# Mississippi Department of Environmental Quality
# Office of Pollution Control

## I-sys 2000 Master Site Detail Report

## Site Name: Hercules Inc

| PHYSICAL ADDRESS | |
|---|---|
| LINE 1: | 613 West 7th Street |
| LINE 2: | |
| LINE 3: | |
| MUNICIPALITY: | Hattiesburg |
| STATE CODE: | MS |
| ZIP CODE: | 39401- |

| MAILING ADDRESS | |
|---|---|
| LINE 1: | 613 West 7th Street |
| LINE 2: | |
| LINE 3: | |
| MUNICIPALITY: | Hattiesburg |
| STATE CODE: | MS |
| ZIP CODE: | 39401- |

| OTHER INFORMATION | |
|---|---|
| MASTER ID: | 002022 |
| COUNTY: | Forrest |
| REGION | SRO |
| SIC 1: | 2822 |
| AIR TYPE: | TITLE V |
| HW TYPE: | LARGE QUANTITY |
| SOLID TYPE: | |
| WATER TYPE: | INDUSTRIAL |
| BRANCH: | Chemical |
| ECED CONTACT: | Yassin, Mohammad |
| BASIN: | |

| AIR PROGRAMS | ☑ SIP | ☐ PSD | ☐ NSPS | ☐ NESHAPS | ☑ MACT |
|---|---|---|---|---|---|

# Mississippi Department of Environmental Quality
## Office of Pollution Control

### Pemits

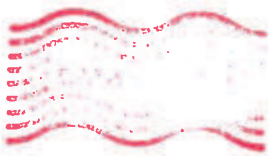
| PROGRAM | PERMIT TYPE | PERMIT # | MDEQ PERMIT CONTACT | ACTIVE |
|---|---|---|---|---|
| HAZ. WASTE | EPA ID | MSD008182081 | | NO |
| AIR | TITLE V | 080000001 | Ketchum, Brian | YES |
| AIR | SOP | 080000001 | Ketchum, Brian | NO |
| WATER | NPDES - MAJOR | MS0001830 | Cook, Charles | NO |
| WATER | NPDES - MAJOR | MS0001830 | Cook, Charles | NO |
| WATER | NPDES - MAJOR | MS0001830 | Beasley, Jerry | YES |
| WATER | PRE-TREATMENT | MSP091286 | Tomkins, Tracy | YES |
| GENERAL | SARA TITLE III | MSR110153 | Lavallee, Louis | YES |
| AIR | TITLE V | 0800-00001 | Glenn, Montie | NO |

### Compliance Actions

| MEDIA | ACTIVITY TYPE | SCHEDULED | COMPLETED | INSPECTED B |
|---|---|---|---|---|
| WATER | CEI - NA | 3/17/99 | 3/17/99 | Yassin, Mohammad |
| WATER | CMI - PRETREATMENT | 11/1/99 | | Sharp, Loyd |
| WATER | CMI - NPDES | 4/1/00 | | Sharp, Loyd |
| WATER | CMI - NPDES | 11/1/99 | | Sharp, Loyd |
| WATER | CEI - NA | 9/30/00 | | Yassin, Mohammad |
| HAZ WASTE | Compliance Evaluation Inspection | 9/30/00 | | Yassin, Mohammad |
| AIR | State Compliance Inspection | 9/30/00 | | Yassin, Mohammad |
| HAZ WASTE | Compliance Evaluation Inspection | 6/30/99 | 6/30/99 | Yassin, Mohammad |
| AIR | State Compliance Inspection | 6/29/99 | 6/29/99 | Yassin, Mohammad |
| WATER | CEI - NA | 6/30/99 | 6/30/99 | Yassin, Mohammad |

# REPORT OF
# PARTICULATE EMISSIONS TESTS
# FOR
# HERCULES, INC.
# BOILERS 1,2,3, AND 4

Hattiesburg, Mississippi
May, 1985



Performed By:
Environmental Monitoring Laboratories
Ridgeland, Mississippi

ENVIRONMENTAL MONITORING LABORATORIES, INC.

P.O. Box 655 * 224-B Hwy 51 North
Ridgeland, Mississippi 39157

(601) 856-3092

May 31, 1985

Subject: Hercules Inc.
P.O. Box 1937
Hattiesburg, Mississippi

On April 30, May 1, and 27, 1984, Environmental Monitoring Laboratories conducted air emissions tests for Hercules, Inc. in Hattiesburg, Mississippi. The tests were performed to determine particulate emissions from four woodwaste boilers in accordance with requirements of the Mississippi Bureau of Pollution Control.

Unless other regulations or conditions apply the allowable particulate emissions from woodwaste boilers is 0.30 grains per dry standard cubic foot.

Results of these tests are:

| | | |
|---|---|---|
| Boiler No. 1..... | 0.03 grains/dscf | tested 5-01-85 |
| Boiler No. 2..... | 0.07 | tested 5-27-85 |
| Boiler No. 3..... | 0.06 | tested 4-30, 5-01-85 |
| Boiler No. 4..... | 0.09 | tested 4-30-85 |

The testing project was coordinated by Mr. Charles Jordon of Hercules, Inc. Mr. Don Watts and Mr. Jesse Thompson of the Mississippi Bureau of Pollution Control were present to observe the tests. Danny Russell of Environmental Monitoring Laboratories was responsible for the collection and analysis of the samples.

Following is a report of the tests. Contents are:


| | | |
|---|---|---|
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| 3.0 | Test Procedures | 3 |
| 4.0 | Data Reduction | 4 |
| 5.0 | Nomenclature | 13 |
| 6.0 | Calibration | 14 |
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| | a. Sampling and Analytical Data | |
| | b. Calibration Data | |

HERCULES

$65 \times 10^6$ Btu/hr gas-fired boiler
i.e. 65,000 ft/hr @ 24 hr/day, 365 day/yr

| | | | | | |
|---|---|---|---|---|---|
| Part - | 5 lb/$10^6$ ft$^3$ | 65,000 ft$^3$/hr | = 0.325 lb/hr | ⇒ 1.4 | TPY |
| $SO_2$ - | 0.6 lb/$10^6$ ft$^3$ | | = 0.039 | ⇒ 0.17 | |
| $NO_x$ - | 140 lb/$10^6$ ft$^3$ | | = 9.1 | ⇒ 39.86 | |
| CO - | 35 lb/$10^6$ ft$^3$ | | = 2.28 | ⇒ 9.96 | |
| VOC - | 2.8 lb/$10^6$ ft$^3$ | | = 0.18 | ⇒ 0.80 | |

EMISSIONS REDUCTIONS - PER BOILER

Part - Obtain from test reports

$SO_2$ - 0.15 lb/ton

$NO_x$ - 2.8 lb/ton

CO - 10 lb/ton

VOC - 1.4 lb/ton

TOTAL EMISSIONS REDUCTIONS

Part -
$SO_2$ -
$NO_x$ -
CO -
VOC -

NET EMISSIONS CHANGE

Part -
$SO_2$ -
$NO_x$ -
CO -
VOC -

NO. 6 $S = 2.9$

~~Part 1.25(S)+~~

Part $10(S) + 3 \frac{lb}{10^3 gal} \Big| \frac{438 \text{ gal}}{hr} = 14.02 \Rightarrow 61.4$

$SO_2$ $157(S) \frac{lb}{10^3 ga} \Big| 438 \Rightarrow 199 \#/hr \Rightarrow 873.47$ TPY

$NO_x$ 55 $\Rightarrow 24.1 \Rightarrow 105.5$

CO 5 $\Rightarrow 2.2 \Rightarrow 9.6$

VOC 1 $0.4 \Rightarrow 1.9$

Currently ~~allowed~~ permitted 705.2 #/hr $SO_2$ if 100% oil used

$$157(2.9) \frac{lb}{10^3 gal} \Big| \frac{x \text{ gal}}{yr} \Big| \frac{T}{2000 \text{ lb}} \Big| = \cancel{40} \text{ TPY}$$

39.9
+19.4
~~59.3~~
59.4

$$\frac{\cancel{40}^{59.4}(10^3)(2000)}{157(2.9)} = x$$

$x = \cancel{175{,}707 \text{ gal/yr}}$ 260925 gal/yr

19.4
40
59.4

HERCULES - CURRENT EMISSIONS (FROM EM. INV)

| | Em. Pt 009 (Boilers 1+2) | | Em Pt 010 (Boilers 3+4) | |
|---|---|---|---|---|
| | #/hr | TPY | #/hr | TPY |
| Part | 37.2 | 163 | 57.9 | 253.6 |
| $SO_2$ | 2.2 | 9.7 | 2.2 | 9.7 |
| $NO_x$ | 41.4 | 181.5 | 41.4 | 181.5 |
| CO | 59.2 | 259.3 | 59.2 | 259.3 |
| VOC | 25.2 | 110.2 | 25.2 | 110.2 |

NET Em. CHANGE (TPY)

Part 1.4 − 163 − 253.6 = −415.2

$SO_2$ 0.17 − 9.7 − 9.7 = −19.23

$NO_x$ 39.86 − 181.5 − 181.5 = −323.14

CO 9.96 − 259.3 − 259.3 = −508.64

VOC 0.8 − 110.2 − 110.2 = −219.6

Therefore, there will be net emissions decreases for all pollutants upon ~~conversion~~ replacement of old boiler

1.0 Tests Results: The following tables list the measured flow parameters and test results.

1.1 Boiler No. 1

5/1/85

| Run. No. | | 1 | 2 | 3 | avg. |
|---|---|---|---|---|---|
| Date | | ~~05-09-84~~ | ~~05-09-84~~ | ~~05-09-84~~ | ------ |
| Time start | | 1144 | 1312 | 1434 | ------ |
| Time end | | 1245 | 1413 | 1537 | ------ |
| PARTICULATE EMISSIONS | #/hr. | 10.9 | 7.4 | 7.9 | 8.7 |
| PARTICULATE EMISSIONS | gr./dscf | 0.03 | 0.02 | 0.02 | 0.03 |
| ALLOWABLE EMISSIONS | gr./dscf | 0.30 | 0.30 | 0.30 | 0.30 |
| VOLUMETRIC FLOWRATE | acfm | 69402 | 67455 | 65705 | 67521 |
| VOLUMETRIC FLOWRATE | dscfm | 40637 | 39629 | 39921 | 40062 |
| VELOCITY | ft./sec. | 54.2 | 52.7 | 51.3 | 52.3 |
| STACK TEMPERATURE | deg F | 364 | 359 | 387 | 370 |
| MOISTURE | % | 9.3 | 9.5 | 7.3 | 8.7 |
| SAMPLE RATE | %isokinetic | 98 | 99 | 96 | 98 |

1.2 Boiler No. 2

| Run. No. | | 1 | 2 | 3 | avg. |
|---|---|---|---|---|---|
| Date | | 05-27-85 | 05-27-85 | 05-27-85 | ------ |
| Time start | | 0823 | 0957 | 1145 | ------ |
| Time end | | 0925 | 1059 | 1247 | ------ |
| PARTICULATE EMISSIONS | #/hr. | 32.6 | 26.5 | 26.5 | 28.5 |
| PARTICULATE EMISSIONS | gr./dscf | 0.08 | 0.07 | 0.07 | 0.07 |
| ALLOWABLE EMISSIONS | gr./dscf | 0.30 | 0.30 | 0.30 | 0.30 |
| VOLUMETRIC FLOWRATE | acfm | 80009 | 78993 | 80030 | 79677 |
| VOLUMETRIC FLOWRATE | dscfm | 45554 | 44734 | 47275 | 45854 |
| VELOCITY | ft./sec. | 62.5 | 61.7 | 62.5 | 62.2 |
| STACK TEMPERATURE | deg F | 387 | 382 | 370 | 380 |
| MOISTURE | % | 9.4 | 10.4 | 7.9 | 9.2 |
| SAMPLE RATE | %isokinetic | 101 | 99 | 97 | 99 |

1.3 Boiler No. 3

| Run. No. ..... | | 1 | 2 | 3 | avg. |
|---|---|---|---|---|---|
| Date ..... | | 04-30-85 | 05-01-85 | 05-01-85 | ------ |
| Time start ..... | | 1438 | 0853 | 1007 | ------ |
| Time end ..... | | 1543 | 0954 | 1108 | ------ |
| PARTICULATE EMISSIONS | #/hr. | 20.8 | 30.2 | 16.2 | 22.4 |
| PARTICULATE EMISSIONS | gr./dscf | 0.05 | 0.08 | 0.04 | 0.06 |
| ALLOWABLE EMISSIONS | gr./dscf | 03.0 | 0.30 | 0.30 | 0.30 |
| VOLUMETRIC FLOWRATE | acfm | 79754 | 77646 | 79188 | 78863 |
| VOLUMETRIC FLOWRATE | dscfm | 45095 | 45118 | 44737 | 44983 |
| VELOCITY | ft./sec. | 62.3 | 60.6 | 61.8 | 61.6 |
| STACK TEMPERATURE | deg F | 384 | 370 | 377 | 377 |
| MOISTURE | % | 10.5 | 9.4 | 11.1 | 10.3 |
| SAMPLE RATE | %isokinetic | 98 | 98 | 99 | 98 |

1.4 Boiler No. 4

| Run. No. ..... | | 1 | 2 | 3 | avg. |
|---|---|---|---|---|---|
| Date ..... | | 04-30-85 | 04-30-85 | 04-30-85 | ------ |
| Time start ..... | | 1005 | 1128 | 1249 | ------ |
| Time end ..... | | 1109 | 1231 | 1352 | ------ |
| PARTICULATE EMISSIONS | #/hr. | 29.1 | 50.5 | 26.8 | 35.5 |
| PARTICULATE EMISSIONS | gr./dscf | 0.07 | 0.13 | 0.07 | 0.09 |
| ALLOWABLE EMISSIONS | gr./dscf | 0.30 | 0.30 | 0.30 | 0.30 |
| VOLUMETRIC FLOWRATE | acfm | 80778 | 79961 | 77569 | 79436 |
| VOLUMETRIC FLOWRATE | dscfm | 48126 | 44910 | 42868 | 45302 |
| VELOCITY | ft./sec. | 63.1 | 62.4 | 60.6 | 62.0 |
| STACK TEMPERATURE | deg F | 373 | 387 | 399 | 386 |
| MOISTURE | % | 6.8 | 10.5 | 10.8 | 9.4 |
| SAMPLE RATE | %isokinetic | 96 | 100 | 101 | 99 |

## 2.0 Source Description

2.1 Hercules operates four identical woodwaste boilers. The boilers are capable of using woodwaste fuel and/or gas. Woodwaste is the primary fuel and gas is used only during wood fuel shortages. Woodwaste fuel is obtained from various sources and may differ in quality. Two masonry stacks serve the boilers--No. 1 and No. 2 share one stack and No. 3 and No. 4 share the other.

2.2 Each boiler was operated normally during the tests on an all woodwaste condition.

## 3.0 Test Procedures

Test procedures used are those described in the Code of Federal Regulations, Title 40, Part 60, Appendix A. Specifically, Method 1 was used to determine the number of sample points, Method 3 to determine excess air and molecular weight of stack gas, and Method 5 to determine flow rates, moisture content, and particulate emissions. The sampling train used is identical to that described in method 5.

There is no access for collecting samples in the masonry stacks. Testing ports are provided in each boiler's breeching in a rectangular vertical section. The placement of the ports does not meet the minimum distance requirements of Method 1, and tapering duct sections and fans proceed and precede the test port sections. Flow conditions at the sample locations however are favorable and cyclonic flow is not excessive. Method 1 rules specify the use of 24 sample points when minimum distance criteria are met. Although minimum distance criteria are not met, 24 sample points were used for these tests. There were no other significant departures from the standard procedures.

# 4.0 Data Reduction

Hercules - Boiler No. 1
Particulate Emissions Test, May 1, 1985

| Collected test data | | RUN 1 | RUN 2 | RUN 3 |
|---|---|---|---|---|
| 1. As | : sq ft | 21.34722 | 21.34722 | 21.34722 |
| 2. Dn | : in. | .228 | .228 | .228 |
| 3. Cp | : dimensionless | .84 | .84 | .84 |
| 4. Theta | : minutes | 60 | 60 | 60 |
| 5. Y | : dimensionless | 1.00 | 1.00 | 1.00 |
| 6. Pbar | : in. Hg | 30.16 | 30.16 | 30.16 |
| 7. Pg | : in. H2O | -.42 | -.42 | -.42 |
| 8. Vm | : cf (dry gas) | 33.018 | 32.722 | 32.205 |
| 9. sqr(DP),avg | : in.H2O^.5 | .7673 | .7461 | .7335 |
| 10. DH | : in. H2O | 1.1396 | 1.0879 | 1.1063 |
| 11. ts | : degrees F | 363.58 | 359.04 | 351.00 |
| 12. tm | : degrees F | 96.46 | 100.38 | 100.31 |
| 13. Vlc | : ml | 69 | 69.5 | 51.5 |
| 14. CO2 | : percent | 4.00 | 3.00 | 3.00 |
| 15. O2 | : percent | 17.00 | 18.00 | 18.00 |
| 16. CO | : percent | .00 | .00 | .00 |
| 17. Mn | : milligrams | 64 | 44 | 46 |

Hercules - Boiler No. 1
Particulate Emissions Test, May 1, 1985

| Calculations: | RUN 1 | RUN 2 | RUN 3 | AVG. |
|---|---|---|---|---|
| 1. Pm : in.Hg<br>(DH/13.6)+Pbar | 30.24 | 30.24 | 30.24 | N/A |
| 2. Ps : in. Hg<br>(Pg/13.6)+Pbar | 30.13 | 30.13 | 30.13 | N/A |
| 3. An : sq ft<br>((Dn/24)^2)(3.1416) | 2.835e-4 | 2.835e-4 | 2.835e-4 | N/A |
| 4. Vmstd: dscf<br>Vm Y(Pm/Pstd)(Tstd/Tm) | 31.66835 | 31.16099 | 30.67386 | N/A |
| 5. Vwstd: scf<br>(.04707cf/ml)(Vlc) | 3.24783 | 3.271365 | 2.424105 | N/A |
| 6. Bws : dimensionless<br>Vwstd/(Vwstd+Vmstd) | .0930179 | .0950085 | .0732403 | .0870889 |
| 7. Md : mol.wt. dry basis<br>.44 CO2+.32 O2+.28(CO+N2) | 29.32 | 29.2 | 29.2 | N/A |
| 8. Ms : mol.wt. wet basis<br>Md(1-Bws)+18 Bws | 28.27 | 28.14 | 28.38 | N/A |
| 9. Vs : ft/sec<br>Kp Cp (sqrDP)sqr(Ts/(Ps Ms)) | 54.19 | 52.66 | 51.30 | 52.72 |
| 10. Q : cfm<br>Vs As(60 sec/min) | 69402 | 67455 | 65705 | 67521 |
| 11. Qstd : dscfm<br>Q(1-Bws)(Ps/Pstd)(Tstd/Ts) | 40637 | 39629 | 39921 | 40062 |
| 12. I : percent<br>[(100 Ts)(.002669 Vlc+(Vm Pm/Tm)]/<br>(60 Theta Vs Ps An) | 97.80 | 98.68 | 96.42 | 97.63 |
| 13. Cs : grams/dscf<br>(Mn/1000)/Vmstd | .0020209 | .0014120 | .0014996 | .0016442 |
| 14. E : pounds/hr<br>(Cs Qstd)(60 min/hr)/454 gm/# | 10.85 | 7.40 | 7.91 | 8.72 |
| 15. C's : grains/dscf<br>(Cs)(15.43 grains/gram) | .03 | .02 | .02 | .03 |
| 16. Xsair: percent<br>100[(O2-.5CO)/(.264 N2-(O2-.5CO))] | 284.85 | 405.41 | 405.41 | 365.22 |

Hercules - Boiler No. 2
Particulate Emissions Test, May 27, 1985

| Collected test data | | RUN 1 | RUN 2 | RUN 3 |
|---|---|---|---|---|
| 1. As | : sq ft | 21.34722 | 21.34722 | 21.34722 |
| 2. Dn | : in. | .228 | .228 | .228 |
| 3. Cp | : dimensionless | .84 | .84 | .84 |
| 4. Theta | : minutes | 60 | 60 | 60 |
| 5. Y | : dimensionless | 1.00 | 1.00 | 1.00 |
| 6. Pbar | : in. Hg | 30.18 | 30.18 | 30.18 |
| 7. Pg | : in. H2O | -.41 | -.41 | -.41 |
| 8. Vm | : cf (dry gas) | 37.705 | 36.686 | 38.378 |
| 9. sqr(DP),avg | : in.H2O^.5 | .8773 | .8649 | .8854 |
| 10. DH | : in. H2O | 1.5229 | 1.435 | 1.5092 |
| 11. ts | : degrees F | 386.67 | 382.00 | 369.96 |
| 12. tm | : degrees F | 88.33 | 94.58 | 98.63 |
| 13. Vlc | : ml | 81 | 87 | 66.5 |
| 14. CO2 | : percent | 7.00 | 5.50 | 4.50 |
| 15. O2 | : percent | 13.50 | 16.00 | 17.00 |
| 16. CO | : percent | .00 | .00 | .00 |
| 17. Mn | : milligrams | 199 | 158.2 | 155.5 |

Hercules - Boiler No. 2
Particulate Emissions Test, May 27, 1985

| Calculations: | RUN 1 | RUN 2 | RUN 3 | AVG. |
|---|---|---|---|---|
| 1. Pm : in.Hg<br>(DH/13.6)+Pbar | 30.29 | 30.29 | 30.29 | N/A |
| 2. Ps : in. Hg<br>(Pg/13.6)+Pbar | 30.15 | 30.15 | 30.15 | N/A |
| 3. An : sq ft<br>((Dn/24)^2)(3.1416) | 2.835e-4 | 2.835e-4 | 2.835e-4 | N/A |
| 4. Vmstd: dscf<br>Vm Y(Pm/Pstd)(Tstd/Tm) | 36.75843 | 35.35440 | 36.72346 | N/A |
| 5. Vwstd: scf<br>(.04707cf/ml)(Vlc) | 3.81267 | 4.09509 | 3.130155 | N/A |
| 6. Bws : dimensionless<br>Vwstd/(Vwstd+Vmstd) | .0939750 | .1038059 | .0785413 | .0921074 |
| 7. Md : mol.wt. dry basis<br>.44 CO2+.32 O2+.28(CO+N2) | 29.66 | 29.52 | 29.4 | N/A |
| 8. Ms : mol.wt. wet basis<br>Md(1-Bws)+18 Bws | 28.56 | 28.32 | 28.50 | N/A |
| 9. Vs : ft/sec<br>Kp Cp (sqrDP)sqr(Ts/(Ps Ms)) | 62.47 | 61.67 | 62.48 | 62.21 |
| 10. Q : cfm<br>Vs As(60 sec/min) | 80009 | 78993 | 80030 | 79677 |
| 11. Qstd : dscfm<br>Q(1-Bws)(Ps/Pstd)(Tstd/Ts) | 45554 | 44734 | 47275 | 45854 |
| 12. I : percent<br>[(100 Ts)(.002669 Vlc+(Vm Pm/Tm)]/<br>(60 Theta Vs Ps An) | 101.26 | 99.18 | 97.48 | 99.31 |
| 13. Cs : grams/dscf<br>(Mn/1000)/Vmstd | .0054137 | .0044747 | .0042344 | .0047076 |
| 14. E : pounds/hr<br>(Cs Qstd)(60 min/hr)/454 gm/# | 32.59 | 26.45 | 26.46 | 28.50 |
| 15. C's : grains/dscf<br>(Cs)(15.43 grains/gram) | .08 | .07 | .07 | .07 |
| 16. Xsair: percent<br>100[(O2-.5CO)/(.264 N2-(O2-.5CO))] | 120.71 | 209.75 | 278.69 | 203.05 |

Hercules - Boiler No. 3
Particulate Emissions Test, April 30 - May 1, 1985

| Collected test data | | RUN 1 | RUN 2 | RUN 3 |
|---|---|---|---|---|
| 1. As | : sq ft | 21.34722 | 21.34722 | 21.34722 |
| 2. Dn | : in. | .228 | .228 | .228 |
| 3. Cp | : dimensionless | .84 | .84 | .84 |
| 4. Theta | : minutes | 60 | 60 | 60 |
| 5. Y | : dimensionless | 1.00 | 1.00 | 1.00 |
| 6. Pbar | : in. Hg | 30.24 | 30.16 | 30.16 |
| 7. Pg | : in. H2O | -.56 | -.29 | -.29 |
| 8. Vm | : cf (dry gas) | 37.035 | 36.047 | 36.561 |
| 9. sqr(DP),avg | : in.H2O^.5 | .8735 | .8526 | .8653 |
| 10. DH | : in. H2O | 1.4958 | 1.4408 | 1.475 |
| 11. ts | : degrees F | 383.50 | 369.63 | 376.67 |
| 12. tm | : degrees F | 105.33 | 88.52 | 92.69 |
| 13. Vlc | : ml | 87.5 | 77 | 94 |
| 14. CO2 | : percent | 6.00 | 2.50 | 4.00 |
| 15. O2 | : percent | 15.00 | 18.00 | 16.50 |
| 16. CO | : percent | .00 | .00 | .00 |
| 17. Mn | : milligrams | 122.3 | 178 | 96.9 |

Hercules - Boiler No. 3
Particulate Emissions Test, April 30 - May 1, 1985

| Calculations: | RUN 1 | RUN 2 | RUN 3 | AVG. |
|---|---|---|---|---|
| 1. Pm : in.Hg<br>(DH/13.6)+Pbar | 30.35 | 30.27 | 30.27 | N/A |
| 2. Ps : in. Hg<br>(Pg/13.6)+Pbar | 30.20 | 30.14 | 30.14 | N/A |
| 3. An : sq ft<br>((Dn/24)^2)(3.1416) | 2.835e-4 | 2.835e-4 | 2.835e-4 | N/A |
| 4. Vmstd: dscf<br>Vm Y(Pm/Pstd)(Tstd/Tm) | 35.08659 | 35.09968 | 35.33451 | N/A |
| 5. Vwstd: scf<br>(.04707cf/ml)(Vlc) | 4.118625 | 3.62439 | 4.42458 | N/A |
| 6. Bws : dimensionless<br>Vwstd/(Vwstd+Vmstd) | .1050530 | .0935953 | .1112847 | .1033110 |
| 7. Md : mol.wt. dry basis<br>.44 CO2+.32 O2+.28(CO+N2) | 29.56 | 29.12 | 29.3 | N/A |
| 8. Ms : mol.wt. wet basis<br>Md(1-Bws)+18 Bws | 28.35 | 28.08 | 28.04 | N/A |
| 9. Vs : ft/sec<br>Kp Cp (sqrDP)sqr(Ts/(Ps Ms)) | 62.27 | 60.62 | 61.83 | 61.57 |
| 10. Q : cfm<br>Vs As(60 sec/min) | 79754 | 77646 | 79188 | 78863 |
| 11. Qstd : dscfm<br>Q(1-Bws)(Ps/Pstd)(Tstd/Ts) | 45095 | 45118 | 44737 | 44983 |
| 12. I : percent<br>[(100 Ts)(.002669 Vlc+(Vm Pm/Tm)]/<br>(60 Theta Vs Ps An) | 97.64 | 97.63 | 99.12 | 98.13 |
| 13. Cs : grams/dscf<br>(Mn/1000)/Vmstd | .0034857 | .0050713 | .0027424 | .0037664 |
| 14. E : pounds/hr<br>(Cs Qstd)(60 min/hr)/454 gm/# | 20.77 | 30.24 | 16.21 | 22.41 |
| 15. C's : grains/dscf<br>(Cs)(15.43 grains/gram) | .05 | .08 | .04 | .06 |
| 16. Xsair: percent<br>100[(O2-.5CO)/(.264 N2-(O2-.5CO))] | 166.22 | 417.83 | 250.00 | 278.02 |

Hercules - Boiler No. 4
Particulate Emissions Test, April 30, 1985

| Collected test data | | RUN 1 | RUN 2 | RUN 3 |
|---|---|---|---|---|
| 1. As | : sq ft | 21.34722 | 21.34722 | 21.34722 |
| 2. Dn | : in. | .228 | .228 | .228 |
| 3. Cp | : dimensionless | .84 | .84 | .84 |
| 4. Theta | : minutes | 60 | 60 | 60 |
| 5. Y | : dimensionless | 1.00 | 1.00 | 1.00 |
| 6. Pbar | : in. Hg | 30.24 | 30.24 | 30.24 |
| 7. Pg | : in. H2O | -.81 | -.81 | -.81 |
| 8. Vm | : cf (dry gas) | 38.267 | 37.628 | 36.466 |
| 9. sqr(DP),avg | : in.H2O^.5 | .8916 | .8731 | .8426 |
| 10. DH | : in. H2O | 1.7608 | 1.4217 | 1.3458 |
| 11. ts | : degrees F | 373.33 | 387.83 | 398.92 |
| 12. tm | : degrees F | 95.94 | 103.40 | 105.50 |
| 13. Vlc | : ml | 57 | 90 | 89.5 |
| 14. CO2 | : percent | 3.50 | 6.00 | 7.00 |
| 15. O2 | : percent | 16.50 | 15.00 | 14.00 |
| 16. CO | : percent | .00 | .00 | .00 |
| 17. Mn | : milligrams | 168.5 | 304.4 | 163.2 |

Hercules - Boiler No. 4
Particulate Emissions Test, April 30, 1985

| Calculations: | RUN 1 | RUN 2 | RUN 3 | AVG. |
|---|---|---|---|---|
| 1. Pm : in.Hg<br>(DH/13.6)+Pbar | 30.37 | 30.34 | 30.34 | N/A |
| 2. Ps : in. Hg<br>(Pg/13.6)+Pbar | 30.18 | 30.18 | 30.18 | N/A |
| 3. An : sq ft<br>((Dn/24)^2)(3.1416) | 2.835e-4 | 2.835e-4 | 2.835e-4 | N/A |
| 4. Vmstd: dscf<br>Vm Y(Pm/Pstd)(Tstd/Tm) | 36.88978 | 35.76409 | 34.52459 | N/A |
| 5. Vwstd: scf<br>(.04707cf/ml)(Vlc) | 2.68299 | 4.2363 | 4.212765 | N/A |
| 6. Bws : dimensionless<br>Vwstd/(Vwstd+Vmstd) | .0677989 | .1059065 | .1087520 | .0941525 |
| 7. Md : mol.wt. dry basis<br>.44 CO2+.32 O2+.28(CO+N2) | 29.22 | 29.56 | 29.68 | N/A |
| 8. Ms : mol.wt. wet basis<br>Md(1-Bws)+18 Bws | 28.46 | 28.34 | 28.41 | N/A |
| 9. Vs : ft/sec<br>Kp Cp (sqrDP)sqr(Ts/(Ps Ms)) | 63.07 | 62.43 | 60.56 | 62.02 |
| 10. Q : cfm<br>Vs As(60 sec/min) | 80778 | 79961 | 77569 | 79436 |
| 11. Qstd : dscfm<br>Q(1-Bws)(Ps/Pstd)(Tstd/Ts) | 48126 | 44910 | 42868 | 45302 |
| 12. I : percent<br>[(100 Ts)(.002669 Vlc+(Vm Pm/Tm)]/<br>(60 Theta Vs Ps An) | 96.19 | 99.94 | 101.07 | 99.07 |
| 13. Cs : grams/dscf<br>(Mn/1000)/Vmstd | .0045677 | .0085113 | .0047271 | .0059354 |
| 14. E : pounds/hr<br>(Cs Qstd)(60 min/hr)/454 gm/# | 29.05 | 50.52 | 26.78 | 35.45 |
| 15. C's : grains/dscf<br>(Cs)(15.43 grains/gram) | .07 | .13 | .07 | .09 |
| 16. Xsair: percent<br>100[(O2-.5CO)/(.264 N2-(O2-.5CO))] | 255.10 | 166.22 | 132.68 | 184.67 |

## 5.0 NOMENCLATURE

| SYMBOL | UNITS | DESCRIPTION |
|---|---|---|
| An | $ft^2$ | Nozzle area |
| As | $ft^2$ | Stack area |
| Bws | dimensionless | Proportion of water vapor |
| CO2 | percent | Carbon dioxide content by volume |
| CO | percent | Carbon monoxide content by volume |
| Cp | dimensionless | Pitot correction factor |
| Cs | grams/dscf | Particulate concentration |
| C's | grains/dscf | Particulate concentration |
| C,50 | gr/dscf@50% xsair | Particulate emissions corrected to 50% excess air |
| Dn | inches | Nozzle diameter |
| delta H | in. $H_2O$ | Pressure drop across meter orifice (also DH) |
| delta P | in. $H_2O$ | Stack velocity pressure head (also DP) |
| E | #/hr | Particulate emission rate |
| F | dscf | Volume of flue gas per $10^6$ BTU |
| I | percent | Percent isokinetic sampling |
| Kp | consistent | Pitot tube constant = 85.49 |
| Mn | milligrams | Particulate sample weight |
| Md | #/# mole | Dry molecular wt. of stack gas |
| Ms | #/# mole | Wet molecular wt. of stack gas |
| N2 | percent | Nitrogen content by volume |
| O2 | percent | Oxygen content by volume |
| Pbar | in. Hg | Barometric pressure |
| Pg | in. $H_2O$ | Static pressure |
| Pm | in. Hg | Meter pressure = Pbar+(delta H/13.6) |
| Ps | in. Hg | Stack pressure = Pbar+(Pg/13.6) |
| Pstd | in. Hg | Standard pressure = 29.92 |
| Q | $ft^3$/min | Volumetric flow rate at stack conditions |
| Qstd | dscf/min | Volumetric flow rate at dry, std. conditions |
| Theta | minutes | Sampling time per run |
| tm | $^oF$ | Meter temperature (Tm denotes $^oR$) |
| ts | $^oF$ | Stack temperature (Ts denotes $^oR$) |
| Tstd | $^oR$ | Standard temperature = $528^o$ |
| Vlc | ml | Volume of water collected |
| Vm | $ft^3$ | Volume of dry gas sampled |
| Vmstd | dscf | Sample volume at standard conditions |
| Vwstd | scf | Sample volume of water vapor |
| Y | dimensionless | Meter correction factor |
| Xsair | percent | Excess air |

## 6.0 Calibrations:

Measurement devices used by Environmental Monitoring Laboratories and subject to changes in measurement precision are initially calibrated prior to use. Those instruments for which calibration factors are subject to change or for which calibration checks are required, are calibrated following each field use or as otherwise directed and noted. Calibration procedures for specific equipment are as follows.

Dry Gas Meter:
Dry gas meters are periodically removed from the sampling consoles and cleaned and repaired (new gaskets etc. as required). Following the overhaul of a meter, the measuring precision is checked by the Bell Prover Method and adjusted when necessary to read to within 2% of 100% accuracy. This service is provided by Big Three Meter Company in Jackson, Mississippi. Overhaul service or any six month period is followed by a five point calibration described in APTD-0576 using either a wet test meter or calibrated dry gas meter (used exclusively for calibrations) as a standard reference. Following field use, a gas meter calibration is checked in one of two ways. [1] Three calibration checks at intermediate orifice settings are performed or [2] orifice meter coefficients are used.

If a meter coefficient obtained from pre-test and post-test checks differs by more than 5%, the coefficient (Y) giving the lower sample volume is used in the calculations.

Orifice:
The orifice coefficient is initially determined and is rechecked following a major gas meter repair and calibration.

Nozzles:
Nozzles are checked before each field use with a precision (.001 in.) dial caliper. Three measurements on different axes are made; an average of those three readings is used in calculations. If the tolerance among measurements exceeds 0.004 inches (highest to lowest reading) the nozzle is repaired and recalibrated or discarded.

Pitot Tubes:
Pitot tubes meeting EPA geometry standards are assigned a coefficient of 0.84. Pitot tubes are visually inspected for damage before, during and after use. Those pitot tubes not meeting the geometry standards are assigned a coefficient from the manufacturer's calibration which it retains unless damaged. All pitot tubes used by Environmental Monitoring Laboratories are manufactured by NAPP, Inc.

Temperature Measuring Instruments:
Most temperature measurements are made with a type K thermocouple and an Omega digital thermocouple thermometer which has an initial calibration traceable to NBS. Other measurements are made using bimetallic dial thermometers. The thermocouples and dial thermometers are checked following or during a test series against an ASTM mercury in glass thermometer.

Barometer:
Aneroid field barometers are checked against and adjusted to readings from a mercury barometer or readings obtained from local weather authorities.

Differential Pressure Gauges:
Velocity head (delta P) and orifice pressure differential (delta H) measurements are made using water manometers of the appropriate range unless otherwise noted in the test data. Manometers do not require calibration.

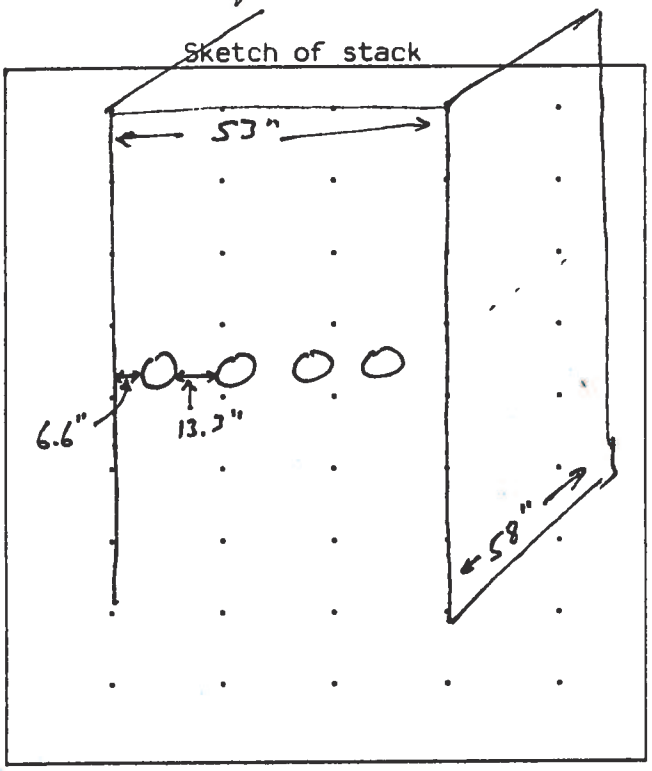
7.0 Appendices
- a. Test Data
- b. Calibration Data

# STACK CONFIGURATION / SAMPLE AND VELOCITY POINTS

Plant Name Hercules Source Boilers 1, 2, 3, 4

Data For: Sample Point Plots Date

Sketch of stack




%Diameter

| | 4 | 6 | 8 | 10 | 12 | 14 | 16 |
|---|---|---|---|---|---|---|---|
| 1 | 6.7 | 4.4 | 3.2 | 2.6 | 2.1 | 1.8 | 1.6 |
| 2 | 25.0 | 14.6 | 10.5 | 8.2 | 6.7 | 5.7 | 4.9 |
| 3 | 75.0 | 29.6 | 19.4 | 14.6 | 11.8 | 9.9 | 8.5 |
| 4 | 93.3 | 70.4 | 32.3 | 22.6 | 17.7 | 14.6 | 12.5 |
| 5 | | 85.4 | 67.7 | 34.2 | 25.0 | 20.1 | 16.9 |
| 6 | | 95.6 | 80.6 | 65.8 | 35.6 | 26.9 | 22.0 |
| 7 | | | 89.5 | 77.4 | 64.4 | 36.6 | 28.3 |
| 8 | | | 96.8 | 85.4 | 75.0 | 63.4 | 37.5 |
| 9 | | | | 91.8 | 82.3 | 73.1 | 62.5 |
| 10 | | | | 97.4 | 88.2 | 79.9 | 71.7 |
| 11 | | | | | 93.3 | 85.4 | 78.0 |
| 12 | | | | | 97.9 | 90.1 | 83.1 |
| 13 | | | | | | 94.3 | 87.5 |
| 14 | | | | | | 98.2 | 91.5 |
| 15 | | | | | | | 95.1 |
| 16 | | | | | | | 98.4 |

$D_e = 2LW/(L+W)$

Stack ~~diameter~~ $D_e$ =

Distance from ports to disturbance:

distance to upstream disturbance

distance to downstream disturbance

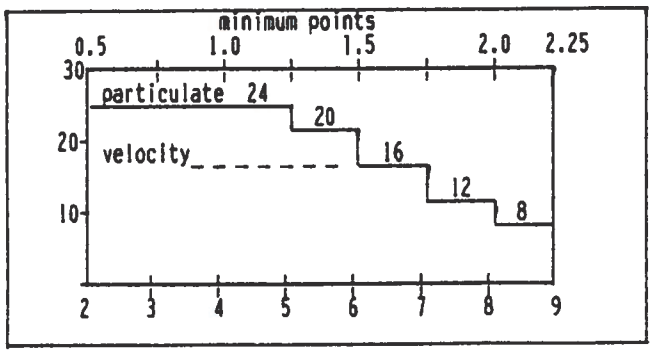
upstream diameters

downstream diameters

Minimum No. points required 24

No. points selected 24

Nipple length




Velocity profile / Sample point layout

pitot I.D.

pitot Cp

| Point No. | "from wall | delta P 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| 1 | 7.8 | | | | |
| 2 | 14.5 | | | | |
| 3 | 24.2 | | | | |
| 4 | 33.8 | | | | |
| 5 | 43.5 | | | | |
| 6 | 53.2 | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |
| 13 | | | | | |
| 14 | | | | | |
| 15 | | | | | |
| 16 | | | | | |

Notes:

DAW 5/1/8

Plant Hercules
Sampling Location Boiler No. 1
Test For Particulate
Test Operators Russell / Little

RUN No. 1
Date ~~4-30-85~~ 5-1-85
Time start 1144 end 1245

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Expite | | Remarks: |
| Sample Box | No. 1 | Minutes/Pt. | 2.5 | $CO_2$ | 4 | | |
| Probe/Pitot | 5'ss | | | $O_2$ | 17 | | |
| Pitot Cp | .84 | NOMOGRAPH | | CO | – | | |
| Nozzle Dia. | .228 | ΔH@ | 1.88 | Time | 1222 | | |
| Filter No. | | Meter Temp. | 92 | | | | |
| | | % $H_2O$ | 10 | Condensate: | | | |
| Amb. Temp. °F | 80 | C-Factor | .98 | tare | 200 | fin 260 | |
| Bar. Press. "Hg | 30. | Stack Temp. | 400 | Silica gel: | | | |
| Static Press. "$H_2O$ | -.42 | Ref. ΔP | 1.05 | tare | 691.0 | fin 700.0 | |

| | Port Point | El. Time, Min. | DGM Reading, Ft.³ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 111.770 | ~~0.38~~ .08 | ~~0.63~~ .11 | 357 | 87 | 87 | 225 | 65 | 1 |
| 2 | 2 | 230 | 112.5 | 0.13 | 0.21 | 366 | 90 | 88 | 225 | 55 | 1 |
| 3 | 3 | 500 | 113.1 | 0.20 | 0.33 | 368 | 90 | 88 | 225 | 55 | 1 |
| 4 | 4 | 730 | 114.0 | 0.03 | 0.05 | 368 | 92 | 89 | 225 | 55 | 1 |
| 5 | 5 | 1030 | 114.4 | 0.39 | 0.65 | 366 | 93 | 89 | 225 | 55 | 1 |
| 6 | 6 | 1230 | 115.6 | 0.98 | 1.70 | 369 | 96 | 89 | 225 | 55 | 2 |
| 7 | | | | | | | | | | | |
| 8 | 1 | 15/0 | 117.187 | 0.98 | 1.70 | 367 | 98 | 89 | 225 | 55 | 2 |
| 9 | 2 | 230 | 119.1 | 0.65 | 1.10 | 366 | 101 | 90 | 225 | 55 | 1 |
| 10 | 3 | 500 | 120.4 | 0.54 | 0.92 | 365 | 100 | 91 | 225 | 55 | 1 |
| 11 | 4 | 730 | 122.0 | 0.51 | 0.85 | 367 | 102 | 91 | 225 | 55 | 1 |
| 12 | 5 | 1000 | 123.2 | 0.69 | 1.20 | 367 | 101 | 91 | 225 | 55 | |
| 13 | 6 | 1230 | 124.6 | 1.45 | 2.50 | 367 | 104 | 92 | 225 | 55 | 2 |
| 14 | | | | | | | | | | | |
| 15 | 1 | 30/0 | 126.708 | 0.85 | 1.45 | 363 | 104 | 92 | 225 | 55 | 2 |
| 16 | 2 | 230 | 128.4 | 0.79 | 1.35 | 364 | 106 | 92 | 235 | 55 | 2 |
| 17 | 3 | 500 | 130.0 | 0.67 | 1.15 | 363 | 105 | 93 | 235 | 60 | 2 |
| 18 | 4 | 730 | 131.2 | 0.70 | 1.20 | 362 | 104 | 93 | 235 | 60 | 2 |
| 19 | 5 | 1000 | 132.8 | 0.91 | 1.55 | 361 | 106 | 94 | 250 | 60 | 2 |
| 20 | 6 | 1230 | 134.5 | 1.25 | 2.20 | 360 | 107 | 94 | 250 | 60 | 3 |
| 21 | | | | | | | | | | | |
| 22 | 1 | 45/0 | 136.494 | 0.05 | 0.08 | 359 | 106 | 96 | 250 | 60 | 1 |
| 23 | 2 | 230 | 136.9 | 0.66 | 1.10 | 359 | 105 | 96 | 250 | 60 | 2 |
| 24 | 3 | 500 | 138.3 | 0.66 | 1.10 | 362 | 105 | 95 | 250 | 60 | 2 |
| 25 | 4 | 730 | 139.8 | 0.78 | 1.35 | 362 | 107 | 95 | 250 | 60 | 2 |
| 26 | 5 | 1000 | 141.3 | 0.87 | 1.50 | 359 | 107 | 96 | 250 | 65 | 2 |
| 27 | 6 | 1230 | 143.0 | 1.15 | 2.00 | 359 | 108 | 96 | 250 | 65 | 3 |
| 28 | end | 60 | 144.788 | | | | | | | | |
| 29 | | | | | | | | | | | |
| 30 | | | | | | | | | | | |
| 31 | | | leak check .044 → .052 = .008 cfm @ 5" Hg | | | | | | | | |
| 32 | | | | | | | | | | | |
| 33 | | | | | | | | | | | |
| 34 | | | 33.018 | .7673 | 1.1396 | 363.58 | | 96.46 | | | |
| 35 | | | | | | | | | | | |

DAW 5/1?

Plant Hercules
Sampling Location Boiler No. 1
Test For Particulate
Test Operators Russell / Little

RUN No. 2
Date 4-30-85 5-1-85
Time start 1312 end 1413

| | | | | | | |
|---|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite | Remarks: |
| Sample Box | No. 2 | Minutes/Pt. | 2.5 | $CO_2$ | 2.0 | |
| Probe/Pitot | S'ss | NOMOGRAPH | | $O_2$ | 18.0 | |
| Pitot Cp | .84 | ΔH@ | 1.88 | CO | — | |
| Nozzle Dia. | .228 | Meter Temp. | 100 | Time | 1404 | |
| Filter No. | | % $H_2O$ | 10 | Condensate: | | |
| Amb. Temp. °F | 78 | C-Factor | 1.0 | tare 200 | fin 263 | |
| Bar. Press. "Hg | 30.16 | Stack Temp. | 370 | Silica gel: | | |
| Static Press. "$H_2O$ | -.42 | Ref. ΔP | 1.0 | tare 671.5 | fin 678.0 | 24-25 K #/L |

| | Port Point | El. Time, Min. | DGM Reading, Ft.³ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A 1 | 0 | 145.716 | 0.07 | 0.11 | 354 | 91 | 91 | 225 | 60 | 1 |
| 2 | 2 | 230 | 146.2 | 0.03 | 0.05 | 352 | 94 | 92 | 225 | 55 | 1 |
| 3 | 3 | 500 | 146.5 | 0.20 | 0.33 | 354 | 94 | 92 | 225 | 55 | 1 |
| 4 | 4 | 730 | 147.6 | 0.31 | 0.52 | 356 | 99 | 92 | 225 | 55 | 1 |
| 5 | 5 | 1000 | 148.4 | 0.38 | 0.65 | 358 | 98 | 93 | 240 | 55 | 1 |
| 6 | 6 | 1230 | 149.6 | 0.60 | 1.05 | 358 | 101 | 94 | 240 | 55 | 2 |
| 7 | | | | | | | | | | | |
| 8 | 1 | 15/0 | 150.964 | 0.99 | 1.75 | 364 | 101 | 94 | 250 | 55 | 3 |
| 9 | 2 | 230 | 152.8 | 0.67 | 1.15 | 361 | 105 | 95 | 250 | 55 | 3 |
| 10 | 3 | 500 | 154.4 | 0.50 | 0.86 | 360 | 105 | 94 | 250 | 55 | 2 |
| 11 | 4 | 730 | 155.6 | 0.35 | 0.60 | 362 | 106 | 95 | 250 | 55 | 1 |
| 12 | 5 | 1000 | 156.7 | 0.69 | 1.20 | 364 | 105 | 95 | 250 | 55 | 2 |
| 13 | 6 | 1230 | 158.3 | 1.25 | 2.20 | 364 | 108 | 95 | 250 | 55 | 5 |
| 14 | | | | | | | | | | | |
| 15 | 1 | 30/0 | 160.327 | 0.82 | 1.45 | 360 | 109 | 96 | 260 | 55 | 3 |
| 16 | 2 | 230 | 161.9 | 0.79 | 1.40 | 365 | 110 | 98 | 260 | 55 | 3 |
| 17 | 3 | 500 | 163.8 | 0.55 | 0.95 | 363 | 110 | 97 | 275 | 55 | 3 |
| 18 | 4 | 730 | 165.1 | 0.65 | 1.15 | 358 | 110 | 97 | 260 | 55 | 3 |
| 19 | 5 | 1000 | 166.7 | 0.88 | 1.55 | 359 | 109 | 97 | 260 | 55 | 3 |
| 20 | 6 | 1230 | 168.4 | 1.45 | 2.60 | 353 | 111 | 98 | 225 | 55 | 6 |
| 21 | | | | | | | | | | | |
| 22 | 1 | 45/0 | 170.261 | 0.09 | 0.16 | 354 | 110 | 97 | 235 | 55 | 1 |
| 23 | 2 | 230 | 170.9 | 0.56 | 0.98 | 357 | 107 | 97 | 245 | 55 | 2 |
| 24 | 3 | 500 | 172.3 | 0.62 | 1.10 | 360 | 109 | 100 | 245 | 55 | 2 |
| 25 | 4 | 730 | 173.4 | 0.71 | 1.25 | 362 | 109 | 99 | 225 | 55 | 3 |
| 26 | 5 | 1000 | 175.2 | 0.75 | 1.30 | 360 | 110 | 98 | 225 | 55 | 3 |
| 27 | 6 | 1230 | 176.6 | 0.97 | 1.75 | 360 | 113 | 98 | 225 | 55 | 4 |
| 28 | end | 60 | 178.438 | | | | | | | | |
| 29 | | | | | | | | | | | |
| 30 | | | leak check: | .083 → .092 ÷ .009 | | cfm @ | 6.14 | | | | |
| 31 | | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| 33 | | | | | | | | | | | |
| 34 | | | 32.722 | .7461 | 1.0879 | 359.04 | | | 100.38 | | |
| 35 | | | | | | | | | | | |

Plant Hercules
Sampling Location Boiler No. 1
Test For Particulate
Test Operators Russell / Little

RUN No. 3
Date ~~5-30-85~~ 5-1-85
Time start 1434 end 1537

| | | | | | |
|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite |
| Sample Box | No. 3 | Minutes/Pt. | 2.5 | $CO_2$ | 3.0 |
| Probe/Pitot | 5'55 | NOMOGRAPH | | $O_2$ | 18 |
| Pitot Cp | .84 | ΔH@ | 1.88 | CO | – |
| Nozzle Dia. | .228 | Meter Temp. | 100 | Time | 1515 |
| Filter No. | | % $H_2O$ | 10 | Condensate: | |
| Amb. Temp. °F | 86 | C-Factor | 1.0 | tare 200 ml | fin 243 ml |
| Bar. Press. "Hg | 30.16 | Stack Temp. | 370 | Silica gel: | |
| Static Press. "$H_2O$ | -.42 | Ref. ΔP | 1.0 | tare 698.0 g | fin 706.5 g |

Remarks:

Grate Cleaning

| Port Point | El. Time, Min. | DGM Reading, Ft.³ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|
| A 1 | 0 | 178.706 | 0.08 | 0.13 | 356 | 95 | 93 | 225 | 70 | 1 |
| 2 | 230 | 179.2 | 0.02 | 0.03 | 353 | 95 | 93 | 225 | 60 | 1 |
| 3 | 500 | 179.4 | 0.08 | 0.13 | 353 | 96 | 94 | 225 | 55 | 1 |
| 4 | 730 | 179.7 | 0.11 | 0.18 | 355 | 97 | 93 | 225 | 55 | 1 |
| 5 | 1000 | 180.1 | 0.20 | 0.34 | 355 | 98 | 94 | 225 | 55 | 1 |
| 6 | 1230 | 181.0 | 0.34 | 0.58 | 352 | 99 | 94 | 225 | 55 | 1 |
| 1 | 15/0 | 182.123 | 1.00 | 1.80 | 359 | 101 | 95 | 225 | 55 | 1 |
| 2 | 230 | 183.9 | 0.66 | 1.15 | 354 | 104 | 94 | 235 | 60 | 1 |
| 3 | 500 | 185.6 | 0.52 | 0.90 | 355 | 105 | 94 | 235 | 60 | 1 |
| 4 | 730 | 186.9 | 0.52 | 0.90 | 352 | 105 | 95 | 235 | 60 | 1 |
| 5 | 1000 | 188.1 | 0.69 | 1.20 | 351 | 107 | 95 | 235 | 60 | 1 |
| 6 | 1230 | 189.9 | 1.40 | 2.55 | 351 | 107 | 95 | 235 | 60 | 2 |
| 1 | 30/0 | 192.000 | 0.90 | 1.60 | 348 | 109 | 95 | 235 | 60 | 1 |
| 2 | 230 | 193.8 | 0.90 | 1.60 | 348 | 109 | 95 | 250 | 55 | 1 |
| 3 | 500 | 195.7 | 0.35 | 0.60 | 350 | 110 | 98 | 250 | 55 | 1 |
| 4 | 730 | 196.7 | 0.68 | 1.20 | 351 | 109 | 96 | 250 | 55 | 1 |
| 5 | 1000 | 198.2 | 0.96 | 1.75 | 351 | 109 | 96 | 250 | 55 | 1 |
| 6 | 1230 | 200.0 | 1.45 | 2.65 | 347 | 112 | 97 | 250 | 60 | 2 |
| 1 | 45/0 | 202.190 | 0.10 | 0.16 | 346 | 110 | 98 | 250 | 55 | 1 |
| 2 | 230 | 202.8 | 0.79 | 1.40 | 347 | 108 | 97 | 250 | 55 | 1 |
| 3 | 500 | 204.5 | 0.70 | 1.25 | 348 | 109 | 97 | 250 | 55 | 1 |
| 4 | 730 | 205.9 | 0.79 | 1.40 | 347 | 108 | 97 | 250 | 55 | 1 |
| 5 | 1000 | 207.5 | 0.73 | 1.30 | 347 | 111 | 98 | 250 | 55 | 1 |
| 6 | 1230 | 209.1 | 0.97 | 1.75 | 348 | 110 | 99 | 250 | 55 | 2 |
| end | 60 | 210.911 | | | | | | | | |
| | | leak check: .068 → .071 = .003 cfm @ 5" | | | | | | | | |
| | | 32.205 | .7335 | 1.1063 | 351.00 | | 100.31 | | | |

PARTICULATE CATCH ANALYSIS:

SAMPLES: Hercules - Boiler No. 1

DATE TAKEN: 5-1-85 DATE ANALYZED: 5-3-85

SAMPLES DELIVERED BY: DGR RECEIVED BY: DGR

ANALYZED BY: DGR

Filter treatment: Oven dried 2hr @ 105°C, desiccated >24hrs, weighed to constant wt.

| FILTERS: | RUN 1 | Run 2 | Run 3 |
|---|---|---|---|
| Filter No. | 1394 | 1395 | 1396 |
| Tare wt., g | .5628 | .5518 | .5530 |
| Final wt., g | .6075 | .5806 | .5840 |
| Net gain, g | .0447 | .0288 | .0310 |

Probe wash treatment: Acetone evaporated over low heat, residue desiccated >24hrs, weighed to constant wt.

| PROBE WASH: | Run 1 | Run 2 | Run 3 | Blank |
|---|---|---|---|---|
| Container ID | H1R1 | H1R2 | H1R3 | — |
| Volume intact? | ✓ | ✓ | ✓ | — |
| Volume, ml | 175 | 170 | 145 | 200 |
| Tare wt., g | (2) 112.7432 | (3) 104.7719 | (5) 109.7088 | |
| Final wt., g | 112.7626 | 104.7872 | 109.7235 | |
| Net gain, g | .0194 | .0153 | .0151 | 0.0001 |
| Less blank, g | −.0001 | −.0001 | −.0001 | |

| PARTICULATE COLLECTED: | Run 1 | Run 2 | Run 3 |
|---|---|---|---|
| Net gains less blank, mg | 64.0 | 44.0 | 46.0 |

DAU 5-27-8

Plant Hercules
Sampling Location Boiler No. 2
Test For Particulates
Test Operators Russell / Little

RUN No. 1
Date 5-27-85
Time start 0823 end 0925

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite | | |
| Sample Box | No1 | Minutes/Pt. | 2.5 | $CO_2$ | 7.0 | | |
| Probe/Pitot | 5'SS | NOMOGRAPH | | $O_2$ | 13.5 | | |
| Pitot Cp | .84 | ΔH@ | 1.88 | CO | | | |
| Nozzle Dia. | .228 | Meter Temp. | 87 | Time | 0850 | | |
| Filter No. | | % $H_2O$ | 10 | Condensate: | | | |
| Amb. Temp. °F | 72 | C-Factor | .99 | tare 200 ml | fin 274 ml | | |
| Bar. Press. "Hg | 30.18 | Stack Temp. | 400 | Silica gel: | | | |
| Static Press. "$H_2O$ | -.41 | Ref. Δ P | 1.05 | tare 663.5 g | fin 670.5 g | | |

Remarks:
30,000 #/hr
@ 0500 - 30000
dropped to 0 at end of Run

| Port Point | El. Time, Min. | DGM Reading, Ft.³ | Velocity Head Δ P, in. $H_2O$ | Orifice Δ H in. $H_2O$ | Stack Temp °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac. in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 0 | 041.161 | 0.39 | 0.66 | 364 | 73 | 72 | 230 | 65 | 1 |
| 2 | 2 30 | 042.3 | 0.10 | 0.16 | 383 | 77 | 72 | 225 | 50 | 1 |
| 3 | 5 00 | 043.0 | 0.10 | 0.16 | 383 | 78 | 73 | 225 | 50 | 1 |
| 4 | 7 30 | 043.8 | 0.08 | 0.13 | 386 | 82 | 75 | 225 | 50 | 1 |
| 5 | 10 00 | 044.2 | 0.08 | 0.13 | 384 | 82 | 75 | 225 | 50 | 1 |
| 6 | 12 30 | 044.8 | 0.04 | 0.06 | 385 | 84 | 76 | 225 | 50 | 1 |
| 7 | | | | | | | | | | |
| 1 | 15 0 | 045.101 | 1.00 | 1.75 | 394 | 85 | 77 | 240 | 55 | 3 |
| 2 | 2 30 | 046.8 | 1.00 | 1.75 | 398 | 90 | 79 | 240 | 55 | 3 |
| 3 | 5 00 | 049.1 | 0.89 | 1.45 | 401 | 93 | 79 | 240 | 55 | 2 |
| 4 | 7 30 | 050.3 | 0.65 | 1.10 | 399 | 96 | 81 | 240 | 55 | 2 |
| 5 | 10 00 | 052.0 | 0.93 | 1.25 | 399 | 97 | 82 | 240 | 65 | 3 |
| 6 | 12 30 | 053.5 | 1.30 | 2.30 | 397 | 98 | 82 | 240 | 55 | 4 |
| 7 | | | | | | | | | | |
| 1 | 30 0 | 055.216 | 0.87 | 1.55 | 387 | 100 | 83 | 250 | 55 | 3 |
| 2 | 2 30 | 056.9 | 1.10 | 1.90 | 399 | 100 | 84 | 250 | 55 | 4 |
| 3 | 5 00 | 059.0 | 1.40 | 2.50 | 392 | 101 | 85 | 250 | 55 | 5 |
| 4 | 7 30 | 060.8 | 1.30 | 2.30 | 386 | 103 | 85 | 250 | 55 | 5 |
| 5 | 10 00 | 063.0 | 1.35 | 2.40 | 380 | 105 | 85 | 250 | 55 | 6 |
| 6 | 12 30 | 064.9 | 1.70 | 3.00 | 377 | 106 | 86 | 250 | 55 | 7 |
| 7 | | | | | | | | | | |
| 1 | 45 0 | 067.278 | 0.93 | 1.60 | 379 | 104 | 87 | 250 | 55 | 5 |
| 2 | 2 30 | 069.1 | 1.10 | 1.90 | 391 | 108 | 87 | 250 | 55 | 5 |
| 3 | 5 00 | 070.9 | 1.35 | 2.40 | 398 | 105 | 87 | 250 | 60 | 7 |
| 4 | 7 30 | 073.0 | 1.50 | 2.65 | 386 | 105 | 87 | 250 | 60 | 8 |
| 5 | 10 00 | 075.5 | 0.92 | 1.55 | 388 | 107 | 87 | 250 | 60 | 5 |
| 6 | 12 30 | 077.2 | 1.10 | 1.90 | 342 | 106 | 88 | 250 | 60 | 6 |
| end | 15 60 | 078.866 | | | | | | | | |
| | | | | | | | | | | |
| | | Leak check: .073 → .083 = .010 cfm @ 8" Hg | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | 37.705 | .8773 | 1.5229 | 38667 | | 88.33 | | | |

Draw
5/28/85

Plant Hercules
Sampling Location Boiler No. 2
Test For Particulate
Test Operators Reuse / Little BPC - Dan Watts

RUN No. 2
Date 5-27-85
Time start 0957 end 1059

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite | | Remarks: |
| Sample Box | No. 1 | Minutes/Pt. | 2.5 | $CO_2$ | 5.5 | | Blr. 2 brought back upto: 33 to 36 M#/hr |
| Probe/Pitot | 5'ss | NOMOGRAPH | | $O_2$ | 16.0 | | |
| Pitot Cp | .84 | ΔH@ | 1.89 | CO | — | | |
| Nozzle Dia. | .228 | Meter Temp. | 95 | Time | 1048 | | |
| Filter No. | | % $H_2O$ | 10 | Condensate: | | | |
| Amb. Temp. °F | 83 | C-Factor | 1.0 | tare 200 | fin 280 | | |
| Bar. Press. "Hg | 30.18 | Stack Temp. | 405 420 | Silica gel: | | | |
| Static Press. "$H_2O$ | -.41 | Ref. ΔP | 1.05 | tare 710.0g | fin 717g | | |

| | Port Point | El. Time, Min. | DGM Reading, Ft.³ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac. in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 079.192 | 0.44 | 0.75 | 367 | 84 | 84 | 250 | 70 | 2 |
| 2 | 2 | 2 30 | 080.4 | 0.21 | 0.35 | 398 | 84 | 84 | 250 | 55 | 1 |
| 3 | 3 | 5 00 | 081.3 | 0.16 | 0.26 | 412 | 89 | 85 | 250 | 55 | 1 |
| 4 | 4 | 7 30 | 082.0 | 0.07 | 0.11 | 410 | 91 | 86 | 250 | 50 | 1 |
| 5 | 5 | 10 00 | 082.5 | 0.07 | 0.11 | 395 | 91 | 86 | 265 | 55 | 1 |
| 6 | 6 | 12 30 | 082.9 | 0.10 | 0.16 | 386 | 93 | 90 | 260 | 55 | 1 |
| 7 | | | | | | | | | | | |
| 8 | 1 | 15/0 | 083.499 | 1.10 | 1.90 | 387 | 91 | 86 | 250 | 55 | 2 |
| 9 | 2 | 2 30 | 085.3 | 0.78 | 1.30 | 395 | 97 | 87 | 270 | 55 | 3 |
| 10 | 3 | 5 00 | 087.1 | 0.77 | 1.30 | 390 | 99 | 88 | 260 | 60 | 3 |
| 11 | 4 | 7 30 | 088.5 | 0.68 | 1.15 | 380 | 101 | 88 | 260 | 55 | 3 |
| 12 | 5 | 10 00 | 089.9 | 0.83 | 1.40 | 372 | 101 | 89 | 260 | 55 | 3 |
| 13 | 6 | 12 30 | 091.5 | 1.50 | 2.60 | 374 | 102 | 90 | 250 | 55 | 3 |
| 14 | | | | | | | | | | | |
| 15 | 1 | 30/0 | 092.977 | 0.96 | 1.65 | 370 | 104 | 90 | 225 | 55 | 4 |
| 16 | 2 | 2 30 | 095.7 | 1.00 | 1.75 | 375 | 103 | 90 | 245 | 55 | 4 |
| 17 | 3 | 5 00 | 097.5 | 1.40 | 2.40 | 378 | 105 | 91 | 260 | 55 | 7 |
| 18 | 4 | 7 30 | 099.5 | 1.35 | 2.35 | 378 | 107 | 91 | 260 | 55 | 7 |
| 19 | 5 | 10 00 | 101.3 | 1.15 | 1.95 | 372 | 109 | 91 | 250 | 55 | 6 |
| 20 | 6 | 12 30 | 103.4 | 1.55 | 2.70 | 380 | 108 | 92 | 250 | 55 | 8 |
| 21 | | | | | | | | | | | |
| 22 | 1 | 45/0 | 105.356 | 0.87 | 1.50 | 379 | 106 | 92 | 250 | 55 | 5 |
| 23 | 2 | 2 30 | 107.0 | 1.00 | 1.70 | 378 | 106 | 92 | 260 | 55 | 5 |
| 24 | 3 | 5 00 | 108.9 | 1.10 | 1.90 | 375 | 106 | 93 | 260 | 55 | 5 |
| 25 | 4 | 7 30 | 110.8 | 1.20 | 2.05 | 373 | 107 | 93 | 260 | 55 | 5 |
| 26 | 5 | 10 00 | 112.5 | 0.85 | 1.45 | 373 | 107 | 93 | 260 | 55 | 5 |
| 27 | 6 | 12 30 | 114.4 | 0.96 | 1.65 | 371 | 106 | 92 | 250 | 55 | 5 |
| 28 | end | 60/15 | 115.878 | | | | | | | | |
| 29 | | | | | | | | | | | |
| 30 | | | Leak check: .063 → .069 = .006 cfm @ 8" Hg | | | | | | | | |
| 31 | | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| 33 | | | | | | | | | | | |
| 34 | | | 36.186 | .4649 | 1.4350 | 582.90 | | 94.58 | | | |
| 35 | | | | | | | | | | | |

Plant Hercules
Sampling Location Boiler No. 2
Test For Particulate
Test Operators Russell / Little

RUN No. 3
Date 5-27-85
Time start 1145 end 1247

| | | | | | |
|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite |
| Sample Box | No.3 | Minutes/Pt. | 2.5 | $CO_2$ | 4.5 |
| Probe/Pitot | 5'SS | | | $O_2$ | 17 |
| Pitot Cp | .84 | NOMOGRAPH | | CO | — |
| Nozzle Dia. | .288 | ΔH@ | 1.88 | Time | 1219 |
| Filter No. | | Meter Temp. | 98 | | |
| | | % $H_2O$ | 10 | Condensate: | |
| Amb. Temp. °F | 87 | C-Factor | 1 | tare 200 | fin 260 |
| Bar. Press. "Hg | 30.18 | Stack Temp. | 400 | Silica gel: | |
| Static Press. "$H_2O$ | -.41 | Ref. ΔP | 1.05 | tare 724.0g | fin 730.5g |

Remarks:

| Port Point | El. Time, Min. | DGM Reading, Ft.³ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 117.654 | 0.44 | 0.75 | 361 | 88 | 87 | 250 | 65 | 1 |
| 2 | 230 | 118.9 | 0.15 | 0.24 | 362 | 90 | 87 | 225 | 55 | 1 |
| 3 | 500 | 119.7 | 0.13 | 0.22 | 368 | 92 | 88 | 225 | 55 | 1 |
| 4 | 730 | 120.2 | 0.13 | 0.22 | 371 | 92 | 87 | 225 | 55 | 1 |
| 5 | 1000 | 121.0 | 0.05 | 0.07 | 368 | 94 | 89 | 225 | 55 | 1 |
| 6 | 1230 | 121.6 | 0.11 | 0.17 | 360 | 94 | 89 | 225 | 55 | 1 |
| | | | | | | | | | | |
| 1 | 15/0 | 122.158 | 1.15 | 2.00 | 362 | 95 | 91 | 235 | 55 | 1 |
| 2 | 230 | 124.3 | 1.15 | 2.00 | 368 | 102 | 91 | 235 | 55 | 1 |
| 3 | 500 | 126.2 | 0.88 | 1.50 | 368 | 105 | 91 | 235 | 55 | 1 |
| 4 | 730 | 127.7 | 0.70 | 1.20 | 363 | 107 | 91 | 235 | 55 | 1 |
| 5 | 1000 | 129.4 | 0.90 | 1.50 | 360 | 108 | 92 | 235 | 55 | 2 |
| 6 | 1230 | 131.2 | 1.55 | 2.70 | 360 | 109 | 93 | 235 | 55 | 2 |
| | | | | | | | | | | |
| 1 | 30/0 | 133.174 | 0.97 | 1.65 | 369 | 109 | 93 | 235 | 60 | 1 |
| 2 | 230 | 134.9 | 1.10 | 1.90 | 374 | 109 | 93 | 235 | 60 | 1 |
| 3 | 500 | 136.7 | 1.40 | 2.40 | 372 | 111 | 93 | 235 | 60 | 2 |
| 4 | 730 | 138.9 | 1.25 | 2.15 | 375 | 112 | 94 | 235 | 60 | 2 |
| 5 | 1000 | 140.9 | 1.25 | 2.15 | 375 | 113 | 95 | 235 | 60 | 2 |
| 6 | 1230 | 143.0 | 1.45 | 2.50 | 366 | 113 | 96 | 240 | 55 | 2 |
| | | | | | | | | | | |
| 1 | 45/0 | 145.000 | 0.92 | 1.55 | 366 | 111 | 95 | 240 | 55 | 2 |
| 2 | 230 | 146.7 | 1.10 | 1.90 | 370 | 110 | 95 | 240 | 55 | 2 |
| 3 | 500 | 148.7 | 1.25 | 2.15 | 372 | 112 | 97 | 240 | 55 | 2 |
| 4 | 730 | 150.7 | 1.30 | 2.25 | 363 | 113 | 96 | 240 | 55 | 2 |
| 5 | 1000 | 152.6 | 0.85 | 1.45 | 366 | 115 | 97 | 240 | 55 | 2 |
| 6 | 1230 | 154.6 | 0.93 | 1.60 | 364 | 113 | 97 | 240 | 55 | 2 |
| end | 15/60 | 156.032 | | | | | | | | |
| | | | | | | | | | | |
| | | Leak check | .074 → | .076 = .002 | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | 38.378 | 0.8854 | 1.5092 | 369.96 | | 98.63 | | | |

## PARTICULATE CATCH ANALYSIS:

SAMPLES: Hercules - Boiler No. 2

DATE TAKEN: 5-27-85 DATE ANALYZED: 5-30-85

SAMPLES DELIVERED BY: DGR RECEIVED BY: DGR

ANALYZED BY: DGR

Filter treatment: Filters oven dried 2 hours at 105° C, desiccated at least 24 hours, weighed to constant weight

| FILTERS: | RUN 1 | Run 2 | Run 3 |
|---|---|---|---|
| Filter No. | 1449 | 1499 | 1447 |
| Tare wt., g | .5202 | .5193 | .5174 |
| 5-30-85 (1700) | .7047 | .6139 | .6199 |
| 5-31-85 (1145) | .7047 | .6140 | .6199 |
| | | | |
| Final wt., g | .7047 | .6140 | .6199 |
| Net gain, g | .1845 | .0947 | .1025 |

Probe wash treatment: Transferred to tared beaker, acetone evaporated over low heat, desiccated at least 24 hours, weighed to constant weight.

| PROBE WASH: | Run 1 | Run 2 | Run 3 | Blank |
|---|---|---|---|---|
| Container ID | H 1 | H 2 | H 3 | — |
| Volume intact? | ✓ | ✓ | ✓ | — |
| Volume, ml | 205 | 190 | 205 | |
| Tare wt., g | (11) 103.2179 | (12) 109.5887 | (13) 108.4845 | (2) 112.7429 |
| 5-30-85 (1700) | 103.2322 | 109.6521 | 108.5376 | 112.7429 |
| 5-31-85 (1145) | 103.2329 | 109.6522 | 108.5375 | 112.7429 |
| | | | | |
| Final wt., g | 103.2324 | 109.6522 | 108.5375 | 112.7429 |
| Net gain, g | .0145 | .0635 | .0530 | 0.0000 |
| Less blank, g | 0 | 0 | 0 | — |

| PARTICULATE | Run 1 | Run 2 | Run 3 |
|---|---|---|---|
| filter+probe | 199.0 | 158.2 | 155.5 |

DAW 5/1/85

Plant Hercules
Sampling Location Boiler No. 3
Test For Particulate
Test Operators Russell / Little

RUN No. 1
Date 4-30-85
Time start 1438 end 1543

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Meter Box | PAC | No. Sample Pts. | 24 | Gas Analysis | Pyrite | Remarks: | |
| Sample Box | No. 1 | Minutes/Pt. | 2.5 | $CO_2$ | 6 | | |
| Probe/Pitot | S'ss | NOMOGRAPH | | $O_2$ | 15 | | |
| Pitot Cp | .84 | ΔH@ | 1.88 | CO | – | | |
| Nozzle Dia. | .228 | Meter Temp. | 107 | Time | 1519 | | |
| Filter No. | | % $H_2O$ | 10 | Condensate: | | | |
| Amb. Temp. °F | 87 | C-Factor | 1.05 | tare 200 ml | fin 280 ml | | |
| Bar. Press. "Hg | 30.24 | Stack Temp. | 400 | Silica gel: | | | |
| Static Press. "$H_2O$ | -.56 | Ref. Δ P | 1.05 | tare 688.5 g | fin 696.0 | 30,000 # steam | |

| | Port Point | El. Time, Min. | DGM Reading, $Ft.^3$ | Velocity Head Δ P, in. $H_2O$ | Orifice Δ H in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac. in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A 1 | 0 | 000.926 | 0.09 | 0.14 | 377 | 95 | 95 | 250 | 70 | 1 |
| 2 | 2 | 230 | 001.5 | 0.12 | 0.20 | 378 | 99 | 95 | 250 | 60 | 1 |
| 3 | 3 | 500 | 002.1 | 0.17 | 0.28 | 376 | 98 | 96 | 250 | 55 | 1 |
| 4 | 4 | 730 | 002.8 | 0.17 | 0.28 | 374 | 100 | 95 | 250 | 55 | 1 |
| 5 | 5 | 1000 | 003.6 | 0.19 | 0.31 | 372 | 101 | 97 | 250 | 55 | 1 |
| 6 | 6 | 1230 | 004.4 | 0.15 | 0.24 | 365 | 103 | 97 | 250 | 55 | 1 |
| 7 | | | | | | | | | | | |
| 8 | 1 | 1510 | 005.044 | 0.95 | 1.65 | 385 | 104 | 98 | 280 | 60 | 1 |
| 9 | 2 | 2 30 | 006.8 | 0.87 | 1.50 | 386 | 107 | 98 | 270 | 60 | 2 |
| 10 | 3 | 500 | 008.6 | 0.45 | 0.75 | 381 | 110 | 98 | 250 | 55 | 1 |
| 11 | 4 | 730 | 009.9 | 0.66 | 1.10 | 374 | 110 | 99 | 250 | 55 | 1 |
| 12 | 5 | 1000 | 011.2 | 1.00 | 1.75 | 376 | 113 | 100 | 240 | 60 | 2 |
| 13 | 6 | 1230 | 013.1 | 1.85 | 3.30 | 375 | 114 | 100 | 250 | 60 | 3 |
| 14 | | | | | | | | | | | |
| 15 | 1 | 30/0 | 015.838 | 0.90 | 1.55 | 391 | 114 | 102 | 265 | 60 | 2 |
| 16 | 2 | 230 | 017.0 | 0.94 | 1.60 | 399 | 114 | 101 | 265 | 60 | 2 |
| 17 | 3 | 500 | 019.0 | 1.50 | 2.60 | 394 | 116 | 101 | 250 | 60 | 3 |
| 18 | 4 | 730 | 020.7 | 1.60 | 2.80 | 378 | 116 | 102 | 250 | 60 | 3 |
| 19 | 5 | 1000 | 023.3 | 1.20 | 2.00 | 375 | 119 | 102 | 250 | 60 | 2 |
| 20 | 6 | 1230 | 025.2 | 1.40 | 2.45 | 380 | 121 | 103 | 235 | 60 | 3 |
| 21 | | | | | | | | | | | |
| 22 | 1 | 45/0 | 027.073 | 0.90 | 1.55 | 402 | 117 | 102 | 235 | 60 | 2 |
| 23 | 2 | 230 | 028.8 | 0.96 | 1.65 | 407 | 115 | 103 | 235 | 60 | 2 |
| 24 | 3 | 500 | 030.6 | 1.65 | 2.90 | 401 | 118 | 104 | 270 | 60 | 3 |
| 25 | 4 | 730 | 032.8 | 1.50 | 2.60 | 390 | 118 | 103 | 260 | 60 | 3 |
| 26 | 5 | 1000 | 034.9 | 0.79 | 1.20 | 384 | 119 | 104 | 250 | 60 | 2 |
| 27 | 6 | 1230 | 036.6 | 0.82 | 1.40 | 385 | 117 | 104 | 250 | 60 | 2 |
| 28 | end | | ~~038.~~ | | | | | | | | |
| 29 | | | 037.961 | | | | | | | | |
| 30 | | | leak check: .088 → | .091 = | .003 @ 6 "Hg | | | | | | |
| 31 | | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| 33 | | | | | | | | | | | |
| 34 | | | 37.035 | .8735 | 1.4958 | 383.5 | | 105.23 | | | |
| 35 | | | | | | | | | | | |

DAW 5/1/85

Plant Hercules
Sampling Location Boiler No. 3
Test For Particulate
Test Operators Russell / Little

RUN No. 2
Date 5-1-85
Time start 0853 end 0954

| | | | | | | |
|---|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite | Remarks: |
| Sample Box | No. 2 | Minutes/Pt. | 2.5 | $CO_2$ | 2.5 | |
| Probe/Pitot | 5'ss | NOMOGRAPH | | $O_2$ | 18.0 | |
| Pitot Cp | .84 | ΔH@ | 1.84 | CO | | |
| Nozzle Dia. | .228 | Meter Temp. | 92 | Time | | |
| Filter No. | | % $H_2O$ | 11 | Condensate: | | |
| Amb. Temp. °F | 72 | C-Factor | .98 | tare 200 ml | fin 265 | |
| Bar. Press. "Hg | 20.16 | Stack Temp. | 390 | Silica gel: | | |
| Static Press. "$H_2O$ | -.29 | Ref. ΔP | 1.05 | tare 774.8 | fin 790 | |

| | Port | Point | El. Time, Min. | DGM Reading, Ft.³ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac. In. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A | 1 | 0 | 038.339 | 0.10 | 0.16 | 361 | 78 | 77 | 225 | 60 | 1 |
| 2 | | 2 | 2 30 | 038.9 | 0.13 | 0.21 | 349 | 81 | 77 | 225 | 50 | 1 |
| 3 | | 3 | 5 00 | 039.6 | 0.19 | 0.31 | 357 | 81 | 78 | 225 | 50 | 1 |
| 4 | | 4 | 7 30 | 040.4 | 0.10 | 0.16 | 358 | 83 | 78 | 225 | 50 | 1 |
| 5 | | 5 | 10 00 | 041.0 | 0.09 | 0.14 | 357 | 84 | 79 | 225 | 50 | 1 |
| 6 | | 6 | 12 30 | 041.5 | 0.15 | 0.24 | 354 | 85 | 79 | 225 | 55 | 1 |
| 7 | | | | | | | | | | | | |
| 8 | B | 1 | 15 0 | 042.200 | 1.10 | 1.85 | 368 | 86 | 80 | 250 | 55 | 4 |
| 9 | | 2 | 2 30 | 044.0 | 0.93 | 1.60 | 366 | 91 | 81 | 250 | 55 | 4 |
| 10 | | 3 | 5 00 | 045.7 | 1.00 | 1.75 | 363 | 92 | 81 | 250 | 55 | 4 |
| 11 | | 4 | 7 30 | 047.5 | 0.69 | 1.20 | 359 | 94 | 81 | 250 | 55 | 3 |
| 12 | | 5 | 10 00 | 049.0 | 0.84 | 1.45 | 354 | 95 | 84 | 250 | 55 | 3 |
| 13 | | 6 | 12 30 | 050.6 | 1.85 | 3.30 | 358 | 95 | 82 | 235 | 50 | 8 |
| 14 | | | | | | | | | | | | |
| 15 | C | 1 | 30 0 | 052.802 | 0.89 | 1.50 | 379 | 98 | 84 | 240 | 55 | 4 |
| 16 | | 2 | 2 30 | 054.6 | 0.95 | 1.65 | 398 | 99 | 84 | 240 | 55 | 4 |
| 17 | | 3 | 5 00 | 056.1 | 0.76 | 1.30 | 402 | 99 | 85 | 250 | 55 | 3 |
| 18 | | 4 | 7 30 | 057.7 | 1.50 | 2.60 | 386 | 100 | 85 | 250 | 55 | 7 |
| 19 | | 5 | 10 00 | 060.0 | 1.20 | 2.05 | 369 | 102 | 86 | 260 | 55 | 6 |
| 20 | | 6 | 12 30 | 061.9 | 1.45 | 2.50 | 372 | 104 | 87 | 260 | 55 | 7 |
| 21 | | | | | | | | | | | | |
| 22 | D | 1 | 45 0 | 063.911 | 0.40 | 0.66 | 384 | 100 | 87 | 250 | 55 | 2 |
| 23 | | 2 | 2 30 | 065.1 | 0.94 | 1.60 | 377 | 99 | 87 | 245 | 55 | 5 |
| 24 | | 3 | 5 00 | 066.6 | 1.65 | 2.95 | 371 | 101 | 87 | 240 | 55 | 8 |
| 25 | | 4 | 7 30 | 069.0 | 1.50 | 2.60 | 375 | 105 | 89 | 240 | 55 | 8 |
| 26 | | 5 | 10 00 | 071.2 | 0.80 | 1.40 | 379 | 105 | 88 | 240 | 55 | 5 |
| 27 | | 6 | 12 30 | 072.9 | 0.82 | 1.40 | 385 | 105 | 91 | 240 | 55 | 5 |
| 28 | end | | 60 | 074.386 | | | | | | | | |
| 29 | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | |
| 31 | | | | leak check .042 → .053 = .011 cfm @ 10" Hg | | | | | | | | |
| 32 | | | | | | | | | | | | |
| 33 | | | | | | | | | | | | |
| 34 | | | | 36.047 | .8526 | 1.4408 | 369.63 | | 98.52 | | | |
| 35 | | | | | | | | | | | | |

DAW 5/1/85

Plant Hercules
Sampling Location Boiler No. 3
Test For Particulate
Test Operators Russell / Little

RUN No. 3
Date 5-1-85
Time start 1007 end 1108

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite | Remarks: | |
| Sample Box | No. 3 | Minutes/Pt. | 2.5 | $CO_2$ | 4 | | |
| Probe/Pitot | .895'ss | NOMOGRAPH | | $O_2$ | 16.5 | | |
| Pitot Cp | .84 | ΔH@ | 1.88 | CO | - | | |
| Nozzle Dia. | .228 | Meter Temp. | 92 | Time | 1041 | | |
| Filter No. | | % $H_2O$ | 10 | Condensate: | | | |
| Amb. Temp. °F | 75 | C-Factor | .98 | tare 200 | fin 283 | | |
| Bar. Press. "Hg | 30.16 | Stack Temp. | 400 | Silica gel: | | | |
| Static Press. "$H_2O$ | -.29 | Ref. ΔP | 1.05 | tare 689.5 | fin 700.5 | | |

| | Port Point | El. Time, Min. | DGM Reading, $Ft.^3$ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac. in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A 1 | 0 | 074.782 | 0.10 | 0.16 | 362 | 86 | 85 | 225 | 65 | 1 |
| 2 | 2 | 230 | 075.4 | 0.12 | 0.18 | 375 | 88 | 85 | 225 | 55 | 1 |
| 3 | 3 | 500 | 076.1 | 0.15 | 0.22 | 376 | 87 | 85 | 225 | 55 | 1 |
| 4 | 4 | 730 | 076.6 | 0.08 | 0.13 | 374 | 88 | 85 | 235 | 55 | 1 |
| 5 | 5 | 1000 | 077.1 | 0.20 | 0.37 | 369 | 89 | 85 | 225 | 55 | 1 |
| 6 | 6 | 1230 | 077.9 | 0.16 | 0.26 | 368 | 91 | 86 | 225 | 55 | 1 |
| 7 | | | | | | | | | | | |
| 8 | 1 | 15/0 | 078.582 | 1.00 | 1.75 | 385 | 91 | 85 | 225 | 55 | 1 |
| 9 | 2 | 230 | 080.5 | 0.98 | 1.70 | 386 | 95 | 86 | 225 | 55 | 1 |
| 10 | 3 | 500 | 082.4 | 1.20 | 2.10 | 376 | 99 | 88 | 235 | 55 | 1 |
| 11 | 4 | 730 | 084.2 | 0.84 | 1.45 | 363 | 101 | 86 | 225 | 55 | 1 |
| 12 | 5 | 1000 | 086.8 | 0.90 | 1.55 | 359 | 101 | 87 | 235 | 55 | 1 |
| 13 | 6 | 1230 | 087.2 | 1.70 | 3.00 | 354 | 102 | 88 | 240 | 50 | 2 |
| 14 | | | | | | | | | | | |
| 15 | 1 | 30/0 | 089.792 | 0.84 | 1.45 | 378 | 102 | 87 | 240 | 55 | 1 |
| 16 | 2 | 230 | 091.4 | 0.89 | 1.55 | 385 | 101 | 87 | 250 | 55 | 1 |
| 17 | 3 | 500 | 093.1 | 1.60 | 2.80 | 377 | 102 | 88 | 250 | 55 | 2 |
| 18 | 4 | 730 | 095.4 | 1.45 | 2.50 | 377 | 104 | 87 | 250 | 55 | 2 |
| 19 | 5 | 1000 | 097.2 | 1.20 | 2.05 | 370 | 106 | 88 | 250 | 55 | 1 |
| 20 | 6 | 1230 | 099.2 | 1.30 | 2.25 | 371 | 105 | 88 | 250 | 55 | 2 |
| 21 | | | | | | | | | | | |
| 22 | 1 | 45/0 | 101.298 | 0.40 | 0.67 | 383 | 104 | 88 | 250 | 55 | 1 |
| 23 | 2 | 230 | 102.5 | 0.94 | 1.60 | 397 | 100 | 88 | 250 | 55 | 1 |
| 24 | 3 | 500 | 104.0 | 1.40 | 2.45 | 398 | 102 | 90 | 250 | 50 | 2 |
| 25 | 4 | 730 | 106.0 | 1.40 | 2.45 | 399 | 105 | 89 | 250 | 50 | 2 |
| 26 | 5 | 1000 | 108.0 | 0.77 | 1.35 | 384 | 105 | 89 | 250 | 50 | 2 |
| 27 | 6 | 1230 | 109.7 | 0.85 | 1.45 | 373 | 105 | 90 | 250 | 50 | 1 |
| 28 | end | 60 | 111.343 | | | | | | | | |
| 29 | | | | | | | | | | | |
| 30 | | | Leak check | .006 → | .011 = | .005 cfm | @ 5" | Hg | | | |
| 31 | | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| 33 | | | | | | | | | | | |
| 34 | | | 36.561 | 0.8453 | 1.4750 | 376.67 | | 92.69 | | | |
| 35 | | | | | | | | | | | |

PARTICULATE CATCH ANALYSIS:

SAMPLES: Hercules - Boiler No. 3

DATE TAKEN: 4-30 & 5-1, 85 DATE ANALYZED: 5-3-85

SAMPLES DELIVERED BY: DGR RECEIVED BY: DGR

ANALYZED BY: DGR

Filter treatment: Oven dried @ 105°C 2 hrs, desiccated >24 hrs, weighed to constant wt.

| FILTERS: | RUN 1 | Run 2 | Run 3 |
|---|---|---|---|
| Filter No. | 1377 | 1393 | 1392 |
| Tare wt., g | .5498 | .5550 | .5774 |
| Final wt., g | .6233 | .6626 | .6296 |
| Net gain, g | .0735 | .1076 | .0522 |

Probe wash treatment: Acetone Evaporated over low heat, residue desiccated >24 hrs, weighed to constant wt.

| PROBE WASH: | Run 1 | Run 2 | Run 3 | Blank |
|---|---|---|---|---|
| Container ID | H3R1 | H3R2 | H3R3 | — |
| Volume intact? | ✓ | ✓ | ✓ | — |
| Volume, ml | 145 | 165 | 175 | |
| Tare wt., g | (6) 114.8362 | (7) 110.1024 | (8) 111.5629 | |
| Final wt., g | 114.8851 | 110.1729 | 111.6077 | |
| Net gain, g | .0489 | .0705 | .0448 | .0001 |
| Less blank, g | -.0001 | -.0001 | -.0001 | |

| PARTICULATE COLLECTED: | Run 1 | Run 2 | Run 3 |
|---|---|---|---|
| Net gains less blank, mg | 122.3 | 178.0 | 96.9 |

Plant Hercules, Inc
Sampling Location Boiler No. 4
Test For Particulate
Test Operators Russell / Little BPC - Jesse Thompson

RUN No. 1
Date 4-30-85
Time start 1005 end 1109

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite | Remarks: | |
| Sample Box | No. 1 | Minutes/Pt. | 2.5 | $CO_2$ | 2.5 | | |
| Probe/Pitot | 5'ss | NOMOGRAPH | | $O_2$ | 16.5 | | |
| Pitot Cp | .84 | ΔH@ | 1.88 | CO | | | |
| Nozzle Dia. | .228 | Meter Temp. | 97 | Time | 1038 | | |
| Filter No. | | % $H_2O$ | 10 | Condensate: | | | |
| Amb. Temp. °F | 80 | C-Factor | 98 | tare 200 ml | fin 250 ml | | |
| Bar. Press. "Hg | 30.24 | Stack Temp. | 360 | Silica gel: | | | |
| Static Press. "$H_2O$ | -.81 | Ref. Δ P | 1.0 | tare 642 g | fin 649.0 g | | |

| | Port | Point | El. Time, Min. | DGM Reading, $Ft.^3$ | Velocity Head Δ P, in. $H_2O$ | Orifice Δ H in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A | 1 | 0 | 887.507 | 0.20 | 0.35 | 333 | 84 | 84 | 235 | 65 | 1 |
| 2 | | 2 | 230 | 888.4 | 0.20 | 0.35 | 342 | 86 | 84 | 235 | 60 | 1 |
| 3 | | 3 | 500 | 889.3 | 0.18 | 0.31 | 351 | 87 | 84 | 250 | 55 | 1 |
| 4 | | 4 | 730 | 890.1 | 0.24 | 0.42 | 359 | 90 | 84 | 250 | 55 | 1 |
| 5 | | 5 | 1000 | 891.0 | 0.28 | 0.50 | 360 | 91 | 85 | 250 | 55 | 1 |
| 6 | | 6 | 1230 | 891.9 | 0.19 | 0.33 | 360 | 93 | 86 | 250 | 55 | 1 |
| 7 | | | | | | | | | | | | |
| 8 | B | 1 | 1500 | 892.734 | 1.35 | 2.30 | 358 | 94 | 87 | 250 | 55 | 3 |
| 9 | | 2 | 230 | 895.1 | 0.96 | 1.75 | 366 | 99 | 87 | 250 | 55 | 3 |
| 10 | | 3 | 500 | 896.7 | 0.89 | 1.60 | 365 | 102 | 88 | 250 | 55 | 3 |
| 11 | | 4 | 730 | 898.4 | 1.00 | 1.85 | 370 | 103 | 88 | 240 | 55 | 3 |
| 12 | | 5 | 1000 | 900.1 | 0.81 | 1.45 | 370 | 105 | 90 | 250 | 55 | 3 |
| 13 | | 6 | 1230 | 901.7 | 1.80 | 3.40 | 366 | 106 | 91 | 250 | 55 | 5 |
| 14 | | | | | | | | | | | | |
| 15 | C | 1 | 1500 | 903.810 | 1.05 | 1.90 | 369 | 107 | 92 | 250 | 55 | 3 |
| 16 | | 2 | 230 | 905.7 | 1.05 | 1.90 | 384 | 107 | 92 | 250 | 55 | 3 |
| 17 | | 3 | 500 | 907.5 | 1.35 | 2.50 | 390 | 108 | 92 | 250 | 55 | 5 |
| 18 | | 4 | 730 | 909.6 | 1.35 | 2.50 | 392 | 111 | 94 | 250 | 55 | 5 |
| 19 | | 5 | 1000 | 911.7 | 1.20 | 2.10 | 392 | 111 | 94 | 260 | 60 | 4 |
| 20 | | 6 | 1230 | 913.9 | 1.90 | 2.45 | 398 | 112 | 95 | 260 | 60 | 5 |
| 21 | | | | | | | | | | | | |
| 22 | D | 1 | 1500 | 915.755 | 0.65 | 1.10 | 390. | 104 | 93 | 260 | 60 | 3 |
| 23 | | 2 | 230 | 917.2 | 0.85 | 1.45 | 392 | 105 | 95 | 260 | 60 | 4 |
| 24 | | 3 | 500 | 918.8 | 1.20 | 2.10 | 392 | 106 | 95 | 260 | 60 | 5 |
| 25 | | 4 | 730 | 920.8 | 1.25 | 2.20 | 391 | 107 | 96 | 260 | 60 | 5 |
| 26 | | 5 | 1000 | 922.7 | 0.64 | 1.10 | 386 | 109 | 96 | 250 | 60 | 4 |
| 27 | | 6 | 1230 | 924.3 | 0.82 | 1.40 | 384 | 110 | 96 | 250 | 60 | 4 |
| 28 | end | | 60 | 925.774 | | | | | | | | |
| 29 | | | | | | | | | | | | |
| 30 | | | | leak check | .045 → .050 = .005 cfm | | | | | | | |
| 31 | | | | | | | | | | | | |
| 32 | | | | | | | | | | | | |
| 33 | | | | 38.267 | .8914 | 1.7608 | 373.33 | | | | | |
| 34 | | | | | | | | | 98.99 | | | |
| 35 | | | | | | | | 101.54 | | | | |

Environmental Monitoring Laboratories

Plant Hercules
Sampling Location Boiler No. 4
Test For Particulate
Test Operators Russell / Little

RUN No. 2
Date 4-30-85
Time start 1128 end 1231

| | | | | | |
|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite |
| Sample Box | No. 3 | Minutes/Pt. | 2.5 | $CO_2$ | 6.0 |
| Probe/Pitot | S.S.S | NOMOGRAPH | | $O_2$ | 15.0 |
| Pitot Cp | .84 | ΔH@ | 1.88 | CO | |
| Nozzle Dia. | .228 | Meter Temp. | 97 | Time | |
| Filter No. | | % $H_2O$ | 10 | | |
| Amb. Temp. °F | 82 | C-Factor | .98 | Condensate: | |
| Bar. Press. "Hg | 30.24 | Stack Temp. | 400 | tare 200 fin 283 | |
| Static Press. "$H_2O$ | -.81 | Ref. ΔP | 1.05 | Silica gel: | |
| | | | | tare 665.5 g fin 672.0 g | |

Remarks:

| | Port Point | Elapsed Time, Min. | DGM Reading, $Ft^3$ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A 1 | 0 | 926.031 | 0.21 | 0.35 | 338 | 95 | 93 | 225 | 70 | 1 |
| 2 | 2 | 230 | 927.0 | 0.19 | 0.32 | 349 | 96 | 94 | 225 | 60 | 1 |
| 3 | 5 | 500 | 927.9 | 0.25 | 0.41 | 356 | 98 | 94 | 225 | 55 | 1 |
| 4 | 7 | 730 | 928.7 | 0.27 | 0.44 | 366 | 101 | 95 | 225 | 55 | 1 |
| 5 | 10 | 1000 | 929.7 | 0.17 | 0.30 | 371 | 100 | 94 | 225 | 55 | 1 |
| 6 | 12 | 1230 | 930.5 | 0.47 | 0.79 | 373 | 102 | 96 | 225 | 55 | 1 |
| 7 | | | | | | | | | | | |
| 8 | B 1 | 15/0 | 931.592 | 1.40 | 2.45 | 380 | 102 | 96 | 240 | 55 | 2 |
| 9 | 2 | 230 | 934.1 | 0.88 | 1.50 | 390 | 107 | 98 | 240 | 55 | 1 |
| 10 | 5 | 500 | 935.9 | 0.99 | 1.70 | 389 | 110 | 97 | 240 | 55 | 2 |
| 11 | 7 | 730 | 937.1 | 0.92 | 1.60 | 390 | 112 | 97 | 240 | 55 | 2 |
| 12 | 10 | 1000 | 939.0 | 0.80 | 1.40 | 393 | 111 | 98 | 240 | 50 | 1 |
| 13 | 12 | 1230 | 940.6 | 1.40 | 2.45 | 394 | 112 | 98 | 250 | 55 | 3 |
| 14 | | | | | | | | | | | |
| 15 | C 1 | 30/0 | 942.540 | 0.93 | 1.60 | 395 | 112 | 97 | 250 | 60 | 2 |
| 16 | 2 | 230 | 944.4 | 0.97 | 1.70 | 399 | 113 | 98 | 250 | 60 | 2 |
| 17 | 5 | 500 | 946.2 | 1.25 | 2.15 | 401 | 113 | 99 | 250 | 60 | 3 |
| 18 | 7 | 730 | 948.2 | 1.25 | 2.15 | 401 | 115 | 100 | 250 | 60 | 3 |
| 19 | 10 | 1000 | 950.2 | 1.30 | 2.25 | 403 | 116 | 100 | 250 | 60 | 4 |
| 20 | 12 | 1230 | 952.2 | 1.45 | 2.50 | 403 | 116 | 100 | 250 | 60 | 5 |
| 21 | | | | | | | | | | | |
| 22 | D 1 | 45/0 | 954.134 | 0.58 | 0.96 | 400 | 114 | 100 | 250 | 60 | 3 |
| 23 | 2 | 230 | 955.5 | 0.69 | 1.20 | 400 | 113 | 100 | 250 | 60 | 3 |
| 24 | 5 | 500 | 957.0 | 1.05 | 1.85 | 403 | 113 | 101 | 250 | 60 | 5 |
| 25 | 7 | 730 | 958.9 | 1.05 | 1.85 | 405 | 116 | 102 | 250 | 60 | 5 |
| 26 | 10 | 1000 | 961.0 | 0.66 | 1.10 | 405 | 114 | 101 | 250 | 60 | 4 |
| 27 | 12 | 1230 | 962.4 | 0.65 | 1.10 | 404 | 113 | 101 | 250 | 60 | 4 |
| 28 | end | 60 | 963.659 | | | | | | | | |
| 29 | | | | | | | | | | | |
| 30 | | | | | | | | | | | |
| 31 | | | Leak check: .012 → .015 = .003 cfm @ 6" Hg | | | | | | | | |
| 32 | | | | | | | | | | | |
| 33 | | | | | | | | | | | |
| 34 | | | 37.628 | .8736 | 1.4217 | 387.80 | | | | | |
| 35 | | | | | | | | | | 103.40 | |

Plant Hercules
Sampling Location Boiler No. 4
Test For Particulate
Test Operators Russell / Little

RUN No. 3
Date 4-30-85
Time start 1249 end 1352

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite | | Remarks: |
| Sample Box | No. 2 | Minutes/Pt. | 2.5 | $CO_2$ | 7.0 | | |
| Probe/Pitot | 5' SS | | | $O_2$ | 14.0 | | |
| Pitot Cp | .84 | NOMOGRAPH | | CO | — | | |
| Nozzle Dia. | .228 | ΔH@ | 1.88 | Time | 1325 | | |
| Filter No. | | Meter Temp. | 106 | | | | |
| | | % $H_2O$ | 10 | Condensate: | | | |
| Amb. Temp. °F | 84 | C-Factor | .99 | tare 200 | fin 282 | | |
| Bar. Press. "Hg | 30.24 | Stack Temp. | 406 | Silica gel: | | | |
| Static Press. "$H_2O$ | -.81 | Ref. ΔP | 1.05 | tare 649.5 | fin 657.0 | | |

| | Port | Point | El. Time, Min. | DGM Reading, $Ft^3$ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A | 1 | 0 | 964.202 | 0.25 | 0.41 | 384 | 99 | 98 | 225 | 70 | 1 |
| 2 | | 2 | 230 | 965.2 | 0.16 | 0.26 | 385 | 101 | 99 | 225 | 60 | 1 |
| 3 | | 3 | 500 | 966.0 | 0.28 | 0.46 | 384 | 102 | 99 | 225 | 60 | 1 |
| 4 | | 4 | 730 | 966.8 | 0.30 | 0.50 | 384 | 103 | 99 | 280 | 55 | 1 |
| 5 | | 5 | 1000 | 967.9 | 0.11 | 0.17 | 386 | 105 | 100 | 275 | 55 | 1 |
| 6 | | 6 | 1230 | 968.5 | 0.14 | 0.23 | 388 | 105 | 100 | 250 | 55 | 1 |
| 7 | | | | | | | | | | | | |
| 8 | B | 1 | 1510 | 969.162 | 1.20 | 2.10 | 395 | 104 | 100 | 250 | 55 | 5 |
| 9 | | 2 | 230 | 971.0 | 0.79 | 1.40 | 398 | 107 | 100 | 250 | 55 | 3 |
| 10 | | 3 | 500 | 972.8 | 1.30 | 2.25 | 399 | 111 | 100 | 240 | 55 | 5 |
| 11 | | 4 | 730 | 974.7 | 0.77 | 1.30 | 401 | 112 | 100 | 230 | 55 | 3 |
| 12 | | 5 | 1000 | 976.3 | 0.65 | 1.10 | 401 | 113 | 101 | 250 | 55 | 3 |
| 13 | | 6 | 1230 | 977.9 | 1.35 1.35 | 2.35 | 404 | 114 | 101 | 250 | 55 | 6 |
| 14 | | | | | | | | | | | | |
| 15 | C | 1 | 1510 | 979.714 | 0.87 | 1.50 | 406 | 112 | 100 | 250 | 55 | 4 |
| 16 | | 2 | 230 | 981.4 | 0.91 | 1.60 | 406 | 113 | 102 | 250 | 55 | 5 |
| 17 | | 3 | 500 | 983.1 | 0.55 | 0.93 | 409 | 113 | 101 | 250 | 55 | 4 |
| 18 | | 4 | 730 | 984.6 | 1.25 | 2.35 | 410 | 114 | 102 | 250 | 55 | 7 |
| 19 | | 5 | 1000 | 986.5 | 1.30 | 2.25 | 413 | 115 | 102 | 250 | 55 | 8 |
| 20 | | 6 | 1230 | 988.4 | 1.55 | 2.70 | 411 | 117 | 102 | 255 | 55 | 10 |
| 21 | | | | | | | | | | | | |
| 22 | D | 1 | 1510 | 990.511 | 0.55 | 0.94 | 404 | 113 | 102 | 275 | 55 | 5 |
| 23 | | 2 | 230 | 991.9 | 0.78 | 1.35 | 402 | 112 | 102 | 265 | 55 | 6 |
| 24 | | 3 | 500 | 993.6 | 0.97 | 1.60 | 402 | 113 | 102 | 265 | 55 | 7 |
| 25 | | 4 | 730 | 995.2 | 1.25 | 2.20 | 402 | 114 | 102 | 260 | 55 | 9 |
| 26 | | 5 | 1000 | 997.3 | 0.65 | 1.10 | 401 | 116 | 104 | 250 | 60 | 6 |
| 27 | | 6 | 1230 | 999.0 | 0.74 | 1.25 | 399 | 115 | 103 | 250 | 60 | 6 |
| 28 | end | | 60/15 | 000.668 | | | | | | | | |
| 29 | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | |
| 31 | | | | Leak Check: | .067 → | .078 → | .01 after @ 11" Hg | | | | | |
| 32 | | | | | | | | | | | | |
| 33 | | | | | | | | | | | | |
| 34 | | | | 36.466 | .8426 | 1.3458 | | | | | | |
| 35 | | | | | | | | | | | | |

PARTICULATE CATCH ANALYSIS:

SAMPLES: Hercules - Boiler No. 4

DATE TAKEN: 4-30-85 DATE ANALYZED: ~~DeR~~ 5-3-85

SAMPLES DELIVERED BY: DeR RECEIVED BY: DeR

ANALYZED BY: DeR

Filter treatment: Oven dried at 105°C 2hrs, desiccated >24hrs
Weighed to constant wt.

| FILTERS: | RUN 1 | Run 2 | Run 3 |
|---|---|---|---|
| Filter No. | 1374 | 1376 | 1375 |
| Tare wt., g | .5537 | .5714 | .5518 |
| Final wt., g | 0.6807 | 0.7753 | 0.6600 |
| Net gain, g | .1270 | .2039 | .1082 |

Probe wash treatment: Acetone evaporated over low heat, residue desiccated >24hrs

| PROBE WASH: | Run 1 | Run 2 | Run 3 | Blank |
|---|---|---|---|---|
| Container ID | H4R1 | H4R2 | H4R3 | — |
| Volume intact? | ✓ | ✓ | ✓ | — |
| Volume, ml | 180 | 190 | 170 | 200 |
| Tare wt., g | (12) 109.5867 | (13) 108.4835 | (14) 104.5659 | (15) 105.7694 |
| Final wt., g | 109.6283 | 108.5841 | 104.6210 | 105.7695 |
| Net gain, g | .0416 | .1006 | .0051 | .0001 |
| Less blank, g | -.0001 | -.0001 | -.0001 | — |

| PARTICULATE COLLECTED: | Run 1 | Run 2 | Run 3 |
|---|---|---|---|
| Net gains less blank, mg | 168.5 | 364.4 | 163.2 |

# DRY GAS METER CALIBRATION

Meter I.D. RAC-591349 Date 2-20-85

Calibration Method DGM/OGA Bell Prove By DGR

Calibration Meter I.D. 651729 y=1.000

Barometric Pressure 30.17

Previous use: Initial Calibration following overhaul on 2-19-85

| Vac in. Hg | DH in. $H_2O$ | Time min. | Calibrating Meter Vi cf | Calibrating Meter Vf cf | Calibrating Meter Temp °F | Field Meter Vi cf | Field Meter Vf cf | Field Meter Temp °F in | Field Meter Temp °F out | Y |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.75 | 15.0 | 713.456 | 720.556 | 66 | 060.002 | 067.241 | 68 · 91 | 67 · 68 | .9920 |
| 1 | 1.00 | 15+ | 720.556 | 729.280 | 66 | 067.241 | 076.199 | 90 · 108 | 68 · 73 | 1.0061 |
| 1 | 1.50 | 15.0 | 729.280 | 738.973 | 67 | 076.199 | 086.127 | 104 · 118 | 73 · 78 | 1.0242 |
| 1 | 2.00 | 15.0 | 738.973 | 749.801 | 68 | 086.127 | 097.471 | 112 · 107 | 77 · 78 | .9958 |
| 1 | 2.50 | 15.0 | 749.801 | 762.243 | 69 | 097.471 | 110.407 | 106 · 109 | 78 · 78 | 1.0069 |
| | | | | | | | | · | Avg | 1.0046 |
| | | | | | | | | · | ·Y= | 1.00 |
| | | | | | | | | · | · | |

$$Y = [(Vcal)(Pbar)(Tdgm)]/[(Vdgm)(Pm)(Tcal)]$$

Where:

Y = Meter correction factor

Vcal = Volume of gas through calibrating meter, $ft.^3$

Vdgm = Volume of gas through field dry gas meter, $ft.^3$

Pbar = Barometric pressure, in. Hg

Pm = Meter pressure, (Pbar+DH/13.6), in. Hg

Tdgm = Average Dry gas meter temp., $^oR$

Tcal = Temperature of gas through calibrating meter, $^oR$

# DRY GAS METER CALIBRATION

Meter I.D. RAC 591349 Date 5-7-85

Calibration Method DGM/DGM By DGR

Calibration Meter I.D. 651729 y=1.00

Barometric Pressure 30.03

Previous use: 4-30, 5-1, 85 - Hercules Bldg. 4, 3, +1

| Vac in. Hg | DH in. $H_2O$ | Time min. | Calibrating Meter Vi cf | Calibrating Meter Vf cf | Calibrating Meter Temp °F | Field Meter Vi cf | Field Meter Vf cf | Field Meter Temp °F in | Field Meter Temp °F out | Y |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 2.75 | 15.0 | 029.845 | 043.266 | 73 | 211.220 | 224.767 | 73 · 104 | 73 · 77 | 1.0002 |
| 4 | 2.00 | 16.5 | 043.266 | 055.621 | 72 | 224.767 | 237.459 | 101 · 111 | 77 · 82 | 1.0065 |
| 2 | 1.00 | 16.0 | 055.621 | 064.466 | 73 | 237.459 | 246.661 | 107 · 107 | 82 · 85 | .9989 |
| | | | | | | | | · | · | |
| | | | | | | | | · | Avg. | 1.0019 |
| | | | | | | | | · | · y= | 1.00 |
| | | | | | | | | · | · | |
| | | | | | | | | · | · | |

$$Y = [(Vcal)(Pbar)(Tdgm)]/[(Vdgm)(Pm)(Tcal)]$$

Where:

Y = Meter correction factor

Vcal = Volume of gas through calibrating meter, $ft.^3$

Vdgm = Volume of gas through field dry gas meter, $ft.^3$

Pbar = Barometric pressure, in. Hg

Pm = Meter pressure, {Pbar+DH/13.6}, in. Hg

Tdgm = Average Dry gas meter temp., °R

Tcal = Temperature of gas through calibrating meter, °R

## THERMOMETER/THERMOCOUPLE CALIBRATION

Date: 6-3-85 By: D&R

Reference Thermometer ASTM Hg/glass 20-760°F

Last Service Hercules 5-27-85

| Field Thermometer | Temp. Source | Reference Temperature | Field Therm. Temperature | % error, absolute |
|---|---|---|---|---|
| 5' T'couple Omega 650 | Tube Furnace | 386 | 390 | <1 |
| Meter In Omega 650 | Room | 76 | 76 | — |
| Meter Out Omega 650 | Room | 76 | 76 | — |
| Impinger out Bimetal-dial | Room | 76 | 70 | <1 |
| Sample Box Bimetal-dial | Tube Furnace | 238 | 230 | <1 |
| | | | | |
| | | | | |

## THERMOMETER/THERMOCOUPLE CALIBRATION

Date: 5-3-85 By: DGR

Reference Thermometer ASTM Hg/glass 20 - 760°F

Last Service Hanlon Bldg 2

| Field Thermometer | Temp. Source | Reference Temperature | Field Therm. Temperature | % error, absolute |
|---|---|---|---|---|
| 5' T'couple Omega 650 | Tube Furnace | 390 | 393 | < 1 |
| Meter In Omega 650 | Room | 72 | 72 | — |
| Meter Out Omega 650 | Room | 72 | 72 | — |
| Impinger out Bimetal-dial | Room | 72 | 65 | 1% |
| Sample Box Bimetal-dial | Tube Furnace | 262 | 255 | 1 |
| | | | | |
| | | | | |

# DRY GAS METER CALIBRATION

Meter I.D. RAC  Date 6-3-85

Calibration Method DGM/DGM  By DGR

Calibration Meter I.D. 651729, ~1.00

Barometric Pressure 30.00

Previous use: Hercules 5-27-85

| Vac in. Hg | DH in. $H_2O$ | Time min. | Calibrating Meter Vi cf | Calibrating Meter Vf cf | Calibrating Meter Temp °F | Field Meter Vi cf | Field Meter Vf cf | Field Meter Temp °F in | Field Meter Temp °F out | Y |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 2.0 | 21.0 | 126.302 | 142.017 | 71 | 280.296 | 296.194 | 71 · 96 | 71 · 75 | .9971 |
| 3 | 1.5 | 15.0 | 142.017 | 151.756 | 70 | 296.194 | 306.204 | 95 · 98 | 75 · 78 | .9995 |
| 2 | 1.0 | 16.0 | 151.756 | 160.503 | 70 | 306.204 | 315.289 | 97 · 97 | 75 · 81 | .9940 |
| | | | | | | | | · | Avg = | .9969 |
| | | | | | | | | · | Y = | 1.00 |
| | | | | | | | | · | · | |
| | | | | | | | | · | · | |

$$Y = [(Vcal)(Pbar)(Tdgm)]/[(Vdgm)(Pm)(Tcal)]$$

Where:

Y = Meter correction factor

Vcal = Volume of gas through calibrating meter, $ft.^3$

Vdgm = Volume of gas through field dry gas meter, $ft.^3$

Pbar = Barometric pressure, in. Hg

Pm = Meter pressure, {Pbar+DH/13.6}, in. Hg

Tdgm = Average Dry gas meter temp., $^oR$

Tcal = Temperature of gas through calibrating meter, $^oR$

MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES
Bureau of Pollution Control
P. O. Box 10385
Jackson, Mississippi 39209
(601) 961-5171

MEMORANDUM

TO: File

FROM: Don Watts

SUBJECT: Hercules, Inc. Woodwaste Boilers Stack Test Review
110-0800-00001
Forrest County

DATE: June 26, 1984

On May 8-9, 1984, and May 22, 1984, stack sampling was performed at Hercules, Inc., Hattiesburg, by EML, Inc. The purpose of the tests was to demonstrate compliance as specified in the Permit to Operate.

