AP-42 Section Number: 9.9.4

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Title: Source Emissions Report For Lexington Alfalfa Dehydrators, Inc., Alfalfa Dehydrating Facility, Darr, NE

AirSource Technologies

AirSource Technologies

October 1993

PLANT #4

SOURCE EMISSIONS REPORT
for
LEXINGTON ALFALFA DEHYDRATORS, INC.
Alfalfa Dehydration Facility
Darr, Nebraska

prepared by
AirSource Technologies

11635 W. 83rd Terrace
Lenexa, Kansas 66214

AirSource Project No. 411922

PREFACE

This report was prepared by AirSource Technologies in response to a test that was conducted at the Lexington Alfalfa Dehydrators, Inc. in Darr, Nebraska on September 9, 1993. Any questions concerning this report should be directed to Mr. Blane Wood, Project Manager, or to Mr. George Cobb, General Manager.

AirSource Technologies

Blane Wood
Project Manager

Approved

George R. Cobb
General Manager

Date: October 15, 1993

SECTION 1

INTRODUCTION

A stack test was conducted by AirSource Technologies on the Lexington Alfalfa Dehydrators alfalfa dehydrator plant in Darr, Nebraska on September 9, 1993.

The AirSource Technologies personnel who conducted the test were: Mr. Blane Wood, Project Manager and Mr. Tom McLean, Technician.

The results of the test were used to evaluate the process' performance with regards to the particulate emission rate.

The appendices contain the following:

Appendix A:	Example Calculations
Appendix B:	Computer Forms
Appendix C:	Particulate Field Data Forms
Appendix D:	Laboratory and Analysis Forms
Appendix E:	Pretest Calibrations
Appendix F:	Posttest Calibrations
Appendix G:	Process Data

SECTION 2

SUMMARY OF RESULTS

The results of the particulate emissions are: 57.52 lb.hr, 26.21 lb/hr, and 24.47 lb/hr for Runs 1, 2 and 3 respectively.

The sampling, and particulate results are shown in Table 1.

Table 1
SUMMARY OF SAMPLING AND PARTICULATE RESULTS
Lexington Alfalfa Dehyrateors, Inc.
Darr, Nebraska

Parameters	Unit of Measure	Run 1	Run 2	Run 3
Particulate Emissions				
Front Half	gr/dscf	0.2453	0.1191	0.1127
Uncorrected	gr/dscf	0.8587	0.4764	0.3945
Corrected to 7% O_2	gr/dscf	1.9627	0.9528	1.3527
Emission Rate	lb/hr	57.52	26.21	24.47
Weight	grams	0.5695	0.2663	0.2492
Isokinetics	%	92.2	94.6	94.8
Stack Flow Rate				
Actual	acfm	36,649	36,323	36,279
Standard Conditions	dscfm	27,355	25,680	25,333
Velocity	ft/min.	5,185	5,139	5,132
Sampling Results				
Sampling Volume	dscf	35.749	34.433	34.052
Avg. Stack Temperature	°F	153	168	172
Avg. ΔP	inches H_2O	1.850	1.758	1.733
Avg. ΔH	inches H_2O	1.25	1.17	1.11
Avg. Meter Temperature	°F	81	82	79
Oxygen, Orsat	%	17.0	17.5	17.0
Carbon Dioxide, Orsat	%	1.5	1.5	1.0
Static Pressure	inches H_2O	0.62	0.62	0.62
Moisture Collected	ml	52.5	75.5	79.4
Moisture	% H_2O	6.5	9.4	9.9
Sampling Time	min.	60	60	60

SECTION 3

PROCESS OPERATION

The alfalfa dehydration plant operates a MEC 125 single pass dryer. No control device was in operation at the time of testing. The conditions for each of the test runs were the same.

Table 2 summarizes the results of the process operations and table 3 process data collected during the tests.

Table 2 SUMMARY OF RESULTS Process Data	
Maximum Continuous Process Weight (Manufacturers Rating)	20,000 lb/hr
Historical Average Process Weight	10,000 lb/hr
Historical Maximum Process Weight	16,000 lb/hr
Type of Fuel Normally Burned	Natural Gas
Approximate Quantity of Fuel Burned Annually	27,000 MCF
Percent Moisture	46% Hay Pile

Table 3 PROCESS DATA			
Time	**Pellet Ct.**	**Moisture** %	**Burner Temp.** °F
12:10	7102	-	-
10:15	7120	7.0	190
10:30	7137	7.0	190
10:45	7155	6.9	190
11:00	7171	6.8	190
11:15	7187	6.9	188
11:30	7203	6.9	193
11:45	7221	7.1	214
12:00	7236	7.2	214
12:15	7253	7.2	220
12:30	7269	7.2	218
12:45	7287	7.3	222
13:01	7304	7.0	222
13:15	7322	7.0	222
13:30	7338	7.0	222
13:45	7357	7.1	222
14:00	7375	6.9	222
14:15	7393	6.9	222
14:30	7411	6.9	222
14:45	7430	7.0	222

SECTION 4

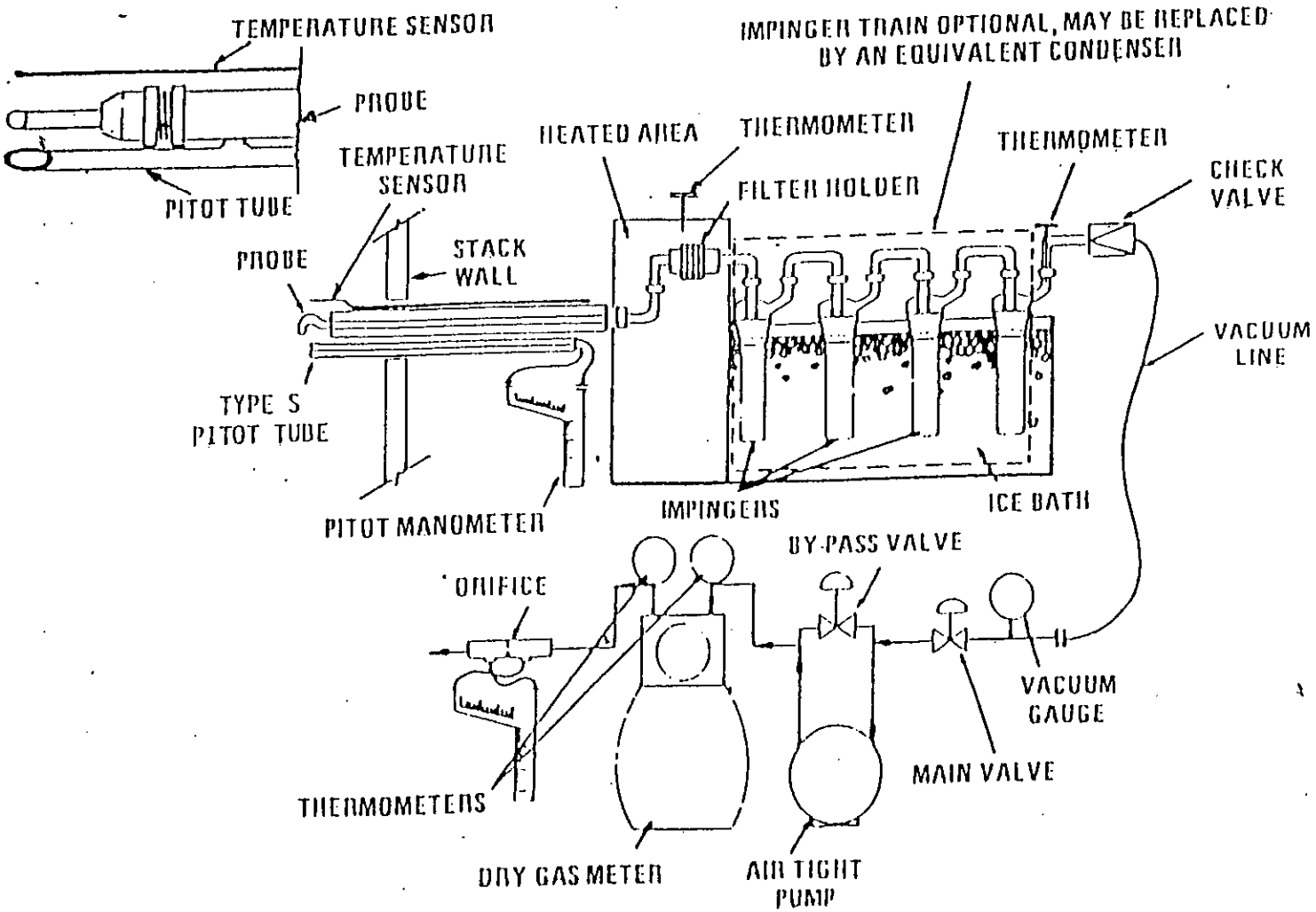
SAMPLING AND ANALYTICAL PROCEDURES

Particulates

EPA Methods 1-4 were used for the determination of traverse point locations, velocities and flows of stack gas, oxygen, carbon dioxide, and moisture. The particulate sampling and recovery of the samples were done according to EPA Method 17 recovery procedures.

Figure 1 shows a schematic of the sampling train.

Figure 2 shows a schematic of the stack and traverse locations.



Schematic of Method 5 sampling train.

