REPORT NO. 98-1159 / 5303
COMPANY Hoover Company
TITLE Compliance
DATE March 30, 1998

Envisage Environmental Incorporated

P.O. Box 152, Richfield, Ohio 44286
Phone (440) 526-0990

Question 5 - #7

HOOVER COMPANY
North Canton, Ohio

Particulate Emission Evaluation

72mmBTU/hr Boiler Exhaust

Conducted - March 30, 1998

1976 - 1996
20
YEARS OF EXCELLENCE
Envisage Environmental Incorporated

SOURCE EVALUATION RESULTS

PREPARED BY

Envisage Environmental Incorporated

P.O. Box 152 Richfield, Ohio 44286
Phone (216) 526-0990

Envisage Environmental Incorporated

April 13, 1998

Mr. Dal Bremer
Hoover Company, Plant 1
110 East Maple Street
North Canton,Ohio 44720

Dear Mr. Bremer:

The following report is the result of the compliance emission evaluation performed at The Hoover Company, North Canton, Ohio. Testing was performed on March 30, 1998 on the exhaust stack of the 72 mmBTU/hr Boiler Exhaust (EPA Source B2-2). The mass emissions of particulate exiting into the atmosphere from the Boiler exhaust stack were measured to verify compliance with the applicable Federal and State operating limitations.

The measurements are true and accurate to the degree specified in the pertinent sections of the Code of Federal Regulations, in force at the time of testing.

I look forward to answering any questions you may have and assisting you in the future.
Respectfully submitted,

ENVISAGE ENVIRONMENTAL INC.

Tyson E. Houchin
Project Supervisor, Air Services

P.O. Box 152 Richfield, Ohio 44286 Phone (440) 526-0990 Fax (440) 526-8555

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Envisage Environmental Incorporated

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INTRODUCTION

Envisage Environmental Incorporated
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INTRODUCTION

Envisage Environmental Incorporated was contracted by The Hoover Company to conducted emission sampling at their facility in North Canton, Ohio. Sampling was performed on March 30, 1998 to measure the mass emissions of total particulate emission emitted into the atmosphere from the exhaust stack of the 72 mmBTU/hr Boiler (EPA Source B2-2). The objective of the test program was to verify the cyclone serving Source B2-2 was operating in compliance with the applicable Federal and State emission operating limitations for particulate emissions. Particulate emissions measurements were conducted in triplicate, with each of the test runs conducted over one (1) hour periods.

The operational procedure for the 72 mmBTU/hr were coordinated and monitored by Hoover Company personnel. Mr. Dal Bremer,The Hoover Company facilitated and coordinated the testing program. The Envisage testing team was supervised by Mr. Tyson Houchin, and the sampling member consisted of Mr. Brad Hunt. The Canton City Health Department was present to witness the sampling event and was represented by Mr. Rick Miller.

DESCRIPTION OF PROGRAM

Envisage Environmental Incorporated
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SAMPLING AND ANALYTICAL PROCEDURES

The sample collection and analysis techniques utilized for this test program were performed in accordance with the following USEPA Reference test methods:

USEPA Method 1	-	Sample and Velocity Traverses for Stationary Sources.
USEPA Method 2	-	Determination of Stack Gas Velocity and Volumetric Flow Rate.
USEPA Method 3	-	Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight.
USEPA Method 4	-	Determination of Moisture Content in Stack Gases.
USEPA Method 5	-	Determination of Particulate Emissions from Stationary Sources.

METHOD 1 - Velocity Traverses

The sampling location at the exhaust of the boiler is a rectangle and has dimensions of 60 inches wide by 36 inches long. Four sample test ports are located on the same plane. The sample ports have an upstream distance from the sample test ports of 10 feet (2.7 equivalent diameters to the nearest disturbance), and a downstream distance from the sample test ports of 15 feet (4.0 equivalent diameters to disturbance). A total of twenty four (24) sample traverse points were used, six (6) per sample port.

METHOD 2 - Velocity Measurement

A five (5) foot "S" type pitot tube conforming to the geometric specifications outlined in Method 2, coupled with a Type K thermocouple were used for measuring the flue gas velocity and temperature. The differential pressures and temperatures were measured by traversing across the gas stream through the sample ports.

METHOD 3 - Oxygen, Carbon Dioxide

Sampling for the determination of dry gas molecular weight was performed utilizing USEPA Method 3 procedures. Integrated samples were extracted from the gas stream during each sample run. The sampling system consists of a stainless steel probe, followed by a Teflon sample line attached to a polyethylene squeeze pump. The squeeze pump was coupled with a leak free Tedlar bag. The concentration of oxygen and carbon dioxide in the sample was determined by using a Baccrach "Fyrite" Gas Analyzer. "Fyrite" analysis provides for the selective absorption of oxygen in chromous chloride and carbon dioxide in potassium hydroxide solutions. The difference in gas volume before and after the absorption represents the amount of constituent gas in the Sample. Each sample was analyzed three (3) times, and the average of the readings for each run were used in calculating the emission rate.

METHOD 4 - Moisture

The moisture content of the gas stream was determined by USEPA Method 4, impinger procedure. The impinger procedure consists of an integrated gas stream sample which is drawn through a series of chilled impingers filled

with deionized distilled water and tarred dry silica gel, by means of calibrated dry gas meter. The net weight of liquid and water absorbed by the silica gel were recorded for the calculation of water content per sample volume.

METHOD 5 - Particulate Emissions

The particulate emissions exiting the exhaust stack were measured by following the procedures outlined in USEPA Method 5. The sampling train consist of a stainless steel nozzle connected to a heated Pyrex liner. The liner was connected to a filter housing loaded with a glass fiber filter. The exit of the filter housing is attached to a series of impingers (Method 4) which contained; 100ml of deionized distilled water in the first two, followed by an empty, and the final impinger containing the 200 grams of dry silica gel.

Samples were taken from the gas stream isokinetically through the nozzle and sample train. The probe was heated and maintained at a temperature of 248° F. ± 25. The housing which contains the filter, was maintained at a temperature of 248°F ± 25. Exit gas temperature of the impingers was maintained below 68°F. with an ice bath. At the conclusion of each test run the sample train was allowed to cool and a leak check of the train and pitot tube was performed. After the leak check the filter was removed and both ends capped and placed in the appropriate test run case. The probe and nozzle cleaning was performed in the field using a nylon bristled brush and a carrier liquid of acetone. The field cleaning of the sampling probe and nozzle follows this procedure; At the conclusion of the test run the nozzle is removed, the inside surface is rinsed, brushed, and rinsed until visually clean of particulate matter. The rinse is collected in a glass sample bottle and capped with a teflon lined lid. The sample probe is rinsed into the same container by tilting the probe assembly and rotating so that the rinse liquid empties into the collection bottle. The nylon bristled brush is then introduced into the liner. By using a forward and rotating action the liner is brushed clean with copious amounts of acetone. Visual inspection is then made and the process repeated until the rinse liquid is visually clean. A final rinse is then rotated down the inclined probe liner. The cleaning brushes are then rinsed and the sample bottle capped and secured in the appropriate test run container.

The rinse samples including the filter are taken and analyzed in the laboratory. The filter samples were oven dried at 220 degrees Fahrenheit for two hours and dried in a desiccator for twenty-four hours after which they were weighed every six hours until a constant weight was obtained. The impinger liquid is measured volumetrically and transferred to a tarred beaker. The liquid is evaporated off and any residue is desiccated as described above. The silica gel is weighed to determine the amount of water collected. The acetone rinse from the probe/nozzle and filter housing was evaporated off and desiccated as described above. The acetone and water blanks were dried along with the probe wash and impinger catch and incorporated into the results. The weights of each fraction were recorded to the nearest 0.1 mg.

GENERAL

All analytical procedures were performed in accordance with the methods specified in the Code of Federal Regulations, Title 40, Part 60, Volume 43.

Example calculations to determine the emission rates can be found in the example calculation section of this report.