On May 8-9, 1984, I observed the stack sampling. On May 22, 1984, Jesse Thompson observed the testing. No problems were noted with the sampling that would affect the acceptability of the test.

I have reviewed the test report and determined that the tests are acceptable. Calculations of the particulate emissions for Boiler #1 have been verified. The numbers for all four boilers, which are identical in size, design, and mode of operation, are similar. Therefore, calculations were not done for the other three boilers.

The test report shows the boilers to be well in compliance. Emissions data is summarized below.

| | Allowable | Boiler 1 | Boiler 2 | Boiler 3 | Boiler 4 |
|---|---|---|---|---|---|
| Particulate* | 0.30 | 0.06 | 0.07 | 0.07 | 0.06 |

*All values are in grains/dscf

DW:cl

$P_{std}$ = 29.92 in Hg.
$T_{std}$ = 68°F = 528°R

HERCULES, INC.
110-0800-00001

Boiler #1
5/9/84 Test

Particulate Test Calculation Review (Method 5)

| | | | RUN 1 | RUN 2 | RUN 3 |
|---|---|---|---|---|---|
| $T_s$ | : | Avg. stack temp: °R | 845.875 | 856.46 | 866.29 |
| $T_m$ | : | Avg. meter temp; °R | 551.25 | 558.44 | 562.58 |
| $\Delta H$ | : | Avg. orifice pressure drop; in. $H_2O$ | 1.21 | 1.1025 | 1.1533 |
| Y | : | Dry gas meter calibration factor; dimensionless | 1.00 | 1.00 | 1.00 |
| $P_{bar}$ | : | Barometric pressure; in. Hg | 30.29 | 30.29 | 30.29 |
| $V_m$ | : | Sample volume (volume metered) at meter conditions; $ft^3$ | 36.215 | 34.68 | 35.948 |
| $V_{mstd}$ | : | Dry gas volume, corrected to std. conditions; dscf $= V_m Y (T_{std}/T_m)[(P_{bar} + (\Delta H/13.6))/P_{std}]$ (correct for leak if leak rate exceeds allowable) See Meth. 5, 6.3, if applicable | 35.22 | 33.28 | 34.25 |
| $V_{lc}$ | : | Vol. of water collected; ml | 95.5 | 90.0 | 96.5 |
| $V_{wstd}$ | : | Vol. of water vapor at std. conditions; scf $= (V_{lc})(.00267)(T_{std}/P_{std})$ | 4.50 | 4.24 | 4.55 |
| $B_{ws}$ | : | Moisture content; dimensionless $(V_{wstd}) / (V_{mstd} + V_{wstd})$ | 0.113 | 0.113 | 0.117 |
| $1 - B_{ws}$ | : | Dry gas fraction | 0.887 | 0.887 | 0.883 |
| $C_p$ | : | Pitot tube coefficient; dimensionless check for proper design or calibration (see 4.1.3 Meth. 2) | 0.84 | 0.84 | 0.84 |
| $(\sqrt{\Delta P})$ avg: | | Average square root of $\Delta P$ $(\Sigma\sqrt{\Delta P})/n$ [where n = no. of points] | 0.833 | 0.814 | 0.831 |
| $P_s$ | : | Stack pressure; in. Hg $= P_{bar}$ + static pressure (in. Hg) | 30.24 | 30.24 | 30.24 |
| $M_d$ | : | Dry molecular wt. of stack gas; lb/lb mole $= 29.0$ or $(\%\ CO_2)(.44) + (\%\ O_2)(.32) + (\%\ N_2 + CO)(.28)$ | 29.74 | 29.92 | 29.60 |
| $M_s$ | : | Wet molecular wt. of stack gas; lb/lb mole $= (M_d)(1 - B_{ws}) + (18 B_{ws})$ | 28.413 | 28.573 | 28.243 |
| $V_s$ | : | Avg. stack gas velocity; ft/sec. $= (85.49)(C_p)(\sqrt{\Delta P})$ avg. $\sqrt{T_s/(P_s M_s)}$ | 59.35 | 58.20 | 60.10 |
| $Q_s$ | : | Volumetric flow rate; dscf/hr $3600\ (1 - B_{ws})(V_s)(A)(T_{std}/T_s)(P_s/P_{std})$ | 2552,326 | 2,471,937 | 2,512,290 |
| $W_a$ | : | Acetone wash blank; mg See Meth. 5 6.6 and 6.7 if applicable | 0 | 0 | 0 |
| $M_n$ | : | Particulate sample wt.; mg filter, wash, blank correction | 117.8 | 119.1 | 177.0 |
| $C_s$ | : | Particulate concentration; grains/dscf $= (0.0154\ gr/mg)(M_n/V_{mstd})$ | 0.0515 | 0.0551 | 0.080 |
| Conversion to appropriate units: $\frac{gr}{dscf} \left\| \frac{\#}{7000\ g} \right\| Q_s \frac{dscf}{hr} \left\| = \#/hr \right.$ | | | 18.78 | 19.46 | 28.56 |
| I | : | Isokimetic variation: $= \frac{100\ T_s\ [(.002669)(V_{lc}) + (V_m/T_m)(P_{bar} + \Delta H/13.6)]}{60\ \Theta\ V_s\ P_s\ A_n}$ | 104.86 | 102.29 | 103.59 |

RECEIVED
MAY 29 REC'D
DEPT ... RESOURCE
BUREAU OF POLLUTION CONTROL

# REPORT OF PARTICULATE EMISSIONS TESTS FOR HERCULES, INC. BOILERS 1,2,3, AND 4

Hattiesburg, Mississippi
May, 1984

DATA CODED

Performed By:
Environmental Monitoring Laboratories
Ridgeland, Mississippi

# ENVIRONMENTAL MONITORING LABORATORIES, INC.

P.O. Box 655 • 224-B Highway 51 North
Ridgeland, Mississippi 39157

(601) 856-3092


May 25, 1984

Subject: Hercules Inc.
P.O. Box 1937
Hattiesburg, Mississippi

On May 8,9 and 22, 1984, Environmental Monitoring Laboratories conducted air emissions tests for Hercules, Inc. in Hattiesburg, Mississippi. The tests were performed to determine particulate emissions from four woodwaste boilers in accordance with requirements of the Mississippi Bureau of Pollution Control.

Unless other regulations or conditions apply the allowable particulate emissions from woodwaste boilers is 0.30 grains per dry standard cubic foot.

Results of these tests are:

| | | |
|---|---|---|
| Boiler No. 1..... | 0.06 grains/dscf | tested 5-09-84 |
| Boiler No. 2..... | 0.07 | tested 5-22-84 |
| Boiler No. 3..... | 0.07 | tested 5-08-84 |
| Boiler No. 4..... | 0.06 | tested 5-08,09-84 |

The testing project was coordinated by Mr. Larry Polk of Hercules, Inc. Mr. Don Watts and Mr. Jesse Thompson of the Mississippi Bureau of Pollution Control were present to observe the tests. Danny Russell of Environmental Monitoring Laboratories was responsible for the collection and analysis of the samples.

Following is a report of the tests. Contents are:


| | | |
|---|---|---|
| 1.0 | Test Results | page 1 |
| 2.0 | Source Description | 3 |
| 3.0 | Test Procedures | 3 |
| 4.0 | Data Reduction | 4 |
| 5.0 | Nomenclature | 13 |
| 6.0 | Calibration | 14 |
| 7.0 | Appendices: | 15 |
| | a. Sampling and Analytical Data | |
| | b. Calibration Data | |

1.0 Tests Results: The following tables list the measured flow parameters and test results.

1.1 Boiler No. 1

| Run. No. | | 1 | 2 | 3 | avg. |
|---|---|---|---|---|---|
| Date | | 05-09-84 | 05-09-84 | 05-09-84 | ------ |
| Time start | | 1127 | 1307 | 1426 | ------ |
| Time end | | 1228 | 1408 | 1428 | ------ |
| PARTICULATE EMISSIONS | #/hr. | 18.8 | 19.5 | 28.8 | 22.4 |
| PARTICULATE EMISSIONS | gr./dscf | 0.05 | 0.06 | 0.08 | 0.06 |
| ALLOWABLE EMISSIONS | gr./dscf | 0.30 | 0.30 | 0.30 | 0.30 |
| VOLUMETRIC FLOWRATE | acfm | 75990 | 74569 | 77821 | 76127 |
| VOLUMETRIC FLOWRATE | dscfm | 42511 | 41215 | 42170 | 41966 |
| VELOCITY | ft./sec. | 59.3 | 58.2 | 60.8 | 59.4 |
| STACK TEMPERATURE | $^{o}$F | 386 | 406 | 396 | 396 |
| MOISTURE | % | 11 | 11 | 12 | 12 |
| SAMPLE RATE | %isokinetic | 105 | 102 | 103 | 103 |

1.2 Boiler No. 2

| Run. No. | | 1 | 2 | 3 | avg. |
|---|---|---|---|---|---|
| Date | | 05-22-84 | 05-22-84 | 05-22-84 | ------ |
| Time start | | 0856 | 1029 | 1153 | ------ |
| Time end | | 0957 | 1130 | 1254 | ------ |
| PARTICULATE EMISSIONS | #/hr. | 27.1 | 25.7 | 28.4 | 27.0 |
| PARTICULATE EMISSIONS | gr./dscf | 0.07 | 0.07 | 0.08 | 0.07 |
| ALLOWABLE EMISSIONS | gr./dscf | 0.30 | 0.30 | 0.30 | 0.30 |
| VOLUMETRIC FLOWRATE | acfm | 77318 | 75704 | 76260 | 76427 |
| VOLUMETRIC FLOWRATE | dscfm | 43125 | 42770 | 43717 | 42871 |
| VELOCITY | ft./sec. | 60.4 | 59.1 | 59.5 | 59.7 |
| STACK TEMPERATURE | $^{o}$F | 384 | 379 | 383 | 382 |
| MOISTURE | % | 11 | 11 | 11 | 11 |
| SAMPLE RATE | %isokinetic | 101 | 101 | 101 | 101 |

1.3 Boiler No. 3

| Run. No. ..... | | 1 | 2 | 3 | avg. |
|---|---|---|---|---|---|
| Date ..... | | 05-08-84 | 05-08-84 | 05-08-84 | ------ |
| Time start ..... | | 0934 | 1107 | 1341 | ------ |
| Time end ..... | | 1036 | 1210 | 1450 | ------ |
| PARTICULATE EMISSIONS | #/hr. | 28.6 | 24.2 | 32.7 | 28.5 |
| PARTICULATE EMISSIONS | gr./dscf | 0.07 | 0.06 | 0.08 | 0.07 |
| ALLOWABLE EMISSIONS | gr./dscf | 03.0 | 0.30 | 0.30 | 0.30 |
| VOLUMETRIC FLOWRATE | acfm | 77749 | 78580 | 77328 | 77886 |
| VOLUMETRIC FLOWRATE | dscfm | 45320 | 45544 | 46142 | 45669 |
| VELOCITY | ft./sec. | 60.7 | 61.4 | 60.4 | 60.8 |
| STACK TEMPERATURE | $^{o}F$ | 358 | 367 | 360 | 362 |
| MOISTURE | % | 11 | 10 | 8 | 10 |
| SAMPLE RATE | %isokinetic | 105 | 103 | 101 | 103 |

1.4 Boiler No. 4

| Run. No. ..... | | 1 | 2 | 3 | avg. |
|---|---|---|---|---|---|
| Date ..... | | 05-08-84 | 05-09-84 | 05-09-84 | ------ |
| Time start ..... | | 1550 | 0744 | 0949 | ------ |
| Time end ..... | | 1632 | 0847 | 1051 | ------ |
| PARTICULATE EMISSIONS | #/hr. | 40.9 | 20.6 | 19.9 | 27.1 |
| PARTICULATE EMISSIONS | gr./dscf | 0.09 | 0.05 | 0.05 | 0.06 |
| ALLOWABLE EMISSIONS | gr./dscf | 0.30 | 0.30 | 0.30 | 0.30 |
| VOLUMETRIC FLOWRATE | acfm | 81756 | 79988 | 77672 | 79805 |
| VOLUMETRIC FLOWRATE | dscfm | 50928 | 48824 | 49208 | 49654 |
| VELOCITY | ft./sec. | 63.8 | 62.5 | 60.6 | 62.3 |
| STACK TEMPERATURE | $^{o}F$ | 347 | 354 | 339 | 347 |
| MOISTURE | % | 6 | 7 | 5 | 6 |
| SAMPLE RATE | %isokinetic | 100 | 101 | 99 | 100 |

## 2.0 Source Description

2.1 Hercules operates four identical woodwaste boilers. The boilers are capable of using woodwaste fuel and/or gas. Woodwaste is the primary fuel and gas is used only during wood fuel shortages. Woodwaste fuel is obtained from various sources and may differ in quality. Two masonry stacks serve the boilers--No. 1 and No. 2 share one stack and No. 3 and No. 4 share the other.

2.2 Each boiler was operated normally during the tests on an all woodwaste condition. Fuel was usually green pine chips. During the third run for Boiler No. 2 fuel was switched from green pine chips to hardwood.

Copies of boiler log sheets and visible emissions records supplied by Hercules are included in the appendix.

## 3.0 Test Procedures

Test procedures used are those described in the Code of Federal Regulations, Title 40, Part 60, Appendix A. Specifically, Method 1 was used to determine the number of sample points, Method 3 to determine excess air and molecular weight of stack gas, and Method 5 to determine flow rates, moisture content, and particulate emissions. The sampling train used is identical to that described in method 5.

There is no access for collecting samples in the masonry stacks. Testing ports are provided in each boiler's breeching in a rectangular vertical section. The placement of the ports does not meet the minimum distance requirements of Method 1, and tapering duct sections and fans proceed and precede the test port sections. Flow conditions at the sample locations however are favorable and cyclonic flow is not excessive. Previous tests were performed using 48 sample points since that was the minimum number required. Amended rules specify the use of 24 sample points when minimum distance criteria are met. Although minimum distance criteria are not met, 24 sample points were used for these tests. There were no other significant departures from the standard procedures.

# 4.0 Data Reduction

4.1 Hercules, Boiler No. 1
Particulate Emissions Test, May 9, 1984

4.1.1 Collected test data

| | | RUN 1 | RUN 2 | RUN 3 |
|---|---|---|---|---|
| 1. As | : sq ft | 21.34722 | 21.34722 | 21.34722 |
| 2. Dn | : in. | .227 | .227 | .227 |
| 3. Cp | : dimensionless | .84 | .84 | .84 |
| 4. Theta | : minutes | 60 | 60 | 60 |
| 5. Y | : dimensionless | 1.00 | 1.00 | 1.00 |
| 6. Pbar | : in. Hg | 30.29 | 30.29 | 30.29 |
| 7. Pg | : in. H2O | -.71 | -.7 | -.7 |
| 8. Vm | : cf | 36.215 | 34.68 | 35.948 |
| 9. sqr(DP),avg | : in.H2O^.5 | .8326 | .8143 | .8395 |
| 10. DH | : in. H2O | 1.2083 | 1.1013 | 1.1533 |
| 11. ts | : degrees F | 385.88 | 396.46 | 406.29 |
| 12. tm | : degrees F | 91.25 | 98.44 | 102.58 |
| 13. Vlc | : ml | 95.5 | 90 | 99.5 |
| 14. CO2 | : percent | 7.50 | 9.00 | 6.50 |
| 15. O2 | : percent | 13.50 | 12.00 | 14.00 |
| 16. CO | : percent | .00 | .00 | .00 |
| 17. Mn | : milligrams | 117.8 | 119.1 | 177 |

Hercules Boiler No. 1
Particulate Emissions Test, May 9, 1984

| 4.1.2 Calculations: | RUN 1 | RUN 2 | RUN 3 | AVG. |
|---|---|---|---|---|
| 1. Pm : in.Hg<br>(DH/13.6)+Pbar | 30.38 | 30.37 | 30.37 | N/A |
| 2. Ps : in. Hg<br>(Pg/13.6)+Pbar | 30.24 | 30.24 | 30.24 | N/A |
| 3. An : sq ft<br>((Dn/24)**2)(3.1416) | 2.810e-4 | 2.810e-4 | 2.810e-4 | N/A |
| 4. Vmstd: dscf<br>Vm Y(Pm/Pstd)(Tstd/Tm) | 35.21952 | 33.28386 | 34.25123 | N/A |
| 5. Vwstd: scf<br>(.04707cf/ml)(Vlc) | 4.495185 | 4.2363 | 4.683465 | N/A |
| 6. Bws : dimensionless<br>Vwstd/(Vwstd+Vmstd) | .1131869 | .1129073 | .1202903 | .1154615 |
| 7. Md : mol.wt. dry basis<br>.44 CO2+.32 O2+.28(CO+N2) | 29.74 | 29.92 | 29.6 | N/A |
| 8. Ms : mol.wt. wet basis<br>Md(1-Bws)+18 Bws | 28.41 | 28.57 | 28.20 | N/A |
| 9. Vs : ft/sec<br>Kp Cp (sqrDP)sqr(Ts/(Ps Ms)) | 59.33 | 58.22 | 60.76 | 59.44 |
| 10. Q : cf/h<br>Vs As(3600sec/hr) | 4559419 | 4474139 | 4669283 | 4567614 |
| 11. Qstd : dscfh<br>Q(1-Bws)(Ps/Pstd)(Tstd/Ts) | 2550676 | 2472888 | 2530226 | 2517930 |
| 12. I : percent<br>[(100 Ts)(.002669 Vlc+(Vm Pm/Tm)]/<br>(60 Theta Vs Ps An) | 104.89 | 102.24 | 102.83 | 103.32 |
| 13. Cs : grams/dscf<br>(Mn/1000)/Vmstd | .0033447 | .0035783 | .0051677 | .0040302 |
| 14. E : pounds/hr<br>(Cs Qstd)/454 | 18.79 | 19.49 | 28.80 | 22.36 |
| 15. C's : grains/dscf<br>(Cs)(15.43 grains/gram) | .05 | .06 | .08 | .06 |
| 16. Xsair: percent<br>100[(O2-.5CO)/(.264 N2-(O2-.5CO))] | 119.30 | 88.18 | 134.36 | 113.95 |

4.2 Hercules, Boiler No. 2
Particulate Emissions Test, May 22, 1984

4.2.1 Collected test data

| | | RUN 1 | RUN 2 | RUN 3 |
|---|---|---|---|---|
| 1. As | : sq ft | 21.34722 | 21.34722 | 21.34722 |
| 2. Dn | : in. | .228 | .228 | .228 |
| 3. Cp | : dimensionless | .84 | .84 | .84 |
| 4. Theta | : minutes | 60 | 60 | 60 |
| 5. Y | : dimensionless | .99 | .99 | .99 |
| 6. Pbar | : in. Hg | 30.20 | 30.20 | 30.20 |
| 7. Pg | : in. H2O | -.8 | -.7 | -.7 |
| 8. Vm | : cf | 35.571 | 35.716 | 35.915 |
| 9. sqr(DP),avg | : in.H2O^.5 | .8453 | .8306 | .8351 |
| 10. DH | : in. H2O | 1.1358 | 1.1297 | 1.1196 |
| 11. ts | : degrees F | 384.21 | 378.71 | 382.96 |
| 12. tm | : degrees F | 79.81 | 87.81 | 90.10 |
| 13. Vlc | : ml | 96 | 90 | 93 |
| 14. CO2 | : percent | 7.00 | 6.50 | 7.00 |
| 15. O2 | : percent | 13.50 | 14.00 | 14.00 |
| 16. CO | : percent | .00 | .00 | .00 |
| 17. Mn | : milligrams | 165.6 | 156.7 | 173.6 |

Hercules, Boiler No. 2
Particulate Emissions Test, May 22, 1984

| 4.2.2 Calculations: | RUN 1 | RUN 2 | RUN 3 | AVG. |
|---|---|---|---|---|
| 1. Pm : in.Hg<br>(DH/13.6)+Pbar | 30.28 | 30.28 | 30.28 | N/A |
| 2. Ps : in. Hg<br>(Pg/13.6)+Pbar | 30.14 | 30.15 | 30.15 | N/A |
| 3. An : sq ft<br>((Dn/24)**2)(3.1416) | 2.835e-4 | 2.835e-4 | 2.835e-4 | N/A |
| 4. Vmstd: dscf<br>Vm Y(Pm/Pstd)(Tstd/Tm) | 34.86334 | 34.49374 | 34.54069 | N/A |
| 5. Vwstd: scf<br>(.04707cf/ml)(Vlc) | 4.51872 | 4.2363 | 4.37751 | N/A |
| 6. Bws : dimensionless<br>Vwstd/(Vwstd+Vmstd) | .1147406 | .1093802 | .1124798 | .1122002 |
| 7. Md : mol.wt. dry basis<br>.44 CO2+.32 O2+.28(CO+N2) | 29.66 | 29.6 | 29.68 | N/A |
| 8. Ms : mol.wt. wet basis<br>Md(1-Bws)+18 Bws | 28.32 | 28.33 | 28.37 | N/A |
| 9. Vs : ft/sec<br>Kp Cp (sqrDP)sqr(Ts/(Ps Ms)) | 60.37 | 59.11 | 59.54 | 59.67 |
| 10. Q : cf/h<br>Vs As(3600sec/hr) | 4639077 | 4542248 | 4575583 | 4585636 |
| 11. Qstd : dscfh<br>Q(1-Bws)(Ps/Pstd)(Tstd/Ts) | 2587523 | 2566196 | 2563045 | 2572254 |
| 12. I : percent<br>[(100 Ts)(.002669 Vlc+(Vm Pm/Tm)]/<br>(60 Theta Vs Ps An) | 101.45 | 101.21 | 101.47 | 101.38 |
| 13. Cs : grams/dscf<br>(Mn/1000)/Vmstd | .0047500 | .0045429 | .0050260 | .0047729 |
| 14. E : pounds/hr<br>(Cs Qstd)/454 | 27.07 | 25.68 | 28.37 | 27.04 |
| 15. C's : grains/dscf<br>(Cs)(15.43 grains/gram) | .07 | .07 | .08 | .07 |
| 16. Xsair: percent<br>100[(O2-.5CO)/(.264 N2-(O2-.5CO))] | 120.71 | 134.36 | 132.68 | 129.25 |

4.3 Hercules, Boiler No. 3
Particulate Emissions Test, May 8, 1984

4.3.1 Collected test data

| | | RUN 1 | RUN 2 | RUN 3 |
|---|---|---|---|---|
| 1. As | : sq ft | 21.34722 | 21.34722 | 21.34722 |
| 2. Dn | : in. | .226 | .226 | .226 |
| 3. Cp | : dimensionless | .84 | .84 | .84 |
| 4. Theta | : minutes | 60 | 60 | 60 |
| 5. Y | : dimensionless | 1.00 | 1.00 | 1.00 |
| 6. Pbar | : in. Hg | 30.24 | 30.24 | 30.24 |
| 7. Pg | : in. H2O | 0 | 0 | 0 |
| 8. Vm | : cf | 37.948 | 38.198 | 37.621 |
| 9. sqr(DP),avg | : in.H2O^.5 | .8652 | .8713 | .8655 |
| 10. DH | : in. H2O | 1.3804 | 1.4158 | 1.3842 |
| 11. ts | : degrees F | 358.33 | 367.46 | 360.33 |
| 12. tm | : degrees F | 85.25 | 93.50 | 91.52 |
| 13. Vlc | : ml | 94 | 88.5 | 70 |
| 14. CO2 | : percent | 6.50 | 7.00 | 7.50 |
| 15. O2 | : percent | 13.50 | 13.00 | 13.00 |
| 16. CO | : percent | .00 | .00 | .00 |
| 17. Mn | : milligrams | 177.7 | 148.7 | 195.7 |

Hercules, Boiler No. 3
Particulate Emissions Test, May 8, 1984

| 4.3.2 Calculations: | RUN 1 | RUN 2 | RUN 3 | AVG. |
|---|---|---|---|---|
| 1. Pm : in.Hg<br>(DH/13.6)+Pbar | 30.34 | 30.34 | 30.34 | N/A |
| 2. Ps : in. Hg<br>(Pg/13.6)+Pbar | 30.24 | 30.24 | 30.24 | N/A |
| 3. An : sq ft<br>((Dn/24)**2)(3.1416) | 2.786e-4 | 2.786e-4 | 2.786e-4 | N/A |
| 4. Vmstd: dscf<br>Vm Y(Pm/Pstd)(Tstd/Tm) | 37.26513 | 36.95470 | 36.52435 | N/A |
| 5. Vwstd: scf<br>(.04707cf/ml)(Vlc) | 4.42458 | 4.165695 | 3.2949 | N/A |
| 6. Bws : dimensionless<br>Vwstd/(Vwstd+Vmstd) | .1061312 | .1013048 | .0827464 | .0967275 |
| 7. Md : mol.wt. dry basis<br>.44 CO2+.32 O2+.28(CO+N2) | 29.58 | 29.64 | 29.72 | N/A |
| 8. Ms : mol.wt. wet basis<br>Md(1-Bws)+18 Bws | 28.35 | 28.46 | 28.75 | N/A |
| 9. Vs : ft/sec<br>Kp Cp (sqrDP)sqr(Ts/(Ps Ms)) | 60.70 | 61.35 | 60.37 | 60.81 |
| 10. Q : cf/h<br>Vs As(3600sec/hr) | 4664919 | 4714820 | 4639684 | 4673141 |
| 11. Qstd : dscfh<br>Q(1-Bws)(Ps/Pstd)(Tstd/Ts) | 2719215 | 2732654 | 2768492 | 2740120 |
| 12. I : percent<br>[(100 Ts)(.002669 Vlc+(Vm Pm/Tm)]/<br>(60 Theta Vs Ps An) | 105.02 | 103.64 | 101.10 | 103.25 |
| 13. Cs : grams/dscf<br>(Mn/1000)/Vmstd | .0047685 | .0040238 | .0053581 | .0047168 |
| 14. E : pounds/hr<br>(Cs Qstd)/454 | 28.56 | 24.22 | 32.67 | 28.48 |
| 15. C's : grains/dscf<br>(Cs)(15.43 grains/gram) | .07 | .06 | .08 | .07 |
| 16. Xsair: percent<br>100[(O2-.5CO)/(.264 N2-(O2-.5CO))] | 122.15 | 110.02 | 108.80 | 113.66 |

4.4 Hercules, Boiler No. 4
Particulate Emissions Test, May 8 9, 1984

4.4.1 Collected test data

| | | RUN 1 | RUN 2 | RUN 3 |
|---|---|---|---|---|
| 1. As | : sq ft | 21.34722 | 21.34722 | 21.34722 |
| 2. Dn | : in. | .226 | .226 | .226 |
| 3. Cp | : dimensionless | .84 | .84 | .84 |
| 4. Theta | : minutes | 60 | 60 | 60 |
| 5. Y | : dimensionless | 1.00 | 1.00 | 1.00 |
| 6. Pbar | : in. Hg | 30.24 | 30.29 | 30.29 |
| 7. Pg | : in. H2O | -.78 | -.75 | -.7 |
| 8. Vm | : cf | 40.917 | 38.593 | 38.472 |
| 9. sqr(DP),avg | : in.H2O^.5 | .9208 | .8947 | .8793 |
| 10. DH | : in. H2O | 1.4229 | 1.3567 | 1.3354 |
| 11. ts | : degrees F | 347.42 | 354.33 | 338.75 |
| 12. tm | : degrees F | 89.23 | 73.54 | 82.87 |
| 13. Vlc | : ml | 50 | 60.5 | 44 |
| 14. CO2 | : percent | 4.00 | 4.00 | 3.50 |
| 15. O2 | : percent | 17.50 | 16.00 | 16.50 |
| 16. CO | : percent | .00 | .00 | .00 |
| 17. Mn | : milligrams | 242.3 | 123.9 | 116.1 |

Hercules, Boiler No. 4
Particulate Emissions Test, May 8 9, 1984

| 4.4.2 Calculations: | RUN 1 | RUN 2 | RUN 3 | AVG. |
|---|---|---|---|---|
| 1. Pm : in.Hg<br>(DH/13.6)+Pbar | 30.34 | 30.39 | 30.39 | N/A |
| 2. Ps : in. Hg<br>(Pg/13.6)+Pbar | 30.18 | 30.23 | 30.24 | N/A |
| 3. An : sq ft<br>((Dn/24)**2)(3.1416) | 2.786e-4 | 2.786e-4 | 2.786e-4 | N/A |
| 4. Vmstd: dscf<br>Vm Y(Pm/Pstd)(Tstd/Tm) | 39.89364 | 38.79191 | 38.00372 | N/A |
| 5. Vwstd: scf<br>(.04707cf/ml)(Vlc) | 2.3535 | 2.847735 | 2.07108 | N/A |
| 6. Bws : dimensionless<br>Vwstd/(Vwstd+Vmstd) | .0557079 | .0683900 | .0516804 | .0585928 |
| 7. Md : mol.wt. dry basis<br>.44 CO2+.32 O2+.28(CO+N2) | 29.34 | 29.28 | 29.22 | N/A |
| 8. Ms : mol.wt. wet basis<br>Md(1-Bws)+18 Bws | 28.71 | 28.51 | 28.64 | N/A |
| 9. Vs : ft/sec<br>Kp Cp (sqrDP)sqr(Ts/(Ps Ms)) | 63.83 | 62.45 | 60.64 | 62.31 |
| 10. Q : cf/h<br>Vs As(3600sec/hr) | 4905365 | 4799263 | 4660290 | 4788306 |
| 11. Qstd : dscfh<br>Q(1-Bws)(Ps/Pstd)(Tstd/Ts) | 3055680 | 2929466 | 2952500 | 2979215 |
| 12. I : percent<br>[(100 Ts)(.002669 Vlc+(Vm Pm/Tm)]/<br>(60 Theta Vs Ps An) | 100.05 | 101.48 | 98.64 | 100.05 |
| 13. Cs : grams/dscf<br>(Mn/1000)/Vmstd | .0060737 | .0031940 | .0030550 | .0041075 |
| 14. E : pounds/hr<br>(Cs Qstd)/454 | 40.88 | 20.61 | 19.87 | 27.12 |
| 15. C's : grains/dscf<br>(Cs)(15.43 grains/gram) | .09 | .05 | .05 | .06 |
| 16. Xsair: percent<br>100[(O2-.5CO)/(.264 N2-(O2-.5CO))] | 327.96 | 221.24 | 255.10 | 268.10 |

## 5.0 NOMENCLATURE

| SYMBOL | UNITS | DESCRIPTION |
|---|---|---|
| An | $ft^2$ | Nozzle area |
| As | $ft^2$ | Stack area |
| Bws | dimensionless | Proportion of water vapor |
| CO2 | percent | Carbon dioxide content by volume |
| CO | percent | Carbon monoxide content by volume |
| Cp | dimensionless | Pitot correction factor |
| Cs | grams/dscf | Particulate concentration |
| C's | grains/dscf | Particulate concentration |
| C,50 | gr/dscf@50% xsair | Particulate emissions corrected to 50% excess air |
| Dn | inches | Nozzle diameter |
| delta H | in. $H_2O$ | Pressure drop across meter orifice (also DH) |
| delta P | in. $H_2O$ | Stack velocity pressure head (also DP) |
| E | #/hr | Particulate emission rate |
| F | dscf | Volume of flue gas per $10^6$ BTU |
| I | percent | Percent isokinetic sampling |
| Kp | consistent | Pitot tube constant = 85.49 |
| Mn | milligrams | Particulate sample weight |
| Md | #/# mole | Dry molecular wt. of stack gas |
| Ms | #/# mole | Wet molecular wt. of stack gas |
| N2 | percent | Nitrogen content by volume |
| O2 | percent | Oxygen content by volume |
| Pbar | in. Hg | Barometric pressure |
| Pg | in. $H_2O$ | Static pressure |
| Pm | in. Hg | Meter pressure = Pbar+(delta H/13.6) |
| Ps | in. Hg | Stack pressure = Pbar+(Pg/13.6) |
| Pstd | in. Hg | Standard pressure = 29.92 |
| Q | $ft^3/hr$ | Volumetric flow rate at stack conditions |
| Qstd | dscf/hr | Volumetric flow rate at dry, std. conditions |
| Theta | minutes | Sampling time per run |
| tm | $^0F$ | Meter temperature (Tm denotes $^0R$) |
| ts | $^0F$ | Stack temperature (Ts denotes $^0R$) |
| Tstd | $^0R$ | Standard temperature = $528^0$ |
| Vlc | ml | Volume of water collected |
| Vm | $ft^3$ | Volume of dry gas sampled |
| Vmstd | dscf | Sample volume at standard conditions |
| Vwstd | scf | Sample volume of water vapor |
| Y | dimensionless | Meter correction factor |
| Xsair | percent | Excess air |

## 6.0 Calibrations:

Measurement devices used by Environmental Monitoring Laboratories and subject to changes in measurement precision are initially calibrated prior to use. Those instruments for which calibration factors are subject to change or for which calibration checks are required, are calibrated following each field use or as otherwise directed and noted. Calibration procedures for specific equipment are as follows.

Dry Gas Meter:
Dry gas meters are periodically removed from the sampling consoles and cleaned and repaired (new gaskets etc. as required). Following the overhaul of a meter, the measuring precision is checked by the Bell Prover Method and adjusted when necessary to read to within 2% of 100% accuracy. This service is provided by Big Three Meter Company in Jackson, Mississippi. Overhaul service or any six month period is followed by a five point calibration described in APTD-0576 using either a wet test meter or calibrated dry gas meter (used exclusively for calibrations) as a standard reference. Following field use, a gas meter calibration is checked in one of two ways. [1] Three calibration checks at intermediate orifice settings are performed or [2] orifice meter coefficients are used.

If a meter coefficient obtained from pre-test and post-test checks differs by more than 5%, the coefficient (Y) giving the lower sample volume is used in the calculations.

Orifice:
The orifice coefficient is initially determined and is rechecked following a major gas meter repair and calibration.

Nozzles:
Nozzles are checked before each field use with a precision (.001 in.) dial caliper. Three measurements on different axes are made; an average of those three readings is used in calculations. If the tolerance among measurements exceeds 0.004 inches (highest to lowest reading) the nozzle is repaired and recalibrated or discarded.

Pitot Tubes:
Pitot tubes meeting EPA geometry standards are assigned a coefficient of 0.84. Pitot tubes are visually inspected for damage before, during and after use. Those pitot tubes not meeting the geometry standards are assigned a coefficient from the manufacturer's calibration which it retains unless damaged. All pitot tubes used by Environmental Monitoring Laboratories are manufactured by NAPP, Inc.

Temperature Measuring Instruments:
Most temperature measurements are made with a type K thermocouple and an Omega digital thermocouple thermometer which has an initial calibration traceable to NBS. Other measurements are made using bimetallic dial thermometers. The thermocouples and dial thermometers are checked following or during a test series against an ASTM mercury in glass thermometer.

Barometer:
Aneroid field barometers are checked against and adjusted to readings from a mercury barometer or readings obtained from local weather authorities.

Differential Pressure Gauges:
Velocity head (delta P) and orifice pressure differential (delta H) measurements are made using water manometers of the appropriate range unless otherwise noted in the test data. Manometers do not require calibration.

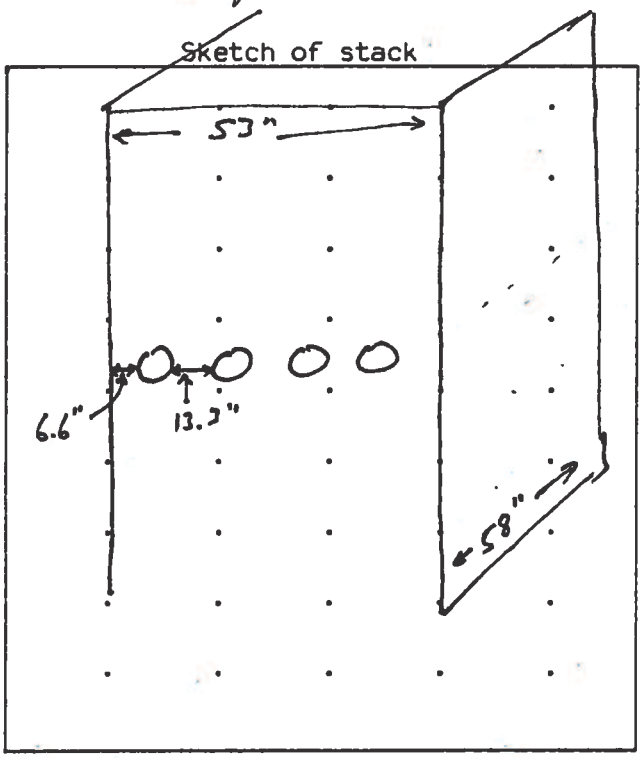
APPENDIX
a. Test Data
b. Calibration Data
c. Boiler Operation Data

# STACK CONFIGURATION / SAMPLE AND VELOCITY POINTS

Plant Name Hercules Source Boilers 1, 2, 3, 4

Data For: Sample Point Plots Date

Sketch of stack




%Diameter

| | 4 | 6 | 8 | 10 | 12 | 14 | 16 |
|---|---|---|---|---|---|---|---|
| 1 | 6.7 | 4.4 | 3.2 | 2.6 | 2.1 | 1.8 | 1.6 |
| 2 | 25.0 | 14.6 | 10.5 | 8.2 | 6.7 | 5.7 | 4.9 |
| 3 | 75.0 | 29.6 | 19.4 | 14.6 | 11.8 | 9.9 | 8.5 |
| 4 | 93.3 | 70.4 | 32.3 | 22.6 | 17.7 | 14.6 | 12.5 |
| 5 | | 85.4 | 67.7 | 34.2 | 25.0 | 20.1 | 16.9 |
| 6 | | 95.6 | 80.6 | 65.8 | 35.6 | 26.9 | 22.0 |
| 7 | | | 89.5 | 77.4 | 64.4 | 36.6 | 28.3 |
| 8 | | | 96.8 | 85.4 | 75.0 | 63.4 | 37.5 |
| 9 | | | | 91.8 | 82.3 | 73.1 | 62.5 |
| 10 | | | | 97.4 | 88.2 | 79.9 | 71.7 |
| 11 | | | | | 93.3 | 85.4 | 78.0 |
| 12 | | | | | 97.9 | 90.1 | 83.1 |
| 13 | | | | | | 94.3 | 87.5 |
| 14 | | | | | | 98.2 | 91.5 |
| 15 | | | | | | | 95.1 |
| 16 | | | | | | | 98.4 |

$D_e = 2LW/(L+W)$

Stack ~~diameter~~ $D_e$ =

Distance from ports to disturbance:

distance to upstream disturbance

distance to downstream disturbance

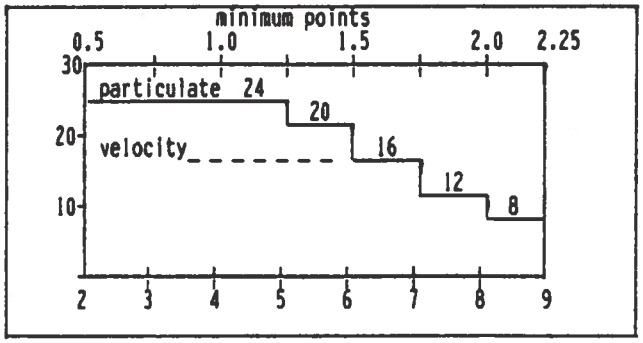
upstream diameters

downstream diameters

Minimum No. points required 24

No. points selected 24

Nipple length




Velocity profile / Sample point layout

pitot I.D.

pitot Cp

| Point No. | "from wall | delta P 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| 1 | 4.8 | | | | |
| 2 | 14.5 | | | | |
| 3 | 24.2 | | | | |
| 4 | 33.8 | | | | |
| 5 | 43.5 | | | | |
| 6 | 53.2 | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |
| 13 | | | | | |
| 14 | | | | | |
| 15 | | | | | |
| 16 | | | | | |

Notes:

1,056

DAW

Plant Hercules
Sampling Location Boiler No.1
Test For Particulate
Test Operators Russell

RUN No. 1
Date 5-9-84
Time start 1127 end 1228

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite | Remarks: | |
| Sample Box | No1 | Minutes/Pt. | 2.5 | $CO_2$ | 7.5 | Nozzle | |
| Probe/Pitot | 5.5 | NOMOGRAPH | | $O_2$ | 13.5 | ⌀ .267 | |
| Pitot Cp | .84 | ΔH@ | 1.61 | CO | - | ⌀ .267 | |
| Nozzle Dia. | .[illegible].227 | Meter Temp. | 90 | Time | | ⌀ .267 | |
| Filter No. | | % $H_2O$ | 10 | Condensate: | | | |
| Amb. Temp. °F | 78 | C-Factor | 0.87 | tare 200ml | fin 289 | | |
| Bar. Press. "Hg | 30.29 | Stack Temp. | 385 | Silica gel: | | | |
| Static Press. "$H_2O$ | -0.71 | Ref. ΔP | 1.2 | tare 700 | fin 706.5 | | |

| Port | Point | El. Time, Min. | DGM Reading, $Ft.^3$ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac. in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| * 1 | 1 | 0 | 895.545 | 0.09 | 0.13 | 376 | 81 | 81 | 230 | 65 | 1 |
| * 2 | 2 | 230 | 896.1 | 0.09 | 0.13 | 376 | 82 | 81 | 230 | 60 | 1 |
| 3 | 3 | 500 | 896.7 | 0.09 | 0.13 | 377 | 82 | 79 | 230 | 60 | 1 |
| | 4 | 730 | 897.4 | 0.35 | 0.54 | 380 | 86 | 81 | 230 | 60 | 1 |
| | 5 | 1000 | 899.5 | 0.05 | 0.08 | 379 | 86 | 81 | 230 | 60 | 1 |
| | 6 | 1230 | 898.7 | 0.11 | 0.18 | 379 | 89 | 81 | 260 | 55 | 1 |
| | | | | | | | | | 250 | | |
| 2 | 1 | 15/0 | 899.743 | 0.73 | 1.15 | 379 | 89 | 83 | 250 | 55 | 1 |
| | 2 | 230 | 901.4 | 0.49 | 0.76 | 380 | 92 | 84 | 250 | 55 | 1 |
| | 3 | 500 | 902.6 | 0.70 | 1.10 | 383 | 93 | 85 | 250 | 55 | 1 |
| | 4 | 730 | 904.2 | 0.73 | 1.15 | 388 | 95 | 86 | 250 | 55 | 1 |
| | 5 | 1000 | 905.7 | 0.99 | 1.50 | 394 | 97 | 85 | 230 | 55 | 1 |
| | 6 | 1230 | 907.5 | 1.45 | 2.25 | 393 | 102 | 86 | 230 | 55 | 1 |
| 3 | 1 | 30/0 | 909.556 | 0.96 | 1.45 | 385 | 101 | 87 | 240 | 55 | 1 |
| | 2 | 230 | 911.3 | 1.10 | 1.65 | 393 | 101 | 87 | 240 | 55 | 1 |
| | 3 | 500 | 913.2 | 1.50 | 2.30 | 390 | 103 | 88 | 250 | 55 | 3 |
| | 4 | 730 | 915.4 | 1.35 | 2.05 | 391 | 104 | 88 | 250 | 55 | 3 |
| | 5 | 1000 | 917.4 | 1.25 | 1.90 | 390 | 105 | 89 | 250 | 55 | 2 |
| | 6 | 1230 | 919.5 | 1.50 | 2.30 | 393 | 105 | 90 | 250 | 55 | 3 |
| 4 | 1 | 45/0 | 921.496 | 0.77 | 1.15 | 383 | 102 | 89 | 250 | 55 | 2 |
| | 2 | 230 | 923.1 | 0.89 | 1.35 | 389 | 104 | 90 | 250 | 55 | 2 |
| | 3 | 500 | 924.9 | 0.90 | 1.35 | 389 | 103 | 90 | 250 | 55 | 2 |
| | 4 | 730 | 926.8 | 1.10 | 1.65 | 396 | 106 | 90 | 250 | 55 | 3 |
| | 5 | 1000 | 928.6 | 0.75 | 1.10 | 391 | 104 | 91 | 275 | 55 | 3 |
| | 6 | 1230 | 930.1 | 1.10 | 1.65 | 393 | 104 | 92 | 260 | 55 | 3 |
| END | | 60/5 | 931.760 | | | | | | | | |
| | | | | | | | | | | | |
| | | | Leak check: 0.005 cfm @ | | 6" Hg | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | 36.215 | 0.8326 | 1.2083 | 385.8 | 96.5 | | | | |

A1.25

.003

Plant Hercules
Sampling Location Boiler No. 1
Test For Particulate
Test Operators Russell / Little

RUN No. 2
Date 5-9-84
Time start 1307 end 1408

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite | Remarks: | |
| Sample Box | No. 2 | Minutes/Pt. | 2.5 | $CO_2$ | 9.0 | | |
| Probe/Pitot | S'S | NOMOGRAPH | | $O_2$ | 12.0 | | |
| Pitot Cp | .84 | ΔH@ | 1.61 | CO | — | | |
| Nozzle Dia. | .227 | Meter Temp. | 98 | Time | | | |
| Filter No. | | % $H_2O$ | 10 | Condensate: | | | |
| Amb. Temp. °F | 83 | C-Factor | .88 | tare 200 ml | fin 283 | | |
| Bar. Press. "Hg | 30.29 | Stack Temp. | 390 | Silica gel: | | | |
| Static Press. "$H_2O$ | -.70 | Ref. ΔP | 1.2 | tare 636 g | fin 643 g | | |

| | Port | Point | El. Time, Min. | DGM Reading, $Ft.^3$ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac In. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 0 | 932.024 | 0.09 | 0.12 | 367 | 90 | 90 | 250 | 70 | 1 |
| 2 | | 2 | 230 | 932.5 | 0.09 | 0.12 | 380 | 91 | 90 | 250 | 70 | 1 |
| 3 | | 3 | 500 | 933.1 | 0.09 | 0.12 | 383 | 93 | 90 | 260 | 65 | 1 |
| 4 | | 4 | 730 | 933.7 | 0.19 | 0.27 | 383 | 95 | 92 | 260 | 65 | 1 |
| 5 | | 5 | 1000 | 934.4 | .25 0.25 | 0.35 | 398 | 96 | 91 | 260 | 65 | 1 |
| 6 | | 6 | 1230 | 935.1 | 0.18 | 0.25 | 387 | 96 | 91 | 260 | 65 | 1 |
| 7 | | | | | | | | | | | | |
| 8 | 2 | 1 | 15/0 | 936.000 | 0.75 | 1.10 | 389 | 98 | 91 | 250 | 60 | 2 |
| 9 | | 2 | 230 | 937.5 | 0.45 | 0.65 | 383 | 100 | 91 | 250 | 55 | 1 |
| 10 | | 3 | 500 | 938.9 | 0.45 | 0.65 | 386 | 102 | 92 | 250 | 55 | 1 |
| 11 | | 4 | 730 | 940.1 | 0.94 | 1.40 | 393 | 103 | 92 | 260 | 55 | 2 |
| 12 | | 5 | 1000 | 941.8 | 0.95 | 1.40 | 399 | 107 | 93 | 270 | 55 | 2 |
| 13 | | 6 | 1230 | 943.8 | 1.2 1.20 | 1.70 | 403 | 109 | 93 | 260 | 55 | 3 |
| 14 | | | | | | | | | | | | |
| 15 | 3 | 1 | 30/0 | 945.304 | 0.94 | 1.40 | 404 | 107 | 94 | 260 | 55 | 2 |
| 16 | | 2 | 230 | 947.0 | 1.20 | 1.70 | 407 | 108 | 95 | 250 | 55 | 3 |
| 17 | | 3 | 500 | 949.1 | 0.90 | 1.35 | 407 | 110 | 96 | 250 | 55 | 2 |
| 18 | | 4 | 730 | 950.6 | 1.40 | 2.20 | 407 | 111 | 95 | 250 | 55 | 4 |
| 19 | | 5 | 1000 | 952.8 | 1.30 | 1.95 | 408 | 111 | 96 | 260 | 55 | 4 |
| 20 | | 6 | 1230 | 954.7 | 1.50 | 2.30 | 405 | 111 | 94 | 250 | 55 | 4 |
| 21 | | | | | | | | | | | | |
| 22 | 4 | 1 | 45/0 | 956.884 | 0.72 | 1.05 | 400 | 109 | 94 | 250 | 55 | 2 |
| 23 | | 2 | 230 | 958.6 | 0.59 | 0.85 | 403 | 108 | 95 | 250 | 55 | 2 |
| 24 | | 3 | 500 | 959.9 | 0.95 | 1.40 | 403 | 107 | 96 | 250 | 55 | 3 |
| 25 | | 4 | 730 | 961.6 | 1.0 1.05 | 1.70 | 404 | 108 | 96 | 250 | 55 | 2 |
| 26 | | 5 | 1000 | 963.5 | 0.75 | 1.10 | 410 | 108 | 96 | 250 | 55 | 3 |
| 27 | | 6 | 1230 | 965.1 | 0.89 | 1.30 | 410 | 108 | 96 | 250 | 55 | 3 |
| 28 | END | | 60/15 | 966.704 | | | | | | | | |
| 29 | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | |
| 31 | | | | Leak check: 0.006 cfm @ 6" Hg | | | | | | | | |
| 32 | | | | | | | | | | | | |
| 33 | | | | | | | | 107.58 | 93.29 | | | |
| 34 | | | | 34.680 | 0.8143 | 1.1013 | 396.46 | | | | | |
| 35 | | | | | | | | | | | | |

G 8.44

Plant Hercules
Sampling Location Boiler No. 1
Test For Particulate
Test Operators Russell/Little

RUN No. 3
Date 5-9-84
Time start 1426 end 1428

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Meter Box | PAC-1 | No. Sample Pts. | 24 | Gas Analysis | Fyrite | Remarks: | |
| Sample Box | No. 3 | Minutes/Pt. | 2.5 | $CO_2$ | 6.5 | | |
| Probe/Pitot | S'S | NOMOGRAPH | | $O_2$ | 13.0 | | |
| Pitot Cp | .84 | ΔH@ | 1.61 | CO | — | | |
| Nozzle Dia. | .227 | Meter Temp. | 105 | Time | | | |
| Filter No. | | % $H_2O$ | 12 | Condensate: | | | |
| Amb. Temp. °F | 85 | C-Factor | .85 | tare 200 ml | fin 290 | | |
| Bar. Press. "Hg | 30.29 | Stack Temp. | 410 | Silica gel: | | | |
| Static Press. "$H_2O$ | -.7 | Ref. Δ P | 1.2 | tare 709.5g | fin 716.0 | | |

| | Port Point | El. Time, Min. | DGM Reading, Ft.³ | Velocity Head Δ P, in. $H_2O$ | Orifice Δ H in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 966.963 | 0.10 | 0.14 | 392 | 96 | 96 | 225 | 70 | 1 |
| 2 | 2 | 230 | 967.6 | 0.10 | 0.14 | 398 | 97 | 97 | 225 | 65 | 1 |
| 3 | 5 | 00 | 968.1 | 0.10 | 0.14 | 390 | 98 | 96 | 225 | 65 | 1 |
| 4 | 7 | 30 | 968.8 | 0.27 | 0.39 | 395 | 100 | 97 | 225 | 60 | 1 |
| 5 | 10 | 00 | 969.8 | 0.15 | 0.21 | 398 | 102 | 98 | 230 | 60 | 1 |
| 6 | 12 | 30 | 970.5 | 0.16 | 0.22 | 401 | 104 | 99 | 230 | 60 | 1 |
| 7 | | | | | | | | | | | |
| 2 | 1 | 15/0 | 971.145 | 0.76 | 1.10 | 403 | 105 | 98 | 230 | 60 | 1 |
| 8 | 2 | 230 | 972.8 | 0.46 | 0.65 | 400 | 105 | 99 | 230 | 60 | 1 |
| 9 | 3 | 500 | 974.1 | 0.70 | 1.05 | 404 | 107 | 99 | 230 | 60 | 1 |
| 10 | 4 | 730 | 975.7 | 1.05 1.05 | 1.55 | 408 | 108 | 99 | 240 | 50 | 2 |
| 11 | 5 | 1000 | 977.4 | 1.10 | 1.65 | 415 | 109 | 99 | 240 | 50 | 2 |
| 12 | 6 | 1230 | 979.2 | 1.20 | 1.80 | 415 | 110 | 99 | 240 | 50 | 2 |
| 13 | | | | | | | | | | | |
| 3 | 1 | 30/0 | 981.095 | 1.05 | 1.55 | 416 | 111 | 99 | 240 | 50 | 2 |
| 14 | 2 | 230 | 983.1 | 1.10 | 1.65 | 416 | 112 | 100 | 250 | 50 | 3 |
| 15 | 3 | 500 | 984.8 | 0.77 | 1.10 | 415 | 111 | 99 | 250 | 50 | 2 |
| 16 | 4 | 730 | 986.4 | 1.40 | 2.10 | 414 | 111 | 99 | 250 | 50 | 3 |
| 17 | 5 | 1000 | 988.4 | 1.20 ✓ | 1.80 | 415 | 113 | 100 | 250 | 50 | 3 |
| 18 | 6 | 1230 | 990.4 | 1.50 | 2.30 | 413 | 113 | 100 | 250 | 50 | 4 |
| 19 | | | | | | | | | | | |
| 4 | 1 | 45/0 | 992.707 | 0.64 | 0.94 | 406 | 111 | 99 | 250 | 50 | 2 |
| 20 | 2 | 230 | 994.2 | 0.92 | 1.35 | 405 | 109 | 97 | 250 | 50 | 3 |
| 21 | 3 | 500 | 995.9 | 0.91 | 1.35 | 406 | 109 | 98 | 250 | 50 | 3 |
| 22 | 4 | 730 | 997.6 | 1.1 1.1 | 1.65 | 408 | 109 | 98 | 250 | 50 | 3 |
| 23 | 5 | 1000 | 999.7 | 0.73 | 1.05 | 407 | 109 | 97 | 250 | 55 | 3 |
| 24 | 6 | 1230 | 1001.2 | 1.20 | 1.80 | 409 | 108 | 97 | 250 | 55 | 4 |
| 25 | END | 60/15 | 1002.911 | | | | | | | | |
| 26 | | | | | | | | | | | |
| 27 | | | | | | | | | | | |
| 28 | | | | | | | | | | | |
| 29 | | | | | | | | | | | |
| 30 | | | Leak Check: 0.005 cfm @ 6" Hg | | | | | | | | |
| 31 | | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| 33 | | | | | | | | | | | |
| 34 | | | | 0.8395 | 1.1533 | 406.29 | 106.88 | 98.29 | | | |
| 35 | | | | | | | | 102.58 | | | |

Environmental Monitoring Laboratories

PARTICULATE CATCH ANALYSIS:

SAMPLES: Hercules, Boiler No. 1

DATE TAKEN: May 9, 1984 DATE ANALYZED: May 10, 11, 1984

SAMPLES DELIVERED BY: D6R RECEIVED BY: D6R

ANALYZED BY: D6R

Filter treatment: 205°C ove, 2 hrs, cooled in desiccator weighed to constant wt.

| FILTERS: | RUN 1 | Run 2 | Run 3 |
|---|---|---|---|
| Filter No. | 1084 | 1085 | 1086 |
| Tare wt., g | 0.5209 | 0.5223 | 0.5325 |
| Final wt., g | 0.5880 | 0.5856 | 0.6345 |
| Net gain, g | 0.0671 | 0.0633 | 0.1020 |

Probe wash treatment: Acetone evaporated down [illegible]

| PROBE WASH: | Run 1 | Run 2 | Run 3 | Blank |
|---|---|---|---|---|
| Container ID | HBI-1 | HBI-2 | HBI-3 | — |
| Volume intact? | ✓ | ✓ | ✓ | — |
| Volume, ml | 205 | 155 | 210 | 200 |
| Tare wt., g | (10) 105.6956 | (11) 103.2247 | (12) 109.5915 | |
| Final wt., g | 105.7463 | 103.2805 | 109.6665 | |
| Net gain, g | 0.0507 | 0.0558 | 0.0750 | 0.0000 |
| Less blank, g | 0.0000 | 0.0000 | 0.0000 | |

| PARTICULATE COLLECTED: | Run 1 | Run 2 | Run 3 |
|---|---|---|---|
| Net gains less blank, mg | 117.8 | 119.1 | 177.0 |

6 ⊘

.015

Plant Hercules
Sampling Location No. 2 Boiler
Test For Particulate
Test Operators Russell Hercules/Larry Polk

RUN No. 1
Date 5-22-84
Time start 0856 end 0957

| | | | | | |
|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite |
| Sample Box | No 1 | Minutes/Pt. | 2.5 | $CO_2$ | 7.0 |
| Probe/Pitot | 5' ss | NOMOGRAPH | | $O_2$ | 13.5 |
| Pitot Cp | .84 | ΔH@ | 1.61 | CO | – |
| Nozzle Dia. | .228 | Meter Temp. | 82 | Time | |
| Filter No. | | % $H_2O$ | 10 | Condensate: | |
| Amb. Temp. °F | 67 | C-Factor | 0.83 | tare 200ml | fin 287 |
| Bar. Press. "Hg | 30.20 | Stack Temp. | 380 | Silica gel: | |
| Static Press. "$H_2O$ | -.80 | Ref. ΔP | 1.25 | tare 713.5 | fin 722.5 |

Remarks:
.227 ⊖
.229 ⊘
.228 ⊕

5-22-84

| Port Point | El. Time, Min. | DGM Reading, Ft.³ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 1 | 0 | 223.132 | 0.77 | 1.10 | 378 | 69 | 68 | 225 | 55 | 1 |
| 2 | 2 30 | 224.9 | 0.85 | 1.20 | 382 | 73 | 69 | 225 | 55 | 1 |
| 3 | 5 00 | 226.3 | 0.20 | 1.75 | 388 | 75 | 69 | 225 | 55 | 2 |
| 4 | 7 30 | 228.2 | 1.40 | 2.05 | 386 | 79 | 69 | 225 | 55 | 2 |
| 5 | 10 00 | 230.2 | 0.78 | 1.10 | 383 | 82 | 69 | 225 | 55 | 1 |
| 6 | 12 30 | 231.8 | 1.00 | 1.45 | 379 | 83 | 70 | 225 | 55 | 1 |
| 2 1 | 15/0 | 233.392 | 0.82 | 1.20 | 378 | 85 | 71 | 225 | 55 | 1 |
| 2 | 2 30 | 235.2 | 0.93 | 1.35 | 389 | 85 | 71 | 225 | 55 | 1 |
| 3 | 5 00 | 236.6 | 0.86 | 1.25 | 389 | 86 | 72 | 225 | 55 | 1 |
| 4 | 7 30 | 238.3 | 1.25 | 1.85 | 386 | 88 | 72 | 225 | 55 | 2 |
| 5 | 10 00 | 240.2 | 1.25 | 1.85 | 382 | 90 | 73 | 225 | 55 | 2 |
| 6 | 12 30 | 242.2 | 1.35 | 2.00 | 381 | 92 | 74 | 225 | 55 | 2 |
| 3 1 | 30/0 | 244.142 | 0.98 | 1.45 | 387 | 92 | 75 | 225 | 55 | 1 |
| 2 | 2 30 | 245.9 | 0.91 | 1.30 | 392 | 91 | 75 | 225 | 55 | 1 |
| 3 | 5 00 | 247.6 | 0.72 | 1.05 | 392 | 92 | 76 | 225 | 55 | 1 |
| 4 | 7 30 | 249.1 | 0.70 | 1.00 | 388 | 91 | 77 | 225 | 55 | 1 |
| 5 | 10 00 | 250.4 | 0.97 | 1.40 | 379 | 92 | 77 | 225 | 55 | 2 |
| 6 | 12 30 | 252.3 | 0.80 | 1.15 | 378 | 92 | 77 | 225 | 55 | 1 |
| 4 1 | 45/0 | 253.811 | 0.50 | 0.71 | 375 | 90 | 77 | 230 | 55 | 1 |
| 2 | 2 30 | 255.2 | 0.15 | 0.20 | 387 | 89 | 78 | 240 | 60 | 1 |
| 3 | 5 00 | 255.9 | 0.15 | 0.20 | 388 | 87 | 77 | 240 | 60 | 1 |
| 4 | 7 30 | 256.7 | 0.21 | 0.29 | 384 | 87 | 78 | 240 | 60 | 1 |
| 5 | 10 00 | 257.8 | 0.21 | 0.29 | 385 | 86 | 78 | 240 | 60 | 1 |
| 6 | 12 30 | 258.4 | 0.05 | 0.07 | 385 | 85 | 78 | 240 | 60 | 1 |
| END | 60/0 | 258.703 | | | | | | | | |

Leak check: 0.004 cfm @ 5" Hg

85.89 73.75

35.571 0.8453 1.1358 384.21

79.81

Environmental Monitoring Laboratories

Plant Hercules
Sampling Location No. 2 Boiler
Test For Particulate
Test Operators Russell

RUN No. 2
Date 5-22-84
Time start 1029 end 1130

GFW 5-22-84

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite | Remarks: | |
| Sample Box | No | Minutes/Pt. | 2.5 | $CO_2$ | 6.5 | | |
| Probe/Pitot | S'SS | NOMOGRAPH | | $O_2$ | 14.0 | | |
| Pitot Cp | .84 | ΔH@ | 1.61 | CO | — | | |
| Nozzle Dia. | .228 | Meter Temp. | 86 | Time | | | |
| Filter No. | | % $H_2O$ | 10 | Condensate: | | | |
| Amb. Temp. °F | 70 | C-Factor | 0.83 | tare 200 ml | fin 279 | | |
| Bar. Press. "Hg | 30.20 | Stack Temp. | 390 | Silica gel: | | | |
| Static Press. "$H_2O$ | -.70 | Ref. ΔP | 1.25 | tare ~~380~~ 692.0 | fin 703 | | |

| Port Point | El. Time, Min. | DGM Reading, Ft.³ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 259.132 | 0.68 | 0.97 | 378 | 74 | 74 | 230 | 55 | 1 |
| 2 | 230 | 260.7 | 0.89 | 1.30 | 380 | 78 | 75 | 230 | 55 | 2 |
| 3 | 500 | 263.0 | 1.30 | 1.90 | 380 | 85 | 76 | 230 | 55 | 2 |
| 4 | 730 | 264.4 | 1.35 | 2.00 | 375 | 87 | 77 | 235 | 50 | 3 |
| 5 | 1000 | 266.5 | 0.80 | 1.15 | 372 | 91 | 78 | 235 | 50 | 2 |
| 6 | 1230 | 268.0 | 1.20 | 1.75 | 371 | 92 | 78 | 235 | 50 | 3 |
| | | | | | | | | | | |
| 1 | 15/0 | 269.793 | 0.85 | 1.25 | 376 | 93 | 80 | 250 | 60 | 3 |
| 2 | 230 | 271.6 | 0.96 | 1.40 | 385 | 94 | 79 | 250 | 60 | 3 |
| 3 | 500 | 273.3 | 1.00 | 1.45 | 384 | 95 | 80 | 250 | 60 | 3 |
| 4 | 730 | 275.1 | 1.20 | 1.75 | 380 | 96 | 81 | 250 | 60 | 3 |
| 5 | 1000 | 276.9 | 1.26 | 1.80 | 376 | 98 | 81 | 250 | 60 | 3 |
| 6 | 1230 | 279.0 | 1.35 | 2.00 | 377 | 99 | 82 | 250 | 60 | 4 |
| | | | | | | | | | | |
| 1 | 30/0 | 280.900 | 0.95 | 1.45 | 381 | 98 | 82 | 250 | 60 | 4 |
| 2 | 230 | 283.0 | 0.98 | 1.30 | 384 | 98 | 84 | 250 | 60 | 4 |
| 3 | 500 | 284.8 | 0.77 | 1.10 | 381 | 99 | 85 | 250 | 60 | 2 |
| 4 | 730 | 286.0 | 0.57 | 0.80 | 380 | 98 | 84 | 250 | 60 | 1 |
| 5 | 1000 | 287.5 | 0.97 | 1.40 | 380 | 99 | 85 | 250 | 60 | 1 |
| 6 | 1230 | 289.3 | 0.84 | 1.20 | 381 | 101 | 86 | 250 | 60 | 2 |
| | | | | | | | | | | |
| 1 | 45/0 | 290.846 | 0.34 | 0.48 | 373 | 99 | 86 | 250 | 60 | 1 |
| 2 | 230 | 292.0 | 0.10 | 0.14 | 380 | 97 | 87 | 250 | 60 | 1 |
| 3 | 500 | 292.6 | 0.12 | 0.15 | 380 | 99 | 87 | 250 | 60 | 1 |
| 4 | 730 | 293.1 | 0.12 | 0.15 | 379 | 94 | 87 | 250 | 60 | 1 |
| 5 | 1000 | 293.9 | 0.12 | 0.15 | 379 | 93 | 86 | 250 | 60 | 1 |
| 6 | 1230 | 294.5 | 0.05 | 0.07 | 377 | 92 | 86 | 250 | 60 | 1 |
| END | 60/15 | 294.848 | | | | | | | | |
| | | | | | | | | | | |
| | | Leak check: 0.007 cfm @ 6" Hg | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | 93.71 | 81.92 | | | |
| | | 315.716 | 0.8306 | 1.1247 | 378.71 | | | | | |

87.81

Plant Hercules
Sampling Location NO. 2 Boiler
Test For Particulate
Test Operators Russell / Little BPC - Jesse Thompson

RUN No. 3
Date 5-22-84
Time start 1153 end 1254

| | | | | | |
|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite |
| Sample Box | No. 3 | Minutes/Pt. | 2.5 | $CO_2$ | 7.0 |
| Probe/Pitot | S'SS | NOMOGRAPH | | $O_2$ | 14.0 |
| Pitot Cp | .84 | ΔH@ | 1.61 | CO | — |
| Nozzle Dia. | .228 | Meter Temp. | 85 | Time | |
| Filter No. | | % $H_2O$ | 10 | Condensate: | |
| Amb. Temp. °F | 70 | C-Factor | .83 | tare 200ml fin 279 | |
| Bar. Press. "Hg | 30.20 | Stack Temp. | 390 | Silica gel: | |
| Static Press. "$H_2O$ | -.70 | Ref. ΔP | 1.25 | tare 756.0g fin 768.0 | |

Remarks: at 1215 began using different fuel changed from pine to hardwood

| Port Point | El. Time, Min. | DGM Reading, Ft.³ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 295.059 | 0.70 | 1.00 | 370 | 78 | 79 | 225 | 60 | 1 |
| 2 | 230 | 296.4 | 0.96 | 1.40 | 379 | 82 | 80 | 225 | 55 | 1 |
| 3 | 500 | 298.0 | 1.35 | 2.00 | 382 | 87 | 80 | 225 | 55 | 2 |
| 4 | 730 | 300.0 | 1.45 | 2.10 | 375 | 93 | 82 | 225 | 55 | 2 |
| 5 | 1000 | 302.1 | 0.80 | 1.15 | 373 | 95 | 82 | 225 | 55 | 1 |
| 6 | 1230 | 303.7 | 0.98 | 1.40 | 375 | 98 | 82 | 225 | 55 | 1 |
| 1 | 15/0 | 305.485 | 0.86 | 1.25 | 383 | 97 | 84 | 225 | 65 | 1 |
| 2 | 230 | 307.1 | 0.97 | 1.40 | 393 | 98 | 85 | 230 | 60 | 1 |
| 3 | 500 | 308.8 | 0.90 | 1.30 | 390 | 99 | 86 | 230 | 60 | 1 |
| 4 | 730 | 310.7 | 1.10 | 1.60 | 390 | 99 | 86 | 230 | 60 | 2 |
| 5 | 1000 | 312.4 | 1.20 | 1.80 | 384 | 101 | 86 | 230 | 60 | 2 |
| 6 | 1230 | 314.3 | 1.40 | 2.05 | 379 | 102 | 87 | 230 | 60 | 2 |
| 1 | 30/0 | 316.391 | 0.97 | 1.40 | 378 | 103 | 86 | 230 | 60 | 1 |
| 2 | 230 | 318.1 | 0.89 | 1.25 | 384 | 99 | 87 | 230 | 60 | 1 |
| 3 | 500 | 319.8 | 0.71 | 1.00 | 389 | 97 | 87 | 230 | 60 | 1 |
| 4 | 730 | 321.5 | 0.56 | 0.80 | 387 | 97 | 87 | 250 | 55 | 1 |
| 5 | 1000 | 322.8 | 0.95 | 1.40 | 388 | 97 | 88 | 250 | 55 | 1 |
| 6 | 1230 | 324.6 | .76 0.86 | 1.10 | 385 | 97 | 87 | 250 | 55 | 1 |
| 1 | 45/0 | 326.229 | 0.38 | 0.54 | 377 | 95 | 87 | 250 | 55 | 1 |
| 2 | 230 | 327.5 | 0.14 | 0.19 | 383 | 94 | 87 | 250 | 55 | 1 |
| 3 | 500 | 328.3 | 0.14 | 0.19 | 387 | 94 | 87 | 250 | 55 | 1 |
| 4 | 730 | 329.1 | 0.14 | 0.19 | 386 | 93 | 87 | 250 | 55 | 1 |
| 5 | 1000 | 329.5 | 0.21 | 0.29 | 387 | 93 | 87 | 250 | 55 | 1 |
| 6 | 1230 | 330.1 | 0.05 | 0.07 | 387 | 94 | 87 | 250 | 55 | 1 |
| | 60/15 | 330.974 | | | | | | | | |
| | | leak check 0.003 cfm @ 5" Hg | | | | | | | | |
| | | | | | | 95.08 | 85.13 | | | |
| | | 35.915 | 0.8351 | 1.1196 | 382.96 | 90.10 | | | | |

new fuel

5-22-84

Environmental Monitoring Laboratories

PARTICULATE CATCH ANALYSIS:

SAMPLES: Hercules Boiler No. 2

DATE TAKEN: 5-22-84 DATE ANALYZED: 5-24-84

SAMPLES DELIVERED BY: DGR RECEIVED BY: DGR

ANALYZED BY: DGR

Filter treatment: _____

| FILTERS: | RUN 1 | Run 2 | Run 3 |
|---|---|---|---|
| Filter No. | 1090 | 1091 | 1092 |
| Tare wt., g | 0.5353 | 0.5321 | 0.5287 |
| Final wt., g | 0.6209 | 0.6153 | 0.6248 |
| Net gain, g | 0.0856 | 0.0832 | 0.0961 |

Probe wash treatment: _____

| PROBE WASH: | Run 1 | Run 2 | Run 3 | Blank |
|---|---|---|---|---|
| Container ID | Herc 2R1 | Herc 2R2 | Herc 2R3 | — |
| Volume intact? | ✓ | ✓ | ✓ | — |
| Volume, ml | 190 | 190 | 180 | 200 |
| Tare wt., g | 112.7415 | 105.6946 | 103.2235 | |
| Final wt., g | 112.8215 | 105.7681 | 103.3010 | |
| Net gain, g | 0.0800 | 0.0735 | 0.0775 | 0.0000 |
| Less blank, g | — | — | — | — |

| PARTICULATE COLLECTED: | Run 1 | Run 2 | Run 3 |
|---|---|---|---|
| Net gains less blank, mg | 165.6 | 156.7 | 173.6 |

Plant Hercules
Sampling Location Boiler No. 3
Test For Particulate
Test Operators Russell

RUN No. 1
Date 5-8-84
Time start 0934 end 1036

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Meter Box | PAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite | | |
| Sample Box | No. 1 | Minutes/Pt. | 2.5 | $CO_2$ | 6.5 | | |
| Probe/Pitot | 5'SS | NOMOGRAPH | | $O_2$ | 12.5 | | |
| Pitot Cp | .84 | ΔH@ | 1.61 | CO | — | | |
| Nozzle Dia. | .226 | Meter Temp. | 85 | Time | | | |
| Filter No. | | % $H_2O$ | 10 | Condensate: | | | |
| Amb. Temp. °F | 68 | C-Factor | .89 | tare 200 | fin 282 | | |
| Bar. Press. "Hg | 30.24 | Stack Temp. | 360 | Silica gel: | | | |
| Static Press. "$H_2O$ | neg. | Ref. ΔP | 1.1 | tare 7400 | fin 7520 | | |

Remarks:
.225
.227
.227

| | Port Point | El. Time, Min. | DGM Reading, Ft.³ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 660.593 | 0.12 | 0.18 | 301 | 69 | 68 | 250 | 50 | 1 |
| 2 | 2 | 2 30 | 661.3 | 0.09 | 0.13 | 347 | 71 | 68 | 250 | 50 | 1 |
| 3 | 3 | 5 00 | 661.8 | 0.12 | 0.18 | 361 | 72 | 68 | 250 | 50 | 1 |
| 4 | 4 | 7 30 | 662.5 | 0.06 | 0.09 | 358 | 73 | 67 | 250 | 50 | 1 |
| 5 | 5 | 10 00 | 663.1 | 0.13 | 0.20 | 347 | 79 | 70 | 250 | 55 | 1 |
| 6 | 6 | 12 30 | 663.6 | 0.13 | 0.20 | 347 | 80 | 69 | 250 | 55 | 1 |
| 7 | | | | | | | | | | | |
| 2 | 1 | 15 00 | 664.262 | 0.97 | 1.60 | 363 | 82 | 71 | 250 | 55 | 2 |
| 8 | 2 | 2 30 | 666.2 | 0.88 | 1.45 | 365 | 91 | 71 | 250 | 55 | 2 |
| 9 | 3 | 5 00 | 667.7 | 0.88 | 1.45 | 367 | 99 | 73 | 250 | 50 | 2 |
| 10 | 4 | 7 30 | 669.5 | 0.53 | 0.85 | 357 | 104 | 74 | 250 | 50 | 2 |
| 11 | 5 | 10 00 | 670.9 | 0.85 | 1.40 | 354 | 107 | 77 | 250 | 50 | 1 |
| 12 | 6 | 12 30 | 672.6 | 0.99 | 1.60 | 352 | 111 | 78 | 250 | 50 | 1 |
| 13 | | | | | | | | | | | |
| 3 | 1 | 30 00 | 674.402 | 0.89 | 1.45 | 373 | 105 | 79 | 250 | 50 | 1 |
| 14 | 2 | 2 30 | 676.1 | 1.00 | 1.65 | 377 | 103 | 79 | 250 | 50 | 2 |
| 15 | 3 | 5 00 | 678.0 | 1.70 | 2.80 | 374 | 102 | 79 | 250 | 50 | 3 |
| 16 | 4 | 7 30 | 680.5 | 1.70 | 2.80 | 364 | 104 | 78 | 250 | 50 | 3 |
| 17 | 5 | 10 00 | 682.8 | 1.45 | 2.20 | 354 | 106 | 80 | 250 | 50 | 3 |
| 18 | 6 | 12 30 | 685.0 | 1.70 | 2.80 | 355 | 106 | 80 | 250 | 50 | 3 |
| 19 | | | | | | | | | | | |
| 4 | 1 | 45 00 | 687.381 | 0.88 | 1.45 | 373 | 104 | 81 | 250 | 50 | 2 |
| 20 | 2 | 2 30 | 689.1 | 0.60 | 0.95 | 373 | 100 | 80 | 250 | 50 | 1 |
| 21 | 3 | 5 00 | 690.7 | 0.60 | 1.70 | 375 | 100 | 80 | 250 | 50 | 3 |
| 22 | 4 | 7 30 | 692.6 | 1.80 | 3.00 | 362 | 103 | 81 | 250 | 60 | 4 |
| 23 | 5 | 10 00 | 695.1 | 0.86 | 1.40 | 352 | 104 | 81 | 250 | 65 | 2 |
| 24 | 6 | 12 30 | 696.8 | 0.99 | 1.60 | 349 | 103 | 81 | 250 | 65 | 2 |
| 25 | END | 60 15 | 698.541 | | | | | | | | |
| 26 | | | | | | | | | | | |
| 27 | | | Leak check 0.005 cfm @ 5" Hg | | | | | | | | |
| 28 | | | | | | | | | | | |
| 29 | | | | | | | | | | | |
| 30 | | | | | | | 94.92 | 79.58 | | | |
| 31 | | | | | | | | | | | |
| 32 | | | 37.948 | .8652 | 1.3804 | 358.33 | | 85.25 | | | |

Environmental Monitoring Laboratories

Plant Hercules
Sampling Location Boiler No. 3
Test For Particulate
Test Operators Russell

RUN No. 2
Date 5-8-84
Time start 1107 end 1210

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite | | Remarks: |
| Sample Box | No. 2 | Minutes/Pt. | 2.5 | $CO_2$ | 8.0 | | |
| Probe/Pitot | 5'SS | NOMOGRAPH | | $O_2$ | 13.0 | | |
| Pitot Cp | .84 | ΔH@ | 1.61 | CO | – | | |
| Nozzle Dia. | .226 | Meter Temp. | 90 | Time | | | |
| Filter No. | | % $H_2O$ | 9 | Condensate: | | | |
| Amb. Temp. °F | 62 | C-Factor | .89 | tare | 2.00 | fin 280 | |
| Bar. Press. "Hg | 30.24 | Stack Temp. | 325 | Silica gel: | | | |
| Static Press. "$H_2O$ | neg | Ref. ΔP | 1.15 | tare | 699.0 | fin 707.5 | |

| Port | Point | El. Time, Min. | DGM Reading, Ft.³ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 698.791 | 0.11 | 0.16 | 354 | 82 | 78 | 225 | 55 | 1 |
| | 2 | 230 | 699.4 | 0.10 | 0.15 | 354 | 84 | 80 | 225 | 50 | 1 |
| | 3 | 500 | 700.0 | 0.13 | 0.19 | 360 | 87 | 82 | 225 | 50 | 1 |
| | 4 | 730 | 700.8 | 0.05 | 0.09 | 358 | 88 | 82 | 225 | 50 | 1 |
| | 5 | 1000 | 701.2 | 0.18 | 0.17 | 353 | 88 | 82 | 225 | 50 | 1 |
| | 6 | 1230 | 701.9 | 0.13 | 0.19 | 355 | 91 | 82 | 225 | 50 | 1 |
| 2 | 1 | 1510 | 702.509 | 0.92 | 1.45 | 378 | 93 | 82 | 225 | 50 | 2 |
| | 2 | 230 | 704.3 | 0.84 | 1.30 | 382 | 98 | 83 | 225 | 50 | 2 |
| | 3 | 500 | 706.2 | 0.81 | 1.30 | 377 | 103 | 84 | 225 | 50 | 2 |
| | 4 | 730 | 708.0 | 0.80 | 1.25 | 368 | 106 | 84 | 225 | 50 | 2 |
| | 5 | 1000 | 709.5 | 1.7 ΔP 0.20 | 1.90 | 362 | 108 | 85 | 225 | 50 | 2 |
| | 6 | 1230 | 711.3 | 1.50 | 2.40 | 363 | 113 | 87 | 225 | 50 | 2 |
| 3 | 1 | 2010 | 713.131 | 0.85 | 1.35 | 382 | 111 | 86 | 225 | 50 | 2 |
| | 2 | 230 | 714.8 | 0.99 | 1.60 | 389 | 109 | 87 | 225 | 50 | 2 |
| | 3 | 500 | 716.6 | 1.7 ΔP 1.70 | 2.80 | 384 | 109 | 87 | 225 | 45 | 4 |
| | 4 | 730 | 719.0 | 1.60 | 2.60 | 373 | 112 | 87 | 225 | 45 | 4 |
| | 5 | 1000 | 721.0 | 1.50 | 2.40 | 364 | 113 | 88 | 225 | 45 | 4 |
| | 6 | 1230 | 723.8 | 1.35 | 2.20 | 362 | 114 | 88 | 225 | 50 | 3 |
| 4 | 1 | 4510 | 725.700 | 0.59 | 0.91 | 378 | 108 | 87 | 250 | 50 | 2 |
| | 2 | 230 | 727.1 | 0.69 | 1.05 | 376 | 105 | 88 | 250 | 50 | 2 |
| | 3 | 500 | 728.6 | 1.75 ΔP 0.75 | 2.90 | 376 | 106 | 87 | 250 | 50 | 2 |
| | 4 | 730 | 731.0 | 1.70 | 2.80 | 361 | 108 | 87 | 250 | 50 | 2 |
| | 5 | 1003 | 733.5 | 0.88 | 1.40 | 354 | 109 | 87 | 250 | 50 | 3 |
| | 6 | 1230 | 735.3 | 0.87 | 1.40 | 356 | 107 | 86 | 250 | 50 | 2 |
| END | | | 736.989 | | | | | | | | |
| | | | | | | | 102.17 | 84.83 | | | |
| | | | 38.198 | 0.8713 | 1.4159 | 367.46 | | | | | |

Leak check 0.002 @ 5" Hg

93.50

Environmental Monitoring Laboratories

Plant Hercules
Sampling Location Boiler No. 3
Test For Particulate
Test Operators Russell

RUN No. 3
Date 5-8-84
Time start 1341 end 1450

| | | | | | |
|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite |
| Sample Box | No. 3 | Minutes/Pt. | 2.5 | $CO_2$ | 7.5 |
| Probe/Pitot | 5' SS | NOMOGRAPH | | $O_2$ | 13.0 |
| Pitot Cp | .84 | ΔH@ | 1.61 | CO | – |
| Nozzle Dia. | .226 | Meter Temp. | 95 | Time | |
| Filter No. | | % $H_2O$ | 11 | Condensate: | |
| Amb. Temp. °F | 65 | C-Factor | .85 | tare 200 ml | fin 260 ml |
| Bar. Press. "Hg | 30.24 | Stack Temp. | 375 | Silica gel: | |
| Static Press. "$H_2O$ | negl. | Ref. ΔP | 1.2 | tare 755.0g | fin 765.0g |

Remarks: 40-50K # steam/hr.

| Port Point | El. Time, Min. | DGM Reading, Ft.³ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 1 | 0 | 737.115 | 0.11 | 0.15 | 359 | 79 | 79 | 250 | 60 | 1 |
| 2 | 2 30 | 737.8 | 0.11 | 0.15 | 361 | 81 | 79 | 250 | 50 | 1 |
| 3 | 5 00 | 738.4 | 0.09 | 0.13 | 359 | 84 | 79 | 250 | 50 | 1 |
| 4 | 7 30 | 739.0 | 0.05 | 0.07 | 351 | 83 | 79 | 250 | 50 | 1 |
| 5 | 10 00 | 739.4 | 0.07 | 0.10 | 345 | 85 | 79 | 250 | 50 | 1 |
| 6 | 12 30 | 739.9 | 0.05 | 0.07 | 344 | 85 | 80 | 250 | 50 | 1 |
| | 15 | | | | | | | | | |
| 2 1 | 15/0 | 740.308 | 0.95 | 1.45 | 362 | 88 | 82 | 250 | 50 | 1 |
| 2 | 2 30 | 742.2 | 0.84 | 1.30 | 368 | 95 | 83 | 250 | 50 | 1 |
| 3 | 5 00 | 743.9 | 0.93 | 1.45 | 366 | 99 | 83 | 250 | 50 | 1 |
| 4 | 7 30 | 745.5 | 0.73 | 1.15 | 356 | 94 | 84 | 250 | 50 | 1 |
| 5 | 10 00 | 747.1 | 1.20 | 1.90 | 348 | 96 | 84 | 230 | 50 | 1 |
| 6 | 12 30 | 748.9 | 1.40 | 2.20 | 351 | 100 | 85 | 240 | 50 | 1 |
| 3 1 | 30/0 | 751.022 | 0.93 | 1.45 | 367 | 101 | 84 | 240 | 50 | 1 |
| 2 | 2 30 | 752.8 | 0.99 | 1.60 | 375 | 100 | 87 | 240 | 50 | 1 |
| 3 | 5 00 | 754.5 | 1.3 0.30 | 2.10 | 371 | 102 | 87 | 240 | 50 | 1 |
| 4 | 7 30 | 757.0 | 1.60 | 2.60 | 357 | 106 | 88 | 240 | 50 | 1 |
| 5 | 10 00 | 758.8 | 1.50 | 2.40 | 354 | 108 | 89 | 240 | 50 | 2 |
| 6 | 12 30 | 761.0 | 1.50 | 2.40 | 355 | 110 | 89 | 250 | 55 | 2 |
| 4 1 | 45/0 | 763.158 | 0.66 | 1.05 | 374 | 109 | 90 | 250 | 55 | 2 |
| 2 | 2 30 | 764.8 | 0.92 | 1.45 | 375 | 108 | 90 | 250 | 55 | 1 |
| 3 | 5 00 | 766.4 | 1.75 0.75 | 2.90 | 374 | 109 | 90 | 250 | 55 | 3 |
| 4 | 7 30 | 768.8 | 1.65 | 2.70 | 363 | 112 | 91 | 250 | 55 | 3 |
| 5 | 10 00 | 771.2 | 0.84 | 1.30 | 360 | 113 | 91 | 250 | 55 | 2 |
| 6 | 12 30 | 773.1 | 1.00 | 1.60 | 358 | 113 | 91 | 250 | 55 | 2 |
| END | 60/15 | 774.736 | | | | | | | | |
| | | Leak check 0.005 cfm @ 6" Hg | | | | | | | | |
| | | | | | | 97.92 | 85.13 | | | |
| | | 37.621 | 0.8655 | 1.3842 | 360.33 | | 91.52 | | | |

lost power.

Environmental Monitoring Laboratories

PARTICULATE CATCH ANALYSIS:

SAMPLES: Hercules, Boiler No. 3

DATE TAKEN: May 8, 1984 DATE ANALYZED: May 10, 11, 1984

SAMPLES DELIVERED BY: DGR RECEIVED BY: DGR

ANALYZED BY: DGR

Filter treatment: 205°C oven 2 hrs, desiccated, weighed to constant wt.

| FILTERS: | RUN 1 | Run 2 | Run 3 |
|---|---|---|---|
| Filter No. | 1076 | 1077 | 1078 |
| Tare wt., g | 0.5646 | 0.5540 | 0.5645 |
| Final wt., g | 0.6391 | 0.6300 | 0.6493 |
| Net gain, g | 0.0745 | 0.0760 | 0.0848 |

Probe wash treatment: acetone evaporated over low heat, cooled, weighed to constant wt

| PROBE WASH: | Run 1 | Run 2 | Run 3 | Blank |
|---|---|---|---|---|
| Container ID | HB3-1 | HB3-2 | HB3-3 | — |
| Volume intact? | ✓ | ✓ | ✓ | — |
| Volume, ml | 150 | 210 | 250 | |
| Tare wt., g | (2) 112.7439 | (3) 104.7714 | (5) 109.7096 | |
| Final wt., g | 112.8471 | 104.8441 | 109.8205 | |
| Net gain, g | 0.1032 | 0.0727 | 0.1109 | |
| Less blank, g | 0.0000 | 0.0000 | | |

| PARTICULATE COLLECTED: | Run 1 | Run 2 | Run 3 |
|---|---|---|---|
| Net gains less blank, mg | 177.7 | 148.7 | 195.7 |

Plant Hercules
Sampling Location Boiler No. 4
Test For Particulate
Test Operators R. Rowell

RUN No. 1
Date 5-8-84
Time start 1530 end 1632

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Meter Box | RAC 1 | No. Sample Pts. | 24 | Gas Analysis | Fyrite | Remarks: | |
| Sample Box | No. 1 | Minutes/Pt. | 2.5 | $CO_2$ | 4.0 | | |
| Probe/Pitot | S.S | NOMOGRAPH | | $O_2$ | 17.5 | | |
| Pitot Cp | .84 | ΔH@ | 1.61 | CO | - | | |
| Nozzle Dia. | .226 | Meter Temp. | 90 | Time | | | |
| Filter No. | | % $H_2O$ | 10 | Condensate: | | | |
| Amb. Temp. °F | 68 | C-Factor | .85 | tare 200 ml | fin 240 | | |
| Bar. Press. "Hg | 30.24 | Stack Temp. | 345 | Silica gel: | | | |
| Static Press. "$H_2O$ | -0.78 | Ref. ΔP | 1.20 | tare 752.0 g | fin 762.0 g | | |

| | Port Point | El. Time, Min. | DGM Reading, Ft.³ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 775.029 | 0.80 | 1.30 | 336 | 77 | 79 | 225 | 60 | 1 |
| | 2 | 2 30 | 776.7 | 0.87 | 1.35 | 334 | 82 | 81 | 225 | 60 | 1 |
| | 3 | 5 00 | 778.5 | 1.20 | 1.85 | 342 | 86 | 80 | 225 | 60 | 2 |
| | 4 | 7 30 | 780.6 | 1.10 | 1.70 | 345 | 92 | 81 | 225 | 50 | 2 |
| | 5 | 10 00 | 782.4 | 0.64 | 0.97 | 345 | 95 | 81 | 230 | 50 | 1 |
| | 6 | 12 30 | 784.0 | 0.83 | 1.25 | 344 | 96 | 81 | 230 | 50 | 1 |
| 2 | 1 | 15/0 | 785.661 | 1.10 | 1.70 | 344 | 98 | 80 | 230 | 50 | 2 |
| | 2 | 2 30 | 787.7 | 1.30 | 2.00 | 345 | 100 | 82 | 240 | 50 | 2 |
| | 3 | 5 00 | 789.7 | 1.80 | 2.90 | 346 | 103 | 84 | 240 | 50 | 3 |
| | 4 | 7 30 | 792.1 | 1.25 | 1.95 | 351 | 102 | 83 | 240 | 50 | 2 |
| | 5 | 10 00 | 794.4 | 1.20 | 1.90 | 354 | 100 | 86 | 240 | 50 | 2 |
| | 6 | 12 30 | 796.3 | 1.40 | 2.20 | 358 | 100 | 84 | 240 | 50 | 3 |
| 3 | 1 | 30/0 | 798.377 | 1.00 | 1.55 | 349 | 99 | 84 | 245 | 55 | 2 |
| | 2 | 2 30 | 800.2 | 0.97 | 1.50 | 345 | 98 | 84 | 250 | 55 | 2 |
| | 3 | 5 00 | 802.1 | 1.25 | 1.95 | 352 | 100 | 84 | 250 | 55 | 3 |
| | 4 | 7 30 | 804.2 | 0.87 | 1.35 | 352 | 98 | 84 | 250 | 55 | 2 |
| | 5 | 10 00 | 805.8 | 0.77 | 1.20 | 354 | 98 | 85 | 250 | 55 | 2 |
| | 6 | 12 30 | 807.5 | 1.80 | 2.90 | 356 | 96 | 85 | 250 | 55 | 4 |
| 4 | 1 | 45/0 | 809.862 | 0.14 | 0.20 | 319 | 95 | 83 | 250 | 55 | 4 |
| | 2 | 2 30 | 810.7 | 0.13 | 0.18 | 336 | 94 | 84 | 250 | 55 | 1 |
| | 3 | 5 00 | 811.2 | 0.32 | 0.48 | 348 | 94 | 83 | 250 | 60 | 1 |
| | 4 | 7 30 | 812.4 | 0.45 | 0.68 | 361 | 96 | 84 | 250 | 65 | 1 |
| | 5 | 10 00 | 813.5 | 0.45 | 0.68 | 361 | 96 | 85 | 250 | 65 | 1 |
| | 6 | 12 30 | 815.0 | 0.35 | 0.51 | 361 | 96 | 85 | 250 | 65 | 1 |
| | | 60/15 | 815.946 | | | | | | | | |

Leak check: 0.003 cfm @ 5" Hg

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 40.917 | .9208 | 1.4229 | 347.42 | | 89.23 | | | |

Environmental Monitoring Laboratories

DAH
5/9/84

Plant Hercules
Sampling Location Boiler No. 4
Test For Particulate
Test Operators Rucco II / Little

RUN No. 2
Date 5-9-84
Time start 0744 end 0847

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Meter Box | RAC | No. Sample Pts. | 24 | Gas Analysis | Fyrite | Remarks: | |
| Sample Box | No. 2 | Minutes/Pt. | 2.5 | $CO_2$ | 4.0 | | |
| Probe/Pitot | S's | NOMOGRAPH | | $O_2$ | 16.0 | | |
| Pitot Cp | .84 | ΔH@ | 1.61 | CO | | | |
| Nozzle Dia. | .236 | Meter Temp. | 75 | Time | | | |
| Filter No. | | % $H_2O$ | 10 | Condensate: | | | |
| Amb. Temp. °F | 54 | C-Factor | .86 | tare 200 fin 250 | | | |
| Bar. Press. "Hg | 30.29 | Stack Temp. | 360 | Silica gel: | | | |
| Static Press. "$H_2O$ | -.75 | Ref. Δ P | 1.20 | tare 707.5 fin 718 | | | |

| | Port Point | El. Time, Min. | DGM Reading, Ft.³ | Velocity Head Δ P, in. $H_2O$ | Orifice Δ H in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 816.111 | 0.72 | 1.10 | 351 | 56 | 54 | 225 | 45 | 1 |
| 2 | 2 | 230 | 817.7 | 0.77 | 1.20 | 344 | 59 | 54 | 225 | 45 | 1 |
| 3 | 5 | 00 | 819.1 | 1.00 | 1.55 | 354 | 63 | 55 | 225 | 45 | 2 |
| 4 | 7 | 30 | 820.9 | 1.00 | 1.55 | 357 | 69 | 55 | 225 | 45 | 2 |
| 5 | 10 | 00 | 822.6 | 0.58 | 0.90 | 358 | 73 | 58 | 225 | 45 | 1 |
| 6 | 12 | 30 | 824.1 | 0.79 | 1.20 | 355 | 77 | 59 | 225 | 45 | 2 |
| 7 | | | | | | | | | | | |
| 8 | 2 1 | 15/0 | 825.600 | 0.97 | 1.50 | 354 | 78 | 60 | 245 | 45 | 2 |
| 9 | 2 | 230 | 827.7 | 1.20 | 1.90 | 354 | 84 | 62 | 245 | 45 | 3 |
| 10 | 3 | 500 | 829.3 | 1.75 | 2.70 | 354 | 87 | 62 | 245 | 45 | 4 |
| 11 | 4 | 730 | 831.5 | 1.20 | 1.85 | 357 | 91 | 64 | 255 | 50 | 3 |
| 12 | 5 | 1000 | 833.6 | 1.15 | 1.80 | 365 | 93 | 65 | 260 | 50 | 3 |
| 13 | 6 | 1230 | 835.4 | 1.20 | 1.85 | 365 | 92 | 67 | 250 | 50 | 3 |
| 14 | | | | | | | | | | | |
| 15 | 3 1 | 30/0 | 837.345 | 1.20 | 1.85 | 360 | 90 | 68 | 250 | 50 | 3 |
| 16 | 2 | 230 | 839.5 | 0.94 | 1.45 | 352 | 87 | 69 | 250 | 50 | 2 |
| 17 | 3 | 500 | 841.2 | 1.7 DAH 0.70 | 2.70 | 357 | 87 | 70 | 250 | 50 | 4 |
| 18 | 4 | 730 | 843.6 | 0.85 | 1.30 | 357 | 89 | 70 | 250 | 50 | 2 |
| 19 | 5 | 1000 | 845.2 | 0.84 | 1.30 | 360 | 89 | 71 | 250 | 60 | 2 |
| 20 | 6 | 1230 | 847.0 | 1.70 | 2.70 | 365 | 88 | 71 | 250 | 60 | 4 |
| 21 | | | | | | | | | | | |
| 22 | 4 1 | 45/0 | 849.130 | 0.15 | 0.22 | 331 | 87 | 72 | 250 | 60 | 1 |
| 23 | 2 | 230 | 849.9 | 0.15 | 0.22 | 336 | 85 | 72 | 260 | 60 | 1 |
| 24 | 3 | 500 | 850.6 | 0.34 | 0.50 | 347 | 82 | 73 | 260 | 60 | 1 |
| 25 | 4 | 730 | 851.7 | 0.32 | 0.48 | 356 | 84 | 73 | 260 | 60 | 1 |
| 26 | 5 | 1000 | 852.8 | 0.30 | 0.45 | 357 | 84 | 73 | 260 | 60 | 1 |
| 27 | 6 | 1230 | 853.8 | 0.20 | 0.29 | 358 | 85 | 74 | 250 | 60 | 1 |
| 28 | END | 60/15 | 854.704 | | | | | | | | |
| 29 | | | | | | | | | | | |
| 30 | | | Leak Check: | 0.002 | cfm @ | 6"Hg | | | | | |
| 31 | | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| 33 | | | | | | | | | | | |
| 34 | | | | | | | 81.33 | 65.46 | | | |
| 35 | | | 38.593 | 0.8947 | 1.3567 | 354.32 | | | | | |

72.54

Plant: Hercules
Sampling Location: Boiler No. 4
Test For: Particulate
Test Operators: Russell / Little

RUN No. 3
Date 5-9-84
Time start 0949 end 1051

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Meter Box | RAC-1 | No. Sample Pts. | 24 | Gas Analysis | Fyrite | | Remarks: |
| Sample Box | No. 3 | Minutes/Pt. | 2.5 | $CO_2$ | 3.5 | | |
| Probe/Pitot | S'SS | NOMOGRAPH | | $O_2$ | 16.5 | | |
| Pitot Cp | .84 | ΔH@ | 1.61 | CO | | | |
| Nozzle Dia. | .226 | Meter Temp. | 80 | Time | | | |
| Filter No. | | % $H_2O$ | 10 | Condensate: tare 200 ml fin 236 ml | | | |
| Amb. Temp. °F | 68 | C-Factor | .86 | Silica gel: tare 765.0 g fin 773.0 g | | | |
| Bar. Press. "Hg | 30.29 | Stack Temp. | 360 | | | | |
| Static Press. "$H_2O$ | -.70 | Ref. ΔP | 1.2 | | | | |

| | Port Point | El. Time, Min. | DGM Reading, Ft.³ | Velocity Head ΔP, in. $H_2O$ | Orifice ΔH in. $H_2O$ | Stack Temp. °F | Meter Temp., °F In | Meter Temp., °F Out | Oven Temp. °F | Imp. Temp. °F | Vac in. Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 856.654 | 0.67 | 1.00 | 341 | 72 | 70 | 225 | 55 | 1 |
| 2 | 2 | 230 | 858.2 | 0.80 | 1.20 | 337 | 75 | 71 | 225 | 50 | 1 |
| 3 | 3 | 500 | 859.9 | 0.99 | 1.50 | 334 | 78 | 72 | 225 | 50 | 1 |
| 4 | 4 | 730 | 861.7 | 0.99 | 1.50 | 336 | 81 | 72 | 225 | 50 | 1 |
| 5 | 5 | 1000 | 863.5 | 0.65 | 1.00 | 338 | 83 | 73 | 225 | 50 | 1 |
| 6 | 6 | 1230 | 865.1 | 0.74 | 1.15 | 338 | 84 | 73 | 225 | 50 | 1 |
| 7 | | | | | | | | | | | |
| 8 | 1 | 1510 | 866.440 | 1.10 | 1.70 | 337 | 84 | 73 | 235 | 55 | 1 |
| 9 | 2 | 230 | 868.6 | 1.20 | 1.90 | 339 | 87 | 74 | 235 | 55 | 1 |
| 10 | 3 | 500 | 870.4 | 1.65 | 2.60 | 338 | 89 | 76 | 240 | 55 | 2 |
| 11 | 4 | 730 | 872.5 | 1.10 | 1.70 | 347 | 92 | 75 | 240 | 55 | 1 |
| 12 | 5 | 1000 | 874.6 | 1.25 | 1.95 | 353 | 93 | 77 | 245 | 55 | 1 |
| 13 | 6 | 1230 | 876.6 | 1.30 | 2.00 | 354 | 93 | 77 | 245 | 55 | 2 |
| 14 | | | | | | | | | | | |
| 15 | 1 | 1510 | 878.381 | 1.15 | 1.80 | 351 | 93 | 78 | 250 | 55 | 2 |
| 16 | 2 | 230 | 880.5 | 0.88 | 1.35 | 335 | 94 | 78 | 250 | 55 | 1 |
| 17 | 3 | 500 | 882.2 | 1.65 | 2.60 | 337 | 93 | 79 | 250 | 55 | 2 |
| 18 | 4 | 730 | 884.7 | 0.93 | 1.40 | 337 | 95 | 79 | 250 | 50 | 1 |
| 19 | 5 | 1000 | 886.3 | 0.97 | 1.50 | 339 | 95 | 80 | 250 | 50 | 1 |
| 20 | 6 | 1230 | 888.1 | 1.70 | 2.70 | 341 | 95 | 80 | 250 | 55 | 2 |
| 21 | | | | | | | | | | | |
| 22 | 1 | 1510 | 890.401 | 0.15 | 0.22 | 321 | 97 | 81 | 250 | 55 | 1 |
| 23 | 2 | 230 | 891.1 | 0.10 | 0.14 | 329 | 92 | 82 | 250 | 55 | 1 |
| 24 | 3 | 500 | 891.9 | 0.30 | 0.45 | 340 | 91 | 83 | 250 | 55 | 1 |
| 25 | 4 | 730 | 892.8 | 0.16 | 0.23 | 339 | 91 | 83 | 250 | 55 | 1 |
| 26 | 5 | 1000 | 893.6 | 0.17 | 0.24 | 339 | 90 | 83 | 250 | 55 | 1 |
| 27 | 6 | 1230 | 894.5 | 0.15 | 0.22 | 336 | 89 | 83 | 250 | 55 | 1 |
| 28 | END | 1510 | 895.126 | | | | | | | | |
| 29 | | | | | | | | | | | |
| 30 | | | Leak check 0.006 @ 6" Hg | | | | | | | | |
| 31 | | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| 33 | | | | | | | 88 | 77 | | | |
| 34 | | | | | | | | | | | |
| 35 | | | 38.472 | 0.8793 | 1.3354 | 338.75 | | 82.87 | | | |

PARTICULATE CATCH ANALYSIS:

SAMPLES: Hercules, Boiler No. 4

DATE TAKEN: May 8, 9, 1984 DATE ANALYZED: May 10, 11, 1984

SAMPLES DELIVERED BY: DGR RECEIVED BY: DGR

ANALYZED BY: DGR

Filter treatment: 205°C over 2hrs, cooled in desiccator, weighed to constant wt.

| FILTERS: | RUN 1 | Run 2 | Run 3 |
|---|---|---|---|
| Filter No. | 1079 | 1082 | 1083 |
| Tare wt., g | 0.5690 | 0.5227 | 0.5258 |
| Final wt., g | 0.6941 | 0.6012 | 0.5645 |
| Net gain, g | 0.1251 | 0.0785 | 0.0387 |

Probe wash treatment: Acetone evaporated over boiling water bath

| PROBE WASH: | Run 1 | Run 2 | Run 3 | Blank |
|---|---|---|---|---|
| Container ID | HB4-1 | HB4-2 | HB4-3 | — |
| Volume intact? | ✓ | ✓ | ✓ | — |
| Volume, ml | 210 | 160 | 205 | 200 |
| Tare wt., g | (6) 114.8371 | (7) 110.1026 | (8) 111.5628 | |
| Final wt., g | 114.9543 | 110.1480 | 111.6402 | |
| Net gain, g | 0.1172 | 0.0454 | 0.0774 | 0.0000 |
| Less blank, g | 0.0000 | 0.0000 | 0.0000 | — |

| PARTICULATE COLLECTED: | Run 1 | Run 2 | Run 3 |
|---|---|---|---|
| Net gains less blank, mg | 242.3 | 123.9 | 116.1 |

# DRY GAS METER CALIBRATION

Meter I.D. 591349 RAC  Date 4-16-84

Calibration Method DGM-OGA Bell Prover  By DGR

Calibration Meter I.D. 651729 y = 1.00

Barometric Pressure 29.81

Previous use: Initial calibration following overhaul on 4-16-84

| Vac in. Hg | DH in. $H_2O$ | Time min. | Calibrating Meter Vi cf | Calibrating Meter Vf cf | Calibrating Meter Temp °F | Field Meter Vi cf | Field Meter Vf cf | Field Meter Temp °F In | Field Meter Temp °F out | Y |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.5 | 15 | 429.267 | 435.799 | 68 | 636.855 | 643.534 | 84 · 96 | 71 · 71 | .9999 |
| 1 | 0.75 | 15 | 435.799 | 443.676 | 68 | 643.534 | 651.653 | 93 · 106 | 71 · 74 | 1.0014 |
| 1 | 1.00 | 15 | 443.676 | 452.711 | 67 | 651.653 | 660.899 | 70 · 97 | 70 · 70 | 0.9928 |
| 1 | 1.50 | 15 | 452.711 | 463.338 | 67 | 660.899 | 671.806 | 98 · 113 | 70 · 73 | 1.0103 |
| 1 | 2.80 | 15 | 463.338 | 477.931 | 68 | 671.806 | 686.806 | 111 · 124 | 73 · 78 | 1.0183 |
| | | | | | | | | · | Avg = | 1.0045 |
| | | | | | | | | · | ± Y = | 1.00 |
| | | | | | | | | · | · | |

$$Y = [(Vcal)(Pbar)(Tdgm)]/[(Vdgm)(Pm)(Tcal)]$$

Where:

Y = Meter correction factor

Vcal = Volume of gas through calibrating meter, $ft.^3$

Vdgm = Volume of gas through field dry gas meter, $ft.^3$

Pbar = Barometric pressure, in. Hg

Pm = Meter pressure, {Pbar+DH/13.6}, in. Hg

Tdgm = Average Dry gas meter temp., $^oR$

Tcal = Temperature of gas through calibrating meter, $^oR$

# DRY GAS METER CALIBRATION

Meter I.D. RAC 1 591349 Date 9-10-84

Calibration Method DGm/DGm By DGR

Calibration Meter I.D. 651729

Barometric Pressure 30.07

Previous use: Hercules Boiler 3, 4, 1 .. May 8 & 9, 1984

| Vac in. Hg | DH in. $H_2O$ | Time min. | Calibrating Meter Vi cf | Calibrating Meter Vf cf | Calibrating Meter Temp °F | Field Meter Vi cf | Field Meter Vf cf | Field Meter Temp °F in | Field Meter Temp °F out | Y |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 0.75 | 15 | 655.395 | 663.202 | 74 | 004.816 | 012.983 | 95·113 | 92·91 | .9966 |
| 3 | 1.20 | 15 | 663.202 | 672.444 | 74 | 012.983 | 022.653 | 113·105 | 91·85 | 1.0004 |
| 3 | 1.80 | 17 | 672.444 | 685.453 | 70 | 022.653 | 036.148 | 105·109 | 83·82 | 1.0046 |
| | | | | | | | | · | Adj= | 1.0005 |
| | | | | | | | | · | ·Y= | 1.00 |
| | | | | | | | | · | · | |
| | | | | | | | | · | · | |
| | | | | | | | | · | · | |

$$Y = [(Vcal)(Pbar)(Tdgm)]/[(Vdgm)(Pm)(Tcal)]$$

Where:

Y = Meter correction factor

Vcal = Volume of gas through calibrating meter, $ft.^3$

Vdgm = Volume of gas through field dry gas meter, $ft.^3$

Pbar = Barometric pressure, in. Hg

Pm = Meter pressure, {Pbar+DH/13.6}, in. Hg

Tdgm = Average Dry gas meter temp., $^oR$

Tcal = Temperature of gas through calibrating meter, $^oR$

# DRY GAS METER CALIBRATION

Meter I.D. SS 1349 Date 5-22-84

Calibration Method D6m - D6m By DGR

Calibration Meter I.D. 651729 D.6M 1.00

Barometric Pressure 30.20

Previous use: Hercules Boiler No. 2 5-22-84

| Vac in. Hg | DH in. $H_2O$ | Time min. | Calibrating Meter Vi cf | Calibrating Meter Vf cf | Calibrating Meter Temp °F | Field Meter Vi cf | Field Meter Vf cf | Field Meter Temp °F in | Field Meter Temp °F out | Y |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 1.0 | 16 | 685.455 | 694.977 | 71 | 334.049 | 344.068 | 99·104 | 94·85 | .9918 |
| 2 | 1.7 | 15 | 694.977 | 706.258 | 71 | 344.068 | 355.794 | 100·106 | 81·79 | .9951 |
| 2 | 0.9 | 15 | 706.258 | 714.674 | 70 | 355.794 | 364.563 | 104·109 | 78·79 | .9983 |
| | | | | | | | | · | Avg | .9951 |
| | | | | | | | | · | Y= | 1.004 |
| | | | | | | | | · | · | |
| | | | | | | | | · | · | |
| | | | | | | | | · | · | |

$$Y = [(Vcal)(Pbar)(Tdgm)]/[(Vdgm)(Pm)(Tcal)]$$

Where:

Y = Meter correction factor

Vcal = Volume of gas through calibrating meter, $ft.^3$

Vdgm = Volume of gas through field dry gas meter, $ft.^3$

Pbar = Barometric pressure, in. Hg

Pm = Meter pressure, {Pbar+DH/13.6}, in. Hg

Tdgm = Average Dry gas meter temp., $^oR$

Tcal = Temperature of gas through calibrating meter, $^oR$

# THERMOMETER CALIBRATION

Date: 5-22-84 By: DER

Calibrating Themometer ASTM mercury in glass 20-760°F

| Field Thermometer I.D. | | Temp. Source | Mercury Therm. °F | Field Therm. °F | Accuracy | Avg. |
|---|---|---|---|---|---|---|
| 5' T'couple w/Omega Digital | 1 | Table | 366 | 362 | 100 | |
| | 2 | Furnace | | | | |
| | 3 | | | | | |
| | 4 | | | | | |
| Meter in T'couple Omega | 1 | Room | 74 | 74 | 100 | |
| | 2 | | | | | |
| | 3 | | | | | |
| | 4 | | | | | |
| Met out T'couple Omega | 1 | Room | 74 | 74 | 100 | |
| | 2 | | | | | |
| | 3 | | | | | |
| | 4 | | | | | |
| Sample Box Dial Metallic | 1 | Sample Box | 230 | 225 | 99 | |
| | 2 | | | | | |
| | 3 | | | | | |
| | 4 | | | | | |
| Impinger outlet Dial Bimetallic | 1 | Room | 74 | 70 | 99 | |
| | 2 | | | | | |
| | 3 | | | | | |
| | 4 | | | | | |
| | 1 | | | | | |
| | 2 | | | | | |
| | 3 | | | | | |
| | 4 | | | | | |

## Visible Emissions Evaluation Record

Plant Name: Hercules Inc.

