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

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

AP-42 Section Number: 9.10.1.2

Reference Number: 12

Title: EPA Method 5 Particulate Emissions Tests Conducted on Western Sugar's Boiler and Pulp Dryer Stacks Located in Billings, Montana

American Environmental Testing Company, Inc.

American Environmental Testing Company, Inc.

January 1990

AP-42 Section 9.10.12
Reference 12
Report Sect.
Reference

1989-90

"EPA METHOD 5 PARTICULATE EMISSIONS TESTS CONDUCTED ON WESTERN SUGAR'S BOILER AND PULP DRYER STACKS LOCATED IN BILLINGS, MONTANA"

American Environmental Testing Company Inc.

801-266-7111

"EPA METHOD 5 PARTICULATE EMISSIONS TESTS CONDUCTED ON WESTERN SUGARS BOILER AND PULP DRYER STACKS LOCATED IN BILLINGS MONTANA"

Principal Chemist

V.Brent Benson
Technical Director

Technicians :

J. Paul Benson
Les D. Schwab

Test Dates :

Pulp Dryer
1/23-24/90
Boiler
1/25/90

Prepared for : Mr. Randy A. Mielke, Regional Engineer

Westen Sugar Company
P. O. Box 30878
Billings, Montana 59107

Prepared by : V. Brent Benson, Technical Director

American Enivironmental Testing, Inc.
565 South Birch Drive
Spanish Fork, Utah 84660

CERTIFICATION OF REPORT INTEGRITY

AMERICAN ENVIRONMENTAL TESTING COMPANY, INC. (AET) certifies that every effort was made to obtain accurate and representative data within the guidelines established by the Utah Bureau of Air Quality and the U. S. Environmental Protection Agency for Method 5 particulate Emissions, as set forth in the Federal Register and the "Quality Assurance Handbook for Air Pollution Measurement Systems".

V. Brent Benson
Technical Director

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APPENDICIES :

A. Calibration Data
B. Field and Laboratory data
C. VEO Test Forms - EPA Method 9
D. 1) Cyclonic Flow Measurements
2) Misc. Data Forms and Plant Parameters

"EPA METHOD 5 PARTICULATE EMISSIONS TESTS CONDUCTED ON WESTERN SUGARS BOILER AND PULP DRYER STACKS LOCATED IN BILLINGS MONTANA"

I. INTRODUCTION:

At the request of Western Sugar Company's Randy Mielke, American Environmental Testing, Inc., (AET) conducted EPA Method 5 Particulate Emissions Tests on the Boiler and Pulp Dryer Stacks. The testing was accomplished at their plant site, located in Billings, Montana. The tests were conducted on January 23,24 & 25 1990.

II. SUMMARY:

The results of the particulate emissions compliance tests for the Boiler and Pulp Dryer Stacks are summarized in Table I.

III. PROCEDURES AND METHODS:

A. General Plant Operations:

Figure I depicts the Pulp Dryer Stacks, Figure II depicts the Boiler Stack. Production data is included in Appendix "D" for the days when emissions compliance tests were conducted on the sources.

B. Emissions Testing:

All of the tests procedures employed were as specified in 40 CFR 60.424 (7-1-85 and as amended) and in the EPA's "Quality Assurance Handbook for Air Pollution Measurement Systems".

Table I
Particulate Summary

Pulp Dryer

Test No.	Particulate Collected (mg)	Volume DSCF	Emissions lbs/hr.	Rate grains/DSCF
1. South	33.7	62.98	1.4884	0.0083
2. North	49.2	60.86	2.2525	0.0125
3. South	50.2	62.95	2.3505	0.0123
4. North	53.9	64.66	2.4203	0.0129
5. South	85.2	60.29	3.7197	0.0218
6. North	63.6	59.01	2.7903	0.0166
Average =	**67.57**	**61.32**	**2.9768**	**0.0171**

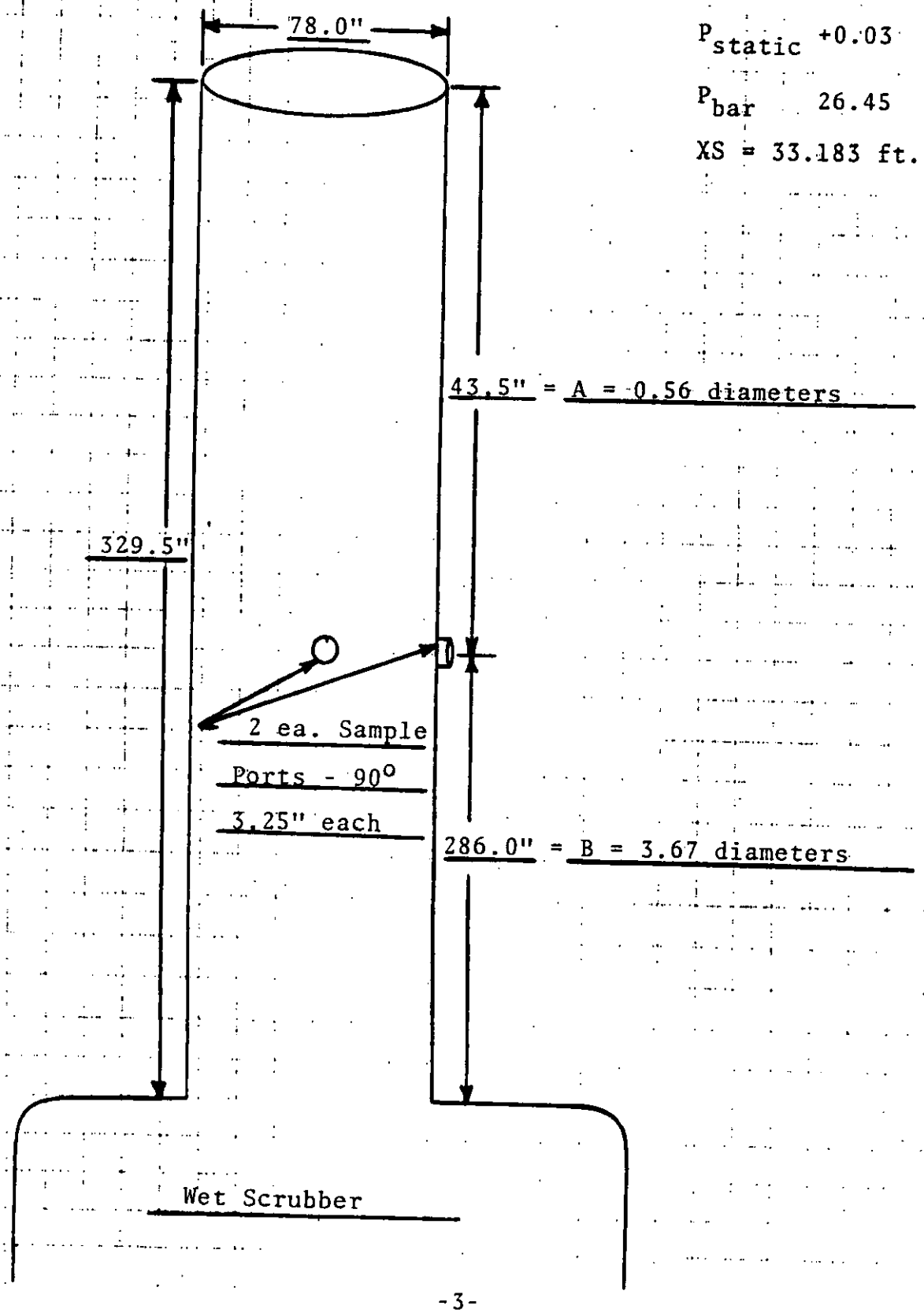
Boiler

Test No.	Particulate Collected (mg)	Volume DSCF	Emissions lbs/hr.	Rate grains/DSCF
1. " " "	270.5	53.42	66.5697	0.0781
2. " " "	265.5	51.18	66.1117	0.0801
3. " " "	276.8	52.05	68.8066	0.0821
Average =	**270.93**	**52.22**	**67.1627**	**0.0801**

American Environmental Testing Co.
565 South Birch Drive
Spanish Fork, Utah 84660
(801) 266-7111

JOB Western Sugar - Billings, Montana
SHEET NO. 1 OF 1
CALCULATED BY VB Benson DATE 1-22-90
CHECKED BY DATE
SCALE West bank of Dryers - Identical

Figure I



T_s 121 °F

P_{static} +0.03

P_{bar} 26.45

XS = 33.183 ft.^{2}

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(801) 266-7111

SHEET NO. 1 OF 1
CALCULATED BY VB Benson DATE 1-25-90
CHECKED BY DATE
SCALE Billings, Montana

Figure II

(Bolier Exhaust Stack)

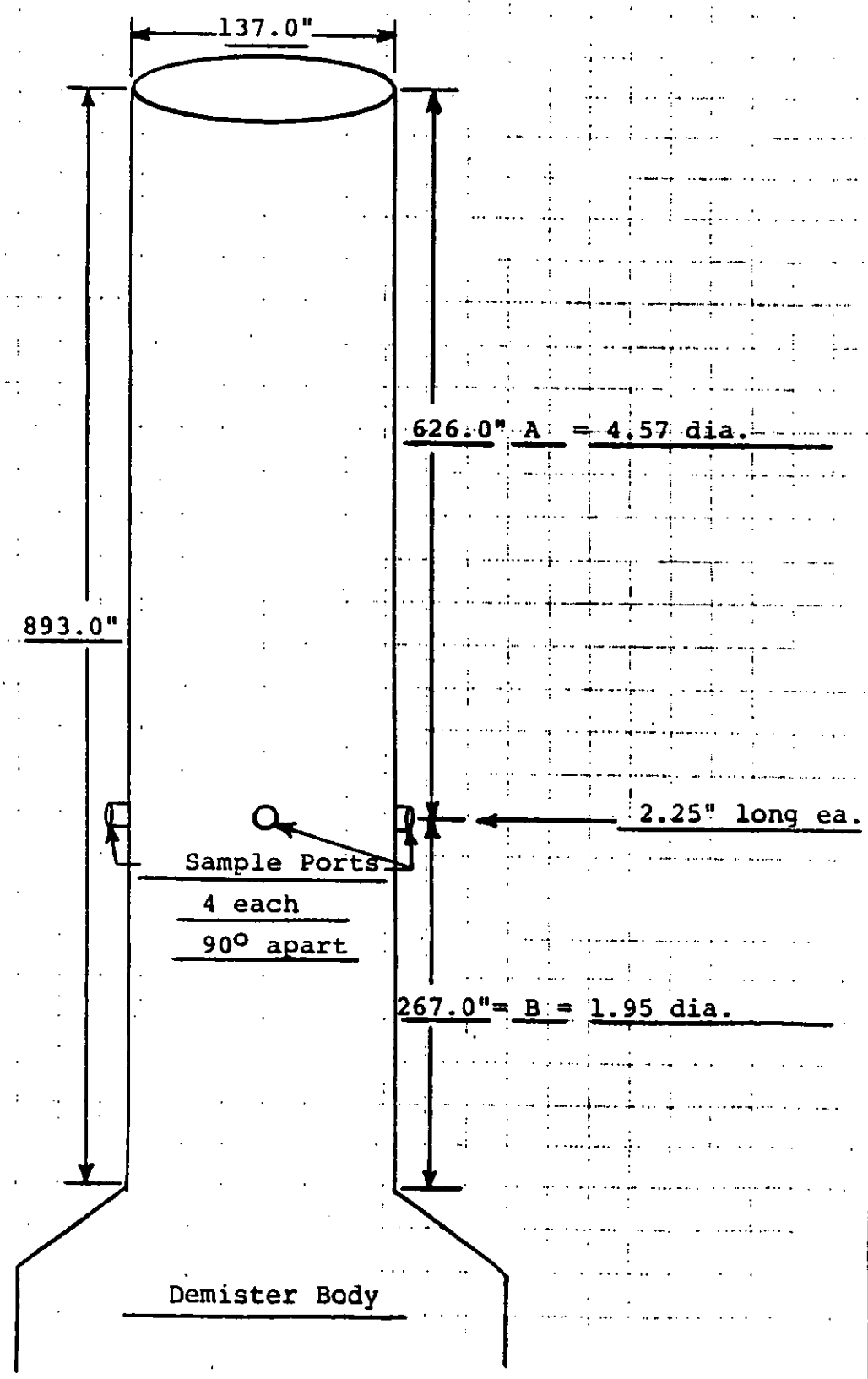

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TABLE II

TRAVERSE POINT CALCULATIONS

Plant Western Sugar Co.

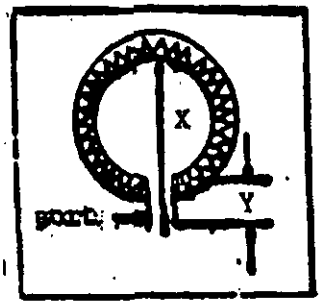
Date 1-22-90

Sampling location West Dryer (N&S)

Inside of far wall to outside of port (distance, X) 81.25'

Inside of near wall to outside of port (distance, Y) 3.25'

Stack I.D. 78.0" = 33.183 ft^2 xs



schematic of sampling location

traverse point number	percent of stack I.D.	stack I.D. inches	product of col. 2 & 3 (to 1/8 in)	distance Y	traverse point location from outside of ports. (sum of columns 4 &5)
1 & 13	2.1	78.0"	1.638	3.25	4.888 = 4 7/8"
2 & 14	6.7	"	5.226	"	8.476 = 8 1/2"
3 & 15	11.8	"	9.204	"	12.454 = 12 1/2"
4 & 16	17.7	"	13.806	"	17.056 = 17 1/8"
5 & 17	25.0	"	19.500	"	22.750 = 22 3/4"
6 & 18	35.6	"	27.768	"	31.018 = 31"
7 & 19	64.4	"	50.232	"	53.484 = 53 1/2"
8 & 20	75.0	"	58.500	"	61.750 = 61 3/4"
9 & 21	82.3	"	64.194	"	67.444 = 67 1/2
10 & 22	88.2	"	68.796	"	72.046 = 72"
11 & 23	93.3	"	72.774	"	76.024 = 76"
12 & 24	97.9	"	76.362	"	79.602 = 79 5/8"

1/2 inch rule for = 24 inch I.D. stacks.
1.0 inch rule for = 24 inch I.C. stacks.

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TABLE III

TRAVERSE POINT CALCULATIONS

Plant Western Sugar Company

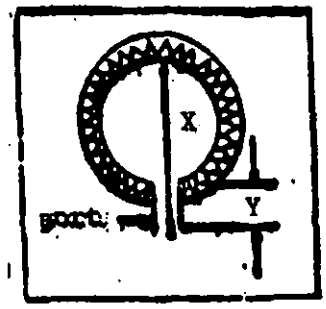
Date 1-25-90

Sampling location Billings, Montana

Inside of far wall to outside of port (distance, X) 11' 7 1/4"

Inside of near wall to outside of port (distance, Y) 2 1.4"

Stack I.D. 11'5" = 102.4 $ft.^2$



schematic of sampling location

traverse point number	percent of stack I.D.	stack I.D. inches	product of col. 2 & 3 (to 1/8 in)	distance Y	traverse point location from outside of ports. (sum of columns 4 &5)
1 & 13	2.1	137.0"	2.877	2.25"	5.127 = 5 1/8"
2 & 14	6.7	"	9.179	"	11.429 = 11 3/8"
3 & 15	11.8	"	16.166	"	18.4156 = 18 3/8"
4 & 16	17.7	"	24.249	"	26.499 = 26 1/2"
5 & 17	25.0	"	35.250	"	36.500 = 36 1/2"
6 & 18	35.6	"	48.772	"	51.022 = 51"
7 & 19	64.4	"	88.228	"	90.478 = 90 1/2"
8 & 20	75.0	"	102.750	"	105.000 = 105"
9 & 21	82.3	"	112.751	"	115.001 = 115"
10 & 22	88.2	"	120.834	"	123.084 = 123 1/8"
11 & 23	93.3	"	127.821	"	130.071 = 130 1/8"
12 & 24	97.9	"	134.123	"	136.373 = 136 3/8"

1/2 inch rule for = 24 inch I.D. stacks. NA

1.0 inch rule for = 24 inch I.C. stacks. NA

1. Calibration :

Calibration data are included in Appendix "A".

2. Traverse Points :

a) Pulp Dryer & Boiler :

The location of each of the points for the Pulp Dryer are given in Table II, the Boiler points in Table III.

IV. RESULTS AND CONCLUSIONS :

A. Method 5 Particulate Tests :

1. Pulp Dryer & Boiler

Tables IV,VI, summarizes the data that was collected on the field and laboratory data forms during compliance testing on the Boiler & Pulp Dryer Stacks. Compliance data calculated from this raw data is given in Tables V,VII.

B. Visible Opacity Determination :

As per requirements, 6.0 minutes of opacity readings were taken during each of the EPA Method 5 Particulate Compliance tests. VEO Field Sheets and the observer's current certification card are included in Appendix "C".

C. Cyclonic Flow Determination :

Prior to the EPA Method 5 Particulate Compliance Tests, a cyclonic flow determination was made on the CMI Baghouse stack. The average angle has to be ≤ 20° degrees, as per 40 CFR Part 60 - Method 2 criteria. The data forms for each of the tests are included in Appendix "D".

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FIELD AND LABORATORY DATA
TABLE IVa

Plant or Job Description : Western Sugar Company - Located In Billings, Montana
Wet Scrubber On Pulp Dryer
Type : Compliance EPA #5
Date : 1/23-24/90

Symbol	Description	Units	1 South	2 North	3 South
Vm	Volume dry gas sampled @ meter conditions	Ft3	66.554	64.264	65.52
Pb	Barometric Pres	"Hg abs	26.38	26.42	26.79
ΔH	Average Pres drop across the orifice meter	"H2O	3.8189	3.57	3.7701
Tm	Average gas meter temp	°R	536.71	535.38	531.58
		°F	76.71	75.38	71.58
Yi	Meter Coefficient		1.07	1.07	1.07
Vw	Total H2O collected, impingers & silica gel	ml	268	249	229.1
CO2		%	2.6	2.4	2.73
O2		%	10.8	10.93	11.2
N2 + CO		%	86.6	86.67	86.07
Rn	Nozzle Dia.	in.	0.5037	0.5037	0.503
Ts	Stack Temp	°R	582.58	584.54	589.42
		°F	122.58	124.54	129.42
Sqr rt ΔP	Velocity head of stack gas	"H2O	0.242	0.2413	0.2509
Cp	Pitot Tube Coefficient		0.8484	0.8484	0.8484
Ps	Static Pres	"H2O	0.03	0.03	0.03
Pabs	Absolute Pres	"Hg	26.38	26.42	26.79
As	Area stack	Ft2	33.183	33.183	33.183
Tt	Net time of test	min.	72	72	72
Mgp	Total Particulate	mg	33.7	49.2	50.2

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FIELD AND LABORATORY DATA
TABLE IVb

Plant or Job Description : Western Sugar Company - Located In Billings, Montana
Wet Scrubber On Pulp Dryer
Type : Compliance EPA #5
Date : 1/23-24/90

Symbol	Description	Units	4 North	5 South	6 North
Vm	Volume dry gas sampled @ meter conditions	Ft3	67.27	62.806	61.523
Pb	Barometric Pres	"Hg abs	26.79	26.79	26.78
ΔH	Average Pres drop across the orifice meter	"H20	3.9678	3.4535	3.3218
Tm	Average gas meter temp	°R	534.42	536.9	533.33
		°F	74.42	76.9	73.33
Yi	Meter Coefficient		1.07	1.07	1.07
Vw	Total H20 collected, impingers & silica gel	ml	271.2	302.2	295.1
CO2		%	1.96	2.2	2.37
O2		%	12.13	12.1	11.87
N2 + CO		%	85.91	85.7	85.76
Rn	Nozzle Dia.	in.	0.503	0.503	0.503
Ts	Stack Temp	°R	597.29	595.5	605.71
		°F	137.29	135.5	145.71
Sqr rt ΔP	Velocity head of stack gas	"H20	0.2531	0.2354	0.2335
Cp	Pitot Tube Coefficient		0.8484	0.8484	0.8484
Ps	Static Pres	"H20	0.03	0.03	0.03
Pabs	Absolute Pres	"Hg	26.79	26.79	26.78
As	Area stack	Ft2	33.183	33.183	33.183
Tt	Net time of test	min.	72	72	72
Mgp	Total Particulate	mg	53.9	85.2	63.6

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DATA SUMMARY
TABLE Va

Plant : Western Sugar Company - Located In Billings, Montana
Wet Scrubber On Plup Dryer
Type : Compliance EPA #5
Date : 1/23-24/90

SYMBOL	DESCRIPTION	UNITS	1 South	2 North	3 South
Vm std	Volume dry gas	dscfm	0.8747	0.8453	0.8742
	sampled @ standard	dscf	62.9784	60.861	62.9451
	Conditions				
Vw gas	Volume water	scf	12.6148	11.7204	10.7837
	vapor collected @				
	standard conditions				
Bws	Proportion by		0.1669	0.1615	0.1463
	volume of water				
	vapor in gas stream				
	ddimensionless				
Md	Dry molecular	lb/lb mole	28.848	28.8212	28.8848
	weight				
Ms	Wet molecular	lb/lb mole	27.0377	27.0738	27.2928
	weight				
Vs	Stack gas	ft/sec	15.8635	15.818	16.3412
	velocity				
Qs	Volumetric flow	ft3/hr	1.2617	1.2639	1.3369
	rate dry basis		X 10 6	X 10 6	X 10 6
	standard conditions				
Iso	Isokinetic	%	99.3405	95.7276	94.4232
	variation				
Cs	Conc. particulat	lb/scf	5.351	8.084	7.9752
	matter in stack		X 10 -4	X 10 -4	X 10 -4
	gas, dry basis				
Emr	Emission rate	lbs/dscf	1.1797	1.7822	1.7582
			X 10 -6	X 10 -6	X 10 -6
		gr/dscf	0.0083	0.0125	0.0123
		lbs/hr	1.4884	2.2525	2.3505

AMERICAN ENVIRONMENTAL TESTING, INCORPORATED
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Spanish Fork, Utah 84660

