✓ M5-320 ___ M5-450 ___ M5W

Particulate filter number 3531066 ✓

Particulate filter sample I.D. 4358 B ✓

Probe rinse Acetone I.D. 4358 A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half Between imp's 2+3.

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	610.2 g	624.6 g	623.8 g	630.5 g	829.5 g
Initial wt	498.6 g	664.0 g	591.4 g	610.5 g	797.8 g
Net wt	111.6 g	-39.4 g	32.4 g	20.0 g	31.7 g

Total moisture 156.3 g 35 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4358 A ✓

IPA IMP. CONTAINER I.D. 4359 A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4360 A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4303A ✓	✓
H_2O_2	4302A ✓	✓
H_2O	4304A ✓	✓
Acetone	4301A ✓	✓

Samples stored and locked ______

Remarks ______

LABORATORY CUSTODY

Received by Dennis DiPaile Date 15 Feb 1983

Remarks rcq # 4061

Filter - green coat, heavy

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/8/83

Sample location Boiler #2 Recovery date 2/8+10/83

Run number 4D M5B Recovered by DO/DS

Particulate sample type ____ M5 ✓ M5-320 ____ M5-450 ____ M5W

Particulate filter number 3531068 ✓

Particulate filter sample I.D. 4361 B ✓

Probe rinse Acetone I.D. 4361 A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half between imp's 2+3.

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	577.8 g	623.0 g	584.4 g	642.1 g	873.5 g
Initial wt	468.0 g	665.4 g	552.6 g	620.9 g	834.5 g
Net wt	109.8 g	-42.4 g	31.8 g	21.2 g	39.0 g

Total moisture 159.4 g 40 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4361 A ✓

IPA IMP. CONTAINER I.D. 4362 A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4363 A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4303 A ✓	✓
H_2O_2	4302 A ✓	✓
H_2O	4304 A ✓	✓
Acetone	4301 A ✓	✓

Samples stored and locked ______

Remarks acetone probe rinse blank #4350A ✓

LABORATORY CUSTODY

Received by [signature] Date 15 Feb. 1983

Remarks reg #4061

Filter - green coat, heavy, w/ some black

DRY MOLECULAR WEIGHT DETERMINATION

PLANT __________
DATE 2.8.83 TEST NO 04 Bag A
SAMPLING TIME (24-hr CLOCK) 1420
SAMPLING LOCATION Boiler #2
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Bag
ANALYTICAL METHOD ORSAT
AMBIENT TEMPERATURE 70
OPERATOR D. Schleffel
ORSAT LEAK CHECKED ✓

COMMENTS:

GAS \ RUN	1 ACTUAL READING	1 NET	2 ACTUAL READING	2 NET	3 ACTUAL READING	3 NET	AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
CO_2	13.6	13.6	13.6	13.6			13.6	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	15.9	2.3	15.9	2.3			2.3	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

DRY MOLECULAR WEIGHT DETERMINATION

PLANT ______

DATE 2.8.83 TEST NO 4 Bag B

SAMPLING TIME (24-hr CLOCK) 1430

SAMPLING LOCATION Boiler #2

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Bag

ANALYTICAL METHOD Orsat

AMBIENT TEMPERATURE 70

OPERATOR D. Schiffel

ORSAT LEAK CHECKED ✓

COMMENTS:

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	13.6	13.6	13.6	13.6			~~12.6~~ 13.6	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	15.9	2.3	15.9	2.3			2.3	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
7	2/11/8	UNIT 2 EAST	M5B

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
5AM5B	RR RA	60	30.05	-.80	353,067	162	0.84	206	1 OF 1

PT-379
DJ-125
OP-999

PROBE LENGTH AND TYPE	NOZZLE, I.D	NOZZLE, NO.	H_2O, (%)	SAMPLE BOX NO	METER BOX NO.	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5 FT GLASS	.223	1A	ND		FB	1.72	1.003	7	.000	ND		320	320		10

pitot tube no leaks
orsat no leaks IT-#447

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F F	P	IMPINGER TEMPERATURE °F
	0	755	708.102										
	10.	8:05	713.796	0.70	1.03	1.03	301	63	62	4.0	327	359	52
	20.	8:15	719.262	0.65	0.95	0.95	303	64	62	4.0	341	330	52
	30.	8:25	724.692	0.65	0.95	0.95	305	68	62	4.0	377	328	53
	40.	8:35	730.183	0.65	0.95	0.95	305	70	62	5.0	321	323	53
	50.	8:45	735.892	0.70	1.02	1.02	305	73	63	5.5	330	323	54
	60.	8:55	741.423	0.65	0.95	0.95	304	75	64	5.5	331	317	54
	70.	9:05	746.950	0.65	0.95	0.95	305	77	65	6.0	330	318	52
	80.	9:15	752.500	0.65	0.95	0.95	304	78	66	6.0	323	337	52
	90.	925	757.988	0.65	0.95	0.95	307	79	68	6.5	324	329	52

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/11/83	UNIT 2 EAST	M5B

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
5BM5B	RR RA JP	60	30.05	-.80	353/913	162	.84	206	1 OF 1

PROBE LENGTH AND TYPE	NOZZLE, I.D.	NOZZLE, NO.	H_2O, (%)	SAMPLE BOX NO	METER BOX NO.	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6 FT GLASS	.221	13	11		FB6	1.59	.960	8	50.000	.386		320	329		10

IT - #449

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F F	SAMPLE BOX TEMPERATURE °F P	IMPINGER TEMPERATURE °F
	0	755	236.455										
	10.	8:05	242.410	0.70	0.86	0.86	301	56	58	4.0	322	297	52
	20.	8:15	247.969	0.65	0.80	0.80	303	57	58	3.5	340	324	52
B-41	30.	8:25	253.558	0.65	0.80	0.80	305	62	58	4.0	332	322	52
	40.	8:35	259.176	0.65	0.80	0.80	305	65	59	4.0	336	319	53
	50.	8:45	265.000	0.70	0.86	0.86	305	67	59	4.0	337	322	53
	60.	8:55	270.627	0.65	0.80	0.80	304	69	60	4.0	329	318	55
	70.	8:05	276.234	0.65	0.80	0.80	305	70	61	5.5	333	317	50
	80.	9:15	281.856	0.65	0.80	0.80	304	71	62	6.0	329	328	50
	90.	925	287.555	0.65	0.80	0.80	307	72	63	6.0	327	328	51

5-C

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/11/83	UNIT TWO EAST	MSB

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
5C-MSB	CLARKE	60	30.05	-.08	353/124	162	.84	206	1 of 1

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6 FT GLASS	.221		11	RA	FGS	1.84	.983	11	.000	4.791		320	320		10

Pretest @ 15

ITC# 450

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F FLTR	PRBE	IMPINGER TEMPERATURE °F
	0	7:55	306.333										
	10.	8:05	311.845	0.7	.98	.98	301	62	62	5.0	327	318	56
	20.	8:15	317.000	0.65	.91	.91	303	64	62	4.5	324	322	54
	30.	8:25	322.180	0.65	.91	.91	303	70	62	5.0	322	328	52
	40.	8:35	327.245	0.65	.91	.91	303	74	63	5.5	326	325	59
	50.	8:45	332.630	0.7	.98	.98	305	77	64	6.0	329	321	50
	60.	8:55	337.737	0.65	.91	.91	304	79	69	6.5	336	315	52
	70.	9:05	342.945	0.65	.91	.91	305	80	67	6.5	336	314	52
	80.	9:15	348.190	0.65	.91	.91	304	80	68	7.0	332	326	50
	90.	9:25	353.282	0.65	.91	.91	307	81	69	7.0	312	324	48

46.949

5.D

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/11/83	UNIT TWO EAST	MSB

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
5D-MSB	CLARKE	60	30.05	-.08	353/123	102	.84	206	1 OF 1

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5 FT GLASS	.215		11	GAD	FB4	1.88	1.030	8.9	.010	1.978		320	320		10

Prelest @ 17"

TC # 448

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F FCTR	PRBE	IMPINGER TEMPERATURE °F
	0	7:55	863.797										
	10.	8:05	868.940	0.7	.98	.98	301	58	58	2.5	311	320	52
	20.	8:15	874.125	0.65	.91	.91	303	60	58	2.5	317	325	52
	30.	8:25	878.910	0.65	.91	.91	305	68	62	3.0	322	328	50
	40.	8:35	883.833	0.65	.91	.91	305	68	60	3.0	325	324	50
	50.	8:45	889.000	0.7	.98	.98	305	70	62	3.5	321	321	48
	60.	8:55	893.845	0.65	.91	.91	304	71	62	4.0	315	317	52
	70.	9:05	898.939	0.65	.91	.91	305	72	64	4.0	319	318	50
	80.	9:15	903.900	0.65	.91	.91	304	73	66	4.5	325	326	52
	90.	9:25	908.861	0.65	.91	.91	302	74	66	5.0	314	321	50
			45.064		.926			65.0					

B-43

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/11/83
Sample location Boiler No. 2 Recovery date 2/11/83
Run number 5AM5B Recovered by DO/DS
Particulate sample type ____ M5 ✓ M5-320 ____ M5-450 ____ M5W
Particulate filter number 3531067 ✓
Particulate filter sample I.D. 4364 B ✓
Probe rinse Acetone I.D. 4364A ✓
Purge train 20 min (check when completed) ✓
Location of filter in back half betw. imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	596.4 g	644.9 g	625.2 g	611.2 g	856.1 g
Initial wt	504.9 g	675.9 g	597.0 g	595.4 g	822.0 g
Net wt	91.5 g	-31.0 g	28.2 g	15.8 g	34.1 g

Total moisture 138.6 g 35 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4364 A ✓
IPA IMP. CONTAINER I.D. 4365A ✓ LIQUID LEVEL MARKED ✓
H_2O_2 IMP. CONTAINER I.D. 4366A ✓ LIQUID LEVEL MARKED ✓
BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED
IPA 4303A ✓ ✓
H_2O_2 4302A ✓ ✓
H_2O 4304A ✓ ✓
Acetone 4301A ✓ ✓

Samples stored and locked ______
Remarks Filter - green coat, medium

LABORATORY CUSTODY

Received by [signature] Date 15 Feb 1983
Remarks reg # 4061

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/11/83

Sample location BzYer #2 Recovery date 2/11/83

Run number 5BM5B Recovered by DB/DS

Particulate sample type ______ M5 ✓ M5-320 ______ M5-450 ______ M5W

Particulate filter number 3531018 - 3531018 ✓

Particulate filter sample I.D. 4367 B ✓

Probe rinse Acetone I.D. 4367 A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. Imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	596.4 g	637.0 g	642.1 g	617.6 g	884.3 g
Initial wt	507.5 g	669.5 g	610.8 g	599.8 g	852.6 g
Net wt	88.9 g	-32.5 g	31.3 g	17.8 g	31.7 g

Total moisture 137.2 g 25 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4367 A ✓

IPA IMP. CONTAINER I.D. 4368 A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4369 A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	Container I.D.	Liquid level marked
IPA	4303 A ✓	✓
H_2O_2	4302 A ✓	✓
H_2O	4304 A ✓	✓
Acetone	4301 A ✓	✓

Samples stored and locked ______

Remarks Filter - green coat, medium

LABORATORY CUSTODY

Received by Gloria White Date 15 Feb 1983

Remarks Reg #4061

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/11/83

Sample location Bayer #2 Recovery date 2/11/83

Run number 5CM5B Recovered by DB/DS

Particulate sample type ______ M5 ✓ M5-320 ______ M5-450 ______ M5W

Particulate filter number 3531124 ✓

Particulate filter sample I.D. 4370 R ✓

Probe rinse Acetone I.D. 4370A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. imp 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	572.8 g	622.0 g	577.2 g	626.9 g	884.6 g
Initial wt	485.4 g	665.9 g	546.1 g	609.1 g	845.4 g
Net wt	87.4 g	-43.9 g	31.1 g	17.8 g	39.2 g

Total moisture 131.6 g   25 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4370 A ✓

IPA IMP. CONTAINER I.D. 4371 A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4372 A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	Container I.D.	Liquid level marked
IPA	4303 A	✓
H_2O_2	4302 A ✓	✓
H_2O	4304 A ✓	✓
Acetone	4381 A ✓	✓

Samples stored and locked ______

Remarks Filter-green coat, medium

LABORATORY CUSTODY

Received by Leonie White Date 15 Feb 1983

Remarks Reg # 4061

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/11/83

Sample location Boiler No. 2 Recovery date 2/11/83

Run number 5DM5B Recovered by D8/DS

Particulate sample type ___ M5 ✓ M5-320 ___ M5-450 ___ M5W

Particulate filter number 3531123 ✓

Particulate filter sample I.D. 4373 B ✓

Probe rinse Acetone I.D. 4373 A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	586.8 g	632.9 g	631.8 g	612.6 g	863.8 g
Initial wt	498.9 g	673.7 g	599.6 g	595.5 g	827.4 g
Net wt	87.9 g	-40.8 g	32.2 g	17.1 g	36.4 g

Total moisture 132.8 g 30 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4373 A ✓

IPA IMP. CONTAINER I.D. 4374 A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4375 A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4303 A ✓	✓
H_2O_2	4302 A ✓	✓
H_2O	4304 A ✓	✓
Acetone	4301 A ✓	✓

Samples stored and locked ______

Remarks Filter green coat, medium

LABORATORY CUSTODY

Received by Louis White Date 15 Feb. 1983

Remarks Req. # 4061

DRY MOLECULAR WEIGHT DETERMINATION

PLANT
DATE 2.11.83 TEST NO 05
SAMPLING TIME (24-hr CLOCK) 1000
SAMPLING LOCATION Boiler #2
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) BAG
ANALYTICAL METHOD ORSAT
AMBIENT TEMPERATURE 70
OPERATOR AB
ORSAT LEAK CHECKED ✓

COMMENTS:

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	12.8	12.8	12.8	12.8			12.8	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	16.0	3.2	16.1	3.3			3.25	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/11/83	UNIT 2 EAST	M5B

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
6AM5B	PR RA NP	60	30.10	.25	353106	162	.84	278	1 OF 1

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5 FT GLASS	.224	2A	11.0		FB4	1.72	1.003	8.0	0.999	11.39		320	320		10

PT - 278
DI - 125
OP - 998
IT - 447

pitot tube no leaks
ORSAT no leaks

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F F	P	IMPINGER TEMPERATURE °F
	0	1050	758.131										
	10.	1100	763.876	0.70	1.03	1.03	311	70	68	4.5	315	303	66
	20.	1110	769.397	0.65	0.96	0.96	313	71	68	4.5	328	334	60
	30.	1120	774.920	0.65	0.96	0.96	313	75	68	5.0	346	312	60
	40.	1130	780.453	0.65	0.96	0.96	315	78	69	5.5	316	312	60
	50.	1140	786.057	0.67	0.98	0.98	316	80	70	6.0	329	316	60
	60.	1150	791.653	0.67	0.98	0.98	314	81	71	6.5	321	318	60
	70.	1200	797.273	0.67	0.98	0.98	316	82	72	7.0	336	317	59
	80.	1210	802.831	0.65	0.96	0.96	315	82	72	7.0	338	324	62
	90.	1220	808.3[illegible]	0.65	0.96	0.96	317	84	73	7.5	338	333	62

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/11/83	UNIT 2 EAST	MSB

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
6BMSB	PR RA JP	60	30.10	+.25	3531062	162	.84	178	1 OF 1

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO	METER ΔH@	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6 FT GLASS	~~.221~~ .227		11.0			1.50	.960	15	.009	9.413		320	320		10

IT-449

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F F	SAMPLE BOX TEMPERATURE °F P	IMPINGER TEMPERATURE °F
	0	1050	287.808										
	10.	1100	293.165	0.70	0.85	0.85	311	63	63	4.0	319	316	60
	20.	1110	299.214	0.65	0.79	0.79	313	64	63	4.0	335	342	56
	30.	1120	304.890	0.65	0.79	0.79	313	68	64	4.5	332	328	56
	40.	1130	310.472	0.65	0.79	0.79	315	72	64	4.5	319	313	56
	50.	1140	316.167	0.67	0.81	0.81	316	74	66	5.0	329	317	58
	60.	1150	321.872	0.67	0.81	0.81	314	75	67	6.0	332	307	58
	70.	1200	327.592	0.67	0.81	0.81	316	76	68	6.0	326	330	58
	80.	1210	333.200	0.65	0.79	0.79	315	77	69	6.5	330	333	60
	90.	1220	338.850	0.65	0.79	0.79	317	77	69	7.0	336	350	60

EMISSION TESTING FIELD DATA

6C

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/11/83	UNIT TWO EAST	M5B

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
6C-M5B	CLARKE	60	30.0	+.25	S3DV/EE	167	.84	178	1 OF 1

Pitot 278

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER Δ H @	METER CAL. FACTOR V	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6 FT GLASS	.211		11	QAK	FB6	1.84	0.983	6.0	.004	8.37		320	324		10

Pretest @ 15" ok

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in.H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in.Hg	SAMPLE BOX TEMPERATURE °F FLTR	PROBE	IMPINGER TEMPERATURE °F
	0	10:50	353.557										
B-5L	10.	11:00	358.565	.7	.85	.85	311	68	68	3.5	313	317	59
	20.	11:10	363.343	.65	.79	.79	313	70	68	3.5	320	323	58
	30.	11:20	368.650	.65	.79	.79	313	74	69	4.0	319	316	57
	40.	11:30	373.500	.65	.79	.79	315	80	70	4.0	[illegible]	315	60 FLTR 322
	50.	11:40	378.300	.67	.81	.81	316	82	71	4.5	316	317	60
	60.	11:50	382.780	.67	.81	.81	314	84	72	4.5	326	322	57
	70.	12:00	387.625	.67	.81	.81	316	84	73	5.0	323	314	57
	80.	12:10	392.655	.65	.79	.79	315	85	74	5.0	327	327	60
	90.	12:20	397.318	.65	.78	.78	317	86	75	5.5	326	340	60

43.761 .79 535

6-D

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	02/11/83	UNIT TWO EAST	M5B

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS. (IN Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
6D-M5B	RLARGO	6[illegible]	30.10	+0.25	555/090	162	.84	178	1 OF 1

PROBE LENGTH AND TYPE	NOZZLE, I.D.	NOZZLE, NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO	METER ΔH @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5 FT GLASS	.219		11	RAD	FB-1	1.88	1.030	7.0	.015	9.374		320	329		10

1.88

Pretest@16" OK

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F FLTR	SAMPLE BOX TEMPERATURE °F PRBE	IMPINGER TEMPERATURE °F
	0	10:50	909.442										
	10.	11:00	914.580	.7	.85	.85	311	66	65	5.0	312	322	62
	20.	11:10	919.185	.65	.79	.79	313	68	66	4.5	328	330	60
	30.	11:20	924.225	.65	.79	.79	313	71	66	5.0	332	314	58
	40.	11:30	928.600	.65	.79	.79	315	74	68	5.5	333	326	61
	50.	11:40	933.490	.67	.81	.81	316	76	69	5.5	326	324	60
	60.	11:50	937.937	.67	.81	.81	314	77	70	6.0	326	324	57
	70.	12:00	942.445	.67	.81	.81	316	78	71	6.5	309	318	58
	80.	12:10	947.200	.65	.79	.79	315	78	71	7.0	321	328	57
	90.	12:20	951.818	.65	.78	.78	317	78	72	7.0	331	328	60

42.376

531

B-52

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/11/83

Sample location Bayer No. E Recovery date 2/11/83

Run number 6AM5B Recovered by DO/DS

Particulate sample type ___ M5 ✓ M5-320 ___ M5-450 ___ M5W

Particulate filter number 3531061 ✓

Particulate filter sample I.D. 4380 B ✓

Probe rinse Acetone I.D. 4380 A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. Imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	584.8 g	636.9 g	645.2 g	615.9 g	922.3 g
Initial wt	497.8 g	674.8 g	615.1 g	598.2 g	881.6 g
Net wt	87.0 g	-37.9 g	30.1 g	17.7 g	40.7 g

Total moisture 137.6 g 45 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4380 A ✓

IPA IMP. CONTAINER I.D. 4381 A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4382 A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

IPA 4377 A ✓ ✓

H_2O_2 4378 A ✓ ✓

H_2O 4379 A ✓ ✓

Acetone 4376 A ✓ ✓

Samples stored and locked ______

Remarks Filter - green coat, medium

LABORATORY CUSTODY

Received by Doris White Date 15 Feb 1983

Remarks Req # 4061

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/11/83

Sample location Dryer #2 Recovery date 2/11/83

Run number 6BM5B Recovered by DO/DS

Particulate sample type ___ M5 ✓ M5-320 ___ M5-450 ___ M5W

Particulate filter number 3531062 ✓

Particulate filter sample I.D. 4384 B ✓

Probe rinse Acetone I.D. 4384 A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	580.7 g	631.9 g	627.8 g	635.5 g	865.4 g
Initial wt	492.6 g	669.1 g	594.4 g	618.6 g	830.3 g
Net wt	88.1 g	-37.2 g	33.4 g	16.9 g	35.1 g

Total moisture 136.3 g 40 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4384 A ✓

IPA IMP. CONTAINER I.D. 4385 A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4386 A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

IPA	4377A	✓
H_2O_2	4378A ✓	✓
H_2O	4379A ✓	✓
Acetone	4376A ✓	✓

Samples stored and locked ______

Remarks filter - green coat, medium

LABORATORY CUSTODY

Received by Thomas White Date 15 Feb 1983

Remarks Reg. # 4061

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ____________ Sample date 2/11/83

Sample location Dryer #2 Recovery date 2/11/83

Run number 6C M5B Recovered by DB/DS

Particulate sample type ____ M5 ✓ M5-320 ____ M5-450 ____ M5W

Particulate filter number 3531108 ✓

Particulate filter sample I.D. 4387 B ✓

Probe rinse Acetone I.D. 4387 A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	576.5 g	631.0 g	619.5 g	621.8 g	827.5 g
Initial wt	498.5 g	660.7 g	592.6 g	606.3 g	800.5 g
Net wt	78.0 g	-29.7 g	26.9 g	15.5 g	27.0 g

Total moisture 117.7 g 20 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4387A ✓

IPA IMP. CONTAINER I.D. 4388A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4389 A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4377A ✓	✓
H_2O_2	4378A ✓	✓
H_2O	4379A ✓	✓
Acetone	4376A ✓	✓

Samples stored and locked ____________

Remarks Filter-green coat, medium

LABORATORY CUSTODY

Received by Alone White Date 15-Feb-1983

Remarks Log # 4061

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/11/83

Sample location Boiler #7 Recovery date 2/11/83

Run number 6DM5B Recovered by DB/DS

Particulate sample type ___ M5 ✓ M5-320 ___ M5-450 ___ M5W

Particulate filter number 3531036 ✓

Particulate filter sample I.D. 4390 B ✓

Probe rinse Acetone I.D. 4390 A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. Imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	543.8 g	628.6 g	581.2 g	623.6 g	852.3 g
Initial wt	468.8 g	663.5 g	553.1 g	607.4 g	820.5 g
Net wt	75.0 g	-34.9 g	28.1 g	16.2 g	31.8 g

Total moisture 116.2 g 35 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4390 A ✓

IPA IMP. CONTAINER I.D. 4391 A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4392 A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

IPA	4377A ✓	✓
H_2O_2	4378A ✓	✓
H_2O	4359A ✓	✓
Acetone	4376A ✓	✓

Samples stored and locked ______

Remarks Filter - green coat, medium
- filter holder broken before recovery - no loss resulting

LABORATORY CUSTODY

Received by Dennis White Date 15-Feb-1983

Remarks Reg. # 4061

DRY MOLECULAR WEIGHT DETERMINATION

PLANT

DATE 2-11-83 TEST NO 06

SAMPLING TIME (24-hr CLOCK) 1230

SAMPLING LOCATION Boiler #2

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Bag

ANALYTICAL METHOD ORSAT

AMBIENT TEMPERATURE 70

OPERATOR [illegible]

ORSAT LEAK CHECKED ✓

COMMENTS:

RUN / GAS	1 ACTUAL READING	1 NET	2 ACTUAL READING	2 NET	3 ACTUAL READING	3 NET	AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb lb-mole
CO_2	13.6	13.6	13.6	13.6			13.6	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	16.1	2.5	16.1	2.5			2.5	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

EMISSION TESTING FIELD DATA

7-A

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/11/83	UNIT 2 EAST	M5BN

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
7AM5BN	PR RA JP	65	30.1	+.20	3551 0125	192	.84	296	1 OF 1

PT 379

DI 125

IT 449

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O, (%)	SAMPLE BOX NO	METER BOX NO	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5 FT GLASS	.223		10		FB4	1.72	1.003	8	0.009	1.295		320	320		10

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F (F)	SAMPLE BOX TEMPERATURE °F (P)	IMPINGER TEMPERATURE °F
	0	1330	808.703										
	10.	1340	814.370	0.67	0.98	0.98	315	76	74	4.0	325	371	59
	20.	1350	819.924	0.65	0.94	0.94	317	79	75	4.0	343	343	60
	30.	1400	825.527	0.67	0.98	0.98	318	80	75	4.0	330	324	56
	40.	1410	831.125	0.67	0.98	0.98	318	83	75	4.5	318	322	57
	50.	1420	836.570	0.64	0.93	0.93	318	86	78	5.0	332	[illegible]	58
	60.	1430	842.295	0.70	1.01	1.01	320	87	77	6.0	323	315	60
	70.	1440	847.913	0.67	0.97	0.97	320	88	77	6.0	327	320	58
	80.	1450	853.352	0.67	0.97	0.97	321	88	78	6.5	338	333	58
	90.	1500	859.095	0.67	0.97	0.97	321	88	79	7.0	339	336	59

EMISSION TESTING FIELD DATA

7-B

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/11/83	UNIT 2 EAST	M5B

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
7BM5B	PB RA VP	65	30.11	-.20	3531 0072	162	.84	296	1 of 1

PT-379
DI-125
IT-447
OP-999

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER ΔH@	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
10' GLASS	.221		1.0		FB6	1.59	.9969	8.5	0.015	9.592		329	329		10

pitot tube no leaks
orsat no leaks

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F F	P	IMPINGER TEMPERATURE °F
	0	1330	339.104										
	10.	1340	344.847	0.67	0.82	0.82	315	69	70	4.0	304	318	58
	20.	1350	350.452	0.65	0.79	0.79	317	70	70	3.5	341	330	59
	30.	1400	356.187	0.67	0.82	0.82	318	73	70	4.0	339	310	61
	40.	1410	361.878	0.67	0.82	0.82	318	76	70	4.5	330	317	61
	50.	1420	367.536	0.64	0.78	0.78	318	78	71	4.5	327	318	61
	60.	1430	373.376	0.70	0.85	0.85	320	79	71	6.0	325	315	61
	70.	1440	379.100	0.67	0.82	0.82	320	80	72	5.5	337	327	60
	80.	1450	384.671	0.67	0.82	0.82	321	80	73	6.0	336	328	60
	90.	1500	390.580	0.67	0.82	0.82	321	80	73	6.5	329	335	60