Address: West 7th St.

City: Hattiesburg Miss

Emission Point: 010

Date: 5-22-84

Is emission point operation normal ? _____

V. E. Observer: Bobbie Draughn

Certification Expiration: 10-19-84

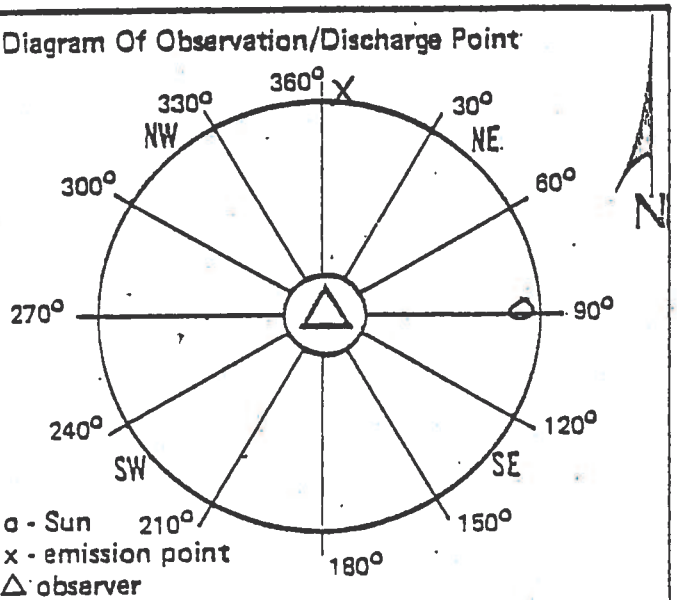
| Set No. | Time Start | Time End | Opacity Sum | Opacity Average |
|---|---|---|---|---|
| 1 | 9 33 Am | 9 39 Am | 250 | 10.4 |
| 2 | 9 39 Am | 9 45 Am | 210 | 8.8 |
| 3 | 9 45 Am | 9 51 Am | 275 | 11.5 |

Overall Average: 10.2

| | Initial | Final |
|---|---|---|
| Distance to discharge | 2 Lengths | |
| Direction to discharge | N | |
| Height of observation point | Ground | |
| Height of discharge | 225 ft. | |
| Plume color | Gray | |
| Plume background | Gray Sky | |
| Water vapor in plume ? | | |
| Wind direction (from) | SE | |
| Wind speed | 10 mph | |
| Ambient temperature | 66° | |
| Discharge temperature | | |
| Sky conditions | Cloudy | |

| Min. | Seconds 0 | 15 | 30 | 45 |
|---|---|---|---|---|
| 0 | 10 | 15 | 15 | 10 |
| 1 | 10 | 10 | 10 | 10 |
| 2 | 10 | 10 | 10 | 10 |
| 3 | 10 | 10 | 10 | 10 |
| 4 | 10 | 10 | 10 | 10 |
| 5 | 10 | 10 | 10 | 10 |
| 0 | 10 | 10 | 10 | 10 |
| 1 | 10 | 10 | 10 | 10 |
| 2 | 10 | 10 | 5 | 5 |
| 3 | 10 | 10 | 10 | 10 |
| 4 | 5 | 5 | 10 | 10 |
| 5 | 5 | 10 | 5 | 10 |
| 0 | 10 | 10 | 15 | 15 |
| 1 | 20 | 20 | 25 | 25 |
| 2 | 10 | 10 | 15 | 15 |
| 3 | 10 | 10 | 10 | 10 |
| 4 | 10 | 5 | 5 | 5 |
| 5 | 5 | 5 | 5 | 5 |

Diagram Of Observation/Discharge Point




Remarks: _____

Received By: _____

## Visible Emissions Evaluation Record

Plant Name: Hercules Inc.

Address: West 7th St.

City: Hattiesburg Miss.

Emission Point: 009

Date: 5-22-84

Is emission point operation normal ? _____

V. E. Observer: Bobbie Draughn

Certification Expiration: 10-19-84

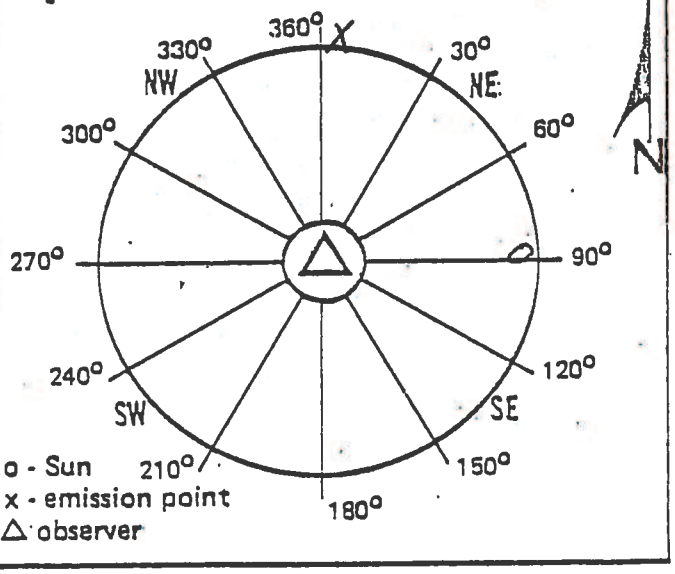
| Set No. | Time | | Opacity | |
|---|---|---|---|---|
| | Start | End | Sum | Average |
| 1 | 9^33 Am | 9^39 Am | 355 | 14.8 |
| 2 | 9^39 Am | 9^45 Am | 475 | 19.8 |
| 3 | 9^45 Am | 9^51 Am | 430 | 17.9 |

Overall Average: 17.5

| | Initial | Final |
|---|---|---|
| Distance to discharge | 2 Lengths | |
| Direction to discharge | N | |
| Height of observation point | Ground | |
| Height of discharge | 200 ft. | |
| Plume color | Gray | |
| Plume background | Gray Sky | |
| Water vapor in plume ? | | |
| Wind direction (from) | SE | |
| Wind speed | 10 mph | |
| Ambient temperature | 66° | |
| Discharge temperature | | |
| Sky conditions | Cloudy | |

| Min. | Seconds 0 | 15 | 30 | 45 |
|---|---|---|---|---|
| 0 | 10 | 15 | 15 | 15 |
| 1 | 20 | 15 | 15 | 15 |
| 2 | 15 | 15 | 15 | 15 |
| 3 | 15 | 15 | 10 | 10 |
| 4 | 15 | 15 | 20 | 15 |
| 5 | 15 | 15 | 15 | 15 |
| 0 | 15 | 15 | 15 | 15 |
| 1 | 15 | 15 | 15 | 15 |
| 2 | 15 | 15 | 15 | 15 |
| 3 | 20 | 25 | 25 | 25 |
| 4 | 25 | 25 | 25 | 25 |
| 5 | 25 | 25 | 25 | 25 |
| 0 | 25 | 25 | 25 | 25 |
| 1 | 20 | 20 | 20 | 20 |
| 2 | 20 | 20 | 20 | 20 |
| 3 | 15 | 15 | 15 | 15 |
| 4 | 15 | 15 | 10 | 15 |
| 5 | 15 | 15 | 10 | 15 |

Diagram Of Observation/Discharge Point




Remarks: _____

Received By: _____

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Rev. 5/17/82

# BOILER ROOM LOG SHEET

Date 5-22-92

| ITEM | | | | | 7-3 SHIFT |
|---|---|---|---|---|---|
| Cleaned fires No. 1 Boiler | Started | | | | 11:00 |
| | Stopped | | | | 12:30 |
| Cleaned fires No. 2 Boiler START | Started | | | | 7:00 |
| | Stopped | | | | 8:00 |
| Cleaned fires No. 3 Boiler | Started | | | | 8:30 |
| | Stopped | | | | 10:00 |
| Cleaned fires No. 4 Boiler | Started | | | | X |
| | Stopped | | | | X |
| Checked Fly Ash Hoppers | No. 1 Boiler | | | | |
| | No. 2 Boiler | | | | |
| | No. 3 Boiler | | | | |
| | No. 4 Boiler | | | | X |
| Residue Received - Gal. | | | | | |
| Residue Burned - Boilers | No. 1 ✓ | No. 2 | No. 3 ✓ | No. 4 | |
| #6 Oil Burned - Boilers | | | | | |

Residue Remaining In S-89 _____ (M Gal.).

Comments:

METER READINGS

| Unit | Start | End | Diff. |
|---|---|---|---|
| #1 | 79937 | | |
| #2 | 68807 | | |
| #3 | 98736 | | |
| #4 | X | X | |
| #5 | X | X | |
| Tet. Gas | 234111 | | |
| #5 Gas | X | X | |
| #5 Oil | X | X | |
| N. | 36707 | | |
| S. | 95087 | | |
| Total | | | |

PERSONNEL

Fireman Foster
#1 Ash Roller Smith
#2 Ash Roller McCullen
Fuel House Howe
#2 Helper Jackson

7-3 Start 6 AM - End 2 PM)
3-11 Start 2 PM - End 10 PM) Read meters at these times
11-7 Start 10 PM - End 6 AM)

# OPACITY EVALUATION - WOOD BURNING BOILERS

Date 5-22-84

| Boiler No. 1 | | | Boiler No. 2 | | | Boiler No. 3 | | | Boiler No. 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | Duration | Note | Time | Duration | Note | Time | Duration | Note | Time | Duration | Note |
| | | | | | | 7:50 | 5 Min | 4 | | | |
| | | | | | | | | | | | |
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NOTES:

1. Load change.
2. Fuel oil adjustment.
3. Cleaning furnace.
4. Meter defect.
5. Cleaning meter lenses.

M = Minutes

# HERCULES

## Visible Emissions Evaluation Record

Plant Name: Hercules Inc

Address: West 7th St

City: Hi'bng Miss

Emission Point: 010

Date: 5-9-84

Is emission point operation normal ? _____

V. E. Observer: Bobbie Draughn

Certification Expiration: _____

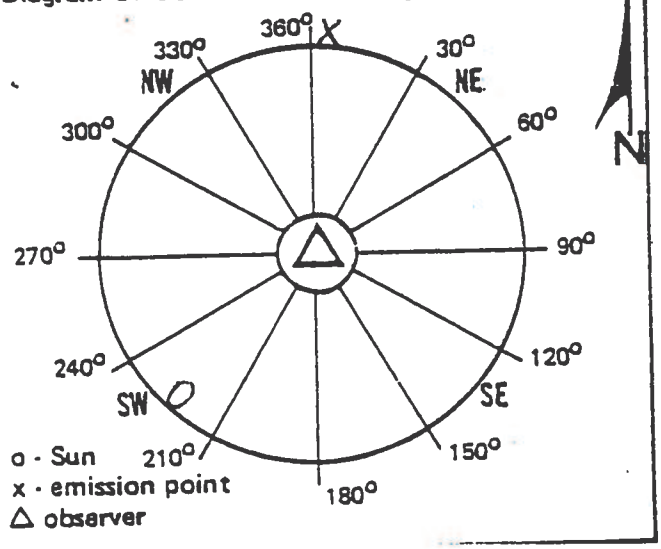
| Set No. | Time | | Opacity | |
|---|---|---|---|---|
| | Start | End | Sum | Average |
| 1 | 1 55 pm | 2 01 pm | 300 | 12.5 |
| 2 | 2 01 pm | 2 07 pm | 295 | 12.3 |
| 3 | 2 07 pm | 2 13 pm | 230 | 9.6 |

Overall Average: 11.5

| | Initial | Final |
|---|---|---|
| Distance to discharge | 2 Lengths | |
| Direction to discharge | N | |
| Height of observation point | Ground | |
| Height of discharge | 225 ft | |
| Plume color | Gray | |
| Plume background | Blue Sky | |
| Water vapor in plume ? | | |
| Wind direction (from) | NW | |
| Wind speed | 10-20 mph | |
| Ambient temperature | 77° | |
| Discharge temperature | | |
| Sky conditions | Clear | |

| | Seconds | | | |
|---|---|---|---|---|
| Min. | 0 | 15 | 30 | 45 |
| 0 | 10 | 10 | 10 | 10 |
| 1 | 10 | 10 | 10 | 10 |
| 2 | 10 | 10 | 15 | 10 |
| 3 | 10 | 15 | 15 | 15 |
| 4 | 15 | 15 | 15 | 15 |
| 5 | 15 | 15 | 15 | 15 |
| 0 | 15 | 10 | 15 | 10 |
| 1 | 15 | 15 | 10 | 15 |
| 2 | 15 | 15 | 15 | 15 |
| 3 | 15 | 15 | 15 | 15 |
| 4 | 15 | 10 | 10 | 10 |
| 5 | 5 | 5 | 5 | 10 |
| 0 | 10 | 10 | 10 | 10 |
| 1 | 10 | 15 | 15 | 10 |
| 2 | 15 | 15 | 15 | 10 |
| 3 | 10 | 15 | 10 | 10 |
| 4 | 5 | 5 | 5 | 5 |
| 5 | 5 | 5 | 5 | 5 |

Diagram Of Observation/Discharge Point




Remarks: _____

Received By: _____

# HERCULES

## Visible Emissions Evaluation Record

Plant Name: Hercules Inc

Address: West 7th St

City: Hattiesburg Miss

Emission Point: 009

Date: 5-9-84

Is emission point operation normal ? _____

V. E. Observer: Bobbie Draughon

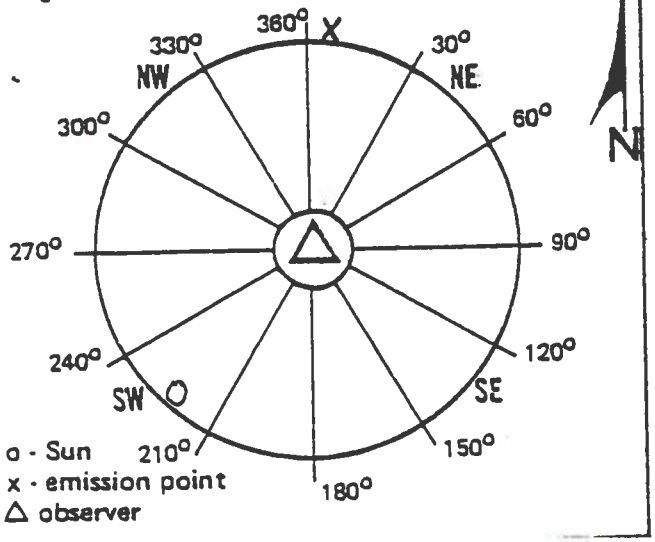
Certification Expiration: _____

| Set No. | Time | | Opacity | |
|---|---|---|---|---|
| | Start | End | Sum | Average |
| 1 | 1 55 PM | 2 01 PM | 310 | 12.9 |
| 2 | 2 01 PM | 2 07 PM | 365 | 15.2 |
| 3 | 2 07 PM | 2 13 PM | 350 | 14.6 |

Overall Average: 14.2

| | Initial | Final |
|---|---|---|
| Distance to discharge | 2 Lengths | |
| Direction to discharge | N | |
| Height of observation point | Ground | |
| Height of discharge | 200 ft. | |
| Plume color | Gray | |
| Plume background | Blue Sky | |
| Water vapor in plume ? | | |
| Wind direction (from) | NW | |
| Wind speed | 10-20 mph | |
| Ambient temperature | 77° | |
| Discharge temperature | | |
| Sky conditions | Clear | |

Diagram Of Observation/Discharge Point




| Min. | Seconds 0 | 15 | 30 | 45 |
|---|---|---|---|---|
| 0 | 10 | 10 | 10 | 10 |
| 1 | 10 | 15 | 10 | 10 |
| 2 | 10 | 10 | 15 | 15 |
| 3 | 10 | 15 | 15 | 15 |
| 4 | 15 | 15 | 15 | 15 |
| 5 | 15 | 15 | 15 | 15 |
| 0 | 15 | 15 | 15 | 15 |
| 1 | 15 | 15 | 15 | 15 |
| 2 | 15 | 15 | 15 | 15 |
| 3 | 20 | 20 | 20 | 20 |
| 4 | 15 | 15 | 15 | 15 |
| 5 | 15 | 10 | 10 | 10 |
| 0 | 10 | 10 | 15 | 15 |
| 1 | 15 | 20 | 20 | 20 |
| 2 | 20 | 15 | 20 | 15 |
| 3 | 15 | 15 | 15 | 15 |
| 4 | 15 | 15 | 15 | 10 |
| 5 | 10 | 10 | 10 | 10 |

Remarks: _____

Received By: _____

S-48
Rev. 5/17/82

# BOILER ROOM LOG SHEET

Date 5-9-84

| ITEM | | | 3/11 SHIF |
|---|---|---|---|
| Cleaned fires No. 1 Boiler | | Started | 8.00 |
| | | Stopped | 1.00 |
| Cleaned fires No. 2 Boiler | OUT | Started | |
| | | Stopped | |
| Cleaned fires No. 3 Boiler | START | Started | 3.20 |
| | | Stopped | 4.35 |
| Cleaned fires No. 4 Boiler | | Started | 5.00 |
| | | Stopped | 6.05 |
| Checked Fly Ash Hoppers | | No. 1 Boiler | |
| | | No. 2 Boiler | |
| | | No. 3 Boiler | |
| | | No. 4 Boiler | |
| Residue Received - Gal. | | | |

| | No. 1 | No. 2 | No. 3 | No. 4 |
|---|---|---|---|---|
| Residue Burned - Boilers | | | | |
| #6 Oil Burned - Boilers | | | | |

Residue Remaining In S-89 _____ (M Gal.). 94% at 2:00 p.m.

Comments:

## METER READINGS

| Unit | Start | End | Diff. |
|---|---|---|---|
| #1 | 84847 | 87294 | 2447 |
| #2 | X | | |
| #3 | 86083 | 89461 | 3378 |
| #4 | 28128 | 31288 | 3160 |
| #5 | X | | |
| Tot. Gas | 228002 | 229862 | 1860 |
| #5 Gas | X | | |
| #5 Oil | X | | |
| N. | 36663 | 36666 | 3 |
| S. | 95036 | 95037 | 1 |
| Total | | | 898,500 |

## PERSONNEL

Fireman Stephens
#1 Ash Roller Smith
#2 Ash Roller Travis
Fuel House Tisdale
#2 Helper Gray

7-3 Start 6 AM - End 2 PM)
3-11 Start 2 PM - End 10 PM) Read meters at these times
11-7 Start 10 PM - End 6 AM)

S-48
Rev. 5/17/82

# BOILER ROOM LOG SHEET

Date [illegible]

| ITEM | | SHIFT |
|---|---|---|
| Cleaned fires No. 1 Boiler | Started | 8 .11 |
| | Stopped | 9 .45 |
| Cleaned fires No. 2 Boiler | Started | X |
| | Stopped | X |
| Cleaned fires No. 3 Boiler | Started | 7 .00 |
| | Stopped | 8 .10 |
| Cleaned fires No. 4 Boiler | Started | 11 .30 |
| | Stopped | 12 .40 |
| Checked Fly Ash Hoppers | No. 1 Boiler | |
| | No. 2 Boiler | X |
| | No. 3 Boiler | |
| | No. 4 Boiler | |
| Residue Received - Gal. | | |

| | No. 1 | No. 2 | No. 3 | No. 4 |
|---|---|---|---|---|
| Residue Burned - Boilers | 0 | X | 0 | 0 |
| #6 Oil Burned - Boilers | | | | |

Residue Remaining In S-89 _____ (M Gal.). 94%

94% at 2 Pm.

Comments:

METER READINGS

| Unit | Start | End | Diff. |
|---|---|---|---|
| #1 | 81943 | 84847 | 2 9 0 4 |
| #2 | X | X | X |
| #3 | 82575 | 86083 | 3 5 0 8 |
| #4 | 25727 | 28128 | 2 4 0 1 |
| #5 | X | X | X |
| Tet. Gas | 224355 | 228002 | 3647 |
| #5 Gas | X | X | X |
| #5 Oil | X | X | X |
| | 36663 | 36663 | 0 |
| | 95034 | 95036 | 6 |
| Total | | | |

880300

PERSONNEL

Fireman [illegible]
#1 Ash Roller [illegible]
#2 Ash Roller [illegible]
Fuel House [illegible]
#2 Helper [illegible]

7-3 Start 6 AM - End 2 PM)
3-11 Start 2 PM - End 10 PM)
11-7 Start 10 PM - End 6 AM)

Read meters at these times

#1 30133
#3 42579
#4 34867

TOTAL STEAM 111,579

TOTAL GAS 551

28 on hill

## OPACITY EVALUATION - WOOD BURNING BOILERS

Date 5-9-84

7-5

| Boiler No. 1 | | | Boiler No. 2 | | | Boiler No. 3 | | | Boiler No. 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | Duration | Note | Time | Duration | Note | Time | Duration | Note | Time | Duration | Note |
| 8:15 | 10 c | 1 | | 0 | | | 0 | | | 0 | |
| | | | | | | | | | | | |
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NOTES:

1. Load change.
2. Fuel oil adjustment.
3. Cleaning furnace
4. Meter defect.
5. Cleaning meter lenses.

Jackson

## OPACITY EVALUATION - WOOD BURNING BOILERS

Date 5-9-84
3/11 SHIFT

| Boiler No. 1 | | | Boiler No. 2 | | | Boiler No. 3 | | | Boiler No. 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | Duration | Note | Time | Duration | Note | Time | Duration | Note | Time | Duration | Note |
| 1 [illegible] | 30-S | 2 | | | | 7:21 | 20-S | 2 | 7:11 | 20-S | 2 |
| | | | | | | 7:58 | 20-S | 2 | 7:53 | 30-S | 2 |
| | | | | | | 9:13 | 20-S | 2 | | | |

NOTES:

1. Load change.
2. Fuel oil adjustment.
3. Cleaning furnace
4. Meter defect.
5. Cleaning meter lenses.

Stephens

HERCULES

## Visible Emissions Evaluation Record

Plant Name: Hercules Inc.

Address: West 7th St.

City: Hattiesburg Miss.

Emission Point: 009

Date: 5-8-84

Is emission point operation normal ?

V. E. Observer: Bobbie Draughn

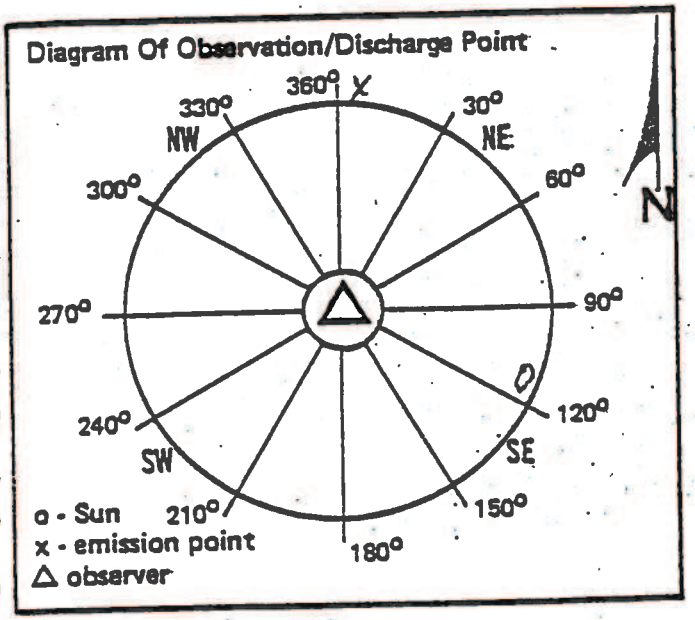
Certification Expiration:

| Set No. | Time Start | Time End | Opacity Sum | Opacity Average |
|---|---|---|---|---|
| 1 | 9^04 Am | 9^10 Am | 240 | 10.0 |
| 2 | 9^09 Am | 9^15 Am | 240 | 10.0 |
| 3 | 9^16 Am | 9^22 Am | 240 | 10.0 |

Overall Average: 10.0

| | Initial | Final |
|---|---|---|
| Distance to discharge | 2 Lengths. | |
| Direction to discharge | N | |
| Height of observation point | Ground | |
| Height of discharge | 200 ft. | |
| Plume color | Gray | |
| Plume background | Gray Sky | |
| Water vapor in plume ? | | |
| Wind direction (from) | W | |
| Wind speed | 5-10 mph | |
| Ambient temperature | 67° | |
| Discharge temperature | | |
| Sky conditions | Cloudy | |

Diagram Of Observation/Discharge Point




| Min. | Seconds 0 | 15 | 30 | 45 |
|---|---|---|---|---|
| 0 | 10 | 10 | 10 | 10 |
| 1 | 10 | 10 | 10 | 10 |
| 2 | 10 | 10 | 10 | 10 |
| 3 | 10 | 10 | 10 | 10 |
| 4 | 10 | 10 | 10 | 10 |
| 5 | 10 | 10 | 10 | 10 |
| 0 | 10 | 10 | 10 | 10 |
| 1 | 10 | 10 | 10 | 10 |
| 2 | 10 | 10 | 10 | 10 |
| 3 | 10 | 10 | 10 | 10 |
| 4 | 10 | 10 | 10 | 10 |
| 5 | 10 | 10 | 10 | 10 |
| 0 | 10 | 10 | 10 | 10 |
| 1 | 10 | 10 | 10 | 10 |
| 2 | 10 | 10 | 10 | 10 |
| 3 | 10 | 10 | 10 | 10 |
| 4 | 10 | 10 | 10 | 10 |
| 5 | 10 | 10 | 10 | 10 |

Remarks:

Received By:

HERCULES

## Visible Emissions Evaluation Record

Plant Name: Hercules Inc.

Address: West 7th St.

City: H'burg. Miss

Emission Point: 010

Date: 5-8-84

Is emission point operation normal ? _____

V. E. Observer: Bobbie Draughn

Certification Expiration: _____

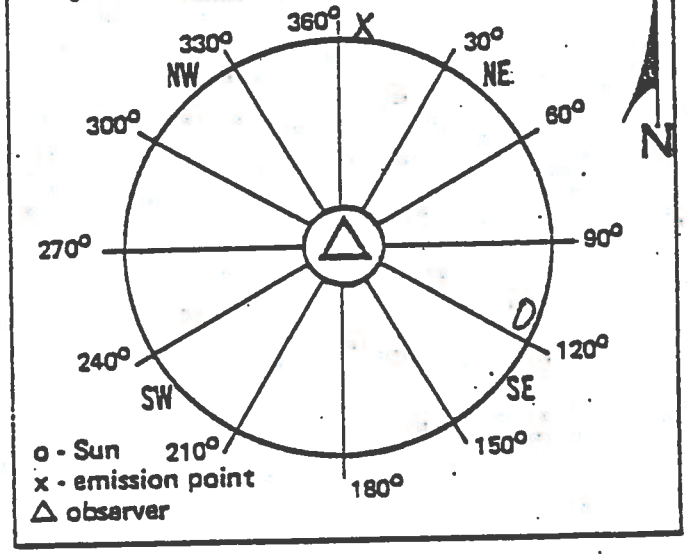
| Set No. | Time | | Opacity | |
|---|---|---|---|---|
| | Start | End | Sum | Average |
| 1 | 9⁰⁴ Am | 9¹⁰ Am | 375 | 15.6 |
| 2 | 9¹⁰ Am | 9¹⁶ Am | 405 | 16.9 |
| 3 | 9¹⁶ Am | 9²² Am | 460 | 19.2 |

Overall Average: 17.2

| | Initial | Final |
|---|---|---|
| Distance to discharge | 2 Lengths | |
| Direction to discharge | N | |
| Height of observation point | Ground | |
| Height of discharge | 225 ft. | |
| Plume color | Gray | |
| Plume background | Gray Sky | |
| Water vapor in plume ? | | |
| Wind direction (from) | W | |
| Wind speed | 5-10 mph | |
| Ambient temperature | 67° | |
| Discharge temperature | | |
| Sky conditions | Cloudy | |

| Min. | Seconds 0 | 15 | 30 | 45 |
|---|---|---|---|---|
| 0 | 15 | 15 | 20 | 20 |
| 1 | 15 | 15 | 15 | 15 |
| 2 | 15 | 15 | 15 | 15 |
| 3 | 15 | 15 | 15 | 15 |
| 4 | 15 | 15 | 20 | 20 |
| 5 | 15 | 15 | 10 | 15 |
| 0 | 20 | 15 | 15 | 15 |
| 1 | 20 | 20 | 15 | 15 |
| 2 | 15 | 15 | 20 | 15 |
| 3 | 15 | 20 | 20 | 20 |
| 4 | 20 | 20 | 15 | 15 |
| 5 | 15 | 15 | 15 | 15 |
| 0 | 15 | 15 | 15 | 25 |
| 1 | 25 | 20 | 20 | 15 |
| 2 | 15 | 20 | 20 | 15 |
| 3 | 20 | 20 | 20 | 20 |
| 4 | 20 | 20 | 15 | 15 |
| 5 | 20 | 20 | 25 | 25 |

Diagram Of Observation/Discharge Point




Remarks: _____

Received By: _____

48
ev. 5/17/82

# BOILER ROOM LOG SHEET

Date 5-[illegible]-[illegible]

| ITEM | | SHIFT |
|---|---|---|
| Cleaned fires No. 1 Boiler | Started | 11.30 |
| | Stopped | 1.25 |
| Cleaned fires No. 2 Boiler | Started | |
| | Stopped | |
| Cleaned fires No. 3 Boiler | Started | 7.25 |
| | Stopped | 9.50 |
| Cleaned fires No. 4 Boiler | Started | 9.51 |
| | Stopped | 10.35 |
| Checked Fly Ash Hoppers | No. 1 Boiler | ✓ |
| | No. 2 Boiler | X |
| | No. 3 Boiler | ✓ |
| | No. 4 Boiler | ✓ |
| Residue Received - Gal. water & Slate dump in | | 4500 |

| | No. 1 | No. 2 | No. 3 | No. 4 |
|---|---|---|---|---|
| Residue Burned - Boilers | 0 | X | 0 | 0 |
| #6 Oil Burned - Boilers | | | | |

Residue Remaining In S-89 _____ (M Gal.): 516 at 6 A.M.
94 70 at 2:PM.

Comments:

## METER READINGS

| Unit | Start | End | Diff. |
|---|---|---|---|
| #1 | 73907 | 76853 | 2946 |
| #2 | X | X | |
| #3 | 72809 | 76318 | 3509 |
| #4 | 16583 | 19212 | 2629 |
| #5 | X | X | |
| Net. Gas | 219743 | 222322 | 3179 |
| #5 Gas | X | X | |
| #5 Oil | X | X | |
| #N | 36663 | 36663 | 0 |
| | 95034 | 95034 | 0 |
| Total | | | |

## PERSONNEL

Fireman [illegible]
#1 Ash Roller Smith
#2 Ash Roller Travis
Fuel House Horne
#2 Helper Myers

898400

7-3 Start 6 AM - End 2 PM)
3-11 Start 2 PM - End 10 PM)
11-7 Start 10 PM - End 6 AM)

#1 33483
#3 40692
#4 38100

Read meters at these times

TOTAL STEAM 112225

TOTAL GAS 461

S-48
Rev. 5/17/82

# BOILER ROOM LOG SHEET

Date 5-8-82

| ITEM | | 3/11 SHIFT |
|---|---|---|
| Cleaned fires No. 1 Boiler | Started | 7.35 |
| | Stopped | 9.05 |
| Cleaned fires No. 2 Boiler | Started | |
| | Stopped | |
| Cleaned fires No. 3 Boiler | Started | 4 |
| | Stopped | 1.35 |
| Cleaned fires No. 4 Boiler | Started | 3.20 |
| | Stopped | 4.20 |
| Checked Fly Ash Hoppers | No. 1 Boiler | |
| | No. 2 Boiler | X |
| | No. 3 Boiler | |
| | No. 4 Boiler | |

| | No. 1 | No. 2 | No. 3 | No. 4 |
|---|---|---|---|---|
| Residue Received - Gal. | | | | |
| Residue Burned - Boilers | | | | |
| #6 Oil Burned - Boilers | | | | |

Residue Remaining In S-89 _____ (M Gal.). 94% at 2:Van.

Comments:

## METER READINGS

| Unit | Start | End | Diff. |
|---|---|---|---|
| #1 | 76853 | 79583 | 2730 |
| #2 | X | X | |
| #3 | 76318 | 79435 | 3117 |
| #4 | 19212 | 22517 | 3305 |
| #5 | X | X | |
| Tot. Gas | 222322 | 224355 | 2033 |
| #5 Gas | X | X | |
| #5 Oil | X | X | |
| N | 36663 | 36665 | 0 |
| S | 95034 | 95034 | 0 |
| Total | | | |

915,200

## PERSONNEL

Fireman Stephens
#1 Ash Roller Smith + Price
#2 Ash Roller McDonald
Fuel House Russell
#2 Helper Gray

7-3 Start 6 AM - End 2 PM)
3-11 Start 2 PM - End 10 PM) Read meters at these times
11-7 Start 10 PM - End 6 AM)

# OPACITY EVALUATION - WOOD BURNING BOILERS

Date 5-8-84

7-3

| Boiler No. | | | Boiler No. 2 | | | Boiler No. 3 | | | Boiler No. 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | Duration | Note | Time | Duration | Note | Time | Duration | Note | Time | Duration | Note |
| | | | | | | | | | | | |
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NOTES:

1. Load change.
2. Fuel oil adjustment.
3. Cleaning furnace.
4. Meter defect.
5. Cleaning meter lenses.

Jackson

# OPACITY EVALUATION - WOOD BURNING BOILERS

Date 5-8-84
3/11

| Boiler No. 1 | | | Boiler No. 2 | | | Boiler No. 3 | | | Boiler No. 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | Duration | Note | Time | Duration | Note | Time | Duration | Note | Time | Duration | Note |
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NOTES:

1. Load change.
2. Fuel oil adjustment.
3. Cleaning furnace
4. Meter defect.
5. Cleaning meter lenses.

Stephens

HERCULES INCORPORATED

HATTIESBURG, MISSISSIPPI 39401

March 30, 1983

RECEIVED
MAR 31 REC'D
DEPT OF NATURAL RESOURCE
BUREAU OF POLLUTION CONTROL

Bureau of Pollution Control
P. O. Box 10385
Jackson, Mississippi 39209

Attention: Don Watts

Dear Mr. Watts:

Please find the enclosed test results for woodwaste boilers 3 and 4 on March 15 and 16, 1983. These results indicate a particulate concentration of 0.079 grains/dscf for boiler 3 and 0.096 grains/dscf for boiler 4 as compared to an allowable concentration of 0.30 grains/dscf.

If I can answer any questions, please call me.

Very truly yours,

Charles Jordan
Environmental Coordinator

CJ:bs

Enclosure

MODEL INPUT DATA
HERCULES, INC
MULTI-SOURCE CRSTER (ONE YEAR)
Jackson-Jackson 77 or MET DATA
Meridian - Burwood 64 => 366 * 1
03866 12863
→ MEM SHR 64

not a leap year
run for 365 days

FIRST IF WORKS

SOUTH STACK

Em Rate = 84.93 #/hr = 10.71 g/sec
Velocity = 32.12 ft/sec = 9.79 m/sec
Diameter = 10 ft = 3.048 m
Temperature = 369 °F = 460.2 °K
Stack Ht = 200 ft = 60.96 m

NORTH STACK

Em Rate = 71.43 #/hr = 9.01 g/sec
Velocity = 31.94 ft/sec = 9.74 m/sec
Diameter = 10 ft = 3.048 m
Temperature = 307 °F = 425.8 °K
Stack Ht = 225 ft = 68.58 m

.3, .5, .7, .9, 1.1

| EMI Rate | ST. Height | | | | | |
|---|---|---|---|---|---|---|
| Q | H | D | V | T | F | EVEV. |
| 31-40 | 41-45 | 46-50 | 51-55 | 56-60 | 61-70 | 71-8 |

FOR SOUTH STACK

① Temp - Avg $T_1 + T_2$

$(373 + 365)/2 = 369°F$

② Vol Flow - Add $(\text{Vol Flow})_1 + (\text{Vol Flow})_2$

$4,320,754 + 4,761,040 = 9,081,794\ ft^3/hr$

③ DIAMETER = 10 ft (given in appl.)

④ St. Ht = 200 ft (given in appl.)

⑤ VEL = Vol Flow / AREA OF STACK OUTLET

$= 9,081,794 / (\pi D^2/4)$

$= 115,633\ ft/hr\ (1hr/60\ min)(1min/60\ sec)$

VEL = 32.12 ft/sec

⑥ Em RATE = $ER_1 + ER_2 = 42.0 + 42.93 = 84.93\ \#/hr$

FOR NORTH STACK

① Temp - Avg $T_3 + T_4$

$(322 + 292)/2 = 307°F$

② Vol Flow - Add $(\text{Vol Flow})_3 + (\text{Vol Flow})_4$

$4,339,692 + 4,692,132 = 9,031,824\ ft^3/hr$

③ DIAMETER = 10 ft (given in appl)

④ St. Ht = 225 ft (given in appl)

⑤ VEL = Vol Flow / AREA

$= 9,031,824 / [\pi(10)^2/4]$

$= 114,997\ ft/hr\ (1hr/3600\ sec)$

VEL = 31.94 ft/sec

⑥ Em RATE = $ER_3 + ER_4 = 30.08 + 41.35 = 71.43\ \#/hr$

Stack Test 10/25/82 Boiler No.1

Em Rate 42.0 #/hr

Vel 60.40 ft/sec

Vol Flow 4,320,754 $ft^3$/hr

2,541,367 dscf/hr

Temp 373 °F

Stack Test 10/26/82 Boiler No.2

Em Rate 42.93 #/hr

Vel 61.95 ft/sec

Vol Flow 4,761,040 $ft^3$/hr

2,867,191 dscf/hr

Temp 365 °F

Stack Test 3/16/83 Boiler No. 3

Em Rate 30.08 #/hr

Vel 56.47 ft/sec

Vol Flow 4,339,692 $ft^3$/hr

2,676,248 dscf/hr

Temp 322 °F

Stack Test 3/15/83 Boiler No. 4

Em Rate 41.35 #/hr

Vel 61.06 ft/sec

Vol Flow 4,692,132 $ft^3$/hr

3,037,676 dscf/hr

Temp 292 °F

| | | | | | |
|---|---|---|---|---|---|
| #1 & 2 - 200 ~~ft~~ | 378° | 4.6' | 62.8 fps | 60.3 #/hr |
| #3 & 4 225 ~~ft~~ | 400° | 10' | 13.6 fps | 69.1 #/hr |

×

---

LAST APPL

009
#1 & #2
Combined

St Ht - 200 ft
DIA 10 ft
Vel 13.6 ft/sec
Temp 400°F

#3 & 4

St. Ht 225 ft
DIA 10 ft
Vel 13.6 ft/sec
Temp 400°F

# REPORT OF
# PARTICULATE EMISSIONS TESTS

## HERCULES, INC.
## WOODWASTE BOILERS - No. 3 and No. 4

## HATTIESBURG, MISSISSIPPI
## MARCH 15 and 16, 1983

Performed By:
Environmental Monitoring Laboratories, Inc.
Ridgeland, Mississippi

# ENVIRONMENTAL MONITORING LABORATORIES, INC.

P.O. Box 655 • 224-B Highway 51 North
Ridgeland, Mississippi 39157

(601) 856-3092


On March 15 and 16, 1983, Environmental Monitoring Laboratories performed air emissions tests on the No. 3 and the No. 4 woodwaste boilers operated by Hercules, Inc. in Hattiesburg, Mississippi.

The tests were performed to determine if particulate emissions from the boilers are within limits established by Mississippi Air Quality Regulation APC-S-1, Section 3, paragraph 4.(b) - specifically 0.30 grains per dry standard cubic foot.

Following is a report of the emissions tests. Contents are:


1.0 Test Results

2.0 Validity of Results

3.0 Source Operation

4.0 Test Proceedures

5.0 Data Reduction - Boiler No. 3

6.0 Raw Data - Boiler No. 3

7.0 Data Reduction - Boiler No. 4

8.0 Raw Data - Boiler No. 4

## 1.0 Test Results

1.1 The average particulate emissions from Boiler No. 3 as determined from three separate samples taken on March 16, 1983, is 0.079 grains per dry standard cubic foot.

The table below is a summary of the pertinent results.

| Boiler No. 3 | | Run 1 | Run 2 | Run 3 | Avg. |
|---|---|---|---|---|---|
| Particulate conc. | grains/dscf | 0.061 | 0.081 | 0.094 | 0.079 |
| Allowable conc. | grains/dscf | 0.30 | 0.30 | 0.30 | 0.30 |
| Emission Rate | #/hr | 22.76 | 30.36 | 37.12 | 30.08 |
| Allowable Emissions | #/hr | 112.51 | 112.83 | 118.75 | 114.70 |
| Velocity | ft/sec | 57.33 | 55.89 | 56.19 | 56.47 |
| Volumetric Flowrate | $ft^3/hr$ | 4405876 | 4294808 | 4318391 | 4339692 |
| Volumetric Flowrate | dscf/hr | 2625348 | 2632585 | 2770810 | 2676248 |
| Stack Temp. | $^oF$ | 341 | 328 | 298 | 322 |

1.2 The average particulate emissions from Boiler No. 4 is determined from three separate samples taken on March 15, 1983, is 0.096 grains per dry standard cubic foot.

The table below is a summary of the pertinent results.

| Boiler No. 4 | | Run 1 | Run 2 | Run 3 | Avg. |
|---|---|---|---|---|---|
| Particulate conc. | grains/dscf | 0.086 | 0.116 | 0.085 | 0.096 |
| Allowable conc. | grains/dscf | 0.30 | 0.30 | 0.30 | 0.30 |
| Emissions Rate | #/hr | 34.32 | 50.20 | 39.54 | 41.35 |
| Allowable Emissions | #/hr | 120.18 | 130.11 | 140.27 | 130.19 |
| Velocity | ft/sec | 60.26 | 59.97 | 62.94 | 61.06 |
| Volumetric Flowrate | $ft^3/hr$ | 4630950 | 4608339 | 4837107 | 4692132 |
| Volumetric Flowrate | dscf/hr | 2804220 | 3035895 | 3272912 | 3037676 |
| Stack Temp. | $^oF$ | 333 | 271 | 272 | 292 |

## 2.0 Validity of Results

2.1 Volumetric flowrate values for both tests are within 3% of the mean values. Emission rates vary by less than 25% for the Boiler No. 3 test and by less than 22% for the Boiler No. 4 test.

2.2 Isokinetic variation: Sampling rates for the Boiler No. 3 test were 97%, 98%, and 96% isokinetic for runs 1, 2, and 3 respectively. Sampling rates for the Boiler No. 4 test were 97%, 94%, and 92% isokinetic for runs 1, 2, and 3 respectively.

2.3 Although there were slight deviations from the standard methods for these tests as described in section 4.0, the samples were representative of emissions under the encountered operating conditions and the results should be considered valid.

## 3.0 Source Operation

Hercules operates four nearly identical woodwaste boilers. The boilers are each capable of using fuel oil and gas although woodwaste is the primary fuel and a fire is maintained at all times with woodwaste.

Because insufficient woodwaste is generated at the facility, additional wood fuel must be purchased. The quality and quantity of the fuel varies.

During the tests the boilers were operated normally at steam production rates of between 50,000 and 60,000 pounds per hour. Fuel used was a mixture of dry and green woodwaste including some pelletized wood fuel. During the second and third runs of the test on Boiler No. 3, the fuel supplied consisted primarily of green chips and shavings.

## 4.0 Test Proceedures

4.1 Sampling and analytical proceedures used are those described in the Code of Federal Regulations, Title 40, Part 60, Appendix A, specifically Reference Method 5. No substantial deviations from the standard proceedures were taken. Each test was performed in triplicate. Testing was observed by Mr. Jesse Thompson of the Mississippi Bureau of Pollution Control.

4.2 A variation from the standard proceedures was necessary due to physical limitations of the sampling site. Method 5 testing requires that samples be taken from sample points as described in Method 1.

Because the masonry stacks serving the boilers have no sampling platforms, testing ports have been installed on each boiler's exhaust duct (breeching) prior to its entering the stack. One stack serves Boilers 1 and 2 and another serves Boilers 3 and 4. Each boiler's ducts have a rectangular vertical section in which sample ports are installed. Tapering duct sections and fans proceed and preceed the short vertical sections and there is less than the required number of diameter distance from disturbances both downstream and upstream of the portholes. The minimum diameter distances required by Method 1 are 0.5 diamters from the sample ports to the nearest downstream disturbance and 2 diameters from the sample ports to nearest upstream disturbance. These minimum diameter distances dictate that 48 points should be sampled.

The deviation from the standard method for these tests is that sampling was performed as though the minimum distances were met; 48 sample points were used. The test for the absence of cyclonic flow as described in Method 1 indicated that the flow at the sample site is acceptable for each boiler. If the cyclonic flow test had indicated unacceptable flow, sampling was to be done at 50% isokinetic to compensate for a possible negative bias from the cyclonic flow.

## 5.0 Data Reduction - Boiler No. 3

### 5.1 Nomenclature

| SYMBOL | UNITS | DESCRIPTION |
|---|---|---|
| An | $ft^2$ | Nozzle area |
| As | $ft^2$ | Stack area |
| Bws | dimensionless | Propor tion by volume of water vapor |
| Cp | dimensionless | Pitot correction factor |
| Cs | grams/dscf | Particulate concentration |
| C's | | Particulate concentration |
| Dn | inches | Nozzle diameter |
| $\Delta H$ | in. $H_2O$ | Pressure drop across meter orifice |
| $\Delta P$ | in. $H_2O$ | Stack velocity pressure head |
| E | #/hr | Particulate emission rate |
| E' | | Particulate emission rate |
| Ea | #/hr | Allowable emissions |
| I | percent | Percent isokinetic sampling |
| Kp | consistent | Pitot tube constant = 85.49 |
| Mn | mg | Particulate sample weight |
| Md | #/# mole | Dry molecular wt. of stack gas |

## 5.2 Summary of Data - Boiler No. 3

| | | | |
|---|---|---|---|
| 1. | As | $ft^2$ | 21.347 |
| 2. | Dn | in. | .228 |
| 3. | An | $ft^2$ | $2.85 \times 10^{-4}$ |
| 4. | Cp | -- | .86 |
| 5. | $\theta$ | min. | 96 |
| 6. | Y | -- | 0.990 |

| | | | | | |
|---|---|---|---|---|---|
| 1. | Vm | $ft^3$ | 57.510 | 58.114 | 59.913 |
| 2. | $\sqrt{\Delta P}$, avg. | $(in.\ H_2O)^{\frac{1}{2}}$ | 0.797 | 0.785 | 0.806 |
| 3. | $\Delta H$ | in. $H_2O$ | 1.434 | 1.440 | 1.522 |
| 4. | Ts | $^oR$ | 801.1 | 788.1 | 757.5 |
| 5. | Tm | $^oR$ | 550.7 | 551.0 | 550.9 |
| 6. | Pbar | in. Hg | 29.60 | 29.60 | 29.60 |
| 7. | Pm | in. Hg | 29.71 | 29.71 | 29.71 |
| 8. | Pg | in. Hg | -.06 | -.06 | -.06 |
| 9. | Ps | in. Hg | 29.54 | 29.54 | 29.54 |
| 10. | Vlc | ml | 106 | 92 | 87 |
| 11. | $O_2$ | % | 18 | 18 | 18 |
| 12. | $CO_2$ | % | 3.5 | 3.5 | 3.5 |
| 13. | $N_2$+CO | % | 78.5 | 78.5 | 78.5 |
| 14. | Mn | mg | 213.3 | 286.6 | 343.3 |
| 15. | | | | | |
| 16. | | | | | |
| 17. | | | | | |

## 5.3 Calculations - Boiler No. 3

| | | | | |
|---|---|---|---|---|
| 1. Vmstd: Vm Y (Pm/Pstd)(Tstd/Tm) | 54.205 | 54.744 | 56.449 | |
| 2. Vwstd: (.04707 $ft^3$/ml)Vlc | 4.989 | 4.330 | 4.095 | |
| 3. Bws: Vwstd/(Vwstd+Vmstd) | 0.084 | 0.073 | 0.068 | |
| 4. Md: .44 $CO_2$+.32 $O_2$+.28($N_2$+CO) | 29.28 | 29.28 | 29.28 | |
| 5. Ms: Md(1-Bws)+18 Bws | 28.33 | 28.45 | 28.52 | |
| 6. Vs: Kp Cp $(\sqrt{\Delta P})\sqrt{Ts/(PsMs)}$ | 57.33 | 55.89 | 56.19 | 56.47 |
| 7. Q: Vs As(3600 sec/hr) | 4405876 | 4294808 | 4318391 | 4339692 |
| 8. Qstd: Q(1-Bws)(Ps/Pstd)(Tstd/Ts) | 2625348 | 2632585 | 2770810 | 2676248 |
| 9. Cs: (.001mg/g)(Mn/Vmstd) | .0039 | .0052 | .0061 | |
| 10. E: (1#/454 g)Cs Qstd | 22.76 | 30.36 | 37.12 | 30.08 |
| 11. C's: (Cs)(15.419 gr/g) | 0.061 | 0.081 | 0.094 | 0.079 |
| 12. Ea: (0.30 gr/dscf)(Qstd) | 112.51 | 112.83 | 118.75 | 114.70 |
| 13. | | | | |
| 14. | | | | |
| 15. | | | | |
| 16. | | | | |
| I: $\frac{100\ Ts\ [.002669\ Vlc + (Vm\ Pm/Tm)]}{60\ \Theta\ Vs\ Ps\ An}$ | 97.2 | 97.9 | 95.9 | |

# 6.0 Raw Data - Boiler No. 3

# ISOKINETIC PRELIMINARY DATA

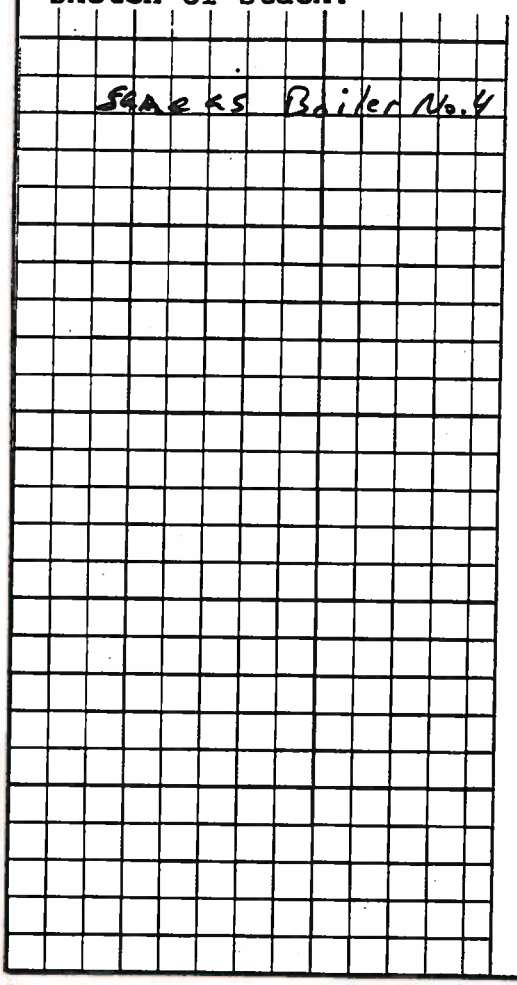
Hercules, Inc Hattiesburg, Miss

Wood Waste Boiler No. 3 — Particulate Test 3-16-83

Diameters upstream <1 downstream <1

No. sample points 48 time/pt. 2 Min.

Sketch of Stack:




| Pt. No. | % Dia. | inches from wall | Preliminary ΔP 1 | α | 2 | α | 3 | α | 4 | α |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 2.4 | .14 | 0 | .7 | +5 | .75 | 0 | .75 | +5 |
| 2 | | 7.3 | .16 | 0 | .89 | 0 | .8 | +5 | .70 | +5 |
| 3 | | 12.1 | .12 | +5 | .9 | 0 | .85 | 0 | .50 | +5 |
| 4 | | 16.5 | .10 | +5 | .86 | 0 | .9 | 0 | .60 | +5 |
| 5 | | 21.8 | .11 | +5 | .75 | +5 | .55 | 0 | .48 | 0 |
| 6 | | 26.6 | .15 | 0 | .8 | +5 | .75 | 0 | 1.0 | 0 |
| 7 | | 31.4 | .15 | 0 | .32 | 0 | 1.7 | -5 | 1.8 | 0 |
| 8 | | 36.3 | .12 | 0 | .45 | -5 | 1.4 | -5 | 1.5 | 0 |
| 9 | | 41.1 | .03 | -5 | .55 | -5 | 1.1 | -5 | 1.1 | -5 |
| 10 | | 45.9 | .05 | -10 | .85 | -5 | 1.1 | 0 | .82 | -5 |
| 11 | | 50.8 | .14 | -20 | 1.7 | -5 | 1.4 | 0 | .78 | -10 |
| 12 | | 55.6 | .08 | -10 | 1.7 | -5 | 1.5 | 0 | .84 | -10 |

Avg. α to obtain Null reading = < 5°

Temps acceptable flow conditions exist for Method 5 sampling.

Preliminary Data:

Pbar 29.6

Pg -.8

ΔH@ 1.79

Tm 95

%$H_2O$ 8%

Ts < 300

ΔPavg x.a

ΔPmax 1.7

Dn .228

Nomograph Reference .93

Meter Box I.D. RAC

Probe I.D. S/T - SS

Pitot Cp .84

Box heat set 250

Notes:

Hercules Inc. - Hattiesburg, MS — Date: 3-16-83 — Pbar: 29.6

Woodwaste Boiler No. 3 — Dn .258 — $P_g$ = -.8"

Run No. 1 Particulate Sample — Sample Time/pt. 2 min — Nomog. Ref.

| Port | Point | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp <250° | Imp Temp <70° | Time | V A C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 562.508 | 0.08 | 0.14 | 324 | 62 | 62 | ✓ | ✓ | 9:30A | 1 |
| | 2 | 563.0 | 0.13 | 0.24 | 320 | 64 | 62 | ✓ | ✓ | 2 | 1 |
| | 3 | 563.5 | 0.10 | 0.18 | 340 | 66 | 62 | ✓ | ✓ | 4 | 1 |
| | 4 | 564.0 | 0.08 | 0.14 | 360 | 66 | 62 | ✓ | ✓ | 6 | 1 |
| | 5 | 564.4 | 0.11 | 0.20 | 370 | 67 | 62 | ✓ | ✓ | 8 | 1 |
| | 6 | 564.9 | 0.15 | 0.28 | 370 | 69 | 61 | ✓ | ✓ | 10 | 1 |
| | 7 | 565.5 | 0.14 | 0.26 | 355 | 70 | 62 | ✓ | ✓ | 12 | 1 |
| | 8 | 566.1 | 0.06 | 0.11 | 360 | 72 | 62 | ✓ | ✓ | 14 | 1 |
| | 9 | 566.4 | 0.02 | 0.04 | 355 | 71 | 62 | ✓ | ✓ | 16 | 1 |
| | 10 | 566.7 | 0.36 | 0.69 | 355 | 73 | 62 | ✓ | ✓ | 18 | 1 |
| | 11 | 567.5 | 0.24 | 0.45 | 345 | 74 | 62 | ✓ | ✓ | 20 | 1 |
| | 12 | 568.2 | 0.03 | 0.05 | 330 | 76 | 63 | ✓ | ✓ | 22 | 1 |
| 2 | 1 | 568.498 | 0.68 | 1.30 | 350 | 81 | 63 | ✓ | ✓ | 0 | 2 |
| | 2 | 569.1 | 0.85 | 1.65 | 360 | 85 | 64 | ✓ | ✓ | 2 | 3 |
| | 3 | 571.0 | 0.85 | 1.65 | 370 | 90 | 65 | ✓ | ✓ | 4 | 3 |
| | 4 | 572.4 | 0.79 | 1.50 | 365 | 96 | 67 | ✓ | ✓ | 6 | 3 |
| | 5 | 573.7 | 0.76 | 1.45 | 355 | 99 | 67 | ✓ | ✓ | 8 | 3 |
| | 6 | 574.9 | 0.90 | 1.75 | 355 | 101 | 68 | ✓ | ✓ | 10 | 3 |
| | 7 | 576.4 | 0.20 | 0.37 | 355 | 99 | 68 | ✓ | ✓ | 12 | 2 |
| | 8 | 577.0 | 0.59 | 1.10 | 350 | 100 | 68 | ✓ | ✓ | 14 | 2 |
| | 9 | 578.2 | 0.62 | 1.15 | 355 | 102 | 72 | ✓ | ✓ | 16 | 2 |
| | 10 | 579.4 | 1.10 | 2.15 | 315 | 104 | 72 | ✓ | ✓ | 18 | 4 |
| | 11 | 580.9 | 1.50 | 3.00 | 310 | 108 | 72 | ✓ | ✓ | 20 | 5 |
| | 12 | 582.8 | 0.95 | 1.85 | 315 | 114 | 73 | ✓ | ✓ | 22 | 3 |
| 3 | 1 | 584.167 | 0.69 | 1.30 | 330 | 110 | 77 | ✓ | ✓ | 0 | 3 |
| | 2 | 585.4 | 0.77 | 1.50 | 330 | 112 | 75 | ✓ | ✓ | 2 | 3 |
| | 3 | 586.8 | 0.84 | 1.60 | 335 | 111 | 74 | ✓ | ✓ | 4 | 3 |
| | 4 | 588.1 | 0.89 | 1.70 | 335 | 112 | 76 | ✓ | ✓ | 6 | 3 |
| | 5 | 589.5 | 0.62 | 1.20 | 340 | 115 | 78 | ✓ | ✓ | 8 | 2 |
| | 6 | 590.7 | 0.62 | 1.20 | 330 | 111 | 77 | ✓ | ✓ | 10 | 2 |
| | 7 | 591.8 | 1.70 | 3.40 | 345 | 116 | 78 | ✓ | ✓ | 12 | 7 |
| | 8 | 593.9 | 1.30 | 2.60 | 340 | 120 | 79 | ✓ | ✓ | 14 | 5 |
| | 9 | 595.5 | 1.10 | 2.15 | 350 | 120 | 82 | ✓ | ✓ | 16 | 5 |
| | 10 | 597.2 | 1.10 | 2.15 | 356 | 122 | 82 | ✓ | ✓ | 18 | 4 |
| | 11 | 598.4 | 1.30 | 2.60 | 335 | 123 | 82 | ✓ | ✓ | 20 | 5 |
| | 12 | 600.4 | 1.30 | 2.60 | 335 | 125 | 83 | ✓ | ✓ | 22 | 5 |

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MADE IN U.S.A.

Hercules

Date: 3-16-83

Woodwaste Boiler No. 3

Run No. 1 Cont'd

| | 1 | 2 | 3 | 4 | 5 | 6 | | 7 | | 8 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Port | Point | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp <250 | Imp Temp < 70° | Time | V A C |
| 1 | 4 | 1 | 602.197 | 0.74 | 1.40 | 315 | 115 | 83 | ✓ | ✓ | 0 | 3 |
| 2 | | 2 | 603.5 | 0.82 | 1.60 | 315 | 114 | 81 | ✓ | ✓ | 2 | 3 |
| 3 | | 3 | 604.9 | 0.59 | 1.15 | 330 | 112 | 81 | ✓ | ✓ | 4 | 3 |
| 4 | | 4 | 606.1 | 0.47 | 0.89 | 325 | 111 | 82 | ✓ | ✓ | 6 | 2 |
| 5 | | 5 | 607.2 | 0.99 | 1.90 | 335 | 113 | 84 | ✓ | ✓ | 8 | 4 |
| 6 | | 6 | 608.6 | 1.50 | 3.00 | 335 | 115 | 84 | ✓ | ✓ | 10 | 7 |
| 7 | | 7 | 610.4 | 1.80 | 3.60 | 330 | 120 | 84 | ✓ | ✓ | 12 | 6 |
| 8 | | 8 | 612.6 | 1.50 | 3.00 | 350 | 122 | 84 | ✓ | ✓ | 14 | 7 |
| 9 | | 9 | 614.5 | 0.97 | 1.90 | 345 | 124 | 85 | ✓ | ✓ | 16 | 4 |
| 10 | | 10 | 616.0 | 0.76 | 1.50 | 330 | 123 | 86 | ✓ | ✓ | 18 | 3 |
| 11 | | 11 | 617.3 | 0.79 | 1.50 | 330 | 122 | 85 | ✓ | ✓ | 20 | 3 |
| 12 | | 12 | 618.6 | 0.88 | 1.70 | 330 | 121 | 85 | ✓ | ✓ | 22 | 3 |
| 13 | END | | 620.018 | | | | | | | | 11.1KA | |
| 14 | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | |
| 16 | | | Leak Check: 0.00 cfm @ 12" Hg | | | | Fyrite: | | | | | |
| 17 | | | | | | | | $O_2$ | 18 | | | |
| 18 | | | Condensate: 89 ml | | | | | $CO_2$ | 3.5 | | | |
| 19 | | | Silicagel: 17g | | | | | | | | | |
| 20 | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | |
| 26 | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | |
| 31 | | | | | | | | | | | | |
| 32 | | | | | | | | | | | | |
| 33 | | | | | | | | | | | | |
| 34 | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | |
| 36 | | | | | | | | | | | | |
| 37 | | | | | | | | | | | | |
| 38 | | | | | | | | | | | | |
| 39 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |

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MADE IN U.S.A.

Hercules
Woodwaste Boiler No. 4
Run No. 2 Particulate Sample

Date: 3-16-83

Pbar 29.60
Pg -.8"

| | Port | Point | $V_m$ | $\Delta P$ | $\Delta H$ | $T_s$ | $T_m$ in | $T_m$ out | Box Temp <250° | Imp Temp <70° | Time | V A C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 620.335 | 0.14 | 0.26 | 0335 | 70 | 70 | ✓ | ✓ | 12:38 P | 1 |
| 2 | | 2 | 620.9 | 0.11 | 0.20 | 335 | 70 | 69 | ✓ | ✓ | 2 | 1 |
| 3 | | 3 | 621.4 | 0.09 | 0.16 | 335 | 71 | 68 | ✓ | ✓ | 4 | 1 |
| 4 | | 4 | 621.8 | 0.09 | 0.16 | 355 | 72 | 68 | ✓ | ✓ | 6 | 1 |
| 5 | | 5 | 622.3 | 0.09 | 0.16 | 355 | 74 | 69 | ✓ | ✓ | 8 | 1 |
| 6 | | 6 | 622.8 | 0.11 | 0.20 | 360 | 74 | 68 | ✓ | ✓ | 10 | 1 |
| 7 | | 7 | 623.4 | 0.14 | 0.26 | 310 | 75 | 68 | ✓ | ✓ | 12 | 1 |
| 8 | | 8 | 623.9 | 0.04 | 0.07 | 320 | 77 | 69 | ✓ | ✓ | 14 | 1 |
| 9 | | 9 | 624.3 | 0.02 | 0.04 | 315 | 78 | 69 | ✓ | ✓ | 16 | 1 |
| 10 | | 10 | 624.5 | 0.14 | 0.26 | 305 | 79 | 70 | ✓ | ✓ | 18 | 1 |
| 11 | | 11 | 625.1 | 0.14 | 0.26 | 315 | 81 | 70 | ✓ | ✓ | 20 | 1 |
| 12 | | 12 | 625.6 | 0.04 | 0.07 | 325 | 83 | 72 | ✓ | ✓ | 22 | 1 |
| 13 | | | | | | | | | | | | |
| 14 | | 1 | 625.98 | 0.72 | 1.40 | 315 | 86 | 72 | ✓ | ✓ | 0 | 2 |
| 15 | | 2 | 627.3 | 0.93 | 1.85 | 315 | 92 | 72 | ✓ | ✓ | 2 | 3 |
| 16 | | 3 | 628.7 | 0.93 | 1.85 | 315 | 96 | 73 | ✓ | ✓ | 4 | 3 |
| 17 | | 4 | 630.2 | 0.84 | 1.65 | 340 | 101 | 73 | ✓ | ✓ | 6 | 3 |
| 18 | | 5 | 631.5 | 0.84 | 1.65 | 320 | 105 | 75 | ✓ | ✓ | 8 | 3 |
| 19 | | 6 | 633.0 | 0.40 | 0.77 | 310 | 105 | 75 | ✓ | ✓ | 10 | 3 |
| 20 | | 7 | 633.9 | 0.40 | 0.77 | 360 | 105 | 76 | ✓ | ✓ | 12 | 1 |
| 21 | | 8 | 634.9 | 0.55 | 1.05 | 355 | 106 | 76 | ✓ | ✓ | 14 | 2 |
| 22 | | 9 | 636.1 | 0.62 | 1.20 | 355 | 107 | 75 | ✓ | ✓ | 16 | 2 |
| 23 | | 10 | 637.4 | 1.10 | 2.20 | 360 | 109 | 78 | ✓ | ✓ | 18 | 4 |
| 24 | | 11 | 638.9 | 1.60 | 3.20 | 360 | 111 | 79 | ✓ | ✓ | 20 | 7 |
| 25 | | 12 | 640.8 | 1.20 | 2.40 | 340 | 115 | 80 | ✓ | ✓ | 22 | 5 |
| 26 | | | | | | | | | | | | 2 |
| 27 | | 1 | 642.545 | 0.70 | 1.35 | 300 | 95 | 76 | ✓ | ✓ | 0 | 3 |
| 28 | | 2 | 643.8 | 0.80 | 1.60 | 300 | 98 | 77 | ✓ | ✓ | 2 | 3 |
| 29 | | 3 | 645.1 | 0.86 | 1.70 | 300 | 100 | 77 | ✓ | ✓ | 4 | 4 |
| 30 | | 4 | 646.6 | 0.90 | 1.80 | 325 | 106 | 78 | ✓ | ✓ | 6 | 4 |
| 31 | | 5 | 648.0 | 0.60 | 1.19 | 355 | 109 | 80 | ✓ | ✓ | 8 | 2 |
| 32 | | 6 | 649.2 | 0.86 | 1.70 | 310 | 113 | 81 | ✓ | ✓ | 10 | 4 |
| 33 | | 7 | 650.7 | 1.70 | 3.40 | 335 | 118 | 82 | ✓ | ✓ | 12 | 7 |
| 34 | | 8 | 652.6 | 1.20 | 2.40 | 320 | 122 | 82 | ✓ | ✓ | 14 | 5 |
| 35 | | 9 | 654.3 | 1.00 | 2.00 | 310 | 123 | 82 | ✓ | ✓ | 16 | 5 |
| 36 | | 10 | 656.0 | 1.10 | 2.20 | 325 | 125 | 83 | ✓ | ✓ | 18 | 5 |
| 37 | | 11 | 657.5 | 1.20 | 2.40 | 355 | 128 | 84 | ✓ | ✓ | 20 | 5 |
| 38 | | 12 | 659.3 | 1.40 | 2.80 | 370 | 130 | 84 | ✓ | ✓ | 22 | 6 |
| 39 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |

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MADE IN U.S.A.

Hercules
Woodwaste Boiler No. 3
Date: 3-16-83
Run No. 2 Cont'd

| Port | Point | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp <250 | Imp Temp <70 | Time | V A C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 1 | 660.897 | 0.74 | 1.45 | 290 | 119 | 85 | ✓ | ✓ | 0 | 3 |
| | 2 | 662.2 | 0.82 | 1.60 | 290 | 116 | 86 | ✓ | ✓ | 2 | 3 |
| | 3 | 663.6 | 0.64 | 1.25 | 295 | 115 | 85 | ✓ | ✓ | 4 | 3 |
| | 4 | 664.8 | 0.56 | 1.10 | 290 | 114 | 85 | ✓ | ✓ | 6 | 3 |
| | 5 | 666.1 | 0.60 | 1.20 | 300 | 118 | 87 | ✓ | ✓ | 8 | 4 |
| | 6 | 667.5 | 1.60 | 3.20 | 300 | 122 | 86 | ✓ | ✓ | 10 | 8 |
| | 7 | 669.5 | 1.80 | 3.60 | 300 | 127 | 88 | ✓ | ✓ | 12 | 10 |
| | 8 | 671.9 | 1.50 | 3.00 | 305 | 131 | 89 | ✓ | ✓ | 14 | 8 |
| | 9 | 673.2 | 0.86 | 1.70 | 350 | 131 | 89 | ✓ | ✓ | 16 | 4 |
| | 10 | 674.6 | 0.72 | 1.40 | 375 | 129 | 89 | ✓ | ✓ | 18 | 4 |
| | 11 | 675.9 | 0.72 | 1.40 | 370 | 129 | 91 | ✓ | ✓ | 20 | 4 |
| | 12 | 677.2 | 0.79 | 1.55 | 370 | 125 | 90 | ✓ | ✓ | 22 | 4 |
| END | | 678.449 | | | | | | | | 2:18 | |

Leak Check: 0.00 cfm at 15" Hg

Condensate: 73
Silica gel: 19g

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Hercules — Date: 3-16-83 — Pbar 26.6

Woodward Boiler No. 3 — pg = -.8"

Run No. 3

COLUMN WRITE ®

| | 1 | 2 | 3 | 4 | 5 | 6 | | 7 | | 8 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Port | Point | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp <250° | Imp. Temp <70° | Time | V A C |
| 1 | 1 | 1 | 678.660 | 0.09 | 0.17 | 325 | 73 | 73 | ✓ | ✓ | 3:11P | 1 |
| 2 | | 2 | 679.1 | 0.09 | 0.17 | 325 | 73 | 72 | ✓ | ✓ | 2 | 1 |
| 3 | | 3 | 679.6 | 0.07 | 0.13 | 325 | 73 | 72 | ✓ | ✓ | 4 | 1 |
| 4 | | 4 | 680.0 | 0.06 | 0.11 | 355 | 75 | 72 | ✓ | ✓ | 6 | 1 |
| 5 | | 5 | 680.4 | 0.06 | 0.11 | 330 | 75 | 72 | ✓ | ✓ | 8 | 1 |
| 6 | | 6 | 680.8 | 0.11 | 0.20 | 365 | 77 | 72 | ✓ | ✓ | 10 | 1 |
| 7 | | 7 | 681.3 | 0.09 | 0.17 | 350 | 78 | 72 | ✓ | ✓ | 12 | 1 |
| 8 | | 8 | 681.8 | 0.03 | 0.05 | 330 | 80 | 73 | ✓ | ✓ | 14 | 1 |
| 9 | | 9 | 682.1 | 0.02 | 0.04 | 210 | 81 | 73 | ✓ | ✓ | 16 | 1 |
| 10 | | 10 | 682.3 | 0.21 | 0.41 | 360 | 84 | 74 | ✓ | ✓ | 18 | 1 |
| 11 | | 11 | 683.1 | 0.21 | 0.41 | 320 | 85 | 75 | ✓ | ✓ | 20 | 1 |
| 12 | | 12 | 683.8 | 0.07 | 0.13 | 300 | 87 | 78 | ✓ | ✓ | 22 | 1 |
| 13 | | | | | | | | | | | | |
| 14 | | 1 | 684.252 | 0.67 | 1.30 | 280 | 88 | 78 | ✓ | ✓ | 0 | 2 |
| 15 | | 2 | 685.5 | 0.86 | 1.70 | 280 | 89 | 78 | ✓ | ✓ | 2 | 3 |
| 16 | | 3 | 686.8 | 0.86 | 1.70 | 290 | 94 | 77 | ✓ | ✓ | 4 | 3 |
| 17 | | 4 | 688.3 | 0.80 | 1.60 | 280 | 98 | 77 | ✓ | ✓ | 6 | 3 |
| 18 | | 5 | 689.6 | 0.80 | 1.60 | 285 | 101 | 78 | ✓ | ✓ | 8 | 3 |
| 19 | | 6 | 691.0 | 0.92 | 1.80 | 290 | 105 | 78 | ✓ | ✓ | 10 | 3 |
| 20 | | 7 | 692.5 | 0.65 | 1.25 | 285 | 107 | 79 | ✓ | ✓ | 12 | 2 |
| 21 | | 8 | 693.8 | 0.52 | 1.00 | 285 | 107 | 80 | ✓ | ✓ | 14 | 2 |
| 22 | | 9 | 695.0 | 0.75 | 1.45 | 285 | 106 | 79 | ✓ | ✓ | 16 | 2 |
| 23 | | 10 | 696.2 | 1.20 | 2.40 | 285 | 109 | 80 | ✓ | ✓ | 18 | 2 |
| 24 | | 11 | 697.8 | 1.60 | 3.20 | 290 | 112 | 80 | ✓ | ✓ | 20 | 6 |
| 25 | | 12 | 699.8 | 1.50 | 3.00 | 290 | 116 | 84 | ✓ | ✓ | 22 | 6 |
| 26 | | | | | | | | | | | | |
| 27 | | 1 | 701.702 | 0.72 | 1.40 | 280 | 110 | 82 | ✓ | ✓ | 0 | 2 |
| 28 | | 2 | 703.0 | 0.79 | 1.50 | 280 | 109 | 83 | ✓ | ✓ | 2 | 3 |
| 29 | | 3 | 704.3 | 0.88 | 1.70 | 285 | 107 | 81 | ✓ | ✓ | 4 | 3 |
| 30 | | 4 | 705.8 | 0.94 | 1.80 | 290 | 109 | 82 | ✓ | ✓ | 6 | 3 |
| 31 | | 5 | 707.3 | 0.84 | 1.65 | 290 | 110 | 84 | ✓ | ✓ | 8 | 3 |
| 32 | | 6 | 708.6 | 0.80 | 1.60 | 290 | 110 | 86 | ✓ | ✓ | 10 | 3 |
| 33 | | 7 | 710.0 | 1.70 | 3.40 | 290 | 112 | 86 | ✓ | ✓ | 12 | 7 |
| 34 | | 8 | 712.0 | 1.40 | 2.80 | 285 | 112 | 84 | ✓ | ✓ | 14 | 6 |
| 35 | | 9 | 713.7 | 1.00 | 2.00 | 285 | 113 | 84 | ✓ | ✓ | 16 | 5 |
| 36 | | 10 | 715.4 | 1.10 | 2.20 | 285 | 114 | 83 | ✓ | ✓ | 18 | 5 |
| 37 | | 11 | 717.0 | 1.40 | 2.80 | 285 | 117 | 87 | ✓ | ✓ | 20 | 6 |
| 38 | | 12 | 718.8 | 1.43 | 2.80 | 280 | 118 | 88 | ✓ | ✓ | 22 | 6 |
| 39 | | | | | | | | | | | | 3 |
| 40 | | | | | | | | | | | | 4 |

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MADE IN U.S.A.

Hercules — Date: 3-16-83

Woodwaste Boiler No: 3

Run No. 3 cont'd

| | Port | Point | Vm | ΔP | ΔH | Ts | Tm | | Box Temp ≥250° | Imp Temp ≤70° | Time | V A C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 1 | 720.558 | 0.82 | 1.60 | 280 | 114 | 88 | ✓ | ✓ | 0 | 3 |
| 2 | | 2 | 722.0 | 0.84 | 1.60 | 280 | 111 | 87 | ✓ | ✓ | 2 | 3 |
| 3 | | 3 | 723.3 | 0.58 | 1.10 | 290 | 108 | 84 | ✓ | ✓ | 4 | 2 |
| 4 | | 4 | 724.5 | 0.52 | 1.00 | 290 | 108 | 84 | ✓ | ✓ | 6 | 2 |
| 5 | | 5 | 725.8 | 1.20 | 2.40 | 290 | 109 | 84 | ✓ | ✓ | 8 | 5 |
| 6 | | 6 | 727.4 | 1.50 | 3.00 | 290 | 112 | 85 | ✓ | ✓ | 10 | 6 |
| 7 | | 7 | 729.3 | 1.80 | 3.60 | 290 | 115 | 85 | ✓ | ✓ | 12 | 8 |
| 8 | | 8 | 731.6 | 1.40 | 2.80 | 285 | 119 | 85 | ✓ | ✓ | 14 | 6 |
| 9 | | 9 | 733.2 | 0.90 | 1.80 | 285 | 118 | 85 | ✓ | ✓ | 16 | 4 |
| 10 | | 10 | 734.6 | 0.71 | 1.39 | 285 | 114 | 85 | ✓ | ✓ | 18 | 3 |
| 11 | | 11 | 736.0 | 0.74 | 1.45 | 285 | 112 | 85 | ✓ | ✓ | 20 | 3 |
| 12 | | 12 | 737.2 | 0.80 | 1.55 | 285 | 112 | 86 | ✓ | ✓ | 22 | 3 |
| 13 | END | | 738.573 | | | | | | | | 4:50 P | |

Leak check 0.00 cfm @ 15" Hg

Condensate: 72

Silica gel: 15g

© WILSON JONES COMPANY G7508 GREEN

MADE IN U.S.A

Analytical Data

Hercules - Boiler No. 3
Tested: March 16, 1983

| FILTERS: | Run 1 | Run 2 | Run 3 | |
|---|---|---|---|---|
| Filter Number | 8376 | 8377 | 8378 | |
| Tare Weight, g | .6101 | .6130 | .6184 | |
| Final Weight, g | .7300 | .7530 | .8268 | |
| Net Gain, g | 0.1199 | 0.1400 | 0.2084 | |

| PROBE WASH | Run 1 | Run 2 | Run 3 | Blank |
|---|---|---|---|---|
| Volume | 144 | 180 | 145 | 100 |
| Tare Weight, g | 114.3933 | 178.6365 | 186.1540 | 114.3973 |
| Final Weight, g | 114.4879 | 178.7845 | 186.2901 | 114.3981 |
| Net Gain, g | 0.0946 | 0.1480 | 0.1361 | .0008 |
| Blank Correction g | -.0012 | -.0014 | -.0012 | - |

| | Run 1 | Run 2 | Run 3 | |
|---|---|---|---|---|
| Mn, mg | 213.3 | 286.6 | 343.3 | |

## 7.0 Data Reduction - Boiler No. 4

## 7.1 Nomenclature - See Section 5.1

## 7.2 Summary of Data - Boiler No. 4

| | | | |
|---|---|---|---|
| 1. | As | $ft^2$ | 21.347 |
| 2. | Dn | in. | .228 |
| 3. | An | $ft^2$ | $2.835 \times 10^{-4}$ |
| 4. | Cp | -- | .86 |
| 5. | $\theta$ | min. | 96 |
| 6. | Y | -- | 0.990 |

| | | | | | |
|---|---|---|---|---|---|
| 1. | Vm | $ft^3$ | 60.512 | 63.448 | 67.352 |
| 2. | $\sqrt{\Delta P}$, avg. | $(in.\ H_2O)^{\frac{1}{2}}$ | 0.846 | 0.898 | 0.947 |
| 3. | $\Delta H$ | in. $H_2O$ | 1.651 | 1.674 | 1.863 |
| 4. | Ts | $^oR$ | 792.9 | 731.4 | 731.7 |
| 5. | Tm | $^oR$ | 548.0 | 549.4 | 552.2 |
| 6. | Pbar | in. Hg | 29.90 | 29.90 | 29.89 |
| 7. | Pm | in. Hg | 30.02 | 30.02 | 30.03 |
| 8. | Pg | in. Hg | - .05 | - .05 | - .05 |
| 9. | Ps | in. Hg | 29.85 | 29.85 | 29.84 |
| 10. | Vlc | ml | 119.5 | 120.0 | 86.5 |
| 11. | $O_2$ | % | 18.5 | 18.5 | 18.5 |
| 12. | $CO_2$ | % | 3.5 | 3.5 | 3.5 |
| 13. | $N_2$+CO | % | 78 | 78 | 78 |
| 14. | Mn | mg | 321.8 | 454.7 | 351.1 |
| 15. | | | | | |
| 16. | | | | | |
| 17. | | | | | |

## 7.3 Calculations - Boiler No. 4

| | | | | |
|---|---|---|---|---|
| 1. Vmstd: $Vm\ Y\ (Pm/Pstd)(Tstd/Tm)$ | 57.913 | 60.569 | 63.991 | |
| 2. Vwstd: $(.04707\ ft^3/ml)Vlc$ | 5.625 | 5.648 | 4.072 | |
| 3. Bws: $Vwstd/(Vwstd+Vmstd)$ | 0.089 | 0.085 | 0.060 | |
| 4. Md: $.44\ CO_2+.32\ O_2+.28(N_2+CO)$ | 29.30 | 29.30 | 29.30 | |
| 5. Ms: $Md(1-Bws)+18\ Bws$ | 28.30 | 28.34 | 28.62 | |
| 6. Vs: $Kp\ Cp\ (\sqrt{\Delta P})\sqrt{Ts/(PsMs)}$ | 60.26 | 59.97 | 62.94 | 61.06 |
| 7. Q: $Vs\ As(3600\ sec/hr)$ | 4630950 | 4608339 | 4837107 | 4692132 |
| 8. Qstd: $Q(1-Bws)(Ps/Pstd)(Tstd/Ts)$ | 2804220 | 3035895 | 3272912 | 3037676 |
| 9. Cs: $(.001mg/g)(Mn/Vmstd)$ | .0056 | .0075 | .0055 | |
| 10. E: $(1\#/454\ g)Cs\ Qstd$ | 34.32 | 50.20 | 39.54 | 41.35 |
| 11. C's: $(cs)(15.419\ gr/g)$ | 0.086 | 0.116 | 0.085 | .096 |
| 12. | | | | |
| 13. | | | | |
| 14. | | | | |
| 15. | | | | |
| 16. | | | | |
| I: $\frac{100\ Ts\ [.002669\ Vlc + (Vm\ Pm/Tm)]}{60\ \Theta\ Vs\ Ps\ An}$ | 97.2 | 93.9 | 92.0 | |

# 8.0 Raw Data - Boiler No. 4

# ISOKINETIC PRELIMINARY DATA

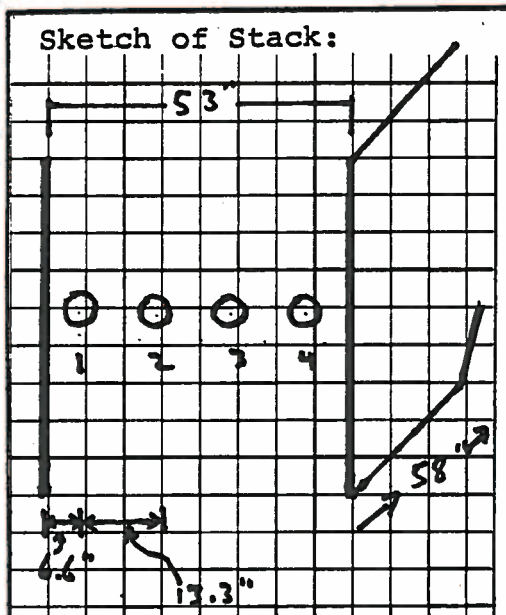
Hercules, Inc - Hattiesburg, Miss

Woodwaste boiler No. 4 Particulate Test

Diameters upstream <1 downstream <1

No. sample points 48 time/pt. 2 min

Sketch of Stack:




| Pt. No. | % Dia. | inches from wall | Preliminary ΔP 1 | α | 2 | α | 3 | α | 4 | α |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | NA | 2.4 | .82" | 0° | .84 | +5 | 1.0 | +5 | .15 | 0 |
| 2 | | 7.3 | .89 | +5 | 1.1 | +5 | 1.3 | +5 | .25 | +5 |
| 3 | | 12.1 | .60 | +15 | 1.1 | +5 | 1.1 | +5 | .25 | +5 |
| 4 | | 16.9 | .80 | +15 | 1.1 | +5 | .95 | +10 | .25 | +5 |
| 5 | | 21.8 | 1.0 | 0 | .65 | +5 | 1.3 | +15 | .25 | +5 |
| 6 | | 26.6 | 1.2 | 0 | 1.6 | 0 | 1.7 | +10 | .35 | 0 |
| 7 | | 31.4 | 1.4 | -5 | 1.7 | +10 | .9 | 0 | .35 | 0 |
| 8 | | 36.3 | 1.1 | -5 | 1.4 | +5 | .8 | +10 | .15 | 0 |
| 9 | | 41.1 | .85 | -5 | 1.1 | +5 | .65 | 0 | .15 | 0 |
| 10 | | 45.9 | .70 | 0 | 1.3 | 0 | .7 | +5 | .20 | 0 |
| 11 | | 50.8 | .65 | 0 | 1.5 | +5 | 1.3 | +10 | .28 | +5 |
| 12 | | 55.6 | .84 | +5 | 1.6 | +5 | 1.7 | +5 | 1.5 | +5 |

Avg. α for Null reading = <10% therefore acceptable flow

Preliminary Data:

Pbar 29.90

Pg neg.

ΔH@ 1.79

Tm 100

%$H_2O$ est. 8%

Ts est. 3[illegible]

ΔPavg ≈ .95

ΔPmax 1.8

Dn .228

Nomograph Reference .95

Meter Box I.D. RAC

Probe I.D. 55.5

Pitot Cp .84

Box heat set 250

Notes:

Hercules, Inc. - Hattiesburg, Ms.
Wood Waste Boiler No. 4
Run No. 1 Particulate Sample

Date: 3-15-83
Dn: .228
Sample time/pt: 2 min.

Pbar: 29.90 "Hg
Ps: -.7 "H2O
Nomograph Ref: .95

| Port | Point | Vm | ΔP | ΔH | Ts °F | Tm °F in | Tm °F out | Box Temp <250 | Imp Temp <70 | Time | Vac. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 370.114 | 0.76 | 1.45 | 325 | 65 | 65 | ✓ | ✓ | 10:10 | 1 |
| | 2 | 371.4 | 0.81 | 1.55 | 325 | 68 | 66 | ✓ | ✓ | 2 | 1 |
| | 3 | 372.8 | 0.45 | .84 | 325 | 71 | 65 | ✓ | ✓ | 4 | 1 |
| | 4 | 373.7 | 0.84 | 1.60 | 325 | 73 | 65 | ✓ | ✓ | 6 | 1 |
| | 5 | 375.0 | 0.95 | 1.90 | 330 | 79 | 65 | ✓ | ✓ | 8 | 1 |
| | 6 | 376.4 | 1.10 | 2.20 | 330 | 84 | 65 | ✓ | ✓ | 10 | 1 |
| | 7 | 378.1 | 1.40 | 2.80 | 330 | 90 | 65 | ✓ | ✓ | 12 | 1 |
| | 8 | 379.7 | 1.10 | 2.05 | 330 | 92 | 65 | ✓ | ✓ | 14 | 1 |
| | 9 | 381.2 | 0.77 | 1.50 | 335 | 95 | 67 | ✓ | ✓ | 16 | 1 |
| | 10 | 382.5 | 0.61 | 1.25 | 335 | 97 | 67 | ✓ | ✓ | 18 | 1 |
| | 11 | 383.7 | 0.65 | 1.30 | 335 | 99 | 71 | ✓ | ✓ | 20 | 1 |
| | 12 | 385.0 | 0.78 | 1.60 | 335 | 97 | 70 | ✓ | ✓ | 22 | 1 |
| | | | | | | | | | | | |
| 2 | 1 | 386.327 | 0.85 | 1.75 | 330 | 97 | 72 | ✓ | ✓ | 0 | 1 |
| | 2 | 387.7 | 0.85 | 2.20 | 330 | 99 | 73 | ✓ | ✓ | 2 | 1 |
| | 3 | 389.1 | 1.05 | 2.20 | 335 | 101 | 76 | ✓ | ✓ | 4 | 1 |
| | 4 | 390.7 | 1.10 | 2.25 | 335 | 105 | 75 | ✓ | ✓ | 6 | 1 |
| | 5 | 392.4 | 0.70 | 1.40 | 335 | 105 | 74 | ✓ | ✓ | 8 | 1 |
| | 6 | 393.7 | 1.10 | 2.25 | 340 | 106 | 74 | ✓ | ✓ | 10 | 1 |
| | 7 | 395.3 | 1.60 | 3.35 | 340 | 110 | 76 | ✓ | ✓ | 12 | 1 |
| | 8 | 397.1 | 1.20 | 2.50 | 340 | 112 | 76 | ✓ | ✓ | 14 | 1 |
| | 9 | 398.8 | 1.00 | 2.00 | 345 | 114 | 78 | ✓ | ✓ | 16 | 1 |
| | 10 | 400.4 | 1.20 | 2.50 | 345 | 115 | 78 | ✓ | ✓ | 18 | 3 |
| | 11 | 402.0 | 1.30 | 2.65 | 350 | 118 | 81 | ✓ | ✓ | 20 | 4 |
| | 12 | 403.7 | 1.40 | 3.00 | 350 | 119 | 82 | ✓ | ✓ | 22 | 5 |
| | | | | | | | | | | | |
| 3 | 1 | 405.6 | 0.97 | 1.95 | 340 | 113 | 84 | ✓ | ✓ | 0 | 4 |
| | 2 | 407.1 | 0.10 | 2.25 | 340 | 111 | 84 | ✓ | ✓ | 2 | 4 |
| | 3 | 408.7 | 1.10 | 2.25 | 340 | 112 | 84 | ✓ | ✓ | 4 | 4 |
| | 4 | 410.2 | 0.89 | 1.80 | 340 | 112 | 84 | ✓ | ✓ | 6 | 3 |
| | 5 | 411.7 | 1.10 | 2.25 | 335 | 113 | 84 | ✓ | ✓ | 8 | 4 |
| | 6 | 413.2 | 1.60 | 4.30 | 330 | 117 | 87 | ✓ | ✓ | 10 | 9 |
| | 7 | 415.6 | 0.72 | 1.90 | 340 | 114 | 85 | ✓ | ✓ | 12 | 4 |
| | 8 | 417.0 | 0.94 | 2.00 | 340 | 114 | 86 | ✓ | ✓ | 14 | 4 |
| | 9 | 418.5 | 0.60 | 1.20 | 340 | 112 | 87 | ✓ | ✓ | 16 | 3 |
| | 10 | 419.7 | 0.72 | 1.30 | 340 | 109 | 88 | ✓ | ✓ | 18 | 3 |
| | 11 | 420.9 | 1.30 | 2.60 | 345 | 109 | 88 | ✓ | ✓ | 20 | 5 |
| | 12 | 422.1 | 1.80 | 3.60 | 350 | 102 | 86 | ✓ | ✓ | 22 | 6 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

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Hercules

Date: 3-15-83

Woodwaste Boiler No.