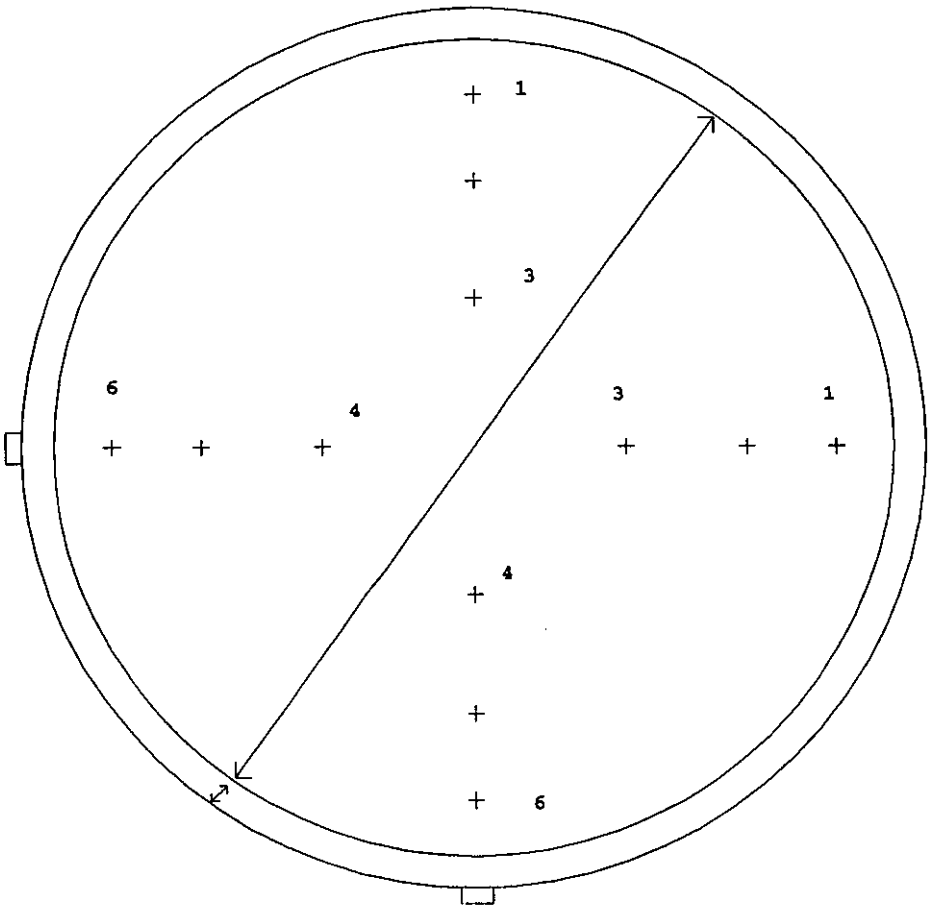
Figure 1

Stack dimensions - Lexington Alfalfa Dehydrators, Inc.

Inside diameter 36"
Port length 3"

Sampling Port Location

7 Diameters upstream from disturbance
2 Diameters downstream from disturbance



Traverse Point Locations
(Excluding Port Length)

1.	1.6"	4.	25.3"
2.	5.2"	5.	30.8"
3.	10.7"	6.	34.4"

Figure 2

APPENDIX A

EXAMPLE CALCULATIONS

NOMENCLATURE

Equation No.	Symbol	Description	Units
1	Vi	Initial meter reading	dcf
	Vf	Final meter reading	dcf
	Vm	Volume meter, actual	dcf
2	Pb	Barometric pressure	in. Hg
	ΔH_{avg}	Average orifice pressure drop	in. H_2O
	Tm_{avg}	Average meter temperature	°F
	Vm_{std}	Volume meter, standard conditions	dscf
3	Vlc	Total moisture collected	grams
	Vw_{std}	Volume of water vapor collected, standard conditions	ft^3
	% H_2O	Percent moisture by volume	-
4	Mf	Mole fraction of dry gas	-
5	% CO_2	Percent carbon dioxide by volume, dry	-
	% O_2	Percent oxygen by volume, dry	-
	% CO	Percent carbon monoxide by volume, dry	-
	% N_2	Percent nitrogen by volume, dry	-
6	Md	Molecular weight, dry stack gas	lb/lb-mole
7	Ms	Molecular weight, stack gas	lb/lb-mole
8	Θi	Sampling time interval	minutes
	Dn	Diameter of nozzle	inches
	ΔPs	Velocity head of S pitot	in. H_2O
	Ts	Temperature of stack gas	°F
	Vm_i	Volume of meter per sampling interval	ft^3
9	Ps	Stack pressure, absolute	in. Hg
	Pg	Stack gas pressure	in. H_20
10	ΔPs_{avg}	Average velocity head of S pitot	in. H_2O
	Ts_{avg}	Average temperature of stack gas	°F
	Vs	Average stack gas velocity	fpm
11	Θ	Total time of test	minutes
	% I	Percent isokinetic	-
12	ID	Inside diameter of stack	inches
	As	Area of stack	in^2
13	Qs	Stack flow rate, dry standard conditions	dscfm
14	m_n	Total particulate matter collected	mg
	Cs_{std}	Concentration of particulate collected, dry basis, standard conditions	gr/dscf

15	Cs_{std}(corr 7% O_2)	Concentration of particulate collected, dry basis standard conditions	gr/dscf (corr to 7% O_2)
16	Cs_{std}(corr 12% CO_2)	Concentration of particulate collected, dry basis standard condition	gr/dscf (corr to 12% CO_2)
17	Cs_{std}	Concentration of particulate collected, actual conditions	gr/acf
18	Ep	Particulate emission rate	lb/hr

PARTICULATE CALCULATION EQUATIONS

1. $V_m = V_f - V_i$

2. $$V_{m(std)} = \frac{17.64\ (V_m)\ Y \left(P_b + \frac{\Delta H_{avg}}{13.6}\right)}{T_{m(avg)} + 460}$$

3. $V_{wc(std)} = 0.0471(V_{lc})$

$$\%\ H_2O = \frac{100(V_{wc(std)})}{V_{m(std)} + V_{wc(std)}}$$

4. $$M_f = \frac{100 - \%H_2O}{100}$$

5. $\%\ N_2 = 100 - (\%CO_2 + \%O_2 + \%CO)$

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

7. $M_s = (M_d \times M_f) + 18(1 - M_f)$

8. $$V_{mi} = \frac{5.168(T_m + 460)(C_p)(\theta_i)(M_f)(D_n^2)}{\sqrt{P_b}} \times \sqrt{\frac{\Delta P_s}{T_S + 460}}$$

9. $$P_s = P_b + \frac{P_g}{13.6}$$

10. $$V_s = 5128.8 \times C_P \times \left(\sqrt{\Delta P_{s(avg)}}\right) \times \sqrt{\frac{T_{s(avg)} + 460}{P_s \times M_s}}$$

11. $$\%\ I = \frac{1039(T_{s(avg)} + 460)(V_{m(std)})}{V_s(\theta)(P_s)(M_f)(D_n^2)}$$

12. $$A_s = \pi \left(\frac{ID}{2}\right)^2$$

13. $$Q_s = \frac{0.122(V_s)(A_s)(M_p)(P_s)}{T_{s(avg)} + 460}$$

14. $$C_{s(std)} = 0.0154\left(\frac{M_n}{V_{m(std)}}\right)$$

15. $$C_{s(act)} = \frac{17.64(C_{s(std)})(P_s)(M_p)}{T_{s(avg)} + 460}$$

16. $$E_p = 0.00857(C_{S(std)})(Q_s)$$

APPENDIX B

COMPUTER FORMS

FILE NAME - DARR.R1 PROG.=VER 06/27/89
RUN # - DARR RUN 1 09-28-1993 16:07:29
LOCATION - DRYER STACK
DATE - SEPTEMBER 9, 1993
PROJECT # - 411922

Initial Meter Volume (Cubic Feet)=	228.475	
Final Meter Volume (Cubic Feet)=	269.178	
Meter Factor=	0.970	
Final Leak Rate (cu ft/min)=	0.006	
Net Meter Volume (Cubic Feet)=	39.482	
Gas Volume (Dry Standard Cubic Feet)=	35.749	
Barometric Pressure (in Hg)=	27.69	
Static Pressure (Inches H20)=	0.62	
Percent Oxygen=	17.0	
Percent Carbon Dioxide=	1.5	
Moisture Collected (ml)=	52.5	
Percent Water=	6.5	
Average Meter Temperature (F)=	81	
Average Delta H (in H20)=	1.25	
Average Delta P (in H20)=	1.850	
Average Stack Temperature (F)=	153	
Dry Molecular Weight=	28.92	
Wet Molecular Weight=	28.21	
Average Square Root of Delta P (in H20)=	1.3594	
% Isokinetic=	92.2	
Pitot Coefficient=	0.84	
Sampling Time (Minutes)=	60.0	
Nozzle Diameter (Inches)=	0.175	
Stack Axis #1 (Inches)=	36.0	
Stack Axis #2 (Inches)=	36.0	
Circular Stack		
Stack Area (Square Feet)=	7.07	
Stack Velocity (Actual, Feet/min)=	5,185	
Flow Rate (Actual, Cubic ft/min)=	36,649	
Flow rate (Standard, Wet, Cubic ft/min)=	29,247	
Flow Rate (Standard, Dry, Cubic ft/min)=	27,355	

Particulate Loading - Front Half

Particulate Weight (g)=	0.5695	Corr. to 7% O2 & 12% CO2	
Particulate Loading, Dry Std. (gr/scf)=	0.2453	0.8587	1.9627
Particulate Loading, Actual (gr/cu ft)=	0.1830		
Emission Rate (lb/hr)=	57.52		

Particulate Loading - Total Catch Including Impingers

Particulate Weight (g)=	0.5832		
Particulate Loading, Dry Std. (gr/scf)=	0.2512	0.8794	2.0100
Particulate Loading, Actual (gr/cu ft)=	0.1875		
Emission Rate (lb/hr)=	58.90		
Percent Impinger Catch=	2.4		

* * METRIC UNITS * *

FILE NAME - DARR.R1 PROG.=VER 06/27/89
RUN # - DARR RUN 1 09-28-1993 16:07:30
LOCATION - DRYER STACK
DATE - SEPTEMBER 9, 1993
PROJECT # - 411922

