Background Report Reference

AP-42 Section Number: 9.10.1.2

Background Chapter: 4

Reference Number: 3

Title: Results of the November 18, 1986, Particulate Emission Compliance Test on the Combined Discharge Stack of the Sugar Dryer and Sugar Cooler at the Southern Minnesota Sugar Cooperative plant in Renville, Minnesota

Interpoll, Inc.

Interpoll, Inc.

December 1986

APPENDIX C

REPORT EXCERPTS FROM REFERENCE 3

(Southern Minnesota Beet Sugar Cooperative, December 8, 1986)

Interpoll Inc.
4500 Ball Road N.E.
Circle Pines, Minnesota 55014

Telephone (612) 786-6020

RESULTS OF THE NOVEMBER 18, 1986, PARTICULATE EMISSION COMPLIANCE TEST ON THE COMBINED DISCHARGE STACK OF THE SUGAR DRYER AND SUGAR COOLER AT THE SOUTHERN MINNESOTA SUGAR COOPERATIVE PLANT IN RENVILLE, MINNESOTA

Submitted to:

SOUTHERN MINNESOTA SUGAR COOPERATIVE
P. O. Box 500
Renville, Minnesota 56284

Attention: Dean DeBelly

Approved by:

Perry Lonnes, Ph.D.
President

Report Number 6-2305
December 8, 1986

1 INTRODUCTION

On November 18, 1986, Interpoll Inc. personnel conducted a particulate emission compliance test on the combined discharge from the Sugar Dryer and Sugar Cooler scrubbers at the Southern Minnesota Sugar Cooperative (SMSC) Plant located in Renville, Minnesota. On-site testing was performed by J. Buresh and C. Mosser. Coordination between testing activities and plant operation was provided by Dean DeBelly of SMSC. The test was witnessed by Carolina Schutt of the Minnesota Pollution Control Agency (MPCA).

The Sugar Dryer and Cooler are rotary drum indirectly heated units manufactured by Stearns-Roger. Particulate emissions from the dryer and cooler are controlled by identical American Air Filter, Type W, Size 24 wet scrubbers. The scrubbers have a nominal air flow of 13,000 ACFM and a scrubber water flow rate of 6 GPM.

Particulate determinations were performed in accordance with EPA Methods 1-5 and 9, CFR Title 40, Part 60, Appendix A (revised July 1, 1986). A preliminary determination of the gas linear velocity profile was made before the first particulate run to allow selection of the appropriate nozzle diameter required for isokinetic sample withdrawal. An Interpoll sampling train which meets or exceeds specifications in the above-cited reference was used to extract particulate samples by means of a heated glass-lined probe.

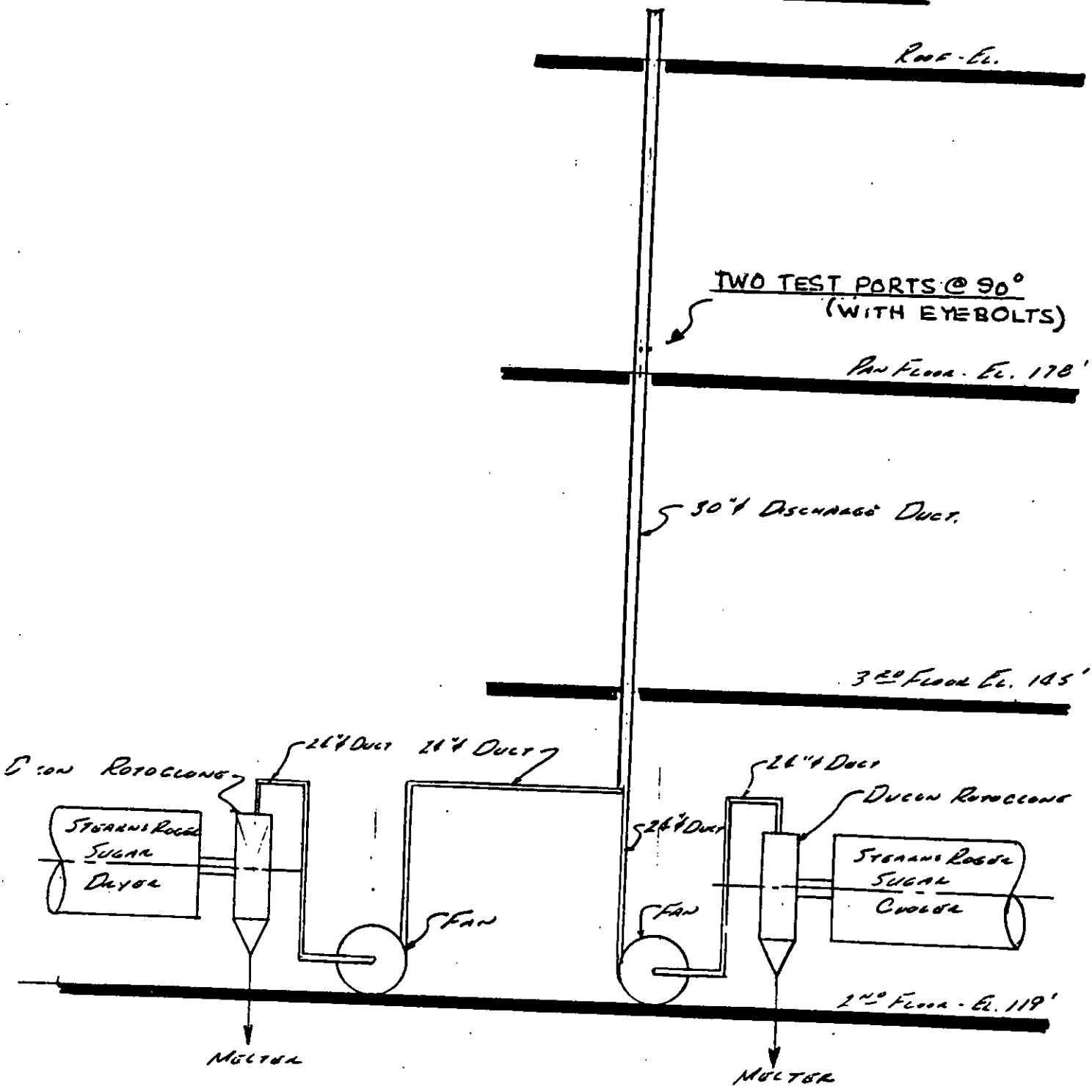
Testing was conducted from two test ports oriented at 90 degrees on the common stack. These test ports are located 30 feet downstream and 20 feet upstream of the nearest flow disturbance. A 12-point traverse was used to extract representative particulate samples. Each traverse point was sampled five minutes to give a total sampling time of 60 minutes per run. Visible emission determinations could not be performed due to a steam plume from an adjacent source.

TABLE 1. Results of the November 18, 1986, Particulate Emission Compliance Test on the Combined Sugar Cooler/Dryer Stack at the Southern Minnesota Sugar Cooperative in Renville, Minnesota.

ITEM		Run 1	Run 2	Run 3	
Date of test		11-18-86	11-18-86	11-18-86	
Time runs were done	(HRS)	800/ 901	926/1027	1038/1139	
Process rate	(KLB/HR)	87.9	87.9	87.9	
Volumetric flow					
actual	(ACFM)	18779	19029	18666	
standard	(DSCFM)	15935	15952	15830	15,906
Gas temperature	(DEG-F)	108	108	107	
Moisture content	(%V/V)	5.72	6.86	5.87	
Gas composition	(%V/V,dry)				
carbon dioxide		0.03	0.03	0.03	
oxygen		20.90	20.90	20.90	
carbon monoxide		0.00	0.00	0.00	
nitrogen		79.07	79.07	79.07	
Isokinetic variation	(%)	101.3	101.1	100.6	
Particulate concentration					
actual	(GR/ACF)	0.01054	0.00792	0.01039	
standard	(GR/DSCF)	0.01243	0.00945	0.01226	
Part. emission rate	(LB/HR)	1.70	1.29	1.66	1.55

* Dry catch only

SO. MINNESOTA SUGAR COOP.

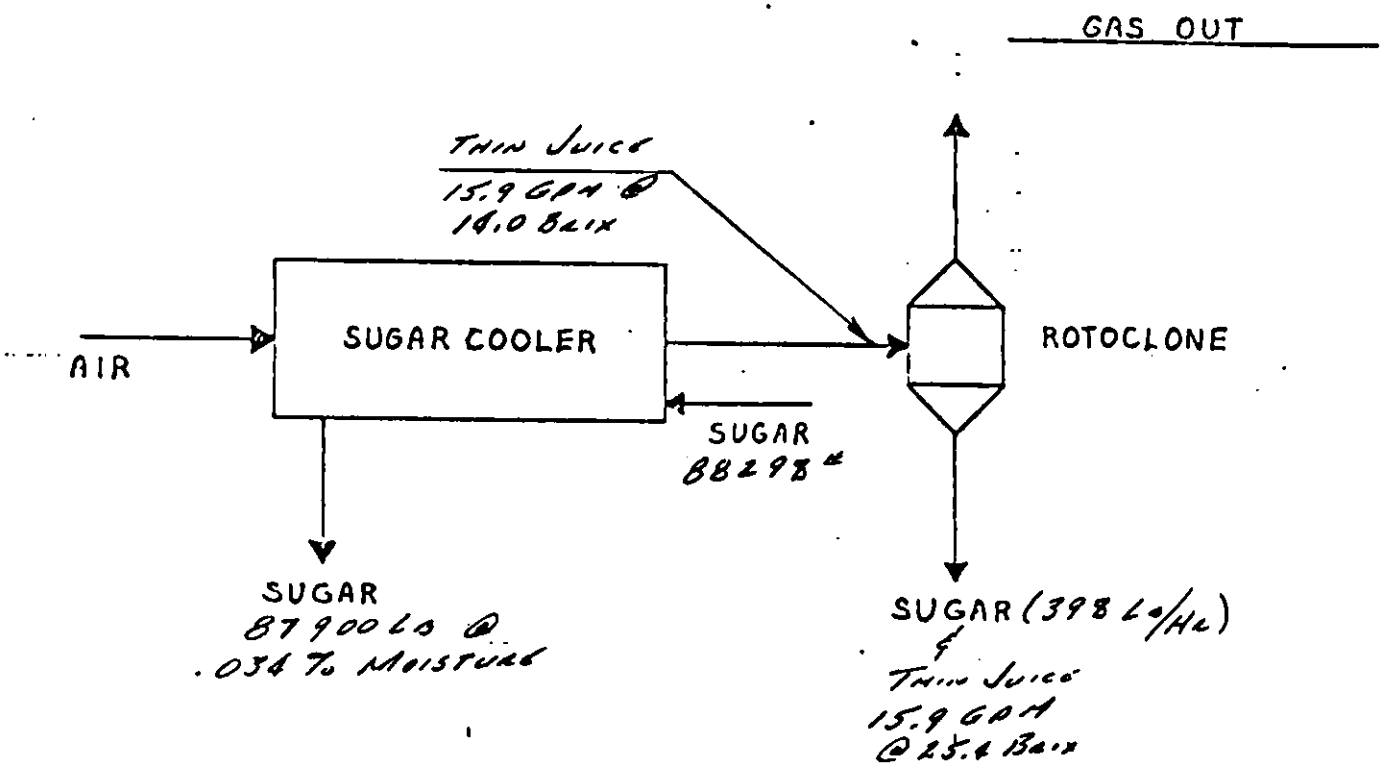


FIRST FLOOR

1ST FLOOR - EL. 100'

SUGAR COOLER & DRYER STACK ELEV.

