AP42 Section:	9.10.1.2
Background Chapter	4
Reference:	23
Title:	Particulate Emission Study for Michigan Sugar Company, Caro, Michigan, Swanson Environmental, Inc., Farmington Hills, MI, December 14, 1989.

APPENDIX V

REPORT EXCERPTS FROM REFERENCE 23

(Michigan Sugar Company, December 14, 1989)

PARTICULATE EMISSION STUDY
FOR
MICHIGAN SUGAR COMPANY
CARO, MICHIGAN

DATE OF TESTING:
December 14, 1989

Prepared For:

Michigan Sugar Company
P.O. Box 1348
Saginaw, Michigan 48605

Prepared By:

Swanson Environmental, Inc.
24156 Haggerty Road
Farmington Hills, Michigan 48024

MA-5491

SWANSON ENVIRONMENTAL INC.

EMISSION STUDY
PULP DRIER STACK
MICHIGAN SUGAR COMPANY
CARO, MICHIGAN
JANUARY 11, 1990
MA-5491

EXECUTIVE SUMMARY

Swanson Environmental, Inc., was retained by Michigan Sugar Company to conduct a study of the particulate emissions from the beet pulp drier at the Caro, Michigan facility.

The purpose of the study was to determine if the particulate emissions were in compliance with Michigan Sugar's Operations Permit (Number 566-89) Special Conditions requirements. The results of the study are as follows:

TABLE 1

TEST NO.	TEST DATE	STACK GAS FLOW RATE (DSCFM)	GRAIN PER DSCF	LBS/1000 LBS ACTUAL-GAS	LBS/1000 LBS DRY 50% EA*	LBS/ HOUR
P-1	12-14-89	41580	0.0595	0.089	0.202	21.22
P-2	12-14-89	35799	0.0669	0.089	0.230	20.52
P-4	12-14-89	31426	0.0727	0.092	0.247	19.58
P-5	12-14-89	31940	0.0676	0.085	0.229	18.49
AVERAGE (P2, P4, P5)		33055	0.0691	0.089	0.235	19.53

* EA = Excess Air

The average result of 0.089 pounds of total particulate per 1000 pounds of air meets the permit requirements of 0.10 pounds as established by the Michigan Department of Natural Resources (MDNR).

Note:

The average results were calclulated using only the results from tests P-2, P-4 and P-5. The data obtained in test P-1 was deemed invalid and test P-3 was discontinued during sampling (see Section 7.0).

EMISSION STUDY
PULP DRIER STACK
MICHIGAN SUGAR COMPANY
CARO, MICHIGAN
JANUARY 11, 1990
MA-5491

1.0 INTRODUCTION

Swanson Environmental, Inc., was retained by Michigan Sugar Company, of Saginaw, Michigan to conduct a particulate emission study on the beet pulp drier stack at their Caro, Michigan facility.

The purpose of the study was to determine if the particulate emissions were in compliance with Michigan Sugar's Operating Permit (Number 566-89) Special Conditions. The test was conducted in accordance with the procedures outlined in 40 CFR 60, Appendix A, for U.S. EPA Method 17.

The study was conducted on December 14, 1989, by Mr. Dan Larin, Mr. Andrew Secord, Mr. Mark Hook and Mr. Thomas Wilk of Swanson Environmental, Inc. Mr. Mark Suhr of Michigan Sugar assisted in the study. Mr. Fred Harris, the MDNR field representative, was present to monitor the study.

2.0 PROCESS DESCRIPTION

The pulp, after being extracted from the beets and discharged from the diffuser, is pressed to remove excess moisture. The pulp is then dried by feeding the material into large revolving drums through which hot air is blown.