EMISSION TESTING FIELD DATA

1-C

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	02/11/83	KMLT TkG EAST	MSTRM

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
7CM5BN	CLARKE	65	30.14	+.02	353/132	162	.84	206	1 OF 1

Pitot 379

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO.	METER BOX NO.	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6 FT GLASS	.221		11	9AC	FB6	1.84	.983	7.0	.009	1.15		320	320		10

Patent @ 16

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F FLTR	PRBE	IMPINGER TEMPERATURE °F
	0	13:30	397.594										
	10.0	13:40	403.390	.67	1.00	1.00	315	75	74	5.0	306	318	58
	20.0	13:50	408.675	.65	.97	.97	317	76	74	4.5	335	319	60
	30.0	14:00	414.075	.67	1.0	1.0	318	80	74	5.0	318	320	58
	40.0	14:10	419.444	.67	1.0	1.0	318	84	74	5.5	322	314	54
	50.0	14:20	424.696	.64	.95	.95	318	88	75	5.5	315	318	56
	60.0	14:30	430.185	.7	1.04	1.04	320	88	76	6.0	314	322	58
	70.0	14:40	435.555	.67	.99	.99	320	89	78	6.5	318	325	60
	80.0	14:50	440.981	.67	.99	.99	321	90	78	7.0	317	324	62
	90.0	15:00	446.378	.67	.99	.99	321	90	80	7.0	317	328	62

480.2

EMISSION TESTING FIELD DATA

7-D

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/11/83	UNIT TWO EAST	M5B

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
7D-M5B	CLARKE	65	30.0	.02	355/131	162	.84	206	1 of 1

Pitot 379

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER ΔH @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5 FT GLASS	.216		11	QAD	FBA	1.88	1.039	6.0	.001	1.562		320	320		10

Pendant @ 16" oil

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F FLTR	SAMPLE BOX TEMPERATURE °F PRBE	IMPINGER TEMPERATURE °F
	0	13:30	952.183										
	10.0	13:40	957.870	.67	1.00	1.00	315	72	70	3.0	329	308	58
	20.0	13:50	962.962	.65	.97	.97	317	72	70	3.5	317	316	54
	30.0	14:00	968.125	.67	1.0	1.0	318	75	71	3.0	322	318	52
	40.0	14:10	973.353	.67	1.0	1.0	318	78	72	3.0	317	316	50
	50.0	14:20	978.444	.69	.95	.95	318	80	72	3.5	306	312	54
	60.0	14:30	983.737	.7	1.04	1.04	320	81	74	4.0	329	326	60
	70.0	14:40	988.898	.67	.99	.99	320	82	74	4.5	337	323	61
	80.0	14:50	994.170	.67	.99	.99	321	82	74	5.0	329	320	60
	90.0	15:00	999.409	.67	.99	.99	321	82	75	5.0	322	318	62

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______________ Sample date 2/11/83

Sample location Boiler No. 20 Recovery date 2/11/83

Run number 7AM5BW Recovered by DO/DS

Particulate sample type ____ M5 ____ M5-320 ____ M5-450 ✓ M5W -320

Particulate filter number 353/125 ✓

Particulate filter sample I.D. 4394 B ✓

Probe rinse H_2O I.D. 4394A

Purge train 20 min (check when completed) ✓

Location of filter in back half between 2nd + 3rd Imp's

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	588.3 g	641.6 g	626.5 g	608.9 g	808.2 g
Initial wt	505.0 g	673.9 g	597.2 g	592.2 g	770.3 g
Net wt	83.3 g	-32.3 g	29.3 g	16.7 g	37.9 g

Total moisture 134.9 g 40 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4394 A ✓

IPA IMP. CONTAINER I.D. 4395 A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4396 A LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4377 A	✓
H_2O_2	4378 A ✓	✓
H_2O	4379 A ✓	✓
Acetone	4376 A N/A	✓

Samples stored and locked ______________

Remarks Filter - green/grey coat, medium

LABORATORY CUSTODY

Received by Alonia White Date 15 Feb 1983

Remarks Log # 4061

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______________ Sample date 2/11/83

Sample location Boiler No. 2 Recovery date 2/11/83

Run number 7B M5B Recovered by DO/DS

Particulate sample type ____ M5 ✓ M5-320 ____ M5-450 ____ M5W

Particulate filter number 3531072 ✓

Particulate filter sample I.D. 4397 B ✓

Probe rinse Acetone I.D. 4397A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half between 2nd + 3rd Imp's.

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	585.2 g	631.7 g	648.8 g	612.8 g	856.8 g
Initial wt	507.2 g	669.4 g	615.8 g	595.4 g	816.8 g
Net wt	78.0 g	-37.7 g	33.0 g	17.4 g	40.0 g

Total moisture 130.7 g 40 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4397 A ✓

IPA IMP. CONTAINER I.D. 4398 A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4399 A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4377 A ✓	✓
H_2O_2	4378 A ✓	✓
H_2O	4379 A ✓	✓
Acetone	4376 A ✓	✓

Samples stored and locked

Remarks filter - green/grey coat, medium

LABORATORY CUSTODY

Received by Doris White Date 15 Feb 1983

Remarks Reg. # 4061

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/11/83

Sample location Boiler #2 Recovery date 2/11/83

Run number 7CM5BW Recovered by DO/DS

Particulate sample type ___ M5 ___ M5-320 ___ M5-450 ✓ M5W-320

Particulate filter number 3531132 ✓

Particulate filter sample I.D. 4400B ✓

Probe rinse H_2O I.D. 4400A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half between 2nd + 3rd Imp's

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	566.7 g	635.2 g	573.6 g	626.4 g	886.8 g
Initial wt	483.6 g	666.4 g	542.9 g	609.4 g	857.5 g
Net wt	83.1 g	-31.2 g	30.7 g	17.0 g	29.3 g

Total moisture 128.9 g 30 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4400A ✓

IPA IMP. CONTAINER I.D. 4401A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4402A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4377A ✓	✓
H_2O_2	4378A ✓	✓
H_2O	4379A ✓	✓
Acetone	4376A N/A	✓

Samples stored and locked ______

Remarks Filter - gray/green coat, medium

LABORATORY CUSTODY

Received by Norma White Date 15 Feb 1983

Remarks req # 4061

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/11/83
Sample location Boiler No 2 Recovery date 2/11/83
Run number 7DM5 B Recovered by DO/DS
Particulate sample type ___ M5 ✓ M5-320 ___ M5-450 ___ M5W
Particulate filter number 353/131 ✓
Particulate filter sample I.D. 4403B ✓
Probe rinse Acetone I.D. 4403B ✓
Purge train 20 min (check when completed) ✓
Location of filter in back half between 2nd + 3rd Imp's.

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	581.4 g	637.5 g	632.5 g	614.0 g	844.3 g
Initial wt	497.8 g	670.1 g	601.5 g	597.8 g	814.0 g
Net wt	83.6 g	-32.6 g	31.0 g	16.2 g	30.3 g

Total moisture 128.5 g   40 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4403A ✓
IPA IMP. CONTAINER I.D. 4404A ✓ LIQUID LEVEL MARKED ✓
H_2O_2 IMP. CONTAINER I.D. 4405A ✓ LIQUID LEVEL MARKED ✓
BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4377A ✓	✓
H_2O_2	4378A ✓	✓
H_2O	4379A ✓	✓
Acetone	4376A ✓	✓

Samples stored and locked ______
Remarks filter - green coat, medium

LABORATORY CUSTODY

Received by Gloria White Date 15 Feb 1983
Remarks rcy #4061

DRY MOLECULAR WEIGHT DETERMINATION

PLANT ______
DATE 2.11.83 TEST NO 70
SAMPLING TIME (24-hr CLOCK) 1505
SAMPLING LOCATION Boiler #2
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Bag ✓
ANALYTICAL METHOD ORSAT
AMBIENT TEMPERATURE 70
OPERATOR D. Schiffeil
ORSAT LEAK CHECKED ✓

COMMENTS:

RUN / GAS	1 ACTUAL READING	1 NET	2 ACTUAL READING	2 NET	3 ACTUAL READING	3 NET	AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb lb-mole
CO_2	13.4	13.4	13.4	13.4			13.4	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	16.0	2.6	16.0	2.6			2.6	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/11/83	UNIT 2 EAST	MSB

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
8AMSB	PR, RA, JP	70	30.09	-1.92		162	.84	~~200~~ 178	1 OF 1

PT-278
DI-125
IT 447

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER ΔH@	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
11 FT GLASS	0.305		11.0		F94	1.72	1.003	17.0	0.009	3.867		320	329		10

pitot tubes no leaks
orsat no leaks

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F F	SAMPLE BOX TEMPERATURE °F P	IMPINGER TEMPERATURE °F
	0	1620	860.601										
	10.		870.024	0.65	3.33	3.33	319	76	75	9.0	311	315	60
	20.		880.863	0.62	3.18	3.18	318	76	74	8.5	333	314	62
B-67	30.		890.491	0.59	3.02	3.02	~~320~~	79	74	9.0	319	267	56
	40.	30.7 1650	891.157	0.~~69~~ 74	3.79	3.35	318	81	73	15.0	320	333	56
	~~50.~~		.	.	.	.				.			
	~~60.~~		.	.	.	.				.			
	~~70.~~		.	.	.	.				.			
	~~80.~~		.	.	.	.				.			
	90.	1750	.	.	.	.				.			

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/11/83	UNIT 2 EAST	M 5B P400

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE C_p	THERM NO.	PAGE
8BM5BP	PR RA HP	70	30.08	-0.2		162	0.84	~~206~~ 178	1 OF 1

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER ΔH@	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6 FT GLASS	0.307		11.0		FB6	1.59	0.960	23	0.013	3.5689		400	320		10

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in.H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in.Hg	SAMPLE BOX TEMPERATURE °F F	SAMPLE BOX TEMPERATURE °F P	IMPINGER TEMPERATURE °F
	0	1620	390.904										
	10		401.501	0.65	2.98	2.98	319	69	71	12.5	322	397	60
	20		411.562	0.62	2.84	2.75	318	69	70	13.5	350	430	60
	30	1650	421.136	0.59	2.75	2.50	320	69	69	14.0	320	385	60
	40												
	50												
	60												
	70												
	80												
	90	1750											

PT - 278
DI - 125
IT - 449

EMISSION TESTING FIELD DATA

B-C

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	02/11/83	KWT T40 EAST	M5B

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
EG-M5B	CLARKE	40	30.08	.02		62	.84	118	1 OF 1

Pitot 298

PROBE LENGTH AND TYPE	NOZZLE, I.D.	NOZZLE, NO.	H_2O, (%)	SAMPLE BOX NO	METER BOX NO.	METER ΔH@	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6' FT GLASS	.305		11	0AC	FE5	1.84	.983	15.0	.001	4.736		320	320		10

Pretest 15" ok

B-69

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F FLTR	SAMPLE BOX TEMPERATURE °F PRBE	IMPINGER TEMPERATURE °F
	0	16:20	446.569										
	10.	16:30	457.000	.65	3.73	3.73	319	74	75	8.0	340	321	62
	20.	16:40	467.350	.62	3.57	3.57	318	76	74	9.0	332	324	58 *
	30.	16:50	477.100	.59	3.38	3.38	320	79	74	10.5	305	270	58
	30.8	16:51	477.329	.74	4.26	4.20	318	81	74	12.5	329	320	60
	50.												
	60.												
			30.760			3.72		536					

* Probe heat off for new sampling location

8-D

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	02/?1/83	UNIT TWO EAST	M5B-A409

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
BDM5B? (P)	CLARKE	70	30.08	+.02		162	.84	178	1 OF 1

Pitot 298

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5' FT GLASS	.304		11	QAD	FB4	1.8	1.030	18	.016	4.973		400	320		10

Probe tip 15" ok

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in.H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in.Hg	SAMPLE BOX TEMPERATURE °F FLTR	PROBE	IMPINGER TEMPERATURE °F
	0	16:20	999.812										
	10.	16:30	009.222	.65	3.73	3.73	319	70	70	13.0	331	450	62
	20.	16:40	018.500	.62	3.57	3.??	318	70	70	16.5	337	386	64
	30.	16:50	26.727	.59	3.38	[illegible]	320	71	69	17.0	295	374	64
	40.					2.7				1.			
	50.												
	60.												
			26.915										
						3.29		530					

8-70

*Probe [illegible]

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/11/83

Sample location Bo Yer No. 2 Recovery date 2/12/83

Run number 8AMSB Recovered by DO/DS

Particulate sample type ______ M5 ✓ M5-320 ______ M5-450 ______ M5W

Particulate filter number 3531122 ✓

Particulate filter sample I.D. 4406B ✓

Probe rinse Acetone I.D. 4406A

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. Imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	538.2 g	647.9 g	629.5 g	617.3 g	831.8 g
Initial wt	495.2 g	672.7 g	605.3 g	603.3 g	806.6 g
Net wt	43.0 g	-24.8 g	24.2 g	14.0 g	25.2 g

Total moisture 81.6 g 30 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4406 A ✓

IPA IMP. CONTAINER I.D. 4407 A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4408 A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. ✓ LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4377 A ✓	✓
H_2O_2	4378 A ✓	✓
H_2O	4379 A ✓	✓
Acetone	4376 A ✓	✓

Samples stored and locked ______

Remarks Filter – 1/2 gray, medium / 1/2 green, light.

LABORATORY CUSTODY

Received by Gloria White Date 15 Feb. 1983

Remarks Req # 4661

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/11/83

Sample location Boiler No. 2 Recovery date 2/12/83

Run number PBM5BP400 Recovered by JO/DS

Particulate sample type ______ M5 ✓ M5-320 400 ______ M5-450 ______ M5W

Particulate filter number 3531121 ✓

Particulate filter sample I.D. 4409B ✓

Probe rinse Acetone I.D. 4409A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	531.9 g	642.0 g	618.8 g	634.2 g	893.0 g
Initial wt	491.0 g	671.3 g	590.2 g	620.9 g	867.0 g
Net wt	40.9 g	-29.3 g	28.6 g	13.3 g	26.0 g

Total moisture 79.5 g   55 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4409A ✓

IPA IMP. CONTAINER I.D. 4410A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4411A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4377A ✓	✓
H_2O_2	4378A ✓	✓
H_2O	4379A ✓	✓
Acetone	4376A ✓	✓

Samples stored and locked ______

Remarks Filter - green coat, medium

LABORATORY CUSTODY

Received by Alexis White Date 15 Feb. 1983

Remarks pkg. #406

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ________ Sample date 2/11/83

Sample location Boiler No. 2 Recovery date 2/12/83

Run number PCM5B Recovered by DO/DS

Particulate sample type ___ M5 ✓ M5-320 ___ M5-450 ___ M5W

Particulate filter number 3531120 ✓

Particulate filter/sample I.D. 4412B ✓

Probe rinse Acetone I.D. 4412A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. Imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	539.5 g	637.1 g	613.4 g	631.3 g	790.9 g
Initial wt	498.6 g	660.6 g	586.2 g	615.1 g	768.1 g
Net wt	40.9 g	-23.5 g	27.2 g	16.2 g	22.8 g

Total moisture 83.6 g 65 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4412A ✓

IPA IMP. CONTAINER I.D. 4413A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4414A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

IPA	4377A ✓	✓
H_2O_2	4378A ✓	✓
H_2O	4379A ✓	✓
Acetone	4376A ✓	✓

Samples stored and locked ________

Remarks Filter - green coat, medium

LABORATORY CUSTODY

Received by Dennis White Date 15 Feb. 1983

Remarks reg #4061

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/11/83

Sample location Bayer No. 2 Recovery date 2/12/83

Run number 8DM5BP400 Recovered by DO/DS

Particulate sample type ____ M5 ✓ M5-320 P400 M5-450 ____ M5W

Particulate filter number 3531107 ✓

Particulate filter sample I.D. 4415B ✓

Probe rinse Acetone I.D. 4415A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. imp 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	504.1 g	630.2 g	571.2 g	633.0 g	835.8 g
Initial wt	467.1 g	663.5 g	544.3 g	617.5 g	808.6 g
Net wt	37.0 g	-33.3 g	26.9 g	15.5 g	27.2 g

Total moisture 73.3 g 75 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D.	4415A ✓		
IPA IMP. CONTAINER I.D.	4416A ✓	LIQUID LEVEL MARKED	✓
H_2O_2 IMP. CONTAINER I.D.	4417A ✓	LIQUID LEVEL MARKED	✓
BLANK CONTAINER(S) I.D.		LIQUID LEVEL MARKED	
IPA	4377A		✓
H_2O_2	4378A ✓		✓
H_2O	4379A		✓
Acetone	4376A ✓		

Samples stored and locked ______

Remarks Filter - green coat, medium

LABORATORY CUSTODY

Received by Gloria White Date 15-Feb-1983

Remarks Reg # 406

DRY MOLECULAR WEIGHT DETERMINATION

PLANT ______

DATE 2.11.83 TEST NO 8

SAMPLING TIME (24-hr CLOCK) 1725

SAMPLING LOCATION Boiler #2

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Bag

ANALYTICAL METHOD Orsat

AMBIENT TEMPERATURE 70

OPERATOR D. Schiffel

ORSAT LEAK CHECKED ✓

COMMENTS:

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	13.3	13.3	13.3	13.3			13.3	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	16.0	2.7	16.0	2.7			2.7	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/12/83	UNIT 2 EAST	M5B

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
9AM5B	RG RA JP	60	30.27	-1.0	3531/09	162	.84	206	40 F J

PT - 379
DI - 125
OP - 999
IT - 447

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5 FT GLASS	.223		11.0		FB4	1.72	1.993	9	.002	1.26		320	320		10

pitot no leaks
orsat no leaks

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F F	P	IMPINGER TEMPERATURE °F
	0	830	891.537										
	10.	840	897.300	0.72	1.05	1.05	313	63	62	4.0	320	333	49
	20.	850	902.930	0.69	1.00	1.00	319	64	62	4.0	334	334	49
	30.	900	908.540	0.69	1.00	1.00	321	67	62	4.5	338	337	49
	40.	910	914.173	0.69	1.00	1.00	321	70	63	5.0	334	335	50
	50.	920	919.851	0.69	1.00	1.00	322	72	63	5.5	315	332	50
	60.	930	925.513	0.70	1.01	1.01	323	74	64	6.0	314	328	51
	70.	940	931.174	0.70	1.01	1.01	324	76	65	7.0	307	316	53
	80.	950	936.885	0.71	1.02	1.02	324	76	66	7.5	305	351	55
	90.	1000	942.595	0.71	1.02	1.02	324	77	66	8.0	295	345	

.837   1.012   ~~2412~~   781.2   ~~526~~ 531.6

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/12/83	UNIT 2 EAST	M5B

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
9AM5B	RR RA JP	60	30.27	-.40	3531195	162	.84	206	1 OF 1

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER ΔH@	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6FT GLASS	.221		11.0		FB	1.59	.969	15	.012	~~[illegible]~~ 947.8		329	329		10

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F F	SAMPLE BOX TEMPERATURE °F P	IMPINGER TEMPERATURE °F
	0	830	421.579										
	10.	840	427.397	0.72	0.88	0.88	313	57	59	4.0	322	316	48
	20.	850	433.125	0.69	0.84	0.84	319	59	59	4.0	330	337	48
	30.	900	438.857	0.69	0.84	0.84	321	62	59	4.5	327	332	49
	40.	910	444.600	0.69	0.84	0.84	321	66	60 ~~62~~	4.5	328	328	50
	50.	920	450.337	0.69	0.84	0.84	322	68	60	5.0	334	326	50
	60.	930	456.100	0.70	0.85	0.85	323	70	61	6.0	334	326	50
	70.	940	461.983	0.70	0.85	0.85	323	70	62	6.5	336	325	51
	80.	950	467.683	0.71	0.86	0.86	324	71	62	7.5	338	332	52
	90.	1000	473.504	0.71	0.86	0.86	324	71	64	7.5	332	330	

0.851

523.3

9-C

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/18/83 (12)	UNIT TWO EAST	MSB

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
9C-MSB	CLARKE	60	30.29	-.04	353/104	162	.84	206	1 OF 1

P.t.2
379

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6 FT GLASS	.221		1.1	RAC	FBS	1.84	.983	15	.000	1.34		320	320		10

Probe @ 15"

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F FLDR	PROBE	IMPINGER TEMPERATURE °F
	0	8:30	477.734										
	10.	8:40	482.700	.72	1.06	1.06	313	65	64	4.5	328	321	53
	20.	8:50	488.160	.69	1.0	1.0	319	66	64	5.5	317	321	54
III	30.	9:00	493.440	.69	1.0	1.0	321	70	60	5.5	317	324	53
1	40.	9:10	498.775	.69	1.0	1.0	321	76	66	6.0	321	328	50
∞	50.	9:20	504.110	.69	1.0	1.0	322	78	66	6.5	322	326	50
	60.	9:30	509.666	.7	1.01	1.01	323	81	69	7.0	317	315	52
	70.	9:40	515.015	.7	1.01	1.01	324	82	70	7.5	322	319	54
	80.	9:50	520.480	.71	1.03	1.03	324	84	71	8.0	320	319	54
	90.	10:00	525.793	.71	1.03	1.03	324	85	72	8.8	317	326	54

48.059

531.6

EMISSION TESTING FIELD DATA

9-D.

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/12/83	UNIT TWO EAST	MSB

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
9D-MSB	CLARKE	60	30.27	-.09	3531 1P3	162	.84	206	1 of 1

pitot 379

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER ΔH@	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
15 FT GLASS	.215		11	QAD	FB	1.88	1.039	10	.000	1.134		329	329		10

Probe @ 15'

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F FLTR	SAMPLE BOX TEMPERATURE °F PROBE	IMPINGER TEMPERATURE °F
	0	830	027.215										
	10.	8:40	031.819	.72	1.06	1.06	313	59	59	3.0	320	332	54
	20.	8:50	037.300	.69	1.0	1.0	319	60	60	3.0	331	329	53
B-79	30.	9:00	042.380	.65	1.0	1.0	321	64	60	3.0	325	329	52
	40.	9:10	047.620	.65	1.0	1.0	321	68	60	3.5	327	325	50
	50.	9:20	052.815	.69	1.0	1.0	327	70	62	4.0	321	324	50
	60.	9:30	058.138	.7	1.01	1.01	323	73	63	4.5	318	324	48
	70.	9:40	063.425	.7	1.01	1.01	324	74	64	4.5	322	323	48
	80.	9:50	068.560	.71	1.03	1.03	324	74	65	5.0	330	320	52
	90.	10:00	073.756	.71	1.03	1.03	324	75	66	5.0	336	329	56

46.541 1.02 525

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/12/83

Sample location Boiler No. 2 Recovery date 2/12/83

Run number 9A M5B Recovered by DO/DS

Particulate sample type ______ M5 ✓ M5-320 ______ M5-450 ______ M5W

Particulate filter number 3531106 ✓

Particulate filter sample I.D. 4418B ✓

Probe rinse Acetone I.D. 4418A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	594.8 g	638.1 g	610.5 g	619.5 g	851.0 g
Initial wt	505.3 g	675.0 g	585.6 g	600.8 g	807.5 g
Net wt	89.5 g	-36.9 g	24.9 g	18.7 g	43.5 g

Total moisture 139.7 g 50 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4418A ✓

IPA IMP. CONTAINER I.D. 4419A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4420A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	LIQUID LEVEL MARKED
IPA	4377A ✓	✓
H_2O_2	4378A ✓	✓
H_2O	4379A ✓	✓
Acetone	4376A ✓	✓

Samples stored and locked ______

Remarks Filter - green coat, medium (darker)

LABORATORY CUSTODY

Received by Dennis White Date 15 Feb 1983

Remarks Reg # 4061

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/12/83

Sample location Boiler No. 2 Recovery date 2/12/83

Run number 9BM5B Recovered by DO/DS

Particulate sample type ____ M5 ✓ M5-320 ____ M5-450 ____ M5W

Particulate filter number 3531/05 ✓

Particulate filter sample I.D. 4421 B ✓

Probe rinse Acetone I.D. 4421A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bot. imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	595.1 g	631.8 g	643.9 g	614.7 g	824.9 g
Initial wt	507.1 g	669.5 g	612.0 g	596.7 g	789.7 g
Net wt	88.0 g	-37.7 g	31.9 g	18.0 g	35.2 g

Total moisture 135.4 g 40 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4421A ✓

IPA IMP. CONTAINER I.D. 4422A LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4423A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

IPA	4377A	✓
H_2O_2	4378A ✓	✓
H_2O	4379A ✓	✓
Acetone	4376A ✓	✓

Samples stored and locked ______

Remarks Filter - green coat ([redacted]), medium

LABORATORY CUSTODY

Received by Doris White Date 15 Feb 1983

Remarks reg. #4061

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/12/83

Sample location Boiler No. 2 Recovery date 2/12/83

Run number 9CM5B Recovered by DO/DS

Particulate sample type ____ M5 ✓ M5-320 ____ M5-450 ____ M5W

Particulate filter number 3531104 ✓

Particulate filter sample I.D. 4424B ✓

Probe rinse Acetone I.D. 4424A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	571.3 g	627.6 g	574.0 g	628.7 g	865.6 g
Initial wt	484.6 g	666.8 g	542.1 g	610.7 g	829.9 g
Net wt	86.7 g	-39.2 g	31.9 g	18.0 g	35.7 g

Total moisture 133.1 g 35 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4424A ✓

IPA IMP. CONTAINER I.D. 4425A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4426A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

IPA 4377A ✓ ✓

H_2O_2 4378A ✓ ✓

H_2O 4379A ✓ ✓

Acetone 4376A ✓ ✓

Samples stored and locked

Remarks Filter - green coat, medium

LABORATORY CUSTODY

Received by Doris White Date 15 Feb. 1983

Remarks Reg. # 4061

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/12/83

Sample location Boiler No. 2 Recovery date 2/12/83

Run number 9DM5B Recovered by DO/DS

Particulate sample type ______ M5 ✓ M5-320 ______ M5-450 ______ M5W

Particulate filter number 3531103 ✓

Particulate filter sample I.D. 4427B ✓

Probe rinse Acetone I.D. 4427A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	583.9 g	630.3 g	619.5 g	629.1 g	837.9 g
Initial wt	498.5 g	670.9 g	588.8 g	608.8 g	800.2 g
Net wt	85.4 g	-40.6 g	30.7 g	20.3 g	37.7 g

Total moisture 133.5 g 40 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4427A ✓

IPA IMP. CONTAINER I.D. 4428A LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4429A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

