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.

AP-42 Section Number: 1.8

Reference Number: 23

Title: Source Test Report For Particulate Emissions Impingement Wet Scrubber Number 3 Boiler: United States Sugar Cane Corporation

January 1991

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air consulting and engineering, Inc.

REPORT CERTIFICATION

To the best of my knowledge, all applicable field and analytical procedures comply with Florida Department of Environmental Regulation requirements and all test data and plant operating data are true and correct.

Stephen L. Neck, P.E.

State of Florida
Registration No. 20020

March 4, 1991

Date

SEAL

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1.0 INTRODUCTION

Personnel from Air Consulting and Engineering, INC.(ACEI) performed annual source emission compliance testing for the U. S. SUGAR CORPORATION (USSC) on January 24, 1991. Testing was performed at the Bryant Sugar Mill Number 3 Boiler wet scrubber outlet.

Testing was designed to fulfill "specific conditions" of the current Florida Department of Environmental Regulation (FDER) operating permit.

Three United States Environmental Protection Agency (USEPA) Method 5 particulate matter (PM) test runs were conducted while the plant was documented to be operating within 10% of permitted production.

Mr. Augusto Blanchard of USSC served as test coordinator and certified production rates.

Mr. Ken Tucker of the Florida Department of Environmental Regulation witnessed most of the testing period.

2.0 SUMMARY and DISCUSSION of RESULTS

Results of the emission testing are provided in Table 1. Complete emission data are located in the report appendices.

The source was found to be operating within full compliance of permit conditions. Stack emissions averaged 37.43 pounds per hour (LB/HR) and 0.129 pounds per million btu(LB/MMBTU) heat input against a "process rate" basis allowable emission of 0.300 LB/MMBTU. Permit conditions limit emissions to 0.10 LB/MMBTU from oil and 0.300 LB/MMBTU from bagasse firing. No oil was used during compliance testing.

Production rate summaries are provided in Appendix A. These data were taken from control room recordings of steam flow, temperature, and pressure as well as feedwater temperature and pressure(Appendix E). Steam integrator readings were recorded at the beginning and end of each particulate test run by Mr. Stephen L. Neck of ACEI.

TABLE 1
EMISSION SUMMARY
U. S. SUGAR CORPORATION
NUMBER 3 BOILER
JANUARY 24, 1991

RUN NUMBER	TIME	ACTUAL EMISSIONS		ALLOWABLE EMISSIONS	
		LB/HR	LB/MMBTU	LB/HR	LB/MMBTU
1	0804-0912 68	45.43	0.156	87.63	0.300
2	0949-1057 65	43.54	0.151	86.50	0.300
3	1130-1240 70	23.33	0.079	89.00	0.300
AVERAGES	--------- 69	37.43	0.129	87.71	0.300

3.0 PROCESS DESCRIPTION AND OPERATION

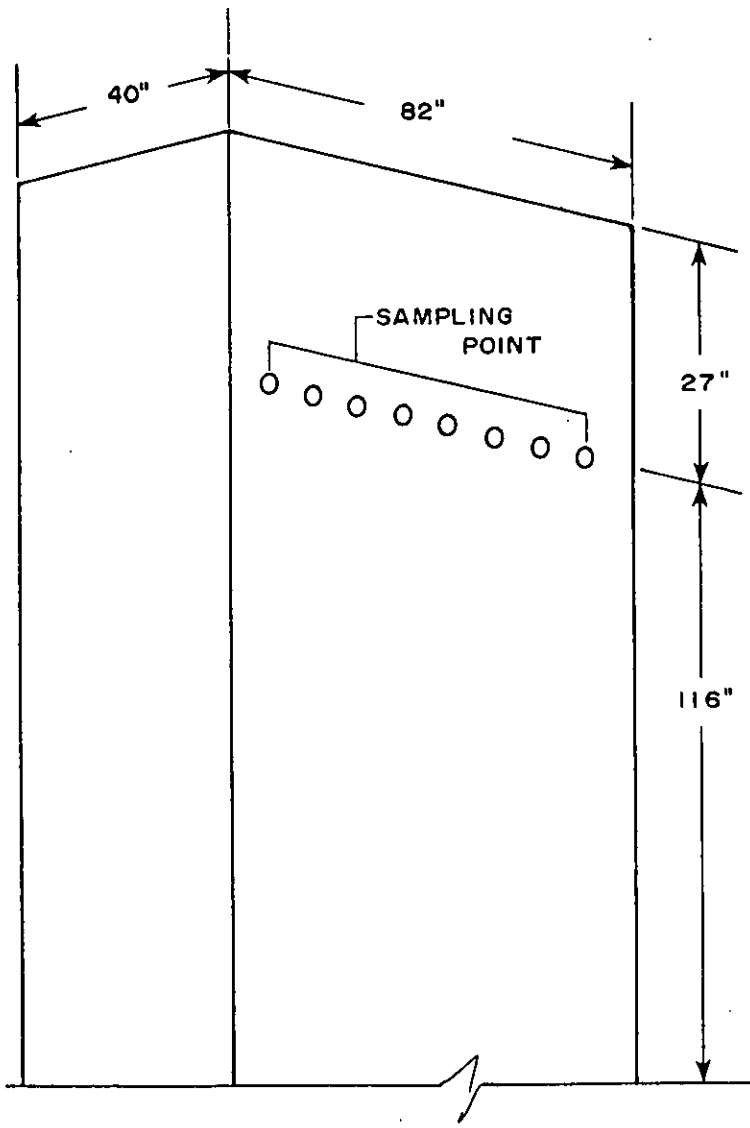
The Number 3 Boiler at the U. S. Sugar Corporation's Bryant plant is a traveling grate stoker design used primarily for bagasse fuel firing. Supplemental oil firing was not used during the emission test series. The boiler averaged 151366 pounds per hour steam production over the three run test period.

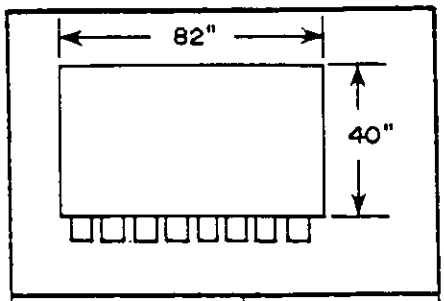
Oil meters, steam integrators, and other production monitoring devices were rigorously calibrated prior to the production season.

4.0 SAMPLING POINT LOCATION

The sampling point location is a single scrubber outlet stack, 82" wide and 40" deep. The stack has eight equally spaced sample points. The ports are located 116" from an upstream disturbance and 27" from the outlet.

Thirty-two test points were sampled for each test run. The traverse were located as shown in Figure 1. The stack configuration is such that there is no reason to evaluate the presence of cyclonic flow.





TRAVERSE POINT NUMBER	INCHES INSIDE STACK WALL
1	5.00"
2	15.00
3	25.00
4	35.00

NOT TO SCALE

FIGURE 1.
SAMPLING POINT LOCATION
BRYANT-BOILER NO. 3
U.S. SUGAR CORPORATION
PAHOKEE, FLORIDA

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5.0 FIELD and ANALYTICAL PROCEDURES- USEPA METHOD 5

Particulate matter samples were collected by the emission measurement method specified by the United States Environmental Protection Agency. A schematic diagram of the sampling train used is provided in Figure 2. All particulate matter captured from the nozzle to and including the filter was included in the calculation of the emission rate of particulate matter.

PREPARATION OF EQUIPMENT

1. FILTERS- Gelman type "A" glass fiber filters were placed in a drying oven for two hours at 105 degrees C, removed and placed in a standard desiccator containing indicating silica gel, allowed to cool for two hours, and weighed to the nearest 0.1 mg. The filters were then re-desiccated for a minimum of six hours and weighed to a constant weight (less than 0.5 mg change from previous weighing). The average of the two constant weights was used as the tare value.

2. NOZZLE, FILTER HOLDER, AND SAMPLING PROBE - The nozzle, filter holder, and sampling probe were washed vigorously with soapy water and brushes, rinsed with distilled water and acetone, and dried pror to the test program. All openings on the equipment were sealed while in transit to the test site.

3. IMPINGERS - The Greenburg-Smith impingers were cleaned, rinsed, and dried as in 2. The impingers were also sealed during transit.

TEST PROCEDURE

Prior to performing the actual particulate matter sample runs, certain stack and stack gas parameters were measured. These preliminary measurements included the average gas temperature, the stack gas velocity head, the stack gas moisture content, and the dimensions at the point where the tests were to be performed. The stack temperature was determined using a bi-metallic thermocouple and calibrated