TEST RESULTS SUMMARY

Envisage Environmental Incorporated
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TEST RESULTS SUMMARY

The Hoover Company

North Canton, Ohio

72 mmBTU/hr Boiler Exhaust

Particulate Emission Evaluation

DATE: March 30, 1998

PARAMETER	Run 1	Run 2	Run 3
Total Particulate Emissions			
Pounds/mmBTU (F Factor COAL)	0.1644	0.2059	0.1628
Pounds/hour	14.42	18.40	14.32
Grains/dscf	0.0665	0.0842	0.0664
System Flow Rates			
Ft/Sec	64.55	64.30	65.18
ACFM	58,093	57,874	58,662
DSCFM	25,287	25,493	25,162
Moisture Content			
Volume percent	6.74	5.29	7.56
Sample Location Temperature			
Degrees Fahrenheit	635	639	641

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TEST RESULTS DETAILED

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TEST RESULTS

The Hoover Company

72 mmBTU/hr Boiler Exhaust

Particulate Emission Evaluation

DATE: March 30, 1998		Symbol	Units	Run 1	Run 2	Run 3
	Time of Day			10:05 11:13	12:05 13:11	14:03 15:07
1	Gas Volume-dry,std.	Vmstd	cu. ft.	36.03	34.56	35.25
2	Condensate Vapor Vol.	Vwstd	cu. ft.	2.60	1.93	2.88
3	Gas Stream Moisture	Bws	vol.dec	0.0674	0.0529	0.0756
4	Mol.Wt-flue gas (dry)	Msd	lb/lb mo.	29.96	29.96	29.96
5	Mol.Wt-flue gas (wet)	Ms	lb/lb mo.	29.15	29.33	29.06
6	Flue Gas Velocity	Vs	ft/sec	64.55	64.30	65.18
7	Flue Gas Volume-Actual	Qs	ACFM	58,093	57,874	58,662
8	Flue Gas Volume-Std.	Qs (Std)	DSCFM	25,287	25,493	25,162
9	Concentrations	Cs				
	Probe		gr/dscf	0.0146	0.0150	0.0195
	Filter		gr/dscf	0.0519	0.0693	0.0469
	Impingers		gr/dscf	0.0007	0.0011	0.0018
	Total Particulate *		gr/dscf	0.0665	0.0842	0.0664
10	Emission Rate	E				
	Probe		lb/hr	3.17	3.27	4.20
	Filter		lb/hr	11.26	15.13	10.12
	Impingers		lb/hr	0.15	0.24	0.40
	Total Particulate *		lb/hr	14.42	18.40	14.32
11	Isokinetic Rate	I	%	102.4	97.4	100.7

* - Totals DO NOT include impinger weights

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OPERATIONAL PARAMETERS

Envisage Environmental Incorporated
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The Hoover Company

Test Date: March ~~20~~ 30, 1998

START TIME #1 @ 10:05

Time	Zone 1 North	Zone 2 North		Zone 1 South	Zone 2 South		Windbox (FD Fan)	Overfire Air	Furnace Draft	Boiler Outlet	Primary DC	Secondary DC
	Pressure - Inches of Water (" H2O)											
TEST #1												
				KLM								
10:05	2.0"	2.5"	1.6"	1.4"	2.0"	1.0"	3.0"	23"	-0.3"	-0.6"	-7.5"	-12.5"
10:20	2.0"	2.9"	1.9"	1.5"	2.0"	1.0"	3.5"	23"	-0.21"	-0.5"	-7.0"	-12.0"
10:35	2.2"	2.8"	1.9"	1.7"	2.5"	1.2"	3.4"	23"	-0.23"	-0.6"	-7.25"	-12.0"
10:50	2.8"	3.4"	2.4"	1.4"	2.1"	1.0"	+4.0"	23"	-0.11"	-0.5"	-7.5"	-12.5"
11:06	2.1"	2.5"	1.6"	1.5"	2.0"	1.0"	+3.0"	23"	-0.25"	-0.6"	-7.0"	-11.5"
11:~~20~~	1.0"	1.2"	0.9"	0.6"	1.0	0.4"	2.0"	23"	00.19"	-0.5'	-5.0"	-8.5"

03/11/98

The Hoover Company

Test Date: March ~~20~~ 30, 1998

Time	Percent Oxygen	Percent Opacity	Percent Opacity (6 Min Avg)	Steam Pressure	Steam Flow Indicated	Steam Flow Integrator	Flue Gas Temp	BFW Temp	Coal Integrator North	Coal Integrator South
	TEST #1 - [illegible]			START TIME 10:05						
10:05	8.86	12.0	13.5	151.7	52,000	225999	660°F	154°F		788743
10:20	8.72	8.8	10.0	152.0	52,000	226011	660°F	152°F		788747
10:35	9.10	11.3	11.0	151.4	51,000	226023	660°F	151°F		788750
10:50	[illegible]	15.8	12.0	151	51,000	226036	650°F	150°F		788755
11:05	7.98	10.7	10.0	151.5	48,000	226048	660°F	154°F		788758
11:[illegible]	9.21	4.6	10.0	153.7	50,000	226055	620°F	156°F		788760
	8.77				50.67	56,000 / 48,000 #/HR				

03/11/98

The Hoover Company

Test Date: March ~~28~~ 30, 1998

START TEST #2 - @ 12:05

Time	Pressure - Inches of Water (" H2O)										
	Zone 1 North	Zone 2 #2 North	Zone 2 #3 North	Zone 1 South	Zone 2 #2 South	Zone 2 #3 South	Windbox (FD Fan)	Overfire Air	Furnace Draft	Boiler Outlet	Primary DC	Secondary DC
TEST #2												
12:05	1.2"	1.7"	0.8"	1.6"	2.0"	1.2"	2.4"	23"	-0.24"	-0.5"	-6.0"	-10.5"
12:20	2.1"	2.8"	1.4"	2.4"	3.1"	2.1"	3.8"	23"	-0.16"	-0.5"	-7.5"	-12.5"
12:35	1.1"	1.6"	0.7"	2.0"	2.6"	1.7"	3.1"	23"	-0.28"	-0.6"	-7.5"	-12.5"
12:50	1.3"	1.9"	0.9"	1.6"	2.4"	1.4"	2.8"	23"	-0.20"	-0.5"	-6.5"	-10.5"
1:05	2.1"	2.8"	1.4"	2.7"	3.3"	2.2"	4.0"	23"	-0.12"	-0.5"	-7.5"	-12.5"
1:12	1.7"	2.3"	1.2"	2.8"	3.2"	2.2"	3.8"	23"	-0.15"	-0.5"	-7.5"	-12.5"

03/11/98

The Hoover Company

Test Date: March ~~20~~ 30, 1998

Time	Percent Oxygen	Percent Opacity	Percent Opacity (6 Min Avg)	Steam Pressure	Steam Flow Indicated	Steam Flow Integrator	Flue Gas Temp	BFW Temp	Coal Integrator North	Coal Integrator South
	TEST #2 - START TEST @ 12:05									
12:05	7.67	8.8	9.0	151.3	52,000	226093	660°F	151°F		788772
12:20	9.11	15.2	15.0	149.4	53,000	226106	660°F	151°F		788776
12:35	8.34	in Cal	in Cal.	150.8	53,000	226119	660°F	150°F		788780
12:50	7.93	9.4	8.0	151.1	53,000	226131	660°F	150°F		788783
1:05	9.39	13.2	13.5	148.1	52,000	226144	660°F	146°F	OUT	788787
1:12	8.29	11.3	13.0	150.6	52,000	226150	660°F	146°F		788790

The Hoover Company

Test Date: March ~~20~~ 30, 1998

Time	Percent Oxygen	Percent Opacity	Percent Opacity (6 Min Avg)	Steam Pressure	Steam Flow Indicated	Steam Flow Integrator	Flue Gas Temp	BFW Temp	Coal Integrator North	Coal Integrator South
	TEST #3 - START TIME									
2:03	8.39	10.0	12.0	152.2	53,000	226193	665°F	140°F		788802
2:18	8.04	8.1	9.0	151.9	52,000	226205	670°F	140°F		788805
2:33	8.52	9.1	9.0	151.7	52,000	226218	670°F	140°F		788809
2:48	8.53	8.4	9.0	152.1	52,000	226231	670°F	142°F		788813
3:03	8.26	5.6	7.0	152.3	52,000	226243	665°F	142°F		788816
3:10	8.75	9.1	7.0	152.1	52,000	226248	665°F	142°F		788817

OUT

03/11/98

The Hoover Company

Test Date: March ~~28~~ 30, 1998

START TIME - 2:03 P.M.