IPA	4377A	✓
H_2O_2	4378A ✓	✓
H_2O	4379A ✓	✓
Acetone	4376A ✓	✓

Samples stored and locked ______

Remarks Filter - green coat, medium, some black around edges

LABORATORY CUSTODY

Received by Gloria White Date 15 Feb 1983

Remarks rec # 4061

pedco

DRY MOLECULAR WEIGHT DETERMINATION

PLANT ______
DATE 2.12.83 TEST NO 09
SAMPLING TIME (24-hr CLOCK) 1015
SAMPLING LOCATION Boiler #2
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Bag
ANALYTICAL METHOD ORSAT
AMBIENT TEMPERATURE 60
OPERATOR D. Scheffel
ORSAT LEAK CHECKED ✓

COMMENTS:

B-84

RUN / GAS	1 ACTUAL READING	1 NET	2 ACTUAL READING	2 NET	3 ACTUAL READING	3 NET	AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb lb-mole
CO_2	13.6	13.6	13.6	13.6			13.6	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	16.1	2.5	16.1	2.5			2.5	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/12/83	UNIT 2 EAST	MSB

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
10AMSB	RG RA JR	60	3927	-.40	3531028	162	.984	128	1 OF 1

PT-278
DJ-125
IT-447

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER Δ H @	METER CAL. FACTOR V	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5 FT GLASS	.224		10		RB4	1.72	1.003	15	.000	1.145		320	320		10

pitot no leaks
orsat no leaks

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F F	P	IMPINGER TEMPERATURE °F
	0	1200	942.~~761~~ 801										
	10.	1210	949.150	0.85	1.24	1.24	325	67	65	5.0	342	314	50
	20.	1220	955.100	0.77	1.12	1.12	326	69	65	5.0	327	321	50
	30.	1230	961.038	0.77	1.12	1.12	326	72	65	5.5	340	321	50
	40.	1240	966.760	0.75	1.09	1.09	326	77	66	6.0	331	323	57
8-85	50.	1250	972.650	0.75	1.09	1.09	325	81	67	6.0	336	329	51
	60.	1300	978.444	0.73	1.06	1.06	326	81	69	7.0	337	325	53
	70.	1310	984.250	0.73	1.06	1.06	327	81	69	7.5	326	330	53
	80.	1320	990.061	0.73	1.06	1.06	327 ~~326~~	81	70	8.0	337	330	54
	90.	1330	995.879	0.73	1.06	1.06	328	82	71	8.5	327	328	54

EMISSION TESTING FIELD DATA

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/12/83	UNIT 2 EAST	M5B P400

RUN NO.	OPERATOR	AMB. TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
10 M5B P400	PL RA JP	60	3027	-.40	353 1027	162	.84	178	1 OF 1

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6 FT GLASS	~~.224~~ .227 JP		11		RB6	1.59	.9960	12	~~.008~~ .008	~~9.49~~ 948.6		400	339		10

IT-449

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE °F F331	SAMPLE BOX TEMPERATURE °F P414	IMPINGER TEMPERATURE °F
	0	1200	473.751										
	10.	1210	480.096	0.85	1.03	1.03	325	61	62	4.0	~~44~~		50
	20.	1220	486.187	0.77	0.93	0.93	326	62	63	4.0	345	412	50
	30.	1230	492.168	0.77	0.93	0.93	326	66	63	4.0	342	400	52
	40.	1240	498.125	0.75	0.90	0.90	326	70	63	4.0	334	413	52
	50.	1250	504.061	0.75	0.90	0.90	325	73	64	4.5	335	408	53
	60.	1300	509.993	0.73	0.88	0.88	326	74	65	4.5	334	411	53
	70.	1310	515.870	0.73	0.88	0.88	327	74	65	4.5	338	403	54
	80.	1320	521.792	0.73	0.88	0.88	327	74	66	4.5	339	409	55
	90.	1330	527.726	0.73	0.88	0.88	328	74	66	6.5	339	420	57

B-86

EMISSION TESTING FIELD DATA

10-C

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/12/83	UNIT TWO EAST	15B

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
10C M5B	CLARK	60	30.27	-.08	353/089	162	.84	178	10.F

Rot# 278

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO	METER ΔH@	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
6 FT GLASS	.211		11	GMK	FB5	1.83	1.04	6.0	.009	.919		320	320		10

Drierite 15" oil

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in.H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in.Hg	SAMPLE BOX TEMPERATURE °F FLTR	PRBE	IMPINGER TEMPERATURE °F
	0	12:00	526.000										
B-8-7	10.	12:10	531.575	.85	1.08	1.08	325	68	68	4.0	317	311	50
	20.	12:20	536.820	.77	.98	.98	326	68	68	4.0	337	338	48
	30.	12:30	542.160	.77	.98	.98	326	72	68	4.5	314	315	48
	40.	12:40	547.370	.75	.95	.95	328	78	68	4.5	317	321	50
	50.	12:50	552.600	.75	.95	.95	325	82	70	5.0	319	317	54
	60.	13:00	557.810	.73	.92	.92	326	84	71	5.0	319	320	52
	70.	13:10	562.989	.73	.92	.92	327	85	72	5.5	321	315	56
	80.	13:20	567.925	.73	.92	.92	327	86	72	6.0	322	328	58
	90.	13:38	573.155	.73	.92	.92	328	86	73	6.0	323	331	60

EMISSION TESTING FIELD DATA

10-D

PLANT & CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE
	2/12/93	WHIT TWO EAST	M5B# R100

RUN NO.	OPERATOR	AMB TEMP (°F)	BAR. PRESS. (IN. Hg)	STATIC PRESS (IN. H_2O)	FILTER NUMBER(S)	STACK INSIDE DIMEN. (INCHES)	PITOT TUBE Cp	THERM NO.	PAGE
1 0 4ABP	CLARKE	60	30.21	-0.9	353 / 088	162		1.28	1 OF 1

Pitot 278

PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NO.	H_2O (%)	SAMPLE BOX NO	METER BOX NO.	METER Δ H @	METER CAL. FACTOR Y	LEAK CHECK IN. Hg	LEAK CHECK CFM	K FACTOR	C FACTOR	PROBE HEAT SET	BOX HEAT SET	REF. ΔP	RECORD DATA MINS
5 FT GLASS	.214		11	4AD	FB4	1.88	1.93	8.0	.010	9.969		400	340		10

Protecto 18"
.005

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in.H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in.H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m_{in}}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m_{out}}$), °F	PUMP VACUUM, in.Hg	SAMPLE BOX TEMPERATURE °F FLTR	SAMPLE BOX TEMPERATURE °F PRBE	IMPINGER TEMPERATURE °F
	0	12100	074.879										
	10.	12110	080.200	.85	1.08	1.08	325	64	63	5.0	342	450	48
	20.	12120	085.290	.77	.98	.98	326	66	64	5.5	326	418	48
	30.	12130	090.428	.77	.98	.98	326	68	64	6.0	329	407	50
	40.	12140	095.500	.75	.95	.95	328	72	65	6.5	330	403	52
	50.	12150	100.600	.75	.95	.95	325	74	66	7.0	321	411	54
	60.	13100	105.525	.73	.92	.92	326	75	67	7.5	324	399	52
	70.	13110	110.500	.73	.92	.92	327	76	68	8.0	309	414	56
	80.	13120	115.580	.73	.92	.92	327	76	68	8.5	320	422	58
	90.	13130	120.457	.73	.92	.92	328	76	68	9.0	326	407	60

E-88

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant _______ Sample date 2/12/83

Sample location Boiler #2 Recovery date 2/12/83

Run number 10AM5B Recovered by DO/DS

Particulate sample type ____ M5 ✓ M5-320 ____ M5-450 ____ M5W

Particulate filter number 353102P ✓

Particulate filter sample I.D. 4431B ✓

Probe rinse Acetone I.D. 4431A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	594.1 g	644.6 g	644.8 g	617.2 g	853.9 g
Initial wt	497.6 g	677.0 g	613.2 g	598.0 g	813.9 g
Net wt	[illegible] g	[illegible] g	[illegible] g	[illegible] g	[illegible] g

Total moisture [illegible] g   40 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4431A ✓

IPA IMP. CONTAINER I.D. 4432A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4433A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4377A ✓	✓
H_2O_2	4378A ✓	✓
H_2O	4379A ✓	✓
Acetone	4376A ✓	✓

Samples stored and locked ________

Remarks Filter - gray/green, medium

LABORATORY CUSTODY

Received by Doris DiNuta Date 15 Feb 1983

Remarks [illegible] 4001 acetone probe rinse # 4431A leaked in transit

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/12/83

Sample location Boiler #2 Recovery date 2/12/83

Run number 10BM5BP400 Recovered by DO/DS

Particulate sample type ____ M5 ✓ M5-320 P400 ____ M5-450 ____ M5W

Particulate filter number 3531027 ✓

Particulate filter sample I.D. 4434B ✓

Probe rinse Acetone I.D. 4434A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	587.5 g	634.2 g	623.9 g	642.6 g	850.3 g
Initial wt	492.7 g	670.8 g	590.5 g	624.1 g	814.8 g
Net wt	[illegible] g	[illegible] g	[illegible] g	[illegible] g	[illegible] g

Total moisture [illegible] g 35 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4434A ✓

IPA IMP. CONTAINER I.D. 4435A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4436A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

IPA	4377A ✓	✓
H_2O_2	4378A ✓	✓
H_2O	4379A ✓	✓
Acetone	4376A ✓	✓

Samples stored and locked

Remarks Filter - green w/ black around edge, medium

LABORATORY CUSTODY

Received by [illegible signature] Date 15 Feb 1983

Remarks reg. # 11061

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/12/83

Sample location Boiler #2 Recovery date 2/12/83

Run number 10 CM5B Recovered by DD/DS

Particulate sample type ______ M5 ✓ M5-320 ______ M5-450 ______ M5W

Particulate filter number 3531089 ✓

Particulate filter sample I.D. 4437B ✓

Probe rinse Acetone I.D. 4437A ✓

Purge train 20 min (check when completed) ✓

Location of filter in back half bet. Imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	589.8 g	629.5 g	624.9 g	628.9 g	849.9 g
Initial wt	501.3 g	662.2 g	591.1 g	610.4 g	820.6 g
Net wt	[illegible] g	[illegible] g	[illegible] g	[illegible] g	[illegible] g

Total moisture [illegible] g 30 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4437A ✓

IPA IMP. CONTAINER I.D. 4438A ✓ LIQUID LEVEL MARKED ✓

H_2O_2 IMP. CONTAINER I.D. 4439A ✓ LIQUID LEVEL MARKED ✓

BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4377A ✓	✓
H_2O_2	4378A ✓	✓
H_2O	4379A ✓	✓
Acetone	4376A ✓	✓

Samples stored and locked ______

Remarks Filter-green, medium w/ black edges

LABORATORY CUSTODY

Received by [illegible signature] Date 15 Feb 1983

Remarks rec #4061 acetone probe rinse #4437 leaked in transit

QUAD TRAIN SAMPLE RECOVERY AND INTEGRITY SHEET

Plant ______ Sample date 2/12/83
Sample location Boiler No. 2 Recovery date 2/12/83
Run number 10DH5BP400 Recovered by DO/DS
Particulate sample type ____ M5 ✓ M5-320 P400 ____ M5-450 ____ M5W
Particulate filter number 3531088 ✓
Particulate filter sample I.D. 4440B ✓
Probe rinse Acetone I.D. 4440A ✓
Purge train 20 min (check when completed) ✓
Location of filter in back half bet. Imp. 2+3

MOISTURE

	1st impinger	2nd impinger	3rd impinger	4th impinger	Silica gel
Final wt	555.3 g	625.5 g	559.7 g	653.4 g	876.8 g
Initial wt	470.4 g	663.4 g	530.3 g	629.8 g	839.3 g
Net wt	[illegible] g	[illegible] g	[illegible] g	[illegible] g	[illegible] g

Total moisture [illegible] g   80 % spent

RECOVERED SAMPLE

PROBE RINSE CONTAINER I.D. 4440A ✓
IPA IMP. CONTAINER I.D. 4441A ✓ LIQUID LEVEL MARKED ✓
H_2O_2 IMP. CONTAINER I.D. 4442A ✓ LIQUID LEVEL MARKED ✓
BLANK CONTAINER(S) I.D. LIQUID LEVEL MARKED

	I.D.	Liquid level marked
IPA	4377A ✓	✓
H_2O_2	4378A ✓	✓
H_2O	4379A ✓	✓
Acetone	4376A ✓	✓

Samples stored and locked ______
Remarks Filter - green, medium, w/ black edges

LABORATORY CUSTODY

Received by Alona White Date 15 Feb 1983
Remarks Rec # 4061

DRY MOLECULAR WEIGHT DETERMINATION

PLANT ____

DATE 2.12.83 TEST NO 10

SAMPLING TIME (24-hr CLOCK) 1330

SAMPLING LOCATION Boiler #2

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Bag

ANALYTICAL METHOD ORSAT

AMBIENT TEMPERATURE 60

OPERATOR D. Scheffel

ORSAT LEAK CHECKED ✓

COMMENTS:

GAS \ RUN	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	13.0	13.0	13.0	13.0			13.0	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	16.0	3.0	16.0	3.0			3.0	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

APPENDIX C

LABORATORY RESULTS

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ________ Run No. 1CM5B ✓
Sample location Boiler No. 2 Analyst KRM
Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881 ✓	Blank ✓	4301A ✓	368 ✓	99881.3 ✓
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 842 ✓	1CM5B ✓	4319A ✓	385 ✓	104289.2 ✓
Filter blank	CT 831 ✓	Blank ✓	4316B ✓	Filter # 3531063 ✓	335.6 ✓
Filter	CT 797 ✓	1CM5B ✓	4319B ✓	Filter # 3531015 ✓	331.0 ✓

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 6 hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881 ✓	0.6 ✓	1 ✓	1 ✓	0.2 ✓	1 ✓	-0.3 ✓	3 ✓
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 842 ✓	125.8 ✓	102.3 ✓	1 ✓	98.1 ✓	1 ✓	62.4 ✓	3 ✓
Filter blank	CT 831 ✓	0.2 ✓	-0.3 ✓	1 ✓	-0.1 ✓	2 ✓	0.2 ✓	3 ✓
Filter	CT 797 ✓	210.9 ✓	181.3 ✓	1 ✓	168.0 ✓	2 ✓	132.4 ✓	3 ✓
Total particulate		336.7 ✓	283.6 ✓		266.1 ✓		194.8 ✓	

Remarks ________ T.J.L.

Data reviewed by Ida Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. 1DM5B ✓
Sample location Boiler No. 2 Analyst KRM
Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881 ✓	Blank ✓	4301A ✓	368 ✓	99881.3 ✓
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 843 ✓	1DM5B ✓	4322A ✓	355 ✓	102016.6 ✓
Filter blank	CT 831 ✓	Blank ✓	4316B ✓	Filter # 3331663 ✓	335.6 ✓
Filter	CT 798 ✓	1DM5B ✓	4322B ✓	Filter # 3331014 ✓✓	328.5 ✓ ✓

C-3

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 6 hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881 ✓	0.6 ✓	1.1 ✓	1 ✓	0.2 ✓	1 ✓	-0.3 ✓	3 ✓
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 843 ✓	110.2 ✓✓	95.0 ✓✓	1 ✓✓	90.6 ✓✓	1 ✓✓	84.1 ✓✓	3 ✓
Filter blank	CT 831 ✓	0.2 ✓	-0.3 ✓	1 ✓	-0.1 ✓	2 ✓	0.2 ✓	3 ✓
Filter	CT 798 ✓	199.1 ✓✓	170.6 ✓	1 ✓✓	160.4 ✓✓	2 ✓✓	142.0 ✓✓	3 ✓ ✓
Total particulate		309.3 ✓✓	265.6 ✓		251.0 ✓✓		226.1 ✓✓	

Remarks ______ T.J.W.

Data reviewed by Lola Burnett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. 2HM5B

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881	Blank	4301A	368	99881.3
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 844	2HM5B	4322A	395	110012.0
Filter blank	CT 831	Blank	4316B	Filter # 3331663	335.6
Filter	CT 799	2HM5B	4322B	Filter # 3331013	330.8

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 24 hours cool, weigh	Number of treatments	Heat to 450°F 24 hours cool, weigh	Number of treatments	Heat to 600°F 24 hours cool, weigh	Number of treatments
Acetone blank	CT 881	0.6						
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 844	161.0	141.3	2	136.4	2	41.2	3
Filter blank	CT 831	0.2						
Filter	CT 799	228.7	196.6	2	190.2	2	181.0	3
Total particulate		389.7	337.9		326.6		222.2	

Remarks ______

Data reviewed by John Bennett 4/21/83 T.J.N.

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. 2BM5B

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881	Blank	4301A	368	99881.3
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 845	2BM5B	4328A	362	98640.0
Filter blank	CT 831	Blank	4316B	Filter # 3331063	335.6
Filter	CT 800	2BM5B	4328B	Filter # 3531071	327.9

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 24 hours cool, weigh	Number of treatments	Heat to 450°F 24 hours cool, weigh	Number of treatments	Heat to 600°F 24 hours cool, weigh	Number of treatments
Acetone blank	CT 881	0.6						
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 845	124.9	103.6	2	91.5	2	28.4	3
Filter blank	CT 831	0.2						
Filter	CT 800	253.1	224.1	2	212.7	2	147.5	3
Total particulate		378.0	327.7		304.2		175.9	

Remarks ______ T.J.K.

Data reviewed by Iris Bennett 1/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______________________ Run No. 3H1115B

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881	Blank	4301A	368	99881.3
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 846	3H1115B	4338A	364	101426.3
Filter blank	CT 831	Blank	4316B	Filter # 3331663	335.6
Filter	CT 801	3H1115B	4335B	Filter # 3531010	330.4

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 6 hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881	0.6	1.1	1	0.2	1	-0.3	3
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 846	119.7	108.7	1	103.6	1	77.4	3
Filter blank	CT 831	0.2	-0.3	1	-0.1	2	0.2	3
Filter	CT 801	237.2	202.4	1	194.6	2	173.7	3
Total particulate		356.9	311.1		298.2		251.1	

Remarks ______________________ TJ.2.

Data reviewed by Fdr Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ ______ Run No. 3BM5B ✓

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881 ✓	Blank ✓	4301A ✓	368 ✓	99881.3 ✓
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 847 ✓	3BM5B ✓	4341A ✓	385 ✓	98393.6 ✓
Filter blank	CT 831 ✓	Blank ✓	4316B ✓	Filter # 3331063 ✓	335.6 ✓
Filter	CT 802 ✓	3BM5B ✓	4341B ✓	Filter # 3331009 ✓	329.2 ✓

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 6 hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881 ✓	0.6 ✓	1.1 ✓	1 ✓	0.2 ✓	1 ✓	-0.3 ✓	3 ✓
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 847 ✓	149.2 ✓	137.1 ✓	1 ✓	131.6 ✓	1 ✓	51.7 ✓	3 ✓
Filter blank	CT 831 ✓	0.2 ✓	-0.3 ✓	1 ✓	-0.1 ✓	2 ✓	0.2 ✓	3 ✓
Filter	CT 802 ✓	227.4 ✓	195.3 ✓	1 ✓	185.5 ✓	2 ✓	160.0 ✓	3 ✓
Total particulate		376.6 ✓	332.4 ✓		317.1 ✓		241.7 ✓	

Remarks ______ T.J.N.

Data reviewed by Ida Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ________ Run No. 3CM5B P400

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881	Blank	4301A	368	99881.3
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 848	3CM5B P400	4344A	405	104307.2
Filter blank	CT 831	Blank	4376B	Filter # 3331063	335.6
Filter	CT 803	3CM5B P400	4344B	Filter # 3331008	332.8

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 6 hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881	0.6	1.1	1	0.2	1	-0.3	3
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 848	145.1	134.3	1	129.3	1	94.9	3
Filter blank	CT 831	0.2	-0.3	1	-0.1	2	0.2	3
Filter	CT 803	190.1	162.5	1	154.9	2	135.9	3
Total particulate		335.2	296.8		284.2		230.8	

Remarks ________ TJN.

Data reviewed by John Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ____________________ Run No. 3DM5B - P4CO ✓

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881 ✓	Blank ✓	4301H ✓	368 ✓	99881.3 ✓
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 849 ✓	3DM5B P4CO ✓	4347H ✓	430 ✓	105558.7 ✓
Filter blank	CT 831 ✓	Blank ✓	4316B ✓	Filter # 3531063 ✓	335.6 ✓
Filter	CT 804 ✓	3DM5B P4CO ✓	4347B ✓	Filter # 3531007 ✓	329.0 ✓

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 6 hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881 ✓	0.6 ✓	1.1 ✓	1 ✓	0.2 ✓	1 ✓	-0.3 ✓	3 ✓
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 849 ✓	106.5 ✓	96.4 ✓	1 ✓	93.8 ✓	1 ✓	60.5 ✓	3 ✓
Filter blank	CT 831 ✓	0.2 ✓	-0.3 ✓	1 ✓	-0.1 ✓	2 ✓	0.2 ✓	3 ✓
Filter	CT 804 ✓	244.9 ✓	217.9 ✓	1 ✓	206.5 ✓	2 ✓	185.2 ✓	3 ✓
Total particulate		351.4 ✓	314.3 ✓		300.3 ✓		245.7 ✓	

Remarks ____________________ T.J.R.

Data reviewed by Ida Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. 4HII5B P400

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881	Blank	4301A	368	99881.3
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 850	4HII5B P400	4352A	405	105368.4
Filter blank	CT 831	Blank	4316B	Filter # 3331663	335.6
Filter	CT 805	4HII5B P400	4352B	Filter # 3530158	359.5

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 6 hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881	0.6	1.1	1	0.2	1	-0.3	3
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 850	173.6	165.7	1	162.7	1	117.3	3
Filter blank	CT 831	0.2	-0.3	1	-0.1	2	0.2	3
Filter	CT 805	225.3	203.4	1	195.0	2	174.2	3
Total particulate		398.9	369.1		357.7		291.5	

Remarks ______ T.J.W.

Data reviewed by Ida Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______________________ Run No. 4BM5B - P4CC

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881	Blank	4301A	368	99881.3
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 851	4BM5B-P4CC	4355A	352	106965.7
Filter blank	CT 831	Blank	4316B	Filter # 3331663	335.6
Filter	CT 866	4BM5B-P4CC	4355B	Filter # 0002530	334.2

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 6 hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881	0.6	1.1	1	0.2	1	-0.3	3
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 851	94.3	81.0	1	84.3	1	62.2	3
Filter blank	CT 831	0.2	-0.3	1	-0.1	2	0.2	3
Filter	CT 866	303.7	215.6	1	215.6	2	214.6	3
Total particulate		398.0	305.6		299.9		276.8	

Remarks ______________________ T.J.K.

Data reviewed by Ida Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. 4C115B

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881	Blank	4301A	368	99881.3
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 852	4C115B	4358A	368	107251.0
Filter blank	CT 831	Blank	4316B	Filter # 3331063	335.6
Filter	CT 801	4C115B	4358B	Filter # 3331066	341.8

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 6 hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881	0.6	1.1	1	0.2	1	0.3	3
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 852	158.8	150.8	1	148.6	1	133.8	3
Filter blank	CT 831	0.2	0.3	1	0.1	2	0.2	3
Filter	CT 801	159.8	169.0	1	162.0	2	116.2	3
Total particulate		318.6	319.8		310.6		250.0	

Remarks ______ T.J.W.

Data reviewed by Dale Bennett 1/31/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

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THERMOGRAVIMETRIC PARTICULATE ANALYSIS

PN 3530-15

Plant ______ Run No. 4DM5B

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881	Blank	4301A	368	99881.3
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 853	4DM5B	4361A	274	100917.1
Filter blank	CT 831	Blank	4316B	Filter # 3531063	335.6
Filter	CT 808	4DM5B	4361B	Filter # 3531068	328.2

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 6 hours, cool, weigh	Number of treatments	Heat to 450°F 6 hours, cool, weigh	Number of treatments	Heat to 600°F 6 hours, cool, weigh	Number of treatments
Acetone blank	CT 881	0.6	1.1	1	0.2	1	-0.3	3
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 853	123.2	117.6	1	115.4	1	89.6	3
Filter blank	CT 831	0.2	0.3	1	-0.1	2	0.2	3
Filter	CT 808	222.8	199.9	1	190.8	2	145.0	3
Total particulate		346.0	317.5		306.2		234.6	

Remarks ______ T.J.K.

Data reviewed by Ida Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. 5HM5B ✓

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881 ✓	Blank ✓	4301A ✓	368 ✓	99881.3 ✓
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 854 ✓	5HM5B ✓	4364A ✓	320 ✓	101482.4 ✓
Filter blank	CT 831 ✓	Blank ✓	4316B ✓	Filter # 3531063 ✓	335.6 ✓
Filter	CT 809 ✓	5HM5B ✓	4364B ✓	Filter # 3531067 ✓	339.2 ✓

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 6 hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881	0.6	1.1	1	0.2	1	-0.3	3
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 854	75.6	64.0	1	56.4	1	39.3	3
Filter blank	CT 831	0.2	-0.3	1	-0.1	2	0.2	3
Filter	CT 809	159.9	137.2	1	129.0	2	113.3	3
Total particulate		235.5	201.2		185.4		152.6	

Remarks ______ TJN

Data reviewed by [signature] 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. 5131115B

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881	Blank	4301A	368	99881.3
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 855	5131115B	4361A	295	105728.4
Filter blank	CT 831	Blank	4316B	Filter # 3331663	335.6
Filter	CT 810	5131115B	4367B	Filter # 3331018	338.4

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 6 hours, cool, weigh	Number of treatments	Heat to 450°F 6 hours, cool, weigh	Number of treatments	Heat to 600°F 6 hours, cool, weigh	Number of treatments
Acetone blank	CT 881	0.6	1.1	1	0.2	1	-0.3	3
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 855	71.1	58.3	1	53.6	1	32.4	3
Filter blank	CT 831	0.2	0.3	1	0.1	2	0.2	3
Filter	CT 810	159.8	137.7	1	129.2	2	87.6	3
Total particulate		230.9	196.0		182.8		120.0	

Remarks ______ TJK.

Data reviewed by Ida Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. 5CM5B ✓

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881 ✓	Blank ✓	4301A ✓	368 ✓	99881.3 ✓
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 856 ✓	5CM5B ✓	4370A ✓	340 ✓ ✓	104608.6 ✓ ✓
Filter blank	CT 831 ✓	Blank ✓	4316B ✓	Filter # 3531663 ✓	335.6 ✓
Filter	CT 811 ✓	5CM5B ✓	4370B ✓	Filter # 3531124 ✓✓	329.6 ✓ ✓

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 24 hours cool, weigh	Number of treatments	Heat to 450°F 24 hours cool, weigh	Number of treatments	Heat to 600°F 24 hours cool, weigh	Number of treatments
Acetone blank	CT 881 ✓	0.6 ✓						
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 856 ✓	63.8 ✓✓	52.9 ✓✓	2 ✓✓	47.5 ✓✓	2 ✓✓	25.1 ✓✓	3 ✓
Filter blank	CT 831 ✓	0.2 ✓						
Filter	CT 811 ✓	155.4 ✓✓	133.2 ✓✓	2 ✓✓	131.0 ✓✓	2 ✓✓	78.6 ✓✓	3 ✓
Total particulate		219.2 ✓✓	186.1 ✓✓		178.5 ✓		103.7 ✓✓	

Remarks ______ T.J.W.

