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: 27

Title: Source Test Report for Particulate Emissions Twin Impingement Wet Scrubbers Number 2 Boiler: Sugar Cane Growers Cooperative of Florida

November 1990

SOURCE TEST REPORT
for
PARTICULATE EMISSIONS

TWIN IMPINGEMENT WET SCRUBBERS
NUMBER 2 BOILER

SUGAR CANE GROWERS COOPERATIVE of FLORIDA
BELLE GLADE,FLORIDA

NOVEMBER 28,1990

PREPARED FOR:
SUGAR CANE GROWERS COOPERATIVE OF FLORIDA
BELLE GLADE,FLORIDA

PREPARED BY:
AIR CONSULTING and ENGINEERING, INC.
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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

Stephen L. Neck, P.E.

State of Florida
Registration No. 20020

December 14, 1990
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 Sugar Cane Growers Cooperative of Florida(SCGCOF) on November 28,1990. Testing was performed at the Number 2 Boiler dual wet scrubber outlets.

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. Blas Marin of SCGCOF served as test coordinator and certified production rates.

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 46.54 pounds per hour (LB/HR) and 0.225 pounds per million btu(LB/MMBTU) heat input against a "process rate" basis allowable emission of 0.235 LB/MMBTU. Permit conditions limit emissions to 0.10 LB/MMBTU from oil and 0.25 LB/MMBTU from residue firing.

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). Residue integrator and oil meter readings were recorded at the beginning and end of each particulate test run by ACEI personnel.

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TABLE 1
EMISSION SUMMARY
SUGAR GROWERS COOPERATIVE OF FLORIDA
NUMBER 2 BOILER
NOVEMBER 28,1990

RUN NUMBER	TIME	ACTUAL EMISSIONS		ALLOWABLE EMISSIONS	
		LB/HR	LB/MMBTU	LB/HR	LB/MMBTU
1	0830-1011 101	41.89	0.206	47.83	0.236
2	1100-1240 100	53.73	0.258	49.01	0.235
3	1330-1510 100	44.01	0.212	48.52	0.233
AVERAGES	--------- 100	46.54	0.225	48.45	0.235

3.0 PROCESS DESCRIPTION AND OPERATION

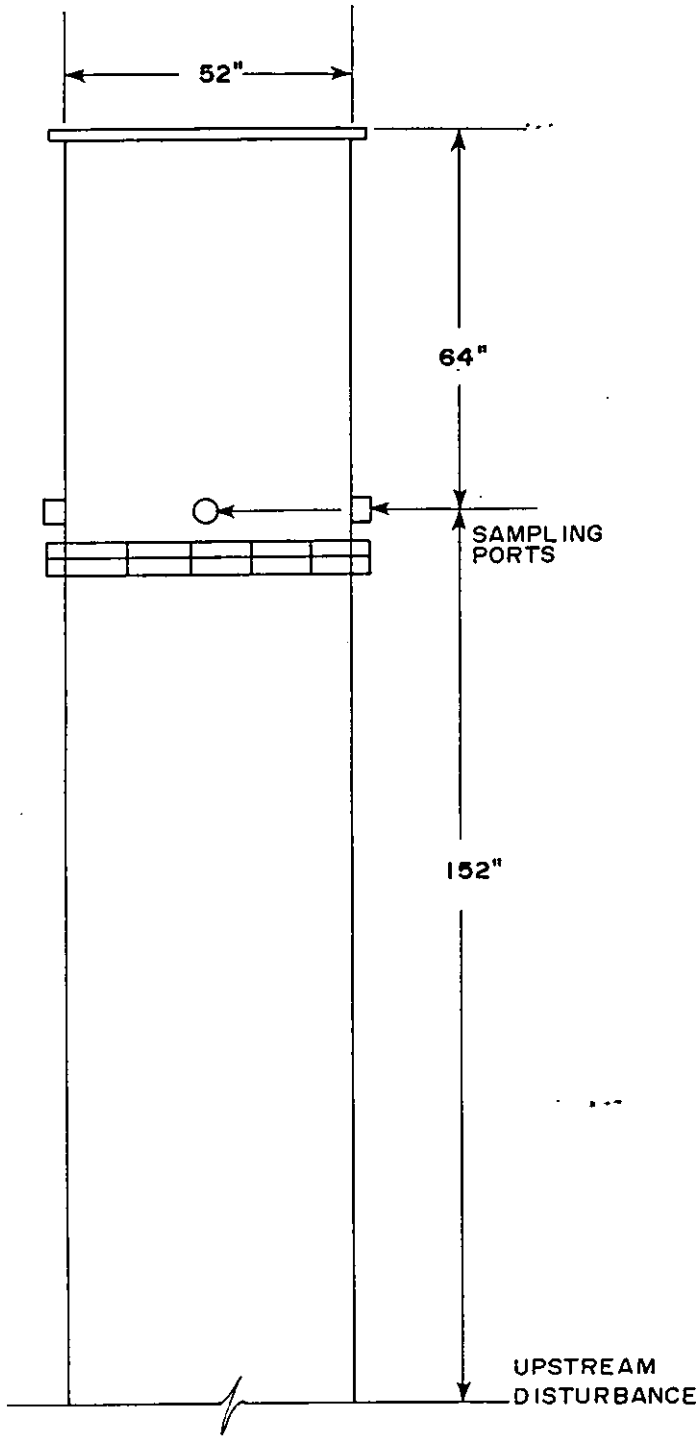
The Number 1 Boiler at Sugar Cane Growers Cooperative is a spreader stoker design used primarily for residue fuel firing. Supplemental oil firing was also utilized for the emission test. The boiler averaged 121,349 pounds per hour steam production over the three run test period.

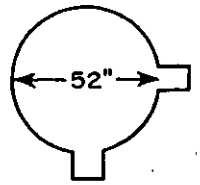
Oil meters, steam integrators, and other production monitoring devices were rigorously calibrated prior to the production season.

4.0 SAMPLING POINT LOCATION

The sampling point location consists of dual scrubber outlet stacks, each 52" in diameter. Each stack has two sample ports 90 degrees apart. The ports on the south stack are located 165" from an upstream disturbance and 52" from the outlet while the north stack ports are 152" from an upstram disturbance and 64" from the outlet.

Twenty-four test points were sampled on each stack 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	1.1
2	3.5
3	6.1
4	9.2
5	13.0
6	18.5
7	33.5
8	39.0
9	42.8
10	45.9
11	48.5
12	50.9

NOTE: NOT TO SCALE
BOTH STACKS ARE IDENTICAL.

FIGURE 1.
SAMPLING POINT LOCATION
BOILER NO. 2
SUGARCANE GROWERS COOP. OF 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