DATA SUMMARY
TABLE Vb

Plant : Western Sugar Company - Located in Billings, Montana
Wet Scrubber On Plup Dryer
Type : Compliance EPA #5
Date : 1/23-24/90

SYMBOL	DESCRIPTION	UNITS	4 North	5 South	6 North
Vm std	Volume dry gas	dscfm	0.8981	0.8373	0.8196
	sampled @ standard	dscf	64.661	60.2859	59.0114
	Conditions				
Vw gas	Volume water	scf	12.7654	14.2246	13.8904
	vapor collected @				
	standard conditions				
Bws	Proportion by		0.1649	0.1909	0.1905
	volume of water				
	vapor in gas stream				
	ddimensionless				
Md	Dry molecular	lb/lb mole	28.7988	28.836	28.854
	weight				
Ms	Wet molecular	lb/lb mole	27.0184	26.7673	26.7859
	weight				
Vs	Stack gas	ft/sec	16.6776	15.5576	15.5646
	velocity				
Qs	Volumetric flow	ft3/hr	1.317	1.1939	1.1744
	rate dry basis		X 10 6	X 10 6	X 10 6
	standard conditions				
Iso	Isokinetic	%	98.0207	100.4534	100.5011
	variation				
Cs	Conc. particulat	lb/scf	8.3358	1.4133	1.0778
	matter in stack		X 10 -4	X 10 -3	X 10 -3
	gas, dry basis				
Emr	Emission rate	lbs/dscf	1.8377	3.1157	2.376
			X 10 -6	X 10 -6	X 10 -6
		gr/dscf	0.0129	0.0218	0.0166
		lbs/hr	2.4203	3.7197	2.7903

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FIELD AND LABORATORY DATA
TABLE VI

Plant or Job Description : Western Sugar Company - Located In Billings, Montana
Wet Scrubber On Boiler
Type : Compliance EPA #5
Date : 1/25/90

Symbol	Description	Units	4 North	5 South	6 North
Vm	Volume dry gas sampled @ meter conditions	Ft3	56.127	54.058	55.166
Pb	Barometric Pres	"Hg abs	26.61	26.49	26.39
ΔH	Average Pres drop across the orifice meter	"H2O	2.7659	2.5042	2.597
Tm	Average gas meter temp	°R	531.94	536.77	536.4
		°F	71.94	76.77	76.4
Yi	Meter Coefficient		1.07	1.07	1.07
Vw	Total H2O collected, impingers & silica gel	ml	252.6	257.9	263.1
CO2		%	5.2	6.8	7.17
O2		%	10.6	10	10.13
N2 + CO		%	84.2	83.2	82.7
Rn	Nozzle Dia.	in.	0.375	0.375	0.375
Ts	Stack Temp	°R	570.08	572.04	569.96
		°F	110.08	112.04	109.96
Sqr rt ΔP	Velocity head of stack gas	"H2O	0.373	0.368	0.3741
Cp	Pitot Tube Coefficient		0.8484	0.8484	0.8484
Ps	Static Pres	"H2O	0.18	0.18	0.18
Pabs	Absolute Pres	"Hg	26.62	26.50	26.40
As	Area stack	Ft2	102.4	102.4	102.4
Tt	Net time of test	min.	72	72	72
Mgp	Total Particulate	mg	270.5	265.5	276.8

AMERICAN ENVIRONMENTAL TESTING, INCORPORATED
565 So. Birch Drive 801-266-7111
Spanish Fork, Utah 84660

DATA SUMMARY
TABLE VII

Plant : Western Sugar Company - Located In Billings, Montana
Wet Scrubber On Boiler
Type : Compliance EPA #5
Date : 1/25/90

SYMBOL	DESCRIPTION	UNITS	4 North	5 South	6 North
Vm std	Volume dry gas	dscfm	0.7419	0.7108	0.7229
	sampled @ standard	dscf	53.4156	51.1794	52.0459
	Conditions				
Vw gas	Volume water vapor collected @ standard conditions	scf	11.8899	12.1394	12.3841
Bws	Proportion by volume of water vapor in gas stream ddimensionless		0.1821	0.1917	0.1922
Md	Dry molecular weight	lb/lb mole	29.256	29.488	29.5524
Ms	Wet molecular weight	lb/lb mole	27.2067	27.2855	27.3319
Vs	Stack gas velocity	ft/sec	24.003	23.7358	24.1139
Qs	Volumetric flow rate dry basis standard conditions	ft3/hr	5.9628 X 10 6	5.7807 X 10 6	5.8685 X 10 6
Iso	Isokinetic variation	%	99.6568	97.7761	98.0007
Cs	Conc. particulat matter in stack gas, dry basis	lb/scf	5.0641 X 10 -3	5.1876 X 10 -3	5.3184 X 10 -3
Emr	Emission rate	lbs/dscf	1.1164 X 10 -5	1.1437 X 10 -5	1.1725 X 10 -5
		gr/dscf	0.0781	0.0801	0.0821
		lbs/hr	66.5697	66.1117	68.8066

APPENDIX A
(Callibration Data)

American Environmental
Testing Company, Inc.
[illegible] North Beach Drive
Spanish Fork, Utah 84660
801-[illegible]

SAMPLE BOX TEMPERATURE SENSOR CALIBRATION

DATE 9/1-87

SAMPLE BOX NO. ① 21-1A + ② 21A-2C

AMBIENT TEMPERATURE 65 F

BAROMETRIC PRESSURE 25.51 In.Hg

CALIBRATOR [illegible]

REFERENCE THERMOMETER ERTCO 105 - DBS,

Thermocouple Location	Reference Point	Temperature Source	Reference Thermometer Temperature	Thermocouple Temperature	Temp. Dev.%
① Oven.	3	Oven On	134	137	
Probe.	4	"	263	262	
Imp. In.	6	"	152	149	
Imp. Out.	5	Cold H_2O	34	35	
Meter In.	1	Oven On	67	68	
Meter Out.	2	"	65	66	
② Oven.	3	Oven On	142	141	
Probe.	4	"	261	260	
Imp. In.	6	"	155	157	
Imp. Out.	5	Cold H_2O	34	34	
Meter In.	1	Meter Oven	66	67	
Meter Out.	2	on. "	66	66	

American Environmental
565 South Birch Dr.
Spanish Fork, Utah 84660
801/266-7111

Pitot Tube Identification Number: 6'A Date 9/1-89

Calibrated By: V.B. Benson - J Paul Benson

	"A" Side Calibration			
Run No.	ΔP_{std} cm H_2O (in. H_2O)	ΔP_s cm H_2O (in. H_2O)	Cp (S)	Dev.
1	0.246	0.344	0.8457	0
2	0.247	0.346	0.8449	-0.0008
3	0.248	0.346	0.8466	+0.0009
		Average	0.8457	

ave = 0.8443 vbb. JL

	"B" Side Calibration			
Run No.	$\Delta P_{std.}$ cm H_2O (in. H_2O)	ΔP_s cm H_2O (in. H_2O)	Cp (S)	Dev.
1	0.247	0.349	0.8413	-0.0015
2	0.248	0.348	0.8442	+0.0014
3	0.248	0.349	0.8430	+0.0002
		Average	0.8428	

$$C_p\ (2) = C_p\ (std) \sqrt{\frac{\Delta P_{std}}{\Delta P_s}}$$

Dev. = C_p (s) - C_p (S) (avg.) (Must be $\leq$ 0.01)

C_p Difference: $A_{avg.} - B_{avg.}$ = 0.003 (must be $\leq$ 0.01) JL vbb

American Environmental
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Spanish Fork, Utah 84660
801/266-7111

Pitot Tube Identification Number: 6'B Date 9/1-89

Calibrated By: T.B. Benson - T.P. Benson

"A" Side Calibration				
Run No.	ΔP_{std} cm H_2O (in. H_2O)	ΔP_s cm H_2O (in. H_2O)	Cp (S)	Dev.
1	0.251	0.346	0.8517	-0.0003
2	0.251	0.345	0.8530	+0.0010
3	0.250	0.345	0.8513	-0.0007
		Average	0.8520	

ave = 0.8484 JBB. JG

"B" Side Calibration				
Run No.	$\Delta P_{std.}$ cm H_2O (in. H_2O)	ΔP_s cm H_2O (in. H_2O)	Cp (S)	Dev.
1	0.251	0.351	0.8456	+0.0009
2	0.251	0.352	0.8444	-0.0003
3	0.250	0.351	0.8440	-0.0007
		Average	0.8447	

$$C_p\ (2) = C_p\ (std) \sqrt{\frac{\Delta P_{std}}{\Delta P_s}}$$

Dev. = C_p (s) - C_p (S) (avg.) (Must be $\leq$ 0.01)

C_p Difference: $A_{avg.} - B_{avg.}$ = 0.007 JG. JBB. (must be $\leq$ 0.01)

309 South Birch Drive
Spanish Fork, Utah 84660
801-798-7111

BALANCE NAME Sartorius-A 200 S (Analytic) NUMBER 35120053

BALANCE NAME Sartorius U 3600 (Top Loader) NUMBER 35120087

CLASSIFICATION OF STANDARD WEIGHTS Type "S" N.B.S.

DATE	0.500g	1.0000g	10.0000g	50.0000g	100.0000g	ANALYST
	A 200 S					
4/1-86	0.5001	0.9999	10.0001	50.0001	100.0001	V.B.B.
4/1-87	0.5000	1.0000	10.0001	49.9999	100.0001	V.B.B.
1/7-88	0.5000	1.0001	10.0000	50.0000	100.0000	V.B.B.
8/5-88	0.5001	1.0000	10.0001	49.9999	100.0001	V.B.B.
2/24-89	0.5000	0.9999	10.0001	50.0001	100.0000	S.A.S.
9/1-89	0.5001	0.9999	9.9999	50.0000	100.0001	[illegible]
	U3600					
4/1-86	0.5	1.0	10.0	50.0	100.0	V.B.B.
4/1-87	0.5	1.0	10.0	49.9	100.1	V.B.B.
1/7-88	0.5	1.1	10.0	50.0	100.0	V.B.B.
8/5-88	0.5	1.0	10.1	50.0	100.0	V.B.B.
2/24-89	0.5	1.0	10.1	49.9	100.1	S.A.S.
9/1-89	0.5	1.0	10.0	49.9	100.1	[illegible]

American Analytical
&
Environmental Laboratory, Inc.

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date: 9/1-89 Thermocouple #: 6'A+6'B dig.

Ambient Temperature: 65 °C Barometric Pressure 25.51 in. Hg

Calibrator: [illegible] Reference: mercury-in-glass: ERTCO ASTM 1105

OTHER: NA

Reference Point Number	Source[a] (specify)	Reference Thermometer Temperature °C	Thermocouple Potentiometer Temperature °C	Temperature difference[b] %
① 6'A. a)	Ice H_2O.	35	34	
b)	Hot H_2O.	120	119	
c)	Boiling H_2O.	201	202	
d)	Hot Oil.	233	233	
e)	Hot Oil.	290	292	
f)	Boiling Oil	415	411	
② 6'B. a)	Ice. H_2O.	35	36	
b)	Hot H_2O.	127	126	
c)	Boiling H_2O.	196	192	
d)	Hot Oil.	239	241	
e)	Hot Oil.	310	310	
f)	Boiling Oil	398	399	

[a]Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, } ^\circ C + 273) - (\text{test thermom temp, } ^\circ C + 273)}{\text{ref temp, } ^\circ C + 273}\right] 100 \leq 1.5\%$

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801-266-7111

METER BOX CALIBRATION DATA FORM
(English units)

Date 9/1-89 Meter box number CR #1(097)

Barometric pressure, P_b = 25.51 in. Hg. Calibrated by V.Brent Benson

Orifice manometer setting (ΔH), in. H_2O	Wet test meter (v_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature[a]: Wet test meter (t_w), °F		Dry gas meter: Inlet (t_{d_i}), °F	Dry gas meter: Outlet (t_{d_o}), °F	Dry gas meter: Average (t_d)[a], °F	Time (Θ), min	Previous 1.111 Y_i	2.116 $\Delta H@_i$ in. H_2O
0.5	5.004	4.490	78.0 77.0	77.5	89 84	85 85	84.5	12.33	1.128	2.002
1.0	5.005	4.530	78.0 78.0	78.0	84 85	85 86	85	8.92	1.116	2.096
1.5	10.008	9.112	79.0 78.0	78.5	85 85	86 86	85.5	14.57	1.108	2.100
2.0	10.010	9.041	79.0 79.0	79.0	86 85	86 87	86	12.40	1.115	2.029
3.0	10.010	9.126	79.0 79.0	79.0	87 86	86 87	86.5	10.63	1.103	2.235
4.0	10.012	9.208	80.0 81.0	80.5	88 87	88 87	87.5	9.28	1.089	2.279
								Average	1.110	2.124

ave ±0.05 1.06 → 1.16 ✓ 05 ✓ 3B

ave ±0 1.974 → 2.274 ✓ 05 ✓ 3B

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801-266-7111

CALCULATION FORM FOR METER BOX CALIBRATION
(English Units)

ΔH	$\frac{\Delta H}{13.6}$	$Y_1 = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6})(t_w + 460)}$	$\Delta H@_1 = \frac{0.0317\ \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\ \theta}{V_w}\right]^2$
0.5	0.0368	$\frac{5.004(25.51)544.5}{(4.490)25.547(537.5)} = \frac{69,506.53578}{61,597.13811}$	$\frac{0.01585}{(25.51)544.5}\left[\frac{537.5(12.33)}{5.004}\right]^2 = \frac{27,802.10986}{13,890.195}$
1.0	0.0735	$\frac{5.005(25.51)545}{(4.530)25.584(538)} = \frac{69,584.26475}{62,351.78976}$	$\frac{0.0317}{(25.51)545}\left[\frac{538(8.92)}{5.005}\right]^2 = \frac{29,143.74513}{13,902.95}$
1.5	0.1103	$\frac{10.008(25.51)545.5}{(9.112)25.620(538.5)} = \frac{139,268.3756}{125,712.5234}$	$\frac{0.04755}{(25.51)545.5}\left[\frac{538.5(14.57)}{10.008}\right]^2 = \frac{29,224.4567}{13,915.705}$
2.0	0.1471	$\frac{10.010(25.51)546}{(9.041)25.657(539)} = \frac{139,423.8846}{125,029.101}$	$\frac{0.0634}{(25.51)546}\left[\frac{539(12.40)}{10.010}\right]^2 = \frac{28,264.54533}{13,928.46}$
3.0	0.2206	$\frac{10.010(25.51)546.5}{(9.126)25.731(539)} = \frac{139,551.5622}{126,568.5761}$	$\frac{0.0951}{(25.51)546.5}\left[\frac{539(10.63)}{10.010}\right]^2 = \frac{31,157.05647}{13,941.215}$
4.0	0.2942	$\frac{10.012(25.51)547.5}{(9.208)25.804(540.5)} = \frac{139,834.8507}{128,424.5469}$	$\frac{0.1268}{(25.51)547.5}\left[\frac{540.5(9.28)}{10.012}\right]^2 = \frac{31,824.74413}{13,966.725}$

American Environmental
Testing Company, Inc.
565 South Birch Drive
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801-266-7111

TEMPERATURE CHECKS:

Date 1/30-90 (Western Sugar)

REFERENCE: ERTCO ASTM 0-500°F Cal Hg therm

SOURCE:

Control Box 2

75	Meter In	74
74	Meter Out	74

Control Box 1

74	Meter In	75
74	Meter Out	74

Box 1A

75	Impinger In	75
74	Impinger Out	75
74	Oven	74

Box 2A

74	Impinger In	73
74	Impinger Out	73
73	Oven	73

Box 1A

73	Impinger In	73
73	Impinger Out	74
74	Oven	74

American Environmental
Testing Company, Inc.
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801-266-7111

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test numbers 30 EPA5. Date 1/27-90 Meter box number 97 (CR#1) Plant Western Sugar (Mont).

Barometric pressure, P_b = 25.13 in. Hg Dry gas meter number #97 Pretest Y 1.110

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	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Average[a] (t_d), °F	Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i $\frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
2.0	10.010	9.132	68	81	82	81.5	12.13	5.0	1.118	$\frac{10.010(25.13)541.5}{(9.132)25.277(528)} = \frac{136215.029}{121,878.0098}$
2.0	10.011	9.131	67	82	83	82.5	12.16	5.0	1.122	$\frac{10.011(25.13)542.5}{(9.128)25.277(527)} = \frac{136,482.133}{121,598.8963}$
2.0	10.014	9.135	66	82	83	82.5	12.18	5.0	1.124	$\frac{10.019(25.13)542.5}{(9.137)25.277(526)} = \frac{136,582.2775}{121,482.8292}$

Y = avg = 1.121 allowed 1.110 ± 0.05

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d.

1/27/90

V_w = Gas volume passing through the wet test meter, ft^3.

V_d = Gas volume passing through the dry gas meter, ft^3.

t_w = Temperature of the gas in the wet test meter, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °F.

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o}, °F.

ΔH = Pressure differential across orifice, in H_2O.

Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.

Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y ±0.05Y.

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

American Environmental

Western Sugar
Billings, Mont.
West Dryer Bank.

501 260-7111

NOZZLE CALIBRATION

Date 1/23 - /90 Calibrated by JBB-JTB-LDS.

Nozzle identification number	D_1, mm, (in.)	D_2, mm, (in.)	D_3, mm, (in.)	ΔD, mm, (in.)	D_{avg}
#1 South. 1/2-#2	0.503	0.505	0.503	0.002	0.5037
#1 North. 1/2-#2	0.503	0.505	0.503	0.002	0.5037
#2 South. 1/2-#2	0.503	0.505	0.504	0.002	0.504
#2 North. 1/2-#2	0.502	0.505	0.504	0.003	0.5036
#3 South. 1/2-#2	0.502	0.505	0.504	0.003	0.5036
#3 North. 1/2-#2	0.502	0.504	0.504	0.002	0.5033

where:

$D_{1,2,3}$ = nozzle diameter measured on a different diameter, mm (in.). Tolerance = measure within 0.25 mm (0.001 in.).

ΔD = maximum difference in any two measurements, mm (in.). Tolerance = 0.1 mm (0.004 in.).

D_{avg} = average of D_1, D_2, D_3.

American Environmental

Western Sugar
Billings, Mont.
Boiler Stack

801 266-7111

NOZZLE CALIBRATION

Date 1/25/90 Calibrated by JBB-LDS.

Nozzle identification number	D_1, mm, (in.)	D_2, mm, (in.)	D_3, mm, (in.)	ΔD, mm, (in.)	D_{avg}
#1 3/8-4	0.374	0.376	0.375	0.002	0.375
#2 3/8-4	0.374	0.376	0.375	0.002	0.375
#3 3/8-4	0.374	0.376	0.375	0.002	0.375

where:

$D_{1,2,3}$ = nozzle diameter measured on a different diameter, mm (in.). Tolerance = measure within 0.25 mm (0.001 in.).

ΔD = maximum difference in any two measurements, mm (in.). Tolerance = 0.1 mm (0.004 in.).

D_{avg} = average of D_1, D_2, D_3.