Data reviewed by Ida Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ____________________ Run No. 5DM5B ✓

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881 ✓	Blank ✓	4301A ✓	368 ✓	99881.3 ✓
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 857 ✓	5DM5B ✓	4373A ✓	334 ✓ ✓	104102.9 ✓ ✓
Filter blank	CT 831 ✓	Blank ✓	4316B ✓	Filter # 3531063 ✓	335.6 ✓
Filter	CT 812 ✓	5DM5B ✓	4373B ✓	Filter # 3531123 ✓	330.4 ✓ ✓

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 24 hours cool, weigh	Number of treatments	Heat to 450°F 24 hours cool, weigh	Number of treatments	Heat to 600°F 24 hours cool, weigh	Number of treatments
Acetone blank	CT 881 ✓	0.6 ✓						
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 857 ✓	64.9 ✓ ✓	51.1 ✓ ✓	2 ✓ ✓	43.8 ✓ ✓	2 ✓ ✓	20.6 ✓ ✓	3 ✓
Filter blank	CT 831 ✓	0.2 ✓						
Filter	CT 812 ✓	153.0 ✓ ✓	132.4 ✓ ✓	2 ✓ ✓	129.9 ✓ ✓	2 ✓ ✓	92.7 ✓ ✓	3 ✓
Total particulate		217.9 ✓ ✓	183.5 ✓ ✓		173.7 ✓ ✓		113.3 ✓ ✓	

Remarks ____________________ T.J.W.

Data reviewed by Ella Barnett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______________ Run No. 6AM5B ✓
Sample location Boiler No. 2 Analyst KRM
Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881 ✓	Blank ✓	4301A ✓	368 ✓	99881.3 ✓
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 858 ✓	6AM5B ✓	4380A ✓	242 ✓ ✓	104461.2 ✓✓
Filter blank	CT 831 ✓	Blank ✓	4316B ✓	Filter # 3531063 ✓	335.6 ✓
Filter	CT 813 ✓	6AM5B ✓	4380B ✓	Filter # 3531061 ✓ ✓	329.6 ✓ ✓

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F _ hours cool, weigh	Number of treatments	Heat to 450°F 24 hours cool, weigh	Number of treatments	Heat to 600°F 24 hours cool, weigh	Number of treatments
Acetone blank	CT 881	0.6 ✓						
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 858 ✓	69.4 ✓✓			41.9 ✓✓	2 ✓✓	20.3 ✓✓	3 ✓
Filter blank	CT 831 ✓	0.2 ✓						
Filter	CT 813 ✓	159.9 ✓✓			140.9 ✓✓	2 ✓✓	101.2 ✓✓	3 ✓
Total particulate		229.3 ✓✓			182.8 ✓✓		127.5 ✓✓	

Remarks ______________ TJR

Data reviewed by Ida Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS

PN 3530-15

Plant ______________________ Run No. 6B1115B

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881	Blank	4301A	368	99881.3
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 859	6B1115B	4384A	225	107409.6
Filter blank	CT 831	Blank	4316B	Filter # 3331063	335.6
Filter	CT 814	6B1115B	4384B	Filter # 3331062	339.1

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F _ hours cool, weigh	Number of treatments	Heat to 450°F 24 hours cool, weigh	Number of treatments	Heat to 600°F 24 hours cool, weigh	Number of treatments
Acetone blank	CT 881	0.6						
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 859	67.0			39.9	2	23.9	3
Filter blank	CT 831	0.2						
Filter	CT 814	149.8			128.4	2	77.3	3
Total particulate		216.8			168.3		101.2	

Remarks ______________________ T.J.N.

Data reviewed by John Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. 6CMSB
Sample location Boiler No. 2 Analyst KRM
Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881	Blank	4301A	368	99881.3
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 860	6CMSB	4387A	244	106081.5
Filter blank	CT 831	Blank	4316B	Filter # 3531CC3	335.6
Filter	CT 815	6CMSB	4387B	Filter # 353110B	313.3

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F _ hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881	0.6			0.2	1	-0.3	3
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 860	43.7			32.8	1	27.1	3
Filter blank	CT 831	0.2			-0.1	2	0.2	3
Filter	CT 815	125.9			102.3	2	77.7	3
Total particulate		169.6			135.1		104.8	

Remarks ______ T.J.W.

Data reviewed by Ida Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

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THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ____________ Run No. 6DMSB ✓
Sample location Boiler No. 2 Analyst KRM
Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881	Blank	4301A	368	99881.3
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 861 ✓	6DMSB ✓	4390A ✓	255 ✓ ✓	103295.9 ✓ ✓
Filter blank	CT 831 ✓	Blank ✓	4316B ✓	Filter # 3531663 ✓	335.6 ✓
Filter	CT 816 ✓	6DMSB ✓	4390B ✓	Filter # 3531036 ✓✓	322.0 ✓ ✓

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F __ hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881 ✓	0.6 ✓			0.2 ✓	1 ✓	-0.3 ✓	3 ✓
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 861 ✓	46.1 ✓			29.2 ✓✓	1 ✓ ✓	25.7 ✓✓	3 ✓
Filter blank	CT 831 ✓	0.2 ✓			-0.1 ✓	2 ✓	0.2 ✓	3 ✓
Filter	CT 816 ✓	140.0 ✓✓			115.9 ✓✓	2 ✓ ✓	87.3 ✓✓	3 ✓
Total particulate		186.1 ✓✓			145.1 ✓✓		113.0 ✓✓	

Remarks ____________ T.J.L.

Data reviewed by Jon Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS

PN 3530-15

Plant ______ Run No. 7BM5B

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881	Blank	4301A	368	99881.3
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 862	7BM5B	4397A	251	105067.3
Filter blank	CT 831	Blank	4316B	Filter # 3531063	335.6
Filter	CT 817	7BM5B	4397B	Filter # 3531072	333.2

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F _ hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881	0.6			0.2	1	-0.3	3
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 862	82.7			31.6	1	21.1	3
Filter blank	CT 831	0.2			0.1	2	0.2	3
Filter	CT 817	139.2			120.5	2	80.5	3
Total particulate		221.9			152.1		101.6	

Remarks ______ TJR.

Data reviewed by Ira Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. 7DM5B
Sample location Boiler No. 2 Analyst KRM
Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881	Blank	4301A	368	99881.3
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 863	7DM5B	4403A	285	104028.3
Filter blank	CT 831	Blank	4316B	Filter # 3531063	335.6
Filter	CT 818	7DM5B	4403B	Filter # 3531131	335.4

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F _ hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881	0.6			0.2	1	-0.3	3
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 863	74.6			33.6	1	18.9	3
Filter blank	CT 831	0.2			-0.1	2	0.2	3
Filter	CT 818	140.9			119.4	2	74.6	3
Total particulate		215.5			153.0		93.5	

Remarks ______ tJR

Data reviewed by Iola Blanck 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. 8HM5B ✓
Sample location Boiler No. 2 Analyst KRM
Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881 ✓	Blank ✓	4301A ✓	368 ✓	99881.3 ✓
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 864 ✓	8HM5B ✓	4406A ✓	310 ✓ ✓	102105.2 ✓ ✓
Filter blank	CT 831 ✓	Blank ✓	4376 B ✓	Filter # 3331063 ✓	335.6 ✓
Filter	CT 819 ✓	8AM5B ✓	4406B ✓	Filter # 3531122 ✓ ✓	332.4 ✓ ✓

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 24 hours, cool, weigh	Number of treatments	Heat to 450°F 24 hours, cool, weigh	Number of treatments	Heat to 600°F 24 hours, cool, weigh	Number of treatments
Acetone blank	CT 881 ✓	0.6 ✓						
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 864 ✓	50.6 ✓	17.9 ✓	2 ✓	14.9 ✓	2 ✓	6.8 ✓	3 ✓
Filter blank	CT 831 ✓	0.2 ✓						
Filter	CT 819 ✓	106.2 ✓	87.7 ✓	2 ✓	85.3 ✓	2 ✓	44.7 ✓	3 ✓
Total particulate		156.8 ✓	105.6 ✓		100.2 ✓		51.5 ✓	

Remarks ______ T.J.W.

Data reviewed by Ila Kennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

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THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. SBM5B P400 –
Sample location Boiler No. 2 Analyst KRM
Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881 ✓	Blank ✓	4301A ✓	368 ✓	99881.3 ✓
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 865 ✓	SBM5B-P400 ✓	4409A ✓	232 ✓ ✓	104344.5 ✓✓
Filter blank	CT 831 ✓	Blank ✓	4316B ✓	Filter # 3531663 ✓	335.6 ✓
Filter	CT 820 ✓	SBM5B P400 ✓	4409B ✓	Filter # 3531121 ✓ ✓	329.8 ✓ ✓

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 6 hours, cool, weigh	Number of treatments	Heat to 450°F 6 hours, cool, weigh	Number of treatments	Heat to 600°F 6 hours, cool, weigh	Number of treatments
Acetone blank	CT 881 ✓	0.6 ✓	1.1 ✓	1 ✓	0.2 ✓	1 ✓	-0.3 ✓	3 ✓
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 865 ✓	23.8 ✓ ✓	12.5 ✓ ✓	1 ✓ ✓	10.3 ✓ ✓	1 ✓ ✓	6.5 ✓ ✓	3 ✓
Filter blank	CT 831 ✓	0.2 ✓	-0.3 ✓	1 ✓	-0.1 ✓	2 ✓	0.2 ✓	3 ✓
Filter	CT 820 ✓	87.7 ✓ ✓	75.4 ✓ ✓	1 ✓ ✓	69.0 ✓ ✓	2 ✓ ✓	52.6 ✓ ✓	3 ✓
Total particulate		111.5 ✓ ✓	87.9 ✓ ✓		79.3 ✓ ✓		59.1 ✓ ✓	

Remarks ______ T.J.R.

Data reviewed by Ila Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. 8CMSB ✓

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881 ✓	Blank ✓	4301A ✓	368 ✓	99881.3 ✓
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 866 ✓	8CMSB ✓	4412A ✓	252 ✓ ✓	110329.7 ✓✓
Filter blank	CT 831 ✓	Blank ✓	4316B ✓	Filter # 3531663 ✓	335.6 ✓
Filter	CT 821 ✓	8CMSB ✓	4412B ✓	Filter # 3531120 ✓ ✓	333.7 ✓ ✓

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 24 hours cool, weigh	Number of treatments	Heat to 450°F 24 hours cool, weigh	Number of treatments	Heat to 600°F 24 hours cool, weigh	Number of treatments
Acetone blank	CT 881 ✓	0.6 ✓						
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 866 ✓	20.6 ✓✓	12.3 ✓✓	2 ✓ ✓	9.4 ✓✓	2 ✓ ✓	5.2 ✓✓	3 ✓
Filter blank	CT 831 ✓	0.2 ✓						
Filter	CT 821 ✓	92.0 ✓✓	77.5 ✓✓	2 ✓✓	75.5 ✓✓	2 ✓ ✓	46.0 ✓✓	3 ✓
Total particulate		112.6 ✓✓	89.8 ✓✓		84.9 ✓		51.2 ✓✓	

Remarks ______ T.J.W.

Data reviewed by Ken Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

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THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______________________ Run No. SDMSB P400

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881	Blank	4301A	368	99881.3
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 867	SDMSB P400	4415A	304	106248.4
Filter blank	CT 831	Blank	4376B	Filter # 3531063	335.6
Filter	CT 822	SDMSB-P400	4415B	Filter # 3531107	331.6

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F 6 hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881	0.6	1.1	1	0.2	1	-0.3	3
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 867	21.6	10.5	1	8.6	1	5.8	3
Filter blank	CT 831	0.2	-0.3	1	-0.1	2	0.2	3
Filter	CT 822	83.9	74.8	1	65.6	2	49.9	3
Total particulate		105.5	85.3		74.2		55.7	

Remarks ______________________ T.J.R.

Data reviewed by John Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. 9A1115B
Sample location Boiler No 2 Analyst KRM
Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 882	Blank	4376A	372	101576.8
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 868	9A1115B	4418A	265	106277.6
Filter blank	CT 832	Blank	4393B	Filter # 3531126	336.4
Filter	CT 823	9A1115B	4418B	Filter # 3531106	332.0

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F _ hours cool, weigh	Number of treatments	Heat to 450°F _ hours cool, weigh	Number of treatments	Heat to 600°F 24 hours cool, weigh	Number of treatments
Acetone blank	CT 882	4.3						
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 868	84.9					19.3	3
Filter blank	CT 832	0.3						
Filter	CT 823	168.0					98.2	3
Total particulate		252.9					117.5	

Remarks ______ T.J.K.
Data reviewed by Ida Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. 9BMSB ✓

Sample location Boiler No 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 882	Blank ✓	4376A	372	101576.8
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 869 ✓	9BMSB ✓	4421A ✓	284 ✓	101351.5 ✓ ✓
Filter blank	CT 832	Blank ✓	4393B	Filter # 3531126 ✓	336.4 ✓
Filter	CT 824 ✓	9BMSB	4421B ✓	Filter # 3531105 ✓ ✓	327.3 ✓

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Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F _ hours cool, weigh	Number of treatments	Heat to 450°F _ hours cool, weigh	Number of treatments	Heat to 600°F 24 hours cool, weigh	Number of treatments
Acetone blank	CT 882 ✓	4.3 ✓						
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 869 ✓	946 ✓					20.4 ✓	3 ✓
Filter blank	CT 832 ✓	0.3 ✓						
Filter	CT 824 ✓	166.6 ✓					96.3 ✓	3 ✓
Total particulate		261.2 ✓					116.7 ✓	

Remarks ______ TJR

Data reviewed by Ila Bennett 4/13/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ ______ Run No. 9cms B

Sample location Boiler No 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 882	Blank	4376 A	372	101576.8
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 870	9cms B	4424 A	338	107964.2
Filter blank	CT 832	Blank	4393 B	Filter # 3531126	336.4
Filter	CT 825	9cms B	4424 B	Filter # 3531104	327.6

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F _ hours cool, weigh	Number of treatments	Heat to 450°F _ hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 882	4.3					0.5	3
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 870	60.8					43.8	3
Filter blank	CT 832	0.3					0.3	3
Filter	CT 825	143.9					78.3	3
Total particulate		204.7					122.1	

Remarks ______ T.J.L.

Data reviewed by Ida Pennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. 9D1115B

Sample location Boiler No 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 882	Blank	4376A	372	101576.8
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 871	9D1115B	4427A	270	107199.7
Filter blank	CT 832	Blank	4393B	Filter# 3531126	336.4
Filter	CT 826	9D1115B	4427B	Filter# 3531103	343.6

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F _ hours cool, weigh	Number of treatments	Heat to 450°F _ hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 882	4.3					0.5	3
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 871	64.7					34.2	3
Filter blank	CT 832	0.3					0.3	3
Filter	CT 826	159.9					85.1	3
Total particulate		224.6					119.3	

Remarks ______ TJW.

Data reviewed by John Bennett 9/26/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______________________ Run No. 10A1115B

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881	Blank	4301A	368	99881.3
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 872	10A1115B	4431A	252	108913.8
Filter blank	CT 831	Blank	4316B	Filter # 3531063	335.6
Filter	CT 827	10A1115B	4431B	Filter # 3531028	327.6

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F _ hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881	0.6			0.2	1	-0.3	3
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 872	108.5			72.8	1	50.5	3
Filter blank	CT 831	0.2			-0.1	2	0.2	3
Filter	CT 827	151.8			130.3	2	107.3	3
Total particulate		260.6			203.1		157.8	

Remarks ______________________ T.J.R.

Data reviewed by Ida Bennett 4/31/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. 10BMSB P400

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881	Blank	4301A	368	99881.3
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 873	10BMSB P400	4434A	262	105605.2
Filter blank	CT 831	Blank	4316B	Filter # 3331063	335.6
Filter	CT 828	10BMSB P400	4434B	Filter # 3331027	325.5

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F _ hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881	0.6			0.2	1	-0.3	3
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 873	66.9			46.6	1	24.8	3
Filter blank	CT 831	0.2			-0.1	2	0.2	3
Filter	CT 828	159.2			133.3	2	111.2	3
Total particulate		226.1			179.9		136.0	

Remarks ______ T.J.R.

Data reviewed by [signature] 4/3/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

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THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______ Run No. 10cmSB ✓

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881 ✓	Blank ✓	4301A ✓	368 ✓	99881.3 ✓
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 874 ✓	10cmSB ✓	4437A ✓	280 ✓ ✓	106295.7 ✓ ✓
Filter blank	CT 831 ✓	Blank ✓	4316B ✓	Filter # 3531063 ✓	335.6 ✓
Filter	CT 829 ✓	10cmSB ✓	4437B ✓	Filter # 3531089 ✓ ✓	335.7 ✓ ✓

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F _ hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881 ✓	0.6 ✓			0.2 ✓	1 ✓	-0.3 ✓	3 ✓
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 874 ✓	66.6 ✓ ✓			58.9 ✓ ✓	1 ✓ ✓	32.1 ✓ ✓	3 ✓
Filter blank	CT 831 ✓	0.2 ✓			-0.1 ✓	2 ✓	0.2 ✓	3 ✓
Filter	CT 829 ✓	143.4 ✓ ✓			117.9 ✓ ✓	2 ✓ ✓	91.4 ✓ ✓	3 ✓
Total particulate		210.0 ✓ ✓			176.8 ✓ ✓		123.5 ✓ ✓	

Remarks ______ T.J.W.

Data reviewed by John Kennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

THERMOGRAVIMETRIC PARTICULATE ANALYSIS
PN 3530-15

Plant ______________________________ Run No. 10 DMSB P400

Sample location Boiler No. 2 Analyst KRM

Relative humidity 50% Density of acetone (ρa) .7908 (g/ml)

Sample type	Lab No.	Sample I.D.	Container No.	Initial Vol. (ml)	Tare Wt. (mg)
Acetone blank	CT 881 ✓	Blank ✓	4301A ✓	368 ✓	99881.3 ✓
Acetone blank (2)					
Acetone blank (3)					
Acetone rinse	CT 875 ✓	10DMSB P400 ✓	4440A ✓	293 ✓ ✓	105517.2 ✓ ✓
Filter blank	CT 831 ✓	Blank ✓	4316B ✓	Filter # 3531063 ✓	335.6 ✓
Filter	CT 830 ✓	10DMSB P400 ✓	4440B ✓	Filter # 3531058 ✓✓	332.1 ✓ ✓

Analysis results (mg)*

Sample type	Lab No.	Initial wt. (ambient)	Heat to 320°F _ hours cool, weigh	Number of treatments	Heat to 450°F 6 hours cool, weigh	Number of treatments	Heat to 600°F 6 hours cool, weigh	Number of treatments
Acetone blank	CT 881 ✓	0.6 ✓			0.2 ✓	1 ✓	-0.3 ✓	3 ✓
Acetone blank (2)								
Acetone blank (3)								
Acetone rinse	CT 875 ✓	64.8 ✓ ✓			53.1 ✓✓	1 ✓ ✓	24.5 ✓ ✓	3 ✓
Filter blank	CT 831 ✓	0.2 ✓			-0.1 ✓	2 ✓	0.2 ✓	3 ✓
Filter	CT 830 ✓	149.0 ✓✓			128.5 ✓✓	2 ✓ ✓	100.2 ✓✓	3 ✓
Total particulate		213.8 ✓✓			181.6 ✓✓		124.7 ✓✓	

Remarks ______________________________ T.J.W.

Data reviewed by Ken Bennett 4/21/83

*These are net weights (gross wt. avg. minus tare wt.) without blank subtraction.

LABORATORY REPORT

PN 3530-15

Hydrogen Peroxide Impinger Solutions

Run No.	PEDCo No.	Total sample volume, ml	SO_2 total mg
1AM5BW	CT 951	420	7224
1BM5BW	CT 952	397	7055
1CM5B	CT 953	400	6652
1DM5B	CT 954	404	6467
2AM5B	CT 955	400	7135
2BM5B	CT 956	393	7678
2CM5BW	CT 957	410	6376
2DM5BW	CT 958	424	6427
3AM5B	CT 959	490	7124
3BM5B	CT 960	403	7031
3CM5BP400	CT 961	343	5827
3DM5BP400	CT 962	394	6797
4AM5BP400	CT 963	435	7362
4BM5BP400	CT 964	408	7678
4CM5B	CT 965	397	6667
4DM5B	CT 966	460	6703
5AM5B	CT 967	403	5398
5BM5B	CT 968	415	5301
5CM5B	CT 969	433	5008
5DM5B	CT 970	445	5059
6AM5B	CT 971	410	5278
6BM5B	CT 972	480	5144
6CM5B	CT 973	446	4546
6DM5B	CT 974	449	4518
7AM5BW	CT 975	432	5087
7BM5B	CT 976	418	5026
7CM5BW	CT 977	415	4800

LABORATORY REPORT

PN 3530-15

Hydrogen Peroxide Impinger Solutions

Run No.	PEDCo No.	Total sample volume, ml	SO_2 total mg
7DM5B	CT 978	397	4955
8AM5B	CT 979	428	3037
8BM5BP400	CT 980	455	2967
8CM5B	CT 981	438	3062
8DM5BP400	CT 982	445	2763
9AM5B	CT 983	405	5266
9BM5B	CT 984	430	5198
9CM5B	CT 985	392	4928
9DM5B	CT 986	416	5001
10AM5B	CT 987	412	5465
10BM5BP400	CT 988	404	5121
10CM5B	CT 989	443	4834
10DM5BP400	CT 990	418	4916
10% H_2O_2 Blank, Runs 1-5	CT 991	305	<0.3
10% H_2O_2 Blank, Runs 6-10	CT 992	308	<0.3
Water Blank, Runs 1-5	CT 901	320	<0.3
Water Blank, Runs 6-10	CT 902	230	<0.2

TSM
3/19/83

PN 3530-15 IPA IMPINGERS

RUN NO.	LAB NO.	SAMPLE VOL.	ML TITRANT	MG H2SO4
1AM5BW	CT903	489	5.4	66.2
1BM5BW	CT904	485	5.15	62.6
1CM5B	CT905	500	4.7	58.9
1BM5B	CT906	519	4.5	58.5
2AM5B	CT907	479	3.05	36.6
2BM5B	CT908	493	2.4	29.7
2CM5BW	CT909	475	3.7	44.0
2DM5BW	CT910	513	1.9	24.4
2DM5BW	CT910R	513	1.87	24.0
3AM5B	CT911	525	3.75	49.3
3AM5B	CT911R	525	3.75	49.3
3BM5B	CT912	504	3.9	49.3
3BM5B	CT912R	504	3.9	49.3
3CM5BF400	CT913	490	4.8	58.9
3DM5BF400	CT914	496	4.3	53.4
4AM5BF400	CT915	493	2.1	25.9
4BM5BF400	CT916	495	2	24.8
4CM5B	CT917	495	2	24.8
4DM5B	CT918	510	1.5	19.2
4DM5B	CT918R	510	1.43	18.3
5AM5B	CT919	465	3.05	35.5
5BM5B	CT920	474	3.1	36.8
5CM5B	CT921	457	2.5	28.6
5DM5B	CT922	458	2.6	29.8
5DM5B	CT922R	458	2.6	29.8
6AM5B	CT923	474	3.2	38.0
6BM5B	CT924	463	3.15	36.5
6CM5B	CT925	475	4.45	53.0
6DM5B	CT926	465	2.12	24.7
6DM5B	CT926R	465	2.1	24.5
7AM5BW	CT927	455	4.6	52.4
7BM5B	CT928	430	3.95	42.6
7CM5BW	CT929	458	4.15	47.6
7DM5B	CT930	460	4.65	53.6
8AM5B	CT931	439	2.9	31.9
8AM5B	CT931R	439	2.9	31.9
8BM5BF400	CT932	458	5.45	62.6
8BM5BF400	CT932R	458	5.5	63.1
8CM5B	CT933	417	6.85	71.6
8DM5BF400	CT934	424	4.4	46.8
9AM5B	CT935	485	8.4	102.1
9BM5B	CT936	467	7.2	84.3
9CM5B	CT937	454	9.15	104.1
9DM5B	CT938	495	8.05	99.9
10AM5B	CT939	552	5.6	77.5
10BM5BF400	CT940	554	5.9	81.9
10CM5B	CT941	529	7	92.8
10DM5BF400	CT942	508	5.55	70.7
10DM5BF400	CT942R	508	5.55	70.7
80% IPA/FLT-BLK	CT943	297	<.05	< 0.2
80% IPA	CT944	348	<.05	< 0.3

NORMALITY OF TITRANT= .01022 ✓

Ida Bennett 3-9-83

CHC

LABORATORY REPORT

PN 3530-15

APRIL 20, 1983

Run No.	Lab No.	Ambient weight, mg	Total particulate M5W, mg	C_{SO_4}, mg/liter	V_{evap}, ml	NWSSP, mg
1AM5BW-PR	CT891	-	120.0	112.8	293	74.5
1AM5BW-F	CT883	228.9	224.0	427.4	235	85.8
1BM5BW-PR	CT892	-	132.3	120.8	291	83.9
1BM5BW-F	CT884	221.1	218.3	419.6	235	82.7
2CM5BW-PR	CT893	-	120.0	51.08	365	94.4
2CM5BW-F	CT885	188.8	187.1	320.4	235	83.5
2DM5BW-PR	CT894	-	137.2	84.24	332	98.7
2DM5BW-F	CT886	191.6	190.5	334.6	235	82.3
7AM5BW-PR	CT895	-	95.8	152.2	320	28.8
7AM5BW-F	CT887	148.4	155.5	316.1	235	53.3
7CM5BW-PR	CT896	-	93.1	111.7	389	33.3
7CM5BW-F	CT888	146.8	154.7	318.5	235	51.7
Blank-PR	CT901	-	0.8	<1.00	305	0.8
Blank-F	CT889	0.3	2.8	1.98	235	2.2
Blank-PR	CT902	-	1.3	<1.00	215	1.3
Blank-F	CT890	0.2	1.1	1.91	235	0.5
Blank-F	CT833	0.1	3.6	1.89	235	3.0
1A-PR-Blank	CT897	-	3.1	1.55	235	2.6
1B-PR-Blank	CT898	-	2.8	<1.00	235	2.8
2C-PR-Blank	CT899	-	2.7	<1.00	235	2.7
2D-PR-Blank	CT900	-	3.1	2.24	235	2.4

Reviewed by Thomas J. Wagner

PEDCO ENVIRONMENTAL, INC.
11499 CHESTER ROAD
CINCINNATI, OHIO 45246

LABORATORY ANALYSIS REPORT

CLIENT: USEPA

PROJECT NO: 3530-15
REQUISITION:
RECEIVED:

SAMPLED BY:

ATTENTION:

REPORTED: 5/17/83

VANADYL HEAT TREATMENTS

SAMPLE ID	BLANK	#1	#2	#3	#4
PARAMETER					
AMBIENT WT. MG	0.0	143.3	175.9	171.5	109.2
160C, 6 HR. MG	0.0	96.7	120.3	126.5	74.6
# OF TREATMENTS	2	2	2	2	2
232C, 6 HR, MG	-0.1	83.3	102.4	100.7	63.8
# OF TREATMENTS	2	2	2	2	2
316C, 6 HR. MG	0.0	80.3	99.3	97.6	61.3
# OF TREATMENTS	3	3	3	3	

SAMPLE ID	PERCENT WEIGHT LOSS AFTER HEATING @:		
	160°C	232°C	316°C
1	33	42	44
2	32	42	44
3	26	41	43
4	32	42	44
AVG	31	42	44

QUESTIONS CONCERNING ANALYTICAL RESULTS SHOULD BE REFERRED TO IDA J. BENNETT

APPROVED BY: Ida Bennett

INORGANIC GROUP

(513) 782-4700

APPENDIX D

SAMPLING AND ANALYTICAL PROCEDURES

SAMPLING AND ANALYTICAL PROCEDURES

A four-train (quad) sampling system was used in this test program. This system allowed four samples to be collected simultaneously at essentially the same point in the gas stream. Each individual sampling train consisted of a Method 5* fronthalf and a Method 8* backhalf. Method 5 sampling procedures were used for all tests, except as noted.