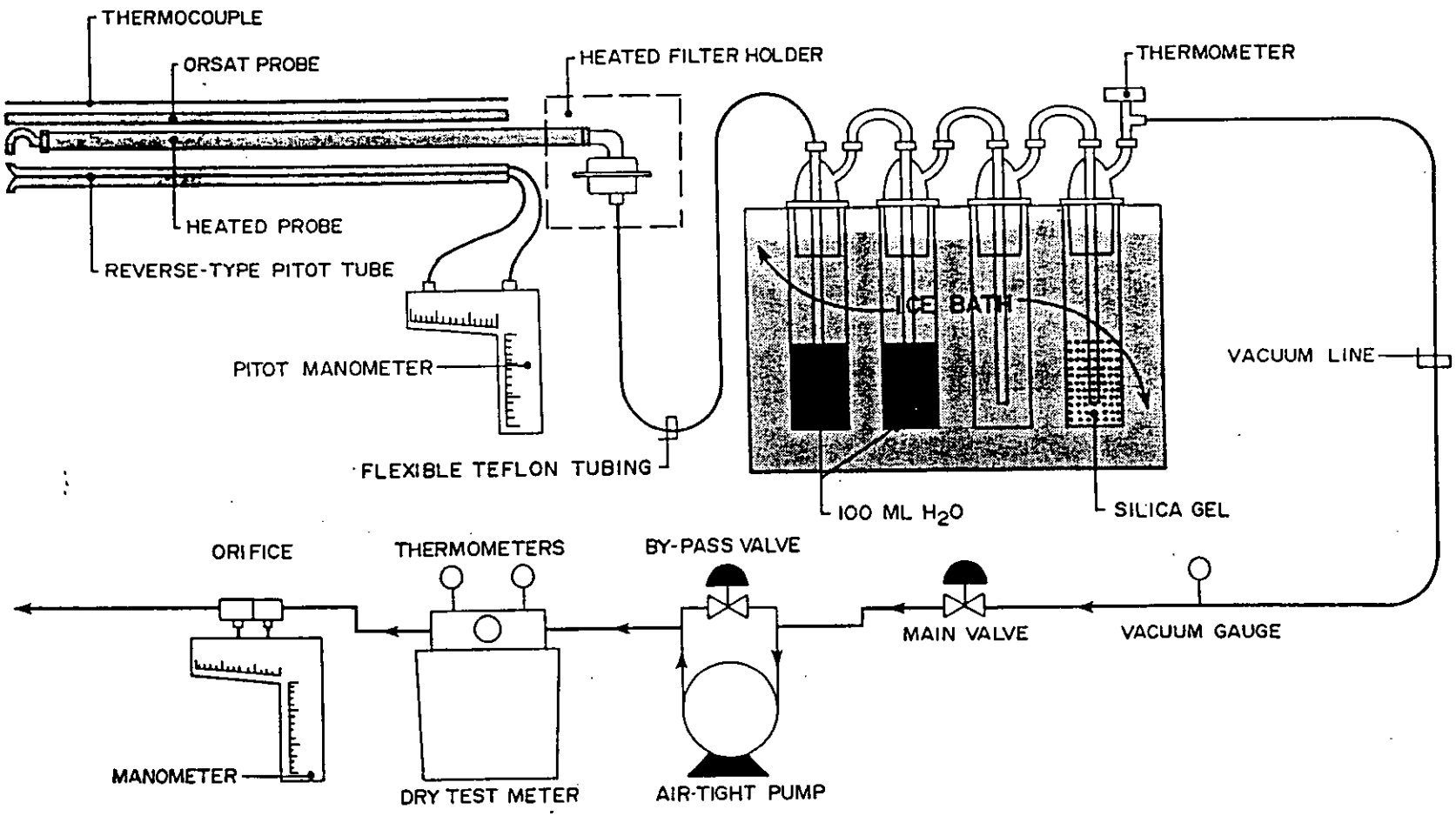

FIGURE 2
EPA METHOD 5 SAMPLING TRAIN

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pyrometer. Velocity head measurements were made with a calibrated type "s" pitot tube and an inclined manometer. Velocity head measurements of 0.05 inches H2O or less were measured using a micromonometer.

The sampling traverse points were selected so that a representative sample could be extracted from the gas stream. The traverse points were located in the center of equal areas, the number of which were dependent upon the distance upstream or downstream from flow disturbances.USEPA Methods 1 and 2 were utilized for this task.

Each particulate matter test run consisted of sampling for a specific amount of time at each point. The type "s" pitot tube was connected to the sampling probe so that an instantaneous velocity head measurement could be made at each traverse point while conducting the test run. The stack gas temperature was also measured at each traverse point. Together with assumed moisture and orsat knowledge as well as known nozzle area, calculations of "isokinetic" (equal energy or velocity) were quickly made and effected for each traverse point during the test run.

The gases sampled passed through the following components: a stainless steel nozzle and glass probe; a glass fiber filter; two impingers charged with 100 ml of distilled water each; one dry impinger; one impinger with 200 grams of silica gel desiccant; a flexible length of tubing; a leak free pump; a calibrated dry gas meter: and, finally, a calibrated flow orifice.

Sample recovery was accomplished in the following manner:

1. The pre-tared filter was removed from its holder and placed in Container 1 and sealed. (This is usually performed in the lab).
2. All sample-exposed surfaces prior to the filter were washed with acetone and placed in Container 2. The container was then sealed and the liquid level marked.
3. The volume of water from the first three impingers was measured for the purpose of calculating the moisture content of the stack gases, then discarded.

4. The silica gel from the fourth impinger was transferred to the original tared container and sealed.

LABORATORY ANALYSIS

The three sample containers from each sample run were analyzed according to the following procedures:

1. The filter was either dried for two hours at 105 degrees C or desiccated for 24 hours at ambient temperature. Following desiccation, the filter was weighed to the nearest 0.1 mg. A minimum of two such weighings six hours apart were made with a variance of less than 0.5 mg.

2. The acetone from Container 2 was transferred to a tared beaker, evaporated to dryness, and weighed in the same manner as above.

3. The used silica gel in its tared container was weighed to the nearest 0.1 gram.

The total sample weight included the weight gains from Sample Containers 1 and 2.

DATA

All relevent field and lab data sheets as well as emission calculations are provided in the report appendices.

APPENDIX A

COMPLETE EMISSION DATA

AND

SAMPLE CALCULATIONS

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Complete Emission Data

PLANT:	U. S. SUGAR CORPORATION	DATE:	1-24-91
LOCATION:	BRYANT, FLORIDA	RUN NUMBER	1
SOURCE:	NUMBER 3 BOILER, SCRUBBER OUTLET	TIME:	0802-0914

TIME INTERVAL	72	MINUTES
OIL:		
FINAL OIL	0	
BEGIN OIL	0	
FACTOR	1	
STEAM:		
FINAL STEAM	687258	
BEGIN STEAM	687076	
FACTOR	1000	
TEMPERATURE	578	DEGREES F
PRESSURE	399	PSIG
	414	PSIA
FEEDWATER:		
TEMPERATURE	260	DEGREES F
PRESSURE	648	PSIG
	663	PSIA
HEAT INPUT:		
STEAM	1287.9	BTU/LB
FEEDWATER	228.6	BTU/LB
NET STEAM	1059.3	BTU/LB
STEAM RATE	151667	LB/HR
BOILER EFFICIENCY	55.0	%
TOTAL FUEL HEAT INPUT	292.11	MMBTUH
STEAM CALIBRATION FACTOR	1.00	
OIL	0.00	GPH
OIL	150000	BTU/GAL
TOTAL HEAT INPUT (OIL)	0.00	MMBTUH
TOTAL HEAT INPUT (NON-OIL)	292.11	MMBTUH
ALLOWABLES:		
ALLOWABLE EMISSION (OIL)	.10	LB/MMBTU
ALLOWABLE EMISSION (NON-OIL)	.30	LB/MMBTU
TOTAL ALLOWABLE EMISSION	87.63	LB/HR
TOTAL ACTUAL EMISSION	45.43	LB/HR
TOTAL ALLOWABLE EMISSION	0.300	LB/MMBTU
TOTAL ACTUAL EMISSION	0.156	LB/MMBTU

AIR CONSULTING and ENGINEERING
COMPLETE EMISSION DATA

PLANT: U. S. SUGAR CORPORATION-BRYANT
SOURCE: NUMBER 3 BOILER
DATE: 1-24-91

RUN NO.:	1	IMPINGER ml	275
BEGIN TIME:	0804	SILICA GEL gms.	6.5
END TIME:	0912	PERCENT O2	8.3
TOTAL RUN TIME:	64.00 min.	PERCENT CO2	12.0
BAROMETRIC PRESSURE:	30.10 "Hg		
STACK PRESSURE:	30.13 "Hg.		
NOZZLE DIAMETER:	.167 inches	PARTICULATE	
METER CORR. FACTOR:	.994		
FINAL METER:	1026.075 cubic ft.	FILTER mg.	130.3
INITIAL METER:	994.000 cubic ft.	WASH mg.	17.3
STACK AREA:	22.780 sq. ft.		

PORT-POINT	VELOCITY HEAD	SQUARE RT. VEL. HEAD	ORIF. DIFF.	STACK TEMP.	METER TEMP.
1-1	2.400	1.549	1.200	157	69
1-2	3.200	1.789	1.600	157	69
1-3	3.400	1.844	1.700	157	69
1-4	3.200	1.789	1.600	157	69
2-1	2.000	1.414	1.000	157	70
2-2	2.600	1.612	1.300	158	70
2-3	3.200	1.789	1.450	158	71
2-4	2.800	1.673	1.400	159	71
3-1	1.700	1.304	.850	159	72
3-2	2.200	1.483	1.100	159	72
3-3	2.700	1.643	1.350	159	73
3-4	2.250	1.500	1.100	158	74
4-1	1.600	1.265	.800	158	75
4-2	2.200	1.483	1.100	158	75
4-3	2.400	1.549	1.200	157	75
4-4	2.200	1.483	1.100	158	76
5-1	1.600	1.265	.800	157	77
5-2	2.200	1.483	1.100	158	77
5-3	2.200	1.483	1.100	157	77
5-4	2.000	1.414	1.000	159	78
6-1	1.200	1.095	.600	159	79
6-2	1.800	1.342	.900	161	79
6-3	2.000	1.414	1.000	161	79
6-4	1.800	1.342	.900	159	79
7-1	1.100	1.049	.550	160	80
7-2	1.400	1.183	.700	160	80
7-3	1.800	1.342	.90	160	81
7-4	1.400	1.183	.70	161	81
8-1	.960	0.980	.48	160	81
8-2	1.400	1.183	.70	161	81
8-3	1.600	1.265	.80	160	82
8-4	1.300	1.140	.65	159	82
AVERAGES	2.057	1.417	1.02	159	76

EMISSION RESULTS
RUN 1

NOZZLE AREA (FT2) :0.0001521				
AVG. VELOCITY HEAD :--------	2.01 "H2O		VOL. FLOW ACFM :	122131
AVG. STACK TEMP.: ---------	159 F		VOL. FLOW SCFMD :	73750
AVG. METER TEMP.: ---------	76 F			
AVG. ORIFICE DIFFERENTIAL:---	1.02 "H2O		PARTICULATE DATA :	
METER STANDARD CUBIC FEET:---	31.691		----------	
% H2O VAPOR: :--------	29.7		POUNDS PER HOUR:	45.435
GAS MOL. WT. DRY: ---------	30.25		POUNDS PER SCF :	0.0000103
GAS MOL. WT. WET: ---------	26.62		GRAINS/SCF:	0.072
% EXCESS AIR: ---------	65.15		GRAINS/SCF @ 8% O2	0.074
AVG. STACK VEL.(FPS)---------	89.36		GRAINS/SCF @50% EA	0.079
MMBTU INPUT: ---------	292.11		POUNDS PER MMBTU:	0.156
PERCENT ISOKINETIC :---------	100.55			