SWANSON ENVIRONMENTAL, INC.
PARTICULATE SAMPLING DATA AND CALCULATIONS

PLANT: MICH. SUGAR SOURCE: PULP DRIER
DATE: 12/14/89

	CLOCK TIME:	60.00	60.00	60.00	60.00
	1.00 NUMBER	P-1	P-2	P-4	P-5
B.	STACK DIAMETER, In	73.01	73.01	73.01	73.01
C.	STACK AREA, Sq.Ft	29.08	29.08	29.08	29.08
D.	No. SAMPLE POINTS	30.00	30.00	30.00	30.00
E.	TOTAL SAMPLE TIME, MIN.	60.00	60.00	60.00	60.00
F.	NOZZLE DIAMETER, In.	0.248	0.248	0.248	0.248
G.	NOZZLE AREA, Sq.Ft.	0.00034	0.00034	0.00034	0.00034
H.	CALIBRATION FACTORS:				
	PITOT TUBE, Cp	0.840	0.840	0.840	0.840
	GAS METER, y	1.005	1.005	1.005	1.005
I.	BAROMETRIC PRESSURE, In.Hg.	29.30	29.30	29.30	29.30
J.	STACK STATIC PRESSURE In.H20	1.30	1.30	1.30	1.30
K.	STACK GAS TEMP.	213.83	269.40	280.17	288.90
L.	AVG. Sq. Rt. VEL. HEAD	0.66	0.68	0.64	0.66
M.	AVG. METER TEMP.	89.37	92.27	88.13	86.53
N.	AVG. METER PRESS., H2O	0.40	0.67	0.39	0.39
O.	METER VOL., ACTUAL Cu. Ft.	27.86	24.13	21.13	20.91
P.	METER VOL., @STP	26.48	22.83	20.13	19.98
Q.	LIQUID VOL., H20 COND., Ml.	249.70	336.80	348.80	355.20
R.	VAPOR VOL., H20 COND., @STP, Cu.Ft.	11.84	15.96	16.53	16.84
S.	TOTAL GAS SAMPLED, @ STP, Cu.Ft.	38.32	38.79	36.66	36.81
T.	%MOISTURE IN EXHAUST GAS				
	1) AT TEST LOCATION	30.89	41.15	45.10	45.74
	2) BEFORE COLLECTOR	0.00	0.00	0.00	0.00
U.	DRY GAS COMP. %O2	13.6	13.7	13.6	13.6
	%CO2	2.4	1.9	1.6	2.0
	%CO	0.0	0.0	0.0	0.0
	%N2	84.0	84.4	84.8	84.4
V.	DENSITY & MOL. Wt. -STACK GAS				
	1)DRY, @ STP,Lbs/Cu.Ft.	0.0748	0.0746	0.0745	0.0746
	2)WET, @ STP,Lbs/Cu.Ft.	0.0661	0.0630	0.0619	0.0618
	3)WET @ STACK,Lbs/Cu.Ft.	0.0509	0.0449	0.0434	0.0428
	4)MOL.Wt., @ STP,Lb/MOLE	28.94	28.86	28.81	28.87

W. WEIGHT OF GAS SAMPLED:				
1)DRY GAS,Lbs	1.98	1.70	1.50	1.49
2)WET GAS,Lbs	2.53	2.45	2.27	2.27
X. TOTAL PARTICULATE COLLECTED (GRAMS)	0.1023	0.0990	0.0949	0.0875
Y. AVERAGE GAS VELOCITY, FPM	2686.50	2940.34	2807.53	2921.04
Z. STACK GAS FLOW RATE				
1)AT STACK, Qa, ACFM	78111	85492	81631	84931
2)AT Std.,Qstd, SCFM	60165	60833	57241	58860
3)Std. DRY,Qdg, SCFM	41580	35799	31426	31940
AA. PERCENT EXCESS AIR	158.58	159.64	154.77	156.65
BB. CONCENTRATION CONVERSION FACTORS:				
1)50% E.A.,AFTER COLLECTOR	1.52	1.45	1.40	1.40
2)50% E.A.,BEFORE COLLECTOR	2.27	2.58	2.68	2.71
3)MOISTURE BEFORE COLLECTOR	1.28	1.44	1.51	1.53
CC. PARTICULATE CONCENTRATION:				
1)Lbs/1000 Lbs., ACTUAL	0.089	0.089	0.092	0.085
2)Lbs/1000 Lbs., DRY	0.114	0.128	0.140	0.129
3)Lbs/1000 Lbs., WET @ 50%E.A	0.135	0.129	0.129	0.119
4)Lbs/1000 Lbs., DRY @ 50%E.A	0.202	0.230	0.247	0.229
5)GRAINS / DSCF	0.0595	0.0669	0.0727	0.0676
6)POUNDS / HOUR	21.22	20.52	19.58	18.49
DD. PERCENT ISOKINETIC	91.70	91.82	92.22	90.05

