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:** 26

**Title:** Source Test Report for Particulate Emissions Twin Impingement Wet Scrubbers Number 1 Boiler: Sugar Cane Growers Cooperative of Florida

November 1990

# SOURCE TEST REPORT
for
PARTICULATE EMISSIONS

TWIN IMPINGEMENT WET SCRUBBERS
NUMBER 1 BOILER

SUGAR CANE GROWERS COOPERATIVE of FLORIDA
BELLE GLADE, FLORIDA

NOVEMBER 19, 1990

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

PREPARED BY:
AIR CONSULTING and ENGINEERING, INC.
2106 N.W. 67th PLACE
SUITE 4
GAINESVILLE, FLORIDA
32607
14642 FLAMINGO DRIVE
WEST PALM BEACH, FLORIDA
33470

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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

Stephen L. Neck, P.E.

State of Florida
Registration No. 20020

December 5, 1990

Date

SEAL



2106 N.W. 67th Place, Suite 4 • Gainesville, Florida 32606 • (904) 335-1889

## 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 19, 1990. Testing was performed at the Number 1 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.

Mr. Ajaya K. Satyal of the Palm Beach County HRS witnessed a portion of the testing.

## 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 43.56 pounds per hour (LB/HR) and 0.211 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.

TABLE 1
EMISSION SUMMARY
SUGAR GROWERS COOPERATIVE OF FLORIDA
NUMBER 1 BOILER
NOVEMBER 19,1990

| RUN NUMBER | TIME | ACTUAL EMISSIONS | | ALLOWABLE EMISSIONS | |
|---|---|---|---|---|---|
| | | LB/HR | LB/MMBTU | LB/HR | LB/MMBTU |
| 1 | 0901-1042 101 | 41.67 | 0.196 | 49.92 | 0.235 |
| 2 | 1126-1305 99 | 44.07 | 0.212 | 48.80 | 0.235 |
| 3 | 1336-1516 105 | 44.95 | 0.224 | 47.11 | 0.235 |
| AVERAGES | 102 | 43.56 | 0.211 | 48.98 | 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 123825 pounds per hour steam production over the three run test period.

## 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 166" from an upstream disturbance and 52" from the outlet while the north stack ports are 154" from an upstram disturbance and 53" from the outlet.

Twenty-four test points were sampled on each stack for each test run. The traverse were located as shown below. The stack configuration was such that there was 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 |

## 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

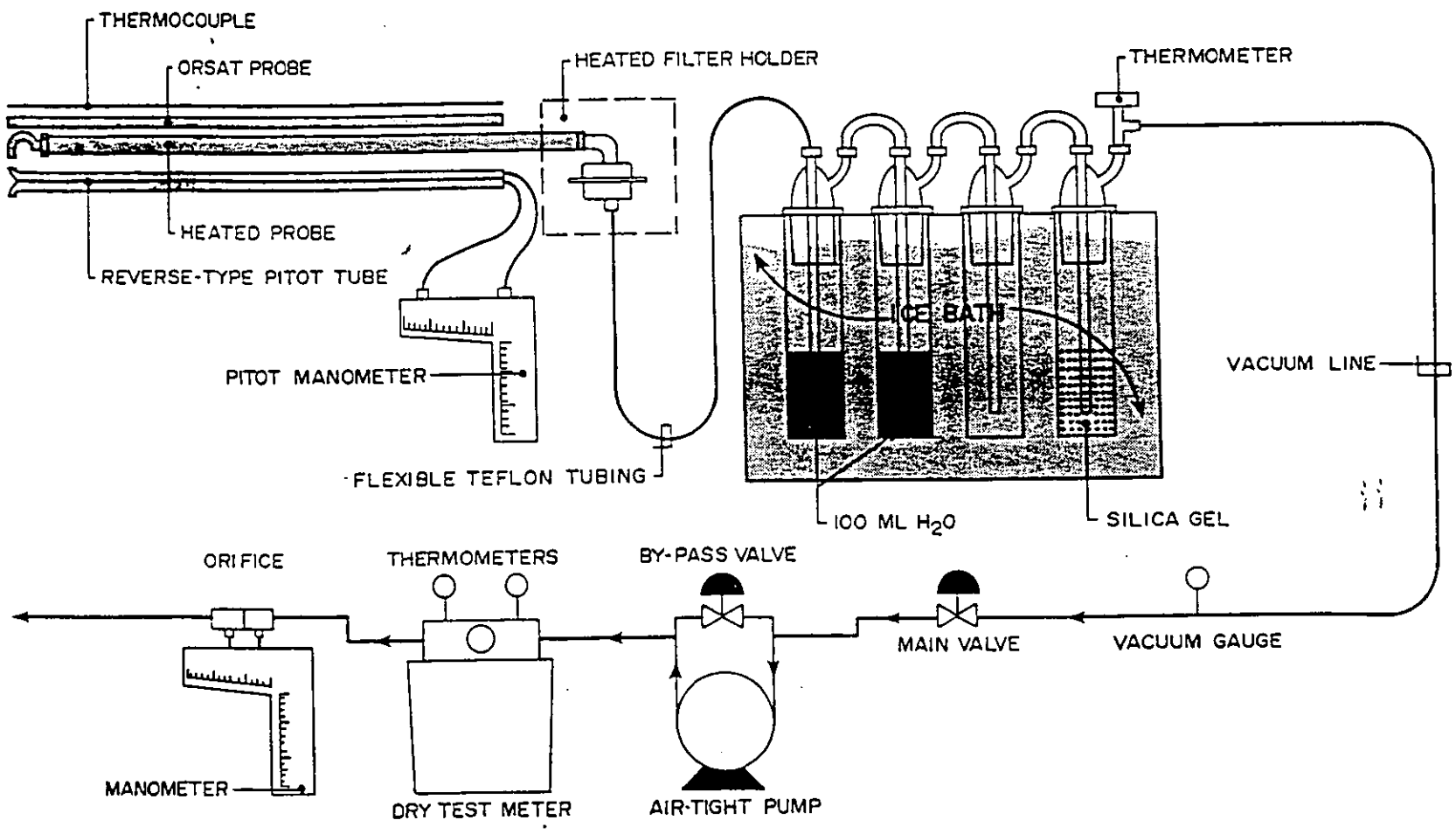


FIGURE 1.
EPA METHOD 5 SAMPLING TRAIN

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and
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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

AIR CONSULTING & ENGINEERING, INC.
COMPLETE EMISSION DATA

| | | | |
|---|---|---|---|
| PLANT: | SUGAR CANE GROWERS COOPERATIVE | DATE | 11-19-90 |
| LOCATION: | BELLE GLADE, FLA | RUN NUMBER | 1 |
| SOURCE: | NUMBER 1 BOILER SCRUBBER OUTLET | TIME | 0901-1305 |

| | | |
|---|---|---|
| TIME INTERVAL | 109 | min. |
| FINAL OIL | 70130 | |
| BEGIN OIL | 69870 | |
| FACTOR | 1 | |
| FINAL STEAM | 587613 | |
| BEGIN STEAM | 587471 | |
| FACTOR | 1600 | |
| TEMPERATURE | 580 | |
| PRESSURE | 440 | |
| FEEDWATER: | | |
| TEMPERATURE: | 260 | |
| PRESSURE: | 600 | |
| STEAM BTU/LB. | 1290.8 | |
| FEEDWATER BTU/LB. | 228.6 | |
| NET STEAM BTU/LB. | 1062.2 | |
| STEAM RATE LB/HR. | 125064 | |
| BOILER EFFICIENY | 62.5 | |
| TOTAL HEAT INPUT | 212.55 | MMBTUH |
| OIL GPH | 143.12 | |
| OIL BTU/GAL. | 150000 | |
| TOTAL OIL BTU INPUT | 21.47 | MMBTUH |
| TOTAL NON-OIL BTU INPUT | 191.08 | MMBTUH |
| ALLOWABLE EMISSION FROM NON-OIL | .25 | LB/MMBTU |
| ALLOWABLE EMISSION FROM OIL | .10 | LB/MMBTU |
| TOTAL ALLOWABLE EMISSION | 49.92 | LB/HR |
| TOTAL ALLOWABLE EMISSION | 0.235 | LB/MMBTU |
| TOTAL ACTUAL EMISSION | 41.67 | LB/HR |
| TOTAL ACTUAL EMISSION | 0.196 | LB/MMBTU |

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Complete Emission Results

| | | | |
|---|---|---|---|
| Plant: | SUGAR GROWERS CO-OP OF FLORIDA | | |
| Location: | BELLE GLADE,FLORIDA | Date: | 11-19-90 |
| Stack: | NUMBER 1 BOILER | Run 1 | From 0901 - 1042 |

| | | | |
|---|---|---|---|
| Y Factor | 0.994 | Nozzle Diameter | 0.237 In |
| Total Time | 96.00 Min | Nozzle Area | 0.000306 $Ft^2$ |
| Stack Area | 29.500 $Ft^2$ | Barometric Pressure | 30.34 In Hg |
| Stack Temperature | 150.5 °F | Meter Temperature | 72.3 °F |
| Stack Pressure | 30.34 In Hg | Meter Orifice Diff | 1.849 In H2O |
| Stack Avg √ Vel Head | 0.874 In H2O | Meter Volume | 65.006 CF |
| | | Condensate Vol | 333.70 ml |

| | | | |
|---|---|---|---|
| 1. | Volume Water Vapor Sampled | 15.707 | SCF |
| 2. | Volume Standard Dry Gas Sampled | 65.259 | SCF |
| 3. | Total Standard Sample Volume | 80.966 | SCF |
| 4. | Percent Moisture | 19.400 | |
| 5. | Percent Dry Air | 80.600 | |
| 6. | Molecular Weight of Dry Flue Gas | 29.880 | |
| 7. | Molecular Weight of Wet Flue Gas | 27.575 | |
| 8. | Specific Gravity Flue Gas | 0.96 | |
| 9. | Percent Oxygen [O2] | 11.00 | |
| 10. | Percent Carbon Dioxide [CO2] | 9.00 | |
| 11. | Percent Excess Air | 107.950 | |
| 12. | Velocity of Flue Gas | 53.615 | FPS |
| 13. | Actual Volumetric Flow Rate | 94897.9 | ACFM |
| 14. | Dry Volumetric Flow Rate | 76487.7 | ACFMD |
| 15. | Standard Volumetric Flow Rate | 67082.4 | SCFMD |
| 16. | Emission Concentration | 0.0725 | gr/SCF |
| 17. | Emission Concentration | 0.0512 | gr/ACF |
| 18. | Emission Rate | 41.67 | lbs/Hr |
| 19. | Percent Isokinetic | 97.6 | |

| | | |
|---|---|---|
| Probe/Nozzle Wash | 19.3 | mg |
| Filter | 287.2 | mg |
| Total | 306.5 | mg |

