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 12.2
Reference
Report Sect. 4
Reference 121

ENTROPY ENVIRONMENTALISTS, INC.

SPECIALISTS IN AIR POLLUTION MEASUREMENT & MANAGEMENT

# STATIONARY SOURCE SAMPLING REPORT

ARMCO INC.

MIDDLETOWN, OHIO

PARTICULATE EMISSIONS COMPLIANCE TESTING

PUSHING PROCESS BAGHOUSE OUTLET

#2 COKE BATTERY

DECEMBER 14 & 15, 1982

P.O. Box 12291, Research Triangle Park, North Carolina 27709
Phone 919-781-3550

## REPORT CERTIFICATION

The sampling and analysis performed for this report was carried out under my direction and supervision.

Date January 5, 1983 Signature _____

David W. Finley

I have reviewed all testing details and results in this test report and hereby certify that the test report is authentic and accurate.

Date January 5, 1983 Signature _____

D. James Grove, P. E.

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# INTRODUCTION

Stationary source sampling was performed for ARMCO Inc. at their Middletown, Ohio facility on December 14 and 15, 1982. Three EPA Method 5 test runs were performed to determine the particulate emissions from the baghouse outlet of the #2 coke battery. Martin Trembly from the United States Environmental Protection Agency and Stephen Samoriga from South Western Ohio Air Pollution Control Agencey were present to observe the testing. Steve Francis acted as coordinator between the plant and Entropy.

Test results are presented in the "Summary of Results" section on the following page. Detailed computer-generated results can be found in Appendix A; Appendix B contains copies of the raw field data. Descriptions of the process and their operation during the tests are given in the "Process Description and Operation" section; production data is presented in Appendix C. The "Sampling and Analytical Procedures" section briefly describes the test procedures. For a detailed description of the equipment and procedures used, refer to Appendix E.

## SUMMARY OF RESULTS

The results of the particulate testing performed on December 14 and 15, 1982 on the baghouse outlet used to control the emission from the pushing operation on the #2 coke battery are summarized in Table 1. For the three runs, the particulate concentration averaged 0.0008 pounds per ton of coke pushed. Detailed run-by-run summaries are presented in Appendix A.

TABLE 1

PARTICULATE TESTS SUMMARY OF RESULTS

Coke Battery Baghouse Outlet

| | 1 | 2 | 3 |
|---|---|---|---|
| RUN DATE | 12/14/82 | 12/14/82 | 12/15/82 |
| TEST TRAIN PARAMETERS: | | | |
| VOLUME OF DRY GAS SAMPLED, SCF* | 16.973 | 16.737 | 16.416 |
| PERCENT ISOKINETIC | 98.5 | 93.4 | 97.5 |
| STACK PARAMETERS: | | | |
| TEMPERATURE, DEG. F | 84 | 94 | 91 |
| AIR FLOW RATES SCFM*, DRY | 39,684 | 39,894 | 38,782 |
| ACFM, WET | 42,579 | 43,586 | 42,298 |
| METHOD 5 TEST RESULTS: | | | |
| CATCH, MILLIGRAMS | 0.9 | 1.2 | 1.7 |
| GRAINS PER DSCF* | 0.000818 | 0.00111 | 0.00160 |
| LBS PER PUSH | 0.00695 | 0.00945 | 0.0133 |
| LBS PER TON PUSHED | 0.000552 | 0.000750 | 0.00105 |

* 68 Deg. F. - 29.92 in. Hg.

## PROCESS DESCRIPTION AND OPERATION

ARMCO Inc. uses coke batteries in Middletown, Ohio to produce coke for use in the manufacture of steel. The coke is produced by heating coal in an air tight oven which forces the volatile compounds from the coal; the hot coke is then pushed out of the oven.

To control emissions during the pushing process, a movable hood is mounted over the oven door. The gases are ducted from the hood to a cinder hopper where loose cinders are caught. Leaving the cinder hopper, the gases then pass through the baghouse where the majority of the particulate is removed. Five modules make up the baghouse; during testing, only three modules were in operation. Each module is exhausted by a fan to the atmosphere; module #3 has a stack on the fan outlet which provided the sampling location as shown in Figure 1.

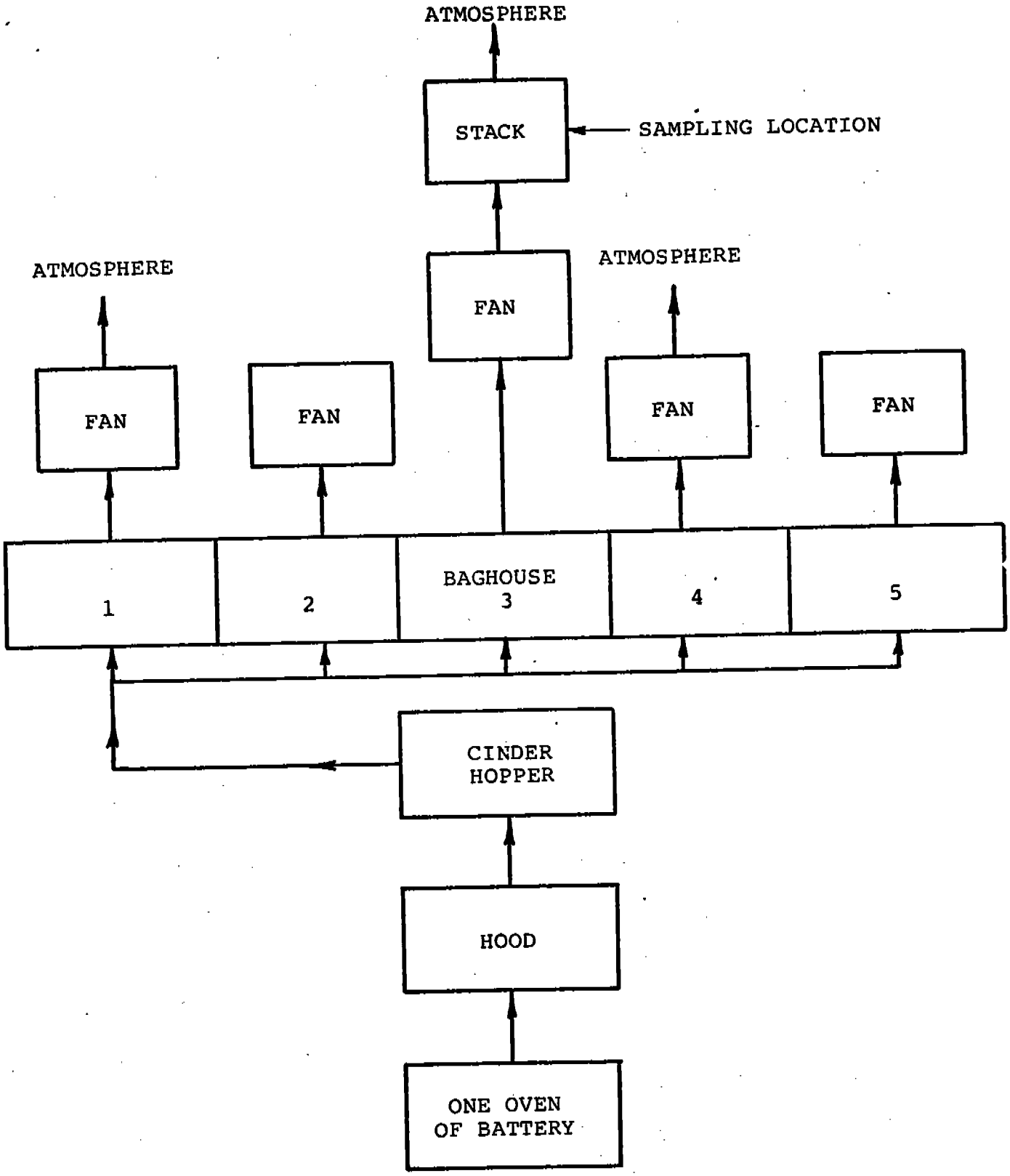



FIGURE 1. AIR FLOW SCHEMATIC SHOWING SAMPLING LOCATION

## SAMPLING AND ANALYTICAL PROCEDURES

All sampling and analytical procedures used were those generally recommended by the United States Environmental Protection Agency and the Ohio State Environmental Protection Agency. Complete details of the equipment and procedures used are described in Appendix E, which is extracted from 40 CFR (Code of Federal Regulations) Part 60.

The number and location of the sampling points were determined following the procedures outlined in Method 1. The stack cross section was divided into 12 equal areas, i.e., six points on each of two perpendicular traverse axes labeled A and B as shown in Figures 2 and 3. Each point was sampled for the duration of one push (1.5 minutes), for a net run time of 18 minutes, i.e., for 12 pushes.

Velocity measurements were made according to Method 2. Method 3 procedures were used to determine flue gas composition and molecular weight. Particulate emissions determinations followed the procedures outlined in Method 5.

All sampling equipment used was manufactured by Nutech Corporation or Entropy Environmentalists, Inc.