Time	Zone 1 North	Zone 2 #2 North	Zone 2 #3 North	Zone 1 South	Zone 2 #2 South	Zone 2 #3 South	Windbox (FD Fan)	Overfire Air	Furnace Draft	Boiler Outlet	Primary DC	Secondary DC
	Pressure - Inches of Water (" H2O)											
	TEST #3 -											
2:03	1.3"	2.0"	0.4"	2.1"	2.6"	1.6"	3.1"	23"	-0.32"	-0.6"	-7.0"	-12.0"
2:18	1.5"	2.2"	0.5"	2.0"	2.6"	1.6"	3.1"	23"	-0.24"	-0.5"	-6.5"	-11.0"
2:33	1.6"	2.2"	0.5"	2.2"	2.8"	1.8"	3.4"	23"	-0.24"	-0.6"	-7.0"	-11.5"
2:48	1.4"	2.0"	0.4"	2.1"	2.7"	1.8"	3.3"	23"	-0.24"	-0.6"	-7.0"	-12.0"
3:03	1.2"	1.8"	0.4"	1.8"	2.3"	1.4"	2.8"	23"	-0.25"	-0.6"	-6.5"	-11.0"
3:10	1.4"	2.0"	0.4"	1.8"	2.6	1.6"	3.1"	23"	-0.20	-0.5"	-7.0"	-11.5"

SAMPLE POINT LOCATION DIAGRAM

Envisage Environmental Incorporated
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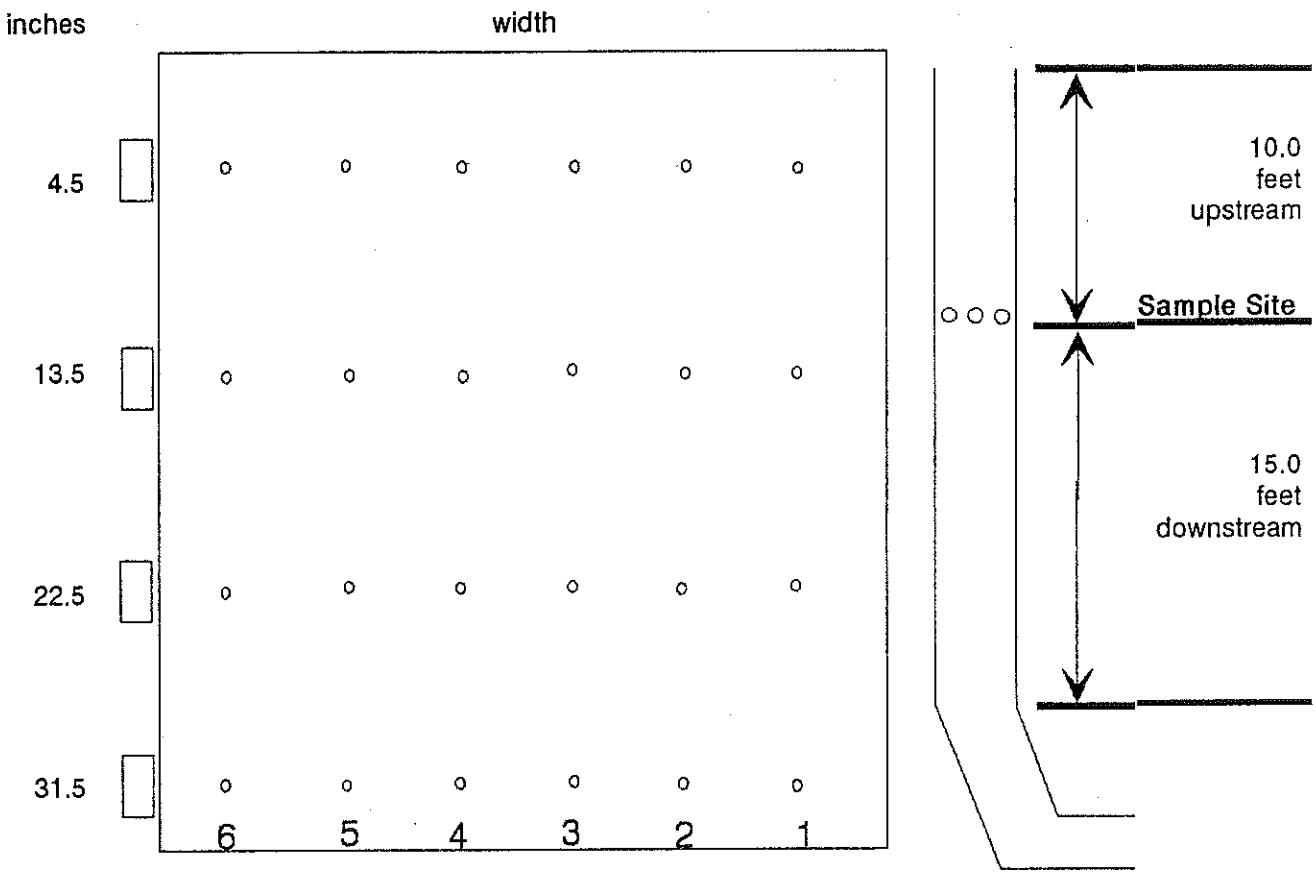
SAMPLE POINT LOCATIONS

Facility: The Hoover Company
Location: 72 mmBTU/hr Boiler Exhaust
Source No: B2-2

Width	60 inches
Length	36 inches
Area	15.00 square feet



Point #	Distance From Inside Wall
1	5.0 inches
2	15.0 inches
3	25.0 inches
4	35.0 inches
5	45.0 inches
6	55.0 inches

Stack Description: Rectangle

10.0	Feet, Upstream Disturbance Distance
15.0	Feet, Downstream Disturbance Distance
15.00	Square Feet, Cross Section Area
4	Number of Traverses
3.8	Feet, Equivalent Diameter
2.7	Equivalent Upstream Diameters
4.0	Equivalent Downstream Diameters
24	Total Number of Sampling Points

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SAMPLING TRAIN DIAGRAM

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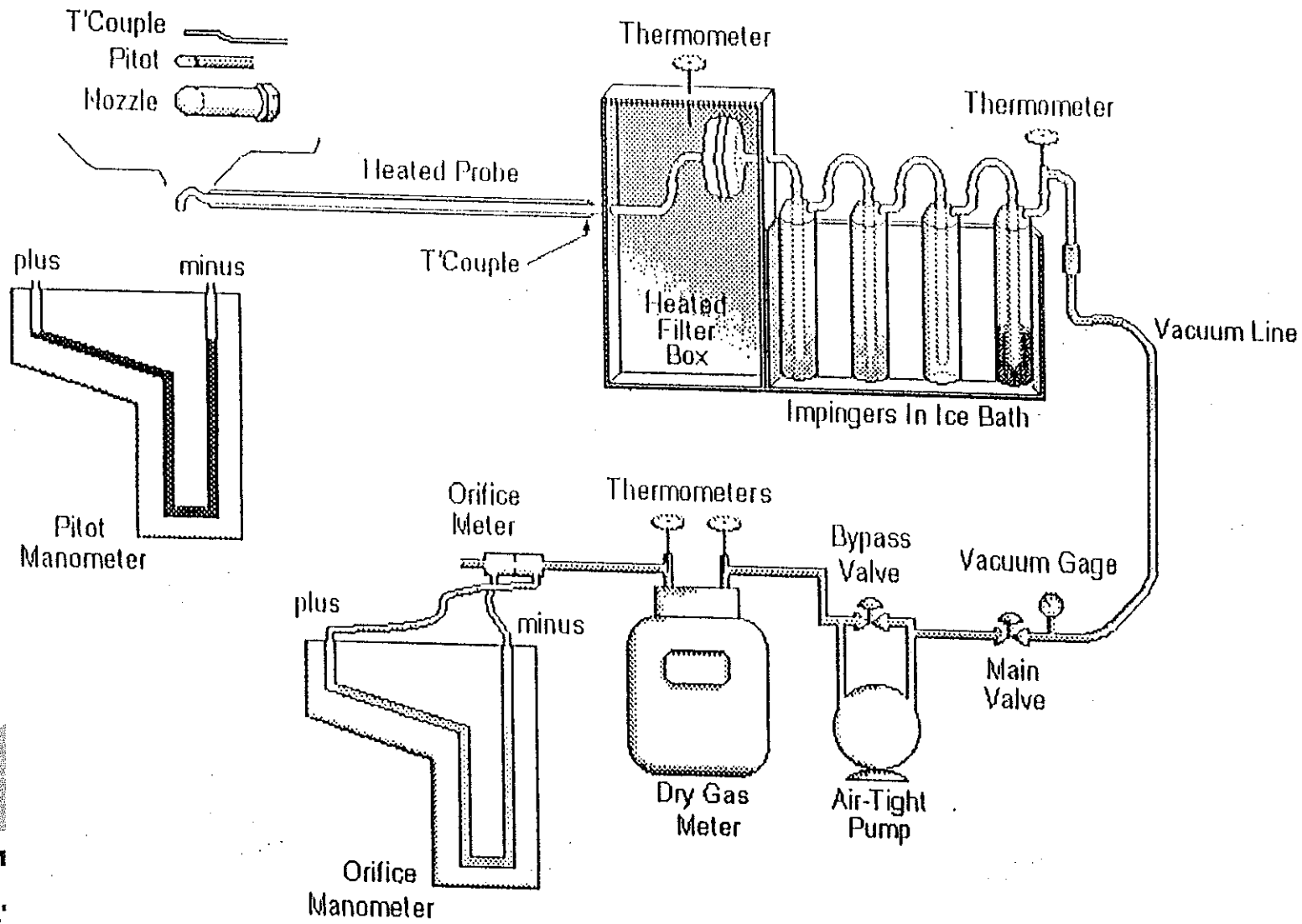
Method 5 Sampling Train