APPENDIX B
(Field and Laboratory Data)

AMERICAN ENVIRONMENTAL TESTING, INCORPORATED

565 So. Birch Drive 801-266-7111
Spanish Fork, Utah 84660

PARTICULATE FIELD DATA FORMAT

1	Plant	Western Sugar Co.
2	City	Billings,Montana
3	Location	Dryer Stack, Compliance #1-5
4	Operator	J. Paul Benson
5	Date	1/23-90
6	Stack Diameter (in)	78
7	Sample Box Number	CR-1
8	Meter Box Number	1
9	Meter H@	2.245
10	Meter Calibration,Y	1.07
11	Pitot Tube, Cp	0.8484
12	Probe Length (ft)	6
13	Probe Liner Material	Stainless Steel
14	Probe Heater Setting (°F)	248
15	Ambient Temperature (°F)	67
16	Barometeric Press., Pb (inHg)	26.38
17	Assumed Moisture (%)	13
18	Static Pressure, Ps (inH2O)	0.03
19	C Factor	0
20	Reference P (inH2O)	0.07
21	Nozzle Identification Number	1/2-A
22	Nozzle Diameter (in)	0.5037
23	Thermometer Number	1-A
24	Pretest Leak Rate (CFM)	0.006
25	Leak Check Vacuum (inH2O)	24.2
26	Filter Number	MD-1
27	Gas Analysis	
28	CO (%)	0
29	CO2 (%)	2.6
30	O2 (%)	10.8
31	N2 (%)	86.6

PRETEST CALCULATIONS

NOZZLE DIAMETER		PRETEST DATA		ISOKINETIC °H	
Dn = 0.5037				°H = 2.0015	
constant	0.0357	Cp	0.8484	constant	849.8000
Qm	0.75	Imp V(H2O)(ml)	67.5000	°H2	1.0000
Pb(in HG)	26.38	Gel H2O(g)	12.0000	Mds	28.8480
Pgm(in H2O)	0.03	V(H2O)(ml)	127.8000	Mm	28.8480
Pm	26.3822	Vm(acf)	49.2300	K	28.5927
Cp	0.8484	h avg	0.2000	°P	0.0700
Tm(°F)	72	Vwc	6.0155	°H = 2.0015	
Tm(°R)	532	Vwc	4o.1017		
Bwm	0	Bws = 0.1154			
Bws	0.13				
Ts(°F)	123				
Ts(°R)	583				
Mds	28.848				
Ms	27.4378				
Pb(in HG)	26.38				
Pgs(in H2O)	0.03				
Ps	26.3822				
(°P)avg	0.07				
Dn = 0.3819					

Sample Point	Meter Temperature Outlet (°F)	Meter Temperature Inlet (°F)	Stack Temp Ts (°F)	Gas Volume Vm (ft3)	Gas Volume difference (ft3)
starting				1765.723	
1	75	72	124	1768.26	2.54
2	76	72	124	1771.05	2.79
3	76	72	122	1773.83	2.78
4	77	73	123	1776.67	2.84
5	77	73	122	1779.67	3.00
6	77	73	122	1782.71	3.04
7	78	73	122	1785.7	2.99
8	77	73	122	1788.73	3.03
9	77	73	122	1791.75	3.02
10	78	73	124	1794.78	3.03
11	78	73	123	1797.65	2.87
12	77	73	123	1800.505	2.85
13	76	73	118	1802.58	2.08
14	78	74	115	1804.91	2.33
15	76	73	120	1807.27	2.36
16	78	74	125	1809.82	2.55
17	77	74	125	1812.37	2.55
18	76	72	124	1814.91	2.54
19	77	71	124	1817.69	2.78
20	76	72	124	1820.41	2.72
21	76	72	123	1823.19	2.78
22	76	72	124	1826.2	3.01
23	76	73	124	1829.23	3.03
24	76	71	123	1832.277	3.05
avg °F		74.69	122.58		
avg °R		534.69	582.58		
total				66.554000000	66.554000000
average	76.70833333	72.00000007	122.58333333		
Sample Point	Meter Temperature Inlet(°F)	Meter Temperature Outlet (°F)	Stack Temp (°F) T	Gas Volume Vm	Gas Volume Vm

Velocity Head ΔPs (inH2O)	Pressure Diff ΔH (inH2O)	Sqrt ΔPs	Sampling Time (min)	Clock Time (24 hrs)	Vacuum (inHg)
				1035	
0.05	3.21	0.2236	3	1038	5.7
0.06	3.86	0.2449	3	1041	7.2
0.06	3.87	0.2449	3	1044	7.3
0.06	3.87	0.2449	3	1047	7.7
0.07	4.53	0.2646	3	1050	9.1
0.07	4.53	0.2646	3	1053	9.1
0.07	4.53	0.2646	3	1056	9.2
0.07	4.53	0.2646	3	1059	9.3
0.07	4.53	0.2646	3	1102	9.4
0.07	4.52	0.2646	3	1105	9.5
0.06	3.88	0.2449	3	1108	8.3
0.06	3.87	0.2449	3	1111	8.2
0.03	1.95	0.1732	3	1203	4.2
0.04	2.62	0.2000	3	1206	5.4
0.04	2.59	0.2000	3	1209	5.5
0.05	3.22	0.2236	3	1212	6.3
0.05	3.22	0.2236	3	1215	6.4
0.05	3.22	0.2236	3	1218	6.5
0.06	3.86	0.2449	3	1221	6.9
0.06	3.86	0.2449	3	1224	7.3
0.06	3.87	0.2449	3	1227	7.8
0.07	4.50	0.2646	3	1230	9.2
0.07	4.51	0.2646	3	1233	9.6
0.07	4.51	0.2646	3	1236	9.8

			72	72	
0.059100000	3.8189	0.2420	3	1143.000007	7.704100007
Velocity Head ΔPs	Pressure Diff ΔH	Sqrt ΔPs	Sampling Time	Clock Time	Vacuum

Probe Temperature Exit (°F)	Filter Temperature (°F)	Impinger Temperature Outlet (°F)
267	269	43
263	253	38
230	242	38
257	241	39
239	242	42
239	246	45
249	252	48
233	241	49
235	239	50
255	257	51
247	258	53
249	253	55
257	263	40
244	264	34
257	268	48
235	267	41
229	248	38
232	238	40
258	247	43
250	262	46
253	266	49
260	262	51
230	261	53
255	266	54

247.0416667 Probe Exit Temperature (°F)	247.0416667 Filter Temperature (°F)	45.33333333 Outlet Impinger Temperature (°F)

POST TEST CALCULATION

VOLUME DRY GAS		VOLUME H20 VAPOR		MOISTURE CONTENT	
Vm(std)	= 62.9784	Vw(std)	= 12.6148	Bws	= 0.1669
Vm	66.55400000	Vic(mls)	268		
Vm(std)	= 62.9784	Vw(std)	= 12.6148		

MOL WT DRY STACK GASES		STACK VELOCITY		DRY STACK FLOW RATE	
Mds	= 28.8480	Vs	= 15.8635	Q(std)	= 1.2617E+06
MOL WT WET STACK GASES		Kp	85.49		
Mws	= 27.0377	Vs	= 15.8635		

ISOKINETIC CALCULATION

An = 1.3838E-03

ISO = 99.3405

PARTICULATE CONCENTRATION

Cs = 5.3510E-04

Mn 33.7

Cs = 5.3510E-04

lbs/dscf = 1.1797E-06

grains/dscf = 0.0083

lbs/hr = 1.4884

Initial Leak Check Rate

		Pitot Tubes
Finish	1765.671	A = OK
Start	1765.652	B = OK
Rate = 0.0190		

Vac. = 23.2

Final Leak Check Rate

		Pitot Tubes
Finish	1832.463	A = Ok
Start	1832.452	B = Ok
Rate = 0.0110		

Vac. = 23.3

American Environmental
Testing Company, Inc.
505 South Birch Drive
Spanish Fork, Utah 84660
801-266-7111

South #1

LABORATORY DATA
(METHOD 5)

Company Western Sugar Billings Mont. Run No. #1 Compliance

Sampling Location West Dryer - So. Date 1-23-90

MOISTURE COLLECTED

		~~GM/ML~~	Water Weight/~~Volume Gain~~ ~~GM/ML~~
IMPINGER 1	Final Weight/Volume	741.4	
	Initial Weight/Vol.		
	Increase	577.4	+164.0
IMPINGER 2	Final Weight/Volume	667.6	
	Initial Weight/Vol.		
	Increase	594.3	+73.3
IMPINGER 3	Final Weight/Volume	464.9	
	Initial Weight/Vol.		
	Increase	455.9	+9.0
IMPINGER 4	Final Weight/Volume	823.4	
	Initial Weight/Vol.		
	Increase	801.7	+21.7

PARTICULATE COLLECTED +268.0 g total

FRONT-HALF ANALYSIS (Nozzle, Probe, Filter, and Hot Box Glassware)

(1) Filter & Particulates 0.7138
(2) Filter Tare Weight 0.6990g WD-1
(3) Net Dry Particulates (1&2) 0.0148 = 14.8 mg.
(4) Particulates Caught in Nozzle, Probe, Glassware 12.0 mg.
(5) Total Front Catch (3&4) 26.8 mg.

BACK-HALF ANALYSIS (Impingers, and Connecting Glassware)

(1) Particulate Caught in Impingers Evaporated Down at Less Than 120 F 6.9 mg.

TOTAL PARTICULATE CATCH (Sum of Front and Back-Half Catches

33.7 mg.

JN MAVB 1/23/90

American Environmental
Testing Company, Inc.
565 South Birch Drive
Spanish Fork, Utah 84660
801-266-7111

ORSAT ANALYSIS

(Ave. of 3 Analyses Each)

TEST NO. DESCRIPTION	VOLUME PERCENT - DRY			
	NITROGEN	OXYGEN	CARBON DIOXIDE	CARBON MONOXIDE
Dryer Stack #1	86.6 %	10.8%	2.6 %	< 0.1 %
Compliance #1	86.6 %	10.8 %	2.6 %	< 0.1 %
	86.6 %	10.8%	2.6 %	< 0.1 %
AVERAGE	86.6 %	10.8%	2.6%	< 0.1%

JAP 1/23/90 MAQB

AMERICAN ENVIRONMENTAL TESTING, INCORPORATED

565 So. Birch Drive 801-266-7111

Spanish Fork, Utah 84660

PARTICULATE FIELD DATA FORMAT

1	Plant	Western Sugar Co.
2	City	Billings,Montana
3	Location	Dryer Stack, Compliance #2 - N
4	Operator	J. Paul Benson
5	Date	1/23-90
6	Stack Diameter (in)	78
7	Sample Box Number	CR-1
8	Meter Box Number	1
9	Meter H@	2.245
10	Meter Calibration,Y	1.07
11	Pitot Tube, Cp	0.8484
12	Probe Length (ft)	6'
13	Probe Liner Material	Stainless Steel
14	Probe Heater Setting (°F)	248
15	Ambient Temperature (°F)	69.6
16	Barometeric Press., Pb (inHg)	26.42
17	Assumed Moisture (%)	16
18	Static Pressure, Ps (inH2O)	0.03
19	C Factor	0
20	Reference P (inH2O)	0.07
21	Nozzle Identification Number	1/2-4
22	Nozzle Diameter (in)	0.5037
23	Thermometer Number	1-4
24	Pretest Leak Rate (CFM)	0.006
25	Leak Check Vacuum (inH2O)	24.2
26	Filter Number	40-2
27	Gas Analysis	
28	CO (%)	0
29	CO2 (%)	2.4
30	O2 (%)	10.93
31	N2 (%)	86.67

PRETEST CALCULATIONS

NOZZLE DIAMETER		PRETEST DATA		ISOKINETIC °H	
Dn = 0.5037				°H = 1.8880	
constant	0.0357	Cp	0.8484	constant	849.8000
Qm	0.75	Imp V(H2O)(ml)	67.5000	°Hd	1.0000
Pb(in Hg)	26.42	Gel H2O(g)	12.0000	Mds	28.8212
Pgm(in H2O)	0.03	V(H2O)(ml)	127.8000	Mm	28.8212
Pm	26.4222	Vm(acf)	49.2300	K	26.9720
Cp	0.8484	°h avg	0.2000	°P	0.0700
Tm(°F)	72	Vwc	6.0155	°H = 1.8880	
Tm(°R)	532	Vmc	46.1716		
Bwm	0	Bws = 0.1153			
Bws	0.16				
Ts(°F)	123				
Ts(°R)	583				
Mds	28.8212				
Ms	27.0898				
Pb(in Hg)	26.42				
Pgs(in H2O)	0.03				
Ps	26.4222				
(°P)avg	0.07				
Dn = 0.3809					

Sample Point	Meter Temperature Outlet (°F)	Meter Temperature Inlet (°F)	Stack Temp Ts (°F)	Gas Volume Vm (ft3)	Gas Volume difference (ft3)
starting				1832.745	
1	76	73	123	1834.92	2.17
2	76	73	122	1837.18	2.26
3	75	72	125	1839.66	2.48
4	75	72	124	1842.16	2.50
5	77	72	125	1844.78	2.62
6	77	73	122	1847.51	2.73
7	76	72	122	1850.23	2.72
8	77	73	124	1853.18	2.95
9	78	74	126	1856.08	2.90
10	78	74	126	1859.02	2.94
11	77	73	127	1861.95	2.93
12	77	73	128	1864.886	2.94
13	78	75	123	1865.21	0.32
14	78	75	124	1869.45	4.24
15	77	73	123	1871.94	2.49
16	78	74	125	1874.45	2.51
17	78	74	125	1877.13	2.68
18	78	74	123	1879.85	2.72
19	78	74	126	1882.57	2.72
20	78	75	123	1885.29	2.72
21	78	75	126	1888.2	2.91
22	78	74	126	1891.13	2.93
23	78	73	125	1894.05	2.92
24	78	74	126	1897.009	2.96
avg °F		75.38	124.54		
avg °R		535.38	584.54		
total				64.264000000	64.264000000
average	77.25	73.5	124.5416666667		
Sample Point	Meter Temperature Inlet(°F)	Meter Temperature Outlet (°F)	Stack Temp (°F) T	Gas Volume Vm	Gas Volume Vm

Velocity Head ΔPs (inH2O)	Pressure Diff ΔH (inH2O)	Sqrt ΔPs	Sampling Time (min)	Clock Time (24 hrs)	Vacuum (inHg)
				1500	
0.04	2.43	0.2000	3	1503	4.3
0.04	2.44	0.2000	3	1506	4.5
0.05	3.03	0.2236	3	1509	5.6
0.05	3.03	0.2236	3	1512	5.8
0.06	3.64	0.2449	3	1515	6.9
0.06	3.66	0.2449	3	1518	7.1
0.06	3.65	0.2449	3	1521	7.2
0.07	4.26	0.2646	3	1524	8.3
0.07	4.25	0.2646	3	1527	8.3
0.07	4.25	0.2646	3	1530	8.5
0.07	4.23	0.2646	3	1533	8.7
0.07	4.23	0.2646	3	1536	8.8
0.04	2.44	0.2000	3	1603	4.9
0.04	2.44	0.2000	3	1606	4.9
0.05	3.04	0.2236	3	1609	5.9
0.05	3.04	0.2236	3	1612	6.1
0.06	3.65	0.2449	3	1615	7.1
0.06	3.66	0.2449	3	1618	7.1
0.06	3.64	0.2449	3	1621	7.2
0.06	3.66	0.2449	3	1624	7.3
0.07	4.25	0.2646	3	1627	8.3
0.07	4.25	0.2646	3	1630	8.6
0.07	4.25	0.2646	3	1633	8.7
0.07	4.25	0.2646	3	1636	8.9
			72	72	
0.05875	3.5700	0.2413	3	1569.5	7.041666667
Velocity Head ΔPs	Pressure Diff ΔH	Sqrt ΔPs	Sampling Time	Clock Time	Vacuum

Probe Temperature Exit (°F)	Filter Temperature (°F)	Impinger Temperature Outlet (°F)
268	258	37
255	237	36
250	232	37
235	242	36
230	235	37
235	233	37
254	240	39
269	259	41
230	253	42
241	262	41
233	228	42
237	236	43
265	234	38
266	239	35
253	254	36
264	263	37
254	259	38
232	235	38
235	242	38
269	227	39
263	235	40
260	244	42
257	234	42
251	262	42

250.33333333 Probe Exit Temperature (°F)	250.33333333 Filter Temperature (°F)	38.875 Outlet Impinger Temperature (°F)

POST TEST CALCULATION

VOLUME DRY GAS		VOLUME H20 VAPOR		MOISTURE CONTENT	
Vm(std)	= 60.8610	Vw(std)	= 11.7204	Bws	= 0.1615
Vm	64.264000000	Vic(mls)	249		
Vm(std)	= 60.8610	Vw(std)	= 11.7204		

MOL WT DRY STACK GASES		STACK VELOCITY		DRY STACK FLOW RATE	
Mds	= 28.8212	Vs	= 15.8180	Q(std)	= 1.2639E+06
MOL WT WET STACK GASES		Kp	85.49		
Mws	= 27.0738	Vs	= 15.8180		

ISOKINETIC CALCULATION		PARTICULATE CONCENTRATION	
An	= 1.3838E-03	Cs	= 8.0840E-04
ISO	= 95.7276	Mn	49.2
		Cs	= 8.0840E-04
		lbs/dscf	= 1.7822E-06
		grains/dscf	= 0.0125
		lbs/hr	= 2.2525

Initial Leak Check Rate

		Pitot Tubes
Finish	1832.708	A = OK
Start	1832.696	B = OK
Rate	= 0.0120	

Vac. = 22.2

Final Leak Check Rate

		Pitot Tubes
Finish	1897.166	A = OK
Start	1897.161	B = OK
Rate	= 0.0050	

Vac. = 22.3

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Run #2

LABORATORY DATA
(METHOD 5)

Company Western Sugar Billings Mont. Run No. #2 Compliance

Sampling Location West Dryer - Stk. Date 1-23-90

MOISTURE COLLECTED

		GM/ML	Water Weight/Volume Gain GM/ML
IMPINGER 1	Final Weight/Volume	731.6	
	Initial Weight/Vol.		
	Increase	577.3	+154.3
IMPINGER 2	Final Weight/Volume	670.8	
	Initial Weight/Vol.		
	Increase	597.9	+72.9
IMPINGER 3	Final Weight/Volume	460.4	
	Initial Weight/Vol.		
	Increase	455.7	+4.7
IMPINGER 4	Final Weight/Volume	833.4	
	Initial Weight/Vol.		
	Increase	816.3	+17.1

PARTICULATE COLLECTED 249.0g

FRONT-HALF ANALYSIS (Nozzle,Probe,Filter,and Hot Box Glassware)

(1)	Filter & Particulates	0.6899
(2)	Filter Tare Weight	0.6655 W-0-2
(3)	Net Dry Particulates (1&2)	0.0244 = 24.4mg.
(4)	Particulates Caught in Nozzle,Probe,Glassware	21.5mg.
(5)	Total Front Catch (3&4)	45.9mg.

BACK-HALF ANALYSIS (Impingers,and Connecting Glassware)

(1)	Particulate Caught in Impingers Evaporated Down at Less Than 120 F	3.3mg.

TOTAL PARTICULATE CATCH (Sum of Front and Back-Half Catches

49.2 mg.

MRQB
1/23/90

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Western Sugar:
Billings, Mont.

ORSAT ANALYSIS

(Ave. of 3 Analyses Each)

TEST NO. DESCRIPTION	VOLUME PERCENT - DRY			
	NITROGEN	OXYGEN	CARBON DIOXIDE	CARBON MONOXIDE
#2 North. 1/23-90	86.7	10.9	2.4	<0.1
West Dryer	86.5	11.0	2.5	<0.1
Bank.	86.8	10.9	2.3	<0.1
AVERAGE	86.67	10.93	2.4	<0.1

JA 1/23/90 MAQB

AMERICAN ENVIRONMENTAL TESTING, INCORPORATED

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PARTICULATE FIELD DATA FORMAT

1	Plant	Western Sugar Co.
2	City	Billings, Montana
3	Location	Dryer Stack, Compliance #3 - S
4	Operator	J. Paul Benson
5	Date	1/24-90
6	Stack Diameter (in)	78
7	Sample Box Number	CR-1
8	Meter Box Number	1
9	Meter ΔH@	2.245
10	Meter Calibration, Y	1.07
11	Pitot Tube, Cp	0.8484
12	Probe Length (ft)	6'
13	Probe Liner Material	Stainless Steel
14	Probe Heater Setting (°F)	248
15	Ambient Temperature (°F)	69.0
16	Barometeric Press., Pb (inHg)	26.79
17	Assumed Moisture (%)	16
18	Static Pressure, Ps (inH2O)	0.03
19	C Factor	0
20	Reference ΔP (inH2O)	0.07
21	Nozzle Identification Number	1/2-A
22	Nozzle Diameter (in)	0.503
23	Thermometer Number	1-A
24	Pretest Leak Rate (CFM)	0.009
25	Leak Check Vacuum (inH2O)	22.2
26	Filter Number	MD-3
27	Gas Analysis	
28	CO (%)	0
29	CO2 (%)	2.73
30	O2 (%)	11.2
31	N2 (%)	86.07

PRETEST CALCULATIONS

NOZZLE DIAMETER		PRETEST DATA		ISOKINETIC °H	
Dn = 0.503				°H = 1.5906	
constant	0.0357	Cp	0.8484	constant	849.8000
Qm	0.75	Imp V(H2O)(ml)	67.5000	°Ha	1.0000
Pb(in HG)	26.79	Gel H2O(g)	12.0000	Mds	28.8848
Pgm(in H2O)	0.03	V(H2O)(ml)	127.8000	Mm	28.8848
Pm	26.7922	Vm(acf)	49.2300	K	26.5104
Cp	0.8484	°h avg	0.2000	°P	0.0600
Tm(°F)	72	Vwc	6.0155	°H = 1.5906	
Tm(°R)	532	Vac	46.8179		
Bwm	0	Bws = 0.1139			
Bws	0.16				
Ts(°F)	130				
Ts(°R)	590				
Mds	28.8848				
Ms	27.1432				
Pb(in HG)	26.79				
Pgs(in H2O)	0.03				
Ps	26.7922				
(°P)avg	0.06				
Dn = 0.3986					

Sample Point	Meter Temperature Outlet (°F)	Meter Temperature Inlet (°F)	Stack Temp Ts (°F)	Gas Volume Vm (ft3)	Gas Volume difference (ft3)
starting				1897.443	
1	68	66	128	1899.82	2.38
2	70	67	127	1902.25	2.43
3	70	67	127	1904.69	2.44
4	71	68	128	1907.11	2.42
5	71	68	127	1909.77	2.66
6	72	69	130	1912.42	2.65
7	73	69	129	1915.08	2.66
8	74	69	127	1917.93	2.85
9	73	69	127	1920.82	2.89
10	74	69	127	1923.72	2.90
11	75	70	129	1926.77	3.05
12	74	70	128	1929.823	3.05
13	73	70	127	1932.32	2.50
14	76	71	126	1934.79	2.47
15	76	71	126	1937.43	2.64
16	75	71	127	1940.11	2.68
17	75	70	129	1942.81	2.70
18	75	70	131	1945.65	2.84
19	75	71	132	1948.54	2.89
20	74	71	134	1951.42	2.88
21	75	71	135	1954.33	2.91
22	75	71	136	1957.17	2.84
23	76	72	136	1960.06	2.89
24	75	71	133	1962.963	2.90

avg °F		71.58	129.42		
avg °R		531.58	589.42		
total				65.52	65.52
average	73.541666667	69.625	129.41666667		
Sample Point	Meter Temperature Inlet(°F)	Meter Temperature Outlet (°F)	Stack Temp (°F) T	Gas Volume Vm	Gas Volume Vm

Velocity Head ΔPs (inH2O)	Pressure Diff ΔH (inH2O)	Sqrt ΔPs	Sampling Time (min)	Clock Time (24 hrs)	Vacuum (inHg)
				830	
0.05	2.96	0.2236	3	833	5.8
0.05	2.97	0.2236	3	836	5.9
0.05	2.97	0.2236	3	839	6.1
0.05	2.97	0.2236	3	842	6.1
0.06	3.57	0.2449	3	745	7.3
0.06	3.56	0.2449	3	748	7.6
0.06	3.57	0.2449	3	851	7.7
0.07	4.18	0.2646	3	854	9.1
0.07	4.18	0.2646	3	857	9.3
0.07	4.18	0.2646	3	900	9.5
0.08	4.77	0.2828	3	903	10.8
0.08	4.78	0.2828	3	906	10.8
0.05	2.99	0.2236	3	933	6.5
0.05	3.00	0.2236	3	936	6.5
0.06	3.61	0.2449	3	939	7.8
0.06	3.60	0.2449	3	942	8.1
0.06	3.58	0.2449	3	945	8.2
0.07	4.16	0.2646	3	948	9.5
0.07	4.16	0.2646	3	951	9.8
0.07	4.14	0.2646	3	954	9.9
0.07	4.14	0.2646	3	957	9.9
0.07	4.13	0.2646	3	1000	10.1
0.07	4.14	0.2646	3	1003	10.1
0.07	4.15	0.2646	3	1036	10.2