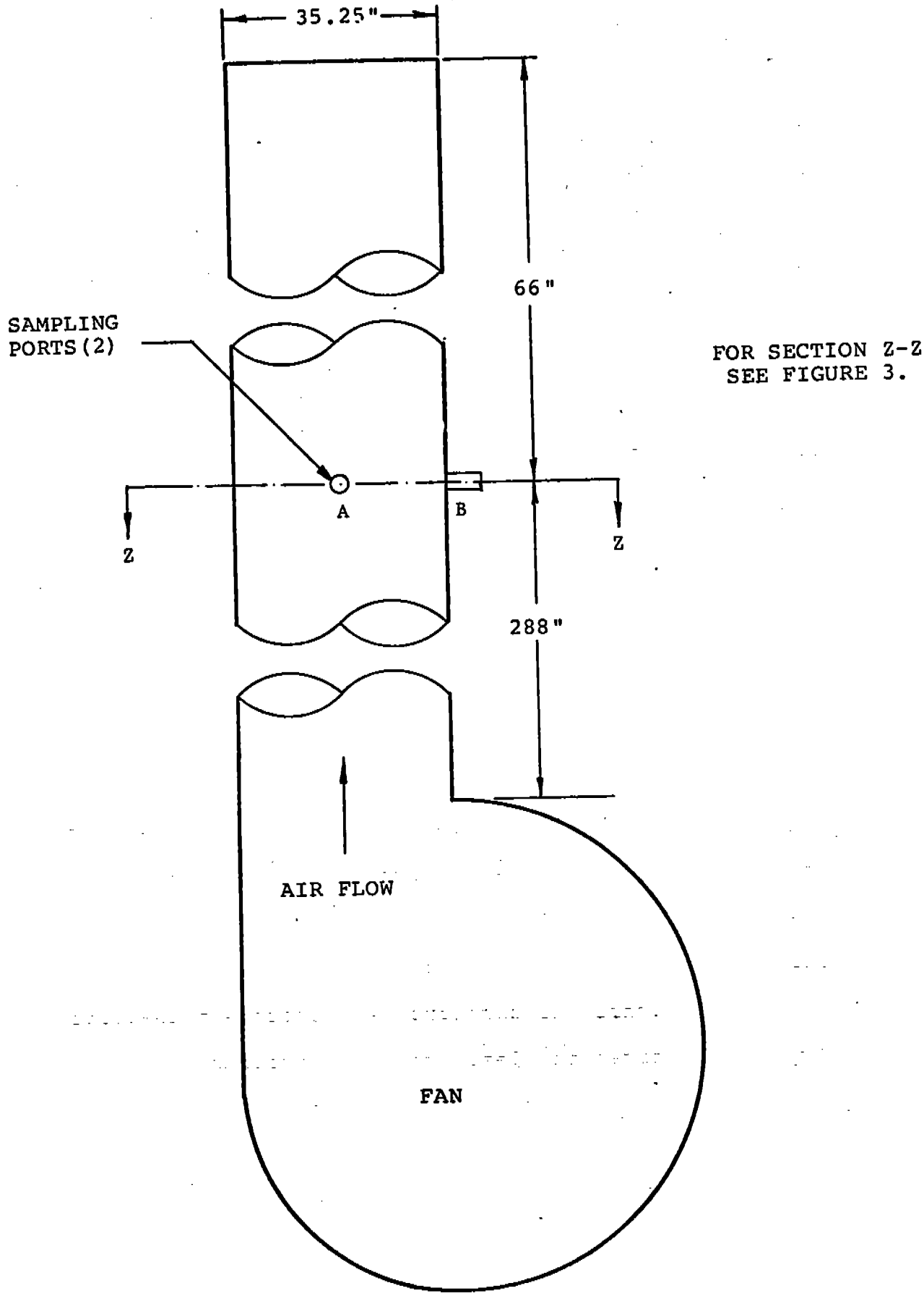
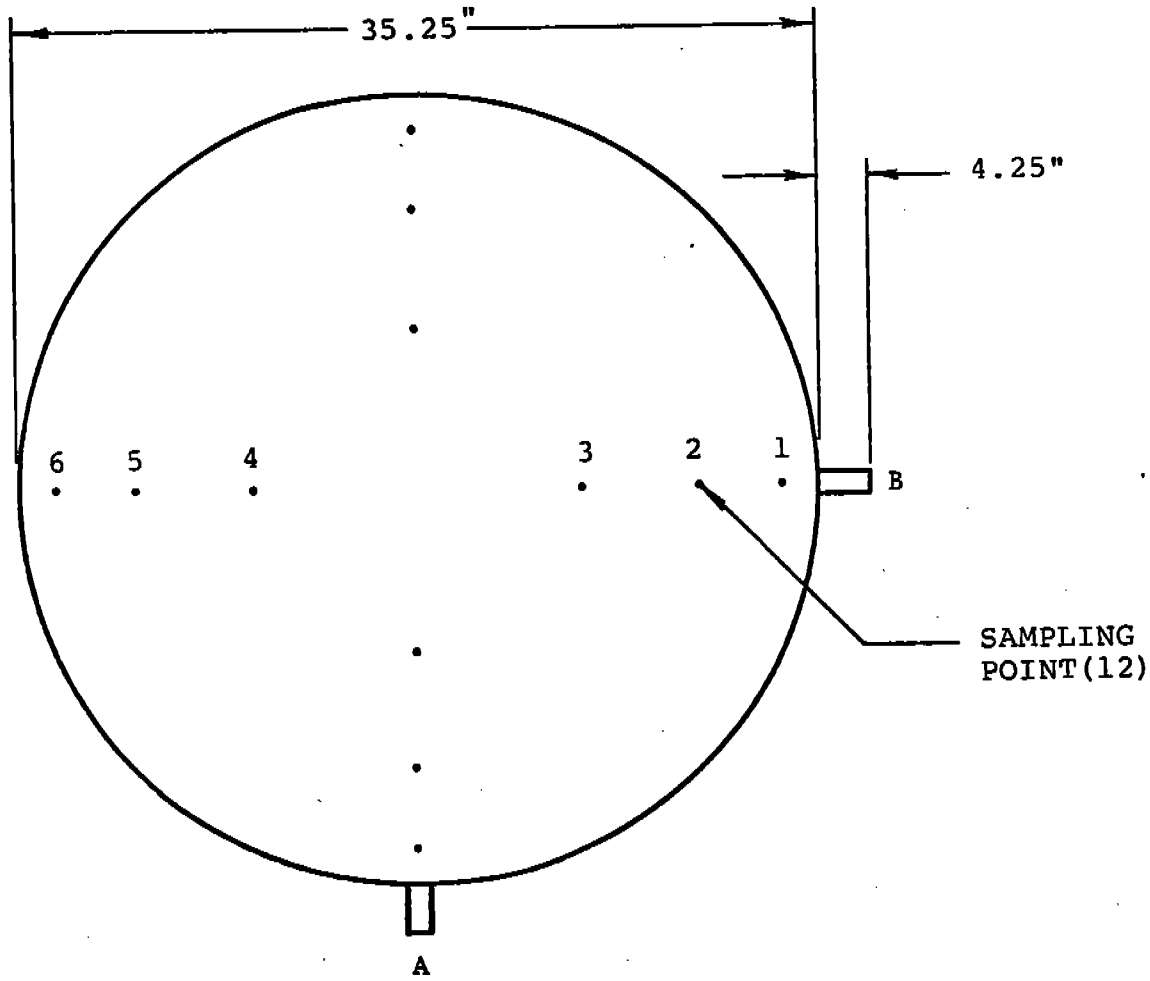



FIGURE 2. STACK DIMENSIONS AND SAMPLING PORT LOCATIONS




SECTION Z-Z

FIGURE 3. STACK CROSS SECTION SHOWING SAMPLING POINT LOCATIONS

# APPENDICES

APPENDIX A

# PARTICULATE FIELD DATA & RESULTS TABULATION

PLANT: ARMCO, Inc., Middletown, OH

| RUN | SAMPLING LOCATION | TEST TEAM LEADER |
|---|---|---|
| 1 | Coke Battery Baghouse Outlet | David W. Finley |
| 2 | Coke Battery Baghouse Outlet | David W. Finley |
| 3 | Coke Battery Baghouse Outlet | David W. Finley |

| | | 1 | 2 | 3 |
|---|---|---|---|---|
| | RUN DATE | 12/14/82 | 12/14/82 | 12/15/82 |
| | RUN START TIME | 750 | 1158 | 926 |
| | RUN FINISH TIME | 1106 | 910 | 1300 |
| | NET SAMPLING POINTS | 12 | 12 | 12 |
| Theta | NET RUN TIME, MINUTES | 18.00 | 18.00 | 18.00 |
| Dia | NOZZLE DIAMETER, INCHES | 0.173 | 0.176 | 0.173 |
| Cp | PITOT TUBE COEFFICIENT | 0.840 | 0.840 | 0.840 |
| Y | DRY GAS METER CAL. FACTOR | 0.985 | 0.985 | 0.985 |
| Pbar | BAROMETRIC PRESSURE, IN. HG. | 29.20 | 29.40 | 29.25 |
| Delta H | AVG. PRESS. DIFFERENTIAL OF ORIFICE METER, IN. H2O | 2.813 | 2.982 | 2.707 |
| Vm | VOLUME OF METERED GAS SAMPLE DRY ACTUAL CUBIC FEET | 16.808 | 16.781 | 16.362 |
| tm | DRY GAS METER TEMP., DEG. F | 46 | 56 | 50 |
| Vm(std) | VOLUME OF METERED GAS SAMPLE @ DRY STD. COND., DSCF* | 16.973 | 16.737 | 16.416 |
| Vlc | VOLUME OF WATER CATCH IN IMPINGERS & SIL. GEL.,ML | 4.5 | 6.5 | 6.0 |
| Vw(std) | VOLUME OF WATER VAPOR, SCF* | 0.212 | 0.306 | 0.282 |
| %H2O | MOISTURE, PERCENT BY VOLUME | 1.2 | 1.8 | 1.7 |
| Mfd | DRY MOLE FRACTION | 0.988 | 0.982 | 0.983 |

(continued next page)

| | | 1 | 2 | 3 |
|---|---|---|---|---|
| Md | DRY MOLECULAR WT, LB/LB-MOLE | 28.84 | 28.84 | 28.84 |
| Ms | WET MOLECULAR WT, LB/LB-MOLE | 28.70 | 28.64 | 28.65 |
| Pg | STACK STATIC PRESS., IN H2O | -1.4 | -1.8 | -1.6 |
| Ps | ABSOLUTE STACK PRESS., IN HG | 29.10 | 29.27 | 29.13 |
| ts | STACK TEMPERATURE, DEG. F | 84 | 94 | 91 |
| Delta P | AVG VELOCITY HEAD. IN. H2O | 3.2640 | 3.3710 | 3.1780 |
| vs | STACK GAS VELOCITY, FT/SEC | 104.7 | 107.2 | 104.0 |
| A | STACK AREA, SQUARE INCHES | 976.0 | 976.0 | 976.0 |
| Qsd | STACK FLOW RATE, DRY SCFM* | 39,684 | 39,894 | 38,782 |
| Qaw | STACK FLOW RATE, WET ACFM | 42,579 | 43,586 | 42,298 |
| %I | PERCENT ISOKINETIC | 98.5 | 93.4 | 97.5 |
| | METHOD 5 RESULTS: | | | |
| mg | CATCH, MILLIGRAMS | 0.9 | 1.2 | 1.7 |
| | CONCENTRATIONS | | | |
| Gr/DSCF | GRAINS PER DSCF* | 0.000818 | 0.00111 | 0.00160 |
| Lb/P | POUNDS PER PUSH | 0.00696 | 0.00945 | 0.0133 |
| Lb/T | POUNDS PER TON PUSHED | 0.000552 | 0.000750 | 0.00105 |

68 Deg. F - 29.92 in. Hg.

# EXAMPLE PARTICULATE TEST CALCULATIONS NO. 1

## Coke Battery Baghouse Outlet

### VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

$$Vm(std) = 17.64 * Y * Vm * \frac{(Pbar + Delta\ H/13.6)}{(460 + tm)}$$

$$Vm(std) = 17.64 * 0.985 * 16.808 * \frac{(29.20 + 2.813/13.6)}{(460 + 46)} = 16.973 \text{ DSCF}$$

### VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

$$Vw(std) = 0.04707 * Vlc$$

$$Vw(std) = 0.04707 * 4.5 = 0.212 \text{ SCF}$$

### PERCENT MOISTURE, BY VOLUME, AS MEASURED IN STACK GAS

$$\%H2O = 100 * Vw(std) / (Vw(std) + Vm(std))$$

$$\%H2O = \frac{0.212}{0.212 + 16.973} * 100 = 1.2\ \%$$

### DRY MOLE FRACTION OF STACK GAS

$$Mfd = 1 - \%H2O/100$$

$$Mfd = 1 - 1.2/100 = 0.988$$

### WET MOLECULAR WEIGHT OF STACK GAS

$$Ms = (Md * Mfd) + (0.18 * \%H2O)$$

$$Ms = 28.84 * 0.988 + (0.18 * 1.2) = 28.70 \text{ LB/LB-MOLE}$$

## ABSOLUTE STACK GAS PRESSURE

$$Ps = Pbar + Pg / 13.6$$

$$Ps = 29.20 + ( -1.3 / 13.6) = 29.10 \text{ IN. HG.}$$

## AVERAGE STACK GAS VELOCITY [Note: (Delta p)avg is square of avg sq. root]

$$vs = 85.49 * Cp * SQRT\left[\frac{(Delta\ p)avg * (460 + ts)}{Ps * Ms}\right]$$

$$vs = 85.49 * 0.840 * SQRT\left[\frac{3.2640 * (460 + 84)}{29.10 * 28.70}\right] = 104.7 \text{ FT/SEC}$$