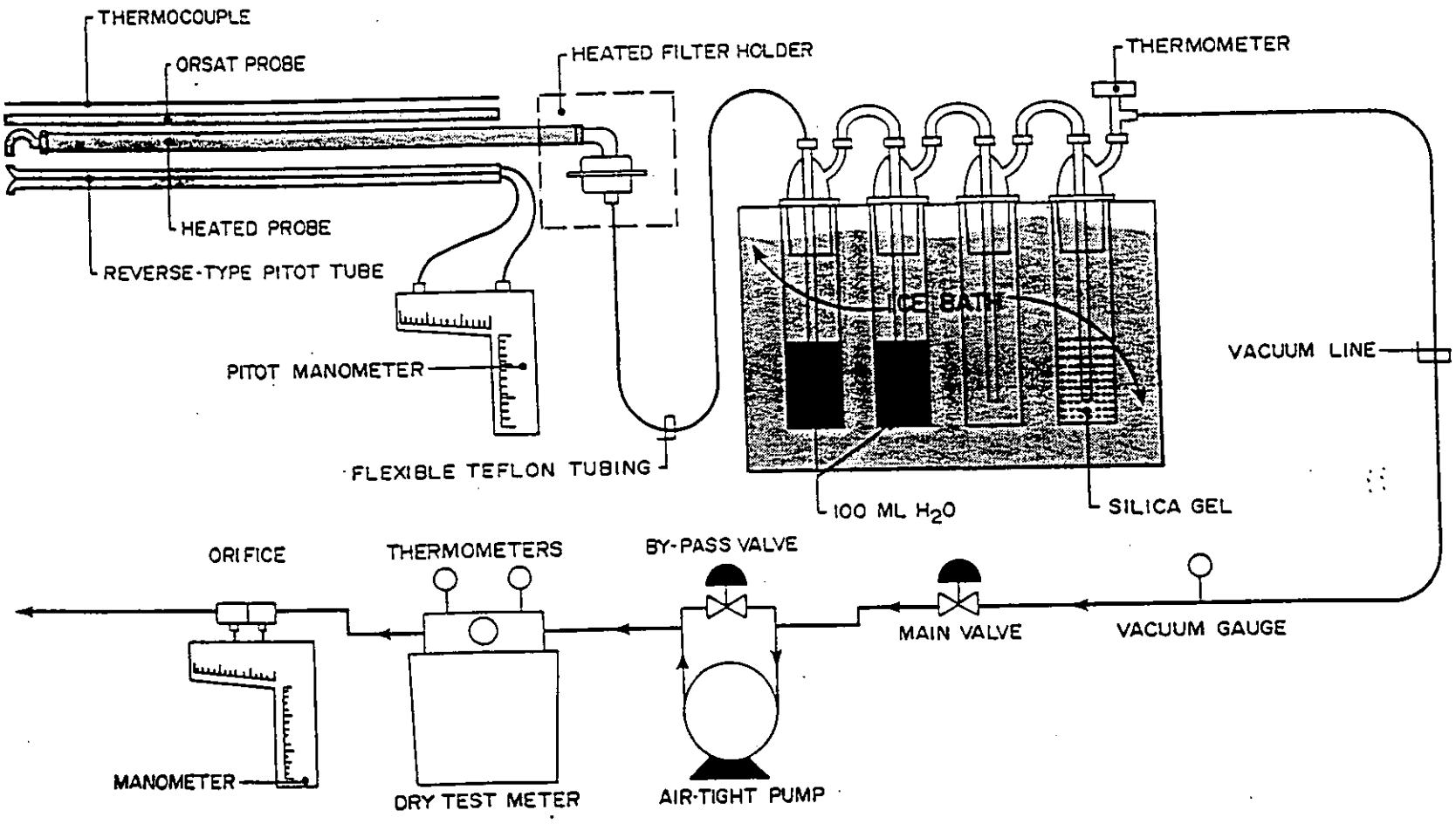

FIGURE 1.
EPA METHOD 5 SAMPLING TRAIN

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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:	SUGAR CANE GROWERS COOPERATIVE	DATE	11-28-90
LOCATION:	BELLE GLADE, FLA	RUN NUMBER	1
SOURCE:	NUMBER 2 BOILER SCRUBBER OUTLET	TIME	0830-1011

TIME INTERVAL	111	min.
FINAL OIL	1220	
BEGIN OIL	980	
FACTOR	1	
FINAL STEAM	168691	
BEGIN STEAM	168553	
FACTOR	1600	
TEMPERATURE	580	
PRESSURE	430	
FEEDWATER:		
TEMPERATURE:	260	
PRESSURE:	600	
STEAM BTU/LB.	1291.7	
FEEDWATER BTU/LB.	228.6	
NET STEAM BTU/LB.	1063.1	
STEAM RATE LB/HR.	119351	
BOILER EFFICIENY	62.5	
TOTAL HEAT INPUT	203.01	MMBTUH
OIL GPH	129.73	
OIL BTU/GAL.	150000	
TOTAL OIL BTU INPUT	19.46	MMBTUH
TOTAL NON-OIL BTU INPUT	183.55	MMBTUH
ALLOWABLE EMISSION FROM NON-OIL	.25	LB/MMBTU
ALLOWABLE EMISSION FROM OIL	.10	LB/MMBTU
TOTAL ALLOWABLE EMISSION	47.83	LB/HR
TOTAL ALLOWABLE EMISSION	0.236	LB/MMBTU
TOTAL ACTUAL EMISSION	41.89	LB/HR
TOTAL ACTUAL EMISSION	0.206	LB/MMBTU

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Complete Emission Results

Plant:	SUGAR GROWERS COOPERATIVE		
Location:	BELLE GLADE,FLORIDA	Date:	11-28-90
Stack:	NUMBER 2 BOILER	Run 1	From 0830 - 1011

Y Factor	0.994	Nozzle Diameter	0.230 In
Total Time	96.00 Min	Nozzle Area	0.000289 Ft^2
Stack Area	29.496 Ft^2	Barometric Pressure	30.40 In Hg
Stack Temperature	155.7 °F	Meter Temperature	77.6 °F
Stack Pressure	30.20 In Hg	Meter Orifice Diff	1.398 In H2O
Stack Avg J Vel Head	0.804 In H2O	Meter Volume	57.262 CF
		Condensate Vol	325.00 ml

1.	Volume Water Vapor Sampled	15.298	SCF
2.	Volume Standard Dry Gas Sampled	56.968	SCF
3.	Total Standard Sample Volume	72.266	SCF
4.	Percent Moisture	21.200	
5.	Percent Dry Air	78.800	
6.	Molecular Weight of Dry Flue Gas	29.948	
7.	Molecular Weight of Wet Flue Gas	27.415	
8.	Specific Gravity Flue Gas	0.95	
9.	Percent Oxygen [O2]	10.30	
10.	Percent Carbon Dioxide [CO2]	9.60	
11.	Percent Excess Air	94.962	
12.	Velocity of Flue Gas	49.789	FPS
13.	Actual Volumetric Flow Rate	88115.4	ACFM
14.	Dry Volumetric Flow Rate	69435.0	ACFMD
15.	Standard Volumetric Flow Rate	60105.2	SCFMD
16.	Emission Concentration	0.0813	gr/SCF
17.	Emission Concentration	0.0555	gr/ACF
18.	Emission Rate	41.89	lbs/Hr
19.	Percent Isokinetic	100.9	

Probe/Nozzle Wash	36.4	mg
Filter	263.8	mg
Total	300.2	mg

AIR CONSULTING & ENGINEERING, INC.
COMPLETE EMISSION DATA

PLANT:	SUGAR CANE GROWERS COOPERATIVE	DATE	11-28-90
LOCATION:	BELLE GLADE, FLA	RUN NUMBER	2
SOURCE:	NUMBER 2 BOILER SCRUBBER OUTLET	TIME	1100-1240

TIME INTERVAL	105	min.
FINAL OIL	1550	
BEGIN OIL	1310	
FACTOR	1	
FINAL STEAM	168879	
BEGIN STEAM	168745	
FACTOR	1600	
TEMPERATURE	580	
PRESSURE	430	
FEEDWATER:		
TEMPERATURE:	260	
PRESSURE:	600	
STEAM BTU/LB.	1291.7	
FEEDWATER BTU/LB.	228.6	
NET STEAM BTU/LB.	1063.1	
STEAM RATE LB/HR.	122514	
BOILER EFFICIENY	62.5	
TOTAL HEAT INPUT	208.39	MMBTUH
OIL GPH	137.14	
OIL BTU/GAL.	150000	
TOTAL OIL BTU INPUT	20.57	MMBTUH
TOTAL NON-OIL BTU INPUT	187.82	MMBTUH
ALLOWABLE EMISSION FROM NON-OIL	.25	LB/MMBTU
ALLOWABLE EMISSION FROM OIL	.10	LB/MMBTU
TOTAL ALLOWABLE EMISSION	49.01	LB/HR
TOTAL ALLOWABLE EMISSION	0.235	LB/MMBTU
TOTAL ACTUAL EMISSION	53.73	LB/HR
TOTAL ACTUAL EMISSION	0.258	LB/MMBTU

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Complete Emission Results

Plant:	SUGAR GROWERS COOPERATIVE		
Location:	BELLE GLADE,FLORIDA	Date:	11-28-90
Stack:	NUMBER 2 BOILER	Run 2	From 1100 - 1240

Y Factor	0.994	Nozzle Diameter	0.230 In
Total Time	96.00 Min	Nozzle Area	0.000289 Ft^2
Stack Area	29.496 Ft^2	Barometric Pressure	30.20 In Hg
Stack Temperature	153.4 °F	Meter Temperature	82.0 °F
Stack Pressure	30.20 In Hg	Meter Orifice Diff	1.406 In H2O
Stack Avg √ Vel Head	0.807 In H2O	Meter Volume	57.508 CF
		Condensate Vol	325.00 ml

1.	Volume Water Vapor Sampled	15.298	SCF
2.	Volume Standard Dry Gas Sampled	56.377	SCF
3.	Total Standard Sample Volume	71.675	SCF
4.	Percent Moisture	21.300	
5.	Percent Dry Air	78.700	
6.	Molecular Weight of Dry Flue Gas	29.948	
7.	Molecular Weight of Wet Flue Gas	27.403	
8.	Specific Gravity Flue Gas	0.95	
9.	Percent Oxygen [O2]	10.30	
10.	Percent Carbon Dioxide [CO2]	9.60	
11.	Percent Excess Air	94.962	
12.	Velocity of Flue Gas	49.893	FPS
13.	Actual Volumetric Flow Rate	88298.2	ACFM
14.	Dry Volumetric Flow Rate	69490.7	ACFMD
15.	Standard Volumetric Flow Rate	60378.1	SCFMD
16.	Emission Concentration	0.1038	gr/SCF
17.	Emission Concentration	0.0710	gr/ACF
18.	Emission Rate	53.73	lbs/Hr
19.	Percent Isokinetic	99.5	

Probe/Nozzle Wash	84.9	mg
Filter	294.4	mg
Total	379.3	mg

AIR CONSULTING & ENGINEERING, INC.
COMPLETE EMISSION DATA

PLANT:	SUGAR CANE GROWERS COOPERATIVE	DATE	11-28-90
LOCATION:	BELLE GLADE, FLA	RUN NUMBER	3
SOURCE:	NUMBER 2 BOILER SCRUBBER OUTLET	TIME	1330-1510

TIME INTERVAL	110	min.
FINAL OIL	1910	
BEGIN OIL	1630	
FACTOR	1	
FINAL STEAM	169069	
BEGIN STEAM	168929	
FACTOR	1600	
TEMPERATURE	580	
PRESSURE	430	
FEEDWATER:		
TEMPERATURE:	260	
PRESSURE:	600	
STEAM BTU/LB.	1291.7	
FEEDWATER BTU/LB.	228.6	
NET STEAM BTU/LB.	1063.1	
STEAM RATE LB/HR.	122182	
BOILER EFFICIENY	62.5	
TOTAL HEAT INPUT	207.83	MMBTUH
OIL GPH	152.73	
OIL BTU/GAL.	150000	
TOTAL OIL BTU INPUT	22.91	MMBTUH
TOTAL NON-OIL BTU INPUT	184.92	MMBTUH
ALLOWABLE EMISSION FROM NON-OIL	.25	LB/MMBTU
ALLOWABLE EMISSION FROM OIL	.10	LB/MMBTU
TOTAL ALLOWABLE EMISSION	48.52	LB/HR
TOTAL ALLOWABLE EMISSION	0.233	LB/MMBTU
TOTAL ACTUAL EMISSION	44.01	LB/HR
TOTAL ACTUAL EMISSION	0.212	LB/MMBTU

AIR CONSULTING AND ENGINEERING, INC.