10/30/80



SUGAR COOLER

SUGAR IS COOLED FROM 130°F TO 100°F.

SUGAR INCREASE IN THIN JUICE

= (FLOW)(SP. GR. OUT − SP. GR IN)

= (15.9)(500)(1.107 − 1.057)

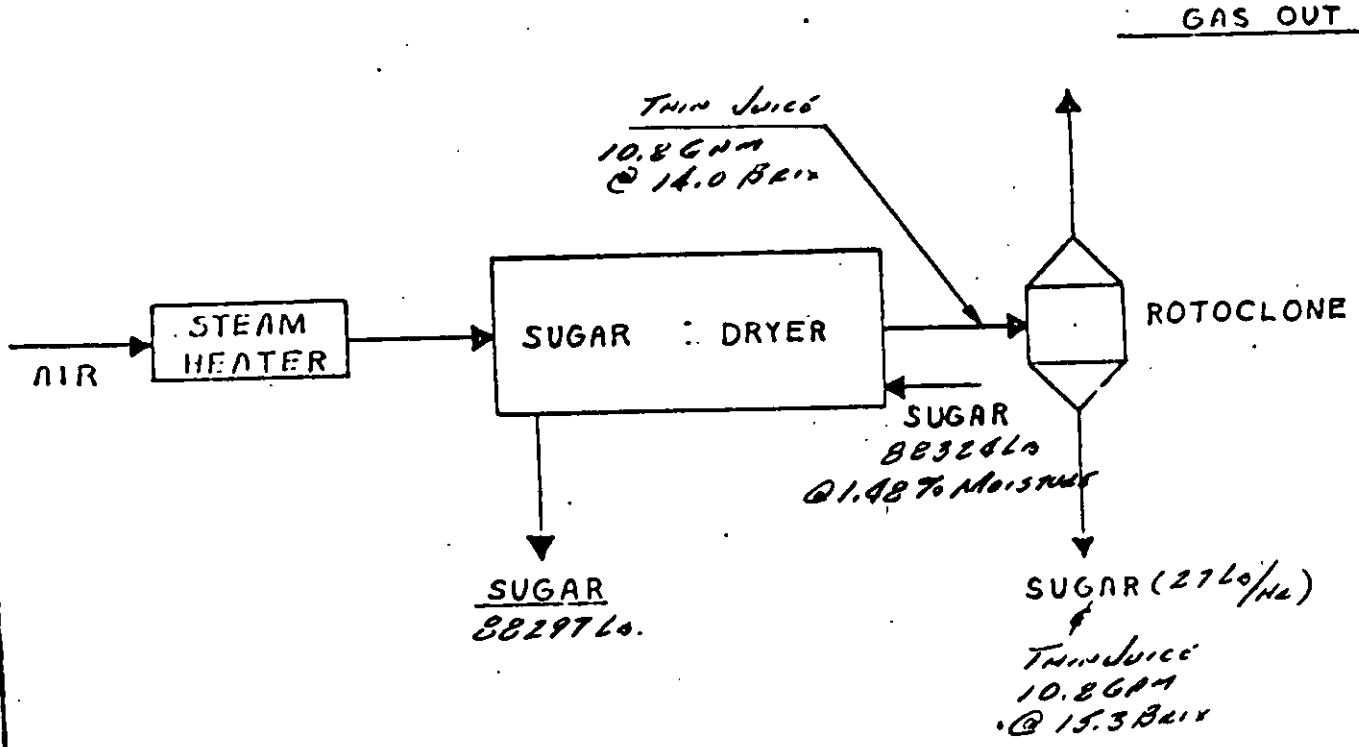
= 398 LB/HR

RPD 11/19/86

N·K·FERGUSON

SUGAR COOLER

2738



SUGAR DRYER

SUGAR IS DRIED AND COOLED FROM 140°F TO 130°F.

SUGAR INCREASE IN THIN JUICE

= (FLOW)(SP. GRAV OUT − SP. GRAV IN)

= (10.8)(500)(1.062 − 1.057)

= 27 LBS/HR

W.D.P. 11/19/86

M·K·FERGUSON

SUGAR DRYER

DRAWN BY T. H. Dyer	APPROVED BY	CONTRACT NUMBER 2738	SHEET NUMBER
CHECKED BY	DATE 11/19/86		

Filename: BEET3.WQ1
Date: 02-Dec-94
Facility: Southern Minnesota Beet Sugar Cooperative
Location: Renville, Minnesota
Source: Sugar dryer & cooler w/wet scrubbers--combined stack after identical controls
Test date: Nov. 18, 1986

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	108	108	107	
	Pressure	in. HG	29.0	29.0	29.0	
	Moisture	%	5.72	6.86	5.87	
	Oxygen	%	20.9	20.9	20.9	
	Volumetric flow, actual	acfm	18779	19029	18666	
	Volumetric flow, standard*	dscfm	15935	15952	15831	
	Isokinetic variation	%	101.3	101.1	100.6	
Sugar produced--cooler output	Process rate	TPH	43.95	43.95	43.95	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.01243	0.00945	0.01226	
	CO2	% dv	0.03	0.03	0.03	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	1.70	1.29	1.66	
	CO2	lb/hr	32.8	32.8	32.5	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.0386	0.0294	0.0379	0.0353
	CO2	lb/ton	0.745	0.746	0.741	~~0.744~~
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.0193	0.0147	0.0189	0.0176
	CO2	kg/Mg	0.373	0.373	0.370	~~0.372~~

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

Test No. 1
Combined Dryer/Cooler Stack

3.1 Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)

Date of run	Run 1 11-18-86	Run 2 11-18-86	Run 3 11-18-86
Dry basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.90	20.90	20.90
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	79.07	79.07	79.07
Wet basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	19.70	19.47	19.67
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	74.55	73.65	74.43
water vapor.....	5.72	6.86	5.87
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.22	28.10	28.20
Specific gravity.....	0.975	0.971	0.974
Water mass flow.....(LB/HR)	2715	3297	2773

 0.000 0.000 0.000

Test No. 1
Combined Dryer/Cooler Stack

3.2 Results of Particulate Loading Determinations-------Method 5

	Run 1	Run 2	Run 3
Date of run	11-18-86	11-18-86	11-18-86
Time run start/end.....(HRS)	800/ 901	926/1027	1038/1139
Static pressure.....(IN.WC)	-0.28	-0.28	-0.28
Cross sectional area (SQ.FT)	5.94	5.94	5.94
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	42.0	43.0	40.0
impingers.....(GRAMS)	0.0	0.0	0.0
desiccant.....(GRAMS)	29.0	43.0	32.0
total.....(GRAMS)	71.0	86.0	72.0
Total particulate material..			
.....collected(grams)	0.0444	0.0337	0.0432
Gas meter coefficient.....	1.0061	1.0061	1.0061
Barometric pressure..(IN.HG)	28.99	28.99	28.99
Avg. orif.pres.drop..(IN.WC)	2.68	2.75	2.67
Avg. gas meter temp..(DEF-F)	79.1	94.2	94.5
Volume through gas meter....			
at meter conditions...(CF)	57.37	58.87	58.20
standard conditions.(DSCF)	55.12	55.03	54.37
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.249	.249	.249
Avg.stack gas temp ..(DEG-F)	108	108	107
Volumetric flow rate.....			
actual.....(ACFM)	18779	19029	18666
dry standard.....(DSCFM)	15935	15952	15830
Isokinetic variation.....(%)	101.3	101.1	100.6
Particulate concentration...			
actual.....(GR/ACF)	0.01054	0.00792	0.01039
dry standard.....(GR/DSCF)	0.01243	0.00945	0.01226
Particle mass rate...(LB/HR)	1.70	1.29	1.66

Test No. 1
Combined Dryer/Cooler Stack

Results of Volumetric Flow Rate Determination-------Method 2

Date of Determination.....	11-18-86
Time of Determination.....(HRS)	740
Barometric pressure.....(IN.HG)	28.76
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	12
Shape of duct.....	Round
Stack diameter.....(IN)	33
Duct area.....(SQ.FT)	5.94
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.28
Avg. gas temp.....(DEG-F)	108
Moisture content.....(% V/V)	5.72
Avg. linear velocity.....(FT/SEC)	50.3
Gas density.....(LB/ACF)	.06544
Molecular weight.....(LB/LBMOLE)	28.84
Mass flow of gas.....(LB/HR)	70315
Volumetric flow rate.....	
actual.....(ACFM)	17909
dry standard.....(DSCFM)	15076

(EPA Method 5) Filter
Gravimetric Analysis Lab
Data Sheet
FR 42(160)

Date of Analysis 11-19-86
Technician RCV

---

(1)

interpoll

Job SMSC Date 11-18-86
City/State Reynolds Mn Log# 4268-04
Source Combined Sugar Dryer & Cooler
Test Site STACK
Sample type _____ Tech JTB
Remarks: Test/Run 1/1
1 of 1

Special Handling Required _____
Filter No. 6329
Filter Type 4"G
Filter Tare Wt. 0.6321_1 g
Filter + Sample Wt. 0.6590_2 g
Comments _____

---

(2)

interpoll

Job SMSC Date 11-18-86
City/State Reynolds Mn Log# 4268-07
Source Combined Sugar Dryer & Cooler
Test Site STACK
Sample type _____ Tech JTB
Remarks: Test/Run 1/2
1 of 1

Special Handling Required _____
Filter No. 6334
Filter Type 0.6359
Filter Tare Wt. 0.6523_1 g
Filter + Sample Wt. _____$_2$ g
Comments _____

---

(3)

interpoll

Job SMSC Date 11-18-86
City/State _____ Log# 4268-10
Source Combined Sugar Dryer Cooler
Test Site STACK
Sample type _____ Tech JTB
Remarks: Test/Run 1/3
1 of 1

Special Handling Required _____
Filter No. 6335
Filter Type 4"G
Filter Tare Wt. 0.6321_1 g
Filter + Sample Wt. 0.6481_2 g
Comments _____

RESULTS:

1/ 0.0267	2/ 0.0164	3/ 0.0160
0.0444	0.0337	0.0432

L-0186/P

INTERPOLL INC.
EPA Method 5 Probe (Cyclone) Wash
Gravimetric Analysis Laboratory Data Sheet
(CFR Title 40 Part 60 Appendix A)

Date of Analysis 11-19-86
Technician CoJ

EPA-M5 Acetone R.B SPEC ≤ 7.8 µg/cc
Actual acetone residue blank 0 µg/cc

(1)

interpoll

Job SMSC Date 11-18-86
City/State Renville Mn Log# 4268-03
Source Combined Sugar Dryer Cooler
Test Site Stack
Sample type _____ Tech JB
Remarks: Test/Run 1/1
1 of 1

Special Handling Required _____
Evaporating Dish No. 41
Volume of acetone 135 (1) cc
E. Dish Tare Wt. 68.9189 (2) g
E. Dish + Sample Wt. 68.9364 (3) g
Comments _____

(2)

interpoll

Job SMSC Date 11-18-86
City/State Renville Mn Log# 4268-06
Source Combined Sugar Dryer & Cooler
Test Site Stack
Sample type _____ Tech JB
Remarks: Test/Run 1/2
1 of 1