## DRY VOLUMETRIC STACK GAS FLOW RATE @ STANDARD CONDITIONS

$$Qsd = \frac{60}{144} * Mfd * vs * A * \frac{Tstd}{ts + 460} * \frac{Ps}{Pstd}$$

$$Qsd = \frac{60}{144} * 0.988 * 104.7 * 976.0 * \frac{528}{84 + 460} * \frac{29.10}{29.92}$$

$$Qsd = 39,684 \text{ SCFM}$$

## WET VOLUMETRIC STACK GAS FLOW RATE @ STACK CONDITIONS

$$Qaw = 60 / 144 * vs * A$$

$$Qaw = 60 / 144 * 104.7 * 976.0 = 42,579 \text{ ACFM}$$

## PERCENT ISOKINETIC OF SAMPLING RATE

$$\%I = \frac{Pstd}{Tstd} * \frac{100}{60} * \frac{(ts + 460) * Vm(std)}{Ps * vs * Mfd * Theta * Area\text{-}nozzle,\ sq.ft.}$$

$$\%I = \frac{29.92}{528} * \frac{100}{60} * \frac{( 84 + 460) * 16.973}{29.10 * 104.7 * 0.988 * 18.00 * 0.0001632}$$

$$\%I = 98.5 \ \%$$

GRAINS PER DRY STANDARD CUBIC FOOT

$$Gn/DSCF = \frac{7000}{453,592} * \frac{mgs}{Vm(std)}$$

$$Gn/DSCF = \frac{7000}{453,592} * \frac{0.9}{16.973} = 0.000818 \quad GN/DSCF$$

POUNDS PER PUSH

$$Lb/P = Gn/DSCF * 1/7000 * Qs * Min/Push$$

$$Lb/P = 0.000818 * 1/7000 * 39,684 * 1.5 = 0.00696 \text{ LBS/PUSH}$$

POUNDS PER TON OF COKE PUSHED

$$Lb/T = \frac{Lb/P}{Tons/Push}$$

$$Lb/T = \frac{0.00696}{12.6} = 0.000552 \quad LB/TON$$

APPENDIX B

# Preliminary Field Data

PLANT NAME Armco

LOCATION Middletown Ohio

SAMPLING LOCATION Coke Baghouse outlet

DUCT DEPTH
FROM INSIDE FAR WALL TO OUTSIDE OF PORT 39 1/2

NIPPLE LENGTH 4 1/4

DEPTH OF DUCT 35 1/4

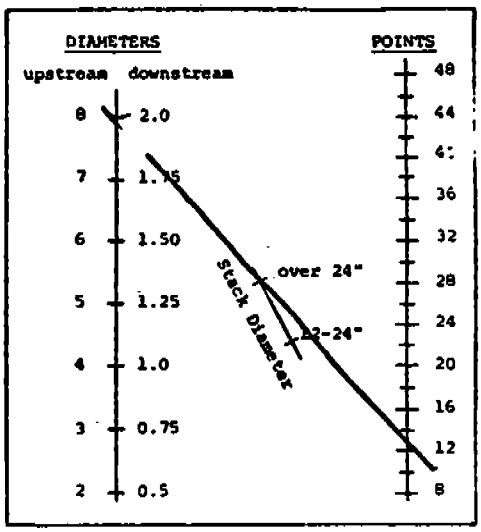
WIDTH (RECTANGULAR DUCT) _____

EQUIVALENT DIAMETER:

$$D_E = \frac{2 \times \text{DEPTH} \times \text{WIDTH}}{\text{DEPTH} + \text{WIDTH}} = \frac{2(\quad)(\quad)}{(\quad + \quad)} = \_\_\_\_$$

| DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE: | UPSTREAM | DOWNSTREAM |
|---|---|---|
| FEET | 288" | 66" |
| STACK DIAMETERS | 8 | 2 |

STACK AREA = _____ = 976 $IN^2$




| Point | % OF DIAMETER | DISTANCE FROM INSIDE WALL | DISTANCE FROM OUTSIDE OF PORT |
|---|---|---|---|
| 1 | 4.4 | 1 1/2 | 5 3/4 |
| 2 | 14.6 | 5 1/8 | 9 7/8 |
| 3 | 29.6 | 10 1/2 | 14 3/4 |
| 4 | 70.4 | 24 7/8 | 29 1/8 |
| 5 | 85.4 | 30 1/8 | 34 3/8 |
| 6 | 95.6 | 33 5/8 | 37 7/8 |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |
| 14 | | | |
| 15 | | | |
| 16 | | | |
| 17 | | | |
| 18 | | | |
| 19 | | | |
| 20 | | | |
| 21 | | | |
| 22 | | | |
| 23 | | | |
| 24 | | | |

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

| | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.7 | 4.4 | 3.2 | 2.6 | 2.1 | 1.8 | 1.6 | 1.4 | 1.3 | 1.1 | 1.1 |
| 2 | 25.0 | 14.6 | 10.5 | 8.2 | 6.7 | 5.7 | 4.9 | 4.4 | 3.9 | 3.5 | 3.2 |
| 3 | 75.0 | 29.6 | 19.4 | 14.6 | 11.8 | 9.9 | 8.5 | 7.5 | 6.7 | 6.0 | 5.5 |
| 4 | 93.3 | 70.4 | 32.3 | 22.6 | 17.7 | 14.6 | 12.5 | 10.9 | 9.7 | 8.7 | 7.9 |
| 5 | | 85.4 | 67.7 | 34.2 | 25.0 | 20.1 | 16.9 | 14.6 | 12.9 | 11.6 | 10.5 |
| 6 | | 95.6 | 80.6 | 65.8 | 35.6 | 26.9 | 22.0 | 18.8 | 16.5 | 14.6 | 13.2 |
| 7 | | | 89.5 | 77.4 | 64.4 | 36.6 | 28.3 | 23.6 | 20.4 | 18.0 | 16.1 |
| 8 | | | 96.8 | 85.4 | 75.0 | 63.4 | 37.5 | 29.6 | 25.0 | 21.8 | 19.4 |
| 9 | | | | 91.8 | 82.3 | 73.1 | 62.5 | 38.2 | 30.6 | 26.2 | 23.0 |
| 10 | | | | 97.4 | 88.2 | 79.9 | 71.7 | 61.8 | 38.8 | 31.5 | 27.2 |
| 11 | | | | | 93.3 | 85.4 | 78.0 | 70.4 | 61.2 | 39.3 | 32.3 |
| 12 | | | | | 97.9 | 90.1 | 83.1 | 76.4 | 69.4 | 60.7 | 39.8 |
| 13 | | | | | | 94.3 | 87.5 | 81.2 | 75.0 | 68.5 | 60.2 |
| 14 | | | | | | 98.2 | 91.5 | 85.4 | 79.6 | 73.8 | 67.7 |
| 15 | | | | | | | 95.1 | 89.1 | 83.5 | 78.2 | 72.8 |
| 16 | | | | | | | 98.4 | 92.5 | 87.1 | 82.0 | 77.0 |
| 17 | | | | | | | | 95.6 | 90.3 | 85.4 | 80.6 |
| 18 | | | | | | | | 98.6 | 93.3 | 88.4 | 83.9 |
| 19 | | | | | | | | | 96.1 | 91.3 | 86.8 |
| 20 | | | | | | | | | 98.7 | 94.0 | 89.5 |
| 21 | | | | | | | | | | 96.5 | 92.1 |
| 22 | | | | | | | | | | 98.9 | 94.5 |
| 23 | | | | | | | | | | | 96.8 |
| 24 | | | | | | | | | | | 98.9 |

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 25.0 | 16.7 | 12.5 | 10.0 | 8.3 | 7.1 | 6.3 | 5.6 | 5.0 | 4.5 | 4.2 |
| 2 | 75.0 | 50.0 | 37.5 | 30.0 | 25.0 | 21.4 | 18.8 | 16.7 | 15.0 | 13.6 | 12.5 |
| 3 | | 83.3 | 62.5 | 50.0 | 41.7 | 35.7 | 31.3 | 27.8 | 25.0 | 22.7 | 20.8 |
| 4 | | | 87.5 | 70.0 | 58.3 | 50.0 | 43.8 | 38.9 | 35.0 | 31.8 | 29.2 |
| 5 | | | | 90.0 | 75.0 | 64.3 | 56.3 | 50.0 | 45.0 | 40.9 | 37.5 |
| 6 | | | | | 91.7 | 78.6 | 68.8 | 61.1 | 55.0 | 50.0 | 45.8 |
| 7 | | | | | | 92.9 | 81.3 | 72.2 | 65.0 | 59.1 | 54.2 |
| 8 | | | | | | | 93.8 | 83.3 | 75.0 | 68.2 | 62.5 |
| 9 | | | | | | | | 94.4 | 85.0 | 77.3 | 70.8 |
| 10 | | | | | | | | | 95.0 | 86.4 | 79.2 |
| 11 | | | | | | | | | | 95.5 | 87.5 |
| 12 | | | | | | | | | | | 95.8 |

ENTROPY ENVIRONMENTALISTS, INC.

