AP42 Section:	9.10.1.2
Background Chapter	4
Reference:	21
Title:	Results of the November 14 and 15, 1990, State Particulate Emission Compliance Test on the Sugar Cooler and Sugar Granulator at the ACS Moorehead Plant, Interpoll Laboratories, Inc., Circle Pines, MN, December 11, 1990.

APPENDIX T

REPORT EXCERPTS FROM REFERENCE 21

(American Crystal Sugar Company, December 11, 1990)

Interpoll Laboratories, Inc.
4500 Ball Road N.E.
Circle Pines, Minnesota 55014-1819

TEL: (612) 786-6020
FAX: (612) 786-7854

RESULTS OF THE NOVEMBER 14 AND 15, 1990 STATE PARTICULATE EMISSION COMPLIANCE TEST ON THE SUGAR COOLER AND SUGAR GRANULATOR AT THE ACS MOORHEAD PLANT

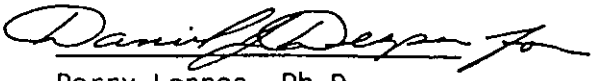
Submitted to:

AMERICAN CRYSTAL SUGAR COMPANY
2500 North Eleventh Street
P.O. Box 1037
Moorhead, Minnesota 56560

Attention:

Dave Waldon

Approved by:



Perry Lonnes, Ph.D.
Director
Field Testing Division

Report Number 0-3202
December 11, 1990
KE/kce

1 INTRODUCTION

On November 14 and 15, 1990, Interpoll Laboratories personnel conducted a particulate emission compliance test on the Sugar Cooler and Sugar Granulator at the American Crystal Sugar (ACS) Plant located in Moorhead, Minnesota. On-site testing was performed by D. Van Hoever and M. Kaehler. Coordination between testing activities and plant operation was provided by Dan Gust of ACS. The tests were not witnessed by a member of the Minnesota Pollution Control Agency.

The granulator and sugar cooler dry and cool the sugar in the later part of the overall process. After the juice is boiled down to the point where the crystal size and concentration in the mother liquor is appropriate; the entire mass is mixed; the crystal separated from the mother liquor and washed with high purity water in centrifugals; then scrolled off and conveyed by elevator to the granulator. The granulator is a horizontal rotary drum dryer. Heated air flows counter current to the sugar crystals passage through the drum and removes the excess moisture. Louvers in the drum cause the sugar to be carried up the side of the rotating drum, much like a cement mixer. This causes the sugar to fall through the heated air stream and increases the speed and efficiency of drying. The dried sugar is then conveyed by elevator to the sugar cooler which is also a horizontal rotary drum. The counter current flow of ambient air through the drum cools the sugar. Finally, the cooled sugar is screened for crystal size control. Particulate emissions from the granulator and cooler are controlled by Rotoclones.

Evaluations were performed in accordance with EPA Methods 1 - 5, CFR Title 40, Part 60, Appendix A (revised July 1, 1989). A preliminary determination of the gas linear velocity profile was made before the first particulate determination to allow selection of the appropriate nozzle diameter required for isokinetic sample withdrawal. An Interpoll Labs sampling train which meets or exceeds specifications in the above-cited

Table 1. Summary of the Results of the November 14, 1990 Particulate Emission Compliance Test on the Sugar Cooler at the American Crystal Sugar Company in Moorhead, Minnesota.

ITEM		Run 1	Run 2	Run 3
Date of test		11-14-90	11-14-90	11-14-90
Time runs were done	(HRS)	938/1040	1102/1204	1226/1329
Process rate	(TPH)	39.7	34.1	36.6
Volumetric flow				
actual	(ACFM)	14075	14382	12971
standard	(DSCFM)	12162	12397	11167
Gas temperature	(DEG-F)	97	97	98
Moisture content	(%V/V)	4.65	4.87	4.79
Gas composition	(%V/V,dry)			
carbon dioxide		0.03	0.03	0.03
oxygen		20.90	20.90	20.90
nitrogen		79.07	79.07	79.07
Isokinetic variation	(%)	102.0	103.3	98.8
Particulate concentration				
actual	(GR/ACF)	.0412	.0424	.0426
standard	(GR/DSCF)	.0477	.0492	.0496
Part. emission rate	(LB/HR)	4.97	5.23	4.74

Note: Dry + Organic Wet Catch

2 SUMMARY AND DISCUSSION

The important results of the particulate emission compliance test on the Sugar Cooler and Sugar Granulator are summarized in Tables 1 and 2. As will be noted, the particulate emission rate averaged 4.98 LB/HR for the Sugar Cooler and 2.54 LB/HR for the Sugar Granulator. The average particulate concentrations for the Sugar Cooler and Sugar Granulator were 0.049 and 0.029 GR/DSCF, respectively.

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

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job A.C.S/Moorhead | Source Sugar Cooler
Team Leader MK | Test Site Stack
Date Submitted 11-16-90 | Date of Test 11-14-90
Test No. 1 | No. of Runs Completed 3
Date of Analysis 11-19-90 | Technician R. Gibson

0	Test 1 Run 0 Field Blank Log Number 1743-03 Comments	Dish No. 2 Dish Tare Wt. 46.2262 g Dish+Sample Wt. 46.2268 g Sample Wt. 0.0006 g
1	Test 1 Run 1 Log Number -06 Comments	Dish No. 7 Dish Tare Wt. 50.0319 g Dish+Sample Wt. 50.0357 g Sample Wt. 0.0038 g
2	Test 1 Run 2 Log Number -09 Comments	Dish No. 11 Dish Tare Wt. 47.7584 g Dish+Sample Wt. 47.7628 g Sample Wt. 0.0044 g
3	Test 1 Run 3 Log Number -12 Comments	Dish No. 14 Dish Tare Wt. 49.7341 g Dish+Sample Wt. 49.7379 g Sample Wt. 0.0038 g
4	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g
5	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g