Special Handling Required _____
Evaporating Dish No. 410
Volume of acetone 135 (1) cc
E. Dish Tare Wt. 73.3893 (2) g
E. Dish + Sample Wt. 73.4066 (3) g
Comments _____

(3)

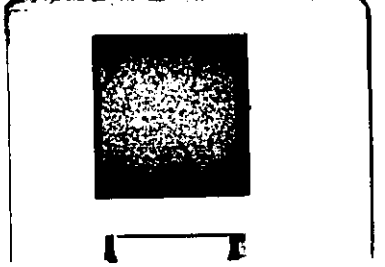
interpoll

Job SMSC Date 11-18-86
City/State _____ Log# 4268-09
Source Combined Sugar Dryer Cooler
Test Site Stack
Sample type _____ Tech JB
Remarks: Test/Run 1/3
1 of 1

Special Handling Required _____
Evaporating Dish No. 604
Volume of acetone 145 (1) cc
E. Dish Tare Wt. 74.8728 (2) g
E. Dish + Sample Wt. 74.9000 (3) g
Comments _____

RESULTS:

1/ 0.0175 E-6 2/ 0.0173 3/ 0.0272



5-4
#3

Interpoll Inc.
4500 Ball Road N.E.
Circle Pines, Minnesota 55014

Telephone (612) 786-6020

RESULTS OF THE NOVEMBER 18, 1986, PARTICULATE EMISSION COMPLIANCE TEST ON THE COMBINED DISCHARGE STACK OF THE SUGAR DRYER AND SUGAR COOLER AT THE SOUTHERN MINNESOTA SUGAR COOPERATIVE PLANT IN RENVILLE, MINNESOTA

Submitted to:

SOUTHERN MINNESOTA SUGAR COOPERATIVE
P. O. Box 500
Renville, Minnesota 56284

Attention: Dean DeBelly

Approved by:

Report Number 6-2305
December 8, 1986

Perry Lonnes, Ph.D.
President

TABLE OF CONTENTS

ABBREVIATIONS

ACFM	actual cubic feet per minute
cc (ml)	cubic centimeter (milliliter)
DSCFM	standard cubic foot of dry gas per minute
DSML	dry standard milliliter
DEG-F (^{O}F)	degrees Fahrenheit
DIA.	diameter
FT/SEC	feet per second
GPM	gallons per minute
GR/ACF	grains per actual cubic foot
GR/DSCF	grains per dry standard cubic foot
g	gram
HP	horsepower
HRS	hours
IN.	inches
IN. HG.	inches of mercury
IN. WC.	inches of water
LB	pound
LB/DSCF	pounds per dry standard cubic foot
LB/HR	pounds per hour
LB/10^{6}BTU	pounds per million British Thermal Units heat input
LB/MMBTU	pounds per million British Thermal Units heat input
MW	megawatt
mg/DSCM	milligrams per dry standard cubic meter
microns (μm)	micrometer
MIN.	minutes
ohm-cm	ohm-centimeter
PPH	pounds per hour
PPM	parts per million
PSI	pounds per square inch
SQ. FT.	square feet
v/v	percent by volume
w/w	percent by weight

Standard conditions are defined as 68 ^{O}F (20 ^{O}C) and 29.92 IN. of mercury pressure.

1 INTRODUCTION

On November 18, 1986, Interpoll Inc. personnel conducted a particulate emission compliance test on the combined discharge from the Sugar Dryer and Sugar Cooler scrubbers at the Southern Minnesota Sugar Cooperative (SMSC) Plant located in Renville, Minnesota. On-site testing was performed by J. Buresh and C. Mosser. Coordination between testing activities and plant operation was provided by Dean DeBelly of SMSC. The test was witnessed by Carolina Schutt of the Minnesota Pollution Control Agency (MPCA).

The Sugar Dryer and Cooler are rotary drum indirectly heated units manufactured by Stearns-Roger. Particulate emissions from the dryer and cooler are controlled by identical American Air Filter, Type W, Size 24 wet scrubbers. The scrubbers have a nominal air flow of 13,000 ACFM and a scrubber water flow rate of 6 GPM.

Particulate determinations were performed in accordance with EPA Methods 1-5 and 9, CFR Title 40, Part 60, Appendix A (revised July 1, 1986). A preliminary determination of the gas linear velocity profile was made before the first particulate run to allow selection of the appropriate nozzle diameter required for isokinetic sample withdrawal. An Interpoll sampling train which meets or exceeds specifications in the above-cited reference was used to extract particulate samples by means of a heated glass-lined probe.

Testing was conducted from two test ports oriented at 90 degrees on the common stack. These test ports are located 30 feet downstream and 20 feet upstream of the nearest flow disturbance. A 12-point traverse was used to extract representative particulate samples. Each traverse point was sampled five minutes to give a total sampling time of 60 minutes per run. Visible emission determinations could not be performed due to a steam plume from an adjacent source.

The important results of the tests are summarized in Section 2. Detailed results are presented in Section 3. Field data and all other supporting information are presented in the appendices.

2 SUMMARY AND DISCUSSION

The important results of the particulate emission compliance test are summarized in Table 1. As will be noted, the particulate emission rate averaged 1.55 LB/HR. Visible emissions could not be determined due to obscuration by steam from adjacent emission points.

No difficulties were encountered in the field or in the laboratory evaluation of the samples. On the basis of this fact and a complete review of the entire data and results, it is our opinion that the particulate concentrations and emission rates reported herein are accurate and closely reflect the actual values which existed at the time the tests were performed.

TABLE 1. Results of the November 18, 1986, Particulate Emission Compliance Test on the Combined Sugar Cooler/Dryer Stack at the Southern Minnesota Sugar Cooperative in Renville, Minnesota.

ITEM		Run 1	Run 2	Run 3
Date of test		11-18-86	11-18-86	11-18-86
Time runs were done	(HRS)	800/ 901	926/1027	1038/1139
Process rate	(KLB/HR)	87.9	87.9	87.9
Volumetric flow				
actual	(ACFM)	18779	19029	18666
standard	(DSCFM)	15935	15952	15830
Gas temperature	(DEG-F)	108	108	107
Moisture content	(%V/V)	5.72	6.86	5.87
Gas composition	(%V/V,dry)			
carbon dioxide		0.03	0.03	0.03
oxygen		20.90	20.90	20.90
carbon monoxide		0.00	0.00	0.00
nitrogen		79.07	79.07	79.07
Isokinetic variation	(%)	101.3	101.1	100.6
Particulate concentration				
actual	(GR/ACF)	0.01054	0.00792	0.01039
standard	(GR/DSCF)	0.01243	0.00945	0.01226
Part. emission rate	(LB/HR)	1.70	1.29	1.66

* Dry catch only

3 RESULTS

The results of all field and laboratory evaluations are presented in this section. Gas composition results (Orsat and moisture) are presented first followed by the computer printout of the particulate and opacity observations. Preliminary measurements including test port locations are given in the appendices.

The results have been calculated on a Sperry PC Computer using programs written in Extended BASIC specifically for source testing calculations. EPA-published equations have been used as the basis of the calculation techniques in these programs.

The particulate emission rate has been calculated using the product of the concentration times flow method (as recommended by the EPA) rather than the ratio of areas method.

Test No. 1
Combined Dryer/Cooler Stack

3.1 Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)

Date of run	Run 1 11-18-86	Run 2 11-18-86	Run 3 11-18-86
Dry basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.90	20.90	20.90
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	79.07	79.07	79.07
Wet basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	19.70	19.47	19.67
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	74.55	73.65	74.43
water vapor.....	5.72	6.86	5.87
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.22	28.10	28.20
Specific gravity.....	0.975	0.971	0.974
Water mass flow.....(LB/HR)	2715	3297	2773

 0.000 0.000 0.000

Test No. 1
Combined Dryer/Cooler Stack

3.2 Results of Particulate Loading Determinations-------Method 5

	Run 1	Run 2	Run 3
Date of run	11-18-86	11-18-86	11-18-86
Time run start/end.....(HRS)	800/ 901	926/1027	1038/1139
Static pressure.....(IN.WC)	-0.28	-0.28	-0.28
Cross sectional area (SQ.FT)	5.94	5.94	5.94
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	42.0	43.0	40.0
impingers.....(GRAMS)	0.0	0.0	0.0
desiccant.....(GRAMS)	29.0	43.0	32.0
total.....(GRAMS)	71.0	86.0	72.0
Total particulate material..			
.....collected(grams)	0.0444	0.0337	0.0432
Gas meter coefficient.....	1.0061	1.0061	1.0061
Barometric pressure..(IN.HG)	28.99	28.99	28.99
Avg. orif.pres.drop..(IN.WC)	2.68	2.75	2.67
Avg. gas meter temp..(DEF-F)	79.1	94.2	94.5
Volume through gas meter....			
at meter conditions...(CF)	57.37	58.87	58.20
standard conditions.(DSCF)	55.12	55.03	54.37
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.249	.249	.249
Avg.stack gas temp ..(DEG-F)	108	108	107
Volumetric flow rate.....			
actual.....(ACFM)	18779	19029	18666
dry standard.....(DSCFM)	15935	15952	15830
Isokinetic variation.....(%)	101.3	101.1	100.6
Particulate concentration...			
actual.....(GR/ACF)	0.01054	0.00792	0.01039
dry standard.....(GR/DSCF)	0.01243	0.00945	0.01226
Particle mass rate...(LB/HR)	1.70	1.29	1.66

Test No. 1
Combined Sugar Dryer/Cooler Stack

3.3 Results of Opacity Observations - EPA Method 9*

Percent Opacity	Optical Density	Relative Frequency (%)
0	.0000	
5	.0223	
10	.0458	
15	.0706	
20	.0969	
25	.1249	
30	.1549	
35	.1871	
40	.2219	
45	.2596	
50	.3010	
55	.3468	
60	.3979	
65	.4559	
70	.5229	
75	.6021	
80	.6990	
85	.8239	
90	1.0000	
95	1.3010	
99	2.0000	

Time Average

Observer: J. Buresh
Cert Date: 10-22-86
Date of Observation: 11-18-86
Time of Observation:

*Unable to observe due to obscuration from adjacent steam plumes.