# PARTICULATE FIELD DATA

Run # 1

Company Name Armco — Time Start
Address Middletown Ohio — Time Finish
Sampling Location Coke Baghouse outlet
Date 12/14/82 Team Leader DR Technicians PLO
Barometric Pressure, in. Hg 29.20 Static Pressure, in. $H_2O$ -1.35
Sampling Train Leak Test Vacuum, in. Hg 15 5
Sampling Train Leak Rate, cu. ft./min. .000 .000

**EQUIPMENT CHECKS**

- ✓ Pitots, pre-test
- Pitots, post-test
- – Orsat Sampling System
- – Tedlar Bag
- ✓ Thermocouple @ 40 °F

**IDENTIFICATION NUMBERS**

Reagent Box 206 Nozzle 203 Diameter .173
Meter Box N-2 T/C Readout blue
Umbilical – T/C Probe Neo-4
Sample Box 13 Orsat Pump –
Probe 4-1 Tedlar Bag –

| Filter # | Tare |
|---|---|
| W2455 | .4011 |
| | |
| | |

**NOMOGRAPH SET-UP** Nomograph #

$\Delta H_@$ 1.62 C Factor .89-.05 = .84
Meter Temp 56 Stack Temp 35, 70, 100
% Moisture 2 Ref. ΔP 2.0,

| Sample Point | Clock Time, Min. | Dry Gas Meter Reading, Cu. Ft. | Pitot Reading (Δp), In. $H_2O$ | Orifice Setting (ΔH), In. $H_2O$ Ideal | Orifice Setting (ΔH), In. $H_2O$ Actual | Gas Meter Temp. °F | Pump Vacuum In. Hg Gauge | Filter Box Temp. °F | Imp. Exit Temp. °F | Stack Temp. °F |
|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 0/0 | 997.113 | 3.5 | 3.5 | 3.50 | | | | | 34 |
| | 15 | | 3.5 | 3.5 | 3.50 | | | | | 35 |
| | 30 | | 3.8 | 3.5 | 3.56 | 40 | 1 | 250 | 40 | 40 |
| | 45 | 0750 | 3.2 | 3.2 | 3.20 | | | | | 40 |
| | 60 | | 3.2 | 3.2 | 3.20 | | | | | 42 |
| | 75 | | 3.2 | 3.2 | 3.20 | | | | | 44 |
| 2 | 90/0 | 998.616 | 4.0 | 4.0 | 4.00 | | | | | 45 |
| | 15 | | 3.8 | 3.8 | 3.80 | | | | | 50 |
| | 30 | | 3.2 | 3.2 | 3.20 | | | | | 60 |
| | 45 | 0816 | 3.2 | 3.2 | 3.20 | 40 | 1 | 250 | 40 | 60 |
| | 60 | | 3.2 | 3.2 | 3.20 | | | | | 60 |
| | 75 | | 3.2 | 3.2 | 3.20 | | | | | 64 |
| 3 | 90/0 | 000.200 | 4.0 | 3.50 | 3.50 | | | | | 66 |
| | 15 | | 4.0 | 3.5 | 3.50 | | | | | 90 |
| | 30 | | 4.0 | 3.5 | 3.50 | | | | | 101 |
| | 45 | | 3.8 | 3.2 | 3.20 | 42 | | 250 | 46 | 110 |
| | 60 | | 3.8 | 3.2 | 3.20 | | | | | 110 |
| | 75 | | 3.8 | 3.2 | 3.20 | | 1 | | | 110 |
| 4 | 90/0 | 001.656 | 3.8 | 3.2 | 3.20 | | 1 | 250 | | 35 |
| | 15 | | 3.8 | 3.0 | 3.06 | | | | | 35 |
| | 30 | | 3.2 | 2.70 | 2.70 | | | | 40 | 34 |
| | 45 | 0859 | 2.8 | 2.2 | 2.20 | 43 | | | | 35 |
| | 60 | | 2.8 | 2.2 | 2.20 | | | | | 35 |
| | 75 | | 2.8 | 2.2 | 2.20 | | 1 | | | 35 |
| | 90/0 | 003.043 | | | | | | | | |

$V_m$ $(\overline{\sqrt{\Delta p}})^2$ $\overline{\Delta H}$ $\overline{T_m}$ $\overline{T_s}$

# PARTICULATE FIELD DATA

page 2

Company Name Armco Run # 1

Sampling Location Coke Baghouse outlet. Date 12/14/82

| Sample Point | Clock Time, Min. | Dry Gas Meter Reading, Cu. Ft. | Pitot Reading (Δp), In. $H_2O$ | Orifice Setting (ΔH), In. $H_2O$ Ideal | Orifice Setting (ΔH), In. $H_2O$ Actual | Gas Meter Temp. °F | Pump Vacuum In. Hg Gauge | Filter Box Temp. °F | Imp. Exit Temp. °F | Stack Temp. °F |
|---|---|---|---|---|---|---|---|---|---|---|
| | 590/0 | 003.043 | 3.00 | 2.8 | 2.80 | | | | | 75 |
| | 15 | | 2.3 | 2.0 | 2.00 | | | | | 78 |
| | 30 | | 2.0 | 1.70 | 1.70 | 45 | 1 | 250 | 45 | 91 |
| | 45 | | 2.0 | 1.7 | 1.70 | | | | | 107 |
| | 60 | | 2.0 | 1.7 | 1.70 | | | | | 113 |
| | 75 | | 2.0 | 1.7 | 1.70 | | | | | 117 |
| 6 | 90/0 | 004.289 | 4.0 | 3.30 | 3.30 | | | | | 74 |
| | 15 | | 3.8 | 3.2 | 2.20 | | | | | 74 |
| | 30 | | 3.2 | 2.60 | 2.60 | 45 | 1 | 250 | 45 | 78 |
| | 45 | 0.95 | 3.2 | 2.60 | 2.60 | | | | | 93 |
| | 60 | | 3.8 | 3.2 | 3.20 | | | | | 100 |
| | 75 | | 3.8 | 3.2 | 3.20 | | | | | 112 |
| 7 | 90/0 | 005.708 | 3.2 | 2.6 | 2.60 | | | | | 120 |
| | 15 | | 3.2 | 2.6 | 2.60 | | | | | 74 |
| | 30 | 0.948 | 2.8 | 2.3 | 2.30 | | | | | 73 |
| | 45 | | 2.8 | 2.3 | 2.30 | 45 | 1 | 250 | 45 | 73 |
| | 60 | | 2.8 | 2.3 | 2.30 | | | | | 87 |
| | 75 | | 2.4 | 2.0 | 2.00 | | | | | 103 |
| (2) 8 | 90/0 | 007.001 | 4.20 | 3.50 | 3.50 | | | | | 113 |
| | 15 | | 3.8 | 3.2 | 3.20 | | | | | 75 |
| | 30 | | 3.4 | 2.8 | 2.80 | | | | | 75 |
| | 45 | 1.000 | 3.4 | 2.8 | 2.80 | 46 | 1 | 250 | 45 | 88 |
| | 60 | | 3.4 | 2.8 | 2.80 | | | | | 104 |
| | 75 | | 3.4 | 2.8 | 2.80 | | | | | 116 |
| (3) 9 | 90/0 | 008.458 | 3.8 | 3.2 | 3.20 | | | | | 74 |
| | 15 | | 3.8 | 3.2 | 3.20 | | | | | 74 |
| | 30 | | 3.2 | 2.6 | 2.60 | 50 | 1 | 250 | 45 | 78 |
| | 45 | 1.013 | 3.2 | 2.6 | 2.60 | | | | | 90 |
| | 60 | | 3.2 | 2.6 | 2.60 | | | | | 106 |
| | 75 | | 3.8 | 3.2 | 3.20 | | | | | 108 |
| (4) 10 | 90/0 | 009.900 | 3.4 | 2.8 | 2.80 | | | | | 76 |
| | 15 | | 3.0 | 2.6 | 2.60 | | | | | 109 |
| | 30 | | 3.8 | 3.2 | 3.20 | | | | | 115 |
| | 45 | 1.057 | 3.8 | 3.2 | 3.20 | 50 | 1 | 250 | 45 | 119 |
| | 60 | | 3.8 | 3.2 | 3.20 | | | | | 128 |
| | 75 | | 3.8 | 3.2 | 3.20 | | | | | 126 |
| (5) 11 | 90/0 | 11.264 | 2.8 | 3.0 | 3.20 | | | | | 89 |
| | 15 | | 3.2 | 2.6 | 2.60 | | | | | 89 |
| | 30 | | 3.2 | 2.6 | 2.60 | 50 | 1 | 250 | 45 | 104 |
| | 45 | | 3.0 | 2.4 | 2.40 | | | | | 104 |

$\overline{V_m}$ $\overline{(\sqrt{\Delta p})^2}$ $\overline{\Delta H}$ $\overline{T_m}$ $\overline{T_s}$

# PARTICULATE FIELD DATA

page 2

Company Name Armco Run # 1

Sampling Location Coke Baghouse outlet Date 12/14/92

| Sample Point | Clock Time, Min. | Dry Gas Meter Reading, Cu. Ft. | Pitot Reading (Δp), In. $H_2O$ | Orifice Setting (ΔH), In. $H_2O$ Ideal | Orifice Setting (ΔH), In. $H_2O$ Actual | Gas Meter Temp. °F | Pump Vacuum In. Hg Gauge | Filter Box Temp. °F | Imp. Exit Temp. °F | Stack Temp. °F |
|---|---|---|---|---|---|---|---|---|---|---|
| | 60 | 1055 | 3.0 | 2.4 | 2.40 | | | | | 121 |
| | 75 | | 3.0 | 2.4 | 2.40 | | | | | 127 |
| (6) | 90/0 | 12625 | 3.0 | 2.4 | 2.40 | | | | | 87 |
| | 15 | 1106 | 3.0 | 2.4 | 2.40 | | | | | 87 |
| | 30 | | 3.0 | 2.4 | 2.40 | 50 | 1 | 250 | 45 | 100 |
| | 45 | 1106 | 2.8 | 2.3 | 2.30 | | | | | 115 |
| | 60 | | 2.8 | 2.3 | 2.30 | | | | | 118 |
| | 75 | | 2.8 | 2.3 | 2.30 | | | | | 118 |
| | 90/off | 13.921 | | | | | | | | |

| $V_m$ | $(\sqrt{\Delta p})^2$ | $\overline{\Delta H}$ | $\overline{T_m}$ | $\overline{T_s}$ |
|---|---|---|---|---|
| 16.808 | 3.264 | 2.813 | 46 | 84 |

ENTROPY ENVIRONMENTAL INC.

# PARTICULATE FIELD DATA

Run # 2

Company Name Cemco — Time Start
Address Middletown Ohio — Time Finish
Sampling Location Coke Baghouse outlet
Date 12/14/82 Team Leader DF Technicians PLO
Barometric Pressure, in. Hg 29.40 Static Pressure, in. $H_2O$ -1.75

| | | | | | |
|---|---|---|---|---|---|
| Sampling Train Leak Test Vacuum, in. Hg | 15 | 5 | 5 | 8 | |
| Sampling Train Leak Rate, cu. ft./min. | .000 | .000 | .000 | .000 | |

**EQUIPMENT CHECKS**

- ✓ Pitots, pre-test
- – Pitots, post-test
- – Orsat Sampling System
- – Tedlar Bag
- ✓ Thermocouple @ 100 °F