Blank Solvent Wt. 0.0006 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0006	0.0032	0.0038	0.0032	D-1	

LSC-03.G

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job A.C.S./Moorhead
Team Leader MK
Date Submitted 11-15-90
Test No. 1
Date of Analysis 11-16-90
Transport Leakage [X] None [ ] _____ ml

Source Sugar Cooker
Test Site Stack
Date of Test 11-14-90
No. of Runs Completed 3
Technician R. Gulsvig
Solvent ~~Gr~~ DI H2O

0	Test 1 Run 0 Field Blank Log Number 1743-01 Vol. of Solvent 100 ml *Solvent Residue 2.0 ug/ml	Dish No. 72 Dish Tare Wt. 64.1083 g Dish+Sample Wt. 64.1085 g Sample Wt. 0.0002 g
1	Test 1 Run 1 Vol. of Solvent 170 ml Log Number -04 Comments	Dish No. 76 Dish Tare Wt. 70.2561 g Dish+Sample Wt. 70.3397 g Sample Wt. 0.0836 g
2	Test 1 Run 2 Vol. of Solvent 170 ml Log Number -07 Comments	Dish No. 77 Dish Tare Wt. 80.0596 g Dish+Sample Wt. 80.1473 g Sample Wt. 0.0877 g
3	Test 1 Run 3 Vol. of Solvent 170 ml Log Number -10 Comments	Dish No. 79 Dish Tare Wt. 85.9295 g Dish+Sample Wt. 86.0004 g Sample Wt. 0.0709 g
4	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

*Solvent Residue 2.0 ug/ml = [(Sample Wt. 0.0002 g)(10^6)]/Vol. of Sol. 100 ml
EPA-MS Acetone Residue Blank Spec. < 7.8 ug/ml

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0002	0.0833	0.0874	0.0706	D-2	

LSC-01YR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job A.C.S./Moorhead
Team Leader MK
Date Submitted 11-15-90
Test No. 1
Date of Analysis 11-16-90

Source Sugar Cooler
Test Site Stack
Date of Test 11-14-90
No. of Runs Completed 3
Technician R. Cubin

	Test 1 Run 0 Field Blank	Filter No. 2811 Filter Type 4"GF
0	Log Number 1793-02 Comments	Filter Tare Wt. .9299 g Filter+Sample Wt. .9300 g Sample Wt. 0.0001 g
	Test 1 Run 1	Filter No. 2814 Filter Type 4"GF
1	Log Number -05 Comments	Filter Tare Wt. .9296 g Filter+Sample Wt. .9508 g Sample Wt. 0.0212 g
	Test 1 Run 2	Filter No. 2832 Filter Type 4"GF
2	Log Number -08 Comments	Filter Tare Wt. .9442 g Filter+Sample Wt. .9675 g Sample Wt. 0.0233 g
	Test 1 Run 3	Filter No. 2833 Filter Type 4"GF
3	Log Number -11 Comments	Filter Tare Wt. .9147 g Filter+Sample Wt. .9403 g Sample Wt. 0.0256 g
	Test ____ Run ____	Filter No. ____ Filter Type ____
4	Log Number ____ Comments	Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g
	Test ____ Run ____	Filter No. ____ Filter Type ____
5	Log Number ____ Comments	Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0001	0.0212	0.0233	0.0256		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.1077	0.1145	0.0994		

LSC-02PR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job ACS/Moorhead — Source Granulator
Team Leader MK — Test Site Stack
Date Submitted 11-16-90 — Date of Test 11-15-90
Test No. — No. of Runs Completed 3
Date of Analysis 11-19-90 — Technician P. Gibson

0	Test ___ Run 0	Dish No. ___
	Field Blank	Dish Tare Wt. ___ g
	Log Number ___	Dish+Sample Wt. ___ g
	Comments ___	Sample Wt. ___ g
1	Test 2 Run 1	Dish No. 16
	Log Number 1743-15	Dish Tare Wt. 52.8212 g
	Comments ___	Dish+Sample Wt. 52.8254 g
	___	Sample Wt. 0.0042 g
2	Test 2 Run 2	Dish No. 61
	Log Number -18	Dish Tare Wt. 44.5893 g
	Comments ___	Dish+Sample Wt. 44.5948 g
	___	Sample Wt. 0.0055 g
3	Test 2 Run 3	Dish No. 107
	Log Number -21	Dish Tare Wt. 44.0702 g
	Comments ___	Dish+Sample Wt. 44.0749 g
	___	Sample Wt. 0.0047 g
4	Test ___ Run ___	Dish No. ___
	Log Number ___	Dish Tare Wt. ___ g
	Comments ___	Dish+Sample Wt. ___ g
	___	Sample Wt. ___ g
5	Test ___ Run ___	Dish No. ___
	Log Number ___	Dish Tare Wt. ___ g
	Comments ___	Dish+Sample Wt. ___ g
	___	Sample Wt. ___ g

Blank Solvent Wt. 0.0006 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0006	0.0036	0.0046	0.0041	D-4	

LSC-03.GF

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job A.C.S./Moorhead
Team Leader MK
Date Submitted 11-15-90
Test No. 2
Date of Analysis 11-16-90
Transport Leakage ☒ None ☐ _____ ml

Source Granulator
Test Site Stack
Date of Test 11-15-90
No. of Runs Completed 3
Technician R. Eubanks
Solvent DI H2O