			72	72	
0.0633333333	3.7701	0.2509	3	902.41666667	8.4416666667
Velocity Head ΔPs	Pressure Diff ΔH	Sqrt ΔPs	Sampling Time	Clock Time	Vacuum

Probe Temperature Exit (°F)	Filter Temperature (°F)	Impinger Temperature Outlet (°F)
231	242	33
238	245	33
241	256	33
248	258	34
243	259	35
245	259	36
233	250	35
249	243	36
266	252	37
260	254	38
268	247	37
269	262	38
268	242	41
266	251	41
259	249	40
253	249	41
247	249	43
265	243	44
255	236	45
230	227	46
240	229	48
236	231	49
237	236	49
251	258	49

249.91666667	249.91666667	40.04166667
Probe Exit Temperature (°F)	Filter Temperature (°F)	Outlet Impinger Temperature (°F)

POST TEST CALCULATION

VOLUME DRY GAS		VOLUME H2O VAPOR		MOISTURE CONTENT	
Vm(std)	= 62.9451	Vw(std)	= 10.7837	Bws	= 0.1463
Vm	65.52	Vic(mls)	229.1		
Vm(std)	= 62.9451	Vw(std)	= 10.7837		

MOL WT DRY STACK GASES		STACK VELOCITY		DRY STACK FLOW RATE	
Mds	= 28.8848	Vs	= 16.3412	Q(std)	= 1.3369E+06
MOL WT WET STACK GASES		Kp	85.49		
Mws	= 27.2928	Vs	= 16.3412		

ISOKINETIC CALCULATION		PARTICULATE CONCENTRATION	
An	= 1.3800E-03	Cs	= 7.9752E-04
ISO	= 94.4232	Mn	50.2
		Cs	= 7.9752E-04
		lbs/dscf	= 1.7582E-06
		grains/dscf	= 0.0123
		lbs/hr	= 2.3505

Initial Leak Check Rate

		Pitot Tubes
Finish	1897.364	A = OK
Start	1897.355	B = OK
Rate	= 0.0090	

Vac. = 22.2

Final Leak Check Rate

		Pitot Tubes
Finish	1963.119	A = Ok
Start	1963.111	B = Ok
Rate	= 0.0080	

Vac. = 22.3

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South #3

LABORATORY DATA
(METHOD 5)

Company Western Sugar Billings Mont. Run No. #3 Compliance

Sampling Location #3 South. Date 1-24-90

MOISTURE COLLECTED

		GM/ML	Water Weight/Volume Gain GM/ML
IMPINGER 1	Final Weight/Volume	714.5	
	Initial Weight/Vol.		
	Increase	576.8	137.7
IMPINGER 2	Final Weight/Volume	663.2	
	Initial Weight/Vol.		
	Increase	598.1	65.1
IMPINGER 3	Final Weight/Volume	462.5	
	Initial Weight/Vol.		
	Increase	456.0	6.5
IMPINGER 4	Final Weight/Volume	843.4	
	Initial Weight/Vol.		
	Increase	823.6	19.9

229.1 Total

PARTICULATE COLLECTED

FRONT-HALF ANALYSIS (Nozzle,Probe,Filter,and Hot Box Glassware)

(1) Filter & Particulates	0.6857g.
(2) Filter Tare Weight	0.6608g. W-D-3
(3) Net Dry Particulates (1&2)	0.0249 = 24.9mg
(4) Particulates Caught in Nozzle,Probe,Glassware	15.3mg.
(5) Total Front Catch (3&4)	40.2

BACK-HALF ANALYSIS (Impingers,and Connecting Glassware)

(1) Particulate Caught in Impingers Evaporated Down at Less Than 120 F	10.0mg.

TOTAL PARTICULATE CATCH (Sum of Front and Back-Half Catches

50.2mg.

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ORSAT ANALYSIS

(Ave. of 3 Analyses Each)

TEST NO.	DESCRIPTION	VOLUME PERCENT - DRY			
		NITROGEN	OXYGEN	CARBON DIOXIDE	CARBON MONOXIDE
Compliance #3-S.		86.1 %	11.2 %	2.7 %	<0.1 %
Western Sugar, MT.		86.0 %	11.2 %	2.8 %	<0.1 %
		86.1 %	11.2 %	2.7 %	<0.1 %
AVERAGE		86.07 %	11.2 %	2.73 %	<0.1 %

JAB 1/24/90 MAQB

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PARTICULATE FIELD DATA FORMAT

1	Plant	Western Sugar Co.
2	City	Billings, Montana
3	Location	Dryer Stack, Compliance #4 - N
4	Operator	J. Paul Benson
5	Date	1/24-90
6	Stack Diameter (in)	78
7	Sample Box Number	CR-1
8	Meter Box Number	1
9	Meter ΔH@	2.245
10	Meter Calibration, Y	1.07
11	Pitot Tube, Cp	0.8484
12	Probe Length (ft)	6'
13	Probe Liner Material	Stainless Steel
14	Probe Heater Setting (°F)	248
15	Ambient Temperature (°F)	69.6
16	Barometeric Press., Pb (inHg)	26.79
17	Assumed Moisture (%)	14
18	Static Pressure, Ps (inH2O)	0.03
19	C Factor	0
20	Reference ΔP (inH2O)	0.07
21	Nozzle Identification Number	1/2-4
22	Nozzle Diameter (in)	0.503
23	Thermometer Number	1-4
24	Pretest Leak Rate (CFM)	0.012
25	Leak Check Vacuum (inH2O)	22.8
26	Filter Number	WD-4
27	Gas Analysis	
28	CO (%)	0
29	CO2 (%)	1.96
30	O2 (%)	12.13
31	N2 (%)	85.91

PRETEST CALCULATIONS

NOZZLE DIAMETER		PRETEST DATA		ISOKINETIC °H	
Dn = 0.503				°H = 1.8586	
constant	0.0357	Cp	0.8484	constant	849.8000
Qm	0.75	Imp V(H2O)(ml)	67.5000	°H2-	1.1240
Pb(in Hg)	26.79	Gel H2O(g)	12.0000	Mds	28.7988
Pgm(in H2O)	0.03	V(H2O)(ml)	127.8000	Mm	28.7988
Pm	26.7922	Vm(act)	49.2300	K	30.9765
Cp	0.8484	°h avg	0.2000	°P	0.0600
Tm(°F)	72	Vwc	6.0155	°H = 1.8586	
Tm(°R)	532	Vmc	46.8179		
Bwm	0	Bws = 0.1139			
Bws	0.14				
Ts(°F)	130				
Ts(°R)	590				
Mds	28.7988				
Ms	27.2870				
Pb(in Hg)	26.79				
Pgs(in H2O)	0.03				
Ps	26.7922				
(°P)avg	0.06				
Dn = 0.3991					

Sample Point	Meter Temperature Outlet (°F)	Meter Temperature Inlet (°F)	Stack Temp Ts (°F)	Gas Volume Vm (ft3)	Gas Volume difference (ft3)
starting				1963.404	
1	73	72	137	1965.83	2.43
2	75	72	139	1968.34	2.51
3	74	71	141	1971.02	2.68
4	74	70	138	1973.75	2.73
5	75	71	135	1976.47	2.72
6	75	70	133	1979.19	2.72
7	75	71	129	1982.1	2.91
8	75	71	131	1985.02	2.92
9	75	71	132	1987.96	2.94
10	73	71	130	1990.88	2.92
11	76	72	131	1994.04	3.16
12	75	73	130	1997.142	3.10
13	76	73	138	1999.48	2.34
14	76	73	139	2001.91	2.43
15	76	73	142	2004.4	2.49
16	77	74	144	2007.11	2.71
17	77	74	143	2009.82	2.71
18	77	74	141	2012.55	2.73
19	77	74	142	2015.45	2.90
20	78	75	140	2018.39	2.94
21	79	75	139	2021.32	2.93
22	79	74	139	2024.43	3.11
23	79	74	140	2027.55	3.12
24	80	75	142	2030.674	3.12
avg °F		74.42	137.29		
avg °R		534.42	597.29		
total				67.27	67.27
average	76.208333333	72.625	137.2916666 7		
Sample Point	Meter Temperature Inlet (°F)	Meter Temperature Outlet (°F)	Stack Temp (°F) T	Gas Volume Vm	Gas Volume Vm

Velocity Head Ps (inH2O)	Pressure Diff H (inH2O)	Sqrt Ps	Sampling Time (min)	Clock Time (24 hrs)	Vacuum (inHg)
				1120	
0.05	3.06	0.2236	3	1123	5.9
0.05	3.06	0.2236	3	1126	5.8
0.06	3.65	0.2449	3	1129	7.1
0.06	3.66	0.2449	3	1132	7.1
0.06	3.69	0.2449	3	1135	7.1
0.06	3.70	0.2449	3	1138	7.2
0.07	4.35	0.2646	3	1141	8.3
0.07	4.33	0.2646	3	1144	8.3
0.07	4.32	0.2646	3	1147	8.5
0.07	4.34	0.2646	3	1150	8.5
0.08	4.96	0.2828	3	1153	9.9
0.08	4.97	0.2828	3	1156	9.9
0.04	2.45	0.2000	3	1203	5.1
0.05	3.06	0.2236	3	1206	6.1
0.05	3.05	0.2236	3	1209	6.1
0.06	3.65	0.2449	3	1212	7.3
0.06	3.66	0.2449	3	1215	7.3
0.06	3.67	0.2449	3	1218	7.4
0.07	4.27	0.2646	3	1221	8.7
0.07	4.30	0.2646	3	1224	8.8
0.07	4.31	0.2646	3	1227	9.2
0.08	4.92	0.2828	3	1230	10.6
0.08	4.91	0.2828	3	1233	10.8
0.08	4.90	0.2828	3	1236	10.7
			72	72	
0.0645833333	3.9678	0.2531	3	1179.5	7.9875
Velocity Head Ps	Pressure Diff H	Sqrt Ps	Sampling Time	Clock Time	Vacuum

Probe Temperature Exit (°F)	Filter Temperature (°F)	Impinger Temperature Outlet (°F)
232	241	39
249	248	37
262	249	37
238	236	38
251	241	38
255	247	39
239	258	40
249	261	39
265	268	40
267	269	40
233	234	40
236	238	41
268	266	40
259	269	38
248	269	37
233	257	40
240	249	41
251	254	42
246	261	43
266	267	44
231	264	46
235	244	47
230	236	49
269	238	47

248	248	40.91000007
Probe Exit Temperature (°F)	Filter Temperature (°F)	Outlet Impinger Temperature (°F)

POST TEST CALCULATION

VOLUME DRY GAS		VOLUME H2O VAPOR		MOISTURE CONTENT	
Vm(std)	= 64.6610	Vw(std)	= 12.7654	Bws	= 0.1649
Vm	67.27	Vic(mls)	271.2		
Vm(std)	= 64.6610	Vw(std)	= 12.7654		

MOL WT DRY STACK GASES		STACK VELOCITY		DRY STACK FLOW RATE	
Mds	= 28.7988	Vs	= 16.6776	Q(std)	= 1.3170E+06

MOL WT WET STACK GASES		Kp	85.49
Mws	= 27.0184	Vs	= 16.6776

ISOKINETIC CALCULATION		PARTICULATE CONCENTRATION	
An	= 1.3800E-03	Cs	= 8.3358E-04
ISO	= 98.0207	Mn	53.9
		Cs	= 8.3358E-04
		lbs/dscf	= 1.8377E-06
		grains/dscf	= 0.0129
		lbs/hr	= 2.4203

Initial Leak Check Rate

		Pitot Tubes
Finish	1963.369	
Start	1963.357	A = OK
Rate	= 0.0120	B = OK
	Vac. = 22.8	

Final Leak Check Rate

		Pitot Tubes
Finish	2030.844	A = OK
Start	2030.831	B = OK
Rate	= 0.0130	
	Vac. = 22.8	

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North 4

LABORATORY DATA
(METHOD 5)

Company Western Sugar Billings Plant Run No. #4 Compliance

Sampling Location #4 North West Bank of Dryer Date 1-24-90

MOISTURE COLLECTED

		GM/~~ML~~	Water Weight/~~Volume Gain~~ GM/~~ML~~
IMPINGER 1	Final Weight/Volume	694.9	
	Initial Weight/Vol.		
	Increase	577.1	+ 117.8
IMPINGER 2	Final Weight/Volume	708.1	
	Initial Weight/Vol.		
	Increase	597.4	+ 110.7
IMPINGER 3	Final Weight/Volume	479.5	
	Initial Weight/Vol.		
	Increase	456.0	+ 23.5
IMPINGER 4	Final Weight/Volume	813.9	
	Initial Weight/Vol.		
	Increase	794.7	+ 19.2

PARTICULATE COLLECTED 271.2g total

FRONT-HALF ANALYSIS (Nozzle, Probe, Filter, and Hot Box Glassware)

(1)	Filter & Particulates	0.6868
(2)	Filter Tare Weight	0.6683 W-D-4
(3)	Net Dry Particulates (1&2)	0.0185 = 18.5mg.
(4)	Particulates Caught in Nozzle, Probe, Glassware	~~21.8 mg.~~ 22.0mg.
(5)	Total Front Catch (3&4)	~~40.3~~ 40.6mg.

BACK-HALF ANALYSIS (Impingers, and Connecting Glassware)

(1)	Particulate Caught in Impingers Evaporated Down at Less Than 120 F	~~20.4 mg.~~ 13.3mg.

TOTAL PARTICULATE CATCH (Sum of Front and Back-Half Catches

~~60.7 mg.~~ 53.9mg.

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ORSAT ANALYSIS

(Ave. of 3 Analyses Each)

TEST NO.	DESCRIPTION	VOLUME PERCENT - DRY			
		NITROGEN	OXYGEN	CARBON DIOXIDE	CARBON MONOXIDE
Compliance # 4-N		86.0 %	12.2 %	1.8 %	< 0.1 %
Western Sugar M.T.		86.0 %	12.1 %	1.9 %	< 0.1 %
Dryer Stacks.		86.0 %	12.1 %	1.9 %	< 0.1 %
	AVERAGE	86.0 %	12.13 %	1.86 %	< 0.1 %

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PARTICULATE FIELD DATA FORMAT

1	Plant	Western Sugar Co.
2	City	Billings,Montana
3	Location	Dryer Stack, Compliance #5 - S
4	Operator	J. Paul Benson
5	Date	1/24-90
6	Stack Diameter (in)	78
7	Sample Box Number	CR-1
8	Meter Box Number	1
9	Meter ΔH@	2.245
10	Meter Calibration,Y	1.07
11	Pitot Tube, Cp	0.8484
12	Probe Length (ft)	6'
13	Probe Liner Material	Stainless Steel
14	Probe Heater Setting (°F)	248
15	Ambient Temperature (°F)	69.6
16	Barometeric Press., Pb (inHg)	26.79
17	Assumed Moisture (%)	14
18	Static Pressure, Ps (inH2O)	0.03
19	C Factor	0
20	Reference ΔP (inH2O)	0.07
21	Nozzle Identification Number	1/2-4
22	Nozzle Diameter (in)	0.503
23	Thermometer Number	1-4
24	Pretest Leak Rate (CFM)	0.016
25	Leak Check Vacuum (inH2O)	22.8
26	Filter Number	WU-5
27	Gas Analysis	
28	CO (%)	0
29	CO2 (%)	2.2
30	O2 (%)	12.1
31	N2 (%)	85.7

PRETEST CALCULATIONS

NOZZLE DIAMETER		PRETEST DATA		ISOKINETIC 'H	
Dn = 0.503				'H = 1.6537	
constant	0.0357	Co	0.8464	constant	849.8000
Um	0.75	Imp V(H2O)(ml)	67.5000	'Ha	1.0000
Pb(in HG)	26.79	Gel H2O(g)	12.0000	Mds	28.8360
Pga(in H2O)	0.03	V(H2O)(ml)	127.8000	Ma	28.8360
Pm	26.7922	Vm(act)	49.2300	K	27.5624
Co	0.8464	'h avg	0.2000	'P	0.0600
Tm('F)	72	Vwc	6.0155	'H = 1.6537	
Tm('R)	532	Vwc	46.8179		
Bwm	0	Bws = 0.1139			
Bws	0.14				
Ts('F)	130				
Ts('R)	590				
Mds	28.836				
Ms	27.3190				
Pb(in HG)	26.79				
Pgs(in H2O)	0.03				
Ps	26.7922				
('P)avg	0.06				
Dn = 0.3992					

Sample Point	Meter Temperature Outlet (°F)	Meter Temperature Inlet (°F)	Stack Temp Ts (°F)	Gas Volume Vm (ft3)	Gas Volume difference (ft3)
starting				2031.549	
1	80	76	136	2033.67	2.12
2	81	78	135	2035.79	2.12
3	81	77	133	2037.92	2.13
4	81	77	136	2040.38	2.46
5	82	78	135	2042.88	2.50
6	81	77	136	2045.39	2.51
7	80	76	137	2048.12	2.73
8	79	75	135	2050.85	2.73
9	79	75	137	2053.55	2.70
10	79	74	136	2056.34	2.79
11	78	74	136	2059.25	2.91
12	78	73	137	2062.156	2.91
13	77	73	135	2064.45	2.29
14	77	74	135	2067.96	3.51
15	78	73	137	2069.49	1.53
16	78	75	133	2072.01	2.52
17	78	73	134	2074.74	2.73
18	78	74	134	2077.49	2.75
19	79	75	136	2080.21	2.72
20	78	74	135	2082.97	2.76
21	79	75	136	2085.87	2.90
22	78	73	136	2088.82	2.95
23	79	73	137	2091.59	2.77
24	79	72	135	2094.355	2.77

avg °F		76.90	135.50		
avg °R		536.90	595.50		
total				62.806000000	62.806000000
average	79.04166666667	74.75	135.5		
Sample Point	Meter Temperature Inlet (°F)	Meter Temperature Outlet (°F)	Stack Temp (°F) T	Gas Volume Vm	Gas Volume Vm

Velocity Head ΔPs (inH2O)	Pressure Diff ΔH (inH2O)	Sqrt ΔPs	Sampling Time (min)	Clock Time (24 hrs)	Vacuum (inHg)
				1600	
0.04	2.48	0.2000	3	1603	5.2
0.04	2.49	0.2000	3	1606	5.3
0.04	2.50	0.2000	3	1609	5.4
0.05	3.10	0.2236	3	1612	6.5
0.05	3.11	0.2236	3	1615	6.6
0.05	3.10	0.2236	3	1618	6.6
0.06	3.71	0.2449	3	1621	8.3
0.06	3.72	0.2449	3	1624	8.4
0.06	3.70	0.2449	3	1627	8.4
0.06	3.71	0.2449	3	1630	8.4
0.07	4.32	0.2646	3	1633	9.8
0.07	4.31	0.2646	3	1636	10
0.04	2.47	0.2000	3	1653	5.9
0.05	3.09	0.2236	3	1656	7.1
0.05	3.08	0.2236	3	1659	7.1
0.05	3.10	0.2236	3	1702	7.2
0.06	3.71	0.2449	3	1705	8.8
0.06	3.72	0.2449	3	1708	8.9
0.06	3.71	0.2449	3	1711	9
0.06	3.71	0.2449	3	1714	9
0.07	4.33	0.2646	3	1717	10.7
0.07	4.32	0.2646	3	1720	11.2
0.06	3.70	0.2449	3	1723	9.2
0.06	3.71	0.2449	3	1726	9.3

			72	72	
0.055833333	3.4535	0.2354	3	1659.5	6.0125
Velocity Head ΔPs	Pressure Diff ΔH	Sqrt ΔPs	Sampling Time	Clock Time	Vacuum

Probe Temperature Exit (°F)	Filter Temperature (°F)	Impinger Temperature Outlet (°F)
250	258	39
267	265	36
261	269	37
266	261	38
263	258	38
257	255	39
253	236	39
232	237	40
264	253	41
267	269	43
245	269	43
242	247	44
263	251	45
266	259	44
266	268	45
255	258	46
238	247	47
248	257	48
239	255	49
263	260	50
246	258	51
245	247	52
241	238	53
238	235	53

253.20833333 Probe Exit Temperature (°F)	253.20833333 Filter Temperature (°F)	44.16666667 Outlet Impinger Temperature (°F)

POST TEST CALCULATION

VOLUME DRY GAS		VOLUME H20 VAPOR		MOISTURE CONTENT	
Vm(std)	= 60.2859	Vw(std)	= 14.2246	Bws	= 0.1909
Vm	62.806000000	Vic(mls)	302.2		
Vm(std)	= 60.2859	Vw(std)	= 14.2246		

MOL WT DRY STACK GASES		STACK VELOCITY		DRY STACK FLOW RATE	
Mds	= 28.8360	Vs	= 15.5576	Q(std)	= 1.1939E+06
MOL WT WET STACK GASES		Kp	85.49		
Mws	= 28.7673	Vs	= 15.5576		

ISOKINETIC CALCULATION

An = 1.3800E-03

ISO = 100.4534

PARTICULATE CONCENTRATION

Cs = 1.4133E-03

Mn 85.2

Cs = 1.4133E-03

lbs/dscf = 3.1157E-06

grains/dscf = 0.0218

lbs/hr = 5.7197

Initial Leak Check Rate

		Pitot Tubes
Finish	2031.131	
Start	2031.115	A = OK
Rate = 0.0160		B = OK

Vac. = 22.8

Final Leak Check Rate

		Pitot Tubes
Finish	2030.844	A = Ok
Start	2031	B = Ok
Rate = -0.1560		

Vac. = 22.8

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South #5

LABORATORY DATA
(METHOD 5)

Company Western Sugar - Billings Run No. #5 Compliance EPA 5

Sampling Location South Dryer Stack West Bank Date 1/24-90

MOISTURE COLLECTED

		GM/ML	~~Water Weight/Volume Gain~~ ~~GM/ML~~
IMPINGER 1	Final Weight/Volume	743.0	
	Initial Weight/Vol.		
	Increase	562.0	181.0
IMPINGER 2	Final Weight/Volume	669.4	
	Initial Weight/Vol.		
	Increase	578.5	90.9
IMPINGER 3	Final Weight/Volume	503.8	
	Initial Weight/Vol.		
	Increase	494.8	9.0
IMPINGER 4	Final Weight/Volume	784.9	
	Initial Weight/Vol.		
	Increase	763.6	21.3
			302.2 Total

PARTICULATE COLLECTED

FRONT-HALF ANALYSIS (Nozzle, Probe, Filter, and Hot Box Glassware)

(1)	Filter & Particulates	0.7118
(2)	Filter Tare Weight	0.6688 WA-5
(3)	Net Dry Particulates (1&2)	0.0430 = 43.0mg.
(4)	Particulates Caught in Nozzle, Probe, Glassware	21.8mg.
(5)	Total Front Catch (3&4)	64.8mg.