APPENDIX A

RESULTS OF PRELIMINARY FLOW RATE DETERMINATIONS

Test No. 1
Combined Dryer/Cooler Stack

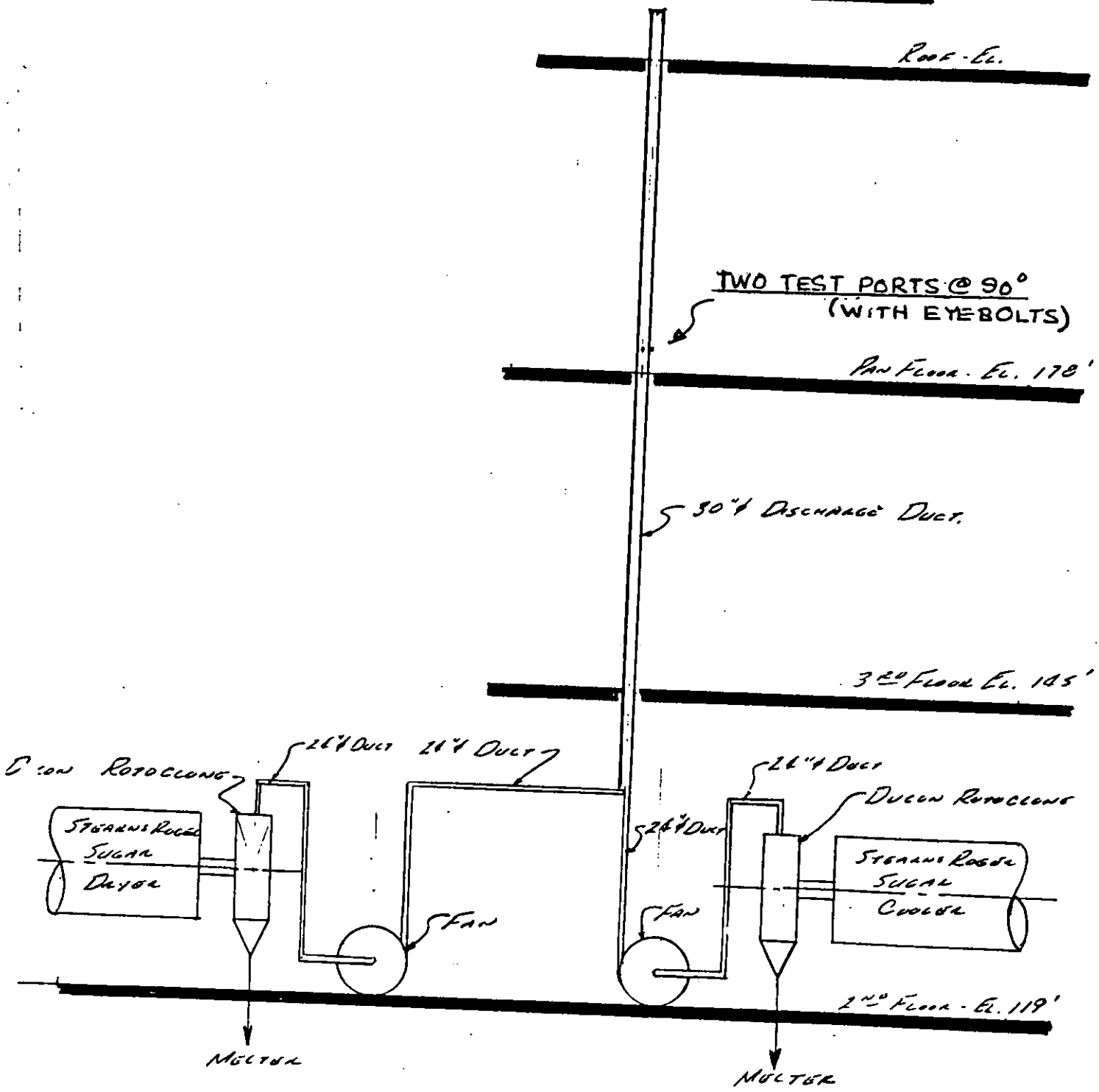
Results of Volumetric Flow Rate Determination-------Method 2

Date of Determination.....	11-18-86
Time of Determination.....(HRS)	740
Barometric pressure.....(IN.HG)	28.76
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	12
Shape of duct.....	Round
Stack diameter.....(IN)	33
Duct area.....(SQ.FT)	5.94
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.28
Avg. gas temp.....(DEG-F)	108
Moisture content.....(% V/V)	5.72
Avg. linear velocity.....(FT/SEC)	50.3
Gas density.....(LB/ACF)	.06544
Molecular weight.....(LB/LBMOLE)	28.84
Mass flow of gas.....(LB/HR)	70315
Volumetric flow rate.....	
actual.....(ACFM)	17909
dry standard.....(DSCFM)	15076

APPENDIX B

LOCATION OF TEST PORTS

SO. MINNESOTA SUGAR COOP.



FIRST FLOOR

1ST FLOOR - EL. 100'

SUGAR COOLER & DRYER STACK ELEV.

M.R.D.

10/30/80

APPENDIX C

METHODS 2-5 FIELD DATA SHEETS

Preliminary Data — Method 2

— Interpoll Inc. —

Job S. Minnesota Sugar Co.

Source Combined sugar Dryer + Cooler Date 11-18-86

Test No. 1 Run No. 1

Stack dimensions: 33 in.

Dry bulb 108 °F Wet bulb 102 °F

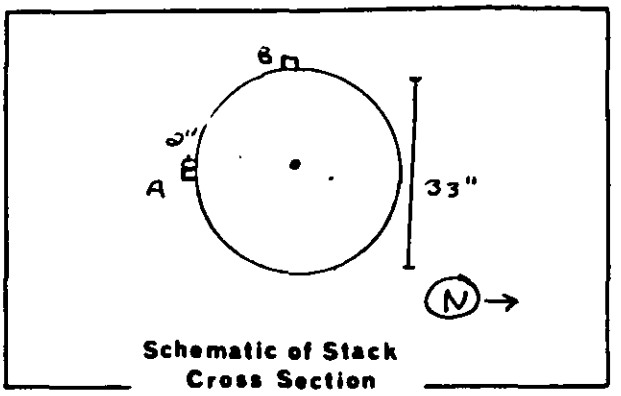
Rel. hum. ____ % B_{wo} 4 %

Barometric pressure (P_b) 28.36 in. Hg

Static pressure (P_g) -.28 in. WC ____ in. Hg

Operators JB & CM

Pitot No. ____ C_p .840 Port Length 2"



Schematic of Stack Cross Section

Traverse Point No.	Distance from Stack wall	Distance from End of Port	(.840) Velocity Head (in. WC)	Temperature (°F)
A 1	1.45	3.45	.62	
2	4.82	6.82	.76	
3	9.77	11.77	.80	
4	23.23	25.23	.78	
5	28.18	30.18	.75	
6	31.54	33.54	.69	
B 1			.43	
2			.68	
3			.74	
4			.78	
5			.77	
6			.64	
25				avg. 108

S-0034R

Sample Log Sheet

Job Southern Minnesota Sugar Company

Unit and Sampling Location Combined Cooling and Drying

Date 11-18-86 Test 1 Run 1

Sample Train: Leak check pretest : < 0.02 cfm at 15 in. Hg. (vac.) ☑

posttest: 0.00 cfm at 6 in. Hg. (vac.)

Particulate Sample Type and Number	Weights		
	Final	Tare	Difference
Ellis #1329			
PW			
Total (M_n)			g

Impinger ☐ Condenser ☑

Impinger Number	Weights		
	Final	Tare	Difference
Condenser	412	0	42
Desiccant	1419	1390	29
Total (M_{wo})			71 g

Integrated Flue Gas Sampling Data

FG Train No. B1 Box No. 11 Bag No. 1

Bag Material Tedlar Bag Volume 414 L

Pretest leak check 0.00 cc/min at 15 in. Hg. 320-P No. 7

Time	cc/min.	Time	cc/min.
(0800)			
	(400)		
(0901)	(400)		

Operator J.B. 320-P Reading _____ % v/v

S-0046R

EPA Method 5 Field Data Sheet

Job SMSC Operators JB & CM Pitot No. 4-10 C_p .840

Source Combined sugar Cooling & Drying Sampling Train No. 9 $\Delta H_@$ 1.70 Bar. Press. 28.99 in.Hg. B_{wo} 4 %

Date 11-18-86 Test 1 Run 1 Gasmeter coeff. 1.0061 Amb. Temp. 83 °F Nozzle No. 7-2 Nozzle Dia. .249 in.

Traverse Point No.	Sampling Time (min)	Sample Volume (ft^3)	Velocity Head (in. WC)	Orifice Meter (in. WC)	ΔV (mcf)	Vac. (inHg)	Stack Temp (°F) 1	Probe Temp (°F) 2	Oven Temp (°F) 3	Oxygen (% v/v) 4	Gasmeter temp IN (°F) 5	Gasmeter temp OUT (°F) 6
	(0900)	(506.20)										
A 6	5	510.78	.72	2.48	0.82	1.9	108	250	250	20.9	85	76
5	10	515.13	.83	2.45	5.05	2.0	108			20.9	88	76
4	15	520.15	.87	3.06	0.21		108			20.9	89	76
3	20	525.21	.87	3.03	5.31	2.4	108			20.9	94	76
2	25	530.95	.79	2.71	0.10	2.2	108	250	250	20.9	94	77
1	30	541.55	.65	2.28	4.55		108			20.9	96	77
B 6	35	539.19	.73	2.56	9.26	2.0	108			20.9	96	78
5	40	544.24	.85	2.98	4.35		108			20.9	96	80
4	45	549.20	.87	3.06	9.50	2.5	108			20.9	96	80
3	50	554.31	.83	2.92	4.54		108	250	250	20.9	98	80
2	55	559.17	.70	2.47	9.17		108			20.9	100	80
1	60	563.57	.62	2.19	3.55		108			20.9	100	81
	(0901)											
	$\theta t = 60$	$V_{std} = 57.37$		$\bar{\Delta H} = 2.60$							$\bar{t}_m$ 91	

0=20.9

C-3

Sample Log Sheet

Job Southern Minnesota Sugar Co.
Unit and Sampling Location Combined Sugar Cooling & Drying Stack
Date 11-18-86 Test 1 Run 2

Sample Train: Leak check pretest : < 0.02 cfm at 15 in. Hg. (vac.) ☑
posttest: 0.00 cfm at 7 in. Hg. (vac.)

Particulate Sample Type and Number	Weights		
	Final	Tare	Difference
Filter #6334			
PW			
Total (M_n)			g

Impinger ☐ Condenser ☑

Impinger Number	Weights		
	Final	Tare	Difference
Condenser	43	0	43
Desiccant	1346	1303	43
Total (M_{wo})			86 g

Integrated Flue Gas Sampling Data

FG Train No. B1 Box No. 11 Bag No. 2
Bag Material tedlar Bag Volume 44 L
Pretest leak check 0.00 cc/min at 15 in. Hg. 320-P No. 7

Time	cc/min.	Time	cc/min.
(0926)			
	(400)		
(1021)	(400)		

Operator JB 320-P Reading _____ % v/v

S-0046R

EPA Method 5 Field Data Sheet

Job SMSC Operators JB + CM Pitot No. 4-10 C_p .840

Source Combined Sugar Cooling + Drying Stack Sampling Train No. 9 $\Delta H_@$ 1.70 Bar. Press. 28.99 in.Hg. B_{wo} 5 %

Date 11-18-86 Test 1 Run 2 Gasmeter coeff. 1.0061 Amb. Temp. 85°F Nozzle No. 7-2 Nozzle Dia. .249 in.

Traverse Point No.	Sampling Time (min)	Sample Volume (ft^3)	Velocity Head (in. WC)	Orifice Meter (in. WC)	ΔV (mcf)	Vac. (in Hg)	Stack Temp (°F) 1	Probe Temp (°F) 2	Oven Temp (°F) 3	Oxygen (% v/v) 4	Gasmeter temp IN (°F) 5	Gasmeter temp OUT (°F) 6
	(0926)	(564.00)										
B 6	5	568.55	.79	2.63	8.74	2.0	108	250	250	20.9	92	82
5	10	573.72	.86	2.94	3.79		108			20.9	100	82
4	15	579.01	.91	3.13	9.02		108			20.9	102	82
3	20	584.18	.94	3.24	4.35	2.7	108			20.9	104	83
2	25	589.18	.77	2.67	9.19		108	250	250	20.9	106	84
1	30	593.48	.60	2.08	3.48	2	108			20.9	107	85
A 6	35	598.27	.75	2.61	8.27	2.4	108			20.9	104	85
5	40	603.24	.81	2.81	3.24	2.6	108			20.9	106	86
4	45	608.33	.64	2.92	8.32		108	250	250	20.9	106	46
3	50	613.42	.84	2.92	3.34	2.8	108			20.9	106	86
2	55	618.21	.77	2.68	8.25		108			20.9	107	87
1	60	622.81	.67	2.41	2.87		108			20.9	107	87
	(1027)						108					
	Θt = 60	Vstd = 58.87		$\overline{\Delta H}$ 2.75							$\overline{t_m}$ = 94.2	

Sample Log Sheet

Job Southern Minnesota Sugar Company

Unit and Sampling Location Combined Sugar Drying & Cooling Stack

Date 11-18-86 Test 1 Run 3

Sample Train: Leak check pretest :< 0.02 cfm at 15 in. Hg. (vac.) ☑

posttest: 0.00 cfm at 6 in. Hg. (vac.)