Initial Meter Volume (Cubic Meters)=	6.469		
Final Meter Volume (Cubic Meters)=	7.622		
Meter Factor=	0.970		
Final Leak Rate (cu m/min)=	0.0002		
Net Meter Volume (Cubic Meters)=	1.118		
Gas Volume (Dry Standard Cubic Meters)=	1.012		
Barometric Pressure (mm Hg)=	703		
Static Pressure (mm H20)=	16		
Percent Oxygen=	17.0		
Percent Carbon Dioxide=	1.5		
Moisture Collected (ml)=	52.5		
Percent Water=	6.5		
Average Meter Temperature (C)=	27		
Average Delta H (mm H20)=	31.8		
Average Delta P (mm H20)=	47.0		
Average Stack Temperature (C)=	67		
Dry Molecular Weight=	28.92		
Wet Molecular Weight=	28.21		
Average Square Root of Delta P (mm H20)=	6.8510		
% Isokinetic=	92.2		
Pitot Coefficient=	0.84		
Sampling Time (Minutes)=	60.0		
Nozzle Diameter (mm)=	4.44		
Stack Axis #1 (Meters)=	0.914		
Stack Axis #2 (Meters)=	0.914		
Circular Stack			
Stack Area (Square Meters)=	0.657		
Stack Velocity (Actual, m/min)=	1,580		
Flow rate (Actual, Cubic m/min)=	1,038		
Flow rate (Standard, Wet, Cubic m/min)=	828		
Flow rate (Standard, Dry, Cubic m/min)=	775		
Particulate Loading - Front Half			
Particulate Weight (g)=	0.5695	Corr. to 7% O2 & 12% CO2	
Particulate Loading, Dry Std. (mg/cu m)=	562.6	1969.2	4501.0
Particulate Loading, Actual (mg/cu m)=	419.8		
Emission Rate (kg/hr)=	26.11		
Particulate Loading - Total Catch Including Impingers			
Particulate Weight (g)=	0.6		
Particulate Loading, Dry Std. (mg/cu m)=	576.2	2016.6	4609.3
Particulate Loading, Actdal (mg/cu m)=	429.9		
Emission Rate (kg/hr)=	26.74		
Percent Impinger Catch=	2.4		

FILE NAME - DARR.R1
RUN # - DARR RUN 1
LOCATION - DRYER STACK
DATE - SEPTEMBER 9, 1993
PROJECT # - 411922

PROG.=VER 06/27/89
09-28-1993 16:07:31

Point #	Delta P (in. H20)	Delta H (in. H20)	Stack T (F)	Meter T In(F)	Meter T Out(F)
1	1.700	1.20	154	82	81
2	1.800	1.20	158	81	82
3	2.000	1.30	157	80	80
4	1.800	1.30	148	82	80
5	1.800	1.20	150	70	68
6	1.700	1.10	147	72	73
7	2.100	1.40	156	79	80
8	2.000	1.30	150	77	82
9	1.900	1.30	162	89	91
10	1.800	1.30	155	88	88
11	1.900	1.30	153	88	86
12	1.700	1.10	150	87	84

Fraction	Final Wt. (g)	Tare Wt. (g)	Blank Wt. (g)	Net Wt. (g)
DRY CATCH	0.0000	0.0000	0.0000	0.0000
FILTER	30.4202	30.0511	-0.0006	0.3697

Fraction	Final Wt. (g)	Tare Wt. (g)	Vol. (ml)	Net Wt. (g)
PROBE RINSE	70.0155	69.8159	110.0	0.1998
IMPINGERS	239.8052	239.7896	200.0	0.0137

Probe Rinse Blank (mg/ml)= -0.0020
Impinger Blank (mg/ml)= 0.0095

FILE NAME - DARR.R2
RUN # - DARR RUN 2
LOCATION - DRYER STACK
DATE - SEPTEMBER 9, 1993
PROJECT # - 411922

PROG.=VER 06/27/89
09-28-1993 16:08:50

Initial Meter Volume (Cubic Feet)=	269.332		
Final Meter Volume (Cubic Feet)=	308.597		
Meter Factor=	0.970		
Final Leak Rate (cu ft/min)=	0.000		
Net Meter Volume (Cubic Feet)=	38.087		
Gas Volume (Dry Standard Cubic Feet)=	34.433		
Barometric Pressure (in Hg)=	27.69		
Static Pressure (Inches H20)=	0.62		
Percent Oxygen=	17.5		
Percent Carbon Dioxide=	1.5		
Moisture Collected (ml)=	75.5		
Percent Water=	9.4		
Average Meter Temperature (F)=	82		
Average Delta H (in H20)=	1.17		
Average Delta P (in H20)=	1.758		
Average Stack Temperature (F)=	168		
Dry Molecular Weight=	28.94		
Wet Molecular Weight=	27.92		
Average Square Root of Delta P (in H20)=	1.3249		
% Isokinetic=	94.6		
Pitot Coefficient=	0.84		
Sampling Time (Minutes)=	60.0		
Nozzle Diameter (Inches)=	0.175		
Stack Axis #1 (Inches)=	36.0		
Stack Axis #2 (Inches)=	36.0		
Circular Stack			
Stack Area (Square Feet)=	7.07		
Stack Velocity (Actual, Feet/min)=	5,139		
Flow Rate (Actual, Cubic ft/min)=	36,323		
Flow rate (Standard, Wet, Cubic ft/min)=	28,332		
Flow Rate (Standard, Dry, Cubic ft/min)=	25,680		

Particulate Loading - Front Half

Particulate Weight (g)=	0.2663	Corr. to 7% O2 & 12% CO2	
Particulate Loading, Dry Std. (gr/scf)=	0.1191	0.4764	0.9528
Particulate Loading, Actual (gr/cu ft)=	0.0842		
Emission Rate (lb/hr)=	26.21		

Particulate Loading - Total Catch Including Impingers

Particulate Weight (g)=	0.2851		
Particulate Loading, Dry Std. (gr/scf)=	0.1275	0.5100	1.0201
Particulate Loading, Actual (gr/cu ft)=	0.0901		
Emission Rate (lb/hr)=	28.06		
Percent Impinger Catch=	6.6		

* * METRIC UNITS * *

FILE NAME - DARR.R2 PROG.=VER 06/27/89
RUN # - DARR RUN 2 09-28-1993 16:08:51
LOCATION - DRYER STACK
DATE - SEPTEMBER 9, 1993
PROJECT # - 411922

Initial Meter Volume (Cubic Meters)=	7.626		
Final Meter Volume (Cubic Meters)=	8.738		
Meter Factor=	0.970		
Final Leak Rate (cu m/min)=	0.0000		
Net Meter Volume (Cubic Meters)=	1.078		
Gas Volume (Dry Standard Cubic Meters)=	0.975		
Barometric Pressure (mm Hg)=	703		
Static Pressure (mm H20)=	16		
Percent Oxygen=	17.5		
Percent Carbon Dioxide=	1.5		
Moisture Collected (ml)=	75.5		
Percent Water=	9.4		
Average Meter Temperature (C)=	28		
Average Delta H (mm H20)=	29.6		
Average Delta P (mm H20)=	44.7		
Average Stack Temperature (C)=	75		
Dry Molecular Weight=	28.94		
Wet Molecular Weight=	27.92		
Average Square Root of Delta P (mm H20)=	6.6774		
% Isokinetic=	94.6		
Pitot Coefficient=	0.84		
Sampling Time (Minutes)=	60.0		
Nozzle Diameter (mm)=	4.44		
Stack Axis #1 (Meters)=	0.914		
Stack Axis #2 (Meters)=	0.914		
Circular Stack			
Stack Area (Square Meters)=	0.657		
Stack Velocity (Actual, m/min)=	1,566		
Flow rate (Actual, Cubic m/min)=	1,029		
Flow rate (Standard, Wet, Cubic m/min)=	802		
Flow rate (Standard, Dry, Cubic m/min)=	727		
Particulate Loading - Front Half			
Particulate Weight (g)=	0.2663	Corr. to 7% O2 & 12% CO2	
Particulate Loading, Dry Std. (mg/cu m)=	273.1	1092.5	2185.0
Particulate Loading, Actual (mg/cu m)=	193.0		
Emission Rate (kg/hr)=	11.90		
Particulate Loading - Total Catch Including Impingers			
Particulate Weight (g)=	0.3		
Particulate Loading, Dry Std. (mg/cu m)=	292.4	1169.6	2339.3
Particulate Loading, Actual (mg/cu m)=	206.6		
Emission Rate (kg/hr)=	12.74		
Percent Impinger Catch=	6.6		

FILE NAME - DARR.R2
RUN # - DARR RUN 2
LOCATION - DRYER STACK
DATE - SEPTEMBER 9, 1993
PROJECT # - 411922

PROG.=VER 06/27/89
09-28-1993 16:08:52

Point #	Delta P (in. H20)	Delta H (in. H20)	Stack T (F)	Meter T In(F)	Meter T Out(F)
1	2.000	1.30	172	78	80
2	2.000	1.30	173	81	82
3	1.800	1.20	158	82	81
4	1.700	1.20	163	84	83
5	1.800	1.20	168	84	83
6	1.700	1.20	157	85	82
7	1.600	1.00	168	82	80
8	1.700	1.10	174	82	81
9	1.700	1.10	170	82	81
10	1.700	1.10	166	83	82
11	1.900	1.30	173	83	81
12	1.500	0.98	168	84	81

Fraction	Final Wt. (g)	Tare Wt. (g)	Blank Wt. (g)	Net Wt. (g)
DRY CATCH	239.6770	239.6570	200.0000	0.0000
FILTER	33.8369	33.6858	-0.0006	0.1517

Fraction	Final Wt. (g)	Tare Wt. (g)	Vol. (ml)	Net Wt. (g)
PROBE RINSE	70.7191	70.6048	145.0	0.1146
IMPINGERS	239.6777	239.6570	200.0	0.0188

Probe Rinse Blank (mg/ml)= -0.0020
Impinger Blank (mg/ml)= 0.0095

FILE NAME - DARR.R3 PROG.=VER 06/27/89
RUN # - DARR RUN 3 09-29-1993 10:03:16
LOCATION - DRYER STACK
DATE - SEPTEMBER 9, 1993
PROJECT # - 411922

Initial Meter Volume (Cubic Feet)=	308.738		
Final Meter Volume (Cubic Feet)=	347.350		
Meter Factor=	0.970		
Final Leak Rate (cu ft/min)=	0.000		
Net Meter Volume (Cubic Feet)=	37.454		
Gas Volume (Dry Standard Cubic Feet)=	34.052		
Barometric Pressure (in Hg)=	27.69		
Static Pressure (Inches H20)=	0.62		
Percent Oxygen=	17.0		
Percent Carbon Dioxide=	1.0		
Moisture Collected (ml)=	79.4		
Percent Water=	9.9		
Average Meter Temperature (F)=	79		
Average Delta H (in H20)=	1.11		
Average Delta P (in H20)=	1.733		
Average Stack Temperature (F)=	172		
Dry Molecular Weight=	28.84		
Wet Molecular Weight=	27.77		
Average Square Root of Delta P (in H20)=	1.3155		
% Isokinetic=	94.8		
Pitot Coefficient=	0.84		
Sampling Time (Minutes)=	60.0		
Nozzle Diameter (Inches)=	0.175		
Stack Axis #1 (Inches)=	36.0		
Stack Axis #2 (Inches)=	36.0		
Circular Stack			
Stack Area (Square Feet)=	7.07		
Stack Velocity (Actual, Feet/min)=	5,132		
Flow Rate (Actual, Cubic ft/min)=	36,279		
Flow rate (Standard, Wet, Cubic ft/min)=	28,115		
Flow Rate (Standard, Dry, Cubic ft/min)=	25,333		