Complete Emission Results

Plant:	SUGAR GROWERS COOPERATIVE		
Location:	BELLE GLADE,FLORIDA	Date:	11-28-90
Stack:	NUMBER 2 BOILER	Run 3	From 1330 - 1510

Y Factor	0.994		Nozzle Diameter	0.230	In
Total Time	96.00	Min	Nozzle Area	0.000289	Ft^2
Stack Area	29.496	Ft^2	Barometric Pressure	30.20	In Hg
Stack Temperature	153.1	°F	Meter Temperature	83.6	°F
Stack Pressure	30.20	In Hg	Meter Orifice Diff	1.429	In H2O
Stack Avg √ Vel Head	0.815	In H2O	Meter Volume	58.198	CF
			Condensate Vol	320.00	ml

1.	Volume Water Vapor Sampled	15.062	SCF
2.	Volume Standard Dry Gas Sampled	56.889	SCF
3.	Total Standard Sample Volume	71.951	SCF
4.	Percent Moisture	20.900	
5.	Percent Dry Air	79.100	
6.	Molecular Weight of Dry Flue Gas	29.948	
7.	Molecular Weight of Wet Flue Gas	27.451	
8.	Specific Gravity Flue Gas	0.95	
9.	Percent Oxygen [O2]	10.30	
10.	Percent Carbon Dioxide [CO2]	9.60	
11.	Percent Excess Air	94.962	
12.	Velocity of Flue Gas	50.331	FPS
13.	Actual Volumetric Flow Rate	89073.7	ACFM
14.	Dry Volumetric Flow Rate	70457.3	ACFMD
15.	Standard Volumetric Flow Rate	61243.0	SCFMD
16.	Emission Concentration	0.0838	gr/SCF
17.	Emission Concentration	0.0576	gr/ACF
18.	Emission Rate	44.01	lbs/Hr
19.	Percent Isokinetic	99.0	

Probe/Nozzle Wash	28.6	mg
Filter	280.5	mg
Total	309.1	mg

Avg = 10.3

Temp = 154

Flow rate = 60,575

Dif -- 2.098 mmBtu/hr, 140 gal/hr

Bagasse -185.43

206.41

Plant: SUGAR GROWERS COOPERATIVE
Date: 11-28-90
Stack: NUMBER 2 BOILER

Vwv Volume Water Vapor Sampled
Vwv = 0.04707 x 325 = 15.298 SCF

VMstd Volume Standard Dry Gas Sampled
VMstd = 17.64 x 57.262 x 0.994 x
[30.40 + (1.398 / 13.6)] / (77.6 + 460) = 56.968 SCF

Vt Total Standard Sample Volume
Vt = 15.298 + 56.968 = 72.266 SCF

W Percent Water = (15.298 / 72.266) x 100 = 21.2 %

FDA Percent Dry Air = (1 - 0.212) x 100 = 78.8 %

Md Molecular Weight of Dry Stack Gas
Md = (0.44 X 9.60 %CO_2) + (0.32 X 10.30 %O_2) +
[0.28 X (80.10 %N_2 + 0.00 %CO)] = 29.948

Ms Molecular Weight of Wet Stack Gas
Ms = (29.948 x 0.788) + (18 x 0.212) = 27.415

SG Specific Gravity Stack Gas
SG = 27.415 / 28.84 = 0.95

Ea Percent Excess Air

$$Ea = \frac{((10.3\ \%O_2) - (0\ \%CO / 2) \times 100)}{[(.264 \times (80.1\ \%N_2)) - (10.3\ \%O_2) - (0\ \%CO / 2)]}$$

Ea = 94.962

Vs Velocity of Stack
Vs = (85.49 x 0.84 x 0.804) x -[(155.7 + 460) / (30.20 x 27.415
Vs = 49.789

Qa Actual Volumetric Flow
Qa = (29.496 x 49.789 x 60) = 88115.4 ACFM

Qd Dry Volumetric Flow
Qd = (88115.4 x 0.788) = 69435.0 ACFMD

Qsd Standard Volumetric Flow
Qsd = 88115.4 x 0.788 x [528 / (155.7 + 460)] x
(30.20 / 29.92) = 60105.2 SCFMD

Plant: SUGAR GROWERS COOPERATIVE
Date: 11-28-90
Stack: NUMBER 2 BOILER

ESTP Emission Rate
gr/SCF = [0.01543 x (36.4 + 263.8)] / (56.968)
gr/SCF = 0.0813

Lbs/Hr Emission Rate
Lbs/Hr = 0.0813 / 7000 x 60105.2 x 60 = 41.89

I Percent Isokinetic
I = 100 x (155.7 + 460) x [(0.002669 x 325.0) + (57.262 x 0.994 ,
(77.6 + 460)) x (30.40 + (1.398 / 13.6))] /
(60 x 96 x 49.789 x 30.20 x 0.000289)
I = 100.9 %

Plant: SUGAR GROWERS COOPERATIVE
Date: 11-28-90
Stack: NUMBER 2 BOILER
Run Number: 1

Average SQR Velocity Head = 0.804
Velocity Head Inputs:

0.4800	0.5200	0.5200	0.5200	0.5700	0.5700	0.67
0.7000	1.1500	1.1500	1.0500	1.0500	0.5400	0.54
0.6400	0.6900	0.8100	1.0000	1.1000	1.1500	1.20
1.1000	0.9000	0.8200	0.3300	0.3300	0.4300	0.58
0.6800	0.6300	0.6300	0.5800	0.5600	0.5200	0.47
0.4400	0.3000	0.3000	0.3300	0.4500	0.5800	0.61
0.6200	0.6500	0.6500	0.7200	0.6200	0.6000	

Average Orifice Pressure = 1.398
Orifice Pressure Inputs:

1.0000	1.1000	1.1000	1.1000	1.2000	1.2000	1.40
1.4500	2.4000	2.4000	2.2000	2.2000	1.1000	1.10
1.3500	1.4500	1.7000	2.1000	2.3000	2.4000	2.50
2.3000	1.9000	1.7000	0.6900	0.6900	0.9000	1.20
1.4500	1.3000	1.3000	1.2000	1.2000	1.1000	1.00
0.9000	0.6500	0.6500	0.6900	0.9500	1.2000	1.30
1.3000	1.3500	1.3500	1.5000	1.3000	1.3000	

Average Stack Temperature = 155.7
Stack Temperature Inputs:

151	155	158	159	160	161	1
162	162	163	160	160	160	1
160	161	162	161	162	161	1
159	158	158	153	151	151	1
152	152	153	153	153	152	1
152	151	151	150	150	150	1
151	152	152	151	151	151	

Average Meter Temperature = 77.6
Meter Temperature Inputs:

72	72	72	72	72	72	
73	73	74	74	75	75	
76	76	76	77	77	77	
78	78	78	78	79	79	
80	80	80	80	80	80	
81	81	81	81	81	81	
81	81	81	82	82	82	

Plant: SUGAR GROWERS COOPERATIVE
Date: 11-28-90
Stack: NUMBER 2 BOILER
Run Number: 2

Average SQR Velocity Head = 0.807
Velocity Head Inputs:

0.5200	0.5200	0.5900	0.5200	0.8200	0.9000	0.98
0.9400	0.8600	0.8400	0.7900	0.7600	0.5600	0.56
0.6200	0.7600	0.8800	0.9700	1.0500	1.1000	0.97
0.8000	0.7600	0.6700	0.3300	0.3800	0.4700	0.62
0.7200	0.6800	0.6800	0.6400	0.6000	0.5200	0.52
0.4600	0.3000	0.3200	0.3500	0.4800	0.5700	0.62
0.6200	0.7000	0.7200	0.6800	0.6300	0.6000	

Average Orifice Pressure = 1.406
Orifice Pressure Inputs:

1.1000	1.1000	1.1000	1.2500	1.7000	1.9000	2.10
2.0000	1.8000	1.8000	1.6500	1.6000	1.2000	1.20
1.3000	1.6000	1.8500	2.1000	2.2000	2.3000	2.10
1.6500	1.6000	1.4000	0.6900	0.8000	1.0000	1.26
1.5000	1.4000	1.4000	1.3000	1.3000	1.1000	1.10
1.0000	0.6300	0.6700	0.7300	1.0000	1.2000	1.35
1.3500	1.5000	1.5000	1.4500	1.3500	1.3000	

Average Stack Temperature = 153.4
Stack Temperature Inputs:

153	153	154	155	155	155	1
155	157	156	156	154	154	1
154	155	157	157	157	156	1
155	155	155	152	151	151	1
151	152	152	153	153	154	1
152	150	150	151	151	151	1
152	152	151	151	151	152	

Average Meter Temperature = 82.0
Meter Temperature Inputs:

77	77	77	77	77	77	
78	78	79	79	80	80	
81	81	81	82	82	82	
82	82	82	83	83	83	
83	83	83	84	84	84	
85	85	85	85	85	85	
85	85	85	85	85	85	

Plant: SUGAR GROWERS COOPERATIVE
Date: 11-28-90
Stack: NUMBER 2 BOILER
Run Number: 3

Average SQR Velocity Head = 0.815
Velocity Head Inputs:

0.5200	0.5500	0.5200	0.6200	0.7200	0.8000	1.10
1.1000	0.9800	0.9500	0.9500	0.8300	0.5400	0.60
0.6000	0.6700	0.8000	0.9300	0.9300	1.1000	1.00
0.8500	0.7400	0.6800	0.3600	0.4200	0.5200	0.65
0.6500	0.7200	0.6700	0.6700	0.5700	0.5700	0.51
0.4700	0.3200	0.3200	0.3800	0.4800	0.6000	0.70
0.6200	0.6700	0.7200	0.6900	0.6500	0.6000	

Average Orifice Pressure = 1.429
Orifice Pressure Inputs:

1.1000	1.1500	1.1000	1.3000	1.5000	1.7000	2.30
2.3000	2.1000	2.0000	2.0000	1.7500	1.1300	1.25
1.2500	1.4000	1.7000	1.9500	1.9500	2.3000	2.10
1.8000	1.5500	1.4000	0.7600	0.8800	1.1000	1.40
1.4000	1.5000	1.4000	1.4000	1.2000	1.2000	1.10
1.0000	0.6700	0.6700	0.8000	1.0000	1.2500	1.50
1.3000	1.4000	1.5000	1.4500	1.3500	1.3000	

Average Stack Temperature = 153.1
Stack Temperature Inputs:

153	153	153	154	154	155	1
157	156	155	154	154	154	1
154	154	155	155	155	156	1
154	154	154	152	152	151	1
152	152	153	153	153	153	1
152	151	151	151	151	151	1
152	153	153	152	152	151	

Average Meter Temperature = 83.6
Meter Temperature Inputs:

80	80	80	80	80	80
81	82	82	82	82	83
83	83	83	83	84	84
84	85	85	85	85	85
85	85	85	85	85	85
85	85	85	85	85	85
85	85	85	85	85	85

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 _____
PAGE ____ OF ____

PLANT Sugar Cane Growers Cooperative
SOURCE No. 2 Boiler
PLANT LOCATION Belle Glade, FL
TYPE OF SAMPLING TRAIN EPA-5
TYPE OF SAMPLES PM
DATE 11-28-90 RUN NO. 3
TIME START 1330 TIME END 1510
SAMPLE TIME 48.2 (min/pt) = 96 Total min
ASSUMED MOISTURE ____ % FDA ____
NOMOGRAPH C_f ____ PITOT CORR. ____
P_b ____ "Hg P_s ____ "Hg
WEATHER ____ TEMP. ____ °F
METER BOX NO. ____ H ____ Y ____
NOZZLE CAL. ____ ____ ____ = .230
STACK DIMENSIONS ____
STACK AREA 29.496 ft.² EFFECTIVE ____ ft.²
STACK HEIGHT ____ ft.
STACK DIAMETER: UPSTRM. ____ DNSTRM. ____
PORT SIZE ____ in. NIPPLE LENGTH ____ in.
U CORD LENGTH ____
REMARKS: ____

130191
OIL
130163 1321
168929 57m
169069 1516
.665
.6880
.4084 43.613
279.6
28.0
307.6 60985 second

MAT'L PROCESSING RATE ____
GAS METER READINGS: FINAL 176.755 ft.³
INITIAL 118.557 ft.³
NET ____ ft.³
FILTER NO. 2875 IMP. VOL. GAIN 305 ml.
SIL GEL NO. 34 WT. GAIN 15 ml.
TOTAL CONDENSATE 320 ml.

ORSAT

	1	2	3	4	AVG.
% CO_2					9.6
% O_2					10.3
% CO					
% N_2					

F_O = ____ F_O RANGE = ____
ORSAT ANALYZER ____

LEAK CHECKS
PRE 0.00 cfm 17 "Hg POST 0.00 cfm 18.5 "Hg
METER BOX/PUMP ____ GAS SAMPLE SYST. ____
ORSAT BAG ____
PITOT TUBE NO. 1601 PRE-TEST 6.4
POST-TEST(+) 4.3 / 15 H_2O/Sec
POST-TEST(−) 3.8 / 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 (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)
ST-1		1332	119.70	.52	1.1	1.1	153	242	68	80	5.5
2		1334	120.84	.55	1.15	1.15	153	240	59	80	5.5
3		1336	121.93	.52	1.1	1.1	153	241	57	80	5.5
4		1338	123.1	.62	1.3	1.3	154	233	57	80	6.5
5		1340	124.1	.72	1.5	1.5	154	239	58	80	7
6		1342	125.67	.80	1.7	1.7	155	253	59	80	8

ACE AIR CONSULTING & ENGINEERING, INC.

TEST ID _____

PAGE ____ OF ____

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.	METER ORIFICE PRESS. DIFF. ("H_2O) ACTUAL	STACK GAS TEMP. (°F)	SAMPLE BOX TEMP. (°F)	LAST IMPINGER TEMP. (°F)	DRY GAS METER TEMP. (°F)	VACUUM ON SAMPLE TRAIN ("Hg)
S-1-7		1344	127.–	1.1	2.3	2.3	157	269	60	81	10.5
8		1346	128.70	1.1	2.3	2.3	157	264	60	81	11
9		1348	130.20	.98	2.0	2.0	156	259	61	82	11
10		1350	131.70	.95	2.0	2.0	155	249	63	82	10.5
11		1352	133.17	.95	2.0	2.0	154	255	63	82	10.5
12		1354	134.55	.83	1.75	1.75	154	255	63	82	10
S-2-1		1357	135.66	.54	1.13	1.13	154	271	66	83	7.0
2		1359	136.83	.60	1.25	1.25	153	271	64	83	8.0
3		1401	137.05	.60	1.25	1.25	154	269	63	83	8.0
4		1403	139.17	.67	1.4	1.4	154	272	64	83	9
5		1405	140.5	.80	1.7	1.7	155	263	64	83	10
6		1407	141.88	.93	1.95	1.95	155	256	64	83	11.5
7		1409	143.27	.93	1.95	1.95	155	254	64	84	11.5
8		1411	144.80	1.1	2.3	2.3	156	231	64	84	14
9		1413	146.29	1.0	2.1	2.1	151	225	65	84	13.5
10		1415	147.66	.85	1.8	1.8	154	232	66	84	12
11		1417	148.91	.74	1.55	1.55	154	260	66	85	10.5
12		1419	150.15	.68	1.4	1.4	154	265	66	85	10.5
N-1-1		1423	151.00	.36	.76	.76	152	266	67	85	7
2		1425	151.97	.42	.88	.88	152	271	67	85	8
3		1427	153.04	.52	1.1	1.1	151	271	66	85	9
4		1429	154.20	.65	1.4	1.4	152	255	66	85	11
5		1431	155.40	.65	1.4	1.4	152	250	67	85	11
6		1433	156.60	.72	1.5	1.5	152	248	67	85	11.5
7		1435	157.–	.67	1.4	1.4	153	258	68	85	11.5

ACE AIR CONSULTING & ENGINEERING, INC.

TEST ID _____

PAGE ____ OF ____

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					
N-1-8		1437	159.–	.67	1.4	1.4	~~262~~ 153	262	69	85	11.5
9		1439	160.17	.57	1.2	1.2	153	264	70	85	11
10		1441	160.28	.57	1.2	1.2	153	260	70	85	11
11		1443	162.35	.51	1.1	1.1	152	254	70	85	10
12		1445	163.39	.47	1.0	1.0	152	257	69	85	10
N-2-1		1448	164.3	.32	.67	.67	157	265	69	85	8.5
2		1450	165.20	.32	.67	.67	151	266	68	85	8.5
3		1452	166.1	.38	.80	.80	151	260	68	85	8.5
4		1454	167.12	.48	1.0	1.0	151	254	69	85	10.0
5		1456	168.24	.60	1.25	1.25	151	256	69	85	12
6		1458	169.47	.70	1.5	1.5	152	258	70	85	13.5
7		1500	170.67	.62	1.3	1.3	153	253	69	85	13.5
8		1502	171.87	.67	1.4	1.4	153	251	70	85	13.5
9		1504	173.–	.72	1.5	1.5	152	235	70	85	14.5
10		1506	174.36	.69	1.45	1.45	152	225	71	85	14.5
11		1508	175.–	.65	1.35	1.35	151	225	71	85	14
12		1510	176.755	.60	1.3	1.3	151	225	71	85	13.5