SAMPLING APPARATUS

The sampling train(s) used in these tests met design specifications established by the Federal EPA and was assembled by PEDCo personnel. Each train, set up as shown in Figure D-1, consisted of:

Nozzle - Stainless steel (316) with sharp, tapered leading edge and accurately measured round opening.

Probe - Borosilicate glass with a heating system capable of maintaining the desired gas temperature at the exit end during sampling.

Filter Holder - Pyrex glass with heating system capable of maintaining a filter temperature at desired levels.

Impingers - Five impingers connected in series with glass ball joints. The first, fourth, and fifth impingers were of the Greenburg-Smith design, modified by replacing the tip with a 1/2 inch I.D. glass tube extending to 1/2 inch from the bottom of the flask.

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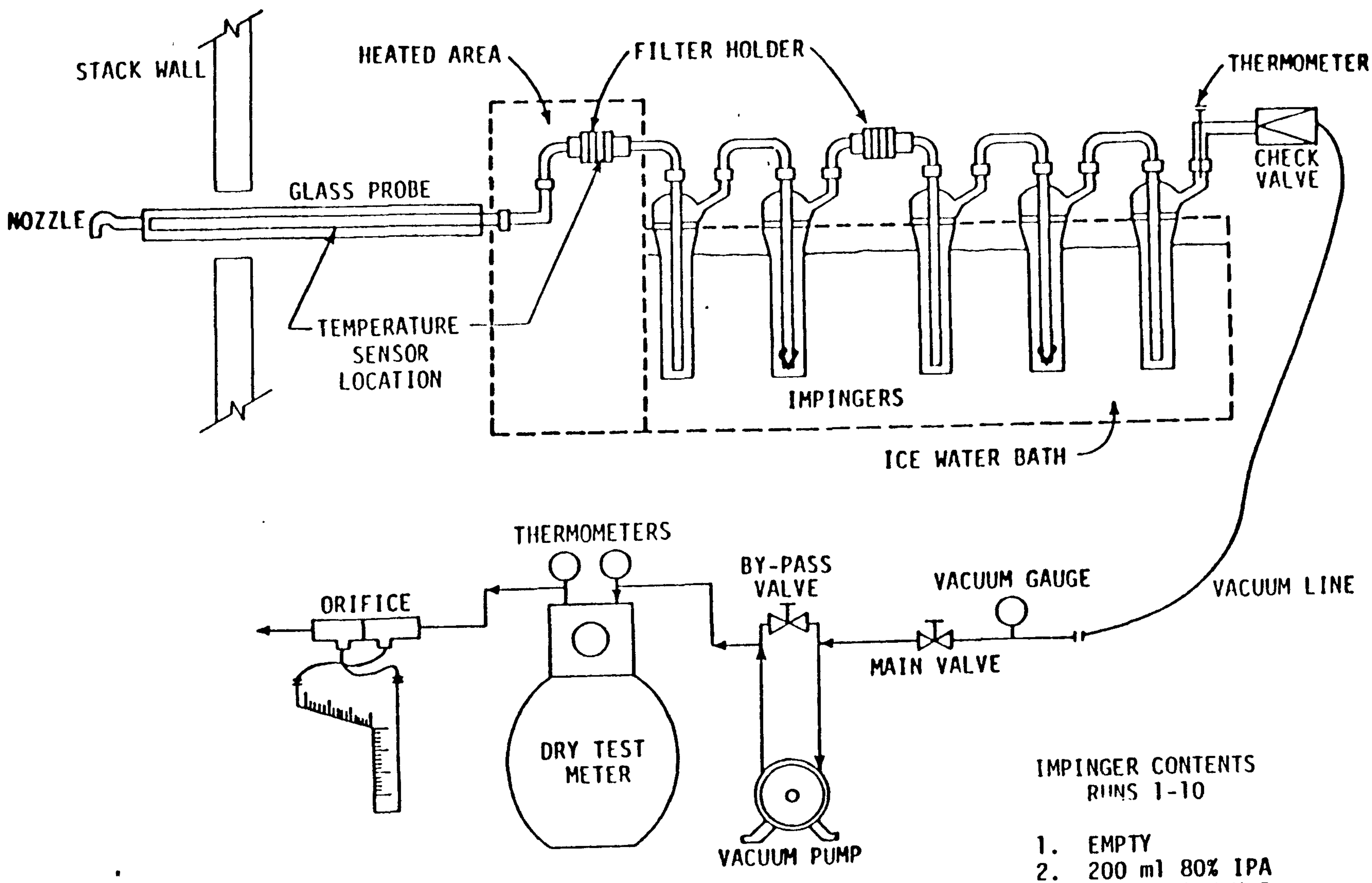
*40 CFR 60, Appendix A, July 1981.



IMPINGER CONTENTS
RUNS 1-10

1. EMPTY
2. 200 ml 80% IPA
3. 100 ml 10% H_2O_2
4. 100 ml 10% H_2O_2
5. 400 g SILICA GEL

Figure D-1. Methods 5 and 8 sampling train schematic.

Back-Half Filter Holder - Unheated Pyrex glass inserted between the second and third impingers to prevent carryover of any sulfuric acid mist.

Metering System - Vacuum guage, leak-free pump, thermometers capable of measuring temperature to within 5°F, calibrated dry gas meter, and related equipment to maintain an isokinetic sampling rate and to determine sample volume.

A single pitot-tube and thermocouple located as shown in Figure D-2 were used to measure stack gas velocity. Equipment consisted of:

Pitot Tube - Type S pitot tube that met all geometry standards was attached to the probe system to monitor stack gas velocity pressure.

Temperature Gauge - A Chromel/Alumel Type-K thermocouple (or equivalent) was attached to the pitot tube, in an interference-free arrangement, to monitor stack gas temperature within 5°F by the use of a digital indicator.

Draft Gauge - An inclined manometer made by Dwyer with a readability of 0.01 inch H_2O in the 0 to 1 inch range was used.

Barometer - Aneroid type to measure atmospheric pressures to within $\pm$0.1 inch Hg.

Probe and filter temperatures were monitored using multi-terminal digital indicators with thermocouple leads located in the middle of each probe and immediately behind the Method 5 filter frits. Rheostat devices were used to control individual probe temperatures. Filter temperatures were maintained at the desired level by the use of individual temperature controllers.

SAMPLING PROCEDURE

After selecting the sampling site, the stack pressure, temperature, molecular weight, moisture content, and range of

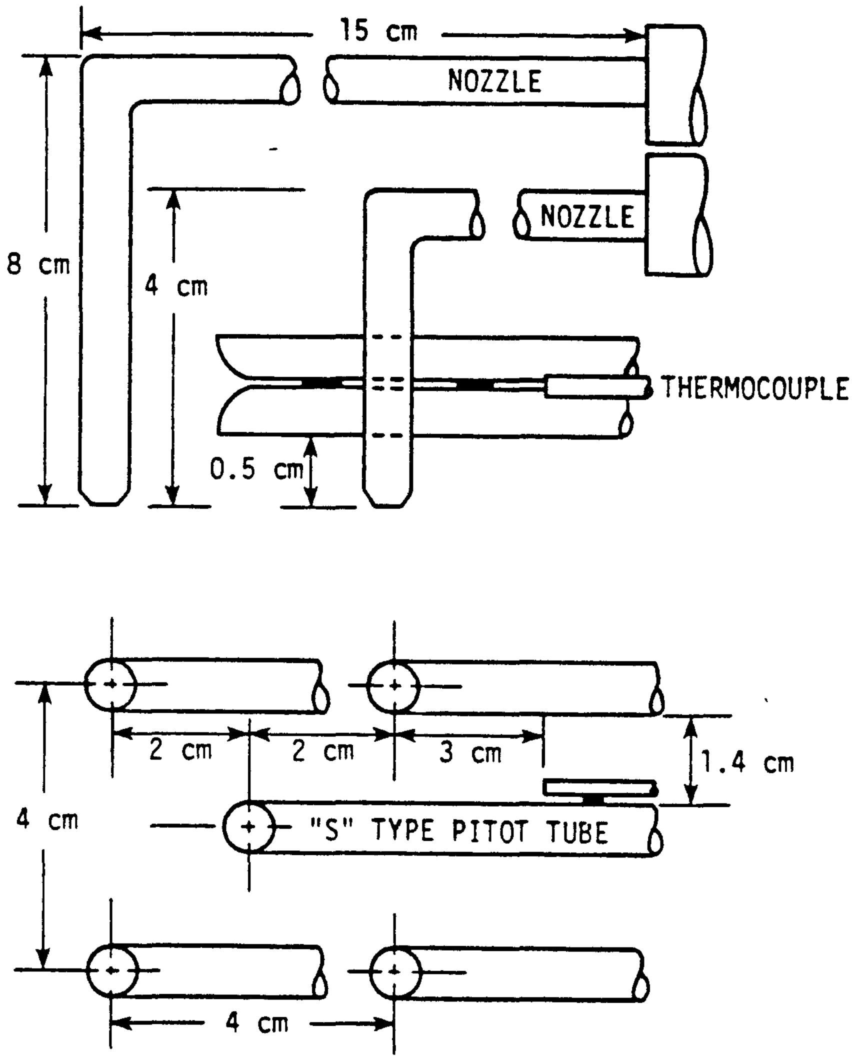


Figure D-2. Four-train sampling system showing nozzle, pitot tube, and thermocouple position.

velocity head in the general sampling area were measured according to procedures described in the Federal Register.* A single sampling point located approximately 0.6 m from the stack wall was selected to allow all four nozzles to be positioned at points of equal velocity.

Individual sampling train components were assembled and labeled. Glass fiber filters** (3-in. diameter) used in the Method 5 position were heated to 315 °C prior to identification and tare weighing to the nearest 0.1 mg on an analytical balance. Each sample train had a Method 8 backhalf, modified by adding a fifth impinger behind the filter to minimize evaporation loss of IPA by additional cooling of the hot sample gas prior to its contacting the IPA. An unheated glass fiber filter** assembly was inserted between the second and third impingers to preclude any sulfuric acid mist carryover. The contents of each impinger was as follows:

Impinger	Contents - All Runs
1	Empty
2	200-ml 80% IPA
3	100-ml 10% H_2O_2
4	100-ml 10% H_2O_2
5	400-grams silica gel

The sampling train subassemblies (probes, filter holders, impingers) were transported to the test site and assembled in the quad train configuration as shown in Figure D-3. The sampling trains were leak checked at the sampling site prior to each test

*40 CFR 60, Appendix A, Reference Methods 2, 3, and 4, July 1, 1981.

**Whatman RA 934AH.

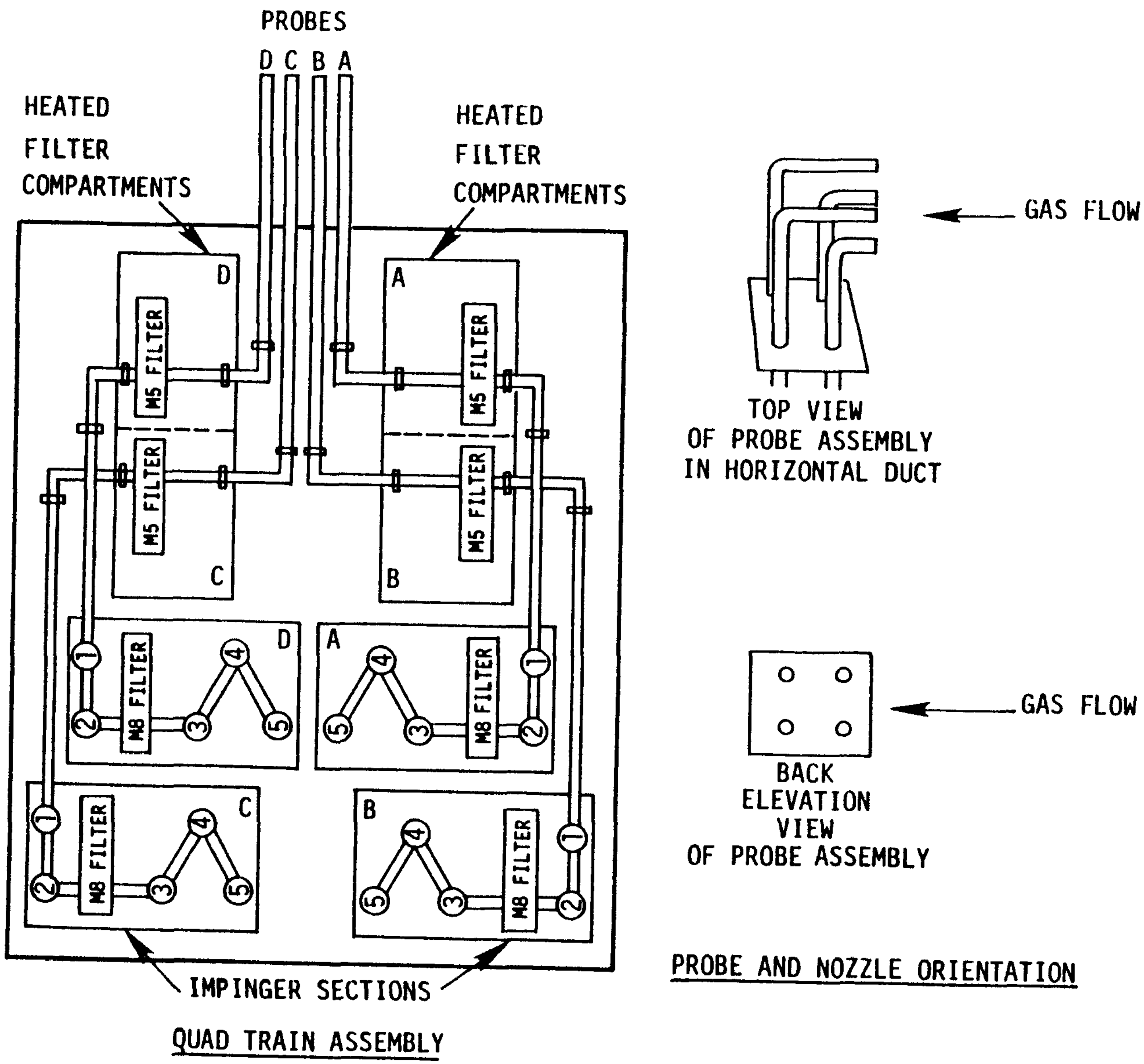


Figure D-3. Quad train configuration.

run by plugging the inlet to the nozzle and pulling a 15 inch Hg vacuum, and at the conclusion of the test by plugging the inlet to the nozzle and pulling a vacuum equal to the highest vacuum reached during the test run.

The pitot tube and lines were leak checked at the test site prior to each test run. The check was made by blowing into the impact opening of the pitot tube until 3 or more inches of water were recorded on the manometer and then capping the impact opening and holding it for 15 seconds to assure it was leak free. The static pressure side of the pitot tube was leak checked using the same procedure, except suction was used to obtain the 3 inch H_2O manometer reading. Crushed ice was placed around the impingers to keep the temperature of the gases leaving the last impinger at 20°C or less. For each train, the probe and filter were preheated to the desired temperature prior to sampling and maintained at that temperature throughout the run. The particular conditions for each type of train were:

> <u>Method 5B (Designated M5B)</u> - probe and filter assembly heated to 160°C (320°F).
>
> <u>Modified Method 5B (Designated M5B-P400)</u> - probe heated to 204°C (400°F) to minimize cold spots and filter assembly heated to 160°C (320°F).
>
> <u>Method 5BW (Designated M5BW)</u> - probe and filter assembly heated to 160°C (320°F).

During sampling, stack gas and sampling train data were recorded at 10-minute intervals and when significant changes in stack flow conditions occurred. Isokinetic sampling rates were set throughout the sampling period with the aid of a programmable calculator. All sampling data were recorded on the Particulate Field Data Sheet.

SAMPLE RECOVERY

The components of the quad train sample system were labeled and disassembled at the stack for transport to the sample clean-up/setup area. The filter and probe assemblies were recovered as follows:

- All filters were carefully removed from the filter holder and placed in a petri dish. These filters were sealed and labeled for shipment.

- For Methods 5B and M5B-P400, loose particulate from all sample exposed surfaces prior to the filter and acetone washings were placed in a polyethylene container, sealed, and labeled. For Method 5BW, deionized, distilled water was used for the probe rinse. Particulate was removed from the nozzle and probe with a nylon brush. The liquid level was marked after each container was sealed.

The impinger section of each sample train (modified Method 8) was removed from its ice bath and purged with ambient air for 15 minutes before recovering the contents. The long glass connector between the front filter holder and first impinger was not purged.

The contents were recovered as follows:

- After gravimetric weighing, the contents of the first and second impingers (condensate and 80 percent IPA) were placed in a polyethylene container. The impingers and connecting glassware between the front and backhalf filter were rinsed with 80 percent IPA and the rinse was added to the container along with the backhalf filter. The containers were then sealed, labeled, and the liquid level marked.

- After gravimetric weighing, the contents of the third and fourth impingers (10 percent H_2O_2) were placed in a polyethlyene container. The impingers and connecting glassware were rinsed with deionized, distilled water and the rinse was added to the container. The containers were then sealed, labeled, and the liquid level marked.

- The color of the silica gel was noted on the sample recovery sheet and the net weight gain determined gravimetrically.

Blank samples were taken for each new batch (or a minimum of two) of the following reagents: acetone; deionized, distilled water; 80 percent IPA; 10 percent H_2O_2; and a filter. In addition, each probe was rinsed prior to initial use with either water or acetone (depending on method type), and these rinses were retained for probe rinse blank analysis.

SAMPLE LABELING

The sample label identifies the test run number, sample train, and each component of the individual train. The run numbers are consecutive from 1 to 10. Since each run consists of four single trains, each train was identified by a letter A, B, C, or D.

The last item of the label identifies the sample method and the component of the recovered sample. For example, identification No. 1C M5B-IPA indicates Test Run 1, Sample Train C, Method 5B sample method at 160°C (320°F) and the IPA impinger contents and rinse. Another example is 4A M5B-P400-Probe indicating Test Run 4, Sample Train A, Modified Method 5B sample method (filter at 160°C and probe at 204°C), and the probe rinse fraction.

SAMPLE RECEIPT AND CHAIN OF CUSTODY

Every sample entering the lab for analysis was assigned a unique alphanumeric identity on a Sample Receipt and Record Sheet (log). In the sample log-in book, this number was correlated with sample identification label and with the number of the analysis requisition form. A copy of the analysis requisition was kept with the samples and later with the raw data.

The samples remained in a locked sample storage room until removed for analysis. Transfer was documented on a Sample Control Record which is maintained by the sample custodian. The Sample Control Record documents all custody changes which occur in the laboratory and each procedure performed on the sample.

Release of samples requires notation of the Sample Control Record and verification of information and sample container condition. If the sample is to be transferred between two persons (i.e., two analysts), the transfer must take place through the sample custodian. In other words, the sample will be returned to the sample custodian and reissued.

SAMPLE ANALYSIS

Particulate Analysis

Initially, the filter particulate catch was placed in a tared glass weighing dish, desiccated for 24 hours, and weighed to the nearest 0.1 mg until a constant weight was achieved. The probe rinse fraction was transferred to a tared beaker and evaporated to dryness at ambient temperature and pressure, desiccated for 24 hours, and weighed to the nearest 0.1 mg until a constant weight was achieved.

For this study a constant weight was defined as a difference of no more than 0.5 mg or 1 percent of the net weight, whichever was greater, between successive weighings, with at least 6 hours of desiccation between weighings. This is the same definition as for Method 5. Because previous data have shown that samples containing a significant amount of sulfuric acid may not come to a constant weight, each sample received a maximum of three separate weighings. In any case, the lowest weight achieved was reported as the ambient weight.

After this initial gravimetric analysis at ambient conditions, probe rinse and filter fractions were subjected to the sequence of heat treatments as outlined in the analytical matrix (Table 3-2). The samples were heated in an oven at the specified temperature for either 6 or 24 hours as indicated. Each sample fraction was cooled and desiccated for 24 hours after removal from the oven and weighed to the nearest 0.1 mg. Each sample was desiccated from an additional 3 hours and weighed to the nearest 0.1 mg. The lower weight achieved was reported.

Selected samples received additional heat treatments in order to evaluate sample stability. Prior to advancing to the next step of an analytical sequence, a heat treatment was repeated at the same time and temperature condition until a stable weight was obtained for these selected samples. For this study a stable weight was defined as a difference of no more than 5.0 mg or 10 percent of the net sample weight, whichever was greater, between successive treatments at the same conditions. The number of treatments required to achieve a stable weight was recorded for each sample fraction up to a maximum of three treatments. The lowest weight achieved at a given treatment temperature was reported as the weight for that temperature condition. Filter and acetone blanks were treated in a similar manner as the samples.

Water-Soluble Sulfate Determination

Each sample fraction plus blanks were handled and analyzed as follows:

- Filter - The filter was cut into small pieces and placed in a 125-ml Erlenmeyer flask with a standard type joint equipped with an air condenser. The contents of the shipping container were rinsed into the flask. About 50 ml of distilled water was added and the contents gently refluxed for 6 to 8 hours. The solution was then cooled and diluted with water to exactly 250 ml in a volumetric flask. This solution was reserved for total soluble sulfate analysis, which is described below.

- Probe Rinse - The probe wash was poured into a 250 ml volumetric flask. The sample bottle was rinsed with distilled water and the rinsings were added to the flask. The solution was then diluted to the mark with distilled water (or, if greater than 250 ml, the volume was measured). This solution was reserved for total soluble sulfate analysis, which is described below.

Total Soluble Sulfate--

A 15-ml aliquot* was drawn from the settled samples (filter and rinse) into separate sample containers with a clean, dry pipet (only solution was transferred--no solid; if necessary, a portion of the sample was centrifuged). The sulfate ion ($SO_4^{=}$)

*The pipet is not rinsed. This deviation from normal procedures is necessary because the volume removed from the volumetric flask is required in the calculations.

concentration in each aliquot was determined by ion chromatography (IC). A syringe was used to inject 1 ml of the aliquot into the 100-μl sample loop of the IC, thereby flushing the loop with sample. The conductivity response of the sample was compared with the calibration curve to obtain $SO_4^=$ concentration in mg/liter. Dilutions were prepared and reanalyzed if the initial response was out of the linear calibration range (i.e., greater than 15 mg/liter). Blank filter and water samples were prepared and analyzed in the same manner as the actual samples.

Mass Determination--

<u>Filter and Rinse Solution Preparation</u> - The remaining contents of each volumetric flask (235 ml) were poured into separate tared 250-ml beakers, and the flask was rinsed with distilled water to transfer all particulate matter. The filter solution was in Beaker A and the rinse solution was in Beaker B. These solutions were evaporated to approximately 100 ml at 105°C and allowed to cool before the next analysis was made.

<u>Filter and Rinse Solution Analysis</u> - Five drops of phenolphthalein indicator were added to all the tared beakers. Concentrated NH_4OH was then added drop by drop until the solution turned pink. The samples were returned to the oven and evaporated to dryness at 105°C, then cooled in a desiccator and weighed to a constant weight. Results were reported to the nearest 0.1 mg. For this method, "constant weight" means a difference of no more than 0.5 mg or 1 percent of the total weight less beaker and/or filter tare, whichever is greater, between two consecutive weighings, with no less than 6 hours of desiccation time between weighings.

Calculations--

<u>Nomenclature</u>--

FP = weight of particulate* on the filter in Beaker A, mg

PRP = weight of probe rinse particulate* in Beaker B, mg

*Particulate with H2SO4 converted to (NH4)2SO4.

$NWSSP$ = weight of nonwater-soluble sulfate particulate*, mg

AS_f = weight of ammonium sulfate in filter sample, mg

AS_{pr} = weight of AS in probe rinse sample, mg

V_{evap} = volume of solution evaporated in Beaker A (filter) or Beaker B (probe rinse), ml

C_{SO_4} = concentration of sulfate in filter or probe rinse solution aliquots, mg/liter

Equations--

FP(mg) = gross weight Beaker A - tare weight Beaker A - filter tare weight   Eq. 1

PRP(mg) = gross weight Beaker B - tare weight Beaker B   Eq. 2

$$AS(mg) = C_{SO_4}\ (mg/liter) \times V_{evap}\ (ml) \times \frac{liter}{1000\ ml} \times 1.376\ \left(\frac{mg\ AS}{mg\ SO_4}\right) \qquad \text{Eq. 3}$$

Mass of Nonwater-Soluble Sulfate Particulate

The sum of the particulate** collected on the filter (FP) and the particulate* collected in the probe rinse (PRP) is equal to the sum of nonwater-soluble sulfate particulate (NWSSP) and ammonium sulfate (AS) in both samples:

$$FP + PRP = NWSSP + AS_f + AS_{pr} \qquad \text{Eq. 4}$$

The NWSSP can be found be rearranging the equation and substituting appropriate values determined using Equations 1, 2, and 3.

$$NWSSP = FP + PRP - AS_f - AS_{pr} \qquad \text{Eq. 5}$$

---

*Particulate excluding water-soluble sulfates.