Run No. 1 cont'd

3-15-83

| | Port | Point | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp <250° | Imp Temp <70° | Time | V A c |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 1 | 423.678 | 0.13 | 0.24 | 300 | 95 | 83 | ✓ | ✓ | 0 | 1 |
| 2 | | 2 | 424.2 | 0.11 | 0.20 | 300 | 93 | 85 | ✓ | ✓ | 2 | 1 |
| 3 | | 3 | 424.6 | 0.10 | 0.18 | 300 | 90 | 85 | ✓ | ✓ | 4 | 1 |
| 4 | | 4 | 425.3 | 0.10 | 0.18 | 310 | 87 | 82 | ✓ | ✓ | 6 | 1 |
| 5 | | 5 | 425.7 | 0.16 | 0.30 | 325 | 87 | 84 | ✓ | ✓ | 8 | 1 |
| 6 | | 6 | 426.2 | 0.28 | 0.54 | 325 | 86 | 82 | ✓ | ✓ | 10 | 1 |
| 7 | | 7 | 427.0 | 0.25 | 0.49 | 330 | 87 | 82 | ✓ | ✓ | 12 | 1 |
| 8 | | 8 | 427.7 | 0.08 | 0.15 | 330 | 87 | 82 | ✓ | ✓ | 14 | 1 |
| 9 | | 9 | 428.2 | 0.04 | 0.06 | 330 | 86 | 81 | ✓ | ✓ | 16 | 1 |
| 10 | | 10 | 428.5 | 0.30 | 0.58 | 335 | 86 | 81 | ✓ | ✓ | 18 | 1 |
| 11 | | 11 | 429.1 | 0.37 | 0.71 | 340 | 87 | 81 | ✓ | ✓ | 20 | 1 |
| 12 | | 12 | 430.1 | 0.04 | 0.15 | 340 | 87 | 80 | ✓ | ✓ | 22 | |
| 13 | END | | 430.626 | | | | | | | | 11:51 A | |

Leak check: 0.00 cfm @ 14" Hg

Condensate: 100 ml

Silica gel: 19.5 g

Fyrite:

$O_2$ = 16.5%

$CO_2$ = 3.5%

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MADE IN U.S.A

Hercules
Woodward Boiler No. 4
Run No. 2 Particulate Sample

Date: 3-15-83

Pbar 29.90
Pg = -.7
Nomo Ref = .98

| | Port | Point | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp <250° | Imp. Temp <70° | Time | A/C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 430.927 | 0.78 | 1.45 | 295 | 77 | 77 | ✓ | ✓ | 1:00P | 1 |
| 2 | | 2 | 432.2 | 0.81 | 1.50 | 295 | 80 | 77 | ✓ | ✓ | 2 | 1 |
| 3 | | 3 | 433.6 | 0.56 | 1.05 | 295 | 83 | 77 | ✓ | ✓ | 4 | 1 |
| 4 | | 4 | 434.6 | 0.88 | 1.65 | 295 | 86 | 78 | ✓ | ✓ | 6 | 1 |
| 5 | | 5 | 435.9 | 0.95 | 1.80 | 295 | 87 | 78 | ✓ | ✓ | 8 | 2 |
| 6 | | 6 | 437.3 | 1.20 | 2.30 | 290 | 90 | 77 | ✓ | ✓ | 10 | 4 |
| 7 | | 7 | 438.9 | 1.20 | 2.30 | 285 | 93 | 77 | ✓ | ✓ | 12 | 4 |
| 8 | | 8 | 440.4 | 1.10 | 2.10 | 275 | 95 | 77 | ✓ | ✓ | 14 | 4 |
| 9 | | 9 | 442.0 | 0.75 | 1.40 | 270 | 96 | 77 | ✓ | ✓ | 16 | 2 |
| 10 | | 10 | 443.2 | 0.65 | 1.20 | 255 | 97 | 78 | ✓ | ✓ | 18 | 2 |
| 11 | | 11 | 444.4 | 0.65 | 1.20 | 260 | 97 | 77 | ✓ | ✓ | 20 | 2 |
| 12 | | 12 | 445.6 | 0.83 | 1.55 | 275 | 98 | 80 | ✓ | ✓ | 22 | 2 |
| 13 | | | | | | | | | | | | |
| 14 | 2 | 1 | 446.954 | 0.94 | 1.80 | 260 | 93 | 78 | ✓ | ✓ | 0 | 3 |
| 15 | | 2 | 448.3 | 1.10 | 2.10 | 260 | 94 | 81 | ✓ | ✓ | 2 | 4 |
| 16 | | 3 | 449.8 | 1.10 | 2.10 | 260 | 95 | 81 | ✓ | ✓ | 4 | 5 |
| 17 | | 4 | 451.4 | 1.10 | 2.10 | 260 | 98 | 80 | ✓ | ✓ | 6 | 5 |
| 8 | | 5 | 453.0 | 0.70 | 1.30 | 260 | 98 | 80 | ✓ | ✓ | 8 | 5 |
| 19 | | 6 | 454.2 | 1.70 | 3.30 | 260 | 102 | 79 | ✓ | ✓ | 10 | 9 |
| 20 | | 7 | 455.9 | 1.70 | 3.30 | 260 | 106 | 79 | ✓ | ✓ | 12 | 9 |
| 21 | | 8 | 458.0 | 1.20 | 2.30 | 250 | 112 | 80 | ✓ | ✓ | 14 | 6 |
| 22 | | 9 | 459.6 | 1.20 | 2.30 | 255 | 114 | 82 | ✓ | ✓ | 16 | 6 |
| 23 | | 10 | 461.4 | 1.20 | 2.30 | 280 | 114 | 84 | ✓ | ✓ | 18 | 6 |
| 24 | | 11 | 463.0 | 1.40 | 2.80 | 250 | 113 | 85 | ✓ | ✓ | 20 | 8 |
| 25 | | 12 | 464.7 | 1.60 | 3.20 | 255 | 113 | 85 | ✓ | ✓ | 22 | 9 |
| 26 | | | | | | | | | | | | |
| 27 | 3 | 1 | 466.875 | 1.10 | 2.20 | 250 | 103 | 85 | ✓ | ✓ | 0 | 6 |
| 28 | | 2 | 468.2 | 1.40 | 2.70 | 250 | 102 | 92 | ✓ | ✓ | 2 | 8 |
| 29 | | 3 | 470.0 | 1.20 | 2.70 | 250 | 104 | 84 | ✓ | ✓ | 4 | 7 |
| 30 | | 4 | 471.6 | 0.97 | 1.85 | 250 | 104 | 84 | ✓ | ✓ | 6 | 6 |
| 31 | | 5 | 473.2 | 1.30 | 2.50 | 250 | 104 | 84 | ✓ | ✓ | 8 | 8 |
| 32 | | 6 | 474.8 | 1.70 | 3.30 | 250 | 105 | 83 | ✓ | ✓ | 10 | 11 |
| 33 | | 7 | 476.7 | 0.47 | 0.87 | 250 | 103 | 84 | ✓ | ✓ | 12 | 2 |
| 34 | | 8 | 477.7 | 1.10 | 2.10 | 250 | 103 | 83 | ✓ | ✓ | 14 | 6 |
| 35 | | 9 | 479.1 | 0.75 | 1.45 | 250 | 101 | 83 | ✓ | ✓ | 16 | 5 |
| 36 | | 10 | 480.5 | .83 | 1.60 | 255 | 101 | 85 | ✓ | ✓ | 18 | 5 |
| 17 | | 11 | 481.7 | 1.40 | 2.80 | 250 | 102 | 95 | ✓ | ✓ | 20 | 10 |
| 38 | | 12 | 483.5 | 1.70 | 3.30 | 260 | 105 | 84 | ✓ | ✓ | 22 | 12 |
| 39 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |

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MADE IN U.S.A

Hercules
Woodwaste Boiler No. 4
Run No 2. cont'd

Date: 3-15-83

3-15-83

| | Port | Point | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp <250° | Imp Temp <70 | Time | V A C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 1 | 485.615 | 0.20 | 0.28 | 250 | 99 | 82 | ✓ | ✓ | 0 | 1 |
| 2 | | 2 | 486.3 | 0.24 | 0.45 | 250 | 96 | 82 | ✓ | ✓ | 2 | 1 |
| 3 | | 3 | 487.1 | 0.16 | 0.29 | 250 | 94 | 85 | ✓ | ✓ | 4 | 1 |
| 4 | | 4 | 487.7 | 0.13 | 0.24 | 245 | 92 | 82 | ✓ | ✓ | 6 | 1 |
| 5 | | 5 | 488.2 | 0.24 | 0.45 | 245 | 91 | 83 | ✓ | ✓ | 8 | 1 |
| 6 | | 6 | 489.0 | 0.32 | 0.60 | 245 | 91 | 80 | ✓ | ✓ | 10 | 1 |
| 7 | | 7 | 489.8 | 0.32 | 0.60 | 245 | 93 | 83 | ✓ | ✓ | 12 | 1 |
| 8 | | 8 | 490.7 | 0.08 | 0.15 | 250 | 92 | 84 | ✓ | ✓ | 14 | 1 |
| 9 | | 9 | 491.3 | 0.08 | 0.15 | 265 | 91 | 84 | ✓ | ✓ | 16 | 1 |
| 10 | | 10 | 491.8 | 0.29 | 0.57 | 255 | 91 | 81 | ✓ | ✓ | 18 | 1 |
| 11 | | 11 | 492.6 | 0.37 | 0.73 | 250 | 90 | 81 | ✓ | ✓ | 20 | 1 |
| 12 | | 12 | 493.6 | 0.20 | 0.38 | 250 | 92 | 85 | ✓ | ✓ | 22 | 1 |
| 13 | END | | 494.375 | | | | | | | | 2:42P | 1 |

Leak Check: 0.00 cfm @ 15" Hg

Condensate: 103 g

Silica gel: 17g

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Hercules
Woodwaste Boiler No: 4
Run No. 3 Particulate Sample

Date: 3-15-83

Pbar: 29.89
$P_g$ = -.7"

| Port | Point | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp <250° | Imp Temp <70° | Time | VAC. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 494.834 | 0.88 | 1.70 | 285 | 75 | 75 | ✓ | ✓ | 3:40P | 1 |
| | 2 | 496.2 | 0.86 | 1.65 | 285 | 80 | 75 | ✓ | ✓ | 2 | 1 |
| | 3 | 497.6 | 0.63 | 1.20 | 285 | 85 | 75 | ✓ | ✓ | 4 | 1 |
| | 4 | 498.9 | 0.93 | 1.75 | 290 | 88 | 75 | ✓ | ✓ | 6 | 1 |
| | 5 | 500.2 | 1.10 | 2.10 | 300 | 94 | 75 | ✓ | ✓ | 8 | 2 |
| | 6 | 501.8 | 1.40 | 2.80 | 305 | 100 | 76 | ✓ | ✓ | 10 | 3 |
| | 7 | 503.5 | 1.50 | 3.00 | 305 | 104 | 76 | ✓ | ✓ | 12 | 3 |
| | 8 | 505.4 | 1.30 | 2.60 | 305 | 107 | 78 | ✓ | ✓ | 14 | 3 |
| | 9 | 507.1 | 0.85 | 1.65 | 295 | 106 | 78 | ✓ | ✓ | 16 | 1 |
| | 10 | 508.6 | 0.73 | 1.40 | 305 | 105 | 78 | ✓ | ✓ | 18 | 1 |
| | 11 | 509.9 | 0.73 | 1.40 | 295 | 104 | 77 | ✓ | ✓ | 20 | 1 |
| | 12 | 511.2 | 0.91 | 1.80 | 290 | 105 | 78 | ✓ | ✓ | 22 | 1 |
| | | | | | | | | | | | |
| 2 | 1 | 512.606 | 0.89 | 1.75 | 290 | 102 | 78 | ✓ | ✓ | 0 | 1 |
| | 2 | 514.1 | 1.20 | 2.30 | 290 | 104 | 80 | ✓ | ✓ | 2 | 2 |
| | 3 | 515.7 | 1.20 | 2.30 | 290 | 107 | 80 | ✓ | ✓ | 4 | 2 |
| | 4 | 517.3 | 1.30 | 2.60 | 280 | 107 | 79 | ✓ | ✓ | 6 | 2 |
| | 5 | 519.1 | 0.99 | 1.90 | 280 | 110 | 79 | ✓ | ✓ | 8 | 1 |
| | 6 | 520.5 | 1.80 | 3.70 | 275 | 114 | 81 | ✓ | ✓ | 10 | 5 |
| | 7 | 522.4 | 1.90 | 3.80 | 270 | 115 | 81 | ✓ | ✓ | 12 | 5 |
| | 8 | 524.7 | 1.40 | 2.70 | 270 | 116 | 84 | ✓ | ✓ | 14 | 2 |
| | 9 | 526.5 | 1.20 | 2.30 | 270 | 114 | 82 | ✓ | ✓ | 16 | 2 |
| | 10 | 528.2 | 1.40 | 2.70 | 270 | 113 | 84 | ✓ | ✓ | 18 | 2 |
| | 11 | 529.9 | 1.40 | 2.70 | 270 | 111 | 83 | ✓ | ✓ | 20 | 3 |
| | 12 | 531.7 | 1.40 | 2.70 | 275 | 112 | 85 | ✓ | ✓ | 22 | 3 |
| | | | | | | | | | | | |
| 3 | 1 | 533.405 | 1.20 | 2.30 | 275 | 104 | 84 | ✓ | ✓ | 0 | 3 |
| | 2 | 535.0 | 1.40 | 2.70 | 270 | 104 | 84 | ✓ | ✓ | 2 | 3 |
| | 3 | 536.8 | 1.10 | 2.10 | 270 | 104 | 80 | ✓ | ✓ | 4 | 2 |
| | 4 | 538.4 | 0.99 | 1.90 | 260 | 107 | 82 | ✓ | ✓ | 6 | 2 |
| | 5 | 539.9 | 1.40 | 2.70 | 250 | 107 | 83 | ✓ | ✓ | 8 | 3 |
| | 6 | 541.6 | 1.80 | 3.70 | 255 | 111 | 84 | ✓ | ✓ | 10 | 5 |
| | 7 | 543.7 | 1.30 | 2.60 | 250 | 113 | 84 | ✓ | ✓ | 12 | 4 |
| | 8 | 545.6 | 1.00 | 1.95 | 255 | 113 | 83 | ✓ | ✓ | 14 | 3 |
| | 9 | 547.0 | 0.76 | 1.45 | 260 | 112 | 84 | ✓ | ✓ | 16 | 2 |
| | 10 | 548.4 | 0.90 | 1.75 | 260 | 111 | 85 | ✓ | ✓ | 18 | 2 |
| | 11 | 549.7 | 1.40 | 2.70 | 265 | 111 | 86 | ✓ | ✓ | 20 | 4 |
| | 12 | 551.5 | 1.80 | 3.60 | 271 | 112 | 84 | ✓ | ✓ | 22 | 5 |

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Hercules
Woodwaste Boiler No. 4
Run No. 3 Cont'd

Date: 3-15-83

28-SIE

| | Port | Point | Vm | ΔP | ΔH | Ts | Tm | | Box Temp <250 | Imp Temp <70 | Time | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 1 | 553.484 | 0.14 | 0.26 | 250 | 102 | 83 | ✓ | ✓ | 0 | 1 |
| 2 | | 2 | 554.0 | 0.23 | 0.42 | 250 | 99 | 84 | ✓ | ✓ | 2 | 1 |
| 3 | | 3 | 554.7 | 0.15 | 0.28 | 250 | 96 | 80 | ✓ | ✓ | 4 | 1 |
| 4 | | 4 | 555.4 | 0.15 | 0.28 | 250 | 96 | 82 | ✓ | ✓ | 6 | 1 |
| 5 | | 5 | 556.0 | 0.21 | 0.39 | 245 | 95 | 82 | ✓ | ✓ | 8 | 1 |
| 6 | | 6 | 556.6 | 0.35 | 0.66 | 250 | 97 | 82 | ✓ | ✓ | 10 | 1 |
| 7 | | 7 | 557.6 | 0.36 | 0.67 | 250 | 98 | 83 | ✓ | ✓ | 12 | 1 |
| 8 | | 8 | 558.5 | 0.18 | 0.33 | 250 | 98 | 82 | ✓ | ✓ | 14 | 1 |
| 9 | | 9 | 559.1 | 0.11 | 0.19 | 255 | 99 | 83 | ✓ | ✓ | 16 | 1 |
| 10 | | 10 | 559.5 | 0.33 | 0.60 | 255 | 100 | 83 | ✓ | ✓ | 18 | 1 |
| 11 | | 11 | 560.4 | 0.46 | 0.86 | 260 | 100 | 82 | ✓ | ✓ | 20 | 1 |
| 12 | | 12 | 561.4 | 0.28 | 0.51 | 260 | 102 | 83 | ✓ | ✓ | 22 | 1 |
| 13 | END | | 562.186 | | | | | | | | 5:33P | |

Leak check 0.00 cfm @ 10" Hg

Condensate 71 ml
Silica Gel: 15.5g

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Analytical Data

Hercules - Boiler No. 4
Tested: March 15, 1983

| FILTERS: | Run 1 | Run 2 | Run 3 | |
|---|---|---|---|---|
| Filter Number | 8375 | 8370 | 8371 | |
| Tare Weight, g | .6199 | .5775 | .5819 | |
| Final Weight, g | .8224 | .8707 | .7784 | |
| Net Gain, g | 0.2025 | 0.2932 | 0.1965 | |

| PROBE WASH | Run 1 | Run 2 | Run 3 | Blank |
|---|---|---|---|---|
| Volume | 170 | 175 | 180 | 100 |
| Tare Weight, g | 112.0254 | 112.7453 | 111.5213 | 114.3973 |
| Final Weight, g | 112.1461 | 112.9082 | 111.6773 | 114.3981 |
| Net Gain, g | 0.1207 | 0.1629 | 0.1560 | .0008 |
| Blank Correction g | -0.0014 | -0.0014 | -0.0014 | - |

| | Run 1 | Run 2 | Run 3 | |
|---|---|---|---|---|
| Mn, mg | 321.8 | 454.7 | 351.1 | |

HERCULES INCORPORATED
HATTIESBURG, MISSISSIPPI 39401

RECEIVED
1983 MAR -2 AM 9:21
AIR & WATER POLLUTION CONTROL COMMISSION
STATE OF MISSISSIPPI

March 1, 1983

Bureau Of Pollution Control
P. O. Box 10385
Jackson, Mississippi 39209

ATTN: Don Watts

Dear Mr. Watts:

Re your February 11, 1983, letter we have reviewed your comments and expect to comply with them starting in March.

Please find the enclosed test results for woodwaste boilers 1 and 2 on October 25 and 26, 1982. These results indicate a particulate concentration of 0.12 grains/dscf for boiler 1 and 0.11 grains/dscf for boiler 2 as compared to an allowable concentration of 0.30 grains/dscf.

The dates of ~~April~~ March 15 and 16, 1983, have been set up for sampling boilers 3 and 4.

If I can answer any question please call me.

Very truly yours,

Charles Jordan
Environmental Coordinator

CSJ:ml

Enclosure

Change per phone call w/ CJ by DAW 3/4/83

# REPORT OF
# PARTICULATE EMISSIONS TESTS

## HERCULES
## WOODWASTE BOILERS-NO. 1 and NO. 2

## HATTIESBURG, MISSISSIPPI
## OCTOBER 25 and 26, 1982

Performed By:
Environmental Monitoring Laboratories, Inc.
Ridgeland, Mississippi

# ENVIRONMENTAL MONITORING LABORATORIES, INC.

P.O. Box 655 • 224-B Highway 51 North
Ridgeland, Mississippi 39157

(601) 856-3092


On October 25 and 26, 1982, Environmental Monitoring Laboratories performed air emissions tests on two of four woodwaste boilers operated by Hercules, Inc. in Hattiesburg, Mississippi.

The tests were performed to determine particulate emissions from woodwaste boilers No. 1 and No. 2. Particulate emissions from woodwaste boilers not classified under New Source Performance Standards or otherwise restricted by permit condition are limited to 0.30 grains per dry standard cubic foot as described in Air Quality Regulations APC-S-1 Section 3, paragraph 4.(b).

Following is a report of the results of the emissions tests. Contents are:


1.0 Test Results

2.0 Validity of Results

3.0 Source Operation

4.0 Test Proceedures

5.0 Data Reduction - Boiler No. 1

6.0 Raw Data - Boiler No. 1

7.0 Data Reduction - Boiler No. 2

8.0 Raw Data - Boiler No. 2

## 1.0 Test Results

1.1 The average particulate emissions concentration from Boiler No. 1 as determined from three separate samples taken on October 25, 1982, is 0.12 grains per dry standard cubic foot.

The table below is a summary of the pertinent results

| Boiler No. 1 | | Run 1 | Run 2 | Run 3 | Avg. |
|---|---|---|---|---|---|
| Particulate conc. | grains/dscf | 0.09 | 0.13 | 0.13 | 0.12 |
| Allowable Conc. | grains/dscf | 0.30 | 0.30 | 0.30 | 0.30 |
| Emission rate | #/hr | 31.72 | 46.69 | 47.58 | 42.00 |
| Allowable emissions | #/hr | 110.2 | 106.9 | 109.7 | 108.9 |
| Velocity | ft/sec. | 61.19 | 59.36 | 60.66 | 60.40 |
| Volumetric flowrate | $ft^3/hr$ | 4604327 | 4181535 | 4176401 | 4320754 |
| Volumetric flowrate | dscf/hr | 2571205 | 2493529 | 2559366 | 2541367 |
| Stack Temperature | $^oF$ | 386 | 369 | 364 | 373 |

1.2 The average particulate emissions concentration from Boiler No. 2 as determined from three separate samples taken on October 26, 1982, is 0.11 grains per dry standard cubic foot.

The table below is a summary of the pertinent results:

| Boiler No. 2 | | Run 1 | Run 2 | Run 3 | Avg. |
|---|---|---|---|---|---|
| Particulate conc. | grains/dscf | 0.05 | 0.11 | 0.16 | 0.11 |
| Allowable conc. | grains/dscf | 0.30 | 0.30 | 0.30 | 0.30 |
| Emission rate | #/hr | 20.34 | 44.41 | 64.03 | 42.93 |
| Allowable emissions | #/hr | 125.3 | 122.3 | 121.1 | 122.9 |
| Velocity | ft/sec | 62.50 | 61.39 | 61.97 | 61.95 |
| Volumetric flowrate | $ft^3/hr$ | 4803141 | 4717864 | 4762116 | 4761040 |
| Volumetric flowrate | dscf/hr | 2922962 | 2853446 | 2825164 | 2867191 |
| Stack Temperature | $^oF$ | 372 | 358 | 364 | 365 |

## 2.0 Validity of Results

2.1 The largest deviation from the average volumetric flowrate for both tests is less than 7%. Considerable variation in emission results was experienced with both tests. Emissions values were within 25% of the mean for the test on Boiler 1. Emissions values for Boiler 2 varied as much as 55%.

The average emissions rates of each boiler, however, were extremely close, which is to be expected of two nearly identical boilers. The wide variations from one run to another may be due to the fact that different qualities of woodwaste may fuel a boiler from one time period to another. Woodwaste is purchased from a variety of sources.

2.2 Isokinetic variation: The sampling rates for the Boiler No. 1 test were 101.9%, 94.0% and 89.2% isokinetic for Runs 1, 2, and 3 respectively. The third run was below the desired 90% to 110% range due to a sharp decrease in moisture content. The effect, if any, of this below-isokinetic rate would be to bias the results high.

The sampling rates for the Boiler No. 2 test were 96.9%, 96.4%, and 96.4% for Runs 1, 2, and 3 respectively.

2.3 Although there were slight deviations from the standard methods for these tests as described in section 4.0, the samples were representative of emissions under the encountered operating conditions and the results should be considered valid.

## 3.0 Source Operation

Hercules operates four nearly identical woodwaste boilers. The boilers are each capable of using fuel oil and gas although woodwaste is the primary fuel and a fire is maintained at all times with woodwaste.

Because insufficient woodwaste is generated at the facility, additional wood fuel must be purchased. the quality and quantity of the fuel varies.

On the two days of testing, the supply of wood fuel was low. In order to test the boilers under an "all woodwaste" condition, the supply was shifted to an all wood condition during the test for each boiler.

## 4.0 Test Proceedure

4.1 Sampling and analytical proceedures used are those described in the Code of Federal Regulations, Title 40, Part 60, Appendix A, specifically Reference Method 5. No substantial deviations from the standard proceedures were taken. Each test was performed in triplicate. Testing was observed by Mr. Jesse Thompson of the Mississippi Bureau of Pollution Control.

4.2 A variation from the standard proceedures was necessary due to physical limitations of the sampling site. Method 5 testing requires that samples be taken from sample points as described in Method 1.

Because the masonry stacks serving the boilers have no sampling platforms, testing ports have been installed on each boiler's exhaust duct (breeching) prior to its entering the stack. One stack serves Boilers 1 and 2 and another serves Boilers 3 and 4. Each boiler's ducts have a rectangular vertical section in which sample ports are installed. Tapering duct sections and fans proceed and preceed the short vertical sections and there is less than the required number of diameter distance from disturbances both downstream and upstream of the portholes. The minimum diameter distances required by Method 1 are 0.5 diameters from the sample ports to the nearest downstream disturbance and 2 diameters from the sample ports to nearest upstream disturbance. These minimum diameter distances dictate that 48 points should be sampled.

The deviation from the standard method for these tests is that sampling was performed as though the minimum distances were met; 48 sample points were used. The test for the absense of cyclonic flow as described in Method 1 indicated that the flow at the sample site is acceptable for each boiler. If the cyclonic flow test had indicated unacceptable flow, sampling was to be done at 50% isokinetic to compensate for a possible negative bias from the cyclonic flow.

## 5.0 Data Reduction - Boiler No. 1

### 5.1 Nomenclature

| SYMBOL | UNITS | DESCRIPTION |
|---|---|---|
| An | $ft^2$ | Nozzle area |
| As | $ft^2$ | Stack area |
| Bws | dimensionless | Propor tion by volume of water vapor |
| Cp | dimensionless | Pitot correction factor |
| Cs | grams/dscf | Particulate concentration |
| C's | grains/dscf | Particulate concentration |
| Dn | inches | Nozzle diameter |
| ΔH | in. $H_2O$ | Pressure drop across meter orifice |
| ΔP | in. $H_2O$ | Stack velocity pressure head |
| E | #/hr | Particulate emission rate |
| E' | | Particulate emission rate |
| Ea | | Allowable emissions |
| I | percent | Percent isokinetic sampling |
| Kp | consistent | Pitot tube constant = 85.49 |
| Mn | mg | Particulate sample weight |
| Md | #/# mole | Dry molecular wt. of stack gas |

| SYMBOL | UNITS | DESCRIPTION |
|---|---|---|
| Ms | #/# mole | Wet molecular wt. of stack gas |
| Pbar | in. Hg | Barometric pressure |
| Pg | in. Hg | Static pressure in stack |
| Pm | in. Hg | Meter pressure = Pbar + ($\Delta$H/13.6) |
| Ps | in. Hg | Stack pressure = Pbar + Pg |
| Pstd | in. Hg | Standard pressure = 29.92 |
| Q | $ft^3/hr$ | Volumetric flow rate @ stack conditions |
| Qstd | dscf/hr | Volumetric flow rate @ dry, std. conditions |
| $\theta$ | minutes | Sampling time per run |
| Tm | $^oR$ | Average meter temperature |
| Ts | $^oR$ | Average stack temperature |
| Tstd | $^oR$ | Standard temperature = $528^o$ |
| Vlc | ml | Volume of water collected |
| Vm | $ft^3$ | Volume of dry gas sampled |
| Vmstd | dscf | Sample volume @ standard conditions |
| Vwstd | scf | Sample volume of water vapor |
| Y | dimensionless | Meter correction factor |
| Xa | percent | Excess air |

## 5.2 Summary of Data - Boiler No. 1

| | | | |
|---|---|---|---|
| 1. | As | $ft^2$ | 21.347 |
| 2. | Dn | in. | .188 |
| 3. | An | $ft^2$ | $1.928 \times 10^{-4}$ |
| 4. | Cp | -- | .86 |
| 5. | $\theta$ | min. | 94, 88, 86 * |
| 6. | Y | -- | 1.00 |

| | | | | | |
|---|---|---|---|---|---|
| 1. | Vm | $ft^3$ | 38.828 | 34.240 | 33.416 |
| 2. | $\sqrt{\Delta P}$, avg. | $(in. H_2O)^{\frac{1}{2}}$ | .838 | .825 | .850 |
| 3. | $\Delta H$ | in. $H_2O$ | .615 | .545 | .622 |
| 4. | Ts | $^oR$ | 846.0 | 829.3 | 823.8 |
| 5. | Tm | $^oR$ | 537.4 | 540.1 | 541.5 |
| 6. | Pbar | in. Hg | 30.27 | 30.24 | 30.24 |
| 7. | Pm | in. Hg | 30.32 | 30.28 | 30.29 |
| 8. | Pg | in. Hg | -.022 | -.015 | -.015 |
| 9. | Ps | in. Hg | 30.25 | 30.23 | 30.23 |
| 10. | Vlc | ml | 107 | 56.5 | 42.0 |
| 11. | $O_2$ | % | 15.0 | 15.0 | 15.0 |
| 12. | $CO_2$ | % | 5.5 | 5.5 | 5.5 |
| 13. | $N_2$+CO | % | 79.5 | 79.5 | 79.5 |
| 14. | Mn | mg | 216.5 | 289.1 | 278.4 |
| 15. | | | | | |
| 16. | | | | | |
| 17. | | | | | |

*One negative point during Run 1, four during Run2, and five during Run 3.

## 5.3 Calculations - Boiler No. 1

| | | | | |
|---|---|---|---|---|
| 1. Vmstd: $Vm\ Y\ (Pm/Pstd)(Tstd/Tm)$ | 38.659 | 33.876 | 32.986 | |
| 2. Vwstd: $(.04707\ ft^3/ml)Vlc$ | 5.036 | 2.659 | 1.977 | |
| 3. Bws: $Vwstd/(Vwstd+Vmstd)$ | .115 | .073 | .057 | |
| 4. Md: $.44\ CO_2+.32\ O_2+.28(N_2+CO)$ | 29.48 | 29.48 | 29.48 | |
| 5. Ms: $Md(1-Bws)+18\ Bws$ | 28.16 | 28.64 | 28.83 | |
| 6. Vs: $Kp\ Cp\ (\sqrt{\Delta P})\sqrt{Ts/(PsMs)}$ | 61.19 | 59.36 | 60.66 | 60.40 |
| 7. Q: $Vs\ As(3600\ sec/hr)$ | 4604327 | 4181535 | 4176401 | 4320754 |
| 8. Qstd: $Q(1-Bws)(Ps/Pstd)(Tstd/Ts)$ | 2571205 | 2493529 | 2559366 | 2541367 |
| 9. Cs: $(.001mg/g)(Mn/Vmstd)$ | .0056 | .0085 | .0084 | |
| 10. E: $(1\#/454\ g)Cs\ Qstd$ | 31.72 | 46.69 | 47.58 | 42.00 |
| 11. C's: $(Cs)(15.419\ gr/g)$ | 0.09 | 0.13 | 0.13 | 0.12 |
| 12. | | | | |
| 13. | | | | |
| 14. | | | | |
| 15. | | | | |
| 16. | | | | |
| I: $\frac{100\ Ts\ [.002669\ Vlc + (Vm\ Pm/Tm)]}{60\ \Theta\ Vs\ Ps\ An}$ | 101.9 | 94.0 | 89.2 | |

*As reduced by area represented by negative areas.

# 6.0 Raw Data - Boiler No. 1

# ISOKINETIC PRELIMINARY DATA

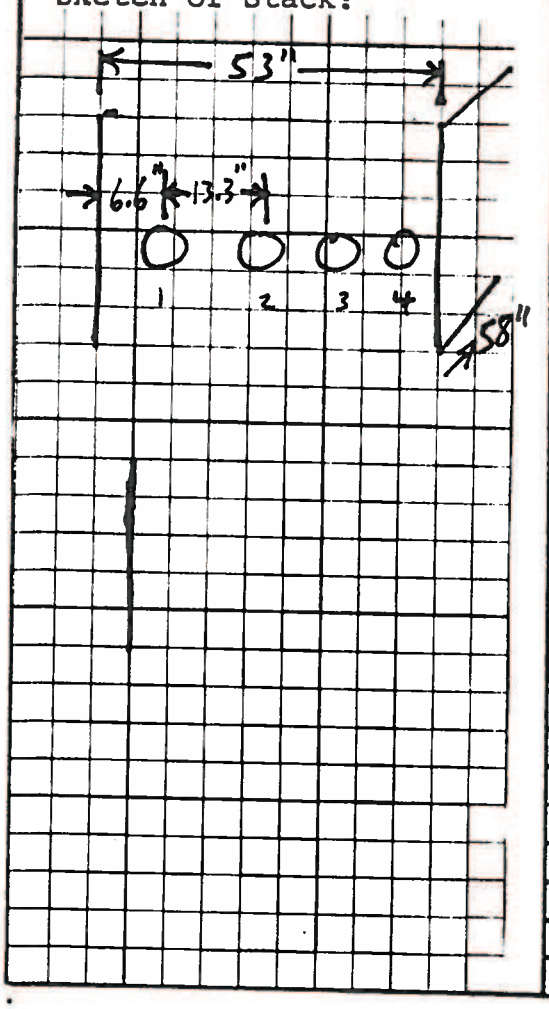
Hercules - No. 1 Boiler

10-25-82

Diameters upstream < 1 downstream < 1

No. sample points 48 time/pt. 2

Sketch of Stack:




| Pt. No. | % Dia. | inches from wall | Preliminary ΔP 1 ∠ 2 ∠ 3 ∠ 4 | ∠ |
|---|---|---|---|---|
| 1 | NA | 2.4 | .10 -45° .95 -20 .8 -5 .8 | 0° |
| 2 | | 7.3 | .13 -45 1.10 -10 1.2 -10 .85 | -5 |
| 3 | | 12.1 | .10 0 .98 -10 1.2 -5 .20 | -5 |
| 4 | | 16.9 | .08 0 .80 -5 1.3 -5 1.4 | -5 |
| 5 | | 21.8 | .05 0 .10 -10 .6 0 1.1 | 0 |
| 6 | | 26.6 | .15 -20 .65 -10 .5 0 1.3 | 0 |
| 7 | | 31.4 | .40 -20 Neg 0 1.5 0 1.5 | 5 |
| 8 | | 36.3 | .60 -15 .35 0 1.8 0 1.5 | 5 |
| 9 | | 41.1 | .15 0 .90 0 1.5 +5 1.05 | 5 |
| 10 | | 45.9 | .40 0 .90 0 1.5 0 .95 | 5 |
| 11 | | 50.8 | .40 0 .90 0 1.7 0 .95 | 0 |
| 12 | | 55.6 | .40 0 .90 0 1.7 0 .95 | 0 |

Preliminary Data:

Pbar 30.27 "Hg

Pg -.30"H₂O

ΔH@ 1.73"H₂O

Tm 90°F

%H₂O 7%

Ts 380°F

ΔPavg .8

ΔPmax 1.8

Dn .188

Nomograph Reference 2.21

Meter Box I.D. L.S. - 1

Probe I.D. S-S.S.

Pitot Cp .86

Box heat set 250°F

Notes:

AVG. ∠ to obtain null reading is 5.7°. Therefore acceptable flow conditions exist.

Hercules - Woodwaste Boiler No. 1 10-25-82 Pbar 30.27

10-25-82 Pg = ~~neg~~ -.30

Run No. 1

| Port | Point | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp | Imp Temp | Time | VAC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 319.900 | .07 | .05 | 375 | 74 | 72 | 250 | 70 | 12:49P | 2 |
| | 2 | 320.2 | .05 | .03 | 375 | 74 | 72 | 250 | 70 | 2 | 2 |
| | 3 | 320.4 | .25 | .19 | 375 | 74 | 72 | 250 | 70 | 2 | 2 |
| | 4 | 320.8 | .25 | .19 | 375 | 74 | 72 | 250 | 70 | 2 | 2 |
| | 5 | 321.3 | .60 | .48 | 375 | 75 | 72 | 250 | 70 | 2 | 2 |
| | 6 | 321.9 | .55 | .44 | 375 | 75 | 72 | 250 | 70 | 2 | 2 |
| | 7 | 322.6 | .25 | .19 | 380 | 76 | 72 | 250 | 70 | 2 | 2 |
| | 8 | 323.1 | .25 | .19 | 380 | 76 | 72 | 250 | 70 | 2 | 2 |
| | 9 | 323.5 | .15 | .12 | 385 | 76 | 72 | 250 | 70 | 2 | 2 |
| | 10 | 324.0 | .25 | .19 | 390 | 76 | 72 | 250 | 70 | 2 | 2 |
| | 11 | 324.4 | .15 | .12 | 390 | 76 | 72 | 250 | 70 | 2 | 2 |
| | 12 | 324.9 | .15 | .12 | 385 | 76 | 72 | 250 | 70 | 2 | 2 |
| 2 | 1 | 325.195 | 1.1 | .9 | 380 | 76 | 72 | 250 | 70 | 2 | 3 |
| | 2 | 326.2 | 1.1 | .9 | 380 | 80 | 72 | 250 | 70 | 2 | 3 |
| | 3 | 327.2 | .80 | .65 | 380 | 82 | 73 | 250 | 70 | 2 | 3 |
| | 4 | 328.2 | .55 | .44 | 390 | 82 | 73 | 250 | 70 | 2 | 3 |
| | 5 | 328.9 | .50 | .40 | 385 | 80 | 73 | 250 | 70 | 2 | 3 |
| | 6 | 329.7 | .65 | .51 | 385 | 80 | 73 | 250 | 70 | 2 | 3 |
| | 7 | 330.5 | .20 | .17 | 385 | 80 | 73 | 250 | 70 | 2 | 2 |
| | 8 | 331.0 | .05 | .03 | 390 | 80 | 72 | 250 | 70 | 2 | 2 |
| | 9 | 331.2 | .90 | .72 | 390 | 80 | 72 | 250 | 70 | 2 | 2 |
| | 10 | 332.1 | .90 | .72 | 395 | 80 | 74 | 250 | 70 | 2 | 3 |
| | 11 | 333.1 | .90 | .72 | 400 | 82 | 74 | 250 | 70 | 2 | 3 |
| | 12 | 334.0 | .90 | .72 | 400 | 82 | 74 | 250 | 70 | 2 | 3 |
| 3 | 1 | 335.020 | 1.1 | .9 | 380 | 82 | 74 | 250 | 70 | 2 | 3 |
| | 2 | 336.0 | 1.1 | .9 | 380 | 84 | 74 | 250 | 70 | 2 | 3 |
| | 3 | 337.1 | 1.1 | .9 | 390 | 84 | 74 | 250 | 70 | 2 | 3 |
| | 4 | 338.1 | 1.1 | .9 | 390 | 84 | 74 | 250 | 70 | 2 | 3 |
| | 5 | 339.2 | 1.1 | .9 | 390 | 85 | 74 | 250 | 70 | 2 | 3 |
| | 6 | 340.3 | neg. | - | - | - | - | - | - | - | - |
| | 7 | 340.3 | 1.2 | .97 | 390 | 85 | 74 | 250 | 70 | 2 | 3 |
| | 8 | 341.4 | 1.3 | 1.05 | 390 | 85 | 74 | 250 | 70 | 2 | 4 |
| | 9 | 342.5 | 1.2 | .97 | 390 | 86 | 74 | 250 | 70 | 2 | 4 |
| | 10 | 343.6 | 1.2 | .97 | 390 | 86 | 74 | 250 | 70 | 2 | 4 |
| | 11 | 344.7 | 1.3 | 1.05 | 395 | 86 | 75 | 250 | 70 | 2 | 4 |
| | 12 | 345.8 | 1.5 | 1.2 | 395 | 88 | 75 | 250 | 70 | 2 | 4 |

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Hercules - Boiler No. 1

10-25-82

Run No. 1 Cont'd

10-25-82

| | Part, Point | | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp | Imp Temp | Time | V | A | C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 1 | 347.108 | .85 | .68 | 385 | 86 | 74 | 250 | 70 | 2 | | | 3 |
| 2 | | 2 | 348.0 | .85 | .68 | 385 | 85 | 74 | 250 | 70 | 2 | | | 3 |
| 3 | | 3 | 348.9 | .35 | .27 | 385 | 84 | 74 | 250 | 70 | 2 | | | 3 |
| 4 | | 4 | 349.5 | .95 | .76 | 385 | 84 | 74 | 250 | 70 | 2 | | | 3 |
| 5 | | 5 | 350.5 | 1.0 | .80 | 385 | 84 | 74 | 250 | 70 | 2 | | | 3 |
| 6 | | 6 | 351.5 | 1.0 | .80 | 385 | 85 | 74 | 250 | 70 | 2 | | | 3 |
| 7 | | 7 | 352.5 | 1.1 | .90 | 385 | 86 | 74 | 250 | 70 | 2 | | | 4 |
| 8 | | 8 | 353.6 | 1.1 | .9 | 385 | 86 | 74 | 250 | 70 | 2 | | | 4 |
| 9 | | 9 | 354.6 | 1.0 | .80 | 390 | 86 | 74 | 250 | 70 | 2 | | | 3 |
| 10 | | 10 | 355.7 | .90 | .73 | 390 | 86 | 74 | 250 | 70 | 2 | | | 3 |
| 11 | | 11 | 356.6 | 1.0 | .80 | 390 | 86 | 74 | 250 | 70 | 2 | | | 3 |
| 12 | | 12 | 357.7 | 1.1 | .90 | 390 | 86 | 74 | 250 | 70 | 2 | | | 4 |
| 13 | END | | 358.728 | | | | | | | | 2:24P | | | |

leak check < .02 cfm at 5" Hg

condensate: ~~70 ml~~ 99 ml

silica gel 8 g

Filter No 8281

Hercules - Boiler 1

10-25-82

Run No. 2

$P_{bar} = 30.24$

$P_s = -.2$

| Port | Point | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp | Imp Temp | Time | V A C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 358.915 | .1 | .03 | 355 | 74 | 72 | 250 | 70 | 3:31P | 2 |
| | 2 | 359.2 | .02 | .01 | 355 | 74 | 72 | 250 | 70 | 2 | 2 |
| | 3 | 359.3 | neg | - | - | - | - | - | - | 0 | - |
| | 4 | 359.3 | neg | - | - | - | - | - | - | 0 | - |
| | 5 | 359.3 | neg | - | - | - | - | - | - | 0 | - |
| | 6 | 359.3 | .05 | .02 | 355 | 74 | 72 | 250 | 70 | 2 | 2 |
| | 7 | 359.4 | .07 | .03 | 360 | 74 | 72 | 250 | 70 | 2 | 2 |
| | 8 | 357.4 | .22 | .14 | 365 | 74 | 72 | 250 | 70 | 2 | 2 |
| | 9 | 360.0 | .15 | .09 | 370 | 75 | 72 | 250 | 70 | 2 | 2 |
| | 10 | 360.4 | .05 | .02 | 370 | 75 | 72 | 250 | 70 | 2 | 2 |
| | 11 | 360.6 | .13 | .06 | 365 | 75 | 72 | 250 | 70 | 2 | 2 |
| | 12 | 360.9 | .13 | .06 | 360 | 75 | 72 | 250 | 70 | 2 | 2 |
| | | - | | | | | | | | | |
| 2 | 1 | 361.222 | 1.2 | .81 | 360 | 76 | 73 | 250 | 70 | 2 | 4 |
| | 2 | 362.2 | 1.2 | .81 | 365 | 80 | 73 | 250 | 70 | 2 | 4 |
| | 3 | 363.3 | .76 | .51 | 370 | 80 | 73 | 250 | 70 | 2 | 3 |
| | 4 | 364.1 | .57 | .38 | 370 | 80 | 74 | 250 | 70 | 2 | 3 |
| | 5 | 364.8 | .50 | .33 | 370 | 80 | 74 | 250 | 70 | 2 | 3 |
| | 6 | 365.5 | .55 | .36 | 370 | 80 | 74 | 250 | 70 | 2 | 3 |
| | 7 | 366.1 | .35 | .23 | 370 | 80 | 74 | 250 | 70 | 2 | 3 |
| | 8 | 366.7 | .05 | .02 | 370 | 90 | 74 | 250 | 70 | 2 | 2 |
| | 9 | 367.0 | 1.0 | .69 | 370 | 80 | 74 | 250 | 70 | 2 | 4 |
| | 10 | 367.9 | 1.0 | .69 | 370 | 82 | 74 | 250 | 70 | 2 | 4 |
| | 11 | 368.9 | 1.1 | .75 | 370 | 84 | 74 | 250 | 70 | 2 | 4 |
| | 12 | 369.9 | .9 | .6 | 370 | 89 | 76 | 250 | 70 | 2 | 4 |
| | | | | | | | | | | | |
| 3 | 1 | 370.786 | 1.3 | .89 | 370 | 94 | 78 | 250 | 70 | 2 | 4 |
| | 2 | 371.8 | 1.1 | .75 | 370 | 98 | 80 | 250 | 70 | 2 | 4 |
| | 3 | 372.8 | 1.1 | .75 | 370 | 94 | 80 | 250 | 70 | 2 | 4 |
| | 4 | 373.8 | 1.1 | .75 | 370 | 92 | 80 | 250 | 70 | 2 | 4 |
| | 5 | 374.8 | 1.1 | .75 | 370 | 92 | 78 | 250 | 70 | 2 | 4 |
| | 6 | 375.8 | neg | - | - | - | - | - | - | 0 | - |
| | 7 | 375.8 | 1.4 | .95 | 370 | 90 | 78 | 250 | 70 | 2 | 4 |
| | 8 | 376.8 | 1.4 | .95 | 370 | 90 | 78 | 250 | 70 | 2 | 4 |
| | 9 | 377.9 | 1.2 | .81 | 370 | 90 | 78 | 250 | 70 | 2 | 4 |
| | 10 | 378.9 | 1.4 | .95 | 370 | 90 | 78 | 250 | 70 | 2 | 4 |
| | 11 | 380.0 | 1.6 | 1.1 | 375 | 90 | 78 | 250 | 70 | 2 | 5 |
| | 12 | 381.2 | 1.6 | 1.1 | 375 | 90 | 78 | 250 | 70 | 2 | 5 |

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Hercules - Boiler No. 1

10-25-82

Run No. 2 Cont'd

| | Port, Point | | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp | Imp Temp | Time | V A C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 1 | 382.378 | .90 | .60 | 370 | 88 | 76 | 250 | 70 | 2 | 4 |
| 2 | | 2 | 383.3 | .97 | .65 | 370 | 90 | 78 | 250 | 70 | 2 | 4 |
| 3 | | 3 | 384.2 | .35 | .09 | 370 | 90 | 78 | 250 | 70 | 2 | 4 |
| 4 | | 4 | 384.6 | .72 | .48 | 370 | 87 | 78 | 250 | 70 | 2 | 4 |
| 5 | | 5 | 385.4 | 1.1 | .75 | 375 | 87 | 78 | 250 | 70 | 2 | 4 |
| 6 | | 6 | 386.4 | 1.0 | .69 | 375 | 90 | 78 | 250 | 70 | 2 | 4 |
| 7 | | 7 | 387.3 | 1.1 | .75 | 375 | 90 | 78 | 250 | 70 | 2 | 4 |
| 8 | | 8 | 388.3 | 1.2 | .81 | 375 | 90 | 78 | 250 | 70 | 2 | 4 |
| 9 | | 9 | 389.3 | 1.0 | .69 | 375 | 90 | 78 | 250 | 70 | 2 | 4 |
| 10 | | 10 | 390.3 | .95 | .64 | 370 | 88 | 78 | 250 | 70 | 2 | 4 |
| 11 | | 11 | 391.2 | 1.0 | .69 | 375 | 88 | 78 | 250 | 70 | 2 | 4 |
| 12 | | 12 | 392.2 | 1.1 | .75 | 385 | 88 | 76 | 250 | 70 | 2 | 4 |
| 13 | END | | 393.155 | | | | | | | | 5:01P | |

Leak check 0.00 cfm @ 8" Hg

condensate: 50 ml

silica gel: 65 g

Filter No. 8282

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Hercules - Boiler No1 Pbar 30.24

10-25-82

Run No. 3

10-25-82

| Port | Point | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp | Imp Temp | Time | VAC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 393.329 | .10 | .03 | 360 | 72 | 70 | 250 | 70 | 5:49P | 2 |
| | 2 | 393.5 | .05 | .02 | 360 | 72 | 70 | 250 | 70 | 2 | 2 |
| | 3 | 393.6 | neg | — | — | — | — | — | — | 0 | — |
| | 4 | 393.6 | neg | — | — | — | — | — | — | 0 | — |
| | 5 | 393.6 | neg | — | — | — | — | — | — | 0 | — |
| | 6 | 393.6 | .06 | .02 | 360 | 74 | 72 | 250 | 70 | 2 | 2 |
| | 7 | 393.8 | .09 | .03 | 360 | 74 | 72 | 250 | 70 | 2 | 2 |
| | 8 | 394.1 | .20 | 1.3 | 360 | 76 | 74 | 250 | 70 | 2 | 2 |
| | 9 | 394.5 | .20 | 1.3 | 365 | 80 | 74 | 250 | 70 | 2 | 2 |
| | 10 | 394.9 | .03 | .01 | 370 | 82 | 76 | 250 | 70 | 2 | 2 |
| | 11 | 395.0 | .20 | 1.3 | 370 | 82 | 78 | 250 | 70 | 2 | 2 |
| | 12 | 395.4 | .05 | .02 | 370 | 86 | 80 | 250 | 70 | 2 | 2 |
| 2 | 1 | 395.664 | 1.1 | .75 | 360 | 90 | 82 | 250 | 70 | 2 | 3 |
| | 2 | 396.6 | 1.1 | .75 | 360 | 96 | 82 | 250 | 70 | 2 | 3 |
| | 3 | 397.6 | .85 | .57 | 365 | 96 | 82 | 250 | 70 | 2 | 3 |
| | 4 | 398.5 | .60 | .40 | 365 | 90 | 80 | 250 | 70 | 2 | 3 |
| | 5 | 399.2 | .53 | .36 | 365 | 90 | 79 | 250 | 70 | 2 | 3 |
| | 6 | 399.9 | .75 | .5 | 360 | 90 | 78 | 250 | 70 | 2 | 3 |
| | 7 | 400.7 | .20 | .13 | 360 | 90 | 76 | 250 | 70 | 2 | 2 |
| | 8 | 401.2 | neg | — | — | — | — | — | — | 0 | — |
| | 9 | 401.2 | 1.0 | .69 | 365 | 90 | 76 | 250 | 70 | 2 | 3 |
| | 10 | 402.1 | .85 | .56 | 365 | 90 | 76 | 250 | 70 | 2 | 3 |
| | 11 | 402.9 | .55 | .36 | 365 | 90 | 76 | 250 | 70 | 2 | 3 |
| | 12 | 403.6 | .68 | .45 | 365 | 90 | 75 | 250 | 70 | 2 | 3 |
| 3 | 1 | 404.415 | 1.2 | .80 | 365 | 88 | 74 | 250 | 70 | 2 | 3 |
| | 2 | 405.4 | 1.2 | .80 | 365 | 90 | 74 | 250 | 70 | 2 | 3 |
| | 3 | 406.5 | 1.1 | .75 | 370 | 90 | 74 | 250 | 70 | 2 | 3 |
| | 4 | 407.4 | 1.1 | .75 | 370 | 90 | 74 | 250 | 70 | 2 | 3 |
| | 5 | 408.4 | .52 | .34 | 370 | 92 | 73 | 250 | 70 | 2 | 3 |
| | 6 | 409.1 | neg | — | — | — | — | — | — | 0 | — |
| | 7 | 409.1 | 1.4 | .95 | 370 | 94 | 73 | 250 | 70 | 2 | 3 |
| | 8 | 410.0 | 1.4 | .95 | 365 | 94 | 72 | 250 | 70 | 2 | 4 |
| | 9 | 411.1 | 1.4 | .95 | 360 | 96 | 72 | 250 | 70 | 2 | 4 |
| | 10 | 412.2 | 1.3 | .89 | 360 | 96 | 72 | 250 | 70 | 2 | 4 |
| | 11 | 413.3 | 1.4 | .95 | 365 | 96 | 72 | 250 | 70 | 2 | 4 |
| | 12 | 414.4 | 1.4 | .95 | 365 | 96 | 72 | 250 | 70 | 2 | 4 |

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Hercules - Boiler No. 1
10-25-82
Run No. 3 cont'd

JH 10-25-82

| | Port | Point | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp | Imp Temp | Time | Vac |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 1 | 415.485 | .95 | .64 | 360 | 92 | 72 | 250 | 70 | 2 | 3 |
| 2 | | 2 | 416.4 | .98 | .66 | 360 | 92 | 72 | 250 | 70 | 2 | 3 |
| 3 | | 3 | 417.3 | .25 | .16 | 365 | 90 | 70 | 250 | 70 | 2 | 2 |
| 4 | | 4 | 417.9 | 1.2 | .8 | 360 | 88 | 70 | 250 | 70 | 2 | 3 |
| 5 | | 5 | 418.8 | 1.1 | .69 | 360 | 90 | 70 | 250 | 70 | 2 | 3 |
| 6 | | 6 | 419.7 | 1.1 | .69 | 355 | 92 | 70 | 250 | 70 | 2 | 3 |
| 7 | | 7 | 420.7 | 1.1 | .69 | ~~360~~ 350 | 94 | 70 | 250 | 70 | 2 | 3 |
| 8 | | 8 | 421.6 | 1.3 | .89 | ~~365~~ 345 | 94 | 70 | 250 | 70 | 2 | 4 |
| 9 | | 9 | 422.6 | 1.3 | .89 | ~~360~~ 340 | 96 | 70 | 250 | 70 | 2 | 4 |
| 10 | | 10 | 423.6 | 1.3 | .89 | ~~365~~ 345 | 96 | 70 | 250 | 70 | 2 | 4 |
| 11 | | 11 | 424.7 | 1.1 | .78 | ~~365~~ 345 | 96 | 70 | 250 | 70 | 2 | 4 |
| 12 | | 12 | 425.7 | 1.3 | .89 | ~~365~~ 345 | 96 | 70 | 250 | 70 | 2 | 4 |
| 13 | END | | 426.745 | | | | | | | | 7:16 P | |

Leak check 0.00 cfm at 10" Hg

Condensate: 30 ml
silica gel: 6.0g

Filter No. 8283

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Analytical Data

Hercules - Boiler No. 1
Tested: 10-25-82

| FILTERS: | Run 1 | Run 2 | Run 3 | |
|---|---|---|---|---|
| Filter Number | 8281 | 8282 | 8283 | |
| Tare Weight, g | .5693 | .5754 | .5731 | |
| Final Weight, g | .6854 | .7504 | .7500 | |
| Net Gain, g | .1161 | .1750 | .1769 | |

| PROBE WASH | Run 1 | Run 2 | Run 3 | Blank |
|---|---|---|---|---|
| Volume, ml | 178 | 160 | 159 | 200 |
| Tare Weight, g | 112.0233 | 112.7270 | 111.5147 | 114.3857 |
| Final Weight, g | 112.1249 | 112.8721 | 111.6172 | 114.3870 |
| Net Gain, g | .1016 | .1151 | .1025 | .0013 |
| Blank Correction,g | -.0012 | -.0010 | -.0010 | |

| | Run 1 | Run 2 | Run 3 | |
|---|---|---|---|---|
| Mn, mg | 216.5 | 289.1 | 278.4 | |

## 7.0 Data Reduction - Boiler No. 2

7.1 Nomenclature - See Section 5.1

## 7.2 Summary of Data - Boiler No. 2

| | | | |
|---|---|---|---|
| 1. | As | $ft^2$ | 21.347 |
| 2. | Dn | in. | .228 |
| 3. | An | $ft^2$ | $2.835 \times 10^{-4}$ |
| 4. | Cp | -- | .86 |
| 5. | $\theta$ | min. | 96 |
| 6. | Y | -- | 1.00 |

| | | | | | |
|---|---|---|---|---|---|
| 1. | Vm | $ft^3$ | 58.574 | 59.468 | 58.943 |
| 2. | $\sqrt{\Delta P}$, avg. | $(in.\ H_2O)^{\frac{1}{2}}$ | .868 | .860 | .863 |
| 3. | $\Delta H$ | in. $H_2O$ | 1.361 | 1.447 | 1.380 |
| 4. | Ts | $^oR$ | 832.4 | 817.6 | 824.1 |
| 5. | Tm | $^oR$ | 533.3 | 546.3 | 547.0 |
| 6. | Pbar | in. Hg | 30.29 | 30.31 | 30.33 |
| 7. | Pm | in. Hg | 30.39 | 30.42 | 30.43 |
| 8. | Pg | in. Hg | 0.000 | 0.000 | 0.000 |
| 9. | Ps | in. Hg | 30.29 | 30.31 | 30.33 |
| 10. | Vlc | ml | 97.5 | 101.5 | 116.5 |
| 11. | $O_2$ | % | 15.0 | 15.0 | 15.0 |
| 12. | $CO_2$ | % | 5.5 | 5.5 | 5.5 |
| 13. | $N_2$+CO | % | 79.5 | 79.5 | 79.5 |
| 14. | Mn | mg | 186.1 | 412.9 | 595.4 |
| 15. | | | | | |
| 16. | | | | | |
| 17. | | | | | |

## 7.3 Calculations - Boiler No. 2

| | | | | |
|---|---|---|---|---|
| 1. Vmstd: $Vm\ Y\ (Pm/Pstd)(Tstd/Tm)$ | 58.903 | 58.436 | 57.865 | |
| 2. Vwstd: $(.04707\ ft^3/ml)Vlc$ | 4.589 | 4.778 | 5.484 | |
| 3. Bws: $Vwstd/(Vwstd+Vmstd)$ | .072 | .076 | .087 | |
| 4. Md: $.44\ CO_2+.32\ O_2+.28(N_2+CO)$ | 29.48 | 29.48 | 29.48 | |
| 5. Ms: $Md(1-Bws)+18\ Bws$ | 28.65 | 28.61 | 28.49 | |
| 6. Vs: $Kp\ Cp\ (\sqrt{\Delta P})\sqrt{Ts/(PsMs)}$ | 62.50 | 61.29 | 61.97 | 61.95 |
| 7. Q: $Vs\ As(3600\ sec/hr)$ | 4803141 | 4717864 | 4762116 | 4761040 |
| 8. Qstd: $Q(1-Bws)(Ps/Pstd)(Tstd/Ts)$ | 2922962 | 2853446 | 2875164 | 2867191 |
| 9. Cs: $(.001mg/g)(Mn/Vmstd)$ | .0032 | .0071 | .0103 | |
| 10. E: $(1\#/454\ g)Cs\ Qstd$ | 20.34 | 44.41 | 64.03 | 42.93 |
| 11. C's: $(Cs)(15.419\ gr/g)$ | 0.05 | 0.11 | 0.16 | 0.11 |
| 12. | | | | |
| 13. | | | | |
| 14. | | | | |
| 15. | | | | |
| 16. | | | | |
| I: $\frac{100\ Ts\ [.002669\ Vlc + (Vm\ Pm/Tm)]}{60\ \Theta\ Vs\ Ps\ An}$ | 96.9 | 96.4 | 96.4 | 96.6 |

# 8.0 Raw Data - Boiler No. 2

# ISOKINETIC PRELIMINARY DATA

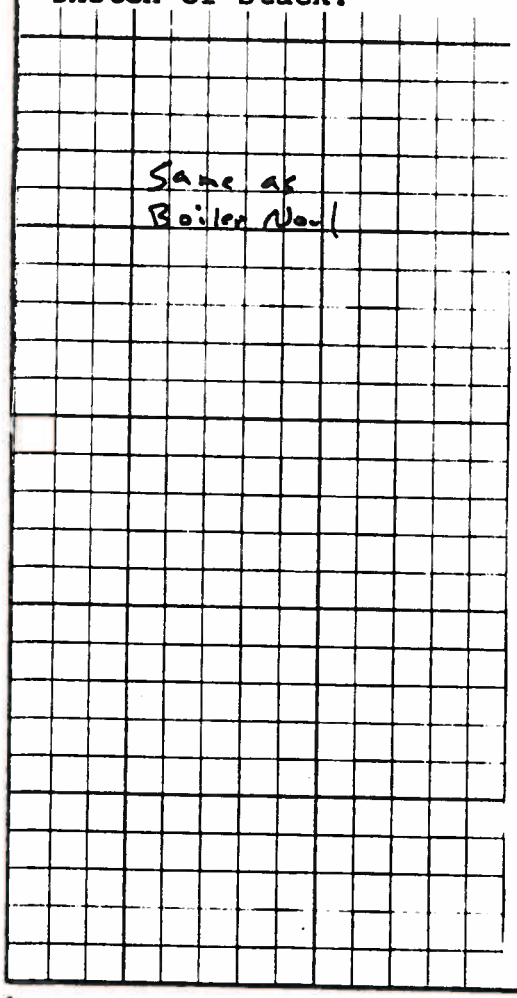
Hercules - Boiler No-2

Oct. 26-82

Diameters upstream < 1 downstream < 1

No. sample points 48 time/pt. 2

Sketch of Stack:




| Pt. No. | % Dia. | inches from wall | Preliminary ΔP 1 | α | 2 | α | 3 | α | 4 | α |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | NA | 2.4 | .5 | 30° | .35 | 25 | .5 | 10 | .3 | 10 |
| 2 | | 7.3 | .45 | 10 | .6 | 30 | .5 | 10 | .4 | 10 |
| 3 | | 12.1 | .5 | 0 | .65 | 15 | .6 | 5 | .3 | 5 |
| 4 | | 16.5 | .7 | 10 | .7 | 5 | .5 | 5 | .2 | 0 |
| 5 | | 21.8 | .9 | 5 | .85 | 0 | .45 | 5 | .2 | 0 |
| 6 | | 26.6 | 1.2 | 0 | .2 | 0 | .45 | 0 | .15 | 0 |
| 7 | | 31.4 | 1.0 | -5 | 1.0 | 0 | .25 | 0 | .2 | 0 |
| 8 | | 36.3 | .6 | -5 | .7 | 0 | .15 | 0 | .15 | 0 |
| 9 | | 41.1 | .6 | 0 | .7 | 0 | .4 | 0 | .05 | 5 |
| 10 | | 45.9 | .6 | 0 | .9 | 0 | .55 | 0 | .56 | 0 |
| 11 | | 50.9 | .65 | 0 | 1.0 | 10 | .7 | 5 | 2.0 | 0 |
| 12 | | 55.6 | .65 | 5 | 1.2 | 5 | .5 | 5 | 2.0 | 0 |

Preliminary Data:

Pbar 30.29

Pg negligible

ΔH@ 1.73

Tm 90

%$H_2O$ 7

Ts 380°F

ΔPavg ≈.5

ΔPmax 2.0

Dn .228

Nomograph Reference L.C

Meter Box I.D. L.S.-1

Probe I.D. S-S.S.

Pitot Cp .86

Box heat set 250°F

Notes:

Avg. α for all readings = 5.0°.

Therefore flow is acceptable.

Hercules Boiler No. 2
10-26-82
Run No. 1

$P_{bar} = 30.29$

| Port, Point | | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp | Imp Temp | Time 10: | V M C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 427.2 | .90 | 1.5 | 360 | 62 | 60 | 250 | 60 | 10:20 | 3 |
| | 2 | 428.7 | .80 | 1.3 | 360 | 64 | 60 | 250 | 70 | 2 | 3 |
| | 3 | 429.5 | .18 | 0.3 | 360 | 64 | 60 | 250 | 70 | 2 | 2 |
| | 4 | 430.1 | .85 | 1.4 | 360 | 64 | 60 | 250 | 70 | 2 | 3 |
| | 5 | 431.3 | 1.1 | 1.8 | 360 | 68 | 60 | 250 | 70 | 2 | 4 |
| | 6 | 432.8 | 1.2 | 2.0 | 360 | 70 | 60 | 250 | 70 | 2 | 4 |
| | 7 | 434.3 | 1.5 | 2.5 | 360 | 74 | 62 | 250 | 70 | 2 | 5 |
| | 8 | 436.0 | 1.5 | 2.5 | 360 | 76 | 62 | 250 | 70 | 2 | 5 |
| | 9 | 437.7 | 1.05 | 1.75 | 360 | 78 | 62 | 250 | 70 | 2 | 4 |
| | 10 | 439.2 | .88 | 1.45 | 370 | 78 | 64 | 250 | 70 | 2 | 4 |
| | 11 | 440.6 | .88 | 1.45 | 370 | 77 | 64 | 250 | 70 | 2 | 4 |
| | 12 | 441.9 | 1.05 | 1.75 | 365 | 78 | 64 | 250 | 70 | 2 | 4 |
| 2 | 1 | 443.359 | .70 | 1.15 | 375 | 76 | 64 | 250 | 70 | 2 | 3 |
| | 2 | 444.5 | .85 | 1.4 | 380 | 76 | 64 | 250 | 70 | 2 | 4 |
| | 3 | 445.8 | .85 | 1.4 | 380 | 78 | 65 | 250 | 70 | 2 | 4 |
| | 4 | 447.2 | 1.0 | 1.65 | 380 | 78 | 66 | 250 | 70 | 2 | 4 |
| | 5 | 448.5 | .82 | 1.3 | 380 | 80 | 66 | 250 | 70 | 2 | 4 |
| | 6 | 449.6 | .64 | 1.05 | 380 | 80 | 66 | 250 | 70 | 2 | 4 |
| | 7 | 450.7 | 1.5 | 2.5 | 385 | 80 | 66 | 250 | 70 | 2 | 5 |
| | 8 | 452.3 | 1.3 | 2.2 | 385 | 84 | 67 | 250 | 70 | 2 | 5 |
| | 9 | 453.7 | 1.05 | 1.75 | 380 | 85 | 68 | 250 | 70 | 2 | 4 |
| | 10 | 455.4 | 1.05 | 1.75 | 380 | 84 | 68 | 250 | 70 | 2 | 4 |
| | 11 | 456.9 | 1.1 | 1.8 | 375 | 85 | 68 | 250 | 70 | 2 | 4 |
| | 12 | 458.3 | 1.3 | 2.2 | 375 | 86 | 68 | 250 | 70 | 2 | 5 |
| 3 | 1 | 460.0 | .59 | .97 | 370 | 82 | 68 | 250 | 70 | 2 | 3 |
| | 2 | 461.1 | .59 | .97 | 370 | 82 | 68 | 250 | 70 | 2 | 3 |
| | 3 | 462.2 | 1.0 | 1.65 | 365 | 82 | 68 | 250 | 70 | 2 | 4 |
| | 4 | 463.6 | .95 | 1.60 | 365 | 84 | 68 | 250 | 70 | 2 | 4 |
| | 5 | 464.9 | .80 | 1.3 | 380 | 84 | 70 | 250 | 70 | 2 | 4 |
| | 6 | 466.3 | .90 | 1.5 | 385 | 85 | 70 | 250 | 70 | 2 | 4 |
| | 7 | 467.6 | .45 | .72 | 385 | 84 | 70 | 250 | 70 | 2 | 3 |
| | 8 | 468.6 | .42 | .67 | 385 | 83 | 70 | 250 | 70 | 2 | 3 |
| | 9 | 469.5 | .75 | 1.3 | 380 | 82 | 70 | 250 | 70 | 2 | 4 |
| | 10 | 470.7 | 1.1 | 1.8 | 380 | 84 | 70 | 250 | 70 | 2 | 5 |
| | 11 | 472.1 | 1.4 | 2.4 | 375 | 88 | 72 | 250 | 70 | 2 | 5 |
| | 12 | 473.9 | 1.4 | 2.4 | 375 | 91 | 72 | 250 | 70 | 2 | 5 |

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Hercules Boiler 2
10-26-82
Run No. 2 / cont'd

10-26-82

| Port | Point | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp | Imp Temp | Time | Unit A/C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 1 | 475.565 | .35 | .56 | 360 | 80 | 72 | 250 | 70 | 2 | 3 |
| | 2 | 476.5 | .43 | .69 | 360 | 80 | 72 | 250 | 70 | 2 | 3 |
| | 3 | 477.4 | .25 | .46 | 325 | 80 | 72 | 250 | 70 | 2 | 3 |
| | 4 | 478.0 | .17 | .26 | 375 | 80 | 72 | 250 | 70 | 2 | 3 |
| | 5 | 478.8 | .17 | .26 | 375 | 80 | 72 | 250 | 70 | 2 | 3 |
| | 6 | 479.4 | .20 | .32 | 375 | 80 | 72 | 250 | 70 | 2 | 3 |
| | 7 | 480.2 | .22 | .35 | 375 | 80 | 72 | 250 | 70 | 2 | 3 |
| | 8 | 480.9 | .14 | .22 | 375 | 80 | 72 | 250 | 70 | 2 | 3 |
| | 9 | 481.4 | .04 | .07 | 375 | 80 | 72 | 250 | 70 | 2 | 3 |
| | 10 | 481.8 | .35 | .56 | 375 | 80 | 72 | 250 | 70 | 2 | 3 |
| | 11 | 482.7 | 1.20 | 2.00 | 370 | 80 | 72 | 250 | 70 | 2 | 4 |
| | 12 | 484.0 | 1.50 | 2.50 | 370 | 88 | 72 | 250 | 70 | 2 | 5 |
| END: | | 485.785 | | | | | | | | 12:01 PM | |

Leak check: 0.00 cfm @ 8" Hg

condensate: 84 ml

silica gel: ~~6.0~~ g 13.5

Filter No. 8284

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Hercules Boiler 2
10-26-82
Run No. 2

Pbar = 30.31

Da 228

| | Port, Point | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp | Imp Temp | Time | Vc/A/C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 1 | 486.032 | .90 | 1.50 | 350 | 80 | 76 | 250 | 70 | 1.23 | 5 |
| 2 | 2 | 487.4 | .64 | 1.05 | 350 | 80 | 76 | 250 | 70 | 2 | 4 |
| 3 | 3 | 488.5 | .17 | .26 | 355 | 80 | 76 | 250 | 70 | 2 | 2 |
| 4 | 4 | 489.1 | .90 | 1.50 | 355 | 80 | 76 | 250 | 70 | 2 | 5 |
| 5 | 5 | 490.5 | 1.05 | 1.75 | 360 | 84 | 76 | 250 | 70 | 2 | 6 |
| 6 | 6 | 491.9 | 1.30 | 2.20 | 360 | 86 | 76 | 250 | 70 | 2 | 7 |
| 7 | 7 | 493.6 | 1.60 | 2.70 | 365 | 90 | 76 | 250 | 70 | 2 | 8 |
| 8 | 8 | 495.3 | 1.50 | 2.50 | 360 | 92 | 76 | 250 | 70 | 2 | 8 |
| 9 | 9 | 497.1 | 1.05 | 1.75 | 360 | 92 | 76 | 250 | 70 | 2 | 6 |
| 10 | 10 | 498.6 | .85 | 1.40 | 360 | 92 | 77 | 250 | 70 | 2 | 5 |
| 11 | 11 | 499.9 | .90 | 1.50 | 355 | 92 | 78 | 250 | 70 | 2 | 5 |
| 12 | 12 | 501.3 | 1.05 | 1.75 | 350 | 92 | 78 | 250 | 70 | 2 | 6 |
| 13 | | | | | | | | | | | |
| 14 | 2 1 | 502.788 | .83 | 1.35 | 350 | 92 | 78 | 250 | 70 | 2 | 5 |
| 15 | 2 | 504.1 | .90 | 1.50 | 350 | 92 | 78 | 250 | 70 | 2 | 5 |
| 16 | 3 | 505.4 | .90 | 1.50 | 355 | 92 | 79 | 250 | 70 | 2 | 5 |
| 17 | 4 | 506.8 | 1.05 | 1.75 | 360 | 94 | 80 | 250 | 70 | 2 | 6 |
| 18 | 5 | 508.3 | .52 | .82 | 360 | 93 | 80 | 250 | 70 | 2 | 4 |
| 19 | 6 | 509.3 | .75 | 1.20 | 360 | 92 | 80 | 250 | 70 | 2 | 5 |
| 20 | 7 | 510.5 | 1.60 | 2.70 | 365 | 96 | 80 | 250 | 70 | 2 | 8 |
| 21 | 8 | 512.3 | 1.40 | 2.40 | 360 | 100 | 80 | 250 | 70 | 2 | 8 |
| 22 | 9 | 514.1 | 1.10 | 1.80 | 360 | 100 | 80 | 250 | 70 | 2 | 6 |
| 23 | 10 | 515.6 | 1.05 | 1.75 | 360 | 100 | 80 | 250 | 70 | 2 | 6 |
| 24 | 11 | 517.1 | 1.10 | 1.80 | 355 | 98 | 81 | 250 | 70 | 2 | 6 |
| 25 | 12 | 518.6 | 1.30 | 2.20 | 355 | 100 | 82 | 250 | 70 | 2 | 7 |
| 26 | | | | | | | | | | | |
| 27 | 3 1 | 520.218 | .68 | 1.10 | 355 | 98 | 82 | 250 | 70 | 2 | 5 |
| 28 | 2 | 521.4 | .96 | 1.50 | 355 | 96 | 82 | 250 | 70 | 2 | 6 |
| 29 | 3 | 522.8 | 1.05 | 1.75 | 355 | 96 | 82 | 250 | 70 | 2 | 6 |
| 30 | 4 | 524.4 | 0.97 | 1.60 | 360 | 98 | 82 | 250 | 70 | 2 | 6 |
| 31 | 5 | 525.7 | .84 | 1.45 | 360 | 98 | 82 | 250 | 70 | 2 | 5 |
| 32 | 6 | 527.1 | 1.05 | 1.75 | 365 | 98 | 82 | 250 | 70 | 2 | 6 |
| 33 | 7 | 528.5 | .22 | .34 | 365 | 96 | 82 | 250 | 70 | 2 | 3 |
| 34 | 8 | 529.3 | .60 | .99 | 360 | 94 | 82 | 250 | 70 | 2 | 4 |
| 35 | 9 | 530.3 | .65 | 1.05 | 360 | 94 | 82 | 250 | 70 | 2 | 4 |
| 36 | 10 | 531.5 | 1.05 | 1.75 | 355 | 95 | 82 | 250 | 70 | 2 | 6 |
| 37 | 11 | 532.9 | 1.40 | 2.40 | 355 | 98 | 82 | 250 | 70 | 2 | 8 |
| 38 | 12 | 534.6 | 1.40 | 2.40 | 355 | 100 | 82 | 250 | 70 | 2 | 8 |
| 39 | | | | | | | | | | | |
| 40 | | | | | | | | | | | |

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Hercules No. 2 Boiler

10-26-82

Run No. 2 cont'd

10-26

| | Port | Point | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp | Imp Temp | Time | V A C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 1 | 536.3 | .46 | .74 | 355 | 96 | 82 | 250 | 70 | 2 | 4 |
| 2 | | 2 | 537.3 | .51 | .81 | 355 | 94 | 82 | 250 | 70 | 2 | 4 |
| 3 | | 3 | 538.4 | .30 | .48 | 360 | 94 | 82 | 250 | 70 | 2 | 3 |
| 4 | | 4 | 539.2 | .19 | .30 | 360 | 92 | 82 | 250 | 70 | 2 | 3 |
| 5 | | 5 | 539.8 | .19 | .30 | 360 | 90 | 82 | 250 | 70 | 2 | 3 |
| 6 | | 6 | 540.5 | .25 | .39 | 360 | 90 | 82 | 250 | 70 | 2 | 3 |
| 7 | | 7 | 541.2 | .25 | .39 | 360 | 90 | 82 | 250 | 70 | 2 | 3 |
| 8 | | 8 | 541.9 | .07 | .10 | 360 | 90 | 82 | 250 | 70 | 2 | 2 |
| 9 | | 9 | 542.3 | .07 | .10 | 360 | 88 | 82 | 250 | 70 | 2 | 2 |
| 10 | | 10 | 542.8 | .42 | .67 | 360 | 88 | 82 | 250 | 70 | 2 | 4 |
| 11 | | 11 | 543.7 | .45 | .72 | 355 | 90 | 82 | 250 | 70 | 2 | 4 |
| 12 | | 12 | 544.6 | .35 | .55 | 350 | 90 | 82 | 250 | 70 | 2 | 4 |
| 13 | END | | 545.500 | | | | | | | | 3:01 PM | |

Leak check, 0.02 cfm @ 8" Hg

Condensate: 86 ml

Silica gel: 13.5 g

Filter No. 8285

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Hercules - Boiler 2

10-26-82

Run No. 3

Pbar = 20.23

| | 1 | 2 | 3 | 4 | 5 | 6 | | 7 | | 8 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Port | Pt | Va | ΔP | ΔH | Ts | Ta in oar | | Box Temp | Imp Temp | Time | V A C |
| 1 | 1 | 1 | 545.619 | .90 | 1.50 | 360 | 82 | 80 | 200 | 70 | 3:38P | 4 |
| 2 | | 2 | 547.0 | .72 | 1.15 | 360 | 85 | 80 | 225 | 70 | 2 min | 4 |
| 3 | | 3 | 548.2 | .30 | .48 | 360 | 86 | 80 | 225 | 70 | 2 | 3 |
| 4 | | 4 | 548.9 | .88 | 1.30 | 365 | 86 | 80 | 225 | 70 | 2 | 4 |
| 5 | | 5 | 550.3 | 1.05 | 1.75 | 370 | 88 | 80 | 225 | 70 | 2 | 5 |
| 6 | | 6 | 551.7 | 1.30 | 2.20 | 370 | 92 | 80 | 250 | 70 | 2 | 5 |
| 7 | | 7 | 553.2 | 1.60 | 2.70 | 370 | 95 | 80 | 250 | 70 | 2 | 6 |
| 8 | | 8 | 555.1 | 1.40 | 2.40 | 370 | 97 | 80 | 250 | 70 | 2 | 6 |
| 9 | | 9 | 556.8 | 1.05 | 1.75 | 365 | 97 | 80 | 250 | 70 | 2 | 5 |
| 10 | | 10 | 558.2 | .95 | 1.55 | 365 | 96 | 81 | 250 | 70 | 2 | 4 |
| 11 | | 11 | 559.6 | .95 | 1.55 | 365 | 96 | 81 | 250 | 70 | 2 | 4 |
| 12 | | 12 | 560.9 | 1.05 | 1.75 | 365 | 96 | 81 | 250 | 70 | 2 | 5 |
| 13 | | | | | | | | | | | | |
| 14 | 2 | 1 | 562.410 | .84 | 1.40 | 365 | 96 | 81 | 250 | 70 | 2 | 4 |
| 15 | | 2 | 563.7 | .84 | 1.40 | 365 | 96 | 82 | 250 | 70 | 2 | 4 |
| 16 | | 3 | 565.1 | .86 | 1.45 | 365 | 96 | 81 | 250 | 70 | 2 | 4 |
| 17 | | 4 | 566.4 | .98 | 1.60 | 370 | 96 | 81 | 250 | 70 | 2 | 4 |
| 18 | | 5 | 567.8 | .16 | .25 | 370 | 94 | 81 | 250 | 70 | 2 | 2 |
| 19 | | 6 | 568.4 | .88 | 1.45 | 370 | 90 | 81 | 250 | 70 | 2 | 4 |
| 20 | | 7 | 569.6 | 1.60 | 2.70 | 375 | 96 | 81 | 250 | 70 | 2 | 6 |
| 21 | | 8 | 571.4 | 1.50 | 2.50 | 375 | 100 | 82 | 250 | 70 | 2 | 6 |
| 22 | | 9 | 573.1 | 1.05 | 1.75 | 370 | 100 | 82 | 250 | 70 | 2 | 5 |
| 23 | | 10 | 574.6 | .99 | 1.65 | 365 | 100 | 82 | 250 | 70 | 2 | 5 |
| 24 | | 11 | 576.0 | 1.05 | 1.75 | 365 | 95 | 82 | 250 | 70 | 2 | 5 |
| 25 | | 12 | 577.5 | 1.20 | 2.00 | 360 | 100 | 82 | 250 | 70 | 2 | 5 |
| 26 | | | | | | | | | | | | |
| 27 | | 1 | 579.345 | .70 | 1.15 | 360 | 96 | 82 | 250 | 70 | 2 | 4 |
| 28 | | 2 | 580.4 | .95 | 1.60 | 360 | 94 | 82 | 250 | 70 | 2 | 5 |
| 29 | | 3 | 581.7 | 1.00 | 1.65 | 360 | 96 | 82 | 250 | 70 | 2 | 5 |
| 30 | | 4 | 583.2 | .92 | 1.50 | 360 | 96 | 82 | 250 | 70 | 2 | 5 |
| 31 | | 5 | 584.6 | .85 | 1.40 | 360 | 96 | 82 | 250 | 70 | 2 | 5 |
| 32 | | 6 | 585.8 | 1.05 | 1.75 | 365 | 96 | 82 | 250 | 70 | 2 | 3 |
| 33 | | 7 | 587.3 | .30 | .48 | 365 | 94 | 81 | 250 | 70 | 2 | 3 |
| 34 | | 8 | 588.1 | 0.70 | 1.15 | 365 | 92 | 80 | 250 | 70 | 2 | 4 |
| 35 | | 9 | 589.3 | .70 | 1.15 | 370 | 92 | 80 | 250 | 70 | 2 | 4 |
| 36 | | 10 | 590.5 | 1.30 | 2.20 | 370 | 92 | 80 | 250 | 70 | 2 | 6 |
| 37 | | 11 | 591.9 | 1.50 | 2.50 | 360 | 99 | 80 | 250 | 70 | 2 | 6 |
| 38 | | 12 | 593.7 | 1.40 | 2.40 | 360 | 100 | 80 | 250 | 70 | 2 | 7 |
| 39 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |

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Hercules No. 2 Boiler
10-26-82
Run No. 3 cont'd

10-26-82

| | Port, Point | | Vm | ΔP | ΔH | Ts | Tm in | Tm out | Box Temp | Imp Temp | Time | A/C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 1 | 595.371 | .32 | .51 | 360 | 96 | 80 | 250 | 70 | 2 | 3 |
| 2 | | 2 | 596.2 | .47 | .75 | 360 | 92 | 81 | 250 | 70 | 2 | 4 |
| 3 | | 3 | 597.2 | .32 | .51 | 360 | 92 | 81 | 250 | 70 | 2 | 3 |
| 4 | | 4 | 598.0 | .14 | .22 | 360 | 90 | 81 | 250 | 70 | 2 | 3 |
| 5 | | 5 | 598.6 | .14 | .22 | 360 | 88 | 80 | 250 | 70 | 2 | 3 |
| 6 | | 6 | 599.1 | .21 | .33 | 360 | 88 | 80 | 250 | 70 | 2 | 3 |
| 7 | | 7 | 599.8 | .21 | .33 | 360 | 88 | 80 | 250 | 70 | 2 | 3 |
| 8 | | 8 | 600.4 | .06 | .08 | 360 | 87 | 80 | 250 | 70 | 2 | 2 |
| 9 | | 9 | 600.8 | .03 | .04 | 360 | 86 | 80 | 250 | 70 | 2 | 2 |
| 10 | | 10 | 601.0 | .60 | .97 | 360 | 86 | 80 | 250 | 70 | 2 | 4 |
| 11 | | 11 | 602.1 | .60 | .97 | 360 | 90 | 80 | 250 | 70 | 2 | 4 |
| 12 | | 12 | 603.2 | .85 | 1.40 | 360 | 92 | 80 | 250 | 70 | 2 | 5 |
| 13 | END | | 604.562 | | | | | | | | 5:16 PM | |

Leak Check:

condensate: 100 ml
silica gel: 16.5 gm

Filter No. 8238

© WILSON JONES COMPANY G7508 GREEN MADE IN U.S.A

Analytical Data

Hercules - Boiler No. 2
Tested: 10/26/82

| FILTERS: | Run 1 | Run 2 | Run 3 | |
|---|---|---|---|---|
| Filter Number | | 8285 | 8238 | |
| Tare Weight, g | .5804 | .5765 | .5849 | |
| Final Weight, g | .7066 | .7702 | .9585 | |
| Net Gain, g | .1262 | .1937 | .3736 | |

| PROBE WASH | Run 1 | Run 2 | Run 3 | Blank |
|---|---|---|---|---|
| Volume, ml | 179 | 180 | 240 | 200 |
| Tare Weight, g | 112.0236 | 112.7281 | 111.5101 | 114.3857 |
| Final Weight, g | 112.0847 | 112.9485 | 111.7335 | 114.3870 |
| Net Gain, g | .0611 | .2204 | .2234 | .0013 |
| Blank Correction, g | -.0012 | -.0012 | -.0016 | .0013 |

| | Run 1 | Run 2 | Run 3 | |
|---|---|---|---|---|
| Mn, mg | 186.1 | 412.9 | 595.4 | |

PERFORMANCE EVALUATION TESTS
FOR THE
DETERMINATION OF PARTICULATE EMISS

HERCULES, INC.
HATTIESBURG, MISSISSIPPI

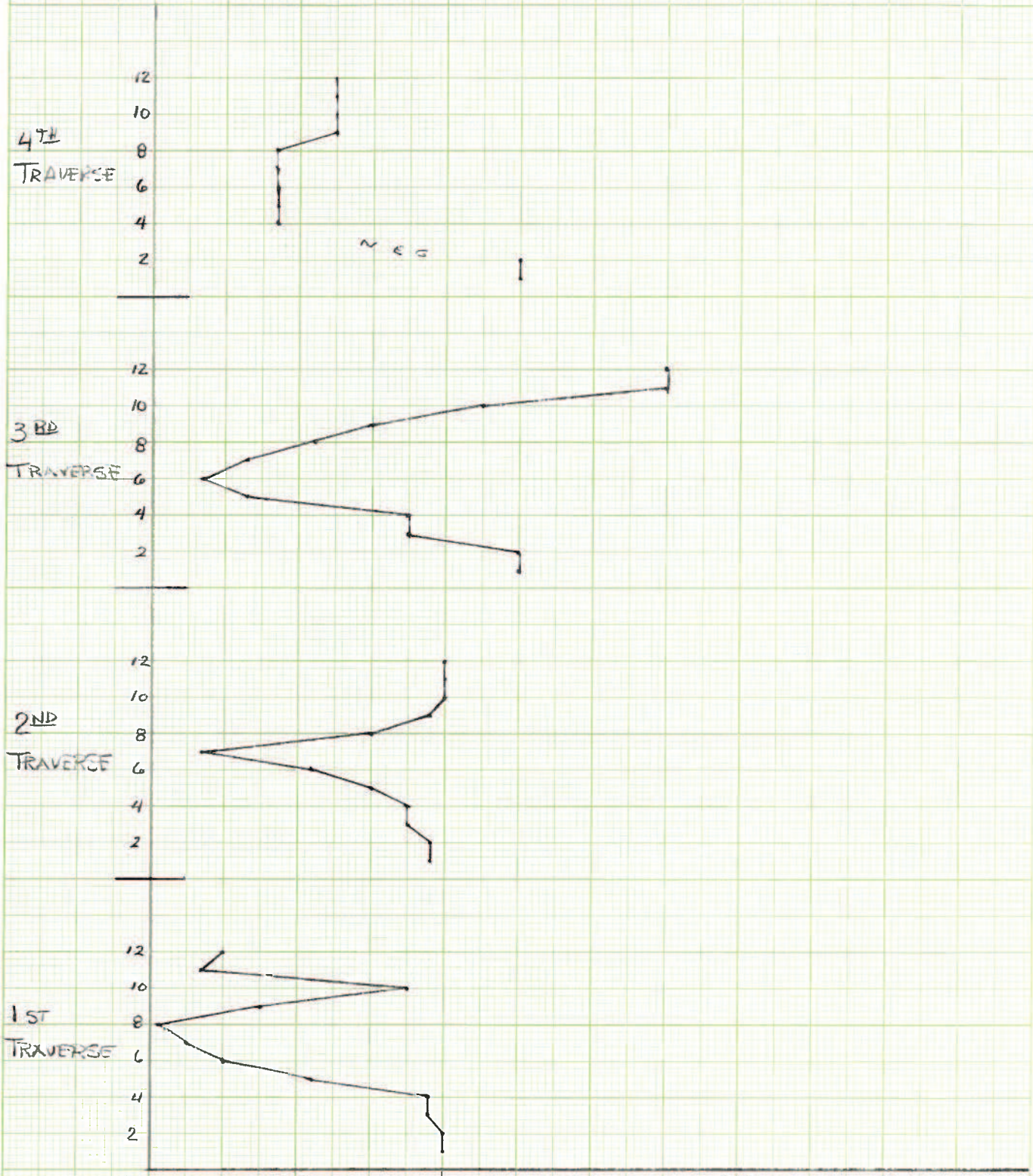
JANUARY, 1976

Environmental Protection Systems

ENGINEERING AND MANAGEMENT
AIR, LAND, AND WATER RESOUR

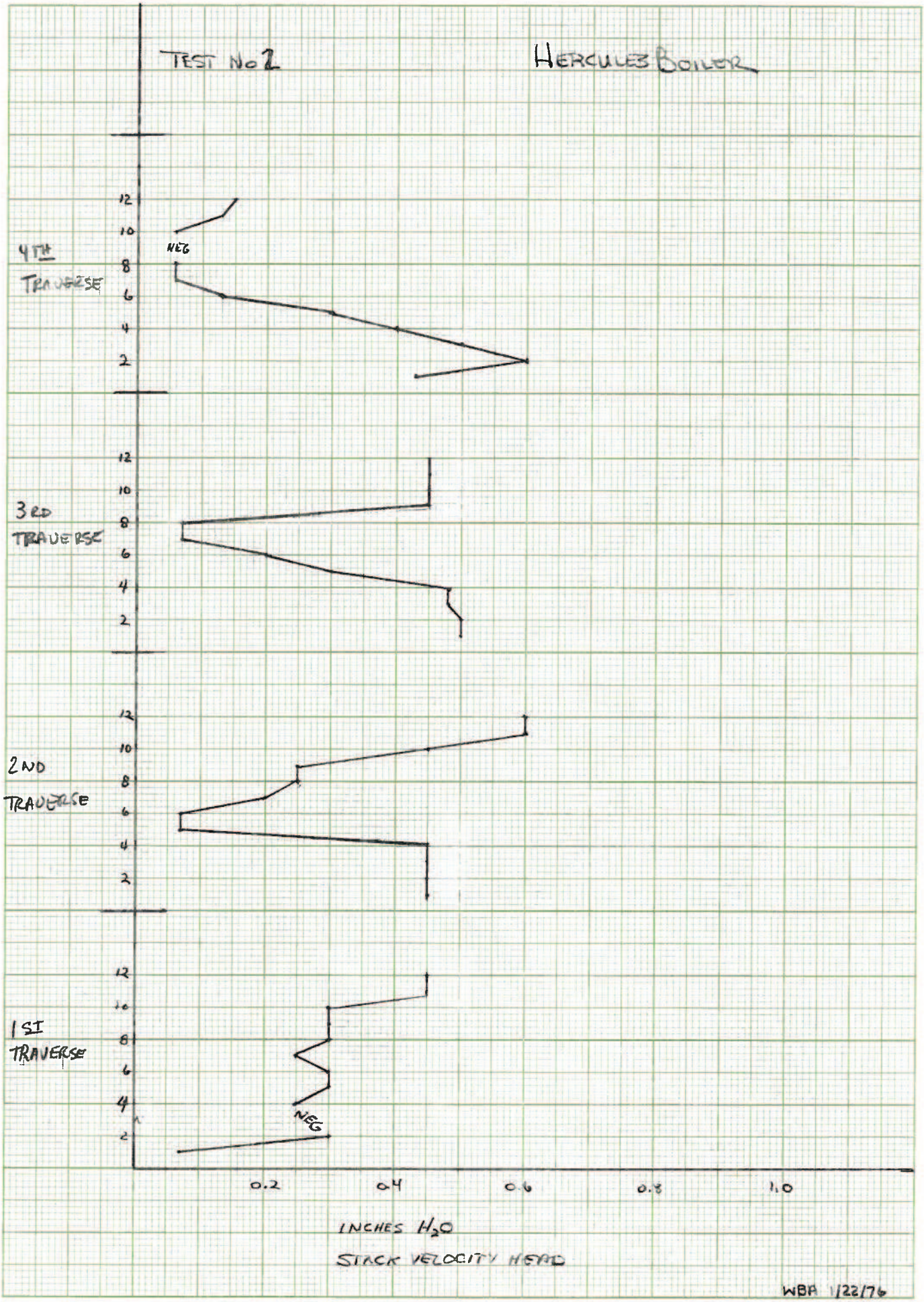
TEST No 1

HERCULES BOILER




WBA 1/22/76

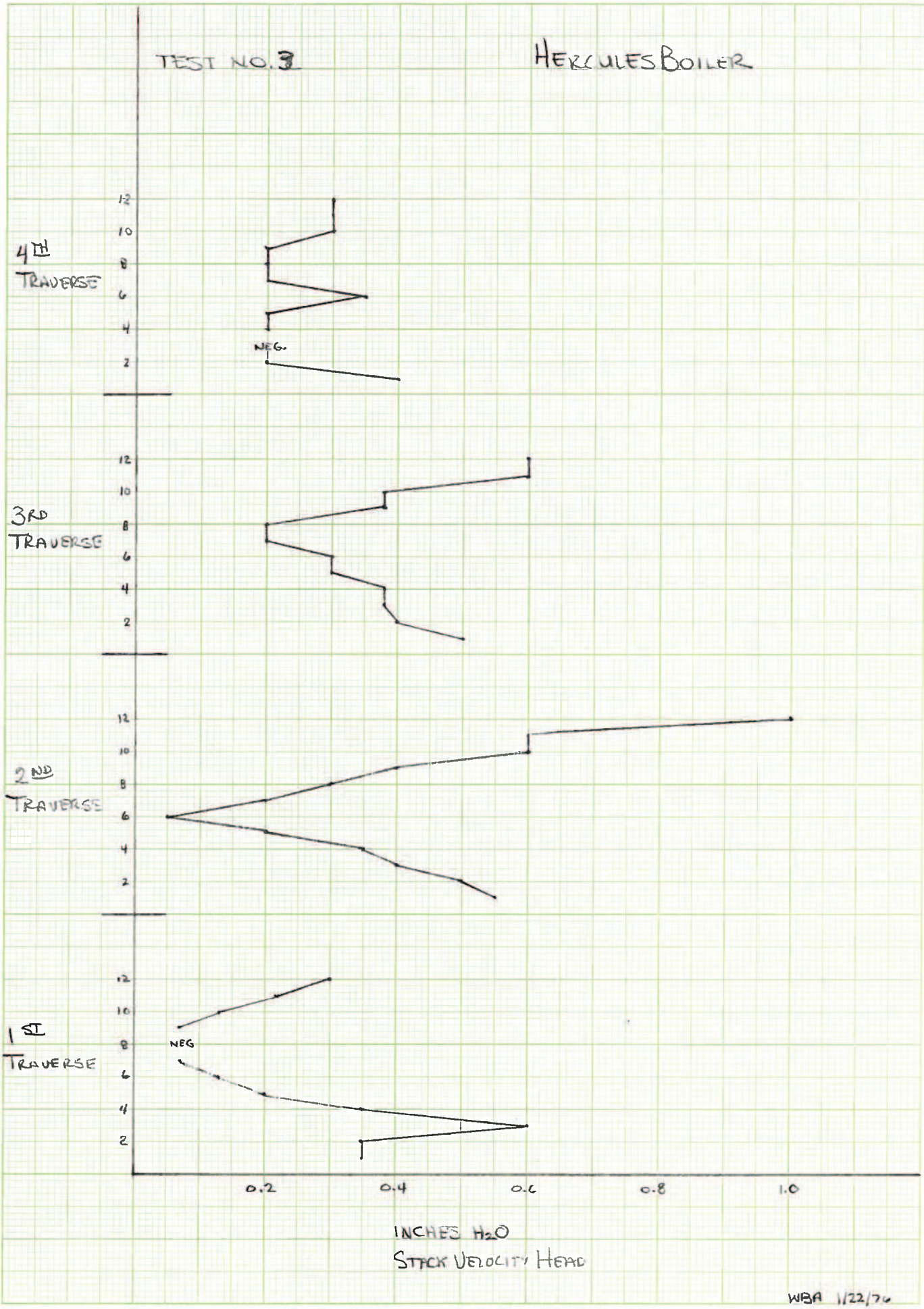
46 1240
KE 20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.




46 1240
20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO MADE IN U.S.A.

TEST NO. 3

HERCULES BOILER




WBA 1/22/76

46 1240
K&E 20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

# HERCULES BOILER

RUN # 1

| TRAVERSE POINT → PORT | $R_1$ | $R_2$ | $R_3$ | $R_4$ |
|---|---|---|---|---|
| 1 | .4 | .38 | .5 | .5 |
| 2 | .4 | .38 | .5 | 5 |
| 3 | .38 | .35 | .35 | NEGATIVE |
| 4 | .38 | .35 | .35 | .17 |
| 5 | .22 | .3 | .13 | .17 |
| 6 | .1 | .22 | .07 | .17 |
| 7 | .05 | .07 | .13 | .17 |
| 8 | .012 | .3 | .22 | .17 |
| 9 | .15 | .38 | .3 | .25 |
| 10 | .35 | .4 | .45 | .25 |
| 11 | .07 | .4 | .7 | .25 |
| 12 | .1 | .4 | .7 | .25 |

STACK VELOCITY HEAD, INCHES $H_2O$

# HERCULES BOILER — RUN #2

| TRAVERSE POINT → PORT | $R_1$ 4 | $R_2$ 3 | $R_3$ 2 | $R_4$ 1 |
|---|---|---|---|---|
| 1 | .07 | .45 | .45 | .43 |
| 2 | .3 | .45 | .45 | .6 |
| 3 | NEGATIVE | .45 | .43 | .5 |
| 4 | .25 | .45 | .43 | .4 |
| 5 | .3 | .07 | .3 | .3 |
| 6 | .3 | .07 | .2 | .13 |
| 7 | .25 | .2 | .07 | .06 |
| 8 | .3 | .25 | .07 | .06 |
| 9 | .3 | .25 | .45 | NEGATIVE |
| 10 | .3 | .45 | .45 | .06 |
| 11 | .45 | .6 | .45 | .13 |
| 12 | .45 | .6 | .45 | .15 |

STACK VELOCITY HEAD, INCHES $H_2O$

# HERCULES BOILER RUN #3

| TRAVERSE POINT ↓ / PORT → | $R_1$ | $R_2$ | $R_3$ | $R_4$ |
|---|---|---|---|---|
| 1 | .35 | .55 | .5 | .4 |
| 2 | .6 | .5 | .4 | .2 |
| 3 | .6 | .4 | .38 | NEGATIVE |
| 4 | .35 | .35 | .38 | .2 |
| 5 | .2 | .2 | .3 | .2 |
| 6 | .13 | .05 | .3 | .35 |
| 7 | .07 | .2 | .2 | .2 |
| 8 | NEGATIVE | .3 | .2 | .2 |
| 9 | .07 | .4 | .38 | .2 |
| 10 | .13 | .6 | .38 | .3 |
| 11 | .22 | .6 | .6 | .3 |
| 12 | .3 | 1.00 | .6 | .3 |

STACK VELOCITY HEAD, INCHES $H_2O$

# PERFORMANCE EVALUATION TESTS

# FOR THE

# DETERMINATION OF PARTICULATE EMISSIONS

for

HERCULES, INC.

HATTIESBURG, MISSISSIPPI

by

ENVIRONMENTAL PROTECTION SYSTEMS

106 UPTON DRIVE

JACKSON, MISSISSIPPI

Test Number 76163

January, 1976

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## PURPOSE

The purpose of this performance evaluation test was to establish the particulate emissions from a woodwaste boiler owned and operated by Hercules, Inc., located at Hattiesburg, Mississippi. Environmental Protection Systems was retained to perform the required particulate emissions tests.

## CONCLUSION

Three (3) performance tests were conducted on January 14, 1976, in accordance with the procedures outlined in the Federal Register, Volume 36, Number 247, Part II, by the Environmental Protection Agency and the Mississippi Air and Water Pollution Control Commission. The results of the three (3) tests are shown below in tabular form in the Data Summary.

## DATA SUMMARY

| Run Number | Emission Loading Grains/dscf | Emission Loading Corrected to 12% $CO_2$ | Emission Rate lbs/hr | Percent Isokinetic (%) |
|---|---|---|---|---|
| 1 | .1209 | .3225 | 60.41 | 98 |
| 2 | .0693 | .1848 | 35.30 | 98 |
| 3 | .0639 | .1705 | 34.30 | 98 |
| Average | .0847 | .2260 | 43.34 | 98 |

## DISCUSSION

A performance evaluation test was conducted on January 14, 1976, on a woodwaste boiler operated by Hercules, Inc., located at Hattiesburg, Mississippi.

The boiler is classified as a combination boiler which is defined as a fuel burning operation utilizing a mixture of combustibles such as, but not limited to, fossil fuels plus bark, oil plus bark or spent wood, or water treatment sludge. According to the MAWPCC Air Quality Regulation APC-S-1, 1972, the combination boilers may be allowed emissions up to 0.30 grains per standard dry cubic foot. The average emissions for the tested boiler as determined by three (3) tests was found to be .0847 Grains/dscf.

## EMISSION SOURCE SAMPLING PROCEDURE

The test methods and procedures used for this performance evaluation were those outlined in the Federal Register, Volume 36, Number 247, Part II, as promulgated by the Environmental Protection Agency (EPA). Method 1 for determination of sample and velocity traverses was used to arrive at the correct number of sampling points. The determination of stack gas velocity and volumetric flow rate was performed in accordance with Method 2 using a type S pitot tube. Method 3--Gas Analysis for Carbon Dioxide, Excess Air, and Dry Molecular Weight was used for this test and an integrated sample was collected and analyzed. Methods 4 and 5 were followed to establish the moisture content and particulate emissions, respectively.

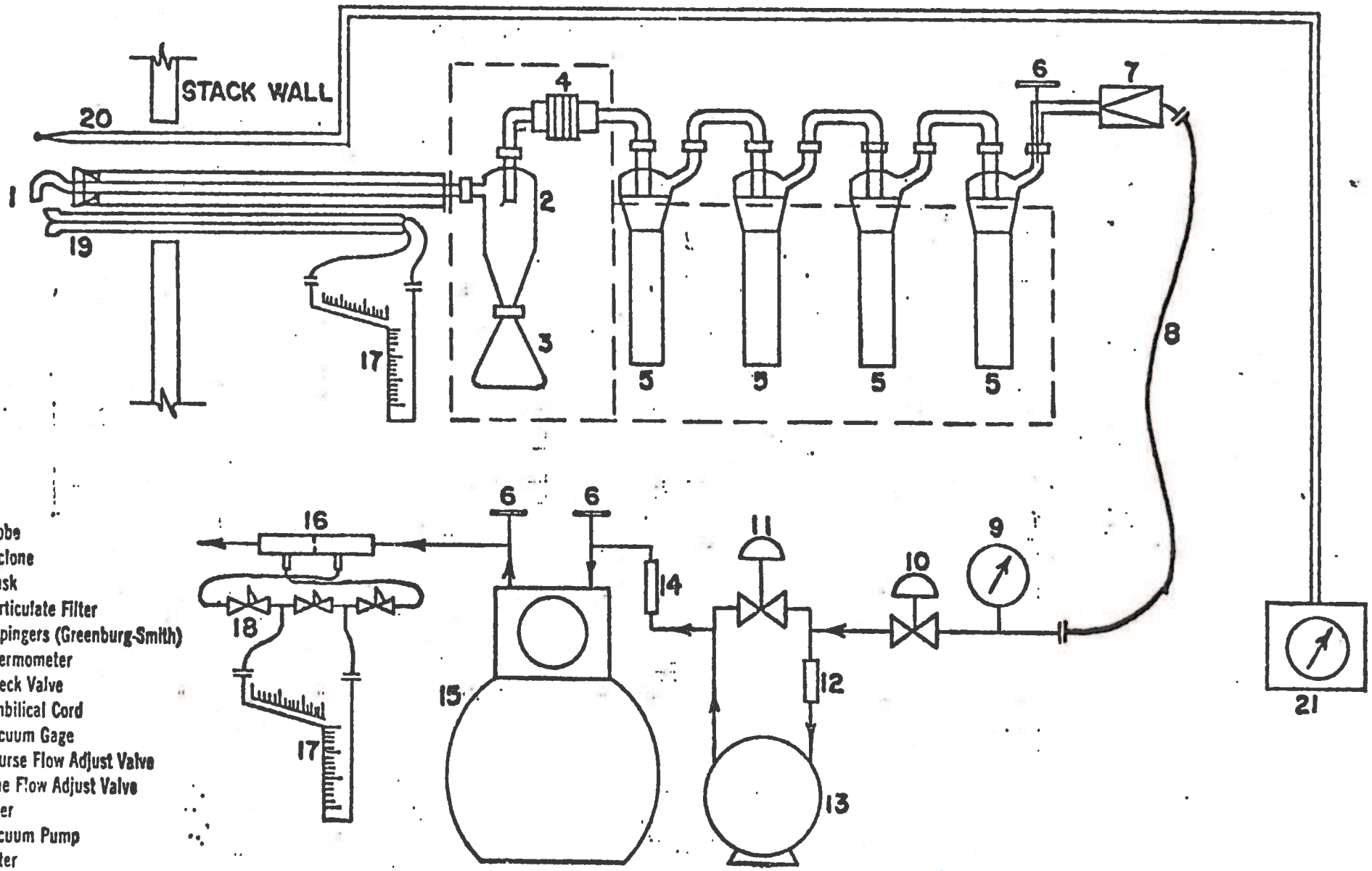
The EPA Method 5 relies on the removal of a dust-laden gaseous sample from the duct followed by the subsequent removal of the particulate matter on a filter media. Concurrently a measurement of the sample volume is made to determine particulate concentration. The sample is removed from the stack by using a prescribed traversing procedure, which in effect is an approximate integration of collected mass and sample volume over the cross-sectional area of the

stack. The velocity distribution is also determined during the sample traverse. This information is used with the particulate concentration to determine mass emission rates. Method 5 requires that isokinetic sampling conditions be maintained. Thus at each traverse point the sample velocity at the nozzle is adjusted to equal the duct velocity. The sampling train required to maintain isokinetic conditions is discussed in the following section.

## DESCRIPTION OF ISOKINETIC SAMPLING TRAIN

The sampling train used to conduct this sampling was manufactured by the Research Appliance Company according to the construction details provided by EPA. The sampling train can be divided into component parts as follows:

1. Nozzle and probe
2. Pitot tube (S-Type)
3. Cyclone or by-pass
4. Filter
5. Impinger
6. Sampling box
7. Umbilical cord
8. Meter or control box
9. External equipment
    a. Omega thermocouple-pyrometer
    b. Gas analysis apparatus (ORSAT)




1) Probe
2) Cyclone
3) Flask
4) Particulate Filter
5) Impingers (Greenburg-Smith)
6) Thermometer
7) Check Valve
8) Umbilical Cord
9) Vacuum Gage
10) Course Flow Adjust Valve
11) Fine Flow Adjust Valve
12) Oiler
13) Vacuum Pump
14) Filter
15) Dry Gas Meter
16) Orifice Tube
17) Incline Manometer
18) Solenoid Valves
19) Pitot
20) Thermocouple
21) Pyrometer

PROPERTY OF
RESEARCH APPLIANCE Co. ALLISON PARK, PA.

| | | | |
|---|---|---|---|
| TOLERANCES<br>DEC. ±<br>FRACT. ± | TITLE<br>STAK SAMPLER FLOW SYSTEM | | |
| | DWG. NO.<br>1748 | MATL | SCALE |
| NO. REQ'D | DRAWN BY<br>R.G. | APPR. | DATE<br>6-23-69 |
| FINISH | | JIG NO. | ART NO. |

## DESCRIPTION OF SAMPLING SITE

The sampling site was located on a custom-built platform adjacent to the exhaust breeching approximately twenty (20) feet above the ground level. Four (4) sampling ports were located in a horizontal line equally spaced from each other. The sampling ports were located at less than one (1) stack diameter upstream and one (1) diameter downstream from a potential fluid disturbance. The equivalent stack diameter was calculated to be 55.38 inches. In this case, a required number of sampling points, forty-eight (48), were calculated in accordance with the prescribed EPA procedures. The sampling port arrangement and sampling points are shown in Figure 1.

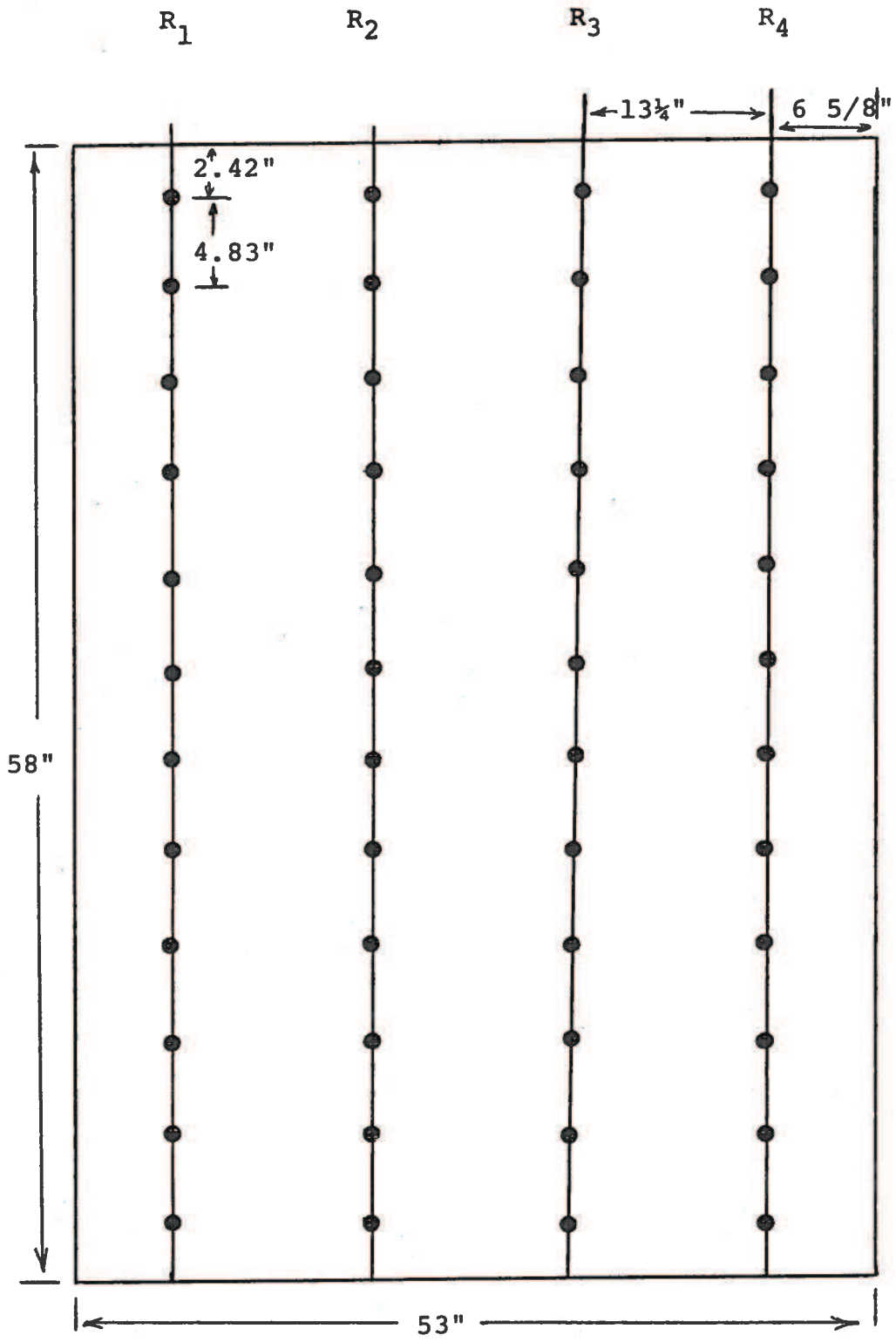



FIGURE 1: Location of Ports and Traverse Points

# PARTICULATE TEST CALCULATIONS

Plant Hercules, Stack Boiler, Date 1/14/76

Bar. Press. 30.54 "Hg, Stack Press. 30.54 "Hg, Stack Dia 55.38 in., Stack Area 21.35 $ft^2$

Ave. Stack Temp. 279.8°F, Ave. Meter Temp. 79.6°F, Ave. $\sqrt{h}$ 0.55 "$H_2O$, Nozzle Dia. .375 in.

$C_p$ 0.83, Meter Vol. 71.695 $ft^3$, Moisture plus Silica Gel 1003 ml, Sample Time 94 min.

Orsat Analysis: $CO_2$ 4.5%, $O_2$ 15.0%, CO 0.2%, $N_2$ 78.3% Ave. Orifice $\Delta H$ 2.12 "$H_2O$

Nozzle Dia. and Area: 1/4 in.---0.000341 $ft^2$, 3/8 in.---0.000767 $ft^2$, 1/2 in.---0.013 $ft^2$

3/16 in.---0.0001916 $ft^2$, 1/8 in.---0.000085 $ft^2$

1) $V_{wv}$ = (0.0474) x (Moisture + Silica Gel)ml = 47.54 scf

2) $V_{stpd} = (17.71) \times (P_o + \frac{\overline{\Delta H}}{13.6}) \times (V_m) \times (\frac{1}{T_m + 460})$ = 72.23 scf

3) $V_t = (V_{wv}) + (V_{stpd})$ = 119.77 scf

4) $W = \frac{V_{wv}}{V_t}$ = 0.40

5) FDA = (1.0) - (W) = 0.60

6) $M_d = [(0.44) \times (\_\_ \%CO_2)] + [(0.32) \times (\_\_ \%O_2)] + [(0.28) \times (\_\_ \%N_2 + \_\_ \%CO)]$ = 28.76

7) $M_s = [(M_d) \times (FDA)] + [(18) \times (W)]$ = 24.49

8) $G_s = \frac{M_s}{28.99}$ = 0.84

9) Excess Air, $EA = \frac{\left[ (\_\_ \%O_2) - (\frac{\_\_}{2} \%CO) \right]}{[(0.266) \times (\_\_ \%N_2)] - \left[ (\_\_ \%O_2) - (\frac{\_\_}{2} \%CO) \right]} \times 100$ = 246 %

10) $\overline{U} = (174) \times (C_p) \times (\sqrt{\overline{h}}) \times \left(\sqrt{\frac{T_s + 460}{G_s}}\right) \times \left(\sqrt{\frac{29.92}{P_s}}\right)$ = 2333 fpm

11) $Q_s = (\overline{U}) \times (A_s)$ = 49814 cfm

12) $Q_d = (Q_x) \times (FDA)$ = 29888 cfm

13) $Q_{stpd} = (Q_d) \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 21856 cfm

14) $V_i = (\overline{U}) \times (A_n) \times (FDA) \times (Time) \times \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 73.81 scf

15) Percent Isokinetic $= \frac{(V_{stpd})(100)}{(V_i)}$ = 98 %

PARTICULATE TEST CALCULATIONS - Cont'd.

16) Percent Isokinetic by the EPA = $\dfrac{\left[(0.00267)\times(V_{H_2O})+\dfrac{(Vm)}{(Tm+460)}\times(P_{bar}+\dfrac{\Delta H}{13.6})\right](Ts+460)}{(Vs)\times(Time)\times(Ps)\times(An)}$ = 98 %

17) $E_{stp} = \dfrac{(15.43)\times(Y)}{V_{stpd}}$

18) $E_{12} = \dfrac{(12)\times(E_{stp})}{(CO_2\%)}$

19) $E_{50} = \dfrac{(E_{stp})\times(100+EA\%)}{150}$

20) $E_m = (E_{stp})\times(Q_{stpd})\times(0.00857)$

| Particulate Lab Analysis (Y) | | Particulate Concentrations, grains/scf ($E_{stp}$) | ($E_{12}$) | ($E_{50}$) | Emission Rate, lbs/hr. ($E_m$) |
|---|---|---|---|---|---|
| Probe | 0.3088 gm | 0.1209 | 0.3225 | | 60.41 |
| Filter | 0.2573 gm | | | | |
| Imp. $H_2O$ | gm | | | | |
| Organics | gm | | | | |
| After Filter | gm | | | | |
| Total | 0.5661 gm | | | | |

COMMENTS:

# PARTICULATE TEST CALCULATIONS

Plant Hercules, Stack Boiler, Date 11/14/76

Bar. Press. 30.54 "Hg, Stack Press. 30.54 "Hg, Stack Dia. 55.38 in., Stack Area 21.35 $ft^2$

Ave. Stack Temp. 279.2°F, Ave. Meter Temp. 87.6°F, Ave. $\sqrt{h}$ .56 $"H_2O$, Nozzle Dia. .375 in.