0	Test ____ Run 0 Field Blank Log Number ____ Vol. of Solvent ____ ml *Solvent Residue 2.0 ug/ml	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
1	Test 2 Run 1 Vol. of Solvent 160 ml Log Number 1743-13 Comments ____	Dish No. 303 Dish Tare Wt. 49.5732 g Dish+Sample Wt. 49.6228 g Sample Wt. 0.0496 g
2	Test 2 Run 2 Vol. of Solvent 160 ml Log Number -16 Comments ____	Dish No. 304 Dish Tare Wt. 60.5533 g Dish+Sample Wt. 60.5769 g Sample Wt. 0.0236 g
3	Test 2 Run 3 Vol. of Solvent 150 ml Log Number -19 Comments ____	Dish No. 305 Dish Tare Wt. 56.0210 g Dish+Sample Wt. 56.1239 g Sample Wt. 0.1029 g
4	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Vol. of Solvent ____ ml Log Number ____ Comments ____	Dish No. ____ Dish Tare Wt. ____ g Dish+Sample Wt. ____ g Sample Wt. ____ g

*Solvent Residue ___ ug/ml = [(Sample Wt. ____ g)(10^6)]/Vol. of Sol. ____ ml
EPA-M5 Acetone Residue Blank Spec. ≤ 7.8 ug/ml

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0002	0.0493	0.0233	0.1026	D-5	

LSC-01YR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job A.C.S. / Moorhead
Team Leader MK
Date Submitted 11-15-90
Test No. 1
Date of Analysis 11-16-90

Source Granulator
Test Site Stack
Date of Test 11-15-90
No. of Runs Completed 3
Technician R. Cuthrell

0	Test ____ Run 0 Field Blank Log Number ____ Comments ____	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g
1	Test 2 Run 1 Log Number 1793 -14 Comments ____	Filter No. 2815 Filter Type 4" GF Filter Tare Wt. .9335 g Filter+Sample Wt. .9435 g Sample Wt. 0.0100 g
2	Test 2 Run 2 Log Number -17 Comments ____	Filter No. 2816 Filter Type 4" GF Filter Tare Wt. .9138 g Filter+Sample Wt. .9341 g Sample Wt. 0.0203 g
3	Test 2 Run 3 Log Number -20 Comments ____	Filter No. 2807 Filter Type 4" GF Filter Tare Wt. .9404 g Filter+Sample Wt. .9637 g Sample Wt. 0.0233 g
4	Test ____ Run ____ Log Number ____ Comments ____	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Log Number ____ Comments ____	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
0.0001	0.0100	0.0203	0.0233		

=

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0629	0.0485	0.1300		

LSC-02PR

Interpoll Laboratories
(612) 786-6020

Chain of Custody
Sample Deposition Sheet

Job A.C.S. / Moorhead, MN
Team Leader M. Kuehler
Date Submitted 11-15-90
Test No. 1

Source Sugar Cooler
Test Site Stack
Date of Test 11-14-90
No. of Runs Completed 3

No. of Samples	Type of Sample	Analysis Required	Comments
3+1	Probe Wash: ☐ Acetone ☒ D.I. Water	☒ As per EPA M-5 ☐ Other _____	
3+1	Filter: ☒ 4" G.F. ☐ S.S. Thimble ☐ 2.5" G.F. ☐ 47 mm G.F.	☒ As per EPA M-5 ☐ As per EPA M-17 ☐ Other _____	
3+1	Impinger Catch: ☒ D.I. Water ☐ 3% H_2O_2 ☐ 4M5 Hg Only ☐ 4M5 Metals ☐ 1.0 N NaOH ☐ Other _____	☒ MN Protocol ☐ WI Protocol ☐ EPA M-6 or 8 ☐ Acid Gases ☐ Formaldehyde ☐ Metals ☐ Other _____	
—	Integrated Gas sample	☐ As per EPA M-3 ☐ As per EPA M-10 ☐ Other _____	
—	Oxides of Nitrogen (NO_x)	☐ As per EPA M-7A ☐ Other _____	Date _____ Time (HRS) _____
—	☐ Fuel Sample ☐ Aggregate	☐ Attached fuel Form #S-0163RRR	
—	Particle Size	☐ X-Ray Sedigraph ☐ Bahco Method ☐ Other _____	
—	Audit Samples ☐ Sulfur Dioxide ☐ Oxides of Nit. ☐ Other _____	☐ As per EPA M-6 ☐ As per EPA M-7A ☐ Other _____	

Source Information

1) Type of Source: ☐ Boiler ☐ Asphalt Plant ☐ Incinerator ☐ Dryer ☒ Other Cooler
NA 2) Fuel: ☐ Coal ☐ Wood ☐ Gas ☐ Oil ☐ RDF ☐ Other _____
NA 3) Is sample combustible? ☐ No ☐ Yes
NA 4) Does sample need special handling? ☐ No ☐ Yes If yes, explain _____

S-278RRRR

Filename: BEET21.WQ1
Date: 18-Jan-95
Facility: American Crystal Sugar
Location: Moorehead, Minnesota
Source: Sugar cooler (horiz. rotating drum cooled w/ ambient air) with rotoclone
Test date: November 14, 1990

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	97	97	98	
Sugar cooler with rotoclone	Pressure	in. HG	28.62	28.62	28.62	
	Moisture	%	4.65	4.87	4.79	
	Oxygen	%	20.9	20.9	20.9	
	Volumetric flow, actual	acfm	14075	14382	12971	
	Volumetric flow, standard*	dscfm	12169	12406	11178	
	Isokinetic variation	%	102	103.3	98.8	
Sugar cooler throughput rate		TPH	39.70	34.10	36.60	
	Pollutant concentrations:					
	Total PM	G/dscf	0.0477	0.0492	0.0496	
	Filterable PM	G/dscf	0.0463	0.0476	0.0480	
	Condensible organic PM	G/dscf	0.00142	0.001633	0.00160	
	CO2	% vol	0.03%	0.03%	0.03%	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	4.83	5.06	4.60	
	Condensible organic PM	lb/hr	0.148	0.174	0.153	
	CO2	lb/hr	0.250	0.255	0.230	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.12	0.15	0.13	0.13
	Condensible organic PM	lb/ton	0.0037	0.0051	0.0042	0.0043
	CO2	lb/ton	0.0063	0.0075	0.0063	neglig.
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.061	0.074	0.063	0.066
	Condensible organic PM	kg/Mg	0.0019	0.0025	0.0021	0.0022
	CO2	kg/Mg	0.0032	0.0037	0.0031	neglig.

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

Filename: BEET21A.WQ1
Date: 18-Jan-95
Facility: American Crystal Sugar
Location: Moorehead, Minnesota
Source: Sugar granulator (horiz. rotating drum dryer) with rotoclone
Test date: November 15, 1990

D. Emission Data/Mass Flux Rates/Emission Factors

Test ID	Parameter	Units	Values reported			
			Run 1	Run 2	Run 3	Run 4
1	Stack temperature	Deg F	108	104	105	
Sugar granulator with rotoclone	Pressure	in. HG	28.75	28.75	28.75	
	Moisture	%	7.82	7.14	6.89	
	Oxygen	%	20.9	20.9	20.9	
	Volumetric flow, actual	acfm	12572	12039	11958	
	Volumetric flow, standard*	dscfm	10351	10057	9998	
	Isokinetic variation	%	103.4	99.1	99.7	
Sugar granulator output rate		TPH	39.70	34.10	36.60	
	Pollutant concentrations:					
	Total PM	G/dscf	0.03235	0.01506	0.04037	
	Filterable PM	G/dscf	0.0305	0.0135	0.0391	
	Condensible organic PM	G/dscf	0.00185	0.001522	0.00127	
	CO2	% vol	0.03%	0.03%	0.03%	
	Pollutant mass flux rates:					
	Filterable PM	lb/hr	2.71	1.17	3.35	
	Condensible organic PM	lb/hr	0.164	0.131	0.109	
	CO2	lb/hr	0.213	0.207	0.206	
	Emission factors (ENGLISH UNITS):					AVERAGE
	Filterable PM	lb/ton	0.07	0.03	0.09	0.06
	Condensible organic PM	lb/ton	0.0041	0.0038	0.0030	0.0037
	CO2	lb/ton	0.0054	0.0061	0.0056	neglig.
	Emission factors (METRIC UNITS):					AVERAGE
	Filterable PM	kg/Mg	0.034	0.017	0.046	0.032
	Condensible organic PM	kg/Mg	0.0021	0.0019	0.0015	0.0018
	CO2	kg/Mg	0.0027	0.0030	0.0028	neglig.

*DSCFM BASED ON A STANDARD TEMPERATURE OF 68 DEGREES FAHRENHEIT

reference was used to extract particulate samples by means of a heated glass-lined probe. Wet catch samples were collected in the back half of the Method 5 sampling train and analyzed as per Minnesota Rules, Part 7005.0500. Gas samples were not collected since ambient air is used in the cooling and granulating processes.

Testing on the Sugar Cooler was performed using two test ports oriented at 90 degrees on the stack. These test ports are located 14 stack diameters downstream of the nearest flow disturbance and 2.6 stack diameters upstream of the stack exit. A 12-point traverse was used to collect representative particulate samples. Each traverse point was sampled 5 minutes to give a total sampling time of 60 minutes per run.

Testing on the Sugar Granulator was also performed using two test ports oriented at 90 degrees on the stack. These test ports are located 9.4 stack diameters downstream of the nearest flow disturbance and 2.4 stack diameters upstream of the stack exit. A 12-point traverse was used to collect representative particulate samples. Each traverse point was sampled 5 minutes to give a total sampling time of 60 minutes per run.

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

2 SUMMARY AND DISCUSSION

The important results of the particulate emission compliance test on the Sugar Cooler and Sugar Granulator are summarized in Tables 1 and 2. As will be noted, the particulate emission rate averaged 4.98 LB/HR for the Sugar Cooler and 2.54 LB/HR for the Sugar Granulator. The average particulate concentrations for the Sugar Cooler and Sugar Granulator were 0.049 and 0.029 GR/DSCF, respectively.

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

Test No. 1
Sugar Cooler Stack

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

Date of run	Run 1 11-14-90	Run 2 11-14-90	Run 3 11-14-90
Dry basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.90	20.90	20.90
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	79.07	79.07	79.07
Wet basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	19.93	19.88	19.90
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	75.40	75.22	75.29
water vapor.....	4.65	4.87	4.79
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	28.34	28.31	28.32
Specific gravity.....	0.979	0.978	0.978
Water mass flow.....(LB/HR)	1663	1780	1575
FO	0.000	0.000	0.000

Test No. 2
Sugar Granulator Stack

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

Date of run	Run 1 11-15-90	Run 2 11-15-90	Run 3 11-15-90
Dry basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	20.90	20.90	20.90
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	79.07	79.07	79.07
Wet basis (orsat)			
carbon dioxide.....	0.03	0.03	0.03
oxygen.....	19.27	19.41	19.46
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	72.88	73.43	73.62
water vapor.....	7.82	7.14	6.89
Dry molecular weight.....	28.84	28.84	28.84
Wet molecular weight.....	27.99	28.07	28.09
Specific gravity.....	0.967	0.969	0.970
Water mass flow.....(LB/HR)	2461	2166	2073
FO	0.000	0.000	0.000

Test No. 1
Sugar Cooler Stack

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

	Run 1	Run 2	Run 3
Date of run	11-14-90	11-14-90	11-14-90
Time run start/end.....(HRS)	938/1040	1102/1204	1226/1329
Static pressure.....(IN.WC)	-0.58	-0.58	-0.58
Cross sectional area (SQ.FT)	3.90	3.90	3.90
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	24.0	20.0	26.0
desiccant.....(GRAMS)	12.0	19.0	7.0
total.....(GRAMS)	36.0	39.0	33.0
Total particulate material..			
.....collected(grams)	0.1077	0.1145	0.0994
Gas meter coefficient.....	1.0016	1.0016	1.0016
Barometric pressure..(IN.HG)	28.62	28.62	28.62
Avg. orif.pres.drop..(IN.WC)	1.20	1.29	0.97
Avg. gas meter temp..(DEF-F)	88.5	96.3	99.0
Volume through gas meter....			
at meter conditions...(CF)	37.66	39.39	34.13
standard conditions.(DSCF)	34.83	35.92	30.95
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.183	.183	.183
Avg.stack gas temp ..(DEG-F)	97	97	98
Volumetric flow rate.....			
actual.....(ACFM)	14075	14382	12971
dry standard.....(DSCFM)	12162	12397	11167
Isokinetic variation.....(%)	102.0	103.3	98.8
Particulate concentration...			
actual.....(GR/ACF)	0.04122	0.04237	0.04264
dry standard.....(GR/DSCF)	0.04772	0.04918	0.04955
Particle mass rate...(LB/HR)	4.975	5.226	4.743

Test No. 2
Sugar Granulator Stack

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

	Run 1	Run 2	Run 3
Date of run	11-15-90	11-15-90	11-15-90
Time run start/end.....(HRS)	804/ 911	933/1034	1103/1205
Static pressure.....(IN.WC)	-0.64	-0.64	-0.64
Cross sectional area (SQ.FT)	3.90	3.90	3.90
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	42.0	63.0	60.0
desiccant.....(GRAMS)	12.0	18.0	18.0
total.....(GRAMS)	54.0	81.0	78.0
Total particulate material..			
.....collected(grams)	0.0629	0.0485	0.1300
Gas meter coefficient.....	1.0016	1.0016	1.0016
Barometric pressure..(IN.HG)	28.75	28.75	28.75
Avg. orif.pres.drop..(IN.WC)	0.87	2.42	2.43
Avg. gas meter temp..(DEF-F)	84.2	88.8	90.7
Volume through gas meter....			
at meter conditions...(CF)	32.07	53.34	53.53
standard conditions.(DSCF)	30.00	49.68	49.68
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.183	.244	.244
Avg.stack gas temp ..(DEG-F)	108	104	105
Volumetric flow rate.....			
actual.....(ACFM)	12572	12039	11958
dry standard.....(DSCFM)	10338	10046	9986
Isokinetic variation.....(%)	103.4	99.1	99.7
Particulate concentration...			
actual.....(GR/ACF)	0.02659	0.01257	0.03370
dry standard.....(GR/DSCF)	0.03235	0.01506	0.04037
Particle mass rate...(LB/HR)	2.867	1.297	3.456

Test No. 1
Sugar Cooler Stack

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

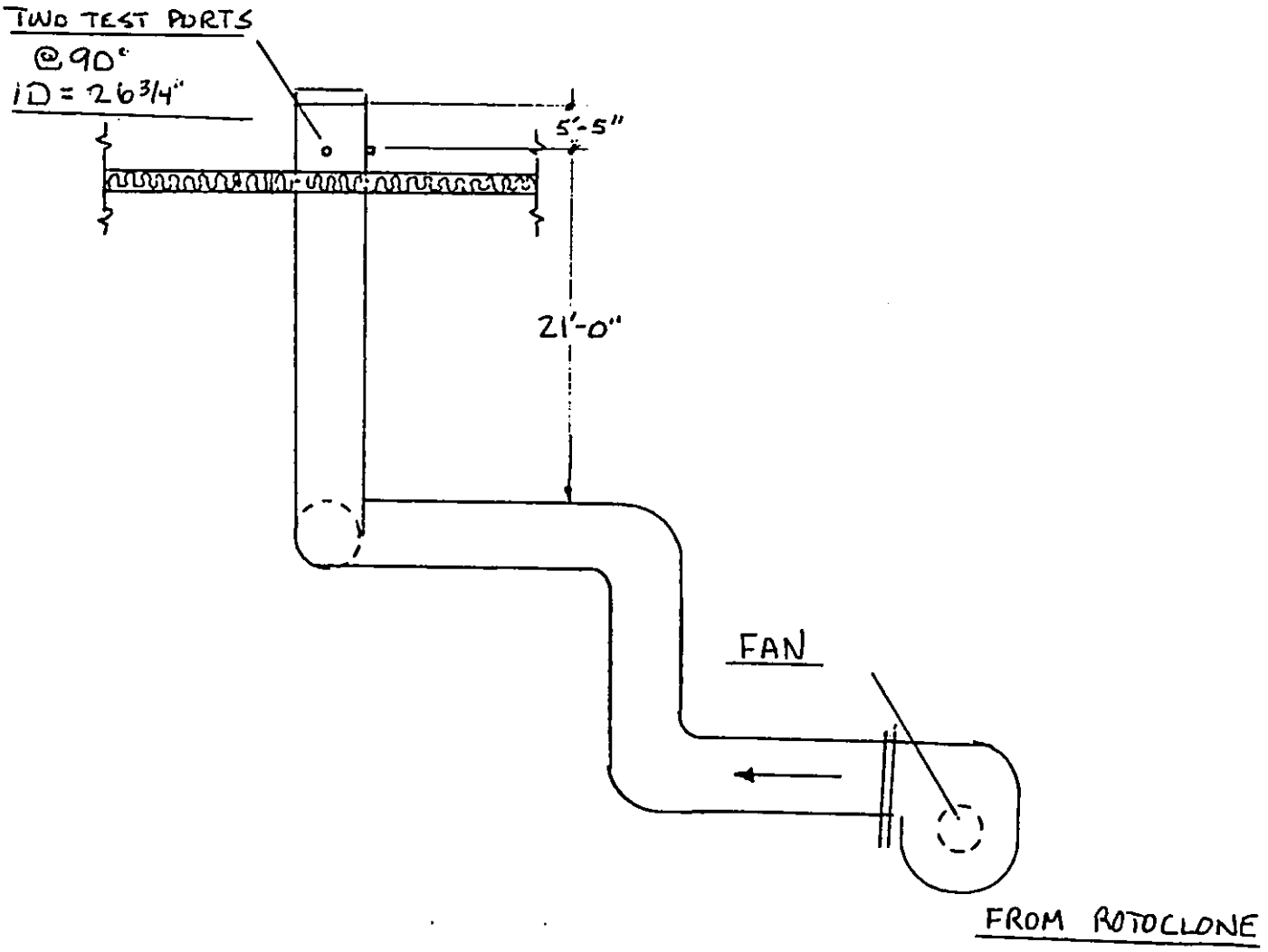
Date of Determination.....	11-14-90
Time of Determination.....(HRS)	910
Barometric pressure.....(IN.HG)	28.62
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	12
Shape of duct.....	Round
Stack diameter.....(IN)	26.75
Duct area.....(SQ.FT)	3.90
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.58
Avg. gas temp.....(DEG-F)	85
Moisture content.....(% V/V)	4.65
Avg. linear velocity.....(FT/SEC)	56.8
Gas density.....(LB/ACF)	.06809
Molecular weight.....(LB/LBMOLE)	28.84
Mass flow of gas.....(LB/HR)	54371
Volumetric flow rate.....	
actual.....(ACFM)	13308
dry standard.....(DSCFM)	11742

Test No. 2
Sugar Granulator Stack

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

Date of Determination.....	11-15-90
Time of Determination.....(HRS)	740
Barometric pressure.....(IN.HG)	28.75
Pitot tube coefficient.....	.84
Number of sampling ports.....	2
Total number of points.....	12
Shape of duct.....	Round
Stack diameter.....(IN)	26.75
Duct area.....(SQ.FT)	3.90
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.64
Avg. gas temp.....(DEG-F)	122
Moisture content.....(% V/V)	7.82
Avg. linear velocity.....(FT/SEC)	54.3
Gas density.....(LB/ACF)	.06327
Molecular weight.....(LB/LBMOLE)	28.84
Mass flow of gas.....(LB/HR)	48226
Volumetric flow rate.....	
actual.....(ACFM)	12705
dry standard.....(DSCFM)	10192

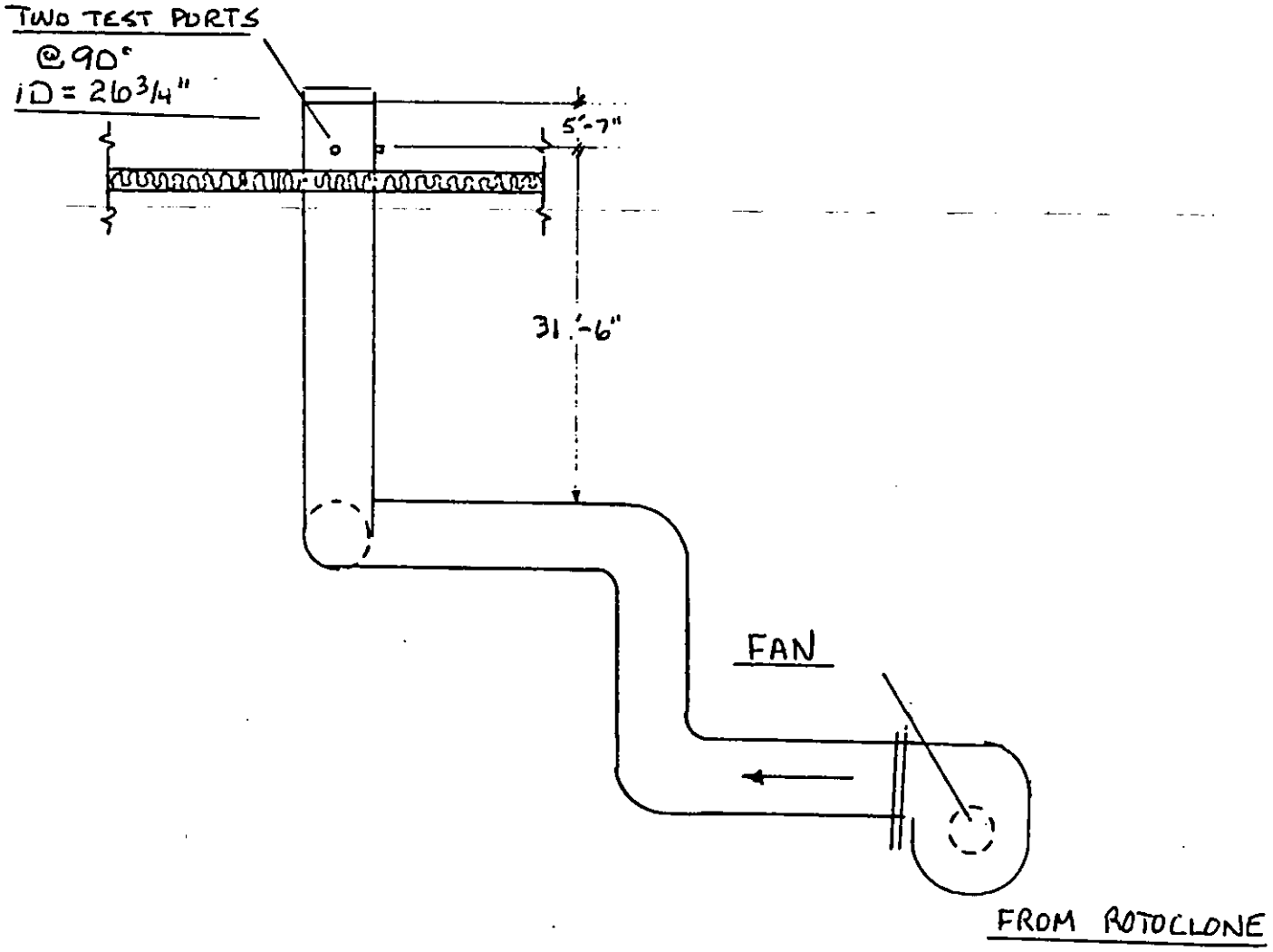
AMERICAN CRYSTAL SUGAR
MOORHEAD PLANT
SUGAR GRANULATOR



DHD 12/90

NOT TO SCALE

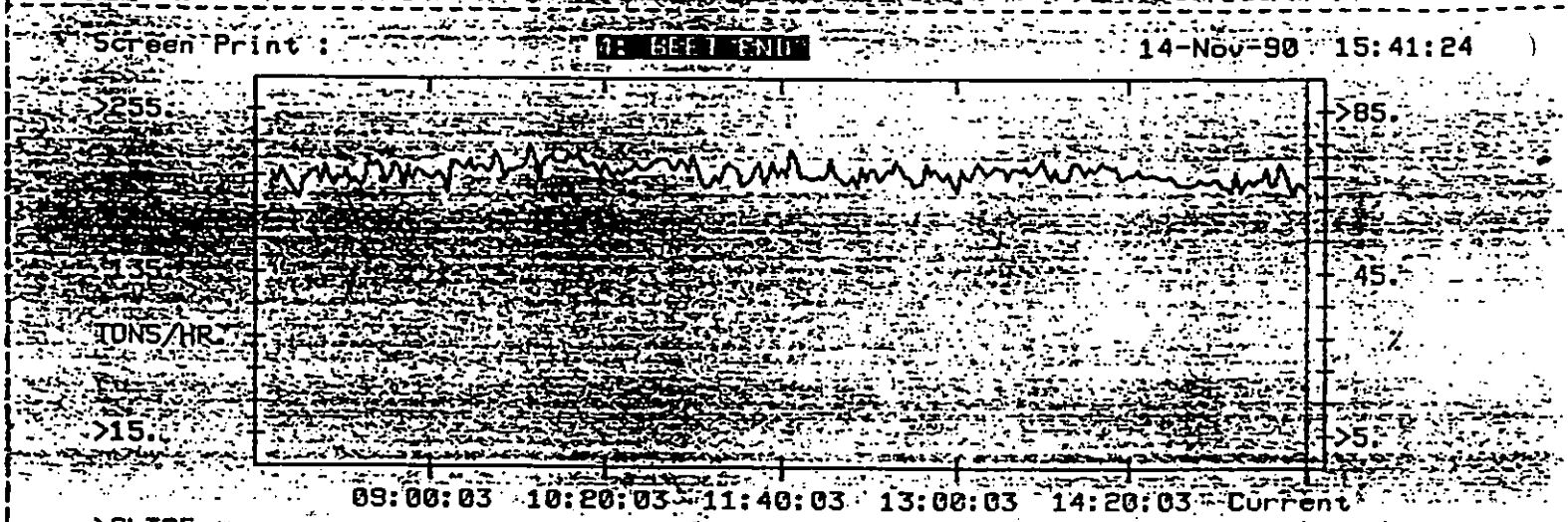
AMERICAN CRYSTAL SUGAR
MOORHEAD PLANT
SUGAR COOLER



DHD 12/90

NOT TO SCALE

Screen Print from Node: 4



>SLICE

Data Pts >240 Time Scale >8 >Hours >Start Time >15:40:03 >14-Nov-90

	Tag	Descriptor	14-Nov-90	Value at 15:40:03	Units	Eng. Min	Eng. Max
OFF	1A14	SEWER LK		21.4	GPM	.0	714.0
ON	SLICE	BEET SLICE		196.	TONS/HR.	0.	300.
OFF	CRJ-FT	RAW JUICE FLOW		1020.00	GPM	.00	1500.00

CONFIG 2

	12:25	12:30	12:35	12:40	12:45	12:50	12:55	1:00	1:05	1:10	1:15	1:20
Spray Press.	36	36	36	36	36	36	36	36	36	36	36	36
Press. Drop	1.9	2	2.1	2.1	2.2	2.3	2.4	2.5	2.6	2.6	2.6	2.6
Speed	1080											
Parsons Reading	2810	2860	2888	2960	3048	3089	3218	3544	3300	3367	3414	3480	3542
Slice Rate	206	207	210	208	212	209	205	208	211	211	211	213	212

Rotoclone: Cooler

DAN Chute

Person Taking Readings

Time of Test: 12:25 / 1
Start STOP

Date 11 / 14 / 90

F-3

Time	11:05	11:10	11:15	11:20	11:25	11:30	11:35	11:40	11:45	11:50	11:55	12:00	12:05
Spray Press.	36	36	36	36	36	36	36	36	36	36	36	36	36
Press. Drop	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.8	1.8	1.8
Speed	1080												
Parsons Read	1821	1870	1904	1997	2090	2136	2188	2234	2306	2341	2404	2476	2502
Slice Rate	212	214	212	209	214	208	206	213	214	215	206	204	201

Rotoclone: Cooler

Time of Test: 11:05 / 12:05
Start Stop

Date 11 / 14 / 90

Dan Gust

Person Taking Readings:

F-2

Log #2

	9:40	9:45	9:50	9:55	10:00	10:05	10:10	10:15	10:20	10:25	10:30	10:35
Spray Press.	36	36	36	36	36	36	36	36	36	36	36	36
Press. Drop	2	1.9	1.7	1.6	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Speed	1080	—	—	—	—	—	—	—	—	—	—	—
Parsons Read	557	660	738	789	856	723	1065	1067	1160	1232	1294	1351
Slice Rate	208	217	220	217	215	217	222	218	218	216	214	213

Rotoclone: Cooler

DAN Guest

Person Taking Readings.

Time of Test: 9:40 / 10:40
Start STOP

Date 11 / 14 / 90

#1

Time	8:05	8:10	8:15	8:20	8:25	8:30	8:35	8:40	8:45	8:50	8:55	9:00	9:05	9:10
Spray Press.	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Press. Drop	7.5	7	7	7.2	7.2	7	5	6.5	7	7	6.8	6.8	7	7
Speed	900													
Parsons Ready	66	154	210	251	308	364	457	443	565	606	668	719	776	812
Slice Rate	223	217	205	211	215	218	213	210	217	217	215	214	215	211

Rotoclone: Granulator

Dust

Person Taking Readings.

Time of Test: 8:10 / 9:10
Start STOP

Date 11 / 15 / 10

Time	9:35 AM	9:40	9:45	9:50	9:55	10:00	10:05	10:15	10:20	10:25	10:30	10:35
Spray Press.	45	45	45	45	45	45	45	45	45	45	45	45
Press. Drop	7	7	7	7	7	7	7	7	7	7	7	7
Speed	90											
Parsons Read	1099	1451	1825	2216	2727	3324	4086	4593	1535	1516	1463	1700	1762
Slice Pos.	217	215	212	217	208	213	212	210	210	211	210	216	217

Rotoclone: SRFNJ Weather

DAN Gust

Person taking Readings:

Time of Test: 9:35 / 10:35
Start Stop

Date 11 / 15 / 90

8-7

Time	11:20 A	11:25	11:30	11:35	11:40	11:45	11:50	11:55	12:00 P
Spray Press.	45	45	45	45	45	45	45	45	45
Press. Drop	7	7	7	7	7	7.8	7.7	7.7	7.7
Speed	900								
Parsons Read	2142	2183	2245	2307	2363	2420	2487	2553	2574
Slice Rate	218	206	208	146	209	210	207	219	210

12:05 P	12:10	12:15	12:20	12:25	12:30	12:35	12:40	12:45	12:50
45	45	45	45	45	45	45	45	45	45
7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
2651	2708	2780	2826	2874					
205	212	217	215	209					

RotoJector GRANULATOR

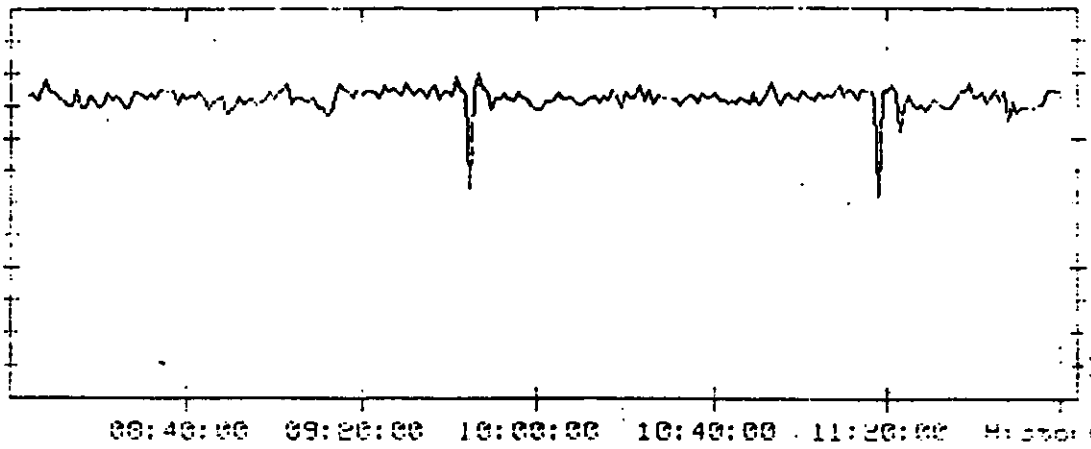
Time of Test: 11:00 12:05
Start STOP

Date 11 / 15 / 90

Person Taking Readings:

F-9
11/3

Screen Print : 4:—BEET END— 15-Nov-90 12:48:30



>SLICE

Data Pts >240 Time Scale >240 >Minutes >Start Time >12:00:00 >15-Nov-90

	Tag	Descriptor	15-Nov-90 Value at 12:00:00	Units	Eng. Min	Eng. Max
OFF	1A14	SEWER LK	17.9	GPM	.0	714.0
ON	SLICE	BEET SLICE	216.	TONS/HR.	0.	300.
OFF	CRJ-FT	RAW JUICE FLOW	1072.50	GPM	.00	1500.00

OPER 3