SHEET No. 3

Caro Factory — 78 Day Beginning 7 A.M. 12-14-89

Lime	Day	To Date	Lime Cake	Day	To Date	Molasses	Day	To Date	Dried Pulp	Day	To Date
Rock to Kiln, Tons			% CaO in Cake			Molasses Prod. Tons			Pulp Produced Tons		
Rock % on Beets			% CaO in Sewer			Molasses Prod. % on Beets			Pulp Produced % Beets		
Discard from Kiln, Tons			Sugar in Cake % on Beets			Sugar in Mol. Prod. Tons					
Discard from Slacker, Tons			Sugar in Lime Sewer Tons			Sugar in Mol. Prod. % on Beets					
Lime Bought or Sold, Tons			Sugar in Lime Sewer % on Beets								
CaO Introduced Tons											
CaO Introduced % on Beets											

Hour	Lime Cake 1st % Sugar	Lime Cake 2nd % Sugar	Lime Cake 3rd % Sugar	Lime Cake Composite	Lime Sewer % Sugar	Milk of Lime Be	Milk of Lime % CaO	Limed Juice CaO per 100 ml	Kiln Gas % CO_2	Molasses Produced Brix	Pol.	App. Purity	Sucrose	Raff.	True Purity	SO_2	Inv. Sugar	Pulp Wet Moist. %	Pulp Press Moist. %	Pulp Dry Moist. %	Pulp Dry Sugar %	Pellets Moist. %	Pellets Sugar %	Condensed Water Boiler Feed	Mosco Bot	Sugar %	Seal Tank	Sugar %
7			.2			19		225		86.7	50.4	58.13	70	B								10.29		0	0	0	VL	
8								260	26.0											13.45				0	0	0	VL	
9	.3					20		240										II	92.4			1015		0	0	0	VL	
10								225												8.05			4.0	0	0	0	VL	
11			.3					240										II	—			1144		0	0	0	VL	
PM 12						21		215												890				0	0	0	VL	
1	.1							230														1144		0	0	0	VL	
2						18		265		83.3	48.0	57.6	7.0	B						945				0	0	0	VL	
Avg.																												
3			.9			19		250		83.2	48.4	58.17	68	B								—		0	0	0	L	
4								213												15				0	0	0	VL	
5		.2				20		200										#1	84.9			1025		0	0	0	VL	
6								210												1610		1199	5.6	VL	VL	0	VL	
7			.1			22		235										#3	91.3	940				L	VL	0	L	
8								230											71.3			1015		0	0	0	L	
9	.1					23		215																				
10								200		83.2	48	58.3	65	B						1685				0	0	0	L	
Avg.																												
11		.1				24		200		80.4	47.2	58.70	6.8									1084		0	0	0	L	
AM 12								205												1650				0	0	0	VL	
1	.6					22		230										#2	71.5			1105		0	0	0	L	
2								210												1401			2.1	0	VL	0	L	
3		.1				23		215														1132		0	VL	0	L	
4								200										#2	70.5	13.27				0	VL	0	L	
5	.7					21		200		79.2	45.4	57.3	91									11.03		0	VL	0	L	
6								250												13.56				0	VL	VL	L	
Avg.																												
24 hr Avg.	.36	.13	.36			21.00		2.23	26.0	82.7	47.38	57.32	7.2						72.14	12.81		10.89	4.00					

FORM 120 (Rev. 4-87)
HERITAGE PRESS 87-1005

TO: OPERATIONS
DEC-08-'94 THU 11:05 ID:MI SUGAR-CARO PLANT TEL NO:517-673-7520 #184 P01

CARO FACTORY — **DIFFUSER DATA** — **DATE** 1/14/89

No. Days Slicing 24
Beginning 7:00 A.M.

