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AP-42 Section 11.6
Reference 53
Report Sect. 4
Reference 64

# EMISSION TESTS ON #2 KILN BAGHOUSE

March 31 and April 1, 1987

Prepared for

Southwestern Portland Cement
North End "E" Street
Victorville, California 92392

April 1987

Prepared by

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Bakersfield, California 93308

Report PS-87-1079/Project 5949-87

#6

# EMISSION TESTS ON #2 KILN BAGHOUSE

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Southwestern Portland Cement
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Reference 43 Precalciner Kiln. Downrated from A (PSM) to D (MRI) because of lack of certification of CEMS and inappropriate combustion gas data. Contains data on $NH_3$, HCl, CO, and $CO_2$. Rate HCl, CO, & $CO_2$ B w/ $NH_3$ D (questionable method)

Prepa

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Report PS-87-1079/Project 5949-87

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# SECTION 1

# INTRODUCTION

At the request of Southwestern Portland Cement (SWPC), Pape & Steiner Environmental Services conducted a series of emission tests on the effluent of the #2 kiln at their plant north of Victorville, California on March 31 and April 1, 1987. The purpose of these tests was to determine compliance with SBCAPCD emission limits and to determine emissions of $NH_3$ and HCl.

Triplicate particulate and $SO_2$ tests were performed using EPA Method 5/8. Triplicate $NO_x$, CO, $CO_2$, and $O_2$ tests were performed using CARB Method 1-100. Triplicate $NH_3$ and HCl tests were performed using a Modified Method 5 procedure. $NH_3$ was collected in 0.1 N HCl and HCl was collected in 0.1 N NaOH. SWPC personnel collected process samples during the tests to correlate process conditions with the measured emissions.

The EPA Method 5/8 train and the Modified Method 5 train for HCl were operated at 250°F. The Modified Method 5 train for $NH_3$ had an instack filter (approximately 400°F) to differentiate between solid particulates at the stack temperature and condensible particulates which were a vapor at the stack temperature. In addition, all three trains were operated isokinetically and simultaneously so that the filterable particulate portions of each train should have been comparable as well as stack gas temperatures, moisture and volumetric flowrates.

Section 2 of the report presents the test matrix for this program.

## SECTION 2

## TEST MATRIX

Table 2-1 summarizes the test matrix for this program. All tests for all pollutants were increased to three hours in length to collect enough material for chemical analysis. Representatives of SWPC and SBCAPCD were on hand on both days to observe the tests conducted by Pape & Steiner Environmental Services.

Section 3 summarizes the results of these tests.

TABLE 2-1. SWPC #2 KILN TEST MATRIX

| Date | Test No. | Test Parameter | Test Time |
|---|---|---|---|
| 03/31/87 | 1 | Particulates/$SO_2$<br>$NH_3$, HCl,<br>$NO_x$, CO, $CO_2$ $O_2$ | 1:48 pm - 5:24 pm |
| 04/01/87 | 2 | Particulates/$SO_2$<br>$NH_3$, HCl,<br>$NO_x$, CO, $CO_2$ $O_2$ | 7:50 am - 11:30 am |
| | 3 | Particulates/$SO_2$<br>$NH_3$, HCl,<br>$NO_x$, CO, $CO_2$ $O_2$ | 12:23 pm - 4:06 pm |

## SECTION 3

## TEST RESULTS

Table 3-1 summarizes the results of the particulate tests using the EPA Method 5/8 sampling train. Tables 3-1 and 3-2 present the results of the $NH_3$ and HCl tests using the Modified Method 5 sampling trains. Table 3-4 compares the measurement data obtained by the various sampling trains.

### 3.1 COMPLIANCE DETERMINATION

For an average volumetric flowrate of 171,062 dscfm, Rule 404 allows a particulate matter concentration of 0.0274 gr/dscf. All three tests conducted on the #2 kiln baghouse stack were in compliance with Rule 404 regardless of whether just the front half (i.e., nozzles, probe and filter catch) or both the front and the back half (i.e., nozzle, probe, filter and impingers) of the EPA Method 5/8 sampling train was used to determine compliance. The average grain loading based on front half catch was 0.0012 gr/dscf and the grain loading based on the total catch was 0.0051 gr/dscf, both of which are well below the standard.

For a kiln process weight rate of 225 tons per hour, Rule 405 limits particulate mass emissions to 24.32 lb/hr. Once again. all three tests were in compliance with the standard. The front half catch resulted in an emission rate of 1.76 lb/hr while the total catch yielded an emission rate of 7.45 lb/hr.

## 3.2 COMPARISON OF MEASUREMENT METHODS

The intent of operating the EPA Method 5/8 train, the Modified Method 5/$NH_3$ train and the Modified Method 5/HCl train simultaneously was to determine the variability in the filterable particulate portion of the emission data. Basically, Table 3-4 illustrates that good agreement was obtained between the EPA Method 5/8 train and the Modified Method 5/HCl train, when measuring filterable particulates. The Modified Method 5/$NH_3$ train gave some surprising results. The filterable particulates were approximately an order of magnitude higher using the in-stack glass fiber thimble. The thimbles used on these tests were Whatman GF 30x100 mm glass filter thimbles. A call was made to Whatman to determine what type of glass fiber paper was used to make these thimbles. Whatman USA indicated it definitely wasn't 934 AH (E-type glass) paper and indicated they would check with Whatman UK who actually provides these thimbles. It appears that the glass fiber paper is a high sodium paper which has a notoriously high $SO_2$ uptake. Hence, the results of the filterable particulate tests using the in-stack thimble are invalid.

Physical measurements, such as stack gas temperature, moisture and volumetric flowrate, were all in good agreement which indicates that repeatable data were obtained during the test program.

## 3.3 $NH_3$

The $NH_3$ concentration in the exhaust gases was 2.87 ppm over the three tests. The in-stack thimble and the impingers were analyzed separately and only trace amounts of $NH_3$ compounds (0.02 ppm) were found in the front half of the sampling train. Virtually all the $NH_3$ was found in the cold impingers indicating that the $NH_3$ is a vapor at the operating temperature of the baghouse.

## 3.4 HCl

Similar results were obtained with the HCl tests. Only a small amount (0.19 ppm) of HCl was found in the front half of the sampling train, whereas a large amount (37.65 ppm) was found in the impingers. This sampling train operated at 250°F which is approximately 150°F below the operating temperature of the baghouse and yet most of the HCl was found in the impingers and not as a solid in the front of the train. Obviously the HCl is present as a vapor, even at the lower sampling train temperatures. It is interesting to note that over 200 mg of HCl was found in the impingers via chemical analysis and that the total weight of condensible particulates from the EPA Method 5/8 train was only 33 mg. It appears that this chloride is very volatile and it is partially lost during evaporation of the impinger catch to dryness at 150°F. It is evident that if the condensible particulate catch were evaporated at ambient temperature and pressure, a much higher condensible particulate weight would be obtained.

## 3.5 CONCLUSIONS

Based on the results of these tests, there are interferences from $NH_3$ and HCl (or another volatile compound such as $NH_4Cl$) which influence the particulate matter determination. These compounds are not present in the solid form at the operating temperature of the baghouse (approximately 400°F) or the operating temperature of the sampling train (approximately

250°F). They are present as vapors which are collected in the impinger train. When the impinger train solutions are evaporated to dryness, a large amount of condensible particulate is formed. The amount of particulate depends on the temperature at which the evaporation is carried out. Enough condensible material is present to cause the total particulate (filterable plus condensible) emission standard to be violated. A baghouse or an ESP cannot control gaseous pollutants such as the compounds found in this study. The test method for particulates need to be modified so as to exclude the condensible particulates formed in the impingers due to reaction of species such as $NH_3$, $SO_2$ and HCl.

6 - 85.99     - 70.59 5

14.33     14.118

5 $\frac{560}{14.118 \times 25.6}$ 5     Avg 5 runs = 521 #/hr

361.42     = 1.549 $\frac{\#NO_x}{MMBTU}$ 5

$\frac{521}{\cancel{14.118}\ 14.33 \times 25.6}$ = 1.420 $\frac{\#NO_x}{MMBTU}$ 6

Total     $\frac{65.45}{100}$

T - L
34.55

LAS CRUCES HILTON

705 South Telshor Boulevard Las Cruces, New Mexico 88001 505/522-4300
Reservations 1-800/HILTONS

Need - Coal rate for test on 7/21
3/31/87 & 4/1/87 and/or BTU/T cl
if KF = 225 TPH does cl = 147 TPH
= LOI ?

Need Coal rate
" Clinker " —
" KF "

Coal BTU or Clinker BTU/T

Sunnyside Coal @ 13,061 BTU/lb

LOI
3/31 - 34.77
4/1 - 34.68
34.725 Avg.

TABLE 3-1. SUMMARY OF SOURCE EMISSION TEST DATA
(EPA METHOD 5/8)

Unit Tested: #2 Kiln  Location: Baghouse Outlet

| Test Number | 1 | 2 | 3 | Average |
|---|---|---|---|---|
| Date | 03/31/87 | 04/01/87 | 04/01/87 | |
| Test Condition — Kiln Feed — | 225 TPH | 225 TPH | 225 TPH | |
| Clinker — | 121.4 " | 121.4 " | 121.4 " | |
| Barometric Pressure (in. Hg) | 26.72 | 26.51 | 26.46 | |
| Stack Pressure (in. Hg) | 26.69 | 26.48 | 26.43 | |
| Stack Area ($ft^2$) | 139.63 | 139.63 | 139.63 | |
| Elapsed Sampling Time (min.) | 192 | 192 | 192 | |
| Volume Gas Sampled (dscf) | 134.1740 | 133.058 | 130.100 | |
| **GAS DATA** | | | | |
| Average Gas Velocity (fps) | 39.9 | 40.4 | 39.3 | 39.9 |
| Average Gas Temp. (°F) | 403.7 | 407.9 | 407.6 | 406.4 |
| Gas Flowrate (dscfm) | 173,143 | 172,556 | 167,485 | 171,062 |
| Gas Analysis (Dry % Basis) | | | | |
| Carbon Dioxide | 19.93 | 20.53 | 21.14 | 20.53 |
| Oxygen | 8.87 | 8.86 | 8.49 | 8.74 |
| Water | 3.59 | 3.87 | 3.96 | 3.81 |
| **EMISSION CONCENTRATION** | | | | |
| Filterable Particulate (gr/dscf) | 0.0013 | 0.0010 | 0.0013 | 0.0012 |
| Total Particulate Matter (gr/dscf) | 0.0039 | 0.0068 | 0.0045 | 0.0051 |
| CO (ppm) | 664.18 | 667.68 | 881.04 | 737.63 |
| CO @ 3% $O_2$ | 988.26 | 992.65 | 1270.80 | 1083.90 |
| $SO_2$ (ppm) | 2.08 | 1.84 | 2.26 | 2.06 |
| $SO_2$ @ 3% $O_2$ | 3.09 | 2.74 | 3.26 | 3.03 |
| $NO_x$ (ppm) | 641.75 | 654.37 | 647.39 | 647.84 |
| $NO_x$ @ 3% $O_2$ | 954.89 | 972.86 | 933.77 | 953.84 |
| **EMISSION RATE** | | | | |
| Filterable Particulate (lb/hr) | 1.86 | 1.50 | 1.92 | 1.76 |
| Total Particulate (lb/hr) | 5.83 | 10.02 | 6.51 | 7.45 |
| CO (lb/hr) | 509.19 | 510.14 | 653.37 | 557.57 |
| $NO_x$ (lb/hr) | 808.28 | 821.38 | 788.72 | 806.13 |
| Condensible particulate or reaction products #/hr — | 3.97 | 8.52 | 4.59 | 5.69 |
| $NO_x$ - (lb./ton clinker) | 6.66 | 6.77 | 6.50 | 6.64 |
| $NO_x$ - (lb./MMBTU) | 1.93 | 1.96 | 1.88 | 1.92 |
| $NO_x$ - (lb/TKF) | 3.59 | 3.65 | 3.51 | 3.58 |
| Coal Fuel Rate — Pyroclone — | 8.6 | 8.6 | 8.6 | |
| Tons/hour — Kiln — | 7.45 | 7.45 | 7.46 | |
| Total | 16.05 | 16.05 | 16.06 | |

TABLE 3-2. SUMMARY OF SOURCE EMISSION TEST DATA (MODIFIED METHOD 5/$NH_3$)

Unit Tested: #2 Kiln

Location: Baghouse Outlet

| Test Number | 1 | 2 | 3 | Average |
|---|---|---|---|---|
| Date | 03/31/87 | 04/01/87 | 04/01/87 | |
| Test Condition | 225 TPH | 225 TPH | 225 TPH | |
| Barometric Pressure (in. Hg) | 26.72 | 26.51 | 26.46 | |
| Stack Pressure (in. Hg) | 26.69 | 26.48 | 26.43 | |
| Stack Area ($ft^2$) | 139.63 | 139.63 | 139.63 | |
| Elapsed Sampling Time (min.) | 192 | 192 | 192 | |
| Volume Gas Sampled (dscf) | 125.0829 | 118.4094 | 126.5623 | |
| **GAS DATA** | | | | |
| Average Gas Velocity (fps) | 44.5 | 40.0 | 43.1 | 41.5 |
| Average Gas Temp. (°F) | 411.1 | 412.8 | 418.9 | 414.3 |
| Gas Flowrate (dscfm) | 175,512 | 167,550 | 178,397 | 173,820 |
| Gas Analysis (Dry % Basis) | | | | |
| Carbon Dioxide | 19.93 | 20.53 | 21.14 | 20.53 |
| Oxygen | 8.87 | 8.86 | 8.49 | 8.74 |
| Water | 5.11 | 5.22 | 5.40 | 5.24 |
| **EMISSION CONCENTRATION** | | | | |
| Filterable Particulate (gr/dscf) | 0.0079 | 0.0073 | 0.0073 | 0.0075 |
| Filterable $NH_3$ (ppm) | 0.02 | 0.02 | 0.01 | 0.02 |
| Filterable $NH_3$ @ 3% $O_2$ | 0.03 | 0.02 | 0.01 | 0.02 |
| Vapor $NH_3$ (ppm) | 2.80 | 2.95 | 2.87 | 2.87 |
| Vapor $NH_3$ @ 3% $O_2$ | 4.17 | 4.40 | 4.14 | 4.24 |
| **EMISSION RATE** | | | | |
| Filterable Particulate (lb/hr) | 11.87 | 10.48 | 11.14 | 11.16 |
| Filterable $NH_3$ (lb/hr) | 0.01 | 0.01 | 0.005 | 0.008 |
| Vapor $NH_3$ (lb/hr) | 1.32 | 1.33 | 1.375 | 1.342 |

TABLE 3-3. SUMMARY OF SOURCE EMISSION TEST DATA (MODIFIED METHOD 5/HCl)

Unit Tested: #2 Kiln

Location: Baghouse Outlet

| Test Number | 1 | 2 | 3 | Average |
|---|---|---|---|---|
| Date | 03/31/87 | 04/01/87 | 04/01/87 | |
| Test Condition | 225 TPH | 225 TPH | 225 TPH | |
| Barometric Pressure (in. Hg) | 26.72 | 26.51 | 26.46 | |
| Stack Pressure (in. Hg) | 26.69 | 26.48 | 26.43 | |
| Stack Area ($ft^2$) | 139.63 | 139.63 | 139.63 | |
| Elapsed Sampling Time (min.) | 192 | 192 | 192 | |
| Volume Gas Sampled (dscf) | 128.7035 | 126.6796 | 115.3164 | |
| GAS DATA | | | | |
| Average Gas Velocity (fps) | 39.0 | 39.8 | 39.0 | 39.3 |
| Average Gas Temp. (°F) | 398.7 | 403.3 | 401.8 | 401.3 |
| Gas Flowrate (dscfm) | 167,516 | 168,647 | 165,106 | 167,090 |
| Gas Analysis (Dry % Basis) | | | | |
| Carbon Dioxide | 19.93 | 20.53 | 21.14 | 20.53 |
| Oxygen | 8.87 | 8.86 | 8.49 | 8.74 |
| Water | 5.11 | 5.18 | 5.31 | 5.20 |
| EMISSION CONCENTRATION | | | | |
| Filterable Particulate (gr/dscf) | 0.0011 | 0.0005 | 0.0011 | 0.0009 |
| Filterable HCl (ppm) | 0.18 | 0.18 | 0.21 | 0.19 |
| Filterable HCl @ 3% $O_2$ | 0.27 | 0.27 | 0.30 | 0.28 |
| Vapor HCl (ppm) | 39.03 | 37.51 | 36.40 | 37.65 |
| Vapor HCl @ 3% $O_2$ | 55.15 | 52.96 | 49.86 | 52.66 |
| EMISSION RATE | | | | |
| Filterable Particulate (lb/hr) | 1.52 | 0.67 | 1.57 | 1.25 |
| Filterable HCl (lb/hr) | 0.17 | 0.18 | 0.20 | 0.18 |
| Vapor HCl (lb/hr) | 37.71 | 36.48 | 34.66 | 36.28 |

TABLE 3-4. COMPARISON OF STACK GAS MEASUREMENTS

| Date | Test No. | Sampling Train | Stack Gas Parameter | | | | |
|---|---|---|---|---|---|---|---|
| | | | Temp. (°F) | Moisture (%) | Flowrate (dscfm) | Filterable Particulates (gr/dscf) | Filterable Particulates (lb/hr) |
| 03/31/87 | 1 | Method 5/8 | 403.7 | 3.59 | 173,143 | 0.0013 | 1.86 |
| | | $MM5/NH_3$ | 411.1 | 5.11 | 175,512 | 0.0079[a] | 11.87[a] |
| | | MM5/HCl | 398.7 | 5.11 | 167,516 | 0.0011 | 1.52 |
| 04/01/87 | 2 | Method 5/8 | 407.9 | 3.87 | 172,556 | 0.0010 | 1.50 |
| | | $MM5/NH_3$ | 412.8 | 5.22 | 167,550 | 0.0073[a] | 10.48[a] |
| | | MM5/HCl | 403.3 | 5.18 | 168,647 | 0.0005 | 0.67 |
| | 3 | Method 5/8 | 407.6 | 3.96 | 167,485 | 0.0013 | 1.92 |
| | | $MM5/NH_3$ | 418.9 | 5.40 | 178,397 | 0.0073[a] | 11.14[a] |
| | | MM5/HCl | 401.8 | 5.31 | 165,106 | 0.0011 | 1.57 |
| | | Mean | 407.3 | 4.75 | 170,657 | 0.0011 | 1.51 |
| | | Std. Dev. | 6.3 | 0.72 | 4440 | 0.0003 | 0.45 |
| | | % RSD | 1.5 | 15.2 | 2.6 | 28.1 | 29.7 |

[a] $MM5/NH_3$ data not included in calculations.

## SECTION 4

## SAMPLING PROCEDURES

This section of the report describes the equipment and procedures used to conduct the particulate gaseous tests on this program.

### 4.1 PRELIMINARY MEASUREMENTS

Before conducting the stack tests a series of preliminary measurements were made to determine:

- The location of the sampling site and the number and location of the sampling points to be used (EPA Method 1)
- The velocity, temperature, and pressure of the gases in the stack (EPA Method 2)
- The composition of the stack gases (EPA Method 3)
- The moisture content of the stack gases (psychrometric chart)

Using the results of these preliminary measurements and the calibration constants for the sampling train, a series of calculations were made to determine the value of K, a constant, and $N_d$, ideal nozzle diameter, required to run an isokinetic test according to the equation:

$$\Delta H = \left\{ \frac{60^2 \pi^2 K_p{}^2 C_p{}^2 (1 - B_{wo})^2 P_s MW_d}{576^2 K_o{}^2 MW_s P_m} \right\} (N_d{}^4) \left( \frac{T_m}{T_s} \right) (\Delta P)$$

where

$$K = \left\{ \frac{60^2 \pi^2 K_p^2 C_p^2 (1 - B_{wo})^2 P_s MW_d}{576^2 K_o^2 MW_s P_m} \right\}$$

An actual nozzle, whose diameter was as close as possible to the ideal nozzle diameter, was selected for the test. Isokinetic sampling rates for each sampling point in the stack were computed using the equation:

$$\Delta H = (K)(N_d^4)\left(\frac{T_m}{T_s}\right)(\Delta P)$$

Since K and $N_d$ are known, and remain constant during a test, the only variables are the meter temperatures, the stack temperature and the velocity pressure for each sampling point.

4.2 PREPARATION OF THE PARTICULATE-$SO_x$ SAMPLING TRAIN

All sampling train components were cleaned in the laboratory (soap and water, tap water rinse, distilled water rinse, and IPA rinse) to eliminate previous contamination. The sampling train components were sealed and transported to the sampling site in a mobile lab. The EPA Method 5/8 equipment used to measure particulates (filterable and total) and $SO_x$ consisted of:

- A calibrated 316 stainless steel nozzle for isokinetic sampling
- A heated Pyrex glass sampling probe (6 feet long) equipped with an S-type pitot tube and a thermocouple to measure stack velocity pressure and temperature

- A heated Pyrex glass filter holder containing a weighed 100-mm Reeve Angel 934 AH glass fiber filter
- A Pyrex glass impinger train in an icebath (impinger 1 contains 100 ml 80-percent IPA; a Pyrex glass filter holder containing a 47-mm Reeve Angel 934 AH filter; bubbler 2 and impinger 3 each contain 100 ml of 3-percent $H_2O_2$; bubbler 4 contains a weighed amount of silica gel)
- An umbilical to connect the probe and sample box to the control module
- A control module containing a vacuum pump, a calibrated dry gas meter and a calibrated orifice meter to measure the pressure, temperature and flowrate throughout the train.

The sampling train was charged in the mobile lab using freshly prepared reagents. Each impinger and its contents was weighed to the nearest 0.1 gm on a calibrated electronic balance. Blanks of all filters and reagents were retained for subsequent analysis. The sampling point locations were marked on the probe using a high-temperature marker. The sampling train was completely assembled and lifted to the sampling site.

## 4.3 SAMPLING PROCEDURES FOR PARTICULATE-$SO_x$ SAMPLING TRAIN

Prior to a test, the sampling train was heated and leak-checked at 15 inches Mercury to insure leakage was less than 0.02 cfm. The S-type pitot tube was also leak-checked. The sampling train was installed on the unirail and the probe was inserted into the stack at the farthest point. An isokinetic sampling rate was calculated using an HP-41CV calculator for each sampling point on the traverse (6 points per traverse; 4 traverses at 90°). Each point was sampled for an equal period of time (8 minutes) and all pertinent data was recorded on the data sheet for each point. The probe and sample box were maintained at 250°F throughout the traverse. The gases leaving the impinger train were maintained at <70°F. At the end of a traverse, the probe was withdrawn from the stack and the entire sampling train was transferred (in tact) to the next sampling port. Another traverse of the stack was completed and the sampling train was withdrawn for the final leak check. This leak check was performed at 15 inches Mercury or at the highest vacuum achieved during the test. The S-type pitot tube was also checked at this time. The sampling train was then purged with ambient air for 15 minutes using the highest $\Delta H$ measured during the test. After the train was purged, the probe, nozzle, filter holder, and impinger train was sealed with tin foil and lowered to the mobile lab for sample recovery.

### 4.4 SAMPLE RECOVERY PROCEDURES FOR PARTICULATE-$SO_x$ SAMPLING TRAIN

Sample recovery occurred in the mobile lab. The nozzle and probe were brushed and rinsed three times using ACS reagent grade acetone into a polyethylene sample bottle. The 100-mm filter was removed from the 4-inch filter holder and sealed in its petri dish. The front half of the 4-inch glass filter holder was brushed and rinsed with acetone. Each impinger was removed from the icebath, wiped dry and weighed to the nearest 0.1 gm. The contents of impinger 1 were transferred to a polyethylene sample bottle. The back half of the 4-inch glass filter holder, the glass connectors, impinger 1, and the front half of the 2-inch filter holder were rinsed with 80-percent IPA and the rinsings were transferred to this same bottle. The 47-mm filter from the 2-inch filter holder was sealed in its petri dish. The contents of bubbler 2 and impinger 3 were transferred to a polyethylene sample bottle. Distilled water rinsings of the back half of the 2-inch filter holder, bubbler 2, the connector, and impinger 3 were transferred to this same bottle. All sample bottles and petri dishes were marked and labeled. A chain-of-custody log was completed and the field data sheet was also labeled with the sample ID numbers. The sampling train was then recharged in preparation for the next test.

## 4.5 PREPARATION OF THE PARTICULATE-$NH_3$ SAMPLING TRAIN

All sampling train components were cleaned in the laboratory (soap and water, tap water rinse, distilled water rinse, and IPA rinse) to eliminate previous contamination. The sampling train components were sealed and transported to the sampling site in a mobile lab. The Modified EPA Method 5 equipment used to measure particulates (filterable) and $NH_3$ consisted of:

- A calibrated 316 stainless steel nozzle for isokinetic sampling
- A heated Pyrex glass sampling probe (6 feet long) equipped with an S-type pitot tube and a thermocouple to measure stack velocity pressure and temperature
- A heated Pyrex glass filter holder containing a weighed 100-mm Reeve Angel 934 AH glass fiber filter
- A Pyrex glass impinger train in an icebath (impingers 1 and 2 contained 100 ml of 0.1 N HCl; impinger 3 was dry; bubbler 4 contained a weighed amount of silica gel)

- An umbilical to connect the probe and sample box to the control module
- A control module containing a vacuum pump, a calibrated dry gas meter and a calibrated orifice meter to measure the pressure, temperature and flowrate throughout the train.

The sampling train was charged in the mobile lab using freshly prepared reagents. Each impinger and its contents was weighed to the nearest 0.1 gm on a calibrated electronic balance. Blanks of all filters and reagents were retained for subsequent analysis. The sampling point locations were marked on the probe using a high-temperature marker. The sampling train was completely assembled and lifted to the sampling site.

## 4.6 SAMPLING PROCEDURES FOR PARTICULATE-$NH_3$ SAMPLING TRAIN

Prior to a test, the sampling train was heated and leak-checked at 15 inches Mercury to insure leakage was less than 0.02 cfm. The S-type pitot tube was also leak-checked. The sampling train was installed on the unirail and the probe was inserted into the stack at the farthest point. An isokinetic sampling rate was used for each sampling point on the traverses (6 points per traverse, 4 traverses). Each point was sampled for an equal period of time (8 minutes) and all pertinent data was recorded on the data sheet for each point. The probe and sample box were maintained at 250°F throughout the traverse. The gases leaving the impinger train were maintained at <70°F. At the end of a traverse, the probe was withdrawn from the stack and the entire sampling train was transferred (in tact) to the next sampling port. After completing the traverses, the sampling train was withdrawn for the final leak check. This leak check was performed at 15 inches Mercury or at the highest vacuum achieved during the test. The S-type pitot tube was also checked at this time. The sampling train was sealed with tin foil and lowered to the mobile lab for sample recovery.

## 4.7 SAMPLE RECOVERY PROCEDURES FOR PARTICULATE-$NH_3$ SAMPLING TRAIN

Sample recovery occurred in the mobile lab. The nozzle and probe were brushed and rinsed three times using distilled water into a polyethylene sample bottle. The 100-mm filter was removed from the 4-inch filter holder and sealed in its petri dish. The front half of the 4-inch glass filter holder was brushed and rinsed with distilled water. Each impinger was removed from the icebath, wiped dry and weighed to the nearest 0.1 gm. The contents of impingers 1 2 and 3 were transferred to a polyethylene sample bottle. The back half of the 4-inch glass filter holder, the glass connectors, impingers 1, 2 and 3 were rinsed with distilled water and the rinsings were transferred to this same bottle. All sample bottles and petri dishes were marked and labeled. A chain-of-custody log was completed and the field data sheet was also labeled with the sample ID numbers. The sampling train was then recharged in preparation for the next test.

## 4.8 PREPARATION OF THE PARTICULATE-HCl SAMPLING TRAIN

All sampling train components were cleaned in the laboratory (soap and water, tap water rinse, distilled water rinse, and IPA rinse) to eliminate previous contamination. The sampling train components were sealed and transported to the sampling site in a mobile lab. The Modified EPA Method 5 equipment used to measure particulates (filterable) and HCl consisted of:

- A calibrated 316 stainless steel nozzle for isokinetic sampling
- A heated Pyrex glass sampling probe (6 feet long) equipped with an S-type pitot tube and a thermocouple to measure stack velocity pressure and temperature
- A heated Pyrex glass filter holder containing a weighed 100-mm Reeve Angel 934 AH glass fiber filter
- A Pyrex glass impinger train in an icebath (impingers 1 and 2 contained 100 ml of 0.1 N NaOH; impinger 3 was dry; bubbler 4 contained a weighed amount of silica gel)
- An umbilical to connect the probe and sample box to the control module
- A control module containing a vacuum pump, a calibrated dry gas meter and a calibrated orifice meter to measure the pressure, temperature and flowrate throughout the train.

The sampling train was charged in the mobile lab using freshly prepared reagents. Each impinger and its contents was weighed to the nearest 0.1 gm on a calibrated electronic balance. Blanks of all filters and reagents were retained for subsequent analysis. The sampling point locations were marked on the probe using a high-temperature marker. The sampling train was completely assembled and lifted to the sampling site.

## 4.9 SAMPLING PROCEDURES FOR PARTICULATE-HCl SAMPLING TRAIN

Prior to a test, the sampling train was heated and leak-checked at 15 inches Mercury to insure leakage was less than 0.02 cfm. The S-type pitot tube was also leak-checked. The sampling train was installed on the unirail and the probe was inserted into the stack at the farthest point. An isokinetic sampling rate was used for each sampling point on the traverses (6 points per traverse, 4 traverses). Each point was sampled for an equal period of time (8 minutes) and all pertinent data was recorded on the data sheet for each point. The probe and sample box were maintained at 250°F throughout the traverse. The gases leaving the impinger train were maintained at <70°F. At the end of a traverse, the probe was withdrawn from the stack and the entire sampling train was transferred (in tact) to the next sampling port. After completing the traverses, the sampling train was withdrawn for the final leak check. This leak check was performed at 15 inches Mercury or at the highest vacuum achieved during the test. The S-type pitot tube was also checked at this time. The sampling train was sealed with tin foil and lowered to the mobile lab for sample recovery.

## 4.10 SAMPLE RECOVERY PROCEDURES FOR PARTICULATE-HCl SAMPLING TRAIN

Sample recovery occurred in the mobile lab. The nozzle and probe were brushed and rinsed three times using distilled water into a polyethylene sample bottle. The 100-mm filter was removed from the 4-inch filter holder and sealed in its petri dish. The front half of the 4-inch glass filter holder was brushed and rinsed with distilled water. Each impinger was removed from the icebath, wiped dry and weighed to the nearest 0.1 gm. The contents of impingers 1 2 and 3 were transferred to a polyethylene sample bottle. The back half of the 4-inch glass filter holder, the glass connectors, impingers 1, 2 and 3 were rinsed with distilled water and the rinsings were transferred to this same bottle. All sample bottles and petri dishes were marked and labeled. A chain-of-custody log was completed and the field data sheet was also labeled with the sample ID numbers. The sampling train was then recharged in preparation for the next test.

## 4.11 SAMPLING PROCEDURES FOR CONTINUOUS MONITORING

The continuous monitors used in the Pape & Steiner Mobile Monitoring Lab are shown in Table 4-1. Figure 4-1 is a schematic of the continuous monitoring system. The procedures used to continuously monitor stack gases for $NO_x$, CO, $CO_2$ and $O_2$ strictly follow EPA Method 20.

Sample is taken from the stack using a 316 stainless steel probe. A heated Balston filter holder and fiberglass filter (99.9999 percent efficiency retention of 0.6 micron particles) was connected to the outlet of the probe. Sample gas was transported through heated Teflon sample line (maintained at $<250°F$) by a Teflon-lined diaphragm pump to a TECO Model 300 $NO_2$ to NO converter and then to a 316 stainless steel refrigeration type conditioner (Hankison Model E-4G-SS). The sample gas was passed through the conditioner two separate times under vacuum before entering the pump, then two additional times under pressure. The clean, dry sample gas (approximately 35°F) was then transported to the continuous analyzer system through an unheated Teflon line. A series of flowmeters, valves, and regulators maintain constant flow through the system at a constant pressure.