BACK-HALF ANALYSIS (Impingers, and Connecting Glassware)

(1)	Particulate Caught in Impingers Evaporated Down at Less Than 120 F	20.4mg.

TOTAL PARTICULATE CATCH (Sum of Front and Back-Half Catches

85.2 mg.

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Western Sugar,
Montana, Billings.

ORSAT ANALYSIS

(Ave. of 3 Analyses Each)

TEST NO.	DESCRIPTION	VOLUME PERCENT - DRY			
		NITROGEN	OXYGEN	CARBON DIOXIDE	CARBON MONOXIDE
Compliance #5-S.		85.7 %	12.1 %	2.2 %	< 0.1 %
Dryer Stack		85.7 %	12.1 %	2.2 %	< 0.1 %
1/24/90		85.7 %	12.1 %	2.2 %	< 0.1 %
	AVERAGE	85.7 %	12.1 %	2.2 %	< 0.1 %

AMERICAN ENVIRONMENTAL TESTING, INCORPORATED

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Spanish Fork, Utah 84660

PARTICULATE FIELD DATA FORMAT

1	Plant	Western Sugar Co.
2	City	Billings,Montana
3	Location	Dryer Stack, Compliance #6 - N
4	Operator	J. Paul Benson
5	Date	1/24-90
6	Stack Diameter (in)	78
7	Sample Box Number	CR-1
8	Meter Box Number	1
9	Meter ΔH@	2.245
10	Meter Calibration,Y	1.07
11	Pitot Tube, Cp	0.8484
12	Probe Length (ft)	6'
13	Probe Liner Material	Stainless Steel
14	Probe Heater Setting (°F)	248
15	Ambient Temperature (°F)	69.6
16	Barometeric Press., Pb (inHg)	26.78
17	Assumed Moisture (%)	14
18	Static Pressure, Ps (inH2O)	0.03
19	C Factor	0
20	Reference ΔP (inH2O)	0.07
21	Nozzle IdentificationNumber	1/2-A
22	Nozzle Diameter (in)	0.503
23	Thermometer Number	1-A
24	Pretest Leak Rate (CFM)	0.006
25	Leak Check Vacuum (inH2O)	22.8
26	FilterNumber	MD-6
27	Gas Analysis	
28	CO (%)	0
29	CO2 (%)	2.37
30	O2 (%)	11.87
31	N2 (%)	85.76

PRETEST CALCULATIONS

NOZZLE DIAMETER

Dn = 0.503

constant	0.0357
Qm	0.75
Pb(in HG)	26.78
Pgm(in H2O)	0.03
Pm	26.7822
Cp	0.8484
Ta(°F)	72
Tm(°R)	532
Bwm	0
Bws	0.14
Ts(°F)	130
Ts(°R)	590
Mds	28.854
Ms	27.3344
Pb(in HG)	26.78
Pgs(in H2O)	0.03
Ps	26.7822
(°P)avg	0.06

Dn = 0.3992

PRETEST DATA

Cp	0.8484
Imp V(H2O)(ml)	67.5000
Gel H2O(g)	12.0000
V(H2O)(ml)	127.8000
Vm(acf)	49.2300
°h avg	0.2000
Vwc	6.0155
Vmc	46.8004

Bws = 0.1139

ISOKINETIC °H

°H = 1.6538

constant	849.8000
°H2	1.0000
Mds	28.8540
Mm	28.8540
K	27.5640
°P	0.0600

°H = 1.6538

Sample Point	Meter Temperature Outlet (°F)	Meter Temperature Inlet (°F)	Stack Temp Ts (°F)	Gas Volume Vm (ft3)	Gas Volume difference (ft3)
starting				2094.809	
1	74	71	139	2097.02	2.21
2	75	71	140	2099.21	2.19
3	75	71	143	2101.7	2.49
4	74	70	145	2104.17	2.47
5	74	70	147	2106.65	2.48
6	75	71	146	2109.12	2.47
7	74	71	142	2111.62	2.50
8	74	70	148	2114.3	2.68
9	75	70	149	2117.01	2.71
10	75	72	150	2119.62	2.61
11	76	71	144	2122.49	2.87
12	75	71	143	2125.387	2.90
13	75	71	137	2127.65	2.26
14	76	72	143	2129.85	2.20
15	76	72	144	2132.3	2.45
16	76	72	143	2134.78	2.48
17	76	71	147	2137.25	2.47
18	76	72	151	2139.71	2.46
19	76	72	150	2142.33	2.62
20	76	72	147	2145.01	2.68
21	76	71	149	2147.69	2.68
22	77	72	149	2150.57	2.88
23	77	72	148	2153.45	2.88
24	77	72	153	2156.332	2.88
avg °F		73.33	145.71		
avg °R		533.33	605.71		
total				61.522000000	61.522000000
average	75.41666667	71.25	145.70833333		
Sample Point	Meter Temperature Inlet(°F)	Meter Temperature Outlet (°F)	Stack Temp (°F) T	Gas Volume Vm	Gas Volume Vm

Velocity Head ΔPs (inH2O)	Pressure Diff ΔH (inH2O)	Sqrt ΔPs	Sampling Time (min)	Clock Time (24 hrs)	Vacuum (inHg)
				1830	
0.04	2.44	0.2000	3	1833	4.9
0.04	2.44	0.2000	3	1836	4.9
0.05	3.03	0.2236	3	1839	6.1
0.05	3.02	0.2236	3	1842	6.2
0.05	3.01	0.2236	3	1845	6.3
0.05	3.02	0.2236	3	1848	6.4
0.05	3.04	0.2236	3	1851	6.2
0.06	3.60	0.2449	3	1854	7.4
0.06	3.60	0.2449	3	1857	7.5
0.06	3.60	0.2449	3	1900	7.6
0.07	4.24	0.2646	3	1903	9.2
0.07	4.25	0.2646	3	1906	9.3
0.04	2.45	0.2000	3	1933	5.4
0.04	2.43	0.2000	3	1936	5.4
0.05	3.03	0.2236	3	1939	6.7
0.05	3.04	0.2236	3	1942	6.8
0.05	3.02	0.2236	3	1945	6.8
0.05	3.00	0.2236	3	1948	6.8
0.06	3.60	0.2449	3	1951	7.3
0.06	3.62	0.2449	3	1954	7.3
0.06	3.61	0.2449	3	1957	7.5
0.07	4.22	0.2646	3	2000	9.8
0.07	4.22	0.2646	3	2003	9.8
0.07	4.19	0.2646	3	2006	10
			72	72	
0.055	3.3218	0.2335	3	1909.5	7.15
Velocity Head ΔPs	Pressure Diff ΔH	Sqrt ΔPs	Sampling Time	Clock Time	Vacuum

Probe Temperature Exit (°F)	Filter Temperature (°F)	Impinger Temperature Outlet (°F)
248	252	37
255	261	36
250	264	36
248	243	35
249	265	35
264	266	37
233	268	38
232	262	39
262	263	40
265	256	41
260	249	43
233	238	45
236	241	41
248	257	42
244	268	43
253	269	43
258	260	43
262	260	44
267	251	44
266	248	44
255	247	46
249	233	47
244	239	48
240	249	48

250.45833333 Probe Exit Temperature (°F)	250.45833333 Filter Temperature (°F)	41.458333333 Outlet Impinger Temperature (°F)

POST TEST CALCULATION

VOLUME DRY GAS		VOLUME H20 VAPOR		MOISTURE CONTENT	
Vm(std)	= 59.0114	Vw(std)	= 13.8904	Bws	= 0.1905
Vm	61.523000000	Vic(mls)	295.1		
Vm(std)	= 59.0114	Vw(std)	= 13.8904		

MOL WT DRY STACK GASES		STACK VELOCITY		DRY STACK FLOW RATE	
Mds	= 28.8540	Vs	= 15.5646	Q(std)	= 1.1744E+06

MOL WT WET STACK GASES		Kp	85.49
Mws	= 26.7059	Vs	= 15.5646

ISOKINETIC CALCULATION		PARTICULATE CONCENTRATION	
An	= 1.3000E-03	Cs	= 1.0778E-03
ISO	= 100.5011	Mn	63.6
		Cs	= 1.0778E-03
		lbs/dscf	= 2.3760E-06
		grains/dscf	= 0.0166
		lbs/hr	= 2.7903

Initial Leak Check Rate

Finish	2094.62	Pitot Tubes	
Start	2094.614	A = OK	
Rate	= 0.0060	B = OK	

Vac. = 22.8

Final Leak Check Rate

Finish	2156.53	Pitot Tubes	
Start	2156.521	A = Ok	
Rate	= 0.0090	B = Ok	

Vac. = 22.8

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North #6

LABORATORY DATA
(METHOD 5)

Company Western Sugar Billings, Mont. Run No. #6 North.

Sampling Location West Dryer - North Stack. Date

MOISTURE COLLECTED

		~~GM/ML~~	Water Weight/~~Volume Gain~~ ~~GM/ML~~
IMPINGER 1	Final Weight/Volume	719.8	
	Initial Weight/Vol.		
	Increase	576.9	142.9
IMPINGER 2	Final Weight/Volume	713.2	
	Initial Weight/Vol.		
	Increase	597.6	115.6
IMPINGER 3	Final Weight/Volume	466.7	
	Initial Weight/Vol.		
	Increase	454.7	12.0
IMPINGER 4	Final Weight/Volume	830.0 805.4	
	Initial Weight/Vol.		
	Increase		24.6

PARTICULATE COLLECTED 295.1 = Total

FRONT-HALF ANALYSIS (Nozzle, Probe, Filter, and Hot Box Glassware)

(1)	Filter & Particulates	0.6894
(2)	Filter Tare Weight	0.6599 WD-6
(3)	Net Dry Particulates (1&2)	0.0295 = 29.5 mg.
(4)	Particulates Caught in Nozzle, Probe, Glassware	20.8 mg.
(5)	Total Front Catch (3&4)	51.3 mg.

BACK-HALF ANALYSIS (Impingers, and Connecting Glassware)

(1)	Particulate Caught in Impingers Evaporated Down at Less Than 120 F	12.3 mg.

TOTAL PARTICULATE CATCH (Sum of Front and Back-Half Catches

63.6 mg.

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Weston Sugar.
Billings, Montana
Sugar Plant.

ORSAT ANALYSIS

(Ave. of 3 Analyses Each)

TEST NO.	DESCRIPTION	VOLUME PERCENT - DRY			
		NITROGEN	OXYGEN	CARBON DIOXIDE	CARBON MONOXIDE
Compliance #6-N		95.7 %	11.9 %	2.4 %	< 0.1 %
Dryer Stack		95.8 %	11.9 %	2.3 %	< 0.1 %
1/24-90		95.8 %	11.8 %	2.4 %	< 0.1 %
	AVERAGE	95.76 %	11.87 %	2.37 %	< 0.1 %

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PARTICULATE FIELD DATA FORMAT

1	Plant	Western Sugar Co.
2	City	Billings,Montana
3	Location	Boiler Stack, Compliance #1
4	Operator	J. Paul Benson
5	Date	1/25-90
6	Stack Diameter (in)	137
7	Sample Box Number	CR-1
8	Meter Box Number	1
9	Meter ΔHe	2.245
10	Meter Calibration,Y	1.07
11	Pitot Tube, Cp	0.8484
12	Probe Length (ft)	6'
13	Probe Liner Material	Stainless Steel
14	Probe Heater Setting (°F)	248
15	Ambient Temperature (°F)	41.2
16	Barometeric Press., Pb (inHg)	26.61
17	Assumed Moisture (%)	14
18	Static Pressure, Ps (inH2O)	0.18
19	C Factor	0
20	Reference ΔP (inH2O)	0.14
21	Nozzle IdentificationNumber	3/8 - 4
22	Nozzle Diameter (in)	0.375
23	Thermometer Number	1-A
24	Pretest Leak Rate (CFM)	0.110
25	Leak Check Vacuum (inH2O)	22.8
26	FilterNumber	B-1
27	Gas Analysis	
28	CO (%)	0
29	CO2 (%)	5.2
30	O2 (%)	10.6
31	N2 (%)	84.2

PRETEST CALCULATIONS

NOZZLE DIAMETER		PRETEST DATA		ISOKINETIC ΔH	
Dn = 0.375				ΔH = 1.2248	
constant	0.0357	Cp	0.8484	constant	849.8000
Qm	0.75	Imp V(H2O)(ml)	67.5000	ΔH@	1.0000
Pb(in Hg)	26.61	Gel H2O(g)	12.0000	Mds	29.2560
Pgm(in H2O)	0.18	V(H2O)(ml)	127.8000	Mm	29.2560
Pm	26.6232	Vm(acf)	49.2300	K	8.7484
Cp	0.8484	ΔH avg	0.2000	ΔP	0.1400
Tm(°F)	72	Vwc	6.0155	ΔH = 1.2248	
Tm(°R)	532	Vmc	46.5035		
Bwm	0	Bws = 0.1145			
Bws	0.14				
Ts(°F)	115				
Ts(°R)	575				
Mds	29.256				
Ms	27.6802				
Pb(in Hg)	26.61				
Pgs(in H2O)	0.18				
Ps	26.6232				
(ΔP)avg	0.14				
Dn = 0.3215					

Sample Point	Meter Temperature Outlet (°F)	Meter Temperature Inlet (°F)	Stack Temp Ts (°F)	Gas Volume Vm (ft3)	Gas Volume difference (ft3)
starting				2156.891	
1	71	68	115	2159.21	2.32
2	68	65	111	2161.552	2.34
3	71	66	110	2163.92	2.37
4	71	68	111	2166.31	2.39
5	72	68	112	2168.7	2.39
6	73	68	118	2171.089	2.39
7	72	68	109	2173.22	2.13
8	74	71	105	2175.38	2.16
9	75	71	111	2177.57	2.19
10	75	71	109	2179.77	2.20
11	75	70	112	2181.97	2.20
12	77	72	113	2184.249	2.28
13	76	70	109	2186.45	2.20
14	75	71	108	2188.79	2.34
15	74	69	110	2191.14	2.35
16	75	71	108	2193.5	2.36
17	77	72	107	2195.78	2.28
18	76	71	112	2198.111	2.33
19	74	70	109	2200.66	2.55
20	75	72	111	2203.22	2.56
21	74	71	110	2205.69	2.47
22	75	72	109	2208.13	2.44
23	74	71	106	2210.58	2.45
24	76	72	107	2213.018	2.44

avg °F		71.94	110.08		
avg °R		531.94	570.08		
total				56.127	56.127
average	73.958333333	69.91666667	110.08333333		
Sample Point	Meter Temperature Inlet (°F)	Meter Temperature Outlet (°F)	Stack Temp (°F) T	Gas Volume Vm	Gas Volume Vm

Velocity Head ΔPs (inH20)	Pressure Diff ΔH (inH20)	Sqrt ΔPs	Sampling Time (min)	Clock Time (24 hrs)	Vacuum (inHg)
				1030	
0.14	2.74	0.3742	3	1033	5.3
0.14	2.74	0.3742	3	1036	5.2
0.15	2.95	0.3873	3	1039	5.5
0.15	2.95	0.3873	3	1042	5.6
0.15	2.95	0.3873	3	1045	5.6
0.15	2.92	0.3873	3	1048	5.8
0.11	2.18	0.3317	3	1113	4.8
0.12	2.40	0.3464	3	1116	4.9
0.12	2.36	0.3464	3	1119	5.1
0.12	2.39	0.3464	3	1122	5.2
0.12	2.37	0.3464	3	1125	5.3
0.13	2.56	0.3606	3	1128	5.6
0.12	2.39	0.3464	3	1143	5.4
0.14	2.79	0.3742	3	1146	6.1
0.14	2.77	0.3742	3	1149	6.2
0.14	2.79	0.3742	3	1152	6.4
0.13	2.60	0.3606	3	1155	6.2
0.14	2.77	0.3742	3	1158	6.3
0.17	3.38	0.4123	3	1203	7.6
0.17	3.37	0.4123	3	1206	7.7
0.15	2.98	0.3873	3	1209	7.3
0.15	2.99	0.3873	3	1212	7.3
0.15	3.00	0.3873	3	1215	7.3
0.15	3.00	0.3873	3	1218	7.3

			72	72	
0.1395833333	2.7659	0.3750	3	1130.5	0.0416666667
Velocity Head ΔPs	Pressure Diff ΔH	Sqrt ΔPs	Sampling Time	Clock Time	Vacuum

Probe Temperature Exit (°F)	Filter Temperature (°F)	Impinger Temperature Outlet (°F)
253	229	38
233	232	38
233	234	39
265	236	40
263	236	39
267	244	40
234	243	40
235	248	39
236	246	39
232	229	39
240	233	40
269	234	40
270	269	42
229	269	39
233	267	41
229	265	43
238	262	44
244	263	42
229	233	45
234	234	47
247	262	46
239	264	44
242	253	46
237	256	47

242.95833333	242.95833333	41.54166667
Probe Exit Temperature (°F)	Filter Temperature (°F)	Outlet Impinger Temperature (°F)

POST TEST CALCULATION

VOLUME DRY GAS		VOLUME H2O VAPOR		MOISTURE CONTENT	
Vm(std)	= 53.4156	Vw(std)	= 11.8899	Bws	= 0.1821
Vm	56.127	Vic(ml's)	252.6		
Vm(std)	= 53.4156	Vw(std)	= 11.8899		

MOL WT DRY STACK GASES		STACK VELOCITY		DRY STACK FLOW RATE	
Mds	= 29.2560	Vs	= 24.0030	Q(std)	= 5.9628E+06
MOL WT WET STACK GASES		Kp	85.49		
Mws	= 27.2067	Vs	= 24.0030		

ISOKINETIC CALCULATION		PARTICULATE CONCENTRATION	
An	= 7.6699E-04	Cs	= 5.0641E-03
ISO	= 99.6568	Mn	270.5
		Cs	= 5.0641E-03
		lbs/dscf	= 1.1164E-05
		grains/dscf	= 0.0781
		lbs/hr	= 66.5697

Initial Leak Check Rate

Finish	2156.71	Pitot Tubes	
Start	2156.6	A = OK	
Rate	= 0.1100	B = OK	

Vac. = 22.8

Final Leak Check Rate

Finish	2213.197	Pitot Tubes	
Start	2213.183	A = Ok	
Rate	= 0.0140	B = Ok	

Vac. = 22.8

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LABORATORY DATA
(METHOD 5)

Company Western Sugar Billings Mont. Run No. #1 Compliance.

Sampling Location Boiler Stack Date 1-25-90

MOISTURE COLLECTED

		GM/ML	Water Weight/Volume Gain GM/ML
IMPINGER 1	Final Weight/Volume	764.9	
	Initial Weight/Vol.		
	Increase	576.6	+ 188.3
IMPINGER 2	Final Weight/Volume	~~658.3~~ 645.3	
	Initial Weight/Vol.		
	Increase	599.1	+ 46.2
IMPINGER 3	Final Weight/Volume	458.3	
	Initial Weight/Vol.		
	Increase	455.8	+ 2.5
IMPINGER 4	Final Weight/Volume	802.9	
	Initial Weight/Vol.		
	Increase	787.3	+ 15.6

PARTICULATE COLLECTED 252.6 g total.

JB 1/25/90 MAQB

FRONT-HALF ANALYSIS (Nozzle, Probe, Filter, and Hot Box Glassware)

(1) Filter & Particulates	0.9040
(2) Filter Tare Weight	0.6567g B-1
(3) Net Dry Particulates (1&2)	0.2473 = 247.3mg.
(4) Particulates Caught in Nozzle, Probe, Glassware	9.5mg.
(5) Total Front Catch (3&4)	256.8 mg.

BACK-HALF ANALYSIS (Impingers, and Connecting Glassware)

(1) Particulate Caught in Impingers Evaporated Down at Less Than 120 F	13.7mg.

TOTAL PARTICULATE CATCH (Sum of Front and Back-Half ~~Catches~~

270.5mg.