STACK SAMPLING FIELD DATA SHEET

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

0825 1300980

TEST ID _____
PAGE ____ OF ____

PLANT Sugar Cane Growers Cooperative
SOURCE No. 2 Boiler
PLANT LOCATION Belle Glade, Florida
TYPE OF SAMPLING TRAIN EPA-5
TYPE OF SAMPLES Particulate (Pm)
DATE 11-28-90 RUN NO. 1
TIME START 0830 TIME END 1011
SAMPLE TIME 48 / 2 (min/pt) = 96 Total min
ASSUMED MOISTURE 20 % FDA .8
NOMOGRAPH C_f 2.1 PITOT CORR. .84
P_b 30.4 "Hg P_s 30.2 "Hg
WEATHER Clear TEMP. ____ °F
METER BOX NO. 1 H 2.05 Y 0.994
NOZZLE CAL. .229 .231 .230 = .230
STACK DIMENSIONS 52 x 2 Stacks
STACK AREA 29.496 ft² EFFECTIVE ____ ft²
STACK HEIGHT ____ ft.
STACK DIAMETER: UPSTRM. ____ DNSTRM. ____
PORT SIZE ____ in. NIPPLE LENGTH ____ in.
U CORD LENGTH ____
REMARKS: ____

2.1 x 91
168 6
1301220
1016
.6750
.4082
266.8
267
26.7
293.5
41.00 lb/hr
506

MAT'L PROCESSING RATE ____
GAS METER READINGS: FINAL 60.584 ft³
INITIAL 3.322 ft³
NET 57.262 ft³
FILTER NO. 2873 IMP. VOL. GAIN 315 ml.
SIL GEL NO. 57 WT. GAIN 10.0 ml.
TOTAL CONDENSATE ____ ml.

ORSAT

	1	2	3	4	AVG.
% CO_2					9.6
% O_2					10.3
% CO					
% N_2					

F_O = ____ F_O RANGE = ____
ORSAT ANALYZER ____

LEAK CHECKS
PRE 0.00 cfm 18 "Hg POST 0.00 cfm 17.5 "Hg
METER BOX/PUMP ____ GAS SAMPLE SYST. ____
ORSAT BAG ____
PITOT TUBE NO. 1601 PRE-TEST O.K.
POST-TEST(+) 4.6 / 15 H_2O/Sec
POST-TEST(−) 4.2 / 15 H_2O/Sec
PYROMETER NO. 1
BOX OPERATOR Neck PROBE HOLDER Gerard

43695 x 2 29758 x 2 20.408 x 2

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)
5-1-1		0832	—	.48	1.00	1.00	151	259	61	72	5.0
2		0834	5.50	.52	1.1	1.1	155	265	48	72	5.0
3		0836	6.49	.52	1.1	1.1	158	269	45	72	5.0
4		0838	7.56	.52	1.1	1.1	159	265	45	72	5.5
5		0840	8.67	.57	1.2	1.2	160	258	44	72	6.5
6		0842	9.78	.57	1.2	1.2	161	255	45	72	6.5

AGE AIR CONSULTING & ENGINEERING, INC.

.72

TEST ID _____

PAGE ____ OF ____

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					
1-7		0844	11.0	.67	1.4	1.4	162	255	45	72	7.0
1-8		0846	12.22	.70	1.45	1.45	162	252	45	73	7.5
9		0848	13.75	1.15	2.4	2.4	162	250	46	73	11.0
10		0850	15.32	1.15	2.4	2.4	163	245	46	74	11.5
11		0852	16.84	1.05	2.2	2.2	160	243	47	74	11
12		0854	18.34	1.05	2.2	2.2	160	246	48	75	11
S-2-1		0858	19.45	.54	1.1	1.1	160	260	50	75	7
2		0900	20.54	.54	1.1	1.1	161	262	49	75	7
3		0902	21.73	.64	1.35	1.35	160	259	48	76	8
4		0904	22.95	.69	1.45	1.45	161	263	48	76	8.5
5		0906	24.25	.81	1.7	1.7	162	272	47	76	10
6		0908	25.70	1.00	2.1	2.1	161	267	47	77	12
7		0910	27.22	1.1	2.3	2.3	162	269	48	77	13.5
8		0912	28.78	1.15	2.4	2.4	161	261	48	77	14.5
9		0914	30.4	1.2	2.5	2.5	160	256	48	77	15
10		0916	31.94	1.1	2.3	2.3	159	252	49	78	15
11		0918	33.41	.9	1.9	1.9	158	252	50	78	13
12		0920	34.835	.82	1.7	1.7	158	250	50	78	12
N-1-1		0924	35.72	.33	.69	.69	153	268	53	78	7
2		0926	36.58	.33	.69	.69	151	269	52	79	7
3		0928	37.55	.43	.9	.9	151	274	52	79	8
4		0930	38.65	.58	1.2	1.2	151	267	50	79	10
5		0932	39.87	.68	1.45	1.45	152	267	50	80	11
6		0934	41.06	.63	1.3	1.3	152	272	50	80	10.5
7		0936	42.23	.63	1.3	1.3	153	273	50	80	10.5

AGE AIR CONSULTING & ENGINEERING, INC.

TEST ID _____

PAGE ____ OF ____

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)
N1-8		0938	43.42	.58	1.2	1.2	153	266	51	80	10.5
9		0940	44.52	.56	1.2	1.2	153	270	52	80	10.5
10		0942	45.63	.52	1.1	1.1	152	271	52	80	10
11		0944	46.66	.47	1.0	1.0	152	270	53	80	10
12		0946	47.—	.44	.9	.9	152	270	53	81	9
N2-1		0949	48.46	.30	.65	.65	151	270	56	81	7.5
2		0951	49.28	.30	.65	.65	151	273	55	81	7.5
3		0953	50.15	.33	.69	.69	150	271	54	81	8
4		0955	51.14	.45	.95	.95	150	271	54	81	9.5
5		0957	52.26	.58	1.2	1.2	150	267	54	81	11
6		0959	53.42	.61	1.3	1.3	151	262	53	81	11.5
7		1001	54.60	.62	1.3	1.3	151	260	54	81	11.5
8		1003	55.74	.65	1.35	1.35	152	247	55	81	12
9		1005	56.91	.65	1.35	1.35	152	249	54	82	12
10		1007	58.18	.72	1.5	1.5	151	254	55	82	14
11		1009	59.38	.62	1.3	1.3	151	254	55	82	13
12		1011	60.584	.60	1.3	1.3	151	254	56	82	13

STACK SAMPLING FIELD DATA SHEET

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

TEST ID _____
PAGE ____ OF ____

PLANT Sugar Cane Growers Cooperative
SOURCE No. 2 Boiler
PLANT LOCATION Belle Glade, FL.
TYPE OF SAMPLING TRAIN EPA-5
TYPE OF SAMPLES PM
DATE 11-28-90 RUN NO. 2
TIME START 1100 TIME END 1240
SAMPLE TIME 48, 2 (min/pt) = 96 Total min
ASSUMED MOISTURE 21 % FDA .79
NOMOGRAPH C_f 2.1 PITOT CORR. .84
P_b 30.4 "Hg P_s 30.2 "Hg
WEATHER Clear TEMP. ____ °F
METER BOX NO. 1 H ____ Y .994
NOZZLE CAL. 73.54 ____ = .230
STACK DIMENSIONS (73.54 equ) 52" ϕ x 2
STACK AREA 29.496 ft² EFFECTIVE ____ ft²
STACK HEIGHT ____ ft.
STACK DIAMETER: UPSTRM. ____ DNSTRM. ____
PORT SIZE ____ in. NIPPLE LENGTH ____ in.
U CORD LENGTH 125'
REMARKS:

1301310 1058
.651
130850 (1243)
168879
.7030
.4081
.2949
.807 .3239 56.39 scf
45.44 2985 FPM
88043 ACFM
60078 scfm

MAT'L PROCESSING RATE ____
GAS METER READINGS: FINAL 118.300 ft³
INITIAL 60.792 ft³
NET ____ ft³
FILTER NO. 2874 IMP. VOL. GAIN 310 ml.
SIL GEL NO. 24 WT. GAIN 15 ml.
TOTAL CONDENSATE 325 ml.

ORSAT

	1	2	3	4	AVG.
% CO_2					9.6
% O_2					10.3
% CO					
% N_2					

F_O = ____ F_O RANGE = ____
ORSAT ANALYZER ____

LEAK CHECKS
PRE 0.00 cfm 17 "Hg POST ____ cfm 21.5 "Hg
METER BOX/PUMP ____ GAS SAMPLE SYST. ____
ORSAT BAG ____
PITOT TUBE NO. 1601 PRE-TEST OK
POST-TEST(+) 3.5 / 15 H_2O/Sec
POST-TEST(−) 3.4 / 15 H_2O/Sec
PYROMETER NO. 1
BOX OPERATOR Neck PROBE HOLDER Gerard

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)
S1-1		1102	61.95	.52	1.1	1.1	153	275	58	77	5.0
2		1104	63.05	.52	1.1	1.1	153	273	57	77	5.0
3		1106	64.10	.52	1.1	1.1	154	273	54	77	5.0
4		1108	65.26	.59	1.25	1.25	155	273	53	77	6.5
5		1110	66.55	.82	1.7	1.7	155	262	54	77	8
6		1112	67.93	.90	1.90	1.9	155	261	55	77	9

AGE AIR CONSULTING & ENGINEERING, INC.

TEST ID _____

PAGE ____ OF ____

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					
S-1-7		1114	69.33	.98	2.1	2.1	156	252	55	78	9.5
8		1116	70.78	.94	2.0	2.0	155	251	57	78	9.5
9		1118	72.17	.86	1.8	1.8	157	260	58	78	10
10		1120	73.53	.84	1.8	1.8	156	260	58	79	10
11		1122	74.88	.79	1.65	1.65	156	262	58	79	10
12		1124	76.16	.76	1.6	1.6	154	263	59	80	10
S-2-1		1127	77.28	.56	1.2	1.2	154	260	60	80	8
2		1129	78.40	.56	1.2	1.2	154	264	59	81	8
3		1131	79.58	.62	1.3	1.3	154	252	58	81	9
4		1133	80.8	.76	1.6	1.6	155	263	60	81	10.5
5		1135	82.18	.88	1.85	1.85	157	264	59	81	12
6		1137	83.63	.97	2.1	2.1	157	271	59	82	13.5
7		1139	85.15	1.05	2.2	2.2	157	274	60	82	15.0
8		1141	86.70	1.1	2.3	2.3	156	256	60	82	16
9		1143	88.—	.97	2.1	2.1	155	247	61	82	15.5
10		1145	89.55	.80	1.65	1.65	155	245	62	82	13
11		1147	90.84	.76	1.6	1.6	155	243	62	82	13
12		1150	92.11	.67	1.4	1.4	155	244	62	82	12
N-1-1		1153	92.98	.33	.69	.69	152	266	64	83	7.5
2		1155	93.98	.38	.8	.8	157	269	64	83	8.5
3		1157	94.89	.47	1.0	1.0	151	268	62	83	10
4		1159	96.05	.62	1.26	1.26	151	266	61	83	12
5		1201	97.30	.72	1.5	1.5	157	266	61	83	13.5
6		1203	98.52	.68	1.4	1.4	152	270	62	83	13.5
7		1205	99.74	.68	1.4	1.4	152	269	62	83	13.5

74.1

AGE AIR CONSULTING & ENGINEERING, INC.

$29.496 = \frac{\pi D^2}{4}$

TEST ID _____

PAGE ____ OF ____

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)
N-1-8		1207	100.93	.64	1.3	1.3	153	269	63	84	13.5
9		1209	102.1	.60	1.3	1.3	153	264	64	84	13.5
10		1211	103.22	.52	1.1	1.1	154	260	64	84	13
11		1213	104.29	.52	1.1	1.1	154	254	64	85	13
12		1215	105.29	.46	1.0	1.0	152	264	64	85	12.5
N-2-1		1218	106.10	.30	.63	.63	150	259	66	85	9
2		1220	106.96	.32	.67	.67	150	254	66	85	9.5
3		1222	107.94	.35	.73	.73	151	254	64	85	10.5
4		1224	108.87	.48	1.0	1.0	151	249	64	85	12.0
5		1226	109.98	.57	1.2	1.2	151	248	63	85	13.5
6		1228	111.14	.62	1.35	1.35	151	252	63	85	15
7		1230	112.28	.62	1.35	1.35	152	251	64	85	15
8		1232	113.53	.70	1.5	1.5	152	247	64	85	17
9		1234	114.75	.72	1.5	1.5	152	258	65	85	17
10		1236	115.96	.68	1.45	1.45	151	266	65	85	17
11		1238	117.15	.63	1.35	1.35	151	273	65	85	16.5
12		1240	118.300	.60	1.3	1.3	151	267	66	85	17

APPENDIX C

LABORATORY ANALYSES

AIR CONSULTING & ENGINEERING, inc. PARTICULATE LAB DATA

SOURCE SCGCOF No. 2 BOILER

PROBE RINSE	RUN 1	RUN 2	RUN 3	BLANK	
CONTAINER NUMBER	S-13	S-22	S-26	S34	
TOTAL VOLUME (ml)	175	165	185	100	LIQUID LEVEL —
1st GROSS WEIGHT (g)	103.5964	103.7262	103.5697	105.4288	DATE & TIME: 12-1-90 1600
2nd GROSS WEIGHT (g)	103.5964	103.7259	103.5698	105.4286	DATE & TIME: 12-2-90 1600
AVERAGE GROSS WEIGHT (g)	103.5964	103.7161	103.5698	105.4287	
TARE WEIGHT (g)	103.5600	103.6312	103.5412	105.4272	
SUB NET WEIGHT (g)	0.0364	0.0849	0.0286	.0015	
ACETONE BLANK (g)					
TOTAL NET WEIGHT (mg)	36.4	84.9	28.6	1.5	

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	2873	2874	2875	2864	
1st GROSS WEIGHT (g)	0.6720	0.7026	0.6887	0.4211	DATE & TIME: 12-1-90 1600
2nd GROSS WEIGHT (g)	0.6720	0.7024	0.6890	0.4211	DATE & TIME: 12-2-90 1600
AVERAGE GROSS WEIGHT (g)	0.6720	0.7025	0.6889	0.4211	
TARE WEIGHT (g)	0.4082	0.4081	0.4084	0.4209	
SUB NET WEIGHT (g)	0.2638	0.2944	0.2805	.0002	
TOTAL NET WEIGHT (mg)	263.8	294.4	280.5	0.2	

TARE BALANCE CHECK

SEE LAB BOOK

1st GROSS WEIGHT BALANCE CHECK

0 0 10.0g —
0.5g 0.5000 100.0g 99.9999
%RH 35 DATE 12-1-90
Signature S. F. Dale

2nd GROSS WEIGHT BALANCE CHECK

0 0.0 10.0g —
0.5g 0.4999 100.0g 99.9999
%RH 38 DATE 12-2-90
Signature S. F. Dale

APPENDIX D

QUALITY ASSURANCE

AND

CHAIN OF CUSTODY

AIR CONSULTING AND ENGINEERING, Inc.

SAMPLE RECOVERY AND CHAIN OF CUSTODY

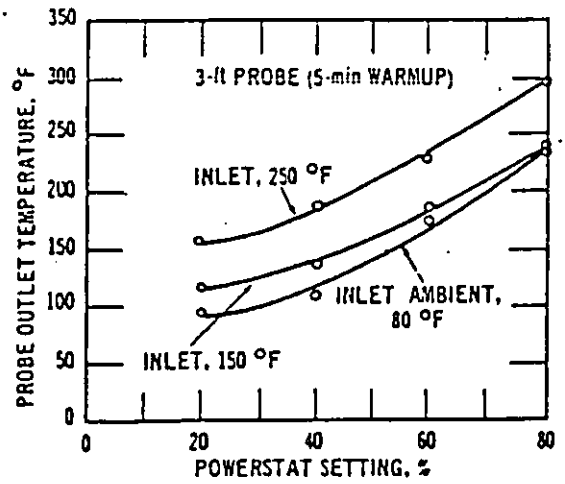
PLANT NAME SUGAR CANE GROWERS TEST DATE 11-28-90
SOURCE NAME No. 2 BOILER SAMPLE RECOVERED BY S.L. NECK
TYPE OF SAMPLE PARTICULATE PARTICULATE ANALYSES BY S.L. NECK

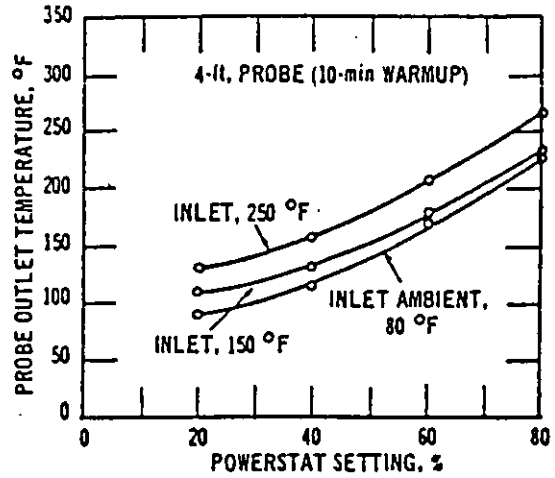
SAMPLE RECOVERY

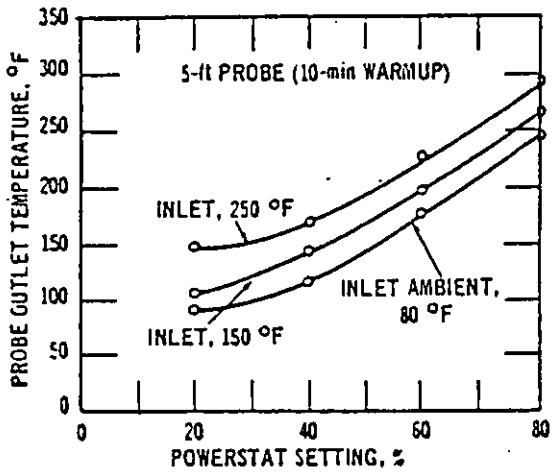
RUN NO.	CONTAINER NO.	LIQUID LEVEL MARKED	COLOR	COMMENTS
1	FILTER 2873		BLACK ~~LIGHT~~	
	PROBE WASH	✓	LIGHT	
2	FILTER 2874		BLACK ~~DARK~~	
	P.W.	✓	DARK	
3	FILTER 2875		BLACK	
	P.W	✓	LIGHT	
ACETONE / WATER BLANK (CIRCLE)		✓		
FILTER BLANK	2864			

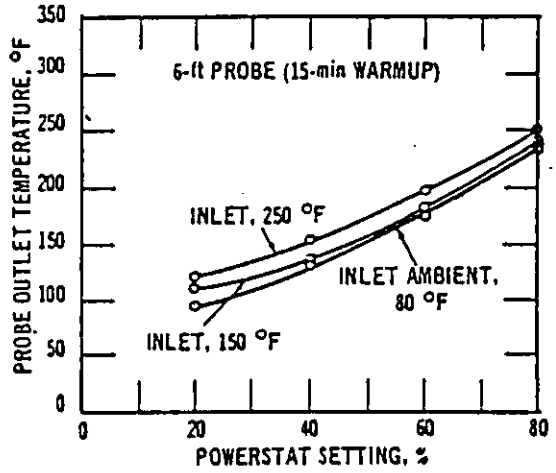
SILICA GEL

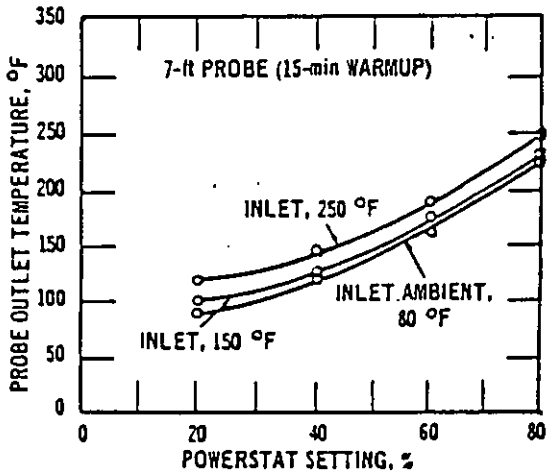
RUN NO.	CONTAINER NO.	FINAL WT. (g)	INIT. WT. (g)	NET WT. (g)	COLOR
1	51	210.0	200.0	10.0	O.K
2	24	215.0	200.0	15.0	O.K
3	34	215.0	200.0	15.0	O.K
			200.0		
			200.0		
			200.0		
			200.0		
			200.0		











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

Probe temperatures.

AIR CONSULTING & ENGINEERING, inc. POST TEST CALIBRATION

DATE 12-16-90 METER BOX NUMBER 1 LEAK CHECK 0.00 CFM at 15 In. Hg.

CLIENT SUGAR GROWERS #2,3,4,5,8 SOURCE _____ THERMOCOUPLE NUMBER _____ PYROMETER NUMBER 1

FLIGHT SERVICE Pb 30.12 In. Hg. ACE BAROMETER Pb 30.12 In. Hg.

ASTM GLASS THERMOMETER 150 °F / THERMOCOUPLE 150 °F ASTM GLASS THERMOMETER 74 °F / METER TEMP 73 °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				
1.7	2.1	407.80	423.065	15.265	980.818	996.581	15.763	72 75 73.5	79 83 81	1251 1312 21	21.5
1.7	2.1	423.065	436.232	13.167	996.581	1010.145	13.564	75 77 76	83 85 84	1315 1333 18	21.5
1.7	2.1	436.232	446.511	10.279	10.145	20.724	10.579	77 78 77.5	85 87 86	1335 1349 16	

CALIBRATED BY: S. J. Peck

$$\bar{Y} = 0.980$$

$$Y_1 = \frac{(15.265)(30.12)(541)}{15.763\,[30.12 + 2.1/13.6][533.5]} = .977$$

$$Y_2 = \frac{(13.167)(30.12)(544)}{(13.564)(30.12 + 2.1/13.6)(536)} = .980$$

$$Y_3 = \frac{(10.279)(30.12)(546)}{(10.579)(30.12 + 2.1/13.6)(537.5)} = .982$$

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. 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 J. Wurts

STANDARD METER CALIBRATION
Meter Number 1040616

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:

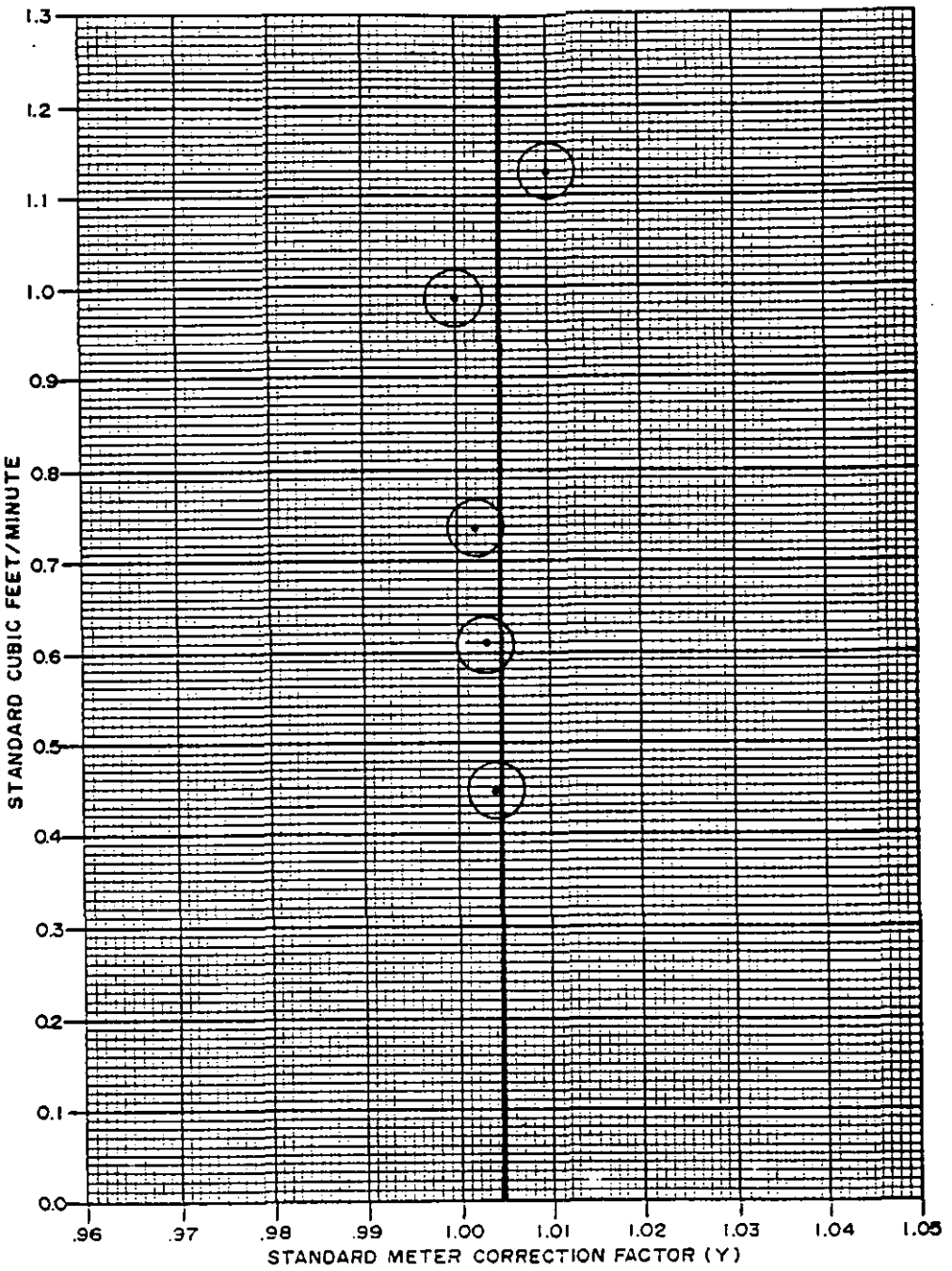
$$Y_a \times Y_s = Y$$

Y_a = actual ratio of field meter to standard meter

Y_s = 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 November 23, 1990, and is checked and/or recalibrated at least annually.



STANDARD METER CALIBRATION CURVE
METER SERIAL NO. 1040616 (SOUTH)
NOVEMBER 23, 1990

AIR CONSULTING
and
ENGINEERING

AIR CONSULTING & ENGINEERING — STANDARD METER CALIBRATION

DATE 11-23-90 LEAK CHECK 0.000 CFM at 12 in. Hg.

METER SERIAL NUMBER 1040616 (South) BAROMETRIC PRESSURE 30.07 in. Hg.