At the beginning and end of each test day, a leak check was performed on the entire CEMS by capping off the sampling probe. A leak check was successful only if the pressure at the analyzer system and the flow through the rotameters to the individual analyzers all dropped to zero. If

## TABLE 4-1. CONTINUOUS MONITORING LAB

### $NO_x$ CHEMILUMINESCENT ANALYZER -- THERMO ELECTRON MODEL 10

| | |
|---|---|
| Response Time (0-90%) | 1.5 sec -- NO mode<br>1.7 sec -- $NO_x$ mode |
| Zero Drift | Negligible after 1/2 hour warmup |
| Linearity | ±1% of full scale |
| Accuracy | Derived from the NO or $NO_2$ calibration gas, ±1% of full scale |
| Output | 0.100 mV, 0-10 mV, 0-5 V, 0-10 V |

### $O_2$ ANALYZER, FUEL TYPE -- TELEDYNE MODEL 326

| | |
|---|---|
| Response Time (0-90%) | 60 seconds |
| Accuracy | ±1% of scale at constant temperatures; ±1% of scale of ±5% of reading, whichever is greater, over the operating temperature range |
| Output | 0-1 V |

### $CO_2$/CO INFRARED ANALYZER -- ANARAD MODEL AR-600

| | |
|---|---|
| Response Time (0-90%) | 5 seconds |
| Zero Drift | ±1% |
| Span Drift | ±1% |
| Linearity | 1% |
| Resolution | Less than 1% of full scale |
| Output | 0-1 V |

### $SO_2$ UV ANALYZER -- DUPONT MODEL 400

| | |
|---|---|
| Response Time (0-90%) | Less than 1 second |
| Zero Drift | Less than 1% full scale in 24 hours |
| Linearity | ±1% full scale |
| Accuracy | ±2% full scale |
| Output | 0-10 mV |
| Operating Ranges | 0-100 ppm, 0-1000 ppm |

### STRIP CHART RECORDERS (3) -- LINEAR MODEL 486

| | |
|---|---|
| Pen Response | 20 inches/second |
| Span -- full scale | 1 mV through 10 V |
| Zero Set | Electronically adjustable full scale with 1 full scale of zero supression |
| Accuracy | Total limit of error ±0.5% |
| Dead Band | |
| Linearity | |
| Repeatability | |

### SCOTSMAN TRAILER

Fully Insulated
Air conditioned
8-ft x 14-ft x 11-ft

1. Filter 0.6 μ, 99.9999 percent efficient
2. Duct
3. 316 stainless steel probe
4. 3/8-inch, heated (250°F) Teflon
5. Four-pass conditioner-dryer, 316 stainless steel internals
6. 3/8-inch, unheated Teflon
7. Teflon-lined sample pump
8. 3/8-inch unheated Teflon
9. Rotameter
10. 1/4-inch Teflon tubing
11. Calibration gas manifold
12. Calibration gas selector valve
13. Calibration gas cylinders
14. Backpressure regulator
15. Auxiliary analysis port

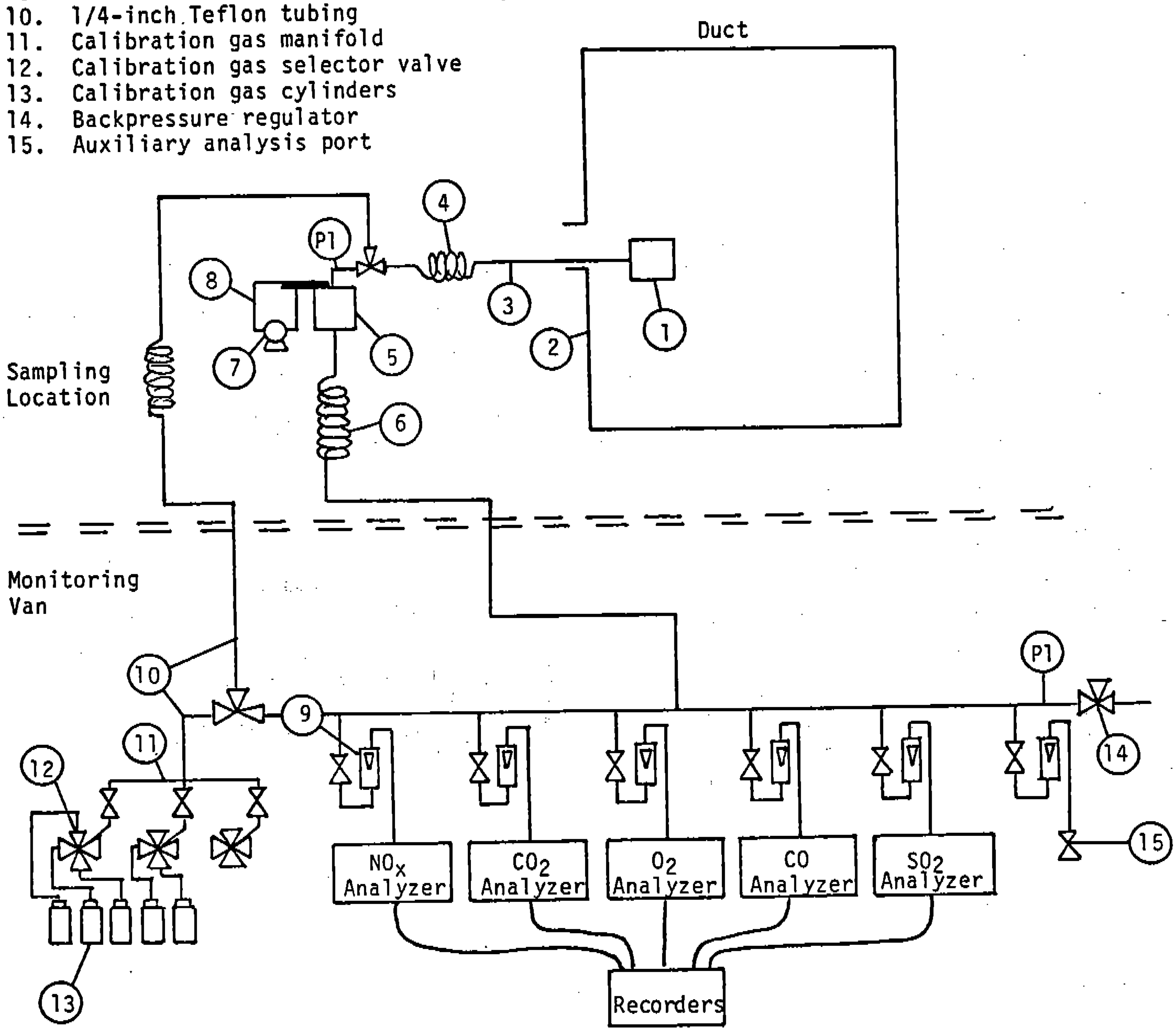



Figure 4-1. Schematic of Continuous Monitoring System.

the CEMS pass this leak check, an external calibration check of the CEMS was then performed (beginning and end of each test day). EPA Protocol 1 and NBS traceable calibration gases from compressed gas cylinders were flowed through the entire CEMS. An external calibration was considered successful if the $NO_x$ concentration measured by the analyzer agreed within 5 percent of the cylinder value.

Internal calibration of the $NO_x$, CO, $CO_2$ and $O_2$ analyzers were also performed. EPA Protocol 1 and NBS traceable gas was used to calibrate the $NO_x$ analyzer and NBS traceable gas ($\pm$1%) was used to calibrate the CO, $CO_2$ and $O_2$ analyzers before and after each test condition. Zero and calibration gas values were recorded on the continuous monitor strip charts and the field data sheets.

Test data was collected by recording 4-minute averages at each of 24 sampling points in the stack. Data collected over the 96-minute test period was averaged and reported. A fuel gas analysis was used to calculate the F-Factor, dscf/MMBtu corrected to zero percent O2 (standard conditions 60°F, 29.92 inches Mercury) as described in 40 CFR 60.45.

# SECTION 5

# ANALYSIS PROCEDURES

This section of the report describes the procedures used to analyze the samples collected during the test program. All analyses were performed in the Pape & Steiner climate-controlled laboratory in Bakersfield.

## 5.1 ANALYSIS OF PARTICULATE-$SO_x$ SAMPLES

### 5.1.1 Nozzle, Probe, Filter Holder Wash

The volume of the acetone washings were measured and the washings were transferred to clean, tared, aluminum weighing dishes. The dishes were placed on a hot plate in a fume hood and gently heated to dryness. The dishes with the dry residue were desiccated and weighed repeatedly at 6-hour intervals until a constant weight was achieved (to the nearest 0.01 mg with a tolerance of $\leq$0.1 mg between weighings). The ACS reagent grade acetone blank was treated in the same manner.

### 5.1.2 Filter

The 100 mm filter was removed from its petri dish and transferred to an oven where it was heated for 2 hours at 105°C. The filter was then desiccated and weighed repeatedly at 6-hour intervals until a constant weight was achieved (to nearest 0.01 mg with a tolerance of <0.1 mg between weighings). An unused, tared blank filter was treated in the same manner.

This wouldn't nec. get all of the $SO_3$ ??

5.1.3 Filterable Particulate Sulfate

The acetone washings residue and the 100 mm filter were combined and then leached with distilled water to remove sulfate and the leach was diluted to 100 ml. An aliquot was passed through ion exchange resin and titrated against 0.01N $BaCl_2$ (which was previously standardized against 0.0100N $H_2SO_4$) using the barium-thorin titration procedure specified in EPA Method 8. The acetone blank and 100 mm filter blank were treated in an identical manner.

5.1.4 Condensible Particulate, Sulfate, and $SO_3$

The 47-mm glass fiber filter was leached with distilled water and the leach was added to the contents and washings from impinger 1. The volume was measured and an aliquot was transferred to a clean, tared aluminum weighing tin. The tin was placed on a hot plate in a fume hood and gently heated to dryness. The tin with the dry residue was desiccated and weighed repeatedly at 6-hour intervals until a constant weight was achieved (to nearest 0.01 mg with a tolerance of <0.1 mg between weighings). Another aliquot was taken and diluted to 100 ml and analyzed for sulfate using the barium-thorin titration procedure. A blank 47-mm filter and 80-percent IPA solution were treated in the same manner.

5.1.5 $SO_2$

The volume of contents and washings from bubbler 2 and impinger 3 was measured and an aliquot was analyzed for sulfate using the barium-thorin procedure. A 3-percent $H_2O_2$ blank was treated in the same manner.

## 5.2 FUEL

A sample of the fuel fired during this test program was collected and sent to Zalco Analytical Laboratories, Inc. for analysis. Analysis was performed by Zalco in accordance with EPA Title 40 Section 60.45. The specific procedures are itemized in Table 5-1. The results appear at the end of this section.

## 5.3 $NH_3$ ANALYSIS

The $NH_3$ samples and a blank 0.1 N HCl solution were analyzed by EPA Method 350.2 using the sulfuric acid titrametric endpoint procedure after distillation of the $NH_3$ from the 0.1 N HCl solution.

## 5.4 HCL ANALYSIS

The acidified HCl samples and a blank 0.1 N NaOh solution were titrated with Mercuric Nitrate in the presence of mixed diphenylcarbazone-bromophenol blue indicator to a blue-violet end point in accordance with EPA Method 325.3

## TABLE 5-1. FUEL ANALYSIS METHODS

### LABORATORY TEST PROCEDURES FOR FUEL OILS AND FUEL GASES

Reference: EPA Title 40, Section 60.45

| | |
|---|---|
| FUEL OIL TESTS: | |
| Sediment and Water, Vol. % | ASTM D4007-81 |
| Gravity by Hydrometer (API) | ASTM D1298-80 |
| API Gravity Corrected to 60°F | ASTM Table 5A |
| Gross Calorific Value (Btu/lb) | ASTM D2015-77 |
| Ultimate Analysis (C, H, O, N, S, wt. %) | |
| Carbon, Hydrogen | ASTM D3178-73 |
| Nitrogen (chemiluminescence detector) | ASTM D3431-80 |
| Sulfur | ASTM D2622-82 |
| Ash | ASTM D482 |
| Oxygen | ASTM D3176-74 |
| GASEOUS FUELS BY GAS-LIQUID CHROMATOGRAPHY: | |
| Gas Analysis | ASTM D1945-81 |
| Sulfur Analysis | CPA B16 |
| Calculation of Gross Calorific Value | ASTM D3588-81 |
| Component Weight %, F-factor calculations | EPA 40:60.45 |
| PROCEDURES FOR SCRUBBER LIQUOR ANALYSIS: | |
| Specific Gravity | ASTM D1429 |
| Chlorides | ASTM D512-67 |

**WYOMING ANALYTICAL LABORATORIES, INC.**

605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Ms. Linda Trapp
Pape and Steiner
Environmental Services
5801 Norris Road
Bakersfield, CA 93308

Date: April 20, 1987

Request No.: 3269

REPORT OF ANALYSIS

Southwestern Portland Cement
tested 03/31 & 04/01/87
#2 Kiln Outlet

| LAB NO. | SAMPLE ID | AMMONIA, as N mg | BLANK CORRECTED AMMONIA, as N, mg |
|---|---|---|---|
| B0329 | FHW - Test 1 - P&S ID# 10272 | <0.01 | <0.01 |
| B0330 | FHW - Test 2 - P&S ID# 10282 | <0.01 | <0.01 |
| B0331 | FHW - Test 3 - P&S ID# 10298 | 0.03 | 0.01 |
| B0332 | Blank DI - P&S ID# 10271 | 0.03 | ---- |
| B0337 | Thimble - Filter #I - Test 1 P&S ID# 10284 | 0.10 | 0.03 |
| B0338 | Thimble - Filter #II - Test 2 P&S ID# 10285 | 0.08 | 0.02 |
| B0339 | Thimble - Filter #III - Test 3 P&S ID# 10308 | 0.05 | <0.01 |
| B0340 | Thimble - Filter #IV - Blank P&S ID# 10294 | 0.07 | ---- |

(reported on original volume basis.)



SGR:gva

WYOMING ANALYTICAL LABORATORIES, INC.
605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

Ms. Linda Trapp
Pape and Steiner
Environmental Services
5801 Norris Road
Bakersfield, CA 93308

Date: April 20, 1987

Request No.: 3258

## REPORT OF ANALYSIS

Southwestern Portland Cement, #2 Kiln Outlet
DI/0.1N HCl dated 04/01/87

| LAB NO. | SAMPLE ID | AMMONIA, as N, mg | BLANK CORRECTED AMMONIA, as N, mg |
|---|---|---|---|
| B0290 | P&S ID# 10273 Test 1 | 7.67 | 5.86 |
| B0291 | P&S ID# 10283 Test 2 | 5.57 | 3.71 |
| B0292 | P&S ID# 10309 Test 3 | 7.98 | 6.07 |
| B0293 | P&S ID# 10264 0.1N HCl Blank | 0.50 | ---- |

Southwestern Portland Cement, #2 Kiln Outlet
DI/NaOH dated 04/01/87

| LAB NO. | SAMPLE ID | HCl, mg | BLANK CORRECTED HCl, mg |
|---|---|---|---|
| B0294 | P&S ID# 10265 Blank | 0.87 | ---- |
| B0295 | P&S ID# 10276 Test 1 | 221 | 219 |
| B0296 | P&S ID# 10288 Test 2 | 203 | 201 |
| B0297 | P&S ID# 10297 Test 3 | 185 | 183 |

All numbers reported on basis of original volume

Sonja G Ringen

Sonja G. Ringen
Laboratory Manager

SGR:gva

Ms. Trapp
April 20,1987
Request #3269


| LAB NO. | SAMPLE ID | HCl, mg | BLANK CORRECTED HCl, mg |
|---|---|---|---|
| B0326 | FHW - Test 1 - P&S ID# 10274 | 0.99 | 0.90 |
| B0327 | FHW - Test 2 - P&S ID# 10286 | 1.10 | 1.01 |
| B0328 | FHW - Test 3 - P&S ID# 10295 | 1.10 | 1.01 |
| * B0294 | Blank - P&S ID# 10265 | 0.87 | ---- |
| B0333 | Filter #876 - Test 1 P&S ID# 10275 | <0.01 | <0.01 |
| B0334 | Filter #890 - Test 2 P&S ID# 10287 | <0.01 | <0.01 |
| B0335 | Filter #891 - Test 3 P&S ID# 10296 | 0.03 | 0.03 |
| B0336 | Filter #892 - Blank P&S ID# 10267 | 0.01 | ---- |

(reported on original volume basis.)

* Also reported on request #3258

Sonja G. Ringen
Sonja G. Ringen
Laboratory Manager

SGR:gva



WAL
WYOMING ANALYTICAL LABORATORIES, INC.
605 South Adams (307) 742-7995 LARAMIE, WYOMING 82070

## SECTION 6

## QUALITY ASSURANCE

### 6.1 PARTICULATE/$SO_2$/$NH_3$/HCl SAMPLING EQUIPMENT

A detailed record of repair and maintenance to each sampling train is kept. Preventative maintenance to each system is performed periodically to avoid complete component breakdown during a field test.

A detailed record of sampling system calibrations is also kept. Calibration data for the sampling nozzles, pitot tubes, dry gas meters and orifice meters are available for review. Results of the EPA Quality Assurance Branch biannual audits of the dry gas meter and orifice meter combinations are also logged and verify our in-house calibration data. The calibration data for the equipment used on this program can be found at the end of this section.

### 8.2 LAB ANALYSIS

All field samples are assigned a label and an ID number. This ID is also affixed to a chain-of-custody log and to the field data sheet to eliminate any chance of sample mixup.

Prior to analysis, all glassware is thoroughly cleaned (soap and water, tap water rinse, distilled water rinse, IPA rinse) to eliminate any contamination. The evaporating dishes used to evaporate the washings are treated the same as a sample (dried in an oven, desiccated and weighed repeatedly at 6-hour intervals until a constant weight is achieved). The glassware used to measure volumes and make transfers and dilutions are all NBS Class A to insure accurate measurements. All weighings are carried out on a Mettler Model H54AR analytical balance supported by a marble table in a separate room from the main analytical laboratory. The balance is calibrated regularly against an NBS Class S-1 weight.

All reagents used in the field and in the laboratory are ACS reagent grade and blanks of these reagents are evaluated for every set of tests. Blanks are taken in the field from the squeeze bottles and not the original container. Records are kept on these blanks to insure consistent quality of the reagents. Prior to use, the IPA is also analyzed to insure no peroxides are present which could lead to high $SO_3$ and low $SO_2$ values.

## 6.3 CONTINUOUS MONITORS

The $NO_x$ analyzer is calibrated before and after each test using an EPA Protocol 1 gas ($\pm$ 1 percent) traceable to NBS. The CO, $CO_2$, and $O_2$ analyzers are calibrated before and after each test using a certified gas mixture ($\pm$ 1 percent).

A system check was performed during calibration checks. This was done by introducing span gas at the inlet to the sampling handling system (after the heated line) and measuring the response. The purpose of this test is to check the sampling handling portion of the continuous monitor system for sample loss. All external checks were within $\pm 5$ percent of the tank value.

The CO interferences in NDIR-type analyzers described in EPA Method 10, caused by $CO_2$, have been eliminated by utilizing an electronic crosstalk feature in the dual $CO/CO_2$ analyzer. The crosstalk is setup by injecting a known amount of CO-free $CO_2$ and balancing out the CO interference response. Once this has been done, the CO values will automatically be corrected for the amount of $CO_2$ being analyzed at any particular instant.

A multipoint calibration linearity check of the continuous analyzers were performed on December 10, 1986. These results were well within CARB limitations of $\pm 2$ percent of full scale. Table 6-1 lists the results of this check. The calibration certificates for the gases used on this test program appear at the end of this section.

TABLE 6-1. MULTIPOINT CALIBRATION LINEARITY CHECKS
(TRAILER 2 - December 10, 1986)

| Gas | Cal Gas (ppm) | Final Reading (ppm) | Difference (ppm) | % Difference (CARB allowable ±2% Full Scale) |
|---|---|---|---|---|
| $NO_x$ | 0 | 0 | 0 | 0 |
| | 40.0 | 40.0 | 0 | 0 |
| | 90.3 | 92 | 1.7 | 1.7 |
| | 203.6 | 205 | 1.4 | 0.6 |
| $SO_2$ | 0 | 0 | 0 | 0 |
| | 7* | 5 | -2 | -2.0 |
| | 51.53 | 51 | -0.53 | -0.5 |
| CO | 0 | 0 | 0 | 0 |
| | 24.96 | 24 | -0.96 | 0.2 |
| | 201 | 202 | 1.0 | 0.2 |
| $CO_2$ | 0 | 0 | 0 | 0 |
| | 8.04 | 8.0 | -0.04 | -0.2 |
| | 14.1 | 14.1 | 0 | 0 |
| $O_2$ | 0 | 0 | 0 | 0 |
| | 4.03 | 4.0 | -0.03 | -0.3 |
| | 20.9 | 20.8 | -0.1 | -0.4 |

Method 20 $NO_x$ Checks:

| | $NO_x$ Response | $NO_2$ Response |
|---|---|---|
| 201 ppm CO | 0 | |
| 51.53 ppm $SO_2$ | 0 | |
| 18.5 ppm $NO_2$ Converter Efficiency | | 18 |

*EPA Method 5/8

BPR14

APPENDIX

Pape & Steiner Environmental Services

# SAMPLING POINT LOCATION DATA SHEET

Plant . SWPC

Date 3/31/87

Test Location #2 Kiln Outlet

Upstream Dist./Dia. 92" / 10.6Ø

Downstream Dist./Dia. 416"/2.6Ø

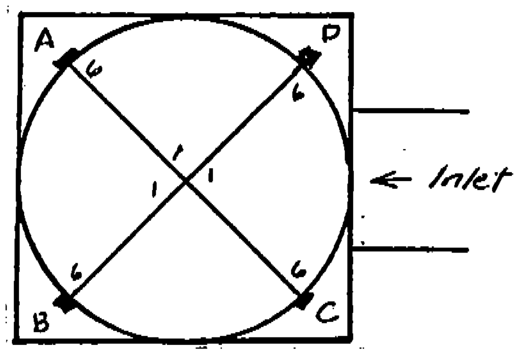
No. of Sampling Points 24

Stack Dimension 160

Coupling Length 5.5

3 -inch MPT/FPT/Flange

has hooks
100' electric
special plugs




| Sample Point | Dist | Sample Point | Dist | Sample Point | Dist | Sample Point | Dist |
|---|---|---|---|---|---|---|---|
| 1 | 8.9 | | | | | | |
| 2 | 16.2 | | | | | | |
| 3 | 24.4 | | | | | | |
| 4 | 33.9 | | | | | | |
| 5 | 45.5 | | | | | | |
| 6 | 62.4 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

SAMPLING POINT RELOCATION:

Pape & Steiner Environmental Services

# VELOCITY TRAVERSE DATA SHEET

Plant SWPC
Date 3-31-87
Test Location Baghouse Outlet
Static Pressure (in. wg) -0.14
Barometric Pressure
Probe Type/Length glass / 6'
Pitot Coefficient 0.840
Stack Dimension 160"

| | Smpl Pt. | ΔP | Ts | Smpl Pt | ΔP | Ts | Smpl Pt. | ΔP | Ts | Smpl Pt | ΔP | Ts |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A- | 1 | 0.34 | 395 | | | | | | | | | |
| | 2 | 0.41 | 396 | | | | | | | | | |
| | 3 | 0.40 | 400 | | | | | | | | | |
| | 4 | ~~0.45~~ 0.50 | 402 | | | | | | | | | |
| | 5 | 0.50 | 403 | | | | | | | | | |
| | 6 | 0.43 | 400 | | | | | | | | | |
| D- | 1 | 0.23 | 395 | | | | | | | | | |
| | 2 | 0.21 | 397 | | | | | | | | | |
| | 3 | 0.21 | 400 | | | | | | | | | |
| | 4 | 0.23 | 401 | | | | | | | | | |
| | 5 | 0.21 | 403 | | | | | | | | | |
| | 6 | 0.16 | 400 | | | | | | | | | |

SAMPLING POINT RELOCATION:

$\overline{\sqrt{\Delta p}} = 0.5550$

$\overline{\Delta p} = 0.3080$

$T_s = 400.00$

Pape & Steiner Environmental Services

PLANT SWPC TEST TYPE MS/8 FIELD TEST DATA SHEET (Page 1 of 2)

Date 3-31-87
Test Location BAG OUT
Run Number 1
Stack Diameter 160"
Operator BH
Filter No. 884

Barometric Pressure 26.72
Static in. wg. -0.38
Probe Type/Length GL-6'
Pitot Coefficient 0.84
Meter Box No./γ 609/0.9983
Nozzle No./Size 1852/.3217

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| 80% IPA | 539.2 | 527.7 | 11.50 |
| 3% $H_2O_2$ | 576.2 | 535.0 | 41.20 |
| 3% $H_2O_2$ | 559.0 | 558.8 | .20 |
| | | | |
| Silica Gel S.G. | 745.5 | 690.9 | 54.60 |
| | | Total | 107.50 |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| | | | |

| Leak Rate | cfm | "Hg |
|---|---|---|
| Initial @ nozzle | .018 | 15 |
| Final | | |

| Sample Point | Time (1348) | ΔP in wg | ΔH in wg | Gas Meter Volume $Ft^3$ | Temperature °F Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A 1 | 0 | .35 | 1.69 | 616.188 | 405 | 269 | 256 | 70 | 79 | 77 | 9 | 0.592 | |
| 2 | 8 | .46 | 2.27 | 623.31 | 405 | 270 | 249 | 47 | 98 | 81 | 12 | 0.678 | |
| 3 | 16 | .43 | 2.12 | 631.22 | 405 | 251 | 247 | 48 | 95 | 83 | 13.5 | 0.656 | Blank Ace 10266 |
| 4 | 24 | .49 | 2.42 | 639.05 | 406 | 229 | 247 | 56 | 98 | 84 | 14 | 0.700 | |
| 5 | 32 | .52 | 2.57 | 647.21 | 404 | 247 | 249 | 48 | 96 | 85 | 14 | 0.721 | Blank MF 10267 |
| 6 | 40 | .43 | 2.13 | 655.18 | 402 | 239 | 253 | 51 | 96 | 86 | 14 | 0.656 | |
| | 48 | | | 663.174 | | | | | | | | | Blank IPA 10268 |
| D 1 | 1445 48 | .22 | 1.08 | 663.174 | 405 | 244 | 254 | 66 | 87 | 86 | 6.5 | 0.469 | |
| 2 | 56 | .19 | 0.95 | 667.90 | 405 | 273 | 258 | 46 | 103 | 88 | 5 | 0.436 | Blank Am 10269 |
| 3 | 64 | .25 | 1.25 | 674.78 | 406 | 248 | 252 | 50 | 106 | 89 | 6 | 0.500 | |
| 4 | 72 | .25 | 1.25 | 680.79 | 404 | 242 | 246 | 53 | 106 | 89 | 6 | 0.500 | Blank $SO_2$ 10270 |
| 5 | 80 | .25 | 1.25 | 686.90 | 404 | 225 | 255 | 51 | 106 | 90 | 6 | 0.500 | |
| 6 | 88 | .19 | 0.95 | 693.05 | 404 | 252 | 246 | 49 | 106 | 90 | 5 | 0.436 | |
| | 96 | | | 698.479 | | | | | | | | | |
| | | | | | 404 | | | | 91.8 | | | 0.5703 | |

~~1.4.995~~

700625

A-4

Pape & Steiner Environmental Services

PLANT SWPC TEST TYPE M5/8 FIELD TEST DATA SHEET (Page 2 of 2)

Date 3-31-87
Test Location BAG-OUT
Run Number 1
Stack Diameter 160"
Operator BH
Filter No.

Barometric Pressure
Static in. wg.
Probe Type/Length
Pitot Coefficient
Meter Box No./8
Nozzle No./Size

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| | | | |
| | | | |
| | | | |
| | | | |
| S.G. | | | |
| Total | | | |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| | | | |
| Leak Rate | cfm | "Hg | |
| Initial | | | |
| Final @ NOZZLE | | | |

| Sample Point | 1540 Time | ΔP in wg | ΔH in wg | Gas Meter Volume $Ft^3$ | Temperature °F Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C 1 | 96 | .20 | 0.99 | 698.479 | 405 | 251 | 251 | 58 | 96 | 89 | 5 | 0.447 | FHW-1 10277 |
| 2 | 104 | .17 | 0.85 | 703.87 | 401 | 248 | 251 | 42 | 105 | 90 | 4.5 | 0.412 | |
| 3 | 112 | .16 | 0.80 | 709.21 | 403 | 253 | 253 | 44 | 105 | 90 | 4 | 0.400 | MF-1 10278 |
| 4 | 120 | .12 | 0.60 | 714.18 | 401 | 256 | 244 | 40 | 106 | 90 | 4 | 0.346 | BHW-1 10279 |
| 5 | 128 | .14 | 0.70 | 718.78 | 404 | 240 | 258 | 40 | 106 | 91 | 4 | 0.374 | AMF-1 |
| 6 | 136 | .10 | 0.50 | 723.57 | 402 | 243 | 247 | 39 | 107 | 91 | 3 | 0.316 | 10280 |
| B 1 | 144 | .35 | 1.75 | 727.777 | 402 | 254 | 247 | 55 | 98 | 91 | 8 | 0.592 | $SO_2$-1 10281 |
| 2 | 1648 152 | .43 | 2.16 | 735.11 | 403 | 268 | 256 | 40 | 106 | 91 | 13 | 0.656 | |
| 3 | 160 | .43 | 2.15 | 743.40 | 402 | 262 | 250 | 40 | 100 | 91 | 13 | 0.656 | |
| 4 | 168 | .49 | 2.44 | 751.30 | 407 | 253 | 242 | 40 | 103 | 90 | 14 | 0.700 | |
| 5 | 176 | .49 | 2.44 | 759.62 | 403 | 247 | 243 | 39 | 98 | 90 | 14 | 0.700 | |
| 6 | 184 | .39 | 1.95 | 768.19 | 400 | 238 | 247 | 39 | 97 | 89 | 13 | 0.624 | |
| | 192 | | | 775.858 | | | | | | | | | PURGE 15 MIN |
| | | | | | | | | | | | | | |
| | | | 1.55 | 159.670 | 403.67 | | | | 94.04 | | | 0.5445 | |

Pape & Steiner Environmental Services

PLANT SWPC TEST TYPE $NH_3$ FIELD TEST DATA SHEET (Page 1 of 2)

Date 3/31/87
Test Location Kiln Out
Run Number 1 - $NH_3$
Stack Diameter 160
Operator JS
Filter No. T-1

Barometric Pressure 26.72
Static in. wg. -0.38
Probe Type/Length G/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/1.0018
Nozzle No./Size 448/.3086

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| .1N HCl | 644.6 | 556.1 | 88.5 |
| .1N HCl | 571.2 | 552.0 | 19.2 |
| Blank | 456.4 | 453.5 | 2.9 |
| | | | |
| S.G. | 800.4 | 765.8 | 34.6 |
| | | Total | 145.2 |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| | | | |

| Leak Rate | cfm | "Hg |
|---|---|---|
| Initial | 0.003 | 15 bypass |
| Final | 0.005 | 15 nozzle |

| Sample Point | Time | ΔP in wg | ΔH in wg | Gas Meter Volume $Ft^3$ | Temperature °F Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D 1 | 1:48 0 | 0.20 | 1.11 | 750.934 | 401 | 283 | 262 | 67 | 75 | 75 | 6.5 | 0.447 | pitot ok |
| 2 | 8 | 0.21 | 1.16 | 755.863 | 411 | 274 | 259 | 63 | 81 | 77 | 6.5 | 0.458 | FHW-1 10272 |
| 3 | 16 | 0.23 | 1.27 | 760.760 | 412 | 254 | 260 | 55 | 83 | 79 | 6.5 | 0.480 | |
| 4 | 24 | 0.25 | 1.39 | 765.894 | 415 | 250 | 257 | 53 | 85 | 80 | 7.0 | 0.500 | BHW-1 10273 |
| 5 | 32 | 0.25 | 1.39 | 771.315 | 410 | 240 | 266 | 53 | 86 | 81 | 7.5 | 0.500 | Blank HCl 10264 |
| 6 | 40 | 0.21 | 1.17 | 776.790 | 410 | 234 | 256 | 53 | 87 | 82 | 6.5 | 0.458 | |
| | 48 | | | 781.925 | | | | | | | | | Blank DI 10271 |
| C 1 | 2:48 0 | 0.25 | 1.41 | 781.925 | 400 | 225 | 252 | 51 | 84 | 82 | 2.0 | 0.500 | |
| 2 | 8 | 0.18 | 1.00 | 787.340 | 412 | 252 | 261 | 55 | 88 | 83 | 5.5 | 0.424 | MF-1 10284 |
| 3 | 16 | 0.18 | 1.00 | 792.055 | 414 | 242 | 255 | 45 | 89 | 84 | 5.5 | 0.424 | |
| 4 | 24 | 0.15 | 0.84 | 796.710 | 412 | 231 | 252 | 46 | 89 | 85 | 5.0 | 0.387 | 10294 Blank MF |
| 5 | 32 | 0.14 | 0.78 | 801.000 | 412 | 241 | 257 | 48 | 89 | 85 | 5.0 | 0.374 | |
| 6 | 40 | 0.15 | 0.84 | 805.145 | 412 | 237 | 257 | 47 | 89 | 85 | 5.0 | 0.387 | |
| | 48 | | | 809.454 | | | | | | | | | |
| | | | | | | | | | | | | | |

Pape & Steiner Environmental Services

PLANT SWPC TEST TYPE M17/NH$_3$ FIELD TEST DATA SHEET (Page 2 of 2)

Date 3/31/87
Test Location Kiln Out
Run Number 1 - NH$_3$
Stack Diameter 160
Operator JS
Filter No. T-I

Barometric Pressure 26.72
Static in. wg. -0.38
Probe Type/Length G/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/1.0018
Nozzle No./Size 1448/.3086

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| | | | |
| | | | |
| | | | |
| | | | |
| S.G. | | | |
| | | Total | |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| | | | |

| Leak Rate | cfm | "Hg |
|---|---|---|
| Initial | | |
| Final | 0.003 | 17 nozzle |

| Sample Point | Time | ΔP in wg | ΔH in wg | Gas Meter Volume Ft$^3$ | Temperature °F Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B 1 | 3:41 0 | 0.38 | 2.15 | 809.454 | 402 | 253 | 257 | 42 | 87 | 84 | 10.5 | 0.616 | |
| 2 | 8 | 0.43 | 2.40 | 816.095 | 414 | 275 | 262 | 43 | 89 | 85 | 12.5 | 0.656 | white deposits |
| 3 | 16 | 0.42 | 2.34 | 823.154 | 416 | 272 | 261 | 46 | 89 | 84 | 12.5 | 0.648 | on hot to cold conn. |
| 4 | 24 | 0.44 | 2.46 | 830.196 | 414 | 258 | 261 | 48 | 89 | 85 | 13.0 | 0.663 | |
| 5 | 32 | 0.58 | 3.25 | 837.382 | 411 | 244 | 257 | 48 | 90 | 85 | 17.0 | 0.762 | |
| 6 | 40 | 0.52 | 2.91 | 845.173 | 411 | 245 | 264 | 50 | 88 | 86 | 16.5 | 0.721 | |
| | 48 | | | 853.258 | | | | | | | | | |
| A 1 | 4:41 0 | 0.35 | 1.94 | 853.258 | 412 | 230 | 260 | 50 | 81 | 81 | 9.5 | 0.592 | |
| 2 | 8 | 0.41 | 2.28 | 859.570 | 413 | 242 | 260 | 45 | 86 | 81 | 11.5 | 0.640 | |
| 3 | 16 | 0.44 | 2.44 | 866.379 | 414 | 246 | 257 | 46 | 88 | 82 | 13.5 | 0.663 | |
| 4 | 24 | 0.53 | 2.93 | 873.474 | 417 | 236 | 260 | 47 | 87 | 82 | 16.0 | 0.728 | |
| 5 | 32 | 0.52 | 2.88 | 881.120 | 412 | 240 | 258 | 42 | 86 | 83 | 16.0 | 0.721 | |
| 6 | 40 | 0.52 | 2.90 | 888.848 | 410 | 227 | 260 | 42 | 85 | 82 | 16.5 | 0.721 | pitot ok |
| | 48 | | | 896.550 | | | | | | | | | |
| | 192 | | 1.84 | 145.616 | 411.08 | | | | 84.33 | | | 0.5613 | |