AIR CONSULTING & ENGINEERING, INC.
Complete Emission Data

PLANT:	U. S. SUGAR CORPORATION	DATE:	1-24-91
LOCATION:	BRYANT, FLORIDA	RUN NUMBER	2
SOURCE:	NUMBER 3 BOILER, SCRUBBER OUTLET	TIME:	0946-1100

TIME INTERVAL	74	MINUTES
OIL:		
FINAL OIL	0	
BEGIN OIL	0	
FACTOR	1	
STEAM:		
FINAL STEAM	687520	
BEGIN STEAM	687336	
FACTOR	1000	
TEMPERATURE	576	DEGREES F
PRESSURE	398	PSIG
	413	PSIA
FEEDWATER:		
TEMPERATURE	260	DEGREES F
PRESSURE	643	PSIG
	658	PSIA
HEAT INPUT:		
STEAM	1291.6	BTU/LB
FEEDWATER	228.6	BTU/LB
NET STEAM	1063.0	BTU/LB
STEAM RATE	149189	LB/HR
BOILER EFFICIENCY	55.0	%
TOTAL FUEL HEAT INPUT	288.34	MMBTUH
STEAM CALIBRATION FACTOR	1.00	
OIL	0.00	GPH
OIL	150000	BTU/GAL
TOTAL HEAT INPUT (OIL)	0.00	MMBTUH
TOTAL HEAT INPUT (NON-OIL)	288.34	MMBTUH
ALLOWABLES:		
ALLOWABLE EMISSION (OIL)	.10	LB/MMBTU
ALLOWABLE EMISSION (NON-OIL)	.30	LB/MMBTU
TOTAL ALLOWABLE EMISSION	86.50	LB/HR
TOTAL ACTUAL EMISSION	43.54	LB/HR
TOTAL ALLOWABLE EMISSION	0.300	LB/MMBTU
TOTAL ACTUAL EMISSION	0.151	LB/MMBTU

AIR CONSULTING and ENGINEERING
COMPLETE EMISSION DATA

PLANT: U. S. SUGAR CORPORATION-BRYANT
SOURCE: NUMBER 3 BOILER
DATE: 1-24-91

RUN NO.:	2	IMPINGER ml	275
BEGIN TIME:	0949	SILICA GEL gms.	5.8
END TIME:	1057	PERCENT O2	8.2
TOTAL RUN TIME:	64.00 min.	PERCENT CO2	12.0
BAROMETRIC PRESSURE:	30.10 "Hg		
STACK PRESSURE:	30.13 "Hg.		
NOZZLE DIAMETER:	.167 inches	PARTICULATE	
METER CORR. FACTOR:	.994		
FINAL METER:	58.752 cubic ft.	FILTER mg.	130.9
INITIAL METER:	26.266 cubic ft.	WASH mg.	10.2
STACK AREA:	22.780 sq. ft.		

PORT-POINT	VELOCITY HEAD	SQUARE RT. VEL. HEAD	ORIF. DIFF.	STACK TEMP.	METER TEMP.
1-1	2.800	1.673	1.400	158	79
1-2	3.200	1.789	1.600	159	79
1-3	3.400	1.844	1.700	159	79
1-4	2.200	1.483	1.100	158	79
2-1	2.800	1.673	1.400	158	79
2-2	2.700	1.643	1.350	160	80
2-3	3.400	1.844	1.700	157	80
2-4	2.500	1.581	1.250	160	80
3-1	1.800	1.342	.900	159	81
3-2	2.200	1.483	1.100	160	81
3-3	2.800	1.673	1.400	159	81
3-4	2.200	1.483	1.100	159	82
4-1	1.800	1.342	1.900	159	82
4-2	2.400	1.549	1.200	160	82
4-3	2.000	1.414	1.000	159	83
4-4	2.000	1.414	1.000	159	83
5-1	1.400	1.183	.700	159	83
5-2	2.200	1.483	1.100	158	83
5-3	2.300	1.517	1.150	158	84
5-4	1.800	1.342	.900	160	84
6-1	1.500	1.225	.750	160	85
6-2	1.900	1.378	.900	160	85
6-3	2.000	1.414	1.000	160	85
6-4	1.800	1.342	.900	161	85
7-1	1.100	1.049	.550	160	86
7-2	1.400	1.183	.700	160	86
7-3	1.800	1.342	.90	160	86
7-4	1.400	1.183	.70	161	86
8-1	1.000	1.000	.50	160	87
8-2	1.300	1.140	.65	160	87
8-3	1.600	1.265	.80	160	87
8-4	1.300	1.140	.65	161	87
AVERAGES	2.062	1.419	1.06	159	83

EMISSION RESULTS
RUN 2

NOZZLE AREA (FT2) :0.0001521				
AVG. VELOCITY HEAD :--------	2.01	"H2O	VOL. FLOW ACFM :	122423
AVG. STACK TEMP.: ---------	159	F	VOL. FLOW SCFMD :	73880
AVG. METER TEMP.: ---------	83	F		
AVG. ORIFICE DIFFERENTIAL:---	1.06	"H2O	PARTICULATE DATA :	
METER STANDARD CUBIC FEET:---	31.670		----------	
% H2O VAPOR: :--------	29.6		POUNDS PER HOUR:	43.540
GAS MOL. WT. DRY: ---------	30.25		POUNDS PER SCF :	0.0000098
GAS MOL. WT. WET: ---------	26.62		GRAINS/SCF:	0.069
% EXCESS AIR: ---------	63.73		GRAINS/SCF @ 8% O2	0.070
AVG. STACK VEL.(FPS)---------	89.57		GRAINS/SCF @50% EA	0.075
MMBTU INPUT: ---------	288.34		POUNDS PER MMBTU:	0.151
PERCENT ISOKINETIC :---------	100.31			

AIR CONSULTING & ENGINEERING,INC.
Complete Emission Data

PLANT:	U. S. SUGAR CORPORATION	DATE:	1-24-91
LOCATION:	BRYANT, FLORIDA	RUN NUMBER	3
SOURCE:	NUMBER 3 BOILER, SCRUBBER OUTLET	TIME:	1127-1244

TIME INTERVAL	74	MINUTES
OIL:		
FINAL OIL	0	
BEGIN OIL	0	
FACTOR	1	
STEAM:		
FINAL STEAM	687775	
BEGIN STEAM	687586	
FACTOR	1000	
TEMPERATURE	579	DEGREES F
PRESSURE	400	PSIG
	415	PSIA
FEEDWATER:		
TEMPERATURE	260	DEGREES F
PRESSURE	650	PSIG
	665	PSIA
HEAT INPUT:		
STEAM	1293.3	BTU/LB
FEEDWATER	228.6	BTU/LB
NET STEAM	1064.7	BTU/LB
STEAM RATE	153243	LB/HR
BOILER EFFICIENCY	55.0	%
TOTAL FUEL HEAT INPUT	296.65	MMBTUH
STEAM CALIBRATION FACTOR	1.00	
OIL	0.00	GPH
OIL	150000	BTU/GAL
TOTAL HEAT INPUT (OIL)	0.00	MMBTUH
TOTAL HEAT INPUT (NON-OIL)	296.65	MMBTUH
ALLOWABLES:		
ALLOWABLE EMISSION (OIL)	.10	LB/MMBTU
ALLOWABLE EMISSION (NON-OIL)	.30	LB/MMBTU
TOTAL ALLOWABLE EMISSION	89.00	LB/HR
TOTAL ACTUAL EMISSION	23.33	LB/HR
TOTAL ALLOWABLE EMISSION	0.300	LB/MMBTU
TOTAL ACTUAL EMISSION	0.079	LB/MMBTU

AIR CONSULTING and ENGINEERING
COMPLETE EMISSION DATA

PLANT: U. S. SUGAR CORPORATION-BRYANT
SOURCE: NUMBER 3 BOILER
DATE: 1-24-91

RUN NO.:	3	IMPINGER ml	275
BEGIN TIME:	1130	SILICA GEL gms.	6.0
END TIME:	1240	PERCENT O2	8.7
TOTAL RUN TIME:	64.00 min.	PERCENT CO2	11.3
BAROMETRIC PRESSURE:	30.13 "Hg		
STACK PRESSURE:	30.10 "Hg.		
NOZZLE DIAMETER:	.167 inches	PARTICULATE	
METER CORR. FACTOR:	.994	---	
FINAL METER:	91.410 cubic ft.	FILTER mg.	66.9
INITIAL METER:	58.960 cubic ft.	WASH mg.	8.7
STACK AREA:	22.780 sq. ft.		