Particulate Loading - Front Half

Particulate Weight (g)=	0.2492	Corr. to 7% O2 & 12% CO2	
Particulate Loading, Dry Std. (gr/scf)=	0.1127	0.3945	1.3527
Particulate Loading, Actual (gr/cu ft)=	0.0787		
Emission Rate (lb/hr)=	24.47		

Particulate Loading - Total Catch Including Impingers

Particulate Weight (g)=	0.3795		
Particulate Loading, Dry Std. (gr/scf)=	0.1716	0.6006	2.0593
Particulate Loading, Actual (gr/cu ft)=	0.1198		
Emission Rate (lb/hr)=	37.26		
Percent Impinger Catch=	34.3		

* * METRIC UNITS * *

FILE NAME - DARR.R3 PROG.=VER 06/27/89
RUN # - DARR RUN 3 09-29-1993 10:03:16
LOCATION - DRYER STACK
DATE - SEPTEMBER 9, 1993
PROJECT # - 411922

Initial Meter Volume (Cubic Meters)=	8.742		
Final Meter Volume (Cubic Meters)=	9.836		
Meter Factor=	0.970		
Final Leak Rate (cu m/min)=	0.0000		
Net Meter Volume (Cubic Meters)=	1.061		
Gas Volume (Dry Standard Cubic Meters)=	0.964		
Barometric Pressure (mm Hg)=	703		
Static Pressure (mm H20)=	16		
Percent Oxygen=	17.0		
Percent Carbon Dioxide=	1.0		
Moisture Collected (ml)=	79.4		
Percent Water=	9.9		
Average Meter Temperature (C)=	26		
Average Delta H (mm H20)=	28.3		
Average Delta P (mm H20)=	44.0		
Average Stack Temperature (C)=	78		
Dry Molecular Weight=	28.84		
Wet Molecular Weight=	27.77		
Average Square Root of Delta P (mm H20)=	6.6301		
% Isokinetic=	94.8		
Pitot Coefficient=	0.84		
Sampling Time (Minutes)=	60.0		
Nozzle Diameter (mm)=	4.44		
Stack Axis #1 (Meters)=	0.914		
Stack Axis #2 (Meters)=	0.914		
Circular Stack			
Stack Area (Square Meters)=	0.657		
Stack Velocity (Actual, m/min)=	1,564		
Flow rate (Actual, Cubic m/min)=	1,027		
Flow rate (Standard, Wet, Cubic m/min)=	796		
Flow rate (Standard, Dry, Cubic m/min)=	717		
Particulate Loading - Front Half			
Particulate Weight (g)=	0.2492	Corr. to 7% O2 & 12% CO2	
Particulate Loading, Dry Std. (mg/cu m)=	258.5	904.7	3102.0
Particulate Loading, Actual (mg/cu m)=	180.4		
Emission Rate (kg/hr)=	11.11		
Particulate Loading - Total Catch Including Impingers			
Particulate Weight (g)=	0.4		
Particulate Loading, Dry Std. (mg/cu m)=	393.5	1377.4	4722.5
Particulate Loading, Actual (mg/cu m)=	274.7		
Emission Rate (kg/hr)=	16.91		
Percent Impinger Catch=	34.3		

FILE NAME - DARR.R3
RUN # - DARR RUN 3
LOCATION - DRYER STACK
DATE - SEPTEMBER 9, 1993
PROJECT # - 411922

PROG.=VER 06/27/89
09-29-1993 10:03:17

Point #	Delta P (in. H20)	Delta H (in. H20)	Stack T (F)	Meter T In(F)	Meter T Out(F)
1	1.500	0.97	168	77	77
2	1.700	1.10	170	79	78
3	1.700	1.10	168	81	79
4	1.900	1.20	176	81	78
5	1.700	1.10	169	81	79
6	1.600	1.00	172	81	79
7	2.000	1.30	174	79	78
8	1.900	1.30	171	78	78
9	1.800	1.20	176	79	78
10	1.700	1.00	176	79	78
11	1.700	1.10	171	79	78
12	1.600	1.00	168	80	78

Fraction	Final Wt. (g)	Tare Wt. (g)	Blank Wt. (g)	Net Wt. (g)
DRY CATCH	0.0000	0.0000	0.0000	0.0000
FILTER	31.5864	31.4608	-0.0006	0.1262

Fraction	Final Wt. (g)	Tare Wt. (g)	Vol. (ml)	Net Wt. (g)
PROBE RINSE	74.2020	74.0792	120.0	0.1231
IMPINGERS	281.6969	281.5648	200.0	0.1302

Probe Rinse Blank (mg/ml)= -0.0020
Impinger Blank (mg/ml)= 0.0095

APPENDIX C

PARTICULATE FIELD DATA FORMS

TRAVERSE POINT LOCATIONS

PROJECT NO. 41922

PLANT ~~Leighton~~ Dark

DATE 9-9-93

SAMPLING LOCATION Dryer Stack

INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE (Distance A) 39

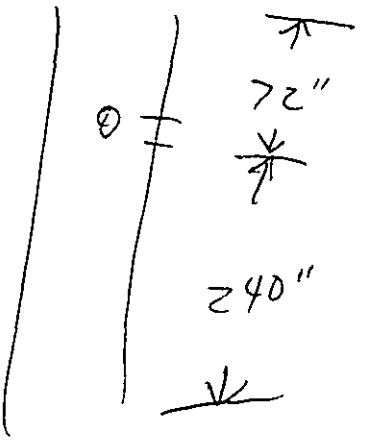
INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE (Distance B) 3

STACK I.D. (Distance A - Distance B) 36

NEAREST UPSTREAM DISTURBANCE (in.) 7

NEAREST DOWNSTREAM DISTURBANCE (in.) 2

OPERATOR B. Wood



DRAWING OF STACK

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)	
					Decimal	Fraction to nearest 1/8 in.
1	4.4	36	1.6		1.8	160
2	14.6		5.2		1.9	156
3	29.6		10.7		2.0	151
4	70.4		25.3		2.0	155
5	85.4		30.8		2.0	160
6	95.6		34.4		1.9	158
7						
8						
9						
10						
11						
12						

Comments:

Reviewed by: _____ Date: _____

PRELIMINARY VELOCITY TRAVERSE

PROJECT NO. 4/1922

PLANT Dorr Alfalfa

DATE 9-9-93

LOCATION Dryer Stack

STACK I.D. 36

BAROMETER PRESSURE IN. Hg 27.69

SITE TO BARO. ELEVATION (ft.) 0

CORRECTED BARO. PRESSURE ~~27.69~~ 27.69

TEMPERATURE METER NO. 2

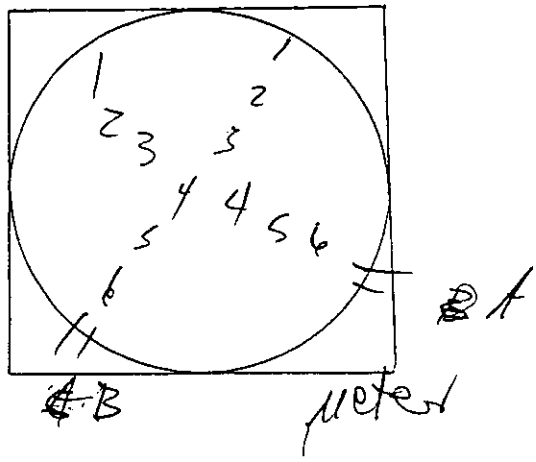
THERMOCOUPLE I.D. NO. T. Pitot

PITOT (Cp) .84

OPERATORS B. Cabral
T. McLean

STACK GAUGE PRESSURE (In. H_2O) .62

FINAL PITOT LEAK CK. AT ≥3" H_2O (P) F



SCHEMATIC OF TRAVERSE POINT LAYOUT

TRAVERSE POINT NUMBER	VELOCITY HEAD ΔP, IN. H_2O	STACK TEMP. °F	CYCLONIC FLOW DETERMINATION		TRAVERSE POINT NUMBER	VELOCITY HEAD ΔP, IN. H_2O	STACK TEMP. °F	CYCLONIC FLOW DETERMINATION	
			ΔP, AT 0° REFERENCE	ANGLE (±) WHICH YIELDS A NULL ΔP				ΔP, AT 0° REFERENCE	ANGLE (±) WHICH YIELDS A NULL ΔP
A 1	1.9	160	.2	3	B 1	1.7	152	.1	6 2
2	1.9	160	.1	3	2	1.6	150	0	0
3	2.0	155	0	—	3	1.7	147	0	0
4	2.0	155	0	—	4	1.5	149	0	0
5	2.0	156	0	—	5	1.4	146	0	0
6	1.9	156	.1	6 2	6	1.2	141	0	0

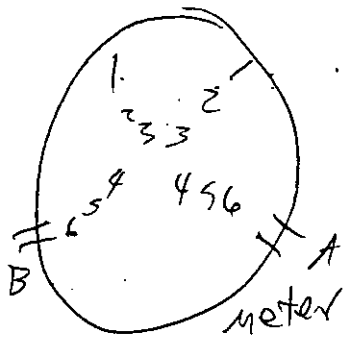
Comments:

Reviewed by: _____ Date: _____

AIRSOURCE TECHNOLOGIES

11635 W 83RD TERRACE
Lenexa, Kansas 66215
(913) 492-1613
FAX: (913) 492-1012

PROJECT NO. 4/1922 | PROJECT LEADER B. Wood
RUN NO. 1 | CONSOLE OPERATOR B. Wood
DATE 9-9-93 | LAB PERSON B. Wood
SAMPLE TYPE Particulate | SUPPORT PERSONNEL: T. McCoy
PLANT Dorr Alfalfa
SAMPLING LOCATION Dryer Stack
TOTAL SAMPLING TIME 60
METER NO. 2 | ASSUMED MOISTURE 15 %
UMBILICAL CORD I.D. NO. 50' | METER CORRECTION FACTOR .970
UMBILICAL/SAMPLER HOOKUP 1 | METER ΔH @ 1.707
OVEN BOX NO. — | BAROMETRIC PRESSURE 27.69 in Hg
PROBE NO. 3-1 | STATIC PRESSURE .62 in H_2O
PROBE LENGTH & TYPE 3' S,S, | RECORD DATA EVERY 5 MIN
PITOT NO. 17' | PITOT COEFFICIENT .84
THERMOCOUPLE I.D. NO. T1 | NOZZLE DIAMETER .175 in
NOZZLE NO. .175 | STACK AXIS #1 36
NOZZLE TYPE (SS) VG/Q | STACK AXIS #2 36



SCHEMATIC OF TRAVERSE POINT LAYOUT

SAMPLE TRAIN LEAK CHECKS	INITIAL	FINAL
TIME (24 HRS.)	1010	1125
VACUUM, in. Hg	≥15	1"
CFM	.012	.006
PITOT LEAK CHECK ≥3" H_2O	Pass	Pass

INITIAL METER VOLUME	228.475
FINAL METER VOLUME	269.178

ORSAT/FYRITE

TRIAL	PERCENT CO_2	PERCENT CO_2 + O_2	PERCENT O_2
1	1.5		17.0
2	1.5	-	17.0
3			
AVG	1.5		17.0

RECOVERY DATA

	FINAL	INITIAL	DIFFERENCE
IMP. 1	134	100	34
IMP. 2	108	100	8
IMP. 3	3	0	3
IMP. 4	551.6	544.1	7.5
TOTAL:			(52.5)

COMMENTS:

FILTER NO: 9-3-4 | % BLUE 90

REVIEWED BY: _____

Run No. 1 Project No. 4/1922 Location Dryer Stack Dart Date 9-9-93 Operator B. Ward Page 1 of 1

Traverse Point Number	Sample Time (min)	Clock Time (24-hr)	Dry Gas Meter ft³ Initial 228.475		Velocity Head Δp in. H_2O	Orifice ΔH in. H_2O		Stack Temp. °F	Dry Gas Meter Temperature °F		Pump VAC. in. Hg	Probe Temp. °F	Filter Temp. °F	Impinger Temp. °F	
		1016	Desired	Actual		Desired	Actual		Inlet	Outlet		N/A	N/A		
A 1	5	1021	231.72	231.74	1.7	1.13	1.2	154	82	81	1	—	—	61	
2	10	1026	235.06	235.03	1.8	1.19	1.2	158	81	82	1			52	
3	15	1031	238.57	238.43	2.0	1.32	1.3	157	80	80	1			52	
4	20	1036	241.93	241.88	1.8	1.21	1.3	148	82	80	1			50	
5	25	1041	245.21	245.24	1.8	1.18	1.2	150	70	68	1			52	
6	30	1046	248.43	248.457	1.7	1.13	1.1	147	72	73	1			52	
		1051													
B 1	5	1056	252.03	252.04	2.1	1.39	1.4	156	79	80	1			58	
2	10	1101	255.55	255.46	2.0	1.34	1.3	150	77	82	1			55	
3	15	1106	259.02	258.94	1.9	1.27	1.3	162	89	91	1			56	
4	20	1111	262.41	262.44	1.8	1.21	1.3	155	88	88	1			51	
5	25	1116	265.89	265.99	1.9	1.28	1.3	153	88	86	1			52	
6	30	1121	269.18	269.178	1.7	1.15	1.1	150	87	84	1			52	

AIRSOURCE TECHNOLOGIES

11635 W 83RD TERRACE
Lenexa, Kansas 66215
(913) 492-1613
FAX: (913) 492-1012

PROJECT NO. 4/1922 | PROJECT LEADER B. Wood
RUN NO. 2 | CONSOLE OPERATOR B.Wood
DATE 9-9-93 | LAB PERSON B. Wood
SAMPLE TYPE Particulate | SUPPORT PERSONNEL: T. McCoo
PLANT Dark Alfalfa
SAMPLING LOCATION Dryer Stack
TOTAL SAMPLING TIME 60
METER NO. 2 | ASSUMED MOISTURE 15 %
UMBILICAL CORD I.D. NO. 50' | METER CORRECTION FACTOR .970
UMBILICAL/SAMPLER HOOKUP 2 | METER ΔH @ 1.707
OVEN BOX NO. — | BAROMETRIC PRESSURE 27.69 in Hg
PROBE NO. 3-1 | STATIC PRESSURE .62 in H_2O
PROBE LENGTH & TYPE 3' S.S. | RECORD DATA EVERY 5 MIN
PITOT NO. 17" | PITOT COEFFICIENT .84
THERMOCOUPLE I.D. NO. T1 | NOZZLE DIAMETER .175 in
NOZZLE NO. .175 | STACK AXIS #1 36
NOZZLE TYPE (SS) G I O | STACK AXIS #2 36

See Run 1

SCHEMATIC OF TRAVERSE POINT LAYOUT

SAMPLE TRAIN LEAK CHECKS	INITIAL	FINAL
TIME (24 HRS.)	1139	1255
VACUUM, in. Hg	≥15	1"
CFM	.004	.000
PITOT LEAK CHECK ≥3" H_2O	Pass	Pass

INITIAL METER VOLUME	269.332
FINAL METER VOLUME	308.597

ORSAT/FYRITE

TRIAL	PERCENT CO_2	PERCENT CO_2 + O_2	PERCENT O_2
1	1.5		17.5
2	1.5	—	17.5
3			
AVG	1.5		17.5

RECOVERY DATA

	FINAL	INITIAL	DIFFERENCE
IMP. 1	154	100	54
IMP. 2	106	100	6
IMP. 3	3	0	3
IMP. 4	582.1	573.6	8.5
TOTAL:			(75.5)

COMMENTS:

FILTER NO.: 9-3-5 | % BLUE 90

REVIEWED BY: _____

Run No. 2 Project No. 411922 Location Dryer Stack Door Date 9-9-93 Operator B. Ward Page 1 of 1

Traverse Point Number	Sample Time (min)	Clock Time (24-hr)	Dry Gas Meter ft³ Initial 269.332		Velocity Head Δp in. H_2O	Orifice ΔH in. H_2O		Stack Temp. °F	Dry Gas Meter Temperature °F		Pump VAC. in. Hg	Probe Temp. °F	Filter Temp. °F	Impinger Temp. °F	
		1145	Desired	Actual		Desired	Actual		Inlet	Outlet		N/A	N/A		
B 1	5	1150	272.79	272.82	2.0	1.29	1.3	172	78	80	1	—	—	60	
2	10	1155	276.26	276.25	2.0	1.29	1.3	173	81	82	1			47	
3	15	1200	279.60	279.50	1.8	1.19	1.2	158	82	81	1			46	
4	20	1205	282.84	282.83	1.7	1.12	1.2	163	84	83	1			48	
5	25	1210	286.17	286.13	1.8	1.18	1.2	168	84	83	1			49	
6	30	1215	289.42	289.491	1.7	1.13	1.2	157	85	82	1			51	
		1220													
A 1	5	1225	292.54	292.54	1.6	1.04	1.0	168	82	80	1			57	
2	10	1230	295.74	295.78	1.7	1.10	1.1	174	82	81	1			47	
3	15	1235	298.95	298.93	1.7	1.10	1.1	170	82	81	1			50	
4	20	1240	302.15	302.04	1.7	1.11	1.1	166	83	82	1			49	
5	25	1245	305.57	305.57	1.9	1.23	1.3	173	83	81	1			49	
6	30	1250	308.60	308.597	1.5	.98	.98	168	84	81	1			50	

AIRSOURCE TECHNOLOGIES

11635 W 83RD TERRACE
Lenexa, Kansas 66215
(913) 492-1613
FAX: (913) 492-1012

PROJECT NO. 4/1922 — PROJECT LEADER B. Wood
RUN NO. 3 — CONSOLE OPERATOR B. Wood
DATE 9-9-93 — LAB PERSON B. Wood
SAMPLE TYPE Particulate — SUPPORT PERSONNEL: T. McCann
PLANT Dorr Alfalfa
SAMPLING LOCATION Dryer Stack
TOTAL SAMPLING TIME 60
METER NO. 2 — ASSUMED MOISTURE 15 %
UMBILICAL CORD I.D. NO. 50' — METER CORRECTION FACTOR .970
UMBILICAL/SAMPLER HOOKUP 3 — METER ΔH @ 1.707
OVEN BOX NO. — — BAROMETRIC PRESSURE 27.69 in Hg
PROBE NO. 3-1 — STATIC PRESSURE .62 in H_2O
PROBE LENGTH & TYPE 3' SS — RECORD DATA EVERY 5 MIN
PITOT NO. 12" — PITOT COEFFICIENT .84
THERMOCOUPLE I.D. NO. T1 — NOZZLE DIAMETER .175 in
NOZZLE NO. .175 — STACK AXIS #1 36
NOZZLE TYPE (SS) G10 — STACK AXIS #2 36

See Run 1

SCHEMATIC OF TRAVERSE POINT LAYOUT

SAMPLE TRAIN LEAK CHECKS	INITIAL	FINAL
TIME (24 HRS.)	1320	1436
VACUUM, in. Hg	≥15	1"
CFM	.003	.000
PITOT LEAK CHECK ≥3" H_2O	Pass	Pass

INITIAL METER VOLUME	308.738
FINAL METER VOLUME	347.350

ORSAT/FYRITE

TRIAL	PERCENT CO_2	PERCENT CO_2 + O_2	PERCENT O_2
1	1.0		17.0
2	1.0		17.0
3			
AVG	1.0		17.0

RECOVERY DATA

	FINAL	INITIAL	DIFFERENCE
IMP. 1	165	100	65
IMP. 2	105	100	5
IMP. 3	—	100	2
IMP. 4	545.8	538.4	7.4
TOTAL:			(79.4)

COMMENTS:

FILTER NO.: 9-3-6 — % BLUE 90

REVIEWED BY: _____

Run No. 3 Project No. 4/1922 Location Dryer Stack - Dayl Date 9-9-93 Operator B. Wood Page 1 of 1

Traverse Point Number	Sample Time (min)	Clock Time (24-hr)	Dry Gas Meter ft³ Initial 308,738 Desired	Dry Gas Meter ft³ Actual	Velocity Head Δp in. H_2O	Orifice ΔH in. H_2O Desired	Orifice ΔH in. H_2O Actual	Stack Temp. °F	Dry Gas Meter Temperature °F Inlet	Dry Gas Meter Temperature °F Outlet	Pump VAC. in. Hg	Probe Temp. °F	Filter Temp. °F	Impinger Temp. °F	
		1327										N/A	N/A		
A 1	5	1332	311.73	311.71	1.5	.97	.97	168	77	77	1	—	—	65	
2	10	1337	314.92	314.88	1.7	1.10	1.1	170	79	78	1			56	
3	15	1342	318.13	318.19	1.7	1.11	1.1	168	81	79	1			51	
4	20	1347	321.50	321.49	1.9	1.22	1.2	176	81	78	1			50	
5	25	1352	324.70	324.66	1.7	1.10	1.1	169	81	79	1			50	
6	30	1357	327.81	327.803	1.6	1.03	1.0	172	81	79	1			50	
		1402													
B 1	5	1407	331.26	331.24	2.0	1.28	1.3	174	79	78	1			57	
2	10	1412	334.63	334.64	1.9	1.23	1.3	171	78	78	1			50	
3	15	1417	337.90	337.98	1.8	1.15	1.2	176	79	78	1			50	
4	20	1422	341.08	341.07	1.7	1.09	1.0	176	79	78	1			52	
5	25	1427	344.27	344.20	1.7	1.10	1.1	171	79	78	1			54	
6	30	1432	347.38	347.350	1.6	1.04	1.0	168	80	78	1			54	

APPENDIX D

LABORATORY AND ANALYSIS FORMS

AIRSOURCE TECHNOLOGIES

11635 WEST 83RD TERRACE
LENEXA KS 66214
(913) 492-1613
FAX: (913) 492-1613

			PROBE RINSE BLANK — 0.002 mg/ml			FILTER BLANK - 0.0006g	
STACK ID	RUN NO.		FIL/BEAKER NO.	FINAL WEIGHT	TARE WEIGHT	ml	COMMENTS
Inlet	1	F	9-3-1	31.4254	31.3612		
		PR	8-23-31	68.2304	68.2022	60	
	2	F	9-3-2	29.5469	29.4658		
		PR	8-23-34	69.0549	69.0181	95	
	3	F	9-3-3	33.1930	33.0693		
		PR	8-26-1	70.4746	70.4340	110	
Dam	1	F	9-3-4	30.4202	30.0511		
		PR	8-26-2	70.0155	69.8159	110	
	2	F	9-3-5	33.8369	33.6858		
		PR	8-26-3	70.7191	70.6048	145	
	3	F	9-3-6	31.5864	31.4608		
	~~Bl~~	PR	8-26-4	74.2020	74.0792	120	
	Bl	F	9-3-7	35.6281	35.6283		
	Bl	PR	8-26-5	72.6654	72.6660	100	
		F					
		PR					
		F					
		PR					
		F					
		PR					
		F					
		PR					
		F					
		PR					
		F					
		PR					
		F					
		PR					
		F					
		PR					
		F		33.8369			

FINAL FILTER WEIGHING

Project No.:	Analyst: Caleb
Filter Type and Size: 8" Gelman Teflon	Weight Unit: grams

Filter Treatment:

- X Desiccate 24 hours/6 hours between weighings
- ____ Oven Treated
- ____ Other

Balance Check:				
Weight Value(g)	30	30	30	
Initial Check(g)	30.0002	30.0000	30.0003	
Final Check(g)	30.0002	30.0000	30.0002	
Date:	9-16-93	9-17-93	9-24-93	
Time (24 hr):	1635	1115	1300	
Filter No.	Weigh No. 1	Weigh No. 2	Weigh No. 3	Average
9-3-1	31.4261	31.4251	31.4256	31.4254
-2	29.5501	29.5493	29.5498	29.5496
-3	33.1936	33.1923	33.1931	
9-3-4	30.4199	30.4180	30.4199	
-5	33.8370	33.8367		33.8369
-6	31.5865	31.5862		31.5864
9-3-7	35.6282	35.6279		35.6281

FINAL FILTER WEIGHING

Project No.: 04	Analyst: ABB
Filter Type and Size: 85 mm Teflo	Weight Unit: grams

Filter Treatment: flat plank

X Desiccate 24 hours/6 hours between weighings

____ Oven Treated

____ Other

Balance Check:				
Weight Value(g)	30			
Initial Check(g)	30.0002			
Final Check(g)	30.0001			
Date:	9-25-93			
Time (24 hr):	1005			
Filter No.	Weigh No. 4	Weigh No.____	Weigh No.____	Average
9-3-3	33.1929			33.1930
9-3-4	30.4204			30.4202

INITIAL FILTER WEIGHING

Analyst: GBB	bottom only
Filter Type and Size: flat pack	Weight Unit: grams

Filter Treatment:

X Desiccate 24 hours/6 hours between weighings
____ Oven Treated
____ Other

Balance Check:				
Weight Value(g)	30	30		
Initial Check(g)	30.0003	30.0002		
Final Check(g)	30.0002	30.0003		
Date:	9-4-93	9-6-93		
Time (24 hr):	~~05~~ 1730	1330		
Filter No.	Weigh No. 1	Weigh No. 2	Weigh No. 3	Average
9-3-1	31.3612	31.3612		31.3612
-2	29.4657	29.4659		29.4658
-3	33.0695	33.0690		33.0693
-4	30.0512	30.0510		30.0511
-5	~~29.4657~~ 33.6860	33.6860		33.6858
9-3-6	31.4609	31.4606		31.4608
-7	35.6284	35.6281		35.6283
-8	31.1033	31.1031		31.1032
-9	31.8227	31.8227		31.8227
9-3 -10	31.1125	31.1123		31.1124

aj 33.6856

FINAL BEAKER WEIGHING

Project No.: sf	Analyst: Cobb
Beaker Size: 150 ml	Weight Unit: grams

Beaker Treatment:

X Desiccate 24 hours/6 hours between weighings

____ Other

Balance Check:					
Weight Value(g)	70	70	70		
Initial Check(g)	70.0001	69.9998 ~~70.0~~	70.0001		
Final Check(g)	69.9999	69.9999	70.0000		
Date:	9-15-93	9-17-93	9-24-93		
Time (24 hr):	1630	1120	1300		
Beaker No.	Weigh No. 1	Weigh No. 2	Weigh No. 3	Average	ml.
8-23-31	68.2305	68.2303		68.2304	120
8-23-34	69.0552	69.0546	69.0551	69.0549	95
8-26-1	70.4741	70.4733	70.4744		110
-2	70.0162	70.0135	70.0152		110
-3	70.7195	70.7175	70.7189		145
-4	74.2022	74.2003	74.2019		120
8-26-5	72.6659	72.6654		72.6656	160

FINAL BEAKER WEIGHING

Project No.: af	Analyst: GBS
Beaker Size: 150 ml	Weight Unit: grams

Beaker Treatment:

X Desiccate 24 hours/6 hours between weighings

____ Other

Balance Check:					
Weight Value(g)	70				
Initial Check(g)	70.0000				
Final Check(g)	70.0001				
Date:	9-25-93				
Time (24 hr):	1000				
Beaker No.	Weigh No. 4	Weigh No.____	Weigh No.____	Average	ml.
8-26-1	70.4748			70.4746	
2	70.0157			70.0155	
3	70.7192			70.7191	
4	74.2020			74.2020	

INITIAL BEAKER WEIGHING

Analyst: Cobb	
Beaker Size: 150 ml	Weight Unit: grams

Beaker Treatment:
X Desiccate 24 hours/6 hours between weighings
___ Other

Balance Check:

Weight Value(g)	70	70	70	
Initial Check(g)	69.9998	69.9998	69.9999	
Final Check(g)	69.9997	69.9998	69.9999	
Date:	8-27-93	8-27-93	8-30-93	
Time (24 hr):	0950	~~0916~~55	1110	
Beaker No.	Weigh No. 1	Weigh No. 2	Weigh No. 3	Average
8-26-1	70.4332	70.4345	70.4353	
-2	69.8150	69.8161	69.8178	
-3	70.6040	70.6050	70.6062	
-4	74.0781	74.0793	74.0815	
-5	72.6656	72.6666	72.6678	
-6	67.8960	67.8971	67.8987	
-7	66.7755	66.7766	66.7782	
-8	67.6740	67.6752	67.6768	
8-26-9	68.2764	68.2773	68.2784	
-10	67.1959	67.1969	67.1989	
-11	70.2046	70.2058	70.2075	
-12	67.7773	67.7785	67.7804	
-13	75.4094	75.4105	75.4126	
-14	~~75.4094~~ a 68.5536	68.5545	68.5564	
-15	73.1443	73.1450	73.1474	
-16	68.1527	68.1538	68.1555	
8-26-17	75.1544	75.1554	75.1575	

INITIAL BEAKER WEIGHING

Analyst: GBS	
Beaker Size: 150ml	Weight Unit: grams

Beaker Treatment:

X Desiccate 24 hours/6 hours between weighings

____ Other

Balance Check:

Weight Value(g)	70	70	70	
Initial Check(g)	69.9998	70.0000	69.9999	
Final Check(g)	69.9999	70 69.9998	69.9998	
Date:	~~8-30-93~~ 8-31-93	9-1-93	9-3-93	
Time (24 hr):	~~1700~~ 0855	1000	1700	
Beaker No.	Weigh No. 4	Weigh No. 5	Weigh No. 6	Average
8-26-1	70.4342	70.4337		70.4340
-2	69.8160	69.8157		69.8159
-3	70.6050	70.6046		70.6048
-4	74.0793	74.0791		74.0792
-5	72.6662	72.6657		72.6660
-6	67.8971	67.8964	67.8967	67.8969
-7	66.7763	66.7758		66.7761
-8	67.6749	67.6737	67.6742	67.6740
8-26-9	68.2774	68.2765	68.2770	68.2768
-10	67.1965	67.1962		67.1964
-11	70.2056	70.2051		70.2054
-12	67.7783	67.7779		67.7781
-13	75.4102	75.4097		75.4100
-14	68.5544	68.5537	68.5542	68.5540
-15	73.1448	73.1444		73.1446
-16	68.1537	68.1534		68.1536
8-26-17	75.1554	75.1546	75.1551	75.1549

8-31-93

APPENDIX E

PRETEST CALIBRATIONS

BAROMETER CALIBRATION SHEET

Date	8-15-93
Barometer Number	~~#~~ 1
Ambient Temperature	74°
Calibrator	Ryder

Barometer Reading	28.85
Reference Barometer Reading	28.80
Difference	.05

Acceptance Criteria: Difference ≤ 0.1 inch

CONSOLE WORKSHEET

NAME Rigden K FACTOR .5312 PROJECT # _____

DATE 8/30/93 TRAIN ID #2 PREVIOUS Y FACTOR .990

ORIFICE # 2 PYROMETER # _____

	RUN NUMBER 1	2
DGM		
FINAL READING	110.36	114.07
INITIAL READING	106.8	110.50
INLET & OUTLET TEMPERATURES		
INITIAL	69 / 67	71 / 68
FINAL	71 / 68	74 / 69
TIME Sec	300	300
ORIFICE RDG. "E	1.50	1.50
BAR. PRESSURE	28.85	28.85
ROOM TEMP.	68 / 68	68 / 68
PUMP VACUUM Hg"	16	16

CONSOLE CALIBRATION

Project	411775	Orifice number	2
Date	AUG 31 93	Orifice K factor	.5312
Operator	RIGDON	Previous Y factor	.990
Console Number	2		

	Run 1	Run 2
Final DGM Volume	110.360	114.070
Inital DGM Volume	106.800	110.500
Net DGM Volume (Vm)	3.560	3.570
In/Out DGM Temp.		
Inlet Deg. F		
initial	69.0	71.0
final	71.0	74.0
Outlet Deg. F		
initial	67.0	68.0
final	68.0	69.0
Avg. DGM Temp Deg. F	68.8	70.5
Time, sec.	300.0	300.0
Orifice DH, in. H2O	1.50	1.50
Baro. Press., in. Hg	28.85	28.85
Room temp., Deg. F		
initial	68.0	68.0
final	68.0	68.0
Avg.Room Temp.	68.0	68.0
Pump Vacuum, in. Hg	16	16
Vcr (std)	3.335	3.335
Vm (std)	3.440	3.438
Y Factor	.970	.970
Delta H@	1.714	1.699

Average Y	.970
Average Delta H@	1.707

+/- 2% criteria		
Percent of Avg Y	.02	
	PASS	
+/- 5% criteria		
Percent of final Y	2.09	
	PASS	

GRC 6/8/90

CONSOLE CALIBRATION

Project	411775	Orifice number	2
Date	AUG 31 93	Orifice K factor	.5312
Operator	RIGDON	Previous Y factor	.990
Console Number	2		

	Run 1	Run 2

GRC 6/11/90

ORFICE BRACKETING

Project		962002	Bracket Orfices:	
Date		AUG 31 93	Orifice No. 1	4.
Operator		RIGDON	Orifice N0.1 K factor	.
Orfice Number		2	Orifice No. 2	7.
Orfice Y factor		.97	Orifice N0.2 K factor	.
		Orfice #1	Orfice #2	
Final DGM Volume		116.780	121.490	
Inital DGM Volume		114.600	117.200	
Net DGM Volume (Vm)		2.180	4.290	
In/Out DGM Temp.				
Inlet				
	initial	74.0	77.0	
	final	74.0	74.0	
Outlet			74.0	
	initial	69.0	69.0	
	final	69.0	69.0	
Avg. DGM Temp		71.5	72.3	
Time, sec.		300.0	300.0	
Orifice DH, in. H2O		.58	2.25	
Baro. Press., in. Hg		28.85	28.85	
Room temp., Deg. F				
	initial	72.0	72.0	
	final	72.0	72.0	
Avg. Room Temp.		72.0	72.0	
Pump Vacuum, in. Hg		15	15	
Vcr (std)		2.001	4.006	
Vm (std)		2.090	4.125	
Y Factor (brackets)		.957	.971	
+/- 2% criteria				
Percent of Y		1.33	.10	
		PASS	PASS	

BRACKETING WORKSHEET

NAME Bigler K.FACTOR 1. ~~.3199~~ 2. ~~.6405~~

PROJECT # _____ DATE 8/30/93 TRAIN I.D. #2

ORIFICE # 1. 4 2. 7

DGM	1	2
Final Reading	116.78	121.49
Initial reading	114.60	119.2
Difference		

INLET & OUTLET TEMP.

Initial	74/69	74/69
Final	74/69	74/69
Avg. Temp.		
Time	300	300
Orifice rdg. ^H	.58	2.25
Bar. Pressure	28.85	28.85
Room Temp.	72/72	72/72
Pump Vacuum	15	15

DRY GAS METER THERMOCOUPLE CALIBRATION SHEET

Date	8/30/93	Thermocouple Number	#2
Calibrator	Ryden	Reference Mercury-in-glass	ASTM
		Other	

Thermocouple	Source	Reference Thermometer Temperature (°F)	Thermocouple Potentiometer Temperature (°F)	Temperature Difference* (°F)
Inlet	Ambient Air	73°	74	+1
	Hot Water Bath	131	131	0°
Outlet	Ambient Air	73°	74°	+1
	Hot Water Bath	131	132°	+1

* Reference Temperature -- Thermocouple Temperature ≤ ± 5.4 °F

TYPE S PITOT TUBE CALIBRATION

PITOT # [redacted] extension for M17

Calibrator: B Wood	Project no.:
Date: 8-15-93	Probe no.: 3-1

Pitot Tube Assembly Level?	Y / N
Pitot Tube Openings Damaged?	Y / N (If yes explain below)
α^1 1 ° (<10°)	β^1 0 ° (<5°)
α^2 1 ° (<10°)	β^2 1 ° (<5°)
Y = 1 O = 1 A = .940 in.	
Z = A sin Y .016 in. (<1/8 in.)	
W = A sin O .016 in. (<1/32 in.)	
P^- .470 in.	P^+ .470 in.
DT = .385 in.	
Calibration Required?	Y / N (If yes explain below)
Comments:	

APPENDIX F

POSTTEST CALIBRATIONS

STACK THERMOCOUPLE CALIBRATION SHEET

Date 8-22-93 Thermocouple Number 3-1

Ambient Temp. _____ F Barometric Pressure _____ in. Hg

Calibrator B. Wood Reference: mercury-in-glass ASTM

Other _____

Reference Point Number[a]	Source[b] (Specify)	Reference Thermometer Temperature F	Thermocouple Potentiometer Temperature F	Temperature Difference[c] %
1	Ambient	91°	93°	.003%
2	Tube Oven	248	252	.005%

[a] Every 50°F for each reference point

[b] Type of calibration system used

[c] $\frac{\text{(ref temp, °F + 460) - (test thermom temp, °F + 460)}}{\text{ref temp, °F + 460}} \times 100 \leq 1.5\%$.

UMBILICAL HOOKUP THERMOCOUPLE CALIBRATION SHEET

Date 9-22-93	Thermocouple Number	1
Calibrator B. Wood	Reference:mercury-in-glass	
	Other	

Source	Reference Thermometer Temperature F	Thermocouple Potentiometer Temperature F	Temperature Difference[a] F
Ambient Air	90	91	1
Ice Bath	38	39	1

[a]ReferenceTemperature - Thermocouple Temperature ≤ ± 2°F

UMBILICAL HOOKUP THERMOCOUPLE CALIBRATION SHEET

Date 8-22-93	Thermocouple Number	2
Calibrator B. Wood	Reference:mercury-in-glass	
	Other	

Source	Reference Thermometer Temperature F	Thermocouple Potentiometer Temperature F	Temperature Difference[a] F
Ambient Air	90	91	1
Ice Bath	39	39	0

[a]ReferenceTemperature - Thermocouple Temperature ≤ ± 2°F

UMBILICAL HOOKUP THERMOCOUPLE CALIBRATION SHEET

Date 8-22-93	Thermocouple Number	3
Calibrator B. Wood	Reference:mercury-in-glass	
	Other	

Source	Reference Thermometer Temperature F	Thermocouple Potentiometer Temperature F	Temperature Difference[a] F
Ambient Air	91	91	0
Ice Bath	40	40	0

[a]ReferenceTemperature - Thermocouple Temperature ≤ ± 2°F

BAROMETER CALIBRATION SHEET

Date	9-15-93
Barometer Number	#1
Ambient Temperature	72°
Calibrator	Bigdon

Barometer Reading	29.00
Reference Barometer Reading	29.05
Difference	.05

Acceptance Criteria: Difference ≤ 0.1 inch

CONSOLE WORKSHEET

NAME Ryder K FACTOR 5312 PROJECT # _____

DATE 9/16/93 TRAIN ID #2 PREVIOUS Y FACTOR .970

ORIFICE # 2 PYROMETER # _____

	RUN NUMBER 1	2
DGM		
FINAL READING	354.38	358.10
INITIAL READING	350.80	354.50
INLET & OUTLET TEMPERATURES		
INITIAL	78 / 78	79 / 78
FINAL	79 / 78	79 / 78
TIME Sec	300	300
ORIFICE RDG. ^H	1.50	1.50
BAR. PRESSURE	29.15	29.15
ROOM TEMP.	78 / 78	78 / 78
PUMP VACUUM Hg"	15"	15"

CONSOLE CALIBRATION

Project	411775	Orifice number	2
Date	SEPT 16 93	Orifice K factor	.5312
Operator	RIGDON	Previous Y factor	.970
Console Number	2		