**IDENTIFICATION NUMBERS**

| | | | |
|---|---|---|---|
| Reagent Box | 206 | Nozzle | 201 |
| Diameter | .176 | | |
| Meter Box | W-2 | T/C Readout | Blue |
| Umbilical | – | T/C Probe | Rus-4 |
| Sample Box | | Orsat Pump | – |
| Probe | 4-5 | Tedlar Bag | – |

| Filter # | Tare |
|---|---|
| W1788 | .4065 |
| | |
| | |

**NOMOGRAPH SET-UP** Nomograph # 90

| | | | |
|---|---|---|---|
| $\Delta H_@$ | 1.62 | C Factor | ~~.99~~ .05 = .95 |
| Meter Temp | 60 | Stack Temp | 100 |
| % Moisture | 2 | Ref. ΔP | 2.2 |

| Sample Point | Clock Time, Min. | Dry Gas Meter Reading, Cu. Ft. | Pitot Reading (Δp), In. $H_2O$ | Orifice Setting (ΔH), In. $H_2O$ Ideal | Orifice Setting (ΔH), In. $H_2O$ Actual | Gas Meter Temp. °F | Pump Vacuum In. Hg Gauge | Filter Box Temp. °F | Imp. Exit Temp. °F | Stack Temp. °F |
|---|---|---|---|---|---|---|---|---|---|---|
| B 1 | 0/0 | 14.071 | 4.0 | 3.4 | 3.40 | | | | | 68 |
| | 15 | | 3.8 | 3.2 | 3.20 | | | | 45 | 76 |
| | 30 | 1.56 | 3.2 | 2.8 | 2.80 | 60 | 1 | 250 | | 72 |
| | 45 | | 3.2 | 2.8 | 2.80 | | | | | 111 |
| | 60 | | 3.2 | 2.8 | 2.80 | | | | | 118 |
| | 75 | | 3.2 | 2.8 | 2.80 | | | | | 122 |
| 2 | 90/0 | 15.50 | 3.2 | 2.8 | 2.80 | | | | | 81 |
| | 15 | | 4.1 | 3.5 | 3.50 | | | | | 87 |
| | 30 | | 3.4 | 2.9 | 2.90 | | | | | 111 |
| | 45 | 1.210 | 3.4 | 2.9 | 2.90 | 60 | 1 | 250 | 45 | 122 |
| | 60 | | 3.4 | 2.9 | 2.90 | | | | | 130 |
| | 75 | | 3.4 | 2.9 | 2.90 | | | | | 132 |
| 3 | 90/0 | 16.908 | 3.4 | 2.9 | 2.90 | | | | | 85 |
| | 15 | | 3.2 | 2.8 | 2.80 | | | | | 85 |
| | 30 | | 2.8 | 2.3 | 2.30 | | | | | 85 |
| | 45 | 1.21 | 2.8 | 2.3 | 2.30 | 60 | 1 | 250 | 45 | 126 |
| | 60 | | 2.8 | 2.3 | 2.30 | | | | | 129 |
| | 75 | | 3.0 | 2.50 | 2.50 | | | | | 138 |
| 4 | 90/0 | 18.315 | 3.8 | 3.2 | 3.20 | | | | | 82 |
| | 15 | | 3.8 | 3.2 | 3.20 | | | | | 82 |
| | 30 | | 3.4 | 2.9 | 2.90 | | | | | 90 |
| | 45 | 1.37 | 3.2 | 2.8 | 2.80 | 60 | 1 | 250 | 45 | 98 |
| | 60 | | 3.0 | 2.5 | 2.50 | | | | | 113 |
| | 75 | | 3.0 | 2.5 | 2.50 | | | | | 123 |
| | 90 | 19.771 | | | | | | | | |

$V_m$ $\overline{(\sqrt{\Delta p})^2}$ $\overline{\Delta H}$ $\overline{T_m}$ $\overline{T_s}$

ENTROPY

# PARTICULATE FIELD DATA

page 2

-1,75

Company Name Armco Run # 2

Sampling Location coke Baghouse outlet Date 12/14/90

| Sample Point | Clock Time, Min. | Dry Gas Meter Reading, Cu. Ft. | Pitot Reading (Δp), In. $H_2O$ | Orifice Setting (ΔH), In. $H_2O$ Ideal | Orifice Setting (ΔH), In. $H_2O$ Actual | Gas Meter Temp. °F | Pump Vacuum In. Hg Gauge | Filter Box Temp. °F | Imp. Exit Temp. °F | Stack Temp. °F |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 90/0 | 19.77 | 3.6 | 3.6 | 3.00 | | | | | 85 |
| | 15 | | 2.8 | 2.3 | 2.30 | | | | | 81 |
| | 30 | | 2.8 | 2.3 | 2.30 | 60 | 5 | 250 | 45 | 88 |
| | 45 | 12.50 | 3.2 | 2.8 | 2.80 | | | | | 98 |
| | 60 | | 3.2 | 2.8 | 2.80 | | | | | 108 |
| | 75 | | 3.2 | 2.8 | 2.80 | | | | | 114 |
| 6 | 90/0 | 21.192 | 3.8 | 3.2 | 3.20 | | | | | 75 |
| | 15 | | 3.6 | 3.0 | 3.00 | | | | | 84 |
| | 30 | | 3.6 | 3.0 | 3.00 | 60 | 5 | 250 | 45 | 93 |
| | 45 | 13.13 | 3.4 | 2.9 | 2.90 | | | | | 111 |
| | 60 | | 3.4 | 2.9 | 2.90 | | | | | 119 |
| | 75 | | 3.4 | 2.9 | 2.90 | | | | | 123 |
| A(1) 7 | 90/0 | 22.623 | 2.8 | 2.3 | 2.30 | | | | | 85 |
| | 15 | | 3.8 | 3.2 | 3.20 | | | | | 85 |
| | 30 | | 3.8 | 3.2 | 3.20 | | | | | 91 |
| | 45 | 13.28 | 3.8 | 3.2 | 3.20 | 60 | 5 | 250 | 45 | 107 |
| | 60 | | 3.0 | 2.5 | 2.50 | | | | | 115 |
| | 75 | | 3.0 | 2.5 | 2.50 | | | | | 119 |
| (2) 8 | 90/0 | 23.970 | 4.0 | 3.8 | 3.80 | | | | | 35 |
| | 15 | | 3.8 | 3.5 | 3.50 | | | | | 33 |
| | 30 | 0.75 | 3.8 | 3.5 | 3.50 | | | | | 53 |
| | 45 | | 3.9 | 3.5 | 3.50 | 48 | 6 | 250 | 45 | 68 |
| | 60 | | 3.8 | 3.5 | 3.50 | | | | | 71 |
| | 75 | | 3.8 | 3.5 | 3.50 | | | | | 72 |
| (3) 9 | 90/0 | 25.585 | 3.8 | 3.5 | 3.50 | | | | | 66 |
| | 15 | | 3.0 | 2.8 | 2.80 | | | | | 67 |
| | 30 | | 3.2 | 3.0 | 3.00 | | | | | 71 |
| | 45 | 0.10 | 3.2 | 3.0 | 3.00 | | | | | 87 |
| | 60 | 0 | 3.2 | 3.0 | 3.00 | 50 | 6 | 250 | 45 | 94 |
| | 75 | | 3.2 | 3.0 | 3.00 | | | | | 100 |
| (4) 10 | 90/0 | 27.013 | 3.4 | 3.0 | 3.00 | | | | | 72 |
| | 15 | | 3.2 | 2.9 | 2.90 | | | | | 71 |
| | 30 | 0.7 | 3.0 | 3.7 | 3.70 | | | | | 73 |
| | 45 | 0.7 | 2.8 | 2.5 | 2.50 | 50 | 6 | 250 | 45 | 85 |
| | 60 | 0 | 2.6 | 2.3 | 2.30 | | | | | 100 |
| | 75 | | 2.6 | 2.3 | 2.30 | | | | | 110 |
| (5) 11 | 90/0 | 28.386 | 2.0 | 1.8 | 1.80 | | | | | 78 |
| | 15 | | 3.8 | 3.4 | 3.40 | | | | | 79 |
| | 30 | 0.46 | 3.8 | 3.4 | 3.40 | 50 | 6 | 250 | 45 | 94 |
| | 45 | 0 | 3.8 | 3.4 | 3.40 | | | | | 108 |

$\overline{V_m}$ $\overline{(\sqrt{\Delta p})^2}$ $\overline{\Delta H}$ $\overline{T_m}$ $\overline{T_s}$

Leak check 24.134

# PARTICULATE FIELD DATA

page 2

Company Name Armco Run # 2

Sampling Location Lake Baghouse outlet Date 12/15/82

| Sample Point | Clock Time, Min. | Dry Gas Meter Reading, Cu. Ft. | Pitot Reading (Δp), In. $H_2O$ | Orifice Setting (ΔH), In. $H_2O$ Ideal | Orifice Setting (ΔH), In. $H_2O$ Actual | Gas Meter Temp. °F | Pump Vacuum In. Hg Gauge | Filter Box Temp. °F | Imp. Exit Temp. °F | Stack Temp. °F |
|---|---|---|---|---|---|---|---|---|---|---|
| | 60 | | 3.8 | 3.4 | 3.40 | | | | | 128 |
| | 75 | | 3.8 | 3.4 | 3.40 | | | | | 129 |
| (6) 12 | 90/0 | 29.711 | 4.0 | 3.8 | 3.80 | | | | | 78 |
| | 15 | | 3.8 | 3.5 | 3.50 | | | | | 76 |
| | 30 | | 3.8 | 3.5 | 3.50 | 50 | 6 | 250 | 45 | 82 |
| | 45 | 0 91° | 3.8 | 3.5 | 3.50 | | | | | 97 |
| | 60 | | 3.6 | 3.3 | 3.30 | | | | | 108 |
| | 75 | | 3.6 | 3.3 | 3.30 | | | | | 120 |
| | 90/OFF | 31.021 | | | | | | | | |

| $V_m$ | $(\sqrt{\Delta p})^2$ | $\overline{\Delta H}$ | $\overline{T_m}$ | $\overline{T_s}$ |
|---|---|---|---|---|
| 16.781 | 3.371 | 2.982 | 56 | 94 |

# PARTICULATE FIELD DATA

Run # 3

Company Name Armco
Address Middletown Ohio
Sampling Location Cole Baghouse output
Date 12/15/82 Team Leader DF Technicians PLO
Barometric Pressure, in. Hg 29.25 Static Pressure, in. $H_2O$ -1.60
Sampling Train Leak Test Vacuum, in. Hg 15 8
Sampling Train Leak Rate, cu. ft./min. .000 .000

Time Start
Time Finish

**EQUIPMENT CHECKS**

- ✓ Pitots, pre-test
- Pitots, post-test
- — Orsat Sampling System
- — Tedlar Bag
- ✓ Thermocouple @ 45 °F