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801-266-7111

Western Sugar
Billings, Montana.
1/25.90

ORSAT ANALYSIS

(Ave. of 3 Analyses Each)

TEST NO.	DESCRIPTION	VOLUME PERCENT - DRY			
		NITROGEN	OXYGEN	CARBON DIOXIDE	CARBON MONOXIDE
	Compliance #1	84.2 %	10.6 %	5.2 %	<0.1 %
	Boiler Stack	84.2 %	10.6 %	5.2 %	<0.1 %
		84.2 %	10.6 %	5.2 %	<0.1 %
	AVERAGE	84.2 %	10.6 %	5.2 %	<0.1 %

JAP
1/25/90
MAQB

AMERICAN ENVIRONMENTAL TESTING, INCORPORATED

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PARTICULATE FIELD DATA FORMAT

1	Plant	Western Sugar Co.
2	City	Billings, Montana
3	Location	Boiler Stack, Compliance #2
4	Operator	J. Paul Benson
5	Date	1/25-90
6	Stack Diameter (in)	137
7	Sample Box Number	CR-1
8	Meter Box Number	1
9	Meter $\Delta H@$	2.245
10	Meter Calibration, Y	1.07
11	Pitot Tube, Cp	0.8484
12	Probe Length (ft)	6'
13	Probe Liner Material	Stainless Steel
14	Probe Heater Setting (°F)	248
15	Ambient Temperature (°F)	47.7
16	Barometeric Press., Pb (inHg)	26.49
17	Assumed Moisture (%)	18
18	Static Pressure, Ps (inH2O)	0.18
19	C Factor	0
20	Reference ΔP (inH2O)	0.14
21	Nozzle Identification Number	3/8 - 4
22	Nozzle Diameter (in)	0.375
23	Thermometer Number	1-A
24	Pretest Leak Rate (CFM)	0.011
25	Leak Check Vacuum (inH2O)	22.8
26	Filter Number	B-2
27	Gas Analysis	
28	CO (%)	0
29	CO2 (%)	6.8
30	O2 (%)	10
31	N2 (%)	83.2

PRETEST CALCULATIONS

NOZZLE DIAMETER		PRETEST DATA		ISOKINETIC ΔH	
Dn = 0.375				ΔH = 1.1330	
constant	0.0257	Cp	0.8484	constant	849.8000
Δm	0.75	Imp V(H2O)(ml)	87.5000	ΔH@	1.0000
Pb(in Hg)	26.49	Gel H2O(g)	12.0000	Mds	29.4880
Pgm(in H2O)	0.18	V(H2O)(ml)	127.8000	Mm	29.4880
Pm	26.5032	Vm(act)	49.2300	K	8.0926
Cp	0.8484	Δh avg	0.2000	ΔP	0.1400
Tm(°F)	72	Vwc	6.0155	ΔH = 1.1330	
Tm(°R)	532	Vac	46.2939		
Bwm	0	Bws = 0.1150			
Bws	0.18				
Ts(°F)	115				
Ts(°R)	575				
Mds	29.488				
Ms	27.4202				
Pb(in Hg)	26.49				
Pgs(in H2O)	0.18				
Ps	26.5032				
(ΔP)avg	0.14				
Dn = 0.3204					

Sample Point	Meter Temperature Outlet (°F)	Meter Temperature Inlet (°F)	Stack Temp Ts (°F)	Gas Volume Vm (ft3)	Gas Volume difference (ft3)
starting				2213.496	
1	76	73	110	2215.77	2.27
2	77	74	114	2218.06	2.29
3	75	72	110	2220.35	2.29
4	74	71	111	2222.71	2.36
5	76	72	113	2225.06	2.35
6	75	71	116	2227.428	2.37
7	75	71	113	2229.48	2.05
8	76	72	112	2231.48	2.00
9	78	73	112	2233.51	2.03
10	77	73	113	2235.56	2.05
11	79	74	110	2237.6	2.04
12	79	75	111	2239.801	2.20
13	80	76	109	2242.01	2.21
14	83	78	110	2244.22	2.21
15	80	75	110	2246.51	2.29
16	80	75	112	2248.82	2.31
17	81	76	111	2251.13	2.31
18	80	76	110	2253.419	2.29
19	80	76	113	2255.77	2.35
20	81	77	114	2258.19	2.42
21	82	77	113	2260.63	2.44
22	83	77	115	2262.94	2.31
23	84	78	113	2265.25	2.31
24	84	78	114	2267.554	2.30
avg °F		76.77	112.04		
avg °R		536.77	572.04		
total				54.058000000	54.058000000
average	78.75833333	74.583333333	112.04166667		
Sample Point	Meter Temperature Inlet(°F)	Meter Temperature Outlet (°F)	Stack Temp (°F) T	Gas Volume Vm	Gas Volume Vm

Velocity Head Ps (inH20)	Pressure Diff H (inH20)	Sqrt Ps	Sampling Time (min)	Clock Time (24 hrs)	Vacuum (inHg)
				1430	
0.14	2.56	0.3742	3	1433	5.1
0.14	2.57	0.3742	3	1436	5.1
0.14	2.57	0.3742	3	1439	5.1
0.15	2.75	0.3873	3	1442	5.5
0.15	2.75	0.3873	3	1445	5.7
0.15	2.73	0.3873	3	1448	5.7
0.11	2.01	0.3317	3	1503	4.3
0.11	2.02	0.3317	3	1506	4.3
0.11	2.02	0.3317	3	1509	4.3
0.11	2.02	0.3317	3	1512	4.3
0.11	2.03	0.3317	3	1515	4.5
0.13	2.40	0.3606	3	1518	5.2
0.13	2.41	0.3606	3	1533	5.1
0.13	2.42	0.3606	3	1536	5.2
0.14	2.59	0.3742	3	1539	6
0.14	2.58	0.3742	3	1542	6.1
0.14	2.59	0.3742	3	1545	6.1
0.14	2.60	0.3742	3	1548	6.1
0.15	2.77	0.3873	3	1603	6.2
0.16	2.95	0.4000	3	1606	6.9
0.16	2.96	0.4000	3	1609	7
0.14	2.58	0.3742	3	1612	6.3
0.14	2.60	0.3742	3	1615	6.3
0.14	2.59	0.3742	3	1618	6.3

			72	72	
0.1358333333	2.5042	0.3680	3	1525.5	5.5291666667
Velocity Head Ps	Pressure Diff H	Sqrt Ps	Sampling Time	Clock Time	Vacuum

Probe Temperature Exit (°F)	Filter Temperature (°F)	Impinger Temperature Outlet (°F)
269	270	48
269	270	41
262	264	38
254	252	39
269	254	40
259	264	41
244	267	43
229	269	43
231	248	37
232	241	42
268	248	44
255	262	46
256	269	45
245	270	43
263	240	42
260	266	44
269	270	46
258	268	47
239	248	48
242	253	44
245	249	45
266	256	46
268	269	42
260	254	43

254.00000007	254.00000007	43.20833333
Probe Exit Temperature (°F)	Filter Temperature (°F)	Outlet Impinger Temperature (°F)

POST TEST CALCULATION

VOLUME DRY GAS		VOLUME H2O VAPOR		MOISTURE CONTENT	
Vm(std)	= 51.1794	Vw(std)	= 12.1394	Bws	= 0.1917
Vm	54.0588000000	Vlc(ml's)	257.9		
Vm(std)	= 51.1794	Vw(std)	= 12.1394		

MOL WT DRY STACK GASES		STACK VELOCITY		DRY STACK FLOW RATE	
Mds	= 29.4660	Vs	= 23.7358	Q(std)	= 5.7807E+06
MOL WT WET STACK GASES		Kp	85.49		
Mws	= 27.2855	Vs	= 23.7358		

ISOKINETIC CALCULATION

An = 7.6699E-04

ISO = 97.7761

PARTICULATE CONCENTRATION

Cs = 5.1876E-03

Mn 265.5

Cs = 5.1876E-03

lbs/dscf = 1.1437E-05

grains/dscf = 0.0801

lbs/hr = 66.1117

Initial Leak Check Rate

Finish	2213.437	Pitot Tubes
Start	2213.426	A = OK
Rate = 0.0110		B = OK

Vac. = 22.8

Final Leak Check Rate

Finish	2267.728	Pitot Tubes
Start	2267.715	A = OK
Rate = 0.0110		B = OK

Vac. = 22.8

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LABORATORY DATA
(METHOD 5)

Company Western Sugar Billings Mont. Run No. #2 Compliance

Sampling Location Boiler Stack Date 1-25-90

MOISTURE COLLECTED

		~~GM/ML~~	Water Weight ~~Volume Gain~~ ~~GM/ML~~
IMPINGER 1	Final Weight/Volume	739.8	
	Initial Weight/Vol.		
	Increase	~~566.0~~	+ 173.8
IMPINGER 2	Final Weight/Volume	649.0	
	Initial Weight/Vol.		
	Increase	585.1	+ 63.9
IMPINGER 3	Final Weight/Volume	499.4	
	Initial Weight/Vol.		
	Increase	496.1	+ 3.3
IMPINGER 4	Final Weight/Volume	790.6	
	Initial Weight/Vol.		
	Increase	773.7	+ 16.9

PARTICULATE COLLECTED 257.9 g total

FRONT-HALF ANALYSIS (Nozzle, Probe, Filter, and Hot Box Glassware)

(1)	Filter & Particulates	0.8981
(2)	Filter Tare Weight	0.6600 B-2
(3)	Net Dry Particulates (1&2)	0.2381 = 238.1 mg.
(4)	Particulates Caught in Nozzle, Probe, Glassware	11.0 mg.
(5)	Total Front Catch (3&4)	249.1 mg

BACK-HALF ANALYSIS (Impingers, and Connecting Glassware)

(1)	Particulate Caught in Impingers Evaporated Down at Less Than 120 F	16.4 mg.

TOTAL PARTICULATE CATCH (Sum of Front and Back-Half Catches

265.5 mg.

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801-266-7111

Western Sugar
Billings, Montana
1/25-90

ORSAT ANALYSIS

(Ave. of 3 Analyses Each)

TEST NO. DESCRIPTION	VOLUME PERCENT - DRY			
	NITROGEN	OXYGEN	CARBON DIOXIDE	CARBON MONOXIDE
Compliance #2	83.2 %	10.0%	6.8%	<0.1 %
Boiler Stack	83.2%	10.0 %	6.8%	<0.1 %
	83.2 %	10.0 %	6.8%	<0.1 %
AVERAGE	83.2 %	10.0%	6.8 %	<0.1 %

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Spanish Fork, Utah 84660

PARTICULATE FIELD DATA FORMAT

1	Plant	Western Sugar Co.
2	City	Billings, Montana
3	Location	Boiler Stack, Compliance #3
4	Operator	J. Paul Benson
5	Date	1/25-90
6	Stack Diameter (in)	137
7	Sample Box Number	CR-1
8	Meter Box Number	1
9	Meter Hé	2.245
10	Meter Calibration,)	1.07
11	Pitot Tube, Cp	0.8484
12	Probe Length (ft)	6'
13	Probe Liner Material	Stainless Steel
14	Probe Heater Setting (°F)	246
15	Ambient Temperature (°F)	40.9
16	Barometeric Press., Pb (inHg)	26.39
17	Assumed Moisture (%)	18
18	Static Pressure, Ps (inH2O)	0.18
19	C Factor	0
20	Reference ΔP (inH2O)	0.14
21	Nozzle Identification Number	3/8 - 4
22	Nozzle Diameter (in)	0.375
23	Thermometer Number	1-A
24	Pretest Leak Rate (CFM)	0.008
25	Leak Check Vacuum (inH2O)	22.8
26	Filter Number	B-3
27	Gas Analysis	
28	CO (%)	0
29	CO2 (%)	7.17
30	O2 (%)	10.13
31	N2 (%)	82.7

PRETEST CALCULATIONS

NOZZLE DIAMETER		PRETEST DATA		ISOKINETIC %I	
Dn = 0.375				%I = 1.1333	
constant	0.0357	Cp	0.8484	constant	849.8000
Um	0.75	Imp V(H2O)(ml)	67.5000	%Ha	1.0000
Pb(in HG)	26.39	Gel H2O(g)	12.0000	Mds	29.5524
Pgm(in H2O)	0.18	V(H2O)(ml)	127.8000	Mm	29.5524
Pm	26.4032	Vm(act)	49.2300	K	8.0947
Cp	0.8484	%h avg	0.2000	%P	0.1400
Tm(°F)	72	Vwc	6.0155	%I = 1.1333	
Tm(°R)	532	Vwc	46.1192		
Bwm	0	Bws = 0.1154			
Bws	0.18				
Ts(°F)	115				
Ts(°R)	575				
Mds	29.5524				
Ms	27.4730				
Pb(in HG)	26.39				
Pgs(in H2O)	0.18				
Ps	26.4032				
(%P)avg	0.14				
Dn = 0.3203					

Sample Point	Meter Temperature Outlet (°F)	Meter Temperature Inlet (°F)	Stack Temp Ts (°F)	Gas Volume Vm (ft3)	Gas Volume difference (ft3)
starting				2274.22	
1	79	76	107	2276.66	2.46
2	79	76	109	2279.1	2.42
3	77	75	106	2281.38	2.28
4	78	76	111	2283.73	2.35
5	77	74	112	2286.08	2.35
6	76	73	107	2288.429	2.35
7	77	73	108	2290.47	2.04
8	78	74	109	2292.47	2.00
9	79	75	114	2294.59	2.12
10	79	74	109	2296.7	2.11
11	78	74	112	2298.89	2.19
12	78	73	108	2301.118	2.23
13	78	73	110	2303.26	2.14
14	80	75	114	2305.52	2.26
15	80	75	110	2307.83	2.31
16	78	74	111	2310.15	2.32
17	78	73	112	2312.45	2.30
18	79	74	109	2314.815	2.36
19	80	76	113	2317.31	2.49
20	79	75	109	2319.82	2.51
21	78	73	108	2322.29	2.47
22	79	74	109	2324.67	2.38
23	79	74	108	2327.03	2.36
24	80	75	112	2329.386	2.36

avg °F		76.40	109.96		
avg °R		536.40	569.96		
total				55.166000000	55.166000000
average	78.458333333	74.333333333	109.95833333		
Sample Point	Meter Temperature Inlet (°F)	Meter Temperature Outlet (°F)	Stack Temp (°F) T	Gas Volume Vm	Gas Volume Vm

Velocity Head ΔPs (inH2O)	Pressure Diff ΔH (inH2O)	Sqrt ΔPs	Sampling Time (min)	Clock Time (24 hrs)	Vacuum (inHg)
				1710	
0.14	2.61	0.3742	3	1713	5
0.14	2.60	0.3742	3	1716	5.1
0.14	2.60	0.3742	3	1719	5.1
0.15	2.77	0.3873	3	1722	5.4
0.15	2.76	0.3873	3	1725	5.5
0.15	2.78	0.3873	3	1728	5.6
0.11	2.04	0.3317	3	1743	4.3
0.11	2.04	0.3317	3	1746	4.4
0.12	2.21	0.3464	3	1749	4.9
0.12	2.22	0.3464	3	1752	4.9
0.13	2.39	0.3606	3	1755	5.2
0.13	2.41	0.3606	3	1758	5.5
0.12	2.22	0.3464	3	1813	5.1
0.14	2.58	0.3742	3	1816	5.9
0.14	2.59	0.3742	3	1819	6
0.14	2.58	0.3742	3	1822	6.1
0.14	2.58	0.3742	3	1825	6.1
0.15	2.78	0.3873	3	1828	6.7
0.17	3.14	0.4123	3	1843	7.4
0.17	3.15	0.4123	3	1846	7.4
0.16	2.96	0.4000	3	1849	7.2
0.15	2.78	0.3873	3	1852	7.1
0.15	2.78	0.3873	3	1855	7.1
0.15	2.77	0.3873	3	1858	7.1
			72	72	
0.140410000	2.5970	0.3741	3	1865.5	5.8375
Velocity Head ΔPs	Pressure Diff ΔH	Sqrt Ps	Sampling Time	Clock Time	Vacuum

Probe Temperature Exit (°F)	Filter Temperature (°F)	Impinger Temperature Outlet (°F)
235	269	34
264	266	34
260	270	35
265	261	35
235	259	35
237	250	36
252	261	41
253	266	40
254	265	37
267	265	38
240	269	37
252	260	38
239	341	43
243	246	40
269	258	39
262	264	40
252	260	39
239	239	41
262	249	41
268	251	42
263	235	43
249	244	42
245	236	43
267	236	46

253.4166667 Probe Exit Temperature (°F)	253.4166667 Filter Temperature (°F)	39.125 Outlet Impinger Temperature (°F)

POST TEST CALCULATION

VOLUME DRY GAS		VOLUME H2O VAPOR		MOISTURE CONTENT	
Vm(std)	= 52.0459	Vw(std)	= 12.3841	Bws	= 0.1922

Vm	55.16000000	Vic(mls)	263.1
Vm(std)	= 52.0459	Vw(std)	= 12.3841

MOL WT DRY STACK GASES		STACK VELOCITY		DRY STACK FLOW RATE	
Mds	= 29.5524	Vs	= 24.1139	Q(std)	= 5.8685E+06

MOL WT WET STACK GASES		Kp	85.49
Mws	= 27.3319	Vs	= 24.1139

ISOKINETIC CALCULATION		PARTICULATE CONCENTRATION	
An	= 7.6079E-04	Cs	= 5.3184E-03
ISO	= 98.0007	Mn	276.8
		Cs	= 5.3184E-03
		lbs/dscf	= 1.1725E-05
		grains/dscf	= 0.0821
		lbs/hr	= 68.8066

Initial Leak Check Rate

		Pitot Tubes	
Finish	2274.577	A	= OK
Start	2274.569	B	= OK
Rate	= 0.0080		

Vac. = 22.8

Final Leak Check Rate

		Pitot Tubes	
Finish	2329.54	A	= Ok
Start	2329.531	B	= Ok
Rate	= 0.0090		

Vac. = 22.8

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LABORATORY DATA
(METHOD 5)

Company Western Sugar Billings Mont. Run No. #3 Compliance

Sampling Location Boiler Stack Date 1-25-90.

MOISTURE COLLECTED

		GM/ML	Water Weight/Volume Gain GM/ML
IMPINGER 1	Final Weight/Volume	1064.0	
	Initial Weight/Vol.		
	Increase	576.7	+177.5
IMPINGER 2	Final Weight/Volume	670.3	
	Initial Weight/Vol.		
	Increase	603.3	+ 67.0
IMPINGER 3	Final Weight/Volume	458.7	
	Initial Weight/Vol.		
	Increase	455.3	+ 3.4
IMPINGER 4	Final Weight/Volume	797.9	
	Initial Weight/Vol.		
	Increase	782.7	+ 15.2

PARTICULATE COLLECTED 263.1g total

FRONT-HALF ANALYSIS (Nozzle,Probe,Filter,and Hot Box Glassware)

(1)	Filter & Particulates	0.9014
(2)	Filter Tare Weight	0.6520 B-3
(3)	Net Dry Particulates (1&2)	~~0.2444 10.6 mg.~~ =244.4
(4)	Particulates Caught in Nozzle,Probe,Glassware	10.6 mg.
(5)	Total Front Catch (3&4)	255.0 mg.

BACK-HALF ANALYSIS (Impingers,and Connecting Glassware)

(1)	Particulate Caught in Impingers Evaporated Down at Less Than 120 F	21.8 mg.

TOTAL PARTICULATE CATCH (Sum of Front and Back-Half Catches

276.8 mg.

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Western Sugar
Billings, Mont.
1/25-90

ORSAT ANALYSIS

(Ave. of 3 Analyses Each)

TEST NO.	DESCRIPTION	VOLUME PERCENT - DRY			
		NITROGEN	OXYGEN	CARBON DIOXIDE	CARBON MONOXIDE
Compliance #3.		82.7	10.1	7.2	<0.1
Boiler Stack.		82.7	10.2	7.1	<0.1
		82.7	10.1	7.2	<0.1
	AVERAGE	82.7	10.13	7.17	<0.1

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Western Sugar Co.
Billings, Mont.
West Dryer Bank.
South.
1/23/90 →

NOZZLE PROBE AND PREFILTER WASHING

ACETONE BLANK

Volume Liquid	350 mls.
Final Weight	99.7658
Tare Weight	99.7655
Residue	0.0003

RUN 1

Volume Liquid	350 mls. adj.
Color	Clear - Some part.
Final Weight	98.2830
Tare Weight	98.2707
Residue & Blank	0.0123
- Blank	0.0003
Residue	0.0120
	= 12.0 mg

RUN 2

Volume Liquid	350 mls adj.
Color	Clear - Some part.
Final Weight	98.2986
Tare Weight	98.2830
Residue & Blank	0.0156
- Blank	0.0003
Residue	0.0153 = 15.3 mg.

RUN 3

Volume Liquid	350 mls adj.
Color	Clear - Some part.
Final Weight	98.3207
Tare Weight	98.2986
Residue & Blank	0.0221
- Blank	0.0003
Residue	0.0218
	= 21.8 mg.

IMPINGER LIQUID (BACK HALF ANALYSIS)

DISTILLED WATER BLANK

Volume Liquid	250 mls.
Final Weight	102.7134
Tare Weight	102.7132
Residue	0.0002

RUN 1

Weight Collected	268.0 g.
Final Weight	95.7664
Tare Weight	95.7593
Residue & Blank	0.0071
- Blank	0.0002
Residue	0.0069
	= 6.9 mg

RUN 2

Weight Collected	229.1 g.
Final Weight	95.7766
Tare Weight	95.7664
Residue & Blank	~~95.7664~~ 0.0102
- Blank	0.002
Residue	0.0100
	= 10.0 mg

RUN 3

Weight Collected	302.2 g. ~~297.2 mg~~
Final Weight	95.7972
Tare Weight	95.7766
Residue & Blank	0.0206
- Blank	0.0002
Residue	0.0204
	20.4 mg.

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Westbrook Sugar
Billings, Mont.
WEST Dryer Bank.
North.
1/23/90 →

NOZZLE PROBE AND PREFILTER WASHING

ACETONE BLANK

Volume Liquid	
Final Weight	
Tare Weight	
Residue	

See South

RUN 1

Volume Liquid	350 mls. adj.
Color	Clear - some solids
Final Weight	98.0165
Tare Weight	97.9947
Residue & Blank	0.0218
- Blank	0.0003
Residue	0.0215

=21.5mg.

MSA-1

RUN 2

Volume Liquid	350 mls. adj.
Color	Clear - some solids.
Final Weight	98.0288
Tare Weight	98.0265
Residue & Blank	0.0223
- Blank	0.0002
Residue	0.0220

=22.0mg.

MSA-1

RUN 3

Volume Liquid	350 mls. adj.
Color	Clear - some solids.
Final Weight	98.0599
Tare Weight	98.0388
Residue & Blank	0.0211
- Blank	0.0003
Residue	0.0208

=20.8mg.

MSA-1

IMPINGER LIQUID
(BACK HALF ANALYSIS)

DISTILLED WATER BLANK

Volume Liquid	
Final Weight	
Tare Weight	
Residue	

See South

RUN 1

Weight Collected	249.0 g.
Final Weight	110.1763
Tare Weight	110.1828
Residue & Blank	0.0032
- Blank	0.0002
Residue	0.0033

=3.3mg.

MSA-2

RUN 2

Weight Collected	271.2 g.
Final Weight	110.1898
Tare Weight	110.1763
Residue & Blank	0.0135
- Blank	0.0002
Residue	0.0133

=13.3mg.

MSA-2

RUN 3

Weight Collected	295.1 g.
Final Weight	110.2023
Tare Weight	110.1898
Residue & Blank	0.0125
- Blank	0.0002
Residue	0.0123

=12.3mg.