STD GAS METER TEMPERATURE 67 °F/ ASTM GLASS THERMOMETER TEMPERATURE 69 °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			
-0.1	-1.1	0.000	5.333	5.333	272.003	277.309	5.306	70	67	12
-0.1	-1.1	5.333	10.664	5.331	277.309	282.600	5.291	70	67	12
-0.1	-1.1	10.664	15.982	5.318	282.600	287.877	5.277	70	67	12
-0.3	-1.9	0.000	5.490	5.490	288.149	293.623	5.474	70	67	9
-0.3	-1.9	5.490	12.799	7.309	293.623	300.898	7.275	70	67	12
-0.3	-1.9	12.799	18.278	5.479	300.898	306.359	5.461	70	67	9
-0.4	-2.5	0.000	5.160	5.160	306.712	311.863	5.151	70	67	7
-0.4	-2.5	5.160	10.321	5.161	311.863	317.017	5.154	70	67	7
-0.4	-2.5	10.321	15.488	5.167	317.017	322.173	5.156	70	67	7
-0.5	-3.7	0.000	7.481	7.481	322.562	330.068	7.506	70	67	8
-0.5	-3.7	7.481	14.039	6.558	330.068	336.655	6.587	70	67	7
-0.5	-3.7	14.039	19.649	5.610	336.655	342.278	5.623	70	67	6
-0.7	-5.3	0.000	5.639	5.639	342.648	348.279	5.631	70	67	5
-0.7	-5.3	5.639	11.268	5.629	348.279	353.889	5.610	70	67	5
-0.7	-5.3	11.268	16.889	5.621	353.889	359.498	5.609	70	67	5

CALIBRATED BY: G. F. Gabel

	Y	SCFM	Y	SCFM	Y	SCFM	Y	SCFM	Y	SCFM
Run 1	1.002	0.445	1.002	0.611	1.002	0.738	1.000	0.986	1.009	1.129
Run 2	1.005	0.445	1.004	0.610	1.002	0.738	0.999	0.986	1.011	1.127
Run 3	1.005	0.444	1.002	0.610	1.003	0.739	1.001	0.986	1.010	1.126
Average	1.004	0.444	1.003	0.610	1.002	0.738	1.000	0.986	1.010	1.127

air consulting and engineering

APPENDIX E

PRODUCTION RATE CERTIFICATION

BOILER OPERATION PARAMETERS

PLANT Sugar Cane Growers Cooperative BOILER NUMBER 2

DATE 11-28-90 RUN NUMBER 1 OIL METER FACTOR 10

STEAM INTEGRATOR FACTOR 1600 SCRUBBER(S) PRESS.DROP 5, 5

SCRUBBER(S) GPM _____, _____

OPERATOR SIGNATURE N. G SCRUBBER(S)H2O LEVEL _____, _____

Ph(if applicable) _____, _____

INITIAL INTEGRATOR 168553 FINAL INTEGRATOR 168691

TIME	OIL	STEAM			FEEDWATER	
	METER READING	LBS.FLOW	TEMP.	PRESSURE	TEMP.	PRESSURE
0825	1360980	115000	580	425	260	600
8:45		125000	580	430	260	600
9:05		125000	580	430	260	600
9:25		120000	580	425	260	600
9:45		120000	580	430	260	600
10:05		120000	580	430	260	600
1016	1360 1220	120000	580	430	260	600

111 MINUTES

BOILER OPERATION PARAMETERS

PLANT Sugar Cane Growers

BOILER NUMBER 2

DATE 11-28-90 RUN NUMBER 2

OIL METER FACTOR 1

STEAM INTEGRATOR FACTOR 1600

SCRUBBER(S) PRESS.DROP 5, 5

SCRUBBER(S) GPM ____, ____

OPERATOR SIGNATURE KS

SCRUBBER(S)H2O LEVEL ____, ____

Ph(if applicable) 8, 8

INITIAL INTEGRATOR 168745

FINAL INTEGRATOR 168879

TIME	OIL	STEAM			FEEDWATER	
	METER READING	LBS.FLOW	TEMP.	PRESSURE	TEMP.	PRESSURE
1058	130310	120000	580	430	260	600
11:18		120000	580	430	260	600
11:38		120000	580	430	260	600
11:58		118000	580	430	260	600
12:18		120000	580	430	260	600
12:38		120000	580	430	260	600
12:43	130550					
	130 1550					

105

BOILER OPERATION PARAMETERS

PLANT Sugar Cane Growers Cooperative BOILER NUMBER 2

DATE 12-28-70 RUN NUMBER 3 OIL METER FACTOR

STEAM INTEGRATOR FACTOR 1600 SCRUBBER(S) PRESS.DROP 5.5

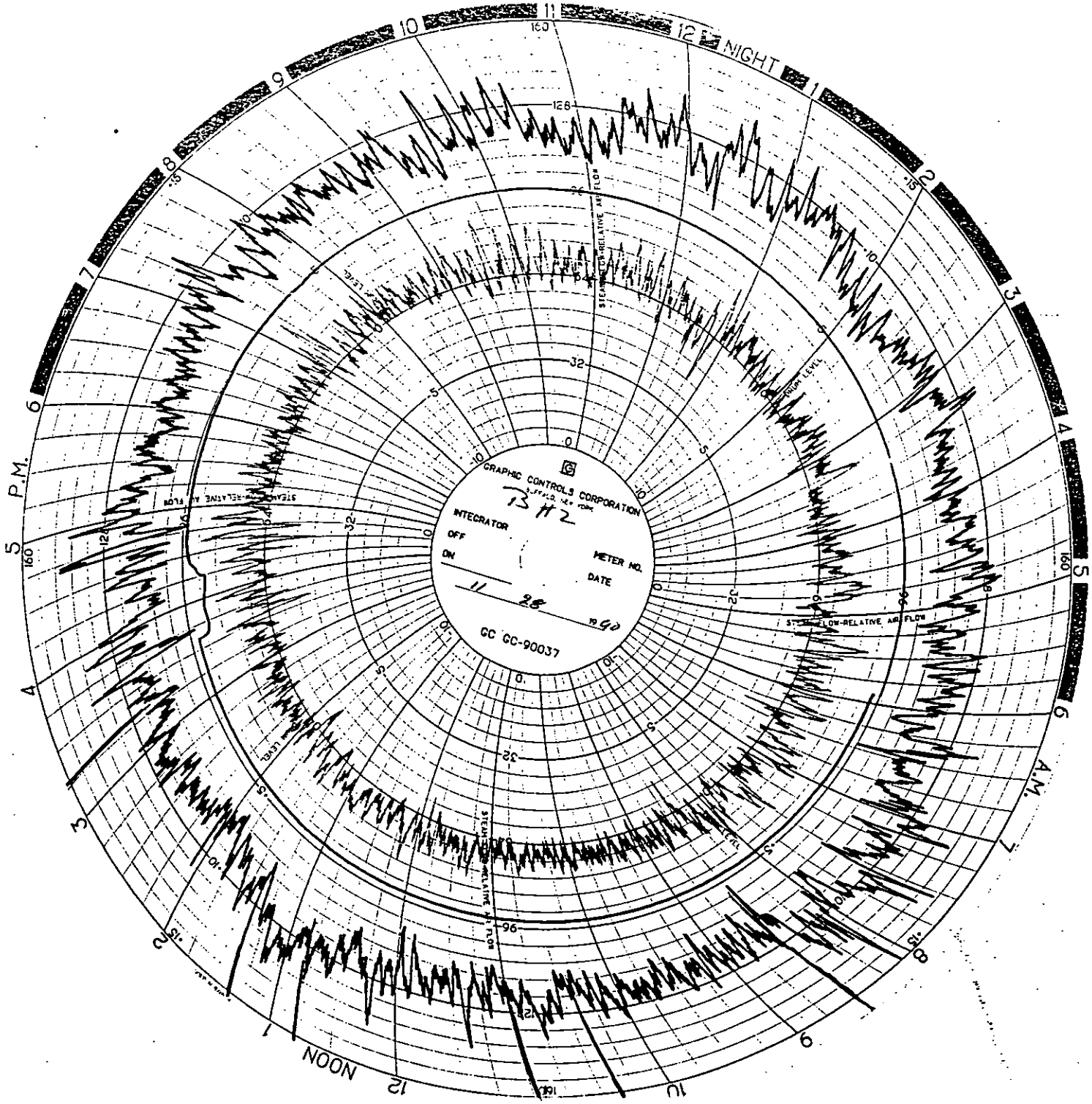
SCRUBBER(S) GPM

OPERATOR SIGNATURE SOS SCRUBBER(S)H2O LEVEL 7.7

Ph(if applicable) 7.7

INITIAL INTEGRATOR 168929 FINAL INTEGRATOR 169069

TIME	OIL	STEAM			FEEDWATER	
	METER READING	LBS.FLOW	TEMP.	PRESSURE	TEMP.	PRESSURE
1321	130163	120000	580	430	260	600
1:41		116000	580	430	260	600
2:01		118000	580	430	260	600
2:21		120000	580	430	260	600
2:41		120000	580	430	260	600
3:01		120000	580	440	260	600
3:11		116000	580	430	260	600
1516	130191					


GRAPHIC CONTROLS CORPORATION
BUFFALO, NEW YORK
B H 2
INTEGRATOR
OFF
ON
METER NO.
DATE
11 28 1990
GC GC-90037
NIGHT
A.M.
NOON
P.M.
STEAM FLOW-RELATIVE AIR FLOW
STEAM FLOW-RELATIVE AIR FLOW
STEAM FLOW-RELATIVE AIR FLOW
STEAM FLOW-RELATIVE AIR FLOW
SUMP LEVEL
SUMP LEVEL

APPENDIX F

PROJECT PARTICIPANTS

PROJECT PARTICIPANTS

ACEI:	
STEPHEN L. NECK,P.E.	FIELD TESTING REPORT PREPARTION
GERARD GAUTHREAUX	FIELD TESTING
SCGCOF:	
JOSE ALVEREZ	PROJECT COORDINATOR
BLAS MARIN	TEST COORDINATOR
PALM BEACH COUNTY:	
AJAYA K. SATYAL	TEST OBSERVER