**Particulate with H_2SO_4 converted to $(NH_4)_2SO_4$.

Sulfuric Acid Mist Analysis

The volume of the sample solution was recorded and the pH of the sample determined. The sample volume was diluted to 500 ml with 80 percent IPA. A 100 ml aliquot of this solution was pipetted into a 250 ml Erlenmeyer flask with 2 to 3 drops of thorin indicator and titrated to a pink end point using 0.0100 N barium perchlorate. If the end point color was not correct, the sample was passed through an ion exchange resin and retitrated. A blank was titrated for each sample in the same manner.

Sulfur Dioxide Analysis

The sample was diluted to 500 ml with deionized, distilled water. A 20 ml aliquot of this solution was pipetted into a 250 Erlenmeyer flask with 80 ml of 100 percent IPA and 2 to 3 drops thorin indicator. The solution was then titrated to a pink end point using 0.0100 N barium perchlorate. A blank was titrated in the same manner.

APPENDIX E

CALIBRATION PROCEDURES AND RESULTS

CALIBRATION PROCEDURES AND RESULTS

All of the equipment used was calibrated according to the procedures outlined in Maintenance, Calibration, and Operation of Isokinetic Source-Sampling Equipment.*

NOZZLE DIAMETER

The nozzles were calibrated by making three separate measurements using different inside diameters and calculating the average. If a deviation of more than 0.004 inches was found the nozzle was either discarded or reamed out and remeasured. A micrometer was used for measuring. These calibration data are shown in Figures E-1a and b.

PITOT TUBE CALIBRATION

The pitot tubes used in sampling were constructed by PEDCo Environmental and met all requirements of Method 2, Section 4.1 of the Federal Register.** Therefore, a baseline coefficient of 0.84 was assigned to each pitot tube. See Figures E-2 and E-3 for alignment requirements of Method 2, and Figures E-4a and b for actual inspection data of the pitot tubes used during the test program.

---

*Office of Air Programs Publication No. APTD-0576.

**40 CFR 60, Appendix A, Reference Method 2, July 1981.

Date 2/6/83 Calibrated by DO/DS

Nozzle identification number	D_1, in.	D_2, in.	D_3, in.	ΔD, in.	D_{avg}
1A	.222	.223	.224	.002	.223
1B	.222	.221	.221	.001	.221
1C	.221	.221	.220	.001	.221
1D	.214	.217	.214	.003	.215
2A	.223	.224	.224	.001	.224
2B	.226	.227	.227	.001	.227
2C	.211	.211	.212	.001	.211
2D	.209	.210	.210	.001	.210

where:

$D_{1,2,3,}$ = nozzle diameter measured on a different diameter, in. Tolerance = measure within 0.001 in.

ΔD = maximum difference in any two measurements, in. Tolerance = 0.004 in.

D_{avg} = average of D_1, D_2, and D_3.

Figure E-1a. Nozzle calibration data.

Date 2·11·83 Calibrated by D. Scheffel

Nozzle identification number	D_1, in.	D_2, in.	D_3, in.	ΔD, in.	D_{avg}
8 A	.306	.304	.305	.002	.305
8 B	.308	.306	.306	.002	.307
8 C	.305	.305	.305	.000	.305
8 D	.304	.303	.305	.002	.304
For Runs 8 + 10					

where:

$D_{1,2,3,}$ = nozzle diameter measured on a different diameter, in. Tolerance = measure within 0.001 in.

ΔD = maximum difference in any two measurements, in. Tolerance = 0.004 in.

D_{avg} = average of D_1, D_2, and D_3.

Figure E-1b. Nozzle calibration data.

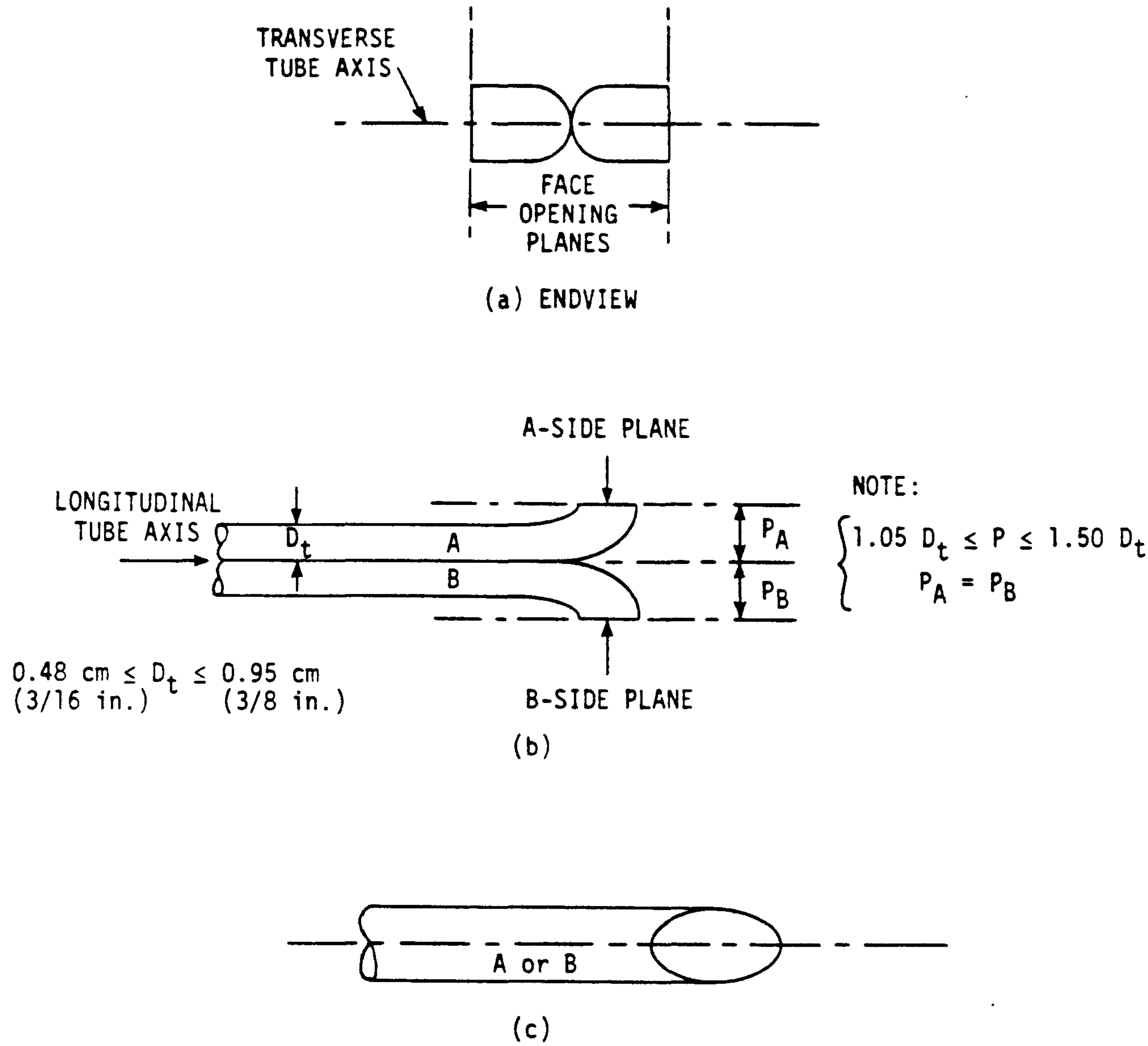


Figure E-2. Properly constructed Type S pitot tube, shown in: (a) end view; face opening planes perpendicular to transverse axis; (b) top view; face opening planes parallel to longitudinal axis; (c) side view; both legs of equal length and centerlines coincident, when viewed from both sides. Baseline coefficient values of 0.84 may be assigned to pitot tubes constructed this way.

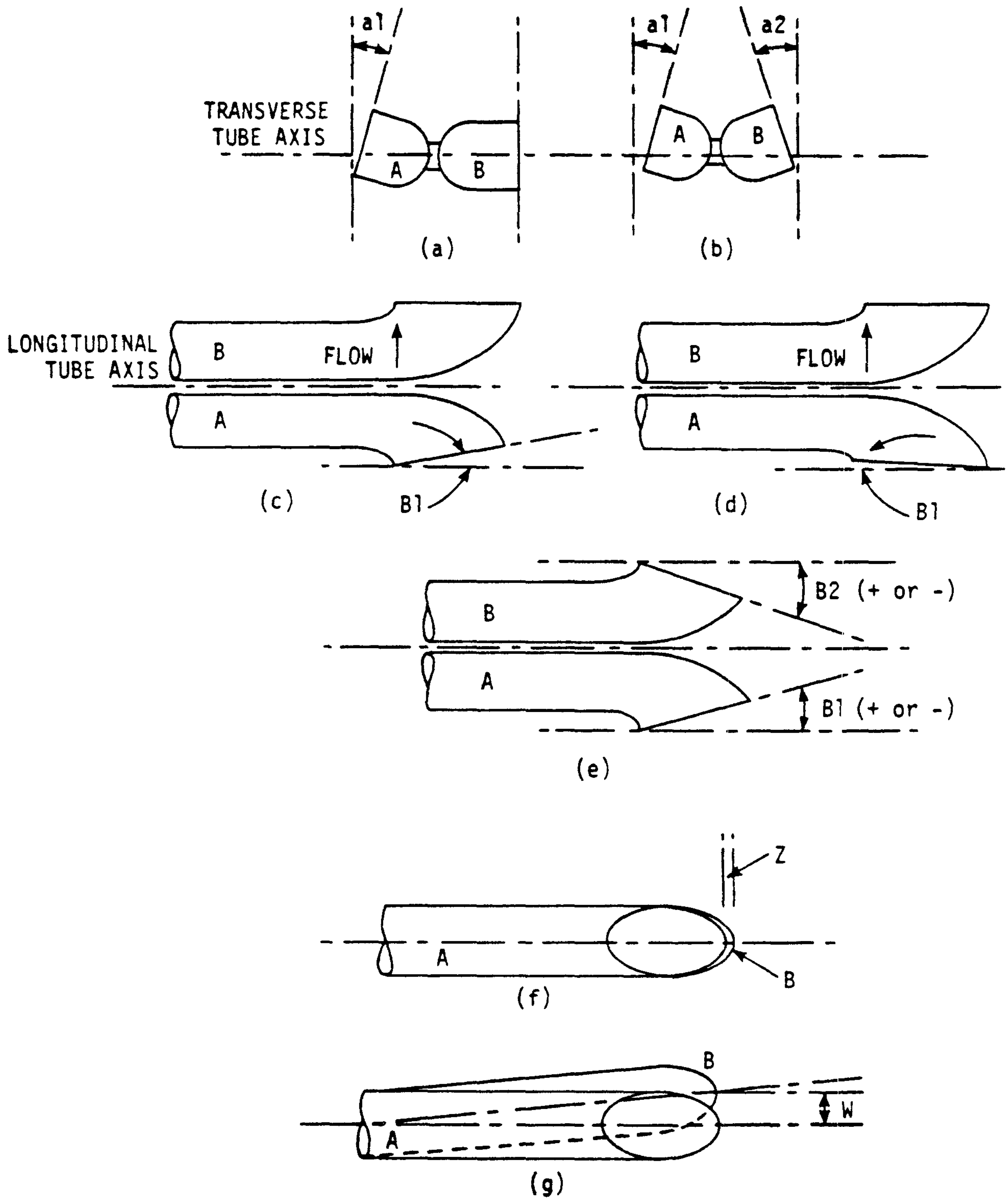


Figure E-3. Types of face-opening misalignment that can result from field use or improper construction of Type S pitot tubes. These will not affect Cp so long as a_1 and a_2 <10°, B_1 and B_2 <5°, z <0.32 (1/8 in.) and w <0.08 cm (1/32 in.).

Pitot Tube No. 278 Date 1/7/82 Inspector E. Armstrong

α_1 Degrees	α_2 Degrees	β_1 Degrees	β_2 Degrees
2 0	1.0	0.0	2.0
<10°	<10°	<5°	<5°

D_t Inches	P Inches	1.05 D_t Inches	1.50 D_t Inches
0.375	0.962	0.394	0.563
$0.185 \leq P_t < 0.380$	-	-	-

γ Degrees	ϕ Degrees	P_{sin} (γ) Inches	P_{sin} (ϕ) Inches
1.0	0.0	0.017	0.000
-	-	<0.125	<0.03125

P_1 Inches	P_2 Inches	$\lvert P_1 - P_2 \rvert$ Inches	Meet specifications
0.500	0.462	0.038	yes
$1.05\ D_t < P_1 < 1.50\ D_t$	$1.05\ D_t < P_2 < 1.50\ D_t$		

Lower line in each table is limits for meeting specifications.

Figure E-4a. Pitot tube inspection data sheet.

Pitot Tube No. #379 Date 2/1/83 Inspector R. A[illegible]

α_1 Degrees	α_2 Degrees	β_1 Degrees	β_2 Degrees
4°	5°	3.5°	1.5°
<10°	<10°	<5°	<5°

D_t, Inches	P Inches	1.05 D_t Inches	1.50 D_t Inches
.375	1.020	.343	.56[illegible]
$0.185 \leq P_t < 0.380$	-	-	-

γ Degrees	ϕ Degrees	$P_{sin}(\gamma)$ Inches	$P_{sin}(\phi)$ Inches
5.5°	1.5°	.0952	.0261
-	-	<0.125	<0.03125

P_1 Inches	P_2 Inches	$\lvert P_1 - P_2 \rvert$ Inches	Meet specifications
5.10	5.10	0.0	yes
$1.05\ D_t < P_1 < 1.50\ D_t$	$1.05\ D_t < P_2 < 1.50\ D_t$	≤ 0.010	

Lower line in each table is limits for meeting specifications.

Figure E-4b. Pitot tube inspection data sheet.

DRY GAS METER AND ORIFICE METER

Figure E-5 was the set-up used for the initial and post-test calibration. A wet test meter with a 2-cubic-feet-per-minute capacity and ±1 percent accuracy was used. The pump was run for approximately 15 minutes at an orifice manometer setting of 0.5 inch of water to heat up the pump and wet the interior surface of the wet test meter. The information on Figure E-6 (example calculation sheet) was gathered for the initial calibration and then, the ratio of accuracy of the wet test meter to the dry test meter, and the $\Delta H@$ were calculated.

POST-TEST METER CALIBRATION CHECK

A post-test meter calibration check was made on the meter box used during the test to check its accuracy against its last calibration check. This post-test calibration must be within ±5 percent of the initial calibration. The initial calibration was performed as described in APTD-0576. The post-test calibration was performed using the same method as the initial calibration. Three calibration runs were made using the average orifice setting obtained during each test run and with the vacuum set at the average value obtained during each test run. After running the post-test calibration check all three runs were within the ±5 percent range allowed by the Federal Register.*

The initial and post-test meter box calibration data are presented in Figures E-7a through h.

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*40 CFR 60, Appendix A, Reference Method 2, July 1981.

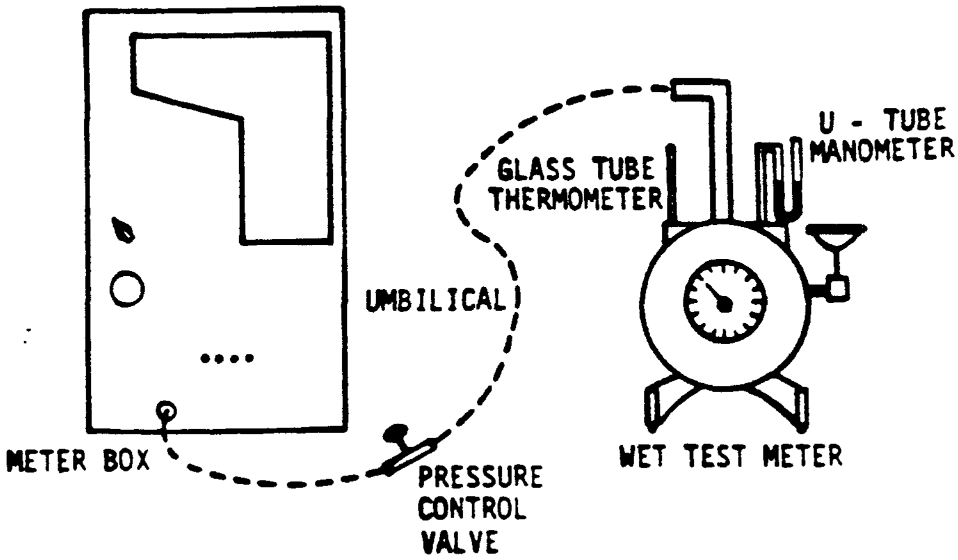

Figure E-5. Calibration setup.

DATE ______________________ METER BOX NO. ______________________

BAROMETRIC PRESSURE, P_b = ______ in. Hg. DRY GAS METER NO. ______________________

Orifice manometer setting ΔH in. H_2O	Gas volume wet test meter V_w, ft^3	Gas volume dry gas meter V_d, ft^3	Wet test meter t_w, °F	Dry gas meter Inlet t_{di}, °F	Dry gas meter outlet t_{dn}, °F	Dry gas meter Average t_d, °F	Time θ, min	γ	ΔH@
0.5	5								
1.0	5								
1.5	10								
2.0	10								
3.0	10								
4.0	10								

Average ______

ΔH	$\frac{\Delta H}{13.6}$	γ: $\dfrac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6})(t_w + 460)}$	ΔH@: $\dfrac{0.0317 \Delta H}{P_b (t_d + 460)} \left[\dfrac{(t_w + 460)\theta}{V_w}\right]^2$
0.5	0.0368		
1.0	0.0737		
1.5	0.110		
2.0	0.147		
3.0	0.221		
4.0	0.294		

γ = Ratio of accuracy of wet test meter to dry test meter. Tolerance = ± 0.01
ΔH@ = Orifice of pressure differential that gives 0.75 cfm of air at 70°F and 29.92 inches of mercury, in H_2). Tolerance = +0.15.

Figure E-6. Calibration data sheet.

DATE: FEBRUARY 1, 1983 METER BOX NO. FB#4

CALIBRATOR: [illegible signature] BAROMETRIC PRESSURE (P_b) 29.27 in. Hg

Leak Checks:

- Positive (minimum 5 in. H2O): [illegible]
- Negative (within 3 in. Hg of absolute): .001 cfm* 27.5 in. Hg

*Not to exceed 0.005 cfm.

Orifice manometer setting ΔH in H_2O	Volume wet test meter V_w ft^3	Volume dry gas meter V_d ft^3	Temperatures: Wet test meter T_w °F	Temperatures: Dry gas meter Inlet T_i °F	Temperatures: Dry gas meter Outlet T_o °F	Temperatures: Dry gas meter Average T_d °F	Duration of test θ min	Vacuum setting in Hg	γ	ΔH@ in H_2O
0.5	5.0	445.695 451.562	73 73	76 78	76 76	76.5	12 28.6/60	8.5	1.0352	1.790
1.0	5.0	451.065 455.947	73 72	75 79	76 76	77.25	8 53.9/60	10.5	1.0348	1.808
1.5	10.0	456.192 465.969	72 71	78 79	76 76	77.25	14 54.1/60	10.0	1.0300	1.896
2.0	10.0	466.384 476.177	71 70.5	79 80	76 75	77.5	13 7.8/60	10.5	1.0288	1.957
3.0	10.0	476.626 486.424	70.5 70.5	80 80	75 76	77.75	10 33.8/60	10.0	1.0268	1.896
4.0	10.0	486.894 496.689	70.5 70.5	80 80	75 76	77.75	9 13.2/60	10.0	1.0247	1.927
								Average	1.030	~~1.88~~ 1.88

γ must not deviate by more than ±0.02 γ.
ΔH@ must not deviate by more than 0.15 in H_2O.

ΔH	γ: $\frac{(V_w)(P_b)(T_d + 460)}{(V_d)(P_b + \Delta H/13.6)(T_w + 460)}$	ΔH@: $\frac{(0.0317)(\Delta H)}{(P_b)(T_d + 460)}\left[\frac{(T_w + 460)(\theta)}{(V_w)}\right]^2$
0.5	$\frac{(5.0)(29.27)(536.5)}{(4.864)(29.31)(532.0)}$	$\frac{(.0317)(0.5)}{(29.27)(536.5)}\left[\frac{(532.0)(12.48)}{(5.0)}\right]^2$
1.0	$\frac{(5.0)(29.27)(537.25)}{(4.882)(29.34)(532.0)}$	$\frac{(.0317)(1.0)}{(29.27)(537.25)}\left[\frac{(532.0)(8.90)}{(5.0)}\right]^2$
1.5	$\frac{(10.0)(29.27)(537.25)}{(9.777)(29.38)(531.5)}$	$\frac{(.0317)(1.5)}{(29.27)(537.25)}\left[\frac{(531.5)(14.90)}{(10.0)}\right]^2$
2.0	$\frac{(10.0)(29.27)(537.5)}{(9.793)(29.42)(530.75)}$	$\frac{(.0317)(2.0)}{(29.27)(537.5)}\left[\frac{(530.75)(13.13)}{(10.0)}\right]^2$
3.0	$\frac{(10.0)(29.27)(537.75)}{(9.795)(29.49)(530.5)}$	$\frac{(.0317)(3.0)}{(29.27)(537.75)}\left[\frac{(530.5)(10.56)}{(10.0)}\right]^2$
4.0	$\frac{(10.0)(29.27)(537.75)}{(9.795)(29.56)(530.5)}$	$\frac{(.0317)(4.0)}{(29.27)(537.75)}\left[\frac{(530.5)(9.22)}{(10.0)}\right]^2$

Figure E-7a. Particulate sampling meter box initial calibration.

DATE: 2/16/83

BAROMETRIC PRESSURE (P_{bar}): 29.44 in. Hg

PLANT:

PROJECT MANAGER: J. PROCHASKA

METER BOX NO. FB-4

PRETEST Y: 1.030 ΔH@: 1.88

PROJECT NO. 3530-15

CALIBRATOR: R. ANTIESBERGER

Orifice manometer setting* ΔH in. H_2O	Wet test meter volume V_w ft^3	Dry gas meter volume V_d ft^3	Temperatures: Wet test meter T_w °F	Dry gas meter: Inlet T_{di} °F	Dry gas meter: Outlet T_{di} °F	Dry gas meter: Average T_d °F	Vacuum setting** in. Hg	Duration of run Ø min	γ	ΔH@
1.0	11	129.315 140.048	73 73	77 80	73 76	76.5	10	19 42/60	1.029	1.85
1.0	11	140.048 150.822	73 73	80 81	76 76	78.25	10	19 52/60	1.028	1.85
1.0	12	150.822 162.620	73 73	81 81	76 78	79	10	21 43/60	1.026	1.76
								Post-test average***	1.027	1.82

γ	ΔH@
$\frac{(V_w)(P_{bar})(T_d + 460)}{(V_d)(P_{bar} + \Delta H/13.6)(T_w + 460)}$	$\frac{(0.0317)(\Delta H)}{(P_{bar})(T_d + 460)}\left[\frac{(T_w + 460)(Ø)}{(V_w)}\right]^2$
$\frac{(11.000)(29.44)(536.5)}{(10.733)(29.51)(533)}$	$\frac{(.0317)(1.0)}{(29.44)(536.5)}\left[\frac{(533)(19.7)}{(11.000)}\right]^2$
$\frac{(11.000)(29.44)(538.25)}{(10.774)(29.51)(533)}$	$\frac{(.0317)(1.0)}{(29.44)(538.25)}\left[\frac{(533)(19.86)}{(11.000)}\right]^2$
$\frac{(12.000)(29.44)(539)}{(11.798)(29.51)(533)}$	$\frac{(.0317)(1.0)}{(29.44)(539)}\left[\frac{(533)(21.71)}{(12.000)}\right]^2$

*To be the average ΔH used during the test series.

**To be the highest vacuum used during the test series.

***Post-test γ must be within the range, pre-test γ ±0.05γ

Post-test ΔH@ must be within the range, pre-test $\overline{\Delta H@}$ ±0.15

Figure E-7b. Particulate sampling meter box post-test calibration.

DATE: February 1, 1983 METER BOX NO. FB#5

CALIBRATOR: [illegible] BAROMETRIC PRESSURE (P_b) 29.53 in. Hg

Leak Checks:

Positive (minimum 5 in. H_2O): [illegible]

Negative (within 3 in. Hg of absolute): 0.001 cfm* 25 in. Hg

*Not to exceed 0.005 cfm.

Orifice manometer setting ΔH in H_2O	Volume wet test meter V_w ft^3	Volume dry gas meter V_d ft^3	Temperatures: Wet test meter T_w °F	Dry gas meter: Inlet T_i °F	Dry gas meter: Outlet T_o °F	Dry gas meter: Average T_d °F	Duration of test θ min	Vacuum setting in Hg	Y	ΔH@ in H_2O
0.5	5.0	[illegible]	73	92	83	88.0	12 44.7/60	10.0	0.9556	1.906
		[illegible]	73	92	83					
1.0	5.0	945.232	73	92	84	88.25	9 53/60	9.5	0.9826	1.942
		[illegible]	73	93	84					
1.5	10.0	[illegible]	73	92	83	88.5	14 44.3/60	9.2	0.9525	1.812
		[illegible]	73	95	84					
2.0	10.0	[illegible]	73	95	84	90.0	12 52.3/60	11.0	0.9930	1.837
		972.154	73	96	85					
3.0	10.0	972.70[illegible]	73	96	85	91.0	10 34.4/60	10.0	0.9936	1.555
		983.142	73	98	85					
4.0	10.0	983.630	73	97	85	91.25	9 14.9/60	11.0	0.9858	1.893
		994.072	73	98	85					
								Average	0.983	1.84

Y must not deviate by more than ±0.02 Y.

ΔH@ must not deviate by more than 0.15 in H_2O.

ΔH	Y	ΔH@
	$\frac{(V_w)(P_b)(T_d + 460)}{(V_d)(P_b + \Delta H/13.6)(T_w + 460)}$	$\frac{(0.0317)(\Delta H)}{(P_b)(T_d + 460)}\left[\frac{(T_w + 460)(\theta)}{(V_w)}\right]^2$
0.5	$\frac{(5.0)(29.53)(548.0)}{(5.212)(29.57)(533.0)}$	$\frac{(.0317)(0.5)}{(29.53)(545.0)}\left[\frac{(533.0)(12.74)}{(5.0)}\right]^2$
1.0	$\frac{(5.0)(29.53)(548.25)}{(5.213)(29.65)(533.0)}$	$\frac{(.0317)(1.0)}{(29.53)(548.25)}\left[\frac{(533.0)(9.[illegible])}{(5.0)}\right]^2$
1.5	$\frac{(10.0)(29.53)(548.5)}{(10.435)(29.64)(533.0)}$	$\frac{(.0317)(1.5)}{(29.53)(545.5)}\left[\frac{(533.0)(14.74)}{(10.0)}\right]^2$
2.0	$\frac{(10.0)(29.53)(550.0)}{(10.444)(29.68)(533.0)}$	$\frac{(.0317)(2.0)}{(29.53)(550.0)}\left[\frac{(533.0)(12.87)}{(10.0)}\right]^2$
3.0	$\frac{(10.0)(29.53)(551.0)}{(10.439)(29.75)(533.0)}$	$\frac{(.0317)(3.0)}{(29.53)(551.0)}\left[\frac{(533.0)(10.57)}{(10.0)}\right]^2$
4.0	$\frac{(10.0)(29.53)(551.25)}{(10.442)(29.82)(533.0)}$	$\frac{(.0317)(4.0)}{(29.53)(551.25)}\left[\frac{(533.0)(9.25)}{(10.0)}\right]^2$

Figure E-7c. Particulate sampling meter box initial calibration.