	TEMPERATURE							TOWER		SCREEN	PH			DIFFUSION JUICE			SUGAR		WEIGHTOMETER		KNIFE CHANGE		REMARKS
	1 Cold Juice	2 Circ. Jul.	3 Mixer	4 C.T.	5 Fresh Water	6 Press Water	7 R.J.	8 Amp.	Level	Pressure	C.T	Press Water	Fresh Water	Brix	Purity	pH	Press Water	Conc.	Reading	Tons / Hr.	Time	Slicer #	
7	59	69	61	71	59	81	47	74	58	20	5.7	5.6	6.3	15.1	88.74	6.0	1.66	17.4	233380	130			1.66 - Soft water
8	60	69	61	71	59	81	46	76	40	20	5.5	5.6	5.8			5.8	1.14		232450	70			
9	63	68	62	71	58	77	54	100	60	20	5.6	6.0	6.1	15.1	87.41	5.9	1.66	18.0	233640	135			
10	57	68	58	70	59	80	45	78	58	20	5.6	6.4	6.0			5.9	.83		233780	135	10:25	I	
11	58	68	59	70	59	80	44	76	52	20	5.5	5.2	6.0	14.1	87.94	6.0	.84	17.8	233840	120			
12	57	68	58	71	58	80	45	74	52	20	5.4	4.8	5.8			5.9	1.33		234975	136			
1	59	69	60	70	59	80	47	74	56	20	5.4	5.9	5.6	15.8	87.34	5.8	1.64	17.6	233110	135			
2	58	68	59	71	59	80	46	76	48	20	5.4	5.8	5.6			5.8	1.92		233245	135			
3	59	67	59	71	57	76	47	78	48	20	5.6	5.8	6.0	15.2	88.66	5.9	2.13	17.6	233380	135			
4	58	69	59	71	58	80	48	80	48	20	5.7	5.9	5.6			5.9	1.79		233515	135			
5	58	69	59	71	59	80	45	80	46	20	5.7	6.0	5.9	15.9	90.56	5.9	1.78	7.4	233650	135			
6	62	68	62	70	59	66	49	80	46	20	56	56	59			59	179		233785	135			
7	60	68	60	70	59	76	50	94	40	20	58	59	58	159	89.95	59	180	18.2	233920	135			
8	59	67	60	70	60	70	46	90	50	20	56	60	59			59	120		234056	135			
9	59	68	60	70	60	80	47	80	50	20	56	57	59	146	90.41	59	179	18.0	234190	135			
10	58	66	59	71	58	80	45	76	48	20	5.6	5.9	5.8			5.8	1.19		234325	135			
11	57	66	67	70	59	79	43	76	46	20	5.5	5.9	5.8	14.9	90.86	5.8	1.35	17.8	234460	135			
12	58	66	59	70	58	77	45	76	48	20	5.8	6.1	5.8			5.9	1.35		234595	135			
1	59	68	60	70	58	76	49	78	54	20	5.9	6.3	6.0	15.9	89.30	6.0	1.45	17.2	234730	135	3:00	II	
2	61	70	61	70	58	79	45	76	52	20	5.8	5.5	5.9			6.0	1.50		234865	135			
3	61	69	62	69	59	79	48	74	56	20	5.7	6.0	6.0	15.9	89.30	6.0	1.56	17.6	235000	135			
4	59	69	60	70	59	81	43	72	54	20	5.8	6.1	6.0			6.0	1.56		235135	135			
5	61	68	61	70	58	80	44	72	54	20	5.7	6.2	5.9	15.6	89.10	6.0	1.66	18.0	235270	135			
6	60	68	60	71	58	78	46	74	54	20	5.8	6.2	6.0			6.0	1.66		235405	135			

SHIFT I: TONS SLICED 995

DELAYS: 8:15 - 8:30 : Dryer Kick-out
11:45 - 11:55 : " " "

SHIFT II: TONS SLICED 1080

DELAYS: 5:30 Dryer Down
6:20 " "
7:50 " "

SHIFT III: TONS SLICED 1080 **TOTAL:** 2155

DELAYS:

161-A (Rev. 8-87)

HERITAGE PRESS 87-1988

		PULP PRODUCED					PRESSED PULP			DRY PULP			PELLET PULP			% SUGAR IN PRESSED PULP			
		---TONS---		% ON BEETS			-----% MOISTURE-----			-----% MOISTURE-----			-----% MOISTURE-----			-% SUGAR-		---TONS---	
DATE	DAY	DAY	TODATE	DAY	TD	AVE	DAY	TOTAL	TODATE	DAY	TOTAL	TODATE	DAY	TOTAL	TODATE	DAY	TD	DAY	TD
11/24	58	179	9995	5.50	5.49	172	73.18	4116.37	74.84	11.15	673.31	12.02	11.15	595.72	10.64	.30	.28	9.77	512.
11/25	59	169	10164	5.51	5.49	172	66.82	4183.19	74.70	10.38	683.69	11.99	10.34	606.06	10.63	.24	.28	7.36	519.
11/26	60	168	10332	5.50	5.49	172	66.55	4249.74	74.56	10.24	693.93	11.96	10.73	616.79	10.63	.27	.28	8.25	528.
11/27	61	126	10458	5.51	5.49	171	67.53	4317.27	74.44	11.99	705.92	11.96	11.44	628.23	10.65	.27	.28	6.17	534.28
11/28	62	133	10591	5.52	5.50	171	69.52	4386.79	74.35	11.20	717.12	11.95	11.14	639.37	10.66	.28	.28	6.75	541.03
11/29	63	155	10746	5.49	5.50	171	66.10	4452.89	74.21	14.71	731.83	12.00	11.41	650.78	10.67	.25	.28	7.06	548.09
11/30	64	145	10891	5.49	5.50	170	67.03	4519.92	74.10	13.14	744.97	12.02	10.61	661.39	10.67	.21	.28	5.54	553.63
WK 9		1075		5.50			68.10			11.83			10.97			.26		50.90	
TD			10891		5.50				74.10			12.02			10.67		.28		553.63
12/01	65	159	11050	5.49	5.50	170	70.62	4590.54	74.04	10.09	755.06	11.99	11.04	672.43	10.67	.26	.28	7.53	561.16
12/02	66	77	11127	5.48	5.49	169	70.03	4660.57	73.98	8.46	763.52	11.93	10.52	682.95	10.67	.21	.28	2.95	564.11
12/03	67	114	11241	5.52	5.50	168	75.85	4736.42	74.01	8.21	771.73	11.87	10.32	693.27	10.67	.32	.28	6.61	570.72
12/04	68	118	11359	5.50	5.50	167	73.43	4809.85	74.00	9.53	781.26	11.84	10.74	704.01	10.67	.24	.28	5.15	575.87
12/05	69	164	11523	5.50	5.50	167	71.08	4880.93	73.95	12.68	793.94	11.85	11.72	715.73	10.68	.27	.28	8.05	583.92
12/06	70	152	11675	5.51	5.50	167	71.72	4952.65	73.92	9.71	803.65	11.82	10.53	726.26	10.68	.21	.28	5.80	589.72
12/07	71	159	11834	5.51	5.50	167	74.96	5027.61	73.94	9.22	812.87	11.78	10.31	736.57	10.67	.33	.28	9.52	599.24
WK 10		943		5.50			72.53			9.70			10.74			.27		45.61	
TD			11834		5.50				73.94			11.78			10.67		.28		599.24
12/08	72	175	12009	5.50	5.50	167	77.03	5104.64	73.98	9.59	822.46	11.75	10.72	747.29	10.68	.32	.28	10.18	609.42
12/09	73	166	12175	5.51	5.50	167	73.98	5178.62	73.98	11.28	833.74	11.74	10.07	757.36	10.67	.30	.28	9.03	618.45
12/10	74	182	12357	5.51	5.50	167	75.23	5253.85	74.00	11.05	844.79	11.73	10.23	767.59	10.66	.31	.28	10.25	628.70
12/11	75	174	12531	5.52	5.50	167	74.55	5328.40	74.01	10.80	855.59	11.72	10.68	778.27	10.66	.27	.28	8.52	637.22
12/12	76	68	12599	5.48	5.50	166	75.95	5404.35	74.03	10.26	865.85	11.70	10.33	788.60	10.66	.22	.28	2.73	639.95
12/13	77	166	12765	5.50	5.50	166	73.08	5477.43	74.02	11.75	877.60	11.70	11.17	799.77	10.66	.23	.28	6.95	646.90
12/14	78	174	12939	5.52	5.50	166	77.16	5554.59	74.06	12.81	890.41	11.72	10.89	810.66	10.67	.29	.28	9.15	656.05
WK 11		1105		5.51			75.28			11.08			10.58			.28		56.81	
TD			12939		5.50				74.06			11.72			10.67		.28		656.05
12/15	79	181	13120	5.50	5.50	166	73.38	5627.97	74.05	12.10	902.51	11.72	10.77	821.43	10.67	.24	.28	7.90	663.95
12/16	80	190	13310	5.51	5.50	166	71.88	5699.85	74.02	12.00	914.51	11.72	10.84	832.27	10.67	.27	.28	9.32	673.27
12/17	81	186	13496	5.49	5.50	167	73.00	5772.85	74.01	11.97	926.48	11.73	10.87	843.14	10.67	.28	.28	9.48	682.75
12/18	82	171	13667	5.49	5.50	167	77.87	5850.72	74.06	10.81	937.29	11.72	10.66	853.80	10.67	.33	.28	10.28	693.03
12/19	83	182	13849	5.49	5.50	167	73.93	5924.65	74.06	12.31	949.60	11.72	10.95	864.75	10.68	.26	.28	8.62	701.65
12/20	84	156	14705	5.51	5.77	175	71.58	5996.23	74.03	11.09	960.69	11.72	10.46	875.21	10.67	.24	.28	6.79	708.44
12/21	85	163	14868	5.49	5.77	175	71.62	6067.85	74.00	10.06	970.75	11.70	11.07	886.28	10.68	.21	.28	6.24	714.68
WK 12		1229		5.50			73.32			11.48			10.80			.26		58.63	
TD			14868		5.77				74.00			11.70			10.68		.28		714.68

MIDWEST RESEARCH INSTITUTE

Project/Acct. No. 4602-03 Date/Time 12/9/94

Project Title SUGAR BEET PROCESSING AP-42

Signature [signature] Verified by _____ (signature/date)

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CARO, MICHIGAN FACILITY

TEST DATE: 12/14/89

TEST NO.	TIME DURATION
P-2	3:13 - 4:23 PM
P-4	7:35 - 9:25 AM
P-5	10:00 - 11:10 PM

TOTAL DRY PULP PRODUCED ON 12/14/89 = 174 tons = 7.25 tons/hr. AVERAGE

AVERAGE OVER TEST RUN

TEST NO.	SLICE RATE (tons/hr)	PRESSED PULP MOISTURE (%)	DRIED PULP MOISTURE (%)
P-2	135	82.6	15.0
P-4	135	71.3	9.4
P-5	135	71.3	16.45

$$\%\ \text{Solids} = \frac{\text{Dry Pulp Produced} - \text{Dry Pulp Moisture} * \text{Pulp Produced}}{\text{Beets Sliced}}$$

P-2: $\%\ \text{Solids} = \frac{7.25 - (0.15 * 7.25)}{135} = \frac{6.14}{135} \times 100 = 4.6\%$

P-4: $\%\ \text{Solids} = \frac{7.25 - (0.094 * 7.25)}{135} = \frac{6.57}{135} \times 100 = 4.9\%$

P-5: $\%\ \text{Solids} = \frac{7.25 - (0.145 * 7.25)}{135} = \frac{6.06}{135} \times 100 = 4.5\%$

MRI

MIDWEST RESEARCH INSTITUTE

Project/Acct. No. 4602-03 Date/Time 12/9/94

Project Title ~~Sugar~~ Beet Processing - AP-42

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$$\text{Process Rate (tons/hr.)} = \frac{\text{Beets Sliced} * \% \text{ Solids}}{1 - \left(\frac{\text{wet pulp moisture (\%)}}{100}\right)}$$

P-2: Rate $= \frac{135 * 0.046}{1 - \left(\frac{82.6}{100}\right)} = \frac{6.21}{0.174} = 35.7$ tons/hr.

P-4: Rate $= \frac{135 * 0.049}{1 - \left(\frac{71.3}{100}\right)} = \frac{6.62}{0.287} = 23.1$ tons/hr.

P-5: Rate $= \frac{135 * 0.045}{1 - \left(\frac{71.3}{100}\right)} = \frac{6.08}{0.287} = 21.2$ tons/hr.

Filename: BEET23.WQ1
Date: 19-Jan-95
Facility: Michigan Sugar Company
Location: Caro, Michigan
Source: Pulp dryer with multiclones (Natural gas-fired)
Test date: December 14, 1989

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 2	Run 4	Run 5	Average
1	Stack temperature	Deg F	269.4	280.17	288.9	
	Pressure	in. HG	29.30	29.30	29.30	
	Moisture	%	41.15	45.1	45.74	
	Oxygen	%	13.7	13.6	13.6	
	Volumetric flow, actual	acfm	85492	81631	84931	
	Volumetric flow, standard*	dscfm	35800	31425	31938	
	Isokinetic variation	%	91.7	91.82	92.22	
	Wet pulp feed rate	TPH	35.7	23.1	21.2	
	Pollutant concentrations:					
	Filterable PM	G/dscf	0.0669	0.0727	0.0676	
	CO2	% dv	1.9	1.6	2.0	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	20.5	19.6	18.5	
	CO2	lb/hr	4662	3446	4378	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.58	0.85	0.87	0.77
	CO2	lb/ton	131	149	206	162
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.29	0.42	0.44	0.38
	CO2	kg/Mg	65	75	103	81

*DSCFM BASED ON A STANDARD TEMPERATURE OF 70 DEGREES FAHRENHEIT

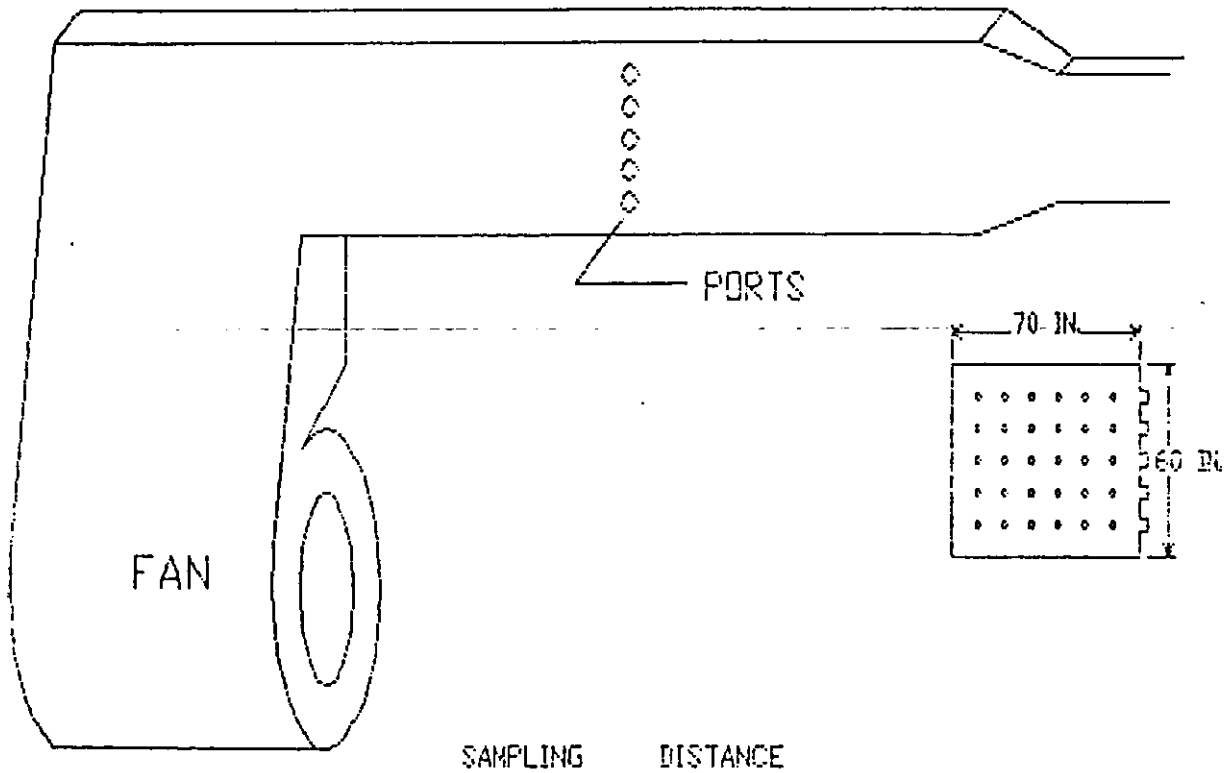
The drying reduces the pulp moisture to approximately 12% from a high of approximately 80%. The moist air leaves the drum and passes through a multiclone, which separates particulate from the air stream. The hopper of the multiclone is aspirated and the air flow is recirculated back to the combustion chamber of the drying furnace. The particulate suspended in the air flow is incinerated by the flame of the drying furnace. The moist air leaving the multiclone is discharged via a 60 x 70 inch rectangular duct inside the facility.

3.0 PRELIMINARY TESTS AND CALCULATIONS

Prior to the start of testing, the stack diameter was measured and a total of 30 traverse points were selected. Five 4-inch diameter sampling ports were previously installed on the retangular duct (see Figure 1). Preliminary velocity traverses (U.S. EPA Method 2) and wet bulb-dry bulb moisture determinations (U.S. EPA Method 4) were performed at the sampling location. All velocity measurements were determined by using a calibrated S-type pitot tube with an attached thermocouple probe.

Following the calculation of gas density and gas velocities, a sampling nozzle size was determined which would allow isokinetic sampling at all measured points.

FIGURE 1
BEET PULP DRIER STACK
MICHIGAN SUGAR COMPANY
CARO MICHIGAN



SAMPLING POINTS	DISTANCE FROM PORT
1	65 INCHES
2	53 INCHES
3	41 INCHES
4	29 INCHES
5	17 INCHES
6	5 INCHES

4.0 PARTICULATE SAMPLING EQUIPMENT/PROCEDURE

The apparatus used to sample the drier stack emissions, known as a sampling train, followed the provisions stipulated in 40 CFR 60, Appendix A, for U.S. EPA Method 17. This method is also approved by the Michigan Department of Natural Resources, as Method 5C. The sampling train components were:

1. An appropriately sized stainless steel sample nozzle;
2. One 47 mm A/E glass fiber filter backed up with a ceramic thimble and a holder;
3. A six-foot stainless steel sample probe;
4. A one-half inch diameter flexible sample line;
5. Four impingers placed in an insulated ice water bath in the following sequence:
   a) A modified impinger containing 100 ml of distilled water;
   b) A second modified impinger containing 100 ml of distilled water;
   c) An empty standard Greenburg-Smith impinger to act as a dry condensate trap; and
   d) A modified impinger containing approximately 300 grams of pre-dried silica gel.
6. Sample gas measuring train containing the following components in sequence:
   a) An umbilical sampling line;
   b) A vacuum gauge;
   c) A leakless, oil type pump;
   d) A calibrated dry test gas meter;
   e) A calibrated gas flow orifice; and
   f) An inclined water column manometer.

All acetone flushing solutions were placed in individual preweighed aluminum dishes and the acetone was evaporated at 70° F. The aluminum dishes were desiccated for 24 hours, weighed, and then redesiccated for an additional 12 hours. The initial and final weights were determined on the same analytical balance.

6.0 TESTING RESULTS

The results of the study conducted on December 14, 1989 are in Table 1 of the Executive Summary. All field sampling data, velocity traverse data, and calibration sheets are located in the Appendix.

7.0 PROBLEMS ENCOUNTERED

Upon completion of test P-1, the sampling system did not pass a post-test leak check. In accordance with U.S. EPA regulations, the data obtained in test P-1 is invalid and therefore was not used to determine average results.

Test P-3 was discontinued during the sampling period, due to furnace flame-out. Since final data was not obtained for this test run, no results were determined.

8.0 CONCLUSION

The Michigan Sugar pulp drier stack at the Caro, Michigan facility had an average emission rate of 0.089 pounds per 1000 pounds of actual stack gas. This value is below the maximum allowable emission standard (0.10 pounds total particulate per 1000 pounds of gas) as set forth by the