Plant: SUGAR GROWERS CO-OP OF FLORIDA
Date: 11-19-90
Stack: NUMBER 1 BOILER

Vwv Volume Water Vapor Sampled
Vwv = 0.04707 x 333.7 = 15.707 SCF

VMstd Volume Standard Dry Gas Sampled
VMstd = 17.64 x 65.006 x 0.994 x
[ 30.34 + ( 1.849 / 13.6)] / ( 72.3 + 460) = 65.259 SCF

Vt Total Standard Sample Volume
Vt = 15.707 + 65.259 = 80.966 SCF

W Percent Water = ( 15.707 / 80.966) x 100 = 19.4 %

FDA Percent Dry Air = (1 - 0.194) x 100 = 80.6 %

Md Molecular Weight of Dry Stack Gas
Md = (0.44 X 9.00 %CO2) + (0.32 X 11.00 %O2) +
[0.28 X (79.90 %N2 + 0.10 %CO)] = 29.880

Ms Molecular Weight of Wet Stack Gas
Ms = ( 29.880 x 0.806 ) + ( 18 x 0.194 ) = 27.575

SG Specific Gravity Stack Gas
SG = 27.575 / 28.84 = 0.96

Ea Percent Excess Air

$$Ea = \frac{((11\ \%O2)-(.1\ \%CO / 2) \times 100)}{[(.264 \times (79.9\ \%N2)) - (11\ \%O2)-(.1\ \%CO / 2)]}$$

Ea = 107.950

Vs Velocity of Stack
Vs = (85.49 x 0.84 x 0.874) x √[( 150.5 + 460) / ( 30.34 x 27.575)]
Vs = 53.615

Qa Actual Volumetric Flow
Qa = ( 29.500 x 53.615 x 60 ) = 94897.9 ACFM

Qd Dry Volumetric Flow
Qd = ( 94897.9 x 0.806 ) = 76487.7 ACFMD

Qsd Standard Volumetric Flow
Qsd = 94897.9 x 0.806 x [ 528 / ( 150.5 + 460 )] x
( 30.34 / 29.92 ) = 67082.4 SCFMD

Plant: SUGAR GROWERS CO-OP OF FLORIDA
Date: 11-19-90
Stack: NUMBER 1 BOILER

ESTP Emission Rate
gr/SCF = [ 0.01543 x ( 19.3 + 287.2 )] / ( 65.259 )
gr/SCF = 0.0725

Lbs/Hr Emission Rate
Lbs/Hr = 0.0725 / 7000 x 67082.4 x 60 = 41.67

I Percent Isokinetic
I = 100 x ( 150.5 + 460) x [(0.002669 x 333.7) + ( 65.006 x 0.994 / ( 72.3 + 460)) x ( 30.34 + ( 1.849 / 13.6))] / (60 x 96 x 53.615 x 30.34 x 0.000306)
I = 97.6 %

Plant: SUGAR GROWERS CO-OP OF-FLORIDA
Date: 11-19-90
Stack: NUMBER 1 BOILER
Run Number: 1

Average SQR Velocity Head = 0.874
Velocity Head Inputs:

| | | | | | | |
|---|---|---|---|---|---|---|
| 0.4300 | 0.4300 | 0.5300 | 0.6100 | 0.7300 | 0.7300 | 0.8200 |
| 0.9200 | 0.9200 | 1.0000 | 0.9200 | 0.8400 | 0.4700 | 0.4500 |
| 0.5100 | 0.6000 | 0.7000 | 0.7300 | 0.8900 | 1.0000 | 1.0000 |
| 0.8300 | 0.7000 | 0.6800 | 0.5200 | 0.6000 | 0.6000 | 0.7000 |
| 0.9200 | 1.1000 | 0.7500 | 0.6400 | 0.7100 | 0.7100 | 0.7700 |
| 0.6700 | 0.4800 | 0.4800 | 0.6300 | 0.8200 | 1.1000 | 1.1500 |
| 1.0500 | 1.1500 | 1.1500 | 1.1000 | 1.1000 | 1.0500 | |

Average Orifice Pressure = 1.849
Orifice Pressure Inputs:

| | | | | | | |
|---|---|---|---|---|---|---|
| 1.0800 | 1.0800 | 1.3000 | 1.5000 | 1.8000 | 1.8000 | 2.0500 |
| 2.3000 | 2.3000 | 2.5000 | 2.3000 | 2.1000 | 1.1800 | 1.1300 |
| 1.2800 | 1.5000 | 1.7500 | 1.8000 | 2.2200 | 2.5000 | 2.5000 |
| 2.1000 | 1.7500 | 1.7000 | 1.3000 | 1.5000 | 1.5000 | 1.7500 |
| 2.3000 | 2.7000 | 1.8500 | 1.6000 | 1.6000 | 1.8000 | 1.9000 |
| 1.7000 | 1.2000 | 1.2000 | 1.5800 | 2.0500 | 2.2500 | 2.2500 |
| 2.2000 | 2.2000 | 2.2000 | 2.2000 | 2.2000 | 2.2000 | |

Average Stack Temperature = 150.5
Stack Temperature Inputs:

| | | | | | | |
|---|---|---|---|---|---|---|
| 145 | 146 | 146 | 150 | 150 | 147 | 149 |
| 149 | 150 | 150 | 150 | 150 | 150 | 150 |
| 149 | 150 | 151 | 150 | 150 | 150 | 149 |
| 151 | 150 | 148 | 149 | 149 | 149 | 148 |
| 149 | 149 | 154 | 153 | 152 | 152 | 152 |
| 153 | 152 | 151 | 152 | 154 | 152 | 152 |
| 152 | 154 | 153 | 155 | 154 | 153 | |

Average Meter Temperature = 72.3
Meter Temperature Inputs:

| | | | | | | |
|---|---|---|---|---|---|---|
| 63 | 63 | 63 | 64 | 64 | 64 | 65 |
| 66 | 66 | 67 | 68 | 68 | 69 | 70 |
| 70 | 70 | 71 | 71 | 72 | 72 | 72 |
| 73 | 73 | 74 | 74 | 75 | 75 | 75 |
| 75 | 75 | 75 | 76 | 76 | 76 | 76 |
| 76 | 77 | 77 | 77 | 77 | 77 | 77 |
| 78 | 78 | 78 | 78 | 78 | 78 | |

AIR CONSULTING & ENGINEERING, INC.
COMPLETE EMISSION DATA

| | | | |
|---|---|---|---|
| PLANT: | SUGAR CANE GROWERS COOPERATIVE | DATE | 11-19-90 |
| LOCATION: | BELLE GLADE, FLA | RUN NUMBER | 2 |
| SOURCE: | NUMBER 1 BOILER SCRUBBER OUTLET | TIME | 1126-1305 |

| | | |
|---|---|---|
| TIME INTERVAL | 113 | min. |
| FINAL OIL | 70460 | |
| BEGIN OIL | 70200 | |
| FACTOR | 1 | |
| FINAL STEAM | 587792 | |
| BEGIN STEAM | 587648 | |
| FACTOR | 1600 | |
| TEMPERATURE | 580 | |
| PRESSURE | 450 | |
| FEEDWATER: | | |
| TEMPERATURE: | 260 | |
| PRESSURE: | 600 | |
| STEAM BTU/LB. | 1289.4 | |
| FEEDWATER BTU/LB. | 228.6 | |
| NET STEAM BTU/LB. | 1060.8 | |
| STEAM RATE LB/HR. | 122336 | |
| BOILER EFFICIENY | 62.5 | |
| TOTAL HEAT INPUT | 207.64 | MMBTUH |
| OIL GPH | 138.05 | |
| OIL BTU/GAL. | 150000 | |
| TOTAL OIL BTU INPUT | 20.71 | MMBTUH |
| TOTAL NON-OIL BTU INPUT | 186.93 | MMBTUH |
| ALLOWABLE EMISSION FROM NON-OIL | .25 | LB/MMBTU |
| ALLOWABLE EMISSION FROM OIL | .10 | LB/MMBTU |
| TOTAL ALLOWABLE EMISSION | 48.80 | LB/HR |
| TOTAL ALLOWABLE EMISSION | 0.235 | LB/MMBTU |
| TOTAL ACTUAL EMISSION | 44.07 | LB/HR |
| TOTAL ACTUAL EMISSION | 0.212 | LB/MMBTU |

AIR CONSULTING AND ENGINEERING, INC.

Complete Emission Results

| | | | |
|---|---|---|---|
| Plant: | SUGAR GROWERS CO-OP OF FLORIDA | | |
| Location: | BELLE GLADE,FLORIDA | Date: | 11-19-90 |
| Stack: | NUMBER 1 BOILER | Run 2 | From 1126 - 1305 |

| | | | | | |
|---|---|---|---|---|---|
| Y Factor | 0.994 | | Nozzle Diameter | 0.237 | In |
| Total Time | 96.00 | Min | Nozzle Area | 0.000306 | $Ft^2$ |
| Stack Area | 29.500 | $Ft^2$ | Barometric Pressure | 30.34 | In Hg |
| Stack Temperature | 146.9 | °F | Meter Temperature | ~~77.1~~ | °F |
| Stack Pressure | 30.34 | In Hg | Meter Orifice Diff | 1.865 | In H2O |
| Stack Avg √ Vel Head | 0.857 | In H2O | Meter Volume | 65.815 | CF |
| | | | Condensate Vol | 301.50 | ml |

| | | | |
|---|---|---|---|
| 1. | Volume Water Vapor Sampled | 14.192 | SCF |
| 2. | Volume Standard Dry Gas Sampled | 65.483 | SCF |
| 3. | Total Standard Sample Volume | 79.675 | SCF |
| 4. | Percent Moisture | 17.800 | |
| 5. | Percent Dry Air | 82.200 | |
| 6. | Molecular Weight of Dry Flue Gas | 29.892 | |
| 7. | Molecular Weight of Wet Flue Gas | 27.775 | |
| 8. | Specific Gravity Flue Gas | 0.96 | |
| 9. | Percent Oxygen [O2] | 11.30 | |
| 10. | Percent Carbon Dioxide [CO2] | 9.00 | |
| 11. | Percent Excess Air | 115.214 | |
| 12. | Velocity of Flue Gas | 52.227 | FPS |
| 13. | Actual Volumetric Flow Rate | 92442.7 | ACFM |
| 14. | Dry Volumetric Flow Rate | 75987.9 | ACFMD |
| 15. | Standard Volumetric Flow Rate | 67039.8 | SCFMD |
| 16. | Emission Concentration | 0.0767 | gr/SCF |
| 17. | Emission Concentration | 0.0556 | gr/ACF |
| 18. | Emission Rate | 44.07 | lbs/Hr |
| 19. | Percent Isokinetic | 98.0 | |

| | | |
|---|---|---|
| Probe/Nozzle Wash | 14.7 | mg |
| Filter | 310.8 | mg |
| Total | 325.5 | mg |