DATE: 2/15/83 METER BOX NO. FB-5

BAROMETRIC PRESSURE (P_{bar}): 29.46 in. Hg PRETEST Y: .983 ΔH@: 1.84

PLANT: PROJECT NO. 3530-15

PROJECT MANAGER: J. PROHASKA CALIBRATOR: R. ANTESBERGER

Orifice manometer setting * ΔH in. H_2O	Wet test meter volume V_w ft^3	Dry gas meter volume V_d ft^3	Temperatures: Wet test meter T_w °F	Dry gas meter: Inlet T_{di} °F	Outlet T_{di} °F	Average T_d °F	Vacuum setting ** in. Hg	Duration of run Ø min	Y	ΔH@
1.0	11	588.580	73	80	72	77.5	10	19 36/60	0.9885	1.806
		599.775	73	84	74					
1.0	10	599.775	73	84	74	80.0	10	17 47/60	0.9849	1.794
		610.037	73	86	76					
1.0	10	610.037	73	86	76	82.25	10	17 53/60	0.9870	1.802
		620.320	73	89	78					
						Post-test average***			0.987	1.80

Y	ΔH@
$\frac{(V_w)(P_{bar})(T_d + 460)}{(V_d)(P_{bar} + \Delta H/13.6)(T_w + 460)}$	$\frac{(0.0317)(\Delta H)}{(P_{bar})(T_d + 460)}\left[\frac{(T_w + 460)(Ø)}{(V_w)}\right]^2$
$\frac{(11.0)(29.46)(537.5)}{(11.195)(29.53)(533.0)}$	$\frac{(.0317)(1.0)}{(29.46)(537.5)}\left[\frac{(533.0)(19.60)}{(11.0)}\right]^2$
$\frac{(10.0)(29.46)(540.0)}{(10.262)(29.53)(533.0)}$	$\frac{(.0317)(1.0)}{(29.46)(540.0)}\left[\frac{(533.0)(17.80)}{(10.0)}\right]^2$
$\frac{(10.0)(29.46)(542.25)}{(10.283)(29.53)(533.0)}$	$\frac{(.0317)(1.0)}{(29.46)(542.25)}\left[\frac{(533.0)(17.88)}{(10.0)}\right]^2$

*To be the average ΔH used during the test series.
**To be the highest vacuum used during the test series.
***Post-test Y must be within the range, pre-test Y ±0.05Y
Post-test ΔH@ must be within the range, pre-test $\overline{\Delta H@}$ ±0.15

Figure E-7d. Particulate sampling meter box post-test calibration.

DATE: 11.5.82 METER BOX NO. EB-6

CALIBRATOR: D. Scheffel BAROMETRIC PRESSURE (P_b) 29.66 in. Hg

Leak Checks:

Positive (minimum 5 in. H2O): ✓

Negative (within 3 in. Hg of absolute): 0.00 cfm* 27 in. Hg

*Not to exceed 0.005 cfm.

Orifice manometer setting ΔH in H_2O	Volume wet test meter V_w ft^3	Volume dry gas meter V_d ft^3	Temperatures: Wet test meter T_w °F	Dry gas meter: Inlet T_i °F	Dry gas meter: Outlet T_o °F	Dry gas meter: Average T_d °F	Duration of test θ min	Vacuum setting in Hg	γ	ΔH@ in H_2O
0.5	10	659.520 669.900	75 75	76 80	74 76	76.5	22 56	10.0	.965	1.456
1.0	10	672.000 682.443	75 75	80 83	76 76	78.75	16 14	10.0	.962	1.496
1.5	10	688.100 698.613	75 75	83 86	76 78	80.75	13 18	8.5	.958	1.501
2.0	10	701.002 711.531	75 75	86 86	78 79	82.25	11 32	11.0	.957	1.500
3.0	10	715.303 725.808	75 75	86 87	80 80	83.25	9 25	9.0	.959	1.515
4.0	10	730.103 740.597	75 75	88 88	80 80	84.0	8 14	7.0	.960	1.524
								Average	.960	1.50

γ must not deviate by more than ±0.02 γ.
ΔH@ must not deviate by more than 0.15 in H_2O.

ΔH	γ: $\frac{(V_w)(P_b)(T_d + 460)}{(V_d)(P_b + \Delta H/13.6)(T_w + 460)}$	ΔH@: $\frac{(0.0317)(\Delta H)}{(P_b)(T_d + 460)}\left[\frac{(T_w + 460)(\theta)}{(V_w)}\right]^2$
0.5	$\frac{(10)(29.66)(536.5)}{(10.38)(29.70)(535)}$	$\frac{(.0317)(0.5)}{(29.66)(536.5)}\left[\frac{(535)(22.6)}{(10)}\right]^2$
1.0	$\frac{(10)(29.66)(538.75)}{(10.443)(29.73)(535)}$	$\frac{(.0317)(1.0)}{(29.66)(538.75)}\left[\frac{(535)(16.23)}{(10)}\right]^2$
1.5	$\frac{(10)(29.66)(540.75)}{(10.513)(29.77)(535)}$	$\frac{(.0317)(1.5)}{(29.66)(540.75)}\left[\frac{(535)(13.3)}{(10)}\right]^2$
2.0	$\frac{(10)(29.66)(542.25)}{(10.529)(29.81)(535)}$	$\frac{(.0317)(2.0)}{(29.66)(542.25)}\left[\frac{(535)(11.53)}{(10)}\right]^2$
3.0	$\frac{(10)(29.66)(543.25)}{(10.505)(29.88)(535)}$	$\frac{(.0317)(3.0)}{(29.66)(543.25)}\left[\frac{(535)(9.47)}{(10)}\right]^2$
4.0	$\frac{(10)(29.66)(544)}{(10.494)(29.95)(535)}$	$\frac{(.0317)(4.0)}{(29.66)(544)}\left[\frac{(535)(8.23)}{(10)}\right]^2$

Figure E-7e. Particulate sampling meter box initial calibration.

DATE: 2/15/83

BAROMETRIC PRESSURE (P_{bar}): 29.46 in. Hg

PLANT: [illegible]

PROJECT MANAGER: J. PROHASKA

METER BOX NO. FB-6

PRETEST Y: .960 ΔH@: 1.50

PROJECT NO. 3530-15

CALIBRATOR: R. ANTESBERGER

Orifice manometer setting* ΔH in. H_2O	Wet test meter volume V_w ft^3	Dry gas meter volume V_d ft^3	Temperatures: Wet test meter T_w °F	Dry gas meter: Inlet T_{di} °F	Dry gas meter: Outlet T_{di} °F	Dry gas meter: Average T_d °F	Vacuum setting** in. Hg	Duration of run Ø min	Y	ΔH@
1.0	10	537.258 548.186	73 73	72 75	67 70	71.0	16 06/60	10	0.9531	1.477
1.0	10	548.186 558.430	73 73	75 78	70 72	73.75	15 59/60	10	0.9752	1.462
1.0	10	558.430 568.355	73 73	78 79	72 73	75.5	16 03/60	10	0.9614	1.470
							Post-test average***		0.963	1.47

Y	ΔH@
$\frac{(V_w)(P_{bar})(T_d + 460)}{(V_d)(P_{bar} + \Delta H/13.6)(T_w + 460)}$	$\frac{(0.0317)(\Delta H)}{(P_{bar})(T_d + 460)}\left[\frac{(T_w + 460)(Ø)}{(V_w)}\right]^2$
$\frac{(10.0)(29.46)(531.0)}{(10.428)(29.53)(533.0)}$	$\frac{(.0317)(1.0)}{(531.0)(29.46)}\left[\frac{(533.0)(16.02)}{(10.0)}\right]^2$
$\frac{(10.0)(29.46)(533.75)}{(10.244)(29.53)(533.0)}$	$\frac{(.0317)(1.0)}{(533.75)(29.46)}\left[\frac{(533.0)(15.98)}{(10.0)}\right]^2$
$\frac{(10.0)(29.46)(535.5)}{(10.425)(29.53)(533.0)}$	$\frac{(.0317)(1.0)}{(535.5)(29.46)}\left[\frac{(533.0)(16.05)}{(10.0)}\right]^2$

*To be the average ΔH used during the test series.

**To be the highest vacuum used during the test series.

***Post-test γ must be within the range, pre-test γ ±0.05γ

Post-test ΔH@ must be within the range, pre-test $\overline{\Delta H@}$ ±0.15

Figure E-7f. Particulate sampling meter box post-test calibration.

DATE: January 31, 983 METER BOX NO. FB#7

CALIBRATOR: [illegible signature] BAROMETRIC PRESSURE (P_b) 29.55 in. Hg

Leak Checks:

Positive (minimum 5 in. H2O): [illegible initials]

Negative (within 3 in. Hg of absolute): 0.000 cfm* 26.5 in. Hg

*Not to exceed 0.005 cfm.

Orifice manometer setting ΔH in H_2O	Volume wet test meter V_w ft^3	Volume dry gas meter V_d ft^3	Temperatures: Wet test meter T_w °F	Dry gas meter: Inlet T_i °F	Dry gas meter: Outlet T_o °F	Dry gas meter: Average T_d °F	Duration of test θ min	Vacuum setting in Hg	γ	ΔH@ in H_2O
0.5	6.0	315.065 321.173	73 73	92 92	82 83	87.25	14 29.4/60	8.5	1.0077	1.622
1.0	5.0	324.763 329.867	73 73	91 92	83 83	87.25	8 47.2/60	8.0	1.0034	1.719
1.5	10.0	330.154 340.376	73 73	92 94	83 83	88.0	14 18.6/60	10.0	1.0021	1.706
2.0	11.0	340.666 351.931	73 73	94 97	84 84	89.75	13 45.6/60	10.0	1.0021	1.733
3.0	10.0	352.295 362.537	73 73	96 98	84 85	90.75	10 14.2/60	10.5	1.0014	1.729
4.0	10.0	363.032 373.284	73 73	98 99	85 85	91.75	8 59.0/60	10.5	0.9997	1.730
								Average	1.003	1.72

γ must not deviate by more than ±0.02 γ.
ΔH@ must not deviate by more than 0.15 in H_2O.

ΔH	γ = $\frac{(V_w)(P_b)(T_d + 460)}{(V_d)(P_b + \Delta H/13.6)(T_w + 460)}$	ΔH@ = $\frac{(0.0317)(\Delta H)}{(P_b)(T_d + 460)}\left[\frac{(T_w + 460)(\theta)}{(V_w)}\right]^2$
0.5	$\frac{(6.0)(29.58)(547.25)}{(6.105)(29.62)(533.0)}$	$\frac{(.0317)(0.5)}{(29.55)(547.25)}\left[\frac{(533.0)(14.49)}{(6.0)}\right]^2$
1.0	$\frac{(5.0)(29.55)(547.25)}{(5.104)(29.65)(533.0)}$	$\frac{(.0317)(1.0)}{(29.55)(547.25)}\left[\frac{(533.0)(8.79)}{(5.0)}\right]^2$
1.5	$\frac{(10.0)(29.58)(548.0)}{(10.222)(29.69)(533.0)}$	$\frac{(.0317)(1.5)}{(29.55)(548.0)}\left[\frac{(533.0)(14.31)}{(10.0)}\right]^2$
2.0	$\frac{(11.0)(29.55)(549.75)}{(11.265)(29.73)(533.0)}$	$\frac{(.0317)(2.0)}{(29.58)(549.75)}\left[\frac{(533.0)(13.76)}{(11.0)}\right]^2$
3.0	$\frac{(10.0)(29.58)(550.75)}{(10.242)(29.80)(533.0)}$	$\frac{(.0317)(3.0)}{(29.55)(550.75)}\left[\frac{(533.0)(10.24)}{(10.0)}\right]^2$
4.0	$\frac{(10.0)(29.55)(551.75)}{(10.252)(29.87)(533)}$	$\frac{(.0317)(4.0)}{(29.55)(551.75)}\left[\frac{(533.0)(8.98)}{(10.0)}\right]^2$

Figure E-7g. Particulate sampling meter box initial calibration.

DATE: 2/16/83 METER BOX NO. FB-7

BAROMETRIC PRESSURE (P_{bar}): 29.44 in. Hg PRETEST Y: 1.003 ΔH@: 1.72

PLANT: PROJECT NO. 3530-15

PROJECT MANAGER: J. PROHASKA CALIBRATOR: R. ANTESBERGER

Orifice manometer setting * ΔH in. H_2O	Wet test meter volume V_w ft^3	Dry gas meter volume V_d ft^3	Temperatures: Wet test meter T_w °F	Dry gas meter: Inlet T_{di} °F	Dry gas meter: Outlet T_{di} °F	Dry gas meter: Average T_d °F	Vacuum setting ** in. Hg	Duration of run Ø min	Y	ΔH@
		002.013	73	77	73					
1.0	10	012.110	73	82	74	76.5	10	17 24/60	.9945	1.726
		012.110	73	77	74					
1.0	10	022.134	73	82	76	77.25	10	17 16/60	1.003	1.696
		022.134	73	82	76					
1.0	14	036.255	73	88	78	81	10	24 19/60	1.004	1.70
							Post-test average***		1.0005	1.707

Y	ΔH@
$\dfrac{(V_w)(P_{bar})(T_d + 460)}{(V_d)(P_{bar} + \Delta H/13.6)(T_w + 460)}$	$\dfrac{(0.0317)(\Delta H)}{(P_{bar})(T_d + 460)}\left[\dfrac{(T_w + 460)(\text{Ø})}{(V_w)}\right]^2$
$\dfrac{(10.000)(29.44)(536.5)}{(10.097)(29.51)(533)}$	$\dfrac{(.0317)(1.0)}{(29.44)(536.5)}\left[\dfrac{(533)(17.4)}{(10.000)}\right]^2$
$\dfrac{(10.000)(29.44)(537.25)}{(10.024)(29.51)(533)}$	$\dfrac{(.0317)(1.0)}{(29.44)(537.25)}\left[\dfrac{(533)(17.26)}{(10.000)}\right]^2$
$\dfrac{(14.000)(29.44)(541)}{(14.121)(29.51)(533)}$	$\dfrac{(.0317)(1.0)}{(29.44)(541)}\left[\dfrac{(533)(24.31)}{(14.000)}\right]^2$

*To be the average ΔH used during the test series.
**To be the highest vacuum used during the test series.
***Post-test γ must be within the range, pre-test γ ±0.05γ
Post-test ΔH@ must be within the range, pre-test $\overline{\Delta H@}$ ±0.15

Figure E-7h. Particulate sampling meter box post-test calibration.

THERMOCOUPLES

Thermocouples were calibrated by comparison against an ASTM-2F thermometer at approximately 32°F, ambient temperature, 100°F, and 500°F. The thermocouples read within 1.5 percent of the reference thermometer throughout the entire range when expressed in degrees Rankine. If a thermocouple did not read within 1.5 percent, a correction formula based on a least squares analysis of the data was utilized. The correction formula corrected the data to within 1.5 percent. Each thermocouple was checked at ambient temperature at the test site to verify the calibration. Calibration data are presented in Figures E-8a and b.

DIGITAL INDICATOR FOR THERMOCOUPLE READOUT

A digital indicator was calibrated by feeding a series of millivolt signals to the input, and comparing the indicator reading with the reading the signal should have generated. Error did not exceed 0.5 percent when the temperatures were expressed in degrees Rankine. Calibration data are shown in Figures E-9a and b.

DRY GAS THERMOMETERS

The dry gas thermometers were calibrated by comparison against an ASTM-2F thermometer at approximately 32°F, at ambient temperature, and at approximately 110°F. The thermometers agreed within 5°F of the reference thermometer. The impinger thermometers were calibrated by comparison against ASTM-2F thermometer at approximately 32°F and ambient temperature. Calibration data are included in Figures E-10a through d and E-11a through d.

Date: 6/3/80 Thermocouple No.: 178

Ambient temperature: 72 °F Barometric pressure: 29.35 " Hg

Calibrator: D Armstrong Reference: Thermocouple #139

Reference point No.	Source,* (specify)	Reference thermometer temperature, °F***	Thermocouple temperature, °F	Difference, %**
1	2	72 (72)	71	0.19
2	1	38 (39)	39	0.00
3	3	95 (94)	95	-0.18
4	3	445 (429)	455	-2.92

Correction factor****: Slope: 0.9335 Intercept: 4.5

Reference point No.	Reference thermometer temperature, °F	Corrected thermocouple temperature, °F	Difference, %**
1	72	71	0.19
2	39	41	-0.40
3	94	93	0.18
4	429	429	0.00

Critical test points are 32°, 100°, and 500°.

*Source: 1) Ice bath
2) Ambient
3) Furnace

**Percent difference

$$\frac{\text{Reference temp. °F - thermocouple temp. °F}}{\text{(Reference temp. °F + 460°F)}} \times 100.$$

Each percent difference must be less than or equal to 1.5%.

***Reference thermometer must be ASTM.

****Correction factor must be determined if any percent difference is >1.5%.

Figure E-8a. Thermocouple calibration data sheet.

Date: 5/13/80 Thermocouple No.: 206

Ambient temperature: 73 °F Barometric pressure: 2924 " Hg

Calibrator: Jim Iverson Reference: ASTM-2F

Reference point No.	Source,* (specify)	Reference thermometer temperature, °F***	Thermocouple temperature, °F	Difference, %**
1	2	73	75	-0.38
2	1	35	34	0.20
3	3	118	111	1.21
4	3	455	444	1.15

Correction factor****: Slope: ________ Intercept: ________

Reference point No.	Reference thermometer temperature, °F	Corrected thermocouple temperature, °F	Difference, %**

Critical test points are 32°, 100°, and 500°.

*Source: 1) Ice bath
2) Ambient
3) Furnace

**Percent difference

$$\frac{\text{Reference temp. °F - thermocouple temp. °F}}{\text{(Reference temp. °F + 460°F)}} \times 100\%$$

Each percent difference must be less than or equal to 1.5%.

***Reference thermometer must be ASTM.

****Correction factor must be determined if any percent difference is >1.5%.

Figure E-8b. Thermocouple calibration data sheet.

Date Nov. 15, 1982 Indicator No. #124 Operator [illegible signature]

Test Point No.	Millivolt signal*	Equivalent temperature, °F*	Digital indicator temperature reading, °F	Difference, %
0	**	76	73.8	0.41%
1		32.0	30.6	0.28%
2		102.7	100.1	0.37%
3		451.1	450.1	0.11%
4		1127.0	1129.5	0.16%

Percent difference must be less than or equal to 0.5%.

Percent difference:

$$\frac{(\text{Equivalent temperature °R} - \text{Digital indicator temperature reading °R})(100\%)}{(\text{Equivalent temperature °R})}$$

Where °R = °F + 460°F

*See thermocouple digital indicator calibration verification device calibration for these values.

**This point is ambient temperature. The device is off and therefore is supplying no signal other than ambient temperature.

Figure E-9a. Thermocouple digital indicator calibration data sheet.

Date Nov. 18, 1982 Indicator No. #125 Operator [signature]

Test Point No.	Millivolt signal*	Equivalent temperature, °F*	Digital indicator temperature reading, °F	Difference, %
0	**	75	74.4	0.11%
1		32.0	31.6	0.08%
2		102.2	100.9	0.23%
3		451.1	449.9	0.13%
4		1127.0	1127.3	-0.02%

Percent difference must be less than or equal to 0.5%.

Percent difference:

$$\frac{(\text{Equivalent temperature } ^\circ R - \text{Digital indicator temperature reading } ^\circ R)(100\%)}{(\text{Equivalent temperature } ^\circ R)}$$

Where °R = °F + 460°F

*See thermocouple digital indicator calibration verification device calibration for these values.

**This point is ambient temperature. The device is off and therefore is supplying no signal other than ambient temperature.

Figure E-9b. Thermocouple digital indicator calibration data sheet.

Date: 6/10/80 Meter Box No.: FB-4

Calibrator: B. Armstrong Reference: ASTM-2F

Inlet

Reference point No.	Source *	Reference thermometer temperature, °F	Dry gas thermometer temperature, °F	Difference, °F**
1	2	72.0	72	0.0
2	1	32.7	32	0.7
3	3	117.0	114	3.0

Outlet

Reference point No.	Source *	Reference thermometer temperature, °F	Dry gas thermometer temperature, °F	Difference, °F**
1	2	72.0	73	1.0
2	1	32.7	34	1.3
3	3	116.0	115	1.0

*Source: 1) Ice bath
2) Ambient
3) Water bath

**Difference must be less than or equal to ±5°F.

Figure E-10a. Dry gas thermometer calibration data sheet.

Date: 6/10/80 **Meter Box No.:** FB-5

Calibrator: B. Armstrong **Reference:** ASTM-2F

Inlet

Reference point No.	Source *	Reference thermometer temperature, °F	Dry gas thermometer temperature, °F	Difference, °F**
1	2	72.0	76	4.0
2	1	32.7	35	2.3
3	3	108.0	106	2.0

Outlet

Reference point No.	Source *	Reference thermometer temperature, °F	Dry gas thermometer temperature, °F	Difference, °F**
1	2	72.0	73	1.0
2	1	32.7	34	1.3
3	3	117.5	115	2.5

***Source:** 1) Ice bath
2) Ambient
3) Water bath

****Difference must be less than or equal to ±5°F.**

Figure E-10b. Dry gas thermometer calibration data sheet.

Date: 6/10/80 Meter Box No.: FB-6

Calibrator: B. Armstrong Reference: ASTM-2F

Inlet

Reference point No.	Source *	Reference thermometer temperature, °F	Dry gas thermometer temperature, °F	Difference, °F**
1	2	72.0	72	0.0
2	1	32.7	32	0.7
3	3	115.0	114	1.0

Outlet

Reference point No.	Source *	Reference thermometer temperature, °F	Dry gas thermometer temperature, °F	Difference, °F**
1	2	72.0	73	1.0
2	1	32.7	32	0.7
3	3	119.0	116	3.0

*Source: 1) Ice bath
2) Ambient
3) Water bath

**Difference must be less than or equal to ±5°F.

Figure E-10c. Dry gas thermometer calibration data sheet.

Date: 6/11/80 Meter Box No.: FB-7

Calibrator: B. Armstrong Reference: ASTM-2F

Inlet

Reference point No.	Source *	Reference thermometer temperature, °F	Dry gas thermometer temperature, °F	Difference, °F**
1	2	72.0	76	4.0
2	1	33.5	38	4.5
3	3	119.0	117	2.0

Outlet

Reference point No.	Source *	Reference thermometer temperature, °F	Dry gas thermometer temperature, °F	Difference, °F**
1	2	72.0	72	0.0
2	1	37.3	37	0.3
3	3	117.0	113	4.0

*Source: 1) Ice bath
2) Ambient
3) Water bath

**Difference must be less than or equal to ±5°F.

Figure E-10d. Dry gas thermometer calibration data sheet.

Date: 12/16/82 Thermometer No.: #447

Ambient temperature: 75° °F Impinger: ✓ NO_x: ______

Calibrator: R. Antesberger Reference: ASTM-3F

Reference point No.	Source *	Reference thermometer temperature, °F	Thermometer temperature, °F	Difference, °F**
1	2	75°	73°	2°
2	1	34°	32°	2°

*Source: 1) Ice Bath
2) Ambient

**Difference must be less than ±2°F at both points

Figure E-11a. Thermometer calibration data sheet.

Date: 12/16/82 Thermometer No.: #448

Ambient temperature: 75° °F Impinger: ✓ NO_x: ______

Calibrator: R. Antesberger Reference: ASTM-3F

Reference point No.	Source *	Reference thermometer temperature, °F	Thermometer temperature, °F	Difference, °F**
1	2	75°	73°	2°
2	1	34°	33°	1°

*Source: 1) Ice Bath
2) Ambient

**Difference must be less than ±2°F at both points

Figure E-11b. Thermometer calibration data sheet.

Date: 12/16/82 Thermometer No.: #449

Ambient temperature: 75° °F Impinger: ✓ NO_x: ______

Calibrator: [illegible] Reference: ASTM-3F

Reference point No.	Source *	Reference thermometer temperature, °F	Thermometer temperature, °F	Difference, °F**
1	2	75°	74°	1°
2	1	34°	32°	2°

*Source: 1) Ice Bath
2) Ambient

**Difference must be less than ±2°F at both points

Figure E-11c. Thermometer calibration data sheet.

Date: 12/16/82 Thermometer No.: # 450

Ambient temperature: 75° °F Impinger: ✓ NO_x: ______

Calibrator: R. ANTESBERGER Reference: ASTM-3F

Reference point No.	Source *	Reference thermometer temperature, °F	Thermometer temperature, °F	Difference, °F**
1	2	75°	77°	2°
2	1	34°	36°	2°

*Source: 1) Ice Bath
2) Ambient

**Difference must be less than ±2°F at both points

Figure E-11d. Thermometer calibration data sheet.

BALANCE

The Mettler electronic balance was calibrated by comparison with Class-S standard weights and agreed within 0.5 g. Calibration data are shown in Figure E-12.

BAROMETER

The field barometer was calibrated to within 0.1 in.Hg of an NBS-traceable mercury-in-glass barometer before each test series. The field barometer was checked against the mercury-in-glass barometer after each test series to determine if it read within 0.2 in.Hg. If it did not reading within 0.2 in.Hg, a correction factor was determined. Calibration data are included in Figure E-13.

ORSAT ANALYZER

The orsat analyzer was calibrated before each test series by determining the percentages of carbon dioxide and oxygen in a calibration gas containing known percentages of each. The analyzer read within 0.5 percent of the known value for each gas. Calibration data are shown in Figures E-14a through c.

Balance No.	Date	Calibrator	Mass determined for					
			~~5~~ 200 g	Error	~~50~~ 500 g	Error	~~100~~ 1000 g	Error
M-1*	12/7/82	D. Osterkant	200.1	+0.1	500.2	+0.2	1000.4	+0.4
M-1*	2/7/83	D. Schiffel	199.8	-0.2	499.5	-0.5	~~50 g~~ 49.9	-0.1

Error must not exceed 0.5 grams at each point.

*Balance was also calibrated by manufacturer on 10/6/82.

Figure E-12. Trip balance calibration data sheet.