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LABORATORY SECTION

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LABORATORY SUMMARY SHEET

The Hoover Company

72 mmBTU/hr Boiler Exhaust

Particulate Emission Evaluation

DATE: March 30, 1998		Symbol	Units	Run 1	Run 2	Run 3
1	Sampling Time	t	minutes	60.0	60.0	60.0
2	Barometric Pressure	Pb	in. Hg	29.91	29.91	29.91
3	Static Pressure	Pg	in. H2O	-13.00	-13.00	-13.00
	Stack Pressure	Ps	in. Hg	28.95	28.95	28.95
4	Gas Meter Volume	Vm	cu. ft.	40.51	39.46	40.03
5	Stack Area	A	sq. ft.	15.00	15.00	15.00
6	Nozzle Diameter	Dn	dec. in.	0.25	0.25	0.25
7	"Y" Factor			0.980	0.980	0.980
8	Meter Temperature		degrees F	135.2	144.4	141.2
		Tm	degrees R	595.2	604.4	601.2
9	Stack Temperature		degrees F	634.8	638.6	641.3
		Ts	degrees R	1094.8	1098.6	1101.3
10	Velocity Head (SQRT)	^P	in. H2O	0.780	0.778	0.784
11	Orifice Pressure	^H	in. H2O	1.20	1.15	1.21
12	Carbon dioxide	CO2	%	10.0	10.0	10.0
13	Oxygen	O2	%	9.0	9.0	9.0
14	Carbon monoxide	CO	%	0.0	0.0	0.0
15	Nitrogen	N2	%	81.0	81.0	81.0
16	Pitot Coefficient	Cp		0.85	0.85	0.85
17	Water Collected	Vlc	ml	55.3	41.0	61.2
18	Sample Weight:	Mn				
	Probe		g	0.0341	0.0335	0.0445
	Filter		g	0.1213	0.1551	0.1072
	Impingers		g	0.0016	0.0025	0.0042

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Sample Date 3/30/98

Client Name

Facility Name The Hoover Company

Location 72 mmBTU/hr Boiler Exh

Fuel Type Coal

Sampler initials 25 TSW

Analysis TH

Analyzer Leak Check TH

USEPA Reference Method 3

Run # Ambient	Analysis 1		Analysis 2		Analysis 3		Results
	Actual Reading	Net	Actual Reading	Net	Actual Reading	Net	Net Average
CO_2	0	0	0	0	0	0	0
O_2	20.9	20.9	20.9	20.9	20.9	20.9	20.9
CO	20.9	0	20.9	0	20.9	0	0

Run # 1	Analysis 1		Analysis 2		Analysis 3		Results
	Actual Reading	Net	Actual Reading	Net	Actual Reading	Net	Net Average
CO_2	10.0	10.0	10.0	10.0	10.0	10.0	10.0
O_2	19.0	9.0	19.0	9.0	19.0	9.0	9.0
CO	19.0	0	19.0	0	19.0	0	0

Run # 2	Analysis 1		Analysis 2		Analysis 3		Results
	Actual Reading	Net	Actual Reading	Net	Actual Reading	Net	Net Average
CO_2	10.0	10.0	10.0	10.0	10.0	10.0	10.0
O_2	19.0	9.0	19.0	9.0	19.0	9.0	9.0
CO	19.0	0	19.0	0	19.0	0	0

Run # 3	Analysis 1		Analysis 2		Analysis 3		Results
	Actual Reading	Net	Actual Reading	Net	Actual Reading	Net	Net Average
CO_2	10.0	10.0	10.0	10.0	10.0	10.0	10.0
O_2	19.0	9.0	19.0	9.0	19.0	9.0	9.0
CO	19.0	0	19.0	0	19.0	0	0

Sample Date 3-30-98

Client Name Hoover

Facility Name

Location Boiler Exhaust

Tare Weights — Initials RC

Sample Turnaround TH

Final Weights MW

USEPA Reference Method 5

Run #	1	2	3	Field Blanks
Case #	205	302	304	4th case
Moisture Collected				
Impinger #'s	1-3	1-3	1-3	
Final vol	240 ml	230 ml	245 ml	
- Initial vol	200 ml	200 ml	200 ml	
Net vol	40 ml	30 ml	45 ml	
Silica Gel				
Impinger #	4	4	4	
Final wt	215.3 g	211.0 g	216.2 g	
- Initial wt	200.0 g	200.0 g	200.0 g	
Net wt	15.3 g	11.0 g	16.2 g	
Particulate				
Probe Wash — Beaker #	#216	#217	#220	#
volume, ml	200	200		
Final wt	101.8921	104.0969	94.2586	
- Initial wt	101.8579	104.0634	94.2141	
Net wt	.0341	.0335	.0445	
Filter #	#714-G	#701-G	#698-G	#
Final wt	1.4731	1.4145	1.4750	
- Initial wt	1.3516	1.3594	1.3678	
Net wt	.1213	.1551	.0072	
Impingers — Beaker #	#402	#403	#405	#
Final wt	165.3652	168.5583	168.9405	
- Initial wt	165.3636	168.5558	168.9363	
Net wt	.0016	.0025	.0042	

COAL ANALYSIS

Envisage Environmental Incorporated
P.O. Box 152 Richfield, Ohio 44286
Phone (440) 526-0990

COAL ANALYSIS SUMMARY

The Hoover Company

North Canton, Ohio

72 mmBTU/hr Boiler Exhaust

Particulate Emission Evaluation

ULTIMATE DATA		RUN 1	RUN 2	RUN 3
% H	As Rec'd	3.72	3.70	3.88
	Dry	4.31	4.26	4.47
% C	As Rec'd	65.13	64.92	66.32
	Dry	75.50	74.77	76.38
% S	As Rec'd	0.78	0.79	0.75
	Dry	0.91	0.91	0.86
% N	As Rec'd	1.31	1.15	1.21
	Dry	1.52	1.33	1.39
% O	As Rec'd	5.93	6.48	6.45
	Dry	6.88	7.46	7.43
% Ash	As Rec'd	9.39	9.78	8.22
	Dry	10.88	11.27	9.47
PROXIMATE DATA				
BTU/LB	As Rec'd	11,280	11,333	11,591
BTU/LB	Dry	13,077	13,054	13,349
MOISTURE %		13.74	13.18	13.17
F FACTOR		9847.1	9742.4	9768.5

Envisage Environmental Incorporated
P.O. Box 152 Richfield, Ohio 44286
Phone (440) 526-0990