Plant: SUGAR GROWERS CO-OP OF FLORIDA
Date: 11-19-90
Stack: NUMBER 1 BOILER
Run Number: 2

Average SQR Velocity Head = 0.857
Velocity Head Inputs:

| | | | | | | |
|---|---|---|---|---|---|---|
| 0.4200 | 0.4200 | 0.5600 | 0.6300 | 0.7600 | 0.7600 | 0.9100 |
| 1.1500 | 1.1000 | 0.9800 | 0.7300 | 0.6800 | 0.4200 | 0.4400 |
| 0.6000 | 0.6000 | 0.6600 | 0.7000 | 0.9100 | 1.0000 | 1.0000 |
| 0.8200 | 0.7200 | 0.6200 | 0.4800 | 0.5000 | 0.6200 | 0.6900 |
| 0.9000 | 0.9800 | 0.9600 | 0.7200 | 0.7000 | 0.6600 | 0.6400 |
| 0.6400 | 0.5300 | 0.5300 | 0.5300 | 0.7100 | 0.9500 | 0.9100 |
| 0.9000 | 1.0500 | 0.9600 | 0.9200 | 0.9000 | 0.9000 | |

Average Orifice Pressure = 1.865
Orifice Pressure Inputs:

| | | | | | | |
|---|---|---|---|---|---|---|
| 1.0500 | 1.0500 | 1.4000 | 1.5800 | 1.9000 | 1.9000 | 2.3000 |
| 2.8800 | 2.6000 | 2.5000 | 1.8000 | 1.7000 | 1.0500 | 1.1000 |
| 1.5000 | 1.5000 | 1.6500 | 1.7500 | 2.2500 | 2.5000 | 2.5000 |
| 2.0500 | 1.8000 | 1.5500 | 1.2000 | 1.2500 | 1.5500 | 1.7000 |
| 2.2500 | 2.4500 | 2.4000 | 1.8000 | 1.7500 | 1.6500 | 1.6000 |
| 1.6000 | 1.3000 | 1.3000 | 1.3000 | 1.8000 | 2.4000 | 2.3000 |
| 2.2500 | 2.6000 | 2.4000 | 2.3000 | 2.2500 | 2.2500 | |

Average Stack Temperature = 146.9
Stack Temperature Inputs:

| | | | | | | |
|---|---|---|---|---|---|---|
| 145 | 143 | 143 | 143 | 143 | 144 | 144 |
| 144 | 143 | 144 | 145 | 145 | 145 | 144 |
| 144 | 144 | 147 | 146 | 145 | 146 | 147 |
| 147 | 147 | 147 | 147 | 148 | 146 | 145 |
| 146 | 148 | 149 | 149 | 148 | 149 | 150 |
| 150 | 149 | 150 | 151 | 150 | 149 | 150 |
| 151 | 150 | 149 | 151 | 151 | 149 | |

Average Meter Temperature = 77.1
Meter Temperature Inputs:

| | | | | | | |
|---|---|---|---|---|---|---|
| 73 | 72 | 72 | 72 | 73 | 73 | 73 |
| 73 | 74 | 74 | 74 | 75 | 75 | 75 |
| 75 | 76 | 76 | 76 | 76 | 77 | 77 |
| 77 | 77 | 77 | 78 | 78 | 78 | 78 |
| 78 | 78 | 78 | 79 | 79 | 79 | 79 |
| 80 | 80 | 80 | 80 | 80 | 80 | 81 |
| 81 | 81 | 81 | 81 | 81 | 81 | |

AIR CONSULTING & ENGINEERING, INC.
COMPLETE EMISSION DATA

| | | | |
|---|---|---|---|
| PLANT: | SUGAR CANE GROWERS COOPERATIVE | DATE | 11-19-90 |
| LOCATION: | BELLE GLADE, FLA | RUN NUMBER | 3 |
| SOURCE: | NUMBER 1 BOILER SCRUBBER OUTLET | TIME | 1336-1516 |

| | | |
|---|---|---|
| TIME INTERVAL | 106 | min. |
| FINAL OIL | 70760 | |
| BEGIN OIL | 70520 | |
| FACTOR | 1 | |
| FINAL STEAM | 587960 | |
| BEGIN STEAM | 587823 | |
| FACTOR | 1600 | |
| TEMPERATURE | 580 | |
| PRESSURE | 440 | |
| FEEDWATER: | | |
| TEMPERATURE: | 260 | |
| PRESSURE: | 600 | |
| STEAM BTU/LB. | 1239.4 | |
| FEEDWATER BTU/LB. | 228.6 | |
| NET STEAM BTU/LB. | 1010.8 | |
| STEAM RATE LB/HR. | 124075 | |
| BOILER EFFICIENY | 62.5 | |
| TOTAL HEAT INPUT | 200.66 | MMBTUH |
| OIL GPH | 135.85 | |
| OIL BTU/GAL. | 150000 | |
| TOTAL OIL BTU INPUT | 20.38 | MMBTUH |
| TOTAL NON-OIL BTU INPUT | 180.29 | MMBTUH |
| ALLOWABLE EMISSION FROM NON-OIL | .25 | LB/MMBTU |
| ALLOWABLE EMISSION FROM OIL | .10 | LB/MMBTU |
| TOTAL ALLOWABLE EMISSION | 47.11 | LB/HR |
| TOTAL ALLOWABLE EMISSION | 0.235 | LB/MMBTU |
| TOTAL ACTUAL EMISSION | 44.95 | LB/HR |
| TOTAL ACTUAL EMISSION | 0.224 | LB/MMBTU |

AIR CONSULTING AND ENGINEERING, INC.

Complete Emission Results

| | | | |
|---|---|---|---|
| Plant: | SUGAR GROWERS CO-OP OF FLORIDA | | |
| Location: | BELLE GLADE,FLORIDA | Date: | 11-19-90 |
| Stack: | NUMBER 1 BOILER | Run 3 | From 1336 - 1516 |

| | | | | | |
|---|---|---|---|---|---|
| Y Factor | 0.994 | | Nozzle Diameter | 0.237 | In |
| Total Time | 96.00 | Min | Nozzle Area | 0.000306 | $Ft^2$ |
| Stack Area | 29.500 | $Ft^2$ | Barometric Pressure | 30.34 | In Hg |
| Stack Temperature | 147.0 | °F | Meter Temperature | 79.7 | °F |
| Stack Pressure | 30.34 | In Hg | Meter Orifice Diff | 1.782 | In H2O |
| Stack Avg √ Vel Head | 0.839 | In H2O | Meter Volume | 64.942 | CF |
| | | | Condensate Vol | 291.60 | ml |

| | | | |
|---|---|---|---|
| 1. | Volume Water Vapor Sampled | 13.726 | SCF |
| 2. | Volume Standard Dry Gas Sampled | 64.290 | SCF |
| 3. | Total Standard Sample Volume | 78.016 | SCF |
| 4. | Percent Moisture | 17.600 | |
| 5. | Percent Dry Air | 82.400 | |
| 6. | Molecular Weight of Dry Flue Gas | 29.892 | |
| 7. | Molecular Weight of Wet Flue Gas | 27.799 | |
| 8. | Specific Gravity Flue Gas | 0.96 | |
| 9. | Percent Oxygen [O2] | 11.30 | |
| 10. | Percent Carbon Dioxide [CO2] | 9.00 | |
| 11. | Percent Excess Air | 115.214 | |
| 12. | Velocity of Flue Gas | 51.113 | FPS |
| 13. | Actual Volumetric Flow Rate | 90469.4 | ACFM |
| 14. | Dry Volumetric Flow Rate | 74546.8 | ACFMD |
| 15. | Standard Volumetric Flow Rate | 65759.4 | SCFMD |
| 16. | Emission Concentration | 0.0798 | gr/SCF |
| 17. | Emission Concentration | 0.0580 | gr/ACF |
| 18. | Emission Rate | 44.95 | lbs/Hr |
| 19. | Percent Isokinetic | 98.1 | |

| | | |
|---|---|---|
| Probe/Nozzle Wash | 22.4 | mg |
| Filter | 309.9 | mg |
| Total | 332.3 | mg |

Avg $O_2$ = 11.2

Temp = 147

Flow = 66,627

Oil = 20.9 mmBtu/hr, 139 gal/hr

Bagasse = 186.1 / 207.0

Plant: SUGAR GROWERS CO-OP OF FLORIDA
Date: 11-19-90
Stack: NUMBER 1 BOILER
Run Number: 3

Average SQR Velocity Head = 0.839
Velocity Head Inputs:

| | | | | | | |
|---|---|---|---|---|---|---|
| 0.4200 | 0.4200 | 0.5200 | 0.5200 | 0.7800 | 0.7300 | 0.830 |
| 0.9100 | 0.8900 | 0.7500 | 0.6600 | 0.7300 | 0.4400 | 0.440 |
| 0.4200 | 0.6200 | 0.6800 | 0.6800 | 0.8300 | 0.9300 | 0.930 |
| 0.8300 | 0.7100 | 0.7300 | 0.5200 | 0.5200 | 0.5500 | 0.750 |
| 0.8000 | 0.9800 | 0.9800 | 0.6900 | 0.6900 | 0.7100 | 0.690 |
| 0.6900 | 0.6400 | 0.5000 | 0.5200 | 0.6200 | 0.8200 | 0.880 |
| 0.9300 | 0.8500 | 0.9300 | 0.9300 | 0.8800 | 0.8000 | |