	RUN 1	RUN 2
Final DGM Volume	354.380	358.100
Inital DGM Volume	350.800	354.500
Net DGM Volume (Vm)	3.580	3.600
In/Out DGM Temp.		
Inlet Deg. F		
initial	78.0	79.0
final	79.0	79.0
Outlet Deg. F		
initial	78.0	78.0
final	78.0	78.0
Avg. DGM Temp Deg. F	78.3	78.5
Time, sec.	300.0	300.0
Orifice DH, in. H2O	1.50	1.50
Baro. Press., in. Hg	29.15	29.15
Room temp., Deg. F		
initial	78.0	78.0
final	78.0	78.0
Avg.Room Temp.	78.0	78.0
Pump Vacuum, in. Hg	15	15
Vcr (std)	3.338	3.338
Vm (std)	3.433	3.451
Y Factor	.972	.967
Delta H@	1.711	1.691
Average Y	.970	
Average Delta H@	1.701	

+/- 2% criteria
Percent of Avg Y .26
PASS

+/- 5% criteria
Percent of final Y .02
PASS

GRC 6/8/90

CONSOLE CALIBRATION

Project	411775	Orifice number	2
Date	SEPT 16 93	Orifice K factor	.5312
Operator	RIGDON	Previous Y factor	.970
Console Number	2		

RUN 1 RUN 2

BRACKETING WORKSHEET

NAME Rigdon K.FACTOR 1. .3199 2. .6405

PROJECT # _____ DATE 9/16/93 TRAIN I.D. #2

ORIFICE # 1. 4 2. 7

DGM	1	2
Final Reading	361.40	346.63
Initial reading	359.20	342.3
Difference	_____	_____
INLET & OUTLET TEMP.		
Initial	79/78	80/79
Final	~~80~~ 79/79	80/79
Avg. Temp.	_____	_____
Time	300	300
Orifice rdg. ^H	.58	2.25
Bar. Pressure	29.15	29.15
Room Temp.	78/78	78/78
Pump Vacuum	16	15

ORFICE BRACKETING

Project	962002	Bracket Orfices:	
Date	SEPT 16 93	Orifice No. 1	4.0000
Operator	RIGDON	Orifice N0.1 K factor	.3199
Orfice Number	2	Orifice No. 2	7.0000
Orfice Y factor	.97	Orifice N0.2 K factor	.6405

	ORFICE #1	ORFICE #2
Final DGM Volume	361.400	366.630
Inital DGM Volume	359.200	362.300
Net DGM Volume (Vm)	2.200	4.330
In/Out DGM Temp.		
Inlet		
initial	79.0	80.0
final	80.0	80.0
Outlet		
initial	78.0	79.0
final	79.0	79.0
Avg. DGM Temp	79.0	79.5
Time, sec.	300.0	300.0
Orifice DH, in. H2O	.58	2.25
Baro. Press., in. Hg	29.15	29.15
Room temp., Deg. F		
initial	78.0	78.0
final	78.0	78.0
Avg. Room Temp.	78.0	78.0
Pump Vacuum, in. Hg	16	15
		0
Vcr (std)	2.010	4.025
Vm (std)	2.102	4.150
Y Factor (brackets)	.956	.970
+/- 2% criteria		
Percent of Y	1.41	.03
	PASS	PASS

GRC 9/13/93

ORFICE BRACKETING

Project	962002	Bracket Orfices:	
Date	SEPT 16 93	Orifice No. 1	4.0000
Operator	RIGDON	Orifice N0.1 K factor	.3199
Orfice Number	2	Orifice No. 2	7.0000
Orfice Y factor	.97	Orifice N0.2 K factor	.6405

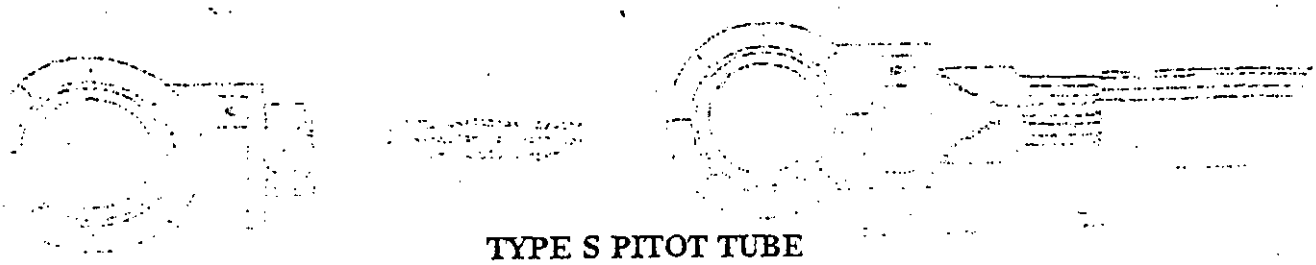
	ORFICE #1	ORFICE #2
Final DGM Volume	361.400	366.630
Inital DGM Volume	359.200	362.300

DRY GAS METER THERMOCOUPLE CALIBRATION SHEET

Date	9/16/93	Thermocouple Number	2
Calibrator	Rigalon	Reference Mercury-in-glass	ASTM
		Other	

Thermocouple	Source	Reference Thermometer Temperature (°F)	Thermocouple Potentiometer Temperature (°F)	Temperature Difference* (°F)
Inlet	Ambient Air	78°	76°	-2°
	Hot Water Bath	131°	130	-1°
Outlet	Ambient Air	78°	77°	
	Hot Water Bath	131°	132°	+1

* Reference Temperature -- Thermocouple Temperature ≤ ± 5.4 °F



TYPE S PITOT TUBE CALIBRATION

PITOT # M 17

Calibrator: Rigdon	Project no.:
Date: 10-1-93	Probe no.: M 17

Pitot Tube Assembly Level?	(Y) / N
Pitot Tube Openings Damaged?	Y / (N) (If yes explain below)

α^1 1 ° (<10°) β^1 0 ° (<5°)

α^2 1 ° (<10°) β^2 1 ° (<5°)

Y = 1 O = 1 A = .940 in.

Z = A sin Y .016 in. (<1/8 in.)

W = A sin O .016 in. (<1/32 in.)

P^{ss} .490 in. P^{s} .490 in.

DT = .385 in.

Calibration Required? Y / (N) (If yes explain below)

Comments:

STACK THERMOCOUPLE CALIBRATION SHEET

Date 9-15-93 Thermocouple Number _____

Ambient Temp. _____ F Barometric Pressure _____ in. Hg

Calibrator _____ Reference: mercury-in-glass _____

Other _____

Reference Point Number[a]	Source[b] (Specify)	Reference Thermometer Temperature F	Thermocouple Potentiometer Temperature F	Temperature Difference[c] %
Ambient 1	Ambient	72°	74°	+2°
Tube Oven	248°	248°	250°	+2°

[a] Every 50°F for each reference point

[b] Type of calibration system used

[c] $\dfrac{\text{(ref temp, °F + 460) - (test thermom temp, °F + 460)}}{\text{ref temp, °F + 460}} \times 100 \leq 1.5\%$.

UMBILICAL HOOKUP THERMOCOUPLE CALIBRATION SHEET

Date 9/15/93	Thermocouple Number	1
Calibrator Rigdon	Reference:mercury-in-glass	Astm
	Other	

Source	Reference Thermometer Temperature F	Thermocouple Potentiometer Temperature F	Temperature Difference[a] F
Ambient Air	72°	73°	+1°
Ice Bath	33°	34°	+1°

[a]ReferenceTemperature - Thermocouple Temperature ≤ ± 2°F

UMBILICAL HOOKUP THERMOCOUPLE CALIBRATION SHEET

Date	9/15/93	Thermocouple Number	2
Calibrator	Riggs	Reference:mercury-in-glass	Astm
		Other	

Source	Reference Thermometer Temperature F	Thermocouple Potentiometer Temperature F	Temperature Difference[a] F
Ambient Air	72°	72°	0°
Ice Bath	33°	33°	0°

[a]ReferenceTemperature - Thermocouple Temperature ≤ ± 2°F

UMBILICAL HOOKUP THERMOCOUPLE CALIBRATION SHEET

Date 9/15/93	Thermocouple Number	3
Calibrator Bigda	Reference:mercury-in-glass	Astm
	Other	

Source	Reference Thermometer Temperature F	Thermocouple Potentiometer Temperature F	Temperature Difference[a] F
Ambient Air	72°	72°	0°
Ice Bath	33°	32°	-1°

[a]ReferenceTemperature - Thermocouple Temperature ≤ ± 2°F

APPENDIX G

PROCESS DATA

PARTICULATE EMISSION TEST
Pellet Dryer — OPERATING DATA
(Type of Source)

Owner	Dave Hanna	Run No.	
Source I.D.		Date	9-7-93

	lbs/hr
Maximum Continuous Process Weight (Manufacturer's Rating)	20,000
Historical Average Process Weight	10,000
Historical Maximum Process Weight	16,000

Type and Sources of Fuels Normally Burned	Natural gas
Approximate Quantities of Each of Above Fuels Burned Annually	27,000 mcF

	Yes	No
Recycling Capability	✓	

Process Data During Run (Averaged)		
Process Weight (dry)	lbs/hr	
Percent Moisture	%	46% Hay Pile
Process Weight (wet)	lbs/hr	
How Process Weight Determined	Lbs of Pellets/Hr.	

Type of Fuel Burned During Run	Natural gas

	Yes	No
Recycling in Progress		✓

Person Responsible for Data: Delmer W. Gugelman

Signature: Delmer W. Gugelman

Title/Position: Production Foreman

• Averages of operating data taken during actual test run, unless requested otherwise.

9.9.93

Every 15 minutes

Time	Pellet ct.	Moisture	Hay Moisture	Burner Temp.
10:00 7102	7120			
10:15	18	7.0		195°
10:30	7137 17	7.0		195°
10:45	7155 18	6.9		195°
11:00	7171 16	6.8		190°
11:15	7187 16	6.9		185°
11:30	7203 16	6.9		193°
11:45	7221 18	7.1		214°
12:00	7236 15	7.2		214°
12:15	7253 17	7.2		220
12:30	7269 16	7.2		218°
12:45	7287 18	7.3		222°
1:01	7304 17	7.0		222°
1:15	7322 18	7.0		222°
1:30	7338 16	7.0		222°
1:45	7357 19	7.1		222°
2:00	7375 18	6.9		222°

9.9.93

2:15	7393 18	6.9		222°
2:30	7411 18	6.9		222°
2:45	7430 19	7.0		222°
3:06				