Pape & Steiner Environmental Services

PLANT SWPC TEST TYPE HCL FIELD TEST DATA SHEET (Page 1 of 2)

Date 3-31-87

Test Location KILN OUT

Run Number 1

Stack Diameter 160"

Operator GWM

Filter No. 876

Barometric Pressure 26.72

Static in. wg. -0.38

Probe Type/Length glass/6' w/ASBESTOS

Pitot Coefficient 0.840

Meter Box No./γ 635/1.0008

Nozzle No./Size 1853/0.3217

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| .1N NaOH | 654.0 | 567.9 | 86.1 |
| .1N NaOH | 571.4 | 548.1 | 23.3 |
| Blank | 455.1 | 450.2 | 4.9 |
| | | | |
| | | | |
| S.G. | 778.8 | 743.7 | 35.1 |
| | | Total | 149.4 |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| | | | |

| Leak Rate | cfm | "Hg |
|---|---|---|
| Initial | 0.018 | 16 |
| Final | | |

| Sample Point | Time | ΔP in wg | ΔH in wg | Gas Meter Volume $Ft^3$ | Temperature °F Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B- 1 | 1348 | 0.33 | 2.39 | 662.882 | 398 | 275 | 240 | 45 | 86 | 85 | 6 | 0.574 | Pitot ✓ OK |
| 2 | 8 | 0.43 | 3.16 | 669.6 | 398 | 255 | 237 | 37 | 99 | 86 | 7 | 0.656 | $K_o$ = 0.6871 |
| 3 | 16 | 0.39 | 2.89 | 677.2 | 396 | 258 | 237 | 38 | 102 | 88 | 7 | 0.624 | 8Oz NaOH 10265 |
| 4 | 24 | 0.47 | 3.49 | 684.7 | 396 | 253 | 230 | 39 | 103 | 91 | 8 | 0.686 | FHW-1 |
| 5 | 32 | 0.44 | 3.28 | 692.8 | 394 | 250 | 235 | 42 | 103 | 93 | 8 | 0.663 | 10274 |
| 6 | 40 | 0.41 | 3.08 | 700.7 | 392 | 249 | 239 | 41 | 106 | 95 | 7 | 0.640 | MF-1 |
| | 48 | | | 708.330 | | | | | | | | | 10275 |
| | | | | | | | | | | | | | BHW-1 |
| A- 1 | 1446 | 0.34 | 2.52 | 715.4 | 401 | 270 | 239 | 51 | 99 | 98 | 7 | 0.583 | 10276 |
| 2 | 8 | 0.43 | 3.20 | 723.1 | 402 | 245 | 246 | 45 | 106 | 98 | 7 | 0.656 | |
| 3 | 16 | 0.46 | 3.43 | 731.3 | 403 | 235 | 237 | 48 | 107 | 100 | 8 | 0.678 | |
| 4 | 24 | 0.47 | 3.51 | 739.6 | 401 | 225 | 235 | 46 | 107 | 100 | 8 | 0.686 | |
| 5 | 32 | 0.54 | 4.03 | 748.0 | 401 | 230 | 248 | 47 | 106 | 101 | 9 | 0.735 | |
| 6 | 40 | 0.43 | 3.23 | 756.188 | 397 | 241 | 240 | 48 | 107 | 101 | 8 | 0.656 | |
| | 48 | | | | | | | | | | | | |

Pape & Steiner Environmental Services

PLANT SWPC TEST TYPE HCL FIELD TEST DATA SHEET (Page 2 of 2)

Date 3-31-87
Test Location KILN OUT
Run Number 1
Stack Diameter 160"
Operator Gwm
Filter No. 876

Barometric Pressure
Static in. wg.
Probe Type/Length
Pitot Coefficient
Meter Box No./γ
Nozzle No./Size

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| | | | |
| | | | |
| | | | |
| | | | |
| S.G. | | | |
| | | Total | |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| | | | |
| Leak Rate | cfm | "Hg | |
| Initial | | | |
| Final | 0.012 | 10 | |

| Sample Point | Time | ΔP in wg | ΔH in wg | Gas Meter Volume $Ft^3$ | Temperature °F Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-1 | 1540 | 0.21 | 1.56 | 761.8 | 400 | 262 | 250 | 56 | 100 | 99 | 4 | 0.458 | |
| 2 | 8 | 0.17 | 1.27 | 766.9 | 400 | 273 | 246 | 51 | 106 | 101 | 3 | 0.412 | |
| 3 | 16 | 0.21 | 1.57 | 772.5 | 401 | 249 | 238 | 50 | 107 | 98 | 4 | 0.458 | |
| 4 | 24 | 0.19 | 1.42 | 777.8 | 402 | 237 | 237 | 50 | 107 | 100 | 3 | 0.436 | |
| 5 | 32 | 0.21 | 1.56 | 783.5 | 403 | 231 | 237 | 48 | 108 | 99 | 4 | 0.458 | |
| 6 | 40 | 0.19 | 1.43 | 788.943 | 396 | 230 | 249 | 50 | 108 | 100 | 3 | 0.436 | |
| | 48 | | | | | | | | | | | | |
| C-1 | 1641 | 0.18 | 1.33 | 794.1 | 399 | 230 | 249 | 46 | 97 | 97 | 3 | 0.424 | |
| 2 | 8 | 0.17 | 1.26 | 799.2 | 400 | 234 | 246 | 44 | 103 | 96 | 3 | 0.412 | |
| 3 | 16 | 0.16 | 1.19 | 804.1 | 398 | 239 | 241 | 43 | 103 | 95 | 3 | 0.400 | |
| 4 | 24 | 0.15 | 1.11 | 808.9 | 400 | 230 | 245 | 44 | 102 | 94 | 3 | 0.387 | |
| 5 | 32 | 0.12 | 0.89 | 813.2 | 395 | 227 | 246 | 45 | 101 | 93 | 2 | 0.346 | |
| 6 | 40 | 0.09 | 0.67 | 816.867 | 395 | 233 | 245 | 44 | 101 | 92 | 2 | 0.300 | |
| | 48 | | | | | | | | | | | | Pitot ✓ OK |
| | | T/A = | 2.23 | Vm = 153.985 | 398.67 | | | | 99. | 46 | | 0.5319 | |

Pape & Steiner Environmental Services

PLANT SWPC TEST TYPE M5/8 FIELD TEST DATA SHEET (Page 1 of 2)

Date 4-1-87
Test Location BAG-OUT
Run Number 2
Stack Diameter 160"
Operator BH
Filter No. 885

Barometric Pressure 26.51
Static in. wg. -0.39
Probe Type/Length GL-6'
Pitot Coefficient 0.84
Meter Box No./γ 609/0.9983
Nozzle No./Size 1852/.3217

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| 80% IPA | 559.0 | 553.2 | 5.80 |
| 3% $H_2O_2$ | 576.1 | 533.9 | 42.20 |
| 3% $H_2O_2$ | 560.5 | 547.7 | 12.8 |
| | | | |
| S.G. | 780.2 | 725.5 | 54.7 |
| | | Total | 115.5 |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| | | | |
| Leak Rate | cfm | "Hg | |
| Initial @ | .016 | 15 | |
| Final | | | |

| Sample Point | 0750 Time | ΔP in wg | ΔH in wg | Gas Meter Volume $Ft^3$ | Temperature °F Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B 1 | 0 | .37 | 1.84 | 790.097 | 404 | 238 | 229 | 50 | 100 | 90 | 7 | 0.608 | |
| 2 | 8 | .42 | 2.10 | 797.38 | 405 | 267 | 274 | 38 | 103 | 89 | 8.5 | 0.648 | FAW-2 10289 |
| 3 | 16 | .46 | 2.30 | 805.57 | 405 | 274 | 266 | 36 | 104 | 89 | 10.0 | 0.678 | |
| 4 | 24 | .50 | 2.50 | 814.07 | 405 | 273 | 265 | 38 | 105 | 90 | 11 | 0.707 | |
| 5 | 32 | .46 | 2.30 | 822.07 | 405 | 269 | 261 | 39 | 105 | 91 | 10 | 0.678 | 10290 MF-2 |
| 6 | 40 | .44 | 2.22 | 830.41 | 404 | 270 | 268 | 43 | 108 | 93 | 9.5 | 0.663 | |
| C 1 | 0844 48 | .23 | 1.15 | 838.296 | 404 | 262 | 271 | 56 | 98 | 95 | 5 | 0.480 | 10291 BHD-2 |
| 2 | 56 | .18 | 0.91 | 844.41 | 404 | 252 | 279 | 54 | 111 | 95 | 4 | 0.424 | 10292 |
| 3 | 64 | .16 | 0.81 | 849.71 | 403 | 253 | 271 | 55 | 111 | 96 | 4 | 0.400 | AMF-2 |
| 4 | 72 | .14 | 0.71 | 854.81 | 406 | 240 | 267 | 51 | 112 | 96 | 3.5 | 0.374 | 10293 |
| 5 | 80 | .13 | 0.66 | 859.56 | 402 | 234 | 272 | 47 | 112 | 97 | 3 | 0.361 | SO2-2 |
| 6 | 88 | .11 | 0.56 | 864.31 | 401 | 231 | 275 | 47 | 112 | 98 | 3 | 0.332 | |
| | 96 | | | 868.479 | | | | | | | | | *AMF YELLOW |
| | | | | | | | | | | | | | |
| | | | | / | | | | | | | | | |

**Pape & Steiner Environmental Services**

PLANT SWPC TEST TYPE M 5/8 FIELD TEST DATA SHEET (Page 2 of 2)

| | |
|---|---|
| Date 4-1-87 | Barometric Pressure |
| Test Location BAG OUT | Static in. wg. |
| Run Number 2 | Probe Type/Length |
| Stack Diameter 160" | Pitot Coefficient |
| Operator BH | Meter Box No./8 |
| Filter No. | Nozzle No./Size |

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| | | | |
| | | | |
| | | | |
| | | | |
| S.G. | | | |
| | | Total | |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| Leak Rate | cfm | "Hg | |
| Initial | | | |
| Final @ NOZZLE | .017 | 12 | |

| Sample Point | 0946 Time | ΔP in wg | ΔH in wg | Gas Meter Volume $Ft^3$ | Temperature °F Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D 1 | 96 | .21 | 1.06 | 868.479 | 404 | 262 | 267 | 54 | 107 | 99 | 4.5 | 0.458 | |
| 2 | 104 | .20 | 1.00 | 874.19 | 413 | 228 | 269 | 59 | 110 | 96 | 4.5 | 0.447 | |
| 3 | 112 | .20 | 1.00 | 879.90 | 413 | 229 | 275 | 54 | 108 | 94 | 4.5 | 0.447 | |
| 4 | 120 | .22 | 1.09 | 885.49 | 416 | 230 | 267 | 53 | 106 | 92 | 4.5 | 0.469 | |
| 5 | 128 | .23 | 1.14 | 891.29 | 414 | 225 | 272 | 55 | 104 | 90 | 4.5 | 0.480 | |
| 6 | 136 | .22 | 1.09 | 897.06 | 412 | 228 | 270 | 63 | 103 | 87 | 4.5 | 0.469 | |
| A 1 | 1042 144 | .33 | 1.62 | 902.565 | 410 | 230 | 272 | 58 | 94 | 87 | 6.5 | 0.574 | |
| 2 | 152 | .39 | 1.93 | 909.52 | 412 | 239 | 269 | 36 | 105 | 86 | 8 | 0.624 | |
| 3 | 160 | .45 | 2.23 | 917.61 | 413 | 225 | 260 | 35 | 104 | 89 | 10 | 0.671 | |
| 4 | 168 | .56 | 2.77 | 925.17 | 412 | 228 | 263 | 32 | 102 | 88 | 12 | 0.748 | |
| 5 | 176 | .52 | 2.55 | 933.94 | 413 | 229 | 259 | 33 | 98 | 87 | 12 | 0.721 | |
| 6 | 184 | .48 | 2.37 | 943.58 | 410 | 226 | 255 | 34 | 100 | 87 | 11 | 0.693 | |
| | 192 | | | 950.964 | | | | | | | | | |
| | | | | | | | | | | | | | PURGE 15 MIN |
| | | | 1.58 | 160.867 | 407.92 | | | | 98.40 | | | 0.5482 | |

Pape & Steiner Environmental Services

PLANT SWPC TEST TYPE $NH_3$ FIELD TEST DATA SHEET (Page 1 of 2)

Date 4/1/87
Test Location Kiln Out
Run Number 2 - $NH_3$
Stack Diameter 160
Operator JB
Filter No. T-II

Barometric Pressure 26.51
Static in. wg. -0.39
Probe Type/Length 6/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/1.0016
Nozzle No./Size 1448/.3086

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| .1N HCl | 620.2 | 544.1 | 76.1 |
| .1N HCl | 559.8 | 537.0 | 22.8 |
| Blank | 454.2 | 448.7 | 5.5 |
| | | | |
| | | | |
| S.G. | 786.8 | 750.5 | 36.3 |
| | | Total | 140.7 |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| | | | |

| Leak Rate | cfm | "Hg |
|---|---|---|
| Initial | 0.003 | 15 nozzle |
| Final | | |

| Sample Point | Time | ΔP in wg | ΔH in wg | Gas Meter Volume $Ft^3$ | Temperature °F Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D 1 | 7:53 0 | 0.35 | 2.03 | 897.493 | 394 | 225 | 225 | 54 | 95 | 95 | 10.5 | 0.592 | pitot ok |
| 2 | 8 | 0.40 | 2.27 | 904.052 | 418 | 271 | 226 | 47 | 98 | 98 | 12.5 | 0.632 | |
| 3 | 16 | 0.45 | 2.53 | 910.895 | 420 | 274 | 232 | 46 | 96 | 95 | 14.5 | 0.671 | |
| 4 | 24 | 0.47 | 2.64 | 918.078 | 417 | 270 | 231 | 54 | 94 | 92 | 16.5 | 0.686 | |
| 5 | 32 | 0.55 | 3.12 | 925.447 | 409 | 262 | 245 | 63 | 93 | 92 | 17.0 | 0.742 | |
| 6 | 40 | 0.49 | 2.77 | 932.975 | 409 | 247 | 233 | 63 | 91 | 91 | 17.0 | 0.700 | |
| | 48 | | | 940.719 | | | | | | | | | |
| C 1 | 8:45 0 | 0.36 | 2.02 | 940.719 | 412 | 242 | 233 | 53 | 87 | 89 | 10.0 | 0.600 | |
| 2 | 8 | 0.40 | 2.25 | 947.175 | 416 | 244 | 244 | 46 | 95 | 92 | 12.0 | 0.632 | |
| 3 | 16 | 0.45 | 2.54 | 954.049 | 418 | 249 | 246 | 41 | 97 | 93 | 14.0 | 0.671 | |
| 4 | 24 | 0.50 | 2.83 | 960.285 | 416 | 240 | 243 | 42 | 98 | 94 | 12.0 | 0.707 | |
| 5 | 32 | 0.45 | 2.57 | 968.905 | 408 | 231 | 236 | 45 | 98 | 96 | 15.0 | 0.671 | |
| 6 | 40 | 0.45 | 2.58 | 976.322 | 408 | 247 | 227 | 43 | 99 | 97 | 15.0 | 0.671 | |
| | 48 | | | 983.845 | | | | | | | | | |
| | | | | | | | | | | | | | |

Pape & Steiner Environmental Services

PLANT SWPC TEST TYPE M17/$NH_3$ FIELD TEST DATA SHEET (Page 2 of 2)

Date 4/1/87
Test Location Kiln Out
Run Number 2 - $NH_3$
Stack Diameter 160
Operator JB
Filter No. T-II

Barometric Pressure 26.51
Static in. wg. -0.39
Probe Type/Length B/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/1.0018
Nozzle No./Size 1448/.3086

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| | | | |
| | | | |
| | | | |
| | | | |
| S.G. | | | |
| | | Total | |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| | | | |
| Leak Rate | cfm | "Hg | |
| Initial | | | |
| Final | 0.004 | 17.5 nozzle | |

| Sample Point | Time | ΔP in wg | ΔH in wg | Gas Meter Volume $Ft^3$ | Temperature °F Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C 1 | 9:46 0 | 0.20 | 1.14 | 983.845 | 410 | 257 | 227 | 49 | 94 | 97 | 6.5 | 0.447 | H/C Comment 210168 |
| 2 | 8 | 0.18 | 1.02 | 988.783 | 415 | 268 | 233 | 47 | 100 | 97 | 6.0 | 0.424 | FHW-2 10282 |
| 3 | 16 | 0.14 | 0.80 | 993.494 | 411 | 250 | 233 | 49 | 101 | 99 | 5.5 | 0.374 | |
| 4 | 24 | 0.13 | 0.75 | 997.789 | 410 | 242 | 234 | 47 | 101 | 100 | 5.0 | 0.361 | BHW-2 10283 |
| 5 | 32 | 0.12 | 0.69 | 1001.880 | 407 | 242 | 235 | 48 | 100 | 99 | 4.5 | 0.346 | |
| 6 | 40 | 0.10 | 0.58 | 1005.830 | 407 | 246 | 229 | 52 | 102 | 99 | 4.5 | 0.316 | stop @ 10:32 lost |
| | 48 | | | 1009.530 | | | | | | | | | power; start 10:34 |
| D 1 | 10:44 0 | 0.20 | 1.16 | 1009.530 | 407 | 264 | 233 | 52 | 105 | 101 | 6.5 | 0.447 | MF2 10285 |
| 2 | 8 | 0.18 | 1.03 | 1014.482 | 421 | 267 | 235 | 45 | 109 | 107 | 6.0 | 0.424 | |
| 3 | 16 | 0.23 | 1.26 | 1019.280 | 423 | 263 | 231 | 49 | 108 | 108 | 7.0 | 0.469 | |
| 4 | 24 | 0.17 | 0.98 | 1024.448 | 421 | 262 | 236 | 51 | 108 | 107 | 6.0 | 0.412 | |
| 5 | 32 | 0.23 | 1.33 | 1028.025 | 415 | 264 | 239 | 48 | 107 | 106 | 7.0 | 0.480 | |
| 6 | 40 | 0.23 | 1.33 | 1034.675 | 415 | 262 | 232 | 51 | 107 | 105 | 7.5 | 0.480 | pitot ok |
| | 48 | | | 1040.095 | | | | | | | | | |
| | 192 | | 1.16 | 142.602 | 412.79 | | | | 98.58 | | | 0.5398 | |

Pape & Steiner Environmental Services

PLANT SWPC TEST TYPE HCl FIELD TEST DATA SHEET (Page 1 of 2)

Date 4-1-87
Test Location KILN OUT
Run Number 2
Stack Diameter 160"
Operator Gwm
Filter No. 890

Barometric Pressure 26.51
Static in. wg. -0.39
Probe Type/Length Glass/6'
Pitot Coefficient 0.840
Meter Box No./γ 635/1.0008
Nozzle No./Size #1853/0.3217

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| .1N NaOH | 626.4 | 547.7 | 78.7 |
| .1N NaOH | 582.9 | 555.7 | 27.2 |
| Blank | 451.6 | 445.9 | 5.7 |
| | | | |
| | | | |
| S.G. | 796.1 | 758.4 | 37.7 |
| | | Total | 149.3 |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| | | | |

| Leak Rate | cfm | "Hg |
|---|---|---|
| Initial | 0.011 | 15 |
| Final | | |

| Sample Point | Time | ΔP in wg | ΔH in wg | Gas Meter Volume $Ft^3$ | Temperature °F Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C-1 | 0750 | 0.16 | 1.12 | 817.213 | 399 | 261 | 245 | 60 | 67 | 66 | 3 | 0.400 | Pitot ✓ OK |
| 2 | 8 | 0.20 | 1.40 | 821.8 | 401 | 255 | 247 | 62 | 72 | 67 | 4 | 0.447 | FHW-2 10286 |
| 3 | 16 | 0.15 | 1.06 | 826.9 | 401 | 252 | 254 | 58 | 76 | 67 | 3 | 0.387 | |
| 4 | 24 | 0.11 | 0.78 | 831.5 | 400 | 248 | 242 | 52 | 78 | 68 | 3 | 0.332 | ME-2 10287 |
| 5 | 32 | 0.13 | 0.92 | 835.4 | 399 | 245 | 256 | 52 | 80 | 69 | 3 | 0.361 | BHW-2 |
| 6 | 40 | 0.08 | 0.57 | 839.8 | 399 | 243 | 247 | 54 | 81 | 70 | 2 | 0.283 | est 10288 |
| | 48 | | | 843.232 | | | | | | | | | |
| D-1 | 0844 | 0.20 | 1.41 | 848.5 | 399 | 254 | 251 | 54 | 73 | 71 | 5 | 0.447 | |
| 2 | 8 | 0.20 | 1.42 | 853.8 | 404 | 240 | 253 | 52 | 83 | 73 | 5 | 0.447 | |
| 3 | 16 | 0.23 | 1.63 | 859.4 | 408 | 237 | 255 | 48 | 85 | 74 | 5 | 0.480 | |
| 4 | 24 | 0.22 | 1.56 | 865.0 | 407 | 237 | 251 | 49 | 85 | 75 | 5 | 0.469 | |
| 5 | 32 | 0.21 | 1.50 | 870.4 | 407 | 260 | 258 | 50 | 86 | 76 | 5 | 0.458 | |
| 6 | 40 | 0.20 | 1.44 | 875.710 | 401 | 266 | 246 | 52 | 87 | 76 | 5 | 0.447 | |
| | 48 | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Pape & Steiner Environmental Services

PLANT SWPC TEST TYPE HCl FIELD TEST DATA SHEET (Page 2 of 2)

Date 4-1-87 
Test Location KILN OUT 
Run Number 2 
Stack Diameter 160" 
Operator Bum 
Filter No. 890 

Barometric Pressure 
Static in. wg. 
Probe Type/Length 
Pitot Coefficient 
Meter Box No./γ 
Nozzle No./Size 

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| | | | |
| | | | |
| | | | |
| | | | |
| S.G. | | | |
| | | Total | |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| | | | |
| Leak Rate | cfm | "Hg | |
| Initial | | | |
| Final | 0.009 | 12 | |

| Sample Point | Time | ΔP in wg | ΔH in wg | Gas Meter Volume $Ft^3$ | Temperature °F Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A - 1 | 0946 | 0.40 | 2.86 | 875.710 | 404 | 228 | 262 | 47 | 82 | 80 | 9 | 0.632 | |
| 2 | 8 | 0.42 | 3.02 | 883.1 | 407 | 262 | 253 | 53 | 91 | 83 | 10 | 0.648 | |
| 3 | 16 | 0.47 | 3.38 | 890.5 | 406 | 232 | 259 | 52 | 89 | 84 | 11 | 0.686 | |
| 4 | 24 | 0.51 | 3.67 | 898.2 | 406 | 230 | 255 | 51 | 88 | 83 | 11 | 0.714 | |
| 5 | 32 | 0.56 | 4.02 | 905.8 | 406 | 230 | 251 | 52 | 87 | 82 | 11 | 0.748 | |
| 6 | 40 | 0.48 | 3.46 | 913.5 | 403 | 233 | 256 | 54 | 88 | 81 | 11 | 0.693 | |
| | 48 | | | 922.181 | | | | | | | | | |
| B- 1 | 1042 | 0.36 | 2.58 | 930.0 | 407 | 274 | 248 | 60 | 84 | 84 | 9 | 0.600 | |
| 2 | 8 | 0.40 | 2.89 | 937.4 | 406 | 270 | 247 | 60 | 93 | 85 | 10 | 0.632 | |
| 3 | 16 | 0.46 | 3.33 | 944.7 | 407 | 243 | 255 | 60 | 93 | 87 | 11 | 0.678 | |
| 4 | 24 | 0.46 | 3.33 | 951.6 | 405 | 237 | 248 | 61 | 92 | 86 | 11 | 0.678 | |
| 5 | 32 | 0.41 | 3.00 | 958.1 | 399 | 228 | 260 | 61 | 93 | 87 | 11 | 0.640 | |
| 6 | 40 | 0.43 | 3.14 | 964.913 | 399 | 230 | 266 | 61 | 92 | 86 | 11 | 0.656 | |
| | 48 | | | | | | | | | | | | |
| | | T/A= | 2.23 | Vm=147.700 | 403.33 | | | | 80.94 | | | 0.5402 | |

Pape & Steiner Environmental Services

PLANT SWPC TEST TYPE Method 5/8 FIELD TEST DATA SHEET (Page 1 of 2)

Date 4-1-87
Test Location BAG OUT
Run Number 3
Stack Diameter 160"
Operator BH
Filter No. 882

Barometric Pressure 26.46
Static in. wg. -0.39
Probe Type/Length GL-6'
Pitot Coefficient 0.84
Meter Box No./ 18609 / .9983
Nozzle No./Size 1852 / .3217

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| 80% IPA | 540.9 | 526.7 | 14.2 |
| 3% $H_2O_2$ | 588.3 | 554.1 | 34.2 |
| 3% $H_2O_2$ | 564.3 | 555.8 | 8.5 |
| | | | |
| | | | |
| S.G. | 819.3 | 760.4 | 58.9 |
| | | Total | 115.8 |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| | | | |
| Leak Rate | cfm | "Hg | |
| Initial @ nozzle | | | |
| Final | | | |

| Sample Point | Time | ΔP in wg | ΔH in wg | Gas Meter Volume $Ft^3$ | Temperature °F Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A 1 | 0 | .33 | 1.60 | 960.416 | 411 | 247 | 243 | 70 | 82 | 84 | 5 | 0.574 | PITOT OK |
| 2 | 8 | .42 | 2.08 | 967.32 | 410 | 268 | 247 | 53 | 103 | 87 | 6.5 | 0.648 | FHW-3 10310 |
| 3 | 16 | .47 | 2.32 | 975.09 | 413 | 251 | 247 | 55 | 105 | 87 | 7 | 0.686 | |
| 4 | 24 | .53 | 2.63 | 983.40 | 411 | 254 | 254 | 61 | 105 | 88 | 8 | 0.728 | 10311 MF-3 |
| 5 | 32 | .52 | 2.57 | 992.18 | 412 | 244 | 248 | 70 | 104 | 88 | 8 | 0.721 | |
| 6 | 40 | .48 | 2.38 | 1000.81 | 412 | 225 | 247 | 62 | 105 | 88 | 7.5 | 0.693 | 10312 BHW-3 |
| D 1 | 1329 48 | .23 | 1.13 | 1009.194 | 410 | 258 | 241 | 53 | 91 | 86 | 3.5 | 0.480 | AMF-3 10313 |
| 2 | 56 | .18 | 0.89 | 1015.15 | 410 | 260 | 244 | 47 | 102 | 86 | 3 | 0.424 | |
| 3 | 64 | .19 | 0.94 | 1020.25 | 406 | 256 | 248 | 51 | 102 | 87 | 3.5 | 0.436 | 502-3 10314 |
| 4 | 72 | .22 | 1.09 | 1025.75 | 409 | 271 | 241 | 56 | 103 | 86 | 3.5 | 0.469 | |
| 5 | 80 | .22 | 1.10 | 1031.50 | 405 | 246 | 243 | 56 | 106 | 88 | 3.5 | 0.469 | |
| 8 | 88 | .17 | 0.85 | 1037.11 | 405 | 243 | 246 | 60 | 107 | 89 | 3 | 0.412 | |
| | 96 | | | 1042.357 | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Pape & Steiner Environmental Services

PLANT SWPC TEST TYPE METHOD 5/8 FIELD TEST DATA SHEET (Page 2 of 2)

Date 4-1-87
Test Location BAG OUT
Run Number 3
Stack Diameter 160"
Operator BH
Filter No. 882

Barometric Pressure
Static in. wg.
Probe Type/Length
Pitot Coefficient
Meter Box No./γ
Nozzle No./Size

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| ~~80% IPA~~ | | ~~526.8~~ | |
| ~~3% $H_2O_2$~~ | | ~~557.5~~ | |
| ~~3% $H_2O_2$~~ | | ~~557.1~~ | |
| | | | |
| ~~S.G.~~ | | ~~637.9~~ | |
| | Total | | |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| | | | |

| Leak Rate | cfm | "Hg |
|---|---|---|
| Initial | | |
| Final @ NOZZLE | .613 | 8 |

| Sample Point | 1423 Time | ΔP in wg | ΔH in wg | Gas Meter Volume $Ft^3$ | Temperature °F Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C 1 | 96 | .15 | 0.75 | 1042.357 | 404 | 229 | 261 | 70 | 98 | 91 | 3 | 0.387 | |
| 2 | 104 | .15 | 0.75 | 1047.24 | 408 | 244 | 245 | 49 | 105 | 90 | 3 | 0.387 | |
| 3 | 112 | .15 | 0.75 | 1052.21 | 410 | 237 | 239 | 51 | 106 | 90 | 3 | 0.387 | |
| 4 | 120 | .15 | 0.75 | 1057.00 | 409 | 234 | 248 | 51 | 106 | 90 | 2.5 | 0.387 | |
| 5 | 128 | .12 | 0.60 | 1061.72 | 405 | 229 | 232 | 48 | 108 | 94 | 2.5 | 0.346 | |
| 6 | 136 | .10 | 0.50 | 1066.31 | 405 | 228 | 242 | 51 | 108 | 96 | 2 | 0.316 | |
| B 1 | 144 | .33 | 1.65 | 1070.390 | 403 | 249 | 243 | 68 | 100 | 91 | 5 | 0.574 | |
| 2 | 1512 152 | .40 | 2.02 | 1077.29 | 406 | 272 | 233 | 52 | 113 | 94 | 6 | 0.632 | |
| 3 | 160 | .44 | 2.24 | 1085.01 | 404 | 238 | 245 | 48 | 115 | 96 | 7 | 0.663 | |
| 4 | 168 | .45 | 2.28 | 1093.23 | 406 | 230 | 246 | 48 | 114 | 98 | 7 | 0.671 | |
| 5 | 176 | .51 | 2.59 | 1101.47 | 405 | 232 | 287 | 50 | 114 | 99 | 8 | 0.714 | |
| 6 | 184 | .36 | 1.83 | 1110.27 | 404 | 229 | 248 | 50 | 112 | 99 | 6 | 0.600 | |
| | 192 | | | 1117.783 | | | | | | | | | |
| | | | | | | | | | | | | | PURGE 15 MIN |
| | | | 1.51 | 157.367 | 407.63 | | | | 97.63 | | | 0.5336 | |

Pape & Steiner Environmental Services

PLANT SWPC TEST TYPE $NH_3$ FIELD TEST DATA SHEET (Page 1 of 2)

Date 4/1/87
Test Location Kiln Out
Run Number 3 - $NH_3$
Stack Diameter 160
Operator JS
Filter No. T-III

Barometric Pressure 26.46
Static in. wg. -0.39
Probe Type/Length 6/6'
Pitot Coefficient 0.84
Meter Box No./Y 446/1.0018
Nozzle No./Size 1448/.3086

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| .1N HCL | 656.4 | 559.2 | 97.2 |
| .1N HCL | 550.7 | 531.6 | 19.1 |
| Blank | 451.9 | 448.2 | 3.7 |
| | | | |
| | | | |
| S.G. | 785.8 | 749.9 | 35.9 |
| | | Total | 155.9 |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| | | | |

| Leak Rate | cfm | "Hg |
|---|---|---|
| Initial | 0.004 | 15 nozzle |
| Final | | |

| Sample Point | Time | ΔP in wg | ΔH in wg | Gas Meter Volume $Ft^3$ | Temperature °F Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D 1 | 12:24 0 | 0.20 | 1.14 | 40.707 | 422 | 271 | 257 | 71 | 102 | 102 | 6.0 | 0.447 | pitot ok |
| 2 | 8 | 0.20 | 1.14 | 45.757 | 425 | 275 | 252 | 69 | 105 | 105 | 5.0 | 0.447 | #NW-3 10298 |
| 3 | 16 | 0.23 | 1.31 | 50.710 | 422 | 276 | 256 | 66 | 103 | 102 | 5.5 | 0.480 | |
| 4 | 24 | 0.25 | 1.42 | 56.050 | 421 | 261 | 116 | 70 | 100 | 100 | 5.5 | 0.500 | lost oven heat 18.6 |
| 5 | 32 | 0.25 | 1.41 | 60.140 | 421 | 272 | 108 | 64 | 97 | 96 | 5.5 | 0.500 | |
| 6 | 40 | 0.23 | 1.29 | 62.049 | 421 | 249 | 97 | 64 | 94 | 92 | 5.5 | 0.480 | 10308 MF-3 |
| | 48 | | | 72.358 | | | | | | | | | 10309 BHW-3 |
| C 1 | 1:22 0 | 0.24 | 1.35 | 72.358 | 410 | 244 | 95 | 65 | 89 | 88 | 5.5 | 0.490 | |
| 2 | 8 | 0.20 | 1.12 | 77.675 | 421 | 261 | 91 | 57 | 95 | 90 | 5.0 | 0.447 | |
| 3 | 16 | 0.21 | 1.18 | 82.645 | 420 | 268 | 89 | 59 | 94 | 91 | 5.0 | 0.458 | |
| 4 | 24 | 0.21 | 1.17 | 87.640 | 421 | 270 | 87 | 59 | 93 | 88 | 5.0 | 0.458 | |
| 5 | 32 | 0.16 | 0.90 | 92.620 | 416 | 254 | 88 | 63 | 97 | 90 | 4.5 | 0.400 | |
| 6 | 40 | 0.18 | 1.03 | 97.069 | 408 | 250 | 88 | 63 | 99 | 92 | 4.5 | 0.424 | |
| | 48 | | | 101.753 | | | | | | | | | |
| | | | | | | | | | | | | | |