COMMERCIAL TESTING & ENGINEERING CO. 29
GENERAL OFFICES: 1919 SOUTH HIGHLAND A
SINCE 1908
SGS

Post-it® Fax Note 7671	Date 4-9-97 # of pages ▶ 3
To TYSON	From KL MONTESANO
Co./Dept. ENVISAGE	Co. HOOVER
Phone #	Phone #
Fax # 4405268555	Fax #

PONDENCE T
E. CENTER S
AUT, OH 440
(216) 224-22
(216) 224-28

ATTN: K. MONTESANO

April 8, 1998

THE HOOVER COMPANY
101 E. Maple Street
North Canton, OH 44720

RECEIVED
APR - 9 1998
KB

Sample identification by
THE HOOVER COMPANY

Kind of sample reported to us Coal

IDENT: EPA Run #1

Sample taken at -----

Sample taken by Submitted

Date sampled March 30, 1998

P.O. NO: I-9559

Date received April 1, 1998

Analysis Report No. 88-46380-A

PROXIMATE ANALYSIS	As Received	Dry Basis
% Moisture	13.74	xxxxx
% Ash	9.39	10.88
% Volatile	26.65	30.89
% Fixed Carbon	50.22	58.23
	100.00	100.00
Btu/lb	11280	13077
% Sulfur	0.78	0.91
MAF Btu		14673

ULTIMATE ANALYSIS	As Received	Dry Basis
% Moisture	13.74	xxxxx
% Carbon	65.13	75.50
% Hydrogen	3.72	4.31
% Nitrogen	1.31	1.52
% Sulfur	0.78	0.91
% Ash	9.39	10.88
% Oxygen(diff)	5.93	6.88
	100.00	100.00

FUSION TEMPERATURE OF ASH, (°F)

	Reducing	Oxidizing
Initial Deformation (IT)	2540	xxxx
Softening (ST)	2615	xxxx
Hemispherical (HT)	2675	xxxx
Fluid (FT)	2700+	xxxx

FREE SWELLING INDEX = 2.0

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Connéaut Laboratory

MEMBE ACI

30

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • TEL: 630-953-9300 FAX: 630-953-9306

SINCE 1908

SGS Member of the SGS Group (Société Générale de Surveillance)

PLEASE ADDRESS ALL CORRESPONDENCE T
2978 E. CENTER S
CONNEAUT, OH 44
TEL: (216) 224-22
FAX: (216) 224-28

April 8, 1998

THE HOOVER COMPANY
101 E. Maple Street
North Canton, OH 44720

Sample identification by
THE HOOVER COMPANY

Kind of sample reported to us Coal

IDENT: EPA Run #2

Sample taken at -----

Sample taken by Submitted

Date sampled March 30, 1998

P.O. NO: I-9559

Date received April 1, 1998

Analysis Report No. 88-46380-B

PROXIMATE ANALYSIS	As Received	Dry Basis
% Moisture	13.18	xxxxx
% Ash	9.78	11.27
% Volatile	26.51	30.53
% Fixed Carbon	50.53	58.20
	100.00	100.00
Btu/lb	11333	13054
% Sulfur	0.79	0.91
MAF Btu		14712

ULTIMATE ANALYSIS	As Received	Dry Basis
% Moisture	13.18	xxxxx
% Carbon	64.92	74.77
% Hydrogen	3.70	4.26
% Nitrogen	1.15	1.33
% Sulfur	0.79	0.91
% Ash	9.78	11.27
% Oxygen (diff)	6.48	7.46
	100.00	100.00

FUSION TEMPERATURE OF ASH, (°F)

	Reducing	Oxidizing
Initial Deformation (IT)	2470	xxxx
Softening (ST)	2555	xxxx
Hemispherical (HT)	2615	xxxx
Fluid (FT)	2670	xxxx

FREE SWELLING INDEX = 2.5

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Conneaut Laboratory

MEMBE ACI

COMMERCIAL TESTING & ENGINEERING CO. 31
GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • TEL: 630-953-9300 FAX: 630-953-9306
SINCE 1908
SGS Member of the SGS Group (Société Générale de Surveillance)
PLEASE ADDRESS ALL CORRESPONDENCE T
2979 E. CENTER
CONNEAUT, OH 440
TEL: (216) 224-22
FAX: (216) 224-28

April 8, 1998

THE HOOVER COMPANY
101 E. Maple Street
North Canton, OH 44720

Sample identification by
THE HOOVER COMPANY

Kind of sample reported to us: Coal

IDENT: EPA Run #3

Sample taken at: -----

Sample taken by: Submitted

Date sampled: March 30, 1998

P.O. NO: I-9559

Date received: April 1, 1998

Analysis Report No. 88-46380-C

PROXIMATE ANALYSIS	As Received	Dry Basis
% Moisture	13.17	xxxxx
% Ash	8.22	9.47
% Volatile	27.42	31.58
% Fixed Carbon	51.19	58.95
	100.00	100.00
Btu/lb	11591	13349
% Sulfur	0.75	0.86
MAF Btu		14745

ULTIMATE ANALYSIS	As Received	Dry Basis
% Moisture	13.17	xxxxx
% Carbon	66.32	76.38
% Hydrogen	3.88	4.47
% Nitrogen	1.21	1.39
% Sulfur	0.75	0.86
% Ash	8.22	9.47
% Oxygen(diff)	6.45	7.43
	100.00	100.00

FUSION TEMPERATURE OF ASH, (°F)

	Reducing	Oxidizing
Initial Deformation (IT)	2480	xxxx
Softening (ST)	2560	xxxx
Hemispherical (HT)	2625	xxxx
Fluid (FT)	2700+	xxxx

FREE SWELLING INDEX = 2.5

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Conneaut Laboratory

MEMBE ACI

FIELD DATA SHEETS

Envisage Environmental Incorporated
P.O. Box 152 Richfield, Ohio 44286
Phone (440) 526-0990

Field Data Cover Sheet

Client: Hoover Company		Date: 3/30/98	Page 1 of 4
Project No. 98-1159 5303 (72 mmBTU/hr)	Operator: TH, BH	Fyrite/Orsat Analysis (Circle one)	
Sampling Location: Boiler Exh.		Source ID: B2-2	
Ambient Temperature: 110°	Static Pressure: -13.0" H2O	CO2	O2 / CO
Barometric Pressure: 29.91	Barometer ID:	1: 9	1: 10 / 1: 0
Probe Length: 5'	Probe ID: 451		
Pitot Coefficient: .85	Geometry of Pitot: Okay (If Suspect use another A - B)	2: 9	2: 10 / 2: 0
Meter Box ID: 1a			
Meter ^ Ha 1.76	Meter Y Factor: .980	3: 9	3: 10 / 3: 0
Date of Last Meter Calibration: 2/25/98	Sample Train ID: 101		

Thermocouple ID's	Hot Box	Probe	Stack	Impinger	Meter In	Meter Out
	2	1	3	4	6	7

Smile the hard parts over :-)

Umbilical Cord #'s 301

Nomograph Reference Data:	^Ha	Tm	%Bws	Ps/Pm	Ts
	1.76	580	6%	.946	1089.67
[redacted]	^P .564	C	^H	K 1.96	

Nozzle Calibration	
Diameter 1	.250
Diameter 2	.250
Diameter 3	.250
Average:	.250

Cyclonic Yaw Angle	Flow Chk Degree
1 5	1 5
2 5	2 4
3 5	3 6
4 10	4 10
5 5	5 5
6 10	6 5
7 5	7 10
8 10	8 5
9 10	9 6
10 5	10 6
11 5	11 10
12 6	12 6
Average:	6.43

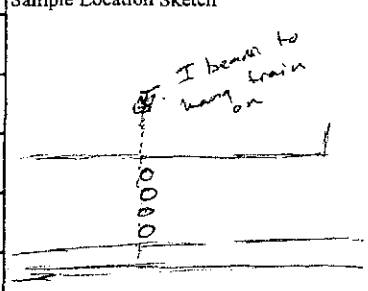
EEI Team Leader Signature: T.E.H.