Particulate Sample Type and Number	Weights		
	Final	Tare	Difference
Filter # 6335			
PW			
Total (M_n)			g

Impinger ☐ Condenser ☑

Impinger Number	Weights		
	Final	Tare	Difference
Condenser	40	0	40
Desiccant	1416	1384	32
Total (M_{wo})			72 g

Integrated Flue Gas Sampling Data

FG Train No. B1 Box No. 11 Bag No. 3

Bag Material tedlar Bag Volume 44 L

Pretest leak check 0.00 cc/min at 15 in. Hg. 320-P No. 7

Time	cc/min.	Time	cc/min.
( )			
	(400)		
( )	(400)		

Operator JB 320-P Reading _____ % v/v

S-0046R

EPA Method 5 Field Data Sheet

Job SMSC Operators JB & CM Pitot No. 4-10 C_p .840

Source Combined Sugar Drying + Cooling Stack Sampling Train No. 9 $\Delta H_@$ 1.70 Bar. Press. 29.99 in.Hg. B_{wo} 5.5 %

Date 11-18-86 Test 1 Run 3 Gasmeter coeff. 1.0061 Amb. Temp. 82 °F Nozzle No. 7-2 Nozzle Dia. .249 in.

Traverse Point No.	Sampling Time (min)	Sample Volume (ft^3)	Velocity Head (in. WC)	Orifice Meter (in. WC)	ΔV (mcf)	Vac. (in Hg)	Stack Temp (°F) 1	Probe Temp (°F) 2	Oven Temp (°F) 3	Oxygen (% v/v) 4	Gasmeter temp IN (°F) 5	Gasmeter temp OUT (°F) 6
	(10.38)	(623.10)										
A 6	5	627.78	.73	2.53	7.81	1.8	108	250	250	20.9	97	86
5	10	632.69	.79	2.75	2.74	1.9	108			20.9	100	87
4	15	637.41	.86	2.96	7.81		108			21.1	102	87
3	20	642.91	.86	2.98	2.93	2.3	108			20.6	103	87
2	25	647.76	.78	2.71	7.81		108			20.9	104	87
1	30	652.14	.63	2.19	2.21		107	250	250	20.9	104	87
B 6	35	656.98	.75	2.61	7.01		107			20.9	102	86
5	40	662.11	.84	2.91	2.07		107			20.9	104	86
4	45	667.28	.88	3.06	7.26	2.6	107			20.9	104	86
3	50	672.25	.82	2.85	2.77		107	250	250	20.9	104	86
2	55	677.08	.74	2.57	7.03		107			20.9	104	86
1	60	681.30	.55	1.92	1.14		107			20.9	104	86
	(11.39)											
	θt = 60	Vsld = 58.20		$\overline{\Delta H}$ = 2.67							$\overline{t_m}$ =	94.5

C-7

APPENDIX D

METHOD 9 FIELD DATA SHEETS

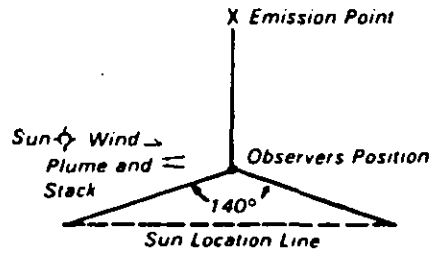
Interpoll Inc.
(612)786-6020

Visible Emissions Form

SOURCE NAME: S Minnesota Sugar Co.	OBSERVATION DATE: 11-18-86
ADDRESS: 1 mi East of Renville on US. 212	START TIME
CITY: Renville / STATE: Mn / ZIP	STOP TIME
PHONE / SOURCE ID NUMBER	
PROCESS EQUIPMENT: Sugar Dryer / cooler — OPERATING MODE: 90+	
CONTROL EQUIPMENT: 4 Scrubbers — OPERATING MODE: 90+	
DESCRIBE EMISSION POINT — START / STOP	
HEIGHT ABOVE GROUND LEVEL — START / STOP; HEIGHT RELATIVE TO OBSERVER — START / STOP	
DISTANCE FROM OBSERVER — START / STOP; DIRECTION FROM OBSERVER — START / STOP	
DESCRIBE EMISSIONS — START / STOP	
EMISSION COLOR — START / STOP; 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 — START / STOP	
DESCRIBE BACKGROUND — START / STOP	
BACKGROUND COLOR — START / STOP; SKY CONDITIONS — START / STOP	
WIND SPEED — START / STOP; WIND DIRECTION — START / STOP	
AMBIENT TEMP. — START / STOP; WET BULB TEMP.; RH,percent	

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1					31				
2					32				
3					33				
4					34				
5					35				
6					36				
7					37				
8					38				
9					39				
10					40				
11					41				
12					42				
13					43				
14					44				
15					45				
16					46				
17					47				
18					48				
19					49				
20					50				
21					51				
22					52				
23					53				
24					54				
25					55				
26					56				
27					57				
28					58				
29					59				
30					60				

Source Layout Sketch — Draw North Arrow



AVERAGE OPACITY FOR HIGHEST PERIOD	NUMBER OF READINGS ABOVE % WERE
RANGE OF OPACITY READINGS — MINIMUM / MAXIMUM	
OBSERVER'S NAME (PRINT): John Buresh	
COMMENTS: Complete interference with other emissions	OBSERVER'S SIGNATURE: John Buresh — DATE: 11-18-86
	ORGANIZATION: Interpoll
I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS — SIGNATURE / TITLE / DATE	CERTIFIED BY: MPCA — DATE: 10-22-86
	VERIFIED BY / DATE

S-0079R

MINNESOTA POLLUTION CONTROL AGENCY

AIR POLLUTION CONTROL ASSOCIATION

This is to certify that,

John Buresh

attended and fulfilled the requirements of the

Visible Emission Evaluation Certification Course

offered by

The Air Pollution Control Association
Upper Midwest Section

In conjunction with the

The Minnesota Pollution Control Agency
Division of Air Quality

on

October 21, 1986

During the course of the test an average deviation of less than 7.5% for a set of 25 white smoke and a set of 25 black smoke was maintained and none of the readings deviated by 20% or more.

By achieving the above accuracy, certification as a "Smoke Reader" is granted for a period of six months from the date of the test.

Roger V. Karn

ROGER V. KARN
Instructor
Visible Emissions Program
MPCA, DAQ

Certificate Number **59-6**

APPENDIX E

LABORATORY DATA SHEETS

4268

Interpoll Inc.
(612)786-6020

Pg ___ of ___

Chain of Custody
Sample Deposition Sheet

Job Southern Minnesota Sugar Co.
Site Combined Dryer/cooler Stack
Team Leader John Buresh
Priority
Date Submitted 11-18-86
Received by
Test No(s). 1
Number of Runs Completed 3

No. of Samples	Type of Sample	Analysis Required	Date Analyzed	Other Information or Special Instructions
3 + 1 Blank	Probe Wash Solvent(s):	☑ As per EPA 5 ☐ _____ _____		
3	Filter: ☑ 4" glass fiber ☐ Stainless steel ☐ ERC	☑ As per EPA 5 ☐ _____ _____		
	Wet Catch	☐ Organic ☐ Inorganic ☐ Other		
3	Orsat	O_2 + CO_2		
	SO_2			
	SO_2 Audit Sample			EPA Control No(s).
	NO_x (Open box tops after unloading)	☐ Colorimetric ☐ Ion Chromatographic		Date / / & Time of arrival at Interpoll
	NO_x Audit Sample			EPA Control No(s).
	Fuel Sample			

Source Information

1) Type of source: ☐ Boiler ☐ Asphalt Plant ☐ Incinerator ☑ Other Dryer/cooler
2) Fuel: ☐ Coal ☐ Wood ☐ Gas ☐ Oil ☐ Other _____
3) Is sample combustible? ☑ No ☐ Yes
4) Does sample need special desiccating? ☑ No ☐ Yes If yes, explain _____
5) Is particle size analysis required ☑ No ☐ Yes If yes, how many run(s)? _____
run preference _____

S-278RRRR

EPA METHOD 3

LABORATORY REPORT

SUMMARY OF ORSAT DATA

Job: Southern Minnesota Sugar Co
Sampling Location: Combined Dryer/Cooler Stack
Sampling Date: 11-15-86
Analysis Date: 11-18-86
Technician: RCV

TEST NO. AND DATE	RUN NO.	RESULTS						
		INTEGRATED (BAG)			GRAB (BULB)			O_2 ANALYZER
		% CO_2	% O_2	% CO	% CO_2	% O_2	% CO	% O_2
4268-05 / 11-18-86	1	0.00	20.90					
4268-08 / 11-18-86	2	0.00	20.90					
4268-11 / 11-18-86	3	0.00	20.90					

Form #L-200 R

Interpoll Inc.
(612)786-6020

EPA Method 3 Data Sheet (Orsat Analysis)

Technician R.G.V
Orsat Analyzer No. 3
Job Southern Minnesota Sugar Co
City/State _____ Fuel Type _____

Date of Analysis 11-18-86
Leak Check Performed ☑ YES ☐ NO
Source Combined Dryer/cooler
Test Site Stack

Sample Identification		Test/Run	Analysis No.	Buret Readings (cc)			Concentration (% v/v,dry)		F_o
				Zero Point	After CO_2	After O_2	CO_2	O_2	
Ambient Air				0.00	0.00	20.90	0.00	20.90	
4268-08	F	1/1	1	0.00	0.00	20.90	0.00	20.90	
	B ✓		2	0.00	0.00	20.90	0.00	20.90	
			3						
			AVG				0.00	20.90	
4268-08	F	1/2	1	0.00	0.00	20.90	0.00	20.90	
	B ✓		2	0.00	0.00	20.90	0.00	20.90	
			3						
			AVG				0.00	20.90	
4268-11	F	1/3	1	0.00	0.00	20.90	0.00	20.90	
	B ✓		2	0.00	0.00	20.90	0.00	20.90	
			3						
			AVG				0.00	20.90	

F = Flask (250 cc all-glass); B = Tedlar bag (5-layer)

Note 1 Analyses performed as per CFR title 40, Part 60, Appendix A, Method 3; KOH for CO_2 and reduced methylene blue for O_2 absorption using a Burrell Orsat Analyzer with a 100 cc buret.

Note 2 Use PC-3 Program "ORSAT" Version 6-85.

L-0192R

INTERPOLL INC.
EPA Method 5 Probe (Cyclone) Wash
Gravimetric Analysis Laboratory Data Sheet
(CFR Title 40 Part 60 Appendix A)

Acetone Blank

Date of Analysis 11-19-86
Technician RCW

EPA-M5 Acetone R.B SPEC ≤ 7.8 µg/cc
Actual acetone residue blank 0 µg/cc

(1)

(8)

interpoll

Job SMSC
City/State Renville Mn
Source Combined sugar cane + Dryer
Test Site Stack
Sample type PW
Remarks: Blank

Date 11/15/86
Log # 4268-01
Tech SB
Test/Run 1/0
___ of ___

Special Handling Required
Evaporating Dish No. 89
Volume of acetone 100 cc
E. Dish Tare Wt. 13.40700 g
E. Dish + Sample Wt. 13.40700 g
Comments

(2)

interpoll

Job
City/State
Source
Test Site
Sample type
Remarks:

Date
Log#
Tech
Test/Run
___ of ___

Special Handling Required
Evaporating Dish No.
Volume of acetone ___ cc
E. Dish Tare Wt. ___ g
E. Dish + Sample Wt. ___ g
Comments

(3)

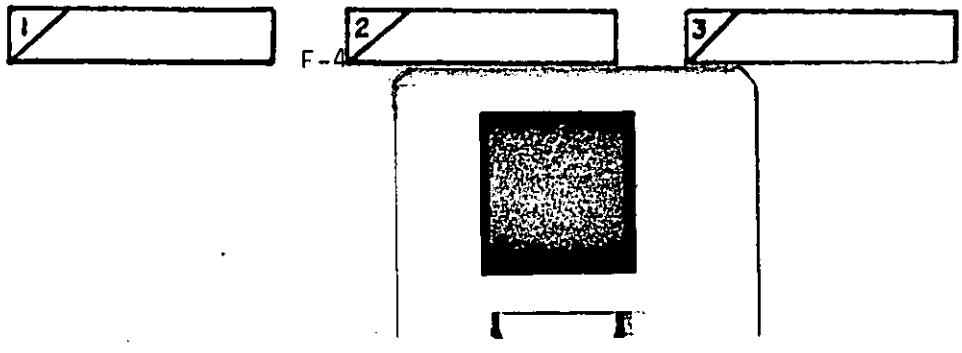
interpoll

Job
City/State
Source
Test Site
Sample type
Remarks:

Date
Log#
Tech
Test/Run
___ of ___

Special Handling Required
Evaporating Dish No.
Volume of acetone ___ cc
E. Dish Tare Wt. ___ g
E. Dish + Sample Wt. ___ g
Comments

RESULTS:



(EPA Method 5) Filter
Gravimetric Analysis Lab
Data Sheet
FR 42(160)

Filter Blank

Date of Analysis 11-19-86
Technician RCV

(1) interpoll

Job SMSC Date 11-18-86
City/State Renwick, MN Log# 4268-02
Source Combined Sugar Dryer Stack
Test Site Stack
Sample type _____ Tech JB
Remarks: Test/Run 1/0
1 of 1

Special Handling Required _____
Filter No. 6407
Filter Type 4"G
Filter Tare Wt. 0.6448 g
Filter + Sample Wt. 0.6448 g
Comments _____

(2) interpoll

Job _____ Date _____
City/State _____ Log# _____
Source _____
Test Site _____
Sample type _____ Tech _____
Remarks: Test/Run _____
_____ of _____

Special Handling Required _____
Filter No. _____
Filter Type _____
Filter Tare Wt. _____ g
Filter + Sample Wt. _____ g
Comments _____

(3) interpoll

Job _____ Date _____
City/State _____ Log# _____
Source _____
Test Site _____
Sample type _____ Tech _____
Remarks: Test/Run _____
_____ of _____

Special Handling Required _____
Filter No. _____
Filter Type _____
Filter Tare Wt. _____ g
Filter + Sample Wt. _____ g
Comments _____

RESULTS:

1	2	3
0.0000		

L-0186/P

INTERPOLL INC.
EPA Method 5 Probe (Cyclone) Wash
Gravimetric Analysis Laboratory Data Sheet
(CFR Title 40 Part 60 Appendix A)

Date of Analysis 11-19-86
Technician DCJ

EPA-M5 Acetone R.B SPEC ≤ 7.8 µg/cc
Actual acetone residue blank 0 µg/cc

(1)

interpoll

Job SMSC Date 11-18-86
City/State Benville Mn Log# 4268-03
Source Combined Sugar Dryer Cooler
Test Site Stack
Sample type _____ Tech JB
Remarks: Test/Run 1/1
1 of 1

Special Handling Required _____
Evaporating Dish No. 41
Volume of acetone 135 cc
E. Dish Tare Wt. 68.9189 g
E. Dish + Sample Wt. 68.9364 g
Comments _____

(2)

interpoll

Job SMSC Date 11-18-86
City/State Benville Mn Log# 4268-06
Source Combined Sugar Dryer & Cooler
Test Site Stack
Sample type _____ Tech JB
Remarks: Test/Run 1/2
1 of 1

Special Handling Required _____
Evaporating Dish No. 410
Volume of acetone 135 cc
E. Dish Tare Wt. 73.3893 g
E. Dish + Sample Wt. 73.4066 g
Comments _____

(3)

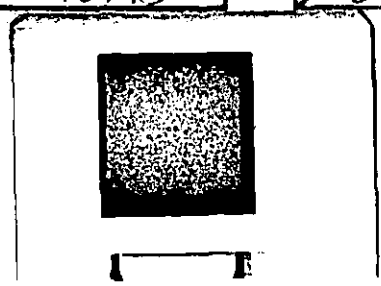
interpoll

Job SMSC Date 11-18-86
City/State _____ Log# 4268-09
Source Combined Sugar Dryer Cooler
Test Site Stack
Sample type _____ Tech JB
Remarks: Test/Run 1/3
1 of 1

Special Handling Required _____
Evaporating Dish No. 604
Volume of acetone 145 cc
E. Dish Tare Wt. 74.8728 g
E. Dish + Sample Wt. 74.9000 g
Comments _____

RESULTS:

1 0.0175 E-6 2 0.0173 3 0.0272



(EPA Method 5) Filter
Gravimetric Analysis Lab
Data Sheet
FR 42(160)

Date of Analysis 11-19-86
Technician Rcv

---

(1)

interpoll

Job SMSC Date 11-18-86
City/State Renville Mn Log# 4268-04
Source Combined Sugar Dryer & Cooler
Test Site STACK
Sample type _____ Tech JTB
Remarks: Test/Run 1/1
1 of 1

Special Handling Required _____
Filter No. 6329
Filter Type 4"G
Filter Tare Wt. 0.6321_1 g
Filter + Sample Wt. 0.6590_2 g
Comments _____

---

(2)

interpoll

Job SMSC Date 11-18-86
City/State Renville Mn Log# 4268-07
Source Combined Sugar Dryer & Cooler
Test Site STACK
Sample type _____ Tech JTB
Remarks: Test/Run 1/2
1 of 1

Special Handling Required _____
Filter No. 6334
Filter Type 0.6359
Filter Tare Wt. 0.6523_1 g
Filter + Sample Wt. _____$_2$ g
Comments _____

---

(3)

interpoll

Job SMSC Date 11-18-86
City/State _____ Log# 4268-10
Source Combined Sugar Dryer Cooler
Test Site STACK
Sample type _____ Tech JTB
Remarks: Test/Run 1/3
1 of 1

Special Handling Required _____
Filter No. 6335
Filter Type 4"G
Filter Tare Wt. 0.6321_1 g
Filter + Sample Wt. 0.6481_2 g
Comments _____

RESULTS:

1	2	3
0.0267	0.0164	0.0160
0.0444	0.0337	0.0432

L-0186/P

APPENDIX F

MPCA EXHIBIT C

MPCA EXHIBIT C FOR INDUSTRIAL PROCESSES

Job SOUTHERN MINNESOTA SUGAR COOPERATIVE

Source SUGAR COOLER

Date NOVEMBER 18, 1986

C. Equipment & Operating Data

1. Process Equip. No./Ident. STEARNS ROGER SUGAR COOLER, C-13207-16

2. Process Equip. Description SUGAR COOLER

3. Process equipment operating under normal operating conditions:

No _____. Yes ✓.

D. Instrument Data on Process Equipment

1. Include copy of production records or instrumentation which indicates rate of production or operation of the equipment, i.e. units per hour, lbs. per hour, pressure, air flow, etc.

E. Air Pollution Control Equipment

1. Type/model control equipment ROTOCLONE DUST COLLECTOR. #W740039

2. Air pressure drop across the control equipment YES.

3. Air flow through the control equipment _____.

4. Was the control equipment operating normally? YES.

5. Data of last major maintenance/cleaning of control equipment _____

F. Plant Manager's Certification

I certify that the information submitted herein is accurate and correct and that no information requessted was withheld from MPCA, Division of Air Quality.

By M. D. DeKelly, Position Mgr of Quality & Engr

mp5:4

S-349

MPCA EXHIBIT C FOR INDUSTRIAL PROCESSES

Job SOUTHERN MINNESOTA SUGAR COOPERATIVE

Source SUGAR DRYER

Date NOVEMBER 18, 1986

C. Equipment & Operating Data

1. Process Equip. No./Ident. S.R. Sugar Dryer - C-13207-1976

2. Process Equip. Description Sugar Dryer

3. Process equipment operating under normal operating conditions:

   No _____. Yes ✓.

D. Instrument Data on Process Equipment

1. Include copy of production records or instrumentation which indicates rate of production or operation of the equipment, i.e. units per hour, lbs. per hour, pressure, air flow, etc.

E. Air Pollution Control Equipment

1. Type/model control equipment Rotoclone Dust Collector "W-740040

2. Air pressure drop across the control equipment YES.

3. Air flow through the control equipment _____.

4. Was the control equipment operating normally? YES.

5. Data of last major maintenance/cleaning of control equipment _____

F. Plant Manager's Certification

I certify that the information submitted herein is accurate and correct and that no information requessted was withheld from MPCA, Division of Air Quality.

By W.D. DeBilly, Position Mgr of Purch & Engr.

mp5:4

S-349

APPENDIX G

PROCESS RATE DATA

Southern Minnesota Sugar Cooperative
P.O. BOX 500 · RENVILLE, MINNESOTA 56284 (612)329-8305

TO: Dean DeBelly, Purch and Engineering Mgr.

FROM: Glenn Augustine, Chief Chemist

DATE: November 19, 1986

SUBJECT: ANALYSES ON SAMPLES TAKEN DURING STACK TESTING

Below are the results of the analyses you requested, please let me know if any further information should be required.