$C_p$ 0.83, Meter Vol. 72.329 $ft^3$, Moisture plus Silica Gel 1015 ml, Sample Time 92 min.

Orsat Analysis: $CO_2$ 4.5%, $O_2$ 15.0%, CO 0.2%, $N_2$ 78.3% Ave. Orifice $\Delta H$ 2.44 $"H_2O$

Nozzle Dia. and Area: 1/4 in.---0.000341 $ft^2$, 3/8 in.---0.000767 $ft^2$, 1/2 in.---0.013 $ft^2$

3/16 in.---0.0001916 $ft^2$, 1/8 in.---0.000085 $ft^2$

1) $V_{wv} = (0.0474) \times (\text{Moisture + Silica Gel})\text{ml}$ = 48.11 scf

2) $V_{stpd} = (17.71) \times \left(P_o + \frac{\overline{\Delta H}}{13.6}\right) \times (V_m) \times \left(\frac{1}{T_m + 460}\right)$ = 71.86 scf

3) $V_t = (V_{wv}) + (V_{stpd})$ = 119.97 scf

4) $W = \frac{V_{wv}}{V_t}$ = 0.40

5) $FDA = (1.0) - (W)$ = 0.60

6) $M_d = [(0.44) \times (\_\_\_\%CO_2)] + [(0.32) \times (\_\_\_\%O_2)] + [(0.28) \times (\_\_\_\%N_2 + \_\_\_\%CO)]$ = 28.76

7) $M_s = [(M_d) \times (FDA)] + [(18) \times (W)]$ = 24.44

8) $G_s = \frac{M_s}{28.99}$ = .84

9) Excess Air, $EA = \frac{\left[(\_\_\_\%O_2) - \left(\frac{\_\_\_\%CO}{2}\right)\right]}{[(0.266) \times (\_\_\_\%N_2)] - \left[(\_\_\_\%O_2) - \left(\frac{\_\_\_\%CO}{2}\right)\right]} \times 100$ = 246 %

10) $\overline{U} = (174) \times (C_p) \times (\sqrt{\overline{h}}) \times \left(\sqrt{\frac{T_s + 460}{G_s}}\right) \times \left(\sqrt{\frac{29.92}{P_s}}\right)$ = 2375 fpm

11) $Q_s = (\overline{U}) \times (A_s)$ = 50699 cfm

12) $Q_d = (Q_x) \times (FDA)$ = 30420 cfm

13) $Q_{stpd} = (Q_d) \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 22262 cfm

14) $V_i = (\overline{U}) \times (A_n) \times (FDA) \times (\text{Time}) \times \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 73.58 scf

15) Percent Isokinetic $= \frac{(V_{stpd})(100)}{(V_i)}$ = 98 %

PARTICULATE TEST CALCULATIONS - Cont'd.

16) Percent Isokinetic by the EPA = $\dfrac{\left[(0.00267)\times(V_{H_2O})+\dfrac{(Vm)}{(Tm+460)}\times(P_{bar}+\dfrac{\Delta H}{13.6})\right](Ts+460)}{(Vs)\times(Time)\times(Ps)\times(An)}$ = 98 %

17) $E_{stp} = \dfrac{(15.43)\times(Y)}{V_{stpd}}$

18) $E_{12} = \dfrac{(12)\times(E_{stp})}{(CO_2\%)}$

19) $E_{50} = \dfrac{(E_{stp})\times(100 + EA\%)}{150}$

20) $E_m = (E_{stp})\times(Q_{stpd})\times(0.00857)$

| Particulate Lab Analysis (Y) | | Particulate Concentrations, grains/scf ($E_{stp}$) | ($E_{12}$) | ($E_{50}$) | Emission Rate, lbs/hr. ($E_m$) |
|---|---|---|---|---|---|
| Probe | 0.2075 gm | 0.0693 | 0.1848 | | 35.3 |
| Filter | 0.1153 gm | | | | |
| Imp. $H_2O$ | gm | | | | |
| Organics | gm | | | | |
| After Filter | gm | | | | |
| Total | 0.3228 gm | | | | |

COMMENTS:

Run #3

# PARTICULATE TEST CALCULATIONS

Plant Hercules, Stack Boiler, Date 1/14/76

Bar. Press. 30.54 "Hg, Stack Press. 30.54 "Hg, Stack Dia. 55.38 in., Stack Area 21.35 $ft^2$

Ave. Stack Temp. 268.4°F, Ave. Meter Temp. 87.8°F, Ave. $\sqrt{h}$ 0.58 "$H_2O$, Nozzle Dia. .375 in.

$C_p$ 0.83, Meter Vol. 76.192 $ft^3$, Moisture plus Silica Gel 1042 ml, Sample Time 92 min.

Orsat Analysis: $CO_2$ 4.5%, $O_2$ 15.0%, CO 0.2%, $N_2$ 78.3% Ave. Orifice $\Delta H$ 2.62 "$H_2O$

Nozzle Dia. and Area: 1/4 in.---0.000341 $ft^2$, 3/8 in.---0.000767 $ft^2$, 1/2 in.---0.013 $ft^2$

3/16 in.---0.0001916 $ft^2$, 1/8 in.---0.000085 $ft^2$

1) $V_{wv} = (0.0474) \times (\text{Moisture + Silica Gel})ml$ = 49.39 scf

2) $V_{stpd} = (17.71) \times \left(P_o + \frac{\overline{\Delta H}}{13.6}\right) \times (V_m) \times \left(\frac{1}{T_m + 460}\right)$ = 75.70 scf

3) $V_t = (V_{wv}) + (V_{stpd})$ = 125.09 scf

4) $W = \frac{V_{wv}}{V_t}$ = 0.39

5) $FDA = (1.0) - (W)$ = 0.61

6) $M_d = [(0.44) \times (\_\_ \%CO_2)] + [(0.32) \times (\_\_ \%O_2)] + [(0.28) \times (\_\_ \%N_2 + \_\_ \%CO)]$ = 28.76

7) $M_s = [(M_d) \times (FDA)] + [(18) \times (W)]$ = 24.51

8) $G_s = \frac{M_s}{28.99}$ = 0.85

9) Excess Air, $EA = \frac{\left[(\_\_ \%O_2) - \left(\frac{\_\_}{2} \%CO\right)\right]}{\left[(0.266) \times (\_\_ \%N_2)\right] - \left[(\_\_ \%O_2) - \left(\frac{\_\_}{2} \%CO\right)\right]} \times 100$ = 246 %

10) $\overline{U} = (174) \times (C_p) \times (\sqrt{\overline{h}}) \times \left(\sqrt{\frac{T_s + 460}{G_s}}\right) \times \left(\sqrt{\frac{29.92}{P_s}}\right)$ = 2427 fpm

11) $Q_s = (\overline{U}) \times (A_s)$ = 51817 cfm

12) $Q_d = (Q_x) \times (FDA)$ = 31609 cfm

13) $Q_{stpd} = (Q_d) \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 23476 cfm

14) $V_i = (\overline{U}) \times (A_n) \times (FDA) \times (\text{Time}) \times \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 77.59 scf

15) Percent Isokinetic $= \frac{(V_{stpd})(100)}{(V_i)}$ = 98 %

PARTICULATE TEST CALCULATIONS - Cont'd.

16) Percent Isokinetic by the EPA = $\dfrac{\left[(0.00267)\times(V_{H_2O})+\dfrac{(Vm)}{(Tm+460)}\times(P_{bar}+\dfrac{\Delta H}{13.6})\right](Ts+460)}{(Vs)\times(Time)\times(Ps)\times(An)}$ = 98 %

17) $E_{stp} = \dfrac{(15.43)\times(Y)}{V_{stpd}}$

18) $E_{12} = \dfrac{(12)\times(E_{stp})}{(CO_2\%)}$

19) $E_{50} = \dfrac{(E_{stp})\times(100+EA\%)}{150}$

20) $E_m = (E_{stp})\times(Q_{stpd})\times(0.00857)$

| Particulate Lab Analysis (Y) | | Particulate Concentrations, grains/scf ($E_{stp}$) | ($E_{12}$) | ($E_{50}$) | Emission Rate, lbs/hr. ($E_m$) |
|---|---|---|---|---|---|
| Probe | 0.2519 gm | 0.0639 | 0.1705 | | 34.3 |
| Filter | 0.0618 gm | | | | |
| Imp. $H_2O$ | gm | | | | |
| Organics | gm | | | | |
| After Filter | gm | | | | |
| Total | 0.3137 gm | | | | |

COMMENTS:

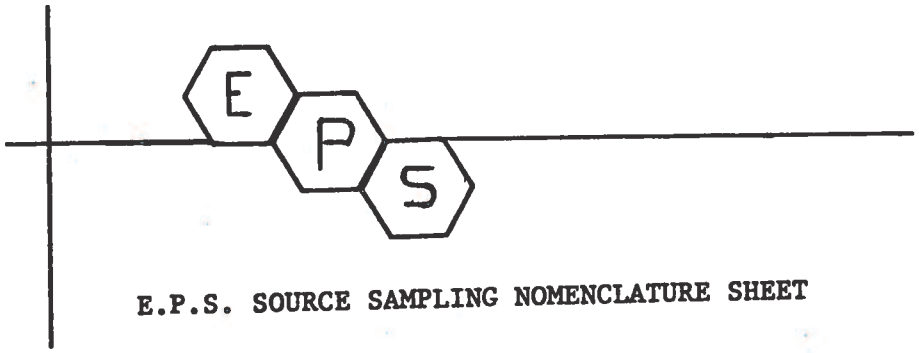
## REFERENCES

Environmental Protection Agency, "Standard of Performance for New Stationary Sources," Federal Register, Vol. 36, No. 247, Part II (1971).

Brenchly, D. L., Turley, C. D., and Yarmac, R. F., Industrial Source Sampling: Ann Arbor Science, Ann Arbor, Michigan (1973).

## ACKNOWLEDGMENTS

A sincere thank you is extended to Mr. Charles Jordan and his staff for their assistance during the sampling period.




E.P.S. SOURCE SAMPLING NOMENCLATURE SHEET

PB - Barometric pressure, inches Hg
PS - Stack pressure, inches Hg
As - Stack area, sq. ft.
AS'- Effective area of positive stack gas flow, sq. ft.
NPTS - Number of traverse points where the pitot velocity head was greater than zero
TS - Stack temperature, $^{o}R$
TM - Meter temperature, $^{o}R$
$\sqrt{\overline{H}}$ - Average square root of velocity head, $\sqrt{\text{inches } H_2O}$
$\overline{\Delta H}$ - Average meter orifice pressure differential, inches $H_2O$
AN - Sampling nozzle area, square feet
CP - S-type pitot tube correction factor
VM - Recorded meter volume sample, cubic feet (meter conditions)
VC - Condensate and silica gel increase in impringers, milliliters
Po - Pressure at the dry test meter orifice, $\left[PB + \frac{\Delta H}{13.6}\right]$ inches Hg
STP - Standard conditions, dry, $70^{o}F$, 29.92 inches Hg

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VWV - Conversion of condensate in milliliters to water vapor in cubic feet (STP)
VSTPD - Volume sampled, cubic feet (STP)
VT - Total water vapor volume and dry gas volume sampled, cubic feet (STP)
W - Moisture fraction of stack gas
FDA - Dry gas fraction
MD - Molecular weight of stack gas, lbs/lb-mole (dry conditions)
MS - Molecular weight of stack gas, lbs/lb-mole (stack conditions)
GS - Specific gravity of stack gas, referred to air
EA - Excess air, %
$\sqrt{\text{HxTS}}$ - Average square root of velocity head times stack temperature
VS - Stack gas velocity, feet per minute
QS - Stack gas flow rate, cubic feet per minute (stack conditions)
QD - Stack gas flow rate, cubic feet per minute (dry conditions)
QSTPD - Stack gas flow rate, cubic feet per minute (STP)
PISO - Percent isokinetic volume sampled (method described in Federal Register)

# APPENDIX

## RAW DATA AND CALIBRATION DATA

## DISCUSSION OF SAMPLING

In an effort to avoid structural damage to the existing boiler stack, EPS utilized a sampling site in the breeching selected by the Hercules engineering staff. The sampling site did not conform to the procedures set forth in the Federal Register; therefore, a maximum number of traverse points (48) was used.

Five (5) negative pressure points were encountered during the entire sampling program. Negative pressure was measured at one (1), two (2) and two (2) traverse points during sampling runs one, two, and three, respectively. These negative pressure traverse points were avoided and sampling was resumed at the next positive pressure point. During the first two tests, an access hatch was inadvertently left open which can account for some of the variation in results between tests. The moisture content was found to be higher than anticipated; however, the high value was accounted for in sampling and maintaining isokinesis.

# CALIBRATION SUMMARY SHEET

## Dry Gas Meter and Orifice

1. $\Delta H@$ = 2.00 for Meter Box S-1461.
2. = 1.01 for Meter Box S-1461.
3. $\Delta H@$ = 1.95 for Meter Box S-1936.
4. = 1.02 for Meter Box S-1936.

## Nozzle (inches)

Micrometer Reading

| 1 | 2 | 3 | 4 | AVG |
|---|---|---|---|---|
| .1873 | .1876 | .1875 | .1876 | .1875 |
| .248 | .249 | .251 | .249 | .249 |
| .249 | .248 | .250 | .252 | .250 |
| .373 | .376 | .375 | .376 | .375 |
| .377 | .375 | .374 | .374 | .375 |
| .502 | .495 | .503 | .498 | .500 |

## Pitot Tube

$$C_{p(s)} = C_{p(std)} \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

$C_{p(s)}$ = 0.83 for tube 002.

Miscellaneous Equipment:

| Description | Calibration Date |
|---|---|
| Barometer | 1/6/76 |
| Thermometers | 1/6/76 |
| Thermacouple/pyrometer | 1/6/76 |
| Magnehelic Gages | 1/6/76 |

# DRY MOLECULAR WEIGHT DETERMINATION

PLANT Hercules

DATE 1/14/76

SAMPLING (24-hr. CLOCK)

SAMPLING LOCATION Hattiesburg, Mississippi

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Integrated

ANALYTICAL METHOD Orsat

AMBIENT TEMPERATURE

OPERATOR Blunt

COMMENTS

| RUN / GAS | 1 | | 2 | | 3 | | AVERAGE NET VOLUME | MULTIPLIER | MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) $M_d$, lb/lb-mole |
|---|---|---|---|---|---|---|---|---|---|
| | ACTUAL READING | NET | ACTUAL READING | NET | ACTUAL READING | NET | | | |
| $CO_2$ | 4.5 | 4.5 | | | | | 4.5 | 44/100 | 1.98 |
| $O_2$ (NET IS ACTUAL $O_2$ READING MINUS ACTUAL $CO_2$ READING) | 19.5 | 15.0 | | | | | 15.0 | 32/100 | 4.80 |
| CO (NET IS ACTUAL CO READING MINUS ACTUAL $O_2$ READING) | 19.7 | 0.2 | | | | | 0.2 | 28/100 | 0.06 |
| $N_2$ (NET IS 100 MINUS ACTUAL CO READING) | 78.3 | 78.3 | | | | | 78.3 | 28/100 | 21.92 |
| | | | | | | | | TOTAL | 28.76 |

ENVIRONMENTAL PROTECTION SYSTEMS
Jackson, Mississippi

## SOURCE SAMPLING FIELD DATA SHEET

Plant Hercules

Sampling Location Hattiesburg, Ms.

Date 1/14/76 Run No. 1

Time Start 9:25 Time End 11:10

Sampling Time/Point 2 min.

DB ____ °F, WB ____ °F, VP @ DP ____ "HG

Bar. Press. 30.54 "Hg, Stack Press. 30.54 "Hg

Moisture ____ %, FDA ____, Gas Den. Fac. ____

Weather partly cloudy

Temp. ____ °F, W/D ____, W/S ____

Sample Box No. 1936 Meter Box No. 1

Meter ΔH@ 2.0 Pitot Corr. Factor ____

Nozzle Dia. ~~1936~~ .375 in., Probe Len. 6 ft.

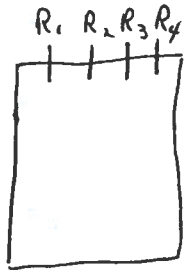
Probe Heater Set. 90% Nomograph Cf .53

Stack Dimensions 55.38 in

Stack Area 21.35 $ft^2$

Stack Height ____ ft

Sketch of Stack




Mat'l Processing Rate ____

Final Gas Meter Reading 820.583 → 71.695 $ft^3$

Initial Gas Meter Reading 748.888 $ft^3$

Condensate Increase in Impingers ____ ml

Moisture in Silica Gel ____ gm

Silica Gel Container No. A Filter No. 0021

Orsat: $CO_2$ ____

$O_2$ ____

CO ____

$N_2$ ____

Excess Air ____

Test Conducted by: Blunt / Kreuz

Remarks: Leak ck ok 8:50 am

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) Calc. | Actual | Stack Gas Temp. (°F) | Gas Sample Temp. @Dry Gas Meter (°F) In | Out | Sample Box Temp. (°F) | Last Impinger Temp. (°F) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 9:25 | 748.9 | .40 | ~~.32~~ 3.20 | | 300 | 57 | 55 | 250 | 60 | 5 |
| 2 | | | 750.6 | .40 | ~~.32~~ 3.20 | | 310 | 62 | 55 | | | 5 |
| 3 | | | 752.4 | .38 | ~~.29~~ 2.9 | | 300 | 68 | 55 | | | 5 |
| 4 | | | [illegible] | [illegible] | [illegible] | | 300 | 71 | 5[illegible] | | | 5 |

Run #7

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) Calc. | Meter Orifice Press. Diff. ("$H_2O$) Actual | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) In | Gas Sample Temp.@ Dry Gas Meter ($^oF$) Out | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | 755.8 | ~~.20~~ .22 | 1.69 | | 300 | 65 | 56 | 250 | 60 | 2 |
| 6 | | | 757.2 | .10 | .82 | | 310 | 68 | 58 | | | 1 |
| 7 | | | 758.3 | .05 | .41 | | 310 | 76 | 58 | | | 1 |
| 8 | | | 759.0 | .012 | .10 | | 310 | 76 | 60 | | | 1 |
| 9 | | | 759.5 | .15 | 1.20 | | 310 | 74 | 60 | | | 1 |
| 10 | | | 760.4 | .35 | 2.70 | | 270 | 78 | 61 | | | 5 |
| 11 | | | 762.0 | .07 | .58 | | 270 | 80 | 62 | | | 1 |
| 12 | | | 763.2 | .10 | .82 | | 270 | 80 | 63 | | | 1 |
| 1 | | | 764.1 | .38 | 2.90 | | 270 | 82 | 64 | | | 6 |
| 2 | | | 765.9 | .38 | 2.90 | | 275 | 85 | 66 | | | 6 |
| 3 | | | 767.6 | .35 | 2.70 | | 275 | 88 | 67 | | | 6 |
| 4 | | | 769.3 | .35 | 2.70 | | 275 | 90 | 68 | | | 6 |
| 5 | | | 770.0 | .30 | 2.23 | | 275 | 91 | 69 | | | 5 |
| 6 | | | 772.6 | ~~.20~~ .22 | 1.69 | | 275 | 91 | 70 | | | 3 |
| 7 | | | 774.0 | .07 | .58 | | 275 | 90 | 70 | | | 1 |
| 8 | | | 775.0 | .30 | 2.70 | | 275 | 90 | 71 | | | 5 |
| 9 | | | 776.7 | .38 | 2.90 | | 275 | 92 | 72 | | | 5 |
| 10 | | | 778.6 | .40 | 3.20 | | 275 | 94 | 73 | | | 6 |
| 11 | | | 780.3 | .40 | 3.20 | | 275 | 95 | 73 | | | 6 |
| 12 | | | 781.9 | .40 | 3.20 | | 275 | 96 | 74 | | | 6 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 1 | | | 784.8 | .50 | 3.80 | | 270 | 94 | 65 | 250 | 60 | 7 |
| 2 | | | 786.0 | .50 | 3.80 | | 270 | 96 | 76 | | | 8 |
| 3 | | | 787.8 | .35 | 2.70 | | 270 | 98 | 78 | | | 5 |
| 4 | | | 789.6 | .35 | 2.70 | | 270 | 98 | 78 | | | 5 |
| 5 | | | 791.3 | .13 | 1.08 | | 270 | 98 | 78 | | | 2 |
| 6 | | | 792.6 | ~~.10~~ .07 | .58 | | 270 | 98 | 78 | | | 2 |
| 7 | | | 793.5 | .13 | 1.08 | | 275 | 93 | 78 | | | 2 |
| 8 | | | 794.4 | ~~.20~~ .22 | 1.69 | | 275 | 92 | 78 | | | 2 |
| 9 | | | 795.8 | .30 | 2.23 | | 275 | 92 | 78 | | | 3 |
| 10 | | | 797.6 | .45 | 3.42 | | 275 | 96 | 78 | | | 7 |
| 11 | | | 799.3 | .70 | ~~5.40~~ 5.35 | | 275 | 100 | 79 | | | 12 |
| 12 | | | 801.4 | .70 | 5.35 | | 275 | 101 | 80 | | | 12 |
| 1 | | | 804.0 | .50 | 3.80 | | 275 | 102 | 80 | | | 7 |
| 2 | | | 806.0 | .50 | 3.80 | | 275 | 102 | 80 | | | 7 |
| 3 | | | 808.0 | — | | | | | | | | |
| 4 | | | 808.1 | .17 | 1.38 | | 275 | 102 | 82 | | | 2 |
| 5 | | | 809.9 | .17 | 1.38 | | 275 | 102 | 82 | | | 2 |
| 6 | | | 811.0 | .17 | 1.38 | | 275 | 102 | 82 | | | 2 |
| 7 | | | 812.4 | .17 | 1.38 | | 275 | 102 | 82 | | | 2 |
| 8 | | | 813.9 | .17 | 1.38 | | 275 | 102 | 82 | | | 2 |

Run #1

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 9 | | | 814.9 | .25 | 1.95 | | 275 | 98 | 82 | 250 | 60 | 3 |
| 10 | | | 816.2 | .25 | 1.95 | | 275 | 98 | 82 | | | 3 |
| 11 | | | 816.6 | .25 | 1.95 | | 275 | 98 | 82 | | | 3 |
| 12 | | | 819.0 | .25 | 1.95 | | 275 | 98 | 82 | | | 3 |
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ENVIRONMENTAL PROTECTION SYSTEMS

Jackson, Mississippi

## SOURCE SAMPLING FIELD DATA SHEET

Plant Hercules

Sampling Location Hattiesburg, Ms.

Date 1/14/76 Run No. 2

Time Start 11:25 Time End 1:05

Sampling Time/Point 2 min

DB ____ °F, WB ____ °F, VP @ DP ____ "HG

Bar. Press. 30.54 "Hg, Stack Press. 30.54 "Hg

Moisture ____ %, FDA ____, Gas Den. Fac. ____

Weather clear & warm

Temp. ____ °F, W/D ____, W/S ____

Sample Box No. ~~1936~~ Meter Box No. 1936

Meter ΔH@ 2.0 Pitot Corr. Factor ____

Nozzle Dia. .375 in., Probe Len. 6 ft.

Probe Heater Set. 900 Nomograph Cf .53

Stack Dimensions ____ in

Stack Area ____ $ft^2$

Stack Height ____ ft

Sketch of Stack

Mat'l Processing Rate ____

Final Gas Meter Reading 893.194 → 72.329 $ft^3$

Initial Gas Meter Reading 820.865 $ft^3$

Condensate Increase in Impingers ____ ml

Moisture in Silica Gel ____ gm

Silica Gel Container No. B Filter No. 0022

Orsat: $CO_2$ ____

$O_2$ ____

CO ____

$N_2$ ____

Excess Air ____

Test Conducted by: Blunt/Kreuz

Remarks: Leak ck ok 11:15 am

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. (°F) | Gas Sample Temp. @ Dry Gas Meter (°F) | | Sample Box Temp. (°F) | Last Impinger Temp. (°F) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 1 | | | 820.9 | .07 | .58 | | 275 | 76 | 76 | 250 | 60 | 2 |
| 2 | | | 821.7 | ~~.45~~ .30 | 2.32 | | 275 | 78 | 76 | | | 2 |
| 3 | | | 822.9 | — | | | ~~275~~ | 79 | 77 | | | |
| 4 | | | | .25 | 1.85 | | 275 | 80 | 76 | | | 3 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 5 | | | 824.3 | .30 | 2.32 | | 275 | 84 | 76 | 250 | 60 | 4 |
| 6 | | | 826.0 | .30 | 2.32 | | 275 | 87 | 76 | | | 4 |
| 7 | | | 827.5 | .25 | 1.95 | | 270 | 90 | 76 | | | 3 |
| 8 | | | 829.0 | .30 | 2.32 | | 270 | 90 | 76 | | | 4 |
| 9 | | | 830.7 | .30 | 2.32 | | 270 | 92 | 76 | | | 4 |
| 10 | | | 832.2 | .30 | 2.32 | | 270 | 93 | 76 | | | 4 |
| 11 | | | 834.0 | .45 | 3.45 | | 270 | 94 | 77 | | | 6 |
| 12 | | | 835.7 | .45 | 3.45 | | 270 | 96 | 77 | | | 6 |
| 1 | | | 838.0 | .45 | 3.45 | | 275 | 96 | 78 | | | 6 |
| 2 | | | 839.9 | .45 | 3.45 | | 275 | 98 | 78 | | | 6 |
| 3 | | | 841.7 | .45 | 3.45 | | 275 | 100 | 79 | | | 6 |
| 4 | | | 843.9 | .45 | 3.45 | | 275 | 100 | 80 | | | 6 |
| 5 | | | 846.1 | .07 | .58 | | 275 | 100 | 80 | | | 1 |
| 6 | | | 846.7 | .07 | .58 | | 275 | 100 | 80 | | | 1 |
| 7 | | | 847.6 | .20 | 1.54 | | 275 | 100 | 80 | | | 2 |
| 8 | | | 848.9 | .25 | 1.95 | | 275 | 100 | 80 | | | 2 |
| 9 | | | 850.2 | .25 | 1.95 | | 270 | 98 | 80 | | | 2 |
| 10 | | | 851.8 | .45 | 3.45 | | 270 | 98 | 80 | | | 6 |
| 11 | | | 853.7 | .60 | 4.55 | | 270 | 99 | 81 | | | 8 |
| 12 | | | 855.8 | .60 | 4.55 | | 285 | 104 | 81 | | | 8 |

Run #2

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 1 | | | 858.0 | .45 | 3.45 | | 300 | 104 | 82 | 250 | 60 | 5 |
| 2 | | | 859.9 | .45 | 3.45 | | 275 | 104 | 82 | | | 5 |
| 3 | | | 861.7 | .43 | 3.30 | | 275 | 104 | 82 | | | 5 |
| 4 | | | 863.7 | .43 | 3.30 | | 280 | 104 | 82 | | | 5 |
| 5 | | | 865.8 | .30 | 2.32 | | 275 | 104 | 82 | | | 3 |
| 6 | | | 867.3 | .20 | 1.59 | | 275 | 102 | 82 | | | 2 |
| 7 | | | 868.7 | .07 | .58 | | 275 | 98 | 83 | | | 1 |
| 8 | | | 869.7 | .07 | .58 | | 275 | 96 | 83 | | | 1 |
| 9 | | | 870.5 | .45 | 3.45 | | 290 | 96 | 83 | | | 5 |
| 10 | | | 872.4 | .45 | 3.45 | | 290 | 98 | 83 | | | 5 |
| 11 | | | 872.3 | .45 | 3.45 | | 290 | 100 | 83 | | | 5 |
| 12 | / | | 872.2 | .45 | 3.45 | | 290 | 101 | 84 | | | 5 |
| 1 | | | 878.1 | .43 | 3.30 | | 295 | 101 | 84 | | | 5 |
| 2 | | | 879.9 | .60 | 4.55 | | 300 | 102 | 84 | | | 9 |
| 3 | | | 881.6 | .50 | 3.80 | | 300 | 102 | 84 | | | 6 |
| 4 | | | 883.6 | .40 | 3.20 | | 300 | 103 | 84 | | | 5 |
| 5 | | | 885.5 | .30 | 2.32 | | 300 | 103 | 84 | | | 4 |
| 6 | | | 887.2 | .13 | 1.08 | | 295 | 102 | 84 | | | 2 |
| 7 | | | 888.4 | .06 | .495 | | 275 | 98 | 84 | | | 1 |
| 8 | | | 889.3 | .06 | .495 | | 275 | 95 | 84 | | | 1 |

Run 2

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 9 | | | 890.1 | — | | | | | | 250 | 60 | ~~7~~ |
| 10 | | | 890.1 | .06 | .495 | | 275 | 94 | 83 | | | 1 |
| 11 | | | 891.0 | .13 | 1.08 | | 275 | 92 | 83 | | | 2 |
| 12 | | | 892.0 | .15 | 1.21 | | 275 | 93 | 83 | | | 2 |

ENVIRONMENTAL PROTECTION SYSTEMS
Jackson, Mississippi

## SOURCE SAMPLING FIELD DATA SHEET

Plant Hercules

Sampling Location Hattiesburg, Ms.

Date 1/14/76 Run No. 3

Time Start 1:40 Time End 3:23

Sampling Time/Point 2 min.

DB ____ °F, WB ____ °F, VP @ DP ____ "HG

Bar. Press. 30.54 "Hg, Stack Press. 30.54 "Hg

Moisture ____ %, FDA ____, Gas Den. Fac. ____

Weather cloudy

Temp. ____ °F, W/D ____, W/S ____

Sample Box No. 1 Meter Box No. 1936

Meter ΔH@ 2.0 Pitot Corr. Factor ____

Nozzle Dia. .375 in., Probe Len. 6 ft.

Probe Heater Set. 90% Nomograph Cf .53

Stack Dimensions ____ in

Stack Area ____ $ft^2$

Stack Height ____ ft

Sketch of Stack

Mat'l Processing Rate ____

Final Gas Meter Reading 971.451 → 76.192 $ft^3$

Initial Gas Meter Reading 895.259 $ft^3$

Condensate Increase in Impingers ____ ml

Moisture in Silica Gel ____ gm

Silica Gel Container No. C Filter No. 0023

Orsat: $CO_2$ ____

$O_2$ ____

CO ____

$N_2$ ____

Excess Air ____

Test Conducted by: Blunt/Kreuz

Remarks: Leak ck ok 1:25 pm

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) Calc. | Meter Orifice Press. Diff. ("$H_2O$) Actual | Stack Gas Temp. (°F) | Gas Sample Temp. @Dry Gas Meter (°F) In | Gas Sample Temp. @Dry Gas Meter (°F) Out | Sample Box Temp. (°F) | Last Impinger Temp. (°F) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | 895.3 | .35 | 2.70 | | 275 | 70 | 69 | 250 | 60 | 2 |
| 2 | | | 896.9 | .60 | 4.55 | | 280 | 75 | 69 | | | 6 |
| 3 | | | 899.2 | .60 | 4.55 | | 280 | 84 | 70 | | | 6 |
| 4 | | | [illegible] | .35 | 2.70 | | 270 | 86 | 70 | | | 3 |

Run #3

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 5 | | | 903.1 | .20 | 1.59 | | 275 | 86 | 70 | 250 | 60 | 1 |
| 6 | | | 904.3 | .13 | 1.08 | | 275 | 87 | 70 | | | 1 |
| 7 | | | 905.5 | .07 | .58 | | 275 | 85 | 70 | | | 1 |
| 8 | | | 906.4 | — | | | | | | | | |
| 9 | | | 906.4 | .07 | .58 | | 275 | 85 | 70 | | | 1 |
| 10 | | | 907.3 | .13 | 1.08 | | 275 | 85 | 71 | | | 1 |
| 11 | | | 908.3 | .22 | 1.62 | | 275 | 85 | 71 | | | 2 |
| 12 | | | 909.7 | .30 | 2.32 | | 275 | 87 | 72 | | | 3 |
| ~~1~~ | | | 911.3 | .55 | 4.20 | | 270 | 90 | 73 | | | 6 |
| ~~2~~ | | | 913.2 | .50 | 3.80 | | 270 | 94 | 74 | | | 6 |
| 3 | | | 915.3 | .40 | 3.10 | | 275 | 96 | 75 | | | 5 |
| ~~3~~4 | | | 917.2 | .35 | 2.70 | | 275 | 96 | 75 | | | 4 |
| ~~4~~5 | | | 918.8 | .20 | 1.59 | | 275 | 95 | 76 | | | 2 |
| 6 | | | 920.2 | .05 | .41 | | 275 | 92 | 76 | | | 1 |
| ~~7~~ | | | 921.1 | .20 | 1.59 | | 275 | 92 | 77 | | | 2 |
| 8 | | | 922.3 | .30 | 2.32 | | 275 | 93 | 77 | | | 3 |
| 9 | | | 923.8 | .40 | 3.10 | | 275 | 95 | 78 | | | 4 |
| 10 | | | 925.8 | .60 | 4.55 | | 270 | 98 | 80 | | | 7 |
| 11 | | | 928.2 | .60 | 4.55 | | 270 | 98 | 80 | | | 7 |
| 12 | | | 929.5 | 1.00 | 7.50 | | 275 | 106 | 81 | | | 14 |

Run #3

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 1 | | | 933.1 | .50 | 3.80 | | 275 | 106 | 82 | 250 | 60 | 4 |
| 2 | | | 934.9 | .40 | 3.10 | | 275 | 108 | 83 | | | 4 |
| 3 | | | 936.8 | .38 | 2.92 | | 275 | 107 | 83 | | | 3 |
| 4 | | | 938.8 | .38 | 2.92 | | 275 | 107 | 83 | | | 3 |
| 5 | | | 940.4 | .30 | 2.32 | | 275 | 106 | 85 | | | 2 |
| 6 | | | 942.0 | .30 | 2.32 | | 275 | 106 | 85 | | | 2 |
| 7 | | | 944.0 | .20 | 1.59 | | 270 | 105 | 85 | | | 2 |
| 8 | | | 945.2 | .20 | 1.59 | | 270 | 103 | 86 | | | 2 |
| 9 | | | 946.7 | .38 | 2.92 | | 275 | 103 | 86 | | | 4 |
| 10 | | | 948.7 | .38 | 2.92 | | 275 | 105 | 87 | | | 4 |
| 11 | | | 950.3 | .60 | 4.55 | | 275 | 107 | 87 | | | 6 |
| 12 | / | | 952.5 | .60 | 4.55 | | 275 | 107 | 87 | | | 6 |
| 1 | | | 954.8 | .40 | 3.10 | | 275 | 107 | 88 | | | 4 |
| 2 | | | 956.6 | .20 | 1.59 | | 275 | 107 | 88 | | | 2 |
| 3 | | | 957.8 | — | | | | | | | | |
| 4 | | | 957.8 | .20 | 1.59 | | 275 | 105 | 88 | | | 2 |
| 5 | | | 958.7 | .20 | 1.59 | | 275 | 105 | 88 | | | 2 |
| 6 | | | 961.0 | .35 | 2.70 | | 275 | 103 | 88 | | | 3 |
| 7 | | | 962.3 | .20 | 1.59 | | 275 | 103 | 88 | | | 2 |
| 8 | | | 963.8 | .20 | 1.59 | | 275 | 103 | 88 | | | 2 |

Run #3

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 9 | | | 965.2 | .20 | 1.59 | | 275 | 103 | 88 | 250 | 60 | 2 |
| 10 | | | 966.5 | .30 | 2.32 | | 275 | 103 | 88 | | | 3 |
| 11 | | | 968.1 | .30 | 2.32 | | 275 | 103 | 88 | | | 3 |
| 12 | | | 969.8 | .30 | 2.32 | | 275 | 103 | 88 | | | 3 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | |

PERFORMANCE EVALUATION TEST
FOR THE DETERMINATION OF
PARTICULATE EMISSIONS

HERCULES, INCORPORATED
HATTIESBURG, MISSISSIPPI

JUNE, 1976

*Environmental Protection Systems*

ENGINEERING AND LABORATORY
SERVICES FOR
AIR, LAND, AND WATER RESOURCE

# PERFORMANCE EVALUATION TEST
# FOR THE DETERMINATION OF
# PARTICULATE EMISSIONS

for

Hercules, Incorporated

Hattiesburg, Mississippi

by

Environmental Protection Systems

106 Upton Drive

Jackson, Mississippi

Test Number 76183

June, 1976

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## PURPOSE

The purpose of this performance evaluation test was to establish the particulate emission from a stack servicing two woodwaste boilers. The boilers, located at Hattiesburg, Mississippi, are owned and operated by Hercules, Incorporated. EPS was retained to perform the required emissions tests.

## CONCLUSION

Six (6) performance tests using two nozzle sizes were conducted on each of the two boilers on May 20 and 21, 1976 in accordance with the procedures outlined in the Federal Register, Volume 36, Number 247, Part II, by the U.S. Environmental Protection Agency and the Mississippi Air and Water Pollution Control Commission. The results of the tests are shown in tabular form in the Data Summary.

## DATA SUMMARY

| Boiler No. | Test No. | Grain Loading Grains/dscf | Nozzle Size | Emission Rate lbs/hr. | Percent Isokinetic (%) |
|---|---|---|---|---|---|
| 1 | 1 | 0.0885 | 3/8" | 40.0 | 102 |
| 1 | 2* | 0.0944 | 3/8" | 35.6 | 108 |
| 1 | 3* | 0.0897 | 3/8" | 35.1 | 103 |
| 1 | Ave | 0.0909 | 3/8" | 36.9 | 104 |
| 1 | 1 | 0.0371 | 3/16" | 15.1 | 102 |
| 1 | 2 | 0.0297 | 3/16" | 11.5 | 101 |
| 1 | 3 | 0.0547 | 3/16" | 21.1 | 98 |
| 1 | Ave | 0.0405 | 3/16" | 15.9 | 100 |

| Boiler No. | Test No. | Grain Loading Grains/dscf | Nozzle Size | Emission Rate lbs/hr | Percent Isokinetic (%) |
|---|---|---|---|---|---|
| 2 | 1* | 0.1658 | 3/8" | 62.5 | 109 |
| 2 | 2 | 0.0648 | 3/8" | 23.7 | 106 |
| 2 | 3** | 0.1205 | 3/8" | 43.6 | 109 |
| 2 | Ave | 0.1170 | 3/8" | 43.2 | 108 |
| 2 | 1 | 0.0854 | 3/16" | 30.3 | 107 |
| 2 | 2 | 0.0928 | 3/16" | 36.1 | 105 |
| 2 | 3* | 0.1612 | 3/16" | 60.0 | 103 |
| 2 | Ave | 0.1131 | 3/16" | 42.1 | 105 |

| | Grain Loading Grains/dscf | |
|---|---|---|
| | Actual | Allowable |
| Stack Total (3/8" nozzle) | 0.1033 | 0.30 |
| Stack Total (3/16"nozzle) | 0.0758 | 0.30 |

*Fire cleaning in boiler during all or most of test

**Fire Cleaning in boiler during approximately half of test

## DISCUSSION

Performance evaluation tests were conducted on May 20 and 21, 1976, on two woodwaste boilers, boiler # 1 (east) and boiler # 2 (west), both common to the south stack. The boilers are operated by Hercules, Incorporated, located at Hattiesburg, Mississippi. The boilers at this facility perform two major operational functions: Specifically the boilers are used to incinerate mostly wood waste generated by the various processes and to process steam for plant usage. Simultaneous performance tests were conducted using prodedures set forth by EPA and the MAWPCC which are described in the Appendix under Discussion of Sampling.

The boilers tested are classified as combination type which has been defined by the MAWPCC as a fuel-burning operation which utilized a mixture of combustibles such as, but not limited to, fossil fuels plus bark, oil plus bark, spent wood, or water treatment sludge. According to the MAWPCC Air Quality Regulations APC-5-1, 1972, a combination boiler may be allowed emissions up to 0.30 grains per standard cubic foot. The average emissions for the tested boilers with both nozzle sizes can be found in the Data Summary.

## EMISSION SOURCE SAMPLING PROCEDURE

The test methods and procedures used for this performance evaluation were those outlined in the Federal Register, Volume 36, Number 247, Part II, as promulgated by the Environmental Protection Agency (EPA). Method 1 for determination of sample and velocity traverses was used to arrive at the correct number of sampling points. The determination of stack gas velocity and volumetric flow rate was performed in accordance with Method 2 using a type S pitot tube. Method 3--Gas Analysis for Carbon Dioxide, Excess Air, and Dry Molecular Weight was used for this test and an integrated sample was collected and analyzed. Methods 4 and 5 were followed to establish the moisture content and particulate emissions, respectively.

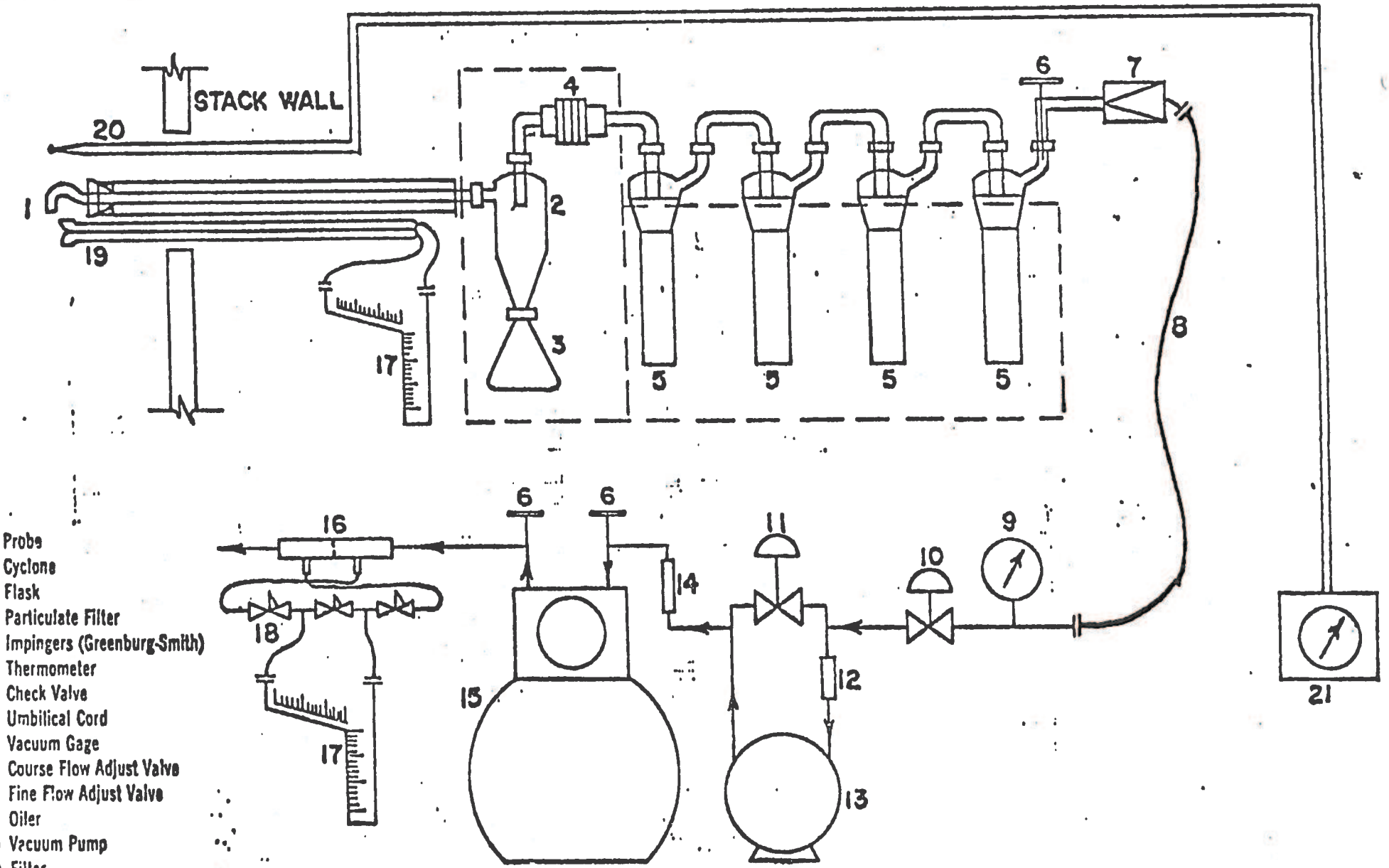
The EPA Method 5 relies on the removal of a dust-laden gaseous sample from the duct followed by the subsequent removal of the particulate matter on a filter media. Concurrently a measurement of the sample volume is made to determine particulate concentration. The sample is removed from the stack by using a prescribed traversing procedure, which in effect is an approximate integration of collected mass and sample volume over the cross-sectional area of the

stack. The velocity distribution is also determined during the sample traverse. This information is used with the particulate concentration to determine mass emission rates. Method 5 requires that isokinetic sampling conditions be maintained. Thus at each traverse point the sample velocity at the nozzle is adjusted to equal the duct velocity. The sampling train required to maintain isokinetic conditions is discussed in the following section.

## DESCRIPTION OF ISOKINETIC SAMPLING TRAIN

The sampling train used to conduct this sampling was manufactured by the Research Appliance Company according to the construction details provided by EPA. The sampling train can be divided into component parts as follows:

1. Nozzle and probe
2. Pitot tube (S-Type)
3. Cyclone or by-pass
4. Filter
5. Impinger
6. Sampling box
7. Umbilical cord
8. Meter or control box
9. External equipment
    a. Omega thermocouple-pyrometer
    b. Gas analysis apparatus (ORSAT)




1) Probe
2) Cyclone
3) Flask
4) Particulate Filter
5) Impingers (Greenburg-Smith)
6) Thermometer
7) Check Valve
8) Umbilical Cord
9) Vacuum Gage
10) Course Flow Adjust Valve
11) Fine Flow Adjust Valve
12) Oiler
13) Vacuum Pump
14) Filter
15) Dry Gas Meter
16) Orifice Tube
17) Incline Manometer
18) Solenoid Valves
19) Pitot
20) Thermocouple
21) Pyrometer

PROPERTY OF
RESEARCH APPLIANCE Co. ALLISON PARK, PA

| | | | |
|---|---|---|---|
| TOLERANCES<br>DEC. ±<br>FRACT. ± | TITLE STAKSAMPLER FLOW SYSTEM | | |
| | DWG. NO. 1748 | MAT'L | SCALE |
| NO. REQ'D | DRAWN BY R.G. | APPR. | DATE 6-23-69 |
| FINISH | | JIG NO. | ART NO. |

## DESCRIPTION OF THE SAMPLING SITES

The sampling sites were located on custom built platforms adjacent to the exhaust breechings approximently twenty (20) feet above the ground level. Since each breeching has the same dimensions, the following discription will apply to both breechings.

Four (4) sampling ports were located in a horizontal line equally spaced from each other. The sampling ports were located at less than one (1) stack diameter upstream and downstream from a potential fluid disturbance. The equivalent stack diameter was calculated to be 55.38 inches. In this case, a required number of sampling points, forty-eight (48), were calculated in accordance with the prescribed EPA procedures. The sampling port arrangements and sampling points are shown in Figure I.

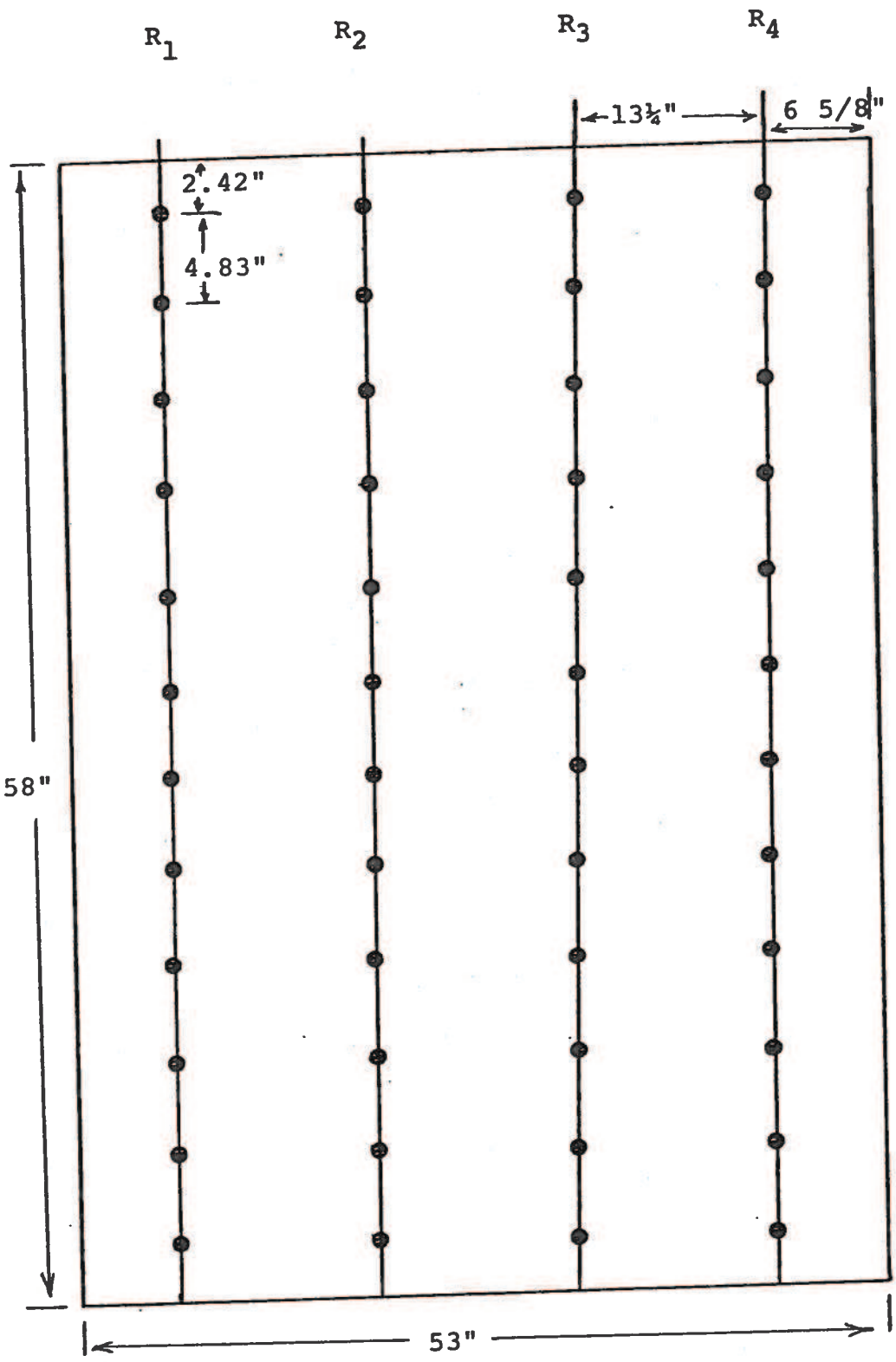



FIGURE 1: Location of Ports and Traverse Points

# PARTICULATE TEST CALCULATIONS

Plant Hercules, Inc., Stack Boiler # 1, Date 5/20/76

Bar. Press. 30.37 "Hg, Stack Press. 30.38 "Hg, Stack Dia 55.38 in., Stack Area 21.35 $ft^2$

Ave. Stack Temp. 387 °F, Ave. Meter Temp 94.9°F, Ave. $\sqrt{h}$ 0.96 "$H_2O$, Nozzle Dia. .375 in.*

$C_p$ 0.83, Meter Vol. 43.757 $ft^3$, Moisture plus Silica Gel 28 ml, Sample Time 88 min.

Orsat Analysis: $CO_2$ 4.7 %, $O_2$ 15.1%, CO 0.2%, $N_2$ 80.0% Ave. Orifice $\Delta H$ 0.95 "$H_2O$

Nozzle Dia. and Area: 1/4 in.---0.000341 $ft^2$, 3/8 in.---0.000767 $ft^2$, 1/2 in.---0.013 $ft^2$

3/16 in.---0.0001916 $ft^2$, 1/8 in.---0.000085 $ft^2$

1) $V_{wv}$ = (0.0474) x (Moisture + Silica Gel)ml = 1.33 scf

2) $V_{stpd} = (17.71) \times (P_o + \frac{\overline{\Delta H}}{13.6}) \times (V_m) \times (\frac{1}{T_m + 460})$ = 42.51 scf

3) $V_t = (V_{wv}) + (V_{stpd})$ = 43.84 scf

4) $W = \frac{V_{wv}}{V_t}$ = 0.03

5) FDA = (1.0) - (W) = 0.97

6) $M_d = [(0.44)x(\_\_\%CO_2)] + [(0.32)x(\_\_\%O_2)] + [(0.28)x(\_\_\%N_2 + \_\_\%CO)]$ = 29.36

7) $M_s = [(M_d) \times (FDA)] + [(18) \times (W)]$ = 29.01

8) $G_s = \frac{M_s}{28.99}$ = 1.00

9) Excess Air, $EA = \frac{\left[\frac{(\_\_\%O_2) - (\_\_\%CO)}{2}\right]}{[(0.266)x(\_\_\%N_2)] - \left[(\_\_\%O_2) - \frac{(\_\_\%CO)}{2}\right]} \times 100$ = --- %

10) $\bar{U} = (174) \times (C_p) \times (\sqrt{\bar{h}}) \times \left(\sqrt{\frac{T_s + 460}{G_s}}\right) \times \left(\sqrt{\frac{29.92}{P_s}}\right)$ = 4004 fpm

11) $Q_s = (\bar{U}) \times (A_s)$ = 85492 cfm

12) $Q_d = (Q_x) \times (FDA)$ = 82927 cfm

13) $Q_{stpd} = (Q_d) \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 52688 cfm

14) $V_i = (\bar{U}) \times (A_n) \times (FDA) \times (Time) \times \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 41.61 scf

15) *Percent Isokinetic $= \frac{(V_{stpd})(100)}{(V_i)}$ = 102 %

*Percent Isokinetic based on a 3/16" nozzle

PARTICULATE TEST CALCULATIONS - Cont'd.

16) Percent Isokinetic by the EPA = $\dfrac{\left[(0.00267)\times(V_{H_2O})+\dfrac{(Vm)}{(Tm+460)}\times(P_{bar}+\dfrac{\Delta H}{13.6})\right](Ts+460)}{(Vs)\times(Time)\times(Ps)\times(An)}$ = 102 %

17) $E_{stp} = \dfrac{(15.43)\times(Y)}{V_{stpd}}$

18) $E_{12} = \dfrac{(12)\times(E_{stp})}{(CO_2\%)}$

19) $E_{50} = \dfrac{(E_{stp})\times(100+EA\%)}{150}$

20) $E_m = (E_{stp})\times(Q_{stpd})\times(0.00857)$

| Particulate Lab Analysis (Y) | | Particulate Concentrations, grains/scf ($E_{stp}$) | ($E_{12}$) | ($E_{50}$) | Emission Rate, lbs/hr. ($E_m$) |
|---|---|---|---|---|---|
| Probe | 0.1211 gm | 0.0885 | 0.2260 | | 40.0 |
| Filter | 0.1226 gm | | | | |
| Imp. $H_2O$ | gm | | | | |
| Organics | gm | | | | |
| After Filter | gm | | | | |
| Total | 0.2437 gm | | | | |

COMMENTS:

# PARTICULATE TEST CALCULATIONS

Plant Hercules, Inc., Stack Boiler # 1, Date 5/20/76

Bar. Press. 30.37 "Hg, Stack Press. 30.38 "Hg, Stack Dia 55.38 in., Stack Area 21.35 $ft^2$

Ave. Stack Temp. 379 °F, Ave. Meter Temp 110 °F, Ave. $\sqrt{h}$ 0.80 $"H_2O$, Nozzle Dia. 0.375 in. *

$C_p$ 0.83, Meter Vol. 41.516 $ft^3$, Moisture plus Silica Gel 27 ml, Sample Time 92 min.

Orsat Analysis: $CO_2$ 4.7%, $O_2$ 15.1%, CO 0.2%, $N_2$ 80.0% Ave. Orifice $\Delta H$ 0.80 $"H_2O$

Nozzle Dia. and Area: 1/4 in.---0.000341 $ft^2$, 3/8 in.---0.000767 $ft^2$, 1/2 in.---0.013 $ft^2$

3/16 in.---0.0001916 $ft^2$, 1/8 in.---0.000085 $ft^2$

1) $V_{wv} = (0.0474) \times (\text{Moisture + Silica Gel})\text{ml}$ = 1.28 scf

2) $V_{stpd} = (17.71) \times \left(P_o + \frac{\overline{\Delta H}}{13.6}\right) \times (V_m) \times \left(\frac{1}{T_m + 460}\right)$ = 39.25 scf

3) $V_t = (V_{wv}) + (V_{stpd})$ = 40.53 scf

4) $W = \frac{V_{wv}}{V_t}$ = 0.03

5) $FDA = (1.0) - (W)$ = 0.97

6) $M_d = [(0.44)\times(\_\_\%CO_2)] + [(0.32)\times(\_\_\%O_2)] + [(0.28)\times(\_\_\%N_2 + \_\_\%CO)]$ = 29.36

7) $M_s = [(M_d) \times (FDA)] + [(18) \times (W)]$ = 29.00

8) $G_s = \frac{M_s}{28.99}$ = 1.00

9) Excess Air, $EA = \frac{\left[(\_\_\%O_2) - \left(\frac{\_\_\%CO}{2}\right)\right]}{[(0.266)\times(\_\_\%N_2)] - \left[(\_\_\%O_2) - \left(\frac{\_\_\%CO}{2}\right)\right]} \times 100$ = --- %

10) $\bar{U} = (174) \times (C_p) \times (\sqrt{\bar{h}}) \times \left(\sqrt{\frac{T_s + 460}{G_s}}\right) \times \left(\sqrt{\frac{29.92}{P_s}}\right)$ = 3321 fpm

11) $Q_s = (\bar{U}) \times (A_s)$ = 70906 cfm

12) $Q_d = (Q_x) \times (FDA)$ = 68779 cfm

13) $Q_{stpd} = (Q_d) \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 44116 cfm

14) $V_i = (\bar{U}) \times (A_n) \times (FDA) \times (Time) \times \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 36.42 scf

15) * Percent Isokinetic $= \frac{(V_{stpd})(100)}{(V_i)}$ = 108 %

*Percent Isokinetic based on 3/16 inch nozzle

Run # 2

PARTICULATE TEST CALCULATIONS - Cont'd.

16) Percent Isokinetic by the EPA = $\dfrac{\left[(0.00267)\times(V_{H_2O})+\dfrac{(Vm)}{(Tm+460)}\times(P_{bar}+\dfrac{\Delta H}{13.6})\right](Ts+460)}{(Vs)\times(Time)\times(Ps)\times(An)}$ = 108 %

17) $E_{stp} = \dfrac{(15.43)\times(Y)}{V_{stpd}}$

18) $E_{12} = \dfrac{(12)\times(E_{stp})}{(CO_2\%)}$

19) $E_{50} = \dfrac{(E_{stp})\times(100+EA\%)}{150}$

20) $E_m = (E_{stp})\times(Q_{stpd})\times(0.00857)$

| Particulate Lab Analysis (Y) | | Particulate Concentrations, grains/scf ($E_{stp}$) | ($E_{12}$) | ($E_{50}$) | Emission Rate, lbs/hr. ($E_m$) |
|---|---|---|---|---|---|
| Probe | 0.1043 gm | 0.0944 | 0.2409 | | 35.6 |
| Filter | 0.1359 gm | | | | |
| Imp. $H_2O$ | gm | | | | |
| Organics | gm | | | | |
| After Filter | gm | | | | |
| Total | 0.2402 gm | | | | |

COMMENTS:

# PARTICULATE TEST CALCULATIONS

Plant Hercules, Inc., Stack Boiler # 1, Date 5/21/76

Bar. Press. 30.23 "Hg, Stack Press. 30.24 "Hg, Stack Dia 55.38 in., Stack Area 21.35 $ft^2$

Ave. Stack Temp. 378 °F, Ave. Meter Temp 102 °F, Ave. $\sqrt{h}$ 0.83 $"H_2O$, Nozzle Dia. 0.375 in. *

$C_p$ 0.83, Meter Vol. 40.686 $ft^3$, Moisture plus Silica Gel 24 ml, Sample Time 92 min.

Orsat Analysis: $CO_2$ 4.7 %, $O_2$ 15.1%, CO 0.2 %, $N_2$ 80.0% Ave. Orifice $\Delta H$ 0.74 $"H_2O$

Nozzle Dia. and Area: 1/4 in.---0.000341 $ft^2$, 3/8 in.---0.000767 $ft^2$, 1/2 in.---0.013 $ft^2$

3/16 in.---0.0001916 $ft^2$, 1/8 in.---0.000085 $ft^2$

1) $V_{wv} = (0.0474) \times (\text{Moisture + Silica Gel})ml$ = 1.14 scf

2) $V_{stpd} = (17.71) \times (P_o + \frac{\overline{\Delta H}}{13.6}) \times (V_m) \times (\frac{1}{T_m + 460})$ = 38.83 scf

3) $V_t = (V_{wv}) + (V_{stpd})$ = 39.97 scf

4) $W = \frac{V_{wv}}{V_t}$ = 0.03

5) FDA = (1.0) - (W) = 0.97

6) $M_d = [(0.44) \times (\_\_\_ \%CO_2)] + [(0.32) \times (\_\_\_ \%O_2)] + [(0.28) \times (\_\_\_ \%N_2 + \_\_\_ \%CO)]$ = 29.36

7) $M_s = [(M_d) \times (FDA)] + [(18) \times (W)]$ = 29.03

8) $G_s = \frac{M_s}{28.99}$ = 1.00

9) Excess Air, $EA = \frac{\left[ (\_\_\_ \%O_2) - (\frac{\_\_\_ \%CO}{2}) \right]}{[(0.266) \times (\_\_\_ \%N_2)] - \left[ (\_\_\_ \%O_2) - (\frac{\_\_\_ \%CO}{2}) \right]} \times 100$ = --- %

10) $\overline{U} = (174) \times (C_p) \times (\sqrt{\overline{h}}) \times \sqrt{\frac{T_s + 460}{G_s}} \times \sqrt{\frac{29.92}{P_s}}$ = 3452 fpm

11) $Q_s = (\overline{U}) \times (A_s)$ = 73691 cfm

12) $Q_d = (Q_x) \times (FDA)$ = 71480 cfm

13) $Q_{stpd} = (Q_d) (\frac{70 + 460}{T_s + 460}) \times (\frac{P_s}{29.92})$ = 45692 cfm

14) $V_i = (\overline{U}) \times (A_n) \times (FDA) \times (Time) \times (\frac{70 + 460}{T_s + 460}) \times (\frac{P_s}{29.92})$ = 37.72 scf

15) * Percent Isokinetic $= \frac{(V_{stpd})(100)}{(V_i)}$ = 103 %

*Percent Isokinetic based on 3/16 inch nozzle

3/8 Inch nozzle Boiler # 1
Run # 3

PARTICULATE TEST CALCULATIONS - Cont'd.

16) Percent Isokinetic by the EPA = $\dfrac{\left[(0.00267)\times(V_{H_2O})+\dfrac{(Vm)}{(Tm+460)}\times(P_{bar}+\dfrac{\Delta H}{13.6})\right](Ts+460)}{(Vs)\times(Time)\times(Ps)\times(An)}$ = 103 %

17) $E_{stp} = \dfrac{(15.43)\times(Y)}{V_{stpd}}$

18) $E_{12} = \dfrac{(12)\times(E_{stp})}{(CO_2\%)}$

19) $E_{50} = \dfrac{(E_{stp})\times(100+EA\%)}{150}$

20) $E_m = (E_{stp})\times(Q_{stpd})\times(0.00857)$

| Particulate Lab Analysis (Y) | | Particulate Concentrations, grains/scf ($E_{stp}$) | ($E_{12}$) | ($E_{50}$) | Emission Rate, lbs/hr. ($E_m$) |
|---|---|---|---|---|---|
| Probe | 0.1247 gm | 0.0897 | 0.2290 | | 35.1 |
| Filter | 0.1010 gm | | | | |
| Imp. $H_2O$ | gm | | | | |
| Organics | gm | | | | |
| After Filter | gm | | | | |
| Total | 0.2257 gm | | | | |

COMMENTS:

# PARTICULATE TEST CALCULATIONS

Plant Hercules, Inc., Stack Boiler # 2, Date 5/20/76

Bar. Press. 30.37 "Hg, Stack Press 30.38 "Hg, Stack Dia 55.38 in., Stack Area 21.35 $ft^2$

Ave. Stack Temp. 380 °F, Ave. Meter Temp. 94.5F, Ave. $\sqrt{h}$ 0.79 "$H_2O$, Nozzle Dia. 0.375 in. *

$C_p$ 0.83 Meter Vol. 40.700 $ft^3$, Moisture plus Silica Gel 17 ml, Sample Time 92 min.

Orsat Analysis: $CO_2$ 4.7 %, $O_2$ 15.1%, CO 0.2%, $N_2$ 80.0% Ave. Orifice $\Delta H$ 0.67 "$H_2O$

Nozzle Dia. and Area: 1/4 in.---0.000341 $ft^2$, 3/8 in.---0.000767 $ft^2$, 1/2 in.---0.013 $ft^2$

3/16 in.---0.0001916 $ft^2$, 1/8 in.---0.000085 $ft^2$

1) $V_{wv} = (0.0474) \times (\text{Moisture + Silica Gel})ml$ = 0.81 scf

2) $V_{stpd} = (17.71) \times (P_o + \frac{\overline{\Delta H}}{13.6}) \times (V_m) \times (\frac{1}{T_m + 460})$ = 39.54 scf

3) $V_t = (V_{wv}) + (v_{stpd})$ = 40.35 scf

4) $W = \frac{V_{wv}}{V_t}$ = 0.02

5) $FDA = (1.0) - (W)$ = 0.98

6) $M_d = [(0.44) \times (\_\_\_\%CO_2)] + [(0.32) \times (\_\_\_\%O_2)] + [(0.28) \times (\_\_\_\%N_2 + \_\_\_\%CO)]$ = 29.36

7) $M_s = [(M_d) \times (FDA)] + [(18) \times (W)]$ = 29.13

8) $G_s = \frac{M_s}{28.99}$ = 1.00

9) Excess Air, $EA = \frac{\left[ (\_\_\_\%O_2) - (\frac{\_\_\_}{2}\%CO) \right]}{\left[ (0.266) \times (\_\_\_\%N_2) \right] - \left[ (\_\_\_\%O_2) - (\frac{\_\_\_}{2}\%CO) \right]} \times 100$ = --- %

10) $\overline{U} = (174) \times (C_p) \times (\sqrt{\overline{h}}) \times \left(\sqrt{\frac{T_s + 460}{G_s}}\right) \times \left(\sqrt{\frac{29.92}{P_s}}\right)$ = 3282 fpm

11) $Q_s = (\overline{U}) \times (A_s)$ = 70061 cfm

12) $Q_d = (Q_x) \times (FDA)$ = 68660 cfm

13) $Q_{stpd} = (Q_d) \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 43987 cfm

14) $V_i = (\overline{U}) \times (A_n) \times (FDA) \times (Time) \times \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 36.32 scf

15) * Percent Isokinetic $= \frac{(V_{stpd})(100)}{(V_i)}$ = 109 %

* Percent Isokinetic based on a 3/16 inch nozzle

PARTICULATE TEST CALCULATIONS - Cont'd.

16) Percent Isokinetic by the EPA = $\dfrac{\left[(0.00267)\times(V_{H_2O})+\dfrac{(Vm)}{(Tm+460)}\times(P_{bar}+\dfrac{\Delta H}{13.6})\right](Ts+460)}{(Vs)\times(Time)\times(Ps)\times(An)}$ = 109 %

17) $E_{stp} = \dfrac{(15.43)\times(Y)}{V_{stpd}}$

18) $E_{12} = \dfrac{(12)\times(E_{stp})}{(CO_2\%)}$

19) $E_{50} = \dfrac{(E_{stp})\times(100+EA\%)}{150}$

20) $E_m = (E_{stp})\times(Q_{stpd})\times(0.00857)$

| Particulate Lab Analysis (Y) | | Particulate Concentrations, grains/scf ($E_{stp}$) | ($E_{12}$) | ($E_{50}$) | Emission Rate, lbs/hr. ($E_m$) |
|---|---|---|---|---|---|
| Probe | 0.2633 gm | 0.1658 | 0.4234 | | 62.5 |
| Filter | 0.1619 gm | | | | |
| Imp. $H_2O$ | gm | | | | |
| Organics | gm | | | | |
| After Filter | gm | | | | |
| Total | 0.4252 gm | | | | |

COMMENTS:

# PARTICULATE TEST CALCULATIONS

Plant Hercules, Inc., Stack Boiler # 2, Date 5/20/76

Bar. Press. 30.37 "Hg, Stack Press. 30.38 "Hg, Stack Dia 55.38 in., Stack Area 21.35 $ft^2$

Ave. Stack Temp. 388 °F, Ave. Meter Temp. 109 °F, Ave. $\sqrt{h_o}$ 0.77 $"H_2O$, Nozzle Dia. 0.375 in. *

$C_p$ 0.83, Meter Vol. 39.366 $ft^3$, Moisture plus Silica Gel 16 ml, Sample Time 92 min.

Orsat Analysis: $CO_2$ 4.7%, $O_2$ 15.1%, CO 0.2 %, $N_2$ 80.0% Ave. Orifice $\Delta H$ 0.67 $"H_2O$

Nozzle Dia. and Area: 1/4 in.---0.000341 $ft^2$, 3/8 in.---0.000767 $ft^2$, 1/2 in.---0.013 $ft^2$

3/16 in.---0.0001916 $ft^2$, 1/8 in.---0.000085 $ft^2$

1) $V_{wv} = (0.0474) \times (\text{Moisture + Silica Gel})ml$ = 0.76 scf

2) $V_{stpd} = (17.71) \times (P_o + \frac{\overline{\Delta H}}{13.6}) \times (V_m) \times (\frac{1}{T_m + 460})$ = 37.27 scf

3) $V_t = (V_{wv}) + (v_{stpd})$ = 38.03 scf

4) $W = \frac{V_{wv}}{V_t}$ = 0.02

5) $FDA = (1.0) - (W)$ = 0.98

6) $M_d = [(0.44)x(\_\_\_\%CO_2)] + [(0.32)x(\_\_\_\%O_2)] + [(0.28)x(\_\_\_\%N_2 + \_\_\_\%CO)]$ = 29.36

7) $M_s = [(M_d) \times (FDA)] + [(18) \times (W)]$ = 29.13

8) $G_s = \frac{M_s}{28.99}$ = 1.00

9) Excess Air, $EA = \frac{\left[\frac{(\_\_\_\%O_2) - (\_\_\_\%CO)}{2}\right]}{[(0.266)x(\_\_\_\%N_2)] - \left[(\_\_\_\%O_2) - \frac{(\_\_\_\%CO)}{2}\right]} \times 100$ = --- %

10) $\overline{U} = (174) \times (C_p) \times (\sqrt{\overline{h}}) \times \sqrt{\frac{T_s + 460}{G_s}} \times \sqrt{\frac{29.92}{P_s}}$ = 32.14 fpm

11) $Q_s = (\overline{U}) \times (A_s)$ = 68612 cfm

12) $Q_d = (Q_x) \times (FDA)$ = 67240 cfm

13) $Q_{stpd} = (Q_d) (\frac{70 + 460}{T_s + 460}) \times (\frac{P_s}{29.92})$ = 42671 cfm

14) $V_i = (\overline{U}) \times (A_n) \times (FDA) \times (\text{Time}) \times (\frac{70 + 460}{T_s + 460}) \times (\frac{P_s}{29.92})$ = 35.23 scf

15) * Percent Isokinetic $= \frac{(V_{stpd})(100)}{(V_i)}$ = 106 %

* Percent Isokinetic based on 3/16 inch nozzle

3/8" Nozzle
Run # 2

PARTICULATE TEST CALCULATIONS - Cont'd.

16) Percent Isokinetic by the EPA = $\dfrac{\left[(0.00267)\times(V_{H_2O})+\dfrac{(Vm)}{(Tm+460)}\times(P_{bar}+\dfrac{\Delta H}{13.6})\right](Ts+460)}{(Vs)\times(Time)\times(Ps)\times(An)}$ = 106 %

17) $E_{stp} = \dfrac{(15.43)\times(Y)}{V_{stpd}}$

18) $E_{12} = \dfrac{(12)\times(E_{stp})}{(CO_2\%)}$

19) $E_{50} = \dfrac{(E_{stp})\times(100+EA\%)}{150}$

20) $E_m = (E_{stp})\times(Q_{stpd})\times(0.00857)$

| Particulate Lab Analysis (Y) | | Particulate Concentrations, grains/scf ($E_{stp}$) | ($E_{12}$) | ($E_{50}$) | Emission Rate, lbs/hr. ($E_m$) |
|---|---|---|---|---|---|
| Probe | 0.0861 gm | 0.0648 | 0.1655 | | 32.7 |
| Filter | 0.0705 gm | | | | |
| Imp. $H_2O$ | gm | | | | |
| Organics | gm | | | | |
| After Filter | gm | | | | |
| Total | 0.1566 gm | | | | |

COMMENTS:

Run # 3

# PARTICULATE TEST CALCULATIONS

Plant Hercules, Inc., Stack Boiler # 2, Date 5/21/76

Bar. Press. 30.23 "Hg, Stack Press. 30.24 "Hg, Stack Dia 55.38 in., Stack Area 21.35 $ft^2$

Ave. Stack Temp. 371 °F, Ave. Meter Temp 100 °F, Ave. $\sqrt{h}$ 0.76 $"H_2O$, Nozzle Dia. 0.375 in. *

$C_p$ 0.83, Meter Vol. 38.896 $ft^3$, Moisture plus Silica Gel 14 ml, Sample Time 90 min.

Orsat Analysis: $CO_2$ 4.7 %, $O_2$ 15.1%, CO 0.2%, $N_2$ 80.0%  Ave. Orifice $\Delta H$ 0.63 $"H_2O$

Nozzle Dia. and Area: 1/4 in.---0.000341 $ft^2$, 3/8 in.---0.000767 $ft^2$, 1/2 in.---0.013 $ft^2$

3/16 in.---0.0001916 $ft^2$, 1/8 in.---0.000085 $ft^2$

1) $V_{wv} = (0.0474) \times (\text{Moisture + Silica Gel})\text{ml}$ = 0.66 scf

2) $V_{stpd} = (17.71) \times (P_o + \frac{\Delta H}{13.6}) \times (V_m) \times (\frac{1}{T_m + 460})$ = 37.24 scf

3) $V_t = (V_{wv}) + (V_{stpd})$ = 37.91 scf

4) $W = \frac{V_{wv}}{V_t}$ = 0.02

5) $FDA = (1.0) - (W)$ = 0.98

6) $M_d = [(0.44)x(\_\_\%CO_2)] + [(0.32)x(\_\_\%O_2)] + [(0.28)x(\_\_\%N_2 + \_\_\%CO)]$ = 29.36

7) $M_s = [(M_d) \times (FDA)] + [(18) \times (W)]$ = 29.16

8) $G_s = \frac{M_s}{28.99}$ = 1.01

9) Excess Air, $EA = \frac{\left[(\_\_\%O_2) - \frac{(\_\_\%CO)}{2}\right]}{[(0.266)x(\_\_\%N_2)] - \left[(\_\_\%O_2) - \frac{(\_\_\%CO)}{2}\right]} \times 100$ = --- %

10) $\bar{U} = (174) \times (C_p) \times (\sqrt{\bar{h}}) \times \left(\sqrt{\frac{T_s + 460}{G_s}}\right) \times \left(\sqrt{\frac{29.92}{P_s}}\right)$ = 3132 fpm

11) $Q_s = (\bar{U}) \times (A_s)$ = 66860 cfm

12) $Q_d = (Q_x) \times (FDA)$ = 65523 cfm

13) $Q_{stpd} = (Q_d) \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 42237 cfm

14) $V_i = (\bar{U}) \times (A_n) \times (FDA) \times (Time) \times \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 34.11 scf

15) * Percent Isokinetic $= \frac{(V_{stpd})(100)}{(V_i)}$ = 109 %

*Percent Isokinetic based on 3/16 inch nozzle

PARTICULATE TEST CALCULATIONS - Cont'd.

16) Percent Isokinetic by the EPA = $\dfrac{\left[(0.00267)\times(V_{H_2O})+\dfrac{(Vm)}{(Tm+460)}\times(P_{bar}+\dfrac{\Delta H}{13.6})\right](Ts+460)}{(Vs)\times(Time)\times(Ps)\times(An)}$ = 109 %

17) $E_{stp} = \dfrac{(15.43)\times(Y)}{V_{stpd}}$

18) $E_{12} = \dfrac{(12)\times(E_{stp})}{(CO_2\%)}$

19) $E_{50} = \dfrac{(E_{stp})\times(100+EA\%)}{150}$

20) $E_m = (E_{stp})\times(Q_{stpd})\times(0.00857)$

| Particulate Lab Analysis (Y) | | Particulate Concentrations, grains/scf ($E_{stp}$) | ($E_{12}$) | ($E_{50}$) | Emission Rate, lbs/hr. ($E_m$) |
|---|---|---|---|---|---|
| Probe | 0.1515 gm | 0.1205 | 0.3077 | | 43.6 |
| Filter | 0.1394 gm | | | | |
| Imp. $H_2O$ | gm | | | | |
| Organics | gm | | | | |
| After Filter | gm | | | | |
| Total | 0.2909 gm | | | | |

COMMENTS:

Run # 1

# PARTICULATE TEST CALCULATIONS

Plant Hercules, Inc., Stack Boiler # 1, Date 5/20/76

Bar. Press. 30.37 "Hg, Stack Press. 30.38 "Hg, Stack Dia. 55.38 in., Stack Area 21.35 $ft^2$

Ave. Stack Temp. 392 °F, Ave. Meter Temp. 112 °F, Ave. $\sqrt{h}$ .87 $"H_2O$, Nozzle Dia. .1875 in.

$C_p$ 0.83 Meter Vol. 40.867 $ft^3$, Moisture plus Silica Gel 26.5 ml, Sample Time 88 min.

Orsat Analysis: $CO_2$ 4.7 %, $O_2$ 15.1%, CO 0.2 %, $N_2$ 80.0% Ave. Orifice $\Delta H$ 0.82 $"H_2O$

Nozzle Dia. and Area: 1/4 in.---0.000341 $ft^2$, 3/8 in.---0.000767 $ft^2$, 1/2 in.---0.013 $ft^2$

3/16 in.---0.0001916 $ft^2$, 1/8 in.---0.000085 $ft^2$

1) $V_{wv} = (0.0474) \times (\text{Moisture + Silica Gel})ml$ = 1.26 scf

2) $V_{stpd} = (17.71) \times \left(P_o + \frac{\overline{\Delta H}}{13.6}\right) \times (V_m) \times \left(\frac{1}{T_m + 460}\right)$ = 38.50 scf

3) $V_t = (V_{wv}) + (V_{stpd})$ = 39.76 scf

4) $W = \frac{V_{wv}}{V_t}$ = 0.03

5) $FDA = (1.0) - (W)$ = 0.97

6) $M_d = \left[(0.44)x(\_\_\_\%CO_2)\right] + \left[(0.32)x(\_\_\_\%O_2)\right] + \left[(0.28)x(\_\_\_\%N_2 + \_\_\_\%CO)\right]$ = 29.36

7) $M_s = \left[(M_d) \times (FDA)\right] + \left[(18) \times (W)\right]$ = 29.00

8) $G_s = \frac{M_s}{28.99}$ = 1.00

9) Excess Air, $EA = \frac{\left[(\_\_\_\%O_2) - \left(\frac{\_\_\_\%CO}{2}\right)\right]}{\left[(0.266)x(\_\_\_\%N_2)\right] - \left[(\_\_\_\%O_2) - \left(\frac{\_\_\_\%CO}{2}\right)\right]} \times 100$ = --- %

10) $\overline{U} = (174) \times (C_p) \times (\sqrt{\overline{h}}) \times \left(\sqrt{\frac{T_s + 460}{G_s}}\right) \times \left(\sqrt{\frac{29.92}{P_s}}\right)$ = 3640 fpm

11) $Q_s = (\overline{U}) \times (A_s)$ = 77705 cfm

12) $Q_d = (Q_x) \times (FDA)$ = 75374 cfm

13) $Q_{stpd} = (Q_d) \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 47609 cfm

14) $V_i = (\overline{U}) \times (A_n) \times (FDA) \times (\text{Time}) \times \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 37.60 scf

15) Percent Isokinetic $= \frac{(V_{stpd})(100)}{(V_i)}$ = 102 %

PARTICULATE TEST CALCULATIONS - Cont'd.

16) Percent Isokinetic by the EPA = $\dfrac{\left[(0.00267)\times(V_{H_2O})+\dfrac{(Vm)}{(Tm+460)}\times(P_{bar}+\dfrac{\Delta H}{13.6})\right](Ts+460)}{(Vs)\times(Time)\times(Ps)\times(An)}$ = 102 %

17) $E_{stp} = \dfrac{(15.43)\times(Y)}{V_{stpd}}$

18) $E_{12} = \dfrac{(12)\times(E_{stp})}{(CO_2\%)}$

19) $E_{50} = \dfrac{(E_{stp})\times(100 + EA\%)}{150}$

20) $E_m = (E_{stp})\times(Q_{stpd})\times(0.00857)$

| Particulate Lab Analysis (Y) | | Particulate Concentrations, grains/scf ($E_{stp}$) | ($E_{12}$) | ($E_{50}$) | Emission Rate, lbs/hr. ($E_m$) |
|---|---|---|---|---|---|
| Probe | 0.0601 gm | 0.0371 | 0.0948 | | 15.1 |
| Filter | 0.0325 gm | | | | |
| Imp. $H_2O$ | gm | | | | |
| Organics | gm | | | | |
| After Filter | gm | | | | |
| Total | 0.0926 gm | | | | |

COMMENTS:

# PARTICULATE TEST CALCULATIONS

Plant Hercules, Inc., Stack Boiler # 1, Date 5/21/76

Bar. Press. 30.23 "Hg, Stack Press. 30.24 "Hg, Stack Dia 55.38 in., Stack Area 21.35 $ft^2$

Ave. Stack Temp. 382 °F, Ave. Meter Temp. 93 °F, Ave. $\sqrt{h}$ 0.82 "$H_2O$, Nozzle Dia. .1875 in.

$C_p$ 0.83, Meter Vol. 36.884 $ft^3$, Moisture plus Silica Gel 23 ml, Sample Time 88 min.

Orsat Analysis: $CO_2$ 4.7%, $O_2$ 15.1%, CO 0.2%, $N_2$ 80.0% Ave. Orifice $\Delta H$ 0.75 "$H_2O$

Nozzle Dia. and Area: 1/4 in.---0.000341 $ft^2$, 3/8 in.---0.000767 $ft^2$, 1/2 in.---0.013 $ft^2$

3/16 in.---0.0001916 $ft^2$, 1/8 in.---0.000085 $ft^2$

1) $V_{wv} = (0.0474) \times (\text{Moisture + Silica Gel})ml$ = 1.09 scf

2) $V_{stpd} = (17.71) \times \left(P_o + \frac{\overline{\Delta H}}{13.6}\right) \times (V_m) \times \left(\frac{1}{T_m + 460}\right)$ = 35.77 scf

3) $V_t = (V_{wv}) + (V_{stpd})$ = 36.86 scf

4) $W = \frac{V_{wv}}{V_t}$ = 0.03

5) $FDA = (1.0) - (W)$ = 0.97

6) $M_d = \left[(0.44)x(\_\_\%CO_2)\right] + \left[(0.32)x(\_\_\%O_2)\right] + \left[(0.28)x(\_\_\%N_2 + \_\_\%CO)\right]$ = 29.36

7) $M_s = \left[(M_d) \times (FDA)\right] + \left[(18) \times (W)\right]$ = 29.02

8) $G_s = \frac{M_s}{28.99}$ = 1.00

9) Excess Air, $EA = \frac{\left[(\_\_\%O_2) - \frac{(\_\_\%CO)}{2}\right]}{\left[(0.266)x(\_\_\%N_2)\right] - \left[(\_\_\%O_2) - \frac{(\_\_\%CO)}{2}\right]} \times 100$ = --- %

10) $\overline{U} = (174) \times (C_p) \times (\sqrt{\overline{h}}) \times \left(\sqrt{\frac{T_s + 460}{G_s}}\right) \times \left(\sqrt{\frac{29.92}{P_s}}\right)$ = 3418 fpm

11) $Q_s = (\overline{U}) \times (A_s)$ = 72977 cfm

12) $Q_d = (Q_x) \times (FDA)$ = 70788 cfm

13) $Q_{stpd} = (Q_d) \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 45034 cfm

14) $V_i = (\overline{U}) \times (A_n) \times (FDA) \times (\text{Time}) \times \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 35.56 scf

15) Percent Isokinetic $= \frac{(V_{stpd})(100)}{(V_i)}$ = 101 %

PARTICULATE TEST CALCULATIONS - Cont'd.

16) Percent Isokinetic by the EPA = $\dfrac{\left[(0.00267)\times(V_{H_2O})+\dfrac{(Vm)}{(Tm+460)}\times(P_{bar}+\dfrac{\Delta H}{13.6})\right](Ts+460)}{(Vs)\times(Time)\times(Ps)\times(An)}$ = 101 %

17) $E_{stp} = \dfrac{(15.43)\times(Y)}{V_{stpd}}$

18) $E_{12} = \dfrac{(12)\times(E_{stp})}{(CO_2\%)}$

19) $E_{50} = \dfrac{(E_{stp})\times(100+EA\%)}{150}$

20) $E_m = (E_{stp})\times(Q_{stpd})\times(0.00857)$

| Particulate Lab Analysis (Y) | | Particulate Concentrations, grains/scf ($E_{stp}$) | ($E_{12}$) | ($E_{50}$) | Emission Rate, lbs/hr. ($E_m$) |
|---|---|---|---|---|---|
| Probe | 0.0397 gm | 0.0297 | 0.0759 | | 11.5 |
| Filter | 0.0292 gm | | | | |
| Imp. $H_2O$ | gm | | | | |
| Organics | gm | | | | |
| After Filter | gm | | | | |
| Total | 0.0689 gm | | | | |

COMMENTS:

# PARTICULATE TEST CALCULATIONS

Plant Hercules, Inc., Stack Boiler # 1, Date 5/21/76

Bar. Press. 30.23 "Hg, Stack Press. 30.24 "Hg, Stack Dia 55.38 in., Stack Area 21.35 $ft^2$

Ave. Stack Temp. 383 °F, Ave. Meter Temp 107 °F, Ave. $\sqrt{h}$ .82 $"H_2O$, Nozzle Dia. .1875 in.

$C_p$ 0.83, Meter Vol. 35.870 $ft^3$, Moisture plus Silica Gel 21 ml, Sample Time 86 min.

Orsat Analysis: $CO_2$ 4.7 %, $O_2$ 15.1%, CO 0.2%, $N_2$ 80.0% Ave. Orifice $\Delta H$ .74 $"H_2O$

Nozzle Dia. and Area: 1/4 in.---0.000341 $ft^2$, 3/8 in.---0.000767 $ft^2$, 1/2 in.---0.013 $ft^2$

3/16 in.---0.0001916 $ft^2$, 1/8 in.---0.000085 $ft^2$

1) $V_{wv} = (0.0474) \times (\text{Moisture + Silica Gel})ml$ = 1.00 scf

2) $V_{stpd} = (17.71) \times (P_o + \frac{\overline{\Delta H}}{13.6}) \times (V_m) \times (\frac{1}{T_m + 460})$ = 33.93 scf

3) $V_t = (V_{wv}) + (V_{stpd})$ = 34.93 scf

4) $W = \frac{V_{wv}}{V_t}$ = 0.03

5) $FDA = (1.0) - (W)$ = 0.97

6) $M_d = [(0.44) \times (\_\_\_ \%CO_2)] + [(0.32) \times (\_\_\_ \%O_2)] + [(0.28) \times (\_\_\_ \%N_2 + \_\_\_ \%CO)]$ = 29.36

7) $M_s = [(M_d) \times (FDA)] + [(18) \times (W)]$ = 29.03

8) $G_s = \frac{M_s}{28.99}$ = 1.00

9) Excess Air, $EA = \frac{\left[(\_\_\_ \%O_2) - (\frac{\_\_\_ \%CO}{2})\right]}{\left[(0.266) \times (\_\_\_ \%N_2)\right] - \left[(\_\_\_ \%O_2) - (\frac{\_\_\_ \%CO}{2})\right]} \times 100$ = --- %

10) $\overline{U} = (174) \times (C_p) \times (\sqrt{\overline{h}}) \times \left(\sqrt{\frac{T_s + 460}{G_s}}\right) \times \left(\sqrt{\frac{29.92}{P_s}}\right)$ = 3421 fpm

11) $Q_s = (\overline{U}) \times (A_s)$ = 73032 cfm

12) $Q_d = (Q_x) \times (FDA)$ = 70841 cfm

13) $Q_{stpd} = (Q_d) \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 45000 cfm

14) $V_i = (\overline{U}) \times (A_n) \times (FDA) \times (\text{Time}) \times \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 34.73 scf

15) Percent Isokinetic $= \frac{(V_{stpd})(100)}{(V_i)}$ = 98 %

PARTICULATE TEST CALCULATIONS - Cont'd.

16) Percent Isokinetic by the EPA = $\dfrac{\left[(0.00267)\times(V_{H_2O})+\dfrac{(Vm)}{(Tm+460)}\times(P_{bar}+\dfrac{\Delta H}{13.6})\right](Ts+460)}{(Vs)\times(Time)\times(Ps)\times(An)}$ = 98 %

17) $E_{stp} = \dfrac{(15.43)\times(Y)}{V_{stpd}}$

18) $E_{12} = \dfrac{(12)\times(E_{stp})}{(CO_2\%)}$

19) $E_{50} = \dfrac{(E_{stp})\times(100+EA\%)}{150}$

20) $E_m = (E_{stp})\times(Q_{stpd})\times(0.00857)$

| Particulate Lab Analysis (Y) | | Particulate Concentrations, grains/scf ($E_{stp}$) | ($E_{12}$) | ($E_{50}$) | Emission Rate, lbs/hr. ($E_m$) |
|---|---|---|---|---|---|
| Probe | 0.0813 gm | 0.0547 | .1396 | | 21.1 |
| Filter | 0.0389 gm | | | | |
| Imp. $H_2O$ | gm | | | | |
| Organics | gm | | | | |
| After Filter | gm | | | | |
| Total | 0.1202 gm | | | | |

COMMENTS:

Run # 1

# PARTICULATE TEST CALCULATIONS

Plant Hercules, Inc, Stack Boiler # 2, Date 5/20/76

Bar. Press. 30.37 "Hg, Stack Press. 30.38 "Hg, Stack Dia 55.38 in., Stack Area 21.35 $ft^2$

Ave. Stack Temp. 394 °F, Ave. Meter Temp. 113 °F, Ave. $\sqrt{h}$ .75 "$H_2O$, Nozzle Dia. .1875 in.

$C_p$ 0.83, Meter Vol. 40.725 $ft^3$, Moisture plus Silica Gel 17.5 ml, Sample Time 96 min.

Orsat Analysis: $CO_2$ 4.7 %, $O_2$ 15.1 %, CO 0.2 %, $N_2$ 80.0 % Ave. Orifice $\Delta H$ 0.62 "$H_2O$

Nozzle Dia. and Area: 1/4 in.---0.000341 $ft^2$, 3/8 in.---0.000767 $ft^2$, 1/2 in.---0.013 $ft^2$

3/16 in.---0.0001916 $ft^2$, 1/8 in.---0.000085 $ft^2$

1) $V_{wv}$ = (0.0474) x (Moisture + Silica Gel)ml = 0.83 scf

2) $V_{stpd} = (17.71) \times (P_o + \frac{\overline{\Delta H}}{13.6}) \times (V_m) \times (\frac{1}{T_m + 460})$ = 38.28 scf

3) $V_t = (V_{wv}) + (V_{stpd})$ = 39.11 scf

4) $W = \frac{V_{wv}}{V_t}$ = 0.02

5) FDA = (1.0) - (W) = 0.98

6) $M_d = [(0.44) \times (\_\_ \%CO_2)] + [(0.32) \times (\_\_ \%O_2)] + [(0.28) \times (\_\_ \%N_2 + \_\_ \%CO)]$ = 29.36

7) $M_s = [(M_d) \times (FDA)] + [(18) \times (W)]$ = 29.12

8) $G_s = \frac{M_s}{28.99}$ = 1.00

9) Excess Air, $EA = \frac{\left[ (\_\_ \%O_2) - (\frac{\_\_}{2} \%CO) \right]}{\left[ (0.266) \times (\_\_ \%N_2) \right] - \left[ (\_\_ \%O_2) - (\frac{\_\_}{2} \%CO) \right]} \times 100$ = --- %

10) $\bar{U} = (174) \times (C_p) \times (\sqrt{\bar{h}}) \times \sqrt{\frac{T_s + 460}{G_s}} \times \sqrt{\frac{29.92}{P_s}}$ = 3141 fpm

11) $Q_s = (\bar{U}) \times (A_s)$ = 67066 cfm

12) $Q_d = (Q_x) \times (FDA)$ = 65725 cfm

13) $Q_{stpd} = (Q_d) (\frac{70 + 460}{T_s + 460}) \times (\frac{P_s}{29.92})$ = 41416 cfm

14) $V_i = (\bar{U}) \times (A_n) \times (FDA) \times (Time) \times (\frac{70 + 460}{T_s + 460}) \times (\frac{P_s}{29.92})$ = 35.68 scf

15) Percent Isokinetic $= \frac{(V_{stpd})(100)}{(V_i)}$ = 107 %

PARTICULATE TEST CALCULATIONS - Cont'd.

16) Percent Isokinetic by the EPA = $\dfrac{\left[(0.00267)\times(V_{H_2O})+\dfrac{(Vm)}{(Tm+460)}\times(P_{bar}+\dfrac{\Delta H}{13.6})\right](Ts+460)}{(Vs)\times(Time)\times(Ps)\times(An)}$ = 107 %

17) $E_{stp} = \dfrac{(15.43)\times(Y)}{V_{stpd}}$

18) $E_{12} = \dfrac{(12)\times(E_{stp})}{(CO_2\%)}$

19) $E_{50} = \dfrac{(E_{stp})\times(100+EA\%)}{150}$

20) $E_m = (E_{stp})\times(Q_{stpd})\times(0.00857)$

| Particulate Lab Analysis (Y) | | Particulate Concentrations, grains/scf $(E_{stp})$ | $(E_{12})$ | $(E_{50})$ | Emission Rate, lbs/hr. $(E_m)$ |
|---|---|---|---|---|---|
| Probe | 0.0742 gm | 0.0854 | 0.2182 | | 30.3 |
| Filter | 0.1378 gm | | | | |
| Imp. $H_2O$ | gm | | | | |
| Organics | gm | | | | |
| After Filter | gm | | | | |
| Total | 0.2120 gm | | | | |

COMMENTS:

Run # 2

# PARTICULATE TEST CALCULATIONS

Plant Hercules, Inc., Stack Boiler # 2, Date 5/21/76

Bar. Press. 30.23 "Hg, Stack Press. 30.24 "Hg, Stack Dia 55.38 in., Stack Area 21.35 $ft^2$

Ave. Stack Temp. 383 °F, Ave. Meter Temp. 94 °F, Ave. $\sqrt{h}$ .82 "$H_2O$, Nozzle Dia. .1875 in.

$C_p$ 0.83, Meter Vol. 40.820 $ft^3$, Moisture plus Silica Gel 18 ml, Sample Time 92 min.

Orsat Analysis: $CO_2$ 4.7%, $O_2$ 15.1%, CO 0.2%, $N_2$ 80.0% Ave. Orifice $\Delta H$ .74 "$H_2O$

Nozzle Dia. and Area: 1/4 in.---0.000341 $ft^2$, 3/8 in.---0.000767 $ft^2$, 1/2 in.---0.013 $ft^2$

3/16 in.---0.0001916 $ft^2$, 1/8 in.---0.000085 $ft^2$

1) $V_{wv} = (0.0474) \times (\text{Moisture + Silica Gel})ml$ = 0.85 scf

2) $V_{stpd} = (17.71) \times (P_o + \frac{\overline{\Delta H}}{13.6}) \times (V_m) \times (\frac{1}{T_m + 460})$ = 39.52 scf

3) $V_t = (V_{wv}) + (V_{stpd})$ = 40.37 scf

4) $W = \frac{V_{wv}}{V_t}$ = 0.02

5) $FDA = (1.0) - (W)$ = 0.98

6) $M_d = [(0.44) \times (\_\_\_\%CO_2)] + [(0.32) \times (\_\_\_\%O_2)] + [(0.28) \times (\_\_\_\%N_2 + \_\_\_\%CO)]$ = 29.36

7) $M_s = [(M_d) \times (FDA)] + [(18) \times (W)]$ = 29.12

8) $G_s = \frac{M_s}{28.99}$ = 1.00

9) Excess Air, $EA = \frac{\left[(\_\_\_\%O_2) - \frac{(\_\_\_\%CO)}{2}\right]}{\left[(0.266) \times (\_\_\_\%N_2)\right] - \left[(\_\_\_\%O_2) - \frac{(\_\_\_\%CO)}{2}\right]} \times 100$ = --- %

10) $\overline{U} = (174) \times (C_p) \times (\sqrt{\overline{h}}) \times \left(\sqrt{\frac{T_s + 460}{G_s}}\right) \times \left(\sqrt{\frac{29.92}{P_s}}\right)$ = 3420 fpm

11) $Q_s = (\overline{U}) \times (A_s)$ = 73020 cfm

12) $Q_d = (Q_x) \times (FDA)$ = 71560 cfm

13) $Q_{stpd} = (Q_d) \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 45471 cfm

14) $V_i = (\overline{U}) \times (A_n) \times (FDA) \times (Time) \times \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 37.54 scf

15) Percent Isokinetic $= \frac{(V_{stpd})(100)}{(V_i)}$ = 105 %

3/16 " nozzle Boiler # 2
Run # 2

PARTICULATE TEST CALCULATIONS - Cont'd.

16) Percent Isokinetic by the EPA = $\dfrac{\left[(0.00267)\times(V_{H_2O})+\dfrac{(Vm)}{(Tm+460)}\times(P_{bar}+\dfrac{\Delta H}{13.6})\right](Ts+460)}{(Vs)\times(Time)\times(Ps)\times(An)}$ = 105 %

17) $E_{stp} = \dfrac{(15.43)\times(Y)}{V_{stpd}}$

18) $E_{12} = \dfrac{(12)\times(E_{stp})}{(CO_2\%)}$

19) $E_{50} = \dfrac{(E_{stp})\times(100+EA\%)}{150}$

20) $E_m = (E_{stp})\times(Q_{stpd})\times(0.00857)$

| Particulate Lab Analysis (Y) | | Particulate Concentrations, grains/scf ($E_{stp}$) | ($E_{12}$) | ($E_{50}$) | Emission Rate, lbs/hr. ($E_m$) |
|---|---|---|---|---|---|
| Probe | 0.1558 gm | 0.0928 | .2368 | | 36.1 |
| Filter | 0.0818 gm | | | | |
| Imp. $H_2O$ | gm | | | | |
| Organics | gm | | | | |
| After Filter | gm | | | | |
| Total | 0.2376 gm | | | | |

COMMENTS:

Run # 3

# PARTICULATE TEST CALCULATIONS

Plant Hercules, Inc., Stack Boiler # 2, Date 5/21/76

Bar. Press. 30.23 "Hg, Stack Press. 30.24 "Hg, Stack Dia 55.38 in., Stack Area 21.35 $ft^2$

Ave. Stack Temp. 389 °F, Ave. Meter Temp. 105 °F, Ave. $\sqrt{h}$ .79 $"H_2O$, Nozzle Dia. .1875 in.

$C_p$ 0.83, Meter Vol. 39.102 $ft^3$, Moisture plus Silica Gel 15 ml, Sample Time 92 min.

Orsat Analysis: $CO_2$ 4.7 %, $O_2$ 15.1 % CO 0.2 %, $N_2$ 80.0 % Ave. Orifice $\Delta H$ .67 $"H_2O$

Nozzle Dia. and Area: 1/4 in.---0.000341 $ft^2$, 3/8 in.---0.000767 $ft^2$, 1/2 in.---0.013 $ft^2$

3/16 in.---0.0001916 $ft^2$, 1/8 in.---0.000085 $ft^2$

1) $V_{wv}$ = (0.0474) x (Moisture + Silica Gel)ml = 0.71 scf

2) $V_{stpd} = (17.71) \times (P_o + \frac{\overline{\Delta H}}{13.6}) \times (V_m) \times (\frac{1}{T_m + 460})$ = 37.11 scf

3) $V_t = (V_{wv}) + (V_{stpd})$ = 37.82 scf

4) $W = \frac{V_{wv}}{V_t}$ = 0.02

5) FDA = (1.0) - (W) = 0.98

6) $M_d = [(0.44) \times (\_\_\_ \%CO_2)] + [(0.32) \times (\_\_\_ \%O_2)] + [(0.28) \times (\_\_\_ \%N_2 + \_\_\_ \%CO)]$ = 29.36

7) $M_s = [(M_d) \times (FDA)] + [(18) \times (W)]$ = 29.14

8) $G_s = \frac{M_s}{28.99}$ = 1.01

9) Excess Air, $EA = \frac{\left[ (\_\_\_ \%O_2) - \frac{(\_\_\_ \%CO)}{2} \right]}{\left[ (0.266) \times (\_\_\_ \%N_2) \right] - \left[ (\_\_\_ \%O_2) - \frac{(\_\_\_ \%CO)}{2} \right]} \times 100$ = --- %

10) $\overline{U} = (174) \times (C_p) \times (\sqrt{\overline{h}}) \times \left(\sqrt{\frac{T_s + 460}{G_s}}\right) \times \left(\sqrt{\frac{29.92}{P_s}}\right)$ = 3290 fpm

11) $Q_s = (\overline{U}) \times (A_s)$ = 70248 cfm

12) $Q_d = (Q_x) \times (FDA)$ = 68843 cfm

13) $Q_{stpd} = (Q_d) \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 43436 cfm

14) $V_i = (\overline{U}) \times (A_n) \times (FDA) \times (Time) \times \left(\frac{70 + 460}{T_s + 460}\right) \times \left(\frac{P_s}{29.92}\right)$ = 35.86 scf

15) Percent Isokinetic $= \frac{(V_{stpd})(100)}{(V_i)}$ = 103 %

3/16 " nozzle Boiler # 2
Run # 3

PARTICULATE TEST CALCULATIONS - Cont'd.

16) Percent Isokinetic by the EPA = $\dfrac{\left[(0.00267)\times(V_{H_2O})+\dfrac{(Vm)}{(Tm+460)}\times(P_{bar}+\dfrac{\Delta H}{13.6})\right](Ts+460)}{(Vs)\times(Time)\times(Ps)\times(An)}$ = 103 %

17) $E_{stp} = \dfrac{(15.43)\times(Y)}{V_{stpd}}$

18) $E_{12} = \dfrac{(12)\times(E_{stp})}{(CO_2\%)}$

19) $E_{50} = \dfrac{(E_{stp})\times(100+EA\%)}{150}$

20) $E_m = (E_{stp})\times(Q_{stpd})\times(0.00857)$

| Particulate Lab Analysis (Y) | | Particulate Concentrations, grains/scf ($E_{stp}$) | ($E_{12}$) | ($E_{50}$) | Emission Rate, lbs/hr. ($E_m$) |
|---|---|---|---|---|---|
| Probe | 0.1236 gm | 0.1612 | 0.4115 | | 60.0 |
| Filter | 0.2610 gm | | | | |
| Imp. $H_2O$ | gm | | | | |
| Organics | gm | | | | |
| After Filter | gm | | | | |
| Total | 0.3876 gm | | | | |

COMMENTS:

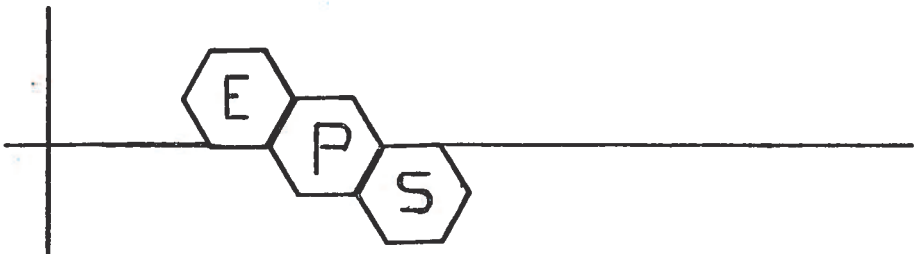
## REFERENCES

Environmental Protection Agency, "Standard of Performance for New Stationary Sources," Federal Register, Volume 36, No. 247, Part II (1971).

Brenchly, D. L., Turley, C. D., and Yarmac, R. F., Industrial Source Sampling: Ann Arbor Science, Ann Arbor, Michigan (1973).

## ACKNOWLEDGMENTS

A sincere thank you is extended to Mr. Charles Jordan and his staff for their assistance during the sampling period.




E.P.S. SOURCE SAMPLING NOMENCLATURE SHEET

PB - Barometric pressure, inches Hg
PS - Stack pressure, inches Hg
As - Stack area, sq. ft.
AS'- Effective area of positive stack gas flow, sq. ft.
NPTS - Number of traverse points where the pitot velocity head was greater than zero
TS - Stack temperature, $^{o}R$
TM - Meter temperature, $^{o}R$
$\sqrt{\overline{H}}$ - Average square root of velocity head, $\sqrt{\text{inches } H_2O}$
$\overline{\Delta H}$ - Average meter orifice pressure differential, inches $H_2O$
AN - Sampling nozzle area, square feet
CP - S-type pitot tube correction factor
VM - Recorded meter volume sample, cubic feet (meter conditions)
VC - Condensate and silica gel increase in impringers, milliliters
Po - Pressure at the dry test meter orifice, $\left[PB + \frac{\Delta H}{13.6}\right]$ inches Hg
STP - Standard conditions, dry, $70^{o}F$, 29.92 inches Hg

- - - - - - - - - - - - - - - - - - - - - - - -

VWV - Conversion of condensate in milliliters to water vapor in cubic feet (STP)
VSTPD - Volume sampled, cubic feet (STP)
VT - Total water vapor volume and dry gas volume sampled, cubic feet (STP)
W - Moisture fraction of stack gas
FDA - Dry gas fraction
MD - Molecular weight of stack gas, lbs/lb-mole (dry conditions)
MS - Molecular weight of stack gas, lbs/lb-mole (stack conditions)
GS - Specific gravity of stack gas, referred to air
EA - Excess air, %
$\sqrt{\text{HxTS}}$ - Average square root of velocity head times stack temperature
VS - Stack gas velocity, feet per minute
QS - Stack gas flow rate, cubic feet per minute (stack conditions)
QD - Stack gas flow rate, cubic feet per minute (dry conditions)
QSTPD - Stack gas flow rate, cubic feet per minute (STP)
PISO - Percent isokinetic volume sampled (method described in Federal Register)

# APPENDIX

## RAW DATA AND CALIBRATION DATA

# CALIBRATION SUMMARY SHEET

## Dry Gas Meter and Orifice

1. $\Delta H@$ = 1.95 for Meter Box S-1461.
2. = 1.01 for Meter Box S-1461.
3. $\Delta H@$ = 1.9 for Meter Box S-1936.
4. = 1.02 for Meter Box S-1936.