**IDENTIFICATION NUMBERS**

Reagent Box 206 Nozzle 203 Diameter .173
Meter Box N-2 T/C Readout blue
Umbilical — T/C Probe new #4
Sample Box 13 Orsat Pump —
Probe 4-1 Tedlar Bag —

| Filter # | Tare |
|---|---|
| W 2162 | .4027 |
| | |
| | |

**NOMOGRAPH SET-UP** Nomograph #

$\Delta H_@$ 1.62 C Factor .99 - .05 = .84
Meter Temp 50 Stack Temp 100
% Moisture 2 Ref. ΔP 2.20

| Sample Point | Clock Time, Min. | Dry Gas Meter Reading, Cu. Ft. | Pitot Reading (Δp), In. $H_2O$ | Orifice Setting (ΔH), In. $H_2O$ Ideal | Orifice Setting (ΔH), In. $H_2O$ Actual | Gas Meter Temp. °F | Pump Vacuum In. Hg Gauge | Filter Box Temp. °F | Imp. Exit Temp. °F | Stack Temp. °F |
|---|---|---|---|---|---|---|---|---|---|---|
| A 1 | 0/0 | 31.212 | 3.0 | 2.5 | 2.50 | | | | | 60 |
| | 15 | | 3.0 | 2.5 | 2.50 | | | | | 62 |
| | 30 | 0.926 | 3.2 | 2.8 | 2.80 | 50 | 3 | 250 | 60 | 65 |
| | 45 | | 3.0 | 2.5 | 2.50 | | | | | 76 |
| | 60 | | 2.8 | 2.4 | 2.40 | | | | | 90 |
| | 75 | | 2.8 | 2.4 | 2.40 | | | | | 103 |
| 2 | 90/0 | 32.600 | 3.2 | 2.8 | 2.80 | | | | | 83 |
| | 15 | | 3.4 | 2.9 | 2.90 | | | | | 83 |
| | 30 | 0.943 | 3.4 | 2.9 | 2.90 | 50 | 3 | 250 | 60 | 86 |
| | 45 | | 3.2 | 2.8 | 2.80 | | | | | 94 |
| | 60 | | 3.2 | 2.8 | 2.80 | | | | | 108 |
| | 75 | | 3.2 | 2.8 | 2.80 | | | | | 127 |
| 3 | 90/0 | 34.009 | 3.2 | 2.8 | 2.80 | | | | | 77 |
| | 15 | | 3.8 | 3.40 | 3.40 | | | | | 83 |
| | 30 | 1.000 | 3.80 | 3.4 | 3.40 | 52 | 3 | 250 | 60 | 96 |
| | 45 | | 3.8 | 3.4 | 3.40 | | | | | 99 |
| | 60 | | 3.8 | 3.4 | 3.40 | | | | | 108 |
| | 75 | | 3.8 | 3.4 | 3.40 | | | | | 114 |
| 4 | 90/0 | 35.345 | 3.2 | 2.8 | 2.80 | | | | | 72 |
| | 15 | | 3.0 | 2.5 | 2.50 | | | | | 79 |
| | 30 | 1.018 | 2.8 | 2.4 | 2.40 | 52 | 3 | 250 | 60 | 81 |
| | 45 | | 2.8 | 2.4 | 2.40 | | | | | 95 |
| | 60 | | 2.6 | 2.2 | 2.20 | | | | | 107 |
| | 75 | | 2.6 | 2.2 | 2.20 | | | | | 116 |
| | 90 | 36.648 | | | | | | | | |

$\overline{V_m}$ $\overline{(\sqrt{\Delta p})^2}$ $\overline{\Delta H}$ $\overline{T_m}$ $\overline{T_s}$

# PARTICULATE FIELD DATA

page 2

Company Name [illegible] Armco Run # [illegible]

Sampling Location Baghouse outlet #2 Date [illegible]

| Sample Point | Clock Time, Min. | Dry Gas Meter Reading, Cu. Ft. | Pitot Reading (Δp), In. $H_2O$ | Orifice Setting (ΔH), In. $H_2O$ Ideal | Orifice Setting (ΔH), In. $H_2O$ Actual | Gas Meter Temp. °F | Pump Vacuum In. Hg Gauge | Filter Box Temp. °F | Imp. Exit Temp. °F | Stack Temp. °F |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 90/0 | 36.648 | 3.4 | 3.40 | 3.40 | | | | | 75 |
| | 15 | | 3.2 | 2.8 | 2.80 | | | | | [illegible] |
| | 30 | | 3.0 | 2.5 | 2.50 | | | | | 92 |
| | 45 | 1035 | 3.0 | 2.5 | 2.50 | 52 | 2 | 250 | [illegible] | 106 |
| | 60 | | 3.0 | 2.5 | 2.50 | | | | | 109 |
| | 75 | | 3.0 | 2.5 | 2.50 | | | | | 119 |
| 6 | 90/0 | 37.975 | 3.4 | 3.40 | 3.40 | | | | | 121 |
| | 15 | | 3.8 | 3.4 | 3.40 | | | | | 72 |
| | 30 | | 3.6 | 2.8 | 2.80 | | | | | 84 |
| | 45 | | 30 | 2.50 | 2.50 | 52 | 2 | 250 | 60 | 96 |
| | 60 | | 3.0 | 2.8 | 2.50 | | | | | 108 |
| | 75 | | 3.0 | 2.5 | 2.50 | | | | | 113 |
| B(1) | 90/0 | 39.472 | 2.0 | 1.7 | 1.70 | | | | | 129 |
| | 15 | | 2.8 | 2.3 | 2.30 | | | | | 80 |
| | 30 | | 2.8 | 2.3 | 2.30 | | | | | 104 |
| | 45 | 1100 | 2.8 | 2.3 | 2.30 | 52 | 2 | 2[illegible] | 60 | 111 |
| | 60 | | 2.8 | 2.3 | 2.30 | | | | | 118 |
| | 75 | | 2.8 | 2.3 | 2.30 | | | | | 125 |
| (2) 8 | 90/0 | 40.665 | 4.8 | 4.0 | 4.00 | | | | | 127 |
| | 15 | | 4.2 | 3.8 | 3.80 | | | | | 67 |
| | 30 | | 3.8 | 3.4 | 3.40 | | | | | 78 |
| | 45 | 1254 | 3.8 | 3.4 | 3.40 | 46 | 5 | 250 | 60 | 91 |
| | 60 | | 3.8 | 3.4 | 3.40 | | | | | 114 |
| | 75 | | 3.8 | 3.4 | 3.40 | | | | | 120 |
| (3) 9 | 90/0 | 42.260 | 4.0 | 3.2 | 3.20 | | | | | 6[illegible] |
| | 15 | | 3.2 | 2.7 | 2.70 | | | | | 76 |
| | 30 | | 3.0 | 2.5 | 2.50 | | | | | 88 |
| | 45 | 1214 | 3.0 | 2.5 | 2.50 | 48 | 4 | 250 | 60 | 125 |
| | 60 | | 3.0 | 2.5 | 2.50 | | | | | 116 |
| | 75 | | 3.0 | 2.5 | 2.50 | | | | | 118 |
| (4) 10 | 90/0 | 43.630 | 3.6 | 3.0 | 3.00 | | | | | 70 |
| | 15 | | 3.4 | 2.8 | 2.80 | | | | | 59 |
| | 30 | 1232 | 3. | 2.5 | 2.50 | | | | | 70 |
| | 45 | | 3.0 | 2.5 | 2.50 | 48 | 4 | 250 | 60 | 79 |
| | 60 | | 3.0 | 2.5 | 2.50 | | | | | 88 |
| | 75 | | 3.0 | 2.5 | 2.50 | | | | | 97 |
| (5) 11 | 90/0 | 44.954 | 3.0 | 2.5 | 2.50 | | | | | 65 |
| | 15 | | 3.2 | 2.7 | 2.70 | | | | | 65 |
| | 30 | 1243 | 3.0 | 2.5 | 2.50 | 48 | 4 | 250 | 60 | 68 |
| | 45 | | 3.0 | 2.5 | 2.50 | | | | | 80 |

$V_m$ $(\overline{\sqrt{\Delta p}})^2$ $\overline{\Delta H}$ $\overline{T_m}$ $\overline{T_s}$

ENTROPY

# PARTICULATE FIELD DATA

page 2

Company Name Armco Run # 3

Sampling Location Baghouse outlet Date 12/15/82

| Sample Point | Clock Time, Min. | Dry Gas Meter Reading, Cu. Ft. | Pitot Reading (Δp), In. $H_2O$ | Orifice Setting (ΔH), In. $H_2O$ Ideal | Orifice Setting (ΔH), In. $H_2O$ Actual | Gas Meter Temp. °F | Pump Vacuum In. Hg Gauge | Filter Box Temp. °F | Imp. Exit Temp. °F | Stack Temp. °F |
|---|---|---|---|---|---|---|---|---|---|---|
| | 68 | | 3.0 | 2.5 | 2.50 | | | | | 93 |
| | 75 | | 3.0 | 2.5 | 2.50 | | | | | 94 |
| (6) 12 | 90/0 | 46.274 | 3.2 | 2.8 | 2.80 | | | | | 67 |
| | 15 | | 3.2 | 2.8 | 2.80 | | | | | 67 |
| | 30 | | 3.0 | 2.5 | 2.50 | | | | | 68 |
| | 45 | 130 | 2.8 | 1.6 | 1.60 | | | | | 74 |
| | 60 | | 3.0 | 2.5 | 2.50 | | | | | 87 |
| | 75 | | 3.0 | 2.5 | 2.50 | | | | | 93 |
| | 90/0 | 47.574 | | | | | | | | |

| $V_m$ | $(\sqrt{\Delta p})^2$ | $\Delta H$ | $T_m$ | $T_s$ |
|---|---|---|---|---|
| 16.362 | 3.178 | 2.707 | 50 | 91 |

NTROPY

# PARTICULATE SAMPLING CLEANUP SHEET

REAGENT BOX(ES)# 0206

Plant ARMCO — Date Received 12/17/82

Sampling Location BAGHOUSE OUTLET — Date Analyzed 12/22/82

| Run # | 1 | 2 | 3 |
|---|---|---|---|
| Run Date | 12/14 | 12/1 | 12/15 |
| **ANALYSIS OF MOISTURE CATCH** | | | |
| Final Reagent Wt., g. | 200.0 | 199.0 | 200.0 |
| Tared Weight, g. | 200.0 | 200.0 | 200.0 |
| CONDENSED WATER, g. | 0.0 | -1.0 | 0.0 |
| Final Silica Gel Wt., g. | 204.5 | 207.5 | 206.0 |
| Tared Wt., g. | 200.0 | 200.0 | 200.0 |
| ABSORBED WATER, g. | 4.5 | 7.5 | 6.0 |
| TOTAL WATER COLLECTED, g. | 4.5 | 6.5 | 6.0 |
| **ANALYSIS OF CATCH FROM NOZZLE TO FILTER, INCLUSIVE** | | | |
| Filter + Particulate, mg. | 403.1 | 408.4 | 405.1 |
| Filter Tare, mg. | 401.1 | 406.5 | 402.7 |
| Filter Catch, mg. | - | - | - |
| Separate Rinsings, mg. | - | - | - |
| FILTER CATCH + RINSINGS, mg. | 2.0 | 1.9 | 2.4 |
| Acetone Volume, ml. | 150 | 100 | 100 |
| Acetone Residue, mg. | 1.1 | 0.7 | 0.7 |
| TOTAL PARTICULATE CATCH, mg. | 0.9 | 1.2 | 1.7 |
| **ANALYSIS OF IMPINGER WATER** | | | |
| Extraction wt., mg. | | | |
| Boildown wt., mg. | | | |
| Impinger Rinse wt. mg.. | | | |
| Acetone Volume, ml. | | | |
| Acetone Residue, mg. | | | |
| Water Volume, ml. | | | |
| Water Residue, mg. | | | |
| TOTAL IMPINGER CATCH, mg. | | | |
| TOTAL TRAIN CATCH | | | |

**BLANK CALCULATION**

| | Acetone | Water |
|---|---|---|
| Volume, ml. | 200 | |
| Residue, mg. | 1.4 | |
| Concen., mg/ml | .007 | |

**NOTES AND COMMENTS**

EPA- 5

ENTROPY

CUSTODY SHEET FOR REAGENT BOX # 0206

Date of Makeup 12/8/82 Initials MEA Locked? ✓

Individual Tare of Reagent: 200 mls. of $H_2O$

Individual Tare of Reagent: _____ mls. of _____

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME Armco

SAMPLING LOCATION Baghouse outlet

| Run Number | Date Used | Initials | Locked? | Date Cleanup | % S. Gel Spent | Initials | Locked? |
|---|---|---|---|---|---|---|---|
| 1 | 12/14/82 | out | ✓ | 12/14/82 | 10% | out | ✓ |
| 2 | 12/14/82 12/15/82 | out | ✓ | 12/15/82 | 10% | out | ✓ |
| 3 | 12/15/82 | out | ✓ | 12/15/82 | 10% | out | ✓ |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Received in Lab Date 12/17/82 Initials MEA Locked? ✓

Zero & Span Balance Initials MEA

Sampling Method: EPA METHOD 5

Remarks:

| Filter # | Tare Weight (mgms) | Used on Test |
|---|---|---|
| W2455 | .4011 | 1 |
| W1788 | .4065 | 2 |
| W2162 | .4027 | 3 |
| | | |
| | | |
| | | |

ENTROPY ENVIRONMENTALISTS, INC.