Moisture- 8 hr composite dry sugar	0.034
Moisture- 6 hr composite wet sugar	1.48

TIME	Thin RDS	Hot (Dryer) RDS	Cold (Cooler) RDS
9:30 am	14.2	15.3	23.4
11:30 am	13.7	15.2	26.2
1:30 pm	14.0	15.1	26.3
3:30 pm	14.0	15.7	25.7
AVERAGE	14.0	15.3	25.4
SP. GRAVITY	1.057	1.062	1.107
FLOW RATE	-	10.8 GPM	15.9 GPM

BY W.D.A. 11/19/86

SUGAR SCALE INTEGRATOR READING
7:50 AM 1300237
3:50 PM 1310581
DIFF. 2344

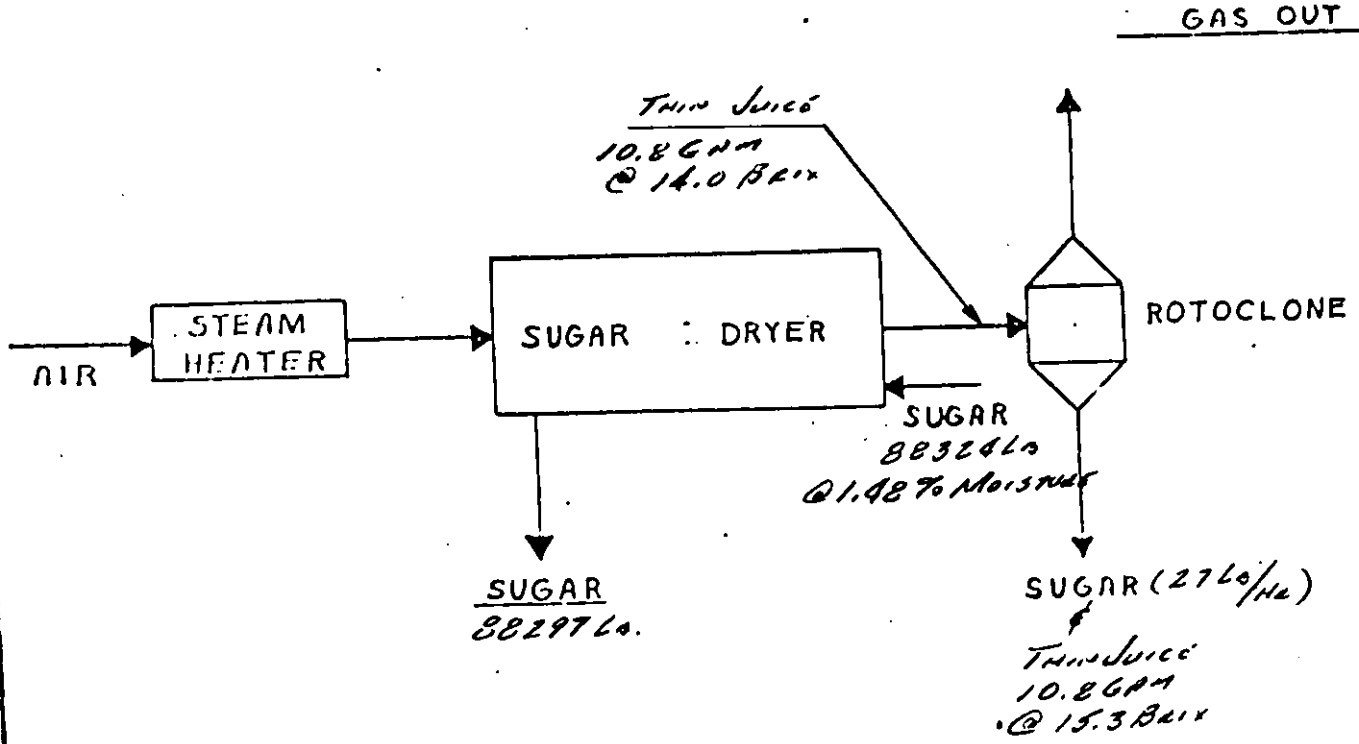
SCALE FACTOR - 1 UNIT = 3000

PROCESS WEIGHT RATE

$$= \frac{(2344)(300)}{8\ HR} = 87,900\ LB/HR$$

BY W.D.A. 11/19/86

cc: H. Doerr
file



SUGAR DRYER

SUGAR IS DRIED AND COOLED FROM 140°F TO 130°F.

SUGAR INCREASE IN THIN JUICE

= (FLOW)(SP. GR$_{OUT}$ − SP. GR$_{IN}$)

= (10.8)(500)(1.062 − 1.057)

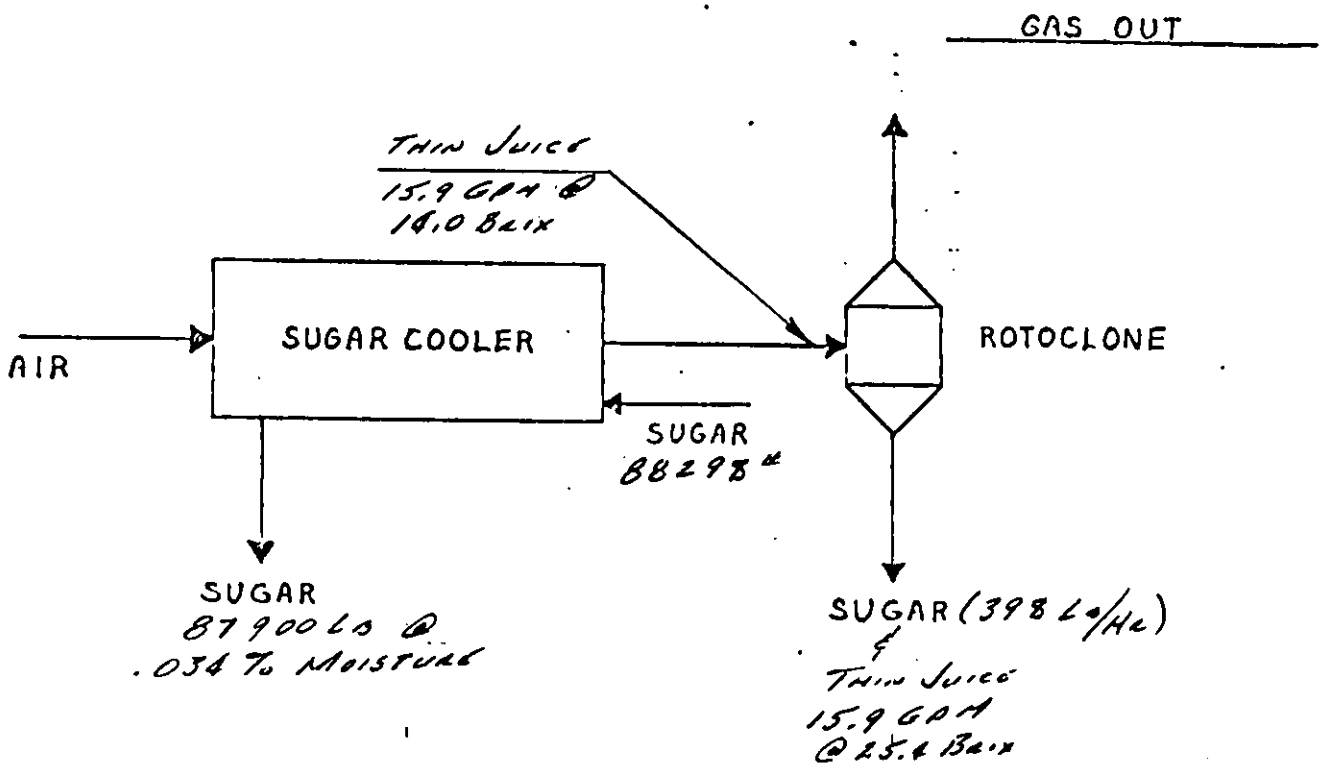
= 27 LBS/HR

W.D.P. 11/19/86

H·K·FERGUSON

SUGAR DRYER

T.M. Dolan		2738	



SUGAR COOLER

SUGAR IS COOLED FROM 130°F TO 100°F.

SUGAR INCREASE IN THIN JUICE

= (FLOW)(SP. GR. OUT − SP. GR IN)

= (15.9)(500)(1.107 − 1.057)

= 398 LB/HR

WPD 11/19/86

H·K·FERGUSON

SUGAR COOLER

2738

APPENDIX H

PROCEDURES

Particulate Loadings and Emission Rates

The particulate emission rates were determined per EPA Methods 1-5, CFR Title 40, Part 60, Appendix A (revised July 1, 1985). In this procedure, a preliminary velocity profile of the gases in the flue is obtained by means of a temperature and velocity traverse. On the basis of these values, sampling nozzles of appropriate diameter are selected to allow isokinetic sampling, a necessary prerequisite for obtaining a representative sample.

The sampling train consists of a heated glass-lined sampling probe equipped with a Type S pitot and a thermocouple. The probe is attached to a sampling module which houses the all-glass in line filter holder in a temperature controlled oven. In addition, the sampling module also houses the condenser case and a Drierite drying column. The sampling module is connected by means of an umbilical cord to the control module which houses the dry test gasmeter, the calibrated orifice, a leakless pump, two inclined manometers, and all controls required for operating the sampling train.

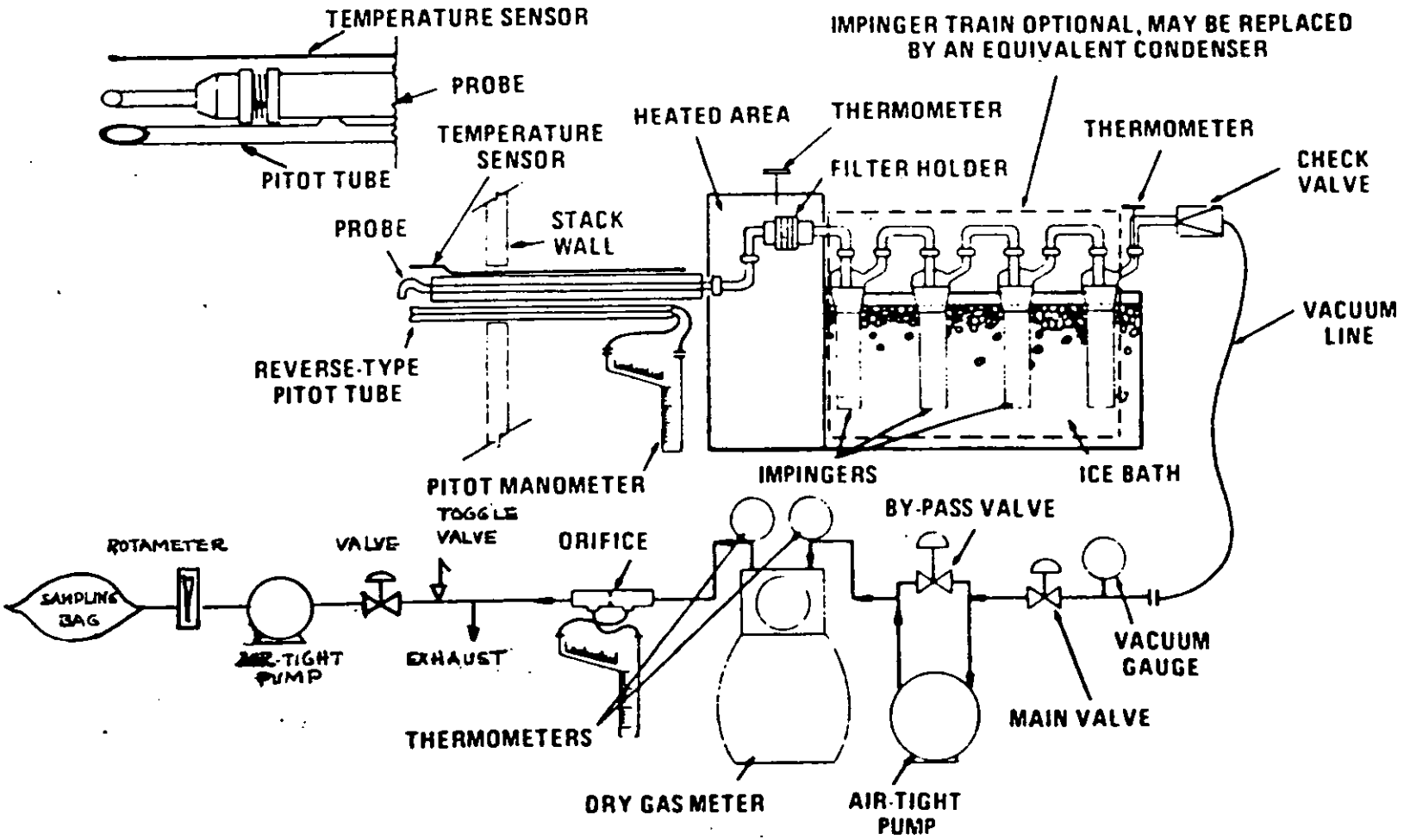
Particulate samples were collected as follows: The sample gas was drawn in through the sampling probe isokinetically and passed through a 4-inch diameter Gelman Type A/E glass fiber filter. The particulates were removed at this point and collected on the filter. The gases then passed through an ice-cooled condenser and a desiccant-packed drying column which quantitatively absorb all moisture from the sample gas stream after which the sample gas passes through the pump and the dry test gasmeter which integrates the sample gas flow throughout the course of the test. A calibrated orifice attached to the outlet of the gasmeter provides instantaneous flow rate data.