## Nozzle (inches)

Micrometer Reading

| 1 | 2 | 3 | 4 | AVG |
|---|---|---|---|---|
| .1873 | .1876 | .1875 | .1876 | .1875 |
| .248 | .249 | .251 | .249 | .249 |
| .249 | .248 | .250 | .252 | .250 |
| .373 | .376 | .375 | .376 | .375 |
| .377 | .375 | .374 | .374 | .375 |
| .502 | .495 | .503 | .498 | .500 |

## Pitot Tube

$$C_{p(s)} = C_{p(std)} \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

$C_{p(s)}$ = 0.83 for tube 002.

## Miscellaneous Equipment:

| Description | Calibration Date |
|---|---|
| Barometer | 5/19/76 |
| Thermometers | 5/19/76 |
| Thermacouple/pyrometer | 5/19/76 |
| Magnehelic Gages | 5/19/76 |

## DISCUSSION OF SAMPLING

Because of the great expense of the platform construction and the possibility of structural damage to the existing boiler stack, sampling sites in the breechings were selected by the Hercules engineering staff. The sampling locations were permitted by the U.S. Environmental Protection Agency (EPA) and the Mississippi Air and Water Pollution Control Commission (MAWPCC) even though they did not conform to the procedures set forth in the Federal Register. Due to this nonconformance and the fact that the two boilers are common to a single stack the following stipulations were set forth and adhered to in sampling:

1. Simultaneous forty-eight point preliminary velocity traverses were performed.

2. Simultaneous testing was conducted using the ideal nozzle size and then the next larger size.

3. A total of six (6) simultaneous tests were run using alternating nozzle sizes.

# DRY MOLECULAR WEIGHT DETERMINATION

PLANT Hercules, Inc.

DATE May 21, 1976

SAMPLING (24-hr. CLOCK)

SAMPLING LOCATION Hattiesburg, Mississippi

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Continuous

ANALYTICAL METHOD Orsat

AMBIENT TEMPERATURE

OPERATOR Blunt

COMMENTS

| RUN / GAS | 1 | | 2 | | 3 | | AVERAGE NET VOLUME | MULTIPLIER | MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) $M_d$, lb/lb-mole |
|---|---|---|---|---|---|---|---|---|---|
| | ACTUAL READING | NET | ACTUAL READING | NET | ACTUAL READING | NET | | | |
| $CO_2$ | 4.6 | 4.6 | 4.5 | 4.5 | 4.9 | 4.9 | 4.7 | 44/100 | 2.068 |
| $O_2$ (NET IS ACTUAL $O_2$ READING MINUS ACTUAL $CO_2$ READING) | 19.7 | 15.1 | 19.6 | 15.1 | 20.0 | 15.1 | 15.1 | 32/100 | 4.832 |
| CO (NET IS ACTUAL CO READING MINUS ACTUAL $O_2$ READING) | 19.9 | 0.2 | 19.8 | 0.2 | 20.2 | 0.2 | 0.2 | 28/100 | 0.056 |
| $N_2$ (NET IS 100 MINUS ACTUAL CO READING) | --- | 80.1 | --- | 80.2 | --- | 79.8 | 80.0 | 28/100 | 22.40 |
| | | | | | | | | TOTAL | 29.356 |

HERCULES INCORPORATED

HATTIESBURG, MISSISSIPPI 39401

May 28, 1976

Environmental Protection Systems
P. O. Box 20382
Jackson, Mississippi 39209

Attn: Brent Blunt

With reference to your performance evaluation tests on May 20 and 21, 1976, would you please include the following wood boiler data in your report.

| May 20, 1976 | Boiler #1 (East) | Boiler #2 (West) |
|---|---|---|
| Steam Rate | 48,625 lbs/hr. | 26,375 lbs/hr. |
| Cleaning Fires | 7:00 AM to 9:00 AM<br>3:30 PM to 5:00 PM | 9:00 AM to 11:00 AM<br>5:00 PM to 6:30 PM |

| May 21, 1976 | | |
|---|---|---|
| Steam Rate | 37,675 lbs/hr. | 38,175 lbs/hr. |
| Cleaning Fires | 10:30 AM to 12:00 Noon | 12:00 Noon to 2:00 PM |

Very truly yours,

Charles Jordan

Charles Jordan
Senior Chemical Engineer

CJ:p

cc: State of Mississippi
Air & Water Pollution Control Commission
P. O. Box 827
Jackson, Mississippi 39205

Attn: Cal Thames

# PRELIMINARY VELOCITY TRAVERSE

PLANT Hercules, Inc.

DATE 5-20-76

LOCATION Hattiesburg, Ms.

STACK I.D.

BAROMETRIC PRESSURE, in. Hg 30.37

STACK GAUGE PRESSURE, in. $H_2O$ 30.38

OPERATORS Blunt / Wells

Boiler #1

SCHEMATIC OF TRAVERSE POINT LAYOUT

| TRAVERSE POINT NUMBER | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | STACK TEMPERATURE ($T_s$), °F |
|---|---|---|
| # 1 | 1.0 | |
| 2 | 1.0 | |
| 3 | 0.6 | |
| 4 | 0.9 | |
| 5 | 1.0 | |
| 6 | 1.1 | |
| 7 | 1.1 | |
| 8 | 1.2 | |
| 9 | 1.2 | |
| 10 | 1.2 | |
| 11 | 1.1 | |
| 12 | 1.1 | |
| #2 1 | 1.1 | |
| 2 | 1.1 | |
| 3 | 1.0 | |
| 4 | 1.1 | |
| 5 | 1.2 | |
| 6 | 0.2 | |
| 7 | 1.5 | |
| 8 | 1.5 | |
| 9 | 1.6 | |
| 10 | 1.5 | |
| 11 | 1.0 | |
| 12 | 1.0 | |
| AVERAGE | | |

| TRAVERSE POINT NUMBER | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | STACK TEMPERATURE ($T_s$), °F |
|---|---|---|
| #3 1 | 1.1 | |
| 2 | 1.1 | |
| 3 | 1.0 | |
| 4 | 0.6 | |
| 5 | 0.6 | |
| 6 | 0.8 | |
| 7 | 0.4 | |
| 8 | 0.25 | |
| 9 | 1.1 | |
| 10 | 1.0 | |
| 11 | 0.9 | |
| 12 | 0.8 | |
| #4 1 | 0.1 | |
| 2 | 0.12 | |
| 3 | — | |
| 4 | 0.1 | |
| 5 | 0.1 | |
| 6 | 0.1 | |
| 7 | 0.3 | |
| 8 | 0.5 | |
| 9 | 0.13 | |
| 10 | 0.15 | |
| 11 | 0.15 | |
| 12 | 0.15 | |
| AVERAGE | | |

# PRELIMINARY VELOCITY TRAVERSE

PLANT Hercules, Inc.

DATE 5-20-76

LOCATION Hattiesburg, Ms.

STACK I.D.

BAROMETRIC PRESSURE, in. Hg 30.37

STACK GAUGE PRESSURE, in. $H_2O$ 30.38

OPERATORS Blunt / Kreus

Boiler #2

SCHEMATIC OF TRAVERSE POINT LAYOUT

| TRAVERSE POINT NUMBER | | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | STACK TEMPERATURE ($T_s$), °F |
|---|---|---|---|
| #1 | 1 | 0.8 | |
| | 2 | 0.8 | |
| | 3 | 0.15 | |
| | 4 | 1.0 | |
| | 5 | 1.0 | |
| | 6 | 1.2 | |
| | 7 | 1.2 | |
| | 8 | 1.2 | |
| | 9 | 1.2 | |
| | 10 | 1.2 | |
| | 11 | 1.0 | |
| | 12 | 1.0 | |
| #2 | 1 | 0.6 | |
| | 2 | 0.9 | |
| | 3 | 0.9 | |
| | 4 | 0.95 | |
| | 5 | 1.0 | |
| | 6 | 1.2 | |
| | 7 | 1.1 | |
| | 8 | 1.0 | |
| | 9 | 1.0 | |
| | 10 | — | |
| | 11 | 1.5 | |
| | 12 | 1.5 | |
| AVERAGE | | | |

| TRAVERSE POINT NUMBER | | VELOCITY HEAD ($\Delta p_s$), in. $H_2O$ | STACK TEMPERATURE ($T_s$), °F |
|---|---|---|---|
| #3 | 1 | 0.5 | |
| | 2 | 0.9 | |
| | 3 | 0.9 | |
| | 4 | 0.9 | |
| | 5 | 0.8 | |
| | 6 | 1.0 | |
| | 7 | 0.3 | |
| | 8 | 0.2 | |
| | 9 | 0.2 | |
| | 10 | 0.2 | |
| | 11 | 0.8 | |
| | 12 | 1.0 | |
| #4 | 1 | 0.1 | |
| | 2 | 0.1 | |
| | 3 | 0.15 | |
| | 4 | 0.15 | |
| | 5 | 0.1 | |
| | 6 | 0.1 | |
| | 7 | 0.1 | |
| | 8 | — | |
| | 9 | 0.1 | |
| | 10 | 0.1 | |
| | 11 | 0.1 | |
| | 12 | 0.1 | |
| AVERAGE | | | |

[redacted] IRO[redacted]TAL [redacted]DTE[redacted]N S[redacted]MS [redacted]

Jackson, Mississippi

boiler #1

## SOURCE SAMPLING FIELD DATA SHEET

Plant Hercules, Inc.

Sampling Location Hattiesburg, Ms.

Date 5-20-76 Run No. 1a

Time Start 9:30 Time End 11:30

Sampling Time/Point 2 min.

DB ____ °F, WB ____ °F, VP @ DP ____ "HG

Bar. Press. 30.37 "Hg, Stack Press. 30.38 "Hg

Moisture ____ %, FDA ____, Gas Den. Fac. ____

Weather ____

Temp. ____ °F, W/D ____, W/S ____

Sample Box No. 1 Meter Box No. 1461

Meter ΔH@ 1.95 Pitot Corr. Factor 0.83

Nozzle Dia. 3/8 in., Probe Len. 6 ft.

Probe Heater Set. ____ Nomograph Cf 1.16

Stack Dimensions ____ in

Stack Area ____ $ft^2$

Stack Height ____ ft

Sketch of Stack

Mat'l Processing Rate ____

Final Gas Meter Reading 1010.800 → 43.757 $ft^3$

Initial Gas Meter Reading 967.043 $ft^3$

Condensate Increase in Impingers ____ ml

Moisture in Silica Gel ____ gm

Silica Gel Container No. A Filter No. 0105

Orsat: $CO_2$ ____

$C_2$ ____

CO ____

$N_2$ ____

Excess Air ____

Test Conducted by: Blunt / Kreuz

Remarks: Leak ck ok 8:30

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. (°F) | Gas Sample Temp. @ Dry Gas Meter (°F) | | Sample Box Temp. (°F) | Last Impinger Temp. (°F) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| #4 | | | | | | | | | | | | |
| 1 | | | 967.0 | .1 | .1 | | 380 | 70 | 70 | 250 | 60 | 1 |
| 2 | | | | — | | | | ~~75~~ | ~~72~~ | | | |
| 3 | | | | — | | | | | | | | |
| | | | | — | | | | | | | | |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 5 | | | 967.5 | .10 | .10 | | 380 | 74 | 72 | 250 | 60 | 1 |
| 6 | | | 967.8 | .30 | .29 | | 380 | 76 | 72 | | | 1 |
| 7 | | | 968.6 | .55 | .54 | | 390 | 77 | 74 | | | 1 |
| 8 | | | 969.3 | .35 | .35 | | 390 | 78 | 75 | | | 1 |
| #9 | | | 970.0 | 1.2 | 1.16 | | 400 | 84 | 78 | | | 1 |
| 10 | | | 970.9 | 1.2 | 1.16 | | 400 | 84 | 78 | | | 1 |
| 11 | | | 972.1 | .95 | .92 | | 380 | 87 | 79 | | | 2 |
| 12 | | | 973.1 | .82 | .79 | | 385 | 89 | 80 | | | 2 |
| #3 | | | 974.0 | .82 | .79 | | 385 | 90 | 80 | | | 2 |
| 2 | | | 974.9 | 1.2 | 1.16 | | 385 | 93 | 82 | | | 2 |
| 3 | | | 976.0 | 1.2 | 1.16 | | 385 | 95 | 83 | | | 2 |
| 4 | | | 977.1 | — | | | | | | | | |
| 5 | | | 977.1 | 1.2 | 1.16 | | 385 | 95 | 84 | | | 2 |
| 6 | | | 978.2 | 1.0 | 0.96 | | 390 | 96 | 84 | | | 2 |
| 7 | | | 979.3 | 1.0 | 0.96 | | 390 | 96 | 86 | | | 2 |
| 8 | | | 980.3 | 0.95 | .92 | | 395 | 96 | 88 | | | 2 |
| 9 | | | 981.3 | 1.0 | .96 | | 390 | 97 | 89 | | | 2 |
| 10 | | | 982.3 | 1.0 | .96 | | 390 | 99 | 90 | | | 2 |
| 11 | | | 983.3 | 1.1 | 1.05 | | 385 | 100 | 91 | | | 2 |
| 12 | | | 984.4 | 1.2 | 1.16 | | 385 | 102 | 92 | | | 2 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| #2 1 | | | 985.6 | 1.2 | 1.16 | | 390 | 104 | 92 | 250 | 60 | 1 |
| 2 | | | 986.8 | 1.1 | 1.05 | | 390 | 106 | 94 | | | 1 |
| 3 | | | 987.8 | 1.1 | 1.05 | | 390 | 108 | 95 | | | 1 |
| 4 | | | 988.8 | 1.1 | 1.05 | | 390 | 109 | 95 | | | 1 |
| 5 | | | 990.0 | 0.83 | 0.81 | | 390 | 110 | 97 | | | 1 |
| 6 | | | 990.8 | ~~1.0~~ 0.1 | 0.1 | | 385 | 110 | 98 | | | 1 |
| 7 | | | 991.4 | 1.5 | 1.42 | | 385 | 109 | 98 | | | 1 |
| 8 | | | 992.4 | 1.5 | 1.42 | | 385 | 110 | 98 | | | 1 |
| 9 | | | 993.5 | 1.8 | 1.70 | | 380 | 113 | 100 | | | 1 |
| 10 | | | 994.9 | 1.5 | 1.42 | | 380 | 115 | 101 | | | 2 |
| 11 | | | 996.2 | 1.5 | 1.42 | | 385 | 116 | 102 | | | 2 |
| 12 | | | 997.6 | 1.5 | 1.42 | | 380 | 118 | 103 | | | 2 |
| #1 1 | | | 998.7 | .95 | .92 | | 380 | 98 | 98 | | | 1 |
| 2 | | | 999.7 | .83 | 0.81 | | 380 | 98 | 98 | | | 2 |
| 3 | | | 1000.7 | .55 | 0.54 | | 400 | 98 | 98 | | | 2 |
| 4 | | | 001.5 | .55 | 0.54 | | 410 | 100 | 98 | | | 2 |
| 5 | | | 002.3 | ~~.55~~ .55 | 0.54 | | 390 | 102 | 98 | | | 2 |
| 6 | | | 003.1 | 1.1 ~~1.0~~ | 1.05 | | 390 | 104 | 98 | | | 2 |
| 7 | | | 004.1 | 0.95 | 0.92 | | 385 | 106 | 98 | | | 2 |
| 8 | | | 005.1 | 1.5 | 1.42 | | 390 | 108 | 99 | | | 3 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 9 | | | 006.3 | 1.5 | 1.42 | | 380 | 110 | 99 | 250 | 60 | 5 |
| 10 | | | 007.6 | 1.1 | 1.05 | | 385 | 112 | 99 | | | 3 |
| 11 | | | 008.7 | 1.0 | 0.96 | | 380 | 115 | 99 | | | 3 |
| 12 | | | 009.7 | 1.0 | 0.96 | | 380 | 115 | 100 | | | |

[redacted]IRO[redacted]TAL [redacted]OTEC[redacted]N S[redacted]MS
Jackson, Mississippi

boiler #1

## SOURCE SAMPLING FIELD DATA SHEET

Plant Hercules Inc.
Sampling Location Hatties burg, Ms.
Date 5-20-76 Run No. 2a
Time Start 2:55 Time End 4:30
Sampling Time/Point 2 min
DB ____ °F, WB ____ °F, VP @ DP ____ "HG
Bar. Press. 30.37 "Hg, Stack Press. 30.38 "Hg
Moisture ____ %, FDA ____, Gas Den. Fac. ____
Weather clear-warm
Temp. ____ °F, W/D ____, W/S ____
Sample Box No. 1 Meter Box No. 1461
Meter ΔH@ 1.95 Pitot Corr. Factor 0.83
Nozzle Dia. 3/8 in., Probe Len. 6 ft.
Probe Heater Set. ____ Nomograph Cf 1.16
Stack Dimensions ____ in
Stack Area ____ $ft^2$
Stack Height ____ ft

Sketch of Stack

Mat'l Processing Rate ____
Final Gas Meter Reading 93.677 & 41.516 $ft^3$
Initial Gas Meter Reading 52.161 $ft^3$
Condensate Increase in Impingers ____ ml
Moisture in Silica Gel ____ gm
Silica Gel Container No. E Filter No. 008

Orsat:

| | | | | |
|---|---|---|---|---|
| $CO_2$ | | | | |
| $O_2$ | | | | |
| CO | | | | |
| $N_2$ | | | | |
| Excess Air | | | | |

Test Conducted by: Blunt / Kreuz

Remarks: Leak ck ok 2:44

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. (°F) | Gas Sample Temp. @ Dry Gas Meter (°F) | | Sample Box Temp. (°F) | Last Impinger Temp. (°F) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| #1 | | | 52.2 | .10 | .10 | | 385 | 104 | 104 | 250 | 60 | 1 |
| 2 | | | 52.5 | .15 | .15 | | 385 | 103 | 105 | | | 1 |
| 3 | | | | — | | | | | | | | |
| 4 | | | | — | | | | | | | | |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) Calc. | Actual | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) In | Out | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | 53.0 | 0.1 | 0.1 | | 380 | 104 | 105 | 250 | 60 | 1 |
| 6 | | | 53.4 | 0.1 | 0.1 | | 380 | 104 | 105 | | | 1 |
| 7 | | | 53.8 | 0.2 | 0.2 | | 385 | 105 | 105 | | | 1 |
| 8 | | | 54.3 | 0.55 | 0.54 | | 385 | 105 | 105 | | | 1 |
| 9 | | | 55.1 | 0.13 | 0.13 | | 385 | 105 | 105 | | | 1 |
| 10 | | | 55.5 | 0.13 | 0.13 | | 380 | ~~106~~ | 105 | | | 1 |
| 11 | | | ~~55.9~~ | 0.15 | 0.15 | | ~~400~~ | 106 | 105 | | | 1 |
| 12 | | | 56.4 | 0.15 | 0.15 | | 400 | 106 | 105 | | | 1 |
| #3 1 | | | 56.8 | 1.10 | 1.05 | | 400 | 106 | 105 | | | ~~1~~ 3 |
| 2 | | | 57.8 | 1.0 | .96 | | 390 | 108 | 105 | | | ~~1~~ 3 |
| 3 | | | 58.9 | 1.0 | .96 | | 390 | 109 | 106 | | | 3 |
| 4 | | | 59.9 | 0.65 | 0.64 | | 370 | 110 | 107 | | | 1 |
| 5 | | | 61.1 | 0.65 | 0.64 | | 380 | 111 | 108 | | | 1 |
| 6 | | | 61.7 | 0.80 | 0.77 | | 380 | 112 | 108 | | | 1 |
| 7 | | | 62.7 | 0.30 | 0.30 | | 380 | 112 | 108 | | | 1 |
| 8 | | | 63.3 | ~~0.25~~ | ~~0.25~~ | | 380 | 112 | 108 | | | 1 |
| 9 | | | 63.8 | ~~0.75~~ 1.10 | ~~0.44~~ 1.05 | | 380 | 112 | 108 | | | 2 |
| 10 | | | 64.9 | 0.80 | 0.77 | | 380 | 114 | 108 | | | 2 |
| 11 | | | 65.8 | 0.65 | 0.64 | | 380 | 114 | 108 | | | 2 |
| 12 | | | 66.8 | 0.80 | 0.77 | | 385 | 114 | 108 | | | 2 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| #2 1 | | | 67.7 | 1.10 | 1.05 | | 380 | 110 | 108 | 260 | 60 | 1 |
| 2 | | | 68.8 | 1.10 | 1.05 | | 380 | 110 | 108 | | | 3 |
| 3 | | | 70.0 | 1.10 | 1.05 | | 380 | 110 | 108 | | | 3 |
| 4 | | | 70.9 | 1.2 | 1.16 | | 380 | 112 | 108 | | | 3 |
| 5 | | | 72.0 | 1.2 | 1.16 | | 380 | 112 | 108 | | | 3 |
| 6 | | | 73.3 | 0.10 | 0.10 | | 380 | 112 | 108 | | | 1 |
| 7 | | | 73.6 | 1.6 | 1.51 | | 420 | 112 | 108 | | | 2 |
| 8 | | | 74.8 | 1.6 | 1.51 | | 420 | 112 | 108 | | | 2 |
| 9 | | | 75.9 | 1.6 | 1.51 | | 400 | 112 | 108 | | | 3 |
| 10 | | | 77.2 | 1.5 | 1.42 | | 390 | 114 | 108 | | | 3 |
| 11 | | | 78.5 | 1.5 | 1.42 | | 390 | 115 | 108 | | | 3 |
| 12 | | | 79.7 | 1.5 | 1.42 | | 390 | 115 | 108 | | | 3 |
| #1 1 | | | 80.9 | 1.0 | 0.96 | | 395 | 117 | 109 | | | 2 |
| 2 | | | 82.0 | 1.0 | 0.96 | | 395 | 116 | 110 | | | 2 |
| 3 | | | 83.1 | 0.4 | 0.39 | | 395 | 116 | 110 | | | 1 |
| 4 | | | 83.8 | 0.9 | 0.87 | | 395 | 116 | 110 | | | 2 |
| 5 | | | 84.7 | 1.2 | 1.16 | | 390 | 116 | 110 | | | 3 |
| 6 | | | 85.8 | 1.2 | 1.16 | | 390 | 116 | 110 | | | 3 |
| 7 | | | 87.0 | 1.2 | 1.16 | | 390 | 118 | 110 | | | 3 |
| 8 | | | 88.1 | 1.2 | 1.16 | | 390 | 119 | 110 | | | 3 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| | | | 89.3 | 1.5 | 1.42 | | 380 | 120 | 110 | 250 | 60 | 3 |
| 9 | | | 90.5 | 1.2 | 1.16 | | 380 | 120 | 110 | | | 3 |
| 10 | | | 91.7 | 0.9 | 0.87 | | 380 | 120 | 110 | | | 2 |
| 11 | | | 92.7 | 0.9 | 0.87 | | 380 | 120 | 110 | | | 2 |
| 12 | | | | | | | | | | | | |

ENVIRONMENTAL PROTECTION SYSTEMS
Jackson, Mississippi

DO, lev

# SOURCE SAMPLING FIELD DATA SHEET

Plant Hercules, Inc.

Sampling Location Hattiesburg, Ms.

Date 5-21-76 Run No. 3a

Time Start 10:48 Time End 12:40

Sampling Time/Point 2 min

DB ____ °F, WB ____ °F, VP @ DP ____ "HG

Bar. Press. 30.23 "Hg, Stack Press 30.24 "Hg

Moisture ____ %, FDA ____, Gas Den. Fac. ____

Weather clear - warm

Temp. ____ °F, W/D ____, W/S ____

Sample Box No. 1 Meter Box No. 1461

Meter ΔH@ 1.95 Pitot Corr. Factor 0.83

Nozzle Dia. 3/8 in., Probe Len. 6 ft.

Probe Heater Set. ____ Nomograph Cf 1.16

Stack Dimensions ____ in

Stack Area ____ $ft^2$

Stack Height ____ ft

Sketch of Stack

Mat'l Processing Rate ____

Final Gas Meter Reading 171.803 → 40.688 $ft^3$

Initial Gas Meter Reading 131.115 $ft^3$

Condensate Increase in Impingers ____ ml

Moisture in Silica Gel ____ gm

Silica Gel Container No. C Filter No. 013

Orsat: $CO_2$ ____

$C_2$ ____

CO ____

$N_2$ ____

Excess Air ____

Test Conducted by: Blunt / Kreuz

Remarks: Leak ck ok 10:30

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. (°F) | Gas Sample Temp. @ Dry Gas Meter (°F) | | Sample Box Temp. (°F) | Last Impinger Temp. (°F) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| #4 1 | | | 131.1 | 0.1 | 0.1 | | 380 | 96 | 96 | 250 | 60 | 1 |
| 2 | | | 131.5 | 0.1 | 0.1 | | 385 | 96 | 96 | | | 1 |
| 3 | | | 131.9 | 0.1 | 0.1 | | 360 | 97 | 97 | | | 1 |
| 4 | | | 132.3 | — | | | | | | | | |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| | | | | — | | | | | | 250 | 60 | |
| 5 | | | | | | | | | | | | |
| 6 | | | 132.3 | 0.1 | 0.1 | | 380 | 98 | 97 | | | 1 |
| 7 | | | 132.7 | 0.4 | 0.4 | | 380 | 100 | 98 | | | 1 |
| 8 | | | 133.3 | 0.45 | 0.44 | | 380 | 101 | 98 | | | 1 |
| 9 | | | 134.1 | 0.30 | 0.30 | | 380 | 102 | 98 | | | 1 |
| 10 | | | 134.7 | 0.1 | 0.1 | | 380 | 104 | 98 | | | 1 |
| 11 | | | 135.1 | 0.1 | 0.1 | | 380 | 104 | 100 | | | 1 |
| 12 | | | 135.5 | 0.1 | 0.1 | | 385 | 106 | 100 | | | 1 |
| #3 1 | | | 135.9 | 1.1 | 1.05 | | 380 | 106 | 100 | | | 1 |
| 2 | | | 136.9 | 1.1 | 1.05 | | 380 | 107 | 102 | | | 1 |
| 3 | | | 138.1 | 1.0 | .96 | | 380 | 109 | 103 | | | 1 |
| 4 | | | 139.1 | 0.9 | 0.87 | | 380 | 110 | 103 | | | 1 |
| 5 | | | 140.2 | 0.9 | 0.87 | | 380 | 112 | 104 | | | 1 |
| 6 | | | 141.1 | 0.7 | 0.68 | | 380 | 113 | 104 | | | 1 |
| 7 | | | 142.2 | 0.65 | 0.64 | | 380 | 114 | 106 | | | 1 |
| 8 | | | 142.9 | 0.65 | 0.64 | | 380 | 115 | 106 | | | 1 |
| 9 | | | 143.8 | 0.85 | 0.82 | | 380 | 116 | 106 | | | 1 |
| 10 | | | 144.9 | 0.85 | 0.82 | | 380 | 116 | 108 | | | 1 |
| 11 | | | 145.9 | 0.55 | 0.54 | | 385 | 117 | 108 | | | 1 |
| 12 | | | 146.6 | 0.30 | 0.30 | | 385 | 117 | 108 | | | 1 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. (°F) | Gas Sample Temp.@ Dry Gas Meter (°F) | | Sample Box Temp. (°F) | Last Impinger Temp. (°F) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| #2 1 | | | 147.2 | 0.55 | ~~0.54~~ 0.54 | | 375 | 113 | 108 | 250 | 60 | 1 |
| 2 | | | 147.9 | 0.65 | 0.64 | | 375 | 113 | 109 | | | 1 |
| 3 | | | 148.9 | 0.85 | 0.82 | | 395 | 113 | 109 | | | 1 |
| 4 | | | 149.8 | 0.90 | 0.87 | | 395 | 113 | 109 | | | 1 |
| 5 | | | 150.8 | 1.10 | 1.05 | | 395 | 114 | 109 | | | 1 |
| 6 | | | 151.8 | 1.10 | 1.05 | | 395 | 114 | 109 | | | 1 |
| 7 | | | 153.1 | ~~0.9~~ 1.0 | 0.96 | | 395 | 114 | 109 | | | 1 |
| 8 | | | 153.9 | 1.0 | 0.96 | | 395 | 114 | 109 | | | 1 |
| 9 | | | 155.0 | 1.0 | 0.96 | | 395 | 114 | 109 | | | 1 |
| 10 | | | 156.1 | 1.0 | 0.96 | | 395 | 114 | 109 | | | 1 |
| 11 | | | 157.1 | 1.0 | 0.96 | | 395 | 115 | 109 | | | 1 |
| 12 | | | 158.2 | 1.0 | 0.96 | | 395 | 115 | 109 | | | 1 |
| #1 1 | | | 158.9 | 1.5 | 1.42 | | 390 | 113 | 108 | | | 1 |
| 2 | | | 160.2 | 1.5 | 1.42 | | 390 | 115 | 108 | | | 1 |
| 3 | | | 162.0 | 1.5 | 1.42 | | 390 | 116 | 109 | | | 1 |
| 4 | | | 162.7 | 1.2 | 1.05 | | 390 | 117 | 109 | | | 1 |
| 5 | | | 163.4 | 1.0 | .96 | | 390 | 117 | 109 | | | 1 |
| 6 | | | 164.3 | 1.0 | .96 | | 390 | 117 | 109 | | | 1 |
| 7 | | | 165.3 | 0.35 | 0.35 | | 390 | 116 | 109 | | | 1 |
| 8 | | | 166.7 | 0.80 | 0.77 | | 400 | 112 | 108 | | | 1 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 9 | | | 167.8 | 1.0 | 0.96 | | 400 | 112 | 108 | 250 | 60 | 1 |
| 10 | | | 168.7 | 1.0 | 0.96 | | 400 | 113 | 108 | | | 1 |
| 11 | | | 169.8 | 0.95 | 0.92 | | 400 | 115 | 108 | | | 1 |
| 12 | | | 170.7 | 0.95 | 0.82 | | 400 | 115 | 108 | | | 1 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | |

[redacted]IRON[redacted]TAL [redacted]TEC[redacted]N SY[redacted]MS
Jackson, Mississippi

boiler #2

## SOURCE SAMPLING FIELD DATA SHEET

Plant Hercules, Inc.
Sampling Location Hatties burg, Ms
Date 5-20-74 Run No. 1 b
Time Start 9:31 Time End 11:29
Sampling Time/Point 2 min.
DB ____ °F, WB ____ °F, VP @ DP ____ "HG
Bar. Press. 30.37 "Hg, Stack Press. 30.38 "Hg
Moisture ____ %, FDA ____, Gas Den. Fac. ____
Weather ____
Temp. ____ °F, W/D ____, W/S ____
Sample Box No. 2 Meter Box No. 1936
Meter ΔH@ 1.90 Pitot Corr. Factor 0.83
Nozzle Dia. 3/8 in., Probe Len. 6 ft.
Probe Heater Set. ____ Nomograph Cf 1.16
Stack Dimensions ____ in
Stack Area ____ $ft^2$
Stack Height ____ ft

Sketch of Stack

Mat'l Processing Rate 694.536 - 40.700
Final Gas Meter Reading 653.836 $ft^3$
Initial Gas Meter Reading ____ $ft^3$
Condensate Increase in Impingers ____ ml
Moisture in Silica Gel ____ gm
Silica Gel Container No. B Filter No. 0106

Orsat:

| | | | | |
|---|---|---|---|---|
| $CO_2$ | | | | |
| $C_2$ | | | | |
| CO | | | | |
| $N_2$ | | | | |
| Excess Air | | | | |

Test Conducted by: Blunt / Wells

Remarks: Leak ck ok 8:30

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. (°F) | Gas Sample Temp. @ Dry Gas Meter (°F) | | Sample Box Temp. (°F) | Last Impinger Temp. (°F) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| #4 1 | | | 653.8 | .1 | .1 | | 370 | 70 | 70 | 250 | 60 | 1 |
| 2 | | | | .26 | .26 | | 385 | 74 | 72 | | | 1 |
| 3 | | | 654.9 | .10 | .10 | | 390 | 76 | 72 | | | 1 |
| 1 | | | | 1 | .1 | | 390 | 78 | 73 | | | 1 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 5 | | | 655.8 | .1 | .1 | | 380 | 90 | 74 | 250 | 60 | 1 |
| 6 | | | 656.1 | .1 | .1 | | 385 | 80 | 74 | | | 1 |
| 7 | | | | — | | | | | | | | |
| 8 | | | 656.6 | .1 | .1 | | 390 | 82 | 75 | | | 1 |
| 9 | | | 656.9 | .65 | .64 | | 395 | 85 | 78 | | | 2 |
| 10 | | | 657.8 | .92 | .89 | | 400 | 88 | 78 | | | 3 |
| 11 | | | 659.0 | .95 | .92 | | 390 | 91 | 79 | | | 3 |
| 12 | | | 660.0 | .82 | .79 | | 390 | 93 | 80 | | | 2 |
| #3 1 | | | 660.9 | .60 | .59 | | 390 | 96 | 82 | | | 1 |
| 2 | | | 661.8 | .82 | .79 | | 390 | 99 | 83 | | | 1 |
| 3 | | | 662.8 | .25 | .25 | | 395 | 100 | 84 | | | 1 |
| 4 | | | 663.4 | .40 | .39 | | 395 | 100 | 85 | | | 1 |
| 5 | | | 664.2 | .60 | .59 | | 400 | 101 | 86 | | | 1 |
| 6 | | | 665.0 | .64 | .63 | | 390 | 101 | 86 | | | 1 |
| 7 | | | 666.0 | .55 | .54 | | 390 | 100 | 88 | | | 1 |
| 8 | | | 666.7 | .60 | .59 | | 390 | 100 | 88 | | | 1 |
| 9 | | | 667.6 | .60 | .59 | | 390 | 98 | 89 | | | 1 |
| 10 | | | 668.5 | .58 | .57 | | 395 | 100 | 90 | | | 1 |
| 11 | | | 669.3 | .64 | .63 | | 390 | 102 | 90 | | | 1 |
| 12 | | | 670.2 | .64 | .63 | | 390 | 102 | 90 | | | 1 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| #2 1 | | | 671.0 | .60 | .59 | | 400 | 104 | 94 | 250 | 60 | 1 |
| 2 | | | 671.9 | .80 | .78 | | 390 | 106 | 93 | | | 1 |
| 3 | | | 672.9 | .95 | .92 | | 395 | 108 | 94 | | | 1 |
| 4 | | | 674.0 | .95 | .92 | | 395 | 109 | 94 | | | 1 |
| 5 | | | 675.1 | 1.10 | 1.05 | | 395 | 110 | 95 | | | 1 |
| 6 | | | 676.1 | .60 | .59 | | 390 | 112 | 96 | | | 1 |
| 7 | | | 677.0 | .50 | .49 | | 390 | 112 | 97 | | | 1 |
| 8 | | | 677.9 | 1.10 | 1.05 | | 390 | 113 | 98 | | | 1 |
| 9 | | | 678.9 | 1.0 | .96 | | 390 | 114 | 98 | | | 1 |
| 10 | | | 680.1 | .95 | .92 | | 395 | 116 | 99 | | | 1 |
| 11 | | | 681.1 | .85 | .82 | | 380 | 116 | 100 | | | 1 |
| 12 | | | 682.2 | .95 | .92 | | 385 | 116 | 100 | | | 1 |
| #1 1 | | | 683.2 | .80 | .78 | | 380 | 96 | 96 | | | 2 |
| 2 | | | 684.3 | .80 | .78 | | 380 | 98 | 96 | | | 2 |
| 3 | | | 685.2 | .80 | .78 | | 385 | 100 | 96 | | | 2 |
| 4 | | | | — | | | | | | | | |
| 5 | | | 686.5 | .1 | .1 | | 380 | 102 | 97 | | | 3 |
| 6 | | | 686.7 | 1.1 | 1.05 | | 380 | 102 | 97 | | | 3 |
| 7 | | | 687.8 | 1.1 | 1.05 | | 385 | 105 | 98 | | | 3 |
| 8 | | | 688.9 | 1.2 | 1.16 | | 380 | 108 | 98 | | | 4 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 9 | | | 690.0 | 1.5 | 1.42 | | 385 | 111 | 99 | 250 | 60 | 6 |
| 10 | | | 691.3 | .95 | .92 | | 385 | 114 | 99 | | | 4 |
| 11 | | | 692.5 | .85 | .92 | | 370 | 114 | 99 | | | 5 |
| 12 | | | 693.4 | .85 | .92 | | 390 | 115 | 100 | | | |
| | | | | | | | | | | | | |
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[redacted] ENVIRONMENTAL [redacted] TECH [redacted] SYSTEMS [redacted]
Jackson, Mississippi

boiler #2

## SOURCE SAMPLING FIELD DATA SHEET

Plant Hercules, Inc.
Sampling Location Hattiesburg, Ms.
Date 5-20-76 Run No. 2b
Time Start 2:56 Time End 4:31
Sampling Time/Point 2 min
DB ____ °F, WB ____ °F, VP @ DP ____ "HG
Bar. Press. 30.37 "Hg, Stack Press. 30.38 "Hg
Moisture ____ %, FDA ____, Gas Den. Fac. ____
Weather clear - warm
Temp. ____ °F, W/D ____, W/S ____
Sample Box No. 2 Meter Box No. 1936
Meter ΔH@ 1.90 Pitot Corr. Factor 0.83
Nozzle Dia. 3/4 in., Probe Len. 6 ft.
Probe Heater Set. ____ Nomograph Cf 1.16
Stack Dimensions ____ in
Stack Area ____ $ft^2$
Stack Height ____ ft

Sketch of Stack

Mat'l Processing Rate ____
Final Gas Meter Reading 775.071 → 39.366 $ft^3$
Initial Gas Meter Reading 735.705 $ft^3$
Condensate Increase in Impingers ____ ml
Moisture in Silica Gel ____ gm
Silica Gel Container No. F Filter No. 0/10

Orsat:

| | | | | |
|---|---|---|---|---|
| $CO_2$ | | | | |
| $O_2$ | | | | |
| CO | | | | |
| $N_2$ | | | | |
| Excess Air | | | | |

Test Conducted by: Blunt / Wells

Remarks: Leak ck ok 2:44

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. (°F) | Gas Sample Temp. @ Dry Gas Meter (°F) | | Sample Box Temp. (°F) | Last Impinger Temp. (°F) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| #4 1 | | | 735.7 | 0.1 | 0.1 | | 380 | 101 | 101 | 250 | 60 | 1 |
| 2 | | | 736.1 | 0.25 | 0.25 | | 380 | 102 | 102 | | | 1 |
| 3 | | | 736.7 | ~~0.15~~ 0.15 | 0.15 | | 380 | 103 | 102 | | | 1 |
| | | | | 0.15 | 0.15 | | 380 | 104 | 102 | | | 1 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 5 | | | 737.7 | 0.1 | 0.1 | | 395 | 105 | 102 | 250 | 60 | 1 |
| 6 | | | 738.1 | 0.1 | 0.1 | | 395 | 105 | 102 | | | 1 |
| 7 | | | 738.4 | 0.1 | 0.1 | | 390 | 105 | 102 | | | 1 |
| 8 | | | 738.8 | — | | | | | | | | |
| 9 | | | 738.8 | 0.1 | 0.1 | | 390 | 105 | 103 | | | 1 |
| 10 | | | 739.2 | 0.1 | 0.1 | | 395 | 105 | 103 | | | 1 |
| 11 | | | 739.6 | 0.1 | 0.1 | | 395 | 106 | 103 | | | 1 |
| 12 | | | 740.0 | 0.1 | 0.1 | | 395 | 106 | 103 | | | 1 |
| #3 1 | | | 740.5 | 0.55 | 0.54 | | 410 | 108 | 103 | | | 1 |
| 2 | | | 741.3 | 0.90 | 0.87 | | 410 | 110 | 103 | | | 1 |
| 3 | | | 742.3 | 0.90 | 0.87 | | 400 | 112 | 104 | | | 1 |
| 4 | | | 743.3 | 0.70 | 0.68 | | 390 | 115 | 104 | | | 2 |
| 5 | | | 744.3 | 0.70 | 0.68 | | 390 | 116 | 104 | | | 2 |
| 6 | | | 745.3 | 1.0 | 0.96 | | 390 | 118 | 105 | | | 4 |
| 7 | | | 746.3 | 0.30 | 0.30 | | 390 | 118 | 105 | | | 1 |
| 8 | | | 747.0 | 0.25 | 0.25 | | 390 | 118 | 106 | | | 1 |
| 9 | | | 747.6 | 0.25 | 0.25 | | 390 | 117 | 106 | | | 1 |
| 10 | | | 748.3 | 0.45 | 0.44 | | 385 | 116 | 106 | | | 1 |
| 11 | | | 749.0 | 0.80 | 0.77 | | 385 | 118 | 106 | | | 3 |
| 12 | | | 749.9 | 1.10 | 1.05 | | 385 | 118 | 106 | | | 4 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| #2 1 | | | 751.0 | 0.60 | 0.59 | | 390 | 110 | 105 | 250 | 60 | 1 |
| 2 | | | 751.8 | 0.80 | 0.77 | | 390 | 110 | 106 | | | 2 |
| 3 | | | 752.8 | 0.90 | 0.87 | | 380 | 112 | 107 | | | 4 |
| 4 | | | 753.8 | 0.90 | 0.87 | | 380 | 114 | 106 | | | 4 |
| 5 | | | 754.9 | 0.95 | 0.92 | | 380 | 116 | 106 | | | 4 |
| 6 | | | 755.9 | 1.2 | 1.16 | | 380 | 116 | 106 | | | 5 |
| 7 | | | 757.4 | 1.2 | 1.16 | | 380 | 118 | 106 | | | 5 |
| 8 | | | 758.3 | 1.0 | .96 | | 385 | 118 | 106 | | | 4 |
| 9 | | | 759.3 | 1.0 | .96 | | 385 | 120 | 106 | | | 4 |
| 10 | | | | — | | | | | | | | |
| 11 | | | 760.5 | 1.5 | 1.42 | | 395 | 122 | 106 | | | 6 |
| 12 | | | 761.7 | 1.5 | 1.42 | | 395 | 122 | 106 | | | 6 |
| #1 1 | | | 762.9 | 0.7 | .68 | | 390 | 118 | 107 | | | 2 |
| 2 | | | 763.9 | 0.8 | .77 | | 380 | 118 | 108 | | | 2 |
| 3 | | | 765.0 | 0.15 | 0.15 | | 385 | 118 | 108 | | | 1 |
| 4 | | | 765.5 | 0.15 | 0.15 | | 385 | 117 | 108 | | | 1 |
| 5 | | | 766.0 | 1.0 | .96 | | 385 | 116 | 108 | | | 4 |
| 6 | | | 767.0 | 1.2 | 1.16 | | 385 | 116 | 108 | | | 6 |
| 7 | | | 768.2 | 1.2 | 1.16 | | 385 | 118 | 108 | | | 6 |
| 8 | | | 769.3 | 1.2 | 1.16 | | 385 | 118 | 108 | | | 6 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 9 | | | 770.5 | 1.5 | 1.42 | | 380 | ~~118~~ 108 | 108 | 250 | 60 | 9 |
| 10 | | | 771.8 | 1.2 | 1.16 | | 385 | 120 | 108 | | | 6 |
| 11 | | | ~~773~~ 773.0 | 0.8 | 0.77 | | 385 | 122 | 108 | | | 4 |
| 12 | | | 774.2 | 0.8 | 0.77 | | 385 | 123 | 108 | | | 2 |
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ENVIRONMENTAL TECH SYSTEMS
Jackson, Mississippi

boiler #2

## SOURCE SAMPLING FIELD DATA SHEET

Plant Hercules, Inc.
Sampling Location Hattiesburg, Ms.
Date 5-21-76 Run No. 3b
Time Start 10:47 Time End 12:40
Sampling Time/Point 2 min
DB ____ °F, WB ____ °F, VP @ DP ____ "HG
Bar. Press. 30.23 "Hg, Stack Press. 30.24 "Hg
Moisture ____ %, FDA ____, Gas Den. Fac. ____
Weather clear - warm
Temp. ____ °F, W/D ____, W/S ____
Sample Box No. 2 Meter Box No. 1936
Meter ΔH@ 1.9 Pitot Corr. Factor 0.83
Nozzle Dia. 3/4 in., Probe Len. 6 ft.
Probe Heater Set. ____ Nomograph Cf 1.16
Stack Dimensions ____ in
Stack Area ____ $ft^2$
Stack Height ____ ft

Sketch of Stack

Mat'l Processing Rate ____
Final Gas Meter Reading 855.166 → 38.896 ft³
Initial Gas Meter Reading 816.270 ft³
Condensate Increase in Impingers ____ ml
Moisture in Silica Gel ____ gm
Silica Gel Container No. D Filter No. 0115

Orsat:

| | | | | | |
|---|---|---|---|---|---|
| $CO_2$ | | | | | |
| $O_2$ | | | | | |
| CO | | | | | |
| $N_2$ | | | | | |
| Excess Air | | | | | |

Test Conducted by: Blunt / Wells

Remarks: Leak ck ok 10:38

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. (°F) | Gas Sample Temp. @ Dry Gas Meter (°F) | | Sample Box Temp. (°F) | Last Impinger Temp. (°F) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| #1 1 | | | 816.3 | 0.70 | 0.68 | | 380 | ~~108~~ 98 | 97 | 250 | 60 | 2 |
| 2 | | | 817.1 | 0.65 | 0.64 | | 380 | 100 | 98 | | | 2 |
| 3 | | | 818.1 | — | | | | | | | | |
| 4 | | | [illegible] | 0.45 | 0.44 | | 380 | 103 | 98 | | | 1 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) Calc. | Meter Orifice Press. Diff. ("$H_2O$) Actual | Stack Gas Temp. (°F) | Gas Sample Temp.@ Dry Gas Meter (°F) In | Gas Sample Temp.@ Dry Gas Meter (°F) Out | Sample Box Temp. (°F) | Last Impinger Temp. (°F) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | 818.9 | 1.1 | 1.05 | | 380 | 105 | 98 | 250 | 60 | 4 |
| 6 | | | 820.0 | 1.5 | 1.42 | | 380 | 110 | 98 | | | 10 |
| 7 | | | 821.2 | 1.5 | 1.42 | | 380 | 112 | 98 | | | 11 |
| 8 | | | 822.5 | 1.2 | 1.16 | | 385 | 116 | 100 | | | 8 |
| 9 | | | 823.7 | 0.90 | 0.87 | | 385 | 118 | 100 | | | 4 |
| 10 | | | 824.8 | 0.70 | 0.68 | | 390 | 118 | 100 | | | 2 |
| 11 | | | 825.8 | 0.70 | 0.68 | | 390 | 118 | 102 | | | 2 |
| 12 | | | 826.8 | 0.70 | 0.68 | | 390 | 118 | 102 | | | 2 |
| #2 1 | | | 827.6 | 0.65 | 0.64 | | 370 | 110 | 102 | | | 2 |
| 2 | | | 828.5 | 0.65 | 0.64 | | 370 | 113 | 103 | | | 2 |
| 3 | | | 829.4 | 0.80 | 0.77 | | 380 | 114 | 104 | | | 3 |
| 4 | | | 830.3 | 1.0 | 196 | | 380 | 116 | 104 | | | 3 |
| 5 | | | | — | | | ~~380~~ | ~~118~~ | ~~104~~ | | | |
| 6 | | | 831.7 | 0.45 | .44 | | 380 | 118 | 104 | | | 1 |
| 7 | | | 832.3 | 1.1 | 1.05 | | 375 | 118 | 105 | | | 5 |
| 8 | | | 833.4 | 0.90 | 0.87 | | 380 | 121 | 106 | | | 4 |
| 9 | | | 834.5 | 0.80 | 0.77 | | 380 | 121 | 106 | | | 3 |
| 10 | | | 835.6 | 0.85 | 0.82 | | 375 | 122 | 107 | | | 3 |
| 11 | | | 836.6 | ~~0.85~~ 1.0 | ~~0.82~~ 0.96 | | 375 | 123 | 107 | | | 4 |
| 12 | | | 837.7 | 1.0 | 0.96 | | 375 | 123 | 107 | | | 4 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| #3 1 | | | 838.8 | 1.0 | 0.96 | | 380 | 112 | 106 | 250 | 60 | 4 |
| 2 | | | 839.8 | 0.8 | 0.77 | | 380 | 114 | 106 | | | 3 |
| 3 | | | 840.9 | 0.90 | 0.87 | | 380 | 116 | 107 | | | 4 |
| 4 | | | 841.9 | 0.90 | 0.87 | | 380 | 118 | 107 | | | 4 |
| 5 | | | 843.0 | 0.90 | 0.87 | | 380 | 118 | 107 | | | 3 |
| 6 | | | 843.0 | 1.0 | 0.96 | | 380 | 119 | 106 | | | 3 |
| 7 | | | 845.2 | 0.13 | 0.13 | | 380 | 119 | 106 | | | 1 |
| 8 | | | 845.6 | 0.40 | 0.39 | | 380 | 116 | 106 | | | 1 |
| 9 | | | 846.3 | 0.40 | 0.39 | | 380 | 116 | 106 | | | 1 |
| 10 | | | 847.0 | 0.90 | 0.87 | | 380 | 117 | 106 | | | 4 |
| 11 | | | 848.0 | 0.90 | 0.87 | | 380 | 117 | 106 | | | 4 |
| 12 | | | 849.0 | 1.0 | 0.96 | | 380 | 117 | 106 | | | 4 |
| #4 1 | | | 850.2 | 0.2 | 0.2 | | ~~380~~ 385 | 112 | 105 | | | 1 |
| 2 | | | 850.8 | 0.2 | 0.2 | | 370 | 113 | 105 | | | 1 |
| 3 | | | 851.3 | 0.25 | 0.25 | | 370 | 113 | 106 | | | 1 |
| 4 | | | 852.2 | 0.1 | 0.1 | | 370 | 113 | 106 | | | 1 |
| 5 | | | 852.6 | 0.1 | 0.1 | | 370 | 112 | 106 | | | 1 |
| 6 | | | 853.1 | 0.1 | 0.1 | | 370 | 112 | 106 | | | 1 |
| 7 | | | 853.6 | 0.1 | 0.1 | | 370 | 107 | 108 | | | 1 |
| 8 | | | 853.9 | ~~0~~ | | | | | | | | |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 9 | | | | — | | | | | | 250 | 60 | |
| 10 | | | 853.9 | 0.1 | 0.1 | | 390 | 116 | 104 | | | 1 |
| 11 | | | 854.2 | 0.1 | 0.1 | | 390 | 116 | 104 | | | 1 |
| 12 | | | 854.6 | 0.15 | 0.15 | | 390 | 116 | 104 | | | 1 |
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IRON TAL TEC SY MS
Jackson, Mississippi

boiler #7

## SOURCE SAMPLING FIELD DATA SHEET

Plant Hercules, Inc.
Sampling Location Hattiesburg, Ms
Date 5-20-76 Run No. 1a
Time Start 12:05 Time End 1:50
Sampling Time/Point 2 min
DB ____ °F, WB ____ °F, VP @ DP ____ "HG
Bar. Press. 30.37 "Hg, Stack Press. 30.38 "Hg
Moisture ____ %, FDA ____, Gas Den. Fac. ____
Weather clear-warm
Temp. ____ °F, W/D ____, W/S ____
Sample Box No. 1 Meter Box No. 1461
Meter ΔH@ 1.95 Pitot Corr. Factor 0.83
Nozzle Dia. 3/16 in., Probe Len. 6 ft.
Probe Heater Set. ____ Nomograph Cf 1.16
Stack Dimensions ____ in
Stack Area ____ $ft^2$
Stack Height ____ ft

Sketch of Stack

Mat'l Processing Rate ____
Final Gas Meter Reading 51.841 → 40.867 $ft^3$
Initial Gas Meter Reading 010.974 $ft^3$
Condensate Increase in Impingers ____ ml
Moisture in Silica Gel ____ gm
Silica Gel Container No. C Filter No. 0107

Orsat:

| | | | | |
|---|---|---|---|---|
| $CO_2$ | | | | |
| $O_2$ | | | | |
| CO | | | | |
| $N_2$ | | | | |
| Excess Air | | | | |

Test Conducted by: Blunt / Kreuz

Remarks: Leak ck ok 12:07 pm

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) $\sqrt{\Delta H}$ | | Stack Gas Temp. (°F) | Gas Sample Temp. @ Dry Gas Meter (°F) | | Sample Box Temp. (°F) | Last Impinger Temp. (°F) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| #1 | | | 10.9 | 1.0 | .96 | 1 | 380 | 102 | 100 | 250 | 60 | 2 |
| 2 | | | 12.0 | 1.0 | .96 | 1 | 385 | 104 | 100 | | | 2 |
| 3 | | | 13.1 | 0.85 | .82 | .92 | 385 | 106 | 100 | | | 2 |
| 4 | | | 14.1 | 1.0 | .96 | 1 | 380 | 107 | 101 | | | 2 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) $\sqrt{H}$ | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 5 | | | 15.2 | 1.2 | 1.16 | 1.09 | 390 | 108 | 98 | 250 | 60 | 1 |
| 6 | | | 16.2 | 1.2 | 1.16 | 1.09 | 390 | 110 | 99 | | | 1 |
| 7 | | | 17.3 | 1.6 | 1.51 | 1.26 | 420 | 113 | 103 | | | 1 |
| 8 | | | 18.7 | 1.6 | 1.51 | 1.26 | 400 | 115 | 104 | | | 1 |
| 9 | | | 19.9 | 1.3 | 1.26 | 1.14 | 410 | 116 | 104 | | | 1 |
| 10 | | | 21.0 | 1.0 | .96 | 1 | 400 | 116 | 104 | | | 1 |
| 11 | | | 22.1 | 1.0 | .96 | 1 | 390 | 116 | 105 | | | 1 |
| 12 | | | 23.1 | 1.0 | .96 | 1 | 390 | 116 | 105 | | | 2 |
| #2 1 | | | 24.1 | 1.1 | 1.05 | 1.05 | 385 | 114 | 106 | | | 2 |
| 2 | | | 25.1 | 1.1 | 1.05 | 1.05 | 385 | 114 | 106 | | | 2 |
| 3 | | | 26.4 | 1.1 | 1.05 | 1.05 | 385 | 115 | 106 | | | 2 |
| 4 | | | 27.4 | 1.1 | 1.05 | 1.05 | 380 | 115 | 108 | | | 2 |
| 5 | | | 28.5 | 1.2 | 1.16 | 1.09 | 390 | 116 | 108 | | | 2 |
| 6 | | | 29.7 | ~~0.1~~ | ~~10~~ | | | | | | | |
| 7 | | | 29.7 | 1.2 | 1.16 | 1.09 | 390 | 116 | 108 | | | 2 |
| 8 | | | 30.8 | 1.6 | 1.51 | 1.26 | 390 | 116 | 108 | | | 2 |
| 9 | | | 32.2 | 1.6 | 1.51 | 1.26 | 390 | 116 | 108 | | | 2 |
| 10 | | | 33.4 | 1.2 | 1.16 | 1.09 | 390 | 117 | 108 | | | 2 |
| 11 | | | 34.4 | 1.2 | 1.16 | 1.09 | 390 | 117 | 108 | | | 2 |
| 12 | | | 35.8 | 1.6 | 1.51 | 1 | 390 | 118 | 108 | | | 2 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| #3 1 | | | 37.0 | 1.0 | 0.96 | 1 | 390 | 118 | 110 | 250 | 60 | 2 |
| 2 | | | 38.1 | 0.80 | 0.77 | .89 | 395 | 119 | 111 | | | 2 |
| 3 | | | 39.0 | 0.90 | 0.87 | .95 | 395 | 119 | 111 | | | 2 |
| 4 | | | 40.0 | 0.80 | 0.77 | .89 | 395 | 119 | 111 | | | 2 |
| 5 | | | 40.9 | 0.80 | 0.77 | .89 | 395 | 119 | 111 | | | 1 |
| 6 | | | 42.0 | 0.65 | 0.64 | .81 | 390 | 120 | 112 | | | 1 |
| 7 | | | 43.0 | 1.10 | 1.05 | 1.05 | 390 | 120 | 112 | | | 1 |
| 8 | | | 44.0 | 0.25 | 0.25 | .5 | 395 | 120 | 112 | | | 1 |
| 9 | | | 44.6 | 0.35 | 0.35 | .59 | 395 | 120 | 112 | | | 1 |
| 10 | | | 45.4 | 0.30 | 0.30 | .55 | 395 | 120 | 113 | | | 1 |
| 11 | | | 46.0 | 0.90 | 0.87 | .95 | 395 | 120 | 114 | | | 1 |
| 12 | | | 46.9 | 0.80 | 0.77 | .89 | 395 | 120 | 115 | | | 1 |
| #f Pitot | | | 47.9 | — | | | | | | | | |
| 2 | | | | — | | | | | | | | |
| 3 | | | | — | | | | | | | | |
| 4 | | | 47.9 | .10 | .10 | .32 | 395 | 118 | 115 | | | 1 |
| 5 | | | 48.2 | .10 | .10 | .32 | 395 | 118 | 115 | | | 1 |
| 6 | | | 48.6 | .10 | .10 | .32 | 395 | 117 | 115 | | | 1 |
| 7 | | | 48.0 | .10 | .10 | .32 | 395 | 117 | 115 | | | 1 |
| 8 | | | 49.4 | .30 | .30 | .55 | 395 | 117 | 115 | | | 1 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) $\sqrt{H}$ | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 9 | | | 49.9 | 0.30 | 0.30 | .55 | 390 | 118 | 115 | 250 | 60 | 1 |
| 10 | | | 50.6 | 0.10 | 0.10 | .32 | 390 | 118 | 115 | | | 1 |
| 11 | | | 51.0 | 0.10 | 0.10 | .32 | 390 | 118 | 115 | | | 1 |
| 12 | | | 51.4 | 0.10 | 0.10 | .32 | 390 | 118 | 115 | | | 1 |
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[redacted] Jackson, Mississippi boiler #1

## SOURCE SAMPLING FIELD DATA SHEET

Plant Hercules, Inc.

Sampling Location Hattiesburg, Ms.

Date 5-21-76 Run No. 2a

Time Start 8:23 Time End 10:12

Sampling Time/Point 2 min

DB ____ °F, WB ____ °F, VP @ DP ____ "HG

Bar. Press. 30.23 "Hg, Stack Press. 30.24 "Hg

Moisture ____ %, FDA ____, Gas Den. Fac. ____

Weather ____

Temp. ____ °F, W/D ____, W/S ____

Sample Box No. 1 Meter Box No. 1461

Meter ΔH@ 1.95 Pitot Corr. Factor 0.93

Nozzle Dia. 3/16 in., Probe Len. 6 ft.

Probe Heater Set. ____ Nomograph Cf 1.16

Stack Dimensions ____ in

Stack Area ____ $ft^2$

Stack Height ____ ft

Sketch of Stack

Mat'l Processing Rate ____

Final Gas Meter Reading 130.721 - 36.884 $ft^3$

Initial Gas Meter Reading 93.837 $ft^3$

Condensate Increase in Impingers ____ ml

Moisture in Silica Gel ____ gm

Silica Gel Container No. A Filter No. 0112

Orsat: $CO_2$ ____

$O_2$ ____

CO ____

$N_2$ ____

Excess Air ____

Test Conducted by: Blunt / Kreuz

Remarks: Leak ck ok 8:10

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) Calc. | Meter Orifice Press. Diff. ("$H_2O$) Actual | Stack Gas Temp. (°F) | Gas Sample Temp. @ Dry Gas Meter (°F) In | Gas Sample Temp. @ Dry Gas Meter (°F) Out | Sample Box Temp. (°F) | Last Impinger Temp. (°F) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| #1 1 | | | 93.8 | 1.0 | .96 | 1 | 380 | 68 | 66 | 250 | 60 | 1 |
| 2 | | | 94.8 | 1.0 | .96 | 1 | 380 | 71 | 65 | | | 1 |
| 3 | | | 95.7 | 1.0 | .96 | 1 | 380 | 74 | 65 | | | 2 |
| 4 | | | 96.7 | 1.1 | 1.1 | 2 | 380 | 76 | 66 | | | 1 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) $\Delta H$ | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 5 | | | 97.2 | 1.1 | 1.05 | 1.05 | 385 | 78 | 67 | 250 | 60 | 1 |
| 6 | | | 98.3 | 1.1 | 1.05 | 1.05 | 385 | 80 | 69 | | | 1 |
| 7 | | | 99.2 | 1.0 | .96 | 1 | 385 | 81 | 71 | | | 1 |
| 8 | | | 100.2 | 1.0 | .96 | 1 | 385 | 83 | 73 | | | 1 |
| 9 | | | 101.2 | .80 | .77 | .89 | 385 | 84 | 75 | | | 1 |
| 10 | | | 102.0 | .80 | .77 | .89 | 385 | 86 | 76 | | | 1 |
| 11 | | | 102.9 | .75 | .73 | .87 | 380 | 88 | 77 | | | 1 |
| 12 | | | 103.8 | .75 | .73 | .87 | 380 | 90 | 78 | | | 1 |
| #2 1 | | | 104.8 | 1.2 | 1.16 | 1.09 | 375 | 92 | 82 | | | 1 |
| 2 | | | 106.1 | 1.2 | 1.16 | 1.09 | 370 | 95 | 82 | | | 1 |
| 3 | | | 107.0 | 1.0 | .96 | 1 | 375 | 98 | 84 | | | 1 |
| 4 | | | 108.1 | 1.0 | .96 | 1 | 375 | 99 | 85 | | | 1 |
| 5 | | | 109.3 | 1.2 | 1.16 | 1.09 | 375 | 101 | 86 | | | 1 |
| 6 | | | 110.3 | 1.2 | 1.16 | 1.09 | 375 | 103 | 88 | | | 1 |
| 7 | | | 111.4 | 1.2 | 1.16 | 1.09 | 395 | 104 | 89 | | | 1 |
| 8 | | | 112.5 | 1.2 | 1.16 | 1.09 | 410 | 105 | 90 | | | 1 |
| 9 | | | 113.7 | — | | | | | | | | |
| 10 | | | 113.7 | 1.5 | 1.42 | 1.22 | 400 | 106 | 92 | | | 1 |
| 11 | | | 114.9 | 1.5 | 1.42 | 1.22 | 400 | 108 | 92 | | | 1 |
| 12 | | | 116.1 | 1.5 | 1.42 | 1.22 | 400 | 110 | 93 | | | 1 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) Calc. | Meter Orifice Press. Diff. ("$H_2O$) Actual | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) In | Gas Sample Temp.@ Dry Gas Meter ($^oF$) Out | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| #3 1 | | | 117.4 | 1.2 | 1.16 | 1.09 | 380 | 105 | 94 | 250 | 60 | 2 |
| 2 | | | 118.5 | 1.2 | 1.16 | 1.09 | 385 | 108 | 96 | | | 2 |
| 3 | | | 119.7 | 1.0 | .96 | 1 | 385 | 108 | 98 | | | 2 |
| 4 | | | 120.7 | 1.0 | .96 | 1 | 385 | 108 | 98 | | | 2 |
| 5 | | | 121.8 | .75 | .73 | .87 | 385 | 109 | 98 | | | 2 |
| 6 | | | 122.7 | .75 | .73 | .87 | 385 | 109 | 98 | | | 2 |
| 7 | | | 123.8 | .75 | .73 | .87 | 385 | 109 | 98 | | | 2 |
| ~~8~~ | | | ~~124.7~~ | ~~.75~~ | ~~.73~~ | | | | | | | |
| 9 | | | 124.7 | .25 | .25 | .5 | 385 | 109 | 98 | | | 1 |
| 10 | | | 125.3 | .25 | .25 | .5 | 380 | 109 | 99 | | | 1 |
| 11 | | | 125.8 | .25 | .25 | .5 | 380 | 109 | 99 | | | 1 |
| 12 | | | 126.4 | 1.0 | .96 | 1 | 385 | 109 | 100 | | | 2 |
| #4 1 | | | 127.4 | 0.1 | 0.1 | .32 | 370 | 102 | 99 | | | 1 |
| 2 | | | 127.8 | ← | | | ~~370~~ | ~~103~~ | ~~100~~ | | | ~~1~~ |
| 3 | | | | — | | | | | | | | |
| 4 | | | | ← | | | | | | | | |
| 5 | | | 127.8 | 0.1 | 0.1 | .32 | 370 | 103 | 100 | | | 1 |
| 6 | | | 128.2 | 0.1 | 0.1 | .32 | 370 | 103 | 100 | | | 1 |
| 7 | | | 128.5 | 0.1 | 0.1 | .32 | 370 | 103 | 100 | | | 1 |
| 8 | | | 128.9 | 0.1 | 0.1 | .32 | 370 | 103 | 100 | | | 1 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 9 | | | 129.3 | 0.1 | 0.1 | .32 | 375 | 104 | 100 | 250 | 60 | 1 |
| 10 | | | 129.6 | 0.1 | 0.1 | .32 | 375 | 104 | 100 | | | 1 |
| 11 | | | 130.0 | 0.1 | 0.1 | .32 | 375 | 104 | 100 | | | 1 |
| 12 | | | 130.4 | 0.1 | 0.1 | .32 | 375 | 104 | 100 | | | 1 |
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ENVIRONMENTAL PROTECTION SYSTEMS
Jackson, Mississippi

Boiler #1

## SOURCE SAMPLING FIELD DATA SHEET

Plant Hercules, Inc

Sampling Location Hattiesburg, Ms.

Date 5-21-76 Run No. 3a

Time Start 1:00 Time End 2:45

Sampling Time/Point 2 min

DB ____ °F, WB ____ °F, VP @ DP ____ "HG

Bar. Press. 30.23 "Hg, Stack Press. 30.24 "Hg

Moisture ____ %, FDA ____, Gas Den. Fac. ____

Weather clear warm

Temp. ____ °F, W/D ____, W/S ____

Sample Box No. 1 Meter Box No. 1461

Meter ΔH@ 1.95 Pitot Corr. Factor 0.83

Nozzle Dia. 3/16 in., Probe Len. 6 ft.

Probe Heater Set. ____ Nomograph Cf 1.16

Stack Dimensions ____ in

Stack Area ____ $ft^2$

Stack Height ____ ft

Sketch of Stack

Mat'l Processing Rate ____

Final Gas Meter Reading 212. $ft^3$

Initial Gas Meter Reading 171.944 $ft^3$

Condensate Increase in Impingers ____ ml

Moisture in Silica Gel ____ gm

Silica Gel Container No. ____ Filter No. 0114

Orsat: $CO_2$ ____

$O_2$ ____

CO ____

$N_2$ ____

Excess Air ____

Test Conducted by: Blunt / Kreuz

Remarks: Leak ck ok 12:50

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) $\sqrt{H}$ Calc. | Meter Orifice Press. Diff. ("$H_2O$) $\sqrt{H}$ Actual | Stack Gas Temp. (°F) | Gas Sample Temp.@Dry Gas Meter (°F) In | Gas Sample Temp.@Dry Gas Meter (°F) Out | Sample Box Temp. (°F) | Last Impinger Temp. (°F) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | 171.9 | 1.0 | 0.96 | 1 | 385 | 96 | 96 | 250 | 250 | |
| 2 | | | | 1.0 | 0.96 | 1 | 385 | 96 | 96 | ) | ) | |
| 3 | | | | 1.0 | 0.96 | 1 | 385 | 97 | 98 | ) | ) | |
| 4 | | | | 0.1 | 0.1 | 1 | 385 | 98 | 98 | ) | ) | |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 5 | | | | 1.1 | 1.05 | 1.05 | 385 | 99 | 98 | 250 | 60 | |
| 6 | | | | 1.0 | .96 | 1 | 385 | 102 | 98 | | | |
| 7 | | | | 1.0 | .96 | 1 | 385 | 104 | 98 | | | |
| 8 | | | | .9 | .87 | .95 | 385 | 106 | 99 | | | |
| 9 | | | | .8 | .77 | .89 | 385 | 108 | 99 | | | |
| 10 | | | | .8 | .77 | .89 | 380 | 110 | 99 | | | |
| 11 | | | | .75 | .73 | .87 | 380 | 112 | 99 | | | |
| 12 | | | | .75 | .73 | .87 | 380 | 114 | 100 | | | |
| 1 | | | | 1.2 | 1.16 | 1.09 | 375 | 114 | 100 | | | |
| 2 | | | | 1.2 | 1.16 | 1.09 | 375 | 115 | 100 | | | |
| 3 | | | | 1.1 | 1.05 | 1.05 | 375 | 115 | 101 | | | |
| 4 | | | | 1.0 | .96 | 1 | 375 | 115 | 101 | | | |
| 5 | | | | 1.1 | 1.05 | 1.05 | 370 | 115 | 101 | | | |
| 6 | | | | 1.2 | 1.16 | 1.09 | 370 | 115 | 101 | | | |
| 7 | | | | 1.2 | 1.16 | 1.09 | 375 | 116 | 101 | | | |
| 8 | | | | 1.2 | 1.16 | 1.09 | 375 | 116 | 102 | | | |
| 9 | | | | — | | | | | | | | |
| 10 | | | | 1.3 | 1.26 | 1.14 | 390 | 116 | 102 | | | |
| 11 | | | | 1.5 | 1.42 | 1.27 | 400 | 116 | 102 | | | |
| 12 | | | | 1.5 | 1.42 | 1.27 | 400 | 116 | 102 | | | |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 1 | | | | 1.2 | 1.16 | 1.09 | 390 | 116 | 103 | 250 | 60 | |
| 2 | | | | 1.2 | 1.16 | 1.09 | 385 | 116 | 103 | | | |
| 3 | | | | 1.0 | .96 | 1 | 385 | 116 | 103 | | | |
| 4 | | | | 1.0 | .96 | 1 | 385 | 116 | 104 | | | |
| 5 | | | | 0.8 | .77 | .89 | 385 | 116 | 104 | | | |
| 6 | | | | 0.75 | .73 | .87 | 385 | 116 | 104 | | | |
| 7 | | | | ~~0.~~ | | | | | | | | |
| 8 | | | | 0.25 | .25 | .5 | 385 | 116 | 105 | | | |
| 9 | | | | 0.25 | .25 | .5 | 385 | 116 | 105 | | | |
| 10 | | | | 0.25 | .25 | .5 | 385 | 116 | 105 | | | |
| 11 | | | | 0.8 | .77 | .89 | 385 | 116 | 105 | | | |
| 12 | | | | 1.0 | .96 | 1 | 385 | 116 | 105 | | | |
| 1 | | | | 0.1 | 0.1 | .32 | 370 | 116 | 105 | | | |
| 2 | | | | — | | | | | | | | |
| 3 | | | | — | | | | | | | | |
| 4 | | | | — | | | | | | | | |
| 5 | | | | 0.1 | 0.1 | .32 | 390 | 115 | 105 | | | |
| 6 | | | | 0.1 | 0.1 | .32 | 390 | 115 | 105 | | | |
| 7 | | | | 0.1 | 0.1 | .32 | 390 | 115 | 105 | | | |
| 8 | | | | 0.1 | 0.1 | .32 | 390 | 115 | 105 | | | |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 9 | | | | 0.1 | 0.1 | .32 | 380 | 115 | 105 | 250 | 60 | |
| 10 | | | | 0.1 | 0.1 | .32 | 380 | 115 | 105 | ) | ) | |
| 11 | | | | 0.1 | 0.1 | .32 | 380 | 115 | 105 | ) | ) | |
| 12 | | | | 0.1 | 0.1 | .32 | 380 | 115 | 105 | ) | ) | |
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[redacted] Jackson, Mississippi

Boiler #2

## SOURCE SAMPLING FIELD DATA SHEET

Plant Hercules, Inc.

Sampling Location Hattiesburg, Ms.

Date 5-20-76 Run No. 1b

Time Start 12:06 Time End 1:53

Sampling Time/Point 2 min

DB ____ °F, WB ____ °F, VP @ DP ____ "HG

Bar. Press. 30.37 "Hg, Stack Press. 30.38 "Hg

Moisture ____ %, FDA ____, Gas Den. Fac. ____

Weather clear - warm

Temp. ____ °F, W/D ____, W/S ____

Sample Box No. 2 Meter Box No. 1936

Meter ΔH@ 1.95 Pitot Corr. Factor 0.83

Nozzle Dia. 3/16 in., Probe Len. 6 ft.

Probe Heater Set. ____ Nomograph Cf 1.16

Stack Dimensions ____ in

Stack Area ____ $ft^2$

Stack Height ____ ft

Sketch of Stack

Mat'l Processing Rate ____

Final Gas Meter Reading 735.415 ~~40.725~~ $ft^3$

Initial Gas Meter Reading 694.690 $ft^3$

Condensate Increase in Impingers ____ ml

Moisture in Silica Gel ____ gm

Silica Gel Container No. D Filter No. 0109

Orsat: $CO_2$ ____

$O_2$ ____

CO ____

$N_2$ ____

Excess Air ____

Test Conducted by: Blunt / Wells.

Remarks: Leak ck ok 12:07

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) $\sqrt{\Delta H}$ Calc. | Meter Orifice Press. Diff. ("$H_2O$) $\sqrt{\Delta H}$ Actual | Stack Gas Temp. (°F) | Gas Sample Temp. @ Dry Gas Meter (°F) In | Gas Sample Temp. @ Dry Gas Meter (°F) Out | Sample Box Temp. (°F) | Last Impinger Temp. (°F) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| #1 1 | | | ~~694.7~~ ~~0.65~~ | 0.65 | 0.64 | .81 | 395 | 102 | 98 | 250 | 60 | 1 |
| 2 | | | 695.5 | 0.70 | 0.69 | .64 | 390 | 103 | 98 | " | " | 1 |
| 3 | | | 696.5 | 0.10 | 0.10 | .32 | 390 | 104 | 98 | " | " | 1 |
| 4 | | | 696.9 | 0.80 | 0.78 | .49 | 390 | 106 | 98 | | | 1 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 5 | | | 697.8 | .80 | .78 | .89 | 390 | 110 | 100 | 250 | 60 | 1 |
| 6 | | | 699.0 | 1.2 | 1.16 | 1.09 | 395 | 112 | 100 | | | 1 |
| 7 | | | 700.1 | 1.6 | 1.51 | 1.26 | 400 | 115 | 100 | | | 1 |
| 8 | | | 701.3 | 1.3 | 1.26 | 1.14 | 390 | 116 | 101 | | | 2 |
| 9 | | | 702.7 | 0.9 | 0.87 | .95 | 395 | 118 | 103 | | | 2 |
| 10 | | | 703.8 | 1.0 | 0.96 | 1 | 390 | 120 | 103 | | | ~~3~~ 2 |
| 11 | | | 704.8 | 0.9 | ~~0.87~~ | .95 | 395 | 122 | 103 | | | 2 |
| 12 | | | 705.9 | 1.0 | 0.96 | 1 | 390 | 122 | 103 | | | 2 |
| #2 1 | | | 707.0 | 0.65 | 0.64 | .61 | 390 | 117 | 104 | | | 1 |
| 2 | | | 707.9 | 0.75 | 0.73 | .87 | 410 | 119 | 104 | | | 1 |
| 3 | | | 708.9 | 0.90 | 0.87 | .95 | 400 | 120 | 104 | | | 1 |
| 4 | | | 709.8 | 1.10 | 1.05 | 1.05 | 400 | 120 | 104 | | | 1 |
| 5 | | | 711.1 | 0.75 | 0.73 | .87 | 390 | 120 | 106 | | | 1 |
| 6 | | | 712.0 | 0.55 | 0.54 | .74 | 390 | 120 | 106 | | | 1 |
| 7 | | | 713.1 | 1.60 | ~~1.60~~ 1.51 | 1.26 | 390 | 120 | 106 | | | 1 |
| 8 | | | 714.1 | 1.0 | 0.96 | 1 | 390 | 120 | 106 | | | 1 |
| 9 | | | 715.3 | 1.0 | 0.96 | 1 | 390 | ~~120~~ 122 | 106 | | | 1 |
| 10 | | | 716.4 | 0.95 | 0.92 | .97 | 390 | 122 | 106 | | | 1 |
| 11 | | | 717.4 | 1.0 | 0.96 | 1 | 390 | 122 | 106 | | | 1 |
| 12 | | | 718.5 | 1.0 | 0.96 | 1 | 390 | 122 | 106 | | | 1 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual # | | In | Out | | | |
| #3 1 | | | 719.6 | 0.65 | 0.64 | .61 | 395 | 122 | 110 | 250 | 60 | 1 |
| 2 | | | 720.6 | 0.90 | 0.88 | .95 | 395 | 122 | 110 | | | 2 |
| 3 | | | 721.7 | 0.90 | 0.87 | .95 | 395 | 122 | 110 | | | 2 |
| 4 | | | 722.7 | 0.80 | 0.77 | .89 | 390 | 122 | 111 | | | 1 |
| 5 | | | 723.7 | 0.90 | 0.87 | .95 | 390 | 124 | 111 | | | 1 |
| 6 | | | 724.8 | 0.90 | 0.87 | .95 | 390 | 124 | 111 | | | 1 |
| 7 | | | 725.8 | 0.10 | 0.10 | .32 | 390 | 126 | 112 | | | 1 |
| 8 | | | 726.3 | 0.30 | 0.30 | .56 | 390 | 124 | 112 | | | 1 |
| 9 | | | 726.9 | 0.30 | 0.30 | .56 | 390 | 124 | 112 | | | 1 |
| 10 | | | 727.7 | 0.40 | 0.40 | .63 | 395 | 124 | 112 | | | 1 |
| 11 | | | 728.3 | 0.40 | 0.40 | .63 | 395 | 124 | 112 | | | 1 |
| 12 | | | 729.1 | 0.40 | 0.40 | .63 | 395 | 124 | 112 | | | 1 |
| #4 1 | | | 729.8 | 0.30 | 0.30 | .56 | 395 | 120 | 112 | | | 1 |
| 2 | | | 730.4 | 0.30 | 0.30 | .56 | 395 | 120 | 112 | | | 1 |
| 3 | | | 731.1 | 0.25 | 0.25 | .5 | 395 | 120 | 112 | | | 1 |
| 4 | | | 731.7 | 0.10 | 0.10 | .32 | 395 | 120 | 112 | | | 1 |
| 5 | | | 732.1 | 0.10 | 0.10 | .32 | 395 | 120 | 112 | | | 1 |
| 6 | | | 732.5 | ~~0.10~~ | 0.10 | .32 | 395 | 120 | 112 | | | 1 |
| 7 | | | 733.0 | 0.10 | 0.10 | .32 | 395 | 120 | 112 | | | 1 |
| 8 | | | 733.4 | 0.10 | 0.10 | .32 | 390 | 120 | 112 | | | 1 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 9 | | | 733.8 | 0.10 | 0.10 | .32 | 400 | 120 | 114 | 250 | 60 | 1 |
| 10 | | | 734.2 | 0.10 | 0.10 | .32 | 400 | 120 | 114 | | | 1 |
| 11 | | | 734.6 | 0.10 | 0.10 | .32 | 400 | 120 | 114 | | | 1 |
| 12 | | | 734.9 | 0.10 | 0.10 | .32 | 410 | 120 | 114 | | | 1 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | |

[redacted] IRONMENTAL PROTECTION SYSTEMS
Jackson, Mississippi

Date 2

## SOURCE SAMPLING FIELD DATA SHEET

Plant Hercules, Inc.

Sampling Location Hattiesburg, Ms

Date 5-21-76 Run No. 2 b

Time Start 8:24 Time End 10:15

Sampling Time/Point 2 min

DB ____ °F, WB ____ °F, VP @ DP ____ "HG

Bar. Press. 30.23 "Hg, Stack Press. 30⅓ "Hg

Moisture ____ %, FDA ____, Gas Den. Fac. ____

Weather ____

Temp. ____ °F, W/D ____, W/S ____

Sample Box No. 2 Meter Box No. 1936

Meter ΔH@ 1.9 Pitot Corr. Factor 0.83

Nozzle Dia. 3/16 in., Probe Len. 6 ft.

Probe Heater Set. ____ Nomograph Cf 1.16

Stack Dimensions ____ in

Stack Area ____ $ft^2$

Stack Height ____ ft

Sketch of Stack

Mat'l Processing Rate ____

Final Gas Meter Reading 816.026 → 40.82 $ft^3$

Initial Gas Meter Reading 775.206 $ft^3$

Condensate Increase in Impingers ____ ml

Moisture in Silica Gel ____ gm

Silica Gel Container No. B Filter No. 0111

Orsat: $CO_2$ ____

$O_2$ ____

CO ____

$N_2$ ____

Excess Air ____

Test Conducted by: Blunt / Wells

Remarks: Leak ck ok

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) Calc. | Meter Orifice Press. Diff. ("$H_2O$) Actual (ΔH) | Stack Gas Temp. (°F) | Gas Sample Temp. @ Dry Gas Meter (°F) In | Gas Sample Temp. @ Dry Gas Meter (°F) Out | Sample Box Temp. (°F) | Last Impinger Temp. (°F) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| #4 1 | | | 775.2 | .25 | .25 | .5 | 385 | 67 | 64 | 250 | 60 | 1 |
| 2 | | | 775.7 | .40 | .39 | .63 | 385 | 68 | 64 | ) | ) | 1 |
| 3 | | | 776.4 | .25 | .25 | .5 | 385 | 70 | 65 | ) | ) | 1 |
| 4 | | | 776.0 | .10 | .10 | .32 | 385 | 72 | 66 | | | 1 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) $\Delta H$ | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 5 | | | ~~774.5~~ 777.5 | .1 | .1 | .32 | 380 | 74 | 66 | 250 | 60 | 1 |
| 6 | | | 777.9 | .1 | .1 | .32 | 380 | 74 | 68 | | | 1 |
| 7 | | | 778.2 | .1 | .1 | .32 | 380 | 76 | 70 | | | 1 |
| 8 | | | 778.6 | — | | | | | | | | |
| 9 | | | 778.6 | .1 | .1 | .32 | 380 | 79 | 72 | | | 1 |
| 10 | | | 779.0 | .15 | .15 | .39 | 385 | 80 | 73 | | | 1 |
| 11 | | | 779.4 | .30 | .30 | .55 | 380 | 82 | 74 | | | 1 |
| 12 | | | 780.0 | .30 | .30 | .55 | 380 | 84 | 75 | | | 1 |
| #3 1 | | | 780.7 | .75 | .73 | .67 | 375 | 86 | 78 | | | 1 |
| 2 | | | 781.6 | .85 | .82 | .92 | 385 | 90 | 79 | | | 2 |
| 3 | | | 782.7 | .85 | .82 | .92 | 385 | 93 | 80 | | | 2 |
| 4 | | | 783.7 | .85 | .82 | .92 | 385 | 95 | 81 | | | 2 |
| 5 | | | 784.6 | .70 | .68 | .84 | 385 | 98 | 83 | | | 1 |
| 6 | | | 785.8 | .90 | .87 | .95 | 380 | 100 | 84 | | | 1 |
| 7 | | | 786.7 | .45 | .44 | .67 | 380 | 101 | 85 | | | 1 |
| 8 | | | 787.5 | .20 | .20 | .45 | 380 | 101 | 86 | | | 1 |
| 9 | | | 788.0 | .45 | .44 | .67 | 380 | 101 | 87 | | | 1 |
| 10 | | | 788.7 | .85 | .82 | .92 | 385 | 101 | 87 | | | 1 |
| 11 | | | 789.9 | .85 | .82 | .92 | 385 | 103 | 88 | | | 2 |
| 12 | | | 790.8 | 1.2 | 1.16 | 1.09 | 395 | 106 | 90 | | | 4 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| #2 1 | | | 791.9 | ~~.65~~ .65 | .64 | .61 | 400 | 106 | 92 | 250 | 60 | 1 |
| 2 | | | 792.9 | .75 | .73 | .67 | 410 | 108 | 93 | | | 1 |
| 3 | | | 793.8 | .75 | .73 | .67 | 400 | 108 | 93 | | | 1 |
| 4 | | | 794.9 | 1.0 | .96 | 1 | 400 | 110 | 94 | | | 3 |
| 5 | | | 795.9 | 1.0 | .96 | 1 | 400 | 112 | 94 | | | 3 |
| 6 | | | 796.9 | 1.0 | .96 | 1 | 410 | 112 | 95 | | | 3 |
| 7 | | | 798.2 | 1.0 | .96 | 1 | 410 | 112 | 95 | | | 3 |
| 8 | | | 799.2 | 1.0 | .96 | 1 | 400 | 113 | 96 | | | 3 |
| 9 | | | 800.3 | .75 | .73 | .67 | 390 | 114 | 97 | | | ~~3~~ 2 |
| 10 | | | 801.3 | .75 | .73 | .67 | 390 | 114 | 98 | | | ~~3~~ 2 |
| 11 | | | 802.2 | 1.0 | .96 | 1 | 385 | 114 | 98 | | | 3 |
| 12 | | | 803.4 | 1.2 | 1.16 | 1.09 | 385 | 114 | 98 | | | 3 |
| #1 1 | | | 804.6 | 0.65 | 0.64 | .61 | 390 | 108 | 99 | | | ~~3~~ 2 |
| 2 | | | 805.5 | 0.75 | 0.73 | .67 | 395 | 110 | 100 | | | 2 |
| 3 | | | 806.4 | —— | | | | ~~###~~ | | | | |
| 4 | | | 806.4 | 0.45 | 0.44 | .67 | 380 | 111 | 100 | | | 1 |
| 5 | | | 807.3 | 1.0 | .96 | 1 | 380 | 112 | 100 | | | 1 |
| 6 | | | ~~808.3~~ 808.3 | 1.2 | 1.16 | 1.09 | 380 | 114 | 100 | | | 4 |
| 7 | | | 809.6 | 1.5 | 1.42 | 1.22 | 380 | 116 | 102 | | | 6 |
| 8 | | | 810.8 | 1.0 | .96 | 1 | 380 | 118 | 102 | | | 6 |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 9 | | | 812.0 | 0.80 | 0.77 | .89 | 380 | 118 | 102 | 250 | 60 | 1 |
| 10 | | | 813.0 | 0.80 | 0.77 | .89 | 380 | 118 | 102 | | | 1 |
| 11 | | | 813.9 | 0.80 | 0.77 | .89 | 380 | 118 | 102 | | | 1 |
| 12 | | | 815.0 | 0.90 | 0.87 | .95 | 380 | 118 | 102 | | | 1 |

[redacted]IRO[redacted]NTA[redacted]OTE[redacted]N S[redacted]EMS
Jackson, Mississippi

boiler 2

SOURCE SAMPLING FIELD DATA SHEET

Plant Hercules, Inc

Sampling Location Hattiesburg, Ms.

Date 5-21-76 Run No. 3b

Time Start 1:00 Time End 2:45

Sampling Time/Point 2 min

DB ____ °F, WB ____ °F, VP @ DP ____ "HG

Bar. Press. 30.23 "Hg, Stack Press. 30.24 "Hg

Moisture ____ %, FDA ____, Gas Den. Fac. ____

Weather clear--warm

Temp. ____ °F, W/D ____, W/S ____

Sample Box No. 2 Meter Box No. 1936

Meter ΔH@ 1.90 Pitot Corr. Factor 0.83

Nozzle Dia. 3/16 in., Probe Len. 6 ft.

Probe Heater Set. ____ Nomograph Cf 1.16

Stack Dimensions ____ in

Stack Area ____ ft²

Stack Height ____ ft

Sketch of Stack

Mat'l Processing Rate ____

Final Gas Meter Reading 895. ft³

Initial Gas Meter Reading 855.462 ft³

Condensate Increase in Impingers ____ ml

Moisture in Silica Gel ____ gm

Silica Gel Container No. ____ Filter No. 0116

Orsat: $CO_2$ ____

$O_2$ ____

CO ____

$N_2$ ____

Excess Air ____

Test Conducted by: Blunt / Wells

Remarks: Leak ck ok 12:50

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading (ft³) | Stack Velocity Head ("H2O) | Meter Orifice Press. Diff. ("H2O) Calc. | Meter Orifice Press. Diff. ("H2O) Actual | Stack Gas Temp. (°F) | Gas Sample Temp.@Dry Gas Meter (°F) In | Gas Sample Temp.@Dry Gas Meter (°F) Out | Sample Box Temp. (°F) | Last Impinger Temp. (°F) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| #4 1 | | | 855.4 | .2 | .2 | .45 | 385 | 97 | 97 | 250 | 60 | |
| 2 | | | | .4 | .39 | .63 | 385 | 98 | 97 | | | |
| 3 | | | | .25 | .25 | .5 | 385 | 98 | 97 | | | |
| 4 | | | | .1 | .1 | .32 | 385 | 98 | 97 | | | |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) $\Delta H$ | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 5 | | | | .1 | .1 | .32 | 385 | 98 | 97 | 250 | 60 | |
| 6 | | | | .1 | .1 | .32 | 385 | 99 | 97 | | | |
| 7 | | | | .1 | .1 | .32 | 385 | 99 | 97 | | | |
| 8 | | | | .1 | .1 | .32 | 385 | 99 | 98 | | | |
| 9 | | | | — | | | | | | | | |
| 10 | | | | .15 | .15 | .39 | 380 | 99 | 98 | | | |
| 11 | | | | .30 | .3 | .55 | 390 | 100 | 98 | | | |
| 12 | | | | .3 | .3 | .55 | 380 | 100 | 98 | | | |
| #3 1 | | | | .75 | .73 | .87 | 390 | 101 | 98 | | | |
| 2 | | | | .75 | .73 | .87 | 390 | 102 | 98 | | | |
| 3 | | | | .85 | .83 | .92 | 390 | 104 | 99 | | | |
| 4 | | | | .85 | .83 | .92 | 390 | 105 | 99 | | | |
| 5 | | | | .90 | .87 | .95 | 390 | 105 | 99 | | | |
| 6 | | | | .4 | .39 | .63 | 395 | 106 | 99 | | | |
| 7 | | | | .25 | .25 | .5 | 395 | 106 | 100 | | | |
| 8 | | | | .45 | .44 | .67 | 395 | 106 | 100 | | | |
| 9 | | | | .45 | .44 | .67 | 395 | 106 | 100 | | | |
| 10 | | | | .85 | .82 | .92 | 390 | 107 | 100 | | | |
| 11 | | | | .85 | .82 | .92 | 390 | 107 | 100 | | | |
| 12 | | | | 1.2 | 1.16 | 1.09 | 385 | 108 | 101 | | | |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| #2 1 | | | | .70 | .69 | .84 | 400 | 109 | 101 | 250 | 60 | |
| 2 | | | | .75 | .73 | .87 | 400 | 110 | 101 | | | |
| 3 | | | | .75 | .73 | .87 | 400 | 110 | 102 | | | |
| 4 | | | | 1.0 | .96 | 1 | 400 | 111 | 102 | | | |
| 5 | | | | 1.0 | .96 | 1 | 410 | 112 | 102 | | | |
| 6 | | | | 1.0 | .96 | 1 | 410 | 112 | 102 | | | |
| 7 | | | | 1.0 | .96 | 1 | 400 | 113 | 103 | | | |
| 8 | | | | 1.0 | .96 | 1 | 400 | 115 | 103 | | | |
| 9 | | | | 1.0 | .96 | 1 | 390 | 117 | 104 | | | |
| 10 | | | | .75 | .73 | .87 | 390 | 118 | 105 | | | |
| 11 | | | | 1.0 | 0.96 | 1 | 390 | 118 | 105 | | | |
| 12 | | | | 1.2 | 1.16 | 1.09 | 390 | 118 | 105 | | | |
| 1 | | | | 0.65 | 0.64 | .81 | 380 | 118 | 105 | | | |
| 2 | | | | 0.65 | 0.64 | .81 | 380 | 118 | 105 | | | |
| 3 | | | | 0.4 | 0.39 | .63 | 380 | 118 | 105 | | | |
| 4 | | | | — | | | | | | | | |
| 5 | | | | 1.0 | .96 | 1 | 385 | 119 | 106 | | | |
| 6 | | | | 1.2 | 1.16 | 1.09 | 385 | 119 | 106 | | | |
| 7 | | | | 1.3 | 1.26 | 1.14 | 385 | 119 | 106 | | | |
| 8 | | | | 1.3 | 1.26 | 1.14 | 385 | 119 | 106 | | | |

| Port and Traverse Point No. | Distance From Inside Stack Wall (in.) | Clock Time | Gas Meter Reading ($ft^3$) | Stack Velocity Head ("$H_2O$) | Meter Orifice Press. Diff. ("$H_2O$) $\sqrt{H}$ | | Stack Gas Temp. ($^oF$) | Gas Sample Temp.@ Dry Gas Meter ($^oF$) | | Sample Box Temp. ($^oF$) | Last Impinger Temp. ($^oF$) | Vacuum on Sample Train ("Hg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calc. | Actual | | In | Out | | | |
| 9 | | | | 0.80 | 0.77 | .49 | 380 | 119 | 106 | 250 | 60 | |
| 10 | | | | 0.80 | 0.77 | .89 | 380 | 119 | 106 | | | |
| 11 | | | | 0.80 | 0.77 | .89 | 380 | 119 | 106 | | | |
| 12 | | | | 0.90 | 0.87 | .95 | 380 | 119 | 106 | | | |
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Boiler # 1 3/8" nozzle

METHOD 5

Form RF-5

Pbar = 29.36

| | Run #1 | Run #2 | Run #3 |
|---|---|---|---|
| Average stack temperature; Ts(°R) | 847.1 | 847.1 | 820 |
| Average dry gas meter temperature: Tm(°R) | | | |
| Tm = $\frac{(\text{avg. temp. in}) + (\text{Avg. temp. out})}{2}$ = | 555 | 570 | 568 |
| Average orifice pressure drop: ΔH (Inches $H_2O$) | | | |
| From data sheet ΔH = | 0.95 | 0.78 | 0.74 |
| Gas volume through meter: Vm($ft^3$) = | 43.76 | 41.52 | 40.69 |
| Dry gas volume: $Vm_{std}$ (std. conditions, $ft^3$) | | | |
| $Vm_{std} = \left(17.71 \frac{°R}{\text{In. Hg}}\right) Vm \left(\frac{Pbar + \frac{\Delta H}{13.6}}{Tm}\right)$ = | 42.50 | 39.25 | 38.42 |
| Volume of water collected: Vlc(ml) = | 28 | 27 | 24 |
| Volume of water vapor: $Vw_{std}$ (std. conditions, $ft^3$) | | | |
| $Vw_{std} = 0.0474 \frac{ft^3}{ml}$ Vlc = | 1.33 | 1.28 | 1.14 |
| Moisture content: Bwo (proportion, dimensionless) | | | |
| $Bwo = \frac{Vw_{std}}{Vm_{std} + Vw_{std}}$ = | 0.0303 | 0.0316 | 0.0288 |

Pitot tube coefficient: Cp (from calibration)

$Cp_{(s)} = Cp_{(std)} \sqrt{\frac{\Delta P_{(std)}}{\Delta P_{(s)}}} =$ .83

Average square root of ΔP:

$(\sqrt{\Delta P})_{avg.}$ [redacted]

$(\sqrt{\Delta P})_{avg.} = \frac{\sum_{i=1}^{n} \Delta P}{n} =$

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| 0.97 | 0.89 | 0.83 |

Stack pressure: Ps (in. Hg)

Ps =

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| 30.38 | 30.38 | 30.24 |

Molecular wt. of stack gas:
Ms (lb/lb-mole) wet basis

Ms =

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| 29.01 | 29.00 | 29.03 |

Average stack gas velocity: Vs (f/s)

$(Vs)_{avg} = Kp\ Cp\ (\sqrt{\Delta P})_{avg.} \sqrt{\frac{(Ts)_{avg}}{Ps\ Ms}} =$

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| 67.47 | 61.91 | 58.89 |

Stack gas volumetric flow rate: Qs($ft^3$/hr)

$Qs = 3600(1-Bwo)(Vs)(A)\left(\frac{T_{std}}{(Ts)_{avg}}\right)\left(\frac{Ps}{P_{std}}\right) =$

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| (3194972.1) | (2927153.1) | (2792988.2 |

Acetone blank correction: Ac(mg)

$Ac = \frac{Rab}{Vag}\ Vaw =$

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| ____ | ____ | ____ |

Total particulate sample weight: Mn (mg)

$Mn = Mn_1 + Mn_2 - Ac =$

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| 243.2 | 240.2 | 225.7 |

Particulate concentration: C's
(gr./s.c.f.)

$C's = 0.0154 \frac{gr.}{mg.} \left( \frac{Mn}{Vm_{std}} \right) =$

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| 0.138 | 0.140 | 0.148 |

Conversion:

Convert C's to units comparable to the applicable regulation:

Calculation: (show units)

$C_s \times Q_s \times \frac{1}{7000} =$

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| 62.98 | 61.14 | 58.07 |

Isokinetic Variation: I

$$I = \frac{Ts \left( 1.667 \frac{min.}{sec.} \right) \left[ \left( 0.00267 \frac{in.\ Hg\text{-}ft.^3}{ml.\text{-}^\circ R} \right) Vlc + \frac{Vm}{Tm} \left( Pbar + \frac{\Delta H}{13.6} \right) \right]}{\theta Vs\ Ps\ An} =$$

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| 98% | 92% | 92% |

Comments:

(Add attachments as necessary)

Form RE-5

Boiler #2 3/8" Nozzle

METHOD 5

| | Run #1 | Run #2 | Run #3 |
|---|---|---|---|
| Average stack temperature; Ts(°R) | 848 | 848 | 839 |
| Average dry gas meter temperature: Tm(°R) | | | |
| Tm = $\frac{\text{(avg. temp. in)+(Avg. temp. out)}}{2}$ = | 554 | 570 | 571 |
| Average orifice pressure drop: ΔH (Inches $H_2O$) | | | |
| From data sheet ΔH = | 0.67 | 0.66 | 0.64 |
| Gas volume through meter: Vm($ft^3$) = | 40.70 | 39.31 | 38.90 |
| Dry gas volume: $Vm_{std}$ (std. conditions, $ft^3$) | | | |
| $Vm_{std} = \left(17.71 \frac{°R}{\text{In. Hg}}\right) Vm \left(\frac{Pbar + \frac{\Delta H}{13.6}}{Tm}\right)$ = | 39.58 | 37.21 | 36.53 |
| Volume of water collected: Vlc(ml) = | 17 | 16 | 14 |
| Volume of water vapor: $Vw_{std}$ (std. conditions, $ft^3$) | | | |
| $Vw_{std} = 0.0474 \frac{ft^3}{ml} Vlc$ = | 0.81 | 0.76 | 0.66 |
| Moisture content: Bwo (proportion, dimensionless) | | | |
| $Bwo = \frac{Vw_{std}}{Vm_{std} + Vw_{std}}$ = | 0.020 | 0.02 | 0.018 |

Pitot tube coefficient: Cp (from calibration)

$Cp_{(s)} = Cp_{(std)} \sqrt{\frac{\Delta P_{(std)}}{\Delta P_{(s)}}} =$ .83

Average square root of ΔP:

$(\sqrt{\Delta P})_{avg.}$ [illegible]

$(\sqrt{\Delta P})_{avg.} = \frac{\sum_{i=1}^{n} \Delta P}{n} =$

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| 0.79 | 0.74 | 0.78 |

Stack pressure: Ps (in. Hg)

Ps =

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| 30.38 | 30.38 | 30.24 |

Molecular wt. of stack gas:
Ms (lb/lb-mole) wet basis

Ms =

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| 29.13 | 29.13 | 29.16 |

Average stack gas velocity: Vs (f/s)

$(Vs)_{avg} = Kp\ Cp\ (\sqrt{\Delta P})_{avg.} \sqrt{\frac{(Ts)_{avg}}{Ps\ Ms}} =$

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| 54.97 | 51.48 | 54.06 |

Stack gas volumetric flow rate: Qs ($ft^3$/hr)

$Qs = 3600(1-Bwo)(Vs)(A)\left(\frac{T_{std}}{(Ts)_{avg}}\right)\left(\frac{Ps}{P_{std}}\right) =$

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| (259971.9) | (24[illegible]9162) | 306958 |

Acetone blank correction: Ac(mg)

$Ac = \frac{Rab}{Vag}\ Vaw =$

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| ____ | ____ | ____ |

Total particulate sample weight: Mn (mg)

$Mn = Mn_1 + Mn_2 - Ac =$

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| 425.2 | 156.6 | 290.9 |

Particulate concentration: C's
(gr./s.c.f.)

$C's = 0.0154 \frac{gr.}{mg.} \left( \frac{Mn}{Vm_{std}} \right) =$

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| 0.165 | 0.066 | 0.123 |

Conversion:

Convert C's to units comparable to the applicable regulation:

Calculation: (show units)

C's x QS x $\frac{1}{7000}$ =

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| 61.45 | 22.98 | 53.92 |

Isokinetic Variation: I

$$I = \frac{Ts \left( 1.667 \frac{min.}{sec.} \right) \left[ \left( 0.00267 \frac{in.\ Hg\text{-}ft.^3}{ml.\text{-}^\circ R} \right) Vlc + \frac{Vm}{Tm} \left( Pbar + \frac{\Delta H}{13.6} \right) \right]}{\theta Vs\ Ps\ An} =$$

| Run #1 | Run #2 | Run #3 |
|---|---|---|
| 106% | 104% | 98% |

Comments:

(Add attachments as necessary)

ES.

Name: Hercules Inc. Address P.O. Box 1937 Wilmington, Hawkesbury, VA 23401

Page ___ of ___

EMS No. [illegible] Plant Type: Resin Extraction & Chemical Mfg.

(x) Major ( ) Minor (x) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Ref # 234 | |
| Emission Point No. | 001 | |
| Emission Data Stack | | |
| Stack Height | 40' | Sept 72 Apl for PTC |
| Assumed Stack Height | | |
| Exit Gas Temperature | 100°F | |
| Exit Diameter | 0.33' | |
| Exit Velocity | 77.4 FPS | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | ton/yr | Date | |
|---|---|---|---|---|---|
| Current Allowable | PM * | 46.5 | .204 | | file |
| | $SO_2$ | | | | |
| | $NO_x$ | | | | |
| | CO | | | | |
| | HC | | | | |
| | Other | | | | |
| Current Actual | PM | | | | |
| | $SO_2$ | | | | |
| | $NO_x$ | | | | |
| | CO | | | | |
| | HC | | | | |
| Methyl Ethyl Ketone | Other | | | | |
| Current Potential | PM | | | | |
| | $SO_2$ | | | | |
| | $NO_x$ | | | | |
| | CO | | | | |
| | HC | | | | |
| | Other | | | | |

| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
|---|---|---|---|---|---|---|---|
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone 16 AQCR 005

UTM North 3469.2 Km Lat. 31° 20' "

UTM East 280.6 Km Long. 89° 18' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | 24 | 7 | 52 |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments [illegible]

:S

Name: _____ Address _____

EMS No. / / - / / / - / / / / Plant Type: _____

( ) Major ( ) Minor ( ) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Ref #5 | |
| Emission Point No. | 001 | |
| Emission Data Stack | | |
| Stack Height | 40' | Sept 72 Hpl for PTO |
| Assumed Stack Height | | |
| Exit Gas Temperature | 92°F | " |
| Exit Diameter | 0.33' | " |
| Exit Velocity | 11.0 fps | [illegible] |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | ton/yr | Date | |
|---|---|---|---|---|---|
| Current Allowable | PM * | 46.5 | 204 | | file |
| | $SO_2$ | | | | |
| | $NO_x$ | | | | |
| | CO | | | | |
| | HC | | | | |
| | Other | | | | |
| Current Actual | PM | | | | |
| | $SO_2$ | | | | |
| | $NO_x$ | | | | |
| | CO | | | | |
| | HC | | | | |
| Philips | Other Control ID | | | | |
| Current Potential | PM | | | | |
| | $SO_2$ | | | | |
| | $NO_x$ | | | | |
| | CO | | | | |
| | HC | | | | |
| | Other | | | | |

| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
|---|---|---|---|---|---|---|---|
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone _____ AQCR _____

UTM North _____ Km Lat. ° ' "

UTM East _____ Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject _____

NSPS _____

NESHAPS _____

SCC Code _____ SIC Code _____

Area _____

Comments No emissions of primary [illegible] according to file.