PORT-POINT	VELOCITY HEAD	SQUARE RT. VEL. HEAD	ORIF. DIFF.	STACK TEMP.	METER TEMP.
1-1	2.400	1.549	1.200	158	83
1-2	3.200	1.789	1.600	158	83
1-3	3.200	1.789	1.600	158	83
1-4	2.000	1.414	1.000	158	83
2-1	2.700	1.643	1.350	160	83
2-2	3.000	1.732	1.500	161	83
2-3	3.300	1.817	1.650	160	83
2-4	2.600	1.612	1.300	160	84
3-1	1.900	1.378	.950	158	84
3-2	2.400	1.549	1.200	159	85
3-3	2.800	1.673	1.400	160	85
3-4	2.100	1.449	1.050	160	85
4-1	1.700	1.304	.850	158	85
4-2	2.200	1.483	1.100	158	86
4-3	2.400	1.549	1.200	157	86
4-4	2.000	1.414	1.000	156	86
5-1	1.700	1.304	.850	157	86
5-2	2.250	1.500	1.100	157	86
5-3	2.400	1.549	1.200	155	86
5-4	1.800	1.342	.900	157	87
6-1	1.100	1.049	.550	156	87
6-2	1.800	1.342	.900	157	87
6-3	2.000	1.414	1.000	159	87
6-4	1.800	1.342	.900	161	87
7-1	1.000	1.000	.500	158	87
7-2	1.400	1.183	.700	157	88
7-3	1.600	1.265	.80	158	88
7-4	1.400	1.183	.70	159	88
8-1	.960	0.980	.48	158	88
8-2	1.300	1.140	.65	158	88
8-3	1.500	1.225	.75	158	88
8-4	1.300	1.140	.65	160	88
AVERAGES	2.038	1.409	1.02	158	86

EMISSION RESULTS
RUN 3

NOZZLE AREA (FT2) :0.0001521				
AVG. VELOCITY HEAD :--------	1.99 "H2O		VOL. FLOW ACFM :	121702
AVG. STACK TEMP.: ---------	158 F		VOL. FLOW SCFMD :	73526
AVG. METER TEMP.: ---------	86 F			
AVG. ORIFICE DIFFERENTIAL:---	1.02 "H2O		PARTICULATE DATA :	
METER STANDARD CUBIC FEET:---	31.505		----------	
% H2O VAPOR: :--------	29.8		POUNDS PER HOUR:	23.338
GAS MOL. WT. DRY: ---------	30.16		POUNDS PER SCF :	0.0000053
GAS MOL. WT. WET: ---------	26.54		GRAINS/SCF:	0.037
% EXCESS AIR: ---------	70.81		GRAINS/SCF @ 8% O2	0.039
AVG. STACK VEL.(FPS)---------	89.04		GRAINS/SCF @50% EA	0.042
MMBTU INPUT: ---------	296.65		POUNDS PER MMBTU:	0.079
PERCENT ISOKINETIC :---------	100.27			

Avg O_2 = 9.3

Temp = 159

Flow = 73,719

mmBtu/hr = 292

SAMPLE CALCULATIONS - RUN 1

NOZZLE AREA (FT.2)	(Dn/12)!2x3.1416/4	0.000152
AVG.VELOCITY HEAD:	(AVG.SQ.RT.)!2	89.40
METER STND. FT3:	(Mf-Mi)xMCFx(AVG.ORF.DIFF./13.6))/29.92)x(528/(Tm+460))	31.674
PERCENT H2O:	((IMP+SG)x(((IMP+SG)x.0474)+SCF)x100	
Mw DRY:	((O2%x.32)+CO2%x.44)+(100-(O2%+CO2)x.28	30.25
Mw WET:	(Mw DRYx(1-%H2O/100))+%H2Ox.18	26.62
% EXCESS AIR:	%O2/(((100-(%O2+%CO2))x.264)-%O2)*100	65.15
STACK VEL.(FPS):	85.49x.84x(AVG.SQ.RT.VEL.HD.)x((Ts+460)/(PsxMwWET))!.5	89.40
% ISOKINETIC:	((Ts+460)xSCFx2992)/(528xFPSxTIMExAn xPs x 60x(1-%O2/100)	100.41
VOL. FLOW (ACFM):	FPS x 60 x As	122192
STND. FLOW(SCFMD):	ACFMx528/(Ts+460)x(1-%H2O/100)x(Ps/29.92)	73811
PARTICULATE LB/HR:	PROBE+FILTER mg./453600 x (SCFMD/SCF) x 60	45.497
PARTICULATE LB/SCF):	PROBE+FILTER mg./453600 /SCF	0.0000103
GRAINS/SCF:	LB/SCF x 7000	0.0719
GR/SCF @ 8% O2:	(12.9/(20.9-%O2))x GR/SCF	0.0736
GR/SCF @ 50% E.A.:	GR/SCF x ((100+ %E.A.)/150)	0.0792
LB/MMBTU:	(LB/HR)/(LB/MMBTUH)	0.156
LB/MMBTU "F" FACTOR:	LB/SCF x "F" FACTOR x (20.9/20.9-%O2)	0.000

APPENDIX B

FIELD DATA SHEETS

STACK SAMPLING FIELD DATA SHEET

ACE AIR CONSULTING & ENGINEERING, INC.
2106 N. W. 67th PLACE · Suites 9 & 10
GAINESVILLE, FLORIDA · 32606

TEST ID 1
PAGE 1 OF 2

PLANT U.S. SUGAR CORPORATION
SOURCE NO. 3 BOILER
PLANT LOCATION BRYANT, FLORIDA
TYPE OF SAMPLING TRAIN EPA-5
TYPE OF SAMPLES PARTICULATE
DATE 1-24-91 RUN NO. 1
TIME START 0804 TIME END 0912
SAMPLE TIME 32.2 (min/pt) = 64 Total min
ASSUMED MOISTURE 3.0 % FDA .70
NOMOGRAPH C_f .15 PITOT CORR. .84
P_b 30.1 "Hg P_s 30.13 "Hg
WEATHER CLEAR TEMP. °F
METER BOX NO. 1 H 2.05 Y .994
NOZZLE CAL. = .167
STACK DIMENSIONS ~~80×82~~ 82×40
STACK AREA 22.78 ft² EFFECTIVE ft²
STACK HEIGHT ft.
STACK DIAMETER: UPSTRM. DNSTRM.
PORT SIZE in. NIPPLE LENGTH in.
U CORD LENGTH 1.25'
REMARKS:

0914 687258
0802 681076

292.11
45.435

$\sqrt{\Delta P}$ = 1.417 (2.01)

.5415 47.56 lb/hr
.4094
0.1321

132.1
20
152 . 31.67 SCF
.70 = FDA
5350 FPM
121850 ACFM
73462 SCFM

USCSEL P.
USCSEL T.B.

MAT'L PROCESSING RATE
GAS METER READINGS: FINAL 1026.075 ft.³
INITIAL 994.000 ft.³
NET ft.³
FILTER NO. 3081 IMP. VOL. GAIN 275 ml.
SIL GEL NO. 54 WT. GAIN 6.5 ml.
TOTAL CONDENSATE 281.5 ml.

ORSAT

	1	2	3	4	AVG.
% CO_2				12.0	~~8.3~~
% O_2				8.3	~~8.3~~
% CO					
% N_2					

F_O = F_O RANGE =
ORSAT ANALYZER

LEAK CHECKS
PRE 0.00 cfm 19 "Hg POST 0.00 cfm 12 "Hg
METER BOX/PUMP GAS SAMPLE SYST.
ORSAT BAG
PITOT TUBE NO. 57 PRE-TEST O.K.
POST-TEST(+) 5.7 / 15 H_2O/Sec
POST-TEST(−) 3.01 15 H_2O/Sec
PYROMETER NO. 1
BOX OPERATOR NE PROBE HOLDER Germs

PORT AND TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE STACK WALL /COMMENTS	CLOCK TIME	GAS METER READING (FT.³)	STACK VELOCITY HEAD	METER ORIFICE PRESS. DIFF. ("H_2O) CALC.	ACTUAL	STACK GAS TEMP. (°F)	SAMPLE BOX TEMP. (°F)	LAST IMPINGER TEMP. F	DRY GAS METER TEMP. (°F)	VACUUM ON SAMPLE TRAIN ("Hg)
1-1		0806	995.05	2.4	1.2	1.2	157	265	40	69	5
2		0808	996.30	3.2	1.6	1.6	157	263	40	69	6
3		0810	997.60	3.4	1.7	1.7	157	262	38	69	7
4		0812	998.84	3.2	1.6	1.6	157	263	38	69	7
2-1		0815	999.85	2.0	1.0	1.0	157	263	39	70	5

AIR CONSULTING & ENGINEERING, INC.

TEST ID 1

PAGE 2 OF 2

PORT AND TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE STACK WALL /COMMENTS	CLOCK TIME	GAS METER READING (ft.^{3})	STACK VELOCITY HEAD	METER ORIFICE PRESS. DIFF. ("H_2O)		STACK GAS TEMP. (°F)	SAMPLE BOX TEMP. (°F)	LAST IMPINGER TEMP. (°F)	DRY GAS METER TEMP. (°F)	VACUUM ON SAMPLE TRAIN ("Hg)
					CALC.	ACTUAL					
2-2		0817	1001.00	2.6	1.3	1.3	158	263	40	70	7
3		0819	1002.2	3.2	1.45	1.45	158	265	41	71	7
4		0821	1003.43	2.8	1.4	1.4	159	266	42	71	7
3-1		0823	4.33	1.7	.85	.85	159	269	42	72	6
2		0825	5.35	2.2	1.1	1.1	159	268	42	72	7
3		0827	6.50	2.7	1.35	1.35	159	272	42	73	8
4		0829	7.58	2.25	1.1	1.1	158	272	43	74	7.5
4-1		0832	8.43	1.6	.8	.8	158	272	42	75	6.0
2		0834	9.42	2.2	1.1	1.1	158	274	43	75	7.5
3		0836	10.53	2.4	1.2	1.2	157	273	43	75	8
4		0838	11.60	2.2	1.1	1.1	158	273	43	76	8
5-1		0840	12.46	1.6	.8	.8	157	269	43	77	7
2		0842	13.48	2.2	1.1	1.1	158	270	43	77	8
3		0844	14.50	2.2	1.1	1.1	157	268	44	77	8
4		0846	15.53	2.0	1.0	1.0	159	266	44	78	8.5
6-1		0849	16.30	1.2	.6	.6	159	265	44	79	7
2		0851	17.28	1.8	.9	.9	161	261	44	79	8
3		0853	18.30	2.0	1.0	1.0	161	261	44	79	9
4		0855	19.20	1.8	.9	.9	159	262	44	79	8.5
7-1		0857	20.05	1.1	.55	.55	160	265	44	80	6.5
2		0859	20.90	1.4	.7	.7	160	264	44	80	7.5
3		0901	21.78	1.8	.9	.9	160	265	45	81	9
4		0903	22.80	1.4	.7	.7	161	267	45	81	8
8-1		0906	23.43	.96	.48	.48	160	267	45	81	7
2		0908	24.28	1.4	.70	.7	161	266	45	81	8
3		0910	25.20	1.6	.8	.8	160	263	46	82	9
4		0912	26.075	1.3	.65	.65	159	262	46	82	9

STACK SAMPLING FIELD DATA SHEET

ACE AIR CONSULTING & ENGINEERING, INC.
2106 N. W. 67th PLACE · Suites 9 & 10
GAINESVILLE, FLORIDA · 32606

TEST ID 2
PAGE 1 OF 2

PLANT U.S. SUGAR - BRYANT
SOURCE NUMBER 3 BOILER
PLANT LOCATION BRYANT, FLORIDA
TYPE OF SAMPLING TRAIN P.M.
TYPE OF SAMPLES EPA-5
DATE 1-24-91 RUN NO. 2
TIME START 0949 TIME END 1057
SAMPLE TIME 32, 2 (min/pt) = 64 Total min
ASSUMED MOISTURE 30 % FDA .70
NOMOGRAPH C_f .50 PITOT CORR. .84
P_b 30.10 "Hg P_g 30.13 "Hg
WEATHER CLEAR TEMP. °F
METER BOX NO. 1 H 2.05 Y .994
NOZZLE CAL. = .167
STACK DIMENSIONS 82 x 40
STACK AREA 22.78 ft.² EFFECTIVE ft.²
STACK HEIGHT ft.
STACK DIAMETER: UPSTRM. DNSTRM.
PORT SIZE in. NIPPLE LENGTH in.
U CORD LENGTH 125
REMARKS:

1.418 = $\sqrt{\Delta P}$
2.01

1100 687520

.5430
.4108
0.1322

288.34
43.540
.199

MAT'L PROCESSING RATE
GAS METER READINGS: FINAL 58.752 ft.³
INITIAL 26.266 ft.³
NET ft.³
FILTER NO. 3083 IMP. VOL. GAIN 275 ml.
SIL GEL NO. 8 WT. GAIN 58 ml.
TOTAL CONDENSATE 330.8 ml.

ORSAT

	1	2	3	4	AVG.
% CO_2					12.0
% O_2					8.2
% CO					
% N_2					

F_O = F_O RANGE =
ORSAT ANALYZER

LEAK CHECKS
PRE 0.00 cfm 11 "Hg POST 0.00 cfm 12 "Hg
METER BOX/PUMP GAS SAMPLE SYST.
ORSAT BAG
PITOT TUBE NO. 57 PRE-TEST 0.15
POST-TEST (+) 5.5 / 15 H_2O/Sec
POST-TEST (−) 4.5 / 15 H_2O/Sec
PYROMETER NO. 1
BOX OPERATOR NECK PROBE HOLDER GONZALO

PORT AND TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE STACK WALL /COMMENTS	CLOCK TIME	GAS METER READING (FT.³)	STACK VELOCITY HEAD	METER ORIFICE PRESS. DIFF. ("H_2O) CALC.	ACTUAL	STACK GAS TEMP. (°F)	SAMPLE BOX TEMP. (°F)	LAST IMPINGER TEMP. F	DRY GAS METER TEMP. (°F)	VACUUM ON SAMPLE TRAIN ("Hg)
1-1		0957	27.54	2.8	1.4	1.4	158	254	44	78	6
2		0953	28.80	3.2	1.6	1.6	159	253	42	79	6
3		0955	30.10	3.4	1.7	1.7	159	254	38	79	7
4		0957	31.23	2.2	1.1	1.1	158	255	38	79	5.5
2-1		1000	32.3	2.8	1.4	1.4	158	254	40	79	6.5

AIR CONSULTING & ENGINEERING, INC.

TEST ID 2

PAGE 2 OF 2

PORT AND TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE STACK WALL /COMMENTS	CLOCK TIME	GAS METER READING (ft.³)	STACK VELOCITY HEAD	METER ORIFICE PRESS. DIFF. ("H₂O) CALC.	METER ORIFICE PRESS. DIFF. ("H₂O) ACTUAL	STACK GAS TEMP. (°F)	SAMPLE BOX TEMP. (°F)	LAST IMPINGER TEMP. (°F)	DRY GAS METER TEMP. (°F)	VACUUM ON SAMPLE TRAIN ("Hg)
2-2		1002	33.5	2.7	1.35	1.35	160	252	40	80	7
3		1004	34.75	3.4	1.7	1.7	157	250	40	80	8
4		1006	35.9	2.5	1.25	1.25	160	254	40	80	7
3-1		1008	36.85	1.8	0.9	0.9	159	254	41	81	6
2		1010	37.95	2.2	1.1	1.1	160	254	41	81	7
3		1012	39.10	2.8	1.4	1.4	159	253	40	81	8
4		1014	40.21	2.2	1.1	1.1	159	251	41	82	7.5
4-1		1017	41.17	1.8	.9	.9	159	253	42	82	6.5
2		1019	42.26	2.4	1.2	1.2	160	256	42	82	8
3		1021	43.30	2.0	1.0	1.0	159	259	41	83	7
4		1023	44.31	2.0	1.0	1.0	159	258	41	83	7
5-1		1026	45.20	1.4	.70	.70	159	261	41	83	7
2		1028	46.15	2.2	1.1	1.1	158	262	41	83	7.5
3		1030	47.20	2.3	1.15	1.15	158	264	42	84	8
4		1032	48.19	1.8	.9	.9	160	265	42	84	8
6-1		1034	49.00	1.5	.75	.75	160	265	42	85	7.5
2		1036	50.00	1.80	.9	.9	160	264	42	85	8
3		1038	51.00	2.0	1.0	1.0	160	263	42	85	8
4		1040	52.00	1.8	.9	.9	161	262	42	85	9
7-1		1043	52.74	1.1	.55	.55	160	261	42	86	6.5
2		1045	53.59	1.4	.70	.70	160	262	42	86	7.5
3		1047	54.56	1.8	.90	.90	160	263	42	86	8.5
4		1049	55.45	1.4	.70	.70	161	262	42	86	8.0
8-1		1051	56.13	1.0	.50	.50	160	263	42	87	7.0
2		1053	56.95	1.3	.65	.65	160	265	42	87	8.0
3		1055	57.85	1.6	.80	.80	160	263	42	87	9.0
4		1057	58.752	1.3	.65	.65	161	260	42	87	9

STACK SAMPLING FIELD DATA SHEET

ACE AIR CONSULTING & ENGINEERING, INC.
2106 N. W. 67th PLACE · Suites 9 & 10
GAINESVILLE, FLORIDA · 32606

TEST ID 3
PAGE 1 OF 2

PLANT U.S. SUGAR CORPORATION
SOURCE NO. 3 BOILER
PLANT LOCATION BRYANT, FLORIDA
TYPE OF SAMPLING TRAIN EPA-5
TYPE OF SAMPLES PM
DATE 1-24-91 RUN NO. 3
TIME START 1130 TIME END 1240
SAMPLE TIME 3.20 / 2 (min/pt) = 64 Total min
ASSUMED MOISTURE 30 % FDA .7
NOMOGRAPH C_f .5 PITOT CORR. .84
P_b 30.13 "Hg P_s 30.10 "Hg
WEATHER CLEAR TEMP. °F
METER BOX NO. 1 H 2.05 Y 0.994
NOZZLE CAL. = .167
STACK DIMENSIONS 82 x 40
STACK AREA 22.78 ft² EFFECTIVE ft²
STACK HEIGHT ft.
STACK DIAMETER: UPSTRM. DNSTRM.
PORT SIZE in. NIPPLE LENGTH in.
I CORD LENGTH 125'
REMARKS:
KEN TUCKER PRESENT

687586 1127
687775 1244

.4750
.4089
.0761

76.1
20.0

296.65 1.409 = √ΔP
23.336 .079 1.987
USSC3R3
USSCB3R3

MAT'L PROCESSING RATE
GAS METER READINGS: FINAL 91.410 ft³
INITIAL 58.960 ft³
NET ft³
FILTER NO. 4024 IMP. VOL. GAIN 275 ml.
SIL GEL NO. 2 WT. GAIN 6.0 ml.
TOTAL CONDENSATE 281.0 ml.

ORSAT

	1	2	3	4	AVG.
% CO_2					11.3
% O_2					8.75
% CO					
% N_2					

F_O = F_O RANGE =
ORSAT ANALYZER

LEAK CHECKS
PRE cfm OK "Hg POST 0.00 cfm 9 "Hg
METER BOX/PUMP GAS SAMPLE SYST.
ORSAT BAG
PITOT TUBE NO. 59 PRE-TEST
POST-TEST(+) 3.8 / 15 H_2O/Sec
POST-TEST(−) 3.6 / 15 H_2O/Sec
PYROMETER NO.
BOX OPERATOR PROBE HOLDER

PORT AND TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE STACK WALL /COMMENTS	CLOCK TIME	GAS METER READING (FT³)	STACK VELOCITY HEAD	METER ORIFICE PRESS. DIFF. ("H_2O) CALC.	ACTUAL	STACK GAS TEMP. (°F)	SAMPLE BOX TEMP. (°F)	LAST IMPINGER TEMP. F	DRY GAS METER TEMP. (°F)	VACUUM ON SAMPLE TRAIN ("Hg)
1-1		1132	60.10	2.4	1.2	1.2	158	261	60	83	5
2		1134	61.34	3.2	1.6	1.6	158	253	52	83	5.5
3		1136	62.60	3.2	1.6	1.6	158	253	48	83	6.0
4		1140	63.68	2.0	1.0	1.0	158	253	49	83	4.5
2-1		1140	64.80	2.7	1.35	1.35	160	254	50	83	6.0

AIR CONSULTING & ENGINEERING, INC.