A representative particulate sample was acquired by sampling for equal periods of time at the centroid of a number of equal area regions in the duct. The sampling rate is adjusted at each site such that an isokinetic sampling condition prevails. Nomographs are used to aid in the rapid determination of the sampling rate.

After sampling is complete, the filter is removed and placed in a clean container. The nozzle and inlet side of the filter holder are quantitatively washed with acetone and the washings are stored in a second container. A brush is often used in the cleaning step to help dislodge deposits. The samples are returned to the laboratory where they are logged in and analyzed. The volume of the acetone rinse ("probe wash") is noted and then the rinse is quantitatively transferred to a tared 120 cc porcelain evaporating dish and the acetone evaporated off at 97-105 ^{o}F. This temperature is used to prevent condensation of atmospheric moisture due to the cooling effect induced by the evaporation of acetone. The acetone-free sample is then transferred to an oven and dried at 105 ^{o}C for 30 minutes, cooled in a desiccator over Drierite, and then weighed to the nearest .01 mg. The filter sample is quantitatively transferred to a 6-inch watch glass and dried in an oven at 105 ^{o}C for two hours. The filter and watch glass are then cooled in a desiccator and the filter weighed to the nearest .01 mg. All weighings are performed in a balance room where the relative humidity is hydrostatted to less than 50% relative humidity. Microscopic examination of the samples is performed if any unusual characteristics are observed. The weight of the acetone rinse is corrected for the acetone blank. The Drierite column is weighed on-site and the water collected by Drierite is added to the condensate so that the total amount of absorbed water may be ascertained.

Integrated gas samples for Orsat analysis were collected at a constant flow rate throughout each particulate run. The gas samples were analyzed using al all-glass Orsat analyzer. Standard commercially prepared solutions were used in the Orsat analyzer (sat. KOH for carbon dioxide and reduced methylene blue for oxygen). In addition to the above, the oxygen content of the flue gas was measured at each traverse during the particulate determinations using a Teledyne Model 320P-4 Portable Oxygen Analyzer to sample the effluent from the Method 5 train.

3a P2(7)



Particulate sampling train.

APPENDIX I

CALCULATION EQUATIONS

CALCULATION EQUATIONS

METHOD 2

$$\bar{V}_s = 85.48\ C_p\ (\sqrt{\Delta p})_{avg}\ \sqrt{\frac{T_{s(avg)}}{P_s\ M_s}}$$

$$Q_{s,d} = 60(1 - B_{ws})\ \bar{V}_s\ A\ \left(\frac{528}{T_{s(avg)}}\right)\ \left(\frac{P_s}{29.92}\right)$$

$$Q_a = 60\ \bar{V}_s\ A$$

$$\dot{m}_g = \frac{4.995\ Q_{s,d}\ G_d}{1 - B_{ws}}$$

$$RH^* = 100\ (vp_{twb}\ 0.0003641\ P_s\ (T_{db} - T_{wb}))/vp_{tdb}$$

$$B^*_{ws} = RH(vp_{tdb})/P_s$$

$$= \frac{4.585 \times 10^{-2}\ P_s M_s}{T_{s\ (avg)}}$$

*Alternate equations for calculating moisture content from wet bulb and dry buld data.

CALCULATION EQUATIONS

METHOD 3

$$\%EA = \frac{100(\%O_2 -).5\%\ CO)}{0.264\%\ N_2 - \%O_2 + 0.5\%\ CO}$$

$$M_d = 0.44(\%CO_2) + 0.32\ (\%O_2) + 0.28\ (\%N_2 + \%CO)$$

$$M_s = M_d\ (I - B_{ws}) + 0.18\ B_{ws}$$

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

CALCULATION EQUATIONS

METHOD 5

$$V_{m(std)} = 17.65\ V_m\ \gamma\ \left(\frac{P_{bar} + \overline{\Delta H}/13.6}{T_{m(avg)}}\right)$$

$$V_{w(std)} = 0.0472\ V_{Is}$$

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

$$I = 0.0944\ \left(\frac{T_{s(avg)}\ V_{m(std)}}{p_s\ V_s\ A_n\ \theta\ (1 - B_{ws})}\right)$$

$$C_s = \frac{15.43\ M_p}{V_{m(std)}}$$

$$C_a = \frac{272.3\ M_p\ P_s}{T_{s(avg)}\ (V_{w(std)} + V_{m(std)})}$$

$$(\dot{m}_p)_1 = 8.5714 \times 10^{-3}\ C_s\ Q_{s,d}$$

$$(\dot{m}_p)_2 = \frac{1.3228 \times 10^{-1}\ M_p\ A}{\theta\ A_n}$$

$$\dot{m}_p = \frac{(\dot{m}_p)_1 + (\dot{m}_p)_2}{2}$$

SYMBOLS

A = Cross sectional area of stack, SQ. FT.

A_n = Cross sectional area of nozzle, SQ. FT.

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

C_p = Pitot tube coefficient, dimensionless

C_a = Concentration of particulate matter in stack gas, wet basis, GR/ACF

C_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, GR/DSCF

EA = Excess air, percent by volume

γ = Dry test meter correction factor, dimensionless

G_d = Specific gravity (relative to air), dimensionless

I = Isokinetic variation, percent by volume

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

$\dot{m}_g$ = Mass flow of wet flue gas, LB/HR

$\dot{m}_p$ = Particulate mass flow, LB/HR

M_s = Molecular weight of stack gas, wet basis, g/g, mole.

M_p = Total amount of particulate matter collected, g

P_{bar} = Atmospheric pressure, IN. HG. (uncompensated)

P_g = Stack static gas pressure, IN. WC.

P_s = Absolute pressure of stack gas, IN.HG.

P_{std} = Standard absolute pressure, 29.92 IN. HG.

A_a = Actual volumetric stack gas flow rate, ACFM

$Q_{s,d}$ = Dry volumetric stack gas flow rate corrected to standard conditions, DSCFM

RH = Relative humidity, %

T_{db} = Dry bulb temperature of stack gas, ^{o}F

T_{wb} = Wet bulb temperature of stack gas, ^{o}F

$T_{m(avg)}$ = Absolute average dry gas meter temperature, ^{o}R

$T_s(avg)$ = Absolute average stack temperature, ^{o}F

T_{std} = Standard absolute temperature, 528 ^{o}F (68 ^{o}F)

θ = Total sampling time, min.

V_{lc} = Total volume of liquid collected in impingers and silica gel, ml

V_m = Volume of gas sample as measured by dry gas meter, CF

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

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

$\bar{V}_s$ = Average actual stack gas velocity, FT/SEC

vp_{tdb} = Vapor pressure at T_{db}, IN. HG.

vp_{twb} = Vapor pressure at T_{wb}, IN. HG

$\overline{\Delta H}$ = Average pressure differential across the orifice meter, IN. WC.

ΔP = Velocity pressure of stack gas, IN. WC.

γ = Dry test meter correction coefficient, dimensionless

ρ = Actual gas density, LB/ACF

APPENDIX J

SAMPLING TRAIN CALIBRATION DATA

Interpoll Inc.
(612)786-6020

EPA Method 5 Nozzle
Calibration Data Sheet

Date of Calibration: November, 1986 Nozzle No. 7-2
Technician: E. Trowbridge

Nozzle rotated by 60 degree increments and diameter measured to nearest 0.001 inch. Observed readings and average:

Position	Diameter (inches)
1	.248
2	.250
3	.250
Average:	.249

Interpoll Inc.
(612)786-6020

S-Type Pitot Tube Inspection Sheet

Pitobe No. 4-10

Pitot tube dimensions:

1. External tubing diameter (D_t) .316 IN.
2. Base to Side A opening plane (P_A) .460 IN.
3. Base to Side B opening plane (P_B) .462 IN.

Alignment:

4. $\alpha_1 < 10^o$ 0
5. $\alpha_2 < 10^o$ 0

6. $B_1 < 5^o$ 0
7. $B_2 < 5^o$ 1°

8. Z <.125" .02
9. W <.0625" .02

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .760 IN.
11. Pitot to probe sheath 3 IN.
12. Pitot to thermocouple (parallel to probe) _____ IN.
13. Pitot to thermocouple (perpendicular to probe) _____ IN.

Date of Inspection: January 3, 1986

Inspected by: E. Trowbridge

S-348(1)

Interpoll Inc.
(612)786-6020

Meter Box Calibration
Data Sheet

Date of Calibration: October 10, 1986
Technician: E. Trowbridge
Barometric Pressure: 29.30

Meter Box No.: 9
Dry Test Meter Serial No.: 949231
Wet Test Meter No.: AL-20

Delta H Actual (in. WC)	Gas Volume Wet Meter	Cal. Index	Diff. Wet Test Meter (in. WC)	Gas Volume Dry Test Meter Vde (cf)	Gas Volume Dry Test Meter Vdf (cf)	Gas Temperature of Meters Tw (deg-F)	Gas Temperature of Meters Tdi (deg-F)	Gas Temperature of Meters Tdo (deg-F)	Time (min)	Meter Coef.	Orifice Constant (in. WC)
.5	2	99.87	.04	919.000	920.990	69.5	80	62	7.54	1.0051	1.698
1.2	3	99.88	.06	915.000	917.985	69.0	80	62	7.38	1.0044	1.685
2.0	3	99.89	.07	922.000	924.980	69.5	84	62	5.68	1.0070	1.716
3.3	5	99.90	.085	936.000	940.980	69.0	86	64	7.50	1.0058	1.750
4.7	5	99.95	.12	942.000	946.000	69.0	90	66	5.92	1.0083	1.631
								Average:		1.0061	1.70

Interpoll Inc.
(612)786-6020

Meter Box Calibration and Usage Status

Date of Report: November 18, 1986

Meter Box No.: 9

Date of Last Calibration: October 10, 1986
Calibration Technician: E. Trowbridge
Wet Test Meter No.: AL-20

Date of Use	Report No.	Initial Meter Reading	Final Meter Reading	Volume/Job (cu. ft.)	Total Volume* (cu. ft.)
October 23, 1986	6-2295	947.20	993.74	46.54	46.54
October 24, 1986	6-2297	994.00	1152.75	158.75	205.29
November 6, 1986	6-2301	153.20	340.43	187.23	392.52
November 13, 1986	6-2303	340.80	506.02	165.22	557.74
November 18, 1986	6-2305	506.20	681.30	175.10	732.84

*Total volume through meter since last calibration