* using the [illegible] [illegible] [illegible] [illegible] source

Name: Hercules Inc  Address [illegible]  Page ____ of ____

ES

EMS No. 1/1/0-0/1/0/0-0/0/0/0/1  Plant Type: ____

(✓) Major ( ) Minor (✓) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Tall Oil Plant (Broach Hot Oil Boiler) | |
| Emission Point No. | 003 | |
| Emission Data Stack | | |
| Stack Height | 85' | Jan 74 API for PTO |
| Assumed Stack Height | | ↓ |
| Exit Gas Temperature | 463°F | ↓ |
| Exit Diameter | 4' | ↓ |
| Exit Velocity | 29.6 fps | ↓ |
| Volumetric Flowrate | 22,318 CFM | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | 10.0 | | 43.9 | | Jan 74 | See Attached Calculation |
| | $SO_2$ | 88.8 | | 388.9 | | " | ↓ |
| | $NO_x$ | | | | | | ↓ |
| | CO | | | | | | ↓ |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | 0.2 | | 0.8 | | " | |
| | $SO_2$ | * | | * | | " | |
| | $NO_x$ | 3.2 | | 13.9 | | " | |
| | CO | 0.3 | | 1.3 | | " | |
| | HC | * | | 0.2 | | " | |
| | Other | | | | | | |
| Current Potential | PM | 0.4 | | 1.8 | | " | |
| | $SO_2$ | * | | 0.1 | | " | |
| | $NO_x$ | 6.1 | | [illegible] | | " | |
| | CO | 0.6 | | [illegible] | | " | |
| | HC | 0.1 | | [illegible] | | " | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | 0.2 | 10.0 | 0.8 | 43.9 | " | |
| | $SO_2$ | * | 88.8 | * | 388.9 | " | |
| | $NO_x$ | 3.2 | | 13.9 | | | |
| | CO | 0.3 | | 1.3 | | | |
| | HC | * | | 0.2 | | | |
| | Other | | | | | | |

UTM Zone ____ AQCR ____

UTM North ____ Km Lat. ____ ° ' "

UTM East ____ Km Long. ____ ° ' "

| Hr/Day | Days/Week | Weeks/Year |
|---|---|---|

Name: Hercules Inc. Address

EMS No. 11110-081010-0101011 Plant Type:
(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Herclor Plant | |
| Emission Point No. | 002 | |
| Emission Data Stack | Flare | |
| Stack Height | 100 ft | |
| Assumed Stack Height | | |
| Exit Gas Temperature | 1700°F | |
| Exit Diameter | 0.167 ft | |
| Exit Velocity | | |
| Volumetric Flowrate | 200 scfm | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | * | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments: ~~Insufficient data to estimate emissions~~
Insignificant emissions

003 Broach Hot Oil Boiler

Natural Gas Combustion

Capacity: 36 MM BTU/hr

Consumption: 158.4 MMCF/yr @ 1025 BTU/CF

8760 hr/yr

I. Allowable

PM

$$\frac{158.4\ MMCF/yr}{\frac{8760\ hr}{yr}} * 1025\ BTU/CF = Q = 18.5\ MMBTU/hr$$

if Q = 18.5 MMBTU/hr => E = 0.54 lb/MMBTU

∴ Allow = 10.0 lb/hr or 43.9 TPY

$SO_2$

use 4.8 lb/MMBTU

=> Allow = 88.8 lb/hr or 388.9 TPY

II Actual

158.4 MMCF/yr * $EF_{N.G.}$ as shown in EF table

III Potential

$$\left(\frac{36\ MMBTU/hr}{1025\ BTU/CF}\right) * EF_{N.G.}$$

above data taken from Jan '94 Apl for PTO

Emission Factors

I Natural Gas

from AP-42 (Sup E) Table 1.4-1

| Pollutant | Emission Factor (EF) (lbs/MMCF) |
|---|---|
| PM | 15 (median of range, 5 |
| $SO_x$ | 0.6 |
| $NO_x$ | 140 (median of range, 120 |
| CO | 17 |
| HC | 3 |

II #2 Fuel Oil (Distillate)

from AP-42 (Sup 3) - Table 1.3-1

| Pollutant | Emission Factor (EF)* (lb/$10^3$ gal) |
|---|---|
| PM | 2 |
| $SO_x$ | 28.8[A.] (142) |
| $NO_x$ | 2.8 |
| CO | 0.63 |
| HC | 0.12 |

A. based on 0.2% Sulfur Content

B @ 1% Sulfur Content

* values used represent

ES

Name: Hercules Inc. Address _____ Page ____ of ____

EMS No. 1/1/0-0/8/0/0-0/0/0/0/1 Plant Type: _____
(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Tall Oil Plant Boilers | |
| Emission Point No. | 004 (Boiler #1) | |
| Emission Data Stack | | |
| Stack Height | 100' | Jan 74 Apl for PTO |
| Assumed Stack Height | | ↓ |
| Exit Gas Temperature | 463° | ↓ |
| Exit Diameter | 4' | ↓ |
| Exit Velocity | 29.6 fps | |
| Volumetric Flowrate | 22,318 CFM | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | 23.8 | | 104.1 | | Jan 74 | See Attached Calculation: |
| | $SO_2$ | 250.5 | | 1097 | | " | ↓ |
| | $NO_x$ | | | | | | ↓ |
| | CO | | | | | | ↓ |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | 2.2 | | 9.5 | | " | |
| | $SO_2$ | 35.2 | | 154 | | " | |
| | $NO_x$ | 11.2 | | 49.2 | | " | |
| | CO | 0.7 | | 3.0 | | " | |
| | HC | 0.1 | | 0.6 | | " | |
| | Other | | | | | | |
| Current Potential | PM | 10.7 | | 46.9 | | " | |
| | $SO_2$ | 147.4 | | 645.6 | | " | |
| | $NO_x$ | 44.2 | | 193.6 | | " | |
| | CO | 2.1 | | 9.2 | | " | |
| | HC | 0.4 | | 1.8 | | " | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | 2.2 | 23.8 | 9.5 | 104 | " | |
| | $SO_2$ | 35.2 | 250.5 | 154 | 1097 | " | |
| | $NO_x$ | 11.2 | | 49.2 | | " | |
| | CO | 0.7 | | 3.0 | | " | |
| | HC | 0.1 | | 0.6 | | " | |
| | Other | | | | | | |

UTM Zone _____ AQCR _____

UTM North _____ Km Lat. ° ' "

UTM East _____ Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject _____

NSPS _____

NESHAPS _____

SCC Code _____ SIC Code _____

Area _____

Comments NOT IN OPERATION NOW

ES

Name: Hercules Inc. Address _____ Page _____ of _____

EMS No. 1116-0180-C0101011 Plant Type: _____
(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | | | Source/Reference |
|---|---|---|---|---|
| Emission Point Description | | Tall Oil Plant Boilers | | |
| Emission Point No. | | 004 (Boiler #2) | | |
| Emission Data | | Stack | | |
| Stack Height | | 100' | | Jan 74 Apl for PTO |
| Assumed Stack Height | | | | ↓ |
| Exit Gas Temperature | | 463° | | |
| Exit Diameter | | 4' | | ↓ |
| Exit Velocity | | 29.6 fps | | |
| Volumetric Flowrate | | 22,318 CFM | | |

| Emission Rates | | lb/hr | ton/yr | Date | |
|---|---|---|---|---|---|
| Current Allowable | PM | 23.8 | 104.1 | Jan 74 | See Attached Calculation |
| | $SO_2$ | 250.5 | 1097 | " | ↓ |
| | $NO^*$ | | | | |
| | CO | | | | |
| | HC | | | | |
| | Other | | | | |
| Current Actual | PM | 2.2 | 9.5 | " | |
| | $SO_2$ | 35.2 | 154 | " | |
| | $NO^*$ | 11.2 | 49.2 | " | |
| | CO | 0.7 | 3.0 | " | |
| | HC | 0.1 | 0.6 | " | |
| | Other | | | | |
| Current Potential | PM | 10.7 | 46.9 | " | |
| | $SO_2$ | 147.4 | 645.6 | " | |
| | $NO^*$ | 44.2 | 193.6 | " | |
| | CO | 2.1 | 9.2 | " | |
| | HC | 0.4 | 1.8 | " | |
| | Other | | | | |

| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
|---|---|---|---|---|---|---|---|
| | PM | 2.2 | 23.8 | 9.5 | 104 | " | |
| | $SO_2$ | 35.2 | 250.5 | 154 | 1097 | " | |
| | $NO^*$ | 11.2 | | 49.2 | | " | |
| | CO | 0.7 | | 3.0 | | " | |
| | HC | 0.1 | | 0.6 | | " | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments

Tall Oil Plant Boilers 004 ← Data taken from Jan 74 Apl for PTO

two Indentical Units

Capacity: 64 MM BTU/hr

Consumption: Resin Pitch 7536 M lb/yr @ 16,800 BTU/lb & 0.26% S
Resin Oils 4455 M lb/yr @ 16,800 BTU/lb & 0.26% S
#6 Fuel Oil 693 M Gal/yr (8 lb/gal) @ 19000 BTU/lb & 2.23% S
Nat. Gas 146,698 MCF/yr @ 1025 BTU/CF

BTU Content:

| | | |
|---|---|---|
| 7536 M lb/yr @ 16,800 BTU/lb | 14.45 | MM BTU/h |
| 4455 M lb/yr @ 16,800 BTU/lb | 8.54 | " |
| 693 M gal/yr @ 19,000 BTU/lb | 12.02 | " |
| 146,698 MCF/yr @ 1025 BTU/CF | 17.17 | " |
| | 52.18 | MM BTU/h |

## I. Allowable Emissions

PM

Q = 52.18 MM BTU/hr => E = 0.46

=> Allow = 23.8 lb/hr or 104.1 TPY

$SO_2$ use 4.8 lb/MM BTU

=> Allow = 250.5 lb/hr or 1097 TPY

## II Potential Emissions

assume #6 Fuel Oil only

(64 MM BTU/hr) (1 lb/19000 BTU) * $EF_{\#6\ oil}$

↳ See EF table attached

continued on back

# Emission Factors

## I Natural Gas

from AP-42 (Sup 8) Table 1.4-1

| Pollutant | Emission Factor (EF) (lbs/MMCF) |
|---|---|
| PM | 10 (median of range, 5-1 |
| $SO_x$ | [illegible] |
| $NO_x$ | 1[illegible]0 (median of range, 120- |
| CO | 17 |
| HC | 8 |

## II # 2 Fuel Oil (Distillate)

from AP-42 (Sup 8) - Table 1.3-1

| Pollutant | Emission Factor (EF)* (lc/$10^3$ gal) |
|---|---|
| PM | 2 |
| $SO_x$ | 144(S) |
| $NO_x$ | 2.8 |
| CO | 0.63 |
| HC | 0.12 |

where S is the Sulfur Content in % by wt.

A. based on 0.2% Sulfur Content EF = 28.8

B @ .1% Sulfur Content EF = 142

Page ____ of ____

Name: Hercules Inc. Address [redacted]

ES

EMS No. [illegible] Plant Type: ____

(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Delnay Plant (flare) | |
| Emission Point No. | 005 | |
| Emission Data Stack | | |
| Stack Height | 100 ft | |
| Assumed Stack Height | | |
| Exit Gas Temperature | 700 °F | |
| Exit Diameter | 0.0417 ft | |
| Exit Velocity | 69 ft/sec | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | 200000 | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | * | | * | | | |
| | $SO_2$ | 35.4 | | 155 | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone ____ AQCR ____

UTM North ____ Km Lat. ____ ° ' "

UTM East ____ Km Long. ____ ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject ____

NSPS ____

NESHAPS ____

SCC Code ____ SIC Code ____

Area ____

Comments [illegible]

Page ____ of ____

Name: Hercules Inc  Address

ES

EMS No. 1116-018100-0010101  Plant Type:
(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Poly-Pale Plant | |
| Emission Point No. | 006 | |
| Emission Data Stack | WATER SCRUBBER | |
| Stack Height ft | 35 | |
| Assumed Stack Height | | |
| Exit Gas Temperature | ambient | |
| Exit Diameter ft | .25 | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | * | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone  AQCR

UTM North  Km  Lat. ° ' "

UTM East  Km  Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code  SIC Code

Area

Comments *Insignificant emissions from natural gas combustion
Insufficient data to determine process emissions

Name: Hercules, Inc

Address

EMS No. 116-0180b-0c0011

Plant Type:

(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Limiting Unit | |
| Emission Point No. | 007 | |
| Emission Data Stack | | |
| Stack Height | | |
| Assumed Stack Height | | |
| Exit Gas Temperature | | |
| Exit Diameter | | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments unit out of operation since 1974

Name: [illegible] Address

EMS No. [illegible] Plant Type:

(✓) Major ( ) Minor (✓) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Rosin Shot | |
| Emission Point No. | 008 | |
| Emission Data Stack | | |
| Stack Height | ft 15 | |
| Assumed Stack Height | | |
| Exit Gas Temperature | ambient | |
| Exit Diameter | ft 1.5 | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | * | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments Insufficient data for estimating emissions.

* [illegible]

11

Name: Hercules Inc. Address _____ Page ____ of ____

EMS No. 1/1/0-0/8/0/0-0/0/0/0/1 Plant Type: _____

(✓) Major ( ) Minor (✓) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Combination Boiler #1 | |
| Emission Point No. | 009 | |
| Emission Data Stack | | |
| Stack Height | 200' | based on May 76 |
| Assumed Stack Height | | Stack test |
| Exit Gas Temperature | 378° | |
| Exit Diameter | 4.6' | |
| Exit Velocity | 62.8 fps | |
| Volumetric Flowrate | 49,531.7 CFM | |

| Emission Rates | | lb/hr | ton/yr | Date | |
|---|---|---|---|---|---|
| Current Allowable | PM | 127.4 | 557.9 | | |
| | $SO_2$ | | | | |
| | $NO_x$ | | | | |
| | CO | | | | |
| | HC | | | | |
| | Other | | | | |
| Current Actual | PM | 60.3 | 264.1 | | |
| | $SO_2$ | | | | |
| | $NO_x$ | | | | |
| | CO | | | | |
| | HC | | | | |
| | Other | | | | |
| Current Potential | PM | 60.3 | 264.1 | | |
| | $SO_2$ | | | | |
| | $NO_x$ | | | | |
| | CO | | | | |
| | HC | | | | |
| | Other | | | | |

| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
|---|---|---|---|---|---|---|---|
| | PM | 60.3 | 127.4 | 264.1 | 557.9 | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone _____ AQCR _____

UTM North _____ Km Lat. ° ' "

UTM East _____ Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject _____

NSPS _____

NESHAPS _____

SCC Code _____ SIC Code _____

Area _____

Comments both units (i.e. boilers #1 & 2) exhaust through same stack

Note these two boilers now have a variance to [illegible]

data taken from May '95 Stack test

Combination Boiler #1 009

2971904.8 CF/hr @ 0.142 gr/DSCF
↑ test result

Actual

$E = (2971904.8\ CF/hr)(0.142\ gr/DSCF)(1\ lb/7000\ gr)$
$= 60.3\ lb/hr$ or $264.1\ TPY$

Allowable use 0.3 gr/DSCF

$E = (2971904.8\ CF/hr)(0.3\ gr/DSCF)(1\ lb/7000\ gr)$
$= 127.4\ lb/hr$ or $557.9\ TPY$

Potential = Actual (No Controls + Continuous Operation)

---

Boiler #2

2701827.5 CF/hr @ 0.116 gr/DSCF

Actual

$E = (2701827.5\ CF/hr)(0.116\ gr/DSCF)(1\ lb/7000\ gr)$
$= 49.2\ lb/hr$ or $215.5\ TPY$

Allowable use 0.3 gr/DSCF

$E = (2701827.5\ CF/hr)(0.3\ gr/DSCF)(1\ lb/7000\ gr)$
$= 115.8\ lb/hr$ or $507.2\ TPY$

Potential = Actual

No Controls - Continuous Operation

See Reverse

Name: Hercules Inc  Address  Page ____ of 11.

EMS No. 1110-018100-010101  Plant Type:
(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Combination Boiler #2 | |
| Emission Point No. | 009 | |
| Emission Data Stack | | |
| Stack Height | 200' | based on May 76 |
| Assumed Stack Height | | Stack Test |
| Exit Gas Temperature | 385° F | ↓ |
| Exit Diameter | 4.6' | |
| Exit Velocity | 53.5 fps | |
| Volumetric Flowrate | 45030.5 CFM | |

| Emission Rates | | lb/hr | | ton/yr | | Date |
|---|---|---|---|---|---|---|
| Current Allowable | PM | 115.8 | | 507.2 | | |
| | $SO_2$ | | | | | |
| | $NO_x$ | | | | | |
| | CO | | | | | |
| | HC | | | | | |
| | Other | | | | | |
| Current Actual | PM | 49.2 | | 215.5 | | |
| | $SO_2$ | | | | | |
| | $NO_x$ | | | | | |
| | CO | | | | | |
| | HC | | | | | |
| | Other | | | | | |
| Current Potential | PM | 49.2 | | 215.5 | | |
| | $SO_2$ | | | | | |
| | $NO_x$ | | | | | |
| | CO | | | | | |
| | HC | | | | | |
| | Other | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | |
| | PM | 49.2 | 115.8 | 215.5 | 507.2 | |
| | $SO_2$ | | | | | |
| | $NO_x$ | | | | | |
| | CO | | | | | |
| | HC | | | | | |
| | Other | | | | | |

UTM Zone  AQCR

UTM North  Km  Lat. ° ' "

UTM East  Km  Long. ° ' "

| | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| Operating Schedule | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code  SIC Code

Area

Comments

ES

Name: Hercules Inc  Address

Page ____ of ____

EMS No. 1/1/0-0/8/0/0-0/0/0/0/1  Plant Type:

(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Combination Boiler #3 | |
| Emission Point No. | 010 | |
| Emission Data Stack | includes Boiler #4 | |
| Stack Height ft | 225 | |
| Assumed Stack Height | | |
| Exit Gas Temperature | 400 °F | |
| Exit Diameter ft | 10 | |
| Exit Velocity ft/sec | 13.6 | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date |
|---|---|---|---|---|---|---|
| Current Allowable | PM | 127.4 | | 557.9 | | |
| | $SO_2$ | | | | | |
| | $NO_x$ | | | | | |
| | CO | | | | | |
| | HC | | | | | |
| | Other | | | | | |
| Current Actual | PM | 69.1 | | 302 | | |
| | $SO_2$ | | | | | |
| | $NO_x$ | | | | | |
| | CO | | | | | |
| | HC | | | | | |
| | Other | | | | | |
| Current Potential | PM | | | | | |
| | $SO_2$ | | | | | |
| | $NO_x$ | | | | | |
| | CO | | | | | |
| | HC | | | | | |
| | Other | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | |
| | PM | | | | | |
| | $SO_2$ | | | | | |
| | $NO_x$ | | | | | |
| | CO | | | | | |
| | HC | | | | | |
| | Other | | | | | |

UTM Zone  AQCR

UTM North  Km  Lat.  ° ' "

UTM East  Km  Long.  ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code  SIC Code

Area

Comments ~~No data available for determination of emissions [illegible] comparible to Boilers [illegible] (cmpt 009)~~

Name: Hercules Inc. Address

Page ____ of ____

EMS No. 11-1910-010001 Plant Type:

(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Combination Boiler #4 | |
| Emission Point No. | 010 | |
| Emission Data Stack | See Combination Boiler #3 | |
| Stack Height | | |
| Assumed Stack Height | | |
| Exit Gas Temperature | | |
| Exit Diameter | | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments No data available for determination of emissions but they are [illegible] to be comparable to boilers #1 & 2 [illegible]

EMS No. 1110-013106-010011 Plant Type:
( ) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Package Boiler #5 | |
| Emission Point No. | 011 | |
| Emission Data Stack | | 3/5/80 |
| Stack Height | 71' | ~~Jan 74~~ Apl for PTO |
| Assumed Stack Height | | |
| Exit Gas Temperature | 250°F | |
| Exit Diameter | 3' | |
| Exit Velocity | 56.3 fps | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | 34.3 | | 150.1 | | Jan 74 | See Attached Calculation |
| | $SO_2$ | 388.3 | | 1700.3 | | " | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | 3.6 | | 37.7 | | " | |
| | $SO_2$ | 115.1 | | 504.3 | | " | |
| | $NO_x$ | 39.8 | | 174.3 | | " | |
| | CO | 5.1 | | 9.4 | | " | |
| | HC | 0.4 | | 1.8 | | " | |
| | Other | | | | | | |
| Current Potential | PM | 26.0 | | 113.9 | | " | |
| | $SO_2$ | 359.3 | | 1573.7 | | " | |
| | $NO_x$ | 107.8 | | 472.2 | | " | |
| | CO | 5.1 | | 22.3 | | " | |
| | HC | 1.0 | | 4.4 | | " | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | 3.6 | 34.3 | 37.7 | 150.1 | " | |
| | $SO_2$ | 115.1 | 388.3 | 504.3 | 1701 | " | |
| | $NO_x$ | 39.8 | | 174.3 | | " | |
| | CO | 5.1 | | 9.4 | | " | |
| | HC | 0.4 | | 1.8 | | " | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments Pre Variance Emissions

Package Boiler #5 (011)

W/o Variance

Capacity: 156 MMBTU/hr

Consumption: 264 MMCF/yr @ 1025 BTU/CF N.G.

$2,880 \times 10^3$ gal/yr @ 19000 BTU/lb #6 Oil

8lb/gal + 2.23% S

8760 hr/yr

Actual

264 MMCF/yr * $EF_{NG}$ ← See table

$2880 \times 10^3$ gal/yr * $EF_{\#6\,oil}$

Allowable

264 MMCF/yr * 1025 BTU/CF 30.9 MMBTU/hr

$2880 \times 10^3$ gal/yr * 19000 BTU/lb 50.0 MMBTU/hr

Q = 80.9 MMBTU/hr

PM

Q = 80.9 MMBTU/hr ⇒ E = 0.42

⇒ A = 34.3 lb/hr or 150.1 TPY

$SO_2$ use 4.8 lb/MMBTU

⇒ A = 388.3 lb/hr or 1700.8 TPY

Potential

assume all #6 Fuel Oil at rated capacity

$$\left[\frac{(156\ \text{MMBTU/hr})}{\left(\frac{19000\ \text{BTU}}{\text{lb}}\right)\left(\frac{8\ \text{lb}}{\text{gal}}\right)}\right] * EF_{\#6\,oil}$$

# #6 Fuel Use Under Variance

Actual

$107.7\ MMCF/yr * EF_{N.G}$

$3936 \times 10^3\ gal * EF_{\#6\ Oil}$

Allowable + Potential

Same as previous calculations

## Emission Factors

III #6 Fuel Oil (Residual)

Table 1.3-1 from AP-42 (Sup 8), Power Plant Use

| Pollutant Type | Emission Factor (EF) (lb / $10^3$ gal) |
|---|---|
| PM | 10(S) + 3 |
| $SO_2$ | 157 (S) |
| $NO_x$ | 105 |
| CO | 5 |
| HC | 1 |

where S is Sulfur in % by wt

IV Coal (Bituminous Coal)

Table 1.1-2 (AP-42, Sup 8)

| Pollutant Type | Emission Factor (EF) lb / ton |
|---|---|
| PM | 16A |
| $SO_x$ | 38S |
| $NO_x$ | 18 |
| CO | — |
| HC | — |

where: A is % by wt of Ash

S is % by wt of Sulfur

, above values for furnace size of >100 MM BTU/hr

ES

Name: Hercules Inc  Address

EMS No. 1/1/0-08/0/0-0/0/0/0/1  Plant Type:
(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Package Boiler #5 | |
| Emission Point No. | 011 | |
| Emission Data Stack | | |
| Stack Height | 71' | Jan 74 Apl for PTO |
| Assumed Stack Height | | |
| Exit Gas Temperature | 360°F | |
| Exit Diameter | 8' | |
| Exit Velocity | 120.4 fps (?) | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | 34.3 | | 150.1 | | Jan 77 | See Attached Calculations |
| | $SO_2$ | 388.3 | | 1700.8 | | " | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | 11.5 | | 50.3 | | " | |
| | $SO_2$ | 157.3 | | 689.0 | | " | |
| | $NO_x$ | 49.3 | | 216.0 | | " | |
| | CO | 2.5 | | 10.8 | | " | |
| | HC | 0.5 | | 2.1 | | " | |
| | Other | | | | | | |
| Current Potential | PM | 26.0 | | 113.9 | | " | |
| | $SO_2$ | 359.3 | | 1573.7 | | " | |
| | $NO_x$ | 107.8 | | 472.2 | | " | |
| | CO | 5.1 | | 22.3 | | " | |
| | HC | 1.0 | | 4.4 | | " | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | 11.5 | 34.3 | 50.3 | 150.1 | " | |
| | $SO_2$ | 157.3 | 388.3 | 689.0 | 1701 | " | |
| | $NO_x$ | 49.3 | | 216.0 | | " | |
| | CO | 2.5 | | 10.8 | | " | |
| | HC | 0.5 | | 2.1 | | " | |
| | Other | | | | | | |

UTM Zone  AQCR

UTM North  Km  Lat. ° ' "

UTM East  Km  Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code  SIC Code

Area

Comments Emissions w/ Variance for increased #6 Fuel Oil Consumption

Name: [illegible] Address: [illegible]

25

EMS No. 1/10-08/00-010/011 Plant Type:

(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Pitch Blowing facility | |
| Emission Point No. | 012 | |
| Emission Data Stack | vents to wood waste boiler | |
| Stack Height | | |
| Assumed Stack Height | | |
| Exit Gas Temperature | | |
| Exit Diameter | | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | * | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments * Insignificant emissions ~~[illegible]~~ natural gas fuel combustion
Insufficient data to [illegible] emissions.

Name: Hercules Inc

Address

EMS No. 1110-0120b-0010011

Plant Type:

(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Pulverized Vinsol Mill | |
| Emission Point No. | 013 | |
| Emission Data Stack | | |
| Stack Height | | |
| Assumed Stack Height | | |
| Exit Gas Temperature | | |
| Exit Diameter | | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments No longer in operation according to Steve West (10/12/77)

Name: Hercules Inc. Address

EMS No. 1/1/0-0/8/0/0-0/0/0/0/1 Plant Type:
(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Truline Flaka Belt & Pack | |
| Emission Point No. | 014 | |
| Emission Data Stack | Baghouse | |
| Stack Height | 40 ft | |
| Assumed Stack Height | | |
| Exit Gas Temperature | 70 °F | |
| Exit Diameter | | |
| Exit Velocity | | |
| Volumetric Flowrate | 2100 cfm | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO^x$ | | | | | | |
| | $CO^x$ | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | * | | | | | |
| | $SO_2$ | | | | | | |
| | $NO^x$ | | | | | | |
| | $CO^x$ | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO^x$ | | | | | | |
| | $CO^x$ | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | PM | Act. | All. | Act. | All. | | |
| | $SO_2$ | | | | | | |
| | $NO^x$ | | | | | | |
| | $CO^x$ | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments ~~Insufficient data to determine process emissions.~~

* Insignificant emissions

ES

Name: Hercules Inc. Address

EMS No. 1/1/0-0/8/0/0-0/0/0/0/1 Plant Type:
(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Hard Resins Area | |
| Emission Point No. | 015 | |
| Emission Data | Stack | |
| Stack Height | 6 ft | |
| Assumed Stack Height | | |
| Exit Gas Temperature | 70°F | |
| Exit Diameter | 1.5 ft | |
| Exit Velocity | [illegible] ft/sec | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | ton/yr | Date | |
|---|---|---|---|---|---|
| Current Allowable | PM | | | | |
| | $SO_2$ | | | | |
| | $NO^x$ | | | | |
| | $CO^x$ | | | | |
| | HC | | | | |
| | Other | | | | |
| Current Actual | PM | < | | | |
| | $SO_2$ | | | | |
| | $NO^x$ | | | | |
| | $CO^x$ | | | | |
| | HC | | | | |
| | Other | | | | |
| Current Potential | PM | | | | |
| | $SO_2$ | | | | |
| | $NO^x$ | | | | |
| | $CO^x$ | | | | |
| | HC | | | | |
| | Other | | | | |

| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
|---|---|---|---|---|---|---|---|
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO^x$ | | | | | | |
| | $CO^x$ | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments: Insignificant emissions from natural gas combustion. Insufficient data to determine process emissions if any. Applicant reports 'none detected'.

ES

Name: Hercules Inc. Address

EMS No. 1110-018010-000001 Plant Type:
(X) Major ( ) Minor (X) Industrial ( ) Commercial

Source/Reference

Emission Point Description: Continuous esterification Unit

Emission Point No.: 016

Emission Data: Stack common vent after condenser

Stack Height: 65 ft

Assumed Stack Height:

Exit Gas Temperature: Ambient

Exit Diameter: 2.25

Exit Velocity:

Volumetric Flowrate:

| Emission Rates | | lb/hr | ton/yr | Date |
|---|---|---|---|---|
| Current Allowable | PM | | | |
| | $SO_2$ | | | |
| | $NO^*$ | | | |
| | $CO^*$ | | | |
| | HC | | | |
| | Other | | | |
| Current Actual | PM | t | | |
| | $SO_2$ | | | |
| | $NO^*$ | | | |
| | $CO^*$ | | | |
| | HC | | | |
| | Other | | | |
| Current Potential | PM | | | |
| | $SO_2$ | | | |
| | $NO^*$ | | | |
| | $CO^*$ | | | |
| | HC | | | |
| | Other | | | |

| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | |
|---|---|---|---|---|---|---|
| | PM | | | | | |
| | $SO_2$ | | | | | |
| | $NO^*$ | | | | | |
| | $CO^*$ | | | | | |
| | HC | | | | | |
| | Other | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments: t Insignificant emissions ~~from~~ natural gas ~~combustion~~. Insufficient data to determine process emissions if any. Applicant reports 'none detected'.

ES

Name: Hercules Inc. Address

EMS No. 1/1/0-0/8/0/0-0/0/0/0/1 Plant Type:
(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Metalyn Unit | |
| Emission Point No. | 017 | |
| Emission Data Stack | | |
| Stack Height | | |
| Assumed Stack Height | | |
| Exit Gas Temperature | NOT | |
| Exit Diameter | IN | |
| Exit Velocity | OPERATION | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments Insignificant emissions from natural gas combustion.
Insufficient data to determine process emissions if any. Applicant reports 'none detected'.

Name: _____ Address _____

EMS No. / / - / / / - / / / / Plant Type: _____

( ) Major ( ) Minor ( ) Industrial ( ) Commercial

Source/Reference

Emission Point Description

Emission Point No.

Emission Data Stack

Stack Height

Assumed Stack Height

Exit Gas Temperature

Exit Diameter

Exit Velocity

Volumetric Flowrate

| Emission Rates | | lb/hr | ton/yr | Date |
|---|---|---|---|---|
| Current Allowable | PM | | | |
| | $SO_2$ | | | |
| | $NO^x$ | | | |
| | CO | | | |
| | HC | | | |
| | Other | | | |
| Current Actual | PM | | | |
| | $SO_2$ | | | |
| | $NO^x$ | | | |
| | CO | | | |
| | HC | | | |
| | Other | | | |
| Current Potential | PM | | | |
| | $SO_2$ | | | |
| | $NO^x$ | | | |
| | CO | | | |
| | HC | | | |
| | Other | | | |

| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | |
|---|---|---|---|---|---|---|
| | PM | | | | | |
| | $SO_2$ | | | | | |
| | $NO^x$ | | | | | |
| | CO | | | | | |
| | HC | | | | | |
| | Other | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments

Name: Hercules Inc  Address

EMS No. 1 10-0 [illegible]  Plant Type:

(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | | | Source/Reference |
|---|---|---|---|---|
| Emission Point Description | Flaking [illegible] Hand [illegible] | | | |
| Emission Point No. | 013 | | | |
| Emission Data Stack | filter | scrubber | | |
| Stack Height ft | 12 | 6 | | |
| Assumed Stack Height | | | | |
| Exit Gas Temperature °F | 70 | 70 | | |
| Exit Diameter ft | 2.4 | 2.6 | | |
| Exit Velocity ft/sec | 75 | 35 | | |
| Volumetric Flowrate | | | | |

| Emission Rates | | lb/hr | | ton/yr | | Date |
|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | |
| | $SO_2$ | | | | | |
| | $NO_x$ | | | | | |
| | CO | | | | | |
| | HC | | | | | |
| | Other | | | | | |
| Current Actual | PM | X | | | | |
| | $SO_2$ | | | | | |
| | $NO_x$ | | | | | |
| | CO | | | | | |
| | HC | | | | | |
| | Other | | | | | |
| Current Potential | PM | | | | | |
| | $SO_2$ | | | | | |
| | $NO_x$ | | | | | |
| | CO | | | | | |
| | HC | | | | | |
| | Other | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | |
| | PM | | | | | |
| | $SO_2$ | | | | | |
| | $NO_x$ | | | | | |
| | CO | | | | | |
| | HC | | | | | |
| | Other | | | | | |

UTM Zone  AQCR

UTM North  Km  Lat. ° ' "

UTM East  Km  Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code  SIC Code

Area

Comments ~~Insufficient data~~ [illegible]

~~[illegible]~~

* Insufficient [illegible]

Name: Hercules Inc. Address

EMS No. 1110-0810-0010-0001 Plant Type:
(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | Source/Reference |
|---|---|
| Emission Point Description: Coal + Staybelite Plant | |
| Emission Point No.: 019 | |
| Emission Data: Stack — no flow rate | |
| Stack Height: 20 ft | |
| Assumed Stack Height | |
| Exit Gas Temperature: ambient | |
| Exit Diameter: 2.17 ft | |
| Exit Velocity | |
| Volumetric Flowrate | |

| Emission Rates | | lb/hr | ton/yr | Date |
|---|---|---|---|---|
| Current Allowable | PM | | | |
| | $SO_2$ | | | |
| | $NO^x$ | | | |
| | CO | | | |
| | HC | | | |
| | Other | | | |
| Current Actual | PM | + | | |
| | $SO_2$ | | | |
| | $NO^x$ | | | |
| | CO | | | |
| | HC | | | |
| | Other | | | |
| Current Potential | PM | | | |
| | $SO_2$ | | | |
| | $NO^x$ | | | |
| | CO | | | |
| | HC | | | |
| | Other | | | |

| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. |
|---|---|---|---|---|---|
| | PM | | | | |
| | $SO_2$ | | | | |
| | $NO^x$ | | | | |
| | CO | | | | |
| | HC | | | | |
| | Other | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

AFS

Comments: Insignificant emissions from natural gas combustion. ~~Insufficient data to determine process emissions. Company applicant reports none detected.~~

ES

EMS No. [illegible] Plant Type:
(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Pilot Plant | |
| Emission Point No. | 021 | |
| Emission Data Stack | | |
| Stack Height | 50 ft | |
| Assumed Stack Height | | |
| Exit Gas Temperature | | |
| Exit Diameter | .08 ft | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO^x$ | | | | | | |
| | $CO^x$ | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | X | | | | | |
| | $SO_2$ | | | | | | |
| | $NO^x$ | | | | | | |
| | $CO^x$ | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO^x$ | | | | | | |
| | $CO^x$ | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO^x$ | | | | | | |
| | $CO^x$ | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments Insignificant [illegible] combustion. [illegible] and there is no information in the file to the contrary.

ES

Name: Hurcules Inc. Address

EMS No. 1110-018106-010101 Plant Type:

(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Hydrogen Furnace | |
| Emission Point No. | 020 | |
| Emission Data Stack | | |
| Stack Height | 45 ft | |
| Assumed Stack Height | | |
| Exit Gas Temperature | | |
| Exit Diameter | 0.17 ft | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | X | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments Insignificant [illegible] combustion.

Name: Hercules Inc. Address

ES

EMS No. 1110-018/010-0/0/c/0/1 Plant Type:
(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | | | Source/Reference |
|---|---|---|---|---|
| Emission Point Description | Resin 731 Area | | | |
| Emission Point No. | 022 | | | |
| Emission Data | Stack | | | |
| Stack Height | 20 ft | | | |
| Assumed Stack Height | | | | |
| Exit Gas Temperature | | | | |
| Exit Diameter | 0.17 ft | | | |
| Exit Velocity | | | | |
| Volumetric Flowrate | | | | |

| Emission Rates | | lb/hr | ton/yr | Date |
|---|---|---|---|---|
| Current Allowable | PM | | | |
| | $SO_2$ | | | |
| | $NO^*$ | | | |
| | $CO^*$ | | | |
| | HC | | | |
| | Other | | | |
| Current Actual | PM | + | - | |
| | $SO_2$ | | | |
| | $NO^*$ | | | |
| | $CO^*$ | | | |
| | HC | | | |
| | Other | | | |
| Current Potential | PM | | | |
| | $SO_2$ | | | |
| | $NO^*$ | | | |
| | $CO^*$ | | | |
| | HC | | | |
| | Other | | | |

| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
|---|---|---|---|---|---|---|---|
| | PM | | | - | | | |
| | $SO_2$ | | | | | | |
| | $NO^*$ | | | | | | |
| | $CO^*$ | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments: Insignificant emissions from natural gas combustion. ~~Insufficient data to determine process emissions~~ #2 if any. ~~Applicant reports 'none detected'~~.

Name: Hercules Inc. Address

ES

EMS No. 1110-018010-0001 Plant Type:
(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | Source/Reference |
|---|---|
| Emission Point Description | Stills + Dresinates Facility |
| Emission Point No. | 023 |
| Emission Data | Stack |
| Stack Height | ONE NO FLOW VENT |
| Assumed Stack Height | only omit steam |
| Exit Gas Temperature | |
| Exit Diameter | |
| Exit Velocity | |
| Volumetric Flowrate | |

| Emission Rates | | lb/hr | ton/yr | Date | |
|---|---|---|---|---|---|
| Current Allowable | PM | | | | |
| | $SO_2$ | | | | |
| | $NO^*$ | | | | |
| | CO | | | | |
| | HC | | | | |
| | Other | | | | |
| Current Actual | PM | * | | | |
| | $SO_2$ | | | | |
| | $NO^*$ | | | | |
| | CO | | | | |
| | HC | | | | |
| | Other | | | | |
| Current Potential | PM | | | | |
| | $SO_2$ | | | | |
| | $NO^*$ | | | | |
| | CO | | | | |
| | HC | | | | |
| | Other | | | | |

| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
|---|---|---|---|---|---|---|---|
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO^*$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments: * Insignificant emissions from natural gas combustion. ~~If sufficient data to determine~~ NO process emissions ~~if any.~~ Applicant records 'none detected'.

Name: Hercules, Inc. Address

EMS No. 1/1/0-0/8/0/0-0/0/0/0/1 Plant Type:

(X) Major ( ) Minor (X) Industrial ( ) Commercial

ES

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Kymene Plant | |
| Emission Point No. | 024 | |
| Emission Data Stack | | |
| Stack Height | 40 ft | |
| Assumed Stack Height | | |
| Exit Gas Temperature | 70°F | |
| Exit Diameter | 0.67 ft | |
| Exit Velocity | 0.1 ft/sec | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | X | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments ~~Insufficient~~ [illegible] emissions, ~~[illegible]~~ [illegible]

Name: _____ Address _____

EMS No. __/__-___/___-____/____ Plant Type: _____

( ) Major ( ) Minor ( ) Industrial ( ) Commercial

| | | | | | Source/Reference |
|---|---|---|---|---|---|
| Emission Point Description | | | | | |
| Emission Point No. | | | | | |
| Emission Data | Stack | | | | |
| Stack Height | | | | | |
| Assumed Stack Height | | | | | |
| Exit Gas Temperature | | | | | |
| Exit Diameter | | | | | |
| Exit Velocity | | | | | |
| Volumetric Flowrate | | | | | |
| Emission Rates | | lb/hr | | ton/yr | Date |
| Current Allowable | PM | | | | |
| | $SO_2$ | | | | |
| | $NO^*$ | | | | |
| | $CO^*$ | | | | |
| | HC | | | | |
| | Other | | | | |
| Current Actual | PM | | | | |
| | $SO_2$ | | | | |
| | $NO^*$ | | | | |
| | $CO^*$ | | | | |
| | HC | | | | |
| | Other | | | | |
| Current Potential | PM | | | | |
| | $SO_2$ | | | | |
| | $NO^*$ | | | | |
| | $CO^*$ | | | | |
| | HC | | | | |
| | Other | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. |
| | PM | | | | |
| | $SO_2$ | | | | |
| | $NO^*$ | | | | |
| | $CO^*$ | | | | |
| | HC | | | | |
| | Other | | | | |

UTM Zone _____ AQCR _____

UTM North _____ Km Lat. _____ o ' "

UTM East _____ Km Long. _____ o ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject _____

NSPS _____

NESHAPS _____

SCC Code _____ SIC Code _____

Area _____

Comments

Name: Hercules Inc. Address

EMS No. 1/1/0-0/8/0/0-0/0/0/0/1 Plant Type:
(X) Major ( ) Minor (X) Industrial ( ) Commercial

ES

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Defoamer Plant | |
| Emission Point No. | 025 | |
| Emission Data Stack | | |
| Stack Height | Vents into | |
| Assumed Stack Height | a closed shed | |
| Exit Gas Temperature | | |
| Exit Diameter | | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | * | | - | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments * Insignificant emissions from natural gas combustion.
~~Insufficient data to determine~~ 110 process emissions ~~if any.~~ Applicant reports 'none detected'.

ES

Name: Hercules Inc. Address

EMS No. 1/1/0-0/8/0/0-0/0/0/0/1 Plant Type:
(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Resin Amine D Plant | |
| Emission Point No. | 026 | |
| Emission Data Stack | | |
| Stack Height | | |
| Assumed Stack Height | | |
| Exit Gas Temperature | | |
| Exit Diameter | | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | * | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments: *Insignificant emissions from natural gas combustion.
~~Insufficient data to determine process [illegible] if any~~. Applicant reports 'none detected'.

ES

Name: Hercules Inc. Address

EMS No. 1/1/0-0/8/0/0-0/0/0/0/1 Plant Type:
(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Resin PS687 Plant | |
| Emission Point No. | 027 | |
| Emission Data Stack | | |
| Stack Height | | |
| Assumed Stack Height | | |
| Exit Gas Temperature | | |
| Exit Diameter | | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | * | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments * Insignificant emissions from natural gas combustion.
~~Insufficient data to determine~~ NO process emissions ~~if any~~. Applicant reports 'none detected'.

ES.

Name: [illegible] Address

EMS No. 1110-019010-0010101 Plant Type:

(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Polyrad-Polyol Unit | |
| Emission Point No. | 028 | |
| Emission Data Stack | | |
| Stack Height | ONE NO FLOW VENT | |
| Assumed Stack Height | | |
| Exit Gas Temperature | | |
| Exit Diameter | | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | * | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | PM | Act. | All. | Act. | All. | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments Insufficient data to determine process emissions [illegible] Applicant [illegible]

[illegible] Insignificant emissions

ES

Name: Hercules, Inc.

Address

EMS No. 1/1/0-0/8/0/0-0/0/0/0/1

Plant Type:

(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Para-Cymene Unit | |
| Emission Point No. | 029 | |
| Emission Data Stack | | |
| Stack Height | CLOSED SYSTEM | |
| Assumed Stack Height | NO VENT | |
| Exit Gas Temperature | | |
| Exit Diameter | | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| Operating Schedule | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments [illegible]

Name: Hercules Inc  Address

EMS No. 1/1b-98bb-0010/1  Plant Type:

(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Para-methane Unit | |
| Emission Point No. | 030 | |
| Emission Data Stack | | |
| Stack Height | CLOSED SYSTEM | |
| Assumed Stack Height | NO VENT | |
| Exit Gas Temperature | | |
| Exit Diameter | | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone  AQCR

UTM North  Km  Lat.  ° ' "

UTM East  Km  Long.  ° ' "

| | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| Operating Schedule | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code  SIC Code

Area

Comments ~~Insufficient data to determine [illegible]~~

Name: Hercules Inc.

Address

ES

EMS No. 1110-018100-0010011

Plant Type:

(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Para-Methane Hydroperoxide Facility | |
| Emission Point No. | 031 | |
| Emission Data Stack | DNE NO FLOW VENT | |
| Stack Height | 30 ft | |
| Assumed Stack Height | | |
| Exit Gas Temperature | | |
| Exit Diameter | 3.0 ft | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | ton/yr | Date | |
|---|---|---|---|---|---|
| Current Allowable | PM | | | | |
| | $SO_2$ | | | | |
| | $NO_x$ | | | | |
| | CO | | | | |
| | HC | | | | |
| | Other | | | | |
| Current Actual | PM | X | | | |
| | $SO_2$ | | | | |
| | $NO_x$ | | | | |
| | CO | | | | |
| | HC | | | | |
| | Other | | | | |
| Current Potential | PM | | | | |
| | $SO_2$ | | | | |
| | $NO_x$ | | | | |
| | CO | | | | |
| | HC | | | | |
| | Other | | | | |

| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
|---|---|---|---|---|---|---|---|
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments Insufficient data to determine [illegible]

+ INSIGNIFICANT [illegible]

Name: Hercules Inc  Address

EMS No. 1/1b-0R1ob-0b1do11  Plant Type:

(x) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Sulfate Turpentine Refining Unit | |
| Emission Point No. | 032 | |
| Emission Data Stack | | |
| Stack Height | 50 ft | |
| Assumed Stack Height | | |
| Exit Gas Temperature | | |
| Exit Diameter | 0.17 ft | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | * | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone  AQCR

UTM North  Km  Lat. ° ' "

UTM East  Km  Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code  SIC Code

Area

Comments Insufficient data to determine process emissions, if any. Applicant report [illegible] [illegible].

+ [illegible]

Name: Hercules Inc. Address

25

EMS No. 11 b-0180b-0010101 Plant Type:

(x) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Synthetic Pine Oil Unit | |
| Emission Point No. | 033 | |
| Emission Data Stack | CLOSED SYSTEM | |
| Stack Height | NO VENT | |
| Assumed Stack Height | | |
| Exit Gas Temperature | | |
| Exit Diameter | | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments Insufficient information for estimation of process emissions, if any. Applicant reports "none detected".

Name: Hercules [redacted] Inc. Address [redacted]

ES

EMS No. 1/1/0-0/8/0/0-0/0/0/0/1 Plant Type:
(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Column 5- Tall Oil Plant | |
| Emission Point No. | 034 | |
| Emission Data Stack | | |
| Stack Height | NOT IN | |
| Assumed Stack Height | OPERATION | |
| Exit Gas Temperature | | |
| Exit Diameter | | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments Insignificant emissions from natural gas combustion.
Insufficient data to determine process emissions if any. Applicant reports 'none detected'.

Name: [illegible]

EMS No. 1110-018010-010101

Plant Type:

ES (X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Paracol Plant | |
| Emission Point No. | 035 | |
| Emission Data Stack | CLOSED SYSTEM | |
| Stack Height | NO VENT | |
| Assumed Stack Height | | |
| Exit Gas Temperature | | |
| Exit Diameter | | |
| Exit Velocity | | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date |
|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | |
| | $SO_2$ | | | | | |
| | $NO_x$ | | | | | |
| | CO | | | | | |
| | HC | | | | | |
| | Other | | | | | |
| Current Actual | PM | | | | | |
| | $SO_2$ | | | | | |
| | $NO_x$ | | | | | |
| | CO | | | | | |
| | HC | | | | | |
| | Other | | | | | |
| Current Potential | PM | | | | | |
| | $SO_2$ | | | | | |
| | $NO_x$ | | | | | |
| | CO | | | | | |
| | HC | | | | | |
| | Other | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | |
| | PM | | | | | |
| | $SO_2$ | | | | | |
| | $NO_x$ | | | | | |
| | CO | | | | | |
| | HC | | | | | |
| | Other | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments Insufficient data to determine [illegible] emissions, if any. Applicant reports 'none detected'.

Permit Status

Check the type of permit your facility currently has in effect. Facilities with multiple permits should list them separatley on the back of this sheet. Include the expiration date for any expired or existing permits.

( ) No Permit

( ) Expired Permit

( 2 ) Tolerance Permits expire 7/31/75.

( ) Performance Evaluation Permit

( ) Construction Permit

(31 ) Operating Permits expire 2/6/77

( ) Variance

Air Pollution Control Equipment Maintenance Cost/Year
(Excluding Capital Cost)

| Souree No. | Equipment Type | Maintenance Cost/Year |
|---|---|---|
| 19, 20 | Fly Ash Arrestors | 6000 |
| 21, 22 | " " " | 6000 |
| 27 | Flare tower | 2000 |
| | | |
| | | |

ES

Name: Hercules Inc

Address

EMS No. 1110-08100-010101

Plant Type:

(X) Major ( ) Minor (X) Industrial ( ) Commercial

| | | Source/Reference |
|---|---|---|
| Emission Point Description | Carbon Regenerating Furnace | |
| Emission Point No. | 036 | |
| Emission Data Stack | | |
| Stack Height | 41 ft | |
| Assumed Stack Height | | |
| Exit Gas Temperature | 170 °F | |
| Exit Diameter | 2.25 ft | |
| Exit Velocity | 4A ft/sec | |
| Volumetric Flowrate | | |

| Emission Rates | | lb/hr | | ton/yr | | Date | |
|---|---|---|---|---|---|---|---|
| Current Allowable | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Actual | PM | X | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Current Potential | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |
| Applicable Baseline Emission Rate | | Act. | All. | Act. | All. | | |
| | PM | | | | | | |
| | $SO_2$ | | | | | | |
| | $NO_x$ | | | | | | |
| | CO | | | | | | |
| | HC | | | | | | |
| | Other | | | | | | |

UTM Zone AQCR

UTM North Km Lat. ° ' "

UTM East Km Long. ° ' "

| Operating Schedule | Hr/Day | Days/Week | Weeks/Year |
|---|---|---|---|
| | | | |

PSD Review Subject

NSPS

NESHAPS

SCC Code SIC Code

Area

Comments Negligible emissions from natural gas combustion and [illegible]

AIR POLLUTANT EMISSIONS SURVEY

FOR OFFICE USE ONLY

Received By:
Reviewed By: Jesse Thompson
County: ~~Forrest~~
SIC Number: 2861
Coordinates: 280.3X3469.6

Firm Name: Hercules Incorporated 545-3450

Person To Contact Regarding This Report: Charles S. Jordan Title: Sr. Chemical Engineer Phone: ~~584-6411~~

Mailing Address: P. O. Box 1937

Plant Address: West Seventh Street

Plant Location: Lat. N 31° 20' Long. W 89° 18'

Nature of Business: (Products) Chemicals

Employees at Plant Location: 800 If Seasonal, Give Range 750-850

Approximate Land Area at Plant Location: 180 acres

Information is representative of calender year 1974 SIC Code 2861 (Major) 2879 & 2822 (Minor)

SECTION 1 - FUEL USE FOR GENERATION OF HEAT, STEAM, AND POWER

Normal Operating Schedule: 3-8 hr. shifts Hours per day 24 Days per week 7 Weeks per year 52

Seasonal and/or Peak Operation Period: (Specify) Continuous

Estimate of Percent of Total Fuel Consumed to Provide Space Heat: 1.2% (Doesn't include air conditioning).

| Source No. | A<br>Size of unit (input) (B)<br>$10^6$ Btu hr | B<br>Type unit (C) | C<br>Installation Date | D<br>Fuel data (D)<br>Type fuel (E) | E<br>Amount per year (F) | F<br>Heat content (G)<br>Btu | G<br>Percent sulfur (G-H) | H<br>Percent ash (coal only) (G-H) |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.6 | McKee | 1940 | Natural Gas | 7,013 MCF | 1,025/CF | 0.00016 | |
| 2 | 1.6 | " | 1944 | " | " | " | " | |
| 3 | 1.6 | " | 1946 | " | " | " | " | |
| 4 | 1.6 | " | 1948 | " | " | " | " | |
| 5 | 1.6 | " | 1950 | " | " | " | " | |

| Source No. | I<br>Air cleaning equipment<br>Type (I) | J<br>Efficiency (J)<br>% | K<br>Estimate of contaminants (M)<br>Type (K) | L<br>Quantity (L) |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Use Additional Sheets If Necessary

| urce No. | A<br>Size of unit (input) (B)<br>$10^6$ Btu hr | B<br>Type unit (C) | C<br>Installation Date | D<br>Fuel data (D)<br>Type fuel (E) | E<br>Amount per year (F) | F<br>Heat content (G)<br>Btu | G<br>Percent sulfur (G-H) | H<br>Percent ash (coal only) (G-H) |
|---|---|---|---|---|---|---|---|---|
| 6 | 1.6 | McKee | 1950 | Natural Gas | 7,013 MCF | 1,025/CF | 0.00016 | |
| 7 | 3.3 | Foster Wheeler | 1941 | " | 14,464 MCF | " | " | |
| 8 | 5.0 | " | 1950 | " | 21,915 MCF | " | " | |
| 9 | 5.0 | " | 1964 | " | " | " | " | |
| 0 | 5.0 | " | 1964 | " | " | " | " | |

| Source No. | I<br>Air cleaning equipment<br>Type (I) | J<br>Efficiency (J)<br>% | K<br>Estimate of contaminants (M)<br>Type (K) | L<br>Quantity (L) |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Use Additional Sheets If Necessary

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| ource No. | Size of unit (input) (B) $10^6$ Btu hr | Type unit (C) | Installation Date | Fuel data (D) Type fuel (E) | Amount per year (F) | Heat content (G) Btu | Percent sulfur (G-H) | Percent ash (coal only) (G-H) |
| 11 | 3.3 | Struthers Wells | 1965 | Natural Gas | 14,464 MCF | 1,025/CF | 0.00016 | |
| 12 | 3.3 | " | 1966 | " | " | " | " | |
| 13 | 8.3 | " | 1966 | " | 36,379 MCF | " | " | |
| 14 | 8.3 | " | 1969 | " | " | " | " | |
| 15 | 13.3 | Riley Stoker | 1968 | " | 58,294 MCF | " | " | |

| | I | J | K | L |
|---|---|---|---|---|
| Source No. | Air cleaning equipment Type (I) | Efficiency (J) % | Estimate of contaminants (M) Type (K) | Quantity (L) |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Use Additional Sheets If Necessary

| ource No. | A<br>Size of unit (input) (B)<br>$10^6$ Btu hr | B<br>Type unit (C) | C<br>Installation Date | D<br>Fuel data (D)<br>Type fuel (E) | E<br>Amount per year (F) | F<br>Heat content (G)<br>Btu | G<br>Percent sulfur (G-H) | H<br>Percent ash (coal only) (G-H) |
|---|---|---|---|---|---|---|---|---|
| 16 | 36 | Broach | 1968 | Natural Gas | 157,788 MCF | 1,025 / CF | 0.00016 | |
| 17 | 64 | Riley Stoker | 1968 | Gas<br>Oil | 199,459 MCF<br>10,738 M lb | 1,025 / CF<br>16,800 / lb | 0.26 | |
| 18 | 64 | " | 1968 | " | " | " | " | |
| 19 | 138 | Wood | 1935 | Gas<br>Oil<br>Wood | 183,000 MCF<br>1,060 M lb<br>72,500 M lb. | 1,025 / CF<br>16,800 / lb<br>8,340 / lb | 0.00016<br>0.6<br>0.0 | |
| 20 | 138 | " | 1935 | " | " | " | " | |

| Source No. | I<br>Air cleaning equipment<br>Type (I) | J<br>Efficiency (J)<br>% | K<br>Estimate of contaminants (M)<br>Type (K) | L<br>Quantity (L) |
|---|---|---|---|---|
| 19 | Fly Ash Arrestors | 92% Rated | Fly Ash, Sand | 17.6 tons/yr. |
| 20 | " | " | " | " |
| | | | | |
| | | | | |
| | | | | |

Use Additional Sheets If Necessary

| ource No. | A<br>Size of unit (input) (B)<br>$10^6$ Btu hr | B<br>Type unit (C) | C<br>Installation Date | D<br>Fuel data (D)<br>Type fuel (E) | E<br>Amount per year (F) | F<br>Heat content (G)<br>Btu | G<br>Percent sulfur (G-H) | H<br>Percent ash (coal only) (G-H) |
|---|---|---|---|---|---|---|---|---|
| 21 | 138 | Wood | 1939 | Gas<br>Oil<br>Wood | 183,000 MCF<br>1,060 M lb<br>72,500 M lb. | 1,025 / CF<br>16,800 / lb<br>8,340 / lb | 0.00016<br>0.6<br>0.0 | |
| 22 | 138 | " | 1939 | | " | " | " | |
| 23 | 156 | Union Iron | 1965 | Gas<br>Oil | | | | |
| | | | | | | | | |
| | | | | | | | | |

| Source No. | I<br>Air cleaning equipment<br>Type (I) | J<br>Efficiency (J)<br>% | K<br>Estimate of contaminants (M)<br>Type (K) | L<br>Quantity (L) |
|---|---|---|---|---|
| 21 | Fly Ash Arrestors | 92% Rated | Fly Ash, Sand | 17.6 tons/yr. |
| 22 | " | " | " | " |
| | | | | |
| | | | | |
| | | | | |

Use Additional Sheets If Necessary

## SECTION II - REFUSE DISPOSAL

Refuse disposed of X On site and X Off site - Location of disposal site and/or name of hauler: Private Individuals

Normal on-site combustion operating schedule: None Hours per day _____ Days per week _____ Weeks per year _____

Seasonal and/or peak operation period: (Specify) Continuous

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| | Waste material | | | | | | Estimate of contaminants (M) | |
| Source No. (A) | Type (N) | Amount per year (F) | Method of disposal (See Code Below) | Incinerator capacity, lb/hr | Auxiliary fuel used (O) | Type and efficiency, air cleaning equipment (I-J) | Type (K) | Quantity per year (L) |
| 24 | Paper | 913 tons/yr. | City pick up | | | | | |
| 25 | Rosin | 730 tons/yr. | On site landfill | | | | | |
| 26 | Dirt | 34,675 tons/yr. | Off site landfill | | | | | |
| | | | | | | | | |
| | | | | | | | | |

METHOD OF DISPOSAL CODE:

1. Open-burning dump.
2. Sanitary landfill. (No burning)
3. Burned in boiler or furnace.
4. Incinerator, single chamber.
5. Incinerator, multiple chamber
6. Incinerator, rotary.
7. Conical metal burner.
8. Other (Specify)

Use Additional Sheets If Necessary

## SECTION III - PROCESS EMISSIONS

Normal operating schedule: 3-8 hr. shifts Hours per day 24 Days per week 7 Weeks per year 52

Seasonal and/or peak operation period: Continuous

NOTE: For intermittent operations, indicate approximate frequency and duration so that estimates of yearly emissions may be obtained.

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| Source No. (A) | Processes or operations releasing contaminants to atmosphere (A - P) | Installation Date | Materials processed and/or used at operations: Type (Q) | Materials processed and/or used at operations: Quantity per year (F) | Quantity of gas discharged from process or operation | Type and efficiency air cleaning equipment (I - J) |
| 27 | Delnav Manufacture ($H_2S$ by-product) | 1961 | $P_2S_5$ Others | 490 tons | 141.3 tons of $SO_2$ | Flare tower ($H_2S \rightarrow SO_2$) |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

SECTION III - PROCESS EMISSIONS (Continued)

| | G | H | I |
|---|---|---|---|
| Source No. (A) | Estimate of contaminants (M) | | Basis of estimate (R) (Please specify basis) |
| | Type (K) | Quantity per year (L) | |
| 27 | $SO_2$ | 141.3 tons | Calculated |
| | | | |
| | | | |
| | | | |
| | | | |

SECTION IV - STACK DATA

| SOURCES VENTED (S) | HEIGHT (Feet) | INSIDE DIAMETER (Feet) | EXIT GAS | | |
|---|---|---|---|---|---|
| | | | Temperature of | Velocity (FPS) | Moisture (%) |
| 19,20 | 200 | 10 | 445°F. | 10.8 | N.A. |
| 21,22 | 225 | 10 | 445°F. | 10.8 | N.A. |
| 27 | 100 | 0.167 | N.A. | N.A. | N.A. |
| | | | | | |

Any supplemental material or data considered pertinent (flow diagrams, reports, summaries, test results, maps) should be submitted with this form.

HERCULES, INC.

| APP. NO | NAME OF PLANT | MAWPCC DECISION ON COMPLIANCE & PERMITTING |
|---|---|---|
| 1 | Millroom & Extractor House | Appears acceptable but will inspect. |
| 2 | Herclor Plant | Appears acceptable, will issue permit to operate. |
| 3 | Tall Oil Plant | Appears acceptable, will issue permit to operate. |
| 4 | Two Riley-Stoker, Union Iron Works, Type MH Steam Boilers | Appears acceptable, but will inspect. MAWPCC needs notification of standard soot-blowing schedule. |
| 5 | Delnav Plant | Will inspect. More engineering review necessary, particularly for $SO_2$ emissions. |
| 6 | Poly-Pale Plant | Will inspect before determining final permit desposition. |
| 7 | Liming Unit | Will inspect. Need information on expected future operation. |
| 8 | Rosin Shed | Will inspect. |
| 9 | Wood Boilers Nos. 1 & 2 | Apparently out-of-compliance, need compliance schedule. |
| 10 | Wood Boilers Nos. 3 & 4 | Apparently out-of-compliance, need compliance schedule. |
| 11 | Package Boiler No. 5, Power House | See No. 4 above. |
| 12 | Pitch-Blowing Facility | Will inspect. Need more information of frequency & duration of operation. |
| 13 | Pulverized Vinsol Mill | Permit decision delayed until future plant operation is determined & proper applications filed, if required. |
| 14 | Truline Flaking Belt & Packaging Area | Will inspect. |
| 15 | Hard Resins Area | Will inspect. |
| 16 | Continuous Esterfication Unit | Appears acceptable, will inspect. |
| 17 | Metalyn Unit | Appears acceptable, will inspect. |
| 18 | Flaking House-Hard Resins Area | Will inspect. |

| | | |
|---|---|---|
| 19 | Foral & Staybelite Plant | Appears acceptable, will inspect. |
| 20 | Hydrogen Furnace | Appears acceptable, will issue permit to operate. |
| 21 | Pilot Plant | JMS Plant too large for permit exclusion, will probably issue short-term permit based on individual project lengths. |
| 22 | Resin 731 Unit | ODOR Appears acceptable, will inspect. |
| 23 | Stills & Dresinates Facility | ODOR Appears acceptable, will inspect. |
| 24 | Kymene Plant | Will inspect. FLU. ONLY |
| 25 | Defoamer Plant | Will inspect. [redacted] O.K. |
| 26 | Resin Amine D (R.A.D.) Plant | Appears acceptable, will inspect. MAY HAVE $NH_3$ |
| 27 | Resin 1977 Plant | Appears acceptable, will inspect. EMN |
| 28 | Polyrad & Polyol Unit | Appears acceptable, will issue permit to operate. |
| 29 | Para-Cymene Unit | Appears acceptable, will issue permit to operate. |
| 30 | Para-Menthane Unit | Appears acceptable, will issue permit to operate. |
| 31 | Para-Menthane Hydroperoxide Facility | Will inspect. HAVE BLOWDOWN TANK, PROB. O.K. |
| 32 | Sulfate Turpentine Refining Unit | Will inspect. DEF. ODOR |
| 33 | Synthetic Pine Oil Facility | Appears acceptable, will issue permit to operate. |
| 34 | Column 5-Tall Oil Plant | Appears acceptable, will issue permit to operate. |
| 35 | Paracol Plant | Will inspect. PROB O.K. |
| 36 | Refuse Disposal | No permit required. |

WBA

# Air & Water Pollution Control Commission

STATE OF MISSISSIPPI

COMMISSIONERS
Ray Tribble
Chairman
Money
James W. Carraway
Vice Chairman
Bassfield
Board of Health
Joe D. Brown
Marine Conservation
Commission
W. J. Demoran
Charles W. Else
Yazoo City
Game & Fish Commission
Barry Q. Freeman
W. E. Gupton
Jackson

Glen Wood, Jr., Executive Director
P. O. Box 827 - Robert E. Lee Building
Jackson, Mississippi 39205

Telephones:
Administrative Offices 601-354-7513
Air Division 601-354-6783
Water Division 601-354-7661

COMMISSIONERS
Oil & Gas Board
Quincy R. Hodges
Hermit A. Jones
Canton
Board of Water
Commissioners
Jack Pepper

ASSOCIATE MEMBERS
State Park System
Dr. John M. King
A & I Board
Paul Burt
Geological Survey
W. H. Moore

January 3, 1973

Mr. Charles S. Jordan, III.
Hercules, Incorporated
P.O. Box 1937
Hattiesburg, Mississippi 39401

SUBJECT: Status of plants in Hercules complex

Dear Mr. Jordan:

Enclosed is a list of the 35 Hercules Plants showing the preliminary permit decisions that have been made following review of the report by Clark-Dietz & Associates.

Mr. Carey Stark, of this office, will contact you shortly, if he has not done so already, to schedule a visit to your facility. Following his visit we will issue Permits to Operate to all plants that qualify and will notify you of the plants that will require additional control.

If you have any additional questions please do not hesitate to contact us.

Very truly yours,

Wayne B. Anderson
Chief of Engineering
Division of Air Pollution Control

WBA:sb

cc: Jerry M. Stubberfield

John D. Davis, III
Clark Dietz & Associates
201 Barnett Building
Jackson, MS 39201

CLARK, DIETZ, AND ASSOCIATES — ENGINEERS, INC.

*Consulting-Engineers*

REPLY TO:

201 BARNETT BUILDING
JACKSON, MISSISSIPPI 39201
TELEPHONE 601-948-5948

November 15, 1973

Mr. Jerry M. Stubberfield, Chief
Division of Air Pollution Control
Mississippi Air & Water Pollution Control Commission
Post Office Box 827
Jackson, Mississippi 39205

Re: Hercules Incorporated
Applications for Permit to Operate

Dear Mr. Stubberfield:

Please find enclosed a copy of our Summary Report describing the emissions to the air from the Hercules Incorporated plant at Hattiesburg. This report is submitted by us on the request of Mr. Charles Jordan of Hercules Incorporated.

We hope there will be sufficient detail and description in this report to prove useful in making decisions regarding the granting of the Permits to Operate for the plants which are in compliance with State Regulations. If we may be of service to clarify any detail in the report, please call us at your convenience.

Should you feel we may be of some assistance at the plant site, we may possibly be able to serve in this manner. Any final plans concerning our on-site availability would be coordinated through Mr. Charles Jordan.

Should you have any questions concerning the enclosed report, please feel free to contact us.

Very truly yours,

CLARK, DIETZ & ASSOCIATES-
ENGINEERS, INC.

John D. Davis III, P.E.

JDD/jm

CC: Mr. Charles Jordan
Mr. Frank Gardner
Mr. James Read

HERCULES INCORPORATED

HATTIESBURG, MISSISSIPPI 39401

November 14, 1973

Mr. Jerry Stubblefield, Chief
Division of Air Pollution
Mississippi Air and Water Pollution Control Commission
P. O. Box 827
Jackson, Ms. 39205

Dear Jerry:

Regarding our 'phone conversation on Nov. 6, 1973; I would like to confirm our discussion concerning the status of our air permit applications and the use of the Clark, Dietz air quality summary of our Hattiesburg, Mississippi plant.

I hope we can supply you and your staff with a copy of the report prior to setting up a hearing before the Commission. I hope this would allow you to become more familiar with our Hattiesburg complex. Also, perhaps you, along with John Davis of Clark, Dietz, could visit our plant for a visual observation and discussion of the summary report prior to meeting with the Commission.

I trust this letter will be evidencing fulfillment of the computerized compliance schedule step reminder we received on Oct. 31, 1973, since our ultimate goal is to clarify the unusually difficult and complicated problems for which thirty-six Hercules Hattiesburg Plant applications for Permits to Operate have been submitted.

Very truly yours,

HERCULES INCORPORATED

BY: Charles S Jordan

Charles S. Jordan, III.

CSJ:ccm

584-6411

RECEIVED
NOV 1973
AIR & WATER POLLUTION
CONTROL COMMISSION
STATE OF MISSISSIPPI

## HERCULES

- BEFORE ESTAB. INDIV C.S, NEED TO VISIT THE PLANT & VERIFY MINOR AGREEMENT WITH GD OBSERVATIONS.
- ALSO SUGGEST THAT WE GET OPINION AS TO COMPLETION DATE OR "PROOF OF COMPLIANCE" DATE HERCULES CAN MEET.

WRITE NOTE TO FILE THAT "SUMMARY REPORT OF AIR EMISSIONS" BY CLARK, DIETZ UPDATES INTO IN APPLICATIONS. SEVERAL APPLICATIONS ARE INCORRECT.

Notes on inspection by WBA CTS

Hercules
File - Forrest.

Fugative dust
Dry weather

Millroom + Extracter - solvent recycle

no pneumatic, all mech conveyors ≈15% moisture

Ketone MIBK extract + steam

Extract product sep. from $H_2O$ + goes to Light + Heavy split.

Light = turpentine etc which goes to still house

Rosin on ground.

Heavy = light + dark rosins

One vent $H_2O$ + Oil scrubber.

Tall Oil - N.E.

Odor here →

Herclor - unsafe + uneconomical - N.E Syn. Rubber

Riley Stoker Boilers - N.V.E. Soot blow 2-3 min tid

Poly Pale Acid Dimerization 1 common vent 20'x2' scrubber 1" Raching

Liming Unit - no run recently 2 nat gas boilers

Heat treat bleach.

Rosin Shed - N.E. Flake Belt - Little used

in process

Wood Boilers. 1-4 Package #5

Pitch Blowing no vent air goes to fire box of

PV Mill - closed. →

Tra Lu. Flake + packages vent being installed.

Hercules

Hard Resins - odors removed, not treated
to be corrected - odors, bad sweet, acrid,

Cond. Ester - Vents NE

Metalene - Vents NE

Flake House - ~~Dust to~~ Baghouse Fugative -

Stabelyte - NE except $H_2$

Fural - NE

$H_2$ Furnace - ~~NE~~ Combustion Prod.

Pilot Plant -

Dowtherm - 36 boilers - Nat. Gas only.

731 - closed system, vacuum

Presonate - ~~closed system, vacuum~~ Rosin & caustic soap

Disproportionate - uses carbon slurry

Kymene - possible dust, conveyor & bag Filter

Hercules

Paracol –

DeFoamer – Silica [redacted] drying –
dust bag – single bag bag

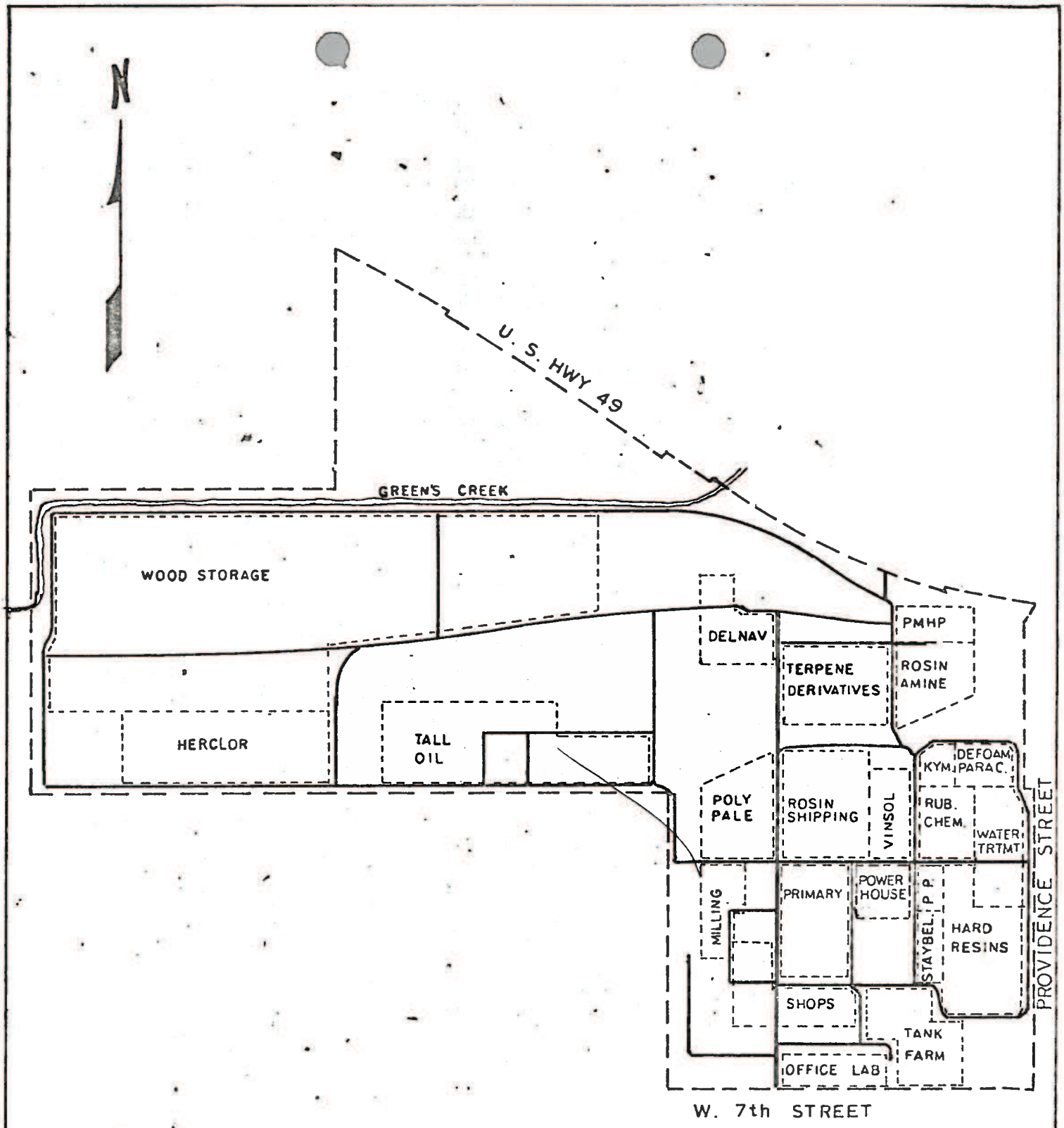
Terps still – Bad odor – open d. tch.
No odors from vapors?

Dolnar – $H_2S$ flare $P_2S_5$ – Stink.
Closed process $N_2$ blanket

Para Menthane – Hydro peroxide – Blow down tank vent

Resin 1977 [redacted] – Hydrogenation over Pd. $H_2$ purge

Rosanmine – $H_2$ + $NH_3$

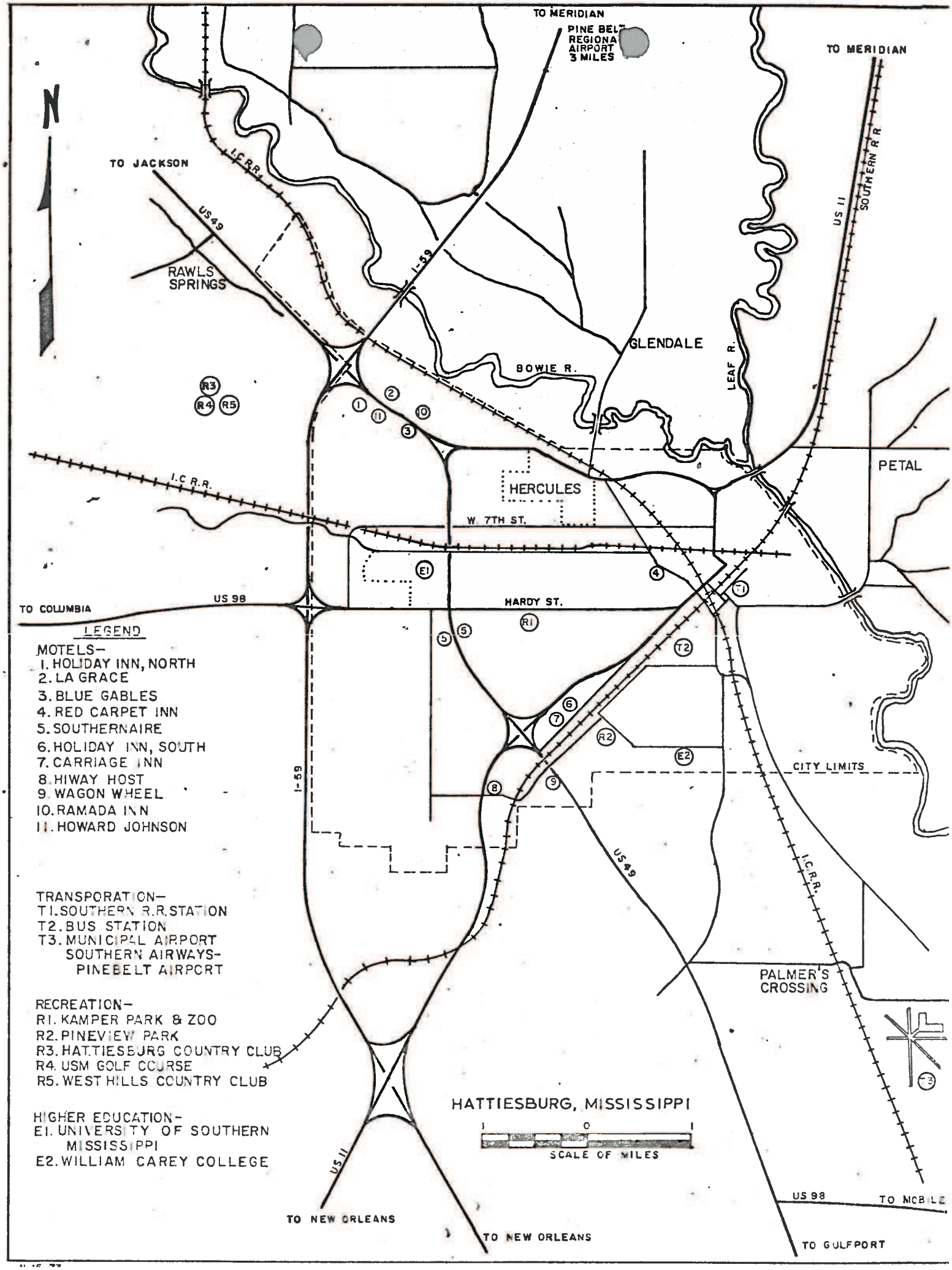



# HATTIESBURG PLANT

## HERCULES INCORPORATED

HATTIESBURG, MISSISSIPPI

SCALE - 1" = 600'


N
TO MERIDIAN
PINE BELT REGIONAL AIRPORT 3 MILES
TO MERIDIAN
TO JACKSON
I.C.R.R.
US 49
I-59
RAWLS SPRINGS
GLENDALE
BOWIE R.
LEAF R.
US 11
SOUTHERN R.R.
PETAL
HERCULES
W. 7TH ST.
I.C.R.R.
HARDY ST.
US 98
TO COLUMBIA
CITY LIMITS
PALMER'S CROSSING
US 49
I.C.R.R.
US 11
I-59
TO NEW ORLEANS
TO NEW ORLEANS
US 98
TO MOBILE
TO GULFPORT
HATTIESBURG, MISSISSIPPI
1 0 1
SCALE OF MILES
LEGEND
MOTELS–
1. HOLIDAY INN, NORTH
2. LA GRACE
3. BLUE GABLES
4. RED CARPET INN
5. SOUTHERNAIRE
6. HOLIDAY INN, SOUTH
7. CARRIAGE INN
8. HIWAY HOST
9. WAGON WHEEL
10. RAMADA INN
11. HOWARD JOHNSON
TRANSPORATION–
T1. SOUTHERN R.R. STATION
T2. BUS STATION
T3. MUNICIPAL AIRPORT
SOUTHERN AIRWAYS–
PINEBELT AIRPORT
RECREATION–
R1. KAMPER PARK & ZOO
R2. PINEVIEW PARK
R3. HATTIESBURG COUNTRY CLUB
R4. USM GOLF COURSE
R5. WEST HILLS COUNTRY CLUB
HIGHER EDUCATION–
E1. UNIVERSITY OF SOUTHERN MISSISSIPPI
E2. WILLIAM CAREY COLLEGE

HERCULES

# APPROPRIATION REQUEST

## FACE SHEET

DATE MARCH 19, 1973 APPROPRIATION NO. 042333

TITLE UTILITIES UTILIZATION AMOUNT $92,000

PLANT HATTIESBURG - EXTRACTOR HOUSE READY FOR USE OCTOBER, 1973

DEPT. ORGANICS PHYSICAL COMPLETION NOVEMBER, 19

FORECAST AMOUNT $98,000 FORECAST GROUP D ASSET PRODUCT CODE 0211

STATE: 1. Why is project needed?
2. What is proposed?
3. How will project pay off?
4. Basis: Profit ☐, Savings ☒, Other ☐

1. The steadily increasing cost of energy has made it imperative that energy be conserved by every economical means.

2. It is proposed to install one new No. 1 crude rosin solution preheater and one new pre-evaporator in the Extractor House to utilize the energy presently lost from condensing extractor stripping steam.

3. This project will pay off by utilizing this energy to increase the concentration of No. 1 crude rosin solution, thus reducing the 90 lb. steam requirements for evaporation at the Refinery. Savings after taxes will amount to $18,754, or a 20.38% return on investment.

CAM RAF CB WCR PBH

Checked in Engineering Department for Form, Accounting Aspects, and Rules Compliance.

DATE

Engineering Department has responsibility in this project. Chief Engineer's approval of engineering adequacy and estimated expenditures is required.

CHIEF ENGINEER DATE

Approved [signature] 3-20-73
MANAGER DATE

S. Fenelon 5/17/73
DATE

Approved or Authorized Robert J. Leahy 5/24/73
DEPARTMENT HEAD DATE

Authorized by: DATE

Authorized by: Executive Committee
Board of Directors

SECRETARY DATE

Five copies of Appropriation Request to be submitted to Engineering Department

HERCULES

# APPROPRIATION REQUEST

## REASON SHEET

2

DATE MARCH 19, 1973 APPROPRIATION NO.

TITLE UTILITIES UTILIZATION PLANT HATTIESBURG

**STATE:** 1. Present facilities.
2. Why they are inadequate.
3. What is proposed under this project.
4. Are all necessary auxiliary and pollution abatement facilities included.
5. To what other capital expenditures will this project commit us.
6. What facilities are to be abandoned, and proposed disposition.

1. Present facilities include one fresh solvent heater and one pre-evaporator which use extractor stripping steam for concentration of No. 1 crude rosin solution and for preheating MIBK. These units use only 60% of the available solvent stripping steam from the extractors.

2. These facilities are inadequate because they do not utilize all the available stripping steam. The No. 1 crude rosin solution is concentrated to approximately 13% in the pre-evaporator, resulting in increased usage of 90 lb. steam at the Refinery.

3. It is proposed that a new No. 1 crude rosin solution preheater and pre-evaporator be installed to utilize the remaining stripping steam to concentrate the No. 1 crude rosin to approximately 30%, thus reducing the usage of 90 lb. steam at the Refinery.

4. All necessary auxiliary and pollution abatement facilities are included in this project.

5. This project will not commit us to any other capital expenditures.

6. No facilities are to be abandoned under this project.

Written by H. M. Macoy Date 3-19-73

HERCULES

# APPROPRIATION REQUEST

## SAVINGS

3

DATE MARCH 19, 1973 APPROPRIATION NO.

TITLE UTILITIES UTILIZATION PLANT HATTIESBURG

Product Wood Unit Tons

| | Unit Cost if Project Is Not Authorized | Unit Cost if Project Is Authorized | Savings Due to Project |
|---|---|---|---|
| Operating Labor | 1.846 | 1.846 | - |
| Repairs Labor | 0.186 | 0.192 | (.006) |
| Maintenance Materials | 0.139 | 0.145 | (.006) |
| Contract Maintenance | 0.002 | 0.002 | - |
| Maintenance Services | 0.053 | 0.053 | - |
| Direct Superintendence | 0.282 | 0.282 | - |
| Chemical Control | 0.304 | 0.304 | - |
| Expense | 0.014 | 0.014 | - |
| Power | 3.736 | 3.570 | 0.166 |
| Containers | - | - | - |
| Packaging, Storing & Shipping | - | - | - |
| Works Accident | - | - | - |
| Plant Overhead | 0.115 | 0.115 | - |
| Wage Benefits Charged to Cost | 0.007 | 0.007 | - |
| Wages Benefits Charged to Indirect Expense | N/C | N/C | - |
| Total Operating Cost | 6.684 | 6.516 | 0.154 |

| Purchased Ingredients | Unit | Quantity | Price | Memo.* | | | |
|---|---|---|---|---|---|---|---|
| - | | | | | | | |
| Internal Ingredients* | | | | | | | |
| Total Ingredient Cost | | | | | | | |
| Total Unit Cost, ex Depreciation | | | | (1) | | | |
| Total Production (~~1,000 units~~) | | | | (2) | 288,365 | | XXXX |
| Total Mill Cost, ex Depreciation (~~$1,000~~) | | | | (1 X 2) | | | 44,408 |
| Depreciation Set Aside (~~$1,000~~) | | | | (Normally 7½% of Project Amount) | XXXX | XXXX | 6,900 |

*Internal ingredients to be calculated at sales or market value. Memo. column is to reflect mill cost of internal ingredients. Difference in total net sales or market value of internal ingredients and total mill cost is $_____

| | |
|---|---|
| Savings Due to Project ($1,000) | 37,508 |
| Less Taxes of 50 % | 18,754 |
| Savings After Taxes (~~$1,000~~) | 18,754 |
| Project Amount (~~$1,000~~) | 92,000 |
| Return on Investment (%) | 20.38 |

Written by H. M. McCoy Date 3-19-73

If the project under consideration does not lend itself to a presentation on a unit cost basis please use total dollar expenditures in lieu of unit cost of manufacture.

DATE MARCH 19, 1973 APPROPRIATION NO.

TITLE UTILITIES UTILIZATION PLANT HATTIESBURG

3A

## STRIPPING STEAM DATA
## EXTRACTOR HOUSE

BTU/Hr. Available - 21,102,500

| Equipment Name | Present Usage (BTU/Hr.) | Proposed Usage (BTU/Hr.) |
|---|---|---|
| No. 1 Pre-evaporator | 7,700,000 | 5,434,952 |
| No. 2 Pre-evaporator | - | 5,623,596 |
| Drop Solution Preheater | - | 2,600,000 |
| Solvent Heater | 6,140,000 | 6,140,000 |
| | 13,840,000 | 19,798,548 |

Increased Usage = 5,958,548 BTU/Hr.

Per cent Utilization of Stripping Steam = 93.3%

DATE MARCH 19, 1973 APPROPRIATION NO.

TITLE UTILITIES UTILIZATION PLANT HATTIESBURG

## SUPPLEMENTARY SAVINGS SHEET



### Repairs Labor

#### Present Method

From 12/72 Cost Sheet, R/L = $53,674
Wood Production = 288,365 Tons
Unit Cost = $0.186/Ton

#### Proposed Method

Estimated Increase in R/L by Percentage of Proposed Material Cost:

$61,949 (new material cost) x 0.03 = $1,858
Proposed R/L = $55,532
Proposed Unit Cost = $0.192/Ton

### Maintenance Materials

#### Present Method

From 12/72 Cost Sheet, M/M = $40,168
Wood Production = 288,365 Tons
Unit Cost = $0.139/Ton

#### Proposed Method

Estimated Increase in M/M by Percentage of Proposed Material Cost:

$61,949 (new material cost) x 0.03 = $1,858
Proposed M/M = $42,026
Proposed Unit Cost = $0.145/Ton

### Power

#### Present Method

From 12/72 Cost Sheet, Power = $1,077,232
Wood Production = 288,365 Tons
Unit Cost = $3.736/Ton

DATE MARCH 19, 1973 APPROPRIATION NO.

TITLE UTILITIES UTILIZATION PLANT HATTIESBURG

SUPPLEMENTARY SAVINGS SHEET (Cont'd) 3C

Power (Cont'd)

Proposed Method

Estimated power savings based on recovery of 5,958,548 BTU/hr. from extractor stripping steam thus reducing the amount of 90 lb. steam required for evaporation of rosin drop solution.

Heat Recovered = 5,958,548 BTU/Hr.
Heating Value = 886 BTU/Lb. 90 psig Steam
Cost to Manf. = 8,000 Hrs./Yr. (Estimated number of hours excess stripping steam is available)

Therefore, Gross Annual Savings =

5,958,548 BTU/Hr. x 1 lb./886 BTU x 0.00096$/Lb. x 8,000 Hrs./Yr.

= $51,650

By reducing 90 lb. steam usage by 5,958,548 BTU/Hr. or 6,725 Lbs./Hr. the power generation of the steam turbine will be reduced by 597,778 KWH/Yr: Purchase of this power will result in an additional annual cost of $3,826.

Calculations:

6,725 Lbs./Hr. x 8,000 Hrs./Yr. = 53,800,000 Lbs./Yr.

Power Decrease = 53,800,000 Lbs./Yr. ÷ 90 Lbs./KWH
= 597,778 KWH/Yr.

Cost to Purchase = 597,778 KWH/Yr. x $0.0064/KWH
= $3,826

Net Annual Power Savings =

$51,650 - $3,826 = $47,824

Therefore,

Proposed Power Cost = $1,029,408/Yr.
Proposed Unit Cost = 3.570$/Ton

HERCULES

# APPROPRIATION REQUEST

## ESTIMATE

DATE MARCH 19, 1973 APPROPRIATION NO.

TITLE UTILITIES UTILIZATION PLANT HATTIESBURG

| QUANTITY | DESCRIPTION | MATERIAL | LABOR | TOTAL |
|---|---|---|---|---|
| | SUMMARY | | | |
| | D & M (9911-0) | $ | $ 400 | $ 400 |
| | Relocation of Facilities - | | | |
| | Dismantling Costs (9923-0) | | 450 | 450 |
| | Reinstallation Costs (9925-0) | 175 | 650 | 825 |
| | Extractor House - | | | |
| | Foundations (2005-3) | 100 | 250 | 350 |
| | Building (2005-4) | 2,655 | 2,300 | 4,955 |
| | Equipment (2005-5) | 44,070 | 2,975 | 47,045 |
| | Piping (2005-6) | 10,710 | 6,500 | 17,210 |
| | Electrical (2005-7) | 355 | 150 | 505 |
| | Instrumentation (2005-8) | 2,884 | 450 | 3,334 |
| | | $60,949 | $14,125 | $75,074 |
| | Sales & Use Tax (9939-0) | | | 1,000 |
| | E & S (9982-0) | | | 7,608 |
| | 10% Contingencies | | | 8,318 |
| | | | | $92,000 |

Estimated by H. M. Macay Date 3-19-73

I.

HERCULES

# APPROPRIATION REQUEST

## ESTIMATE

DATE MARCH 19, 1973 APPROPRIATION NO.

TITLE UTILITIES UTILIZATION PLANT HATTIESBURG

| QUANTITY | DESCRIPTION | MATERIAL | LABOR | TOTAL |
|---|---|---|---|---|
| | D & M (9911-0) | | | |
| | Dismantle building siding | | $ 400 | $ 400 |
| | | | $ 400 | $ 400 |
| | Relocation of Facilities - Dismantling Costs (9923-0) | | | |
| | Remove building windows | | $ 200 | $ 200 |
| | Remove pipe support | | 100 | 100 |
| | Remove instrument air piping | | 150 | 150 |
| | | | $ 450 | $ 450 |
| | Relocation of Facilities - Reinstallation Costs (9925-0) | | | |
| | Reinstall building windows | $ 50 | $ 200 | $ 250 |
| | Reinstall pipe support | 75 | 250 | 325 |
| | Reinstall instrument air piping | 50 | 200 | 250 |
| | | $ 175 | $ 650 | $ 825 |
| | Extractor House - Foundations (2005-3) | | | |
| 3 | Cu. yds. Concrete in place for foundations | $ 100 | $ 250 | $ 350 |
| | | $ 100 | $ 250 | $ 350 |
| | Extractor House - Building (2005-4) | | | |
| 6000 | Lbs. Structural steel, erected | $ 600 | $1,000 | $ 1,600 |
| 60 | Ft. Pipe and fittings for handrails | 75 | 200 | 275 |

Estimated by _____ Date _____

HERCULES

# APPROPRIATION REQUEST

## ESTIMATE

DATE MARCH 19, 1973 APPROPRIATION NO.

TITLE UTILITIES UTILIZATION PLANT HATTIESBURG

| QUANTITY | DESCRIPTION | MATERIAL | LABOR | TOTAL |
|---|---|---|---|---|
| | Extractor House - Building (2005-4) (Cont'd) | | | |
| 440 | Sq. ft. Grating, cut lengths | $ 1,280 | $ 450 | $ 1,730 |
| | Building siding | 500 | 400 | 900 |
| | Building roof | 200 | 250 | 450 |
| | | $ 2,655 | $2,300 | $ 4,955 |
| | Extractor House - Equipment (2005-5) | | | |
| 1 | 2500 sq. ft. Heat exchanger | $38,360 | $ 500 | $38,860 |
| | Remodel 493 sq. ft. heat exchanger | 1,200 | 1,500 | 2,700 |
| 1 | 316 S.S. Condensate egg | 1,900 | 300 | 2,200 |
| 1 | Whirl-A-Way separator Dyna-Therm Model RLH-150-12, carbon steel shell; 304 S.S. element | 1,530 | 200 | 1,730 |
| 1 | Goulds pump Model 3196, 316 S.S., 160 GPM @ 61 ft. head complete with driver | 905 | 100 | 1,005 |
| | Insulate heat exchangers and condensate egg (1-1/2" thick) | 175 | 375 | 550 |
| | | $44,070 | $2,975 | $47,045 |
| | Extractor House - Piping (2005-6) | | | |
| 40 | Ft. 8" pipe Sch. 10 T-304L S.S. | $ 613 | $ | $ 613 |
| 40 | Ft. 6" pipe Sch. 10 T-304L S.S. | 448 | | 448 |
| 80 | Ft. 2" pipe Sch. 10 T-304L S.S. | 348 | | 348 |
| 40 | Ft. 8" pipe Sch. 40 steel | 189 | | 189 |
| 80 | Ft. 4" pipe Sch. 40 steel | 165 | | 165 |

Estimated by _____ Date _____

HERCULES

# APPROPRIATION REQUEST

**ESTIMATE**

DATE MARCH 19, 1973 APPROPRIATION NO.

TITLE UTILITIES UTILIZATION PLANT HATTIESBURG

| QUANTITY | DESCRIPTION | MATERIAL | LABOR | TOTAL |
|---|---|---|---|---|
| | Extractor House - Piping (2005-6) (Cont'd) | | | |
| | T-304L S.S. fittings Sch. 10 | $ 848 | $ | $ 848 |
| | Carbon steel fittings, Sch. 40 | 351 | | 351 |
| | 150 Lb. Carbon steel S.O. flanges | 745 | | 745 |
| 1 | 47" x 24" C.S. 90° reducing ell | 700 | | 700 |
| 1 | 8" T-316 S.S. gate valve, flanged | 985 | | 985 |
| 3 | 6" T-316 S.S. gate valves, flanged | 1,554 | | 1,554 |
| 6 | 2" T-316 S.S. gate valves, flanged | 768 | | 768 |
| 9 | 4" Steel gate valves - flanged | 1,544 | | 1,544 |
| 1 | 3" Steel gate valves - flanged | 147 | | 147 |
| 2 | 1" Steel gate valves - flanged | 150 | | 150 |
| 3 | 3/4" Steel gate valves - flanged | 180 | | 180 |
| | Pipe hangers and misc. fittings | 500 | | 500 |
| | Insulation | 475 | 1,100 | 1,575 |
| | Piping labor | | 5,400 | 5,400 |
| | | $10,710 | $6,500 | $17,210 |
| | Extractor House - Electrical (2005-7) | | | |
| 1 | Size 1 combination starter | $ 220 | $ | $ 220 |
| 1 | Pushbutton control station | 35 | | 35 |
| | Wire, conduit and fittings | 100 | | 100 |
| | Electrical labor | | 150 | 150 |
| | | $ 355 | $ 150 | $ 505 |

Estimated by _____ Date _____



HER. 17155 REV. 7-69

HERCULES

# APPROPRIATION REQUEST

**ESTIMATE**

DATE MARCH 19, 1973 APPROPRIATION NO.

TITLE UTILITIES UTILIZATION PLANT HATTIESBURG

| ANTITY | DESCRIPTION | MATERIAL | LABOR | TOTAL |
|---|---|---|---|---|
| | Extractor House - Instrumentation (2005-8) | | | |
| 1 | D/P cell transmitter | $ 390 | $ | $ 390 |
| 1 | Flow controller | 495 | | 495 |
| 1 | 4" C.I. body, 316 S.S. trim, control valve | 646 | | 646 |
| 1 | 14" No. 12802 Masoneilan level control | 544 | | 544 |
| 1 | 1" C.I. body, 316 S.S. trim, control valve | 234 | | 234 |
| 1 | Orifice plate - 316 S.S. | 35 | | 35 |
| 1 | Pr. 8" - 300 lb. 316 S.S. orifice flanges | 300 | | 300 |
| 2 | Temperature indicators | 60 | | 60 |
| 1 | Pressure gauge 0-60 psig | 40 | | 40 |
| 1 | Pressure gauge 0-20 psig | 40 | | 40 |
| | Tubing, fittings and valves | 100 | | 100 |
| | Instrumentation labor | | 450 | 450 |
| | | $ 2,884 | $ 450 | $ 3,334 |

Estimated by _____ Date _____

HERCULES

# APPROPRIATION REQUEST

## DISTRIBUTION

DATE May 31, 1973 APPROPRIATION NO. 042 333

TITLE UTILITIES UTILIZATION PLANT HATTIESBURG

**CHANGES IN PLANT VALUE**

| | | | |
|---|---|---|---|
| 1. Under this project we propose to remove or abandon the following: (Building and/or A & E) | | | |
| ACCOUNT 2005 | | | |
| Building Material | | 500. | |
| Building Labor | | 400. | |
| | | 900 | |
| Appraisal Overhead | | 88. | |
| | | | $ 988. |
| 2. Estimated cost to remove, alter, relocate, etc. | | | |
| D & M | 400. | | |
| Constructi on Overhead | 33. | | |
| | | 433. | |
| Relocation of Facilities | 1,275. | | $ 1,815. |
| Construction Overhead | 107. | | |
| 3. Totals (Items 1 and 2) | | 1,382. | $ 2,803. |
| 4. Items to be salvaged | | | $ |
| 5. Values to be charged off (Item 3 less Item 4) | | | $ 2,803. |

**DISTRIBUTION OF CHARGES**

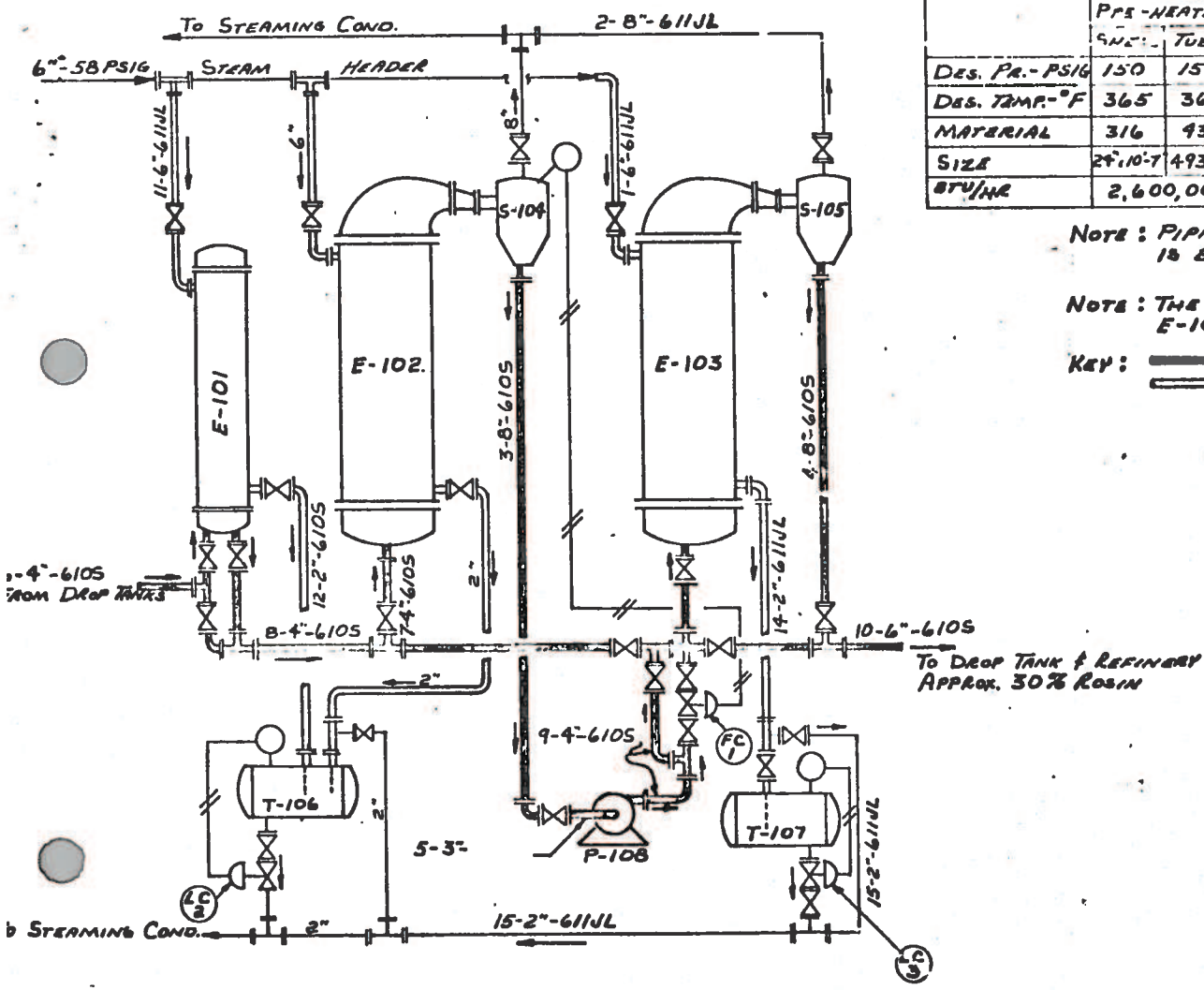
| | |
|---|---|
| A—Charge to Expense | $ 1,382. |
| B—Charge to Depreciation | $ 1,421. |
| C—Charge to Works Accident | $ |
| Totals A, B, C (Same as Item 5 above) | $ 2,803. |
| Amount of Appropriation | $ 92,000. |
| Change in Gross Plant Investment (Asset Product Code 0211, Asset Product Name PRIMARY) | $ 89,197. |

JHM

Note: Use "Distribution of Assets by Product" sheet if more than one Asset Product Code is required.

HER 17158 REV 3-70

CHKD BY ..... DATE ..... EXTRACTOR HOUSE ..... JOB NO. .....



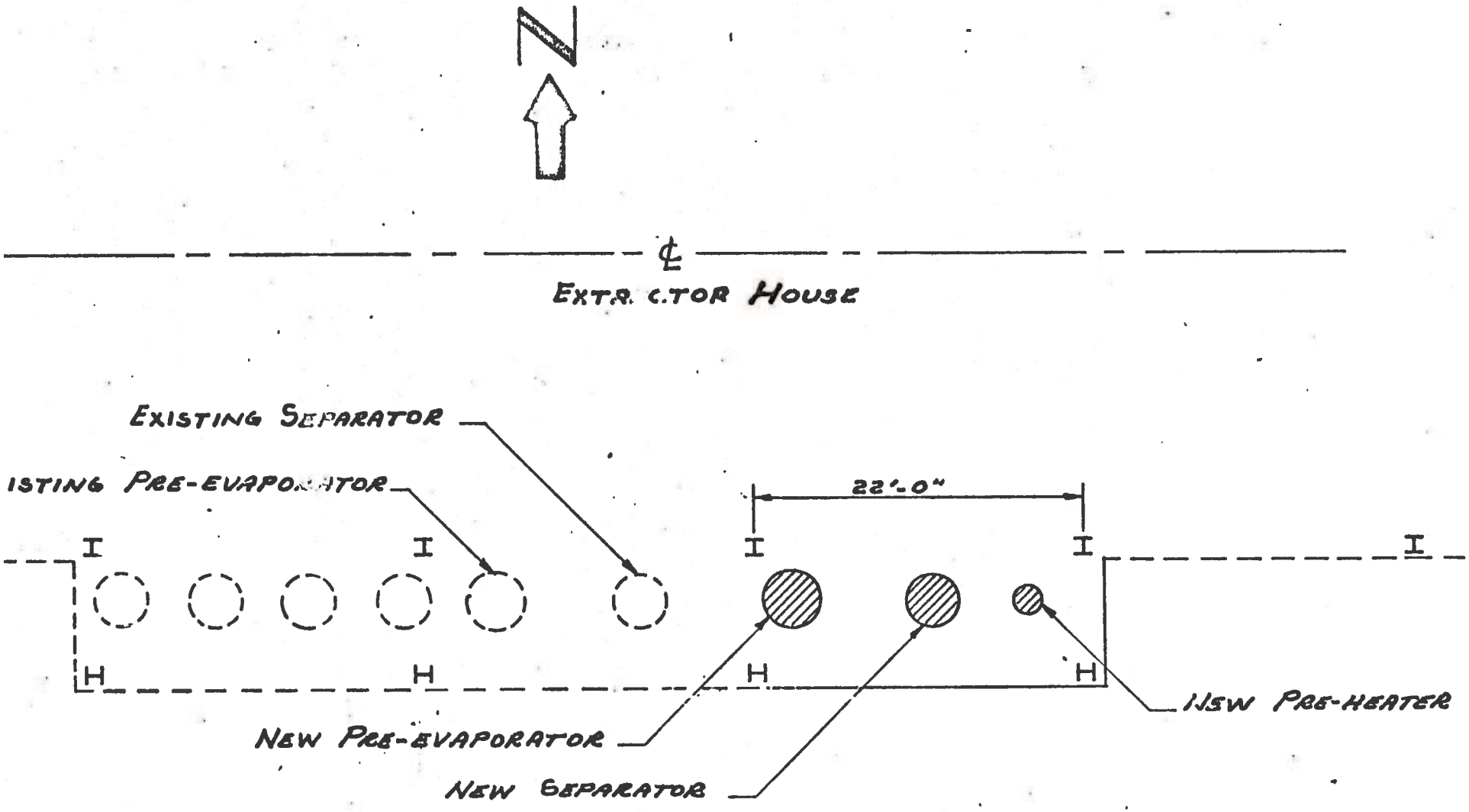

| | E-101 | | E-102 | | E-103 | | S-104 | S-105 | T-106 | T-107 | P- |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre-Heater | | Pre-Evap. #1 | | Pre-Evap. #2 | | SPTR. | SPTR. | Egg | Egg | Pu |
| | Shell | Tubes | Shell | Tubes | Shell | Tubes | | | | | |
| Des. Pr.-PSIG | 150 | 150 | 150 | 50 | 150 | 150 | 150 | 150 | 150 | 150 | 15 |
| Des. Temp.-°F | 365 | 365 | 365 | 210 | 365 | 365 | 365 | 365 | 365 | 365 | 36 |
| Material | 316 | 430 | 316 | 430 | 316L | 430 | C.S.-S.S. | C.S.-S.S. | 316 | 316 | 31 |
| Size | 24"x10'-7" | 493 Ft² | 42"x12' | 1700 Ft² | 47"x12' | 2500 Ft² | 6'-6"x8'-0" | — | 24"x40" | 24"x40" | 16 |
| BTU/HR | 2,600,000 | | 5,434,952 | | 5,520,096 | | — | — | — | — | - |

Note: Piping Not Numbered is Existing.

Note: The Following is Existing Equipment: E-102; T-106

Key: Rosin-Mixk; Steam-Mixk

042-2005-11055-2HM




# PLAN

SCALE — 1" = 10'-0"

012-2005-21056-1HM-0

BY H.M.MACOY DATE 2-15-73
CHKD. BY ..... DATE .....
SUBJECT UTILITIES UTILIZATION
EXTRACTOR HOUSE
SHEET NO. 1 OF 1
JOB NO. .....

HERCULES

# APPROPRIATION REQUEST

## FACE SHEET

DATE OCTOBER 13, 1971 APPROPRIATION NO. 042314

TITLE CONDENSATE COLLECTION AMOUNT $46,300

PLANT HATTIESBURG - COMMON READY FOR USE

DEPT. PINE & PAPER CHEMICALS PHYSICAL COMPLETION April, 1972

FORECAST AMOUNT NONE FORECAST GROUP B ASSET PRODUCT CODE 0925

STATE: 1. Why is project needed? 2. What is proposed? 3. How will project pay off? 4. Basis: Profit ☐, Savings ☒, Other ☐

ppc

1. A project is needed because the existing condensate collection system is inadequate.

2. It is proposed that necessary additions to the existing condensate collection system for the main plant area be made, that the collection tank at the Power House be replaced, and that facilities for collecting condensate in the Tall Oil area be installed.

3. This project will pay off by improving feed water quality as well as reducing the water pumping costs and the chemical treatment costs of steam produced at the Power House and at the Tall Oil boilers. It will also reduce fuel costs in the Tall Oil area. Savings after taxes will amount to $23,180, or a 50.1% return. This project will also increase the total capacity of the Tall Oil boilers.

R.S.George 10/29

Checked in Engineering Department for Form, Accounting Aspects, and Rules Compliance.
F. B. Kendall 10/19/71
DATE

Engineering Department has no responsibility in this project. Chief Engineer's approval of engineering adequacy and estimated expenditures is not required.
D. H. Little 10/21/71
CHIEF ENGINEER DATE

Approved D D Kingery 10-15-71
MANAGER DATE

E. L. Jones 11/1/71 DATE
Approved or Authorized
DEPARTMENT HEAD DATE

Authorized by:
DATE

Authorized by: Executive Committee Board of Directors
SECRETARY DATE

Five copies of Appropriation Request ...

November 4, 1971

## ASSIGNED PROJECT ACCOUNTS

TITLE: CONDENSATE COLLECTION PROJECT NUMBER: 042 314

PLANT: HATTIESBURG DEPARTMENT: P. & P. C.

*700-042314-2044-3 - PROCESS BUILDING - POLY PALE - FOUNDATIONS

5 - - EQUIPMENT

6 - - PIPING

7 - - ELECTRICAL

8 - - INSTRUMENTATION

8502-3 - BOILER HOUSE - INCLUDING FUEL BIN - FOUNDATIONS

4 - - BUILDING

5 - - EQUIPMENT

6 - - PIPING

8 - - INSTRUMENTATIOI

8505-8 - BOILER HOUSE - TALL OIL - INSTRUMENTATION

8701-6 - O. S. STEAM LINES - PIPING

9911-0 - D. & M.

9923-0 - RELOCATION OF FACILITIES - DISMANTLING COSTS

9925-0 - RELOCATION OF FACILITIES - REINSTALLATION COSTS

9939-0 - SALES AND USE TAXES

9982-0 - E. & S. (Plant)

*MLCO codes, as described in Engineering Department Notice 5.1.4, are to be used in conjunction with the assigned Project Account Codes.