Average Orifice Pressure = 1.782
Orifice Pressure Inputs:

| | | | | | | |
|---|---|---|---|---|---|---|
| 1.0500 | 1.0500 | 1.3000 | 1.3000 | 1.9500 | 1.8000 | 1.800 |
| 2.1000 | 2.3000 | 2.3000 | 1.9000 | 1.6500 | 1.1000 | 1.100 |
| 1.0500 | 1.5500 | 1.7000 | 1.7000 | 2.1000 | 2.3000 | 2.300 |
| 2.1000 | 1.7800 | 1.8000 | 1.3000 | 1.3000 | 1.4000 | 1.900 |
| 2.4500 | 2.4500 | 1.7000 | 1.7000 | 1.7000 | 1.7000 | 1.700 |
| 1.6000 | 1.2500 | 1.3000 | 1.5500 | 2.0500 | 2.2000 | 2.300 |
| 2.1000 | 2.3000 | 2.3000 | 2.2000 | 2.0000 | 2.0000 | |

Average Stack Temperature = 147.0
Stack Temperature Inputs:

| | | | | | | |
|---|---|---|---|---|---|---|
| 142 | 143 | 145 | 146 | 146 | 146 | 146 |
| 147 | 148 | 145 | 146 | 146 | 144 | 145 |
| 143 | 143 | 143 | 143 | 145 | 146 | 146 |
| 146 | 145 | 146 | 144 | 144 | 150 | 146 |
| 147 | 147 | 150 | 150 | 150 | 149 | 150 |
| 150 | 149 | 149 | 148 | 150 | 149 | 148 |
| 149 | 149 | 150 | 152 | 152 | 151 | |

Average Meter Temperature = 79.7
Meter Temperature Inputs:

| | | | | | | |
|---|---|---|---|---|---|---|
| 76 | 76 | 76 | 76 | 76 | 76 | 77 |
| 77 | 77 | 78 | 78 | 78 | 79 | 79 |
| 79 | 79 | 79 | 79 | 80 | 80 | 80 |
| 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| 80 | 81 | 81 | 81 | 81 | 81 | 81 |
| 81 | 81 | 81 | 81 | 82 | 82 | 82 |
| 82 | 82 | 82 | 82 | 83 | 83 | |

# APPENDIX B

# FIELD DATA SHEETS

## STACK SAMPLING FIELD DATA SHEET

,2 13.6 x 2 (Two) 3204 FPM 47256 x 2 33525.5 x 2

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

TEST ID _____
PAGE ____ OF ____

PLANT Sugar Growers Coop
SOURCE No. 1 Boiler
PLANT LOCATION Belle Glade, Florida
TYPE OF SAMPLING TRAIN EPA-5
TYPE OF SAMPLES Particulate
DATE 11-19-90 RUN NO. 1
TIME START 0901 TIME END 1042
SAMPLE TIME 28.20 (min/pt) = 96 Total min
ASSUMED MOISTURE 20 % FDA .8
NOMOGRAPH $C_f$ 2.5 PITOT CORR. .84
$P_b$ 30.34 "Hg $P_s$ 30.34 "Hg
WEATHER Clear TEMP. 75 °F
METER BOX NO. 1 H 2.05 Y .994
NOZZLE CAL. .236 .237 .237 = .237
STACK DIMENSIONS ~~29.50~~ 2 @ 52" ID
STACK AREA 29.50 ft² EFFECTIVE _____ ft²
STACK HEIGHT _____ ft.
STACK DIAMETER: UPSTRM. _____ DNSTRM. _____
PORT SIZE _____ in. NIPPLE LENGTH _____ in.
U CORD LENGTH 125'
REMARKS:
J

42.66 21.47 mm Bzl OK
2.15 125064 # Sturm
49.81 212.1 mm Bzl

69740 0805
09870 0858
6880 (4001) 587471 0859
109 mW
701300 1047
587613
67051 scfmp
580 124000 Stm
600 260
65.11b Sup
143 GPH
5.

MAT'L PROCESSING RATE _____
GAS METER READINGS: FINAL 357.350 ft.³
INITIAL 292.344 ft.³
NET 65.006 ft.³
FILTER NO. 2859 IMP. VOL. GAIN 315 ml.
SIL GEL NO. 24 WT. GAIN 18.7 ml.
TOTAL CONDENSATE 333.7 ml.

ORSAT

| | 1 | 2 | 3 | 4 | AVG. |
|---|---|---|---|---|---|
| % $CO_2$ | | | | | 9.0 |
| % $O_2$ | | | | | 11.0 |
| % CO | | | | | |
| % $N_2$ | | | | | |

$F_O$ = _____ $F_O$ RANGE = _____
ORSAT ANALYZER _____

LEAK CHECKS
PRE 0.00 cfm 15 "Hg POST 0.00 cfm 28 "Hg
METER BOX/PUMP _____ GAS SAMPLE SYST. _____
ORSAT BAG _____
PITOT TUBE NO. _____ PRE-TEST OK
POST-TEST(+) 4.5 / 15 $H_2O$/Sec
POST-TEST(−) 3.2 / 15 (.1) $H_2O$/Sec
PYROMETER NO. 1
BOX OPERATOR Neck PROBE HOLDER Gerard

FDA = .809

| 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 | | 0903 | 293.4 | .43 | 1.08 | 1.08 | 145 | 242 | 62 | 63 | 5.0 |
| 2 | | 0905 | 294.45 | .43 | 1.08 | 1.08 | 146 | 249 | 48 | 63 | 5.5 |
| 3 | | 0907 | 295.56 | .53 | 1.3 | 1.3 | 146 | 246 | 45 | 63 | 6.0 |
| 4 | | 0909 | 296.80 | .61 | 1.5 | 1.5 | 150 | 248 | 43 | 64 | 7 |
| 5 | | 0911 | 298.10 | .73 | 1.8 | 1.8 | 150 | 250 | 43 | 64 | 8 |
| 6 | | 0913 | 299.44 | .73 | 1.8 | 1.8 | 147 | 249 | 43 | 64 | 8 |

ACE AIR CONSULTING & ENGINEERING, INC.

(.845)

3105
45797 ACFM
32115 SCFMD

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) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S1-7 | | 0915 | 300.80 | .82 | 2.05 | 2.05 | 149 | 246 | 6545 | 65 | 9.5 |
| 8 | | 0917 | 302.45 | .92 | 2.3 | 2.3 | 149 | 242 | 47 | 66 | 11 |
| 9 | | 0919 | 303.86 | .92 | 2.3 | 2.3 | 150 | 243 | 47 | 66 | 11 |
| 10 | | 0921 | 305.47 | 1.00 | 2.5 | 2.5 | 150 | 242 | 49 | 67 | 12 |
| 11 | | 0923 | 307.01 | .92 | 2.3 | 2.3 | 150 | 243 | 50 | 68 | 12 |
| 12 | | 0925 | 308.50 | .84 | 2.1 | 2.1 | 150 | 242 | 52 | 68 | 11.5 |
| | | | | | | | | | | | |
| S2-1 | | 0929 | 309.60 | .47 | 1.18 | 1.18 | 150 | 239 | 53 | 69 | 7 |
| 2 | | 0931 | 310.68 | .45 | 1.13 | 1.13 | 150 | 237 | 53 | 70 | 7 |
| 3 | | 0933 | 311.83 | .51 | 1.28 | 1.28 | 149 | 241 | 52 | 70 | 8 |
| 4 | | 0935 | 313.05 | .60 | 1.50 | 1.50 | 150 | 242 | 52 | 70 | 9 |
| 5 | | 0937 | 314.40 | .70 | 1.75 | 1.75 | 151 | 244 | 53 | 71 | 11 |
| 6 | | 0939 | 315.76 | .73 | 1.8 | 1.8 | 150 | 241 | 53 | 71 | 11 |
| 7 | | 0941 | 317.25 | .89 | 2.22 | 2.22 | 150 | 241 | 53 | 72 | 13 |
| 8 | | 0943 | 318.82 | 1.0 | 2.5 | 2.5 | 150 | 240 | 54 | 72 | 15 |
| 9 | | 0945 | 320.42 | 1.0 | 2.5 | 2.5 | 149 | 242 | 54 | 72 | 15.5 |
| 10 | | 0947 | 321.90 | .83 | 2.1 | 2.1 | 151 | 240 | 55 | 73 | 14 |
| 11 | | 0949 | 323.25 | .70 | 1.75 | 1.75 | 150 | 244 | 56 | 73 | 12.5 |
| 12 | | 0951 | 324.58 | .68 | 1.7 | 1.7 | 148 | 247 | 57 | 74 | 12.0 |
| | | | | | | | | | | | |
| N1-1 | | 0954 | 325.75 | .52 | 1.3 | 1.3 | 149 | 259 | 58 | 74 | 10 |
| 2 | | 0956 | 326.9 | .60 | 1.5 | 1.5 | 149 | 273 | 56 | 75 | 11 |
| 3 | | 0958 | 328.1 | .60 | 1.5 | 1.5 | 149 | 272 | 56 | 75 | 11 |
| 4 | | 1000 | 329.34 | .70 | 1.75 | 1.75 | 148 | 269 | 54 | 75 | 13 |
| 5 | | 1002 | 330.87 | .92 | 2.3 | 2.3 | 149 | 266 | 54 | 75 | 17 |
| 6 | | 1004 | 332.50 | 1.1 | 2.75 | 2.75 | 149 | 270 | 54 | 75 | 20.5 |
| 7 | | 1006 | 333.93 | .75 | 1.85 | 1.85 | 154 | 274 | 54 | 75 | 15.5 |

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 | | 1008 | 335.27 | .64 | 1.6 | 1.6 | 153 | 273 | 55 | 76 | 14 |
| 9 | | 1010 | 336.54 | .71 | 1.6 | 1.6 | 152 | 268 | 54 | 76 | 14 |
| 10 | | 1012 | 337.92 | .73 | 1.8 | 1.8 | 152 | 273 | 54 | 76 | 14.5 |
| 11 | | 1014 | 339.25 | .77 | 1.9 | 1.9 | 152 | 268 | 54 | 76 | 16 |
| 12 | | 1016 | 340.70 | .67 | 1.7 | 1.7 | 153 | 270 | 54 | 76 | 15 |
| | | | | | | | | | | | |
| N2-1 | | 1020 | 341.70 | .48 | 1.2 | 1.2 | 152 | 269 | 55 | 77 | 11.5 |
| 2 | | 1022 | 342.80 | .48 | 1.2 | 1.2 | 151 | 272 | 54 | 77 | 11.5 |
| 3 | | 1024 | 344.05 | .63 | 1.58 | 1.58 | 152 | 264 | 53 | 77 | 14.0 |
| 4 | | 1026 | 345.— | .82 | 2.05 | 2.05 | 154 | 261 | 53 | 77 | 18 |
| 5 | | 1028 | 347.08 | 1.1 | 2.75 | 2.25 | 152 | 264 | 54 | 77 | 21.5 |
| 6 | | 1030 | 348.50 | 1.15 | 2.9 | 2.25 | 152 | 264 | 54 | 77 | 21.5 |
| 7 | | 1032 | 350.01 | 1.05 | 2.6 | 2.25 | 152 | 264 | 55 | 78 | 21.5 |
| 8 | | 1034 | 351.52 | 1.15 | 2.9 | 2.20 | 154 | 256 | 57 | 78 | 21.5 |
| 9 | | 1036 | 353.00 | 1.15 | 2.9 | 2.2 | 153 | 252 | 57 | 78 | 21.5 |
| 10 | | 1038 | 354.46 | 1.1 | 2.75 | 2.2 | 155 | 249 | 58 | 78 | 21.5 |
| 11 | | 1040 | 355.90 | 1.1 | 2.75 | 2.2 | 154 | 248 | 58 | 78 | 21.5 |
| 12 | | 1042 | 357.350 | 1.05 | 2.6 | 2.2 | 153 | 245 | 58 | 78 | 21.5 |
| | | | | | | | | | | | |
| | | | | | .9025 | | | | | | |
| | | | | | | | | | | | |
| | | | | | .814 | | | | 187.4 | | |
| | | | | | .714 | | | | | | |
| | | | | | | | | | | | |
| | | | | | .764 | 1.9 | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

## 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 Growers Coop
SOURCE No. 1 Boiler
PLANT LOCATION Belglade, FL.
TYPE OF SAMPLING TRAIN EPA-5
TYPE OF SAMPLES P.M
DATE 11-19-90 RUN NO. 2
TIME START 1126 TIME END 1305
SAMPLE TIME 48 / 2 (min/pt) = 96 Total min
ASSUMED MOISTURE ____ % FDA .8
NOMOGRAPH $C_f$ 2.5 PITOT CORR. .84
$P_b$ 30.34 "Hg $P_s$ 30.34 "Hg
WEATHER Clear TEMP. ____ °F
METER BOX NO. 1 H 2.05 Y .994
NOZZLE CAL. ____ = .237
STACK DIMENSIONS ____
STACK AREA 29.50 ft.² EFFECTIVE ____ ft.²
STACK HEIGHT ____ ft.
STACK DIAMETER: UPSTRM. ____ DNSTRM. ____
PORT SIZE ____ in. NIPPLE LENGTH ____ in.
U CORD LENGTH ____
REMARKS:
122336 lb/STM 138.05 GPM
20.71 MM BTU/H
~~129.7~~ MMBTU Steam
1995

70460 1309
70200 1116
587648
587792
7
113 minutes
14.231
129.7
50.46

MAT'L PROCESSING RATE ____
GAS METER READINGS: FINAL 423.515 ft.³
INITIAL 357.700 ft.³
NET 65.815 ft.³
FILTER NO. 2860 IMP. VOL. GAIN 300 ml.
SIL GEL NO. 34 WT. GAIN 1.5 ml.
TOTAL CONDENSATE 301.5 ml.

ORSAT

| | 1 | 2 | 3 | 4 | AVG. |
|---|---|---|---|---|---|
| % $CO_2$ | | | | | 9.0 |
| % $O_2$ | | | | | 11.3 |
| % CO | | | | | |
| % $N_2$ | | | | | |

$F_O$ = ____ $F_O$ RANGE = ____
ORSAT ANALYZER ____

LEAK CHECKS
PRE 0.00 cfm 28 "Hg POST 0.00 cfm 28 "Hg
METER BOX/PUMP ____ GAS SAMPLE SYST. ____
ORSAT BAG ____
PITOT TUBE NO. ____ PRE-TEST O.K.
POST-TEST(+) 3.8 / 15 $H_2O$/Sec
POST-TEST(−) 4.3 / 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 (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) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S1-1 | | 1128 | 358.83 | .42 | 1.05 | 1.05 | 145 ~~228~~ | 228 ~~145~~ | 62 | 73 | 5.5 |
| 2 | | 1130 | 359.90 | .42 | 1.05 | 1.05 | 143 | 225 | 59 | 72 | 5.5 |
| 3 | | 1132 | 361.07 | .56 | 1.4 | 1.4 | 143 | 262 | 53 | 72 | 6.5 |
| 4 | | 1134 | 362.35 | .63 | 1.58 | 1.58 | 143 | 263 | 52 | 72 | 7 |
| 5 | | 1136 | 363.70 | .76 | 1.9 | 1.9 | 143 | 255 | 51 | 73 | 8.5 |
| 6 | | 1138 | 365.10 | .76 | 1.9 | 1.9 | 144 | 251 | 51 | 73 | 8.5 |

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) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S1-7 | | 1140 | 366.65 | .91 | 2.3 | 2.3 | 144 | 255 | 51 | 73 | 10.5 |
| 8 | | 1142 | 368.35 | 1.15 | 2.88 | 2.88 | 144 | 256 | 52 | 73 | 13.5 |
| 9 | | 1144 | 370.01 | 1.1 | 2.6 | 2.6 | 143 | 250 | 52 | 74 | 13.5 |
| 10 | | 1146 | 371.73 | .98 | 2.5 | 2.5 | 144 | 250 | 52 | 74 | 12.5 |
| 11 | | 1148 | 373.14 | .73 | 1.8 | 1.8 | 145 | 246 | 53 | 74 | 10.0 |
| 12 | | 1150 | 374.52 | .68 | 1.7 | 1.7 | 145 | 260 | 54 | 75 | 10.0 |
| | | | | | | | | | | | |
| S2-1 | | 1153 | 375.62 | .42 | 1.05 | 1.05 | 145 | 262 | 56 | 75 | 7.5 |
| 2 | | 1155 | 376.70 | .44 | 1.1 | 1.1 | 144 | 255 | 54 | 75 | 7.5 |
| 3 | | 1157 | 377.77 | .60 | 1.5 | 1.5 | 144 | 250 | 53 | 75 | 9 |
| 4 | | 1159 | 379.00 | .60 | 1.5 | 1.5 | 144 | 244 | 53 | 76 | 9 |
| 5 | | 1201 | 380.30 | .66 | 1.65 | 1.65 | 147 | 255 | 53 | 76 | 10.5 |
| 6 | | 1203 | 381.60 | .70 | 1.75 | 1.75 | 146 | 257 | 52 | 76 | 10.5 |
| 7 | | 1205 | 383.— | .91 | 2.25 | 2.25 | 145 | 264 | 52 | 76 | 13 |
| 8 | | 1207 | 384.68 | 1.0 | 2.5 | 2.5 | 146 | 265 | 52 | 77 | 15 |
| 9 | | 1209 | 386.30 | 1.0 | 2.5 | 2.5 | 147 | 265 | 52 | 77 | 15 |
| 10 | | 1211 | 387.76 | .82 | 2.05 | 2.05 | 147 | 264 | 52 | 77 | 12.5 |
| 11 | | 1213 | 389.17 | .72 | 1.8 | 1.8 | 147 | 265 | 52 | 77 | 11.5 |
| 12 | | 1215 | 390.41 | .62 | 1.55 | 1.55 | 147 | 267 | 52 | 77 | 10.5 |
| | | | | | | | | | | | |
| N1-1 | | 1218 | 391.50 | .48 | 1.2 | 1.2 | 147 | 273 | 55 | 78 | 9 |
| 2 | | 1220 | 392.61 | .50 | 1.25 | 1.25 | 148 | 267 | 53 | 78 | 9.5 |
| 3 | | 1222 | 393.82 | .62 | 1.55 | 1.55 | 146 | 270 | 53 | 78 | 11 |
| 4 | | 1224 | 395.14 | .69 | 1.7 | 1.7 | 145 | 263 | 52 | 78 | 12 |
| 5 | | 1226 | 396.63 | .90 | 2.25 | 2.25 | 146 | 265 | 52 | 78 | 15 |
| 6 | | 1228 | 398.20 | .98 | 2.45 | 2.45 | 148 | 268 | 52 | 78 | 17 |
| 7 | | 1230 | 399.76 | .96 | 2.4 | 2.4 | 149 | 268 | 52 | 78 | |

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) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N1-8 | | 1232 | 401.2 | .72 | 1.8 | 1.8 | 149 | 269 | 53 | 79 | 14 |
| 9 | | 1234 | 402.51 | .70 | 1.75 | 1.75 | 148 | 268 | 53 | 79 | 13.5 |
| 10 | | 1236 | 403.8 | .66 | 1.65 | 1.65 | 149 | 264 | 53 | 79 | 13 |
| 11 | | 1238 | 405.05 | .64 | 1.6 | 1.6 | 150 | 264 | 53 | 79 | 13 |
| 12 | | 1240 | 406.28 | .64 | 1.6 | 1.6 | 150 | 253 | 53 | 80 | 13 |
| | | | | | | | | | | | |
| N2-1 | | 1243 | 407.47 | .53 | 1.3 | 1.3 | 149 | 252 | 56 | 80 | 11.5 |
| 2 | | 1245 | 408.62 | .53 | 1.3 | 1.3 | 150 | 254 | 54 | 80 | 11.5 |
| 3 | | 1247 | 409.95 | .53 | 1.3 | 1.3 | 151 | 248 | 54 | 80 | 11.5 |
| 4 | | 1249 | 411.12 | .71 | 1.8 | 1.8 | 150 | 249 | 55 | 80 | 15.5 |
| 5 | | 1251 | 412.65 | .95 | 2.4 | 2.4 | 149 | 247 | 53 | 80 | 19.5 |
| 6 | | 1253 | 414.23 | .91 | 2.3 | 2.3 | 150 | 245 | 54 | 81 | 19.5 |
| 7 | | 1255 | 415.74 | .90 | 2.25 | 2.25 | 151 | 244 | 54 | 81 | 19.5 |
| 8 | | 1257 | 417.32 | 1.05 | 2.6 | 2.4 | 150 | 245 | 54 | 81 | 21 |
| 9 | | 1259 | 418.90 | .96 | 2.4 | 2.4 | 149 | 248 | 56 | 81 | 21 |
| 10 | | 1301 | 420.45 | .92 | 2.3 | 2.3 | 157 | 248 | 57 | 81 | 21 |
| 11 | | 1303 | 422.00 | .90 | 2.25 | 2.25 | 151 | 246 | 56 | 81 | 21 |
| 12 | | 1305 | 423.515 | .90 | 2.25 | 2.25 | 149 | 242 | 57 | 81 | 21 |

## 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 Growers Coop
SOURCE No. 1 Boiler
PLANT LOCATION Belle Glade, FL
TYPE OF SAMPLING TRAIN EPA-5
TYPE OF SAMPLES P.M
DATE 11-19-90 RUN NO. 3
TIME START 1336 TIME END 1576
SAMPLE TIME 48 / 12 (min/pt) = 96 Total min
ASSUMED MOISTURE 20 % FDA .8
NOMOGRAPH $C_f$ 2.5 PITOT CORR. .84
$P_b$ 30.34 "Hg $P_s$ 30.34 "Hg
WEATHER CLEAR TEMP. _____ °F
METER BOX NO. 1 H 2.05 Y .994
NOZZLE CAL. _____ _____ _____ = .237
STACK DIMENSIONS _____
STACK AREA 29.5 ft.² EFFECTIVE _____ ft.²
STACK HEIGHT _____ ft.
STACK DIAMETER: UPSTRM. _____ DNSTRM. _____
PORT SIZE _____ in. NIPPLE LENGTH _____ in.
U CORD LENGTH _____
REMARKS: _____

70760 1520
70520 1334
587823
587960

17220
14190

303

.7125
.4006

49.55

MAT'L PROCESSING RATE _____
GAS METER READINGS: FINAL 488.907 ft.³
INITIAL 423.965 ft.³
NET 64.942 ft.³
FILTER NO. 2990 IMP. VOL. GAIN 285 ml.
SIL GEL NO. 18 WT. GAIN 6.6 ml.
TOTAL CONDENSATE 291.6 ml.

ORSAT

| | 1 | 2 | 3 | 4 | AVG. |
|---|---|---|---|---|---|
| % $CO_2$ | | | | | 9.0 |
| % $O_2$ | | | | | 11.3 |
| % CO | | | | | |
| % $N_2$ | | | | | |

$F_O$ = _____ $F_O$ RANGE = _____
ORSAT ANALYZER _____

LEAK CHECKS
PRE 0.00 cfm 28 "Hg POST 0.00 cfm 24 "Hg
METER BOX/PUMP _____ GAS SAMPLE SYST. _____
ORSAT BAG _____
PITOT TUBE NO. _____ PRE-TEST O.K.
POST-TEST(+) 3.0 / 15 $H_2O$/Sec
POST-TEST(−) 2.5 / 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 (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) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S1-1 | | 1338 | 425.1 | .42 | 1.05 | 1.05 | 142 | 262 | 66 | 76 | 5.5 |
| 2 | | 1340 | 426.23 | .42 | 1.05 | 1.05 | 143 | 260 | 68 | 76 | 5.5 |
| 3 | | 1342 | 427.40 | .52 | 1.3 | 1.3 | 145 | 256 | 56 | 76 | 6 |
| 4 | | 1344 | 428.26 | .52 | 1.3 | 1.3 | 146 | 257 | 55 | 76 | 8 |
| 5 | | 1346 | 429.93 | .78 | 1.95 | 1.95 | 146 | 258 | 54 | 76 | 8 |
| 6 | | 1348 | 431.30 | .73 | 1.8 | 1.8 | 146 | 255 | 54 | 76 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S1-7 | | 1350 | 432.67 | .73 | 1.8 | 1.8 | 146 | 255 | 54 | 77 | 8 |
| 8 | | 1352 | 434.1 | .83 | 2.1 | 2.1 | 147 | 250 | 54 | 77 | 9 |
| 9 | | 1354 | 435.62 | .91 | 2.3 | 2.3 | 148 | 250 | 54 | 77 | 10.5 |
| 10 | | 1356 | 437.13 | .89 | 2.3 | 2.3 | 145 | 249 | 54 | 78 | 10.5 |
| 11 | | 1358 | 438.55 | .75 | 1.9 | 1.9 | 146 | 249 | 54 | 78 | 9.5 |
| 12 | | 1400 | 439.90 | .66 | 1.65 | 1.65 | 146 | 248 | 54 | 78 | 8 |
| | | | | | | | | | | | |
| S2-1 | | 1405 | 440.92 | .44 | 1.1 | 1.1 | 144 | 244 | 58 | 79 | 6.5 |
| 2 | | 1407 | 441.95 | .44 | 1.1 | 1.1 | 145 | 239 | 58 | 79 | 6.5 |
| 3 | | 1409 | 443.00 | .42 | 1.05 | 1.05 | 143 | 239 | 57 | 79 | 6.5 |
| 4 | | 1411 | 444.20 | .62 | 1.55 | 1.55 | 143 | 250 | 57 | 79 | 9 |
| 5 | | 1413 | 445.54 | .68 | 1.7 | 1.7 | 143 | 252 | 57 | 79 | 9.5 |
| 6 | | 1415 | 446.84 | .68 | 1.7 | 1.7 | 145 | 260 | 56 | 79 | 9.5 |
| 7 | | 1417 | 448.27 | .83 | 2.1 | 2.1 | 146 | 272 | 56 | 80 | 11.5 |
| 8 | | 1419 | 449.80 | .93 | 2.3 | 2.3 | 146 | 266 | 55 | 80 | 13 |
| 9 | | 1421 | 451.33 | .93 | 2.3 | 2.3 | 146 | 269 | 55 | 80 | 13 |
| 10 | | 1423 | 452.83 | .83 | 2.1 | 2.1 | 145 | 266 | 56 | 80 | 12.5 |
| 11 | | 1425 | 454.20 | .71 | 1.78 | 1.78 | 146 | 263 | 56 | 80 | 11 |
| 12 | | 1427 | 455.56 | .73 | 1.8 | 1.8 | 146 | 267 | 56 | 80 | 11 |
| | | | | | | | | | | | |
| N1-1 | | 1429 | 456.82 | .52 | 1.3 | 1.3 | 144 | 269 | 57 | 80 | 9 |
| 2 | | 1431 | 458.00 | .52 | 1.3 | 1.3 | 144 | 266 | 57 | 80 | 9 |
| 3 | | 1433 | 459.20 | .55 | 1.4 | 1.4 | 150 | 270 | 55 | 80 | 10 |
| 4 | | 1435 | 460.62 | .75 | 1.9 | 1.9 | 146 | 270 | 55 | 80 | 12.5 |
| 5 | | 1437 | 462.20 | .98 | 2.45 | 2.45 | 147 | 270 | 54 | 80 | 15 |
| 6 | | 1439 | 463.80 | .98 | 2.45 | 2.45 | 147 | 270 | 54 | 81 | 15 |
| 7 | | 1441 | 465.40 | .69 | 1.7 | 1.7 | 150 | 275 | 54 | 81 | 12 |

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. | ACTUAL | STACK GAS TEMP. (°F) | SAMPLE BOX TEMP. (°F) | LAST IMPINGER TEMP. (°F) | DRY GAS METER TEMP. (°F) | VACUUM ON SAMPLE TRAIN ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N18 | | 1443 | 466.67 | .69 | 1.7 | 1.7 | 150 | 270 | 54 | 81 | 12 |
| 9 | | 1445 | 468.00 | .71 | 1.7 | 1.7 | 150 | 261 | 54 | 81 | 12 |
| 10 | | 1447 | 469.28 | .69 | 1.7 | 1.7 | 149 | 257 | 54 | 81 | 12 |
| 11 | | 1449 | 470.55 | .69 | 1.7 | 1.7 | 150 | 252 | 54 | 81 | 12 |
| 12 | | 1451 | 471.83 | .64 | 1.6 | 1.6 | 150 | 250 | 54 | 81 | 12 |
| | | | | | | | | | | | |
| N2-1 | | 1454 | 472.97 | .50 | 1.25 | 1.25 | 149 | 245 | 58 | 81 | 10.5 |
| 2 | | 1456 | 474.13 | .52 | 1.3 | 1.3 | 149 | 245 | 57 | 81 | 10.5 |
| 3 | | 1458 | 475.37 | .62 | 1.55 | 1.55 | 148 | 240 | 56 | 81 | 12 |
| 4 | | 1500 | 476.8 | .82 | 2.05 | 2.05 | 150 | 239 | 55 | 82 | 15.5 |
| 5 | | 1502 | 478.30 | .88 | 2.2 | 2.2 | 149 | 242 | 55 | 82 | 17 |
| 6 | | 1504 | 479.78 | .93 | 2.3 | 2.3 | 148 | 236 | 54 | 82 | 18 |
| 7 | | 1506 | 481.33 | .85 | 2.1 | 2.1 | 149 | 242 | 54 | 82 | 17 |
| 8 | | 1508 | 482.83 | .93 | 2.3 | 2.3 | 149 | 239 | 55 | 82 | 18 |
| 9 | | 1510 | 484.5 | .93 | 2.3 | 2.3 | 150 | 232 | 55 | 82 | 20.5 |
| 10 | | 1512 | 486.00 | .88 | 2.2 | 2.2 | 152 | 231 | 55 | 82 | 20 |
| 11 | | 1514 | 487.47 | .80 | 2.0 | 2.0 | 152 | 236 | 55 | 83 | 18 |
| 12 | | 1516 | 488.907 | .80 | 2.0 | 2.0 | 151 | 239 | 55 | 83 | 18 |

# APPENDIX C

# LABORATORY ANALYSES

# AIR CONSULTING & ENGINEERING, inc. PARTICULATE LAB DATA

SOURCE SGC No. 1 BOILER

| PROBE RINSE | RUN 1 | RUN 2 | RUN 3 | BLANK | |
|---|---|---|---|---|---|
| CONTAINER NUMBER | S-14 | S-20 | S-21 | S-24 | |
| TOTAL VOLUME (ml) | 160 | 160 | 100 | 100 | LIQUID LEVEL OK |
| 1st GROSS WEIGHT (g) | 103.5914 | 103.4209 | 104.3227 | 100.5755 | DATE & TIME: 11-20 2000 |
| 2nd GROSS WEIGHT (g) | 103.5918 | 103.4214 | 104.3225 | 100.5758 | DATE & TIME: 11-22 1145 |
| AVERAGE GROSS WEIGHT (g) | 103.5916 | 103.4212 | 104.3226 | 100.5757 | |
| TARE WEIGHT (g) | 103.5723 | 103.4065 | 104.3002 | 100.5730 | |
| SUB NET WEIGHT (g) | 19.3 ~~103.5725~~ | ~~0.103~~ 0.147 | .0224 | 2.7 | |
| ACETONE BLANK (g) | | | | | |
| TOTAL NET WEIGHT (mg) | 19.3 | 14.7 | 22.4 | 2.7 | |

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 | 2859 | 2860 | 2990 | 2982 | |
| 1st GROSS WEIGHT (g) | .6873 | .7285 | 0.7105 | 0.4044 | DATE & TIME: 11-20-2000 |
| 2nd GROSS WEIGHT (g) | .6875 | .7290 | 0.7105 | 0.4049 | DATE & TIME: 11-22-1145 |
| AVERAGE GROSS WEIGHT (g) | 0.6874 | 0.7288 | 0.7105 | 0.4047 | |
| TARE WEIGHT (g) | 0.4001 | 0.4190 | 0.4006 | 0.4048 | |
| SUB NET WEIGHT (g) | .2872 | 0.3108 | 0.3099 | — | |
| TOTAL NET WEIGHT (mg) | 287.2 | 310.8 | 309.9 | — | |

| TARE BALANCE CHECK | 1st GROSS WEIGHT BALANCE CHECK | 2nd GROSS WEIGHT BALANCE CHECK |
|---|---|---|
| SEE LAB BOOK | 0 — 10.0g —<br>0.5 g 0.5004 100.0g 99.9999<br>%RH 41 DATE 11-20-90<br>Signature S. L. Peck | 0 — 10.0g —<br>0.5g .5001 100.0g 99.9998<br>%RH 44 DATE 11-22-90<br>Signature S. L. Peck |

# APPENDIX D

# QUALITY ASSURANCE

# AND

# CHAIN OF CUSTODY

# AIR CONSULTING AND ENGINEERING, Inc.

## SAMPLE RECOVERY AND CHAIN OF CUSTODY

PLANT NAME SUGAR GROWER CO-OP TEST DATE 11-19-90
SOURCE NAME No. 1 BOILER SAMPLE RECOVERED BY S. NECK
TYPE OF SAMPLE PARTICULATE PARTICULATE ANALYSES BY S. NECK

### SAMPLE RECOVERY

| RUN NO. | CONTAINER NO. | LIQUID LEVEL MARKED | COLOR | COMMENTS |
|---|---|---|---|---|
| 1 FILTER | 2859 | | GREY | |
| | PROBE WASH | ✓ | | |
| 2 FILTER | 2860 | | GREY | |
| | P.W | ✓ | | |
| 3 FILTER | 2990 | | GREY | |
| | PW | ✓ | | |
| | | | | |
| | | | | |
| | | | | |
| ACETONE / WATER BLANK (CIRCLE) | | | | |
| FILTER BLANK | | | | |

### SILICA GEL

| RUN NO. | CONTAINER NO. | FINAL WT. (g) | INIT. WT. (g) | NET WT. (g) | COLOR |
|---|---|---|---|---|---|
| 1 | 24 | 218.7 | 200.0 | 18.7 | O.K |
| 2 | 34 | 201.5 | 200.0 | 1.5 | O.K |
| 3 | 18 | 206.6 | 200.0 | 6.6 | O.K |
| | | | 200.0 | | |
| | | | 200.0 | | |
| | | | 200.0 | | |
| | | | 200.0 | | |
| | | | 200.0 | | |

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:

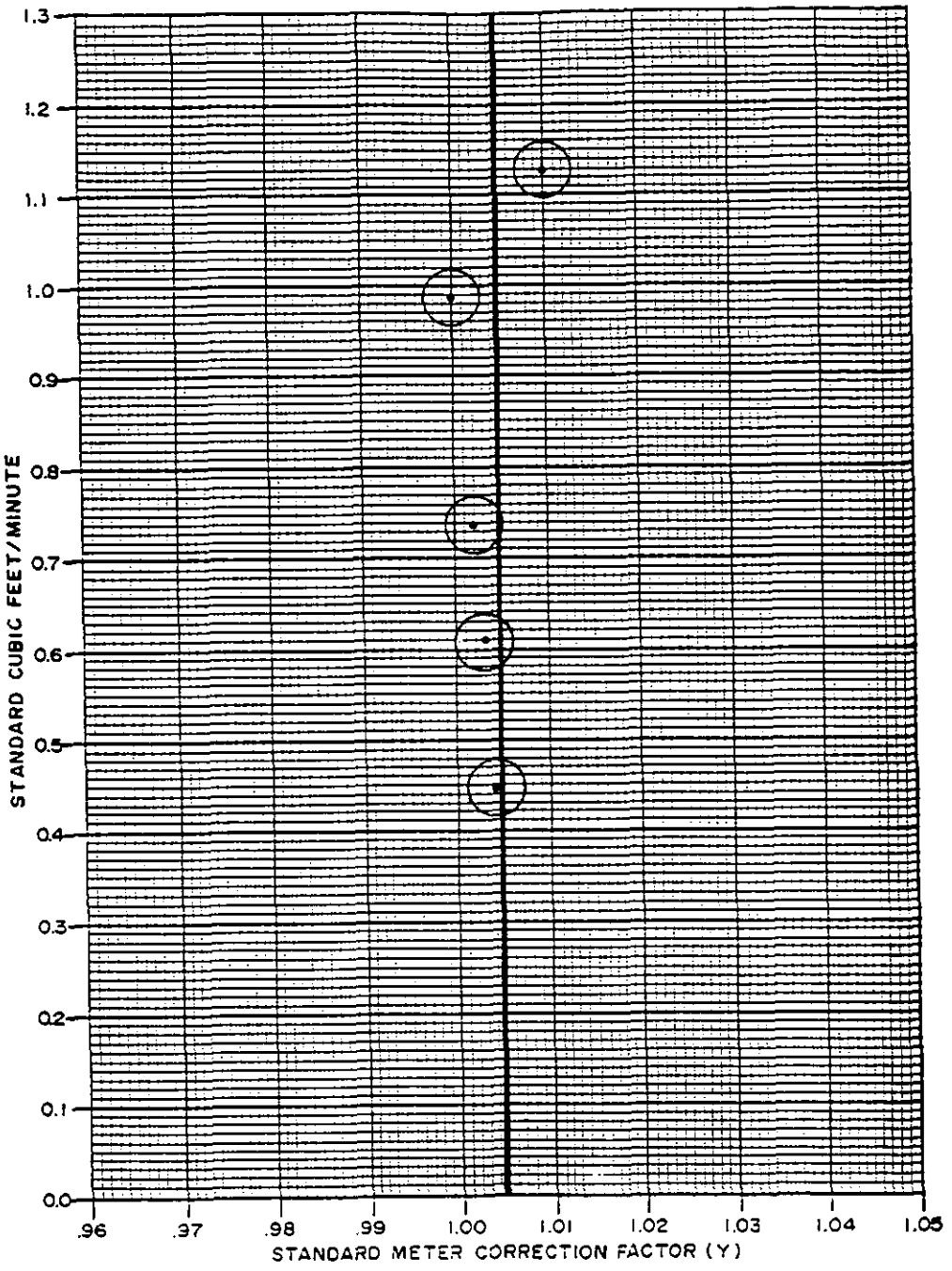
$$Y_a \times Y_s = Y$$

$Y_a$ = 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 64 °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

# AIR CONSULTING & ENGINEERING, inc. POST TEST CALIBRATION

DATE 11-27-90 METER BOX NUMBER 1 LEAK CHECK 0.00 CFM at 24 in. Hg.

CLIENT ASA / SCGCOF SOURCE No 3 & No. 4 Boiler / No. 1 Boiler & ~~No 2 Boiler~~ THERMOCOUPLE NUMBER 1601 PYROMETER NUMBER 1

FLIGHT SERVICE Pb — in. Hg. ACE BAROMETER Pb — in. Hg.

ASTM GLASS THERMOMETER 173 °F / THERMOCOUPLE 173 °F ASTM GLASS THERMOMETER 73 °F / METER TEMP 74 °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 $ft^3$ | | | | |
| -.75 | 1.3 | 374.714 | 382.073 | 7.359 | 979.100 | 986.776 | 7.676 | 73<br>73 | 84<br>85 | 13.0 | 15.0 |
| -.75 | 1.3 | 382.073 | 389.951 | 7.878 | 986.776 | 994.981 | 8.205 | 73<br>73 | 85<br>87 | 14.0 | 15 |
| -.75 | 1.3 | 390.000 | 397.812<br>~~390.00~~ | 7.812 | 995.033 | 1003.188 | 8.155 | 73<br>73 | 87<br>87 | 14.0 | 15 |

CALIBRATED BY: Stephen J. Neck

$Y_1 = 0.976$

$Y_2 = 0.980$

$Y_3 = 0.980$

$Y_{AVG} = 0.98$

603
618
634

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

air consulting and engineering

# AIR CONSULTING & ENGINEERING, INC. — PITOT TUBE CALIBRATION

DATE CALIBRATED 9-25-90 PITOT TUBE 1601

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

$\alpha_1$ = 0 °(<10°), $\alpha_2$ = 1.5 °(<10°), $\beta_1$ = 1 °(<5°), $\beta_2$ = 2 °(<5°)

$\gamma$ = 1.5 ° $\theta$ = 1 ° A = 1.179 in. = (Pa + Pb)

z = A sin $\gamma$ = 0.031 in.; <0.32/<1/8 In.

w = A sin $\theta$ = 0.021 in.; <0.08/<1/32 In.