TEST ID 3

PORT AND TRAVERSE POINT NUMBER	DISTANCE FROM INSIDE STACK WALL /COMMENTS	CLOCK TIME	GAS METER READING (ft.³)	STACK VELOCITY HEAD	METER ORIFICE PRESS. DIFF. ("H₂O) CALC.	METER ORIFICE PRESS. DIFF. ("H₂O) ACTUAL	STACK GAS TEMP. (°F)	SAMPLE BOX TEMP. (°F)	LAST IMPINGER TEMP. (°F)	DRY GAS METER TEMP. (°F)	VACUUM ON SAMPLE TRAIN ("Hg)
2-2		1142	66.05	3.0	1.5	1.5	161	253	50	83	6.5
3		1144	67.30	3.3	1.65	1.65	160	250	51	83	7.0
4		1146	68.50	2.6	1.3	1.3	160	252	51	84	7.0
3-1		1149	69.50	1.9	.95	.95	158	256	54	84	5.5
2		1151	70.50	2.4	1.2	1.2	159	256	53	85	6.5
3		1153	71.75	2.8	1.4	1.4	160	254	53	85	7.0
4		1155	72.18	2.1	1.05	1.05	160	254	52	85	6
4-1		1200	73.6	1.7	.85	.85	158	256	57	85	5
2		1202	74.[illegible]	2.2	1.1	1.1	158	256	57	86	6.5
3		1204	75.72	2.4	1.2	1.2	157	251	52	86	7.0
4		1206	76.80	2.0	1.0	1.0	156	251	52	86	6.5
5-1		1209	77.70	1.7	.85	.85	157	248	53	86	6
2		1211	78.75	2.25	1.1	1.1	157	250	54	86	7
3		1213	79.86	2.4	1.2	1.2	155	249	53	86	7
4		1215	80.9	1.8	.9	.9	157	251	50	87	7
6-1		1217	81.66	1.1	.55	.55	156	249	54	87	5
2		1219	82.70	1.8	.9	.9	157	250	54	87	7
3		1221	83.70	2.0	1.0	1.0	159	252	53	87	7
4		1223	84.70	1.8	.9	.9	161	250	52	87	7
7-1		1225	85.44	1.0	.5	.5	158	249	54	87	5
2		1227	86.30	1.4	.7	.7	157	248	54	88	6
3		1229	87.20	1.6	.8	.8	158	246	54	88	6.5
4		1231	88.13	1.4	.7	.7	159	251	54	88	6.5
8-1		1234	88.83	.96	.48	.48	158	255	55	88	5.5
2		1236	89.68	1.3	.65	.65	158	257	55	88	6.5
3		1238	90.55	1.5	.75	.75	158	259	54	88	7
4		1240	91.410	1.3	.65	.65	160	259	54	88	7

APPENDIX C

LABORATORY ANALYSES

AIR CONSULTING & ENGINEERING, inc. PARTICULATE LAB DATA

SOURCE U.S. SUGAR, BRYANT No. 3

PROBE RINSE	RUN 1	RUN 2	RUN 3	BLANK	
CONTAINER NUMBER	S-10	S-17	S-33	S-36	
TOTAL VOLUME (ml)	185	180	170	150	LIQUID LEVEL ✓
1st GROSS WEIGHT (g)	103.4151	102.6588	100.7718	105.4488	DATE & TIME: 1-30-91/1800
2nd GROSS WEIGHT (g)	103.4156	102.6583	100.7722	105.4486	DATE & TIME: 2/1/91-0420
AVERAGE GROSS WEIGHT (g)	103.4154	102.6586	100.7720	105.4487	
TARE WEIGHT (g)	103.3981	102.6484	100.7635	105.4483	
SUB NET WEIGHT (g)	0.0173	0.0102	0.0087	0.0004	
ACETONE BLANK (g)	–	–	–	–	
TOTAL NET WEIGHT (mg)	17.3	10.2	8.7	0.4	

NOTE: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

FILTER	RUN 1	RUN 2	RUN 3	BLANK	
FILTER NUMBER	3081	3083	4024	3082	
1st GROSS WEIGHT (g)	0.5399	0.5419	0.4757	0.4014	DATE & TIME: 1-30-91/1800
2nd GROSS WEIGHT (g)	0.5395	0.5414	0.4759	0.4014	DATE & TIME: [illegible] 91-0920
AVERAGE GROSS WEIGHT (g)	0.5397	0.5417	0.4758	0.4014	
TARE WEIGHT (g)	0.4094	0.4108	0.4089	0.4018	
SUB NET WEIGHT (g)	0.1303	0.1309	0.0669	[illegible]	
TOTAL NET WEIGHT (mg)	130.3	130.9	66.9	0.4	

TARE BALANCE CHECK

SEE LAB BOOK

1st GROSS WEIGHT BALANCE CHECK

0 0.0000 10.0g —
0.5 g 0.5001 100.0g 100.0005
%RH 38 DATE 1-30-91
Signature S. J. Neck

2nd GROSS WEIGHT BALANCE CHECK

0 ✓ 10.0g ✓
0.5g ✓ 100.0g ✓
%RH 44 DATE 2/1/91
Signature C Hy

APPENDIX D

QUALITY ASSURANCE

AND

CHAIN OF CUSTODY

AIR CONSULTING AND ENGINEERING, Inc.

SAMPLE RECOVERY AND CHAIN OF CUSTODY

PLANT NAME U.S. SUGAR CORP. BRYANT, FL. TEST DATE 1/24/91

SOURCE NAME NO. 3 BOILER SAMPLE RECOVERED BY SLN

TYPE OF SAMPLE PART. PARTICULATE ANALYSES BY SLN/LCH

SAMPLE RECOVERY

RUN NO.	CONTAINER NO.	LIQUID LEVEL MARKED	COLOR	COMMENTS
1	S-10	✓	MED	
1	3081	–	BLK	
2	S-17	✓	"	
2	3083	–	"	
3	S-33	✓	"	
3	4024	–	"	
ACETONE / WATER BLANK (CIRCLE)	S-36	✓	CLEAR	
FILTER BLANK	3082	–	WH.	

SILICA GEL

RUN NO.	CONTAINER NO.	FINAL WT. (g)	INIT. WT. (g)	NET WT. (g)	COLOR
1	54	206.5	200.0	6.5	PINK
2	8	205.8	200.0	5.8	"
3	2	206.0	200.0	6.0	"
			200.0		
			200.0		
			200.0		
			200.0		
			200.0		

AIR CONSULTING & ENGINEERING, inc. POST TEST CALIBRATION

DATE 2-11-91 METER BOX NUMBER 1 LEAK CHECK 0.000 CFM at 29 in. Hg.

CLIENT U.S. SUGAR / TALISMAN SOURCE VARIOUS THERMOCOUPLE NUMBER 36/1160/ PYROMETER NUMBER ~~64~~ 1

FLIGHT SERVICE Pb 30.11 in. Hg. ACE BAROMETER Pb 30.1 in. Hg.

ASTM GLASS THERMOMETER 160/160 °F / THERMOCOUPLE 160/160 °F ASTM GLASS THERMOMETER 64 °F / METER TEMP 64 °F

ΔHS	AVERAGE ΔHD	GAS VOLUME, STANDARD METER			GAS VOLUME, DRY GAS METER			TEMP STANDARD METER	TEMP OF DRY METER	TIME (Minutes)	MAX. VACUUM In. Hg.
		INITIAL	FINAL	ACTUAL ft^3	INITIAL	FINAL	ACTUAL ft^3				
-.5	2.1	513.835	508.00	5.835	193.300	199.452	6.152	~~64~~ 59 ~~66~~ 59	64 66	8	21
-.5	2.1	513.835	522.560	8.725	199.817	209.013	9.196	59 59	66 68	12	21
-.5	2.1	522.560	513.835	7.993	209.013	217.471	8.458	59 59	68 70	11	21

CALIBRATED BY: S Clayton & Neal

RUN NUMBER	SCFM	STANDARD M.C.F.	DELTA Ha	M.C.F.
1	0.75	1.005	2.135	0.959
2	0.74	1.005	2.140	0.963
3	0.74	1.005	2.135	0.963
AVERAGES	0.74	1.005	2.137	0.962

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STANDARD METER CALIBRATION

Air Consulting and Engineering, Inc. (ACE) uses a dry gas meter for the calibration standard. This meter has been calibrated against a wet test meter in triplicate. This data was used to generate a standard meter calibration curve (see next page). Field meter calibrations are corrected to this curve using the following formula:

$$Y_a \times Y_m = Y$$

Y_a = actual ratio of field meter to standard meter

Y_m = ratio of standard meter to wet test meter at a given flow rate (from Calibration Curve)

Y = corrected ratio of field meter

The dry standard meter was calibrated on April 26, 1990, and is checked and/or recalibrated at least annually.

AIR CONSULTING & ENGINEERING — STANDARD METER CALIBRATION

DATE 4-26-90

LEAK CHECK 0.0 CFM at 0.0 In. Hg.

METER BOX NUMBER STD #691751

BAROMETRIC PRESSURE 30.30 In. Hg.

STD GAS METER TEMPERATURE 70 °F/ ASTM GLASS THERMOMETER TEMPERATURE 70 °F

WET ΔH	STD ΔH	GAS VOLUME, WET TEST METER			GAS VOLUME, STD GAS METER			TEMP. WET TEST METER (°F)	TEMP. OF STD. METER (°F)	TIME (Minutes)
		INITIAL	FINAL	ACTUAL ft^3	INITIAL	FINAL	ACTUAL ft^3			
-0.2	-1.1	4.020	9.842	5.822	243.643	249.457	5.814	70	70	13
-0.2	-1.1	9.842	15.577	5.735	249.457	255.194	5.737	70.5	71	13
-0.2	-1.1	5.577	11.240	5.663	255.194	260.872	5.678	70.5	71	13
-0.4	-1.8	2.026	7.602	5.576	261.665	267.296	5.631	70.5	72	9
-0.4	-1.8	7.602	13.171	5.569	267.296	272.923	5.627	70.5	72	9
-0.4	-1.8	3.171	8.734	5.563	272.923	278.539	5.616	70.5	72	9
-0.5	-2.2	9.112	14.275	5.163	278.914	284.153	5.239	70.5	72	7
-0.5	-2.2	4.275	9.434	5.159	284.153	289.386	5.233	70.5	72	7
-0.5	-2.2	9.434	14.600	5.166	289.386	294.632	5.246	70.5	72	7
-0.6	-3.1	5.182	10.663	5.481	295.233	300.834	5.601	70.5	72	6
-0.6	-3.1	0.663	6.124	5.461	300.834	306.424	5.590	70.5	72	6
-0.6	-3.1	6.124	11.579	5.455	306.424	311.997	5.573	70.5	72	6
-0.7	-3.7	2.185	7.422	5.237	312.617	317.993	5.376	70.5	71	5
-0.7	-3.7	7.422	12.658	5.236	317.993	323.366	5.373	70.5	71	5
-0.7	-3.7	2.658	7.888	5.230	323.366	328.737	5.371	70.5	71	5