APPENDIX C

RM 290-S

# DAILY PUSHER REPORT
## COKE PLANT DEPT.

ATE 12-14-82

51 OVENS

| NO. | OVEN NO. | POUNDS CHARGED | TIME PUSHED | TIME CHARGED | NO. | OVEN NO. | POUNDS CHARGED | TIME PUSHED | TIME CHARGED | NO. | OVEN NO. | POUNDS CHARGED | TIME PUSHED | TIME CHARGED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 54 | | 12 08 AM | | 46 | 26 | | 6 09 PM | | 91 | 23 | | 6 04 PM | |
| | 64 | | 26 | | 47 | 36 | | 19 | | 92 | 33 | | 18 | |
| | 74 | | 43 | | 48 | 46 | | 37 | | 93 | 43 | | 35 | |
| | 84 | | 1:03 | | 49 | 56 | | 56 | | 94 | 53 | | 53 | |
| | 6 | | 21 | | 50 | 66 | | 7:13 | | 95 | 63 | | 7:10 | |
| | 16 | | 40 | | 51 | 76 | | 34 | | 96 | 73 | | 28 | |
| | | | | | 52 | 8 | | 52 | | 97 | 83 | | 45 | |
| | | | | | 53 | 18 | | 8:11 | | 98 | 5 | | 8:02 | |
| | | | | | 54 | 28 | | 30 | | 199 | 15 | | 20 | |
| | | | | | 55 | 38 | | 47 | | 100 | 25 | | 38 | |
| | | | | | 56 | 48 | | 9:08 | | 101 | 35 | | 56 | |
| | | | | | 57 | 58 | | 26 | | 102 | 45 | | 9:11 | |
| | | | | | 58 | 68 | | 45 | | 103 | 55 | | 32 | |
| | | | | | 59 | 78 | | 10:03 | | 104 | 65 | | 50 | |
| | | | | | 60 | 1 | | 22 | | 105 | 75 | | 10:08 | |
| | | | | | 61 | 11 | | 41 | | 106 | — | LUNCH | — | |
| | | | | | 62 | 21 | | 11:00 | | 107 | 7 | | 35 | |
| | | | | | 63 | 31 | | 18 | | 108 | 17 | | 56 | |
| | | | | | 64 | — | LUNCH | — | | 109 | 27 | | 11:14 | |
| | | | | | 65 | 41 | | 48 | | 110 | 37 | | 32 | |
| | | | | | 66 | 51 | | 12:06 | | 111 | 47 | | 50 | |
| | | | | | 67 | 61 | | 25 | | 112 | | | | |
| | | | | | 68 | 71 | | 43 | | 113 | | | | |
| | | | | | 69 | 81 | | 1:02 | | 114 | | | | |
| | | | | | 70 | 3 | | 21 | | 115 | | | | |
| | | | | | 71 | 13 | | 40 | | 116 | | | | |
| | | | | | 72 | | | | | 117 | | | | |
| | | | | | 73 | | | | | 118 | | | | |
| | | | | | 74 | | | | | 119 | | | | |
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| | | | | | 76 | | | | | 121 | | | | |
| | | | | | 77 | | | | | | | | | |
| | | | | | 78 | | | | | | | | | |

RM M 7290-S

# DAILY PUSHER REPORT
## COKE PLANT DEPT.

ATE 12-15-82

51 OVENS

| | OVEN NO. | POUNDS CHARGED | TIME PUSHED | TIME CHARGED | NO. | OVEN NO. | POUNDS CHARGED | TIME PUSHED | TIME CHARGED | NO. | OVEN NO. | POUNDS CHARGED | TIME PUSHED | TIME CHARGED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 57 | | 12:08 | | 46 | 39 | | 6:02 AM | | 91 | 26 | | 6:25 AM | |
| | 67 | | 26 | | 47 | 49 | | 19 | | 92 | 36 | | 18 | |
| | 77 | | 43 | | 48 | 59 | | 37 | | 93 | 46 | | 35 | |
| | 9 | | 1:03 | | 49 | 69 | | 56 | | 94 | 56 | | 53 | |
| | 19 | | 21 | | 50 | 79 | | 7:13 | | 95 | 66 | | 7:10 | |
| | 29 | | 40 | | 51 | 2 | | 34 | | 96 | 76 | | 23 | |
| | | | | | 52 | 12 | | 52 | | 97 | 8 | | 45 | |
| | | | | | 53 | 22 | | 8:11 | | 98 | 13 | | 8:02 | |
| | | | | | 54 | 32 | | 30 | | 199 | 28 | | 20 | |
| | | | | | 55 | 42 | | 47 | | 100 | 37 | | 38 | |
| | | | | | 56 | 52 | | 9:08 | | 101 | 48 | | 56 | |
| | | | | | 57 | 62 | | 26 | | 102 | 58 | | 9:11 | |
| | | | | | 58 | 72 | | 45 | | 103 | 68 | | 32 | |
| | | | | | 59 | 82 | | 10:03 | | 104 | 73 | | 50 | |
| | | | | | 60 | 4 | | 22 | | 105 | 1 | | 10:08 | |
| | | | | | 61 | 14 | — | 41 | | 106 | — | LUNCH | — | |
| | | | | | 62 | 24 | | 11:00 | | 107 | 11 | | 35 | |
| | | | | | 63 | 34 | | 18 | | 108 | 21 | | 56 | |
| | | | | | 64 | — | LUNCH | — | | 109 | 31 | | 11:14 | |
| | | | | | 65 | 44 | | 48 | | 110 | 41 | | 32 | |
| | | | | | 66 | 54 | | 12:06 | | 111 | 51 | | 50 | |
| | | | | | 67 | 64 | | 25 | | 112 | | | | |
| | | | | | 68 | 74 | | 43 | | 113 | | | | |
| | | | | | 69 | 84 | | 1:02 | | 114 | | | | |
| | | | | | 70 | 6 | | 21 | | 115 | | | | |
| | | | | | 71 | 16 | | 40 | | 116 | | | | |
| | | | | | 72 | | | | | 117 | | | | |
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| | | | | | 79 | | | | | 124 | | | | |

APPENDIX D

# TEST PARTICIPANTS

| | |
|---|---|
| DAVID W. FINLEY | SAMPLING TEAM LEADER |
| PATRICK L. OWEN | ENGINEERING TECHNICIAN |

APPENDIX E

# CALIBRATIONS

## GENERAL

All measuring equipment Entropy uses is initially calibrated before use. Equipment which can change calibration is both checked upon return from each field use and is also periodically recalibrated in full. When an instrument is found out of calibration, it is so noted in the report and appropriate adjustments are made to the final results. The equipment is then repaired and recalibrated or retired as needed. Specific equipment is handled as follows:

## PITOT TUBE

All pitot tubes used by Entropy, whether separate or attached to a sampling probe, are constructed in-house or by Nutech Corporation. Prior to their initial usage, they are calibrated using EPA geometry standards. In general, if a type "S" pitot tube is assembled correctly, and positioned properly in relation to the probe nozzle, it will have an average Cp of 0.84. As long as it is not damaged, it should not change its calibration. The recalibration schedule for pitot tubes is related to the physical condition and usage of the pitot tube, not a fixed time schedule. Each pitot tube is inspected upon return to the laboratory from each field use.

## DRY GAS METER AND ORIFICE METER

All Entropy meter boxes are calibrated upon purchase and at least once every six months against a secondary test meter (one calibrated against a wet test meter) according to their usage history. Basic procedures are outlined in the EPA Publication No. APTD-0576. The only differences are in the choice of flow rates used and the volumes metered at each flow rate. After each field use, quick checks are performed to insure all changes of less than 5%. These checks compare the orifice against the dry gas meter. If greater than 5% changes occur, recalibration and repair are instituted.

## NOZZLES

Each nozzle is calibrated upon purchase, and thereafter whenever it becomes apparent that the nozzle has become damaged. Each nozzle is inspected upon return to laboratory from each field use. The diameter is measured on four different axes, with the high and low readings differing by no more than 0.004 inches as a tolerance.

## TEMPERATURE MEASURING INSTRUMENTS

After each field use, the thermocouples or thermometers are calibrated against an ASTM precision mercury-in-glass thermometer across a wide range of temperatures. If the initial

reading is not within ± 1.5% of the absolute temperature reading of the standard thermometer, the instrument is adjusted until it is in the acceptable range.

MAGNEHELIC GAUGES

After each field use, each magnehelic gauge is calibrated against an inclined manometer at three different settings (low, medium, high) over the range of the individual gauges. If the readings differ more than ± 5% from the manometer readings, the magnehelics are recalibrated.

BAROMETER

After each field use, each barometer is checked against a mercury barometer.