EEI Team Members: TH, BH

EPA Representative/s: Rick Miller

Traverse Point locations	
1: 5	7:
2: 15	8:
3: 25	9:
4: 35	10:
5: 45	11:
6: 55	12:

Sample Location Sketch



Distance A	~~4'~~ 10'
Distance B	~~10'~~ 15'
Diameter/Dimension	60"x36"
Number of Ports:	4
Port Inside Diameter	4"

NOTES:

Facility Name: Hoover Company	DATE: 3/30/98	Run# 1	Case #: 302	Location: 72 mBTU Boiler Exh.	Page 2 of 4
Start Time: 10:05	End Time: 11:13				

Point #	Sample Time (Min.)	Gas Meter Volume (Ft^3)	Velocity Head Pressure ^P ("H2O)	Velocity Head Pressure Sqrt. ^ P	Orifice Pressure ("H2O)	Stack Temp (F)	Meter Temp In (F)	Meter Temp Out (F)	Pump Vacuum ("Hg)	Filter Holder Temp (F)	Probe Temp (F)	Impinger Temp (F)
1	0	2.51	.76	.872	1.49	634	143	122	3.0	229	241	64
2	5/2.5	4.25	.71	.843	1.39	633	147	122	3.0	241	255	64
3	10/5	6.41	.69	.831	1.35	632	149	123	3.0	254	250	64
4	15/7.5	7.91	.60	.775	1.18	625	149	123	3.0	241	253	64
5	20/10	9.74	.54	.735	1.06	634	149	124	3.0	241	245	64
6	25/12.5	11.02	.56	.748	1.10	627	147	125	3.0	245	243	64
1/7	30/15	12.73	.55	.742	1.08	639	141	125	3.0	251	244	64
2/8	35/17.5	14.11	.58	.762	1.14	639	145	125	3.0	248	257	64
3/9	40/20	16.53	.60	.775	1.18	636	149	125	3.0	247	247	64
4/10	45/22.5	18.08	.60	.775	1.18	635	145	125	3.0	240	232	64
5/11	50/25	19.45	.56	.748	1.10	631	146	125	3.0	241	256	64
6/12	55/27.5	21.20	.58	.762	1.14	622	147	125	3.0	240	256	64
1	60/30	22.65	.56	.748	1.10	638	138	125	3.0	234	241	64
2	32.5	24.21	.64	.800	1.26	638	143	125	3.0	228	228	64
3	35	26.41	.64	.800	1.26	635	148	125	3.0	247	230	64
4	37.5	27.64	.65	.806	1.28	632	147	125	4.0	264	232	64
5	40	29.41	.57	.755	1.12	637	148	125	4.0	291	234	64
6	42.5	31.28	.61	.781	1.20	641	146	125	4.0	258	231	64
1 7	45	33.18	.55	.742	1.08	641	140	125	4.0	241	246	64
2 8	47.5	34.56	.59	.768	1.16	640	144	125	4.0	244	241	64
3 9	50	36.46	.62	.787	1.22	640	147	125	4.0	243	241	64
4 10	52.5	37.83	.67	.819	1.31	640	146	125	4.0	254	251	64
5 11	55	40.0	.64	.800	1.26	639	148	125	4.0	256	251	64
6 12	57.5	41.35	.55	.742	1.08	626	147	125	4.0	241	246	64
	60	43.02										
		Total 40.5		Average .780	Average 1.20	Average 634.75			Average 135.17			

Sample Train Leak Check PRE	0	CFM @ 15	"Hg	Pitot Leak Check PRE	(A) 0 @ 4.9"H20 (B) 0 @ 6.9"H2O
Sample Train Leak Check Post	.004	CFM @ 8	"Hg	Pitot Leak Check POST	(A) 0 @ 5.2"H20 (B) 0 @ 6.1"H2O

Team Supervisor Signature:

EPA Signature:

NOTES:

Post Leak ✓ was good for 16 seconds & then nozzle & union turned & loosened due to heat & the O-ring. EPA said the test was good. He saw no leak before the nozzle turned.

Facility Name: Hoover Company	DATE: 3/30/98	Run# 2	Case #: 205	Location: 72 mmBtu/hr Boiler Exh	Page 3 of 4
Start Time: 12:05	End Time: 13:11				

Point #	Sample Time (Min.)	Gas Meter Volume (Ft^3)	Velocity Head Pressure ^P ("H2O)	Velocity Head Pressure Sqrt. ^ P	Orifice Pressure ("H2O)	Stack Temp (F)	Meter Temp In (F)	Meter Temp Out (F)	Pump Vacuum ("Hg)	Filter Holder Temp (F)	Probe Temp (F)	Impinger Temp (F)
1	0	44.40	.79	.889	1.55	637	149	131	4.0	245	257	68
2	5/2.5	46.31	.64	.800	1.26	640	159	131	4.0	247	241	68
3	10/5	47.91	.63	.794	1.24	641	159	131	4.0	246	243	68
4	15/7.5	49.71	.61	.781	1.20	641	159	131	4.0	244	241	68
5	20/10	51.42	.44	.663	.86	635	159	131	4.0	246	245	68
6	25/12.5	52.83	.46	.678	.90	634	157	131	4.0	245	244	68
1/7	30/15	54.19	.56	.748	1.10	643	150	131	4.0	246	245	64
2/8	35/17.5	55.88	.67	.819	1.31	642	158	132	4.0	251	233	64
3/9	40/20	57.97	.65	.806	1.28	641	161	132	4.0	255	240	64
4/10	45/22.5	59.32	.63	.794	1.24	641	161	132	4.0	241	235	64
5/11	50/25	61.11	.56	.748	1.10	639	160	132	4.0	246	241	64
6/12	55/27.5	62.41	.59	.768	1.16	637	160	136	4.0	241	240	64
1	60/30	64.19	.65	.806	1.28	645	149	133	4.0	246	251	64
2	32.5	65.84	.55	.742	1.08	644	159	133	4.0	247	252	64
3	35	67.53	.56	.748	1.10	637	158	132	4.0	246	251	64
4	37.5	69.00	.55	.742	1.08	638	159	132	4.0	248	249	64
5	40	70.45	.56	.742	1.08	633	158	132	4.0	251	250	64
6	42.5	72.46	.56	.742	1.08	631	158	132	4.0	248	251	64
1 7	45	73.86	.59	.768	1.16	639	142	132	4.0	249	253	64
2 8	47.5	75.73	.60	.775	1.10	639	158	132	4.0	249	253	64
3 9	50	77.31	.67	.819	1.31	636	158	132	4.0	251	256	64
4 10	52.5	78.95	.70	.837	1.37	640	158	132	4.0	256	251	64
5 11	55	80.58	.75	.866	1.47	638	158	132	4.0	251	244	64
6 12	57.5	82.32	.61	.781	1.20	632	159	132	4.0	240	244	64
	60	84.00										
		Total 39.46		Average .778	Average 1.15	Average 638.58			Average 144.44			

Sample Train Leak Check PRE	0	CFM @ 15	"Hg	Pitot Leak Check PRE	(A) 0 @ 5.6"H20 (B) 0 @ 6.4"H2O
Sample Train Leak Check Post	.02	CFM @ 7	"Hg	Pitot Leak Check POST	(A) 0 @ 5.6"H20 (B) 0 @ 5.6"H2O

Team Supervisor Signature:

EPA Signature:

NOTES:

Facility Name: Hoover Company	DATE: 3/30/98	Run# 3	Case #: 304	Location: 72 mmBTU/hr Boiler Exh.	Page 4 of 4
Start Time: 14:03	End Time: 1507				