Pape & Steiner Environmental Services

PLANT SWPC TEST TYPE M17/$NH_3$ FIELD TEST DATA SHEET (Page 2 of 2)

Date 4/1/87
Test Location Kiln Out
Run Number 3 - $NH_3$
Stack Diameter 160
Operator JS
Filter No. F-TTL

Barometric Pressure 26.46
Static in. wg. -0.39
Probe Type/Length 6/6'
Pitot Coefficient 0.84
Meter Box No./γ 446/1.0018
Nozzle No./Size 1448/.3086

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| | | | |
| | | | |
| | | | |
| | | | |
| S.G. | | | |
| | | Total | |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| | | | |
| Leak Rate | cfm | "Hg | |
| Initial | | | |
| Final | 0.006 | 12.5 nozzle | |

| Sample Point | Time | ΔP in wg | ΔH in wg | Gas Meter Volume $Ft^3$ | Temperature °F: Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B 1 | 2:24 0 | 0.37 | 2.08 | 101.753 | 420 | 284 | 98 | 73 | 94 | 94 | 7.5 | 0.608 | |
| 2 | 8 | 0.45 | 2.52 | 108.280 | 422 | 280 | 106 | 61 | 97 | 92 | 9.5 | 0.671 | |
| 3 | 16 | 0.53 | 2.99 | 115.471 | 419 | 275 | 107 | 62 | 100 | 92 | 11.0 | 0.728 | |
| 4 | 24 | 0.50 | 2.84 | 123.330 | 419 | 270 | 103 | 63 | 103 | 96 | 10.5 | 0.707 | |
| 5 | 32 | 0.53 | 3.04 | 131.033 | 415 | 261 | 100 | 63 | 106 | 99 | 11.0 | 0.728 | |
| 6 | 40 | 0.48 | 2.76 | 138.000 | 414 | 252 | 103 | 65 | 104 | 102 | 10.0 | 0.693 | |
| | 48 | | | 146.702 | | | | | | | | | |
| A 1 | 3:19 0 | 0.36 | 2.02 | 146.702 | 419 | 254 | 96 | 73 | 96 | 92 | 7.5 | 0.600 | |
| 2 | 8 | 0.43 | 2.45 | 153.280 | 420 | 270 | 97 | 61 | 107 | 98 | 9.0 | 0.656 | |
| 3 | 16 | 0.50 | 2.87 | 160.411 | 420 | 272 | 97 | 63 | 109 | 103 | 10.5 | 0.707 | |
| 4 | 24 | 0.59 | 3.38 | 168.165 | 420 | 265 | 97 | 65 | 109 | 103 | 12.5 | 0.768 | |
| 5 | 32 | 0.59 | 3.39 | 176.610 | 418 | 244 | 96 | 69 | 108 | 105 | 12.5 | 0.768 | |
| 6 | 40 | 0.53 | 3.03 | 184.999 | 420 | 248 | 99 | 70 | 105 | 103 | 11.5 | 0.728 | pitot ok |
| | 48 | | | 193.279 | | | | | | | | | |
| | 192 | | 1.99 | 152.512 | 418.88 | | | | 98.44 | | | 0.5789 | |

Pape & Steiner Environmental Services

PLANT SWPC TEST TYPE HCL FIELD TEST DATA SHEET (Page 1 of 2)

Date 4-1-87
Test Location KILN OUT
Run Number 3
Stack Diameter 160"
Operator Gwm
Filter No. 891

Barometric Pressure 26.46
Static in. wg. -0.39
Probe Type/Length Glass/6'
Pitot Coefficient 0.840
Meter Box No./γ 635/1.0008
Nozzle No./Size 1285/0.3061

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| .1N NaOH | 606.8 | 520.8 | 86.0 |
| .1N NaOH | 569.9 | 549.1 | 20.8 |
| Blank | 436.1 | 433.6 | 2.5 |
| | | | |
| | | | |
| S.G. | 753.9 | 723.8 | 30.1 |
| | | Total | 139.4 |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| | | | |

| Leak Rate | cfm | "Hg |
|---|---|---|
| Initial | 0.018 | 15 |
| Final | | |

| Sample Point | Time | ΔP in wg | ΔH in wg | Gas Meter Volume Ft$^3$ | Temperature °F Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-1 | 1223 | 0.38 | 2.24 | 965.227 | 400 | 242 | 249 | 60 | 82 | 82 | 5 | 0.616 | Pitot ✓ OK |
| 2 | 8 | 0.44 | 2.61 | 971.9 | 402 | 248 | 254 | 45 | 91 | 83 | 5 | 0.663 | 10295 |
| 3 | 16 | 0.49 | 2.91 | 978.9 | 405 | 257 | 252 | 41 | 95 | 84 | 5 | 0.700 | HAW-3 |
| 4 | 24 | 0.51 | 3.05 | 986.4 | 403 | 250 | 253 | 40 | 97 | 86 | 6 | 0.714 | 10296 |
| 5 | 32 | 0.45 | 2.70 | 993.9 | 402 | 249 | 246 | 40 | 99 | 87 | 5 | 0.671 | MF-3 |
| 6 | 40 | 0.44 | 2.66 | 1001.1 | 400 | 243 | 257 | 40 | 103 | 89 | 5 | 0.663 | 10297 |
| | 48 | | | 1008.375 | | | | | | | | | BHW-3 |
| A-1 | 1320 | 0.35 | 2.08 | 1014.8 | 405 | 225 | 260 | 40 | 89 | 89 | 4 | 0.592 | |
| 2 | 8 | 0.44 | 2.64 | 1021.9 | 405 | 240 | 263 | 40 | 100 | 90 | 5 | 0.663 | |
| 3 | 16 | 0.46 | 2.76 | 1029.2 | 403 | 263 | 258 | 44 | 99 | 90 | 5 | 0.678 | |
| 4 | 24 | 0.50 | 3.01 | 1036.8 | 404 | 270 | 253 | 43 | 102 | 89 | 6 | 0.707 | |
| 5 | 32 | 0.56 | 3.39 | 1044.8 | 401 | 229 | 267 | 47 | 103 | 91 | 7 | 0.748 | |
| 6 | 40 | 0.45 | 2.73 | 1052.096 | 401 | 225 | 254 | 49 | 103 | 92 | 5 | 0.671 | |
| | 48 | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Pape & Steiner Environmental Services

PLANT SWPC TEST TYPE HCL FIELD TEST DATA SHEET (Page 2 of 2 )

Date 4-1-87
Test Location KILN OUT
Run Number 3
Stack Diameter 160"
Operator Gwm
Filter No. 891

Barometric Pressure
Static in. wg.
Probe Type/Length
Pitot Coefficient
Meter Box No./γ
Nozzle No./Size

| Impinger Volumes/Weights | | | |
|---|---|---|---|
| Contents | Final | Initial | Net |
| | | | |
| | | | |
| | | | |
| | | | |
| S.G. | | | |
| | | Total | |

| Gas Composition | | | |
|---|---|---|---|
| Time | $CO_2$ | $O_2$ | CO |
| | | | |
| | | | |
| Leak Rate | cfm | "Hg | |
| Initial | | | |
| Final | 0.016 | 10 | |

| Sample Point | Time | ΔP in wg | ΔH in wg | Gas Meter Volume $Ft^3$ | Temperature °F Stack | Probe | Oven | Imp. | Gas Meter In | Gas Meter Out | Pump Vacuum in. Hg | $\sqrt{\Delta P}$ | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1423 | 0.18 | 1.08 | 1052.096 | 402 | 240 | 251 | 47 | 93 | 92 | 2 | 0.424 | |
| 2 | 8 | 0.23 | 1.39 | 1056.7 | 403 | 250 | 256 | 40 | 103 | 93 | 3 | 0.480 | |
| 3 | 16 | 0.21 | 1.27 | 1062.0 | 403 | 267 | 252 | 43 | 106 | 94 | 3 | 0.458 | |
| 4 | 24 | 0.22 | 1.34 | 1067.1 | 402 | 266 | 250 | 43 | 108 | 96 | 3 | 0.469 | |
| 5 | 32 | 0.19 | 1.16 | 1072.1 | 401 | 259 | 257 | 43 | 106 | 96 | 2 | 0.436 | |
| 6 | 40 | 0.20 | 1.22 | 1077.1 | 401 | 235 | 264 | 41 | 105 | 97 | 3 | 0.447 | |
| | 48 | | | 1082.095 | | | | | | | | | |
| 1 | 1518 | 0.17 | 1.03 | 1086.6 | 400 | 272 | 250 | 43 | 97 | 95 | 2 | 0.412 | |
| 2 | 8 | 0.13 | 0.79 | 1090.8 | 401 | 253 | 252 | 40 | 108 | 97 | 2 | 0.361 | |
| 3 | 16 | 0.13 | 0.79 | 1094.8 | 401 | 248 | 252 | 42 | 105 | 98 | 2 | 0.361 | |
| 4 | 24 | 0.07 | 0.43 | 1098.0 | 401 | 243 | 257 | 44 | 103 | 96 | 2 | 0.265 | |
| 5 | 32 | 0.09 | 0.55 | 1101.4 | 398 | 240 | 257 | 43 | 101 | 95 | 2 | 0.300 | |
| 6 | 40 | 0.05 | 0.30 | 1103.763 | 398 | 237 | 253 | 45 | 101 | 95 | 2 | 0.224 | Pitot ✓ OK |
| | 48 | | | | | | | | | | | | |
| | | T/A = | 1.84 | Vm = 138.536 | 401.75 | | | | 95. | 73 | | 0.5301 | |

Pape & Steiner Environmental Services

# CONTINUOUS MONITOR DATA SHEET

Plant SWPC

Date 3-31-87 Run No. 1

Test Location #2 Kiln Outlet

Operator One

Fuel Type ______ Trailer No. 2

APCD Witness/Number Richard Wales /

Generator Type

Burner Type

$O_2$ Controller Type

Gas Cylinder Nos. Nox: AAL 13472

$O_2/CO_2/CO$: AAL 5965

page 1 of 2

| Time | Sample Point | Fuel Flow | Dry Uncorrected | | | | | | 3% $O_2$ Dry | | Hydrocarbons | | | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $O_2$ % | $CO_2$ % | CO ppm | $SO_2$ ppm | NO ppm | $NO_x$ ppm | ppm | $NO_x$ ppm | THC | $CH_4$ | Non $CH_4$ | | | | |
| | | | 8.07 | 15.00 | 201.5 | | | 813.1 | | | | | | | | | Span Gas Value |
| 1322 | | | 8.07 | 14.30 | | | | 808.0 | | | | | | | | | External Resp |
| | | | | | | | | | | | | | | | | | leak VOK |
| 1348 | | | | | | | | | | | | | | R-1 | C-Port | | ·10-100% Chart |
| 1352 | C-1 | | 8.50 | 20.4 | 610.0 | | | 638.1 | | | | | | | | | |
| 1400 | 2 | | 8.40 | 21.0 | 690.0 | | | 630.0 | | | | | | | | | |
| 1408 | 3 | | 8.40 | 21.9 | 690.0 | | | 605.0 | | | | | | | | | |
| 1416 | 4 | | 8.20 | 23.1 | 880.0 | | | 580.0 | | | | | | | | | |
| 1424 | 5 | | 8.25 | 23.1 | 780.0 | | | 590.0 | | | | | | | | | |
| 1432 | 6 | | 8.50 | 21.4 | 680.0 | | | 630.0 | | | | | | | | | |
| | | | 0 | Ø | -.75 | | | 1.0 | | | | | | | | | Zero Value |
| | | | 7.75 | 15.9 | 125.0 | | | 818.1 | | | | | | | | | Span Resp |
| | | | | | | | | | | | | | | | | | |
| 1450 | B-1 | | 8.75 | 19.4 | 675.0 | | | 595.0 | | | | | | R-1 | B-Port | | (1446) |
| 1458 | 2 | | 8.75 | 19.4 | 725.0 | | | 620.0 | | | | | | | | | |
| 1506 | 3 | | 8.75 | 18.8 | 700.0 | | | 618.0 | | | | | | | | | |
| 1514 | 4 | | 8.50 | 19.0 | 725.0 | | | 630.0 | | | | | | | | | |
| 1522 | 5 | | 8.80 | 18.6 | 660.0 | | | 645.0 | | | | | | | | | |
| 1530 | 6 | | 8.60 | 19.8 | 825.0 | | | 640.0 | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 1544 | A-1 | | 8.70 | 18.5 | 725.0 | | | 650.0 | | | | | | R-1 | A-Port | | (1540) |
| 1552 | 2 | | 8.50 | 18.8 | 725.0 | | | 650.0 | | | | | | | | | |
| 1600 | 3 | | 8.75 | 18.1 | 750.0 | | | 658.0 | | | | | | | | | |
| 1608 | 4 | | 9.00 | 18.3 | 650.0 | | | 620.0 | | | $O_2$ | $CO_2$ | CO | NOx | | | |
| 1616 | 5 | | 9.30 | 17.1 | 450.0 | | | 690.0 | | | Ø | Ø | 75 | 10.0 | Zero | Value | |
| 1624 | 6 | | 9.00 | 18.6 | 650.0 | | | 695.0 | | | 7.80 | 1395 | 275.0 | 838.0 | Span | Resp | |

Pape & Steiner Environmental Services

# CONTINUOUS MONITOR DATA SHEET

Plant: SWPC
Date: 3/31/87 Run No. 1
Test Location: #2 Kiln Outlet
Operator: SWE
Fuel Type: Trailer No. 2

APCD Witness/Number:
Generator Type:
Burner Type:
$O_2$ Controller Type:
Gas Cylinder Nos.:

page 2 of 2

| Time | Sample Point | Fuel Flow | Dry Uncorrected $O_2$ % | $CO_2$ % | CO ppm | $SO_2$ ppm | NO ppm | $NO_x$ ppm | 3% $O_2$ Dry ppm | $NO_x$ ppm | Hydrocarbons THC | $CH_4$ | Non $CH_4$ | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 8.07 | 15.00 | 201.5 | | | 813.1 | | | | | | | | | Span Gas Value |
| 1644 | D-1 | | 9.00 | 19.9 | 550.0 | | | 715.0 | | | | | | R-1 | D-Port | | 1640 |
| 1652 | 2 | | 8.75 | 19.6 | 675.0 | | | 685.0 | | | | | | | | | |
| 1700 | 3 | | 9.00 | 19.3 | 550.0 | | | 685.0 | | | | | | | | | |
| 1708 | 4 | | 9.20 | 18.8 | 475.0 | | | 705.0 | | | | | | | | | |
| 1716 | 5 | | 9.20 | 18.8 | 475.0 | | | 685.0 | | | | | | | | | |
| 1724 | 6 | | 9.20 | 18.9 | 575.0 | | | 695.0 | | | | | | | | | |
| | | | Ø | Ø | 15.0 | | | Ø | | | | | | | | | Zero Value |
| | | | 8.07 | 14.00 | 180.0 | | | 820.0 | | | | | | | | | Span Resp. |
| | | | 7.75 | 13.75 | 200.0 | | | 801.0 | | | | | | | | | External Rsp |
| | | | | | | | | | | | | | | | | | leak ✓ OK |

Pape & Steiner Environmental Services

CONTINUOUS MONITOR DATA SHEET



Plant SWPC

Date 4-1-87 Run No. 2

Test Location #2 Kiln Outlet

Operator SRO

Fuel Type ______ Trailer No. 2

APCD Witness/Number ______

Generator Type ______

Burner Type ______

$O_2$ Controller Type ______

Gas Cylinder Nos. NOx: AAL 13472
$O_2/CO_2/CO$: AAL 5965

| Time | Sample Point | Fuel Flow | Dry Uncorrected | | | | | | 3% $O_2$ Dry | | Hydrocarbons | | | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $O_2$ % | $CO_2$ % | CO ppm | $SO_2$ ppm | NO ppm | $NO_x$ ppm | ppm | $NO_x$ ppm | THC | $CH_4$ | Non $CH_4$ | | | | |
| | | | 8.07 | 15.00 | 201.5 | | | 813.1 | | | | | | | | | Span Gas Value |
| 0730 | | | 7.80 | 14.80 | 250.0 | | | 803.0 | | | | | | | | | [illegible] Resp |
| | | | | | | | | | | | | | | | | | Cals w/OK |
| 0754 | D-1 | | 8.80 | 20.3 | 550.0 | | | 650.0 | | | | | | R-2 | (0750) | | -10-100% Chart |
| 0802 | 2 | | 9.00 | 20.3 | 525.0 | | | 640.0 | | | | | | D-Port | | | |
| 0810 | 3 | | 9.00 | 20.0 | 525.0 | | | 660.0 | | | | | | | | | |
| 0818 | 4 | | 8.80 | 20.4 | 575.0 | | | 665.0 | | | | | | | | | |
| 0826 | 5 | | 9.00 | 20.0 | 580.0 | | | 675.0 | | | | | | | | | |
| 0834 | 6 | | 9.15 | 19.8 | 425.0 | | | 685.0 | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 0848 | A-1 | | 9.00 | 20.3 | 600.0 | | | 700.0 | | | | | | R-2 | (0844) | | |
| 0856 | 2 | | 8.80 | 20.0 | 575.0 | | | 725.0 | | | | | | A-Port | | | |
| 0904 | 3 | | 8.90 | 19.9 | 550.0 | | | 725.0 | | | | | | | | | |
| 0912 | 4 | | 8.90 | 19.6 | 525.0 | | | 725.0 | | | | | | | | | |
| 0920 | 5 | | 8.90 | 20.0 | 600.0 | | | 710.0 | | | | | | | | | |
| 0928 | 6 | | 8.90 | 20.0 | 525.0 | | | 725.0 | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | -.25 | -.25 | 25 | | | -5.0 | | | | | | | | | Zero Value |
| | | | 8.00 | 14.40 | 200.0 | | | 883 | | | | | | | | | Span Resp. |
| | | | | | | | | | | | | | | | | | |
| 0949 | B-1 | | 8.65 | 20.6 | 575.0 | | | 660.0 | | | | | | R-2 | (0945) | | |
| 0957 | 2 | | 8.75 | 20.5 | 600.0 | | | 680.0 | | | | | | | | | |
| 1005 | 3 | | 8.50 | 20.8 | 600.0 | | | 655.0 | | | | | | | | | |
| 1013 | 4 | | 8.65 | 20.5 | 600.0 | | | 645.0 | | | | | | | | | |
| 1021 | 5 | | 9.00 | 20.3 | 650.0 | | | 650.0 | | | | | | | | | |
| 1029 | 6 | | 8.75 | 20.3 | 550.0 | | | 655.0 | | | | | | | | | |

Pape & Steiner Environmental Services

# CONTINUOUS MONITOR DATA SHEET

page 2 of 2

Plant SWPC
Date 4-1-87 Run No. 2
Test Location #2 Kiln Outlet
Operator BW
Fuel Type ____ Trailer No. 2

APCD Witness/Number ____
Generator Type ____
Burner Type ____
$O_2$ Controller Type ____
Gas Cylinder Nos. ____

| Time | Sample Point | Fuel Flow | Dry Uncorrected | | | | | | 3% $O_2$ Dry | | Hydrocarbons | | | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $O_2$ % | $CO_2$ % | CO ppm | $SO_2$ ppm | NO ppm | $NO_x$ ppm | ppm | $NO_x$ ppm | THC | $CH_4$ | Non $CH_4$ | | | | |
| | | | 8.07 | 15.00 | 801.5 | | | 813.1 | | | | | | | | | Span Gas Value |
| | | | | | | | | | | | | | | | | | |
| 1046 | C-1 | | 8.60 | 20.9 | 575.0 | | | 660.0 | | | | | | R-2 | (1042) | | |
| 1054 | 2 | | 8.60 | 20.5 | 575.0 | | | 660.0 | | | | | | C - | Port | | |
| 1102 | 3 | | 8.50 | 20.9 | 780.0 | | | 650.0 | | | | | | | | | |
| 1110 | 4 | | 8.30 | 21.3 | 775.0 | | | 635.0 | | | | | | | | | |
| 1118 | 5 | | 8.40 | 20.9 | 725.0 | | | 640.0 | | | | | | | | | |
| 1126 | 6 | | 8.40 | 20.8 | 675.0 | | | 635.0 | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | .20 | Ø | 75. | | | Ø | | | | | | | | | Zero Value |
| | | | 7.75 | 15.08 | 175.0 | | | 822.0 | | | | | | | | | Span Resp. |

Pape & Steiner Environmental Services

CONTINUOUS MONITOR DATA SHEET

page 1 of 2

Plant: SWPC
Date: 4-1-87 Run No.: 3
Test Location: #2 Kiln Outlet
Operator: SW
Fuel Type: Trailer No.: 2

APCD Witness/Number:
Generator Type:
Burner Type:
$O_2$ Controller Type:
Gas Cylinder Nos.: NOx: AAL 13472
$O_2/CO_2/CO$ AAL 5965

| Time | Sample Point | Fuel Flow | Dry Uncorrected $O_2$ % | $CO_2$ % | CO ppm | $SO_2$ ppm | NO ppm | $NO_x$ ppm | 3% $O_2$ Dry ppm | $NO_x$ ppm | Hydrocarbons THC | $CH_4$ | Non $CH_4$ | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 8.07 | 15.00 | 201.5 | | | 813.1 | | | | | | | | | Span Gas Value |
| 0730 | | | 7.80 | 14.80 | 250.0 | | | 803.5 | | | | | | | | | External Resp |
| | | | | | | | | | | | | | | | | | Leak ✓ OK |
| 1227 | C-1 | | 8.50 | 21.3 | 825.0 | | | 665.0 | | | | | | R-3 (1228) | | | -10-100% Chart |
| 1235 | 2 | | 8.40 | 21.1 | 775.0 | | | 645.0 | | | | | | C-Port | | | |
| 1243 | 3 | | 8.25 | 21.0 | 725.0 | | | 670.0 | | | | | | | | | |
| 1251 | 4 | | 8.25 | 21.3 | 750.0 | | | 680.0 | | | | | | | | | |
| 1259 | 5 | | 8.25 | 21.3 | 725.0 | | | 690.0 | | | | | | | | | |
| 1307 | 6 | | 8.30 | 20.5 | 600.0 | | | 705.0 | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 1325 | B-1 | | 8.30 | 20.5 | 600.0 | | | 690.0 | | | | | | R-3 (1321) | | | |
| 1333 | 2 | | 8.30 | 20.6 | 650.0 | | | 705.0 | | | | | | B-Port | | | |
| 1341 | 3 | | 8.00 | 21.0 | 800.0 | | | 655.0 | | | | | | | | | |
| 1349 | 4 | | 8.20 | 20.9 | 850.0 | | | 690.0 | | | | | | | | | |
| 1357 | 5 | | 7.80 | 21.4 | 950.0 | | | 645.0 | | | | | | | | | |
| 1405 | 6 | | 7.80 | 21.1 | 925.0 | | | 645.0 | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | φ | -.1 | 5.0 | | | 1.0 | | | | | | | | | Zero Value |
| | | | 7.50 | 14.95 | 201.5 | | | 835.0 | | | | | | | | | Span Resp. |
| | | | | | | | | | | | | | | | | | |
| 1427 | A-1 | | 8.30 | 21.0 | 825.0 | | | 610.0 | | | | | | R-3 (1423) | | | |
| 1435 | 2 | | 8.30 | 21.1 | 825.0 | | | 635.0 | | | | | | A-Port | | | |
| 1443 | 3 | | 8.50 | 20.5 | 725.0 | | | 625.0 | | | | | | | | | |
| 1451 | 4 | | 8.25 | 21.0 | 825.0 | | | 620.0 | | | | | | | | | |
| 1459 | 5 | | 8.40 | 20.9 | 850.0 | | | 610.0 | | | | | | | | | |
| 1507 | 6 | | 8.25 | 20.9 | 850.0 | | | 620.0 | | | | | | | | | |

Pape & Steiner Environmental Services

# CONTINUOUS MONITOR DATA SHEET

page 2 of 2

Plant SWPC.

Date 4-1-87 Run No. 3

Test Location #2 Kiln Outlet

Operator SD

Fuel Type Trailer No. 2

APCD Witness/Number

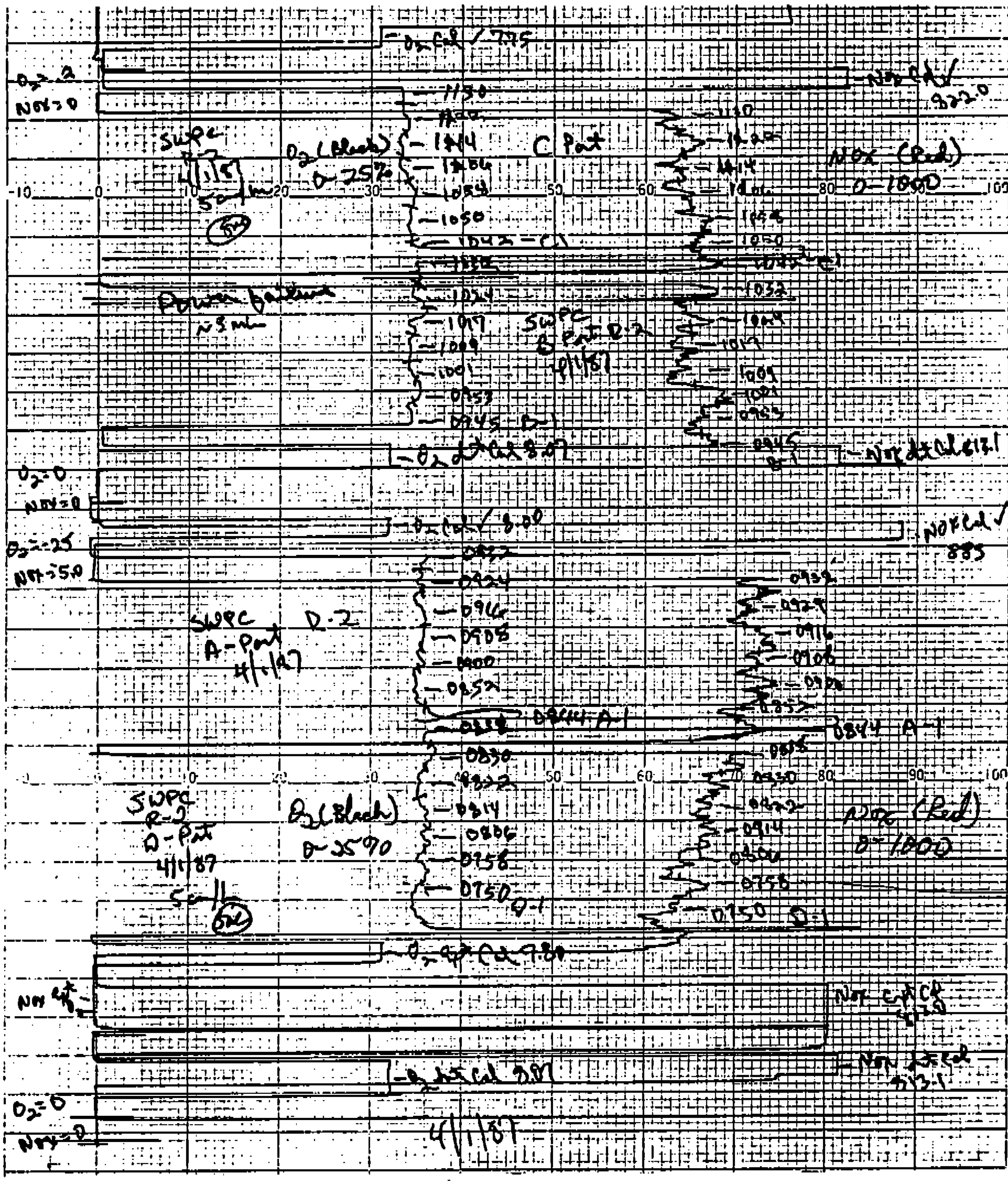
Generator Type

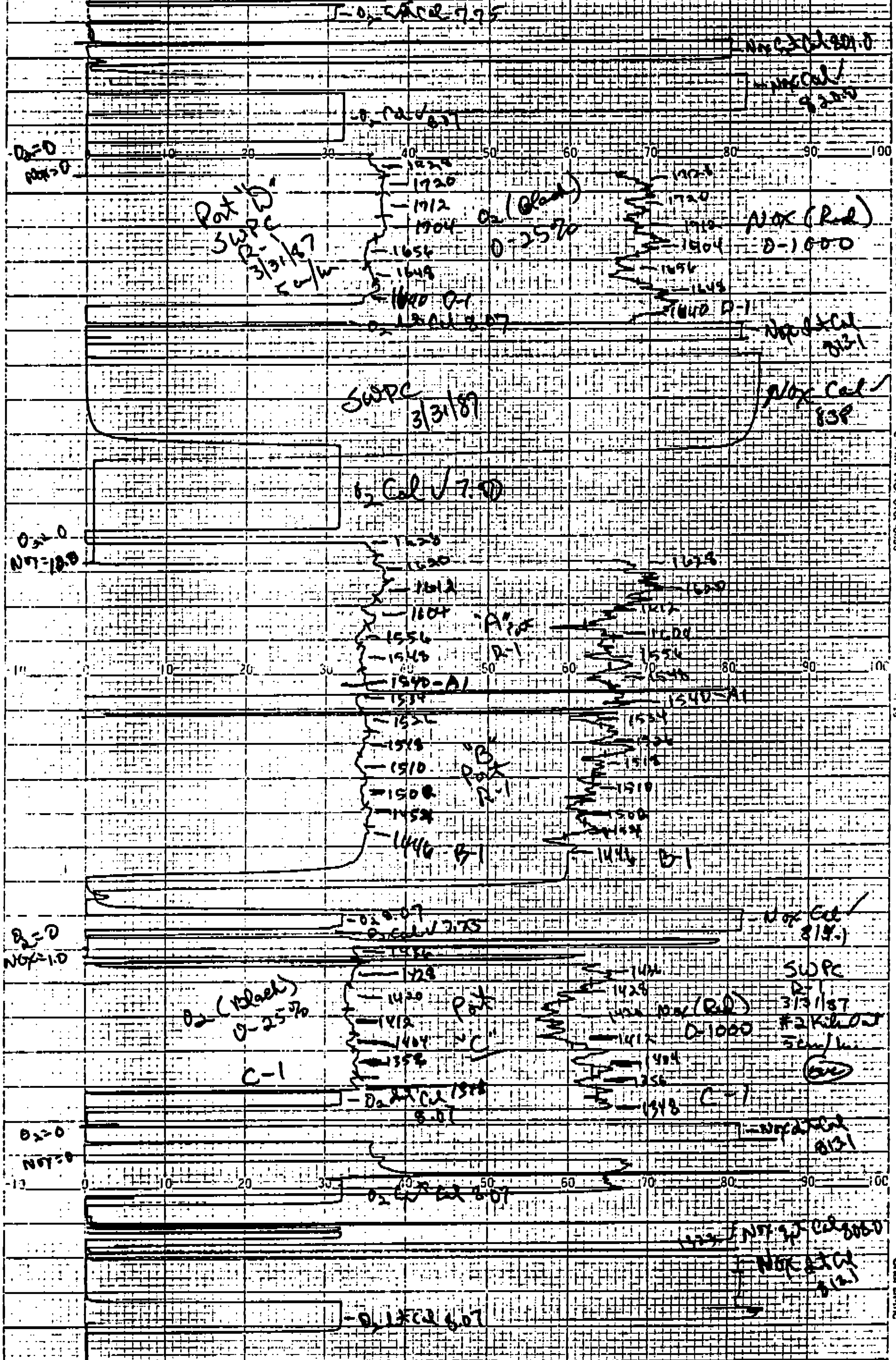
Burner Type

$O_2$ Controller Type

Gas Cylinder Nos.