MSA-2

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801-266-7111

Western Sugar
Billings, Mont.
Boiler 1/90

NOZZLE PROBE AND PREFILTER WASHING

ACETONE BLANK

Volume Liquid	113.0614
Final Weight	113.0612
Tare Weight	0.0002 for
Residue	400 ~~mg~~ acetone mg = 0.2

RUN 1

Volume Liquid	350 mls adj.
Color	Clear (no prec. visible)
Final Weight	110.1556
Tare Weight	110.1459
Residue & Blank	0.0097
- Blank	0.0002
Residue	0.0095 = 9.5 mg.

CF

RUN 2

Volume Liquid	350 mls. adj
Color	Clear (no visible precip.)
Final Weight	110.1668
Tare Weight	110.1556
Residue & Blank	0.0112
- Blank	0.0002
Residue	0.0110 = 11.0 mg.

CF

RUN 3

Volume Liquid	350 mls. adj.
Color	Clear (no visible precip.)
Final Weight	
Tare Weight	110.1668
Residue & Blank	0.0109
- Blank	0.0002
Residue	0.0106 = 10.6 mg.

CF

IMPINGER LIQUID (BACK HALF ANALYSIS)

DISTILLED WATER BLANK

Volume Liquid	500 mls.
Final Weight	99.1321
Tare Weight	99.1320
Residue	0.0001 mg = 0.1

RUN 1

Weight Collected	252.4 g.
Final Weight	96.4372
Tare Weight	96.4234
Residue & Blank	0.0138
- Blank	0.0001
Residue	0.0137 = 13.7 mg

G

RUN 2

Weight Collected	257.9 g.
Final Weight	96.4539
Tare Weight	96.4374
Residue & Blank	0.0165
- Blank	0.0001
Residue	0.0164 = 16.4 mg

G

RUN 3

Weight Collected	263.1 g.
Final Weight	96.5758
Tare Weight	96.5539
Residue & Blank	0.0219
- Blank	0.0001
Residue	0.0218 = 21.8 mg

G

APPENDIX C

(VEO Test Forms - EPA Method 9)

AMERICAN ENVIRONMENTAL TESTING INC.
565 So. Birch Dr. Spanish Fork Ut. 84660

Plant or Job Description: Western Sugar Co.
Billings, Mont.
West Dryer Bank.

Test: W/EPA 5 #1 So.

Location: Dryer Exhaust Stacks

Date: 1/23/90

Control Device: Wet Scrubber

Oberservation Time: 6.0

Certification Date: Until 4/90

Affiliation: AET.

Observer: [illegible]

Distance: @

Direction: S-SW

Height of Point: 75'

Ambient Temperature: 38° early late.

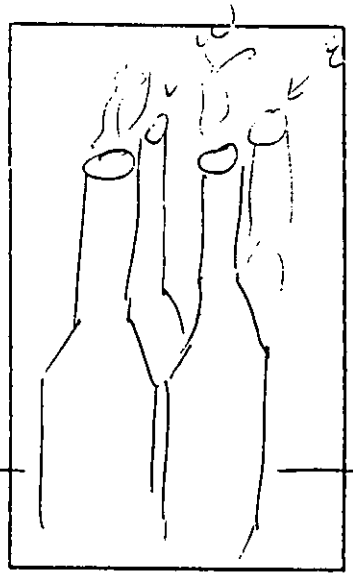
Wind Speed: @ 10-20

Wind Direction: S to W

Sky Condition: Cldy.

Plume Color: White.

Other Info: trailing together.



Starting.

#	Time 0	15	30	45	Sum	Average
1						
2						
3						
4						
5						
6						

Roof

tried at @ 1130 + then again 1245 - either all four stacks + boiler stack trails together or poor background.

● ole.

-0-

AMERICAN ENVIRONMENTAL TESTING INC.
565 So. Birch Dr. Spanish Fork Ut. 84660

Plant or Job Description: Western Sugar Billings, Mont.
EPA 5 Compliance Test.
#2 Test. West Dryer Bank - No. Dryer test.

Test: #1 No. Dryer EPA 9

Location:

Date: 1/23-90

Control Device: Wet Scrubber

Oberservation Time: 6.0

Certification Date: Until 4/90

Affiliation: AET

Observer: [illegible]

Distance: @ 300'

Direction: SW - reader.

Height of Point: @ 75'

Ambient Temperature: 43°F

Wind Speed: @ 15 mph → 20 gust.

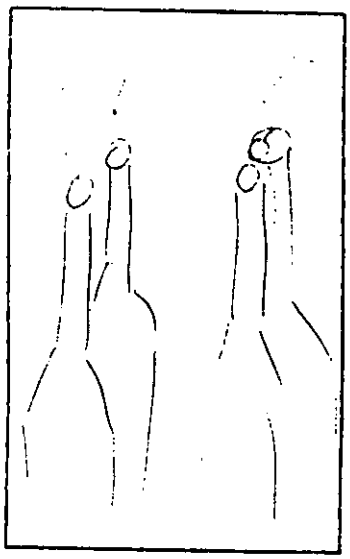
Wind Direction: NW

Sky Condition: Blue Sky

Plume Color: White - attached

Other Info: Trails w/ East Bank

Starting 1518



#	Time 0	15	30	45	Sum	Average
1	5	5	5	<5	<20	<4.0
2	5	<5	<5	5	<20	<4.0
3	5	5	5	5	20	5.0
4	5	<5	5	<5	<20	<4.0
5	<5	5	10	5	<25	<6.25
6	<5	5	5	5	<20	<4.0

● obs.

AMERICAN ENVIRONMENTAL TESTING INC.

565 So. Birch Dr. Spanish Fork Ut. 84660

Plant or Job Description: Western Sugar Company. Billings, Mont. Hydro - West Bank.

Test: W/EPA 5 3 Lo

Location: West Bank

Date: 1/24-90

Control Device: Wet Scrubber.

Oberservation Time: 60 min

Certification Date: Until 4/30

Affiliation: AET

Observer: [illegible]

Distance: @ 250'

Direction: SE

Height of Point: @ 75'

Ambient Temperature: 37

Wind Speed: @ 10 mph

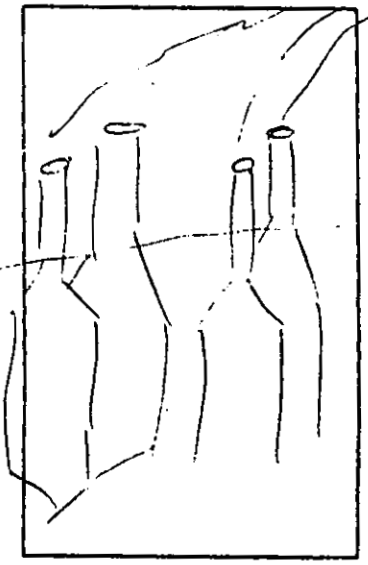
Wind Direction: NW

Sky Condition: Pty cldy

Plume Color: white

Other Info: Trailing w/ East Bank.

Starting 0945



#	Time 0	15	30	60	Sum	Average
1	5	5	10	5		
2	5	5	5	<5		
3	<5	5	5	5		
4	5	5	5	5		
5	10	5	5	5		
6	5	<5	5	5		

AMERICAN ENVIRONMENTAL TESTING INC.
565 So. Birch Dr. Spanish Fork Ut. 84660

Plant or Job Description: Western Sugar Company. Billings, Montana. West Dryer Bank.

Test: #4 North - w/EPA5 Location: North Stack.

Date: 1/24-90 Control Device: Wet Scrubber.

Oberservation Time: 6.0 min Certification Date: Valid 4/90

Affiliation: Am. Environ. Observer: V. Grant Benson

Distance: @ 250' Direction: S.

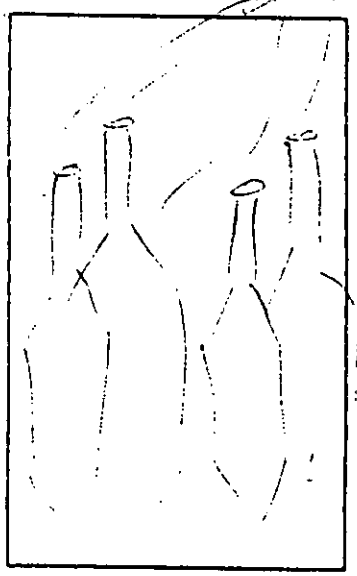
Height of Point: @ 75' Ambient Temperature: 43.0

Wind Speed: @ 15 to 20 mph Wind Direction: NW.

Sky Condition: NW Side - Clear. Plume Color: White.

Other Info: Trailing w/ East Dryer Bank.

Starting - 1145



#	Time 0	15	30	45	Sum	Average
1	5	<5	<5	<5	<20	<4
2	5	5	<5	<5	<20	<5
3	10	5	<5	5	<25	<25
4	5	5	5	<5	<20	<20
5	5	<5	5	10	<25	<25
6	10	5	5	5	25	25

• obs.

AMERICAN ENVIRONMENTAL TESTING INC.
565 So. Birch Dr. Spanish Fork Ut. 84660

Plant or Job Description: Western Sugar Company. Billings, Montana. West Dryer Bank.

Test: #5 South - w/EPA5 Location: South Stack.

Date: 1/24-90 Control Device: Wet Scrubber.

Oberservation Time: 6.0 @ Certification Date: Until 4/90.

Affiliation: Am. Env. Testing. Observer: J. B. Simon

Distance: @ 250' Direction: SW

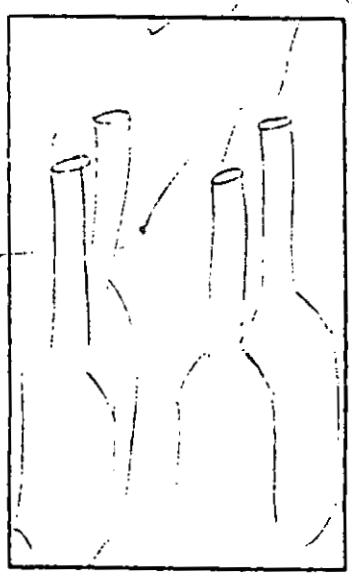
Height of Point: @ 75' Ambient Temperature: 40°F

Wind Speed: 10 mph. Wind Direction:

Sky Condition: Cldy - gray * Plume Color: White.

Other Info: Trailing w/East Dryer (* Prob w/background)

Starting = 1600



#	Time 0	15	30	45	Sum	Average
1	5	5	<5	5	<20	<4.0
2	<5	5	5	5	<20	<4.0
3	10	5	5	<5	<25	<6.25
4	5	5	10	<5	<25	<6.25
5	5	<5	5	5	<20	<4.0
6	10	5	5	5	25	6.25

• Opa.

AMERICAN ENVIRONMENTAL TESTING INC.

565 So. Birch Dr. Spanish Fork Ut. 84660

Plant or Job Description: Western Sugar Company. Billings, Montana West Bayer Bank.

Test: WEPA/5 #6 Stack

Location: West Bank.

Date: 1/24-90

Control Device: Wet Scrubber

Oberservation Time: 6.0 min.

Certification Date: Until

Affiliation: AET

Observer: [illegible]

Distance: @250'

Direction: W-SW

Height of Point: @75'

Ambient Temperature: 41°F

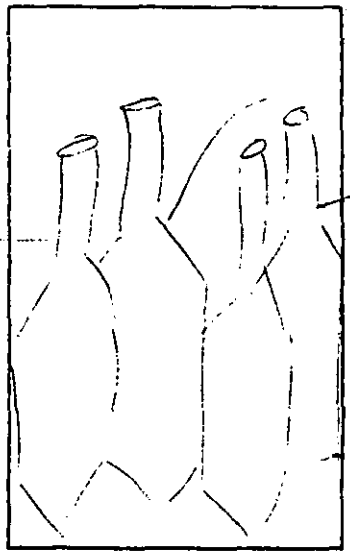
Wind Speed: @15 mph

Wind Direction: NW

Sky Condition: Cldy *

Plume Color: White.

Other Info: * Difficult background for VEO + Training w/East Bayer. Starting 1640



#	Time 0	15	30	45	Sum	Average
1	5	<5	5	5	<20	<5.0
2	5	10	5	<5	<25	<6.25
3	5	5	5	<5	<20	<4.0
4	5	5	5	5	20	5.0
5	5	5	10	<5	<25	<6.25
6	10	5	<5	<5	<25	<6.25

• [illegible]

AMERICAN ENVIRONMENTAL TESTING INC.

565 So. Birch Dr. Spanish Fork Ut. 84660

Plant or Job Description: Western Sugar Company
Billings, Montana
Coal Fired Boiler

Test: #1 Comp EPA 9/5 Cont. Location: Boiler

Date: 1/25-90 Control Device: Wet Scrubber

Oberservation Time: 6.0 min Certification Date: Until 4/90.

Affiliation: Am. Environ Observer: V. Brent Denson

Distance: @ 300 Direction: S-SE

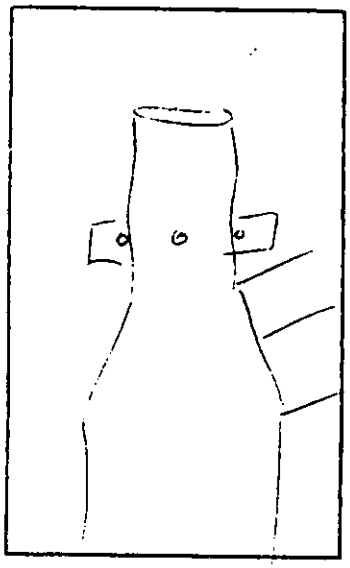
Height of Point: 100' Ambient Temperature: 47°F

Wind Speed: 20-25 mph Wind Direction: SW

Sky Condition: Cldy: Overcast behind Stack. Plume Color: White-Blue (some light brown)

Other Info: Clearing to SW. Detached plume

Starting = 1205



#	Time 0	15	30	45	Sum	Average
1	15	10	20	15	60	15
2	10	15	25	15	65	
3	15	15	10	15	55	
4	15	10	10	15	50	
5	10	20	15	15	60	
6	10	15	15	15	55	

● obs.

-o- Sun.

AMERICAN ENVIRONMENTAL TESTING INC.

565 So. Birch Dr. Spanish Fork Ut. 84660

Plant or Job Description: Western Sugar Company
Billings, Montana
Coal-fired boiler.

Test: #2 Compl. EPA 9/5 Cont. Location: Boiler.

Date: 1/25-90 Control Device: Wet Scrubber.

Oberservation Time: 6.0 min. Certification Date: Until 4/90.

Affiliation: Am. Environ. Observer: [illegible]

Distance: @ 250' Direction: S-SW

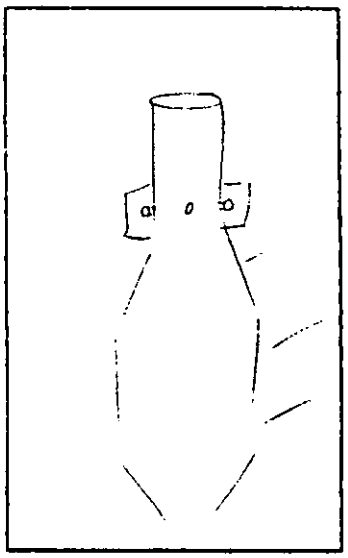
Height of Point: 100' Ambient Temperature: 45°F

Wind Speed: @ 15 mph. Wind Direction: E-NE.

Sky Condition: Cldy-Overcast. Plume Color: White detached steam w/brn. haze.

Other Info:

Starting time: 15:51



#	Time 0	15	30	45	Sum	Average
1	25	20	15	10	70	17.5
2	25	15	15	20	75	18.75
3	30	20	20	15	85	21.25
4	15	20	15	30	80	20
5	25	20	20	25	90	22.5
6	15	15	20	15	65	16.25

19.4% ave.

• ds.

APPENDIX D

(Cyclonic Flow Measurements and Misc. Data Forms and Plant Parameters)

Testing Company, Inc.
309 South Birch Drive
Spanish Fork, Utah 84660
801-266-7111

West Bank of Dryer. South.

METHOD 2
CYCLONIC FLOW DETERMINATION DATA FORM

Plant Western Sugar Co.

Location Billings, Mont.

Date 1/22-90

Bar. Press. ("Hg) 26.45

Pitot Tube (Cp) 6' B=0.8484

Run No. Retest

Operator VBB-JPB-LDS.

Amb. Temp. °F 43° (2100 hrs.)

Static Press. ("H_2O) +0.03

Stack Dimensions 78.0" ID = 33.183 ft²

Port.

Traverse point number	Velocity head (Δp_s), in. H_2O	Stack temp., °F	Cyclonic flow determination: Δp_s at 0° reference	Cyclonic flow determination: Angle (α) which yields a null Δp
1	0.09	119	-0.01	3
2	0.08	120	-0.01	4
3	0.08	121	-0.02	6
4	0.07	122	-0.02	6
5	0.06	123	-0.01	2
6	0.06	122	0	0
7	0.05	123	0	0
8	0.06	122	0	0
9	0.07	121	0	0
10	0.07	120	0	0
11	0.06	122	+0.01	3
12	0.05	123	+0.02	6
13	0.07	120	+0.02	5
14	0.07	121	+0.02	4
15	0.06	122	+0.03	8
16	0.06	122	+0.02	4
17	0.07	123	+0.01	3
18	0.08	123	0	0
19	0.07	124	0	0
20	0.08	125	0	0
21	0.09	124	0	0
22	0.09	123	-0.02	4
23	0.08	122	-0.01	3
24	0.06	122	-0.01	2
Total/Ave. =	1.68/0.07	2929/122.0	0.080/0.011	63
		°R = 582.0	Average angle (α)[a]	2.63° ✓ ok. VBB.

E

W

P_{static} = abs. = 26.452

[a] Average of α must be <10 degrees to be acceptable

Testing Company, Inc.
309 South Birch Drive
Spanish Fork, Utah 84660
801-266-7111

West Bank of Dryer. North.

METHOD 2
CYCLONIC FLOW DETERMINATION DATA FORM

Plant Western Sugar Co. Run No. Pretest.

Location Billings, Mont. Operator WBB-JPA-LBS.

Date 1/22-90 Amb. Temp. °F 42°F (2150 hrs.)

Bar. Press. ("Hg) 26.46 Static Press. ("H_2O) +0.03

Pitot Tube (Cp) 6 B = 0.8484 Stack Dimensions 78.0" ID = 33.183 ft²

Port

Traverse point number	Velocity head (Δp_s), in. H_2O	Stack temp., °F	Cyclonic flow determination: Δp_s at 0° reference	Cyclonic flow determination: Angle (α) which yields a null Δp
1	0.07	119	+0.02	5
2	0.06	119	+0.02	6
3	0.06	120	+0.03	9
4	0.06	120	+0.01	4
5	0.06	120	0	0
6	0.05	121	0	0
7	0.05	122	0	0
8	0.05	121	0	0
9	0.06	121	0	0
10	0.07	120	-0.01	2
11	0.07	119	-0.02	4
12	0.08	119	-0.07	5
13	0.08	118	-0.03	7
14	0.09	119	+0.04	11
15	0.09	119	+0.03	6
16	0.08	120	+0.02	5
17	0.06	120	0	0
18	0.06	120	0	0
19	0.06	120	0	0
20	0.05	119	0	0
21	0.05	119	0	0
22	0.04	120	0	0
23	0.05	120	-0.02	5
24	0.06	119	-0.03	6
Total/Avg.	1.5/0.063	2874/119.8	0.30/0.0125	75

E

W

$P_{abs.}$ = 26.462 °R = 579.8

Average angle (α)[a] 3.125°/α. WBB

[a] Average of α must be < 10 degrees to be acceptable

Testing Company, Inc.
[illegible] South Birch Drive
Spanish Fork, Utah 84660
801-266-7111

METHOD 2
CYCLONIC FLOW DETERMINATION DATA FORM

Coal fired Boiler

Plant Western Sugar Company Run No. Pretest (0915 hrs.)

Location Billings, Montana Operator VBB, JPB-LDS

Date 1/25-90 Amb. Temp. °F 38°

Bar. Press. ("Hg) 26.73 Static Press. ("H_2O) +0.18

Pitot Tube (Cp) 0.8484 - 6'0 Stack Dimensions 137" = ft² x s.

Pnt.	Traverse point number	Velocity head (Δp_s), in. H_2O	Stack temp., °F	Cyclonic flow determination: Δp_s at 0° reference	Cyclonic flow determination: Angle (α) which yields a null Δp
	1	0.14	114	+0.01	3
E	2	0.15	116	+0.02	4
	3	0.17	117	+0.04	6
	4	0.13	110	+0.04	8
	5	0.15	113	0	0
	6	0.14	114	-0.03	6
	7	0.16	115	-0.04	8
	8	0.17	114	-0.02	6
S	9	0.15	112	-0.01	3
	10	0.08	110	+0.02	4
	11	0.11	111	+0.04	8
	12	0.13	114	+0.06	12
	13	0.14	116	+0.04	8
	14	0.15	115	+0.03	7
W	15	0.11	110	+0.02	5
	16	0.13	112	0	0
	17	0.14	113	-0.02	4
	18	0.16	116	-0.04	6
	19	0.17	116	-0.06	13
	20	0.15	114	-0.05	11
N	21	0.14	112	-0.02	5
	22	0.13	110	+0.01	3
	23	0.09	109	+0.03	6
	24	0.11	113	+0.04	9
	Total/Ave.:				

Average angle (α)[a]

[a] Average of α must be < 10 degrees to be acceptable

STATE OF UTAH
DIVISION OF ENVIRONMENTAL HEALTH

This certifies that Brent Benson

has successfully completed the Visible Emissions Evaluation Course conducted by the Bureau of Air Quality and has met the minimum requirements necessary to evaluate visible emissions.

F. Burnell Ardner

Director, Bureau of Air Quality

Valid until APR 19 1990

STATE OF UTAH
DIVISION OF ENVIRONMENTAL HEALTH

This certifies that Paul Benson

has successfully completed the Visible Emissions Evaluation Course conducted by the Bureau of Air Quality and has met the minimum requirements necessary to evaluate visible emissions.