HERCULES

# APPROPRIATION REQUEST

**REASON SHEET**

042314

2

DATE OCTOBER 13, 1971 APPROPRIATION NO.

TITLE CONDENSATE COLLECTION PLANT HATTIESBURG

STATE: 1. Present facilities.
2. Why they are inadequate.
3. What is proposed under this project.
4. Are all necessary auxiliary and pollution abatement facilities included.
5. To what other capital expenditures will this project commit us.
6. What facilities are to be abandoned, and proposed disposition.

1. Present facilities: Present facilities include area condensate headers and three main return headers which return condensate to a collection tank at the Power House and many area headers which dump condensate to the uncontaminated sewer system. The existing arrangement returns only enough condensate to form 38.3% of the feedwater to the Power House boilers and does not return any condensate to the Tall Oil boilers.

2. Why they are inadequate: These facilities are inadequate because lost condensate increases fuel costs, maintenance costs, chemical treatment cost, and water pumping costs. The Power House boiler feedwater could be up to 60% condensate; the Tall Oil boilers can use all of the returnable condensate. The arrangement of the Power House collection tank and feedwater pumps is such that the feedwater temperature must be limited to 200° F. This collection tank has deteriorated to the point that it is not suitable for the proposed modifications.

3. What is proposed under this project: It is proposed that (a) new return headers be installed in the main plant area between the collection tank and area headers in order to obtain 58% condensate in the feedwater, (b) the Tall Oil condensate header be tied into the deaerator to return all available condensate, (c) the Power House collection tank be replaced with a new elevated tank, (d) the Power House feedwater pumps be relocated, and (e) ultraviolet organic monitors be installed in the Tall Oil and Power House condensate systems to warn of contamination.

4. Are all necessary auxiliary and pollution abatement facilities included: All necessary auxiliary and pollution abatement facilities are included.

5. To what other capital expenditures will this project commit us: This project will not commit us to any other capital expenditures.

6. What facilities are to be abandoned, and proposed disposition: The existing collection tank will be removed and scrapped.

5167 ... 1971 RECEIVED

Written by W A Mason Date 10/13/71

042314

# CONDENSATE RETURN DATA
(LB./HR.)

| Area | Condensate Now Returned | To Be Returned After Project | Increase Due To Project |
|---|---|---|---|
| **Main Plant:** | | | |
| Extractor | 1,450 | 13,500 | 12,050 |
| Pexite | 24,000 | 24,000 | - |
| Refinery | 17,500 | 17,500 | - |
| Still House | 15,500 | 15,500 | - |
| Poly-pale | 10,500 | 13,500 | 3,000 |
| Terpene Derivatives | 16,400 | 16,400 | - |
| Power House | 9,800 | 9,800 | - |
| 731 | - | 9,500 | 9,500 |
| Paste Size Tanks | - | 9,500 | 9,500 |
| Staybelite | - | 6,400 | 6,400 |
| Hard Resins | - | 7,200 | 7,200 |
| Rosin Shed | 5,700 | 5,700 | - |
| Poly-pale Tracks | - | 4,500 | 4,500 |
| Foral | - | 2,300 | 2,300 |
| Terpin Hydrate | - | 1,250 | 1,250 |
| Totals | 100,850 | 156,550 | 55,700 |
| % Recovered* | 38.3% | 59.4% | 21.1% |
| **Tall Oil:** | - | 21,210 | 21,210 |
| % Recovered** | 0% | 25.8% | 25.8% |

**Notes:** * Per cent of Power House Gross Steam Production
** Per cent of Tall Oil Boilers Useful Steam Production

HERCULES

# APPROPRIATION REQUEST

**SAVINGS**

042314

3

DATE OCTOBER 13, 1971 APPROPRIATION NO.

TITLE CONDENSATE COLLECTION PLANT HATTIESBURG

Product Steam Unit Million Pounds

| | Unit Cost if Project Is Not Authorized | Unit Cost if Project Is Authorized | Savings Due to Project |
|---|---|---|---|
| Operating Labor | 57.22 | 57.22 | - |
| Repairs Labor | 31.41 | 31.45 | (.04) |
| Maintenance Materials | 16.53 | 16.75 | (.22) |
| Contract Maintenance | 1.57 | 1.57 | - |
| Maintenance Services .36 (R/L + R/M) | 11.40 | 11.49 | (.09) |
| Direct Superintendence | 5.79 | 5.79 | - |
| Chemical Control | .94 | .94 | - |
| Expense | 2.06 | 2.06 | - |
| Power | 29.72 | 31.01 | (1.29) |
| Containers | | | |
| Packaging, Storing & Shipping | | | |
| Works Accident | | | |
| Plant Overhead | 3.24 | 3.24 | - |
| Wage Benefits Charged to Cost | 11.39 | 11.39 | - |
| Wages Benefits Charged to Indirect Expense | - | - | - |
| Total Operating Cost | 171.27 | 172.91 | (1.64) |

| Purchased Ingredients | Unit | Quantity | Price | Memo.* | | | |
|---|---|---|---|---|---|---|---|
| Water Treatment Chem. | | | | | 12.04 | 8.32 | 3.72 |
| Sulphuric Acid | # | 23.6/17.1 | .014 | | .33 | .24 | .09 |
| Natural Gas | MCF | 583.97 | .3868 | | 225.88 | 225.88 | - |
| #5 Fuel Oil | Gal. | 315.0/143.2 | .08723 | | 27.48 | 12.49 | 14.99 |
| **Internal Ingredients*** | | | | | | | |
| Spent Chips Burned | Ton | 153.97 | 1.86 | | 286.36 | 286.36 | - |
| By Products Burned | 1000# | 11.69 | 6.70 | | 78.32 | 78.32 | - |
| Light Ends Burned | " | .113 | 6.70 | | .76 | .76 | - |
| Total Ingredient Cost | | | | | 631.17 | 612.37 | 18.80 |
| Total Unit Cost, ex Depreciation | | | | (1) | 802.44 | 785.28 | 17.16 |
| Total Production (~~1,000 units~~) | | | | (2) | 2904 | 2904 | XXXX |
| Total Mill Cost, ex Depreciation ($1,000) | | | | (1X2) | 2,330,286 | 2,280,453 | 49,833 |
| Depreciation Set Aside ($1,000) | | | | (Normally 7½% of Project Amount) | XXXX | XXXX | 3,473 |

*Internal ingredients to be calculated at sales or market value. Memo. column is to reflect mill cost of internal ingredients. Difference in total net sales or market value of internal ingredients and total mill cost is $_____

| | |
|---|---|
| Savings Due to Project (~~$1,000~~)x | $46,360 |
| Less Taxes of 50 % | 23,180 |
| Savings After Taxes (~~$1,000~~)x | 23,180 |
| Project Amount (~~$1,000~~)x | 46,300 |
| Return on Investment (%) | 50.1% |
| Cash Flow | $26,653 |

Written by W B Mason Date 10/13/71

If the project under consideration does not lend itself to a presentation on a unit cost basis please use total dollar expenditures in lieu of unit cost of manufacture.

# SUPPLEMENTARY SAVINGS SHEET

0423

Product: Steam
Unit: Million Pounds

| | Unit Cost (#/Unit) | | | | | |
|---|---|---|---|---|---|---|
| | Tall Oil | | | Power House | | |
| | Current | After Project | Savings | Current | After Project | Savings |
| Operating Labor | 51.28 | 51.28 | | 59.18 | 59.18 | |
| Repairs Labor | 10.88 | 11.03 | (.15) | 38.19 | 38.19 | |
| Maintenance Materials | 12.36 | 12.51 | (.15) | 17.91 | 18.15 | (.24 |
| Contract Maintenance | | | | 2.09 | 2.09 | |
| Maintenance Services | 3.96 | 4.06 | (.10) | 13.85 | 13.94 | (.09 |
| Direct Superintendence | 5.77 | 5.77 | | 5.80 | 5.80 | |
| Chemical Control | 3.80 | 3.80 | | | | |
| Expense | 2.62 | 2.62 | | 1.87 | 1.87 | |
| Power | 30.10 | 35.96 | (5.86) | 29.59 | 29.37 | .22 |
| Overhead | 13.06 | 13.06 | | | | |
| Wage Benefits | 8.38 | 8.40 | (.02) | 12.38 | 12.38 | |
| Total Operating Cost | 142.21 | 148.49 | (6.28) | 180.86 | 180.97 | (.11 |
| Treatment Chemicals | 22.96 | 17.04 | 5.92 | 8.44 | 5.44 | 3.00 |
| Sulphuric Acid | 1.34 | .99 | .35 | | | |
| Natural Gas | 230.09 | 233.06 | (2.97) | 224.49 | 223.51 | .98 |
| #5 Fuel Oil (Note 1) | | (4.58) | 4.58 | | | |
| #5 Fuel Oil | 110.68 | 54.90 | 55.78 | | | |
| Spent Chip Value | | | | 380.90 | 380.90 | |
| By Products Burned | 286.80 | 286.80 | | 9.50 | 9.50 | |
| Light Ends Burned | 3.05 | 3.05 | | | | |
| Total Ingredient Cost | 654.92 | 591.26 | 63.66 | 623.33 | 619.35 | 3.98 |
| Total Unit Cost | 797.13 | 739.75 | 57.38 | 804.19 | 800.32 | 3.87 |
| Production (Units/Year) | 721 | 721 | | 2183 | 2183 | |
| Savings (Note 2) | | | 40,210 | | | 9,623 |

**Notes:**

1. The #5 Fuel Oil savings of $4.58/MM# steam shown in the Tall Oil column is separate as it is the result of reduced natural gas usage at the Power House. The natural gas saved will be used in the Tall Oil boilers, thus reducing fuel oil usage.

2. The total savings figures are $/year, and the fuel oil savings explained in Note 1. have been credited to the Power House.

3. Individual returns for each area are 349% at Tall Oil and 8.1% at the Power House, after depreciation and taxes.

# SUPPLEMENTARY SAVINGS SHEET

04227

## Tall Oil Steam Data (#/Hr.)

| | | |
|---|---|---|
| Gross Production | | 96,772 |
| Used in Boilers* | | 14,516 |
| Net Useful Production | | 82,256 |
| To Main Plant | 25,741 | |
| Lost to Process | 30,000 | |
| Other Losses | 5,305 | |
| Unreturnable Condensate | 61,046 | 61,046 |
| Net Condensate Available | | 21,210 |

* The steam used in the boilers is the sum of three flows:

1. Steam to turbine pump drives which exhausts to the deaerator at 5 psig.
2. Purge steam to the deaerator at 300 psig.
3. Purge steam to the preheater at 300 psig.

At the above flow rates, the horsepower required by the booster and feed pumps equals 99.6 HP. From the turbine performance curves, the steam input equals 5600#/hr.

The feedwater at the deaerator is at 210° F. From heat balance calculations, the purge steam to the deaerator equals 5656#/hr.

The steam flow to the preheater then equals 3260#/hr. by mass balance.

With return of 21,210#/hr. of condensate and the use of electric drives in the pumps, the following changes occur:

1. Exhaust steam flow decreased by 5600#/hr.
2. Purge steam flow increased by X#/hr.
3. Feedwater flow decreased by (5600 - X) #/hr.
4. Make-up water flow decreased by 21,210#/hr.

Heat balance calculations show that X = -89#/hr.

## Summary

| Flow Stream | Heat Content BTU/# | Flow #/Hr. W/O Condensate | Flow #/Hr. With Condensate |
|---|---|---|---|
| Feedwater at 210° F. | 178.06 | 96,772 | 91,083 |
| Preheater Purge Steam | 1203.5 | 3,260 | 3,260 |
| Deaerator Purge Steam | 1203.5 | 5,656 | 5,567 |
| Exhaust Steam | 1156.1 | 5,600 | 0 |
| Condensate | 310.56 | 0 | 21,210 |
| Make-up Water | 48.02 | 82,256 | 61,046 |
| Useful Steam | 1203.5 | 82,256 | 82,256 |

Recovered Heat = 21,210 (310.56 - 48.02)
= 5,568,500 BTU/hr.
= 67.7 BTU/# of Useful Steam

# SUPPLEMENTARY SAVINGS SHEET

042311

## Savings - Tall Oil

The recovered heat will reduce fuel consumption (specifically #5 fuel oil) required to produce the same amount of useful steam.

| | | |
|---|---|---|
| Overall boiler efficiency | = | .7562 |
| #5 Fuel oil heat content | = | 140,000 BTU/gallon |
| Fuel oil saved | = | $\frac{67.7 \text{ BTU/\# useful steam}}{.7562 \times 140{,}000 \text{ BTU/gallon}} \times 10^6$ |
| | = | 639.5 gallons/MM# useful steam |
| Fuel oil cost | = | $.08723/gallon |
| Fuel savings | = | $55.78/MM pounds of useful steam |

The reduction of make-up water flow will reduce the chemical treatment cost, the sulphuric acid cost and the water pumping power cost which is contained in the Power cost.

| | | | | |
|---|---|---|---|---|
| Chemical savings | = | $22.96/MM\# $\times \frac{21{,}210\text{\#/hr.}}{82{,}256\text{\#/hr.}}$ | = | $5.92/MM# |
| Sulphuric savings | = | $1.34/MM\# $\times \frac{21{,}210\text{\#/hr.}}{82{,}256\text{\#/hr.}}$ | = | $ .35/MM# |
| Power savings | = | $1.039/MM\# $\times \frac{21{,}210\text{\#/hr.}}{82{,}256\text{\#/hr.}}$ | = | $ .27/MM# |

The use of the electric drives on the booster and feed pumps will increase power costs at the flow rates with condensate return, required horsepower = 97.7.

$$\text{Cost} = \frac{97.7 \text{ HP} \times .7457 \text{ KW/HP} \times \$.006926/\text{KWH}}{82{,}256\text{\#/hr.} \times 10^{-6} \text{MM\#/\#}} = \$6.13/\text{MM\#}$$

## Power House Steam Data (#/Hr.)

| | |
|---|---|
| Gross Production* | 263,261 |
| Used in Boilers* | 14,057 |
| Net Useful Production* | 249,204 |
| Condensate Now Returned | 100,850 |
| Make-up Flow | 148,354 |
| Condensate to be Returned | 55,700 |
| Make-up Flow After Project | 92,654 |

* These figures will not change with this project and no fuel savings will be realized as the heat added by the increase of condensate will result in reduced usage of exhaust steam from the steam driven air compressors.

Savings resulting from the reduced make-up water flow are as follows:

| | | |
|---|---|---|
| Chemical treatment savings | = | $8.00/MM\# $\times \frac{55{,}700}{148{,}354}$ |
| | = | $3.00/MM# |
| Power savings | = | $1.039/MM\# $\times \frac{55{,}700}{249{,}204}$ |
| | = | $.22/MM# |

042314

## Miscellaneous Savings in Power House

The use of more condensate and less make-up in the feed to the boilers can reasonably be expected to improve performance and reduce maintenance due to the poor quality of the make-up water.

Expected savings and average costs are:

| Savings Due To: | Labor | Material | Fuel |
|---|---|---|---|
| a) One less tube failure/year of #5 boiler | $165 | $ 55 | $ 406* |
| b) One less tube failure/year in each wood burning boiler | 222 | 10 | 36** |
| c) Two less shutdowns/year of a boiler to clean the economizer | 288 | 60 | 18** |
| d) A 2% increase in economizer efficiency | ____ | ____ | 1,680 |
| Totals | $675 | $125 | $2,140 |

* Cost based upon burning more natural gas in the wood burning boilers at a lower efficiency to make up lost production and extra fuel for heat up.

** Extra fuel required for heat up.

## Cost of Pumping Raw Water

Raw water must be pumped by both river pumps and service water pumps.

$$BHP = \frac{(Q\ GPM)\ (H\ Ft.)\ (S.G.)}{3960\ (E)}$$

For river pumps: H avg. = 180' and E avg. = 80%
For service pumps: H avg. = 142' and E avg. = 82%

Let Q = 2.0006 GPM = 1000#/hr.

$$BHP = \frac{2.0006 \times 180 \times 1}{3960 \times .80} + \frac{2.0006 \times 142 \times 1}{3960 \times .82}$$

$$= .1137 + .0875 = .2012\ HP/1000\#$$

Cost = .2012 HP/1000#/hr. x .7457 KW/HP x $.006926/KWH

= $.001039/1000#

= $1.039/MM#

HERCULES

# APPROPRIATION REQUEST

ESTIMATE

042314

DATE OCTOBER 13, 1971 APPROPRIATION NO.

TITLE CONDENSATE COLLECTION PLANT HATTIESBURG

| QUANTITY | DESCRIPTION | MATERIAL | LABOR | TOTAL |
|---|---|---|---|---|
| | SUMMARY | | | |
| | D & M (9911-0) | $ | $ 500 | $ 500 |
| | Relocation of Facilities - | | | |
| | Dismantling (9923-0) | | 520 | 520 |
| | Reinstallation (9925-0) | 140 | 1,060 | 1,200 |
| | Poly-pale Process Building - | | | |
| | Foundations (2044-3) | 40 | 80 | 120 |
| | Equipment (2044-5) | 1,150 | 110 | 1,260 |
| | Piping (2044-6) | 330 | 320 | 650 |
| | Electrical (2044-7) | 290 | 60 | 350 |
| | Instrumentation (2044-8) | 1,250 | 170 | 1,420 |
| | Boiler House - | | | |
| | Foundations (8502-3) | 80 | 160 | 240 |
| | Building (8502-4) | 200 | 400 | 600 |
| | Equipment (8502-5) | 6,780 | 720 | 7,500 |
| | Piping (8502-6) | 2,600 | 1,800 | 4,400 |
| | Instrumentation (8502-8) | 3,790 | 800 | 4,590 |
| | Tall Oil Boiler House - Instrumentation (8505-8) | 2,860 | 640 | 3,500 |
| | Outside Steam Lines - Piping (8701-6) | 5,640 | 5,300 | 10,940 |
| | Sales & Use Tax (9939-0) | 500 | | 500 |
| | | $25,650 | $12,640 | $38,290 |

Estimated by WBT/wm Date 10/13/71

I.

HERCULES

# APPROPRIATION REQUEST

ESTIMATE

042314

DATE OCTOBER 13, 1971 APPROPRIATION NO.

TITLE CONDENSATE COLLECTION PLANT HATTIESBURG

| QUANTITY | DESCRIPTION | MATERIAL | LABOR | TOTAL |
|---|---|---|---|---|
| | SUMMARY (Cont'd) | | | |
| | E & S (9982-0) | $25,650 | $12,640 | $38,290 |
| | 10% Contingencies | | | 3,820 |
| | | | | 4,190 |
| | | | | $46,300 |

Estimated by W B Mason Date 10/13/71

II.

F. 17155 20M 3-65 13866
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HERCULES

# APPROPRIATION REQUEST

ESTIMATE

042314

DATE OCTOBER 13, 1971 APPROPRIATION NO.

TITLE CONDENSATE COLLECTION PLANT HATTIESBURG

| QUANTITY | DESCRIPTION | MATERIAL | LABOR | TOTAL |
|---|---|---|---|---|
| | D & M (9911-0) | | | |
| | Remove hot well tank and foundation | | $ 500 | $ 500 |
| | | | $ 500 | $ 500 |
| | Relocation of Facilities - Dismantling (9923-0) | | | |
| | Remove hot well tank instrumentation | | $ 40 | $ 40 |
| | Remove four existing pumps | | 160 | 160 |
| | Disconnect and dismantle piping to hot well tank | | 320 | 320 |
| | | | $ 520 | $ 520 |
| | Relocation of Facilities - Reinstallation (9925-0) | | | |
| | Reinstall hot well tank instrumentation | $ 10 | $ 60 | $ 70 |
| | Pour new foundations and reinstall four pumps | 120 | 600 | 720 |
| | Rework and reinstall usable valves and sections of pipe in piping to new condensate tank | 10 | 400 | 410 |
| | | $ 140 | $1,060 | $ 1,200 |
| | Poly-pale Process Building - Foundations (2044-3) | | | |
| 1 | Cu. yd. Concrete in place for foundations | $ 40 | $ 80 | $ 120 |
| | | $ 40 | $ 80 | $ 120 |
| | Poly-pale Process Building - Equipment (2044-5) | | | |
| 1 | Centrifugal pump, steel casing, stainless steel impeller w/1 HP motor | $ 600 | $ 50 | $ 650 |

Estimated by _____ Date _____

HERCULES

# APPROPRIATION REQUEST

ESTIMATE

042314

DATE OCTOBER 13, 1971 APPROPRIATION NO.

TITLE CONDENSATE COLLECTION PLANT HATTIESBURG

| QUANTITY | DESCRIPTION | MATERIAL | LABOR | TOTAL |
|---|---|---|---|---|
| | Poly-pale Process Building - Equipment (2044-5) (Cont'd) | | | |
| 1 | 100 Gallon steel condensate receiver | $ 550 | $ 60 | $ 610 |
| | | $ 1,150 | $ 110 | $ 1,260 |
| | Poly-pale Process Building - Piping (2044-6) | | | |
| 100 | Ft. 2" Sch. 40 carbon steel pipe w/fittings and flanges | $ 110 | $ | $ 110 |
| 40 | Ft. 1" Sch. 40 carbon steel pipe w/fittings and flanges | 40 | | 40 |
| 1 | 2", 200# Screwed carbon steel gate valve | 50 | | 50 |
| 5 | 1", 200# Screwed carbon steel gate valves | 110 | | 110 |
| | Misc. piping materials | 20 | | 20 |
| | Piping labor | | 320 | 320 |
| | | $ 330 | $ 320 | $ 650 |
| | Poly-pale Process Building - Electrical (2044-7) | | | |
| 1 | Size 1 combination starter | $ 220 | $ 20 | $ 240 |
| | Pushbutton, wire, conduit and fittings | 70 | 40 | 110 |
| | | $ 290 | $ 60 | $ 350 |
| | Poly-pale Process Building - Instrumentation (2044-8) | | | |
| 1 | Masoneilan Model 12803 level controller | $ 760 | $ 60 | $ 820 |

Estimated by _____ Date _____



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HERCULES

# APPROPRIATION REQUEST

ESTIMATE

042314

DATE OCTOBER 13, 1971 APPROPRIATION NO.

TITLE CONDENSATE COLLECTION PLANT HATTIESBURG

| QUANTITY | DESCRIPTION | MATERIAL | LABOR | TOTAL |
|---|---|---|---|---|
| | Poly-pale Process Building - Instrumentation (2044-8) (Cont'd) | | | |
| 1 | 1" Annin Model 2660 control valve, C.S. | $ 450 | $ 30 | $ 480 |
| | Misc. tubing fittings and supports | 40 | 80 | 120 |
| | | $ 1,250 | $ 170 | $ 1,420 |
| | Boiler House - Foundations (8502-3) | | | |
| 1.5 | Cu. yds. Concrete in place for tank support foundation | $ 60 | $ 120 | $ 180 |
| .5 | Cu. yd. Concrete in place for separator foundation | 20 | 40 | 60 |
| | | $ 80 | $ 160 | $ 240 |
| | Boiler House - Building (8502-4) | | | |
| 2000 | Lbs. Steel, erected, for tank support | $ 200 | $ 400 | $ 600 |
| | | $ 200 | $ 400 | $ 600 |
| | Boiler House - Equipment (8502-5) | | | |
| 1 | 7500 Gallon, 10' dia. x 12' carbon steel tank with dished heads | $ 6,200 | $ 400 | $ 6,600 |
| 1 | Tangential steam/condensate separator fabricated from 8" and 12" carbon steel pipe | 300 | 200 | 500 |
| 1 | 12" x 12' long pipe for tank vent with 4" flanged water inlet at center and internal distribution plates | 280 | 120 | 400 |
| | | $ 6,780 | $ 720 | $ 7,500 |

Estimated by _____ Date _____

HERCULES

# APPROPRIATION REQUEST

ESTIMATE

042314

DATE OCTOBER 13, 1971 APPROPRIATION NO.

TITLE CONDENSATE COLLECTION PLANT HATTIESBURG

| QUANTITY | DESCRIPTION | MATERIAL | LABOR | TOTAL |
|---|---|---|---|---|
| | Boiler House - Piping (8502-6) | | | |
| 200 | Ft. Carbon steel pipe, various sizes, for condensate tank inlet and outlet lines and condensate dump line | $ 520 | $ | $ 520 |
| | Carbon steel weld fittings and slip-on flanges | 580 | | 580 |
| 5 | 4", 150# Flanged carbon steel gate valves | 840 | | 840 |
| 2 | 3", 150# Flanged carbon steel gate valves | 300 | | 300 |
| 1 | 6", 150# flange insert check valves, C.S. | 100 | | 100 |
| 2 | 4", 150# flange insert check valves, C.S. | 120 | | 120 |
| 2 | 3", 150# flange insert check valves, C.S. | 90 | | 90 |
| | Misc. piping materials and welding supplies | 50 | | 50 |
| | Piping labor | | 1,800 | 1,800 |
| | | $ 2,600 | $1,800 | $ 4,400 |
| | Boiler House - Instrumentation (8502-8) | | | |
| 1 | Model 130 Aqualert detection system | $ 1,500 | $ | $ 1,500 |
| 4 | ASCO 8315C2, 3-way solenoid valves | 380 | | 380 |
| 4 | Constant flow purgemeters | 280 | | 280 |
| 4 | Strainers | 50 | | 50 |
| 1 | Sample cooler | 80 | | 80 |
| 1 | Rotameter | 120 | | 120 |
| 1 | Bimetal thermometer | 30 | | 30 |

Estimated by _____ Date _____

HERCULES

# APPROPRIATION REQUEST

ESTIMATE

042314

DATE OCTOBER 13, 1971 APPROPRIATION NO.

TITLE CONDENSATE COLLECTION PLANT HATTIESBURG

| QUANTITY | DESCRIPTION | MATERIAL | LABOR | TOTAL |
|---|---|---|---|---|
| | Boiler House - Instrumentation (8502-8) (Cont'd) | | | |
| 1 | Flow switch | $ 80 | $ | $ 80 |
| 1 | Temperature switch | 20 | | 20 |
| 1 | Stepping switch | 50 | | 50 |
| 2 | Time delay relays | 70 | | 70 |
| 4 | Alarm relays | 50 | | 50 |
| 1 | Hoffman NEMA 4 enclosure | 40 | | 40 |
| 1 | BETA 8-point alarm annunciator | 500 | | 500 |
| | Armored gage glass for tank | 320 | | 320 |
| | Sample piping | 100 | | 100 |
| | Misc. wire and conduit | 120 | | 120 |
| | Instrumentation labor | | 800 | 800 |
| | | $ 3,790 | $ 800 | $ 4,590 |
| | Tall Oil - Boiler House - Instrumentation (8505-8) | | | |
| 1 | Model 130 Aqualert detection system | $ 1,500 | $ | $ 1,500 |
| 1 | Constant flow purgemeter | 70 | | 70 |
| 1 | Strainer | 10 | | 10 |
| 1 | Sample cooler | 80 | | 80 |
| 1 | Rotameter | 120 | | 120 |
| 1 | Bimetal thermometer | 30 | | 30 |

Estimated by _____ Date _____

HERCULES

# APPROPRIATION REQUEST

ESTIMATE

042314

DATE OCTOBER 13, 1971 APPROPRIATION NO.

TITLE CONDENSATE COLLECTION PLANT HATTIESBURG

| QUANTITY | DESCRIPTION | MATERIAL | LABOR | TOTAL |
|---|---|---|---|---|
| | Tall Oil - Boiler House - Instrumentation (8505-8) (Cont'd) | | | |
| 1 | Flow switch | $ 80 | $ | $ 80 |
| 1 | Temperature switch | 20 | | 20 |
| 1 | Clearview 4-point alarm unit | 240 | | 240 |
| 2 | Ramcon valve actuators w/solenoid pilots | 380 | | 380 |
| 1 | Selector switch | 30 | | 30 |
| 1 | Power supply for alarms | 120 | | 120 |
| | Misc. wire and conduit | 120 | | 120 |
| | Sample piping | 60 | | 60 |
| | Instrument labor | | 640 | 640 |
| | | $ 2,860 | $ 640 | $ 3,500 |
| | Outside Steam Lines - Piping (8701-6) | | | |
| 160 | Ft. 4" Sch. 40 carbon steel pipe | $ 260 | $ | $ 260 |
| 1240 | Ft. 3" Sch. 40 carbon steel pipe | 1,260 | | 1,260 |
| 840 | Ft. 2" Sch. 40 carbon steel pipe | 570 | | 570 |
| 100 | Ft. 1" Sch. 40 carbon steel pipe | 40 | | 40 |
| | 3" and 4" Sch. 40 carbon steel weld fittings and 150# flanges | 640 | | 640 |
| | 1" and 2" Forged steel screwed fittings and unions | 380 | | 380 |
| 1 | 4", 150# flanged carbon steel gate valve | 170 | | 170 |

Estimated by _____ Date _____

HERCULES

# APPROPRIATION REQUEST

ESTIMATE

DATE OCTOBER 13, 1971 APPROPRIATION NO. 042314

TITLE CONDENSATE COLLECTION PLANT HATTIESBURG

| QUANTITY | DESCRIPTION | MATERIAL | LABOR | TOTAL |
|---|---|---|---|---|
| | Outside Steam Lines - Piping (8701-6) (Cont'd) | | | |
| 6 | 3", 150# Flanged carbon steel gate valves | $ 880 | $ | $ 880 |
| 11 | 2", 200# Screwed carbon steel gate valves | 550 | | 550 |
| 2 | 1", 200# Screwed carbon steel gate valves | 50 | | 50 |
| | Misc. piping materials and welding supplies | 200 | | 200 |
| | Piping labor | | 4,800 | 4,800 |
| 160 | Ft. 4" Sch. 40 carbon steel pipe | 260 | | 260 |
| | 4" Weld fittings and flanges | 120 | | 120 |
| 2 | 4" Carbon steel butterfly valves w/stainless shaft and disc | 260 | | 260 |
| | Piping labor | | 500 | 500 |
| | | $ 5,640 | $5,300 | $10,940 |

Estimated by _____ Date _____



ER. 17155 20M 3-65 13866

HERCULES

# APPROPRIATION REQUEST

**DISTRIBUTION**

042314

DATE OCTOBER 19, 1971 APPROPRIATION NO.

TITLE CONDENSATE COLLECTION PLANT HATTIESBURG

**CHANGES IN PLANT VALUE**

1. Under this project we propose to remove or abandon the following: (Building and/or A & E)

| | | | |
|---|---|---|---|
| Account 9100 | | | |
| Unit #1973 - Tank, Steel. Hot Well. 7x26. Acq-47. Scrap. | | $1,293. | |
| Equipment, Labor | | 198. | |
| | | $1,491. | |
| Appraisal Overhead | | 167. | |
| | | | $ 1,658. |

2. Estimated cost to remove, alter, relocate, etc.

| | | | |
|---|---|---|---|
| D & M | $500. | | |
| Construction Overhead | 100. | $ 600. | |
| Relocation of Facilities | $1,720. | | |
| Construction Overhead | 344. | 2,064. | $ 2,664. |

| | |
|---|---|
| 3. Totals (Items 1 and 2) | $ 4,322. |
| 4. Items to be salvaged | $ |
| 5. Values to be charged off (Item 3 less Item 4) | $ 4,322. |

**DISTRIBUTION OF CHARGES**

| | |
|---|---|
| A—Charge to Expense | $ 2,064. |
| B—Charge to Depreciation | $ 2,258. |
| C—Charge to Works Accident | $ |
| Totals A, B, C (Same as Item 5 above) | $ 4,322. |
| Amount of Appropriation | $46,300. |
| Change in Gross Plant Investment (Asset Product Code / Asset Product Name) | $41,978. |

Note: Use "Distribution of Assets by Product" sheet if more than one Asset Product Code is required.

WEC/elp

HERCULES

# APPROPRIATION REQUEST

## DISTRIBUTION OF ASSETS BY PRODUCT

42314

DATE NOVEMBER 2, 1971 APPROPRIATION NO. ~~042312~~

TITLE CONDENSATE COLLECTION PLANT HATTIESBURG

| ASSET PRODUCT CODE | ASSET PRODUCT NAME | AMOUNT | % OF TOTAL |
|---|---|---|---|
| 0217 | Poly-Pale | $ 4,948. | 10.7 |
| 0925 | Power | 27,107. | 58.5 |
| 0950 | Common | 14,245. | 30.8 |
| | TOTAL CHANGE IN GROSS INVESTMENT | $46,300. | 100.0% |

Notes: This form to be used only when more than one asset product code is required.

If project contains more than ten asset product codes, minor value products should be accumulated and coded to Asset Product Code 975, "Reclassified Assets."

RPC/elp

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# POINT SOURCE DATA FORM

| SOURCE NUMBER | REGION | SIC | SITE | PROCESS CODE | DESCRIPTIVE NAME (a) | COORDINATES KM X | COORDINATES KM Y | POLITICAL JURISDICTION | OWNER (b) | TYPE (c) | OPERATING (hours/year) | STACK PARAMETERS HEIGHT (ft.) | STACK PARAMETERS DIA. (ft.) | STACK PARAMETERS TEMP (°F) | STACK PARAMETERS VELOCITY (ft/sec) | MAXIMUM GAS VELOCITY (ACFM) | PLUME RISE (ft²/sec) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | A |

| SOURCE NUMBER | MAXIMUM PROCESS WEIGHT RATE (lb/hr) | NORMAL PROCESS WEIGHT RATE (lb/hr) | COMMENTS (a) | MAXIMUM BOILER CAPACITY ($10^6$ BTU/hr) | (d) EF | COAL (tons/year) | (d) EF | RESIDUAL OIL ($10^3$ Gal/year) | (d) EF | DISTILLATE OIL ($10^3$ Gal/year) | (d) EF | NATURAL GAS ($10^6$ CF/year) | HEAT CONTENT COAL $10^6$ (BTU/ton) | HEAT CONTENT RESIDUAL OIL ($10^3$ BTU/Gal.) | HEAT CONTENT DIST. OIL ($10^3$ BTU/Gal.) | HEAT CONTENT NATURAL GAS (BTU/CF) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | B |

| SOURCE NUMBER | % ASH COAL | SULFUR CONTENT COAL | SULFUR CONTENT RESID. | SULFUR CONTENT DIST. | SULFUR CONTENT NAT. GAS | CONTROL EFFICIENCY PART | CONTROL EFFICIENCY $SO_2$ | DEVICE INDENT | COMMENTS (a) | HAND CALCULATED EMISSIONS (tons/year) PART. | HAND CALCULATED EMISSIONS (tons/year) $SO_2$ | HAND CALCULATED EMISSIONS (tons/year) CO | HAND CALCULATED EMISSIONS (tons/year) HC | HAND CALCULATED EMISSIONS (tons/year) $NO_2$ | ALLOWABLE EMISSIONS PART | ALLOWABLE EMISSIONS $SO_2$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | C |

| SOURCE NUMBER | COMMENTS (a) | |
|---|---|---|
| | | D |

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

(a) Letters and numbers may be put in these columns
(b) Owner → Private 1; Local 2; State 3; Federal 4; Utilities 5.
(c) Type → Process 1; Fuel Combustion 2; Solid Waste Disposal 3.
(d) EF → refers to emission factor set number associated with emission factors on emission factor sheet.

All decimal points are implied and are signified by a ▼ between columns.

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APCO (DUR) 193
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# POINT SOURCE DATA FORM

| SOURCE NUMBER | REGION | SIC | SITE | PROCESS CODE | DESCRIPTIVE NAME (a) | COORDINATES KM X | COORDINATES KM Y | POLITICAL JURISDICTION | OWNER (b) | TYPE (c) | OPERATING (hours/year) | STACK PARAMETERS HEIGHT (ft.) | STACK PARAMETERS DIA. (ft.) | STACK PARAMETERS TEMP (°F) | STACK PARAMETERS VELOCITY (ft/sec) | MAXIMUM GAS VELOCITY (ACFM) | PLUME RISE ($ft^2$/sec) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | A |

| SOURCE NUMBER | MAXIMUM PROCESS WEIGHT RATE (lb/hr) | NORMAL PROCESS WEIGHT RATE (lb/hr) | COMMENTS (a) | MAXIMUM BOILER CAPACITY ($10^6$ BTU/hr) | (d) EF | COAL (tons/year) | (d) EF | RESIDUAL OIL ($10^3$ Gal/year) | (d) EF | DISTILLATE OIL ($10^3$ Gal year) | (d) EF | NATURAL GAS ($10^6$ CF/year) | HEAT CONTENT COAL $10^6$ (BTU/ton) | HEAT CONTENT RESIDUAL OIL ($10^3$ BTU/Gal.) | HEAT CONTENT DIST. OIL ($10^3$ BTU/Gal.) | HEAT CONTENT NATURAL GAS (BTU/CF) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | B |

| SOURCE NUMBER | % ASH COAL | SULFUR CONTENT COAL | SULFUR CONTENT RESID. | SULFUR CONTENT DIST. | SULFUR CONTENT NAT. GAS | CONTROL EFFICIENCY PART | CONTROL EFFICIENCY $SO_2$ | DEVICE INDENT | COMMENTS (a) | HAND CALCULATED EMISSIONS (tons/year) PART. | $SO_2$ | CO | HC | $NO_2$ | ALLOWABLE EMISSIONS PART | ALLOWABLE EMISSIONS $SO_2$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | C |

| SOURCE NUMBER | COMMENTS (a) | |
|---|---|---|
| | | D |

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

(a) Letters and numbers may be put in these columns
(b) Owner → Private = 1; Local = 2; State = 3; Federal = 4; Utilities = 5.
(c) Type → Process = 1; Fuel Combustion = 2; Solid Waste Disposal = 3.
(d) EF → refers to emission factor set number associated with emission factors on emission factor sheet.

All decimal points are implied and are signified by a ▼ between columns.

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# POINT SOURCE DATA FORM

| SOURCE NUMBER | REGION | SIC | SITE | PROCESS CODE | DESCRIPTIVE NAME (a) | COORDINATES KM X | COORDINATES KM Y | POLITICAL JURISDICTION | OWNER (b) | TYPE (c) | OPERATING (hours/year) | STACK PARAMETERS HEIGHT (ft.) | STACK PARAMETERS DIA. (ft.) | STACK PARAMETERS TEMP. (°F) | STACK PARAMETERS VELOCITY (ft/sec) | MAXIMUM GAS VELOCITY (ACFM) | PLUME RISE ($ft^2$/sec) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 0 | 0 | 5 | 2 | 8 | 1 | 9 | | | | | | | | | | | A |

| SOURCE NUMBER | MAXIMUM PROCESS WEIGHT RATE (lb/hr) | NORMAL PROCESS WEIGHT RATE (lb/hr) | COMMENTS (a) | MAXIMUM BOILER CAPACITY ($10^6$ BTU/hr) | (d) EF | COAL (tons/year) | (d) EF | RESIDUAL OIL ($10^3$ Gal/year) | (d) EF | DISTILLATE OIL ($10^3$ Gal/year) | (d) EF | NATURAL GAS ($10^6$ CF/year) | HEAT CONTENT COAL $10^6$ (BTU/ton) | HEAT CONTENT RESIDUAL OIL ($10^3$ BTU/Gal.) | HEAT CONTENT DIST. OIL ($10^3$ BTU/Gal.) | HEAT CONTENT NATURAL GAS (BTU/CF) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | B |

| SOURCE NUMBER | % ASH COAL | SULFUR CONTENT COAL | SULFUR CONTENT RESID. | SULFUR CONTENT DIST. | SULFUR CONTENT NAT. GAS | CONTROL EFFICIENCY PART | CONTROL EFFICIENCY $SO_2$ | DEVICE INDENT | COMMENTS (a) | HAND CALCULATED EMISSIONS (tons/year) PART. | $SO_2$ | CO | HC | $NO_2$ | ALLOWABLE EMISSIONS PART | ALLOWABLE EMISSIONS $SO_2$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | C |

| SOURCE NUMBER | COMMENTS (a) | |
|---|---|---|
| | | D |

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

(a) Letters and numbers may be put in these columns
(b) Owner → Private = 1; Local = 2; State = 3; Federal = 4; Utilities = 5.
(c) Type → Process = 1; Fuel Combustion = 2; Solid Waste Disposal = 3.
(d) EF → refers to emission factor set number associated with emission factors on emission factor sheet.

All decimal points are implied and are signified by a ▼ between columns.

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# POINT SOURCE DATA FORM

| SOURCE NUMBER | REGION | SIC | SITE | PROCESS CODE | DESCRIPTIVE NAME (a) | COORDINATES KM X | COORDINATES KM Y | POLITICAL JURISDICTION | OWNER (b) | TYPE (c) | OPERATING (hours/year) | STACK PARAMETERS HEIGHT (ft.) | STACK PARAMETERS DIA. (ft.) | STACK PARAMETERS TEMP (°F) | STACK PARAMETERS VELOCITY (ft/sec) | MAXIMUM GAS VELOCITY (ACFM) | PLUME RISE ($ft^2$/sec) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | [illegible] | [illegible] | | 01 | [illegible] | | | 20 | 1 | 1 | 8760 | 100 | | | | | | A |

| SOURCE NUMBER | MAXIMUM PROCESS WEIGHT RATE (lb/hr) | NORMAL PROCESS WEIGHT RATE (lb/hr) | COMMENTS (a) | MAXIMUM BOILER CAPACITY ($10^6$ BTU/hr) | (d) E F | COAL (tons/year) | (d) E F | RESIDUAL OIL ($10^3$ Gal/year) | (d) E F | DISTILLATE OIL ($10^3$ Gal/year) | (d) E F | NATURAL GAS ($10^6$ CF/year) | HEAT CONTENT COAL $10^6$ (BTU/ton) | HEAT CONTENT RESIDUAL OIL ($10^3$ BTU/Gal.) | HEAT CONTENT DIST. OIL ($10^3$ BTU/Gal.) | HEAT CONTENT NATURAL GAS (BTU/CF) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | | | | 156 | | | | | | | | | | | | | B |

| SOURCE NUMBER | % ASH COAL | SULFUR CONTENT COAL | SULFUR CONTENT RESID. | SULFUR CONTENT DIST. | SULFUR CONTENT NAT. GAS | CONTROL EFFICIENCY PART | CONTROL EFFICIENCY $SO_2$ | DEVICE INDENT | COMMENTS (a) | HAND CALCULATED EMISSIONS (tons/year) PART. | HAND CALCULATED EMISSIONS $SO_2$ | HAND CALCULATED EMISSIONS CO | HAND CALCULATED EMISSIONS HC | HAND CALCULATED EMISSIONS $NO_2$ | ALLOWABLE EMISSIONS PART | ALLOWABLE EMISSIONS $SO_2$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | | | | | | | | | | | 131.3 | | | | | | C |

| SOURCE NUMBER | COMMENTS (a) | |
|---|---|---|
| | | D |

(a) Letters and numbers may be put in these columns
(b) Owner → Private = 1; Local = 2; State = 3; Federal = 4; Utilities = 5.
(c) Type → Process = 1; Fuel Combustion = 2; Solid Waste Disposal = 3.
(d) EF → refers to emission factor set number associated with emission factors on emission factor sheet.

All decimal points are implied and are signified by a ▼ between columns.

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# POINT SOURCE DATA FORM

| SOURCE NUMBER | REGION | SIC | SITE | PROCESS CODE | DESCRIPTIVE NAME (a) | COORDINATES KM X | COORDINATES KM Y | POLITICAL JURISDICTION | OWNER (b) | TYPE (c) | OPERATING (hours/year) | STACK PARAMETERS HEIGHT (ft.) | STACK PARAMETERS DIA. (ft.) | STACK PARAMETERS TEMP (°F) | STACK PARAMETERS VELOCITY (ft/sec) | MAXIMUM GAS VELOCITY (ACFM) | PLUME RISE ($ft^2$/sec) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | A |

| SOURCE NUMBER | MAXIMUM PROCESS WEIGHT RATE (lb/hr) | NORMAL PROCESS WEIGHT RATE (lb/hr) | COMMENTS (a) | MAXIMUM BOILER CAPACITY ($10^6$ BTU/hr) | (d) EF | COAL (tons/year) | (d) EF | RESIDUAL OIL ($10^3$ Gal/year) | (d) EF | DISTILLATE OIL ($10^3$ Gal/year) | (d) EF | NATURAL GAS ($10^6$ CF/year) | HEAT CONTENT COAL ($10^6$ BTU/ton) | HEAT CONTENT RESIDUAL OIL ($10^3$ BTU/Gal.) | HEAT CONTENT DIST. OIL ($10^3$ BTU/Gal.) | HEAT CONTENT NATURAL GAS (BTU/CF) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | B |

| SOURCE NUMBER | % ASH COAL | SULFUR CONTENT COAL | SULFUR CONTENT RESID. | SULFUR CONTENT DIST. | SULFUR CONTENT NAT. GAS | CONTROL EFFICIENCY PART | CONTROL EFFICIENCY $SO_2$ | DEVICE INDENT | COMMENTS (a) | HAND CALCULATED EMISSIONS (tons/year) PART. | $SO_2$ | CO | HC | $NO_2$ | ALLOWABLE EMISSIONS PART | ALLOWABLE EMISSIONS $SO_2$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | C |

| SOURCE NUMBER | COMMENTS (a) | |
|---|---|---|
| | | D |

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

(a) Letters and numbers may be put in these columns
(b) Owner → Private = 1; Local = 2; State = 3; Federal = 4; Utilities = 5.
(c) Type → Process = 1; Fuel Combustion = 2; Solid Waste Disposal = 3.
(d) EF → refers to emission factor set number associated with emission factors on emission factor sheet.

All decimal points are implied and are signified by a ▼ between columns.

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# POINT SOURCE DATA FORM

| SOURCE NUMBER | REGION | SIC | SITE | PROCESS CODE | DESCRIPTIVE NAME (a) | COORDINATES KM X | COORDINATES KM Y | POLITICAL JURISDICTION | OWNER (b) | TYPE (c) | OPERATING (hours/year) | STACK PARAMETERS HEIGHT (ft.) | STACK PARAMETERS DIA. (ft.) | STACK PARAMETERS TEMP. (°F) | STACK PARAMETERS VELOCITY (ft/sec) | MAXIMUM GAS VELOCITY (ACFM) | PLUME RISE ($ft^2$/sec) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | A |

| SOURCE NUMBER | MAXIMUM PROCESS WEIGHT RATE (lb/hr) | NORMAL PROCESS WEIGHT RATE (lb/hr) | COMMENTS (a) | MAXIMUM BOILER CAPACITY ($10^6$ BTU/hr) | (d) EF | COAL (tons/year) | (d) EF | RESIDUAL OIL ($10^3$ Gal/year) | (d) EF | DISTILLATE OIL ($10^3$ Gal/year) | (d) EF | NATURAL GAS ($10^6$ CF/year) | HEAT CONTENT COAL ($10^6$ BTU/ton) | HEAT CONTENT RESIDUAL OIL ($10^3$ BTU/Gal.) | HEAT CONTENT DIST. OIL ($10^3$ BTU/Gal.) | HEAT CONTENT NATURAL GAS (BTU/CF) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | B |

| SOURCE NUMBER | % ASH COAL | SULFUR CONTENT COAL | SULFUR CONTENT RESID. | SULFUR CONTENT DIST. | SULFUR CONTENT NAT. GAS | CONTROL EFFICIENCY PART | CONTROL EFFICIENCY $SO_2$ | DEVICE INDENT | COMMENTS (a) | HAND CALCULATED EMISSIONS (tons/year) PART. | HAND CALCULATED EMISSIONS (tons/year) $SO_2$ | HAND CALCULATED EMISSIONS (tons/year) CO | HAND CALCULATED EMISSIONS (tons/year) HC | HAND CALCULATED EMISSIONS (tons/year) $NO_2$ | ALLOWABLE EMISSIONS PART | ALLOWABLE EMISSIONS $SO_2$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | C |

| SOURCE NUMBER | COMMENTS (a) | |
|---|---|---|
| | | D |

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

(a) Letters and numbers may be put in these columns
(b) Owner → Private = 1; Local = 2; State = 3; Federal = 4; Utilities = 5.
(c) Type → Process = 1; Fuel Combustion = 2; Solid Waste Disposal = 3.
(d) EF → refers to emission factor set number associated with emission factors on emission factor sheet.

All decimal points are implied and are signified by a ▼ between columns.

# POINT SOURCE DATA FORM

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| SOURCE NUMBER | REGION | SIC | SITE | PROCESS CODE | DESCRIPTIVE NAME (a) | COORDINATES KM X | COORDINATES KM Y | POLITICAL JURISDICTION | OWNER (b) | TYPE (c) | OPERATING (hours/year) | STACK PARAMETERS HEIGHT (ft.) | STACK PARAMETERS DIA. (ft.) | STACK PARAMETERS TEMP (°F) | STACK PARAMETERS VELOCITY (ft/sec) | MAXIMUM GAS VELOCITY (ACFM) | PLUME RISE ($ft^2$/sec) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 2 3 | 4 5 6 | 7 8 9 | 10 11 12 | 13 14 | 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 | 31 32 33 34 35 36 | 37 38 39 40 41 42 | 43 | 44 | 45 | 46 47 48 49 | 50 51 52 | 53 54 55 | 56 57 58 | 59 60 61 | 62 63 64 65 66 | 67 68 69 70 | A |

| SOURCE NUMBER | MAXIMUM PROCESS WEIGHT RATE (lb/hr) | NORMAL PROCESS WEIGHT RATE (lb/hr) | COMMENTS (a) | MAXIMUM BOILER CAPACITY ($10^6$ BTU/hr) | (d) EF | COAL (tons/year) | (d) EF | RESIDUAL OIL ($10^3$ Gal/year) | (d) EF | DISTILLATE OIL ($10^3$ Gal/year) | (d) EF | NATURAL GAS ($10^6$ CF/year) | HEAT CONTENT COAL ($10^6$ BTU/ton) | HEAT CONTENT RESIDUAL OIL ($10^3$ BTU/Gal.) | HEAT CONTENT DIST. OIL ($10^3$ BTU/Gal.) | HEAT CONTENT NATURAL GAS (BTU/CF) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 2 3 | 4 5 6 7 8 9 10 11 12 13 14 15 | 16 17 18 19 20 21 22 23 24 25 26 27 | 28 29 30 31 32 33 34 35 36 37 38 39 | 40 41 42 43 44 45 | 46 | 47 48 49 50 51 52 | 53 | 54 55 56 57 58 59 | 60 | 61 62 63 64 65 66 | 67 | 68 69 70 71 72 73 | 74 75 76 77 78 79 | 80 81 82 83 84 85 | 86 87 88 89 90 91 | 92 93 94 95 96 97 | B |

| SOURCE NUMBER | % ASH COAL | SULFUR CONTENT COAL | SULFUR CONTENT RESID. | SULFUR CONTENT DIST. | SULFUR CONTENT NAT. GAS | CONTROL EFFICIENCY PART | CONTROL EFFICIENCY $SO_2$ | DEVICE INDENT | COMMENTS (a) | HAND CALCULATED EMISSIONS (tons/year) PART. | HAND CALCULATED EMISSIONS (tons/year) $SO_2$ | HAND CALCULATED EMISSIONS (tons/year) CO | HAND CALCULATED EMISSIONS (tons/year) HC | HAND CALCULATED EMISSIONS (tons/year) $NO_2$ | ALLOWABLE EMISSIONS PART | ALLOWABLE EMISSIONS $SO_2$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 2 3 | 4 5 6 | 7 8 9 | 10 11 12 | 13 14 15 | 16 17 18 | 19 20 21 | 22 23 24 | 25 26 27 | 28 29 30 31 32 33 34 35 36 37 38 39 | 40 41 42 43 44 45 | 46 47 48 49 50 51 | 52 53 54 55 56 57 | 58 59 60 61 62 63 | 64 65 66 67 68 69 | 70 71 72 73 74 75 | 76 77 78 79 80 81 | 82 83 84 85 86 87 | C |

| SOURCE NUMBER | COMMENTS (a) | |
|---|---|---|
| 1 2 3 | 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 | 80 |

(a) Letters and numbers may be put in these columns
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(c) Type → Process = 1; Fuel Combustion = 2; Solid Waste Disposal = 3.
(d) EF → refers to emission factor set number associated with emission factors on emission factor sheet.

All decimal points are implied and are signified by a ▼ between columns.

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# POINT SOURCE DATA FORM

| SOURCE NUMBER | REGION | SIC | SITE | PROCESS CODE | DESCRIPTIVE NAME (a) | COORDINATES KM X | COORDINATES KM Y | POLITICAL JURISDICTION | OWNER (b) | TYPE (c) | OPERATING (hours/year) | STACK PARAMETERS HEIGHT (ft.) | STACK PARAMETERS DIA. (ft.) | STACK PARAMETERS TEMP (°F) | STACK PARAMETERS VELOCITY (ft/sec) | MAXIMUM GAS VELOCITY (ACFM) | PLUME RISE (ft²/sec) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | A |

| SOURCE NUMBER | MAXIMUM PROCESS WEIGHT RATE (lb/hr) | NORMAL PROCESS WEIGHT RATE (lb/hr) | COMMENTS (a) | MAXIMUM BOILER CAPACITY ($10^6$ BTU/hr) | (d) EF | COAL (tons/year) | (d) EF | RESIDUAL OIL ($10^3$ Gal/year) | (d) EF | DISTILLATE OIL ($10^3$ Gal/year) | (d) EF | NATURAL GAS ($10^6$ CF/year) | HEAT CONTENT COAL ($10^6$ BTU/ton) | HEAT CONTENT RESIDUAL OIL ($10^3$ BTU/Gal.) | HEAT CONTENT DIST. OIL ($10^3$ BTU/Gal.) | HEAT CONTENT NATURAL GAS (BTU/CF) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | B |

| SOURCE NUMBER | % ASH COAL | SULFUR CONTENT COAL | SULFUR CONTENT RESID. | SULFUR CONTENT DIST. | SULFUR CONTENT NAT. GAS | CONTROL EFFICIENCY PART | CONTROL EFFICIENCY $SO_2$ | DEVICE INDENT | COMMENTS (a) | HAND CALCULATED EMISSIONS (tons/year) PART. | $SO_2$ | CO | HC | $NO_2$ | ALLOWABLE EMISSIONS PART | ALLOWABLE EMISSIONS $SO_2$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | C |

| SOURCE NUMBER | COMMENTS (a) | |
|---|---|---|
| | | D |

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

(a) Letters and numbers may be put in these columns
(b) Owner → Private = 1; Local = 2; State = 3; Federal = 4; Utilities = 5.
(c) Type → Process = 1; Fuel Combustion = 2; Solid Waste Disposal = 3.
(d) EF → refers to emission factor set number associated with emission factors on emission factor sheet.

All decimal points are implied and are signified by a ▼ between columns.

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# POINT SOURCE DATA FORM

| SOURCE NUMBER | REGION | SIC | SITE | PROCESS CODE | DESCRIPTIVE NAME (a) | COORDINATES KM X | COORDINATES KM Y | POLITICAL JURISDICTION | OWNER (b) | TYPE (c) | OPERATING (hours/year) | STACK PARAMETERS HEIGHT (ft.) | STACK PARAMETERS DIA. (ft.) | STACK PARAMETERS TEMP. (°F) | STACK PARAMETERS VELOCITY (ft/sec) | MAXIMUM GAS VELOCITY (ACFM) | PLUME RISE ($ft^2$/sec) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | A |

| SOURCE NUMBER | MAXIMUM PROCESS WEIGHT RATE (lb/hr) | NORMAL PROCESS WEIGHT RATE (lb/hr) | COMMENTS (a) | MAXIMUM BOILER CAPACITY ($10^6$ BTU/hr) | (d) EF | COAL (tons/year) | (d) EF | RESIDUAL OIL ($10^3$ Gal/year) | (d) EF | DISTILLATE OIL ($10^3$ Gal/year) | (d) EF | NATURAL GAS ($10^6$ CF/year) | HEAT CONTENT COAL ($10^6$ BTU/ton) | HEAT CONTENT RESIDUAL OIL ($10^3$ BTU/Gal.) | HEAT CONTENT DIST. OIL ($10^3$ BTU/Gal.) | HEAT CONTENT NATURAL GAS (BTU/CF) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | B |

| SOURCE NUMBER | % ASH COAL | SULFUR CONTENT COAL | SULFUR CONTENT RESID. | SULFUR CONTENT DIST. | SULFUR CONTENT NAT. GAS | CONTROL EFFICIENCY PART | CONTROL EFFICIENCY $SO_2$ | DEVICE INDENT | COMMENTS (a) | HAND CALCULATED EMISSIONS (tons/year) PART. | HAND CALCULATED EMISSIONS (tons/year) $SO_2$ | HAND CALCULATED EMISSIONS (tons/year) CO | HAND CALCULATED EMISSIONS (tons/year) HC | HAND CALCULATED EMISSIONS (tons/year) $NO_2$ | ALLOWABLE EMISSIONS PART | ALLOWABLE EMISSIONS $SO_2$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | C |

| SOURCE NUMBER | COMMENTS (a) | |
|---|---|---|
| | | D |

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

(a) Letters and numbers may be put in these columns
(b) Owner → Private = 1; Local = 2; State = 3; Federal = 4; Utilities = 5.
(c) Type → Process = 1; Fuel Combustion = 2; Solid Waste Disposal = 3.
(d) EF → refers to emission factor set number associated with emission factors on emission factor sheet.

All decimal points are implied and are signified by a ▼ between columns.

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# POINT SOURCE DATA FORM

| SOURCE NUMBER | REGION | SIC | SITE | PROCESS CODE | DESCRIPTIVE NAME (a) | COORDINATES KM X | COORDINATES KM Y | POLITICAL JURISDICTION | OWNER (b) | TYPE (c) | OPERATING (hours/year) | STACK PARAMETERS HEIGHT (ft.) | STACK PARAMETERS DIA. (ft.) | STACK PARAMETERS TEMP (°F) | STACK PARAMETERS VELOCITY (ft/sec) | MAXIMUM GAS VELOCITY (ACFM) | PLUME RISE ($ft^7$/sec) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | A |

| SOURCE NUMBER | MAXIMUM PROCESS WEIGHT RATE (lb/hr) | NORMAL PROCESS WEIGHT RATE (lb/hr) | COMMENTS (a) | MAXIMUM BOILER CAPACITY ($10^6$ BTU/hr) | (d) EF | COAL (tons/year) | (d) EF | RESIDUAL OIL ($10^3$ Gal/year) | (d) EF | DISTILLATE OIL ($10^3$ Gal/year) | (d) EF | NATURAL GAS ($10^6$ CF/year) | HEAT CONTENT COAL ($10^6$ BTU/ton) | HEAT CONTENT RESIDUAL OIL ($10^3$ BTU/Gal.) | HEAT CONTENT DIST. OIL ($10^3$ BTU/Gal.) | HEAT CONTENT NATURAL GAS (BTU/CF) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | B |

| SOURCE NUMBER | % ASH COAL | SULFUR CONTENT COAL | SULFUR CONTENT RESID. | SULFUR CONTENT DIST. | SULFUR CONTENT NAT. GAS | CONTROL EFFICIENCY PART | CONTROL EFFICIENCY $SO_2$ | DEVICE INDENT | COMMENTS (a) | HAND CALCULATED EMISSIONS (tons/year) PART. | $SO_2$ | CO | HC | $NO_2$ | ALLOWABLE EMISSIONS PART | ALLOWABLE EMISSIONS $SO_2$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | C |

| SOURCE NUMBER | COMMENTS (a) | |
|---|---|---|
| | | D |

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

(a) Letters and numbers may be put in these columns
(b) Owner → Private = 1; Local = 2; State = 3; Federal = 4; Utilities = 5.
(c) Type → Process = 1; Fuel Combustion = 2; Solid Waste Disposal = 3.
(d) EF → refers to emission factor set number associated with emission factors on emission factor sheet.

All decimal points are implied and are signified by a ▼ between columns.

HERCULES (BOILERS), HATTIESBURG (TSP/SO2), 1-14-1977

METEOROLOGICAL INPUT DATA FOR THE ANNUAL SEASON

MIXING DEPTH = 1000. METERS
AMBIENT TEMPERATURE = 289. DEGREES,KELVIN
AMBIENT PRESSURE = 1013. MILLIBARS

STABILITY CLASS 1

| | WINDSPEED CLASS | | | | | |
|---|---|---|---|---|---|---|
| WIND DIRECTION | 1 | 2 | 3 | 4 | 5 | 6 |
| N | 0.0002 | 0.0004 | 0.0 | 0.0 | 0.0 | 0.0 |
| NNE | 0.0002 | 0.0007 | 0.0 | 0.0 | 0.0 | 0.0 |
| NE | 0.0001 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ENE | 0.0002 | 0.0003 | 0.0 | 0.0 | 0.0 | 0.0 |
| E | 0.0001 | 0.0001 | 0.0 | 0.0 | 0.0 | 0.0 |
| ESE | 0.0001 | 0.0004 | 0.0 | 0.0 | 0.0 | 0.0 |
| SE | 0.0001 | 0.0001 | 0.0 | 0.0 | 0.0 | 0.0 |
| SSE | 0.0001 | 0.0002 | 0.0 | 0.0 | 0.0 | 0.0 |
| S | 0.0000 | 0.0002 | 0.0 | 0.0 | 0.0 | 0.0 |
| SSW | 0.0001 | 0.0003 | 0.0 | 0.0 | 0.0 | 0.0 |
| SW | 0.0001 | 0.0003 | 0.0 | 0.0 | 0.0 | 0.0 |
| WSW | 0.0000 | 0.0001 | 0.0 | 0.0 | 0.0 | 0.0 |
| W | 0.0001 | 0.0008 | 0.0 | 0.0 | 0.0 | 0.0 |
| WNW | 0.0001 | 0.0004 | 0.0 | 0.0 | 0.0 | 0.0 |
| NW | 0.0000 | 0.0001 | 0.0 | 0.0 | 0.0 | 0.0 |
| NNW | 0.0002 | 0.0006 | 0.0 | 0.0 | 0.0 | 0.0 |

HERCULES (BOILERS), HATTIESBURG (TSP/SO2), 1-14-1977 DEC

SOURCE DATA

| SOURCE NUMBER | SOURCE LOCATION (KILOMETERS) | | SOURCE AREA SQUARE | ANNUAL SOURCE EMISSION RATE (TONS/DAY) | | STACK DATA | | | |
|---|---|---|---|---|---|---|---|---|---|
| | HORIZONTAL | VERTICAL | KILOMETERS | SO2 | PART | HT (M) | DIAM (M) | VEL (M/SEC) | TEMP (DEG.K) |
| 1 | 7.5 | 7.5 | 0.0 | 0.302 | 0.640 | 61.0 | 1.4 | 17.7 | 466. |

HERCULES (BOILERS), HATTIESBURG (TSP/SO2), 1-14-1977 DEC

SOURCE CONTRIBUTIONS TO FIVE MAXIMUM RECEPTORS

ANNUAL SO2

MICROGRAMS PER CUBIC METER

| SOURCE | RECEPTOR 131 | RECEPTOR 116 | RECEPTOR 126 | RECEPTOR 132 | RECEPTOR 130 |
|---|---|---|---|---|---|
| 1 | 100.00 % | 100.00 % | 100.00 % | 100.00 % | 100.00 % |
| | 0.0965 | 0.0918 | 0.0915 | 0.0875 | 0.0871 |
| BACK-GROUND | 0.0 % | 0.0 % | 0.0 % | 0.0 % | 0.0 % |
| | 0. | 0. | 0. | 0. | 0. |
| TOTAL | 100.0 % | 100.0 % | 100.0 % | 100.0 % | 100.0 % |
| | 0.0965 | 0.0918 | 0.0915 | 0.0875 | 0.0871 |

HERCULES (BOILERS), HATTIESBURG (TSP/SO2), 1-14-1977 DEC

SOURCE CONTRIBUTIONS TO FIVE MAXIMUM RECEPTORS

ANNUAL PARTICULATES

MICROGRAMS PER CUBIC METER

| SOURCE | RECEPTOR 131 | RECEPTOR 116 | RECEPTOR 126 | RECEPTOR 132 | RECEPTOR 130 |
|---|---|---|---|---|---|
| 1 | 100.00 % | 100.00 % | 100.00 % | 100.00 % | 100.00 % |
| | 0.2045 | 0.1945 | 0.1940 | 0.1854 | 0.1847 |
| BACK-GROUND | 0.0 % | 0.0 % | 0.0 % | 0.0 % | 0.0 % |
| | 0. | 0. | 0. | 0. | 0. |
| TOTAL | 100.0 % | 100.0 % | 100.0 % | 100.0 % | 100.0 % |
| | 0.2045 | 0.1945 | 0.1940 | 0.1854 | 0.1847 |

AVERAGE CONCENTRATIONS FOR 12 HOURS.

* * * R E C E P T O R  N U M B E R * * *

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| TOTAL CONCENTRATION (UG/M**3) | | | | | | | |
| 0.001 | 0.065 | 0.338 | 0.494 | 0.538 | 0.536 | 0.517 | 0.483 |

11. 180. 1.9 5 425. 292.0 1018.0

* * * R E C E P T O R  N U M B E R * * *

1. 2. 3. 4. 5. 6. 7. 8.

TOTAL CONCENTRATION (UG/M**3)

0.000 0.016 0.345 0.884 1.277 1.481 1.577 1.605

* * * M E T E O R O L O G Y * * *

NO. THETA(DEG) U(M/SEC) KST H(M) T(DEG-K) P(MB)

12. 180. 1.9 6 425. 292.0 1018.0

* * * R E C E P T O R  N U M B E R * * *

1. 2. 3. 4. 5. 6. 7. 8.

TOTAL CONCENTRATION (UG/M**3)

0.0 0.000 0.001 0.019 0.069 0.150 0.248 0.343

* * * R E C E P T O R  N U M B E R * * *

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| TOTAL CONCENTRATION (UG/M**3) | | | | | | | |
| 0.000 | 0.016 | 0.345 | 0.884 | 1.277 | 1.461 | 1.577 | 1.605 |

* * * M E T E O R O L O G Y * * *

| NO. | THETA(DEG) | U (M/SEC) | KST | HL (M) | T (DEG-K) | P (MB) |
|---|---|---|---|---|---|---|
| 6. | 180. | 1.9 | 6 | 1450. | 292.0 | 1018.0 |

* * * R E C E P T O R  N U M B E R * * *

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| TOTAL CONCENTRATION (UG/M**3) | | | | | | | |
| 0.0 | 0.060 | 0.001 | 0.015 | 0.060 | 0.114 | 0.2** | 0.*** |

* * * M E T E O R O L O G Y * * *

| NO. | THETA(DEG) | U (M/SEC) | KST | HL (M) | T (DEG-K) | P (MB) |
|---|---|---|---|---|---|---|
| 7. | 180. | 1.9 | 1 | 425. | 292.0 | 1018.0 |

* * * R E C E P T O R  N U M B E R * * *

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| TOTAL CONCENTRATION (UG/M**3) | | | | | | | |
| 4.144 | 2.135 | 1.366 | 1.019 | 0.820 | 0.686 | 0.607 | 0.528 |

* * * M E T E O R O L O G Y * * *

| NO. | THETA(DEG) | U (M/SEC) | KST | HL (M) | T (DEG-K) | P (MB) |
|---|---|---|---|---|---|---|
| 8. | 180. | 2.8 | 2 | 425. | 292.0 | 1018.0 |

* * * R E C E P T O R  N U M B E R * * *

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| TOTAL CONCENTRATION (UG/M**3) | | | | | | | |
| 1.111 | 2.582 | 1.222 | 0.838 | 0.663 | 0.554 | 0.488 | 0.424 |

* * * M E T E O R O L O G Y * * *

| NO. | THETA(DEG) | U (M/SEC) | KST | HL (M) | T (DEG-K) | P (MB) |
|---|---|---|---|---|---|---|
| 9. | 180. | 2.8 | 3 | 425. | 292.0 | 1018.0 |

* * * R E C E P T O R  N U M B E R * * *

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| TOTAL CONCENTRATION (UG/M**3) | | | | | | | |
| 0.218 | 3.178 | 1.952 | 1.209 | 0.819 | 0.607 | 0.487 | 0.416 |

* * * M E T E O R O L O G Y * * *

| NO. | THETA(DEG) | U (M/SEC) | KST | HL (M) | T (DEG-K) | P (MB) |
|---|---|---|---|---|---|---|
| 10. | 180. | 4.8 | 4 | 425. | 292.0 | 1018.0 |

* * * R E C E P T O R  N U M B E R * * *

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| TOTAL CONCENTRATION (UG/M**3) | | | | | | | |
| 0.000 | 1.243 | 1.*** | 1.*** | 1.*** | 1.*** | 1.*** | 0.*** |

* * * M E T E O R O L O G Y * * *

| NO. | THETA(DEG) | U (M/SEC) | KST | HL (M) | T (DEG-K) | P (MB) |
|---|---|---|---|---|---|---|

HERCULES INC. HATTIESBURG (SO2), 1-14-1977 DEC

3.

* * * S O U R C E S * * *

| NO. | Q (G/SEC) | HS (M) | TS (DEG-K) | VS (M/SEC) | DS (M) | VE (M**3/SEC) | B (KM) | E (KM) |
|---|---|---|---|---|---|---|---|---|
| 1. | 1.60 | 61.0 | 466.0 | 17.7 | 1.40 | 0.0 | 7.500 | 6.500 |

* * * R E C E P T O R S * * *

| NO. | XREC (KM) | YREC (KM) | Z (M) |
|---|---|---|---|
| 1. | 7.500 | 8.000 | 2.0 |
| 2. | 7.500 | 9.000 | 2.0 |
| 3. | 7.500 | 10.000 | 2.0 |
| 4. | 7.500 | 11.000 | 2.0 |
| 5. | 7.500 | 12.000 | 2.0 |
| 6. | 7.500 | 13.000 | 2.0 |
| 7. | 7.500 | 14.000 | 2.0 |
| 8. | 7.500 | 15.000 | 2.0 |

* * * M E T E O R O L O G Y * * *

| NO. | THETA(DEG) | U (M/SEC) | KST | HL (M) | T (DEG-K) | P (MB) |
|---|---|---|---|---|---|---|
| 1. | 180. | 1.9 | 1 | 1450. | 292.0 | 1018.0 |

* * * R E C E P T O R N U M B E R * * *

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| TOTAL CONCENTRATION (UG/M**3) | | | | | | | |
| 0.194 | 0.706 | 0.480 | 0.299 | 0.240 | 0.203 | 0.175 | 0.154 |

* * * M E T E O R O L O G Y * * *

| NO. | THETA(DEG) | U (M/SEC) | KST | HL (M) | T (DEG-K) | P (MB) |
|---|---|---|---|---|---|---|
| 2. | 180. | 2.8 | 2 | 1450. | 292.0 | 1018.0 |

* * * R E C E P T O R N U M B E R * * *

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| TOTAL CONCENTRATION (UG/M**3) | | | | | | | |
| 1.111 | 2.582 | 1.146 | 0.619 | 0.384 | 0.261 | 0.190 | 0.147 |

* * * M E T E O R O L O G Y * * *

| NO. | THETA(DEG) | U (M/SEC) | KST | HL (M) | T (DEG-K) | P (MB) |
|---|---|---|---|---|---|---|
| 3. | 180. | 3.8 | 3 | 1450. | 292.0 | 1018.0 |

* * * R E C E P T O R N U M B E R * * *

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| TOTAL CONCENTRATION (UG/M**3) | | | | | | | |
| 0.218 | 3.178 | 1.452 | 1.208 | 0.811 | 0.591 | 0.437 | 0.341 |

* * * M E T E O R O L O G Y * * *

| NO. | THETA(DEG) | U (M/SEC) | KST | HL (M) | T (DEG-K) | P (MB) |
|---|---|---|---|---|---|---|
| 4. | 180. | 4.8 | 4 | 1450. | 292.0 | 1018.0 |

* * * R E C E P T O R N U M B E R * * *

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| TOTAL CONCENTRATION (UG/M**3) | | | | | | | |
| 0.000 | 1.268 | 1.890 | 1.755 | 1.499 | 1.247 | 1.078 | 0.921 |

* * * M E T E O R O L O G Y * * *

| NO. | THETA(DEG) | U (M/SEC) | KST | HL (M) | T (DEG-K) | P (MB) |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| 11. | 180. | 1.4 | 5 | 425. | 292.0 | 1018.0 |

* * * R E C E P T O R N U M B E R * * *

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|

TOTAL CONCENTRATION (UG/M**3)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.000 | 0.405 | 8.103 | 22.319 | 32.256 | 37.402 | 39.829 | 40.419 |

* * * R E C E P T O R D A T A * * *

| NO. | THETA(DEG) | U (M/SEC) | KST | HE (M) | T (DEG-K) | P (MB) |
|---|---|---|---|---|---|---|
| 12. | 180. | 1.9 | 6 | 425. | 292.0 | 1018.0 |

* * * R E C E P T O R N U M B E R * * *

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|

TOTAL CONCENTRATION (UG/M**3)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.0 | 0.000 | 0.034 | 0.452 | 1.748 | 3.775 | 6.256 | 8.670 |

| | | |

HERCULES INC. HATTIESBURG (TSP), 1-14-1977 DEC

3.

* * * S O U R C E S * * *

| NO. | Q (G/SEC) | HR (M) | TS (DEG-K) | VS (M/SEC) | D(M) | VE(M**3/SEC) | R (KM) | S (KM) |
|---|---|---|---|---|---|---|---|---|
| 1. | 40.40 | 61.0 | 466.0 | 17.7 | 1.40 | 0.0 | 7.500 | 7.500 |

* * * R E C E P T O R S * * *

| NO. | RREC(KM) | SREC(KM) | Z (M) |
|---|---|---|---|
| 1. | 7.500 | 8.000 | 2.0 |
| 2. | 7.500 | 9.000 | 2.0 |
| 3. | 7.500 | 10.000 | 2.0 |
| 4. | 7.500 | 11.000 | 2.0 |
| 5. | 7.500 | 12.000 | 2.0 |
| 6. | 7.500 | 13.000 | 2.0 |
| 7. | 7.500 | 14.000 | 2.0 |
| 8. | 7.500 | 15.000 | 2.0 |

* * * M E T E O R O L O G Y * * *

| NO. | THETA(DEG) | U (M/SEC) | KST | HL (M) | T (DEG-K) | P (MB) |
|---|---|---|---|---|---|---|
| 1. | 180. | 1.9 | 1 | 1450. | 292.0 | 1018.0 |

* * * R E C E P T O R N U M B E R * * *

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| TOTAL CONCENTRATION (UG/M**3) | | | | | | | |
| 105.907 | 17.787 | 10.107 | 7.542 | 6.067 | 5.102 | 4.419 | 3.905 |

* * * M E T E O R O L O G Y * * *

| NO. | THETA(DEG) | U (M/SEC) | KST | HL (M) | T (DEG-K) | P (MB) |
|---|---|---|---|---|---|---|
| 2. | 180. | 2.8 | 2 | 1450. | 292.0 | 1018.0 |

* * * R E C E P T O R N U M B E R * * *

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| TOTAL CONCENTRATION (UG/M**3) | | | | | | | |
| 28.049 | 65.188 | 28.939 | 15.640 | 9.707 | 6.599 | 4.803 | 3.723 |

* * * M E T E O R O L O G Y * * *

| NO. | THETA(DEG) | U (M/SEC) | KST | HL (M) | T (DEG-K) | P (MB) |
|---|---|---|---|---|---|---|
| 3. | 180. | 3.8 | 3 | 1450. | 292.0 | 1018.0 |

* * * R E C E P T O R N U M B E R * * *

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| TOTAL CONCENTRATION (UG/M**3) | | | | | | | |
| 5.499 | 80.249 | 49.281 | 30.506 | 20.474 | 14.668 | 11.036 | 8.619 |

* * * M E T E O R O L O G Y * * *

| NO. | THETA(DEG) | U (M/SEC) | KST | HL (M) | T (DEG-K) | P (MB) |
|---|---|---|---|---|---|---|
| 4. | 180. | 4.8 | 4 | 1450. | 292.0 | 1018.0 |

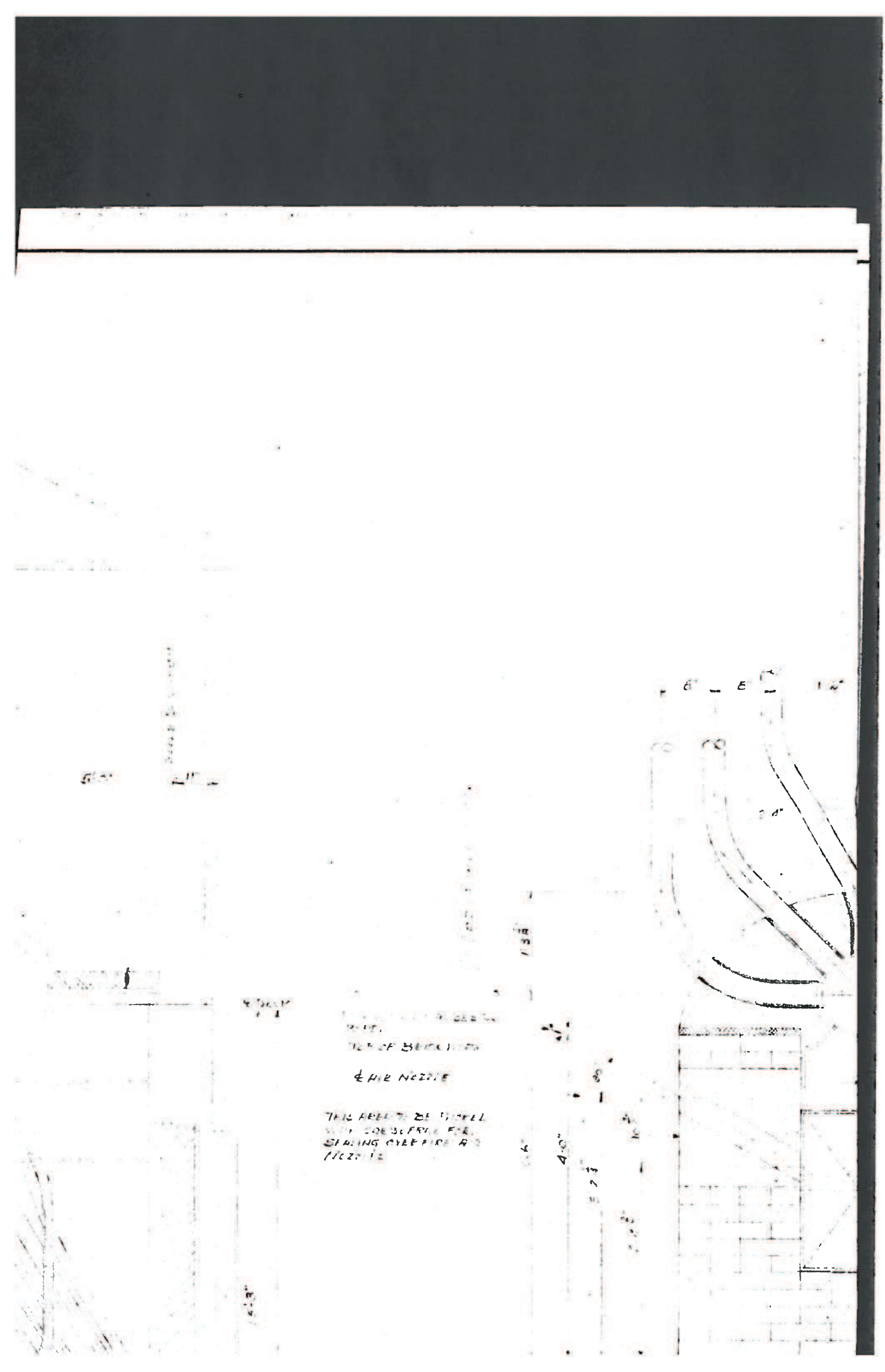
* * * R E C E P T O R N U M B E R * * *

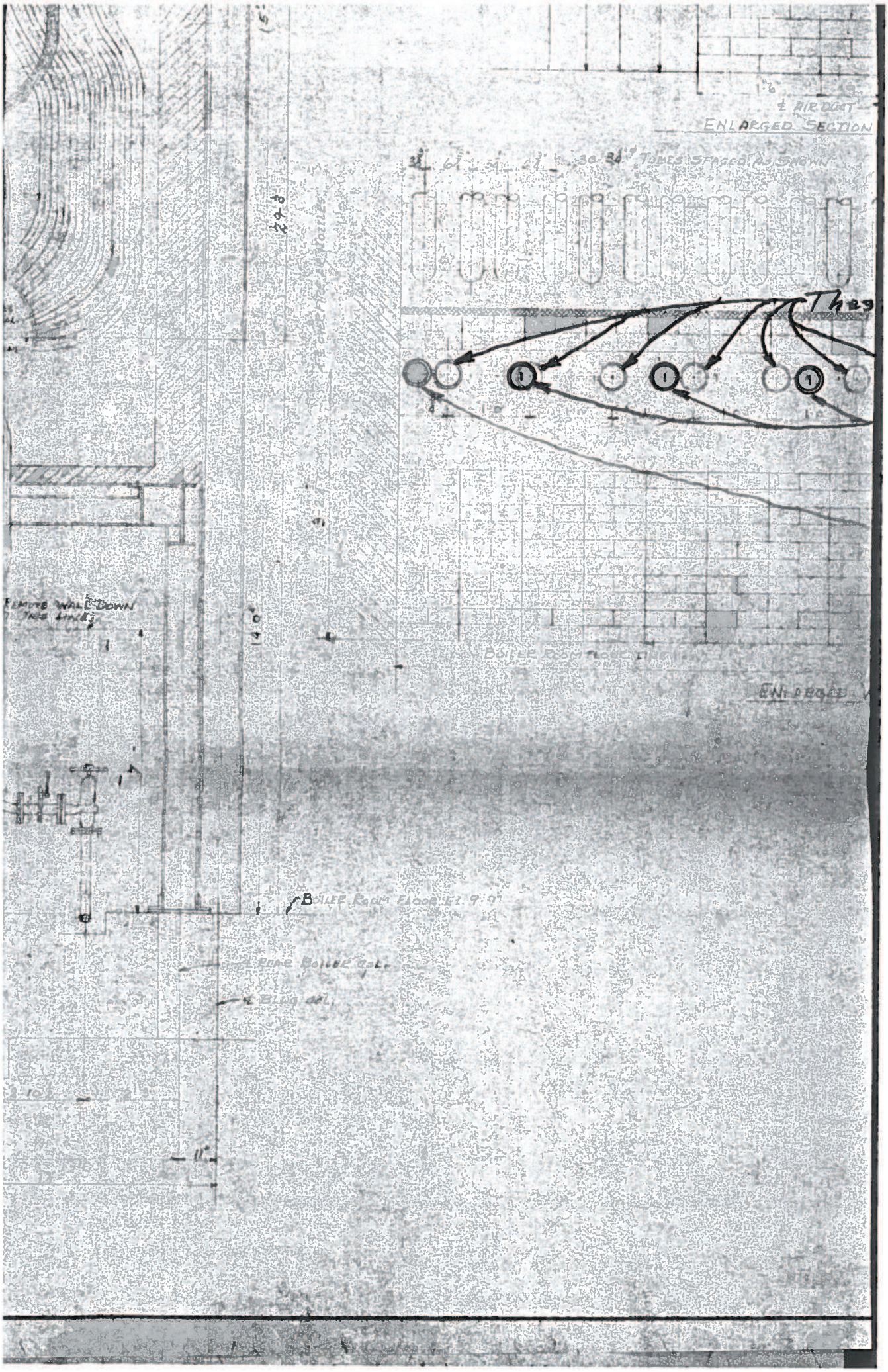
| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| TOTAL CONCENTRATION (UG/M**3) | | | | | | | |
| 0.007 | 32.029 | 47.715 | 44.310 | 37.844 | 31.999 | 27.224 | 23.402 |

* * * M E T E O R O L O G Y * * *

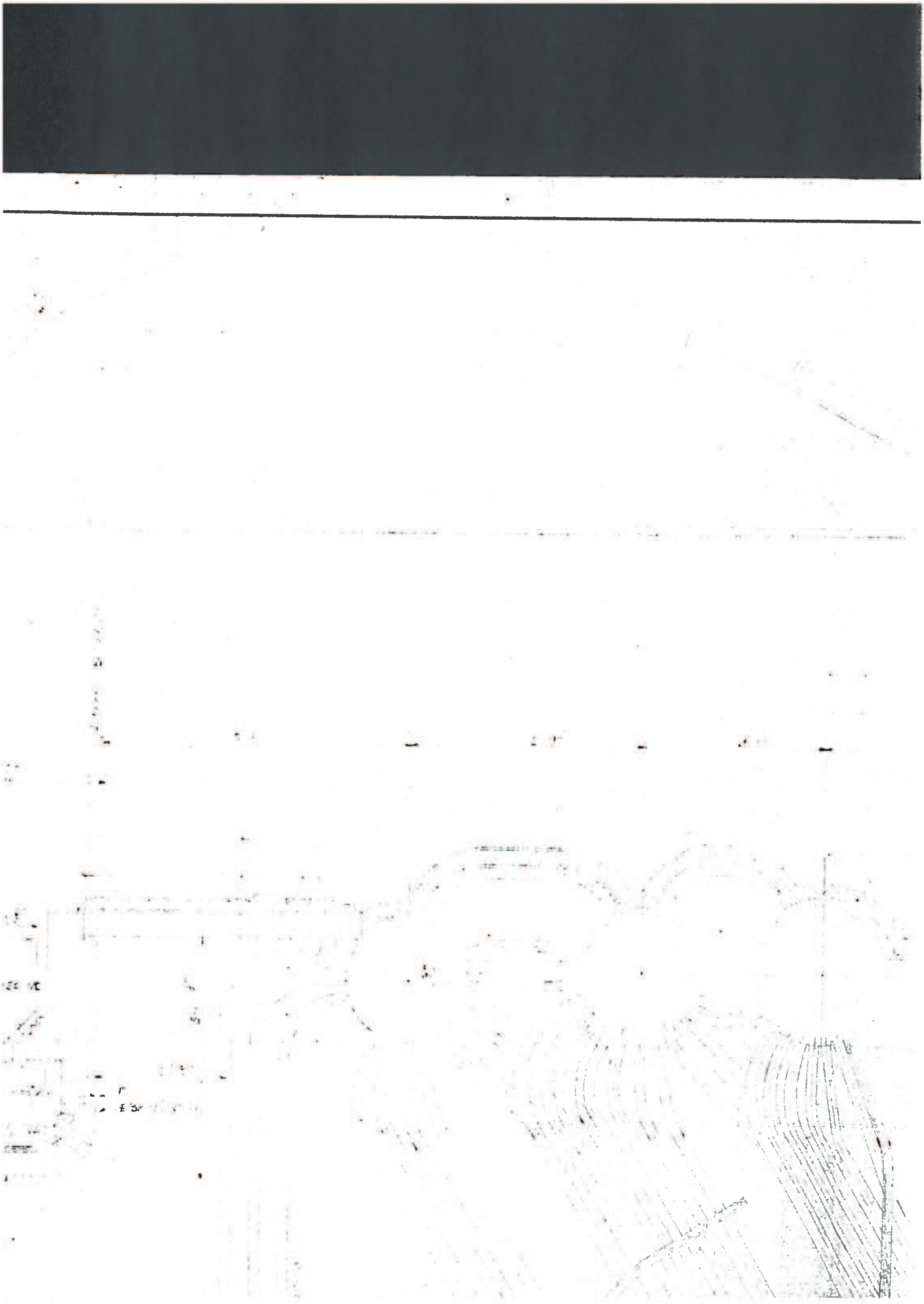
| NO. | THETA(DEG) | U (M/SEC) | KST | HL (M) | T (DEG-K) | P (MB) |
|---|---|---|---|---|---|---|
| 5. | 180. | 1.9 | 5 | 1450. | 292.0 | 1018.0 |

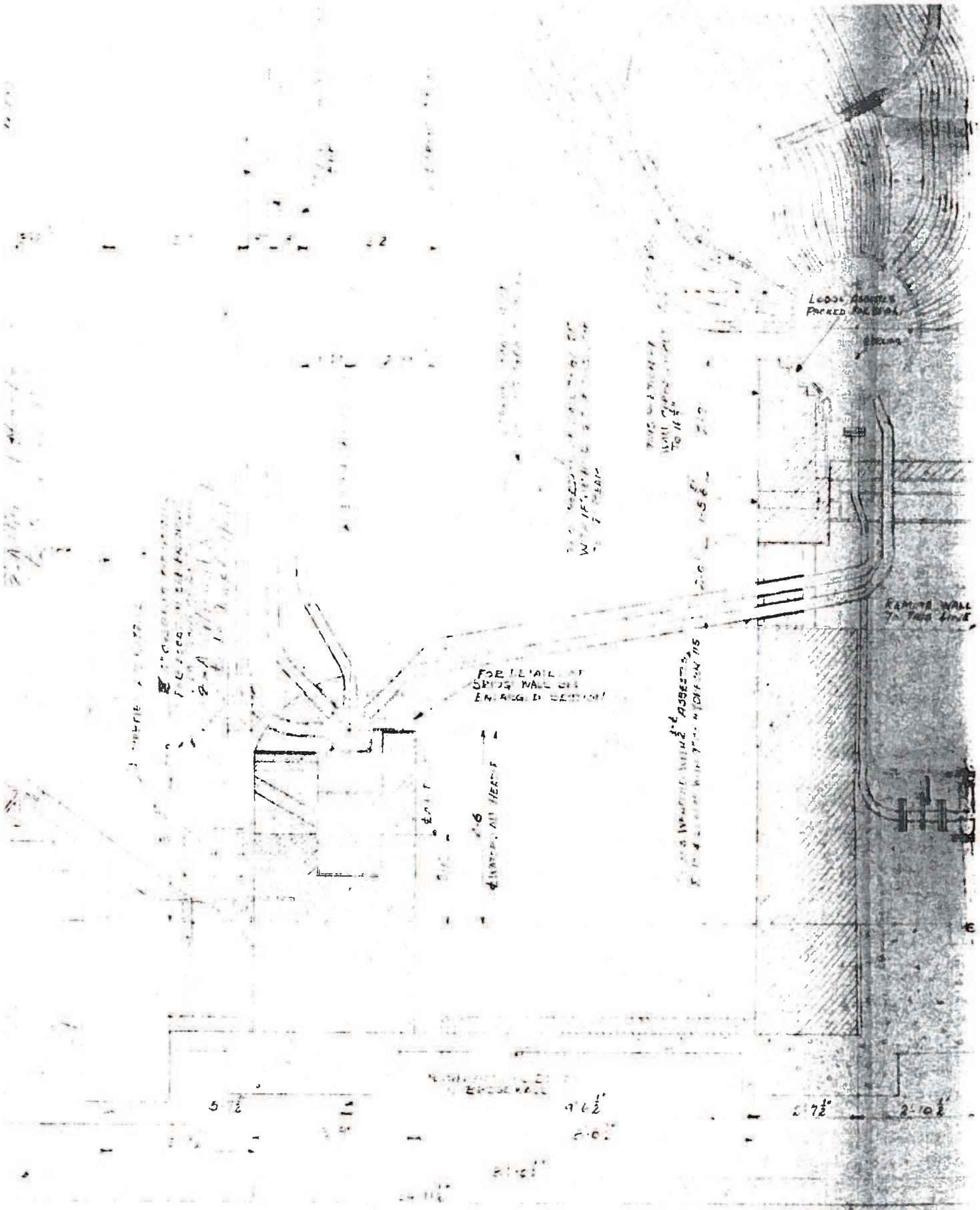
| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| INITIAL CONCENTRATION (UG/ML**3) | | | | | | | |
| 0.015 | 1.642 | 8.244 | 12.464 | 13.580 | 13.534 | 14.043 | 12.454 |



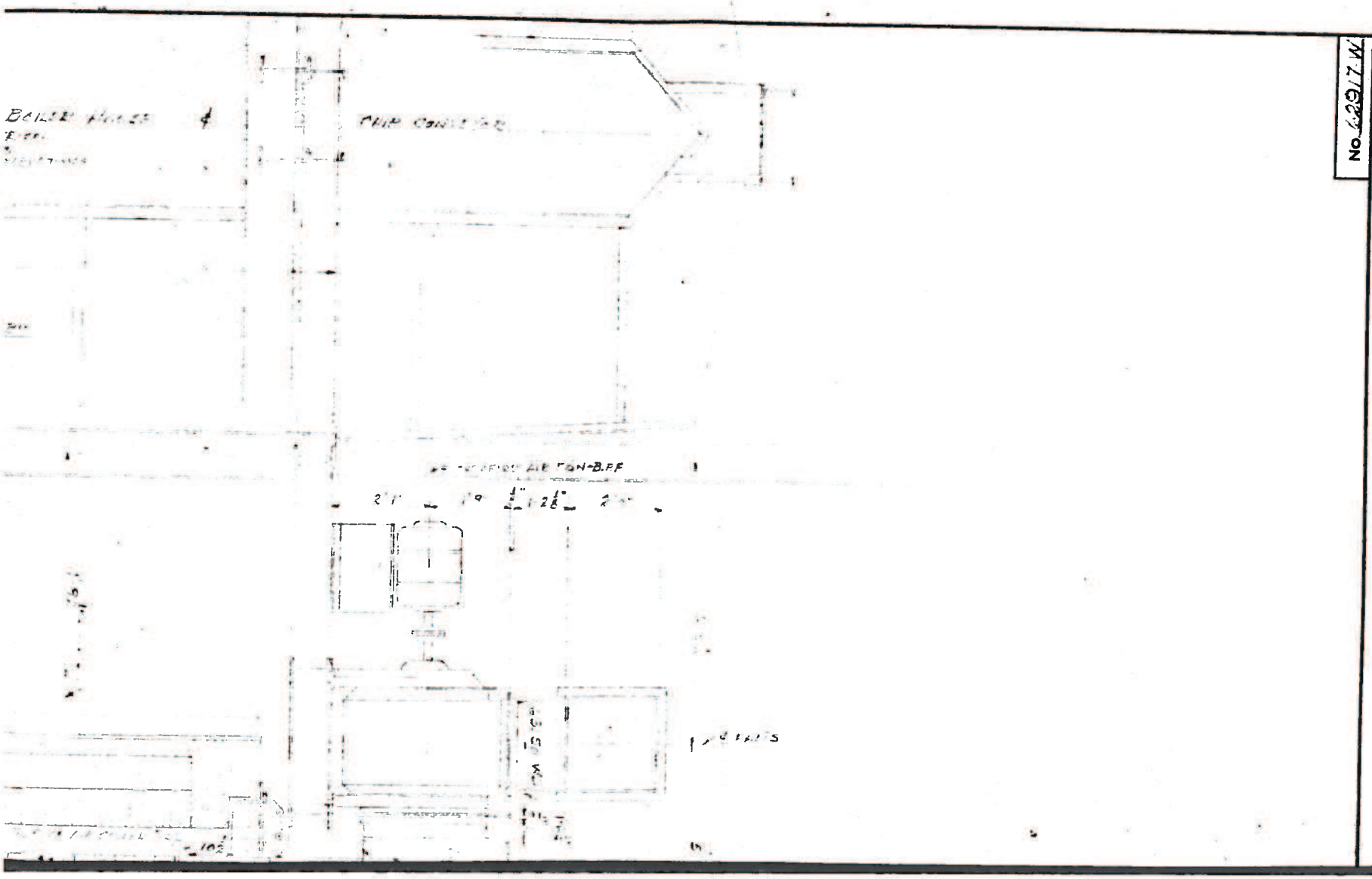


℄ AIR DUCT
ENLARGED SECTION
TUBES SPACED AS SHOWN
Thes
BOILER ROOM FLOOR
ENLARGED
REMOTE WALL DOWN
BOILER ROOM FLOOR EL. 9'-0"
REAR BOILER COL.
℄ BLDG COL.

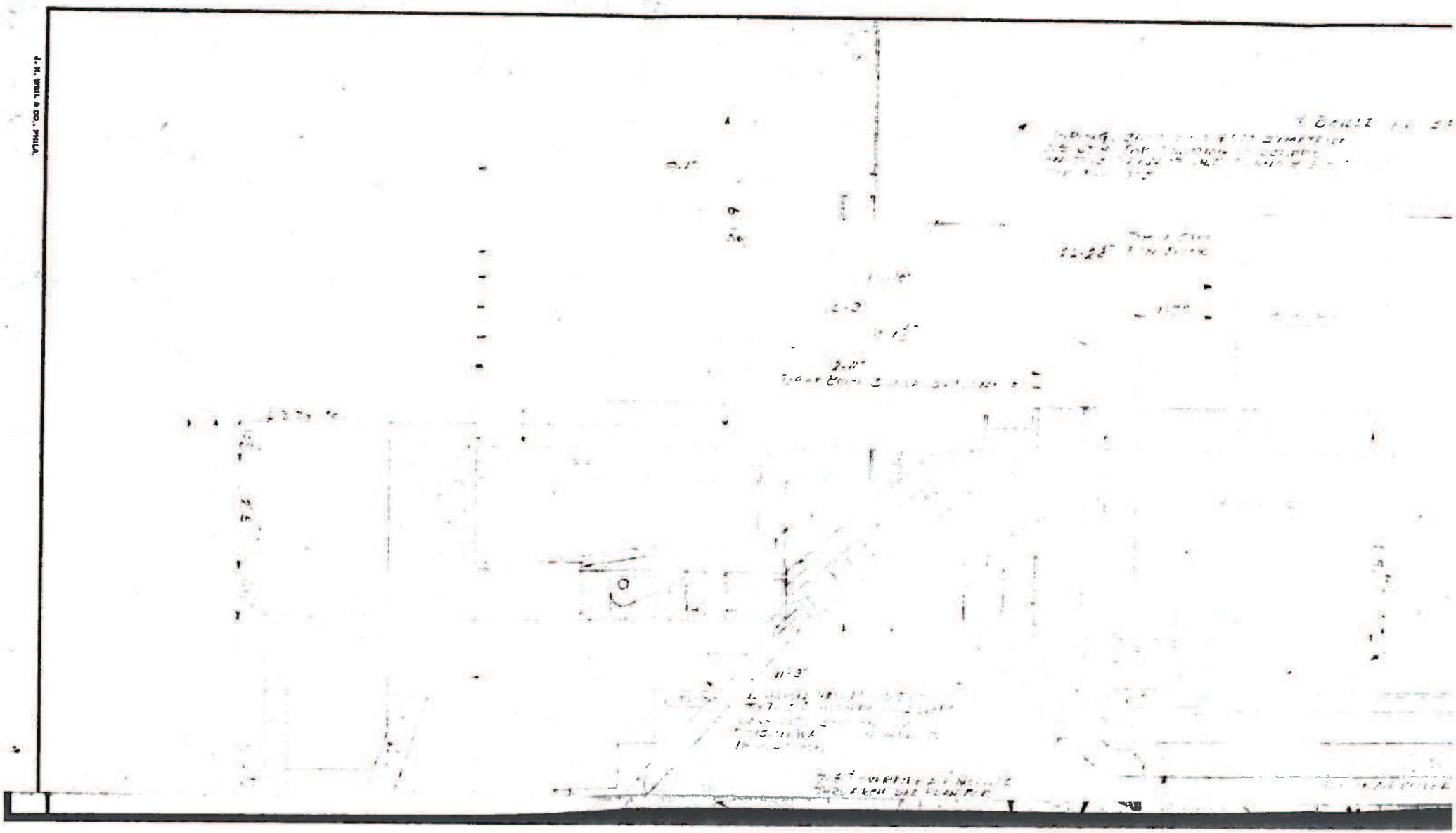





CROSS SECTION - ℄ OF BOILER




No. 62917 W



| PROJ. NO. | DATE | REVISIONS | REVISED BY | CHECKED BY | APPROVED BY |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
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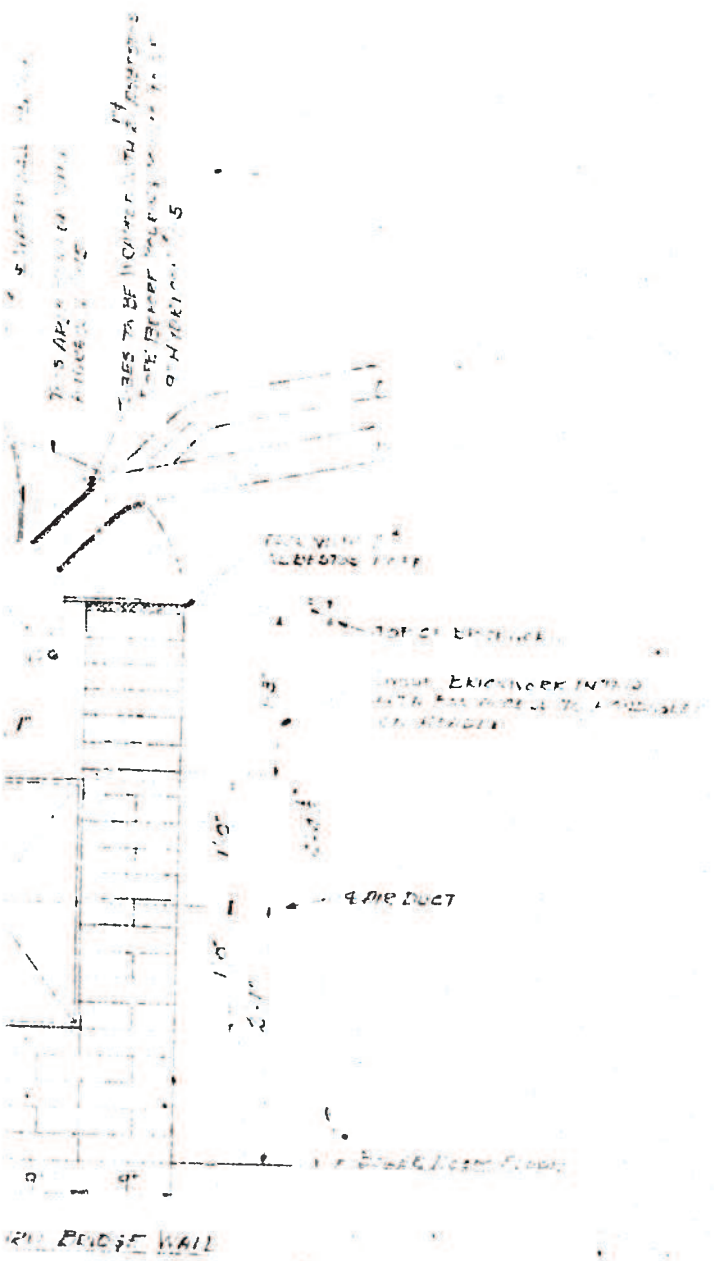
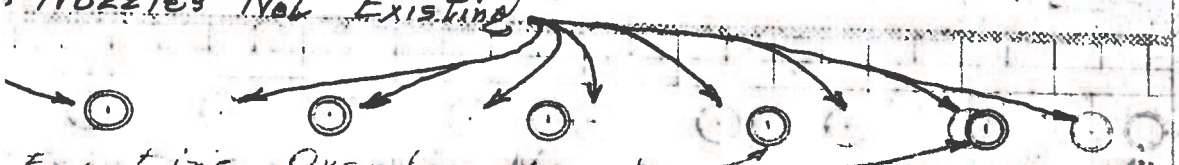


Nozzles Not Existing



Existing Overfire Nozzles

| NO. | TITLE |
|---|---|
| 62983-W | GENERAL ARRGT. ELEVATIONS |
| 62984-W | GENERAL ARRGT. PLANS |
| 63017-W | DUCTWORK DETAILS |
| 63018-W | DUCTWORK DETAILS |

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PLANT HATTIESBURG

BLD'G BOILER HOUSE

BOILERS No 1-2 & 4

ALTERATIONS TO INCREASE CAPACITY & EFFICIENCY

GENERAL ARRANGEMENT

CROSS SECTION

SCALE 1/2" = 1'-0" DATE 8-18-48

DRAWN BY N.G.LIND

CHECKED BY [illegible]

APPROVAL [illegible]

APPROVAL [illegible]

APPROVALS

**HERCULES POWDER CO.**

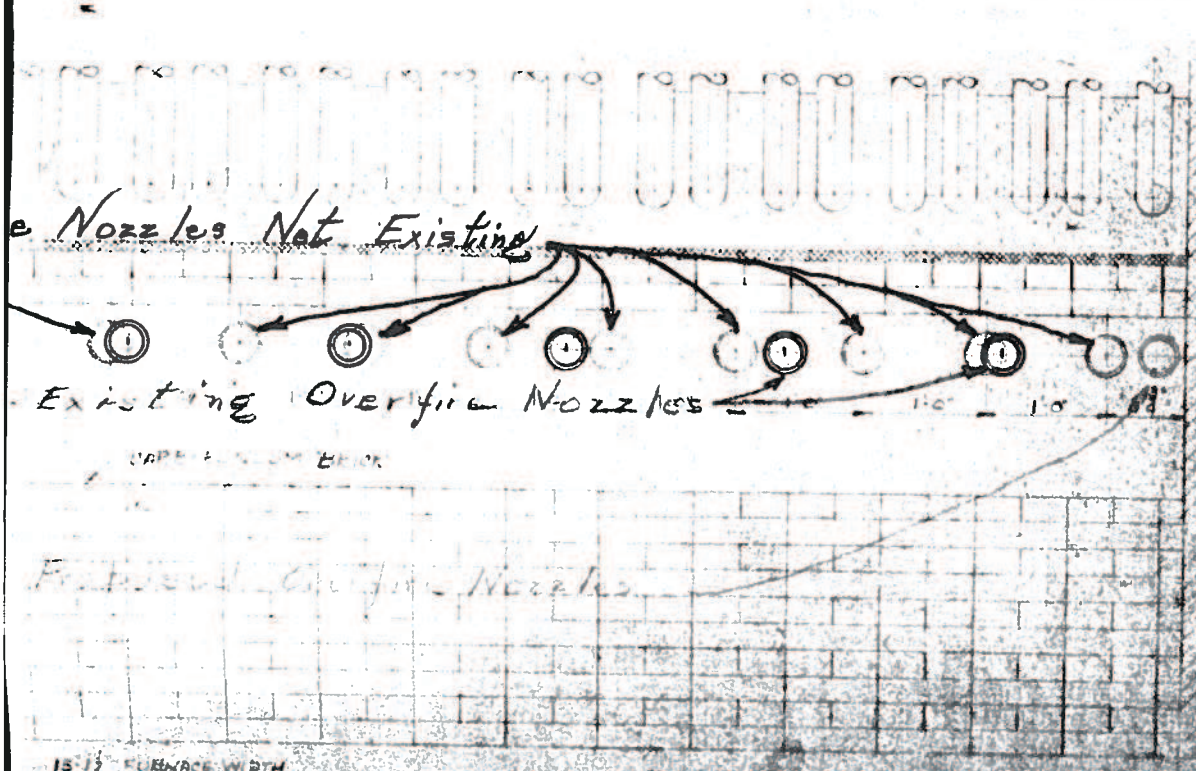
WILMINGTON, DELAWARE

BLD'G NO. 11

PROJECT 1831

DRAWING NO. 62917-W

No. 62917-W




| NO. | TITLE |
|---|---|
| 62983-W | DUCTWORK - DETAILS |
| 62983-W | DUCTWORK - DETAILS |
| 62984-W | GENERAL ARRGT - PLANS |
| 62983-W | GENERAL ARRGT - ELEVATIONS |

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PLANT HATTIESBURG
BLD'G BOILER HOUSE
BOILERS NO 1-2 & 4
ALTERATIONS TO INCREASE CAPACITY & EFFICIENCY
GENERAL ARRANGEMENT
CROSS SECTION

SCALE 1/2" = 1'-0" DATE 8-18-48
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PROJECT 12824
DRAWING NO. 62917-W