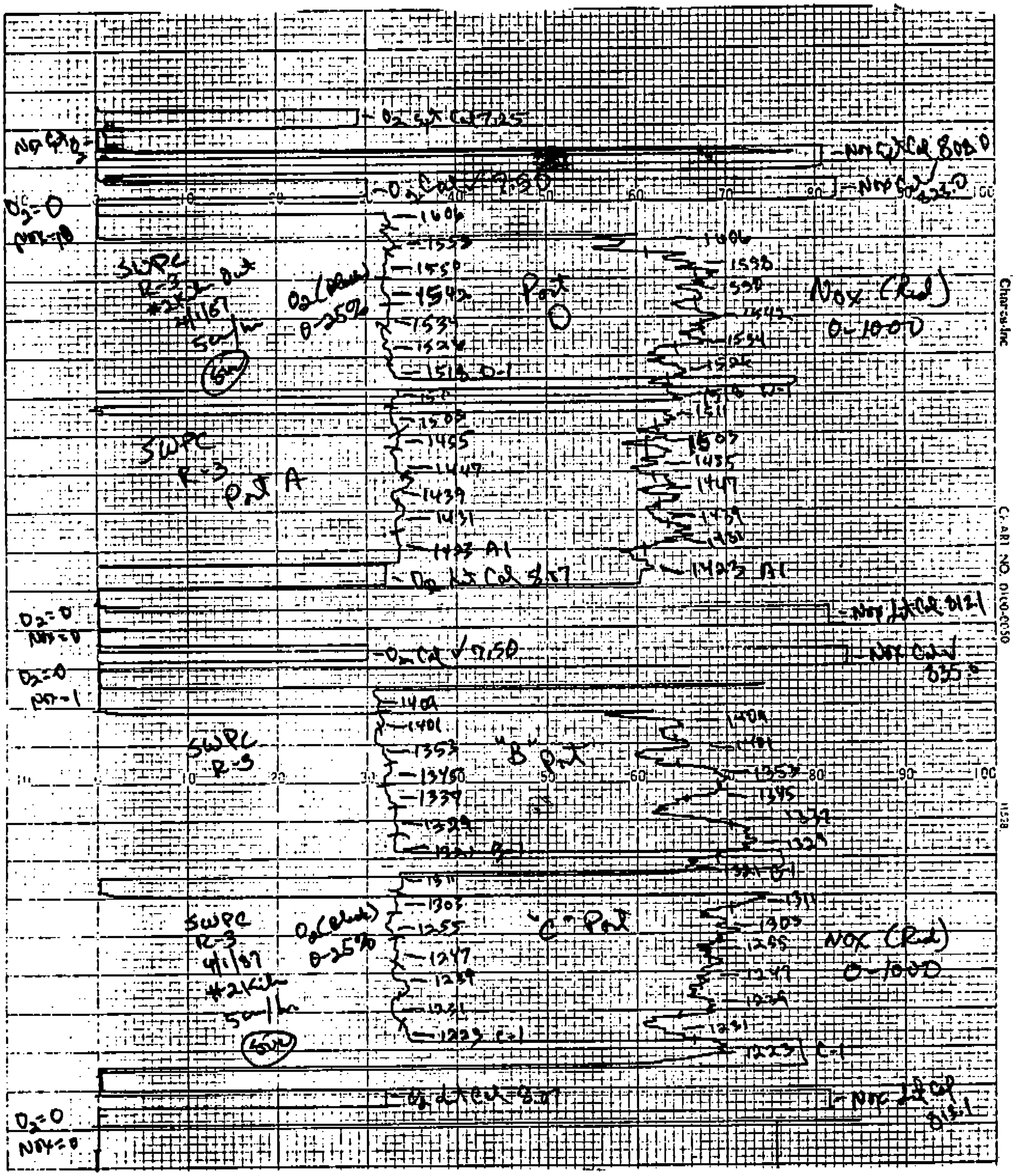
| Time | Sample Point | Fuel Flow | Dry Uncorrected $O_2$ % | $CO_2$ % | CO ppm | $SO_2$ ppm | NO ppm | $NO_x$ ppm | 3% $O_2$ Dry ppm | $NO_x$ ppm | Hydrocarbons THC | $CH_4$ | Non $CH_4$ | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 8.07 | 15.00 | 201.5 | | | 813.0 | | | | | | | | | Span Gas Value |
| 1522 | D-1 | | 8.20 | 21.1 | 950.0 | | | 635.0 | | | | | | R-3 | (1518) | | |
| 1530 | 2 | | 8.00 | 21.3 | 900.0 | | | 645.0 | | | | | | D- | Port | | |
| 1538 | 3 | | 8.20 | 20.9 | 800.0 | | | 670.0 | | | | | | | | | |
| 1546 | 4 | | 8.00 | 21.1 | 775.0 | | | 665.0 | | | | | | | | | |
| 1554 | 5 | | 8.10 | 20.4 | 700.0 | | | 665.0 | | | | | | | | | |
| 1602 | 6 | | 8.10 | 20.5 | 1000.0 | | | 610.0 | | | | | | | | | |
| | | | Ø | Ø | 25 | | | 1.0 | | | | | | | | | Zero Value |
| | | | 7.50 | 14.45 | 175.0 | | | 893.0 | | | | | | | | | Span Resp |
| | | | 7.25 | 14.30 | 201.5 | | | 808.0 | | | | | | | | | System Resp |
| | | | | | | | | | | | | | | | | | Leak ✓ OK |



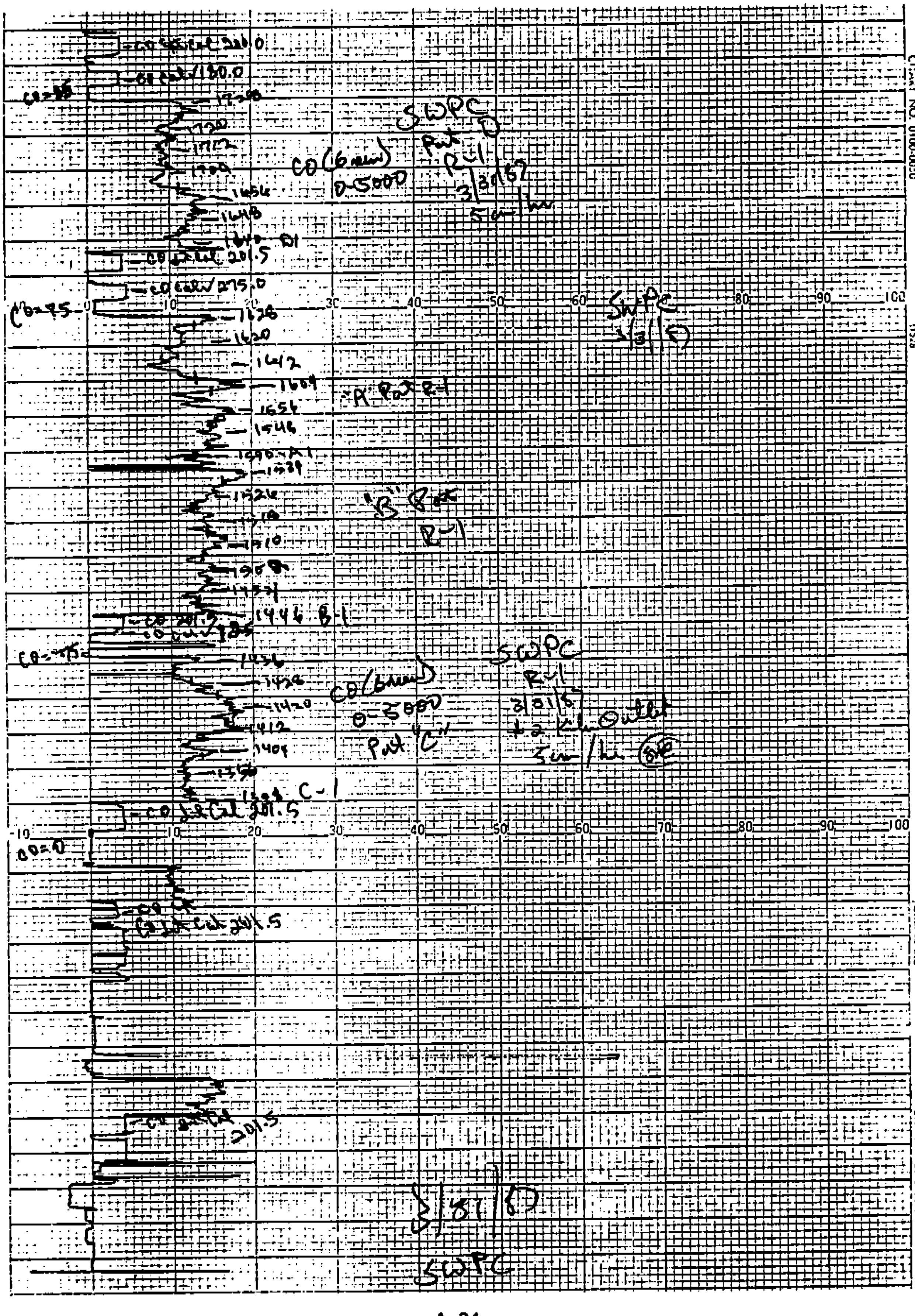


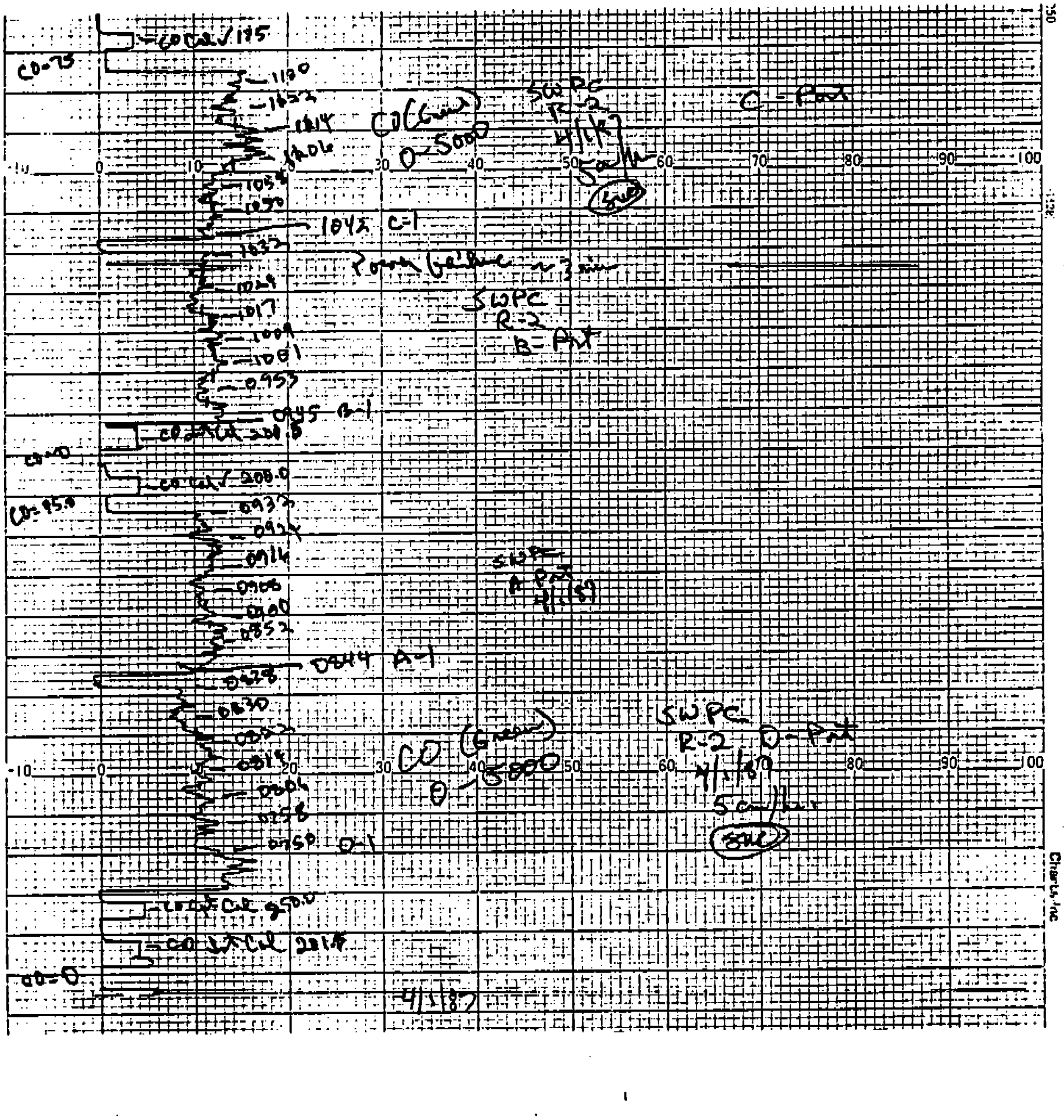
Nox Cal
0-25%
NOx (Red) 0-1000
SWPC
3/31/87
O2 Cal 7.90
"B" Pot R-1
B-1
O2 (Black) 0-25%
C-1
SWPC R-1 3/31/87
CHART NO. 0100-0050

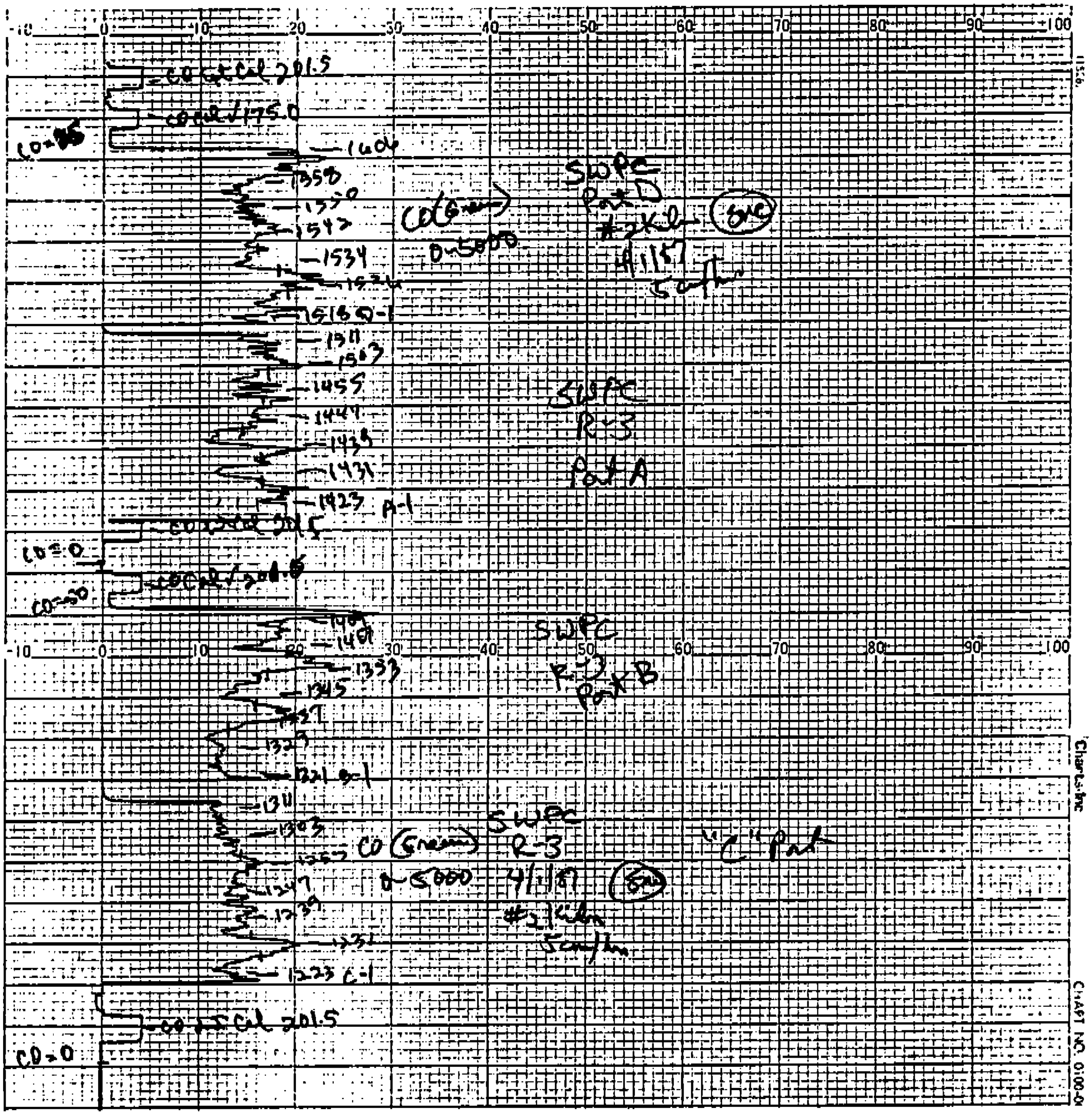
4/1/87

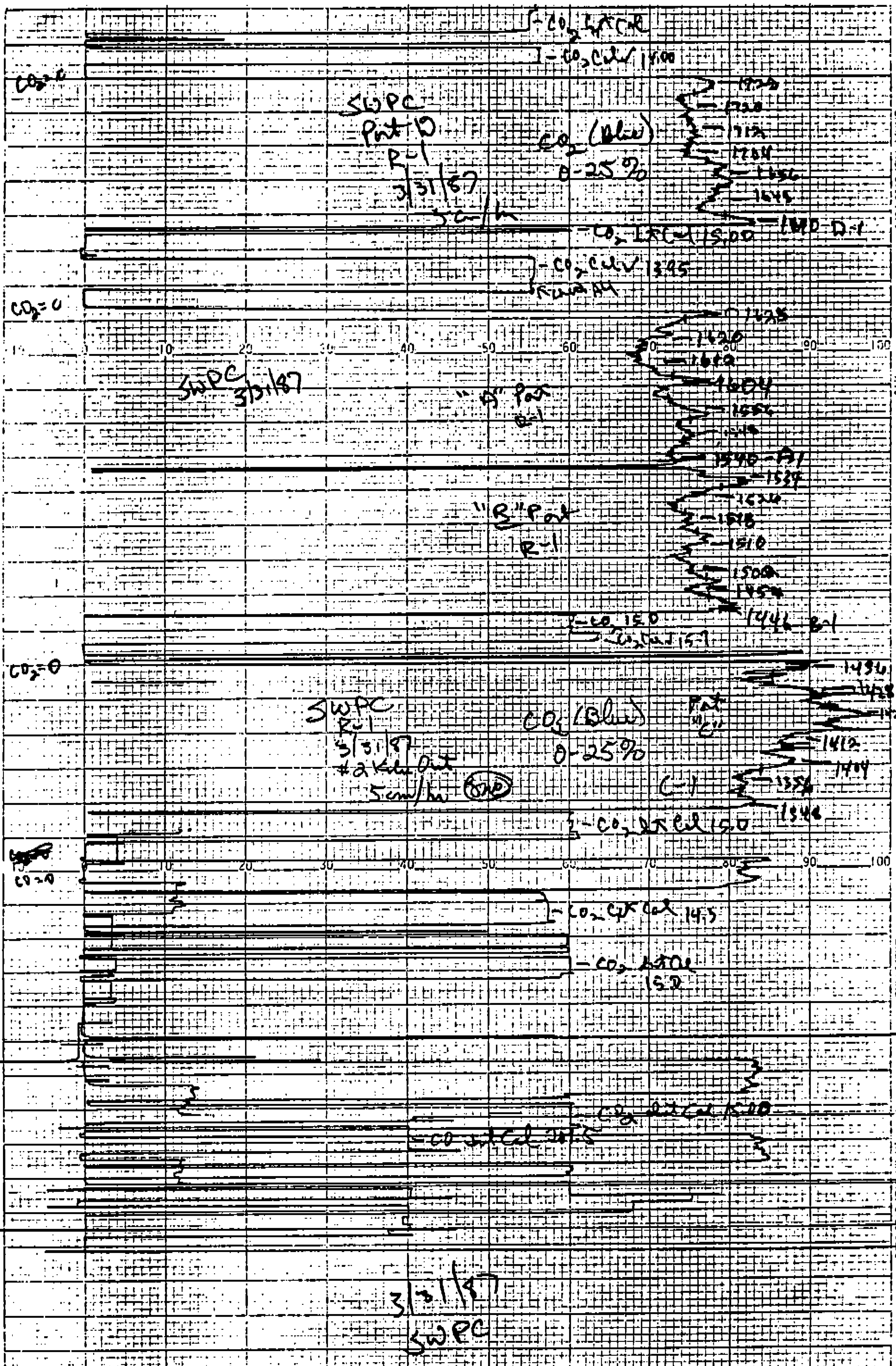


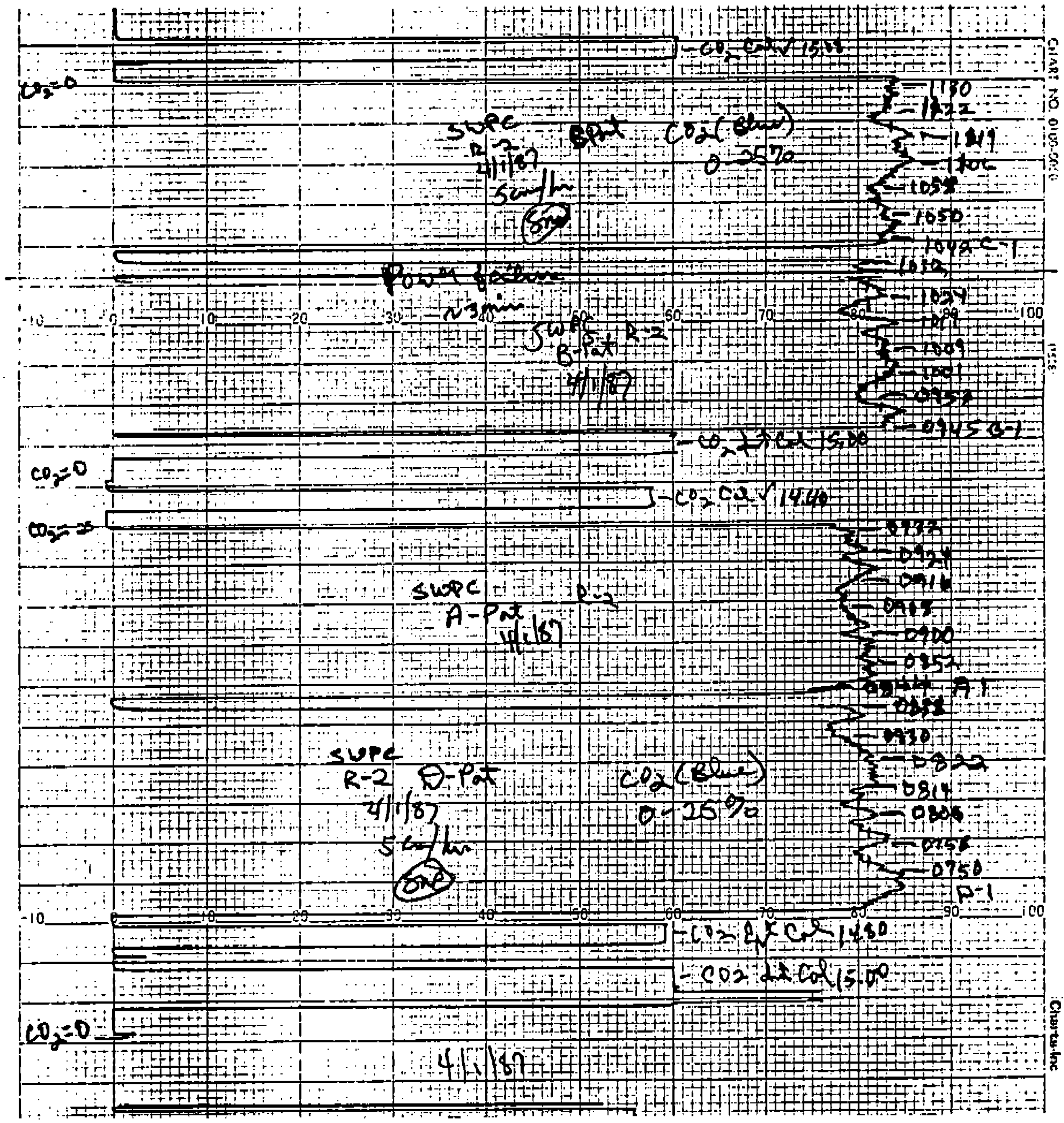
3/31/87

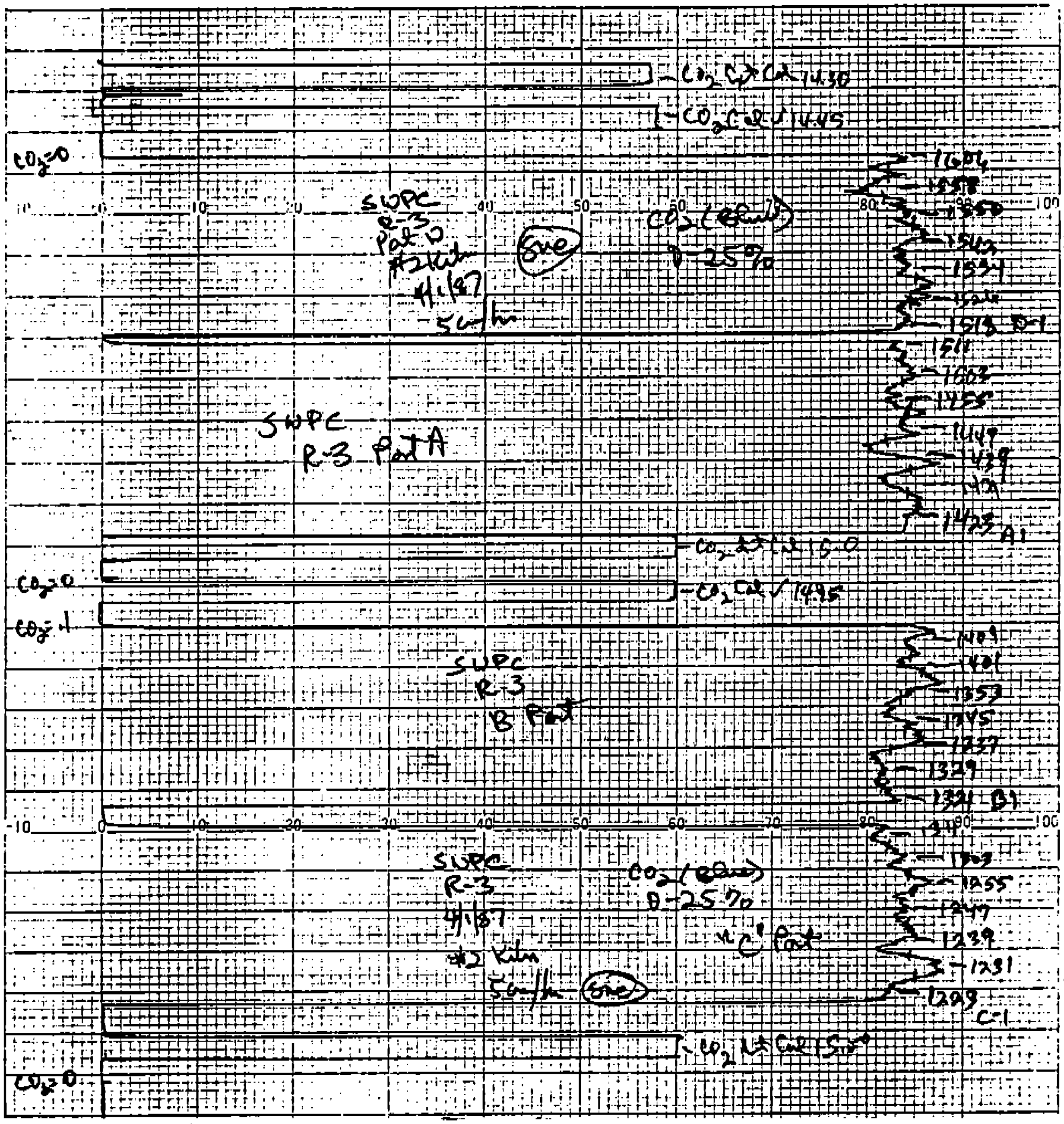

SWPC
Part D
R-1
3/30/87
5cm/hr
CO (6 mm)
0-5000
SWPC
3/31/87
"A" Part R-1
"B" Part
R-1
SWPC
R-1
3/31/87
+2 km Outlet
5cm/hr
CO (6mm)
0-5000
Part "C"
C-1
B-1
CHART NO. 0100-0050
Charts Inc
3/31/87
SWPC


CO(Green)
0-5000
SWPC
R-2
4/1/87
C-Part
C-1
SWPC
R-2
B-Part
B-1
SWPC
A Part
4/1/87
A-1
CO (Green)
0-5000
SWPC
R-2
D-Part
4/1/87
D-1
4/1/87
Charts, Inc


SWPC
Part D
#2 Kiln
4/1/87
SWPC
R-3
Part A
SWPC
R-3
Part B
SWPC
R-3
4/1/87
#2 Kiln
"C" Part
0-5000
CHART NO. 0100-0
Charts Inc


SWPC
Port D
R-1
3/31/87
CO2 (Blue)
0-25%
SWPC 3/31/87
"A" Port
"B" Port
R-1
SWPC
R-1
3/31/87
CO2 (Blue)
0-25%
Port "C"
C-1
3/31/87
SWPC
CHART NO. 0160-0050
Chart Inc.


CO2 = 0
SWPC
R-2
4/1/87
5cm/hr
CO2 (Blue)
0-25%
1130
1050
Power failure
~3min
SWPC
B-Pat R-2
4/1/87
CO2 = 0
CO2 = 25
SWPC
A-Pat
4/1/87
0900
SWPC
R-2 D-Pat
4/1/87
5cm/hr
CO2 (Blue)
0-25%
0806
0750
D-1
CO2 = 0
4/1/87
-10
0
10
20
30
40
50
60
70
80
90
100


SWPC
R-3
Part D
#2 Kiln
4/1/87
5 ton/hr
SWPC
R-3 Part A
SWPC
R-3
B Part
SWPC
R-3
4/1/87
#2 Kiln
5 ton/hr
CO2 (Blue)
0-25%
Charts-Inc

## B. CALIBRATION AND CORRECTION DATA

Company SWPC Date 3/31/87

Station #2 Kiln Baghouse Outlet Test Run 1 A (1 of 3)

| Time 10 minute Intervals | Concentration: Drift Uncorrected (A)/Corrected (B) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | % $O_2$ | | % $CO_2$ | | ppm CO | | ppm $SO_2$ | | ppm $NO_x$ | |
| | A | B | A | B | A | B | A | B | A | B |
| 1:48 C 1 | 8.50 | 8.53 | 20.4 | 20.30 | 610.0 | 616.63 | | | 638.0 | 637.92 |
| 2 | 8.40 | 8.48 | 21.0 | 20.69 | 690.0 | 710.07 | | | 630.0 | 629.75 |
| 3 | 8.40 | 8.54 | 21.9 | 21.35 | 690.0 | 723.49 | | | 605.0 | 604.58 |
| 4 | 8.20 | 8.39 | 23.1 | 22.29 | 880.0 | 927.76 | | | 580.0 | 579.42 |
| 5 | 8.25 | 8.50 | 23.1 | 22.06 | 780.0 | 840.92 | | | 590.0 | 589.25 |
| 2:32 6 | 8.50 | 8.81 | 21.4 | 20.22 | 620.0 | 693.45 | | | 630.0 | 629.08 |
| | | | | | | | | | | |
| | | | | | | | | | | |
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| | | | | | | | | | | |
| MEAN | | 8.54 | | 21.15 | | 752.05 | | | | 611.67 |

| Calibration | % $O_2$ | % $CO_2$ | ppm CO | ppm $SO_2$ | ppm $NO_x$ |
|---|---|---|---|---|---|
| Zero Reading | 0.00 | 0.00 | -75.0 | | 1.0 |
| Span Reading | 7.75 | 15.90 | 125.0 | | 814.1 |
| Span Gas Value | 8.07 | 15.00 | 201.5 | | 813.1 |
| Span Drift Correction Factor | -0.00661 | 0.01000 | -0.00124 | | 0.00000 |
| Zero Drift Correction Factor | 0.00000 | 0.00000 | -12.50000 | | 0.16667 |

## B. CALIBRATION AND CORRECTION DATA

Company SWPC Date 3/31/87

Station #2 Kiln Baghouse Outlet Test Run 1 B (2 of 3)

| Time 10 minute Intervals | Concentration: Drift Uncorrected (A)/Corrected (B) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | % $O_2$ | | % $CO_2$ | | ppm CO | | ppm $SO_2$ | | ppm $NO_x$ | |
| | A | B | A | B | A | B | A | B | A | B |
| 2:50 B 1 | 8.75 | 8.76 | 19.4 | 19.46 | 675.0 | 672.08 | | | 595.0 | 594.13 |
| 2 | 8.75 | 8.79 | 19.4 | 19.57 | 725.0 | 716.29 | | | 620.0 | 617.33 |
| 3 | 8.75 | 8.81 | 18.8 | 19.07 | 700.0 | 685.44 | | | 618.0 | 613.57 |
| 4 | 8.50 | 8.58 | 19.0 | 19.39 | 725.0 | 704.65 | | | 630.0 | 623.73 |
| 5 | 8.80 | 8.91 | 18.6 | 19.09 | 660.0 | 633.64 | | | 645.0 | 636.84 |
| 6 | 8.60 | 8.73 | 19.8 | 20.44 | 825.0 | 793.32 | | | 640.0 | 630.08 |
| 3:44 A 1 | 8.70 | 8.86 | 18.5 | 19.20 | 725.0 | 687.13 | | | 650.0 | 638.19 |
| 2 | 8.50 | 8.68 | 18.8 | 19.62 | 775.0 | 731.51 | | | 650.0 | 636.38 |
| 3 | 8.75 | 8.96 | 18.1 | 19.00 | 750.0 | 700.55 | | | 658.0 | 642.47 |
| 4 | 9.00 | 9.24 | 18.3 | 19.31 | 650.0 | 594.11 | | | 620.0 | 603.20 |
| 5 | 9.30 | 9.57 | 17.1 | 18.15 | 450.0 | 386.88 | | | 690.0 | 670.33 |
| 6 | 9.00 | 9.29 | 18.6 | 19.85 | 650.0 | 582.25 | | | 695.0 | 673.38 |
| MEAN | | 8.93 | | 19.35 | | 657.32 | | | | 631.64 |

| Calibration | % $O_2$ | % $CO_2$ | ppm CO | ppm $SO_2$ | ppm $NO_x$ |
|---|---|---|---|---|---|
| Zero Reading | 0.00 | 0.00 | 75.0 | | 10.0 |
| Span Reading | 7.80 | 13.95 | 275.0 | | 838.0 |
| Span Gas Value | 8.07 | 15.00 | 201.5 | | 813.1 |
| Span Drift Correction Factor | -0.00279 | -0.00583 | -0.00062 | | 0.00153 |
| Zero Drift Correction Factor | 0.00000 | 0.00000 | 6.25000 | | 0.83333 |