Point #	Sample Time (Min.)	Gas Meter Volume (Ft^3)	Velocity Head Pressure ^P ("H2O)	Velocity Head Pressure Sqrt. ^ P	Orifice Pressure ("H2O)	Stack Temp (F)	Meter Temp In (F)	Meter Temp Out (F)	Pump Vacuum ("Hg)	Filter Holder Temp (F)	Probe Temp (F)	Impinger Temp (F)
1	0	87.11	.67	.819	1.31	643	145	135	3.0	246	245	68
2	5/2.5	89.02	.61	.781	1.20	642	158	134	3.0	247	246	66
3	10/5	90.54	.62	.787	1.22	639	158	134	3.0	246	244	66
4	15/7.5	92.04	.64	.800	1.25	640	158	134	3.0	249	241	66
5	20/10	93.55	.64	.800	1.25	637	154	134	3.0	251	245	66
6	25/12.5	95.31	.58	.762	1.14	632	157	134	3.0	249	250	66
1/7	30/15	97.24	.60	.775	1.18	645	144	135	3.0	251	254	66
2/8	35/17.5	98.71	.56	.748	1.10	644	154	133	3.0	254	255	66
3/9	40/20	100.56	.63	.794	1.23	639	155	133	3.0	253	254	66
4/10	45/22.5	101.85	.66	.812	1.29	640	156	133	3.0	254	251	66
5/11	50/25	103.63	.68	.825	1.35	636	153	134	3.0	255	252	66
6/12	55/27.5	105.37	.66	.812	1.29	637	156	134	3.0	253	251	66
1	60/30	107.28	.64	.800	1.25	646	144	134	3.0	255	252	66
2	32.5	108.65	.64	.800	1.25	646	154	134	3.0	249	254	66
3	35	110.34	.64	.800	1.25	646	156	134	3.0	251	253	66
4	37.5	112.26	.58	.762	1.14	642	156	134	3.0	254	252	66
5	40	114.33	.56	.748	1.10	642	156	134	3.0	241	245	66
6	42.5	115.61	.60	.775	1.18	635	156	134	3.0	258	254	66
1 7	45	117.27	.72	.849	1.41	648	150	134	3.0	254	251	64
2 8	47.5	118.96	.71	.846	1.45	646	156	134	3.0	247	249	64
3 9	50	120.77	.69	.831	1.31	646	157	134	3.0	249	251	64
4 10	52.5	122.83	.58	.762	1.14	645	157	134	3.0	251	250	64
5 11	55	124.29	.43	.656	.84	641	157	134	3.0	240	248	64
6 12	57.5	125.71	.43	.656	.84	633	154	134	3.0	254	241	64
	60	127.14										
		Total 40.03		Average .784	Average 1.21	Average 641.25				Average 141.23		

Sample Train Leak Check PRE 0	CFM @ 15 "Hg	Pitot Leak Check PRE (A) 0 @ 6.4 "H20 (B) 0 @ 7.1 "H2O	
Sample Train Leak Check Post 0	CFM @ 1 "Hg	Pitot Leak Check POST (A) 0 @ 7.1 "H20 (B) 0 @ 7.1 "H2O	

EPA Signature: [signature]

Team Supervisor Signature: [signature]

NOTES:

CALIBRATION SECTION

Envisage Environmental Incorporated
P.O. Box 152 Richfield, Ohio 44286
Phone (440) 526-0990

EMTIC GUIDELINE DOCUMENT GD-026

Alternative Method 5 Post Test Calibration

Company:	The Hoover Company			
Test Date:	3/30/98			
Meterbox ID:	1A			
		Run 1	Run 2	Run 3
Time of Test	min	60	60	60
Volume of Meter	dscf	40.51	39.46	40.03
Temperature of Meter	Deg F	135.17	144.44	141.23
	Deg R	595.17	604.44	601.23
Barometric Pressure	in. Hg	29.91	29.91	29.91
Delta H	H2O	1.2	1.15	1.21
Delta H@	H2O	1.76	1.76	1.76
% Oxygen		9	9	9
% Carbon Dioxide		10	10	10
% Carbon Monoxide		0	0	0
% Nitrogen		81	81	81
Dry Molecular Weight of Stack Gas	Md	29.96	29.96	29.96
Dry Gas Meter Calib. Check Value	Yqa	0.957	0.970	0.978
Y Factor		0.98	0.98	0.98
Difference		2%	1%	0%
Average Difference		1.2%		

u:\sect-1\calibrat\postmtr.xls

Envisage Environmental Incorporated
P.O. Box 152 Richfield, Ohio 44286
Phone (440) 526-0990

DRY GAS METER CALIBRATION

Using Wet Test Meter

Meter Box Number	MB 1A	69	deg F, Ambient Temp.
Calibration Date	02/25/98	29.03	"Hg, Baro. Press.

Technician GM Dye

Dry Gas Meter

Orifice Differential	*"H2O*	1.0	2.0	3.0	4.0
Meter Temperature	*deg F*	78.0	82.5	87.8	91.3
Volume	*cu ft*	5.001	5.281	5.448	5.564
Vacuum	*"Hg*	0.0	0.0	0.0	0.0

Wet Test Meter

Orifice Differential	*"H2O*	-1.0	-2.0	-3.0	-4.0
Volume	*cu ft*	5.020	5.022	5.025	5.030
Temperature	*deg F*	64.4	64.4	64.4	64.4
Time of Test	*minutes*	8.55	6.28	5.17	4.55

Totals

Delta H@	.75 cfm	1.64	1.77	1.79	1.84
Y Factor		1.027	0.979	0.956	0.941

Dry Gas Meter	MB 1A	
Average Delta H@		1.76
Average Y Factor		0.976

CALCULATIONS

$$Y = \frac{Vw * Pbar * (Tm)}{Vm * [\ Pbar + (\hat{}H / 13.6)\ ] * (Tw)}$$

$$\hat{}H@ = \frac{.0317 * \hat{}H * Tmo * min}{Pbar * (Tm) * Vw}$$

NOMENCLATURE

Orifice Differential	= ^H	Dry Gas Meter	= sub m
Temperature	= T	Wet Test Meter	= sub w
Volume	= cu ft	Barometric Pressure	= Pbar
Time of Test	= min		

Envisage Environmental Incorporated
P.O. Box 152 Richfield, Ohio 44286
Phone (440) 526-0990

PITOT TUBE CALIBRATION

Pitot Tube ID 451
Date March 6, 1998
Technician Kinat

	^Pstd	^Pp	Cp	Dev from Av
A	0.82	1.15	0.836	0.002
B	0.82	1.14	0.840	0.003
A	0.44	0.6	0.848	0.010
B	0.44	0.6	0.848	0.005
A	0.26	0.37	0.830	0.008
B	0.26	0.36	0.841	0.002

Average Cp for A	0.838
Average Cp for B	0.843
Average Deviation A	0.007
Average Deviation B	0.003
Average	0.840

Pitot Tube ID 451 1/8 nozzle
Date March 6, 1998
Technician Kinat

	^Pstd	^Pp	Cp	Dev from Av
A	0.82	1.15	0.836	0.008
B	0.82	1.15	0.836	0.012
A	0.44	0.59	0.855	0.011
B	0.44	0.59	0.855	0.007
A	0.26	0.36	0.841	0.003
B	0.26	0.35	0.853	0.005

Average Cp for A	0.844
Average Cp for B	0.848
Average Deviation A	0.007
Average Deviation B	0.005
Average	0.846

Pitot Tube ID 451 1/2 nozzle
Date March 6, 1998
Technician Kinat

	^Pstd	^Pp	Cp	Dev from Av
A	0.82	1.15	0.836	0.008
B	0.82	1.15	0.836	0.012
A	0.44	0.59	0.855	0.011
B	0.44	0.59	0.855	0.007
A	0.26	0.36	0.841	0.003
B	0.26	0.35	0.853	0.005

Average Cp for A	0.844
Average Cp for B	0.848
Average Deviation A	0.007
Average Deviation B	0.005
Average	0.846

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EMISSION SAMPLING NOMENCLATURE

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SAMPLING NOMENCLATURE

A = Cross sectional area of stack or duct, $ft.^2$.

A_n = Cross sectional area of nozzle entry plane, $ft.^2$.

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

C = Nomograph correction factor, dimensionless.

C_s = Concentration of particulate matter in gas stream, dry basis-corrected to standard conditions, gr/dscf.

D_n = Nominal diameter of probe nozzle entry plane, in.

E = Particulate Emission Rate, lb./hr.

ΔH = Average pressure differential across orifice, in. of H_2O.

$\Delta H_@$ = Orifice meter calibration factor, in. of H_2O.

I = Percent of isokinetic sampling, %.

K_p = Pitot tube constant, 85.49 ft./sec.

M_d = Molecular weight of gas, dry basis, lb./lb.-mole.

M_n = Total amount of particulate matter collected, g.

M_s = Molecular weight of gas, wet basis, lb./lb.-mole.

M_w = Molecular weight of water, 18 lb./lb.-mole.

P_{bar} = Barometric pressure, in. of H_g.

P_g = Pressure differential from gas stream to atmosphere, (static pressure) in. of H_2O.