F. Burnell Ardner

Director, Bureau of Air Quality

Valid until April 19, 1989

Montana Department of Health and Environmental Sciences
Air Quality Bureau

Visible Emission Field Documentation

SOURCE NAME	WESTERN SILICON CO / WEST PULP DRYERS
LOCATION	NCMA - WEST STACK
MAILING ADDRESS	PO BOX 30878
CITY	BILLINGS
STATE & ZIP	MT.
PHONE #	406 245-3115
SOURCE CONTACT	R. MISCLER / N SHYNE
OBSERVATION DATE	JAN 24 1990
START TIME	12 52
STOP TIME	12 59
PROCESS EQUIPMENT	PULP DRYER
FUEL TYPE	NAT. GAS
OPERATING MODE	
CONTROL EQUIPMENT	WET SCRUBBER - OHMISTER
OPERATING MODE	
DESCRIBE EMISSION POINT	WEST PULP DRYER STACK
HEIGHT ABOVE GROUND LEVEL	75
HEIGHT RELATIVE TO OBSERVER	95
DISTANCE FROM OBSERVER	
DIRECTION FROM OBSERVER	E, NE
DESCRIBE EMISSIONS	LACY
EMISSION COLOR	WHITE
PLUME TYPE: CONTINUOUS ☒ FUGITIVE ☐ INTERMITTENT ☐	
WATER DROPLETS PRESENT: NO ☐ YES ☒	
IF WATER DROPLET PLUME: ATTACHED ☒ DETACHED ☐	
Point in the Plume at Which Opacity was Determined	WHERE STEAM DISSIPATES
DESCRIBE BACKGROUND (Color, etc.)	BLUE
SKY CONDITIONS AND COLOR	CLEAR
WIND DIRECTION	NW
WIND SPEED	15-20 MPH
AMBIENT TEMPERATURE	49 °F
WET BULB TEMP.	—
RH. percent	≈ 45%

SEC / MIN	0	15	30	45
1	5	5	5	5
2	5	5	5	5
3	5	5	5	5
4	5	5	5	5
5	5	5	5	5
6	5	5	5	5
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AVERAGE OPACITY FOR HIGHEST PERIOD 5%

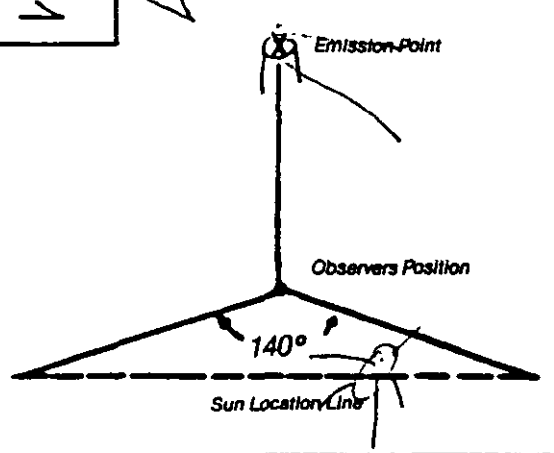
16.1 TON/HR BREAKDOWN PULP TO DRUM

150 TONS/HR SILICATE

Stack with Plume
Sun
Wind

SOURCE LAYOUT SKETCH

Draw North Arrow



COMMENTS (Describe Observation Point)

RUN # 4 NCMA ✓

CLOCK TIME 6 MINUTES FAST FROM ACTUAL

TMK

V.B. BENSON - A.E.T. CO-VEO

OBSERVER'S NAME (Print)	Jim Hughes
OBSERVER'S SIGNATURE	Jim Hughes
DATE	1/24/90
ORGANIZATION	MT. DEPT. HLTH & ENV. SCI - AQB
CERTIFIED BY	MAQB
DATE	OCT. -89

Montana Department of Health and Environmental Sciences
Air Quality Bureau

Visible Emission Field Documentation

Run # 2N - WEST
15:26 MST

SOURCE NAME: WESTERN SUGAR CO - WET PULP DRYER STACKS (2) NORTH & SOUTH		
LOCATION: BILLINGS MT		
MAILING ADDRESS: PO BOX 30878	CITY: BILLINGS	STATE & ZIP: MT 59107
PHONE #: 406 245-3115	SOURCE CONTACT: N. SHYNE / R. MIELKE	
OBSERVATION DATE: 1/23/90	START TIME: 1526	STOP TIME: 1532
PROCESS EQUIPMENT: PULP DRYER	FUEL TYPE: NAT. GAS	OPERATING MODE: 21 T/HR
CONTROL EQUIPMENT: WET SCRUBBER - DEMISTER		OPERATING MODE: ✓
DESCRIBE EMISSION POINT: WEST DRYER PULP STACK		
HEIGHT ABOVE GROUND LEVEL: 75'	HEIGHT RELATIVE TO OBSERVER: 75-80'	
DISTANCE FROM OBSERVER: 250	DIRECTION FROM OBSERVER: NE	
DESCRIBE EMISSIONS: LACY		
EMISSION COLOR: WHITE	PLUME TYPE: CONTINUOUS ☒ FUGITIVE ☐ INTERMITTENT ☐	
WATER DROPLETS PRESENT: NO ☐ YES ☒	IF WATER DROPLET PLUME: ATTACHED ☒ DETACHED ☐	
Point in the Plume at Which Opacity was Determined: WHERE STEAM DISSIPATES		
DESCRIBE BACKGROUND (Color, etc.): NEAR BLUE SKY		
SKY CONDITIONS AND COLOR: CLEAR -	WIND DIRECTION: NW	WIND SPEED: 15-20 MPH
AMBIENT TEMPERATURE: 43°F	WET BULB TEMP.: —	RH. percent: ≈ 65%

SEC / MIN	0	15	30	45
1	5	5	5	5
2	5	5	10	5
3	5	10	5	5
4	5	5	5	5
5	5	5	5	5
6	5	5	10	5
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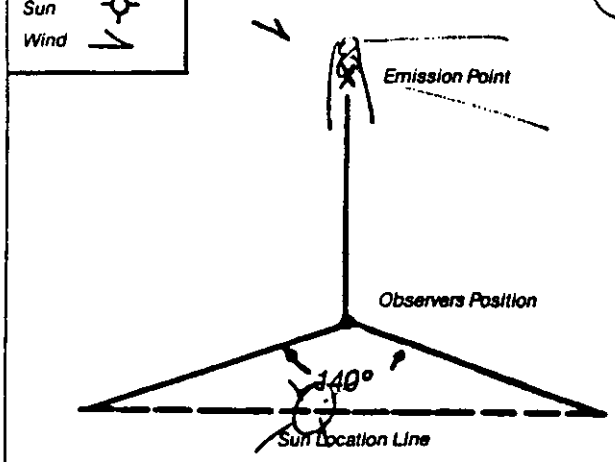
21.0 T/HR IN PRESSED PULP @ 74% H2O BACK DRYER
195 TON/HR BEET SLICED

AVERAGE OPACITY FOR HIGHEST PERIOD: 5.4%

Stack with Plume
Sun
Wind

SOURCE LAYOUT SKETCH

Draw North Arrow



COMMENTS (Describe Observation Point):
CLOCK TIME 6 MINUTES FAST FROM ACTUAL TIME
V.B. BENSON - AET CO-VED

OBSERVER'S NAME (Print): JIM HUGHES			
OBSERVER'S SIGNATURE: J. Hughes	DATE: 1/23/90		
ORGANIZATION: MT DEPT. HLTH & ENV SCI - AQB	CERTIFIED BY: MAQB	DATE: OCT-89	

MONTANA DEPARTMENT OF HEALTH & ENVIRONMENTAL SCIENCES
AIR QUALITY BUREAU
FIELD DATA REDUCTION PROGRAM AND ISOKINETIC CHECK

SOURCE	WESTERN SUGAR CO. - WEST PULP DRYER
RUN	#1-SOUTH
DATE	JAN/23/1990
SAMPLE TIME	72 MIN
# TRAVERSE PTS	24
LEAK RATE	0.0110

********* FIELD DATA *********

VOLUME METERED	66.554
DELTA P - IN H2O	0.05916
DELTA H - IN H2O	3.897
AVG. MTR TEMP - F	74.69
AVG. STK TEMP - F	122.58
ABS. STK PRESS - IN HG	26.3822
BAR. PRESS - IN HG	26.38
% CO2	2.6
% O2	10.8
% N2	86.6
CP	0.8484
Y - MTR CAL FACTOR	1.01
STACK AREA - SQ FT	33.1831
IMPINGERS - GMS H2O	268 ml
BWS	16.69%
TEST TIME - MIN.	72
NOZZLE DIAM. - INCHES	0.5037
MD - LB/LB MOLE	28.648
DELTA H @	2.2450

********* RESULTS *********

VMSTD	62.624	DSCF
MS	27.038	LB/LB MOLE
VS	15.944	FT/SEC
QS	1,268,269.0	DSCF/HR
AVG. DELTA H	3.543	IN H2O
ISO.	98.82	%
[K] FACTOR	59.876	

SOURCE PROCESS RATE 21.0 TONS/HR

SOURCE FUEL TYPE NAT. GAS

SOURCE FUEL FIRING RATE 1798 MCF/DAY

SOURCE AIR POLLUTION CONTROL PARAMETERS

PRESSURE DROP	N.A	IN H2O
DELTA P		IN H2O
H2O FLOWRATE		
PRESSURE DROP		IN H2O

DATA CHECKED BY: Jim Hughes

DATE: 1/24/90

1/88 JH

1/23/90 SLICE RATE = 195 TONS/HR
4,680 TONS/DAY

Montana Department of Health and Environmental Sciences
Air Quality Bureau

Visible Emission Field Documentation

SOURCE NAME: WESTERN SUGAR CO		
LOCATION: BOILER STACK OUTLET		
MAILING ADDRESS: PO BOX 30979	CITY: BILLINGS	STATE & ZIP: MT 59107
PHONE #: 406-245-3115	SOURCE CONTACT: N. SHYNE / R. MIELKE	
OBSERVATION DATE: 1/25/90	START TIME: 12:16	STOP TIME: 12:21
PROCESS EQUIPMENT: POWER BOILER	FUEL TYPE: COAL	OPERATING MODE:
CONTROL EQUIPMENT: WET SCRUBBER - DEMISTER		OPERATING MODE:
DESCRIBE EMISSION POINT: SCRUBBER STACK OUTLET		
HEIGHT ABOVE GROUND LEVEL: 100	HEIGHT RELATIVE TO OBSERVER: 125'	
DISTANCE FROM OBSERVER: 300'	DIRECTION FROM OBSERVER: NNE	
DESCRIBE EMISSIONS: LACY		
EMISSION COLOR: LT BROWN	PLUME TYPE: CONTINUOUS ☒ FUGITIVE ☐ INTERMITTENT ☐	
WATER DROPLETS PRESENT: NO ☐ YES ☒	IF WATER DROPLET PLUME: ATTACHED ☒ DETACHED ☐	
Point in the Plume at Which Opacity was Determined: WITHIN STACK		
DESCRIBE BACKGROUND (Color, etc.): LT DUSKY - WHITE - BLUE - GRAY		
SKY CONDITIONS AND COLOR: GRAY	WIND DIRECTION: SW	WIND SPEED: 20-25
AMBIENT TEMPERATURE: 47°F	WET BULB TEMP.: —	RH. percent: ≈ 45%

SEC / MIN	0	15	30	45
1	15	15	25	20
2	15	20	15	10
3	10	10	20	15
4	15	20	15	15
5	15	10	10	15
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@12:31 MST

N. SCRUBBER Δp = 4.5"

S. SCRUBBER Δp = 4.9

CHIMPON Δp = NA

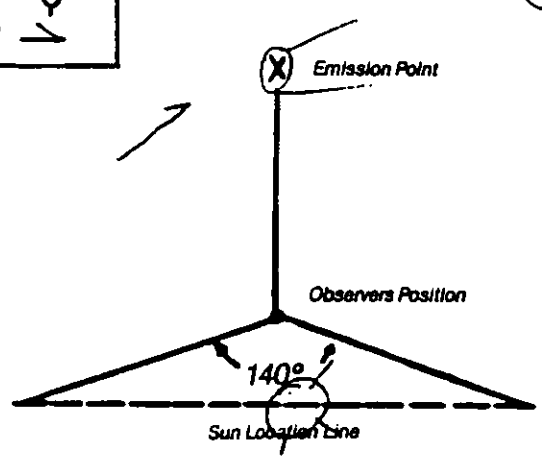
SCRUBBER INLET Δp 5.5 (FAN OUTLET)

BEET SLICE RATE = 185 TON/HR

Stack with Plume
Sun
Wind

SOURCE LAYOUT SKETCH

Draw North Arrow



AVERAGE OPACITY FOR HIGHEST PERIOD: 15.2 %

COMMENTS (Describe Observation Point)

CLOCK TIME 6 MINUTES PAST FROM ACTUAL TIME

COMPLIANCE RUN #1

BP = 26.56" Hg

OBSERVER'S NAME (Print): Jim Hughes		
OBSERVER'S SIGNATURE: Jim Hughes	DATE: 1/25/90	
ORGANIZATION: MT. DEPT. HLTH & ENV. SCI - AQB	CERTIFIED BY: MAQB	DATE: OCT-89

DRYER STACK TESTS 1-23-90 (TEST #1)

PROCESS FEED RATE TO DRYER DURING TEST

= 42 TONS/HR.

PROCESS FEED RATE TO WEST DRUM DURING TEST

= 21 TONS/HR

DRYER STACK TESTS 1-24-90

TEST #2
PROCESS FEED RATE TO DRYER DURING TEST
= 32.2 TONS/HR
PROCESS FEED RATE TO WEST DRUM DURING TEST
= 16.1 TONS/HR

TEST #3
PROCESS FEED RATE TO DRYER DURING TEST
= 37.6 TONS/HR
PROCESS FEED RATE TO WEST DRUM DURING TEST
= 18.8 TONS/HR

DATE JAN 26 1990

TIME	BOILER no. 2 STEAM FLOW	UNDERGRATE PRESSURE	FURNACE DRAFT	BOILER OUT-LET DRAFT	ASH DEPTH		BOILER no. 3 STEAM FLOW	UNDERGRATE PRESSURE	FURNACE DRAFT	BOILER OUT-LET DRAFT	ASH DEPTH		BOILER no. 4 STEAM FLOW	UNDERGRATE PRESSURE	FURNACE DRAFT	BOILER OUT-LET DRAFT	ASH DEPTH		STACK DRAFT	FAN INLET PRESSURE	FAN OUTLET PRESSURE	N SCRUBBER PRESS. DROP	S SCRUBBER PRESS. DROP	CHEVRON PRESS. DROP	STACK COLOR •	OIL TEMP. 120-130°F	OIL PRESS. 8-13 PSI	OIL LEVEL TO POINTER	OIL LEVEL WARM TO TOUCH COOLING WATER	OIL LEVEL IN SIGHT GLASS	OIL LEVEL WARM TO TOUCH COOLING WATER	OIL LEVEL IN SIGHT GLASS	OIL TEMP. 60°C	OIL LEVEL TO POINTER	OIL LEVEL VISIBLE IN ALL GLASSES
8:00	76	.2	.0	.7	1		82	.2	.0	.8	1		82	.2	1	1	1		1.2	2.3	5.5	4.5	5	O	W	120	26	✓	✓	✓	✓	✓	56/63	✓	✓
9:00	74	.2	.05	.7	1		78	.1	.05	.8	1		79	.1	.1	.9	1		1.3	2.4	5.5	4.5	5	O	W	119	26	✓	✓	✓	✓	✓	57/63	✓	✓
10:00	74	.2	.0	.7	1		84	.2	.02	.8	1		77	.2	.1	.9	1		1.2	2.3	5.5	4.5	5	O	W	119	26	✓	✓	✓	✓	✓	57/63	✓	✓
11:00	74	.2	.02	.8	1		82	.2	.05	.9	1		79	.1	.1	.9	1		1.2	2.4	5.5	4.5	5	O	W	119	26	✓	✓	✓	✓	✓	57/63	✓	✓
12:00	70	.2	.0	.8	1		82	.2	.02	.9	1		74	.1	.1	.9	1		1.2	2.4	5.5	4.5	5	O	W	119	26	✓	✓	✓	✓	✓	57/63	✓	✓
1:00	70	.2	.05	.7	1		78	.1	.05	.9	1		72	.2	.15	.9	1		1.2	2.4	5.5	4.5	5	O	W	120	26	✓	✓	✓	✓	✓	56/60	✓	✓
2:00	74	.2	.0	.7	1		76	.1	.05	.9	1		74	.2	.15	1	1		1.2	2.4	5.5	4.5	5	O	W	120	26	✓	✓	✓	✓	✓	57/60	✓	✓
3:00	77	.3	.0	.7	1		78	.2	.02	.8	1		82	.2	.15	.9	1		1.2	2.3	5.5	4.5	5	O	W	121	25	✓	✓	✓	✓	✓	56/60	✓	✓
4:00	74	.3	.0	.7	1		80	.1	.05	.8	1		78	.3	.15	.9	1		1.2	2.4	5.5	4.5	4.9	O	W	120	25	✓	✓	✓	✓	✓	56/63	✓	✓
5:00	80	.3	.03	.8	1		84	.1	.05	.9	1		77	.3	.1	.8	1		1.2	2.4	5.5	4.5	4.8	O	W	120	25	✓	✓	✓	✓	✓	56/58	✓	✓
6:00	81	.2	.03	.8	1		78	.1	.05	.9	1		76	.3	.1	.8	1		1.2	2.4	5.5	4.5	4.8	O	W	120	25	✓	✓	✓	✓	✓	56/60	✓	✓
7:00	72	.2	.05	.8	1		78	.1	.08	.9	1		74	.2	.15	.9	1		1.2	2.4	5.5	4.5	4.8	O	W	120	26	✓	✓	✓	✓	✓	55/60	✓	✓
8:00	68	.2	.05	.8	1		80	.1	.05	.9	1		74	.2	.15	.8	1		1.2	2.4	5.5	4.5	4.8	O	W	120	25	✓	✓	✓	✓	✓	57/60	✓	✓
9:00	64	.2	.05	.8	1		77	.1	.08	.9	1		71	.2	.15	.8	1		1.2	2.6	5.5	4.5	4.9	O	W	120	25	✓	✓	✓	✓	✓	55/57	✓	✓
10:00	68	.2	.08	.8	1		76	.1	.1	.9	1		74	.2	.15	.8	1		1.2	2.4	5.5	4.5	4.9	O	W	120	26	✓	✓	✓	✓	✓	55/58	✓	✓
11:00	70	.2	.05	.8	1		77	.1	.08	.9	1		70	.2	.15	.8	1		1.2	2.4	5.5	4.5	4.9	O	W	121	25	✓	✓	✓	✓	✓	57/60	✓	✓
12:00	70	.2	.05	.8	1		80	.0	.15	1.0	1		70	.2	.1	.7	1		1.2	2.5	5.5	4.5	4.9	O	W	121	25	✓	✓	✓	✓	✓	55/57	✓	✓
1:00	74	.2	.0	.7	1		86	.1	.05	.8	1		94	.2	.15	.9	1		1.2	2.4	5.5	4.5	4.9	O	W	121	25	✓	✓	✓	✓	✓	55/57	✓	✓
2:00	72	.2	.05	.9	1		79	.1	.1	.9	1		94	.2	.15	.8	1		1.2	2.5	5.5	4.5	4.9	O	W	121	25	✓	✓	✓	✓	✓	55/57	✓	✓
3:00	74	.2	.0	.7	1		78	.1	.05	.9	1		82	.2	.15	.9	1		1.2	2.4	5.5	4.5	4.9	O	W	121	25	✓	✓	✓	✓	✓	56/58	✓	✓
4:00	76	.2	.0	.7	1		79	.1	.05	.8	1		76	.2	.15	.8	1		1.2	2.4	5.5	4.5	4.9	O	W	121	26	✓	✓	✓	✓	✓	56/58	✓	✓
5:00	74	.2	.05	.8	1		84	.1	.05	.8	1		76	.2	.1	.8	1		1.2	2.5	5.5	4.5	4.9	O	W	120	25	✓	✓	✓	✓	✓	55/58	✓	✓
6:00	80	.2	.05	.7	1		78	.1	.1	.8	1		74	.2	.15	.8	1		1.2	2.4	5.5	4.5	4.9	O	W	120	26	✓	✓	✓	✓	✓	55/58	✓	✓
7:00	78	.2	.0	.7	1		86	.1	.05	.8	1		76	.3	.15	.9	1		1.2	2.4	5.5	4.5	4.9	O	W	120	25	✓	✓	✓	✓	✓	55/58	✓	✓

• W- WHITE
G- GRAY
B- BLACK

8-4 SHIFT T.P.P.						CAUSTIC	4-12 SHIFT						CAUSTIC	12-8 SHIFT					
BOILER	ALK.	pH	PO_4	SOLIDS	INCHES WATER	BLOWDOWN	BOILER	ALK.	pH	PO_4	SOLIDS	INCHES WATER	BLOWDOWN	BOILER	ALK.	pH	PO_4	SOLIDS	INCHES WATER	BLOWDOWN
1	190	11.6	Pos	1550	-	2#	1	210	11.4	Pos	1400	1"	—	1	120	11.3	Pos	1200	-	2#
2	88	11.2	200	1650	-	8#	2	220	11.6	Pos	1200	1"	2#	2	130	11.2	Pos	1000	-	3#
3	154	11.4	Pos	1290	-	2#	3	160	11.6	[illegible]	1400	1"	4#	3	40	9.6	Pos	120	-	8#
4	190	11.2	200	725	-	2#	4	130	11.3	Pos	800	-	6#	4	40	9.6	Pos	70	-	8#
5							5							5						

LBS. CAUSTIC: BOILER 2#
NALCO 756
SO_3
[illegible] 7[illegible]
[illegible] 7419.29

LBS. CAUSTIC: BOILER 12#
NALCO 756
SO_3
12Am 7683.77
4pm 7555.[illegible]

LBS. CAUSTIC: BOILER 2#
NALCO 756
SO_3
9Am 7809.99
12am 7[illegible]