## B. CALIBRATION AND CORRECTION DATA

Company SWPC  Date 3/31/87

Station #2 Kiln Baghouse Outlet  Test Run 1C (3 of 3)

| Time 10 minute Intervals | % $O_2$ A | % $O_2$ B | % $CO_2$ A | % $CO_2$ B | ppm CO A | ppm CO B | ppm $SO_2$ A | ppm $SO_2$ B | ppm $NO_x$ A | ppm $NO_x$ B |
|---|---|---|---|---|---|---|---|---|---|---|
| 4:44 01 | 9.00 | | 19.9 | 20.01 | 550.0 | 557.03 | | | 715.0 | 714.49 |
| 2 | 8.75 | | 19.6 | 19.93 | 675.0 | 701.65 | | | 685.0 | 683.55 |
| 3 | 9.00 | | 19.3 | 19.84 | 550.0 | 584.79 | | | 685.0 | 682.58 |
| 4 | 9.20 | | 18.8 | 19.53 | 475.0 | 515.52 | | | 705.0 | 701.51 |
| 5 | 9.20 | | 18.8 | 19.74 | 475.0 | 526.75 | | | 685.0 | 680.64 |
| 5:24 6 | 9.20 | | 18.9 | 20.06 | 575.0 | 654.44 | | | 695.0 | 689.59 |
| | | | | | | | | | | |
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| | | | | | | | | | | |
| | | | | | | | | | | |
| MEAN | 9.06 | | | 19.85 | | 590.03 | | | | 692.06 |

| Calibration | % $O_2$ | % $CO_2$ | ppm CO | ppm $SO_2$ | ppm $NO_x$ |
|---|---|---|---|---|---|
| Zero Reading | 0.00 | 0.00 | 15.0 | | 0.0 |
| Span Reading | 8.07 | 14.00 | 180.0 | | 820.0 |
| Span Gas Value | 8.07 | 15.00 | 201.5 | | 813.1 |
| Span Drift Correction Factor | 0.00000 | -0.01111 | -0.03019 | | 0.00141 |
| Zero Drift Correction Factor | 0.00000 | 0.00000 | 2.50000 | | 0.00000 |

## B. CALIBRATION AND CORRECTION DATA

Company SWPC  Date 4/1/87

Station #2 Kiln Baghouse Out  Test Run 2A (1 of 2)

| Time 10 minute Intervals | Concentration: Drift Uncorrected (A)/Corrected (B) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | % $O_2$ | | % $CO_2$ | | ppm CO | | ppm $SO_2$ | | ppm $NO_x$ | |
| | A | B | A | B | A | B | A | B | A | B |
| 7:54 D 1 | 8.80 | 8.80 | 20.3 | 20.33 | 550.0 | 555.53 | | | 660.0 | 647.71 |
| 2 | 9.00 | 9.01 | 20.3 | 20.39 | 525.0 | 540.09 | | | 640.0 | 633.25 |
| 3 | 9.00 | 9.01 | 20.0 | 20.15 | 525.0 | 549.66 | | | 660.0 | 648.36 |
| 4 | 8.80 | 8.82 | 20.4 | 20.61 | 575.0 | 614.37 | | | 665.0 | 648.55 |
| 5 | 9.00 | 9.02 | 20.0 | 20.27 | 500.0 | 539.06 | | | 675.0 | 653.49 |
| 6 | 9.15 | 9.17 | 19.8 | 20.13 | 425.0 | 458.60 | | | 685.0 | 658.27 |
| 8:48 A 1 | 9.00 | 9.03 | 20.3 | 20.69 | 600.0 | 674.41 | | | 700.0 | 667.65 |
| 2 | 8.80 | 8.83 | 20.0 | 20.45 | 575.0 | 653.44 | | | 725.0 | 686.20 |
| 3 | 8.90 | 8.93 | 19.9 | 20.41 | 550.0 | 630.49 | | | 725.0 | 681.00 |
| 4 | 8.90 | 8.94 | 19.6 | 20.16 | 525.0 | 605.57 | | | 725.0 | 675.80 |
| 5 | 8.90 | 8.94 | 20.0 | 20.63 | 600.0 | 711.89 | | | 710.0 | 656.79 |
| 6 | 8.90 | 8.94 | 20.0 | 20.69 | 525.0 | 617.99 | | | 725.0 | 665.37 |
| MEAN | | 8.95 | | 20.41 | | 595.93 | | | | 660.20 |

| Calibration | % $O_2$ | % $CO_2$ | ppm CO | ppm $SO_2$ | ppm $NO_x$ |
|---|---|---|---|---|---|
| Zero Reading | -0.25 | -0.25 | 75.0 | | -5.0 |
| Span Reading | 8.00 | 14.40 | 200.0 | | 883.0 |
| Span Gas Value | 8.07 | 15.00 | 201.5 | | 813.1 |
| Span Drift Correction Factor | 0.00186 | -0.00194 | -0.03164 | | 0.00768 |
| Zero Drift Correction Factor | -0.02083 | -0.02083 | 6.25000 | | -0.41667 |

## B. CALIBRATION AND CORRECTION DATA

Company SWPC  Date 4/1/87

Station #2 Kiln Baghouse Out  Test Run 2B (2of2)

| Time 10 minute Intervals | Concentration: Drift Uncorrected (A)/Corrected (B) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | % $O_2$ | | % $CO_2$ | | ppm CO | | ppm $SO_2$ | | ppm $NO_x$ | |
| | A | B | A | B | A | B | A | B | A | B |
| 9:49 B1 | 8.65 | 8.66 | 20.6 | 20.60 | 575.0 | 583.88 | | | 660.0 | 659.70 |
| 2 | 8.75 | 8.80 | 20.5 | 20.49 | 600.0 | 627.81 | | | 680.0 | 679.07 |
| 3 | 8.50 | 8.57 | 20.8 | 20.78 | 600.0 | 645.70 | | | 655.0 | 653.51 |
| 4 | 8.65 | 8.75 | 20.5 | 20.47 | 600.0 | 663.06 | | | 645.0 | 642.94 |
| 5 | 9.00 | 9.14 | 20.3 | 20.26 | 550.0 | 620.45 | | | 650.0 | 647.33 |
| 6 | 8.75 | 8.91 | 20.3 | 20.25 | 550.0 | 634.67 | | | 655.0 | 651.17 |
| 10:46 C1 | 8.60 | 8.79 | 20.9 | 20.84 | 575.0 | 680.18 | | | 660.0 | 656.09 |
| 2 | 8.60 | 8.82 | 20.5 | 20.43 | 575.0 | 694.39 | | | 660.0 | 655.48 |
| 3 | 8.50 | 8.74 | 20.9 | 20.82 | 700.0 | 877.68 | | | 650.0 | 644.96 |
| 4 | 8.30 | 8.56 | 21.3 | 21.21 | 775.0 | 1001.00 | | | 635.0 | 629.50 |
| 5 | 8.40 | 8.69 | 20.9 | 20.80 | 725.0 | 950.00 | | | 640.0 | 633.87 |
| 6 | 8.40 | 8.72 | 20.8 | 20.69 | 675.0 | 894.27 | | | 635.0 | 628.34 |
| MEAN | | 8.76 | | 20.64 | | 739.43 | | | | 648.54 |

| Calibration | % $O_2$ | % $CO_2$ | ppm CO | ppm $SO_2$ | ppm $NO_x$ |
|---|---|---|---|---|---|
| Zero Reading | 0.20 | 0.00 | 75.0 | | 0.0 |
| Span Reading | 7.75 | 15.08 | 175.0 | | 822.0 |
| Span Gas Value | 8.07 | 15.00 | 201.5 | | 813.0 |
| Span Drift Correction Factor | -0.00537 | 0.00044 | -0.04198 | | 0.00091 |
| Zero Drift Correction Factor | 0.01667 | 0.00000 | 6.25000 | | 0.00000 |

## B. CALIBRATION AND CORRECTION DATA

Company SWPC Date 4/1/87

Station #2 Kiln Baghouse Out Test Run 3A (1 of 2)

| Time 10 minute Intervals | Concentration: Drift Uncorrected (A)/Corrected (B) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | % $O_2$ | | % $CO_2$ | | ppm CO | | ppm $SO_2$ | | ppm $NO_x$ | |
| | A | B | A | B | A | B | A | B | A | B |
| 12:27 C1 | 8.50 | 8.53 | 21.3 | 21.30 | 825.0 | 831.42 | | | 665.0 | 664.25 |
| 2 | 8.40 | 8.47 | 21.1 | 21.10 | 775.0 | 792.59 | | | 645.0 | 642.80 |
| 3 | 8.25 | 8.37 | 21.0 | 21.01 | 725.0 | 751.52 | | | 670.0 | 666.20 |
| 4 | 8.25 | 8.42 | 21.3 | 21.31 | 750.0 | 788.64 | | | 680.0 | 674.61 |
| 5 | 8.25 | 8.47 | 21.3 | 21.31 | 725.0 | 771.97 | | | 690.0 | 682.98 |
| 6 | 8.30 | 8.57 | 20.5 | 20.51 | 600.0 | 642.72 | | | 705.0 | 696.24 |
| 1:25 B1 | 8.30 | 8.62 | 20.5 | 20.52 | 600.0 | 649.92 | | | 690.0 | 679.86 |
| 2 | 8.30 | 8.67 | 20.6 | 20.62 | 650.0 | 714.71 | | | 705.0 | 693.06 |
| 3 | 8.00 | 8.40 | 21.0 | 21.02 | 800.0 | 898.97 | | | 655.0 | 642.38 |
| 4 | 8.20 | 8.66 | 20.9 | 20.92 | 850.0 | 969.62 | | | 690.0 | 675.18 |
| 5 | 7.80 | 8.28 | 21.4 | 21.42 | 950.0 | 1103.02 | | | 645.0 | 629.64 |
| 6 | 7.80 | 8.33 | 21.1 | 21.13 | 925.0 | 1085.65 | | | 645.0 | 628.18 |
| MEAN | | 8.48 | | 21.01 | | 833.40 | | | | 664.62 |

| Calibration | % $O_2$ | % $CO_2$ | ppm CO | ppm $SO_2$ | ppm $NO_x$ |
|---|---|---|---|---|---|
| Zero Reading | 0.00 | -0.10 | 50.0 | | 1.0 |
| Span Reading | 7.50 | 14.95 | 201.5 | | 835.0 |
| Span Gas Value | 8.07 | 15.00 | 201.5 | | 813.1 |
| Span Drift Correction Factor | -0.00589 | 0.00028 | -0.02068 | | 0.00214 |
| Zero Drift Correction Factor | 0.00000 | -0.00833 | 4.16667 | | 0.08333 |

## B. CALIBRATION AND CORRECTION DATA

Company SWPC  Date 4/1/87

Station #2 Kiln Baghouse Out  Test Run 38 (2 of 2)

| Time 10 minute Intervals | Concentration: Drift Uncorrected (A)/Corrected (B) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | % $O_2$ | | % $CO_2$ | | ppm CO | | ppm $SO_2$ | | ppm $NO_x$ | |
| | A | B | A | B | A | B | A | B | A | B |
| 2:27 A1 | 8.30 | 8.32 | 21.0 | 21.03 | 825.0 | 832.73 | | | 610.0 | 609.68 |
| 2 | 8.30 | 8.37 | 21.1 | 21.20 | 825.0 | 848.13 | | | 635.0 | 634.01 |
| 3 | 8.50 | 8.63 | 20.5 | 20.66 | 725.0 | 758.12 | | | 625.0 | 623.37 |
| 4 | 8.25 | 8.42 | 21.0 | 21.22 | 825.0 | 878.66 | | | 620.0 | 617.73 |
| 5 | 8.40 | 8.62 | 20.9 | 21.19 | 850.0 | 921.19 | | | 610.0 | 607.12 |
| 6 | 8.25 | 8.52 | 20.9 | 21.25 | 850.0 | 936.77 | | | 620.0 | 616.43 |
| 3:22 D1 | 8.20 | 8.51 | 21.1 | 21.52 | 950.0 | 1066.10 | | | 635.0 | 630.70 |
| 2 | 8.00 | 8.35 | 21.3 | 21.79 | 900.0 | 1025.64 | | | 645.0 | 639.97 |
| 3 | 8.20 | 8.61 | 20.9 | 21.44 | 800.0 | 923.92 | | | 670.0 | 664.10 |
| 4 | 8.00 | 8.45 | 21.1 | 21.71 | 775.0 | 908.01 | | | 665.0 | 658.45 |
| 5 | 8.10 | 8.60 | 20.4 | 21.05 | 700.0 | 829.78 | | | 665.0 | 657.76 |
| 6 | 8.10 | 8.65 | 20.5 | 21.22 | 1000.0 | 1215.11 | | | 610.0 | 602.65 |
| MEAN | | 8.50 | | 21.27 | | 928.68 | | | | 630.16 |

| Calibration | % $O_2$ | % $CO_2$ | ppm CO | ppm $SO_2$ | ppm $NO_x$ |
|---|---|---|---|---|---|
| Zero Reading | 0.00 | 0.00 | 25.0 | | 1.0 |
| Span Reading | 7.50 | 14.45 | 175.0 | | 823.0 |
| Span Gas Value | 8.07 | 15.00 | 201.5 | | 813.1 |
| Span Drift Correction Factor | -0.00589 | -0.00306 | -0.02130 | | 0.00091 |
| Zero Drift Correction Factor | 0.00000 | 0.00000 | 2.08333 | | 0.08333 |

C. ZERO AND SPAN DRIFT PERCENT CALCULATIONS

| Station Kiln Out#2 Run 1A | $O_2$ (%) | $CO_2$ (%) | CO (ppm) | $SO_2$ (ppm) | $NO_x$ (ppm) |
|---|---|---|---|---|---|
| Initial Span | 8.07 | 15.00 | 201.5 | | 813.1 |
| Measured Span | 7.75 | 15.90 | 125.0 | | 814.1 |
| Zero Drift | 0.00 | 0.00 | -75.0 | | 1.0 |
| Final, Actual Span | 7.75 | 15.90 | 200.0 | | 813.1 |
| Percent Drift | -4.0 | 6.0 | -0.7 | | 0.0 |
| **Station Kiln Out#2 Run 1B** | **$O_2$ (%)** | **$CO_2$ (%)** | **CO (ppm)** | **$SO_2$ (ppm)** | **$NO_x$ (ppm)** |
| Initial Span | 8.07 | 15.00 | 201.5 | | 813.1 |
| Measured Span | 7.80 | 13.95 | 275.0 | | 838.0 |
| Zero Drift | 0.00 | 0.00 | 75.0 | | 10.0 |
| Final, Actual Span | 7.80 | 13.95 | 200.0 | | 828.0 |
| Percent Drift | -3.3 | -7.0 | -0.7 | | 3.1 |
| **Station Kiln Out#2 Run 1C** | **$O_2$ (%)** | **$CO_2$ (%)** | **CO (ppm)** | **$SO_2$ (ppm)** | **$NO_x$ (ppm)** |
| Initial Span | 8.07 | 15.00 | 201.5 | | 813.1 |
| Measured Span | 8.07 | 14.00 | 180.0 | | 820.0 |
| Zero Drift | 0.00 | 0.00 | 15.0 | | 6.0 |
| Final, Actual Span | 8.07 | 14.00 | 165.0 | | 820.0 |
| Percent Drift | 0.0 | -6.7 | -18.1 | | 0.8 |

C. ZERO AND SPAN DRIFT PERCENT CALCULATIONS

| Station #2 Kiln Out<br>Run 2 A | $O_2$ (%) | $CO_2$ (%) | CO (ppm) | $SO_2$ (ppm) | $NO_x$ (ppm) |
|---|---|---|---|---|---|
| Initial Span | 8.07 | 15.00 | 201.5 | | 813.1 |
| Measured Span | 8.00 | 14.40 | 200.0 | | 883.0 |
| Zero Drift | -0.25 | -0.25 | 75.0 | | -5.0 |
| Final, Actual Span | 8.25 | 14.65 | 125.0 | | 888.0 |
| Percent Drift | 2.2 | -2.3 | -37.9 | | 9.2 |
| Station #2 Kiln Out<br>Run 2B | $O_2$ (%) | $CO_2$ (%) | CO (ppm) | $SO_2$ (ppm) | $NO_x$ (ppm) |
| Initial Span | 8.07 | 15.00 | 201.5 | | 813.1 |
| Measured Span | 7.75 | 15.08 | 175.0 | | 822.0 |
| Zero Drift | 0.20 | 0.00 | 75.0 | | 0.0 |
| Final, Actual Span | 7.55 | 15.08 | 100.0 | | 822.0 |
| Percent Drift | -6.4 | 0.5 | -50.4 | | 1.1 |
| Station #2 Kiln Out<br>Run 3A | $O_2$ (%) | $CO_2$ (%) | CO (ppm) | $SO_2$ (ppm) | $NO_x$ (ppm) |
| Initial Span | 8.07 | 15.00 | 201.5 | | 813.1 |
| Measured Span | 7.50 | 14.95 | 201.5 | | 835.0 |
| Zero Drift | 0.00 | -0.10 | 50.0 | | 1.0 |
| Final, Actual Span | 7.50 | 15.05 | 151.5 | | 834.0 |
| Percent Drift | -7.1 | 0.3 | -24.8 | | 2.6 |

C. ZERO AND SPAN DRIFT PERCENT CALCULATIONS

| Station #2 Kiln Out<br>Run 3B | $O_2$ (%) | $CO_2$ (%) | CO (ppm) | $SO_2$ (ppm) | $NO_x$ (ppm) |
|---|---|---|---|---|---|
| Initial Span | 8.07 | 15.00 | 201.5 | | 813.1 |
| Measured Span | 7.50 | 14.45 | 175.0 | | 823.0 |
| Zero Drift | 0.00 | 0.00 | 25.0 | | 1.0 |
| Final, Actual Span | 7.50 | 14.45 | 150.0 | | 822.0 |
| Percent Drift | -7.1 | -3.7 | -25.6 | | 1.1 |

| Station<br>Run | $O_2$ (%) | $CO_2$ (%) | CO (ppm) | $SO_2$ (ppm) | $NO_x$ (ppm) |
|---|---|---|---|---|---|
| Initial Span | | | | | |
| Measured Span | | | | | |
| Zero Drift | | | | | |
| Final, Actual Span | | | | | |
| Percent Drift | | | | | |

| Station<br>Run | $O_2$ (%) | $CO_2$ (%) | CO (ppm) | $SO_2$ (ppm) | $NO_x$ (ppm) |
|---|---|---|---|---|---|
| Initial Span | | | | | |
| Measured Span | | | | | |
| Zero Drift | | | | | |
| Final, Actual Span | | | | | |
| Percent Drift | | | | | |

Pape & Steiner Environmental Services

SAMPLE HANDLING/LOG-IN

Date 3/31 - 4/1/87 Test Location SWPC - #2 Kiln

| | Sample Type | Volume | Comments |
|---|---|---|---|
| 1. | 10264 Blank $NH_3$ (Meth Sample Test) | 156 ~~200~~ | 1/2 to SWPC 1/2 to WHL |
| 2. | 10265 Blank HCl (Meth Sample Test) | 196 | " " " " " " |
| 3. | 10266 Blank Ace (Meth Sample Test) | 100 | |
| 4. | 10267 Blank MF (Meth Sample Test) | - | |
| 5. | 10268 Blank IPA (Meth Sample Test) | 100 | |
| 6. | 10269 Blank AmF (Meth Sample Test) | - | |
| 7. | 10270 Blank $SO_2$ (Meth Sample Test) | 100 | |
| 8. | 10271 Blank DI (Meth Sample Test) | 100 | |
| 9. | 10272 $NH_3$ FHW 1 (Meth Sample Test) | 45 | |
| 10. | 10273 $NH_3$ BHW 1 (Meth Sample Test) | 570 | " " " " " " |
| 11. | 10274 HCl FHW 1 (Meth Sample Test) | 84 | |
| 12. | 10275 HCl MF 1 (Meth Sample Test) | - | |

CHAIN OF CUSTODY

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Pape & Steiner Environmental Services

# SAMPLE HANDLING/LOG-IN

Date 3/31 - 4/1/87 Test Location SWPC - #2 Kiln

| | Sample Type | | | | Volume | Comments |
|---|---|---|---|---|---|---|
| | | Meth | Sample | Test | | |
| 1. | 10276 | HCL | BHW | 1 | 485 | 1/2 SWPC 1/2 WAL |
| 2. | 10277 | 5/8 | FHW | 1 | 94 | |
| 3. | 10278 | 5/8 | MF | 1 | - | |
| 4. | 10279 | 5/8 | BHW | 1 | 200 | |
| 5. | 10280 | 5/8 | AMF | 1 | - | |
| 6. | 10281 | 5/8 | $SO_3$ | 1 | 341 | |
| 7. | 10168 | $NH_3$ | AHC ~~Cond~~ | 2 | - | given to South~~west~~ for analysis |
| 8. | 10282 | $NH_3$ | FHW | 2 | 42 | Wally ? |
| 9. | 10283 | $NH_3$ | BHW | 2 | 582 | 1/2 SWPC 1/2 WAL |
| 10. | 10284 | $NH_3$ | MF | 1 | - | |
| 11. | 10285 | $NH_3$ | MF | 2 | - | |
| 12. | 10286 | HCL | FHW | 2 | 114 | |

CHAIN OF CUSTODY

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Pape & Steiner Environmental Services

SAMPLE HANDLING/LOG-IN

Date 3/31 - 4/1/87 Test Location SWPC - #2 Kiln

| | Sample Type | Volume | Comments |
|---|---|---|---|
| 1. | 10287 HCL (Meth) MF (Sample) 2 (Test) | - | |
| 2. | 10288 HCl (Meth) BHW (Sample) 2 (Test) | 532 | 1/2 SWPC 1/2 WAL |
| 3. | 10289 5/8 (Meth) FHW (Sample) 2 (Test) | 120 | |
| 4. | 10290 5/8 (Meth) MF (Sample) 2 (Test) | - | |
| 5. | 10291 5/8 (Meth) BHW (Sample) 2 (Test) | 180 | |
| 6. | 10292 5/8 (Meth) AMF (Sample) 2 (Test) | - | |
| 7. | 10293 5/8 (Meth) SO2 (Sample) 2 (Test) | 378 | |
| 8. | 10294 NO3 (Meth) Blank MF (Sample) (Test) | - | |
| 9. | 10295 HCL (Meth) FHW (Sample) 3 (Test) | 120 | |
| 10. | 10296 HCL (Meth) MF (Sample) 3 (Test) | - | |
| 11. | 10297 HCL (Meth) BHW (Sample) 3 (Test) | 540 | " " " " |
| 12. | 10298 NO3 (Meth) FHW (Sample) 3 (Test) | 55 | |

CHAIN OF CUSTODY

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Pape & Steiner Environmental Services

SAMPLE HANDLING/LOG-IN

Date 3/31- 4/1/87 Test Location SWPC

| | Sample Type | Volume | Comments |
|---|---|---|---|
| 1. | 10308 $NH_3$ (Meth) MF (Sample) 3 (Test) | - | |
| 2. | 10309 $NH_3$ (Meth) BHW (Sample) 3 (Test) | 600 | 1/2 SWPC 1/2 SWPC |
| 3. | 10310 5/8 (Meth) FHW (Sample) 3 (Test) | 170 | |
| 4. | 10311 5/8 (Meth) MF (Sample) 3 (Test) | - | |
| 5. | 10312 5/8 (Meth) BHW (Sample) 3 (Test) | 200 | |
| 6. | 10313 5/8 (Meth) AMF (Sample) 3 (Test) | - | |
| 7. | 10314 5/8 (Meth) $SO_2$ (Sample) 3 (Test) | 364 | |
| 8. | | | |
| 9. | | | |
| 10. | | | |
| 11. | | | |
| 12. | | | |

CHAIN OF CUSTODY

one

Page 4 of 4

Pape & Steiner Environmental Services

# ANALYTICAL REPORT

SAMPLE TYPE Front Half Wash

SAMPLE COMPONENT Acetone

REQUESTED BY SWPC Kiln #2

ANALYTICAL METHOD Gravimetric

DATE 4/8/87

ANALYST JP

| Sample ID No. | Test No. # | Sample Volume mls | Sample Aliquot | Titer mls or (Absorbance) | Analytical Result (total sample) gms | |
|---|---|---|---|---|---|---|
| | | | | | Uncorrected | Blank corrected |
| | 1 | 94 | | | 0.00809 | 0.00731 |
| | 2 | 120 | | | 0.00718 | 0.00618 |
| | 3 | 170 | | | 0.00933 | 0.00792 |
| | Bl | 100 | | | 0.00083 | |

JPM

Pape & Steiner Environmental Services

# ANALYTICAL REPORT

SAMPLE TYPE Filterable Particulates

DATE 4/8/82

SAMPLE COMPONENT 100mm Filter

ANALYST JP

REQUESTED BY SWPC - Kiln #2

ANALYTICAL METHOD

| Sample ID No. Filter # | Test No. # | Sample Volume | Sample Aliquot | Titer mls or (Absorbance) | Analytical Result (total sample) gms Uncorrected | Analytical Result (total sample) gms Blank corrected |
|---|---|---|---|---|---|---|
| 10-884 | 1 | | | | 0.00355 | 0.00356 |
| 10-885 | 2 | | | | 0.00258 | 0.00259 |
| 10-882 | 3 | | | | 0.00334 | 0.00335 |
| 10-892 | Bl | | | | -0.00001 | |

JP

Pape & Steiner Environmental Services

# ANALYTICAL REPORT

SAMPLE TYPE Condensible Particulates

DATE 4/8/87

SAMPLE COMPONENT 80% IPA + Amf

ANALYST JP

REQUESTED BY SWPC - Kiln #2

ANALYTICAL METHOD Gravimetric

| Sample ID No. | Test No. # | Sample Volume mls | Sample Aliquot mls | Titer mls or (Absorbance) | Analytical Result (total sample) gms | |
|---|---|---|---|---|---|---|
| | | | | | Uncorrected | Blank corrected |
| | 1 | 200 | 100 | | 0.01711 | 0.02330 |
| | 2 | 180 | 100 | | 0.03304 | 0.04964 |
| | 3 | 200 | 100 | | 0.01895 | 0.02698 |
| | Amf | 100 | 50 | | 0.00291 | 0.00036 |
| | IPA | 100 | 100 | | 0.00546 417 | |

JP

#1 - 2(.01711 - .8(.00546) - .2(.00291)) = .01966

1274
- 116
1158 x 2 = 2316

Pape & Steiner Environmental Services

# ANALYTICAL REPORT

SAMPLE TYPE $SO_2$

DATE 4/8/87

SAMPLE COMPONENT $H_2O_2$

ANALYST JP

REQUESTED BY SWPC - Kiln #2

ANALYTICAL METHOD $BaCl_2$ Titration

| Sample ID No. | Test No. # | Sample Volume mls | Sample Aliquot mls | Titer mls or (Absorbance) | Analytical Result mg $H_2SO_4$ (total sample) | |
|---|---|---|---|---|---|---|
| | | | | | Uncorrected | Blank corrected |
| | 1 | 341 | 10 | 2.02 | | 32.66 |
| | 2 | 378 | 10 | 1.61 | | 28.70 |
| | 3 | 364 | 10 | 2.00 | | 34.51 |
| | Bl | 100 | 10 | 0.04 | | 0.19 |
| Standardization 0.01N $H_2SO_4$ / $BaCl_2$ | | | 5.0 | 5.05 | $\frac{5.0(0.01)}{5.065}$ | = 0.00987 N |
| | | | 5.0 | 5.08 | | |

Dup = 99.59%

% recovery 100.2%

JP

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE Front Half Wash ($NH_3$)

DATE 4/8/87

SAMPLE COMPONENT DI $H_2O$ + HCl

ANALYST JP

REQUESTED BY SWPC - Kiln #2

ANALYTICAL METHOD Gravimetric

| Sample ID No. | Test No. # | Sample Volume mls | Sample Aliquot | Titer mls or (Absorbance) | Analytical Result (total sample) gms | |
|---|---|---|---|---|---|---|
| | | | | | Uncorrected | Blank corrected |
| | 1 | 45 | | | 0.00967 | 0.00708 |
| | 2 | 42 | | | 0.00556 | 0.00332 |
| | 3 | 55 | | | 0.00498 | 0.00183 |
| | Bl | 100 | | | 0.00376 | |

JP

Pape & Steiner Environmental Services

# ANALYTICAL REPORT

SAMPLE TYPE Filterable Particulate

DATE 4/8/87

SAMPLE COMPONENT Thimble

ANALYST JP

REQUESTED BY SWPC - Kiln #2

ANALYTICAL METHOD Gravimetric

| Sample ID No. Filter # | Test No. # | Sample Volume | Sample Aliquot | Titer mls or (Absorbance) | Analytical Result (total sample) gms | |
|---|---|---|---|---|---|---|
| | | | | | Uncorrected | Blank corrected |
| I | 1 | | | | 0.05690 | 0.05691 |
| II | 2 | | | | 0.05266 | 0.05267 |
| III | 3 | | | | 0.05790 | 0.05791 |
| IV | Bl | | | | $\bar{0}$.00001 | |

JP

Pape & Steiner Environmental Services

# ANALYTICAL REPORT

SAMPLE TYPE Front Half Wash (HCl) DATE 4/8/87

SAMPLE COMPONENT DI Water ANALYST JP

REQUESTED BY SWPC- Kiln #2

ANALYTICAL METHOD Gravimetric

| Sample ID No. | Test No. | Sample Volume | Sample Aliquot | Titer mls or (Absorbance) | Analytical Result (total sample) gms | |
|---|---|---|---|---|---|---|
| | | | | | Uncorrected | Blank corrected |
| | 1 | 84 | | | 0.00838 | 0.00428 |
| | 2 | 114 | | | 0.00759 | 0.00203 |
| | 3 | 120 | | | 0.01147 | 0.00561 |
| | Bl | 100 | | | 0.00488 | |

JP

Pape & Steiner Environmental Services

ANALYTICAL REPORT

SAMPLE TYPE Filterable Particulate (HCl) DATE 4/8/83

SAMPLE COMPONENT 100 mbs Filter ANALYST JP

REQUESTED BY SWPC - Kiln #2

ANALYTICAL METHOD Gravimetric

| Sample ID No. Filter # | Test No. # | Sample Volume | Sample Aliquot | Titer mls or (Absorbance) | Analytical Result (total sample) gms | |
|---|---|---|---|---|---|---|
| | | | | | Uncorrected | Blank corrected |
| 10-876 | 1 | | | | 0.00454 | 0.00455 |
| 10-890 | 2 | | | | 0.00177 | 0.00178 |
| 10-891 | 3 | | | | 0.00267 | 0.00268 |
| 10-892 | Bl | | | | 0.00001 | |

JP

Pape & Steiner Environmental Services

# ISOKINETIC CALCULATIONS

Standard temperature, $S_t$ 60 (XEQ 60 or 68); 29.92 inches Hg

Test 1- M5/8 Date 3/31/87 Location #2 Kiln Baghouse Outlet

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $T_m$ | 94.04 | $V_m$ | 159.670 | $O_2$ | 8.87 | Stack ID " | 160 |
| $T_s$ | 403.67 | $\gamma$ | 0.9983 | $CO_2$ | 19.93 | Stack Area $Ft^2$ | 139.63 |
| $\sqrt{\Delta P}$ | 0.5445 | $P_b$ | 26.72 | Static | -0.38 | Test Time | 192 |
| $\Delta H$ | 1.55 | $V_{1c}$ | 107.8 | $C_p$ | 0.84 | $N_d$ | 0.3217 |

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 134.1740$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 4.9973$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0359$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.54$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 31.06$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.69$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 39.91$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
334358.39

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 173143.25$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.92$$

Pape & Steiner Environmental Services

# ISOKINETIC CALCULATIONS

Standard temperature, $S_t$ 60 (XEQ 60 or 68); 29.92 inches Hg

Test 1 - $NH_3$ Date 3/31/87 Location #2 Kiln Baghouse Out

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $T_m$ | 84.33 | $V_m$ | 145.616 | $O_2$ | 8.87 | Stack ID " | 160 |
| $T_s$ | 411.08 | $\gamma$ | 1.0018 | $CO_2$ | 19.93 | Stack Area $Ft^2$. | 139.63 |
| $\sqrt{\Delta P}$ | 0.5613 | $P_b$ | 26.72 | Static | -0.38 | Test Time | 192 |
| $\Delta H$ | 1.84 | $V_{1c}$ | 145.2 | $C_p$ | 0.84 | $N_d$ | 0.3086 |

1. Volume of dry gas sampled at standard conditions (dscf)
   (R-17)
   $$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 125.0829$$

2. Stack gas moisture condensed at standard conditions (scf)
   (R-18)
   ($V_{m,std}$ + $V_{w,std}$; R-04)
   $$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 6.7310$$

3. Stack gas proportion of water vapor, by volume
   (R-19)
   $$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0511$$

4. Stack gas dry molecular weight (lb/lb mole)
   (R-21)
   $$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.54$$

5. Stack gas molecular weight (lb/lb mole)
   (R-22)
   $$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.85$$

6. Pressure stack, in. Hg
   (R-23)
   $$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.69$$

7. Stack gas velocity, at stack conditions (ft/sec)
   (R-24)
   $$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 41.46$$

8. Stack gas volume at standard conditions (dscfm)
   (R-26)
   (ACFM; R-25)
   347 299.81
   $$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 175511.51$$

9. Test percent isokinetic
   (R-02)
   $$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.86$$

Pape & Steiner Environmental Services

# ISOKINETIC CALCULATIONS

Standard temperature, $S_t$ 60 (XEQ 60 or 68); 29.92 inches Hg

Test 1- HCL Date 3/31/87 Location #2 Kiln Baghouse

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $T_m$ | 99.46 | $V_m$ | 153.985 | $O_2$ | 8.87 | Stack ID " | 160 |
| $T_s$ | 398.67 | $\gamma$ | 1.0008 | $CO_2$ | 19.93 | Stack Area $Ft^2$ | 139.63 |
| $\sqrt{\Delta P}$ | 0.5319 | $P_b$ | 26.72 | Static | -0.38 | Test Time | 192 |
| $\Delta H$ | 2.23 | $V_{1c}$ | 149.4 | $C_p$ | 0.84 | $N_d$ | 0.3217 |

1. Volume of dry gas sampled at standard conditions (dscf)
   (R-17)
   $$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 128.7035$$

2. Stack gas moisture condensed at standard conditions (scf)
   (R-18)
   ($V_{m,std}$ + $V_{w,std}$; R-04)
   $$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 6.9257$$

3. Stack gas proportion of water vapor, by volume
   (R-19)
   $$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0511$$

4. Stack gas dry molecular weight (lb/lb mole)
   (R-21)
   $$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.54$$

5. Stack gas molecular weight (lb/lb mole)
   (R-22)
   $$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.85$$

6. Pressure stack, in. Hg
   (R-23)
   $$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.69$$

7. Stack gas velocity, at stack conditions (ft/sec)
   (R-24)
   $$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 39.00$$

8. Stack gas volume at standard conditions (dscfm)
   (R-26)
   (ACFM; R-25)
   326 755.97
   $$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 167516.18$$

9. Test percent isokinetic
   (R-02)
   $$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.06$$

Pape & Steiner Environmental Services

# ISOKINETIC CALCULATIONS

Standard temperature, $S_t$ 60 (XEQ 60 or 68); 29.92 inches Hg

Test 2 - H5/8 Date 4/1/87 Location #2 Kiln Baghouse Out

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $T_m$ | 98.40 | $V_m$ | 160.867 | $O_2$ | 8.86 | Stack ID " | 160 |
| $T_s$ | 407.92 | $\gamma$ | 0.9983 | $CO_2$ | 20.53 | Stack Area Ft$^2$ | 139.63 |
| $\sqrt{\Delta P}$ | 0.5482 | $P_b$ | 26.51 | Static | -0.39 | Test Time | 192 |
| $\Delta H$ | 1.58 | $V_{1c}$ | 115.5 | $C_p$ | 0.84 | $N_d$ | 0.3217 |

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)
$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 133.0858$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std}$ + $V_{w,std}$; R-04)
$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 5.3542$$

3. Stack gas proportion of water vapor, by volume
(R-19)
$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0387$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)
$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.64$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)
$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 31.11$$

6. Pressure stack, in. Hg
(R-23)
$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.48$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)
$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 40.41$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
338501.33
$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 172556.28$$

9. Test percent isokinetic
(R-02)
$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.45$$

Pape & Steiner Environmental Services

# ISOKINETIC CALCULATIONS

Standard temperature, $S_t$ 60 (XEQ 60 or 68); 29.92 inches Hg

Test 2-$NH_3$ Date 4/1/87 Location #2 Kiln Baghouse Out

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $T_m$ | 98.58 | $V_m$ | 142.602 | $O_2$ | 8.86 | Stack ID " | 160 |
| $T_s$ | 412.79 | $\gamma$ | 1.0018 | $CO_2$ | 20.53 | Stack Area $Ft^2$ | 139.63 |
| $\sqrt{\Delta P}$ | 0.5398 | $P_b$ | 26.51 | Static | -0.39 | Test Time | 192 |
| $\Delta H$ | 1.76 | $V_{1c}$ | 140.7 | $C_p$ | 0.84 | $N_d$ | 0.3086 |

1. Volume of dry gas sampled at standard conditions (dscf)
   (R-17)
   $$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 118.4094$$

2. Stack gas moisture condensed at standard conditions (scf)
   (R-18)
   ($V_{m,std}$ + $V_{w,std}$; R-04)
   $$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 6.5224$$

3. Stack gas proportion of water vapor, by volume
   (R-19)
   $$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0522$$

4. Stack gas dry molecular weight (lb/lb mole)
   (R-21)
   $$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.64$$

5. Stack gas molecular weight (lb/lb mole)
   (R-22)
   $$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.93$$

6. Pressure stack, in. Hg
   (R-23)
   $$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.48$$

7. Stack gas velocity, at stack conditions (ft/sec)
   (R-24)
   $$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 40.02$$

8. Stack gas volume at standard conditions (dscfm)
   (R-26)
   (ACFM; R-25)
   335 244.24
   $$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 167550.12$$

9. Test percent isokinetic
   (R-02)
   $$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.02$$

Pape & Steiner Environmental Services

# ISOKINETIC CALCULATIONS

Standard temperature, $S_t$ 60 (XEQ 60 or 68); 29.92 inches Hg

Test 2-HCL Date 4/1/87 Location #2 Kiln Baghouse Out

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $T_m$ | 80.94 | $V_m$ | 147.700 | $O_2$ | 8.86 | Stack ID " | 160 |
| $T_s$ | 403.33 | $\gamma$ | 1.0008 | $CO_2$ | 20.53 | Stack Area $Ft^2$ | 139.63 |
| $\sqrt{\Delta P}$ | 0.5402 | $P_b$ | 26.51 | Static | -0.39 | Test Time | 192 |
| $\Delta H$ | 2.23 | $V_{1c}$ | 149.3 | $C_p$ | 0.84 | $N_d$ | 0.3217 |

1. Volume of dry gas sampled at standard conditions (dscf)
   (R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 126.6796$$

2. Stack gas moisture condensed at standard conditions (scf)
   (R-18)
   ($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 6.9211$$

3. Stack gas proportion of water vapor, by volume
   (R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0518$$

4. Stack gas dry molecular weight (lb/lb mole)
   (R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.64$$

5. Stack gas molecular weight (lb/lb mole)
   (R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.93$$

6. Pressure stack, in. Hg
   (R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.48$$

7. Stack gas velocity, at stack conditions (ft/sec)
   (R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 39.83$$

8. Stack gas volume at standard conditions (dscfm)
   (R-26)
   (ACFM; R-25)
   333 639.85

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 168647.20$$

9. Test percent isokinetic
   (R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 96.85$$

# ISOKINETIC CALCULATIONS

Standard temperature, $S_t$ 60 (XEQ 60 or 68); 29.92 inches Hg

Test 3 - M5/8 Date 4/1/87 Location #2 Kiln Baghouse Out

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $T_m$ | 97.63 | $V_m$ | 157.367 | $O_2$ | 8.49 | Stack ID " | 160 |
| $T_s$ | 407.63 | $\gamma$ | 0.9983 | $CO_2$ | 21.14 | Stack Area Ft$^2$ | 139.63 |
| $\sqrt{\Delta P}$ | 0.5336 | $P_b$ | 26.46 | Static | -0.39 | Test Time | 192 |
| $\Delta H$ | 1.51 | $V_{1c}$ | 115.8 | $C_p$ | 0.84 | $N_d$ | 0.3217 |

1. Volume of dry gas sampled at standard conditions (dscf)
   (R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 130.1000$$

2. Stack gas moisture condensed at standard conditions (scf)
   (R-18)
   ($V_{m,std}$ + $V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 5.3681$$

3. Stack gas proportion of water vapor, by volume
   (R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0396$$

4. Stack gas dry molecular weight (lb/lb mole)
   (R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.72$$

5. Stack gas molecular weight (lb/lb mole)
   (R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 31.18$$

6. Pressure stack, in. Hg
   (R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.43$$

7. Stack gas velocity, at stack conditions (ft/sec)
   (R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 39.32$$

8. Stack gas volume at standard conditions (dscfm)
   (R-26)
   (ACFM; R-25)

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 167484.98$$

329390.46

9. Test percent isokinetic
   (R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 100.16$$

Pape & Steiner Environmental Services

# ISOKINETIC CALCULATIONS

Standard temperature, $S_t$ 60 (XEQ 60 or 68); 29.92 inches Hg

Test 3 – $NH_3$ Date 4/1/87 Location #2 Kiln Baghouse Out

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $T_m$ | 98.44 | $V_m$ | 152.572 | $O_2$ | 8.49 | Stack ID " | 160 |
| $T_s$ | 418.88 | $\gamma$ | 1.0018 | $CO_2$ | 21.14 | Stack Area $Ft^2$ | 139.63 |
| $\sqrt{\Delta P}$ | 0.5789 | $P_b$ | 26.46 | Static | -0.39 | Test Time | 192 |
| $\Delta H$ | 1.99 | $V_{1c}$ | 155.9 | $C_p$ | 0.84 | $N_d$ | 0.3086 |

1. Volume of dry gas sampled at standard conditions (dscf)
   (R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 126.5623$$

2. Stack gas moisture condensed at standard conditions (scf)
   (R-18)
   ($V_{m,std}$ + $V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 7.2270$$

3. Stack gas proportion of water vapor, by volume
   (R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0540$$

4. Stack gas dry molecular weight (lb/lb mole)
   (R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.72$$

5. Stack gas molecular weight (lb/lb mole)
   (R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.98$$

6. Pressure stack, in. Hg
   (R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.43$$

7. Stack gas velocity, at stack conditions (ft/sec)
   (R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 43.07$$

8. Stack gas volume at standard conditions (dscfm)
   (R-26)
   (ACFM; R-25)
   360807.88

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 178397.42$$

9. Test percent isokinetic
   (R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.41$$

Pape & Steiner Environmental Services

# ISOKINETIC CALCULATIONS

Standard temperature, $S_t$ 60 (XEQ 60 or 68); 29.92 inches Hg

Test 3 - HCL Date 4/1/87 Location #2 Kiln Baghouse Out

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $T_m$ | 95.73 | $V_m$ | 138.536 | $O_2$ | 8.49 | Stack ID " | 160 |
| $T_s$ | 401.75 | $\gamma$ | 1.0008 | $CO_2$ | 21.14 | Stack Area $Ft^2$ | 139.63 |
| $\sqrt{\Delta P}$ | 0.5301 | $P_b$ | 26.46 | Static | -0.39 | Test Time | 192 |
| $\Delta H$ | 1.84 | $V_{1c}$ | 139.4 | $C_p$ | 0.84 | $N_d$ | 0.3061 |

1. Volume of dry gas sampled at standard conditions (dscf)
(R-17)

$$V_{m,std} = \left(\frac{S_t + 460}{29.92}\right)(\gamma)V_m\left(\frac{P_b + \frac{\Delta H}{13.6}}{T_m + 460}\right) = 115.3164$$

2. Stack gas moisture condensed at standard conditions (scf)
(R-18)
($V_{m,std} + V_{w,std}$; R-04)

$$V_{w,std} = 8.9148 \times 10^{-5}(S_t + 460)(V_{1c}) = 6.4621$$

3. Stack gas proportion of water vapor, by volume
(R-19)

$$B_{wo} = \frac{V_{w,std}}{V_{w,std} + V_{m,std}} = 0.0531$$

4. Stack gas dry molecular weight (lb/lb mole)
(R-21)

$$MW_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO) = 31.72$$

5. Stack gas molecular weight (lb/lb mole)
(R-22)

$$MW_s = MW_d(1 - B_{wo}) + 18(B_{wo}) = 30.99$$

6. Pressure stack, in. Hg
(R-23)

$$P_s = P_b + \left(\frac{P_{static}}{13.6}\right) = 26.43$$

7. Stack gas velocity, at stack conditions (ft/sec)
(R-24)

$$V_s = 85.49(C_p)(\sqrt{\Delta P})_{avg}\sqrt{\frac{T_s + 460}{P_s(MW_s)}} = 39.04$$

8. Stack gas volume at standard conditions (dscfm)
(R-26)
(ACFM; R-25)
327087.89

$$Q_s = 60(1 - B_{wo})V_sA_s\left(\frac{S_t + 460}{T_s + 460}\right)\left(\frac{P_s}{29.92}\right) = 165105.95$$

9. Test percent isokinetic
(R-02)

$$\%I = \frac{9142.88(T_s + 460)(V_{w,std} + V_{m,std})}{(S_t + 460)\ \theta\ V_sP_s(D_n)^2} = 99.47$$

# EMISSION RATE CALCULATIONS

1. Fuel factor at 68°F, 29.92 in. Hg (dscf/mmBtu)

$$\text{F Factor} = \frac{10^6[3.64(\%H) + 1.53(\%C) + 0.57(\%S) + 0.14(\%N) - 0.46(\%O_2)]}{\text{Btu/lb}}$$

2. Fuel factor at 60°F, 29.92 in. Hg (dscf/mmBtu)

$$\text{F Factor}_{60^o} = \text{F Factor}_{68^o}\left(\frac{60 + 460}{68 + 460}\right)$$

3. Emission concentration wet at standard conditions* (gr/scf)

$$\text{gr/scf} = 15.432\left(\frac{\text{Comp (g)}}{V_{m,std} + V_{w,std}}\right)$$

4. Emission concentration dry at standard conditions* (gr/dscf)

$$\text{gr/dscf} = 15.432\left(\frac{\text{Comp (g)}}{V_{m,std}}\right)$$

5. Emission concentration corrected to 12% $CO_2$

$$C\ @\ 12\%\ CO_2 = C_{measured}\left(\frac{12}{\%CO_2\text{ measured}}\right)$$

6. Emission Rate lb/hr from gr/dscf

$$\text{lb/hr} = 0.00857(\text{gr/dscf})(Q_s)$$

7. Gaseous concentration in ppm

$$\text{ppm} = \frac{1.60864(S_t + 460)^*(\text{mg comp})}{MW(V_{m,std})}$$

8. Emission rate lb/hr from ppm

$$\text{lb/hr} = \frac{8.223 \times 10^{-5}(Q_s)(MW)(\text{ppm})}{(S_t + 460)^*}$$

9. Emission concentration corrected to 3% $O_2$

$$\text{ppm @ 3\% } O_2 = \text{ppm measured}\left(\frac{20.9 - 3}{20.9 - \%O_2\text{ measured}}\right)$$



*Standard temperature to be defined

EMISSION RATE CALCULATIONS
(Concluded)

10. Emission factor, lb/mmBtu at 0% $O_2$

$$\text{lb/mmBtu} = F(1.4286 \times 10^{-4}) \left(\frac{20.9}{20.9 - \%O_2}\right) (\text{gr/dscf})$$

$$\text{lb/mmBtu} = F(MW)\left(\frac{1.3711 \times 10^{-6}}{S_t + 460^*}\right)\left(\frac{20.9}{20.9 - \%O_2}\right) (\text{ppm})$$

11. Heating value of fuel, mmBtu/bbl

$$\text{mmBtu/bbl} = 349.786 \times 10^{-6}(\text{Btu/lb})(\text{SpGr})$$

12. Emission Factor, lb/bbl

lb/bbl = (lb/mmBtu)(mmBtu/bbl)

13. Brake Specific Emission Rate = grams per brake horsepower hour

$$= (\text{lb/MMbtu})(453.592 \times 10^{-6})(\text{Btu/brake horsepower hour})$$

14. Maximum Mass Emission Rate (lb/hr)

= (grams/BHP hr)(maximum BHP)(1 lb/453.592 g)

15. Kilograms per thousand Barrels of Feed (Kg/Kbbl)

$$= \frac{\text{lb/hr emission (10.8864)}}{\text{KBPD Feed}}$$

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*Standard temperature to be defined

Pape & Steiner Environmental Services

# EMISSION RATE DATA

Standard Temperature, $S_t$ 60 (60°F or 68°F); 29.92 inches Hg

LOCATION Baghouse Outlet - Kiln 2 Method 5/8

| DATA | | Test 1 | Test 2 | Test 3 | Average |
|---|---|---|---|---|---|
| $V_{m,std}$ | | 134.1740 | 133.0858 | 130.1000 | 132.4533 |
| Bwo | | 0.0359 | 0.0387 | 0.0396 | 0.0381 |
| Qs | | 173143.25 | 172556.28 | 167484.98 | 171061.50 |
| $O_2$ | | 8.87 | 8.86 | 8.49 | 8.74 |
| $CO_2$ | | 19.93 | 20.53 | 21.14 | 20.53 |
| F-Factor | | | | | |
| **LAB DATA** | | | | | |
| Front Half Wash | g | 0.00731 | 0.00618 | 0.00792 | |
| Mass Filter | g | 0.00356 | 0.00259 | 0.00335 | |
| Back Half Catch | g | 0.02330 | 0.04964 | 0.02698 | |
| Front Half Sulfate, | mg $H_2SO_4$ | | | | |
| Back Half Sulfate, | mg $H_2SO_4$ | | | | |
| $H_2O_2$ Catch | mg $H_2SO_4$ | 32.66 | 28.70 | 34.51 | |
| **RESULTS** | | | | | |
| Filt. Particulate | gr/dscf | 0.0013 | 0.0010 | 0.0013 | 0.0012 |
| | gr/dscf @ 12% $CO_2$ | 0.0008 | 0.0006 | 0.0008 | 0.0007 |
| | gr/scf | 0.0012 | 0.0010 | 0.0013 | 0.0012 |
| | lb/hr | 1.86 | 1.50 | 1.92 | 1.76 |
| | lb/MMBtu | | | | |
| Total Particulate | gr/dscf | 0.0039 | 0.0068 | 0.0045 | 0.0051 |
| | gr/dscf @ 12% $CO_2$ | 0.0024 | 0.0040 | 0.0026 | 0.0030 |
| | gr/scf | 0.0038 | 0.0065 | 0.0044 | 0.0049 |
| | lb/hr | 5.83 | 10.02 | 6.51 | 7.45 |
| | lb/MMBtu | | | | |
| Total Sulfate | gr/dscf | | | | |
| | gr/dscf @ 12% $CO_2$ | | | | |
| | gr/scf | | | | |
| | lb/hr | | | | |
| | lb/MMBtu | | | | |
| | lb/MMBtu as Sulfur | | | | |
| $SO_3$ | ppm | | | | |
| | ppm, wet | | | | |
| | lb/hr | | | | |
| $SO_2$ | ppm | 2.08 | 1.84 | 2.26 | 2.06 |
| | ppm, wet | 2.00 | 1.77 | 2.17 | 1.98 |
| | lb/hr | 3.51 | 3.09 | 3.69 | 3.43 |
| | lb/MMBtu | | | | |
| | lb/MMBtu, as Sulfur | | | | |

Pape & Steiner Environmental Services

EMISSION RATE DATA

Standard Temperature, $S_t$ 60 (60°F or 68°F); 29.92 inches Hg

LOCATION #2 Kiln Baghouse Stack - $NH_3$

| DATA | | Test 1 | Test 2 | Test 3 | Average |
|---|---|---|---|---|---|
| $V_{m,std}$ | | 125.0829 | 118.4094 | 126.5623 | 123.3515 |
| Bwo | | 0.0511 | 0.0522 | 0.0540 | 0.0524 |
| Qs | | 175511.51 | 167550.12 | 178397.42 | 173819.68 |
| $O_2$ | | 8.87 | 8.86 | 8.49 | 8.74 |
| $CO_2$ | | 19.93 | 20.53 | 21.14 | 20.53 |
| F-Factor | | | | | |
| **LAB DATA** | | | | | |
| Front Half Wash | g | 0.00708 | 0.00332 | 0.00183 | |
| Mass Filter | g | 0.05691 | 0.05267 | 0.05791 | |
| Back Half Catch | g | | | | |
| Front Half Sulfate, | mg $H_2SO_4$ | | | | |
| Back Half Sulfate, | mg $H_2SO_4$ | | | | |
| $H_2O_2$ Catch | mg $H_2SO_4$ | | | | |
| **RESULTS** | | | | | |
| Filt. Particulate | gr/dscf | 0.0079 | 0.0073 | 0.0073 | 0.0075 |
| | gr/dscf @ 12% $CO_2$ | 0.0048 | 0.0043 | 0.0041 | 0.0044 |
| | gr/scf | 0.0075 | 0.0069 | 0.0069 | 0.0071 |
| | lb/hr | 11.87 | 10.48 | 11.14 | 11.16 ← Bad Numbers |
| | lb/MMBtu | | | | |
| Total Particulate | gr/dscf | | | | |
| | gr/dscf @ 12% $CO_2$ | | | | |
| | gr/scf | | | | |
| | lb/hr | | | | |
| | lb/MMBtu | | | | |
| Total Sulfate | gr/dscf | | | | |
| | gr/dscf @ 12% $CO_2$ | | | | |
| | gr/scf | | | | |
| | lb/hr | | | | |
| | lb/MMBtu | | | | |
| | lb/MMBtu as Sulfur | | | | |
| $SO_3$ | ppm | | | | |
| | ppm, wet | | | | |
| | lb/hr | | | | |
| $SO_2$ | ppm | | | | |
| | ppm, wet | | | | |
| | lb/hr | | | | |
| | lb/MMBtu | | | | |
| | lb/MMBtu, as Sulfur | | | | |

Pape & Steiner Environmental Services

# EMISSION RATE DATA

Standard Temperature, $S_t$ 60 (60°F or 68°F); 29.92 inches Hg

LOCATION #2 Kiln Baghouse Outlet - HCL

| DATA | | Test 1 | Test 2 | Test 3 | Average |
|---|---|---|---|---|---|
| $V_{m,std}$ | | 128.7035 | 126.6796 | 115.3164 | 123.5665 |
| Bwo | | 0.0511 | 0.0518 | 0.0531 | 0.0520 |
| Qs | | 167516.18 | 168647.20 | 165105.95 | 167089.78 |
| $O_2$ | | 8.87 | 8.86 | 8.49 | 8.74 |
| $CO_2$ | | 19.93 | 20.53 | 21.14 | 20.53 |
| F-Factor | | | | | |
| **LAB DATA** | | | | | |
| Front Half Wash | g | 0.00428 | 0.00203 | 0.00561 | |
| Mass Filter | g | 0.00455 | 0.00178 | 0.00268 | |
| Back Half Catch | g | | | | |
| Front Half Sulfate, | mg $H_2SO_4$ | | | | |
| Back Half Sulfate, | mg $H_2SO_4$ | | | | |
| $H_2O_2$ Catch | mg $H_2SO_4$ | | | | |
| **RESULTS** | | | | | |
| Filt. Particulate | gr/dscf | 0.0011 | 0.0005 | 0.0011 | 0.0009 |
| | gr/dscf @ 12% $CO_2$ | 0.0006 | 0.0003 | 0.0006 | 0.0005 |
| | gr/scf | 0.0010 | 0.0004 | 0.0011 | 0.0008 |
| | lb/hr | 1.52 | 0.67 | 1.57 | 1.25 |
| | lb/MMBtu | | | | |
| Total Particulate | gr/dscf | | | | |
| | gr/dscf @ 12% $CO_2$ | | | | |
| | gr/scf | | | | |
| | lb/hr | | | | |
| | lb/MMBtu | | | | |
| Total Sulfate | gr/dscf | | | | |
| | gr/dscf @ 12% $CO_2$ | | | | |
| | gr/scf | | | | |
| | lb/hr | | | | |
| | lb/MMBtu | | | | |
| | lb/MMBtu as Sulfur | | | | |
| $SO_3$ | ppm | | | | |
| | ppm, wet | | | | |
| | lb/hr | | | | |
| $SO_2$ | ppm | | | | |
| | ppm, wet | | | | |
| | lb/hr | | | | |
| | lb/MMBtu | | | | |
| | lb/MMBtu, as Sulfur | | | | |

Pape & Steiner Environmental Services

TEST 1, 2, 3

LOCATION Kiln Baghouse Out

CM $SO_2$, $NO_x$, HC, CO EMISSION RATE DATA

Standard Temperature, $S_t$ 60 (XEQ 60 or 68); 29.92 inches Hg

| ENTER | | | Test 1 | Test 2 | Test 3 | Average |
|---|---|---|---|---|---|---|
| R-22 | $O_2$ | % | 8.87 | 8.86 | 8.49 | 8.74 |
| R-26 | $Q_s$ | | 173143.25 | 172556.28 | 167484.98 | 171061.50 |
| R-15 | $NO_x$ | ppm | 641.75 | 654.37 | 647.39 | 647.84 |
| R-15 | $SO_2$ | ppm | | | | |
| R-15 | CO | ppm | 664.18 | 667.68 | 881.04 | 737.63 |
| R-15 | HC | ppm | | | | |

XEQ FF

XEQ $SO_2$ F-FACTOR ________

RESULTS:

| | | Test 1 | Test 2 | Test 3 | Average | |
|---|---|---|---|---|---|---|
| MW = 46 | | | | | | |
| $NO_x$ | lb/hr | 808.28 | 821.38 | 788.72 | 806.13 | |
| $NO_x$ | ppm @ 3% $O_2$ | 954.89 | 972.86 | 933.77 | 953.84 | |
| $NO_x$ | lb/MMBtu | | | | | |
| $NO_x$ | lb/Bbl | | | | | |
| MW = 64.1 | | | | | | |
| $SO_2$ | lb/hr | | | | | |
| $SO_2$ | ppm @ 3% $O_2$ | | | | | |
| $SO_2$ | lb/MMBtu | | | | | |
| $SO_2$ | lb/Bbl | | | | | |
| MW = 28 | | | | | | |
| CO | lb/hr | 509.19 | 510.14 | 653.37 | 557.57 | |
| CO | ppm @ 3% $O_2$ | 988.26 | 992.65 | 1270.80 | 1083.90 | 0.108 |
| CO | lb/MMBtu | | | | | |
| CO | lb/Bbl | | | | | |
| MW = 16 | | | | | | |
| HC | lb/hr | | | | | |
| HC | ppm @ 3% $O_2$ | | | | | |
| HC | lb/MMBtu | | | | | |
| HC | lb/Bbl | | | | | |

Pape & Steiner Environmental Services

TEST 1,2,3

LOCATION Kiln Baghouse Out

CM $SO_2$, $NO_x$, HC, CO EMISSION RATE DATA

Standard Temperature, $S_t$ 60 (XEQ 60 or 68); 29.92 inches Hg

| ENTER | | | Test 1 | Test 2 | Test 3 | Average |
|---|---|---|---|---|---|---|
| R-22 | $O_2$ | % | 8.87 | 8.86 | 8.49 | 8.74 |
| R-26 | $Q_s$ | | 175511.51 | 167550.12 | 178397.42 | 173819.68 |
| R-15 | $NH_3$ | ppm | 2.82 | 2.97 | 2.88 | 2.89 |
| R-15 | $SO_2$ | ppm | | | | |
| R-15 | CO | ppm | | | | |
| R-15 | HC | ppm | | | | |

XEQ FF

XEQ $SO_2$ F-FACTOR ______

RESULTS:

| | | Test 1 | Test 2 | Test 3 | Average |
|---|---|---|---|---|---|
| MW = 17 | | | | | |
| $NH_3$ | lb/hr | 1.33 | 1.34 | 1.38 | 1.35 |
| $NH_3$ | ppm @ 3% $O_2$ | 4.20 | 4.42 | 4.15 | 4.26 |
| $NO_x$ | lb/MMBtu | | | | |
| $NO_x$ | lb/Bbl | | | | |
| MW = 64.1 | | | | | |
| $SO_2$ | lb/hr | | | | |
| $SO_2$ | ppm @ 3% $O_2$ | | | | |
| $SO_2$ | lb/MMBtu | | | | |
| $SO_2$ | lb/Bbl | | | | |
| MW = 28 | | | | | |
| CO | lb/hr | | | | |
| CO | ppm @ 3% $O_2$ | | | | |
| CO | lb/MMBtu | | | | |
| CO | lb/Bbl | | | | |
| MW = 16 | | | | | |
| HC | lb/hr | | | | |
| HC | ppm @ 3% $O_2$ | | | | |
| HC | lb/MMBtu | | | | |
| HC | lb/Bbl | | | | |

Pape & Steiner Environmental Services

TEST 1,2,3

LOCATION Kiln Baghouse Out

CM $SO_2$, $NO_x$, HC, CO EMISSION RATE DATA

Standard Temperature, $S_t$ 60 (XEQ 60 or 68); 29.92 inches Hg

| ENTER | | | Test 1 | Test 2 | Test 3 | Average |
|---|---|---|---|---|---|---|
| R-22 | $O_2$ | % | 8.87 | 8.86 | 8.49 | 8.74 |
| R-26 | $Q_s$ | | 167516.18 | 168647.20 | 165105.95 | 167089.78 |
| R-15 | HCl | ppm | 39.21 | 37.69 | 36.61 | 37.84 |
| R-15 | $SO_2$ | ppm | | | | |
| R-15 | CO | ppm | | | | |
| R-15 | HC | ppm | | | | |

XEQ FF

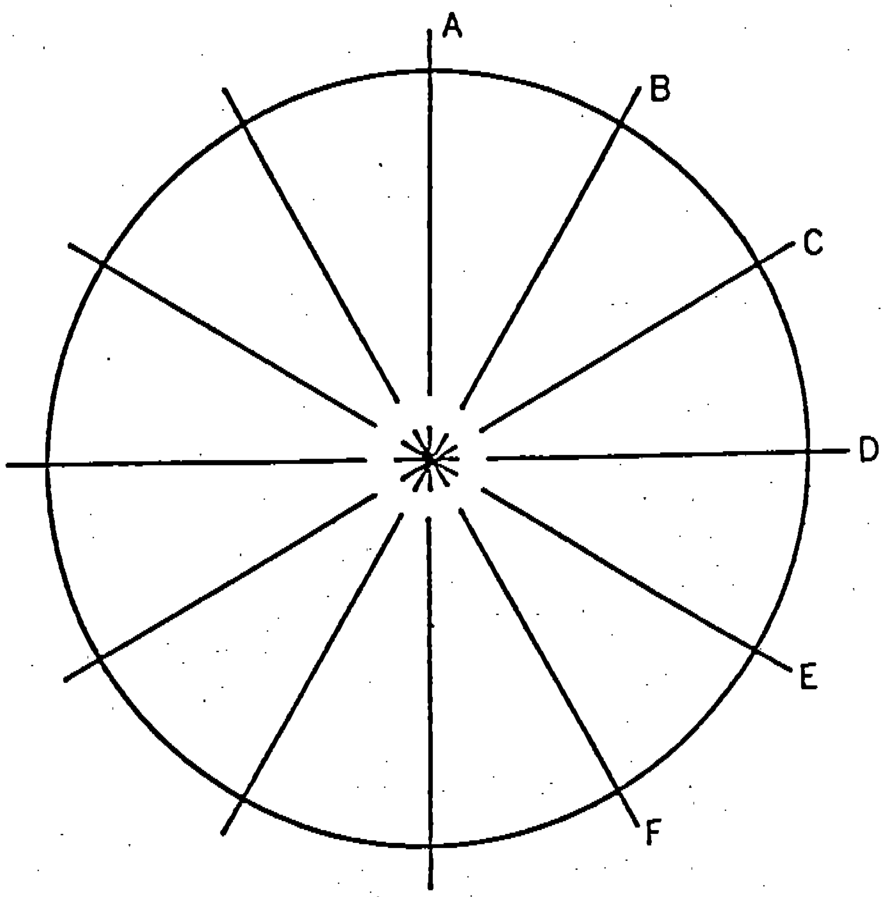
XEQ $SO_2$ F-FACTOR ____________

RESULTS:

| | | Test 1 | Test 2 | Test 3 | Average |
|---|---|---|---|---|---|
| MW = 36.47 | | | | | |
| HCl | lb/hr | 37.88 | 36.66 | 34.86 | 36.47 |
| HCl | ppm @ 3% $O_2$ | 58.34 | 56.03 | 52.81 | 55.73 |
| $NO_x$ | lb/MMBtu | | | | |
| $NO_x$ | lb/Bbl | | | | |
| MW = 64.1 | | | | | |
| $SO_2$ | lb/hr | | | | |
| $SO_2$ | ppm @ 3% $O_2$ | | | | |
| $SO_2$ | lb/MMBtu | | | | |
| $SO_2$ | lb/Bbl | | | | |
| MW = 28 | | | | | |
| CO | lb/hr | | | | |
| CO | ppm @ 3% $O_2$ | | | | |
| CO | lb/MMBtu | | | | |
| CO | lb/Bbl | | | | |
| MW = 16 | | | | | |
| HC | lb/hr | | | | |
| HC | ppm @ 3% $O_2$ | | | | |
| HC | lb/MMBtu | | | | |
| HC | lb/Bbl | | | | |

Pape & Steiner Environmental Services

NOZZLE CALIBRATION DATA




DIAMETER (in.)