DATE: 11-21-79

DRY GAS METER IDENTIFICATION: # 1017057

BAROMETRIC PRESSURE ($P_b$): 29.74 in. Hg

| APPROXIMATE FLOW RATE ($\bar{Q}$) $\Delta H$ / cfm | SPIROMETER ~~(WET METER)~~ GAS VOLUME ($V_s$) $ft^3$ | DRY GAS METER VOLUME ($V_{dg}$) $ft^3$ | TEMPERATURES: SPIROMETER ~~(WET METER)~~ ($t_s$) °F/°R | TEMPERATURES: DRY GAS METER ($t_d$) °F/°R | DRY GAS METER PRESSURE ($\Delta p$) in. $H_2O$/in. Hg | TIME ($\Theta$) min. | FLOW RATE ($Q$) cfm | METER METER COEFFICIENT ($Y_{ds}$) | AVERAGE METER COEFFICIENT ($\bar{Y}_{ds}$) |
|---|---|---|---|---|---|---|---|---|---|
| 0.51 / 0.4 | 1.000 | 1.005 | 530.5 | 532.5 | -0.8 | 2.52 | 0.39 | 1.0008 | |
| / 0.4 | 1.000 | 1.007 | 530.5 | 532.5 | -0.8 | 2.52 | .39 | 0.9988 | 1.0005 |
| / 0.4 | 1.000 | 1.004 | 530.5 | 532.5 | -0.8 | 2.52 | .39 | 1.0018 | |
| 1.25 / 0.6 | 1.000 | 1.002 | 530.5 | 532 | -1.3 | 1.62 | .61 | 1.0041 | |
| / 0.6 | 1.000 | 1.008 | 530.5 | 532 | -1.3 | 1.63 | .61 | .9981 | 0.9991 |
| / 0.6 | 1.000 | 1.011 | 530.5 | 532 | -1.3 | 1.65 | .60 | .9951 | |
| 2.18 / 0.8 | 1.000 | 1.018 | 530.5 | 532.5 | -1.8 | 1.27 | .78 | .9904 | |
| / 0.8 | 1.000 | 1.013 | 530.5 | 532.5 | -1.8 | 1.27 | .78 | .9953 | 0.9947 |
| / 0.8 | 1.000 | 1.010 | 530.5 | 532.5 | -1.8 | 1.27 | .78 | .9983 | |
| 3.3 / 1.0 | 1.000 | 1.020 | 530 | 532.5 | -2.3 | 1.02 | .97 | .9907 | |
| / 1.0 | 1.000 | 1.021 | 530 | 532.5 | -2.3 | 1.03 | .96 | .9897 | 0.9920 |
| / 1.0 | 1.000 | 1.015 | 530 | 532.5 | -2.3 | 1.03 | .96 | .9955 | |
| 4.8 / 1.2 | 1.000 | 1.023 | 530 | 532.5 | -3.1 | 0.88 | 1.12 | .9897 | |
| / 1.2 | 1.000 | 1.021 | 530 | 532.5 | -3.1 | 0.87 | 1.14 | .9917 | 0.9910 |
| / 1.2 | 1.000 | 1.021 | 530 | 532.5 | -3.1 | 0.87 | 1.14 | .9917 | |

Average: .99544 .99546

$$Q = 17.65 \cdot \frac{V_s}{\Theta} \cdot \frac{P_b}{(t_s + 460)}$$

$$Y_{ds} = \frac{V_s}{V_{dg}} \cdot \frac{(t_d + 460)}{(t_s + 460)} \cdot \frac{P_b}{\left(P_b + \frac{\Delta p}{13.6}\right)}$$

ENTROPY ENVIRONMENTALISTS, INC.

Dry Gas Meter Identification: 1017057 Calibration by: Bruce Hawks

Date: October 14, 1982 Barometric Pressure ($P_b$): 29.77 in. Hg

*Date: October 15, 1982 *Barometric Pressure ($P_b$): 29.71 in. Hg

ENTROPY ENVIRONMENTALISTS, INC.



| Approx. Flow Rate (Q) cfm | Spirometer Gas Volume ($V_s$) $ft^3$ | Spirometer Temp. ($t_s$) °F | Dry Gas Meter Gas Volume ($V_{ds}$) $ft^3$ | Dry Gas Meter Temp. ($t_{ds}$) °F | Pressure ($\Delta p$) in. $H_2O$ | Time ($\theta$) min. | Flow Rate (Q) cfm | Meter Meter Coeff. ($Y_{ds}$) | Avg. Meter Coeff. ($\bar{Y}_{ds}$) |
|---|---|---|---|---|---|---|---|---|---|
| 0.20 | 2.004 | 75.2 | 2.001 | 76.0 | 0.00 | 14.585 | 0.135 | 1.0030 | |
| | 2.008 | 75.2 | 2.000 | 76.0 | 0.00 | 14.418 | 0.136 | 1.0055 | |
| | 2.013 | 76.1 | 2.000 | 76.0 | 0.00 | 14.426 | 0.136 | 1.0063 | |
| 0.40 | 5.036 | 75.2 | 5.001 | 74.0 | 0.13 | 12.892 | 0.383 | 1.0044 | |
| | 5.005 | 77.0 | 5.000 | 74.5 | 0.13 | 12.954 | 0.378 | 0.9960 | |
| | 4.909 | 74.3 | 5.000 | 77.0 | 0.13 | 13.080 | 0.369 | 0.9864 | |
| | 5.005 | 77.0 | 5.000 | 77.0 | 0.13 | 12.995 | 0.377 | 1.0007 | |
| 0.60 | 4.968 | 75.2 | 5.000 | 77.0 | 0.30 | 8.680 | 0.562 | 0.9962 | |
| | 4.945 | 75.2 | 5.000 | 77.0 | 0.30 | 8.665 | 0.560 | 0.9916 | |
| | 4.982 | 75.2 | 5.000 | 77.0 | 0.30 | 8.694 | 0.562 | 0.9990 | |
| 0.80 | 8.821 | 75.4 | 9.002 | 76.0 | 0.47 | 11.643 | 0.744 | 0.9835 | |
| | 6.967 | 73.4 | 7.001 | 76.0 | 0.50 | 8.869 | 0.772 | 0.9988 | |
| | 8.852 | 72.5 | 8.997 | 76.0 | 0.50 | 11.373 | 0.768 | 0.9891 | |
| 1.00 | 9.845 | 72.5 | 10.001 | 76.0 | 0.70 | 10.304 | 0.942 | 0.9892 | |
| | 9.886 | 72.5 | 9.998 | 76.0 | 0.70 | 10.301 | 0.946 | 0.9936 | |
| | 9.854 | 71.6 | 9.997 | 76.0 | 0.70 | 10.295 | 0.946 | 0.9921 | |

$$Y_{ds} = \frac{(V_s)\ (t_{ds} + 460)\ (P_b)}{[illegible]}$$

$$Q = (17.64)\ \frac{(P_b)\ (V_s)}{[illegible]}$$

Dry Gas Meter Identification: 1017057 Calibration by: Bruce Hawks

Date: October 14, 1982 Barometric Pressure ($P_b$): 29.77 in. Hg

*Date: October 15, 1982 *Barometric Pressure ($P_b$): 29.71 in. Hg

ENTROPY ENVIRONMENTALISTS, INC.

Page 2 of 2

| Approx. Flow Rate (Q) cfm | Spirometer Gas Volume ($V_s$) $ft^3$ | Spirometer Temp. ($t_s$) °F | Dry Gas Meter Gas Volume ($V_{ds}$) $ft^3$ | Dry Gas Meter Temp. ($t_{ds}$) °F | Pressure ($\Delta p$) in. $H_2O$ | Time ($\Theta$) min. | Flow Rate (Q) cfm | Meter Meter Coeff. ($Y_{ds}$) | Avg. Meter Coeff. ($\bar{Y}_{ds}$) |
|---|---|---|---|---|---|---|---|---|---|
| *1.20 | 15.046 | 75.2 | 15.006 | 73.0 | 0.90 | 12.897 | 1.142 | 0.9963 | |
| | 14.809 | 72.5 | 15.003 | 74.0 | 0.90 | 12.970 | 1.124 | 0.9876 | |
| | 14.754 | 70.7 | 15.011 | 75.0 | 0.90 | 12.991 | 1.122 | 0.9886 | |
| | 14.736 | 71.6 | 15.004 | 75.0 | 0.90 | 13.003 | 1.117 | 0.9862 | |
| *1.40 | 14.791 | 74.3 | 15.002 | 76.0 | 1.40 | 10.919 | 1.329 | 0.9857 | |
| | 14.882 | 74.3 | 15.202 | 76.0 | 1.40 | 11.013 | 1.325 | 0.9787 | |
| | 14.709 | 74.3 | 15.002 | 77.0 | 1.40 | 10.864 | 1.328 | 0.9820 | |

$\bar{Y}_{ds} = 0.9931$

$$Y_{ds} = \frac{(V_s)\ (t_{ds} + 460)\ (P_b)}{\quad}$$

$$Q = (17.64)\ \frac{(P_b)\ (V_s)}{\quad}$$

Meter Box Number: N2 Standard Meter Number: 1017057 Calibration by: BDR

Date: 11-5-82 Barometric Pressure ($P_b$): 29.58 in. Hg

ENTROPY ENVIRONMENTALISTS, INC.

*Date: _____ *Barometric Pressure ($P_b$): _____ in. Hg

| Standard Dry Gas Meter | | | | | Meter Box Metering System | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Gas Volume ($V_{ds}$) $ft^3$ | Temp. ($t_{ds}$) °F | Flow Rate ($Q_{ds}$) cfm | Coeff. at $Q_{ds}$ ($Y_{ds}$) | Time (θ) min. | Orifice Setting (ΔH) in. $H_2O$ | Gas Volume ($V_d$) $ft^3$ | Temp. ($t_d$) °F | Flow Rate ($Q_d$) cfm | Orifice Factor (OF) | Coeff. ($Y_d$) | ΔHe in. $H_2O$ |
| 4.152 | 72 | .407 | .9984 | 10.00 | 0.50 | 4.343 | 84 | .4066 | 3.032 | .9748 | 1.622 |
| 4.148 | 72 | .407 | .9984 | 10.00 | 0.50 | 4.376 | 89 | .4062 | 3.046 | .9754 | 1.611 |
| 8.546 | 72 | .838 | .9917 | 10.00 | 2.10 | 8.909 | 94 | .8312 | 6.271 | .9855 | 1.601 |
| 8.515 | 72 | .835 | .9917 | 10.00 | 2.10 | 8.950 | 100 | .8283 | 6.305 | .9880 | 1.595 |
| 12.571 | 72 | 1.233 | .9855 | 10.00 | 4.70 | 13.056 | 104 | 1.2152 | 9.466 | .9944 | 1.647 |
| 12.601 | 72 | 1.236 | .9855 | 10.00 | 4.70 | 13.096 | 104 | 1.2180 | 9.466 | .9937 | 1.639 |
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| | | | | | | | | AVERAGE | | 0.985 | 1.62 |

NOZZLE NUMBER: 201

| Date | Initials | Dia. 1 | Dia. 2 | Dia. 3 | Dia. 4 | Dia. 5 | Average |
|---|---|---|---|---|---|---|---|
| 11-30-82 | TWA | .177 | .176 | .176 | .175 | .176 | 0.176" |
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NOZZLE NUMBER: 203

| Date | Initials | Dia. 1 | Dia. 2 | Dia. 3 | Dia. 4 | Dia. 5 | Average |
|---|---|---|---|---|---|---|---|
| 11-30-82 | TWA | .173 | .172 | .174 | .173 | .173 | 0.173" |
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SOTDAT/STEEL LIBRARY SYSTEM

Report Title: See title page

Plant and Location: Armco, Middletown, OH

SCC: 30300303

Testing Date(s): 12/14-15/82

By Whom: Entropy

Stack Test Review Attached: No

Reviewed By:

Problems Seen by Reviewer:

Confidentiality Status: unknown

If status is confidential, list confidential pages or sections:

Source of Determination of the Confidentiality Status:

Report Encoded By:

Date Encoded:

Form Numbers:

Comments: