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

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

AP42 Section:	9.10.1.2
Background Chapter	4
Reference:	24
Title:	Particulate Emission Study for Michigan Sugar Company, Carrollton, Michigan, Swanson Environmental, Inc., Farmington Hills, MI, November 1989.

APPENDIX W

REPORT EXCERPTS FROM REFERENCE 24

(Michigan Sugar Company, November 1989)

DEC 11 1989

PARTICULATE EMISSION STUDY
FOR
MICHIGAN SUGAR COMPANY
CARROLTON, MICHIGAN

DATES OF TESTING:
November 14 and 16, 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-5490

SWANSON ENVIRONMENTAL INC.

SWANSON ENVIRONMENTAL INC.

EMISSION STUDY
PULP DRIER STACK
MICHIGAN SUGAR COMPANY
CARROLTON, MICHIGAN
DECEMBER 5, 1989

EXECUTIVE SUMMARY

Swanson Environmental, Inc. was retained by Michigan Sugar Company to sample the particulate emissions from the beet pulp drier located in Carrolton, Michigan.

The purpose of the study was to determine whether the particulate emissions were in compliance with Michigan Sugar's Special Conditions Permit Number 300-86A requirements. The results of the two tests are as follows:

TEST NO.	TEST DATE	STACK GAS FLOW RATE	GRAIN PER DSCF	LBS/1000 LBS GAS	LBS/1000LBS DRY 50% EA	LBS/HOUR
P-1	11/14/89	33672	0.0643	0.084	0.251	18.56
P-2	11/14/89	37871	0.0462	0.064	0.225	14.98
P-3	11/14/89	38795	0.0703	0.100	0.363	23.39
AVERAGE		36779	0.0603	0.083	0.280	18.98
P-1	11/16/89	46482	0.0411	0.069	0.238	16.37
P-2	11/16/89	37617	0.0478	0.067	0.230	15.42
P-3	11/16/89	41090	0.0558	0.085	0.203	19.65
AVERAGE		41730	0.0482	0.074	0.224	17.15

1.0 INTRODUCTION

Swanson Environmental, Inc., was retained by Michigan Sugar Company, of Saginaw, Michigan to conduct two particulate emission tests on the beet pulp drier stack at the Carrolton plant, located in Carrolton, Michigan.

The purpose of the study was to determine whether the particulate emissions from two different aspiration rates were in compliance with Michigan Sugar's Special Conditions Permit Number 300-86A. The tests were in accordance with the procedures outlined for Method 17 of 40 CFR 60, Appendix A.

The study was conducted on November 14 and 16, 1989 by Mr. Mark Hook, Mr. Dan Larin, Mr. Mark Morter, and Mr. Andrew Secord of Swanson Environmental, Inc. Mr. Mark Suhr of Michigan Sugar assisted in the study.

2.0 PROCESS DESCRIPTION

Expanded cossettes, or pulp, 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 drawn. 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 and a side stream is sent through a baghouse. The bag house is aspirated at two different rates and the recirculated air is used to

combust the heating flame. The drier exhaust is discharged to the atmosphere via a 100 foot high, 8 foot diameter stack. Sampling was performed from the elevated walkway located approximately 60 feet above ground level.

3.0 GENERAL

Prior to the start of testing the stack diameter was measured and a total of 12 traverse points were selected. Four 4-inch diameter sampling ports were previously installed on the 96" diameter stack (Figure 1). Preliminary velocity traverses (USEPA Method 2) and wet bulb-dry bulb moisture determinations (USEPA Method 4) were performed at the sampling location. All velocity measurements used 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.

4.0 PARTICULATE SAMPLING PROCEDURE

The sampling train used to sample the drier stack emissions followed 40 CFR 60, Appendix A, USEPA 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 for each;

SWANSON ENVIRONMENTAL, INC.

TABLE 4

PLANT: MI SUGAR
LOCATION: CARROLLTON
DATE: 11-14-89

PARTICULATE EMISSION RATE

TEST No.	TEST DATE	STACK GAS FLOW RATE (DSCFM)	EMISSION RATE GRAIN PER DSCF	CONC. LBS/1000 LBS DRY-GAS	CONC. LBS/1000 LBS DRY 50%E A*	EMISSION RATE LBS HOUR
P-1	11-14-89	33672	0.0643	0.084	0.251	18.56
P-2	11-14-89	37871	0.0462	0.064	0.225	14.98
P-3	11-14-89	38795	0.0703	0.100	0.363	23.39
AVERAGE		36779.46	0.06	0.083	0.280	18.98

* E A = EXCESS AIR

SWANSON ENVIRONMENTAL, INC.
PARTICULATE SAMPLING DATA AND CALCULATIONS

PLANT: MI SUGAR SOURCE: PULP DRIER
DATE: 11-~~1~~-89 14

	CLOCK TIME:	60.00	60.00	60.00
	1.00 NUMBER	P-1	P-2	P-3
B.	STACK DIAMETER, In	96.00	96.00	96.00
C.	STACK AREA, Sq.Ft	50.27	50.27	50.27
D.	No. SAMPLE POINTS	12.00	12.00	12.00
E.	TOTAL SAMPLE TIME, MIN.	60.00	60.00	60.00
F.	NOZZLE DIAMETER, In.	0.310	0.310	0.310
G.	NOZZLE AREA, Sq.Ft.	0.00052	0.00052	0.00052
H.	CALIBRATION FACTORS:			
	PITOT TUBE, Cp	0.828	0.828	0.828
	GAS METER, y	1.005	1.005	1.005
I.	BAROMETRIC PRESSURE, In.Hg.	29.33	29.34	29.30
J.	STACK STATIC PRESSURE In.H20	0.04	0.04	0.04
K.	STACK GAS TEMP.	178.17	197.92	203.75
L.	AVG. Sq. Rt. VEL. HEAD	0.36	0.38	0.38
M.	AVG. METER TEMP.	64.50	64.75	61.25
N.	AVG. METER PRESS., H2O	0.53	0.57	0.54
O.	METER VOL., ACTUAL Cu. Ft.	23.29	24.17	24.68
P.	METER VOL., @STP	23.22	24.09	24.73
Q.	LIQUID VOL., H20 COND., Ml.	362.70	304.10	278.40
R.	VAPOR VOL., H20 COND., @STP, Cu.Ft.	17.19	14.41	13.20
S.	TOTAL GAS SAMPLED, @ STP, Cu.Ft.	40.41	38.51	37.93
T.	%MOISTURE IN EXHAUST GAS			
	1) AT TEST LOCATION	42.55	37.43	34.79
	2) BEFORE COLLECTOR	0.00	0.00	0.00
U.	DRY GAS COMP. %O2	14.3	15.7	16.3
	%CO2	3.1	2.4	1.8
	%CO	0.1	0.2	0.1
	%N2	81.3	81.0	82.7
V.	DENSITY & MOL. Wt. -STACK GAS			
	1)DRY, @ STP,Lbs/Cu.Ft.	0.0743	0.0744	0.0754
	2)WET, @ STP,Lbs/Cu.Ft.	0.0625	0.0640	0.0654
	3)WET @ STACK,Lbs/Cu.Ft.	0.0509	0.0505	0.0511
	4)MOL.Wt., @ STP,Lb/MOLE	28.75	28.79	29.19
W.	WEIGHT OF GAS SAMPLED:			
	1)DRY GAS,Lbs	1.73	1.79	1.87
	2)WET GAS,Lbs	2.52	2.46	2.48
X.	TOTAL PARTICULATE COLLECTED	0.0968	0.0721	0.1128

	(GRAMS)		
Y. AVERAGE GAS VELOCITY, FPM	1432.16	1524.35	1513.72
Z. STACK GAS FLOW RATE			
1)AT STACK, Qa, ACFM	71988	76622	76088
2)AT Std.,Qstd, SCFM	58607	60528	59497
3)Std. DRY,Qdg, SCFM	33672	37871	38795
AA. PERCENT EXCESS AIR	200.11	276.65	297.10
BB. CONCENTRATION CONVERSION FACTORS:			
1)50% E.A.,AFTER COLLECTOR	1.53	1.79	1.91
2)50% E.A.,BEFORE COLLECTOR	2.97	3.49	3.62
3)MOISTURE BEFORE COLLECTOR	1.46	1.37	1.33
CC. PARTICULATE CONCENTRATION:			
1)Lbs/1000 Lbs., ACTUAL	0.084	0.064	0.100
2)Lbs/1000 Lbs., DRY	0.124	0.089	0.133
3)Lbs/1000 Lbs., WET @ 50%E.A	0.129	0.115	0.191
4)Lbs/1000 Lbs., DRY @ 50%E.A	0.251	0.225	0.363
5)GRAINS / DSCF	0.0643	0.0462	0.0703
6)POUNDS / HOUR	18.56	14.98	23.39
DD. PERCENT ISOKINETIC	110.19	101.67	101.88

SWANSON ENVIRONMENTAL, INC.

TABLE 4

PLANT: MI SUGAR
LOCATION: CARROLLTON
DATE: 11-16-89

PARTICULATE EMISSION RATE

TEST No.	TEST DATE	STACK GAS FLOW RATE (DSCFM)	EMISSION RATE GRAIN PER DSCF	CONC. LBS/1000 LBS GAS	LBS/1000 LBS DRY 50%E A*	EMISSION RATE LBS HOUR
P-1	11-16-89	46482	0.0411	0.069	0.238	16.37
P-2	11-16-89	37617	0.0478	0.067	0.230	15.42
P-3	11-16-89	41090	0.0558	0.085	0.203	19.65
AVERAGE		41729.76	0.05	0.074	0.224	17.15

* E A = EXCESS AIR

SWANSON ENVIRONMENTAL, INC.
PARTICULATE SAMPLING DATA AND CALCULATIONS

PLANT: MI SUGAR SOURCE: PULP DRIER
DATE: 11-16-89

	CLOCK TIME:	60.00	60.00	60.00
	1.00 NUMBER	P-1	P-2	P-3
B.	STACK DIAMETER, In	96.00	96.00	96.00
C.	STACK AREA, Sq.Ft	50.27	50.27	50.27
D.	No. SAMPLE POINTS	12.00	12.00	12.00
E.	TOTAL SAMPLE TIME, MIN.	60.00	60.00	60.00
F.	NOZZLE DIAMETER, In.	0.310	0.310	0.310
G.	NOZZLE AREA, Sq.Ft.	0.00052	0.00052	0.00052
H.	CALIBRATION FACTORS:			
	PITOT TUBE, Cp	0.828	0.828	0.828
	GAS METER, y	1.005	1.005	1.005
I.	BAROMETRIC PRESSURE, In.Hg.	28.85	28.85	28.85
J.	STACK STATIC PRESSURE In.H20	4.20	4.20	4.20
K.	STACK GAS TEMP.	190.92	191.50	195.17
L.	AVG. Sq. Rt. VEL. HEAD	0.37	0.37	0.37
M.	AVG. METER TEMP.	51.25	55.50	52.50
N.	AVG. METER PRESS., H2O	0.51	0.54	0.52
O.	METER VOL., ACTUAL Cu. Ft.	23.29	24.17	24.68
P.	METER VOL., @STP	23.43	24.11	24.77
Q.	LIQUID VOL., H20 COND., Ml.	107.80	293.30	202.70
R.	VAPOR VOL., H20 COND., @STP, Cu.Ft.	5.11	13.90	9.61
S.	TOTAL GAS SAMPLED, @ STP, Cu.Ft.	28.54	38.02	34.37
T.	%MOISTURE IN EXHAUST GAS			
	1) AT TEST LOCATION	17.91	36.57	27.95
	2) BEFORE COLLECTOR	0.00	0.00	0.00
U.	DRY GAS COMP. %O2	16.7	15.8	14.2
	%CO2	2.0	3.3	3.5
	%CO	0.0	0.0	0.0
	%N2	81.3	81.0	82.7
V.	DENSITY & MOL. Wt. -STACK GAS			
	1)DRY, @ STP,Lbs/Cu.Ft.	0.0749	0.0754	0.0755
	2)WET, @ STP,Lbs/Cu.Ft.	0.0698	0.0648	0.0674
	3)WET @ STACK,Lbs/Cu.Ft.	0.0548	0.0508	0.0526
	4)MOL.Wt., @ STP,Lb/MOLE	28.99	29.17	29.22
W.	WEIGHT OF GAS SAMPLED:			
	1)DRY GAS,Lbs	1.76	1.82	1.87
	2)WET GAS,Lbs	1.99	2.46	2.32
X.	TOTAL PARTICULATE COLLECTED	0.0624	0.0748	0.0896

(GRAMS)			
Y. AVERAGE GAS VELOCITY, FPM	1434.72	1504.07	1454.58
Z. STACK GAS FLOW RATE			
1)AT STACK, Qa, ACFM	72117	75603	73115
2)AT Std.,Qstd, SCFM	56620	59304	57032
3)Std. DRY,Qdg, SCFM	46482	37617	41090
AA. PERCENT EXCESS AIR	345.36	280.21	184.49
BB. CONCENTRATION CONVERSION FACTORS:			
1)50% E.A.,AFTER COLLECTOR	2.44	1.81	1.63
2)50% E.A.,BEFORE COLLECTOR	3.45	3.43	2.39
3)MOISTURE BEFORE COLLECTOR	1.14	1.36	1.24
CC. PARTICULATE CONCENTRATION:			
1)Lbs/1000 Lbs., ACTUAL	0.069	0.067	0.085
2)Lbs/1000 Lbs., DRY	0.078	0.091	0.106
3)Lbs/1000 Lbs., WET @ 50%E.A	0.169	0.121	0.139
4)Lbs/1000 Lbs., DRY @ 50%E.A	0.238	0.230	0.203
5)GRAINS / DSCF	0.0411	0.0478	0.0558
6)POUNDS / HOUR	16.37	15.42	19.65
DD. PERCENT ISOKINETIC	79.70	101.38	95.31

8 9 1990

DATE	DAY	PULP PRODUCED ===TONS=== DAY	TODATE	% ON BEETS DAY	TD	AVE	PRESSED PULP =====% MOISTURE===== DAY	TOTAL	TODATE	DRY PULP =====% MOISTURE===== DAY	TOTAL	TODATE	PELLET PULP =====% MOISTURE===== DAY	TOTAL	TODATE	% SUGAR IN PRESSED PULP =% SUGAR= DAY	TD	===TONS=== DAY	TD
10/27	30	180	4962	6.02	6.02	165	76.00	2295.44	76.51	10.85	360.04	12.00	10.95	341.96	11.40	.31	.31	9.28	251.63
10/28	31	190	5152	5.99	6.02	166	75.33	2370.77	76.48	10.20	370.24	11.94	9.73	351.69	11.34	.29	.30	9.20	260.83
10/29	32	187	5339	5.99	6.02	167	76.00	2446.77	76.46	12.32	382.56	11.96	11.08	362.77	11.34	.33	.31	10.30	271.13
10/30	33	176	5515	6.00	6.02	167	76.17	2522.94	76.45	11.54	394.10	11.94	10.94	373.71	11.32	.32	.31	9.39	280.52
10/31	34	182	5697	6.02	6.02	168	75.50	2598.44	76.42	10.74	404.84	11.91	10.75	384.46	11.31	.29	.31	8.76	289.28
11/01	35	189	5886	5.97	6.02	168	75.50	2673.94	76.40	10.35	415.19	11.86	10.04	394.50	11.27	.29	.31	9.18	298.46
11/02	36	186	6072	6.01	6.02	169	77.50	2751.44	76.43	11.65	426.84	11.86	10.86	405.36	11.26	.28	.30	8.66	307.12
WK 5		1290		6.00			76.00			11.09			10.62			.30		64.77	
TD			6072		6.02				76.43			11.86			11.26		.30		307.12
11/03	37	167	6239	6.02	6.02	169	77.25	2828.69	76.45	8.84	435.68	11.78	9.79	415.15	11.22	.28	.30	7.77	314.89
11/04	38	170	6409	5.99	6.01	169	75.50	2904.19	76.43	11.37	447.05	11.76	10.82	425.97	11.21	.30	.30	8.52	323.41
11/05	39	175	6584	6.00	6.01	169	74.50	2978.69	76.38	11.05	458.10	11.75	10.55	436.52	11.19	.23	.30	6.70	330.11
11/06	40	188	6372	6.03	5.66	159	75.60	3054.29	76.36	12.12	470.22	11.76	11.50	448.02	11.20	.28	.30	8.74	338.85
11/07	41	176	6548	6.00	5.67	160	75.75	3130.04	76.34	11.67	481.89	11.75	11.17	459.19	11.20	.28	.30	8.22	347.07
11/08	42	186	6734	5.98	5.68	160	75.17	3205.21	76.31	11.30	493.19	11.74	10.51	469.70	11.18	.29	.30	9.01	356.08
11/09	43	186	6920	5.97	5.68	161	75.00	3280.21	76.28	10.70	503.89	11.72	10.15	479.85	11.16	.30	.30	9.34	365.42
WK 6		1248		6.00			75.54			11.01			10.64			.28		58.30	
TD			6920		5.68				76.28			11.72			11.16		.30		365.42
11/10	44	187	7107	5.99	5.69	162	74.00	3354.21	76.23	10.77	514.66	11.70	10.35	490.20	11.14	.30	.30	9.36	374.78
11/11	45	187	7294	6.01	5.70	162	75.00	3429.21	76.20	10.44	525.10	11.67	10.77	500.97	11.13	.27	.30	8.41	383.19
11/12	46	187	7481	6.10	5.71	163	77.00	3506.21	76.22	10.86	535.96	11.65	10.51	511.48	11.12	.30	.30	9.20	392.39
11/13	47	165	7646	5.98	5.71	163	77.00	3583.21	76.24	11.24	547.20	11.64	10.94	522.42	11.12	.32	.30	8.82	401.21
11/14	48	186	7832	5.99	5.72	163	75.67	3658.88	76.23	10.06	557.26	11.61	10.28	532.70	11.10	.28	.30	8.69	409.90
11/15	49	187	8019	5.99	5.73	164	75.33	3734.21	76.21	10.66	567.92	11.59	10.17	542.87	11.08	.25	.30	7.80	417.70
11/16	50	166	8185	5.99	5.73	164	80.00	3814.21	76.28	11.34	579.26	11.59	10.30	553.17	11.06	.32	.30	8.87	426.57
WK 7		1265		6.01			76.29			10.77			10.47			.29		61.15	
TD			8185		5.73				76.28			11.59			11.06		.30		426.57
11/17	51	182	8367	5.98	5.74	164	75.17	3889.38	76.26	10.99	590.25	11.57	11.46	564.63	11.07	.26	.30	7.92	434.49
11/18	52	184	8551	5.99	5.74	164	75.17	3964.55	76.24	11.15	601.40	11.57	10.81	575.44	11.07	.27	.30	8.29	442.78
11/19	53	184	8735	5.99	5.75	165	77.50	4042.05	76.27	11.62	613.02	11.57	10.42	585.86	11.05	.28	.30	8.60	451.38
11/20	54	160	8495	5.80	5.49	157	74.33	4116.38	76.23	10.70	623.72	11.55	10.27	596.13	11.04	.28	.30	7.73	459.11
11/21	55	167	8662	5.79	5.49	157	75.50	4191.88	76.22	11.11	634.83	11.54	10.49	606.62	11.03	.30	.30	8.65	467.76
11/22	56	155	8817	5.80	5.50	157	74.67	4266.55	76.19	10.88	645.71	11.53	10.35	616.97	11.02	.26	.30	6.95	474.71
11/23	57	156	8973	5.78	5.50	157	76.50	4343.05	76.19	11.08	656.79	11.52	10.13	627.10	11.00	.31	.30	8.37	483.08
WK 8		1188		5.88			75.55			11.08			10.56			.28		56.51	
TD			8973		5.50				76.19			11.52			11.00		.30		483.08

Filename: BEET24.WQ1
Date: 19-Jan-95
Facility: Michigan Sugar Company
Location: Carrollton, Michigan
Source: Pulp dryer with multiclones (Natural gas-fired)
Test date: November 14 and 16, 1989

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported						
			Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Average
1	Stack temperature	Deg F	178.17	197.92	203.75	190.92	191.5	195.17	
	Pressure	in. HG	29.33	29.34	29.30	28.85	28.85	28.85	
	Moisture	%	42.55	37.43	34.79	17.91	36.57	27.95	
	Oxygen	%	14.3	15.7	16.3	16.7	15.8	14.2	
	Volumetric flow, actual	acfm	71988	76622	76088	72117	75603	73115	
	Volumetric flow, standard*	dscfm	33670	37872	38798	46479	37617	41091	
	Isokinetic variation	%	110.19	101.67	101.88	79.7	101.38	95.31	
	Wet pulp feed rate	TPH	30.6	30.6	27.5	43.6	42.9	27.8	
	Pollutant concentrations:								
	Filterable PM	G/dscf	0.0643	0.0462	0.0703	0.0411	0.0478	0.0558	
	CO2	% dv	3.1	2.4	1.8	2	3.3	3.5	
	Pollutant mass flux rates:								
	Filterable PM	lb/hr	void	15.0	23.4	void	15.4	19.7	
	CO2	lb/hr	void	6229	4786	void	8507	9856	
	Emission factors (ENGLISH UNITS):								AVERAGE
	Filterable PM	lb/ton		0.49	0.85		0.36	0.71	0.60
	CO2	lb/ton		204	174		198	355	233
	Emission factors (METRIC UNITS):								AVERAGE
	Filterable PM	kg/Mg		0.25	0.43		0.18	0.35	0.30
	CO2	kg/Mg		102	87		99	177	116

*DSCFM BASED ON A STANDARD TEMPERATURE OF 70 DEGREES FAHRENHEIT

MIDWEST RESEARCH INSTITUTE

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

Project Title Sugar Beet Processing - AP-42

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

Phone Contact ☐
Meeting Notes ☐
Work Sheet ☒

CARROLLTON, MICHIGAN FACILITY

TEST DATES: 11/14/89 and 11/16/89

TEST No.	Time	
11/14/89		TOTAL DRY PULP PRODUCED = 186 tons
P-1	10:40 - 11:55	7.75 tons/hr. AVERAGE
P-2	NA (not available)	
P-3	NA (not available)	
11/16/89		TOTAL DRY PULP PRODUCED = 166 tons
P-1	11:11 - 12:20	6.92 tons/hr. AVERAGE
P-2	1:47 - 2:49	
P-3	3:29 - 7:11	

AVERAGE OVER TEST RUN

TEST No.	Slice Rate (tons/hr)	Pressed Pulp Moisture (%)	Dried Pulp Moisture (%)
11/14/89			
P-1	130	77.5	11.0
P-2	130	77.5 (est.)	11.0 (est.)
P-3	130	74.5 (est.)	10.1 (est.)
11/16/89			
P-1	130	86.0	12.5
P-2	125	86.0	12.5
P-3	111	78.0	11.2

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

11/14/89:

P-1:

$$\% \text{ Solids} = \frac{7.75 - (0.11 * 7.75)}{130} = \frac{6.90}{130} \times 100 = 5.3\%$$

MRI

MIDWEST RESEARCH INSTITUTE

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

Project Title Sugar Beet Processing AP-42

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

Phone Contact ☐
Meeting Notes ☐
Work Sheet ☒

P-2: % Solids = $\frac{7.75 - (0.11 * 7.75)}{130} = \frac{6.90}{130} \times 100 = 5.3\%$

P-3: % Solids = $\frac{7.75 - (0.101 * 7.75)}{130} = \frac{6.97}{130} \times 100 = 5.4\%$

11/16/89:

P-1: % Solids = $\frac{6.92 - (0.125 * 6.92)}{130} = \frac{6.05}{130} \times 100 = 4.7\%$

P-2: % Solids = $\frac{6.92 - (0.125 * 6.92)}{125} = \frac{6.05}{125} \times 100 = 4.8\%$

P-3: % Solids = $\frac{6.92 - (0.112 * 6.92)}{111} = \frac{6.14}{111} \times 100 = 5.5\%$

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

11/14/89

P-1: Rate = $\frac{130 * 0.053}{1 - \left(\frac{77.5}{100}\right)} = \frac{6.89}{0.225} = 30.6$ tons/hr.

P-2: Rate = $\frac{130 * 0.053}{1 - \left(\frac{77.5}{100}\right)} = \frac{6.89}{0.225} = 30.6$ tons/hr

P-3: Rate = $\frac{130 * 0.054}{1 - \left(\frac{78.5}{100}\right)} = \frac{7.02}{0.255} = 27.5$ tons/hr.

11/16/89

P-1: Rate = $\frac{130 * 0.047}{1 - \left(\frac{86.0}{100}\right)} = \frac{6.11}{0.14} = 43.6$ tons/hr

P-2: Rate = $\frac{125 * 0.048}{1 - \left(\frac{86.0}{100}\right)} = \frac{6.00}{0.14} = 42.9$ tons/hr

P-3: Rate = $\frac{111 * 0.055}{1 - \left(\frac{78.0}{100}\right)} = \frac{6.11}{0.22} = 27.8$ tons/hr

MRI

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 modified impinger containing 100 ml of distilled water
   c) A standard Greenburg-Smith impinger containing no collecting media to act as a dry condensate trap; and
   d) A modified impinger containing approximately 300 grams of pre-dried silica gel.

6. Sampled 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.

The observed test velocity head reading was used in the isokinetic point sampling rate calculations. The sampling time for each of the 12 points was 5 minutes.

Prior to testing the first and second impingers were loaded with 100 ml of deionized water each. The third impinger remained empty. The fourth impinger was filled with

velocity traverse data, and calibration sheets are located in the appendix.

7.0 DISCUSSION OF RESULTS

The Michigan Sugar Pulp drier stack at Carrolton, Michigan had average emission rates of 0.074 pound, and 0.083 pounds per 1000 pounds of actual stack gas. This falls below the maximum allowable emission standard (0.10 pounds total particulate per 1000 pounds of gas) as set forth by the Michigan Department of Natural Resources in the Air Pollution Control Commission's particulate matter emission schedule, Chapter R336.1331, Subpart J entitled Exhaust Systems serving material handling equipment not otherwise listed in Table 31".

Therefore, the pulp drier exhaust stack complies with the State of Michigan standard pertaining to total particulate emissions under actual operating conditions.

Report Prepared By:
Mark B. Morter
Mark B. Morter
Assistant Environmental Engineer

MM1:MA-5490.R01

CARROLLTON FACTORY

DIFFUSER DATA

TUE DATE 11/14/89 NO. DAYS SLICING 48 BEGINNING 7:00 A.M.

TEMPERATURE DRUM 1	2	3	4	5	6	7	8	SPIRAL HEATER IN	OUT #1	OUT #2	CIRL. JUI. IN	OUT	DIFFUSER WATER TEMP.	FL	pH	DIFFUSION JUICE Bx	PUR.	pH	SUGAR PRESS WATER	COSS.	WEIGHTOMETER INTEG.	TONS/HR.	KNIFE CHANGE TIME	SUCER #	REMARKS
47	75	72	70	70	68	91	65	75	80	84	80	97		225		14.6	92.1	16.2	81	130	7810	130			
47	73	71	70	69	69	87	66	74	81	84	80	97		225				17.3	80	164	7940	130	10:20	2	
47	74	71	70	70	70	88	66	74	82	83	82	97		225		14.5	92.4	17.0	82	159	8070	130	1:45	1	
47	75	71	70	71	71	85	67	73	82	85	81	97		225				17.0	82	169	8200	130			1040
47	74	72	70	70	71	86	67	73	81	85	81	96		225		14.4	91.5	17.2	81	130	8330	130			
47	74	72	70	70	71	86	67	73	81	85	82	97		225					82	135	8460	130			
47	74	72	70	71	71	87	67	73	82	85	81	97		225		14.0	92.1		82	138	8590	130			
47	74	72	70	71	71	88	67	74	81	84	81	96		225					81	112	8720	130			
47	75	72	71	71	71	92	67	74	81	84	80	97		225		14.7	91.2	16.6	80	169	8850	130			
47	75	72	70	70	70	98	67	74	82	84	81	97		225				16.6	80	179	8980	130	7:35	#2	
47	75	72	70	70	70	90	67	74	82	84	80	96		225		14.9	92.9		78	177	9110	130			
47	75	72	70	70	70	88	66	74	82	84	80	96		225				16.8	79	169	9240	130			
47	75	71	70	70	70	85	66	74	82	84	81	97		225		14.3	89.5		80	169	9370	130			1040
47	75	71	70	70	70	85	67	74	82	84	82	97		225				17.2	82	161	9500	130			
47	75	72	70	70	70	87	66	74	82	84	81	97		225		14.1	92.2	16.8	82	169	9630	130			
47	75	72	70	70	70	86	66	74	82	84	80	97		225					78	166	9760	130			
47	75	72	70	70	69	84	64	75	80	85	80	96		225		14.4	91.0	16.6	78	172	9890	130	1:15	#1	50# TANK 12:30
47	74	71	70	70	69	86	64	75	80	85	80	96		225				17.2	79	172	0020	130	3:30	#2	
47	74	71	70	70	69	83	67	75	81	86	81	96		225		14.7	91.2		78	159	0150	130	5:55	#2	
47	74	71	70	70	70	84	64	75	81	85	81	96		225				17.5	78	161	0280	130			
47	74	71	70	70	70	85	64	75	81	86	81	96		225		14.3	90.6	16.7	81	151	0410	130			1024
47	74	71	70	70	70	85	65	75	80	85	80	96		225					80	146	0540	130			
47	74	71	70	70	70	84	66	75	80	85	80	96		225		14.6	90.4	17.0	81	153	0670	119			← NO BEETS
			70	70	70	85	68	73	80	84	81	97		225					81	153	0789	125			
																					0914				

3104

SHIFT I: TONS SLICED _____
DELAYS:

SHIFT II: TONS SLICED _____
DELAYS:

SHIFT III: TONS SLICED _____
DELAYS:

FORM 101-6 (REV. 6-87)

SHEET NO. 3 MOLASSES CONTINUOUS CALCULATION NOVEMBER 14, 1994 48 HR. SEGMENTS

HOUR	LIME CAKE 1ST % SUGAR	LIME CAKE 2ND % SUGAR	LIME CAKE 3RD % SUGAR	LIME SIMER COMPOSITE % SUGAR	MILK OF LIME Be	LIME % CaO	LIMED JUICE CaO per 100 ml	KILN GAS % CO2	MOLASSES PRODUCED BRIX	POL.	APP. PURITY	EH	RAF.
7 AM	.01		.01			.60	.15	3.00	82.9	52.40	63.2	8.50	
8 AM						1.00	1.30		83.7	50.40	60.7	8.40	
9 AM							1.50						
10 AM						.80	1.80						
11 AM							1.30						
12 PM						.90	1.50						
1 PM							1.50						
2 PM							1.50						
1ST AVG.	.01		.01			.83	1.32	3.00	83.30	51.40	61.95	8.50	
3 PM	.04	.06				.80	1.50	2.80	82.1	51.00	62.1	8.30	
4 PM							1.60		86.2	51.40	59.6	8.30	
5 PM						.80	1.50						
6 PM							1.50						
7 PM						1.00	1.60						
8 PM							1.60						
9 PM						.80	1.40						
10 PM							1.50						
2ND AVG.	.04	.06				.85	1.53	2.80	84.20	51.20	60.85	8.30	
11 PM	.09	1.40				.60	1.40		82.9	51.00	61.5	8.30	
12 AM	.02						1.20		82.9	50.60	61.0	8.10	
1 AM						.70	1.40						
2 AM							.90						
3 AM						.50	1.00						
4 AM							1.00						
5 AM						.50	1.30						
6 AM							1.30						
3RD AVG.	.06	1.40				.58	1.19		82.90	50.80	61.25	8.20	
24HR. AVG.	.04	.73	.01			.75	1.34	2.90	83.50	51.13	61.35	8.30	

HOUR	MOLASSES PRODUCED TRUE PURITY	SO2	INV. SUGAR	PRESS WET % MOIST.	PRESS % MOIST.	PULP DRY % MOIST.	PULP DRY % SUGAR	PELLETS % MOIST.	PELLETS % SUGAR	CONDENSED WATER BOILER FEED	CONDENSED WATER HOUSE HOT	CONDENSED WATER % SUGAR	SEAL TANK	SEAL TANK % SUGAR
7 AM					77.00	11.22		10.54	5.60					
8 AM					78.00	10.78		9.60	4.80					
9 AM														
10 AM														
11 AM														
12 PM														
1 PM														
2 PM														
1ST AVG.					77.50	11.00		10.07	5.20					
3 PM					75.00	9.06		9.60	4.80					
4 PM					74.00	11.22		11.62	5.60					
5 PM														
6 PM														
7 PM														
8 PM														
9 PM														
10 PM														
2ND AVG.					74.50	10.14		10.61	5.20					
11 PM					76.00	9.83		10.90	4.20					
12 AM					74.00	8.27		9.40	4.00					
1 AM														
2 AM														
3 AM														
4 AM														
5 AM														
6 AM														
3RD AVG.					75.00	9.06		10.15	4.10					
24HR AVG.					75.67	10.06		10.28	4.83					

3:35 Thur 2 NOV

CARROLLTON FACTORY — **DIFFUSER DATA** — DEER DATE 11/16/89 — NO. DAYS SLICING 50 BEGINNING 7:00 A.M.

TEMPERATURE DRUM 1	2	3	4	5	6	7	8	SPIRAL HEATER In	OUT #1	OUT #2	CIRL. JUI. IN	OUT	DIFFUSER WATER TEMP.	FL.	pH	DIFFUSION JUICE Bx	SUR.	pH	SUGAR PRESS WATER	COSS.	WEIGHTOMETER INTEG.	TONS / HR.	KNIFE CHANGE TIME	SLICER #	REMARKS
47	74	71	70	71	71	90	65	71	79	84	80	97		225		15.6	92.2	16.6	82	135	4054	125	11:05	2	50 2 8:00 AM
47	74	71	70	70	70	91	66	72	80	84	80	97		220				16.4	82	140	4159	125			
47	74	71	70	70	70	92	66	72	81	84	80	97		225		15.0	92.7	17.6	81	164	4284	125			
47	74	71	70	70	70	98	67	72	80	84	80	97		225				17.3	82	120	4409	130			
47	74	71	70	70	70	94	66	72	80	84	80	97		225		14.5	91.3	17.6	83	099	4539	130			1015
47	74	71	70	70	70	91	65	72	80	84	80	97		225					82	092	4669	130			
47	73	71	70	69	70	87	66	72	79	84	80	96		225		14.6	92.4		82	127	4799	125			
47	74	71	70	70	70	90	65	72	80	84	81	96		225					81	109	4924	125			
47	74	71	70	70	70	90	64	71	81	84	81	96		225		14.5	91.7	17.0	81	164	5049	75	3:45	#1	DOWN 3:35 to 5:05
			D	O	W	N														140	5124		6:30	#1	ELECTRIC MOTOR FAILURE
			D	O	W	N														135		90			WOLINE PUMP BELT TO DRYER
47	74	70	68	68	64	84	59	73	82	84	81	97		225					67	125	5214	111			
47	73	69	66	65	63	85	58	72	81	84	81	96		225		13.7	90.5	16.8	68	130	5325	125			
47	73	68	66	66	65	86	61	72	82	84	82	96		225					77	124	5450	125	7:06		
47	73	68	66	66	65	86	63	71	80	84	81	96		225		14.6	90.4	16.2	80	127	5575	120			
47	72	68	66	66	66	92	63	72	82	84	82	97		225					78	156	5695	120			
47	72	68	67	67	67	87	63	73	82	84	82	97		225		14.2	89.4	16.4	77	143	5815	125	11:50	#2	
47	73	68	67	67	67	83	63	72	80	84	81	97		225					77	142	5940	125			
47	73	69	67	67	67	87	61	73	82	85	82	97		225		14.0	96.0	16.6	77	135	6065	125			
47	73	69	67	67	66	95	60	73	78	83	79	97		225					75	153	6190	123			
47	73	69	67	67	66	85	62	73	81	84	81	97		220		14.4	89.2	16.9	75	172	6313	123			
47	73	69	67	67	67	82	63	70	82	84	81	97		220					79	185	6436	123			
47	73	69	67	69	68	83	63	72	81	85	81	97		220		14.6	91.9	17.8	78	174	6559	123			
47	73	69	67	69	69	86	63	73	82	85	81	97		220				17.4	78	177	6682	123			
																					6805				

SHIFT I: TONS SLICED _____
DELAYS:

SHIFT II: TONS SLICED _____
DELAYS:

SHIFT III: TONS SLICED _____
DELAYS: Tolerance 2771
Tolerance 142806
L.M.E. 28.56

FORM 101-B (REV. 6-87)

HERITAGE PRESS 47-1987

SHEET NO. 3 MOLASSES CARROLLTON FACTORY NOVEMBER 16, 1999 50 DAY BEGINNING

HOUR	LIME CAKE 1ST % SUGAR	LIME CAKE 2ND % SUGAR	LIME CAKE 3RD % SUGAR	LIME SEWER COMPOSITE % SUGAR	MILK OF LIME Be	MILK OF LIME % CaO	LIMED JUICE CaO per 100 ml	KILN GAS % CO2	MOLASSES PRODUCED BRIX	MOLASSES PRODUCED POL.	MOLASSES PRODUCED APP. PURITY	MOLASSES PRODUCED EH	MOLASSES PRODUCED RAFF.
7 AM			.10			1.50	1.70		82.1	49.80	60.7	7.70	
8 AM							1.50						
9 AM						.60	1.50						
10 AM							1.40						
11 AM						.60	1.30	36.00	83.2	51.00	60.9	7.50	
12 PM	.10						1.50						
1 PM						.50	1.40						
2 PM				.23			1.50						
1ST AVG.	.10		.10	.23		.80	1.48	36.00	82.70	50.40	60.80	7.60	
3 PM		.80				.50	1.30		82.1	50.20	61.1	7.60	
4 PM							1.60						
5 PM						.50	1.60						
6 PM	.40						1.60						
7 PM						.70	1.20	23.00	80.8	49.80	60.6	7.60	
8 PM							.90						
9 PM						.60	1.00						
10 PM				.90			1.10						
2ND AVG.	.40	.80		.90		.58	1.29	23.00	81.50	50.00	60.85	7.60	
11 PM		1.00				.50	1.00		82.1	48.60	59.2	7.40	
12 AM	.20						1.10						
1 AM						.60	1.20						
2 AM							.90						
3 AM						.80	1.10	32.00	81.2	49.00	60.3	7.50	
4 AM							1.50						
5 AM						.90	1.60						
6 AM				.10			1.30						
3RD AVG.	.20	1.00		.10		.70	1.21	32.00	81.70	48.80	59.75	7.50	
24HR AVG.	.23	.90	.10	.41		.69	1.33	30.33	81.90	49.73	60.47	7.60	

HOUR	MOLASSES PRODUCED TRUE PURITY	MOLASSES PRODUCED SO2	MOLASSES PRODUCED INV. SUGAR	WET % MOIST.	PULP PRESS % MOIST.	PULP DRY % MOIST.	PULP DRY % SUGAR	PELLETS % MOIST.	PELLETS % SUGAR	CONDENSED WATER BOILER FEED	CONDENSED WATER HOUSE HOT	CONDENSED WATER % SUGAR	SEAL TANK	SEAL TANK % SUGAR
7 AM					86.00	13.42		11.98	4.80					
8 AM														
9 AM														
10 AM														
11 AM						11.66		9.80	4.80					
12 PM														
1 PM														
2 PM														
1ST AVG.					86.00	12.54		10.89	4.80					
3 PM						11.22		10.00						
4 PM					78.00				4.80					
5 PM														
6 PM														
7 PM														
8 PM														
9 PM														
10 PM														
2ND AVG.					78.00	11.22		10.00	4.80					
11 PM					76.00				4.00					
12 AM						9.05								
1 AM								9.40						
2 AM														
3 AM														
4 AM														
5 AM														
6 AM														
3RD AVG.					76.00	9.05		9.40	4.00					
24HR AVG.					80.00	11.34		10.30	4.60					