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SAMPLING NOMENCLATURE - continued

P_s = Absolute gas stream pressure, $(P_{bar} + P_g/13.6)$ in. of H_g.

P_{std} = Absolute pressure at standard conditions, 29.92 in. of H_g.

PPM = Parts per million

P_w = Density of water, 0.0022 lb./ml.

$\wedge P_{avg}$ = Average of the square roots of the velocity head readings, in. of H_2O.

Q = Volumetric flow rate at gas stream conditions, A.C.F.M.

Q_{std} = Dry volumetric gas flow rate corrected to standard conditions, D.S.C.F.M.

R = Ideal gas constant, 21.85 in. of H_g-ft^3/ °R-lb.-mole.

t = Total sampling time, minutes.

T_m = Average dry gas meter temperature, °R.

T_s = Average absolute gas stream temperature, °R.

T_{std} = Standard absolute temperature, 528° rankine.

V_{lc} = Volume of water collected in impingers and silica gel, ml.

VOC = Volatile organic compounds

V_m = Volume of gas sample measured at meter box (meter conditions), $ft.^3$.

$V_{m(std)}$= Volume of gas sample measured at meter box (corrected to standard conditions), $ft.^3$.

V_s = Average gas stream velocity, ft./sec.

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SAMPLING NOMENCLATURE - continued

$V_{w(std)}$ = Volume of water vapor in gas sample (standard conditions), $ft.^3$.

13.6 = Specific gravity of mercury (H_g).

$\%CO_2$ = Percent by volume of CO_2 in gas stream (dry basis).

$\%O_2$ = Percent by volume of O_2 in gas stream (dry basis).

%CO = Percent by volume of CO in gas stream (dry basis).

$\%N_2$ = Percent by volume of N_2 in gas stream (dry basis).

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EMISSION SAMPLING CALCULATIONS

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EXAMPLE CALCULATIONS

The Hoover Company

72 mmBTU/hr Boiler Exhaust

Run #	1
Start Time	10:05
Finish Time	11:13

Sample Time (t)	=	60.00	minutes	Pitot Factor (Cp)	=	0.85	
Barometric Pressure (Pb)	=	29.91	in. Hg	Gas Analysis	=	10.00	% CO2
Stack Pressure (Ps)	=	28.95	in. Hg			9.00	% O2
Stack Area (As)	=	15.00	sq.ft.			0.00	% CO
Stack Temp. (Ts)	=	634.75	Degrees F.			81.00	% N2
Nozzle Diameter (Dn)	=	0.25	dec. in.	Sample Weights (Mn)			
Velocity Head (^P)	=	0.78	in. H2O	Probe	=	0.0341	grams
Orifice Pressure (^H)	=	1.20	in. H2O	Filter	=	0.1213	grams
Meter Y Factor (Y)	=	0.980					
Volume of H2O Collected	=	55.30	ml				

Vm std. = Vm x [Tstd/(Tm + 460)] x [Pb + (^H / 13.6) / Pstd))] = 36.03

Vw(std) = 0.04707 x Vlc = 2.60

Bws = Vw(std) / [Vm(std) + Vw(std)] = 0.0674

Md = (.44 x %CO2) + (.32 x %O2) + [.28 x (%N2 + %CO) = 29.96

Ms = [Md x (1 - Bws)] + (18.0 x Bws) = 29.15

Vs = 85.49 x Cp x SQRT[dP]) x [SQRT{(Ts + 460) / (Ms x Ps}] = 64.55

Qs = Vs x As x 60 = 58,093

Qs(std) = Qs x (1 - Bws) x [Tstd / (Ts + 460)] x (Pb + Ps/13.6) / 29.92 = 25,287

Cs = 15.43 x (Mn / Vm (std)) = 0.0665

E = Qstd x Cs x (1 lb / 7000 grains) x (60 minutes / 1 hour) = 14.42

I = {[100 x Ts x ((K3 x Vlc) + (Vm / Tm)) x (Pbar + (^H / 13.6))] / 60 x An x V = 102.41

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EXAMPLE CALCULATIONS

The Hoover Company

72 mmBTU/hr Boiler Exhaust

Run #	2
Start Time	12:05
Finish Time	13:11

Sample Time (t)	=	60.00	minutes	Pitot Factor (Cp)	=	0.85	
Barometric Pressure (Pb)	=	29.91	in. Hg	Gas Analysis	=	10.00	% CO2
Stack Pressure (Ps)	=	28.95	in. Hg			9.00	% O2
Stack Area (As)	=	15.00	sq.ft.			0.00	% CO
Stack Temp. (Ts)	=	638.58	Degrees F.			81.00	% N2
Nozzle Diameter (Dn)	=	0.25	dec. in.	Sample Weights (Mn)			
Velocity Head (^P)	=	0.78	in. H2O	Probe	=	0.0335	grams
Orifice Pressure (^H)	=	1.15	in. H2O	Filter	=	0.1551	grams
Meter Y Factor (Y)	=	0.980					
Volume of H2O Collected	=	41.00	ml				

Vm std. = Vm x [Tstd/(Tm + 460)] x [Pb + (^H / 13.6) / Pstd))] = 34.56

Vw(std) = 0.04707 x Vlc = 1.93

Bws = Vw(std) / [Vm(std) + Vw(std)] = 0.0529

Md = (.44 x %CO2) + (.32 x %O2) + [.28 x (%N2 + %CO) = 29.96

Ms = [Md x (1 - Bws)] + (18.0 x Bws) = 29.33

Vs = 85.49 x Cp x SQRT[dP]) x [SQRT{(Ts + 460) / (Ms x Ps}] = 64.30

Qs = Vs x As x 60 = 57,874

Qs(std) = Qs x (1 - Bws) x [Tstd / (Ts + 460)] x (Pb + Ps/13.6) / 29.92 = 25,493

Cs = 15.43 x (Mn / Vm (std)) = 0.0665

E = Qstd x Cs x (1 lb / 7000 grains) x (60 minutes / 1 hour) = 18.40

I = {[100 x Ts x ((K3 x Vlc) + (Vm / Tm)) x (Pbar + (^H / 13.6))] / 60 x An x V = 97.42

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EXAMPLE CALCULATIONS

The Hoover Company

72 mmBTU/hr Boiler Exhaust

Run #	3
Start Time	14:03
Finish Time	15:07

Sample Time (t)	=	60.00	minutes	Pitot Factor (Cp)	=	0.85	
Barometric Pressure (Pb)	=	29.91	in. Hg	Gas Analysis	=	10.00	% CO2
Stack Pressure (Ps)	=	28.95	in. Hg			9.00	% O2
Stack Area (As)	=	15.00	sq.ft.			0.00	% CO
Stack Temp. (Ts)	=	641.25	Degrees F.			81.00	% N2
Nozzle Diameter (Dn)	=	0.25	dec. in.	Sample Weights (Mn)			
Velocity Head (^P)	=	0.78	in. H2O	Probe	=	0.0445	grams
Orifice Pressure (^H)	=	1.21	in. H2O	Filter	=	0.1072	grams
Meter Y Factor (Y)	=	0.980					
Volume of H2O Collected	=	61.20	ml				

Vm std. = Vm x [Tstd/(Tm + 460)] x [Pb + (^H / 13.6) / Pstd))] = 35.25

Vw(std) = 0.04707 x Vlc = 2.88

Bws = Vw(std) / [Vm(std) + Vw(std)] = 0.0756

Md = (.44 x %CO2) + (.32 x %O2) + [.28 x (%N2 + %CO) = 29.96

Ms = [Md x (1 - Bws)] + (18.0 x Bws) = 29.06

Vs = 85.49 x Cp x SQRT[dP]) x [SQRT{(Ts + 460) / (Ms x Ps}] = 65.18

Qs = Vs x As x 60 = 58,662

Qs(std) = Qs x (1 - Bws) x [Tstd / (Ts + 460)] x (Pb + Ps/13.6) / 29.92 = 25,162

Cs = 15.43 x (Mn / Vm (std)) = 0.0664

E = Qstd x Cs x (1 lb / 7000 grains) x (60 minutes / 1 hour) = 14.32

I = {[100 x Ts x ((K3 x Vlc) + (Vm / Tm)) x (Pbar + (^H / 13.6))] / 60 x An x V = 100.68

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