$P_a$ 0.5895 in. $P_b$ 0.5895 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 | | | | |
| AMBIENT | | | | |
| HOT OVEN | | | | |

FDER - MAXIMUM 5° DIFFERENCE

CALIBRATED BY: _____

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

# AIR CONSULTING & ENGINEERING, INC. PYROMETER CALIBRATION

DATE 7-10-90

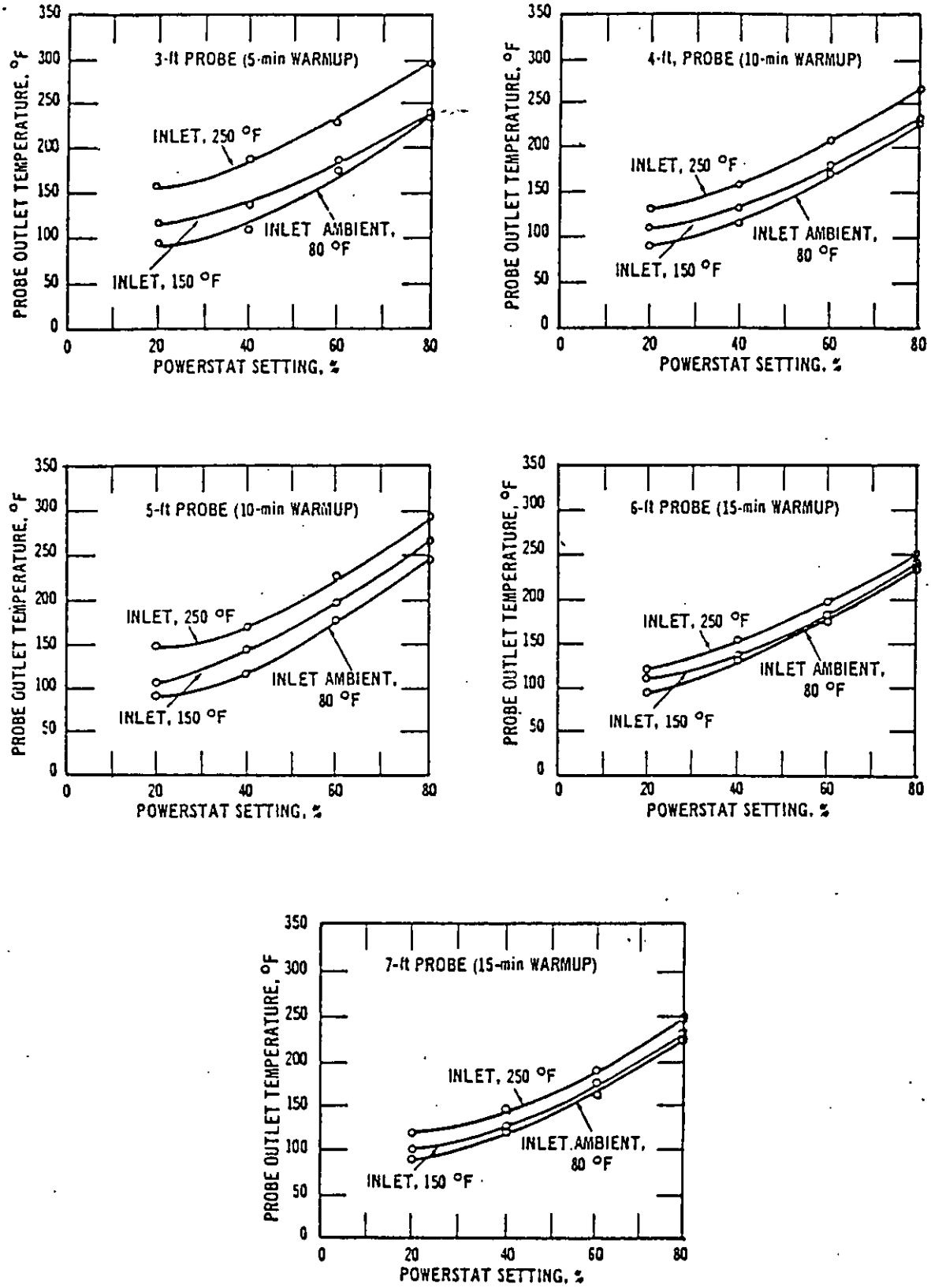
PYROMETER NUMBER METER BOX #1

| 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 J. 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 _____ BOILER NUMBER 1

DATE NOV 19 - 90 OIL METER FACTOR _____

STEAM INTEGRATOR FACTOR 1600 SCRUBBER(S) PRESS. DROP 5.5, 5.0(N)

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

SCRUBBER(S) H2O LEVEL _____, _____

Ph(if applicable) _____, _____

| TIME | OIL | STEAM | | | FEEDWATER | |
|---|---|---|---|---|---|---|
| | METER READING | LBS. FLOW 587793 587648 587613 587477 | TEMP. | PRESSURE | TEMP. | PRESSURE |
| 8:58 | 69870 | 125000 | 580 | 430 | 260 | 600 |
| 9:18 | | 128000 | 580 | 430 | 260 | 600 |
| 9:38 | | 125000 | 580 | 420 | 260 | 600 |
| 9:58 | | 124000 | 580 | 420 | 260 | 600 |
| 10:18 | | 128000 | 580 | 425 | 260 | 600 |
| 10:38 | | 120000 | 580 | 420 | 260 | 600 |
| 10:47 | 70130 | 120000 | 580 | 420 | 260 | 600 |
| | | | | | | |
| | | | | | | |
| 11:16 | 70200 | 120000 | 580 | 420 | 260 | 600 |
| 11:36 | | 118000 | 580 | 410 | 260 | 600 |
| 11:56 | | 120000 | 580 | 420 | 260 | 600 |
| 12:16 | | 120000 | 580 | 430 | 260 | 600 |
| 12:36 | | 120000 | 580 | 420 | 260 | 600 |
| 12:56 | | 120000 | 580 | 430 | 260 | 600 |
| 1:06 | | 120000 | 580 | 440 | 260 | 600 |
| | 70460 | | | | | |
| | | | | | | |
| | | | | | | |

# BOILER OPERATION PARAMETERS

PLANT _____ BOILER NUMBER 1

DATE _____ OIL METER FACTOR _____

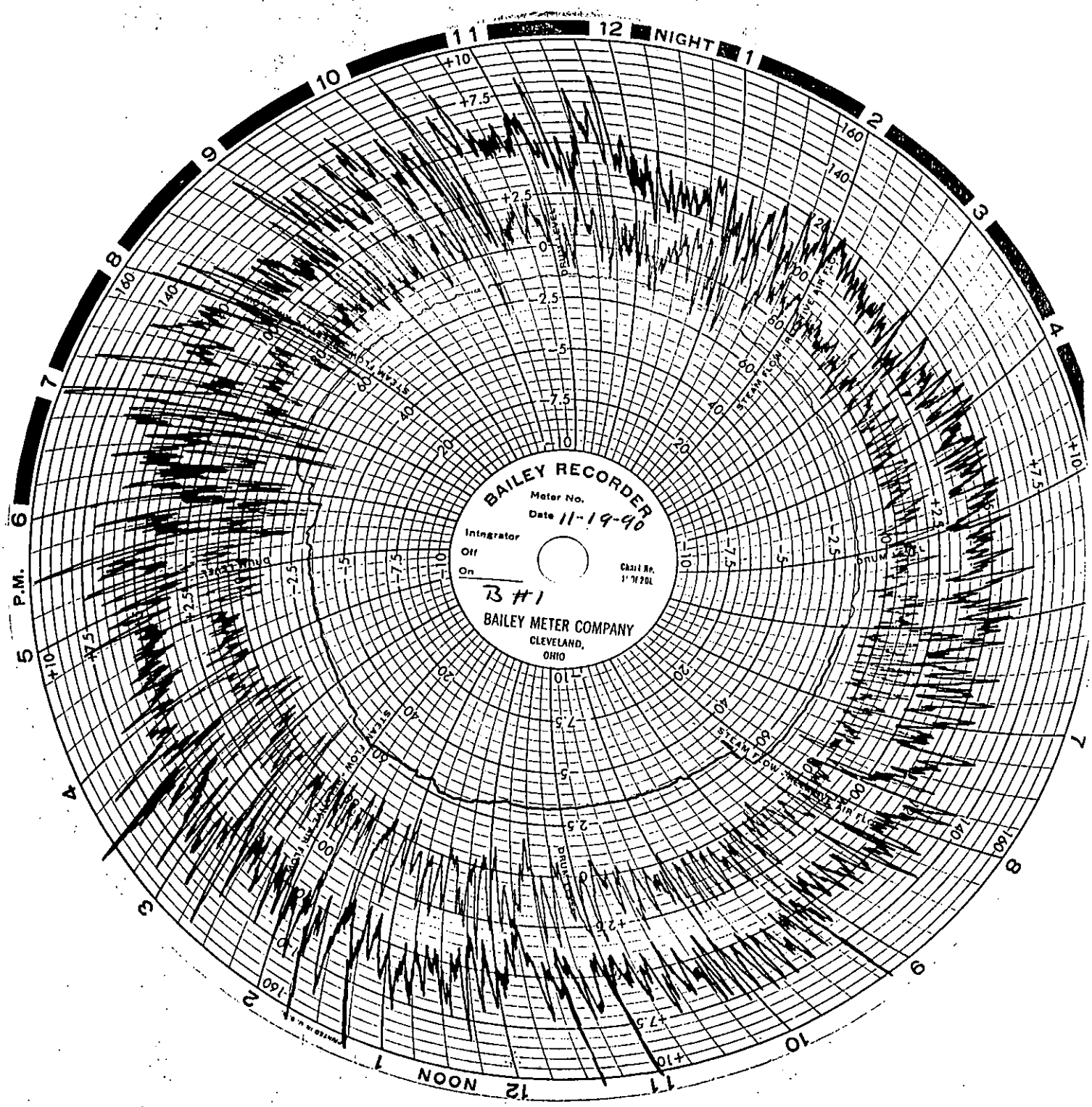
STEAM INTEGRATOR FACTOR 1600 SCRUBBER(S) PRESS. DROP ____, ____

SCRUBBER(S) GPM _____, _____

OPERATOR SIGNATURE [illegible] SCRUBBER(S) H2O LEVEL _____, _____

Ph(if applicable) _____, _____

| TIME | OIL | 587960 587823 STEAM | | | FEEDWATER | |
|---|---|---|---|---|---|---|
| | METER READING | LBS. FLOW | TEMP. | PRESSURE | TEMP. | PRESSURE |
| 1:34 | 70520 | 125000 | 580 | 430 | 260 | 600 |
| 1:54 | | 130000 | 580 | 440 | 260 | 600 |
| 2:14 | | 120000 | 580 | 440 | 260 | 600 |
| 2:34 | | 130000 | 580 | 420 | 260 | 600 |
| 2:54 | | 120000 | 580 | 440 | 260 | 600 |
| 3:14 | | 125000 | 580 | 430 | 260 | 600 |
| 3:29 | | | | | 260 | 600 |
| - | 70760 | | | | | |


BAILEY RECORDER
Meter No.
Date 11-19-90
Integrator
Off
On
B #1
BAILEY METER COMPANY
CLEVELAND,
OHIO
NIGHT
NOON
P.M.
STEAM FLOW - RELATIVE AIR FLOW
DRUM LEVEL

# APPENDIX F

# PROJECT PARTICIPANTS

# PROJECT PARTICIPANTS

ACEI:

| | |
|---|---|
| STEPHEN L. NECK, P.E. | FIELD TESTING<br>REPORT PREPARTION |
| GERARD GAUTHREAUX | FIELD TESTING |

SCGCOF:

| | |
|---|---|
| JOSE ALVEREZ | PROJECT COORDINATOR |
| BLAS MARIN | TEST COORDINATOR |

PALM BEACH COUNTY:

| | |
|---|---|
| AJAYA K. SATYAL | TEST OBSERVER |