CALIBRATED BY: George F. Gabel

	Y	SCFM	Y	SCFM	Y	SCFM	Y	SCFM	Y	SCFM
Run 1	1.004	0.452	0.996	0.624	0.993	0.743	0.987	0.920	0.983	1.055
Run 2	1.002	0.444	0.995	0.623	0.993	0.742	0.986	0.917	0.983	1.055
Run 3	1.000	0.439	0.996	0.622	0.992	0.743	0.988	0.916	0.983	1.053
Average	1.002	0.445	0.996	0.623	0.993	0.743	0.987	0.918	0.983	1.054

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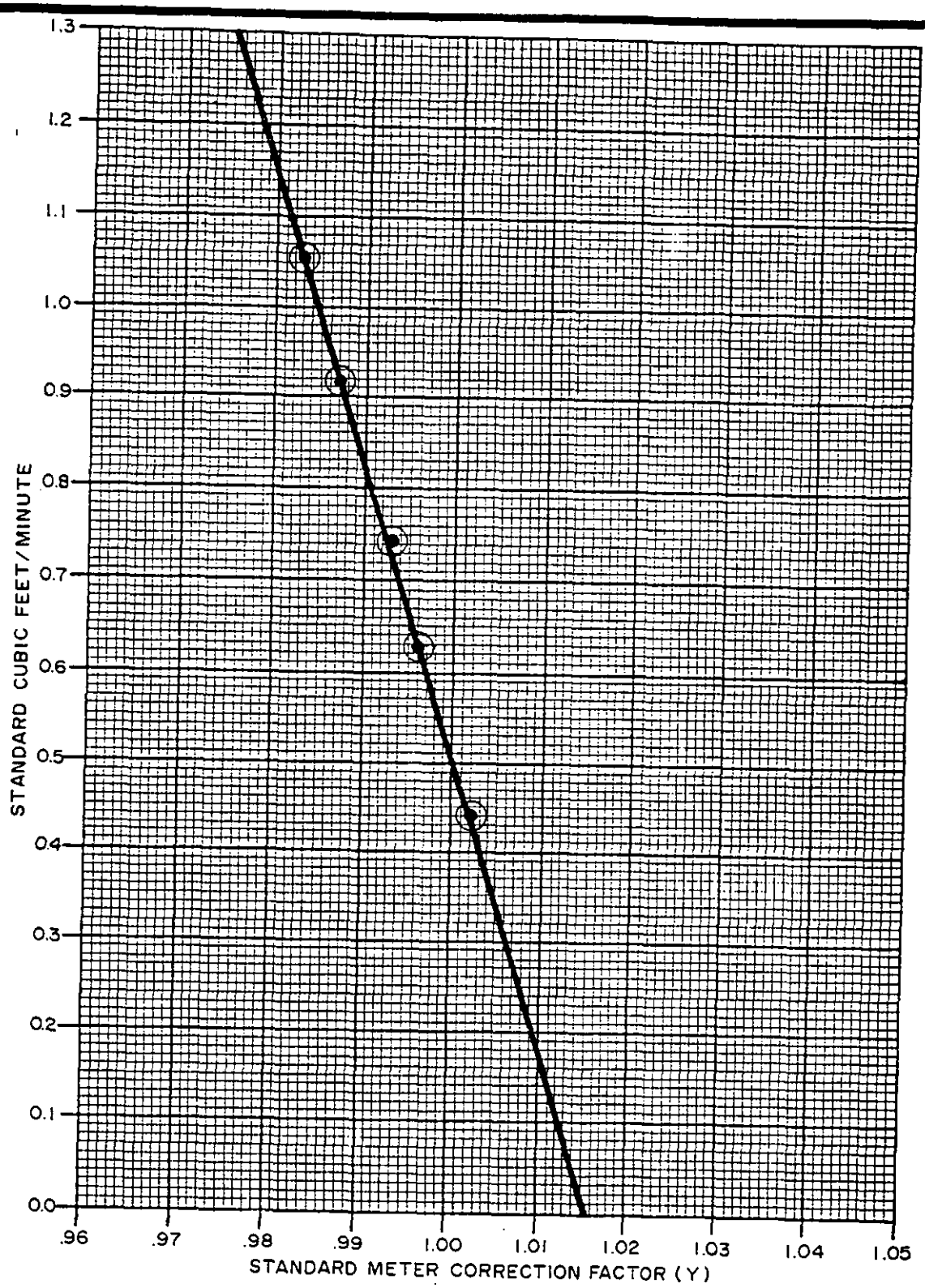


STANDARD METER CALIBRATION CURVE

APRIL 26, 1990

AIR CONSULTING and ENGINEERING

AIR CONSULTING & ENGINEERING — ANNUAL METER CALIBRATION

DATE 6-7-90

LEAK CHECK 0.000 CFM at 12 In. Hg.

METER BOX NUMBER 1

BAROMETRIC PRESSURE 30.02 In. Hg.

DRY GAS METER TEMPERATURE 89 °F/ASTM GLASS THERMOMETER TEMPERATURE 90 °F

ΔHS	AVERAGE ΔHD	GAS VOLUME, STANDARD METER			GAS VOLUME, DRY GAS METER			TEMP. STD. METER	TEMP. OF DRY METER	TIME (Minutes)	TIMER
		INITIAL	FINAL	ACTUAL ft^3	INITIAL	FINAL	ACTUAL ft^3				
-.07	0.5	206.539	214.496	7.957	719.311	727.244	7.933	85	85	21	21
-.15	1.25	215.308	221.239	5.931	728.042	733.952	5.910	85	86	10	
-.22	2.0	221.610	227.578	5.968	734.320	740.265	5.945	85	87	8	
-.32	2.75	228.029	233.291	5.262	740.708	745.940	5.232	86	88	6	
-.40	3.5	233.668	239.592	5.924	746.315	752.205	5.890	87	90	6	
-.50	4.25	240.117	245.527	5.410	752.724	758.112	5.388	87	91	5	

	DELTA H	Ya	SCFM	Ys	Y
	2.004	1.002	0.368	1.004	1.006
	2.041	1.002	0.577	0.998	1.000
	2.061	1.003	0.725	0.993	0.996
	2.054	1.003	0.851	0.989	0.992
	2.063	1.003	0.956	0.985	0.988
	2.082	1.001	1.048	0.983	0.984
MEAN:	2.051	1.002		0.992	0.994

CALIBRATED BY: H. F. Gabel

AIR CONSULTING & ENGINEERING, INC. — PITOT TUBE CALIBRATION

DATE CALIBRATED 11-9-90 PITOT TUBE 5-9

IS PITOT TUBE ASSEMBLY LEVEL YES ARE PITOT TUBE OPENINGS DAMAGED NO

α_1 = 0 °(< 10°), α_2 = 1 °(< 10°), β_1 = 2 °(< 5°), β_2 = 1 °(< 5°)

γ = 1 ° θ = 1 ° A = 1.165 in. = (Pa + Pb)

z = A sin γ = 0.017 in.; < 0.32 / < 1/8 in.

w = A sin θ = 0.017 in.; < 0.08 / < 1/32 in.

P_a 0.583 in. P_b 0.582 in. D_t .375

WAS CALIBRATION REQUIRED NO

THERMOCOUPLE CALIBRATION

SOURCE (SPECIFY)	ASTM GLASS THERMOMETER WITH MERCURY (°F)	PYROMETER (°F)	DEGREE DIFFERENCE	PERCENT DIFFERENCE
ICE BATH	34	34	0	0
AMBIENT	77	77	0	0
HOT OVEN	318	320	2	0.3

CALIBRATED BY: Sid Carter

FDER - MAXIMUM 8° DIFFERENCE

EPA $\left[\frac{(\text{REF. TEMP. °F} + 460°) - (\text{PYROMETER TEMP. °F} + 460°)}{\text{REF. TEMP. °F} + 460°}\right] 100 \leq 1.5\%$