BAROMETER NO.	#317	#226	#229	#317	#227		
	5250 Westerhuff	5261 B.F.Goodrich	3530-5 USEPA	5262 Medical Center	ATC IOWA		

PRETEST

BAROMETER READING	29.62	29.51	28.70	29.45	29.64		
REFERENCE BAROMETER READING	29.62	29.52	28.68	29.49	29.64		
DIFFERENCE*	0.00	0.01	0.02	0.03	.00		
DATE	1-27-83	1-29-83	2-2-83	2-10-83	2/18/83		
CALIBRATOR	JS	MDF	MDF	Cdef	RMA		

POST-TEST

BAROMETER READING	29.45	29.09	29.60				
REFERENCE BAROMETER READING	29.40	29.06	29.59				
DIFFERENCE**	.05	0.03	.01				
DATE	2-10-83	2-3-83	2-18-83				
CALIBRATOR	MDF	Cdef	Cdef				

*Barometer is adjusted so that difference does not exceed 0.05 in. Hg.
**Barometer is not adjusted. If difference exceed 0.10 in. Hg, inform project manager immediately.

Figure E-13. Barometer calibration log.

Reference Gas: AGA Burdox
Cylinder No. 112704
Invoice No. 0382088
Lab Ref. No. VII:46-23

Orsat No.: 101 **Gas (circle one):** O_2 CO_2 CO

Calibrator	Date	Value Det.
D. [illegible]	10.11.82	4.8
R. Antesberger	11/20/82	4.7
R. Antesberger	12/3/82	4.6
[illegible]	2-7-83	4.8

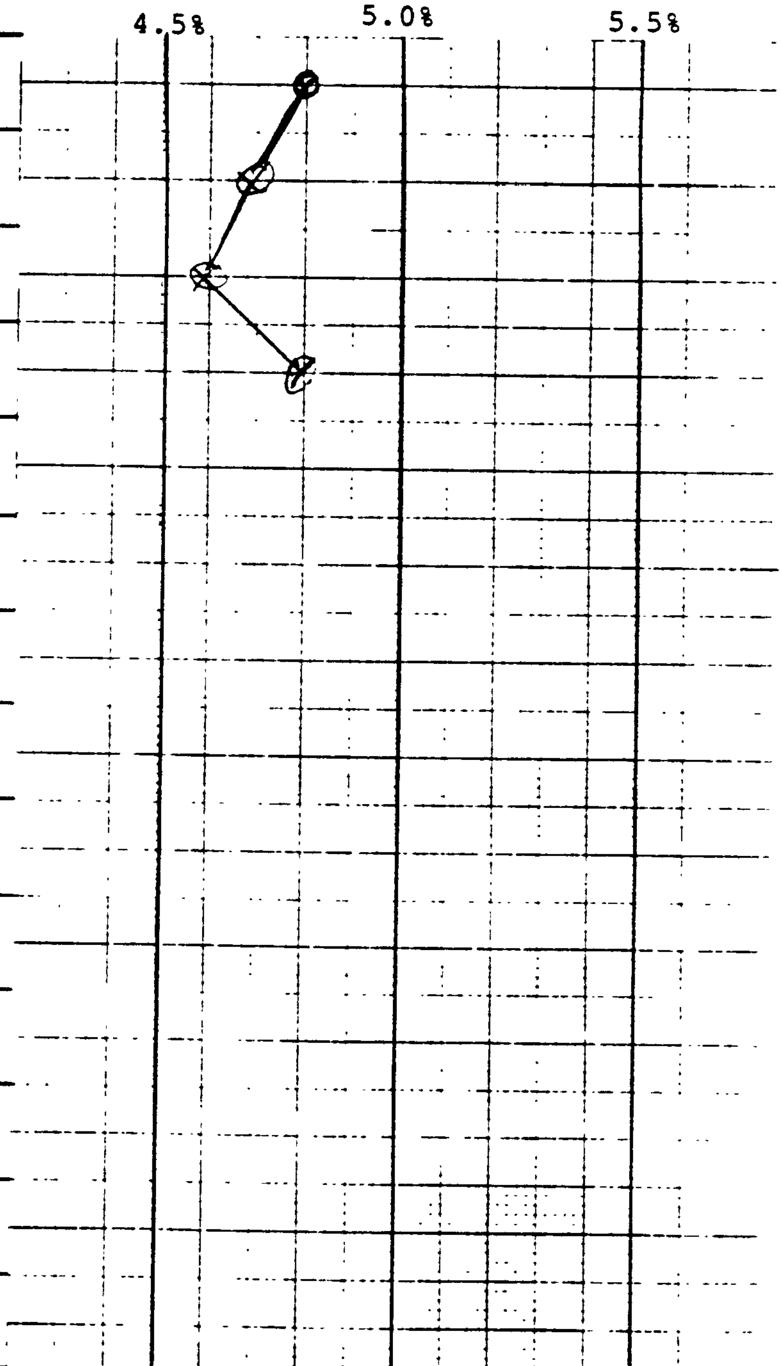

Figure E-14a. Orsat calibration data sheet - CO_2.

Reference Gas: AGA Burdox
Cylinder No. 112704
Invoice No. 0382088
Lab Ref. No. VII:46-23

Orsat No.: "L" **Gas (circle one):** O_2 CO_2 CO

Calibrator	Date	Value Det.
D. Schaffer	10·11·82	4.8
R. Antesberger	11/20/82	5.4
R. Antesberger	12/23/82	4.6
[illegible]	2·2·83	5.2

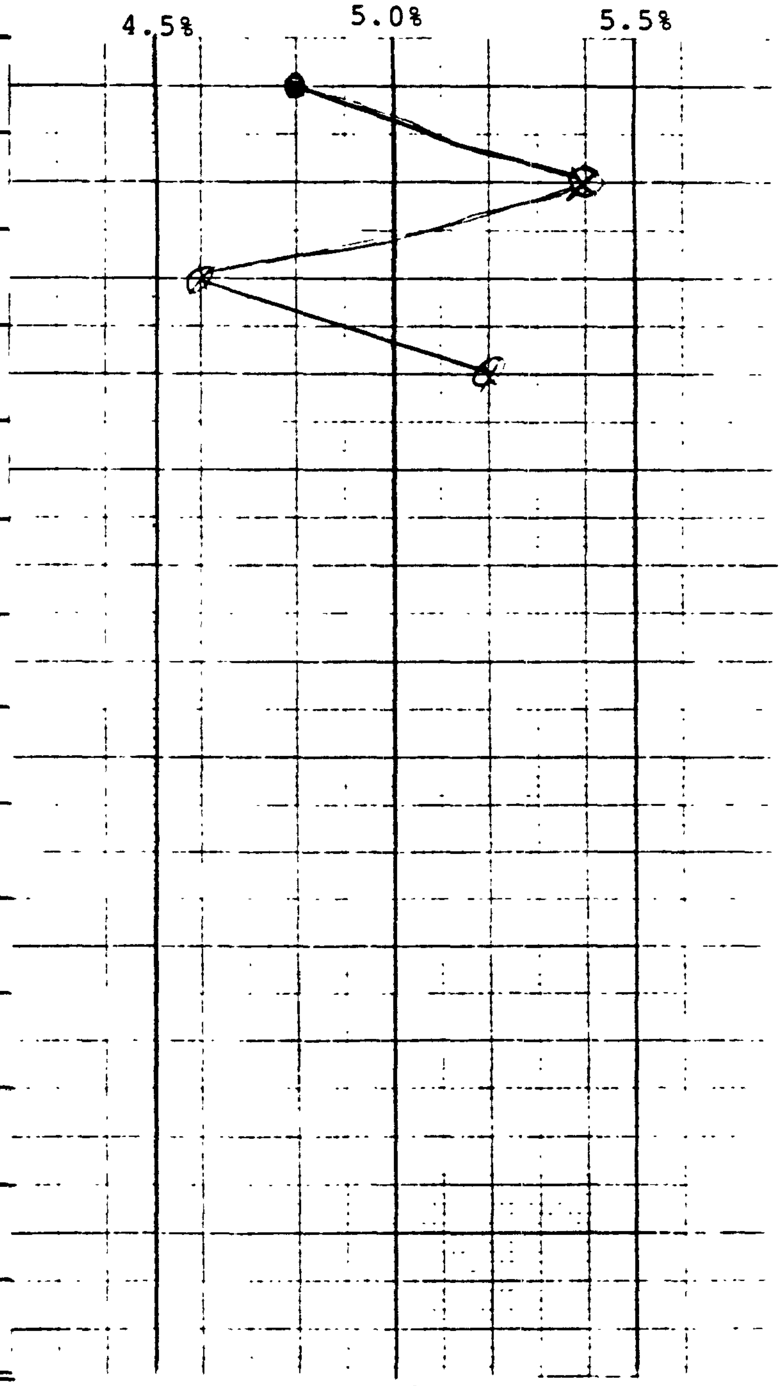

Figure E-14b. Orsat calibration data sheet - O_2.

Reference Gas: AGA Burdox
Cylinder No. 112704
Invoice No. 0382088
Lab Ref. No. VII:46-23

Orsat No.: 1L11

Gas (circle one): O_2 CO_2 CO

Calibrator	Date	Value Det.
N/A		
N/A		
N/A		
[illegible]	2-2-83	46

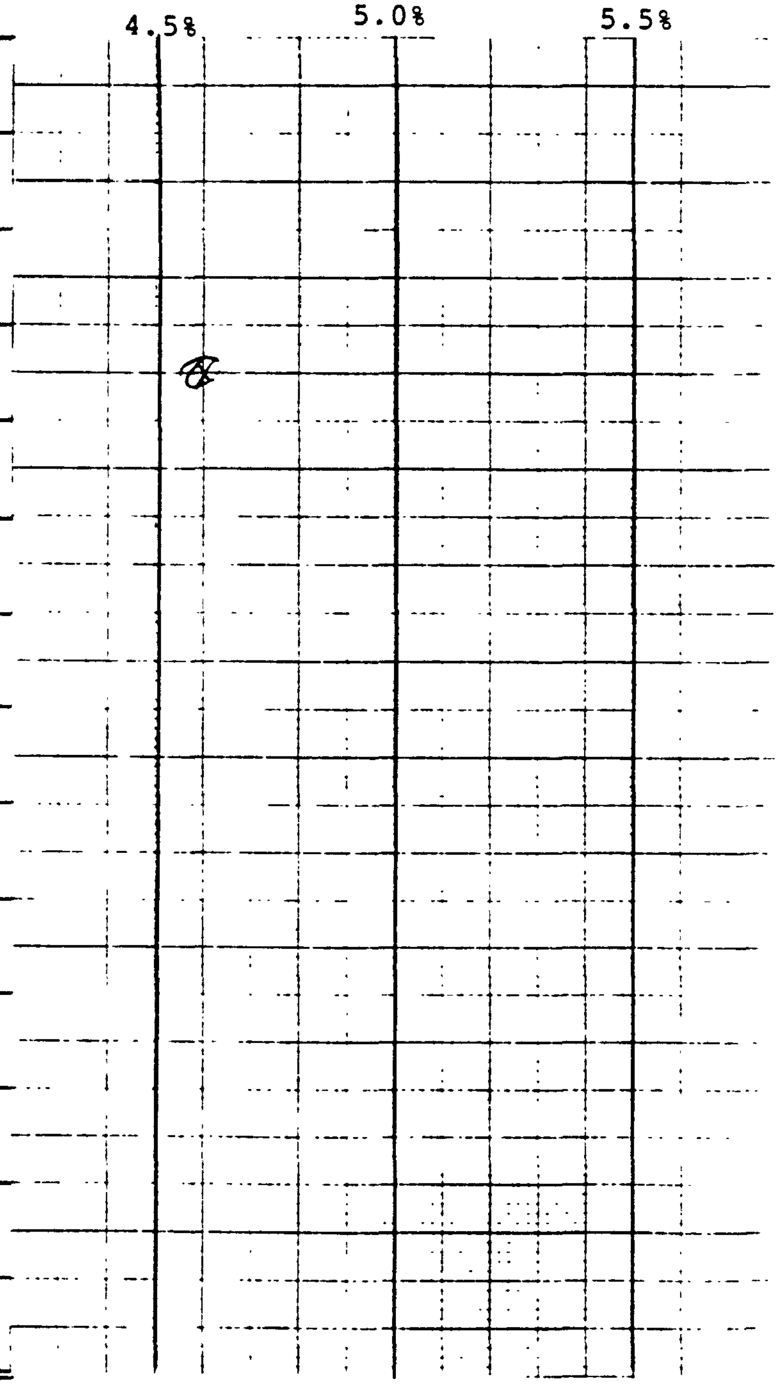

Figure E-14c. Orsat calibration data sheet - CO.

APPENDIX F

QUALITY ASSURANCE SUMMARY

QUALITY ASSURANCE

The following summary addresses the general steps taken to insure data quality and accuracy for any given emission test project.

PROJECT ORGANIZATION AND RESPONSIBILITIES

The project organization and responsibilities of the project team are generally defined in the test plan. Specific responsibilities for this field test are shown in Appendix G, Project Participants.

QUALITY ASSURANCE OBJECTIVE

The primary objective of this program is to refine sampling and analytical techniques of EPA Proposed Method 5B (or develop a new method) that will minimize the collection of condensible sulfate materials in the measurement of particulate emissions from fossil fuel-fired boilers and to evaluate method precision. Therefore, all procedures used in the collection and analysis of emission samples were as outlined in applicable EPA reference methods, where applicable. The sample methodology used for this project (quad train - single point) has been previously validated specifically for research and methods development type projects.

Test results were presented in several units to allow for their comparison with data from other organizations wishing access to the data summary.

DATA REDUCTION, VALIDATION, AND REPORTING

Data reduction and reporting provide one of the greatest potential sources of system error. To help minimize this source of error, PEDCo performs most test method calculations by use of a validated computer program. In addition, hand calculation on standard computer cards to allow accurate input of data into the computer by individuals unfamiliar with testing procedures. The data printout is then validated by comparison with the field and analytical data sheets. In addition, hand calculation checks generally are made to validate the computer output. Other data validations are made whenever possible.

PERFORMANCE AND SYSTEM AUDITS AND FREQUENCY

When feasible, PEDCo performs both performance and system audits. Three types of performance audits were performed for this test program. All dry gas meter systems were audited for accuracy in the field by the use of a critical orifice. In addition, the analytical procedure for sulfur dioxide was audited for accuracy by the use of audit samples supplied by EPA prior to sample analysis. Also, onsite calculations were used to check the completeness and accuracy of the particulate test data.

The PEDCo Project Director was on-site February 11 and performed a general system audit as an internal evaluation of sampling personnel and equipment. The EMB Task Manager was also on-site during the major portion of the test series and performed a separate system audit.

SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

Because the precision of the standard EPA reference methods used had previously been determined, no further attempt was made to assess data precision. These precision results are summarized in "The EPA Program for the Standardization of Stationary Source Emission Test Methodology, A Review," EPA-600/4-76-044. Precision estimates were calculated for within-run M5B and M5B-P400 samples using standard statistical analysis procedures. The mean concentration and standard deviation (with N-1 weightings for sample data) were determined for each group of similar runs. The standard deviations were expressed as a percentage of the mean concentration for comparison purposes (called the relative standard deviation).

Three audit procedures were used to determine accuracy. Accuracy audit procedures used for the dry gas meter and sulfur dioxide, analysis are the standardized written procedures used by the EPA Quality Assurance Division program. The procedure for determining data completeness is the same as that for New Source Performance Standards, as documented in the Code of Federal Registers 40 CFR 60, Section 60.8

INTERNAL QUALITY CONTROL CHECKS

Several internal quality control checks are usually made for each test. Normally, most of these checks deal with the field sampling analysis. For this test series, control samples for the sulfur dioxide analytical procedures were analyzed. Also, filter and reagent blanks were returned to the laboratory for gravimetric analysis. A quality control check of both the initial and final weighing was thus provided. Results of the control sample checks are included in Section 6. Blanks were analyzed according to procedures used for the M5BW and IC analytical work.

CORRECTIVE ACTION

PEDCo has two methods for corrective action. The first involves the use of control limits, such as audit sample results, control sample results, and calibration results. When any of these limits show that the integrity of the data is questionable the procedure is repeated, additional data are collected, or the data are rejected. The second method involves the use of red tags. Whenever any piece of equipment is suspected of producing unacceptable data, the entire apparatus or malfunctioning component is replaced and a red tag is placed on the item. That piece of equipment is then rejected until its ability to perform its function correctly is verified by the proper individuals. The use of numerous control limits and the red tagging system reduces the amount of unacceptable data and provides a system by which to track and correct items and procedures that show an unusally high occurrence of unacceptability.

PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES

PEDCo has a very comprehensive preventive maintenance program. Many of the major components of test equipment have pretest checklists. These checklists ensure that all functions are checked and action is taken to repair or replace any part that shows probability of malfunction. The checks are made before every field test series, however, only the control console (meter box) check are recorded. Even though PEDCo's preventive maintenance program and schedule are not in writing, our commitment of three full-time experienced persons for the express purpose of equipment construction, preparation, calibration, and maintenance has created a program based on experience and skill that cannot be matched by a written guideline.

QUALITY ASSURANCE REPORTS TO MANAGEMENT

The standard quality assurance procedures used in this test program generated sufficient documentation to indicate the data quality. All evidence of the execution of the quality assurance guidelines is reviewed by management. In addition, during weekly meetings of all PEDCo's EMB task managers and project managers, all aspects of the project are discussed including the quality assurance of each task. No written report results from this meeting because all interested parties are verbally apprised of the situation during each meeting.

Two other reports are made to managements, which are not EMB task related. PEDCo's emission test and laboratory groups participants in all national audits by EPA's Quality Assurance Division, and PEDCo's quality assurance coordinator, Tom Wagner, makes several independent checks for management.

APPENDIX G

PROJECT PARTICIPANTS AND SAMPLE LOG

TABLE G-1. FIELD TEST CREW AND RESPONSIBILITIES

Name	Title	Field test assignment
J. Prohaska	Project Manager	Coordinate test activity; sample train setup and disassembly
P. Clarke	Engineer	Site leader; particulate tests meter reader quad train
P. Reinermann	Engineer	Particulate tests meter reader quad train
R. Antesberger	Technician	Assist at sample site; quad train assembly and disassembly
D. Osterhout	Engineer	Site leader; clean up area; setup and recover sample trains
D. Scheffel	Technician	Setup and recover sample trains; Orsat analysis
W. DeWees	Project Director	System audit
G. McAlister	EPA Task Manager	Monitor test performance
J. Sellers	Plant contact	Coordinate plant activities; provide general on-site assistance; record process data
A. Kasprik	Company contact	Project coordination

TABLE G-2. SAMPLE LOG

Date (1983)	Activities
February 5-6	Sample site and equipment setup. All initial measurements were obtained. Sample recovery and setup area organized.
February 7-8	Two test runs were performed daily.
February 9-10	No tests were performed. Boiler operated at reduced load because of malfunctioning condensate pump.
February 11	Four test runs were performed. System audit conducted.
February 12	Two test runs were performed. Packed equipment and left site.

APPENDIX H

PROCESS DATA

Date 2-7-83

Run No. 1

Boiler No. 2

Signed: Hellen

PLANT OPERATIONAL DATA

PEDCo Test

Time	10 am		11:10 am	
Load	379		378	
Number of Oil Burners	18		18	
Opacity Monitor (6 min. average)	21%		21%	
Oil Temp. to Burners (°F.)	260°		260°	
	E	W		
Oxygen at Economizer Exit (%) Teledyne	.9	.5	.9	.8
Bailey	.9	.4	1.0	.5
Combustibles (%)	0	0	0	0
Carbon Monoxide (ppm)	not available			

Remarks

Date 7: 83

Run No.

By

PTC No. 2

PLANT OPERATIONAL DATA

PEDCo Test

Time	2:10 pm		3:15 pm	
Load	379		379	
Number of Oil Burners	18		18	
Opacity Monitor (6 min. average)	23%		25%	
Oil Temp. to Burners (°F.)	260°		260°	
	E	W	E	W
Oxygen at Furnace Exit (%) Teledyne	[illegible]	[illegible]	.6	.4
Oxygen at Furnace Exit (%)	1.1	.5	.75	.35
Combustibles (%)	0	0	0	0
Carbon Monoxide (ppm)	[illegible]	[illegible]	[illegible]	[illegible]

Remarks

2-8-78
3

PLANT OPERATIONAL DATA

PEDCo Test

Time	9am		10:30am	
Load	381		380	
Number of Oil Burners	18		18	
Opacity Monitor (6 min. average)	30%		29%	
Oil Temp. to Burners (°F.)	300°		260°	
	E	W	E	W
Oxygen at Furnace Exit (%)	.75	.35	.7	.4
Combustibles (%)	0	0	0	0
Carbon Monoxide (ppm)	not avail.			

Remarks

PLANT OPERATING DATA

PEDCo Test

Time	≈1230 *	1310	1425	
Load	380 *	380	381	
Number of Oil Burners		18	18	
Opacity Monitor (6 min. average)	30 *	30	30%	
Oil Temp. to Burners (°F.)		250	247°	
Oxygen at Economizer Exit (%)	0.7 [illegible]	0.7 0.3	.65 .2	
Combustibles (%)			0 0	
Carbon Monoxide (ppm)	[illegible]			

Remarks [illegible] OVERSHOOT – O_2 [illegible]

[illegible] * [illegible]

Date [illegible]

Run No. 5

[illegible]

PCC No. 2

PLANT OPERATIONAL DATA

PEDCo Test

Time	[illegible]	[illegible]		
Load	373	[illegible]		
Number of Oil Burners	18			
Opacity Monitor (6 min. average)	[illegible]	[illegible]		
Oil Temp. to Burners (°F.)	18[illegible]	[illegible]		
Oxygen at Economizer Exit (%)	.4 / .7	.5 / .4	[illegible]	[illegible]
Combustibles (%)	—	—	—	—
Carbon Monoxide (ppm)	[illegible]	[illegible]	[illegible]	[illegible]

Remarks [illegible]

[illegible] ~10 [illegible]

[illegible]

Date 2-11-7[illegible]

Run No. 6 POC No. 2

[illegible]

PLANT OPERATIONAL DATA

PEDCo Test

Time	10:46 am	12:[illegible] pm		
Load	380	3[illegible]		
Number of Oil Burners	15	15		
Opacity Monitor (6 min. average)	27%	2[illegible]%		
Oil Temp. to Burners (°F.)	260°	2[illegible]		

	E	W						
* Oxygen at Economizer Exit (%)	.5	.3	.[illegible]	.[illegible]				
Combustibles (%)	0	0	0	0				
Carbon Monoxide (ppm)	[illegible]	7	[illegible]	[illegible]				

Remarks CEM [illegible]

* O₂ [illegible]

Date ______11-77______

Run No. ______7______

PCC No. 2

PLANT OPERATIONAL DATA

PEDCo Test

Time	1:45 pm	2:45		
Load	379	379		
Number of Oil Burners	7			
Opacity Monitor (6 min. average)	20%	20%		

Oil Temp. to Burners (°F.) 255

Oxygen at Economizer Exit (%)	.6	.4	.7	.4			
Combustibles (%)	0	0	0	0			
Carbon Monoxide (ppm)	not available						

Remarks [illegible]

Date ______ -11-82

Run No. 5

PLANT OPERATIONAL DATA

PEDCo Test

Time	4:30 pm			
Load	[illegible]			
Number of Oil Burners	12			
Opacity Monitor (6 min. average)	[illegible]			
Oil Temp. to Burners (°F.)				
Oxygen at Economizer Exit (%)	[illegible]			
Combustibles (%)	[illegible]			
Carbon Monoxide (ppm)	[illegible]			

Remarks ______

Date ______

Run No. ______

______

[illegible] No. 2

PLANT OPERATIONAL DATA

PEDCo Test

Time	[illegible]	9:35 [illegible]				
Load	[illegible]	38[illegible]				
Number of Oil Burners		18				
Opacity Monitor (6 min. average)	[illegible]%	20%				
Oil Temp. to Burners (°F.)	250	259°				
Oxygen at Economizer Exit (%)	.7	.5	[illegible]	[illegible]		
Combustibles (%)			0			
Carbon Monoxide (ppm)						

Remarks ______

Date ____________

Run No. ____________ 2

PLANT OPERATIONAL DATA

PEDCo. Test

Time	12:[illegible]	1:10		
Load	[illegible]	[illegible]		
Number of Oil Burners	[illegible]	/		
Opacity Monitor (6 min. average)	[illegible]	[illegible]		
Oil Temp. to Burners (°F.)	25[illegible]	[illegible]		

Oxygen at Economizer Exit (%)	[illegible]	[illegible]	[illegible]				
Combustibles (%)	0	0					
Carbon Monoxide (ppm)	[illegible]	[illegible]	[illegible]				

Remarks ____________

POWER RESOURCES LABORATORY
9250 W FLAGLER STREET
PO BOX 529100
MIAMI, FLORIDA 33152

ANALYSIS OF FUEL OIL FIRED
JANUARY 1982

DATE SAMPLE RECEIVED AT LABORATORY	1/20/81
API GRAVITY	13.2
DENSITY,LB/GAL	8.144
DENSITY,LB/BBL	342.048
HEAT OF COMBUSTION, B/LB	18300
HEAT OF COMBUSTION, B/GAL	149000
HEAT OF COMBUSTION, KB/BBL	6259
WATER, % BY VOLUME	0.40
SEDIMENT, % BY WEIGHT	0.01
SULFUR, % BY WEIGHT	2.30
SULFUR DIOXIDE EQUIVALENT, LB/MB	2.51
ASH, % BY WEIGHT	0.10
PARTICULATE EQUIVALENT, LB/MB	0.06
VANADIUM IN ASH AS V2O5, % BY WEIGHT	67.
VANADIUM IN OIL AS V2O5, PPM	700.
VANADIUM IN OIL AS V, PPM	392.
VISCOSITY, SSF AT 122 F	225
ASPHALTENES, % BY WEIGHT	7.5

ANALYSIS CERTIFIED BY JANUARY 27, 1982

ORIGINAL TO: E G JONES
COPIES TO: L L WILLIAMS
E F GILBERT
A D SCHMIDT
C D HENDERSON

Figure H-1. Typical fuel oil analysis.

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-450/3-84-007	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Evaluation of Method 5B at an Oil-Fired Boiler		5. REPORT DATE January 1984
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) John Prohaska		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS PEDCo Environmental, Inc. 11499 Chester Road, Post Office Box 46100 Cincinnati, Ohio 45246 - 0100		10. PROGRAM ELEMENT NO.
		11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Emission Measurement Branch Emission Standards and Engineering Division U.S. Environmental Protection Agency Research Triangle Park, N.C. 27711		13. TYPE OF REPORT AND PERIOD COVERED
		14. SPONSORING AGENCY CODE EPA/200/400

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This report describes the development and evaluation of Method 5B at an oil-fired boiler. Different sampling and analysis techniques for measuring nonsulfuric acid particulate matter were compared and evaluated. Statistical analyses of the results comparing the precision of the different techniques are presented.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
		13 B

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