A .3225

B

C .3190

D .3222

E .3230

F

AVG. .3217

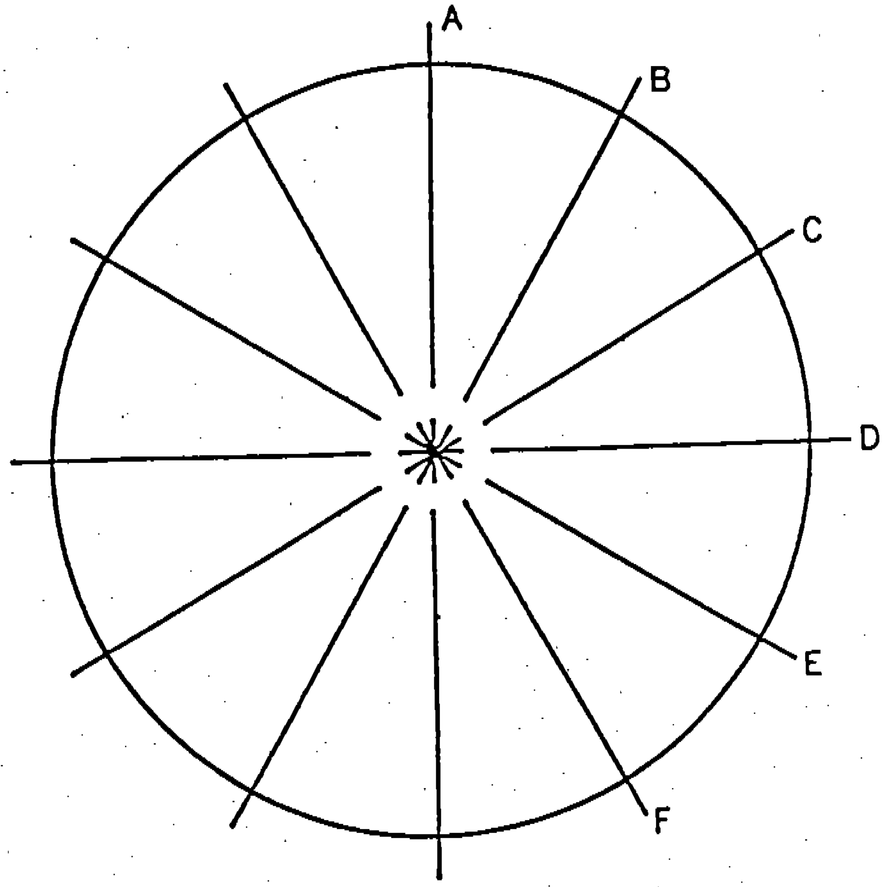
DATE 2-19-86

NOZZLE NO. 1852

OPERATOR JCO

Pape & Steiner Environmental Services

# NOZZLE CALIBRATION DATA




DIAMETER (in.)

A .3205

B

C .3225

D .3228

E .3208

F

AVG. .3217

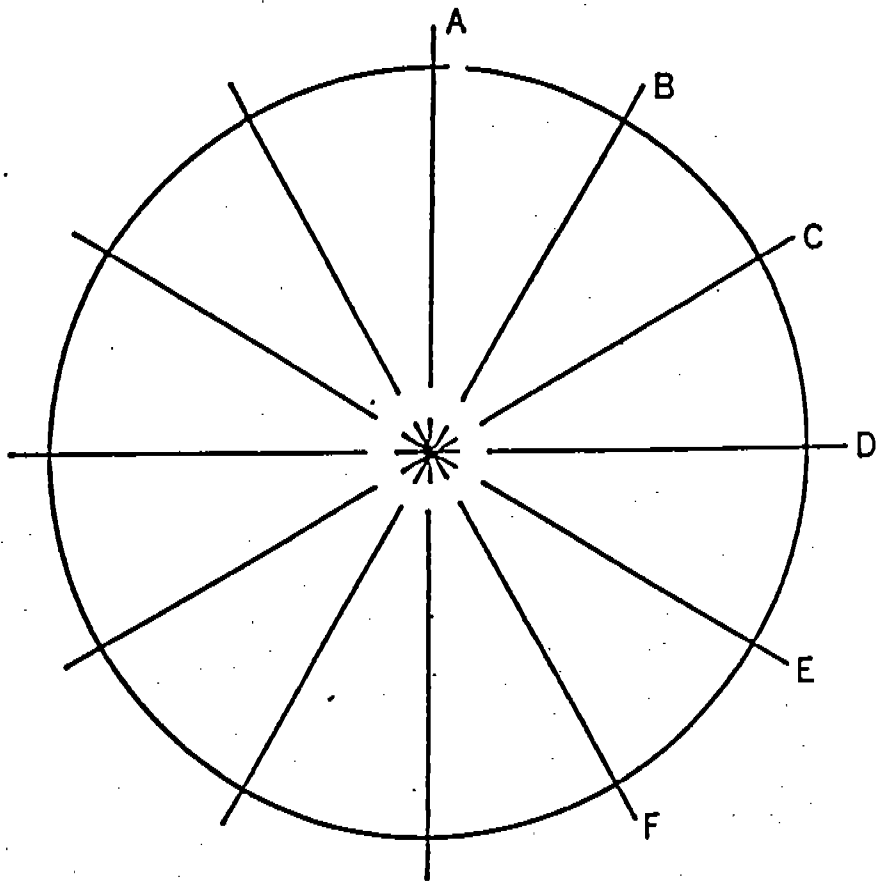
DATE 2-19-86

NOZZLE NO. 1853

OPERATOR JCO

Pape & Steiner Environmental Services

# NOZZLE CALIBRATION DATA




DIAMETER (in.)

A .3087

B ______

C .3082

D .3092

E .3082

F ______

AVG. .3086

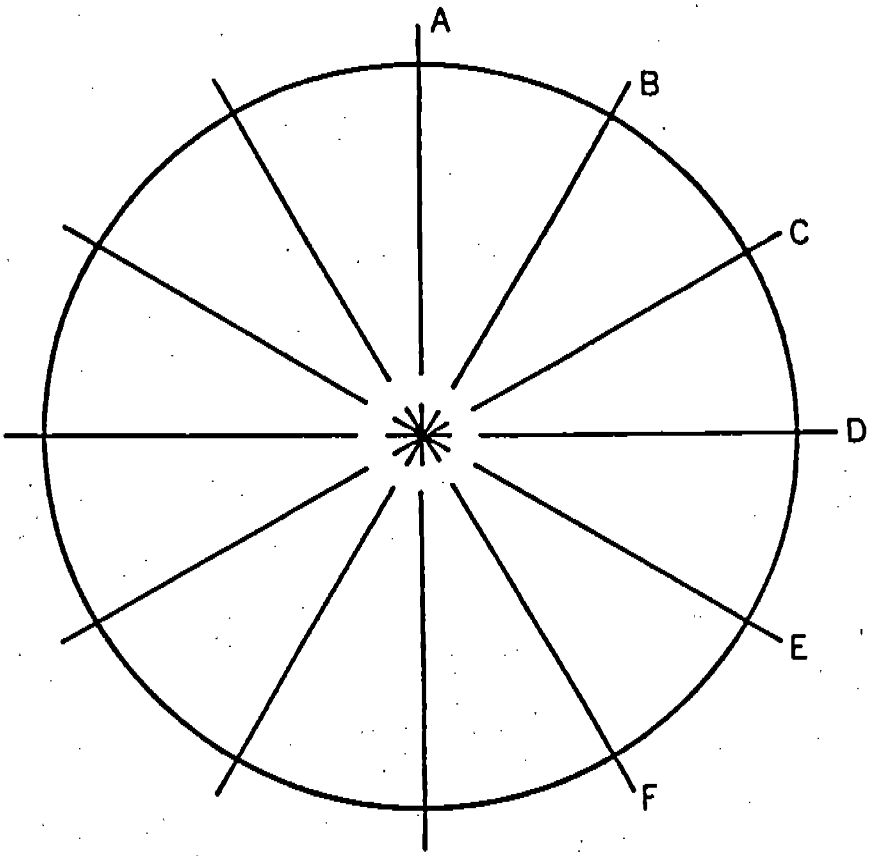
DATE 2-19-86

NOZZLE NO. 1448

OPERATOR JEO

Pape & Steiner Environmental Services

NOZZLE CALIBRATION DATA




DIAMETER (in.)

A .3052

B

C .3063

D .3068

E .3060

F

AVG. .3061

DATE 2-19-86

NOZZLE NO. 1285

OPERATOR JEO

Pape & Steiner Environmental Services

# DRY GAS METER/ORIFICE METER CALIBRATION DATA

Date 2/6/87 Dry Gas Meter No. 56001

Barometric Pressure, in. Hg 29.80 Standard Test Meter No. 69279

Meter Box No. 31D609 Operator CARTER

| | Standard Test Meter | | | Meter Box | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pres. $\Delta H_s$ ("Wg) | Temp. $T_s$ ($^oF$) | Volume Vs ($Ft^3$) | Pres. $\Delta H$ ("Wg) | Temp. $T_{d_i}$ ($^oF$) | Temp. $T_{d_o}$ ($^oF$) | Volume $V_d$ ($Ft^3$) | Time (min) | $\gamma$ | $K_o$ |
| | | 75 | 119.299 | | 108 | 92 | 952.152 | | | |
| | -2.3 | 72 | 97.637 | 0.5 | 101 | 90 | 929.459 | 46 | 0.9911 | 0.8554 |
| | | 73.5 | 21.662 | | 97.75 | | 22.693 | | | |
| | | 73 | 95.940 | | 109 | 88 | 927.684 | | | |
| | -3.9 | 73 | 73.663 | 1.0 | 102 | 82 | 904.556 | 34 | 0.9913 | 0.8339 |
| | | 73 | 22.277 | | 95.25 | | 23.128 | | | |
| | | 75 | 141.675 | | 115 | 93 | 975.343 | | | |
| 29.83 | -5.2 | 75 | 120.856 | 1.5 | 112 | 92 | 953.751 | 26 | 0.9950 | 0.8319 |
| | | 75 | 20.319 | | 103 | | 21.592 | | | |
| | | 75 | 167.883 | | 118 | 94 | 1002.284 | | | |
| 29.83 | -6.6 | 75 | 144.803 | 2.0 | 117 | 93 | 978.553 | 25 | 1.0063 | 0.8280 |
| | | 75 | 23.080 | | 105.5 | | 23.731 | | | |
| | | 75 | 189.609 | | 119 | 94 | 24.483 | | | |
| 29.83 | -9.1 | 75 | 169.401 | 3.0 | 117 | 94 | 3.835 | 18 | 1.0047 | 0.8163 |
| | | 75 | 20.208 | | 106.0 | | 20.648 | | | |
| | | | | | | | | | | |
| | | | | 4.0 | | | | | | |
| | | | | | | | | | | |

Average 0.9983 0.8331

Std.Dev. 0.0072 (0.7%) 0.0142 (1.7%)

$$\gamma = \frac{V_s\left(P_{bar} + \frac{\Delta H_s}{13.6}\right)\left(\frac{T_{d_i} + T_{d_o}}{2} + 460\right)}{V_d\left(P_{bar} + \frac{\Delta H}{13.6}\right)\left(T_s + 460\right)}$$

$$K_o = \frac{\left(\frac{V_s}{t}\right)\left(\frac{T_{d_o}}{T_s}\right)\left(\frac{P_{bar} + \frac{\Delta H_s}{13.6}}{P_{bar} + \frac{\Delta H}{13.6}}\right)}{\left(\frac{T_{d_o}\,\Delta H}{\left(P_{bar} + \frac{\Delta H}{13.6}\right)\left(M_m\right)}\right)^{0.5}}$$

where

$\Delta H_s$ = Standard meter pressure drop

$T_s$ = Standard meter temperature

$V_s$ = Standard test meter dry gas volume

$\Delta H$ = Meter box orifice meter pressure drop

$T_{d_i}$ = Meter box inlet temperature

$T_{d_o}$ = Meter box outlet temperature

$V_d$ = Meter box dry gas volume

$\gamma$ = Meter box correction factor

$K_o$ = Orifice meter calibration constant

$t$ = Calibration time in minutes

$M_m$ = Molecular weight of air (28.96 lb/lb-mole)

$P_{bar}$ = Barometric pressure

Pape & Steiner Environmental Services

# DRY GAS METER/ORIFICE METER CALIBRATION DATA

Date 3-13-87 Dry Gas Meter No. 39009

Barometric Pressure, in. Hg 29.86 Standard Test Meter No. 69279

Meter Box No. 446 Operator CARTER

| | Standard Test Meter | | | Meter Box | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pres. $\Delta H_s$ ("Wg) | Temp. $T_s$ ($^oF$) | Volume Vs ($Ft^3$) | Pres. $\Delta H$ ("Wg) | Temp. $T_{d_i}$ ($^oF$) | Temp. $T_{d_o}$ ($^oF$) | Volume $V_d$ ($Ft^3$) | Time (min) | $\gamma$ | $K_o$ |
| | | 71 | 337.292 | | 87 | 82 | 189.204 | | | |
| | -2.2 | 70 | 314.426 | 0.5 | 86 | 82 | 165.869 | 57 | 0.9986 | 0.7277 |
| | | 71.5 | 22.866 | | 84.25 | | 23.335 | | | |
| | | 70 | 313.518 | | 87 | 82 | 164.951 | | | |
| | -3.6 | 70 | 288.173 | 1.0 | 86 | 80 | 139.316 | 45 | 1.0029 | 0.7195 |
| | | 70 | 25.345 | | 83.75 | | 25.635 | | | |
| | | 73 | 370.906 | | 90 | 84 | 222.964 | | | |
| 29.80 | -4.8 | 73 | 349.669 | 1.5 | 84 | 81 | 201.565 | 31 | 0.9991 | 0.7086 |
| | | 73 | 21.237 | | 84.75 | | 21.399 | | | |
| | | 74 | 394.994 | | 92 | 86 | 247.242 | | | |
| 29.80 | -5.6 | 74 | 372.049 | 2.0 | 90 | 85 | 224.114 | 29 | 0.9996 | 0.7062 |
| | | 74 | 22.945 | | 88.25 | | 23.128 | | | |
| | | 74 | 420.028 | | 94 | 88 | 272.128 | | | |
| 29.80 | -8.0 | 74 | 396.394 | 3.0 | 92 | 86 | 248.649 | 24 | 1.0088 | 0.7144 |
| | | 74 | 23.634 | | 90.00 | | 23.479 | | | |
| | | | | | | | | | | |
| | | | | 4.0 | | | | | | |
| | | | | | | | | | | |

Average 1.0018 0.7153

Std.Dev. 0.0043 (0.4%) 0.0087 (1.2%)

$$\gamma = \frac{V_s\left(P_{bar} + \frac{\Delta H_s}{13.6}\right)\left(\frac{T_{d_i} + T_{d_o}}{2} + 460\right)}{V_d\left(P_{bar} + \frac{\Delta H}{13.6}\right)\left(T_s + 460\right)}$$

$$K_o = \frac{\left(\frac{V_s}{t}\right)\left(\frac{T_{d_o}}{T_s}\right)\left(\frac{P_{bar} + \frac{\Delta H_s}{13.6}}{P_{bar} + \frac{\Delta H}{13.6}}\right)}{\left(\frac{T_{d_o}\,\Delta H}{\left(P_{bar} + \frac{\Delta H}{13.6}\right)\left(M_m\right)}\right)^{0.5}}$$

where

$\Delta H_s$ = Standard meter pressure drop

$T_s$ = Standard meter temperature

$V_s$ = Standard test meter dry gas volume

$\Delta H$ = Meter box orifice meter pressure drop

$T_{d_i}$ = Meter box inlet temperature

$T_{d_o}$ = Meter box outlet temperature

$V_d$ = Meter box dry gas volume

$\gamma$ = Meter box correction factor

$K_o$ = Orifice meter calibration constant

t = Calibration time in minutes

$M_m$ = Molecular weight of air (28.96 lb/lb-mole)

$P_{bar}$ = Barometric pressure

Pape & Steiner Environmental Services

# DRY GAS METER/ORIFICE METER CALIBRATION DATA

Date 2/6/87 Dry Gas Meter No. 1032923

Barometric Pressure, in. Hg 29.92 Standard Test Meter No. 69279

Meter Box No. 31D635C Operator CARTER

| | Standard Test Meter | | | Meter Box | | | | Time | $\gamma$ | $K_o$ |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pres. $\Delta H_s$ ("Wg) | Temp. $T_s$ (°F) | Volume Vs (Ft³) | Pres. $\Delta H$ ("Wg) | Temp. $T_{d_i}$ (°F) | Temp. $T_{d_o}$ (°F) | Volume $V_d$ (Ft³) | (min) | | |
| | | 70 | 930.791 | | 89 | 82 | 909.919 | | | |
| | -2.2 | 68 | 959.480 | 0.5 | 83 | 79 | 888.108 | 55. | 0.9968 | 0.7046 |
| | | 69 | 21.311 | | 83.25 | | 21.811 | | | |
| | | 68 | 958.026 | | 89 | 79 | 886.623 | | | |
| | -3.3 | 67 | 934.301 | 1.0 | 83 | 76 | 862.528 | 44 | 0.9981 | 0.6893 |
| | | 67.5 | 23.665 | | 81.75 | | 24.095 | | | |
| | | 71. | 1002.008 | | 94 | 84 | 931.474 | | | |
| 29.87 | -4.5 | 70.0 | 981.725 | 1.5 | 87 | 82 | 910.858 | 31 | 0.9991 | 0.6813 |
| | | 70.5 | 20.283 | | 86.75 | | 20.616 | | | |
| | | 72. | 26.774 | | 96 | 85 | 956.490 | | | |
| 29.87 | -6.4 | 71. | 3.847 | 2.0 | 94 | 84 | 933.342 | 30.0 | 1.0034 | 0.6851 |
| | | 71.5 | 22.927 | | 89.75 | | 23.148 | | | |
| | | 72 | 55.154 | | 98 | 86 | 984.938 | | | |
| 29.87 | -8.6 | 72 | 32.864 | 3.0 | 97 | 85 | 962.635 | 24.0 | 1.0067 | 0.6752 |
| | | 72 | 22.290 | | 91.5 | | 22.303 | | | |
| | | | | | | | | | | |
| | | | | 4.0 | | | | | | |
| | | | | | | | | | | |

Average 1.0008 0.6871

Std.Dev. 0.0041 (0.4%) 0.0111 (1.6%)

$$\gamma = \frac{V_s \left(P_{bar} + \frac{\Delta H_s}{13.6}\right)\left(\frac{T_{d_i} + T_{d_o}}{2} + 460\right)}{V_d \left(P_{bar} + \frac{\Delta H}{13.6}\right)\left(T_s + 460\right)}$$

$$K_o = \frac{\left(\frac{V_s}{t}\right)\left(\frac{T_{d_o}}{T_s}\right)\left(\frac{P_{bar} + \frac{\Delta H_s}{13.6}}{P_{bar} + \frac{\Delta H}{13.6}}\right)}{\left(\frac{T_{d_o}\,\Delta H}{\left(P_{bar} + \frac{\Delta H}{13.6}\right)(M_m)}\right)^{0.5}}$$

where

$\Delta H_s$ = Standard meter pressure drop

$T_s$ = Standard meter temperature

$V_s$ = Standard test meter dry gas volume

$\Delta H$ = Meter box orifice meter pressure drop

$T_{d_i}$ = Meter box inlet temperature

$T_{d_o}$ = Meter box outlet temperature

$V_d$ = Meter box dry gas volume

$\gamma$ = Meter box correction factor

$K_o$ = Orifice meter calibration constant

$t$ = Calibration time in minutes

$M_m$ = Molecular weight of air (28.96 lb/lb-mole)

$P_{bar}$ = Barometric pressure

# Scott Specialty Gases

a division of Scott Enviro... ental Technology, Inc.

2600 CAJON BLVD. SAN BERNARDINO, CA 92411 PHONE (714) 887-2571

PAPE & STEINER
5801 Norris Road
Bakersfield, CA 93308
Attn: Sue Powers

Date Shipped 1-16-87
Our Project No: 404936
Your P.O. No: SP 8864
Page 1 of 1

## CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES*

(Concentrations are in mole % or ppm)

Cylinder Number AAL13472 Certified Accuracy ±1 % NBS Traceable Analysis Dates: First 01-06-87 Last 01-16-87

| COMPONENTS | CERTIFIED CONC | EXPIRATION DATE | ANALYTICAL PRINCIPLE | PRIMARY STANDARD NBS/SRM's | REPLICATE CONCENTRATIONS FIRST | REPLICATE CONCENTRATIONS SECOND |
|---|---|---|---|---|---|---|
| NITRIC OXIDE | 807.8 ppm | 07-16-87 | CHEM. | 1687B | 810.6 ppm | 807.8 ppm |
| NOX | 813.1 ppm | | | | 813.6 ppm | 813.1 ppm |
| | | | | | | |
| NITROGEN | BALANCE | | | | | |

A-83

Cylinder Number ____ Certified Accuracy ____ % NBS Traceable Analysis Dates: First ____ Last ____

| COMPONENTS | CERTIFIED CONC | EXPIRATION DATE | ANALYTICAL PRINCIPLE | PRIMARY STANDARD NBS/SRM's | REPLICATE CONCENTRATIONS FIRST | REPLICATE CONCENTRATIONS SECOND |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

*We hereby certify the cylinder gas has been analyzed according to EPA Protocol No: 1

Analyst ____ Approved By [signature]

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

CERTIFIED REFERENCE MATERIALS ■ EPA PROTOCOL GASES ■ ACUBLEND™ ■ CALIBRATION & SPECIALTY GAS MIXTURES
PURE GASES ■ ACCESSORY PRODUCTS ■ CUSTOM ANALYTICAL SERVICES

TROY, MICHIGAN / PLUMSTEADVILLE, PENNSYLVANIA

# Scott Specialty Gases

a division of Scott Environmental Technology, Inc.

PLUMSTEADVILLE, PA. 18949   PHONE: (215) 766-8861   TWX: 510-665-9344

SAN BERNARDINO, CA 714-887-2571


Date: 8-21-86

Our Project No.: 403355

Your P.O. No.: SP 5237

PAPE & STEINER
5801 Norris Road
Bakersfield, CA 93308
Attn: Sue Powers

Gentlemen:

Thank you for choosing Scott for your Specialty Gas needs. The analyses for the gases ordered, as reported by our laboratory, are listed below. Results are in volume percent, unless otherwise indicated.

## ANALYTICAL REPORT

Cyl. No. AAL5965   Analytical Accuracy ±1%

| Component | Concentration |
|---|---|
| CARBON MONOXIDE | 201.5ppm |
| NBS TRACEABLE TO SRM1680B | |
| CARBON DIOXIDE | 15.00% |
| OXYGEN | 8.070% |
| NITROGEN | BALANCE |

Cyl. No. ______   Analytical Accuracy ______

| Component | Concentration |
|---|---|
| | |

Cyl. No. ______   Analytical Accuracy ______

| Component | Concentration |
|---|---|
| | |

Cyl. No. ______   Analytical Accuracy ______

| Component | Concentration |
|---|---|
| | |

CERTIFIED

Analyst ______

Approved By [signature]

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

Operating Data for Source Tests 3/31 & 4/1/87

07/21/87 14:52 SOUTHWESTERN PORTLAND CEMENT COMPANY
HP1000-BECKMAN DATA ACQUISITION SYSTEM
Hour Interval Report

PV: FIC-309 Description: K2 FEED RATE Units: TPH
Report Date-time range: 03/31/87 01:00 to 04/01/87 23:00
Screen Date-time range: 03/31/87 01:00 to 04/01/87 16:00

| | Time | Data | Time | Data | | Time | Data | | Time | Data |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0100 | 224.85 | 1100 | 225.16 | | 2100 | 225.01 | | 0700 | 225.00 |
| 3/31 | 0200 | 225.10 | 1200 | 225.00 | | 2200 | 225.08 | | 0800 | 225.06 |
| | 0300 | 224.95 | 1300 | 224.83 | cl. | 2300 | 225.03 | | 0900 | 224.80 |
| | 0400 | 225.01 | 1400 | 225.08 | | 0000 | 224.95 | | 1000 | 225.16 |
| | 0500 | 224.96 | 1500 | 224.97 | 1264 | 0100 | 225.05 | | 1100 | 225.01 |
| | 0600 | 225.11 | 1600 | 224.98 | | 0200 | 225.04 | 4/1 | 1200 | 224.88 |
| | 0700 | 224.84 | 1700 | 224.99 | | 0300 | 224.80 | | 1300 | 225.08 |
| | 0800 | 100.38 | 1800 | 224.89 | | 0400 | 225.05 | | 1400 | 224.95 |
| | 0900 | 153.58 | 1900 | 224.89 | | 0500 | 224.96 | | 1500 | 224.92 |
| | 1000 | 219.82 | 2000 | 224.93 | | 0600 | 225.04 | | 1600 | 225.15 |

L.0001

07/21/87 14:52 SOUTHWESTERN PORTLAND CEMENT COMPANY
HP1000-BECKMAN DATA ACQUISITION SYSTEM
Hour Interval Report

PV: FIC-309 Description: K2 FEED RATE Units: TPH
Report Date-time range: 03/31/87 01:00 to 04/01/87 23:00
Screen Date-time range: 04/01/87 17:00 to 04/01/87 23:00

| Time | Data | Time | Data | Time | Data | Time | Data |
|---|---|---|---|---|---|---|---|
| 1700 | 224.88 | | | | | | |
| 1800 | 225.08 | | | | | | |
| 1900 | 224.90 | | | | | | |
| 2000 | 225.07 | | | | | | |
| 2100 | 224.93 | | | | | | |
| 2200 | 224.89 | | | | | | |
| 2300 | 225.04 | | | | | | |

L.0002

PRINTED FOR: DICK FROM SYSTEM LU: 012

02:54 PM TUE., 21 JULY, 1987

07/21/87 14:52 SOUTHWESTERN PORTLAND CEMENT COMPANY
HP1000-BECKMAN DATA ACQUISITION SYSTEM
Hour Interval Report

PV: FIC-309 Description: K2 FEED RATE Units: TPH
Report Date-time range: 03/31/87 01:00 to 04/01/87 23:00
Screen Date-time range: 04/01/87 17:00 to 04/01/87 23:00

| Time | Data | Time | Data | Time | Data | Time | Data |
|---|---|---|---|---|---|---|---|
| 1700 | 224.88 | | | | | | |
| 1800 | 225.08 | | | | | | |
| 1900 | 224.90 | | | | | | |
| 2000 | 225.07 | | | | | | |

07/21/87 15:03

SOUTHWESTERN PORTLAND CEMENT COMPANY
HP1000-BECKMAN DATA ACQUISITION SYSTEM
Hour Interval Report

PV: FIC-472 Description: PYROCOAL RATE Units: TPH
Report Date-time range: 03/31/87 01:00 to 04/01/87 23:00
Screen Date-time range: 03/31/87 01:00 to 04/01/87 16:00

| Time | Data | Time | Data | Time | Data | Time | Data |
|---|---|---|---|---|---|---|---|
| 0100 | 8.50 | 1100 | 8.60 | 2100 | 8.60 | 0700 | 8.60 |
| 0200 | 8.50 | 1200 | 8.60 | 2200 | 8.60 | 0800 | 8.60 |
| 0300 | 8.50 | 1300 | 8.60 | 2300 | 8.60 | 0900 | 8.6 8.60 |
| 0400 | 8.50 | 1400 | 8.60 | 0000 | 8.60 | 1000 | 8.60 |
| 0500 | 8.50 | 1500 | 8.6 8.60 | 0100 | 8.60 | 1100 | 8.60 |
| 0600 | 8.50 | 1600 | 8.60 | 0200 | 8.57 | 1200 | 8.60 |
| 0700 | 8.50 | 1700 | 8.60 | 0300 | 8.50 | 1300 | 8.60 |
| 0800 | 2.83 | 1800 | 8.60 | 0400 | 8.57 | 1400 | 8.6 8.60 |
| 0900 | 5.72 | 1900 | 8.60 | 0500 | 8.60 | 1500 | 8.60 |
| 1000 | 8.52 | 2000 | 8.60 | 0600 | 8.58 | 1600 | 8.60 |



07/21/87 15:03

SOUTHWESTERN PORTLAND CEMENT COMPANY
HP1000-BECKMAN DATA ACQUISITION SYSTEM
Hour Interval Report

PV: FIC-472 Description: PYROCOAL RATE Units: TPH
Report Date-time range: 03/31/87 01:00 to 04/01/87 23:00
Screen Date-time range: 04/01/87 17:00 to 04/01/87 23:00

| Time | Data | Time | Data | Time | Data | Time | Data |
|---|---|---|---|---|---|---|---|
| 1700 | 8.60 | | | | | | |
| 1800 | 8.60 | | | | | | |
| 1900 | 8.60 | | | | | | |
| 2000 | 8.60 | | | | | | |
| 2100 | 8.68 | | | | | | |
| 2200 | 8.70 | | | | | | |
| 2300 | 8.61 | | | | | | |



07/21/87 15:06

SOUTHWESTERN PORTLAND CEMENT COMPANY
HP1000-BECKMAN DATA ACQUISITION SYSTEM
Hour Interval Report

PV: FIC-472 Description: PYROCOAL RATE Units: TPH

Report Date-time range: 03/31/87 01:00 to 04/01/87 23:00
Screen Date-time range: 03/31/87 01:00 to 04/01/87 16:00

Kiln- Coal Rate

| Time | Data | Time | Data | Time | Data | Time | Data |
|---|---|---|---|---|---|---|---|
| 0100 | 7.49 | 1100 | 7.49 | 2100 | 7.46 | 0700 | 7.49 |
| 0200 | 7.49 | 1200 | 7.49 | 2200 | 7.49 | 0800 | 7.48 |
| 0300 | 7.49 | 1300 | 7.49 | 2300 | 7.49 | 0900 | 7.45 |
| 0400 | 7.49 | 1400 | 7.49 | 0000 | 7.49 | 1000 | 7.45 |
| 0500 | 7.49 | 1500 | 7.49 | 0100 | 7.49 | 1100 | 7.45 |
| 0600 | 7.49 | 1600 | 7.44 | 0200 | 7.40 | 1200 | 7.45 |
| 0700 | 7.49 | 1700 | 7.39 | 0300 | 7.38 | 1300 | 7.41 |
| 0800 | 5.06 | 1800 | 7.39 | 0400 | 7.45 | 1400 | 7.47 |
| 0900 | 7.03 | 1900 | 7.39 | 0500 | 7.42 | 1500 | 7.49 |
| 1000 | 7.48 | 2000 | 7.39 | 0600 | 7.49 | 1600 | 7.49 |

7.45 7.45 7.46

L.0001

07/21/87 15:06

SOUTHWESTERN PORTLAND CEMENT COMPANY
HP1000-BECKMAN DATA ACQUISITION SYSTEM
Hour Interval Report

PV: FIC-471 Description: K2 COAL RATE Units: TPH
Report Date-time range: 03/31/87 01:00 to 04/01/87 23:00
Screen Date-time range: 04/01/87 17:00 to 04/01/87 23:00

| Time | Data | Time | Data | Time | Data | Time | Data |
|---|---|---|---|---|---|---|---|
| 1700 | 7.49 | | | | | | |
| 1800 | 7.49 | | | | | | |
| 1900 | 7.46 | | | | | | |
| 2000 | 7.39 | | | | | | |
| 2100 | 7.39 | | | | | | |
| 2200 | 7.39 | | | | | | |
| 2300 | 7.39 | | | | | | |

L.0002

07/21/87 15:08

SOUTHWESTERN PORTLAND CEMENT COMPANY
HP1000-BECKMAN DATA ACQUISITION SYSTEM
Hour Interval Report

PV: MMBTU2 Description: KL #2 MBTU/TON Units: MBTU
Report Date-time range: 03/31/87 01:00 to 04/01/87 23:00
Screen Date-time range: 03/31/87 01:00 to 04/01/87 16:00

| Time | Data | Time | Data | Time | Data | Time | Data |
|---|---|---|---|---|---|---|---|
| 0100 | 3.35 | 1100 | 3.37 | 2100 | 3.36 | 0700 | 3.37 |
| 0200 | 3.35 | 1200 | 3.37 | 2200 | 3.37 | 0800 | 3.37 |
| 0300 | 3.35 | 1300 | 3.37 | 2300 | 3.37 | 0900 | 3.36 |
| 0400 | 3.35 | 1400 | 3.37 | 0000 | 3.37 | 1000 | 3.36 |
| 0500 | 3.35 | 1500 | 3.37 | 0100 | 3.37 | 1100 | 3.36 |
| 0600 | 3.35 | 1600 | 3.36 | 0200 | 3.35 | 1200 | 3.36 |
| 0700 | 3.35 | 1700 | 3.35 | 0300 | 3.33 | 1300 | 3.35 |
| 0800 | 3.70 | 1800 | 3.35 | 0400 | 3.36 | 1400 | 3.37 |
| 0900 | 3.92 | 1900 | 3.35 | 0500 | 3.36 | 1500 | 3.37 |
| 1000 | 3.43 | 2000 | 3.35 | 0600 | 3.37 | 1600 | 3.37 |

3.37

L.0001

Coal Weekly Composite — As Rcd
1987
March 27 — 12,978 BTU
April 3, — 13,061

13,061 = 26.122 MMBTU/T

| | Test #1 | #2 | #3 | Avg |
|---|---|---|---|---|
| #NOx/MMBTU | 1.93 | 1.96 | 1.88 | 1.92 |

Test #1
NOx @ 908.28 #/hr
(a) = 1.922 #NOx/mmBTU
(b) = 1.976 "
.054

(a) $16.05\ T/hr \times 26.2\ mmBTU/T = 420.51\ mmBTU/hr$

(b) $3.37\ MMBTU/T \times 121.4\ T/hr = 409.12\ mmBTU/hr$

04/21/87 13:08 SOUTHWESTERN PORTLAND CEMENT COMPANY

HP1000-BECKMAN DATA ACQUISITION SYSTEM

Hour Interval Report

PV: MMBTU2 Description: KL #2 MBTU/TON Units: MBTU

Report Date-time range: 03/31/87 01:00 to 04/01/87 23:00

Screen Date-time range: 04/01/87 17:00 to 04/01/87 23:00

| Time | Data | Time | Data | Time | Data | Time | Data |
|---|---|---|---|---|---|---|---|
| 1700 | 3.37 | | | | | | |
| 1800 | 3.37 | | | | | | |
| 1900 | 3.36 | | | | | | |
| 2000 | 3.35 | | | | | | |
| 2100 | 3.37 | | | | | | |
| 2200 | 3.37 | | | | | | |
| 2300 | 3.35 | | | | | | |

L.0002

$$Clinker = \frac{KF \times .89}{1.65} = 0.539394 \times KF$$