AIR CONSULTING & ENGINEERING, INC. PYROMETER CALIBRATION

DATE 7-10-90

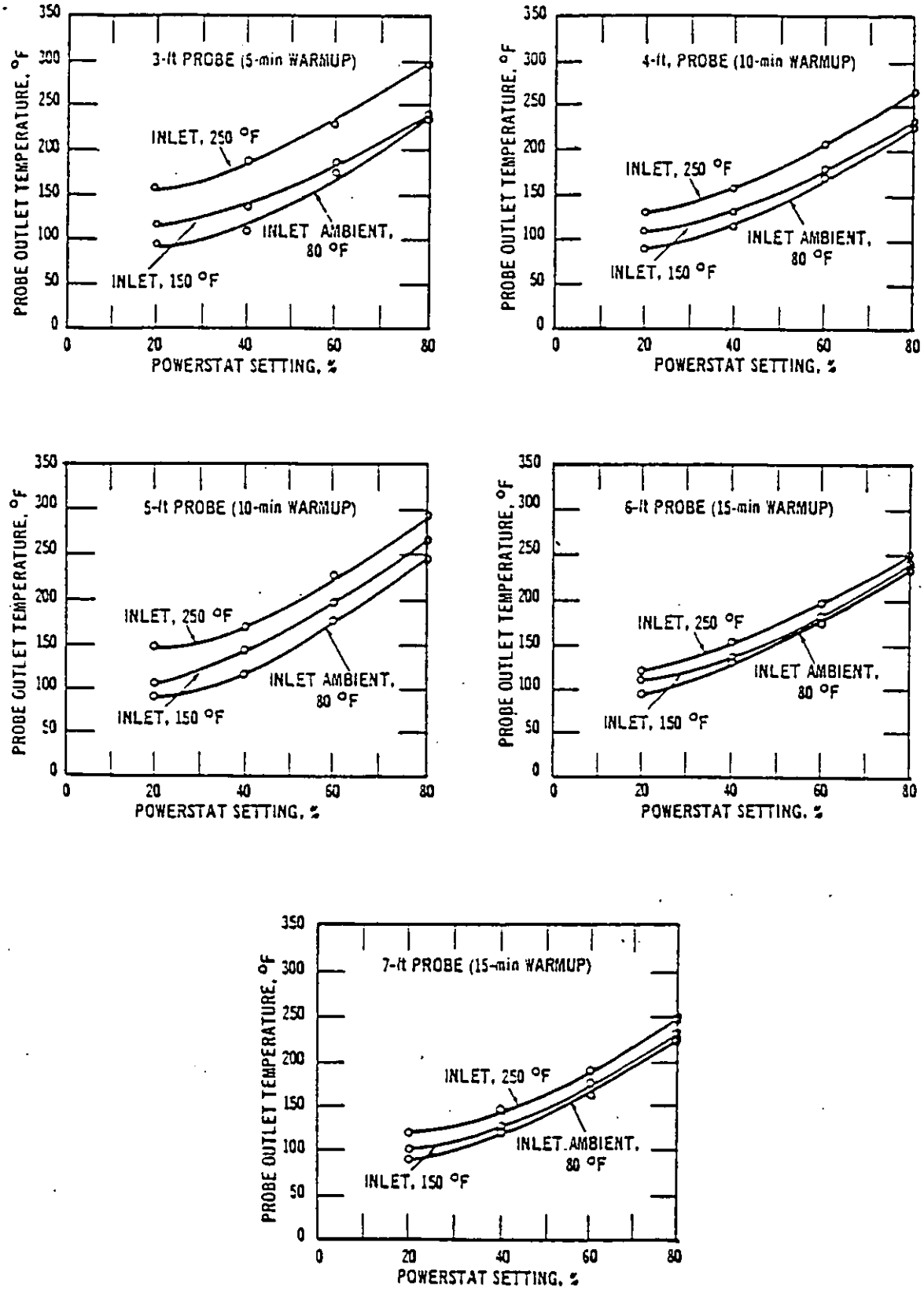
PYROMETER NUMBER METER BOX #1

SOURCE (SPECIFY)	GLASS THERMOMETER WITH NBS MERCURY (°F)	PYROMETER (°F)	DEGREE DIFFERENCE	PERCENT DIFFERENCE
ICE BATH	32°	33°	1	.2%
AMBIENT	94°	96°	2	.4%
HOT OVEN	800°	800°	0	0

FDER - MAXIMUM 5° DIFFERENCE

EPA $\left[\frac{(\text{REF. TEMP. °F} + 460°) - (\text{PYROMETER TEMP. °F} + 460°)}{\text{REF. TEMP. °F} + 460°}\right] 100 \leq 1.5\%$

CALIBRATED BY: Larry L Watts



NOTE: Flow rate held constant at 0.75; 50% change in flow rate has little effect on probe temperature.

Probe temperatures.

APPENDIX E

PRODUCTION RATE CERTIFICATION

BOILER OPERATION PARAMETERS

PLANT U.S. SUGAR - BRYANT

BOILER NUMBER 3

DATE 1-24-91 RUN NUMBER 1

OIL METER FACTOR

STEAM INTEGRATOR FACTOR 1000

SCRUBBER(S) PRESS.DROP ____,____

SCRUBBER(S) GPM _____,_____

OPERATOR SIGNATURE

SCRUBBER(S)H2O LEVEL _____,____

PH(if applicable)_____,_____

INITIAL INTEGRATOR 687026

FINAL INTEGRATOR 687258

TIME	OIL	STEAM			FEEDWATER	
	METER READING	LBS.FLOW	TEMP.	PRESSURE	TEMP.	PRESSURE
0802		155,000	585	400	260	640
0817		155000	585	395	260	650
722		150000	590	400	260	650
8:47		145000	560	400	260	650
9:02		157000	570	400	260	650
9:14		153,000	580	400	260	650
			(578)	(399)		

BOILER OPERATION PARAMETERS

PLANT U.S. SUGAR BRYANT BOILER NUMBER 3

DATE 1-24-91 RUN NUMBER 2 OIL METER FACTOR

STEAM INTEGRATOR FACTOR 1000 SCRUBBER(S) PRESS.DROP 6-6.5

OPERATOR SIGNATURE [signature] SCRUBBER(S) GPM , 6.4

SCRUBBER(S)H2O LEVEL

Ph(if applicable) ,

INITIAL INTEGRATOR 687336 FINAL INTEGRATOR 687520

TIME	OIL	STEAM			FEEDWATER	
	METER READING	LBS.FLOW	TEMP.	PRESSURE	TEMP.	PRESSURE
0946		153,000	577	400	260	640
10:01		150,000	570	400	260	640
10:16		145,000	582	400	260	650
10:31		145,000	576	400	260	640
10:46		157,000	570	390	260	640
11:00		145,000	580	400	260	650
			(576)	(398)	(260)	(643)

BOILER OPERATION PARAMETERS

PLANT U.S. SUGAR - BRYANT BOILER NUMBER 3

DATE 1-24-91 RUN NUMBER 3 OIL METER FACTOR

STEAM INTEGRATOR FACTOR 1000 SCRUBBER(S) PRESS.DROP ___,___

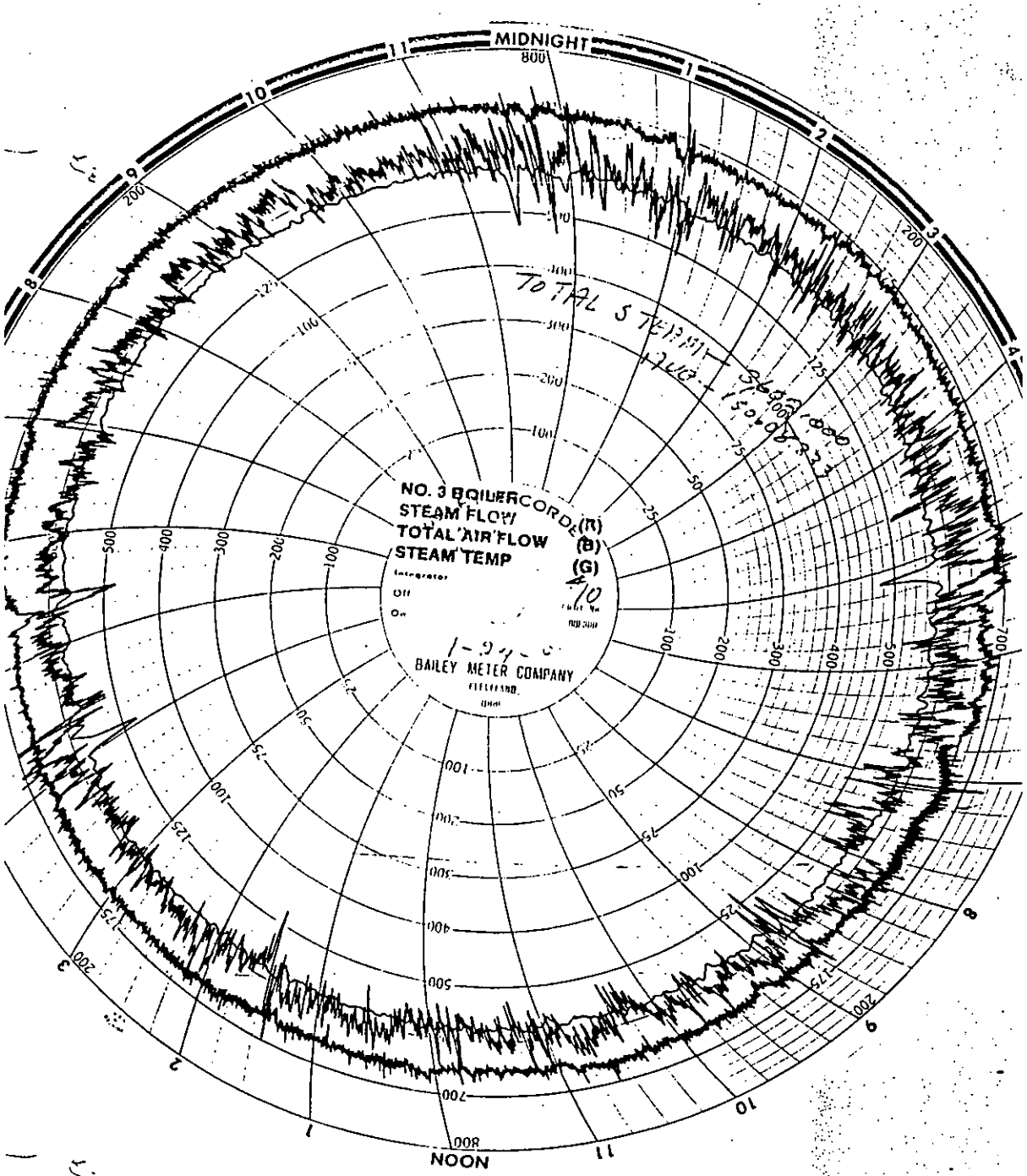
SCRUBBER(S) GPM ___,___

OPERATOR SIGNATURE [signature] SCRUBBER(S)H2O LEVEL ___,___

Ph(if applicable) ___,___

INITIAL INTEGRATOR 687586 FINAL INTEGRATOR 687775

TIME	OIL	STEAM			FEEDWATER	
	METER READING	LBS.FLOW	TEMP.	PRESSURE	TEMP.	PRESSURE
1127		145,000	570	400	260	650
1142		145,000	580	400	260	640
1157		145,000	582	400	260	650
1212		140,000	581	400	260	660
1227		153,000	580	400	260	650
1244		145,000	580	400	260	650
			(579)	(400)	(260)	(650)


MIDNIGHT
NOON
NO. 3 BOILER
STEAM FLOW
TOTAL AIR FLOW
STEAM TEMP
(R)
(B)
(G)
BAILEY METER COMPANY
TOTAL STEAM FLOW

APPENDIX F

PROJECT PARTICIPANTS

PROJECT PARTICIPANTS

ACEI:

STEPHEN L. NECK,P.E.	FIELD TESTING REPORT PREPARATION
GERARD GAUTHREAUX	FIELD TESTING

USSC:

AUGUSTO BLANCHARD	TEST COORDINATOR

FL. DEPT. OF ENVIRONMENTAL REGULATION

KEN TUCKER	TEST OBSERVER

PALM BEACH COUNTY HEALTH DEPT.

JEFF KOERNER	TEST OBSERVER