Stack Test Report # 7

| | |
|---|---|
| AP-42 Section | 9.12.1 |
| Reference | 9 |
| Report Sect. | 4 |
| Reference | 17 |

Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

# STACK EMISSIONS SURVEY
# ADOLPH COORS COMPANY
# BREWERY COMPLEX
# GOLDEN, COLORADO

NOVEMBER 1990

FILE NUMBER 9010-204

Prepared By:

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STACK EMISSIONS SURVEY
ADOLPH COORS COMPANY
BREWERY COMPLEX
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## INTRODUCTION

Western Environmental Services and Testing, Inc. (WEST, Inc.) of Casper, Wyoming conducted a Stack Emissions Survey at Adolph Coor's Company's Brewery Complex located in Golden, Colorado, on November 5 and 6, 1990. The purpose of this survey was to determine the emissions of particulate matter, sulfur dioxide, oxides of nitrogen, and total hydrocarbons from the Combined Cooker Stack and Brew Kettle Stack.

The sampling followed the procedures set forth in the Code of Federal Regulations, Title 40, Chapter I, Part 60, Appendix A, methods 1, 2, 3, 4, 5, modified 6, 7E, and 25A.

Persons present during sampling were:

| | |
|---|---|
| Adolph Coors Company | Ms. Jere Zimmerman<br>Mr. Mark Ivie<br>Mr. Clyde Messersmith |
| Western Environmental | Mr. James Meador<br>Mr. Mike Reynolds<br>Mr. Matt Tikka |

## SUMMARY OF RESULTS

### Combined Cooker Stack

The principal conclusions are:

1. The emissions of particulate matter from the Cooker Stack were equal to 0.130 pounds per hour (0.0034 grains per dry standard cubic foot), based on the average of the "front-half" collections of the three tests for particulates.

2. The emissions of total hydrocarbons (as propane, less methane and ethane) from the Cooker Stack were equal to 0.08 pounds per hour (2.5 parts per million), based on the average of the three tests.

3. The emissions of sulfur dioxide were equal to <0.01 pounds per hour (<0.2 parts per million), based on the average of the three tests.

4. The emissions of oxides of nitrogen were less than 0.03 pounds per hour (<1.0 parts per million), based on the average of the three tests.

## SUMMARY OF RESULTS

Brew Kettle Stack
(Heat Reclaim On)

The principal conclusions are:

1. The emissions of particulate matter from the Brew Kettle Stack were equal to 0.227 pounds per hour (0.0022 grains per dry standard cubic foot), based on the average of the "front-half" collections of the three tests for particulates.

2. The emissions of total hydrocarbons (as propane, less methane and ethane) from the Brew Kettle Stack were equal to 0.69 pounds per hour (8.3 parts per million), based on the average of the three tests.

3. The emissions of sulfur dioxide were equal to 0.03 pounds per hour (0.3 parts per million), based on the average of the three tests.

4. The emissions of oxides of nitrogen were less than 0.09 pounds per hour (<1 part per million), based on the average of the three tests.

## SUMMARY OF RESULTS

### Brew Kettle Stack
### (Heat Reclaim Off)

The principal conclusions are:

1. The emissions of particulate matter from the Brew Kettle Stack were equal to 0.46 pounds per hour (0.0045 grains per dry standard cubic foot), based on the average of the "front-half" collections of the three tests for particulates.

2. The emissions of total hydrocarbons (as propane, less methane and ethane) from the Brew Kettle Stack were equal to 0.98 pounds per hour (11.9 parts per million), based on the average of the three tests.

3. The emissions of sulfur dioxide were not detectable (N.D.) based on the average of the three tests.

4. The emissions of oxides of nitrogen were less than 0.09 pounds per hour (1.0 parts per million), based on the average of the three tests.

SUMMARY OF RESULTS

Combined Cooker Stack

| Run Number | | 1 | 2 | 3 |
|---|---|---|---|---|
| Stack Flow Rate - ACFM | | 5955 | 7104 | 6758 |
| Stack Flow Rate - DSCFM* | | 4187 | 4898 | 4432 |
| % Water Vapor - % Volume | | 7.45 | 8.82 | 12.23 |
| % CO2 - % Volume | | <0.2 | <0.2 | <0.2 |
| % O2 - % Volume | | 20.9 | 20.9 | 20.9 |
| % Excess Air At Sampling Point | | ---- | ---- | ---- |
| Particulates<br>Probe, Cyclone & Filter Catch<br>grains/dscf* | (Can) | 0.0040 | 0.0019 | 0.0043 |
| grains/cf at Stack Conditions | (Cat) | 0.0028 | 0.0013 | 0.0028 |
| lbs/hr | (Caw) | 0.144 | 0.080 | 0.165 |
| Oxides of Nitrogen | ppm | <1.0 | <1.0 | <1.0 |
| | lbs/hr | <0.03 | <0.04 | <0.03 |
| Total Hydrocarbons as Propane (less methane and ethane) | ppm | 0.2 | 3.2 | 4.2 |
| | lbs/hr | <0.01 | 0.11 | 0.13 |
| Sulfur Dioxide | ppm | 0.4 | ND | ND |
| | lbs/hr | 0.02 | ND | ND |
| | | | | |
| | | | | |

* 68 Deg. F., 29.92 "Hg (20 Deg. C., 760 mm Hg)

SUMMARY OF RESULTS

Brew Kettle Stack
(Heat Reclaim On)

| Run Number | | 1 | 2 | 3 |
|---|---|---|---|---|
| Stack Flow Rate - ACFM | | 19241 | 20153 | 24127 |
| Stack Flow Rate - DSCFM* | | 11019 | 11905 | 13610 |
| % Water Vapor - % Volume | | 20.46 | 18.82 | 21.45 |
| % CO2 - % Volume | | <0.2 | <0.2 | <0.2 |
| % O2 - % Volume | | 20.9 | 20.9 | 20.9 |
| % Excess Air At Sampling Point | | ----- | ----- | ----- |
| Particulates<br><u>Probe, Cyclone & Filter Catch</u><br>grains/dscf* | (Can) | 0.0029 | 0.0025 | 0.0013 |
| grains/cf at Stack Conditions | (Cat) | 0.0017 | 0.0015 | 0.0007 |
| lbs/hr | (Caw) | 0.278 | 0.254 | 0.150 |
| Oxides of Nitrogen | ppm | <1.0 | <1.0 | <1.0 |
| | lbs/hr | <0.08 | <0.08 | <0.10 |
| Total Hydrocarbons as Propane (less methane and ethane) | ppm | 8.6 | 8.6 | 7.6 |
| | lbs/hr | 0.65 | 0.70 | 0.71 |
| Sulfur Dioxide | ppm | 0.4 | 0.4 | 0.2 |
| | lbs/hr | 0.04 | 0.05 | 0.03 |
| | | | | |
| | | | | |

* 68 Deg. F., 29.92 "Hg (20 Deg. C., 760 mm Hg)

## SUMMARY OF RESULTS

Brew Kettle Stack
(Heat Reclaim Off)

| Run Number | | 4 | 5 | 6 |
|---|---|---|---|---|
| Stack Flow Rate - ACFM | | 25706 | 23022 | 21652 |
| Stack Flow Rate - DSCFM* | | 14086 | 11797 | 10810 |
| % Water Vapor - % Volume | | 23.34 | 27.54 | 29.24 |
| % CO2 - % Volume | | <0.2 | <0.2 | <0.2 |
| % O2 - % Volume | | 20.9 | 20.9 | 20.9 |
| % Excess Air At Sampling Point | | ----- | ----- | ----- |
| Particulates<br>Probe, Cyclone & Filter Catch<br>grains/dscf* | (Can) | 0.0039 | 0.0027 | 0.0068 |
| grains/cf at Stack Conditions | (Cat) | 0.0021 | 0.0014 | 0.0034 |
| lbs/hr | (Caw) | 0.468 | 0.275 | 0.627 |
| Oxides of Nitrogen | ppm | <1.0 | <1.0 | <1.0 |
| | lbs/hr | 0.10 | <0.08 | <0.08 |
| Total Hydrocarbons as Propane (less methane and ethane) | ppm | 8.6 | 13.6 | 13.6 |
| | lbs/hr | 0.83 | 1.10 | 1.01 |
| Sulfur Dioxide | ppm | ND | ND | ND |
| | lbs/hr | ND | ND | ND |
| | | | | |
| | | | | |

* 68 Deg. F., 29.92 "Hg (20 Deg. C., 760 mm Hg)

## DISCUSSION OF RESULTS

### Combined Cooker Stack

Due to the operations on the Brew Kettle floor, flow rates and emissions varied considerably. The three tests for particulates taken on the stack appeared to be valid representations of the actual emissions during the testing. The indicative parameters calculated from the field data were in close agreement. The moisture percentages were within 28.7 percent of the mean value. The measured flow rates (Qs) were within 8.7 percent of the mean value. The rates of sampling for the three tests were within the specified limits of the isokinetic rate, the greatest deviation being 5.7 percent.

The calculated front-half emissions (pounds per hour) of particulates from the tests showed a range of +0.04 to -0.38 pounds per hour variation from the mean value.

### Brew Kettle Stack - Heat Reclaim On

Due to the operations on the Brew Kettle floor, flow rates and emissions varied considerably. The three tests for particulates taken on the stack appeared to be valid representations of the actual emissions during the testing. The indicative parameters calculated from the field data were in close agreement. The moisture percentages were within 7.0 percent of the mean value. The measured flow rates (Qs) were within 11.8 percent of the mean value. The rates of sampling for the three tests were well within the specified limits of the isokinetic rate, the greatest deviation being 5.1 percent.

The calculated front-half emissions (pounds per hour) of particulates from the tests showed a range of +0.05 to -0.08 pounds per hour variation from the mean value.

Brew Kettle Stack - Heat Reclaim Off

Due to the operations on the Brew Kettle floor, flow rates and emissions varied considerably. The three tests for particulates taken on the stack appeared to be valid representations of the actual emissions during the testing. The indicative parameters calculated from the field data were in close agreement. The moisture percentages were within 12.6 percent of the mean value. The measured flow rates (Qs) were within 15.2 percent of the mean value. The rates of sampling for the three tests were well within the specified limits of the isokinetic rate, the greatest deviation being 8.8 percent.

The calculated front-half emissions (pounds per hour) of particulates from the tests showed a range of +0.37 to -0.18 pounds per hour variation from the mean value.

Oxides of nitrogen were sampled using EPA Method 7E. The analyzer demonstrated excellent calibration following the method. The emissions from the stack were at or below the limits of the monitor.

Sulfur dioxide was sampled simultaneous with the particulate runs. The emissions from the stack were at, or below the detection limits of the method.

Total Hydrocarbons were sampled using EPA Method 25A. Integrated bag samples were pulled during each run and analyzed on a gas chromatograph for methane and ethane. The bag samples showed some methane and ethane levels in the stacks. These values were corrected to propane and deleted from the hydrocarbon analyzer readings.

## DESCRIPTION OF SAMPLING LOCATION

### Combined Cooker

The sampling ports are located on the circular exhaust stack on the seventh floor of the Brewery Complex building. The sampling was done from two ports on the circular stack located more than 8 diameters downstream of a disturbance and more than 2 diameters upstream of the outlet. The area of the stack is 804 square inches. Port and wall thickness is 1/16 inch.

### Brew Kettle Stack

The sampling ports are located on the circular exhaust stack on the seventh floor of the Brewery Complex Building. The sampling was done from two ports on the circular stack located more than 8 diameters downstream of a disturbance and more than 2 diameters upstream of the butterfly damper. The area of the stack is 5945 square inches. Port and wall thickness is 1/8 inches.

## SAMPLING AND ANALYTICAL PROCEDURES

The sampling and analytical procedures used followed the procedures outlined in the Code of Federal Regulations, Title 40, Chapter I, Part 60, Appendix A, methods 1, 2, 3, 4, 5, modified 6, 7E, 18, and 25A.

### Combined Cooker Stack

A preliminary velocity traverse was performed at each of the two ports in order to determine the uniformity of flow in the stack. Particulate samples of 5 minute duration at each of the six traverse points were taken from the two ports using an EPA-type, heated, glass lined probe. A total of 12 points were sampled.

### Brew Kettle Stack

A preliminary velocity traverse was performed at each of the two ports in order to determine the uniformity of flow in the stack. Particulate and sulfur dioxide samples of 5 minute duration at each of the six traverse points were taken from the two ports using an EPA-type, heated, glass-lined probe. A total of 12 points were sampled. Oxides of nitrogen, and total hydrocarbon samples were taken simultaneously with the particulate runs using methods 7E, and 25A respectively. Integrated 22 liter bag samples were taken simultaneously with each run for methane and ethane analyses by method 18. Flow rates on the stack indicated periods or locations of downdrafting within the stack.

Before each test, on all of the stacks, the sampling train was leak-checked at 15 inches of mercury at the nozzle. After each test the train was again leak-checked at the nozzle at more than the highest recorded vacuum reading during the test. Final leak-checking was performed in order to predetermine the possibility of a diluted sample.

Before and after each test period, the pitot lines were checked for leaks under both a vacuum and pressure. Also the lines were checked for clearance and the zero manometer reading verified, before and after each test.

The particulate emissions were calculated from gravimetric analysis using the front-half collections of the EPA-type sampling train in accordance with the EPA "New Source Performance Standards".

Orsat analyses were performed for each test using an integrated sample.

## DESCRIPTION OF TESTS

Personnel from WEST, Inc. arrived at the Adolph Coors Brewery Complex at 1400 hours on Monday, November 5, 1990. After meeting with plant personnel, the equipment was set up on the Combined Cooker Stack and secured for the night at 1900 hours.

On Tuesday, November 6, 1990 personnel arrived at the plant at 0530 hours. Preliminary data were taken and the equipment readied for testing, by 0600 hours. The testing began at 0630 hours and continued without difficulty until the completion of three runs at 1117 hours. The equipment was moved over to the Brew Kettle Stack by 1230 hours.

The equipment was readied for testing on the Brew Kettle Stack by 1330 hours. Testing of the Brew Kettle Stack with the heat reclaim system on, began at 1336 hours and continued without difficulty until the completion of three runs at 1924 hours. A two hour delay between run one and two was due to brew kettle operation.

The Brew Kettle Stack heat reclaim system was turned off and the stack allowed to reach equilibrium. The test equipment was readied by 2030 hours. Testing began at 2050 hours and continued without difficulty until the completion of three runs at 0034 hours on Wednesday, November 7, 1990. The equipment was secured for the night at 0100 hours.

On Wednesday, November 7, personnel arrived at the plant at 0900 hours. The equipment was moved out of the Brewery Complex building and placed elsewhere for further testing.

All of the samples which had been recovered immediately after each run, were placed in the middle laboratory.

Testing at Adolph Coor's Company's Brewery Complex located in Golden, Colorado, was completed at 1200 hours on Wednesday, November 7, 1990.

| | |
|---|---|
| James E. Meador, Jr. | Alan D. Roylance |
| Vice President | Manager of Operations |

APPENDICES

A. Location of Sampling Points

B. Source Emissions Calculations

C. Calibration of Equipment

D. Field Testing Data

E. Analytical Data

F. Chain of Custody and Analysis Request

G. Resumes of Test Personnel

# APPENDIX A

Location of Sampling Points

## APPENDIX A

### Location of Sampling Points
### Combined Cooker

The sampling ports are located on the seventh floor of the Brewery Complex Building. The locations of the sampling points were calculated as follows:

Inside Stack Diameter = 32 inches

Port and Wall Thickness = 1/16 inch

Area of Stack = 804 square inches

| Point Number | Percent of Diameter From Wall | Distance From Wall (inches) |
|---|---|---|
| 1 | 4.4 | 1- 3/8 |
| 2 | 14.6 | 4-11/16 |
| 3 | 29.6 | 9- 1/2 |
| 4 | 70.4 | 22- 1/2 |
| 5 | 85.4 | 27- 5/16 |
| 6 | 95.6 | 30- 5/8 |

## APPENDIX A

### Location of Sampling Points
### Brew Kettle Stack

The sampling ports are located on the seventh floor of the Brewing Kettle Stack. The locations of the sampling points were calculated as follows:

| | |
|---|---|
| Inside Stack Diameter | = 87 inches |
| Port and Wall Thickness | = 1/8 inch |
| Area of Stack | = 5945 square inches |

| Point Number | Percent of Diameter From Wall | Distance From Wall (inches) |
|---|---|---|
| 1 | 4.4 | 3-13/16 |
| 2 | 14.6 | 12-11/16 |
| 3 | 29.6 | 25- 3/4 |
| 4 | 70.4 | 61- 1/4 |
| 5 | 85.4 | 74- 5/16 |
| 6 | 95.6 | 83- 3/16 |

APPENDIX B

Source Emission Calculations

## SAMPLE CALCULATIONS

$$CO\ ppm \times 4.361 \times 10^{-6} \times Q_s = lbs/hr\ CO$$

$$NO_x\ ppm \times 7.164 \times 10^{-6} \times Q_s = lbs/hr\ NO_x$$

$$THC\ ppm \times 6.856 \times 10^{-6} \times Q_s = lbs/hr\ THC$$

## Nomenclature for Particulate Calculations

| Symbol | English Units | Metric Units | Description |
|---|---|---|---|
| $A_s$ | in.$^2$ | $m^2$ | Stack Area |
| $C_{an}$ | gr/dscf | g/dscm | Particulate - Probe, Cyclone and Filter |
| $C_{ao}$ | gr/dscf | g/dscm | Particulate - Total |
| $C_{at}$ | gr/CF @ Stack Conditions | $g/m^3$ | Particulate - Probe, Cyclone and Filter |
| $C_{au}$ | gr/CF @ Stack Conditions | $g/m^3$ | Particulate - Total |
| $C_{aw}$ | lbs/hr | kg/hr | Particulate - Probe, Cyclone and Filter |
| $C_{ax}$ | lbs/hr | kg/hr | Particulate - Total |
| $C_p$ | | | Pitot Tube Calibration Factor |
| $D_n$ | in. | m | Sampling Nozzle Diameter |
| %EA | | | Percent Excess Air At Sampling Point |
| g | 32.2 ft/sec$^2$ | | Acceleration of Gravity |
| %I | | | Percent Isokinetic |
| %M | | | Percent Moisture in the Stack Gas by Volume |

* 528° R, 29.92 "Hg (20°C, 760 mm Hg)

| Symbol | English Units | Metric Units | Description |
|---|---|---|---|
| $M_d$ | | | Mole Fraction of Dry Gas |
| mf | mg | mg | Particulate - Probe, Cyclone and Filter |
| $M_{H_2O}$ | 18 lb/lb-mole | | Molecular Weight of Water |
| $m_t$ | mg | mg | Particulate - Total |
| $MW_{air}$ | lb/lb-mole | g/g-mole | Molecular Weight Of Stack Gas |
| MW | 28.95 lb/ lb-mole | | Molecular Weight Of Air |
| $MW_d$ | lb/lb-mole | g/g-mole | Molecular Weight Of Dry Stack Gas |
| $P_b$ | "Hg Absolute | mm Hg | Barometric Pressure |
| $P_m$ | "$H_2O$ | mm $H_2O$ | Orifice Pressure Drop |
| $P_s$ | "Hg Absolute | mm Hg | Stack Pressure |
| $\Delta P_s$ | "$H_2O$ | mm $H_2O$ | Velocity Head of Stack Gas |
| $P_{std}$ | 29.92 "Hg | 760 mm Hg | Standard Barometric Pressure |
| $Q_a$ | ACFM | $m^3$/hr | Stack Gas Volume At Actual Stack Conditions |
| $Q_s$ | DSCFM | dscm/hr | Stack Gas Volume At 29.92 "Hg, 528°R, Dry |
| R | 21.83 "Hg $ft^3$/lb-mole-°R | | Universal Gas Constant |

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)

| Symbol | English Units | Metric Units | Description |
|---|---|---|---|
| $T_m$ | °F | °C | Average Gas Meter Temperature |
| $T_t$ | min | min | Net Time of Test |
| $T_s$ | °F | °C | Stack Temperature |
| $T_{std}$ | 528°R | 293°K | Standard Temperature |
| $V_m$ | $ft^3$ | $m^3$ | Volume of Dry Gas Sampled @ Meter Conditions |
| $V_{m_{std}}$ | dscf | dscm | Volume of Dry Gas Sampled @ Standard Conditions |
| $V_s$ | fpm | m/sec | Stack Velocity @ Stack Conditions |
| $V_w$ | ml | ml | Total water Collected in Impingers And Silica Gel |
| $V_{w_{gas}}$ | scf | scm | Volume of Water Vapor Collected @ Standard Conditions |
| $\rho_{air}$ | 0.0748 $lbs/ft^3$ | | Density of Air |
| $\rho_{H_2O}$ | 1 g/ml | | Density of Water |
| $\rho_{man}$ | 51.63 $lbs/ft^3$ | | Density of Manometer Oil |

Standard Conditions: 68°F, 29.92 "Hg (20°C, 760 mm Hg)

## Example Particulate Calculations

1. Volume of Dry Gas Sampled At Standard Conditions.*

$$V_{m_{std}} = V_m \left[ \frac{T_{std}}{T_m + 460} \right] \left[ \frac{P_b + \frac{P_m}{13.6}}{P_{std}} \right]$$

$$V_{m_{std}} = 17.65\ V_m \left[ \frac{P_b + \frac{P_m}{13.6}}{T_m + 460} \right] = \text{dscf}$$

$$V_{m_{std}} = \text{dscf} \times 0.028317 - \text{dscm}$$

2. Volume of Water Vapor Collected At Standard Conditions.*

$$V_{w_{gas}} = \frac{(V_w - \text{gms } SO_2 - \text{gms } H_2S)\ \rho_{H_2O}\ R\ T_{std}}{P_{std}\ M_{H_2O}\ 453.6}$$

$$V_{w_{gas}} = 0.0472\ (V_w - \text{gms } SO_2 - \text{gms } H_2S) = \text{scf}$$

$$V_{w_{gas}} = \text{scf} \times 0.028317 = \text{scm}$$

3. Percent Moisture in Stack Gas.

$$\%M = \frac{V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}} \times 100 = \%$$

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)

4. Mole Fraction of Dry Gas.

$$M_d = \frac{100 - \%M}{100}$$

5. Average Molecular Weight of Dry Stack Gas.

$$MW_d = \left(\%CO_2 \times \frac{44}{100}\right) + \left(\%O_2 \times \frac{32}{100}\right) + \left(\%N_2 \times \frac{28}{100}\right) + \left(\%CO \times \frac{28}{100}\right) = \text{lb/lb-mole}$$
$$= \text{g/g-mole}$$

6. Molecular Weight of Stack Gas.

$$MW = MW_d \times M_d + 18\ (1-M_d) = \frac{\text{lb}}{\text{lb-mole}} = \text{g/g-mole}$$

7. Percent Excess Air At Sampling Point.

$$\%EA = \frac{100\ (\%O_2 - 0.5\%\ CO)}{0.265\ (\%N_2) - (\%O_2) + 0.5\ (\%CO)}$$

8. Stack Pressure.

$$P_s = P_b + \frac{\text{stack pressure "}H_2O}{13.6} = \text{"Hg Absolute}$$

$$P_s = \text{"Hg Abs.} \times 25.4 = \text{mm Hg}$$

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)

9. Stack Velocity At Stack Conditions.

$$V_s = C_p \, 60 \left[ \frac{2g \times \rho_{man} \times P_{std} \times MW_{air} \times (T_s + 460) \times \Delta P_s}{12 \times \rho_{air} \times P_s \times MW \times T_{std}} \right]^{1/2}$$

$$V_s = 5123.8 \, C_p \left[ \frac{(T_s + 460)}{P_s \times MW} \right]^{\frac{1}{2}} \times \text{Average} \left[ (\Delta P)^{\frac{1}{2}} \right] = \text{fpm}$$

$$V_s = \text{fpm} \times 0.00508 = \text{m/sec}$$

10. Dry Stack Gas Volume At Standard Conditions.*

$$Q_s = \frac{1}{144} V_s \times A_s \times M_d \times \frac{T_{std}}{T_s + 460} \times \frac{P_s}{P_{std}}$$

$$Q_s = \frac{0.123 \, V_s \times A_s \times M_d \times P_s}{T_s + 460} = \text{DSCFM}$$

$$Q_s = \text{DSCFM} \times 1.6990 = \text{dscm/hr}$$

11. Actual Stack Gas Volume At Stack Conditions.

$$Q_a = \frac{V_s \times A_s}{144} = \text{ACFM}$$

$$Q_a = \text{ACFM} \times 1.6990 = \text{m}^3\text{/hr}$$

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)

12. Percent Isokinetic

$$\%I = \frac{V_{m_{std}} \times (T_s + 460) \times P_{std} \times 100 \times 144}{M_d \times T_{std} \times P_s \times T_t \times V_s \times \frac{\pi D_n^2}{4}}$$

$$\%I = \frac{1039\ V_{m_{std}} \times (T_s + 460)}{M_d \times P_s \times T_t \times V_s\ D_n^2}$$

13. Particulate - Probe, Cyclone, and Filter.

$$C_{an} = \frac{m_f}{V_{m_{std}}} \times \frac{1\ gr}{64.8\ mg}$$

$$C_{an} = 0.0154\ \frac{m_f}{V_{m_{std}}} = gr/dscf$$

$$C_{an} = gr/dscf \times 2.290 = g/dscm$$

14. Particulate - Total.

$$C_{ao} = 0.0154 \times \frac{m_t}{V_{m_{std}}} = gr/dscf$$

$$C_{ao} = gr/dscf \times 2.290 = g/dscm$$

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)

15. Particulate - Probe, Cyclone, and Filter At Stack Conditions.

$$C_{at} = C_{an} \times \frac{P_s}{P_{std}} \times \frac{(T_{std})}{(T_s + 460)} \times M_d$$

$$C_{at} = \frac{17.65 \times C_{an} \times P_s \times M_d}{T_s + 460} = gr/CF$$

$$C_{at} = gr/CF \times 2.290 = g/m^3$$

16. Particulate - Total, At Stack Conditions.

$$C_{au} = \frac{17.65 \times C_{ao} \times P_s \times M_d}{T_s + 460} = gr/CF$$

$$C_{au} = gr/CF \times 2.290 = g/m^3$$

17. Particulate - Probe, Cyclone, and Filter.

$$C_{aw} = C_{an} \times Q_s \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{1 \text{ lb}}{7000 \text{ gr}}$$

$$C_{aw} = 0.00857 \times C_{an} \times Q_s = lbs/hr$$

$$C_{aw} = lbs/hr \times 0.4536 = kg/hr$$

18. Particulate - Total.

$$C_{ax} = 0.00857 \times C_{ao} \times Q_s = lbs/hr$$

$$C_{ax} = lbs/hr \times 0.4536 = kg/hr$$

* 528°R, 29.92 "Hg (20°C, 760 mm Hg)

COORS BREWING COMPANY
GOLDEN, COLORADO

COMBINED COOKER STACK

FILE NO. 9010-204

SOURCE EMISSION CALCULATIONS

| Symbol | Description | Units | COOKER | COOKER | COOKER |
|---|---|---|---|---|---|
| Run No. | | | 1 | 2 | 3 |
| Date | | | 11/06/90 | 11/06/90 | 11/06/90 |
| Begin | | | 0630 MST | 0833 MST | 1015 MST |
| End | | | 0755 MST | 0935 MST | 1117 MST |
| Pb | barometric pressure | "Hg Abs.<br>(mm Hg) | 24.24<br>615.70 | 24.24<br>615.70 | 24.24<br>615.70 |
| Pm | orifice pressure drop | "H2O<br>(mm H2O) | 2.13<br>54.12 | 2.91<br>73.91 | 2.57<br>65.19 |
| Vm | volume dry gas sampled @ meter conditions | cu. ft.<br>(cu. m.) | 58.413<br>1.654 | 70.251<br>1.989 | 65.311<br>1.849 |
| Tm | avg. gas meter temp | deg. F<br>(deg. C) | 82<br>28 | 86<br>30 | 86<br>30 |
| Vmstd | volume dry gas sampled @ standard conditions* | dscf<br>(dscm) | 46.368<br>1.313 | 55.546<br>1.573 | 51.536<br>1.459 |
| Vw | total H2O collected, impingers & silica gel | ml | 79.1 | 113.8 | 152.2 |
| Vwgas | volume water vapor collected @ standard conditions* | scf<br>(scm) | 3.734<br>.106 | 5.371<br>.152 | 7.184<br>.203 |
| %M | moisture in stack gas by volume | % | 7.45 | 8.82 | 12.23 |

* 68 deg. F., 29.92 "Hg (20 deg. C., 760 mm Hg)

Source Emission Calculations

COORS BREWING COMPANY
FILE NO. 9010-204

| Symbol | Description | Units | COOKER | COOKER | COOKER |
|---|---|---|---|---|---|
| Run No. | | | 1 | 2 | 3 |
| Md | mole fraction of dry gas | ------- | .9255 | .9118 | .8777 |
| CO2 | | % | .0 | .0 | .0 |
| O2 | | % | 20.9 | 20.9 | 20.9 |
| N2 | | % | 79.1 | 79.1 | 79.1 |
| %EA | excess air @ sampling point | % | --- | --- | --- |
| MWd | molecular weight of dry stack gas | lb/lb-mole<br>(g/g-mole) | 28.84<br>28.84 | 28.84<br>28.84 | 28.84<br>28.84 |
| MW | molecular weight of stack gas | lb/lb-mole<br>(g/g-mole) | 28.03<br>28.03 | 27.88<br>27.88 | 27.51<br>27.51 |
| dPs | velocity head of stack gas | "H2O<br>(mm H2O) | .077<br>1.95 | .106<br>2.69 | .093<br>2.37 |
| Ts | stack temperature | deg. F<br>(deg. C) | 105<br>41 | 108<br>42 | 114<br>46 |
| Ps | stack pressure | "Hg Abs.<br>(mm Hg) | 24.23<br>615.51 | 24.23<br>615.51 | 24.23<br>615.51 |
| Vs | stack velocity @ stack conditions | fpm<br>(m/sec) | 1067<br>5.42 | 1272<br>6.46 | 1210<br>6.15 |
| As | stack area | sq. in.<br>(sq. met.) | 804<br>.52 | 804<br>.52 | 804<br>.52 |
| Qs | dry stack volume @ standard conditions* | DSCFM<br>(dscm/hr) | 4187<br>7114.15 | 4898<br>8321.50 | 4432<br>7529.61 |
| Qa | actual stack gas volume @ stack conditions | ACFM<br>(cu.m./hr) | 5955<br>10117.45 | 7104<br>12070.20 | 6758<br>11481.68 |

* 68 deg. F., 29.92 "Hg (20 deg. C., 760 mm Hg)

Source Emission Calculations

COORS BREWING COMPANY
FILE NO. 9010-204

| Symbol | Description | Units | COOKER | COOKER | COOKER |
|---|---|---|---|---|---|
| Run No. | | | 1 | 2 | 3 |
| Tt | net time of test | min. | 60 | 60 | 60 |
| Dn | sampling nozzle diameter | in.<br>(m) | .434<br>.011 | .434<br>.011 | .434<br>.011 |
| %I | percent isokinetic | % | 100.68 | 103.11 | 105.72 |
| mf | particulate - probe, cyclone and filter | mg | 12.1 | 6.9 | 14.5 |
| mt | particulate - total | mg | .0 | .0 | .0 |
| Can | particulate - probe, cyclone and filter | gr/dscf*<br>(g/dscm) | .0040<br>.0092 | .0019<br>.0044 | .0043<br>.0099 |
| Cao | particulate - total | gr/dscf*<br>(g/dscm) | .0000<br>.0000 | .0000<br>.0000 | .0000<br>.0000 |
| Cat | particulate - probe, cyclone and filter @ stack conditions | gr/cf<br>(g/cu.m.) | .0028<br>.0064 | .0013<br>.0030 | .0028<br>.0065 |
| Cau | particulate - total @ stack conditions | gr/cf<br>(g/cu.m.) | .0000<br>.0000 | .0000<br>.0000 | .0000<br>.0000 |
| Caw | particulate - probe, cyclone and filter | lbs/hr<br>(kg/hr) | .144<br>.065 | .080<br>.036 | .165<br>.075 |
| Cax | particulate - total | lbs/hr<br>(kg/hr) | .000<br>.000 | .000<br>.000 | .000<br>.000 |

* 68 deg. F., 29.92 "Hg (20 deg. C., 760 mm Hg)

COORS BREWING COMPANY
GOLDEN, COLORADO

BREW KETTLE STACK

FILE NO. 9010-204

SOURCE EMISSION CALCULATIONS

| Symbol | Description | Units | BREW | BREW | BREW |
|---|---|---|---|---|---|
| Run No. | | | 1 | 2 | 3 |
| Date | | | 11/06/90 | 11/06/90 | 11/06/90 |
| Begin | | | 1336 MST | 1700 MST | 1823 MST |
| End | | | 1438 MST | 1802 MST | 1924 MST |
| Pb | barometric pressure | "Hg Abs.<br>(mm Hg) | 24.24<br>615.70 | 24.24<br>615.70 | 24.24<br>615.70 |
| Pm | orifice pressure drop | "H2O<br>(mm H2O) | 1.32<br>33.59 | 1.32<br>33.53 | 1.75<br>44.49 |
| Vm | volume dry gas sampled @ meter conditions | cu. ft.<br>(cu. m.) | 42.966<br>1.217 | 42.838<br>1.213 | 50.152<br>1.420 |
| Tm | avg. gas meter temp | deg. F<br>(deg. C) | 82<br>28 | 82<br>28 | 84<br>29 |
| Vmstd | volume dry gas sampled @ standard conditions* | dscf<br>(dscm) | 34.028<br>.964 | 33.958<br>.962 | 39.643<br>1.123 |
| Vw | total H2O collected, impingers & silica gel | ml | 185.4 | 166.8 | 229.4 |
| Vwgas | volume water vapor collected @ standard conditions* | scf<br>(scm) | 8.751<br>.248 | 7.873<br>.223 | 10.828<br>.307 |
| %M | moisture in stack gas by volume | % | 20.46 | 18.82 | 21.45 |

* 68 deg. F., 29.92 "Hg (20 deg. C., 760 mm Hg)

Source Emission Calculations

COORS BREWING COMPANY
FILE NO. 9010-204

| Symbol | Description | Units | BREW | BREW | BREW |
|---|---|---|---|---|---|
| Run No. | | | 1 | 2 | 3 |
| Md | mole fraction of dry gas | ------- | .7954 | .8118 | .7855 |
| CO2 | | % | .0 | .0 | .0 |
| O2 | | % | 20.9 | 20.9 | 20.9 |
| N2 | | % | 79.1 | 79.1 | 79.1 |
| %EA | excess air @ sampling point | % | --- | --- | --- |
| MWd | molecular weight of dry stack gas | lb/lb-mole<br>(g/g-mole) | 28.84<br>28.84 | 28.84<br>28.84 | 28.84<br>28.84 |
| MW | molecular weight of stack gas | lb/lb-mole<br>(g/g-mole) | 26.62<br>26.62 | 26.80<br>26.80 | 26.51<br>26.51 |
| dPs | velocity head of stack gas | "H2O<br>(mm H2O) | .016<br>.41 | .017<br>.42 | .023<br>.58 |
| Ts | stack temperature | deg. F<br>(deg. C) | 136<br>58 | 130<br>54 | 138<br>59 |
| Ps | stack pressure | "Hg Abs.<br>(mm Hg) | 24.23<br>615.43 | 24.23<br>615.43 | 24.23<br>615.43 |
| Vs | stack velocity @ stack conditions | fpm<br>(m/sec) | 466<br>2.37 | 488<br>2.48 | 584<br>2.97 |
| As | stack area | sq. in.<br>(sq. met.) | 5945<br>3.84 | 5945<br>3.84 | 5945<br>3.84 |
| Qs | dry stack volume @ standard conditions* | DSCFM<br>(dscm/hr) | 11019<br>18721.75 | 11905<br>20226.61 | 13610<br>23123.61 |
| Qa | actual stack gas volume @ stack conditions | ACFM<br>(cu.m./hr) | 19241<br>32691.11 | 20153<br>34239.13 | 24127<br>40991.81 |

* 68 deg. F., 29.92 "Hg (20 deg. C., 760 mm Hg)

Source Emission Calculations

COORS BREWING COMPANY
FILE NO. 9010-204

| Symbol | Description | Units | BREW | BREW | BREW |
|---|---|---|---|---|---|
| Run No. | | | 1 | 2 | 3 |
| Tt | net time of test | min. | 60 | 60 | 60 |
| Dn | sampling nozzle diameter | in. (m) | .610<br>.015 | .610<br>.015 | .610<br>.015 |
| %I | percent isokinetic | % | 105.09 | 97.07 | 99.12 |
| mf | particulate - probe, cyclone and filter | mg | 6.5 | 5.5 | 3.3 |
| mt | particulate - total | mg | .0 | .0 | .0 |
| Can | particulate - probe, cyclone and filter | gr/dscf* (g/dscm) | .0029<br>.0067 | .0025<br>.0057 | .0013<br>.0029 |
| Cao | particulate - total | gr/dscf* (g/dscm) | .0000<br>.0000 | .0000<br>.0000 | .0000<br>.0000 |
| Cat | particulate - probe, cyclone and filter @ stack conditions | gr/cf (g/cu.m.) | .0017<br>.0038 | .0015<br>.0034 | .0007<br>.0017 |
| Cau | particulate - total @ stack conditions | gr/cf (g/cu.m.) | .0000<br>.0000 | .0000<br>.0000 | .0000<br>.0000 |
| Caw | particulate - probe, cyclone and filter | lbs/hr (kg/hr) | .278<br>.126 | .254<br>.115 | .150<br>.068 |
| Cax | particulate - total | lbs/hr (kg/hr) | .000<br>.000 | .000<br>.000 | .000<br>.000 |

* 68 deg. F., 29.92 "Hg (20 deg. C., 760 mm Hg)

COORS BREWING COMPANY
GOLDEN, COLORADO

BREW KETTLE STACK

FILE NO. 9010-204

SOURCE EMISSION CALCULATIONS

| Symbol | Description | Units | BREW | BREW | BREW |
|---|---|---|---|---|---|
| Run No. | | | 4 | 5 | 6 |
| Date | | | 11/06/90 | 11/06/90 | 11/06/90 |
| Begin | | | 2050 MST | 2217 MST | 2333 MST |
| End | | | 2153 MST | 2318 MST | 0034 MST |
| Pb | barometric pressure | "Hg Abs.<br>(mm Hg) | 24.24<br>615.70 | 24.24<br>615.70 | 24.24<br>615.70 |
| Pm | orifice pressure drop | "H2O<br>(mm H2O) | 1.29<br>32.68 | 1.20<br>30.37 | 1.02<br>25.87 |
| Vm | volume dry gas sampled @ meter conditions | cu. ft.<br>(cu. m.) | 47.493<br>1.345 | 44.878<br>1.271 | 41.780<br>1.183 |
| Tm | avg. gas meter temp | deg. F<br>(deg. C) | 81<br>27 | 81<br>27 | 80<br>27 |
| Vmstd | volume dry gas sampled @ standard conditions* | dscf<br>(dscm) | 37.737<br>1.069 | 35.641<br>1.009 | 33.207<br>.940 |
| Vw | total H2O collected, impingers & silica gel | ml | 243.4 | 287.0 | 290.7 |
| Vwgas | volume water vapor collected @ standard conditions* | scf<br>(scm) | 11.488<br>.325 | 13.546<br>.384 | 13.721<br>.389 |
| %M | moisture in stack gas by volume | % | 23.34 | 27.54 | 29.24 |

* 68 deg. F., 29.92 "Hg (20 deg. C., 760 mm Hg)

Source Emission Calculations

COORS BREWING COMPANY
FILE NO. 9010-204

| Symbol | Description | Units | BREW | BREW | BREW |
|---|---|---|---|---|---|
| Run No. | | | 4 | 5 | 6 |
| Md | mole fraction of dry gas | ------- | .7666 | .7246 | .7076 |
| CO2 | | % | .0 | .0 | .0 |
| O2 | | % | 20.9 | 20.9 | 20.9 |
| N2 | | % | 79.1 | 79.1 | 79.1 |
| %EA | excess air @ sampling point | % | --- | --- | --- |
| MWd | molecular weight of dry stack gas | lb/lb-mole<br>(g/g-mole) | 28.84<br>28.84 | 28.84<br>28.84 | 28.84<br>28.84 |
| MW | molecular weight of stack gas | lb/lb-mole<br>(g/g-mole) | 26.31<br>26.31 | 25.85<br>25.85 | 25.67<br>25.67 |
| dPs | velocity head of stack gas | "H2O<br>(mm H2O) | .023<br>.58 | .018<br>.46 | .016<br>.40 |
| Ts | stack temperature | deg. F<br>(deg. C) | 140<br>60 | 147<br>64 | 148<br>65 |
| Ps | stack pressure | "Hg Abs.<br>(mm Hg) | 24.23<br>615.43 | 24.23<br>615.43 | 24.23<br>615.43 |
| Vs | stack velocity @ stack conditions | fpm<br>(m/sec) | 623<br>3.16 | 558<br>2.83 | 524<br>2.66 |
| As | stack area | sq. in.<br>(sq. met.) | 5945<br>3.84 | 5945<br>3.84 | 5945<br>3.84 |
| Qs | dry stack volume @ standard conditions* | DSCFM<br>(dscm/hr) | 14086<br>23931.46 | 11797<br>20043.43 | 10810<br>18366.57 |
| Qa | actual stack gas volume @ stack conditions | ACFM<br>(cu.m./hr) | 25706<br>43674.56 | 23022<br>39113.62 | 21652<br>36787.24 |

* 68 deg. F., 29.92 "Hg (20 deg. C., 760 mm Hg)

Source Emission Calculations

COORS BREWING COMPANY
FILE NO. 9010-204

| Symbol | Description | Units | BREW | BREW | BREW |
|---|---|---|---|---|---|
| Run No. | | | 4 | 5 | 6 |
| Tt | net time of test | min. | 60 | 60 | 60 |
| Dn | sampling nozzle diameter | in.<br>(m) | .610<br>.015 | .610<br>.015 | .610<br>.015 |
| %I | percent isokinetic | % | 91.17 | 102.81 | 104.53 |
| mf | particulate - probe, cyclone and filter | mg | 9.5 | 6.3 | 14.6 |
| mt | particulate - total | mg | .0 | .0 | .0 |
| Can | particulate - probe, cyclone and filter | gr/dscf*<br>(g/dscm) | .0039<br>.0089 | .0027<br>.0062 | .0068<br>.0155 |
| Cao | particulate - total | gr/dscf*<br>(g/dscm) | .0000<br>.0000 | .0000<br>.0000 | .0000<br>.0000 |
| Cat | particulate - probe, cyclone and filter @ stack conditions | gr/cf<br>(g/cu.m.) | .0021<br>.0048 | .0014<br>.0032 | .0034<br>.0077 |
| Cau | particulate - total @ stack conditions | gr/cf<br>(g/cu.m.) | .0000<br>.0000 | .0000<br>.0000 | .0000<br>.0000 |
| Caw | particulate - probe, cyclone and filter | lbs/hr<br>(kg/hr) | .468<br>.212 | .275<br>.125 | .627<br>.285 |
| Cax | particulate - total | lbs/hr<br>(kg/hr) | .000<br>.000 | .000<br>.000 | .000<br>.000 |

* 68 deg. F., 29.92 "Hg (20 deg. C., 760 mm Hg)

# APPENDIX C

## Calibration of Equipment

APPENDIX C

Calibration Data

August 3, 1990

NOZZLES

Set A

| Nozzle No. | Diameter (inches) |
|---|---|
| 1A | 0.192 |
| 2A | 0.188 |
| 3A | 0.257 |
| 4A | 0.318 |
| 5A | 0.358 |
| 6A | 0.379 |
| 7A | 0.434 |
| 8A | 0.497 |
| 9A | 0.499 |
| 10A | 0.560 |

Set B

| Nozzle No. | Diameter (inches) |
|---|---|
| 1B | 0.131 |
| 2B | 0.174 |
| 3B | 0.241 |
| 4B | 0.309 |
| 5B | 0.358 |
| 6B | 0.365 |
| 7B | 0.497 |

Set I

| Nozzle No. | Diameter (inches) |
|---|---|
| I-1 | 0.132 |
| I-2 | 0.199 |
| I-3 | 0.248 |
| I-4 | 0.318 |
| I-5 | 0.374 |
| I-6 | 0.417 |
| I-7 | 0.493 |
| I-8 | 0.574 |
| I-9 | 0.620 |

Set II

| Nozzle No. | Diameter (inches) |
|---|---|
| II-1 | 0.124 |
| II-2 | 0.198 |
| II-3 | 0.252 |
| II-4 | 0.316 |
| II-5 | MIA |
| II-6 | 0.444 |
| II-7 | 0.502 |
| II-8 | 0.565 |
| II-9 | 0.616 |

Set III

| Nozzle No. | Diameter (inches) |
|---|---|
| III-1 | 0.132 |
| III-2 | 0.180 |
| III-3 | 0.253 |
| III-4 | 0.370 |
| III-5 | 0.365 |
| III-6 | 0.426 |
| III-7 | 0.498 |
| III-8 | 0.562 |
| III-9 | 0.614 |

APPENDIX C

Calibration Data

August 3, 1990

PITOT TUBES

| Pitot Length (effective length) | Calibration Factor | | Pitot Length (effective length) | Calibration Factor | |
|---|---|---|---|---|---|
| 32-1 | High | 0.825 | 74-3 | High | 0.845 |
| | Low | 0.819 | | Low | 0.839 |
| 32-2 | High | 0.815 | 122-1 | High | 0.829 |
| | Low | 0.811 | | Low | 0.826 |
| 46-1 | High | 0.847 | 128-1 | High | 0.815 |
| | Low | 0.844 | | Low | 0.818 |
| 49-1 | High | 0.823 | 132-1 | High | 0.841 |
| | Low | 0.814 | | Low | 0.844 |
| 49-3 | High | 0.818 | 132-2 | High | 0.836 |
| | Low | 0.813 | | Low | 0.835 |
| 74-1 | High | 0.836 | 156-2 | High | 0.812 |
| | Low | 0.836 | | Low | 0.814 |
| 74-2 | High | 0.830 | | | |
| | Low | 0.830 | | | |

METER BOX NUMBER 2
Pb = 24.73
Average DGM Y = 1.015

Technician RB
Date 10-5-90

| | Orifice I.D. 15/10.2A K' = 0.3074 | | Orifice I.D. 14/2.5A K' = 0.4248 | |
|---|---|---|---|---|
| | 1 | 2 | 1 | 2 |
| DGM Final | 646.408 | 648.416 | 605.349 | 608.094 |
| Initial | 644.401 | 646.408 | 602.603 | 605.349 |
| Vm | 2.007 | 2.008 | 2.746 | 2.745 |
| Temp Inlet | 76 76 | 76 76 | 69 69 | 70 70 |
| Temp Outlet | 76 76 | 76 76 | 69 70 | 70 70 |
| Avg Tm | 76 | 76 | 69 | 70 |
| Delta H | 0.33 | 0.33 | 0.63 | 0.63 |
| Time | 5:00.13/5.002 | 5:00.23/5.004 | 5:01.94/5.032 | 5:01.31/5.022 |
| Orifice Temp | 76 | 76 | 74 | 76 |
| Vacuum | 19 | 19 | 18 | 18 |
| Vm (std) | 1.636 | 1.637 | 2.270 | 2.265 |
| Vcr (std) | 1.642 | 1.643 | 2.288 | 2.279 |
| DGMCF Y | 1.004 | 1.004 | 1.008 | 1.006 |

| | Orifice I.D. 13/2.5A K' = 0.6408 | | Orifice I.D. 12/10.2A K' = 0.8016 | |
|---|---|---|---|---|
| | 1 | 2 | 1 | 2 |
| DGM Final | 614.280 | 618.365 | 654.290 | 659.388 |
| Initial | 610.215 | 614.280 | 649.213 | 654.290 |
| Vm | 4.065 | 4.085 | 5.077 | 5.098 |
| Temp Inlet | 70 71 | 72 72 | 76 77 | 77 77 |
| Temp Outlet | 71 72 | 72 73 | 76 77 | 77 76 |
| Avg Tm | 71 | 72 | 76 | 77 |
| Delta H | 1.40 | 1.40 | 2.20 | 2.20 |
| Time | 5:00.05/5.0008 | 5:01.49/5.025 | 5:00.01/5.000 | 5:00.73/5.012 |
| Orifice Temp | 76 | 76 | 78 | 78 |
| Vacuum | 15 | 15 | 14 | 14 |
| Vm (std) | 3.355 | 3.366 | 4.161 | 4.171 |
| Vcr (std) | 3.423 | 3.440 | 4.273 | 4.283 |
| DGMCF J | 1.020 | 1.022 | 1.027 | 1.027 |

$$Vm\ (std) = 17.65\ Vm \left[\frac{Pb + \frac{\Delta H}{13.6}}{Tm + 460}\right] \qquad Vcr\ (std) = K^1\left[\frac{(Pb)(Time)}{\sqrt{orifice\ temp}}\right] \qquad Y = \frac{Vcr\ (std)}{Vm\ (std)}$$

# APPENDIX D

## Field Testing Data

Job No. 900-204
Job Name Coors
Run No. 1
Location Cooker Stack

Date 6 November 1990

Operator Meador - Tikka

Sample Box No. 3 Meter Box No. 2

Post. SO2 FIELD DATA

Read and Record at the Start of Each Test Point

K Factor 27.5
Ambient Temp. °F 85 in Bldg
Assumed Moisture % 6.0
Probe Length 74"

| | Before | After |
|---|---|---|
| Pitot Tube Leak Check | OK | OK |

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 15.0 "Hg = 0.000 cfm

$\Delta Ps$ Pm Ts Tm

| Point | Clock Time | Dry Gas Meter, CF | Pitot In. $H_2O$ | Orifice $\Delta H$ in. $H_2O$ Desired | Orifice $\Delta H$ in. $H_2O$ Actual | Pump Vac In. Hg Gauge | Stack Temp. °F | Probe Temp. °F | Oven Temp. °F | Effluent Temp. °F | Dry Gas Temp °F Inlet | Dry Gas Temp °F Outlet | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A6 | 0630 | 90.321 | 0.09 | 2.48 | 2.48 | 4.5 | 110 | 243 | 268 | 65 | 81 | 79 | electrical |
| 5 | 0635 | 95.47 | 0.10 | 2.75 | 2.75 | 5.0 | 115 | 270 | 257 | 60 | 83 | 79 | pwr |
| 4 | 0640 | 100.91 | 0.14 | 4.12 | 4.12 | 9.0 | 112 | 254 | 246 | 60 | 84 | 80 | shut off |
| 3 | 0645 | 107.22 | 0.08 | 2.20 | 2.20 | 6.0 | 99 | 247 | 246 | 58 | 85 | 80 | several times |
| 2 | 0650 | 112.40 | 0.06 | 1.65 | 1.65 | 4.0 | 102 | 238 | 254 | 60 | 86 | 80 | |
| 1 | 0655 | 117.08 | 0.04 | 1.10 | 1.10 | 3.0 | 101 | 239 | 251 | 65 | 84 | 80 | |
| END | 0700 | 120.588 | — | — | — | — | — | — | — | — | — | — | |
| B6 | 0725 | 120.588 | 0.08 | 2.20 | 2.20 | 5.0 | 101 | 265 | 248 | 78 | 82 | 80 | Δ elect supply |
| 5 | 0730 | 125.28 | 0.07 | 1.92 | 1.92 | 5.0 | 98 | 258 | 250 | 58 | 83 | 80 | |
| 4 | 0735 | 130.21 | 0.08 | 2.20 | 2.20 | 4.5 | 100 | 252 | 251 | 57 | 86 | 81 | 3 units |
| 3 | 0740 | 134.81 | 0.08 | 2.20 | 2.20 | 5.0 | 106 | 251 | 270 | 57 | 87 | 81 | |
| 2 | 0745 | 139.78 | 0.06 | 1.65 | 1.65 | 5.0 | 95 | 242 | 272 | 57 | 88 | 81 | 2 cookers |
| 1 | 0750 | 144.21 | 0.04 | 1.10 | 1.10 | 4.0 | 114 | 243 | 270 | 58 | 88 | 81 | only |
| END ALL | 0755 | 147.871 | — | — | — | — | — | — | — | — | — | — | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Pitot Tube Calibration Factor $C_p$ 0.836 Pitot Tube No. 74-1

Volume Collected $V_m$ 58.413 ft³ %$CO_2$ <0.2 %CO <0.2

Water Collected $V_w$ 79.1 ml %$O_2$ 20.9 %$N_2$ 79.1

Time of Test $T_t$ 60 min Area Stack A2 804 in²

Baro. Press. $P_b$ 24.24 "Hg Stack Press. -0.10 in. $H_2O$

Sample Purge: Initial — Final —

Probe Tip No. 7A Probe Tip Dia. 0.434 in.

$V_m$=Dry Gas Meter Calibration Factor 1.015 x 57.55

Dry Gas Meter ____ ft³ - ($T_t$ ____ min x Leak Rate ____ cfm) = ____

$M_F$ = 12.1 $M_T$ = —

IMPINGER CATCH

SAMPLE NO. 1- Cooker

| IMPINGER NO. | SOLUTION USED | AMOUNT OF SOLUTION (ml) | IMP. TIP CONFIGURATION | WEIGHT (grams) | |
|---|---|---|---|---|---|
| 1 | 6% $H_2O_2$ | 100 | modif | Final | 710.4 |
| | | | | Initial | 671.2 |
| | | | | Wt. Gain | 39.2 |
| 2 | 6% $H_2O_2$ | 100 | G. Smith | Final | 700.2 |
| | | | | Initial | 675.1 |
| | | | | Wt. Gain | 25.1 |
| 3 | Dry | — | modif | Final | 474.0 |
| | | | | Initial | 470.5 |
| | | | | Wt. Gain | 3.5 |
| 4 | Silica Gel | — | modif | Final | 780.2 |
| | | | | Initial | 768.9 |
| | | | | Wt. Gain | 11.3 |
| 5 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 6 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| Flask | Ø | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 79.1

DATE: November 6, 1990

SIGNATURE: J. Meadow

ORSAT ANALYSIS RESULTS
Gas Fractional Part

$CO_2$ <0.2

$O_2$ 20.9

CO <0.2

$N_2$ 79.1

SIGNATURE: J. Meadow

DATE: 11/6/90

TIME: 0800

4/85

Job No. 9010-204
Job Name Coors -
Run No. 2
Location Cooker Stack
Date 6 Nov. 1990
Operator Meador - Tikka
Sample Box No. 1 Meter Box No. 2

Part. + $SO_2$ FIELD DATA

Read and Record at the Start of Each Test Point

K Factor 27.5
Ambient Temp. °F 85 in Bldg
Assumed Moisture % 7.0
Probe Length 74"

| | Before | After |
|---|---|---|
| Pitot Tube Leak Check | ok | OK |

Initial Leak @ 15.0 "Hg = 0.000 cfm
Final Leak @ 13.0 "Hg = 0.000 cfm

$\Delta Ps$ Pm Ts Tm

| Point | Clock Time | Dry Gas Meter, CF | Pitot In. $H_2O$ | Orifice $\Delta H$ in. $H_2O$ Desired | Orifice $\Delta H$ in. $H_2O$ Actual | Pump Vac In. Hg Gauge | Stack Temp. °F | Probe Temp. °F | Oven Temp. °F | Effluent Temp. °F | Dry Gas Temp °F Inlet | Dry Gas Temp °F Outlet | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B6 | 0833 | 148.412 | 0.11 | 3.02 | 3.02 | 7.0 | 107 | 271 | 270 | 65 | 82 | 82 | |
| 5 | 0838 | 154.30 | 0.12 | 3.30 | 3.30 | 7.0 | 107 | 271 | 263 | 55 | 83 | 82 | |
| 4 | 0843 | 159.80 | 0.13 | 3.58 | 3.58 | 7.0 | 105 | 258 | 274 | 62 | 86 | 82 | |
| 3 | 0848 | 166.01 | 0.11 | 3.02 | 3.02 | 7.0 | 109 | 255 | 270 | 68 | 88 | 82 | |
| 2 | 0853 | 171.94 | 0.10 | 2.75 | 2.75 | 6.0 | 113 | 251 | 272 | 70 | 89 | 83 | |
| 1 | 0858 | 177.69 | 0.07 | 1.92 | 1.92 | 5.0 | 105 | 248 | 263 | 70 | 89 | 81 | |
| END | 0903 | 182.713 | — | — | — | — | — | — | — | — | — | — | |
| A6 | 0905 | 182.713 | 0.10 | 2.75 | 2.75 | 6.0 | 112 | 263 | 272 | 69 | 89 | 82 | |
| 5 | 0910 | 188.24 | 0.11 | 3.02 | 3.02 | 6.5 | 103 | 257 | 266 | 60 | 90 | 84 | |
| 4 | 0915 | 193.84 | 0.13 | 3.58 | 3.58 | 7.5 | 113 | 254 | 262 | 60 | 92 | 83 | |
| 3 | 0920 | 199.90 | 0.12 | 3.30 | 3.30 | 7.5 | 105 | 248 | 274 | 61 | 93 | 83 | |
| 2 | 0925 | 206.20 | 0.09 | 2.48 | 2.48 | 7.5 | 101 | 252 | 259 | 62 | 94 | 84 | |
| 1 | 0930 | 212.35 | 0.08 | 2.20 | 2.20 | 6.0 | 102 | 251 | 246 | 63 | 94 | 84 | |
| END | 0935 | 217.625 | — | — | — | — | — | — | — | — | — | — | |
| ALL | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Pitot Tube Calibration Factor $C_p$ 0.836 Pitot Tube No. 74-1
Volume Collected $V_m$ 70.251 $ft^3$
Water Collected $V_w$ 113.8 ml
Time of Test $T_t$ 60 min
Baro. Press. $P_b$ 24.24 "Hg

$\%CO_2$ <0.2 $\%CO$ <0.2
$\%O_2$ 20.9 $\%N_2$ 79.1
Area Stack A2 804 $in^2$
Stack Press. -0.10 in. $H_2O$

Sample Purge: Initial ________ Final ________
Probe Tip No. 7A Probe Tip Dia. 0.434 in.
$V_m$=Dry Gas Meter Calibration Factor 1.015 x 69.213
Dry Gas Meter ________ $ft^3$ - ($T_t$ ____ min x Leak Rate ________ cfm) = ________
$M_F$ = 6.9 $M_T$ = —

IMPINGER CATCH

SAMPLE NO. 2 - Coke

| IMPINGER NO. | SOLUTION USED | AMOUNT OF SOLUTION (ml) | IMP. TIP CONFIGURATION | WEIGHT (grams) |
|---|---|---|---|---|
| 1 | 6% $H_2O_2$ | 100 | modif | Final 652.2<br>Initial 594.4<br>Wt. Gain 57.8 |
| 2 | 6% $H_2O_2$ | 100 | G. Smith | Final 604.5<br>Initial 573.3<br>Wt. Gain 31.2 |
| 3 | Dry | — | modif | Final 462.9<br>Initial 455.1<br>Wt. Gain 7.8 |
| 4 | Silica Gel | — | modif | Final 777.8<br>Initial 760.8<br>Wt. Gain 17.0 |
| 5 | | | | Final<br>Initial<br>Wt. Gain |
| 6 | | | | Final<br>Initial<br>Wt. Gain |
| Flask | Ø | | | Final<br>Initial<br>Wt. Gain |

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 113.8

DATE: 11/6/90

SIGNATURE: J. Meeler

ORSAT ANALYSIS RESULTS
Gas Fractional Part

$CO_2$ <0.2

$O_2$ 20.9

CO <0.2

$N_2$ 79.1

SIGNATURE: J. Meeler

DATE: 11/6/90

TIME: 0940

4/85

Job No. 9010-204

Job Name Coors

Run No. 3

Location Coone

Date 6 Nov. 1990

Operator Meador - Tikku

Sample Box No. 1 Meter Box No. 2

Part. + $SO_2$ FIELD DATA

Read and Record at the Start of Each Test Point

K Factor 27.5

Ambient Temp. °F 85 in Bldg

Assumed Moisture % 9.0

Probe Length 74

Pitot Tube Leak Check Before OK After OK

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 16.0 "Hg = 0.000 cfm

△Ps Pm Ts Tm

| Point | Clock Time | Dry Gas Meter, CF | Pitot In. $H_2O$ | Orifice △H in. $H_2O$ Desired | Orifice △H in. $H_2O$ Actual | Pump Vac In. Hg Gauge | Stack Temp. °F | Probe Temp. °F | Oven Temp. °F | Effluent Temp. °F | Dry Gas Temp °F Inlet | Dry Gas Temp °F Outlet | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A6 | 1015 | 217.910 | 0.08 | 2.20 | 2.20 | 5.5 | 115 | 267 | 261 | 75 | 83 | 83 | |
| 5 | 1020 | 222.88 | 0.12 | 3.30 | 3.30 | 8.0 | 118 | 249 | 270 | 60 | 85 | 83 | |
| 4 | 1025 | 228.65 | 0.11 | 3.02 | 3.02 | 9.0 | 115 | 253 | 270 | 62 | 87 | 83 | |
| 3 | 1030 | 234.72 | 0.10 | 2.75 | 2.75 | 8.0 | 116 | 253 | 266 | 68 | 88 | 83 | |
| 2 | 1035 | 240.40 | 0.12 | 3.30 | 3.30 | 8.5 | 117 | 251 | 264 | 64 | 89 | 83 | |
| 1 | 1040 | 246.31 | 0.09 | 2.48 | 2.48 | 6.5 | 114 | 251 | 267 | 62 | 91 | 83 | |
| END | 1045 | 251.665 | — | — | — | — | — | — | — | — | — | — | |
| B6 | 1047 | 251.665 | 0.08 | 2.20 | 2.20 | 6.0 | 109 | 263 | 270 | 70 | 89 | 84 | |
| 5 | 1052 | 256.68 | 0.09 | 2.48 | 2.48 | 6.0 | 112 | 259 | 268 | 61 | 90 | 84 | |
| 4 | 1057 | 261.89 | 0.10 | 2.75 | 2.75 | 7.0 | 113 | 257 | 261 | 59 | 91 | 84 | |
| 3 | 1102 | 267.37 | 0.08 | 2.20 | 2.20 | 6.0 | 116 | 254 | 254 | 58 | 93 | 85 | |
| 2 | 1107 | 272.60 | 0.08 | 2.20 | 2.20 | 6.0 | 113 | 254 | 248 | 57 | 93 | 84 | |
| 1 | 1112 | 277.46 | 0.07 | 1.92 | 1.92 | 6.0 | 115 | 254 | 244 | 56 | 92 | 84 | |
| END | 1117 | 282.256 | — | — | — | — | | | | | | | |
| ALL | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Pitot Tube Calibration Factor $C_p$ 0.836 Pitot Tube No. 74-1

Volume Collected $V_m$ 65.311 $ft^3$

Water Collected $V_w$ 152.2 ml

Time of Test $T_t$ 60 min

Baro. Press. $P_b$ 24.24 "Hg

% $CO_2$ <0.2 % CO <0.2

% $O_2$ 20.9 % $N_2$ 79.1

Area Stack A2 804 $in^2$

Stack Press. -0.10 in. $H_2O$

Sample Purge: Initial ______ Final ______

Probe Tip No. 7A Probe Tip Dia. 0.434 in.

$V_m$=Dry Gas Meter Calibration Factor 1.015 X 64.346

Dry Gas Meter ______ $ft^3$ - ($T_t$ ____ min x Leak Rate ______ cfm) = ______

$M_F$ = 14.5 $M_T$ = ______

IMPINGER CATCH

SAMPLE NO. 3 - Cooker

| IMPINGER NO. | SOLUTION USED | AMOUNT OF SOLUTION (ml) | IMP. TIP CONFIGURATION | WEIGHT (grams) |
|---|---|---|---|---|
| 1 | 6% $H_2O_2$ | 100 | modif | Final 697.3<br>Initial 608.7<br>Wt. Gain 88.6 |
| 2 | 6% $H_2O_2$ | 100 | G. Smith | Final 661.4<br>Initial 621.0<br>Wt. Gain 40.4 |
| 3 | Dry | — | modif | Final 510.8<br>Initial 503.9<br>Wt. Gain 6.9 |
| 4 | Silica Gel | — | modif | Final 787.0<br>Initial 770.7<br>Wt. Gain 16.3 |
| 5 | | | | Final<br>Initial<br>Wt. Gain |
| 6 | | | | Final<br>Initial<br>Wt. Gain |
| Flask | Ø | | | Final<br>Initial<br>Wt. Gain |

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 152.2

DATE: 11/6/90

SIGNATURE: J. Meador

ORSAT ANALYSIS RESULTS
Gas Fractional Part

$CO_2$ <0.2

$O_2$ 20.9

CO <0.2

$N_2$ 79.1

SIGNATURE: J. Meador

DATE: 11/6/90

TIME: 1125

4/85

Job No. 9010 - 204
Job Name Coors
Run No. 1
Location Brew Kettle Stack
Date 6 November 1990
Operator Meador-Tikka-Reynold
Sample Box No. 3 Meter Box No. 2

Pat. + $SO_2$ FIELD DATA

Read and Record at the Start of Each Test Point

B A

K Factor 85
Ambient Temp. °F 70 in bld
Assumed Moisture % 18
Probe Length 89

Pitot Tube Leak Check — Before: OK — After: OK

Initial Leak @ 15.0 "Hg = 0.000 cfm
Final Leak @ 12.0 "Hg = 0.000 cfm

ΔPs Pm Ts Tm

| Point | Clock Time | Dry Gas Meter, CF | Pitot In. $H_2O$ | Orifice ΔH in. $H_2O$ Desired | Orifice ΔH in. $H_2O$ Actual | Pump Vac In. Hg Gauge | Stack Temp. °F | Probe Temp. °F | Oven Temp. °F | Effluent Temp. °F | Dry Gas Temp °F Inlet | Dry Gas Temp °F Outlet | Remarks - Ts @ half point |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B6 | 1336 | 282.605 | 0.008 | 0.68 | 0.68 | 2.0 | 130 | 253 | 254 | 75 | 80 | 81 | 130 |
| 5 | 1341 | 285.48 | 0.010 | 0.85 | 0.85 | 2.5 | 127 | 242 | 278 | 64 | 81 | 81 | 138 |
| 4 | 1346 | 288.75 | 0.020 | 1.70 | 1.70 | 4.0 | 132 | 236 | 270 | 58 | 82 | 81 | 129 |
| 3 | 1351 | 293.15 | 0.002 | 0.16 | 0.16 | 1.0 | 130 | 239 | 263 | 64 | 82 | 81 | 134 downdraft?? |
| 2 | 1356 | 294.52 | 0.044 | 3.52 | 3.52 | 7.0 | 142 | 243 | 260 | 64 | 82 | 81 | 132 |
| 1 | 1401 | 300.20 | 0.038 | 3.04 | 3.04 | 8.0 | 140 | 238 | 258 | 61 | 86 | 81 | 138 |
| END | 1406 | 306.166 | — | — | — | — | — | — | — | — | — | — | |
| A6 | 1408 | 306.166 | 0.030 | 2.40 | 2.40 | 6.0 | 137 | 258 | 256 | 70 | 87 | 82 | 134 |
| 5 | 1413 | 311.41 | 0.000 | 0.000 | 0.00 | 0.0 | 139 | 254 | 256 | 69 | 85 | 81 | 136 downdraft |
| 4 | 1418 | 312.079 | 0.010 | 0.80 | 0.80 | 2.0 | 140 | 266 | 256 | 62 | 85 | 81 | 138 |
| 3 | 1423 | 315.76 | 0.004 | 0.32 | 0.32 | 2.0 | 141 | 261 | 256 | 66 | 85 | 81 | 151 |
| 2 | 1428 | 317.74 | 0.010 | 0.80 | 0.80 | 2.5 | 135 | 264 | 256 | 67 | 84 | 81 | 138 |
| 1 | 1433 | 320.75 | 0.020 | 1.60 | 1.60 | 4.0 | 137 | 260 | 255 | 61 | 85 | 81 | 139 |
| END | 1438 | 324.936 | — | — | — | — | — | — | — | — | — | — | |
| ALL | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Pitot Tube Calibration Factor $C_p$ 0.836 Pitot Tube No. 74-1
Volume Collected $V_m$ 42.966 ft³ %$CO_2$ <0.2 %CO <0.2
Water Collected $V_w$ 185.4 ml %$O_2$ 20.9 %$N_2$ 79.1
Time of Test $T_t$ 60 min Area Stack A2 5945 in²
Baro. Press. $P_b$ 24.24 "Hg Stack Press. -0.14 in. $H_2O$

Sample Purge: Initial ______ Final ______
Probe Tip No. III-9 Probe Tip Dia. 0.610 in.
$V_m$=Dry Gas Meter Calibration Factor 1.015 x 42.331
Dry Gas Meter ______ ft³ - ($T_t$ ____ min x Leak Rate ______ cfm) = ______
$M_F$ = ______ $M_T$ = ______

# IMPINGER CATCH

SAMPLE NO. 1 - Brew Kettle

| IMPINGER NO. | SOLUTION USED | AMOUNT OF SOLUTION (ml) | IMP. TIP CONFIGURATION | WEIGHT (grams) | |
|---|---|---|---|---|---|
| 1 | 6% $H_2O_2$ | 100 | modif | Final | 701.3 |
| | | | | Initial | 574.6 |
| | | | | Wt. Gain | 126.7 |
| 2 | 6% $H_2O_2$ | 100 | G. Smith | Final | 609.2 |
| | | | | Initial | 568.5 |
| | | | | Wt. Gain | 40.7 |
| 3 | Dry | — | modif | Final | 482.1 |
| | | | | Initial | 474.1 |
| | | | | Wt. Gain | 8.0 |
| 4 | Silica Gel | — | modif | Final | 790.0 |
| | | | | Initial | 780.0 |
| | | | | Wt. Gain | 10.0 |
| 5 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 6 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| Flask | Ø | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 185.4

DATE: 11/6/90

SIGNATURE: J. Meador

## ORSAT ANALYSIS RESULTS
Gas Fractional Part

| | |
|---|---|
| $CO_2$ | <0.2 |
| $O_2$ | 20.9 |
| CO | <0.2 |
| $N_2$ | 79.1 |

SIGNATURE: J. Meador

DATE: 11/6/90

TIME: 1440

4/85

Particulate $SO_2$ FIELD DATA

Job No. 9010-204
Job Name Coors
Run No. 8
Location Brew Kettle Stack
Date 6 November 1990
Operator Meador-Tikka-Reynolds
Sample Box No. 1 Meter Box No. 2

Read and Record at the Start of Each Test Point

K Factor 80
Ambient Temp. °F 68 in Bldg
Assumed Moisture % 21
Probe Length 8'

| | Before | After |
|---|---|---|
| Pitot Tube Leak Check | OK | OK |

Initial Leak @ 15.0 "Hg = 0.000 cfm
Final Leak @ 11.0 "Hg = 0.000 cfm

| Point | Clock Time | Dry Gas Meter, CF | Pitot In. $H_2O$ ($\Delta Ps$) | Orifice $\Delta H$ in. $H_2O$ Desired | Orifice $\Delta H$ in. $H_2O$ Actual (Pm) | Pump Vac In. Hg Gauge | Stack Temp. °F | Probe Temp. °F (Ts) | Oven Temp. °F | Effluent Temp. °F | Dry Gas Temp °F Inlet | Dry Gas Temp °F Outlet (Tm) | Remarks Ts @ half Point |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A6 | 1700 | 325.055 | 0.008 | 0.64 | 0.64 | 2.0 | 123 | 254 | 252 | 88 | 80 | 80 | 130 |
| 5 | 1705 | 327.81 | 0.040 | 3.20 | 3.20 | 7.5 | 140 | 238 | 253 | 62 | 81 | 80 | 141 |
| 4 | 1710 | 332.42 | 0.008 | 0.64 | 0.64 | 2.0 | 141 | 236 | 254 | 56 | 82 | 80 | 129 |
| 3 | 1715 | 335.43 | 0.010 | 0.80 | 0.80 | 2.5 | 123 | 256 | 254 | 64 | 81 | 80 | 122 Downdraft |
| 2 | 1720 | 338.65 | 0.002 | 0.16 | 0.16 | 2.0 | 122 | 262 | 255 | 63 | 82 | 80 | 119 |
| 1 | 1725 | 340.37 | 0.014 | 1.12 | 1.12 | 3.0 | 124 | 270 | 257 | 65 | 81 | 80 | 126 |
| END | 1730 | 343.608 | — | — | — | — | — | — | — | — | — | — | |
| B6 | 1732 | 343.608 | 0.028 | 2.24 | 2.24 | 6.0 | 128 | 261 | 259 | 64 | 83 | 80 | 124 |
| 5 | 1737 | 348.32 | 0.008 | 0.64 | 0.64 | 2.5 | 128 | 247 | 259 | 57 | 84 | 80 | 123 |
| 4 | 1742 | 351.60 | 0.030 | 2.40 | 2.40 | 5.5 | 135 | 248 | 258 | 60 | 85 | 81 | 120 |
| 3 | 1747 | 356.45 | 0.030 | 2.40 | 2.40 | 6.0 | 137 | 238 | 256 | 57 | 88 | 81 | 136 |
| 2 | 1752 | 361.30 | 0.004 | 0.32 | 0.32 | 2.0 | 134 | 240 | 256 | 59 | 88 | 81 | 136 |
| 1 | 1757 | 363.72 | 0.016 | 1.28 | 1.28 | 3.0 | 137 | 263 | 256 | 60 | 86 | 81 | |
| END | 1802 | 367.260 | — | — | — | — | — | — | — | — | — | — | |
| ALL | | | | | | | | | | | | | |

Pitot Tube Calibration Factor $C_p$ 0.836 Pitot Tube No. 74-1
Volume Collected $V_m$ ~~42~~ 838 ft³ %$CO_2$ <0.2 %CO <0.2
Water Collected $V_w$ 166.8 ml %$O_2$ 20.9 %$N_2$ 79.1
Time of Test $T_t$ 60 min Area Stack A2 5945 in²
Baro. Press. $P_b$ 24.24 "Hg Stack Press. -0.14 in. $H_2O$

Sample Purge: Initial ______ Final ______
Probe Tip No. IH-9 Probe Tip Dia. 0.610 in.
$V_m$=Dry Gas Meter Calibration Factor 1.015 X 42.205
Dry Gas Meter ______ ft³ - ($T_t$ ____ min x Leak Rate ______ cfm) = ______
$M_F$ = ______ $M_T$ = ______

IMPINGER CATCH

SAMPLE NO. 2 - Brew Kettle

| IMPINGER NO. | SOLUTION USED | AMOUNT OF SOLUTION (ml) | IMP. TIP CONFIGURATION | WEIGHT (grams) |
|---|---|---|---|---|
| 1 | 6% $H_2O_2$ | 100 | modif | Final 711.7<br>Initial 585.8<br>Wt. Gain 125.9 |
| 2 | 6% $H_2O_2$ | 100 | G. Smith | Final 605.5<br>Initial 575.9<br>Wt. Gain 29.6 |
| 3 | Dry | — | modif | Final 467.4<br>Initial 462.1<br>Wt. Gain 5.3 |
| 4 | Silica Gel | — | modif | Final 783.5<br>Initial 777.5<br>Wt. Gain 6.0 |
| 5 | | | | Final<br>Initial<br>Wt. Gain |
| 6 | | | | Final<br>Initial<br>Wt. Gain |
| Flask | Ø | | | Final<br>Initial<br>Wt. Gain |

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 166.8

DATE: 11/6/90

SIGNATURE: J. Menclas

ORSAT ANALYSIS RESULTS
Gas Fractional Part

$CO_2$ <0.2

$O_2$ 20.9

CO <0.2

$N_2$ 79.1

DATE: 11/6/90

SIGNATURE: J. Menclas

TIME: 1815

4/85

Part. + $SO_2$ FIELD DATA

Job No. 9010-204
Job Name Coors
Run No. 3
Location Brew Kettle
Date 6 November 1990
Operator Meador - Tikkar - Reynolds
Sample Box No. 2 Meter Box No. 2

Read and Record at the Start of Each Test Point

K Factor 80
Ambient Temp. °F 68 in Bldg
Assumed Moisture % 21
Probe Length 89

| | Before | After |
|---|---|---|
| Pitot Tube Leak Check | OK | OK |

Initial Leak @ 15.0 "Hg = 0.000 cfm
Final Leak @ 15.0 "Hg = 0.000 cfm

| Point | Clock Time | Dry Gas Meter, CF | Pitot In. $H_2O$ ($\triangle Ps$) | Orifice $\triangle H$ in. $H_2O$ Desired | Orifice $\triangle H$ in. $H_2O$ Actual (Pm) | Pump Vac In. Hg Gauge | Stack Temp. °F (Ts) | Probe Temp. °F | Oven Temp. °F | Effluent Temp. °F | Dry Gas Temp °F Inlet | Dry Gas Temp °F Outlet (Tm) | Remarks T: @ 1st Point |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A6 | 1823 | 367.679 | 0.012 | 0.96 | 0.96 | 2.5 | 132 | 264 | 251 | 74 | 82 | 81 | 132 |
| 5 | 1828 | 370.82 | 0.042 | 3.36 | 3.36 | 7.0 | 134 | 245 | 264 | 64 | 83 | 81 | 138 |
| 4 | 1833 | 376.20 | 0.020 | 1.60 | 1.60 | 6.0 | 136 | 234 | 270 | 63 | 86 | 81 | 141 |
| 3 | 1838 | 380.78 | 0.020 | 1.60 | 1.60 | 5.0 | 130 | 236 | 265 | 68 | 87 | 81 | 138 |
| 2 | 1843 | 385.36 | 0.010 | 0.80 | 0.80 | 2.5 | 138 | 239 | 250 | 70 | 87 | 82 | 140 |
| 1 | 1848 | 388.90 | 0.002 | 0.16 | 0.16 | 2.0 | 131 | 244 | 248 | 68 | 87 | 81 | 130 |
| END | 1853 | 390.476 | — | — | — | — | — | — | — | — | — | — | |
| A6 | 1854 | 390.476 | 0.080 | 5.60 | 4.70 | 13.0 | 131 | 254 | 252 | 70 | 87 | 82 | 146 ΔP 0.070 |
| 5 | 1859 | 395.97 | 0.030 | 2.40 | 2.40 | 7.0 | 140 | 238 | 252 | 65 | 89 | 82 | 140 |
| 4 | 1904 | 400.34 | 0.020 | 1.60 | 1.60 | 5.0 | 142 | 234 | 254 | 65 | 89 | 82 | 140 |
| 3 | 1909 | 405.75 | 0.012 | 0.96 | 0.96 | 5.0 | 139 | 235 | 255 | 65 | 88 | 82 | 138 |
| 2 | 1914 | 409.42 | 0.014 | 1.12 | 1.12 | 5.0 | 142 | 240 | 255 | 66 | 88 | 82 | 136 |
| 1 | 1919 | 412.91 | 0.022 | 1.76 | 1.76 | 5.0 | 130 | 240 | 256 | 64 | 87 | 82 | |
| END | 1924 | 417.090 | — | — | — | — | — | — | — | — | — | — | |
| ALL | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Pitot Tube Calibration Factor $C_p$ 0.836 Pitot Tube No. 77-1

Volume Collected $V_m$ 50.152 ft³
Water Collected $V_w$ 229.4 ml
Time of Test $T_t$ 60 min
Baro. Press. $P_b$ 24.24 "Hg

$\%CO_2$ <0.2 %CO <0.2
$\%O_2$ 20.9 $\%N_2$ 79.1
Area Stack A2 5945 in²
Stack Press. -0.14 in. $H_2O$

Sample Purge: Initial ____ Final ____

Probe Tip No. III-9 Probe Tip Dia. 0.612 in.

$V_m$=Dry Gas Meter Calibration Factor 1.015 x 49.411

Dry Gas Meter ____ ft³ - ($T_t$ ____ min x Leak Rate ____ cfm) = ____

$M_F$ = ____ $M_T$ = ____

IMPINGER CATCH

SAMPLE NO. 3 - Brew Kettle

| IMPINGER NO. | SOLUTION USED | AMOUNT OF SOLUTION (ml) | IMP. TIP CONFIGURATION | WEIGHT (grams) | |
|---|---|---|---|---|---|
| 1 | 6% $H_2O_2$ | 100 | modif | Final | 751.9 |
| | | | | Initial | 614.3 |
| | | | | Wt. Gain | 137.6 |
| 2 | 6% $H_2O_2$ | 100 | G. Smith | Final | 675.3 |
| | | | | Initial | 613.0 |
| | | | | Wt. Gain | 62.3 |
| 3 | Dry | — | modif | Final | 526.8 |
| | | | | Initial | 510.4 |
| | | | | Wt. Gain | 16.4 |
| 4 | Silica Gel | — | modif | Final | 803.6 |
| | | | | Initial | 790.5 |
| | | | | Wt. Gain | 13.1 |
| 5 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| 6 | | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |
| Flask | Ø | | | Final | |
| | | | | Initial | |
| | | | | Wt. Gain | |

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 229.4

DATE: 11/6/90

SIGNATURE: J. Mendez

ORSAT ANALYSIS RESULTS
Gas Fractional Part

$CO_2$ <0.2

$O_2$ 20.9

CO <0.2

$N_2$ 79.1

DATE: 11/6/90

TIME:

SIGNATURE: J. Mendez

4/85

24

Pat + $SO_2$ FIELD DATA

Job No. 9010-204
Job Name Coors
Run No. 4
Location Brew Kettle Stack
Date 6 November 1990
Operator Meador-Tinnea-Reynolds
Sample Box No. 3 Meter Box No. 2

Read and Record at the Start of Each Test Point

K Factor 54 56 58
Ambient Temp. °F 68 in Bldg
Assumed Moisture % 34
Probe Length 8'

Pitot Tube Leak Check Before: ok After: ok

Initial Leak @ 15.0 "Hg = 0.000 cfm
Final Leak @ 12.0 "Hg = 0.000 cfm

| Point | Clock Time | Dry Gas Meter, CF | Pitot In. $H_2O$ ($\Delta Ps$) | Orifice $\Delta H$ in. $H_2O$ Desired | Orifice $\Delta H$ in. $H_2O$ Actual (Pm) | Pump Vac In. Hg Gauge | Stack Temp. °F (Ts) | Probe Temp. °F | Oven Temp. °F | Effluent Temp. °F | Dry Gas Temp °F Inlet | Dry Gas Temp °F Outlet (Tm) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A6 | 2050 | 417.521 | 0.018 | 0.97 | 0.97 | 2.5 | 148 | 264 | 248 | 70 | 79 | 79 | |
| 5 | 2055 | 421.08 | 0.016 | 0.86 | 0.86 | 2.5 | 145 | 243 | 249 | 56 | 79 | 80 | |
| 4 | 2100 | 424.02 | 0.022 | 1.23 | 1.23 | 3.0 | 144 | 239 | 249 | 56 | 79 | 79 | |
| 3 | 2105 | 427.79 | 0.024 | 1.34 | 1.34 | 3.5 | 142 | 236 | 248 | 53 | 80 | 79 | |
| 2 | 2110 | 431.58 | 0.030 | 1.75 | 1.75 | 4.5 | 140 | 235 | 248 | 54 | 81 | 79 | |
| 1 | 2115 | 435.97 | 0.020 | 1.16 | 1.16 | 3.0 | 137 | 234 | 247 | 53 | 83 | 79 | |
| END | 2120 | 439.907 | — | — | — | — | — | — | — | — | — | — | |
| B6 | 2123 | 439.901 | 0.020 | 1.15 | 1.15 | 3.0 | 136 | 244 | 250 | 63 | 82 | 78 | |
| 5 | 2128 | 443.63 | 0.026 | 1.50 | 1.50 | 4.0 | 137 | 235 | 251 | 54 | 83 | 79 | |
| 4 | 2133 | 447.87 | 0.024 | 1.40 | 1.40 | 4.0 | 138 | 232 | 255 | 52 | 83 | 79 | |
| 3 | 2138 | 452.05 | 0.028 | 1.60 | 1.60 | 4.5 | 138 | 231 | 256 | 53 | 84 | 78 | |
| 2 | 2143 | 456.41 | 0.028 | 1.60 | 1.60 | 4.5 | 139 | 238 | 256 | 53 | 85 | 78 | |
| 1 | 2148 | 460.79 | 0.016 | 0.88 | 0.88 | 3.0 | 141 | 242 | 270 | 55 | 85 | 80 | |
| END | 2153 | 464.312 | — | — | — | — | — | — | — | — | — | — | |
| ALL | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Pitot Tube Calibration Factor $C_p$ 0.836 Pitot Tube No. 74-1

Volume Collected $V_m$ 47.493 ft³ %$CO_2$ <0.2 %CO <0.2

Water Collected $V_w$ 243.4 ml %$O_2$ 20.7 %$N_2$ 79.1

Time of Test $T_t$ 60 min Area Stack A2 5945 in²

Baro. Press. $P_b$ 24.24 "Hg Stack Press. -0.14 in. $H_2O$

Sample Purge: Initial — Final —

Probe Tip No. III-9 Probe Tip Dia. 0.610 in.

$V_m$=Dry Gas Meter Calibration Factor 1.015 X 46.791

Dry Gas Meter ______ ft³ - ($T_t$ ____ min x Leak Rate ______ cfm) = ______

$M_F$ = ______ $M_T$ = ______

IMPINGER CATCH

SAMPLE NO. 4 - Brew Kettle

| IMPINGER NO. | SOLUTION USED | AMOUNT OF SOLUTION (ml) | IMP. TIP CONFIGURATION | WEIGHT (grams) |
|---|---|---|---|---|
| 1 | 6% $H_2O_2$ | 100 | modif | Final 770.0<br>Initial 573.4<br>Wt. Gain 196.6 |
| 2 | 6% $H_2O_2$ | 100 | G. Smith | Final 606.9<br>Initial 572.0<br>Wt. Gain 34.9 |
| 3 | Dry | — | modif | Final 486.8<br>Initial 482.5<br>Wt. Gain 4.3 |
| 4 | Silica Gel | — | modif | Final 821.2<br>Initial 813.6<br>Wt. Gain 7.6 |
| 5 | | | | Final<br>Initial<br>Wt. Gain |
| 6 | | | | Final<br>Initial<br>Wt. Gain |
| Flask | Ø | | | Final<br>Initial<br>Wt. Gain |

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 243.4

DATE: 11/6/98

SIGNATURE: J. Meuler

ORSAT ANALYSIS RESULTS
Gas Fractional Part

$CO_2$ <0.2

$O_2$ 20.9

CO <0.2

$N_2$ 79.1

SIGNATURE: J. Meuler

DATE: 11/6/98

TIME: 2200

4/85

Part. + $SO_2$ FIELD DATA

Job No. 9010-204
Job Name Coors
Run No. 5
Location Brew Kettle Stack
Date 6 November 1990
Operator Meador - Ticker - Reynolds
Sample Box No. 1 Meter Box No. 2

Read and Record at the Start of Each Test Point

K Factor ~~60~~ 65
Ambient Temp. °F 65 in Bldg
Assumed Moisture % 23
Probe Length 89"

| | Before | After |
|---|---|---|
| Pitot Tube Leak Check | OK | OK |

Initial Leak @ 15.0 "Hg = 0.000 cfm
Final Leak @ 12.0 "Hg = 0.000 cfm

| Point | Clock Time | Dry Gas Meter, CF | Pitot In. $H_2O$ ($\Delta Ps$) | Orifice $\Delta H$ in. $H_2O$ Desired | Orifice $\Delta H$ in. $H_2O$ Actual (Pm) | Pump Vac In. Hg Gauge | Stack Temp. °F (Ts) | Probe Temp. °F | Oven Temp. °F | Effluent Temp. °F | Dry Gas Temp °F Inlet | Dry Gas Temp °F Outlet (Tm) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B6 | 2217 | 468.121 | 0.018 | 1.08 | 1.08 | 4.5 | 160 | 232 | 252 | 67 | 79 | 79 | 43 |
| 5 | 2222 | 471.62 | 0.014 | 0.84 | 0.84 | 4.0 | 165 | 270 | 264 | 62 | 80 | 79 | 49 |
| 4 | 2227 | 474.92 | 0.016 | 0.96 | 0.96 | 3.0 | 146 | 268 | 267 | 64 | 81 | 79 | 91 |
| 3 | 2232 | 478.31 | 0.024 | 1.44 | 1.44 | 4.0 | 144 | 263 | 275 | 64 | 82 | 78 | 90 |
| 2 | 2237 | 482.27 | 0.020 | 1.70 | 1.70 | 4.5 | 142 | 260 | 272 | 66 | 83 | 78 | |
| 1 | 2242 | 486.02 | 0.012 | 0.84 | 0.84 | 2.5 | 140 | 259 | 268 | 66 | 84 | 79 | |
| END | 2247 | 490.028 | — | — | — | — | — | — | — | — | — | — | |
| A6 | 2248 | 490.028 | 0.022 | 1.43 | 1.43 | 4.0 | 140 | 268 | 269 | 66 | 83 | 79 | |
| 5 | 2253 | 493.88 | 0.006 | 0.42 | 0.42 | 4.0 | 141 | 263 | 260 | 63 | 83 | 79 | |
| 4 | 2258 | 496.43 | 0.024 | 1.56 | 1.56 | 4.5 | 144 | 263 | 260 | 63 | 83 | 79 | |
| 3 | 2303 | 500.41 | 0.024 | 1.56 | 1.56 | 4.5 | 149 | 258 | 260 | 57 | 84 | 79 | |
| 2 | 2308 | 504.62 | 0.022 | 1.54 | 1.54 | 4.5 | 145 | 258 | 259 | 57 | 84 | 79 | |
| 1 | 2313 | 508.82 | 0.014 | 0.98 | 0.98 | 3.0 | 146 | 254 | 258 | 57 | 84 | 79 | |
| END | 2318 | 512.336 | — | — | — | — | — | — | — | — | — | — | |
| ALL | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Pitot Tube Calibration Factor $C_p$ 0.834 Pitot Tube No. 14-1
Volume Collected $V_m$ 44.878 ft³ %$CO_2$ <0.2 %CO <0.2
Water Collected $V_w$ 287.0 ml %$O_2$ 20.9 %$N_2$ 79.1
Time of Test $T_t$ 60 min Area Stack A2 5945 in²
Baro. Press. $P_b$ 24.24 "Hg Stack Press. — 0.14 in. $H_2O$

Sample Purge: Initial ____ Final ____
Probe Tip No. III-9 Probe Tip Dia. 0.610 in.
$V_m$=Dry Gas Meter Calibration Factor 1.015 x 44.215
Dry Gas Meter ____ ft³ - ($T_t$ ____ min x Leak Rate ____ cfm) = ____
$M_F$ = ____ $M_T$ = ____

# IMPINGER CATCH

SAMPLE NO. 5 - Brew Kettle

| IMPINGER NO. | SOLUTION USED | AMOUNT OF SOLUTION (ml) | IMP. TIP CONFIGURATION | WEIGHT (grams) |
|---|---|---|---|---|
| 1 | 6% $H_2O_2$ | 100 | modif | Final 784.1<br>Initial 587.8<br>Wt. Gain 196.3 |
| 2 | 6% $H_2O_2$ | 100 | G. Smith | Final 647.0<br>Initial 577.5<br>Wt. Gain 69.5 |
| 3 | Dry | — | modif | Final 481.0<br>Initial 467.3<br>Wt. Gain 13.7 |
| 4 | Silica Gel | — | modif | Final 792.5<br>Initial 785.0<br>Wt. Gain 7.5 |
| 5 | | | | Final<br>Initial<br>Wt. Gain |
| 6 | | | | Final<br>Initial<br>Wt. Gain |
| Flask | Ø | | | Final<br>Initial<br>Wt. Gain |

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 287.0

DATE: 11/6/90

SIGNATURE: J. Menclor

ORSAT ANALYSIS RESULTS
Gas Fractional Part

$CO_2$ <0.2

$O_2$ 20.9

CO <0.2

$N_2$ 79.1

SIGNATURE: J. Menclor

DATE: 11/6/90

TIME: 2340

4/85

Job No. 9010-204
Job Name COORS
Run No. 6
Location Brew Kettle Stack

Date 6 November 1992

Operator Maeda-Tikka-Reynolds

Sample Box No. 2 Meter Box No. 2

P(?). 150-2 FIELD DATA

Read and Record at the Start of Each Test Point

K Factor 65
Ambient Temp. °F 68 - Bldg
Assumed Moisture % 24
Probe Length 89"

| | Before | After |
|---|---|---|
| Pitot Tube Leak Check | OK | OK |

Initial Leak @ 15.0 "Hg = 0.000 cfm

Final Leak @ 11.0 "Hg = 0.000 cfm

| Point | Clock Time | Dry Gas Meter, CF | Pitot In. $H_2O$ ($\Delta P_s$) | Orifice $\Delta H$ in. $H_2O$ Desired (Pm) | Orifice $\Delta H$ in. $H_2O$ Actual | Pump Vac In. Hg Gauge | Stack Temp. °F (Ts) | Probe Temp. °F | Oven Temp. °F | Effluent Temp. °F | Dry Gas Temp °F Inlet | Dry Gas Temp °F Outlet (Tm) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A6 | 2333 | 512.592 | 0.014 | 0.91 | 0.91 | 2.5 | 147 | 269 | 232 | 69 | 79 | 79 | |
| 5 | 2338 | 515.80 | 0.020 | 1.30 | 1.30 | 3.0 | 140 | 267 | 264 | 62 | 79 | 79 | |
| 4 | 2343 | 519.67 | 0.020 | 1.30 | 1.30 | 4.0 | 143 | 264 | 260 | 55 | 80 | 79 | |
| 3 | 2348 | 523.54 | 0.022 | 1.43 | 1.43 | 4.0 | 141 | 262 | 255 | 54 | 82 | 78 | |
| 2 | 2353 | 527.59 | 0.020 | 1.30 | 1.30 | 4.0 | 142 | 262 | 255 | 55 | 83 | 79 | |
| 1 | 2358 | 531.60 | 0.014 | 0.91 | 0.91 | 2.5 | 151 | 264 | 254 | 56 | 83 | 79 | |
| END | 0003 | 534.968 | — | — | — | — | — | — | — | — | — | — | |
| B6 | 0004 | 534.968 | 0.016 | 1.04 | 1.04 | 2.5 | 149 | 270 | 256 | 58 | 80 | 78 | |
| 5 | 0009 | 538.36 | 0.012 | 0.78 | 0.78 | 2.5 | 153 | 267 | 257 | 56 | 82 | 78 | |
| 4 | 0014 | 541.40 | 0.010 | 0.65 | 0.65 | 2.5 | 162 | 266 | 257 | 58 | 82 | 79 | |
| 3 | 0019 | 544.12 | 0.012 | 0.78 | 0.78 | 2.5 | 163 | 267 | 257 | 58 | 82 | 78 | |
| 2 | 0024 | 547.17 | 0.020 | 1.30 | 1.30 | 4.0 | 148 | 267 | 257 | 58 | 82 | 79 | |
| 1 | 0029 | 550.97 | 0.008 | 0.52 | 0.52 | 2.5 | 146 | 267 | 259 | 57 | 82 | 78 | |
| END | 0034 | 553.755 | — | — | — | — | — | — | — | — | — | — | |
| All | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Pitot Tube Calibration Factor $C_p$ 0.836 Pitot Tube No. 74-1

Volume Collected $V_m$ 41.780 $ft^3$

Water Collected $V_w$ 290.7 ml

Time of Test $T_t$ 60 min

Baro. Press. $P_b$ 24.24 "Hg

$\%CO_2$ <0.2 $\%CO$ <0.2

$\%O_2$ 20.9 $\%N_2$ 79.1

Area Stack A2 5945 $in^2$

Stack Press. -0.14 in. $H_2O$

Sample Purge: Initial ______ Final ______

Probe Tip No. III-9 Probe Tip Dia. 0.610 in.

$V_m$=Dry Gas Meter Calibration Factor 1.015 X 41.163

Dry Gas Meter ______ $ft^3$ - ($T_t$ ____ min x Leak Rate ______ cf
= ______

$M_F$ = ______ $M_T$ = ______

IMPINGER CATCH

SAMPLE NO. 6 Brew Kettle

| IMPINGER NO. | SOLUTION USED | AMOUNT OF SOLUTION (ml) | IMP. TIP CONFIGURATION | WEIGHT (grams) |
|---|---|---|---|---|
| 1 | 6% $H_2O_2$ | 100 | modif | Final 848.1<br>Initial 602.8<br>Wt. Gain 245.3 |
| 2 | 6% $H_2O_2$ | 100 | G. Smith | Final 665.2<br>Initial 630.4<br>Wt. Gain 35.4 |
| 3 | Dry | — | modif | Final 530.0<br>Initial 527.0<br>Wt. Gain 3.0 |
| 4 | Silica Gel | — | modif | Final 780.0<br>Initial 773.0<br>Wt. Gain 7.0 |
| 5 | | | | Final<br>Initial<br>Wt. Gain |
| 6 | | | | Final<br>Initial<br>Wt. Gain |
| Flask | Ø | | | Final<br>Initial<br>Wt. Gain |

TOTAL WEIGHT GAIN OF IMPINGERS (grams) 290.7

DATE: 11/7/90

SIGNATURE: J. Meador

ORSAT ANALYSIS RESULTS
Gas Fractional Part

$CO_2$ <0.2

$O_2$ 20.9

CO <0.2

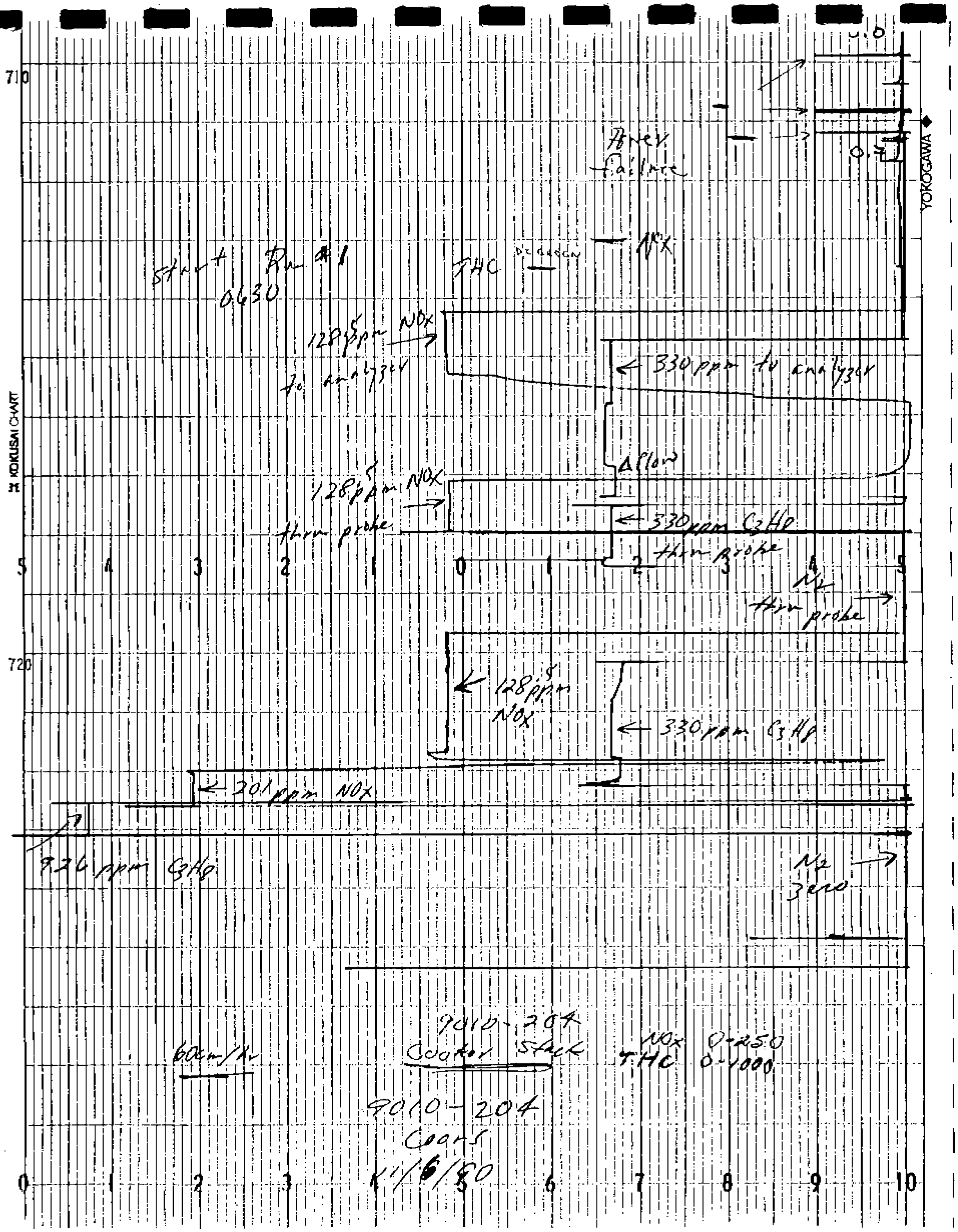
$N_2$ 79.1

SIGNATURE: J. Meador

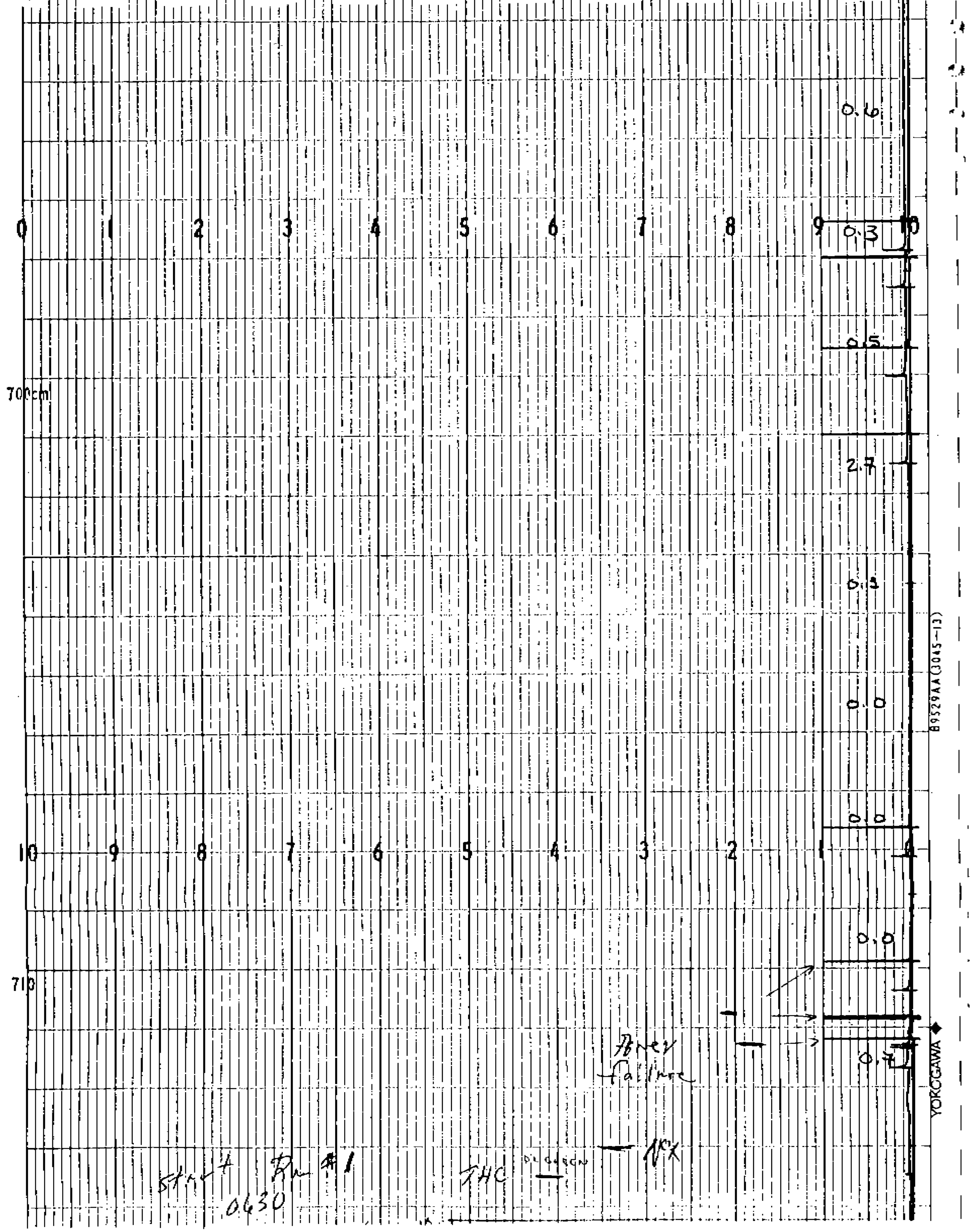
DATE: 11/7/90

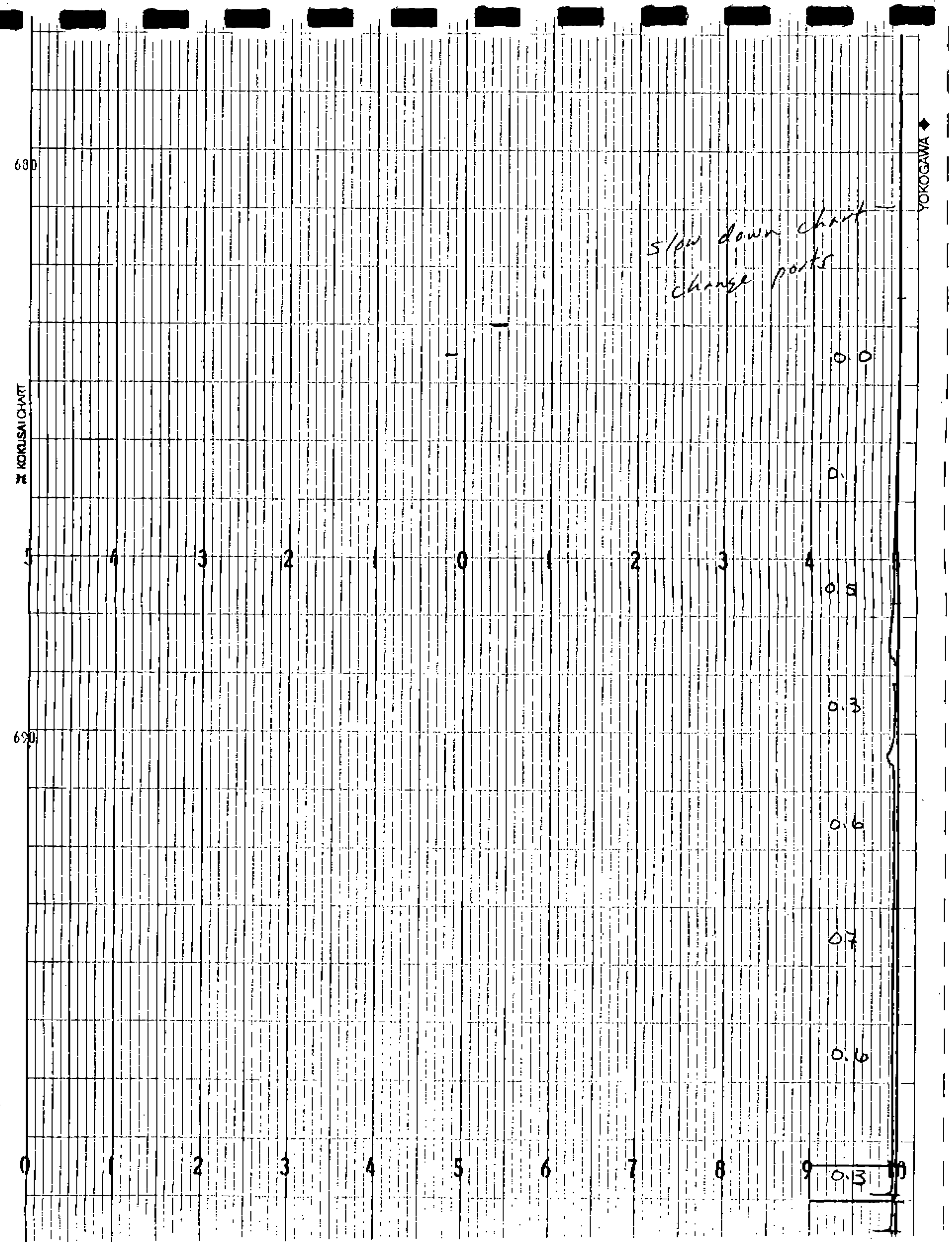
TIME: 0050

4/85

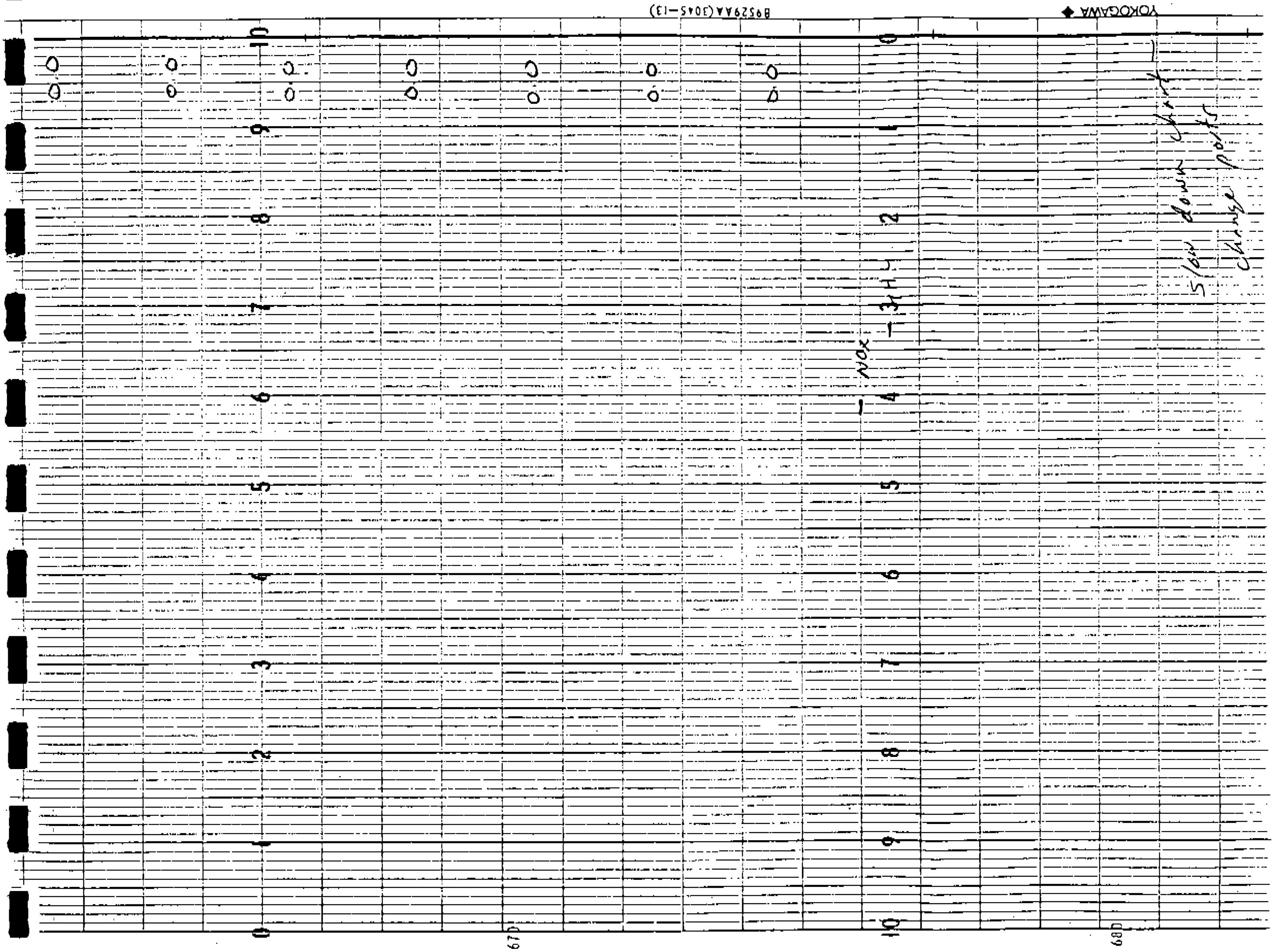


YOKOGAWA
KOKUSAI CHART
Start Run #1
0630
Power failure
THC
NOX
128 ppm NOx
to analyzer
← 330 ppm to analyzer
Δ flow
128 ppm NOx
thru probe
← 330 ppm $C_3H_8$
thru probe
$N_2$
thru probe
← 128 ppm NOx
← 330 ppm $C_3H_8$
← 201 ppm NOx
926 ppm $C_3H_8$
$N_2$
zero
60 cm/hr
9010-204
Cooker stack
NOx 0-250
THC 0-1000
9010-204
Coors
11/6/80

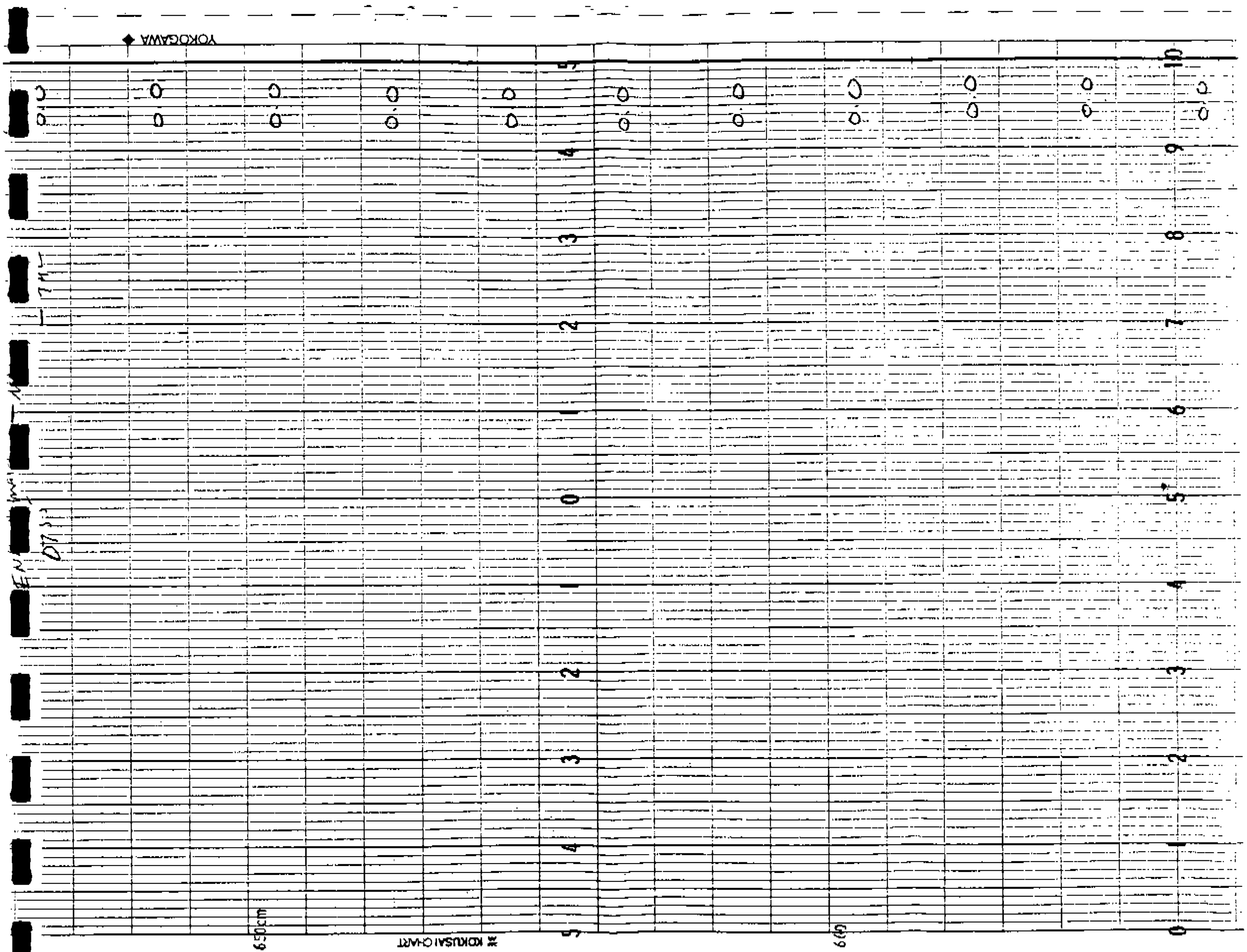

0.6
0.3
0.5
2.7
0.1
0.0
0.0
0.0
0.7
Start Run #1
0630
THC
10x
Brief failure
700cm
710
B9529AA(3045-13)
YOKOGAWA

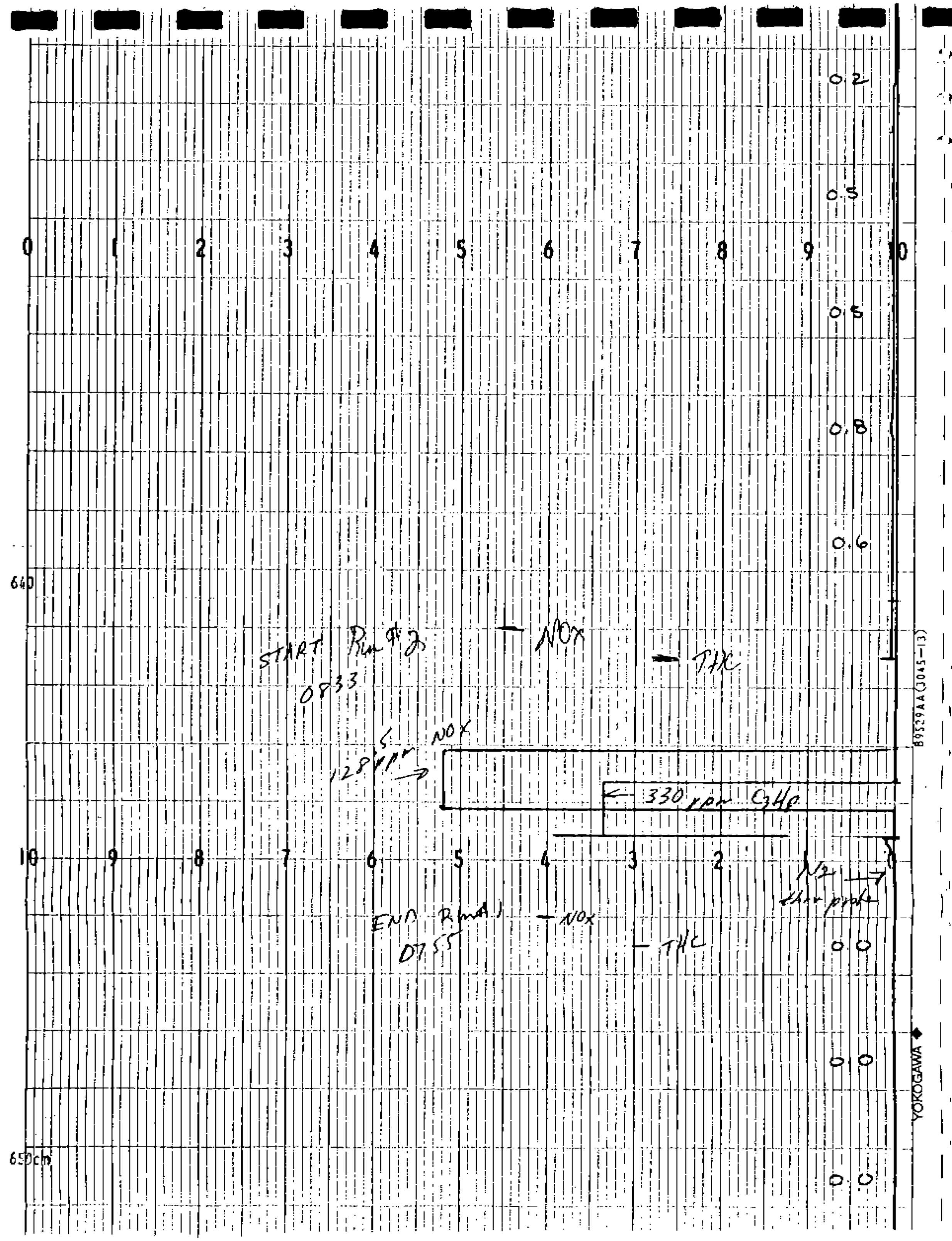


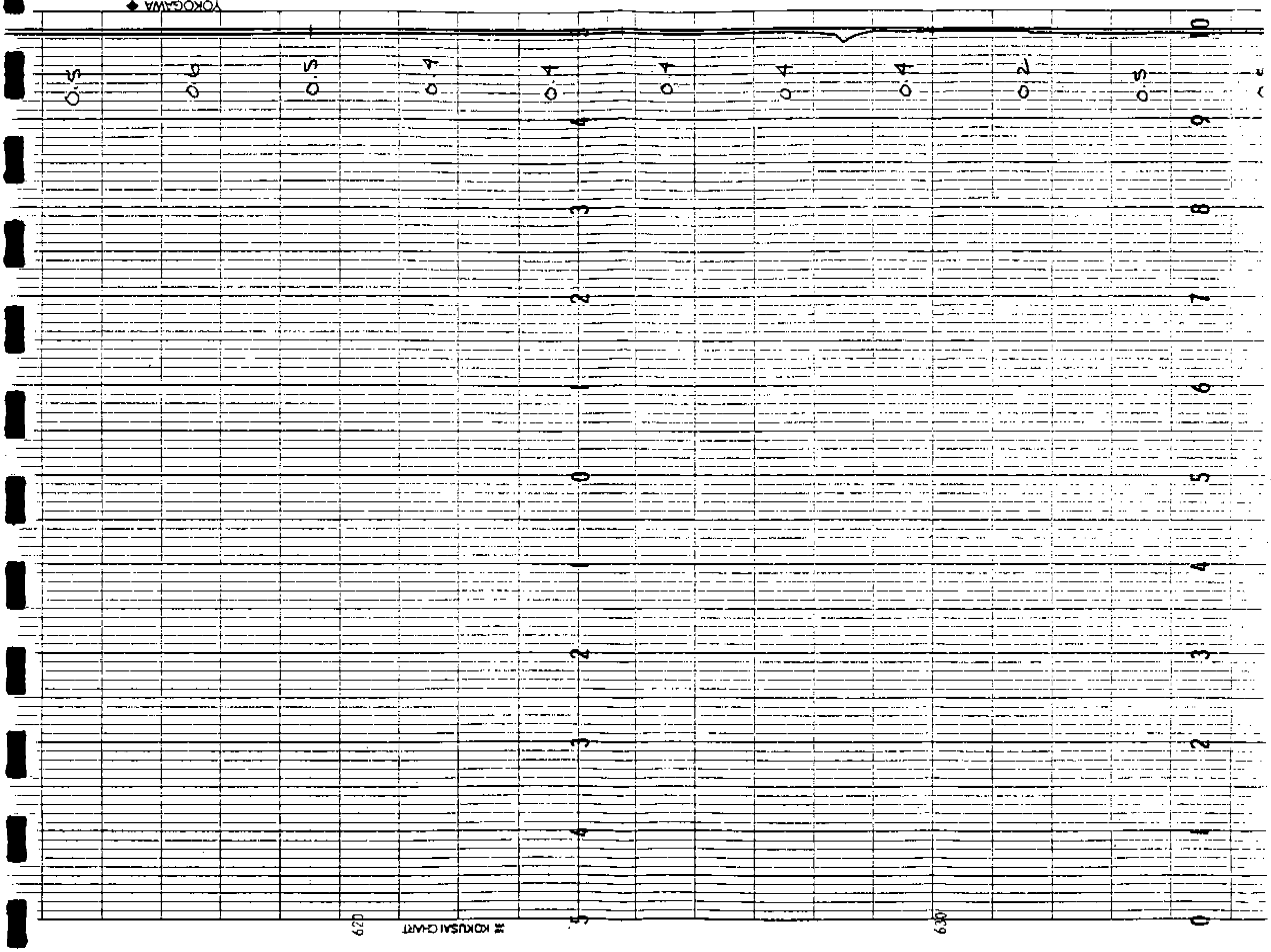
YOKOGAWA
KOKUSAI CHART
Slow down chart
change ports
0.0
0.5
0.3
0.6
0.7
0.6
0.3

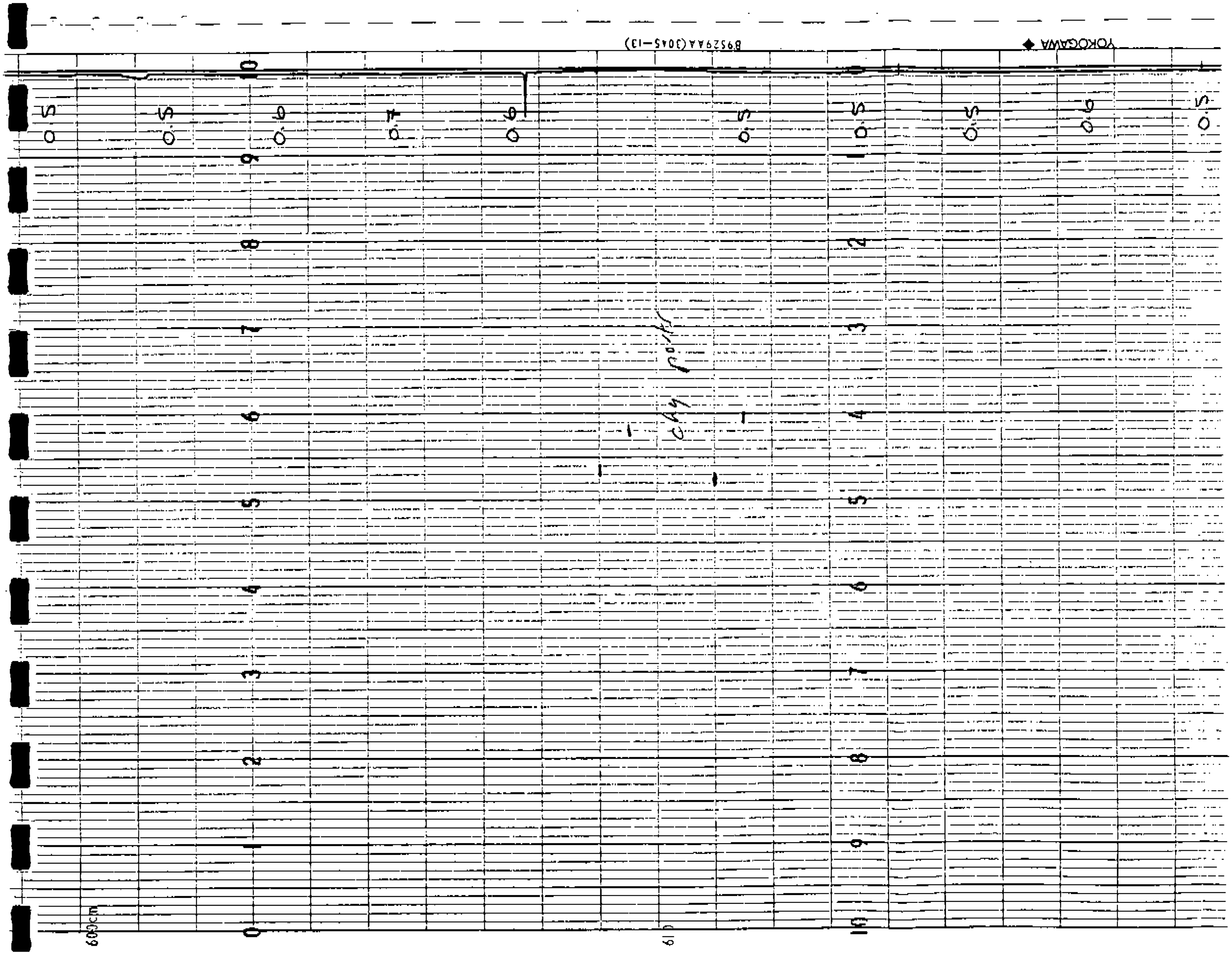


YOKOGAWA
B9529AA (3045-13)
NOx
slow down chart
change ports

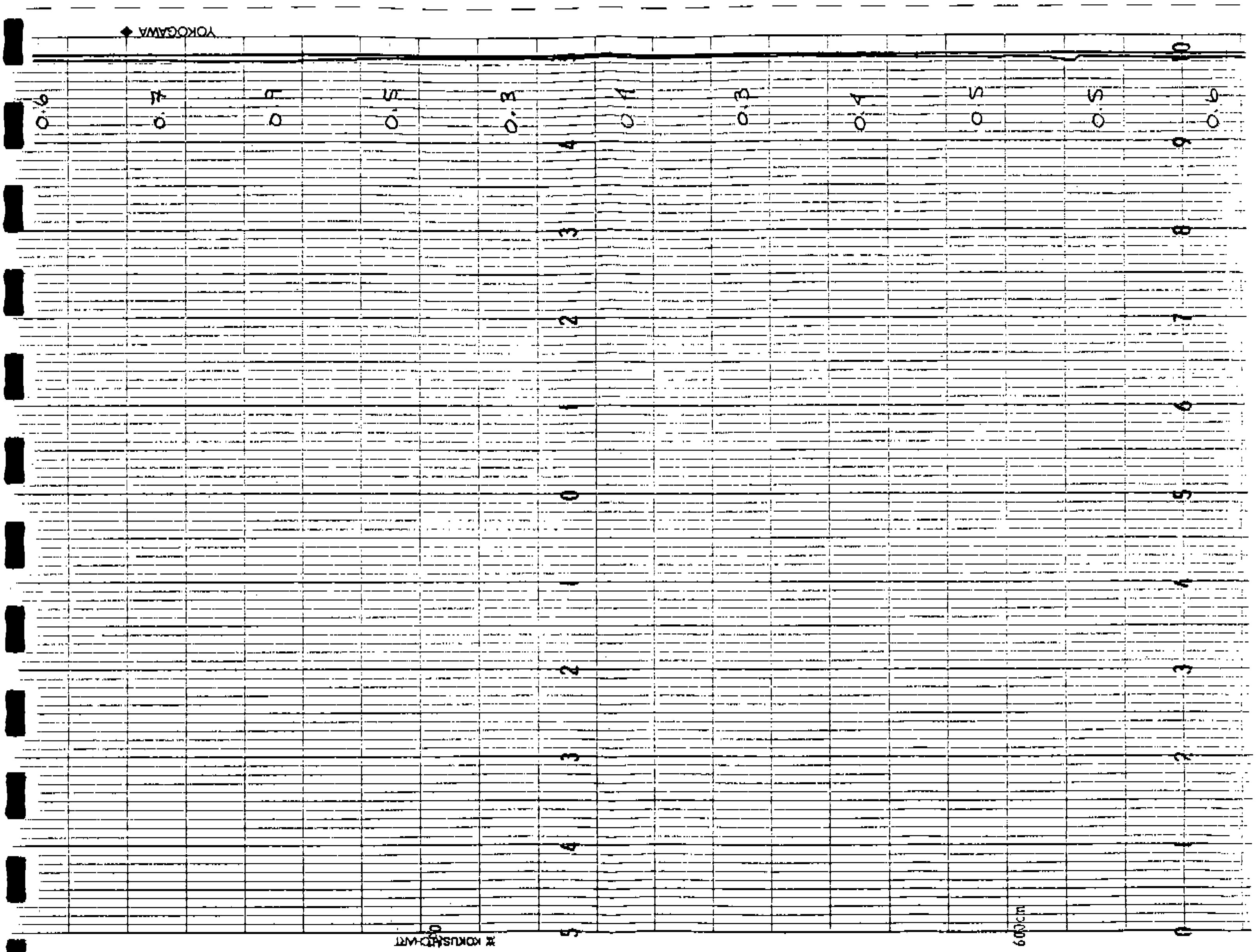

YOKOGAWA
KOKUSAI CHART
650cm
660

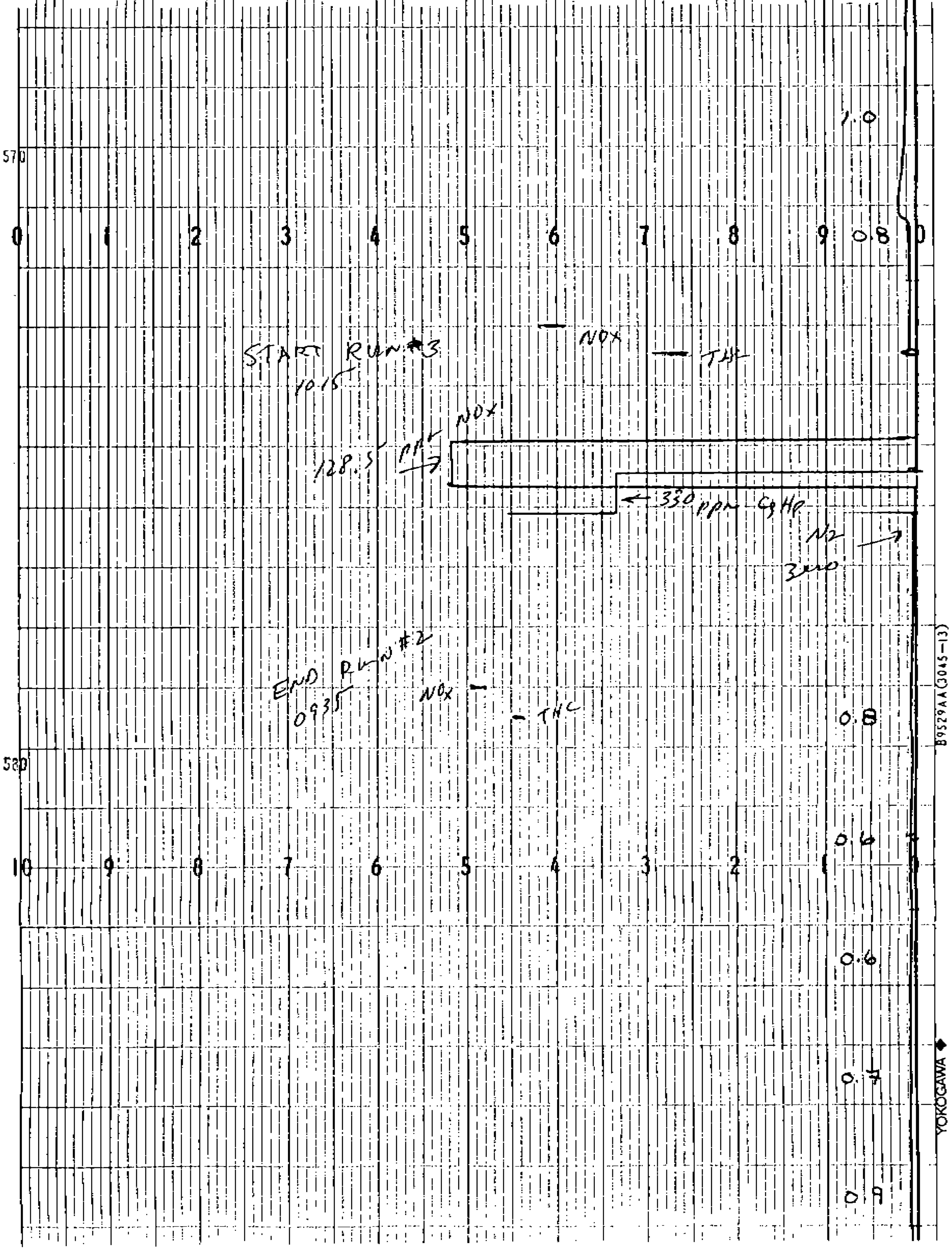

START Run #2
0833
— NOx
— THC
128.5 ppm NOx
330 ppm C3H8
N2 thru probe
END Run #1
0755
— NOx
— THC
0.2
0.5
0.5
0.8
0.6
0.0
0.0
0.0
640
650cm
YOKOGAWA
B9529AA(3045-13)



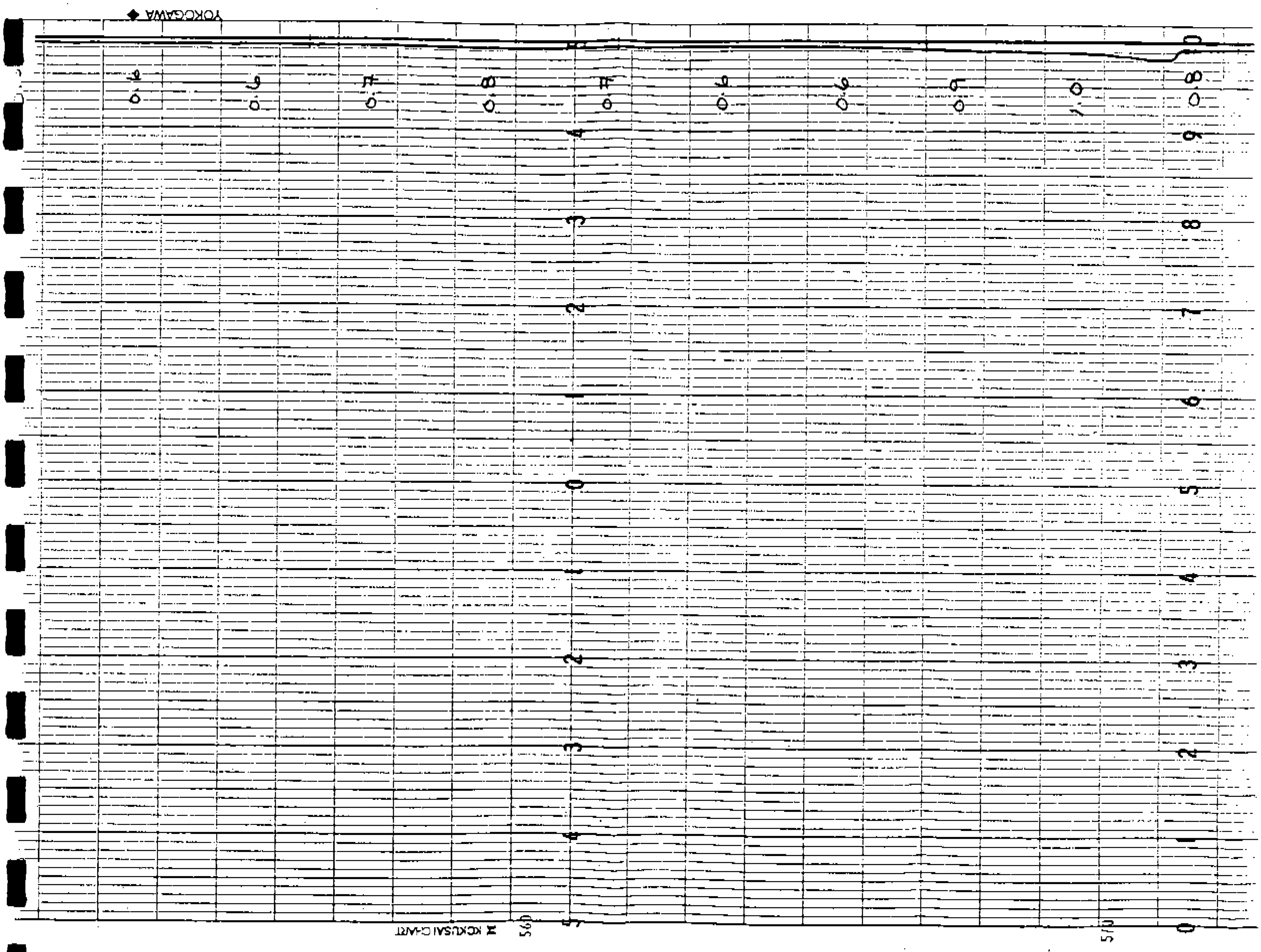


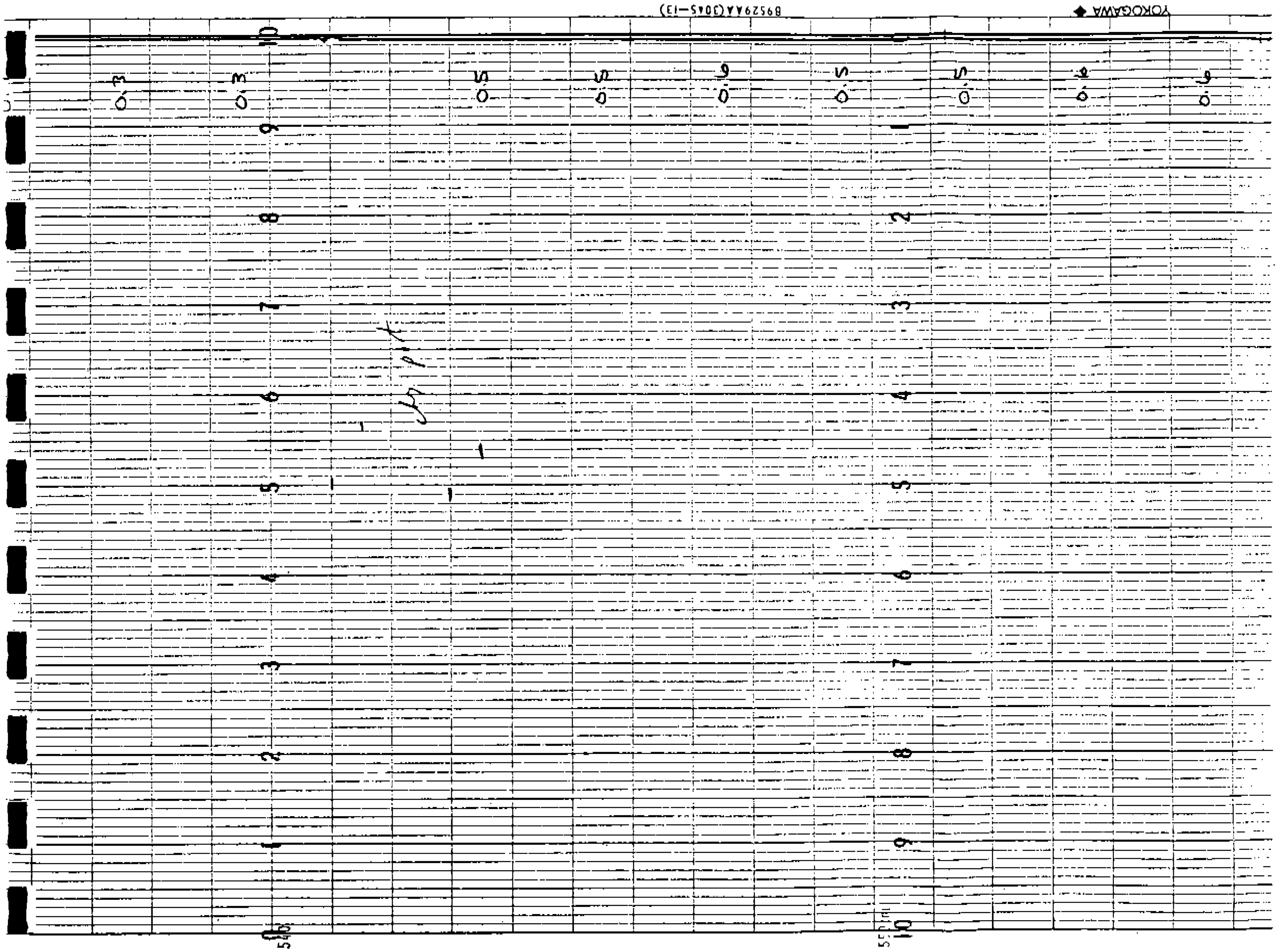
600cm
610

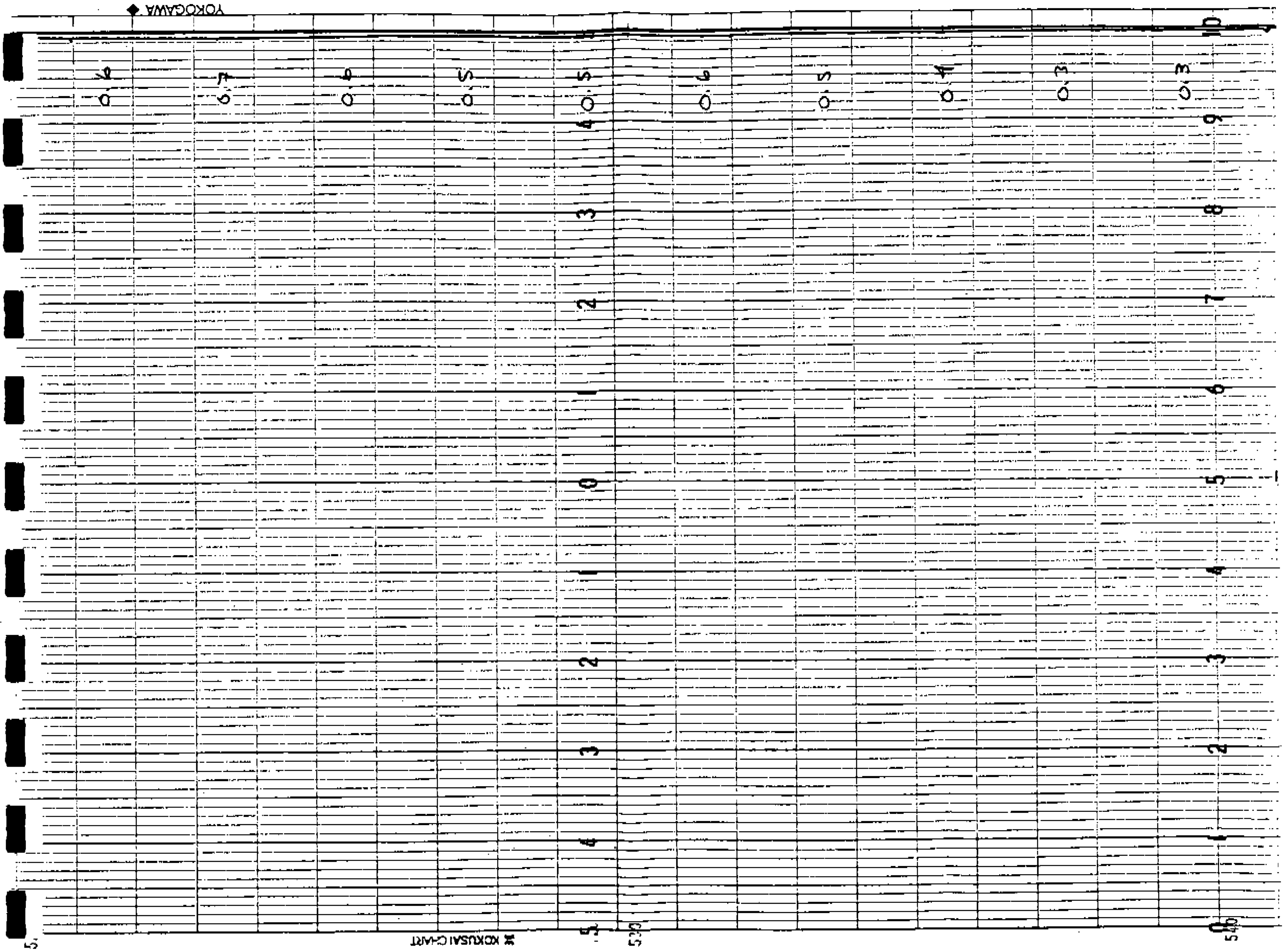


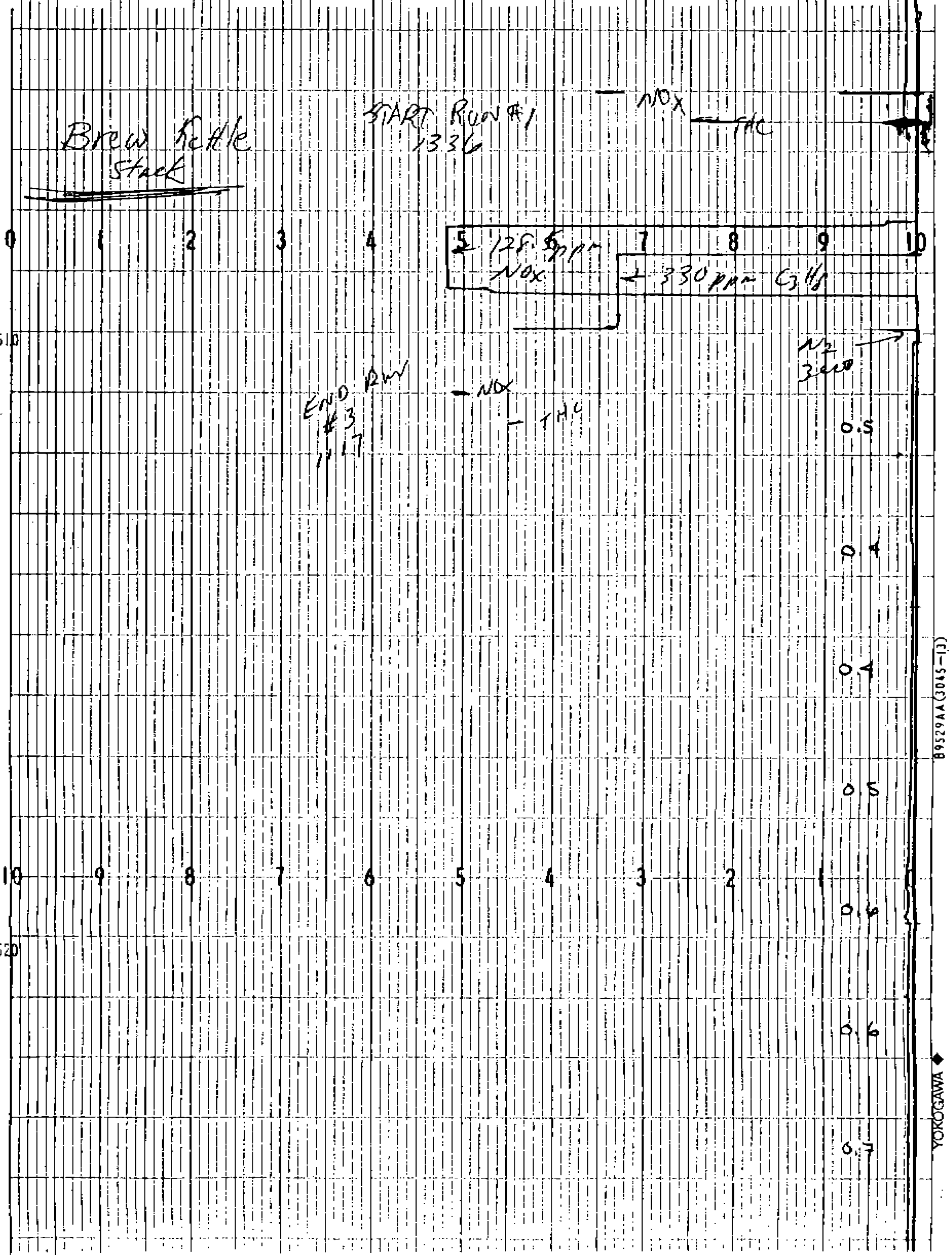


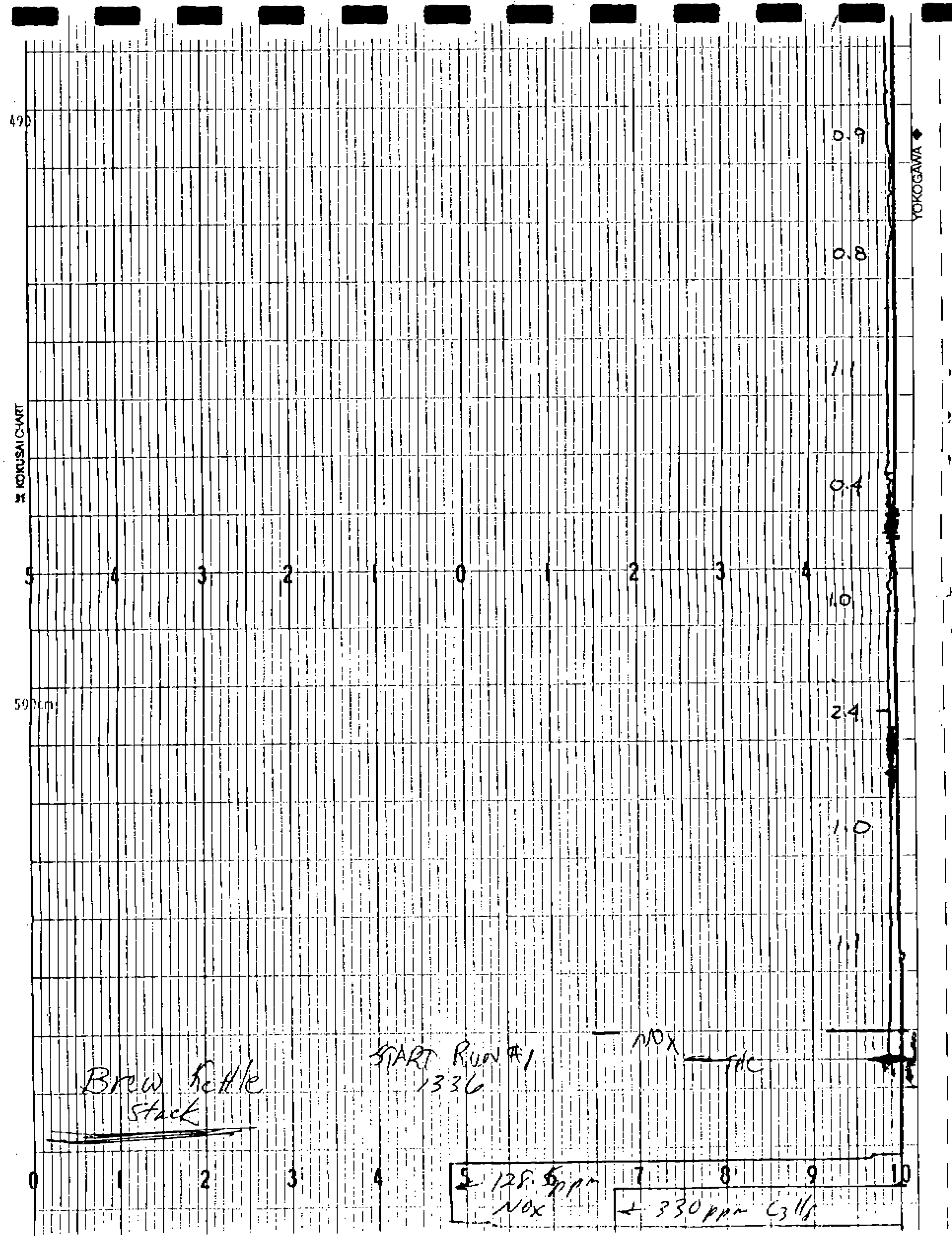
START RUN #3
1015
NOx
THC
128.5 ppm NOx
← 330 ppm $C_3H_8$
$N_2$
zero
END RUN #2
0935
NOx
THC
B9529AA(3045-13)
YOKOGAWA

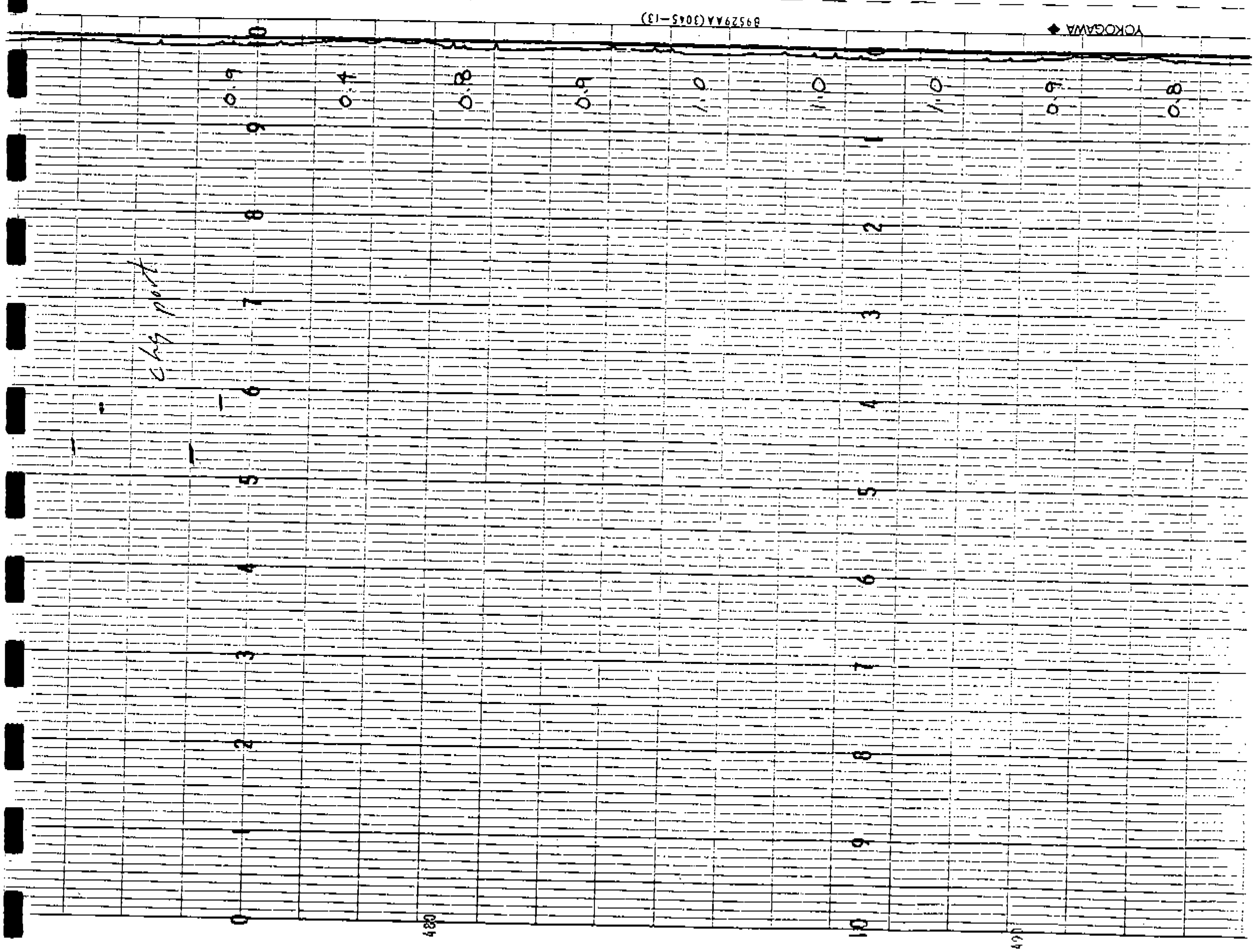




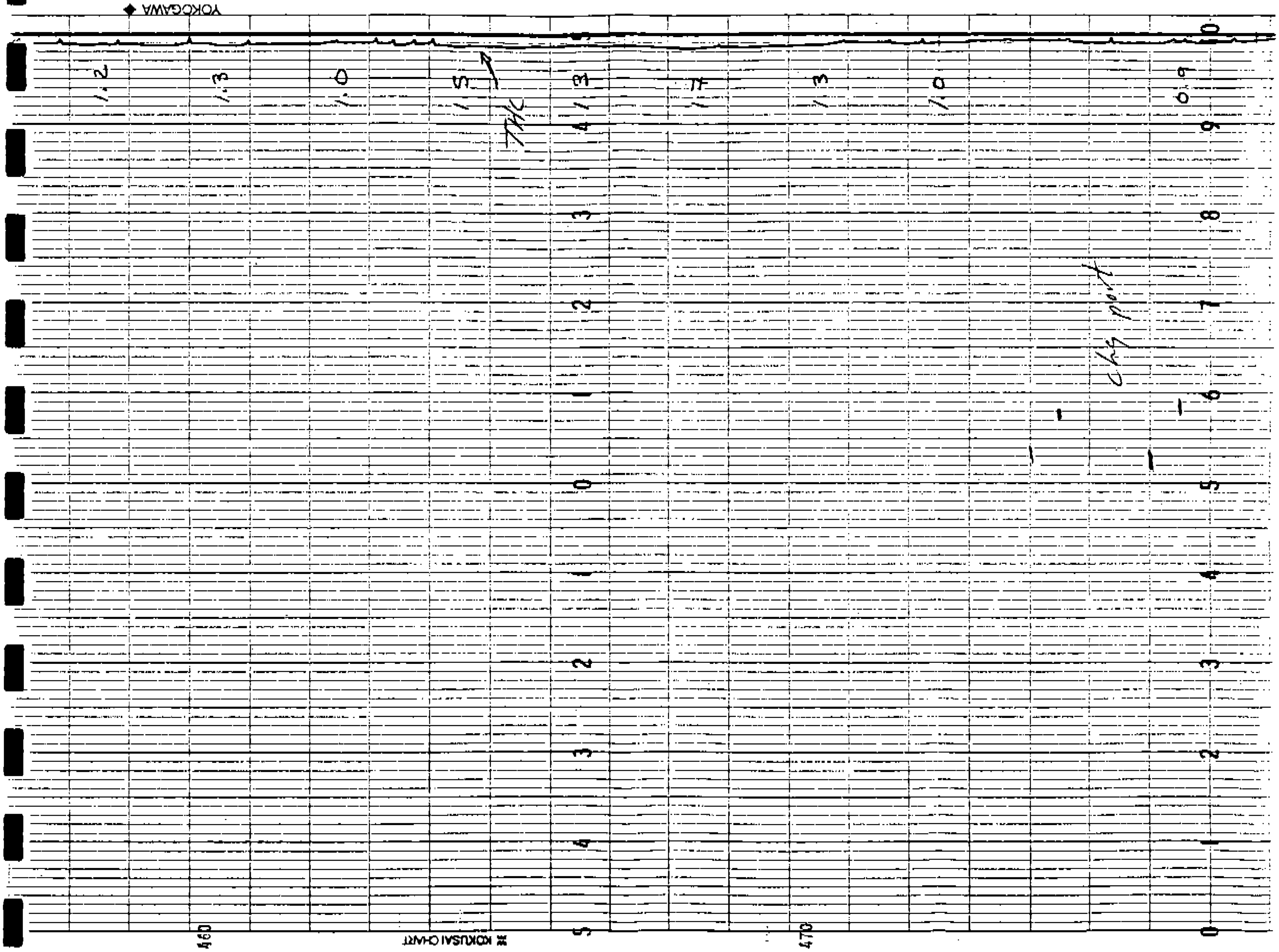



Brew Kettle
Stack
START RUN #1
1336
NOX
THC
128.5 ppm
NOx
330 ppm C3H8
N2
3 zero
END RUN
#3
1417
NOX
THC
0.5
0.4
0.4
0.5
0.6
0.6
0.7
B9529AA(3045-13)
YOKOGAWA

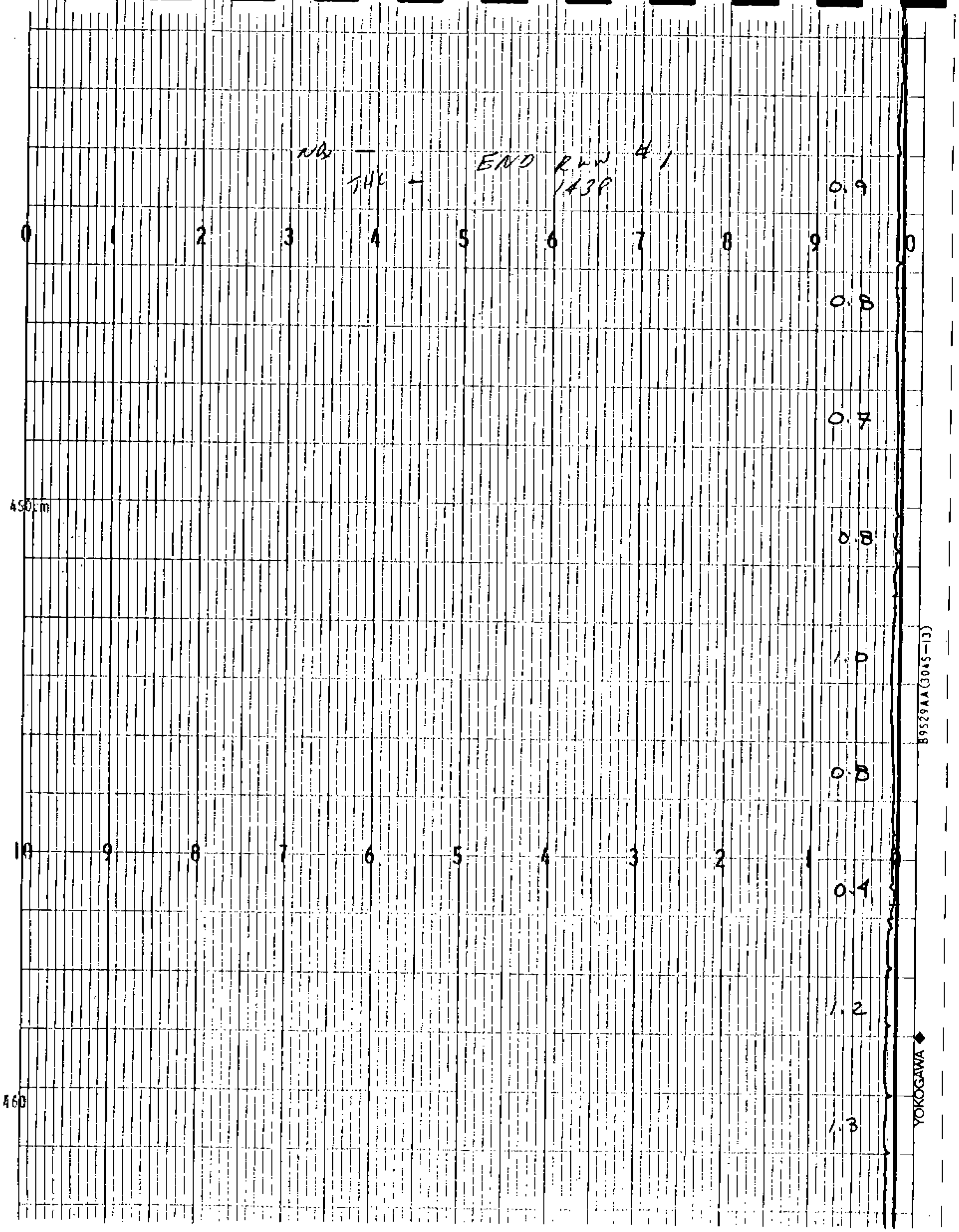

YOKOGAWA
KOKUSAI CHART
490
500cm
0.9
0.8
0.4
1.0
2.4
1.0
Brew Kettle Stack
START RUN #1 1336
NOX
THC
128.5 ppm NOx
330 ppm C3H8

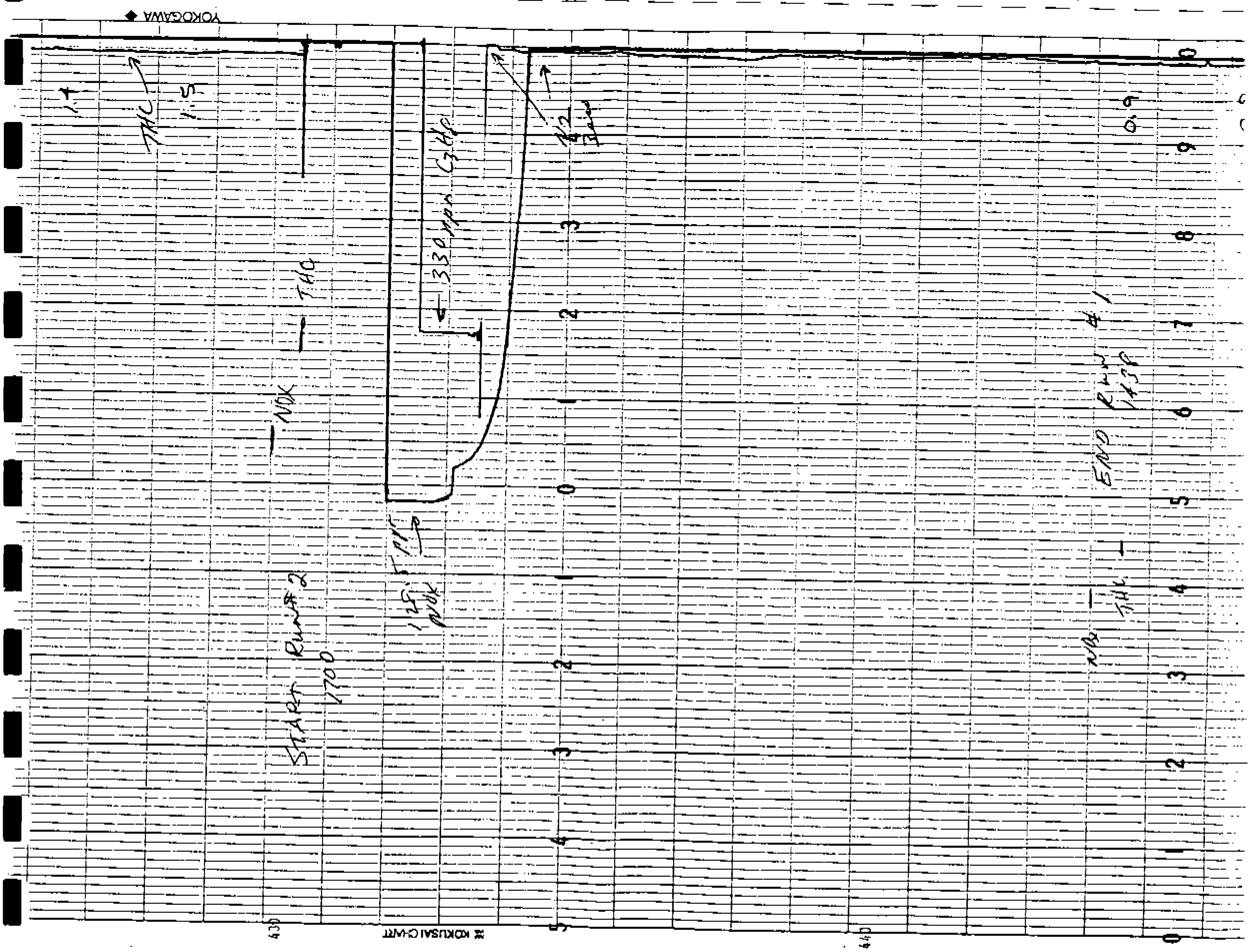


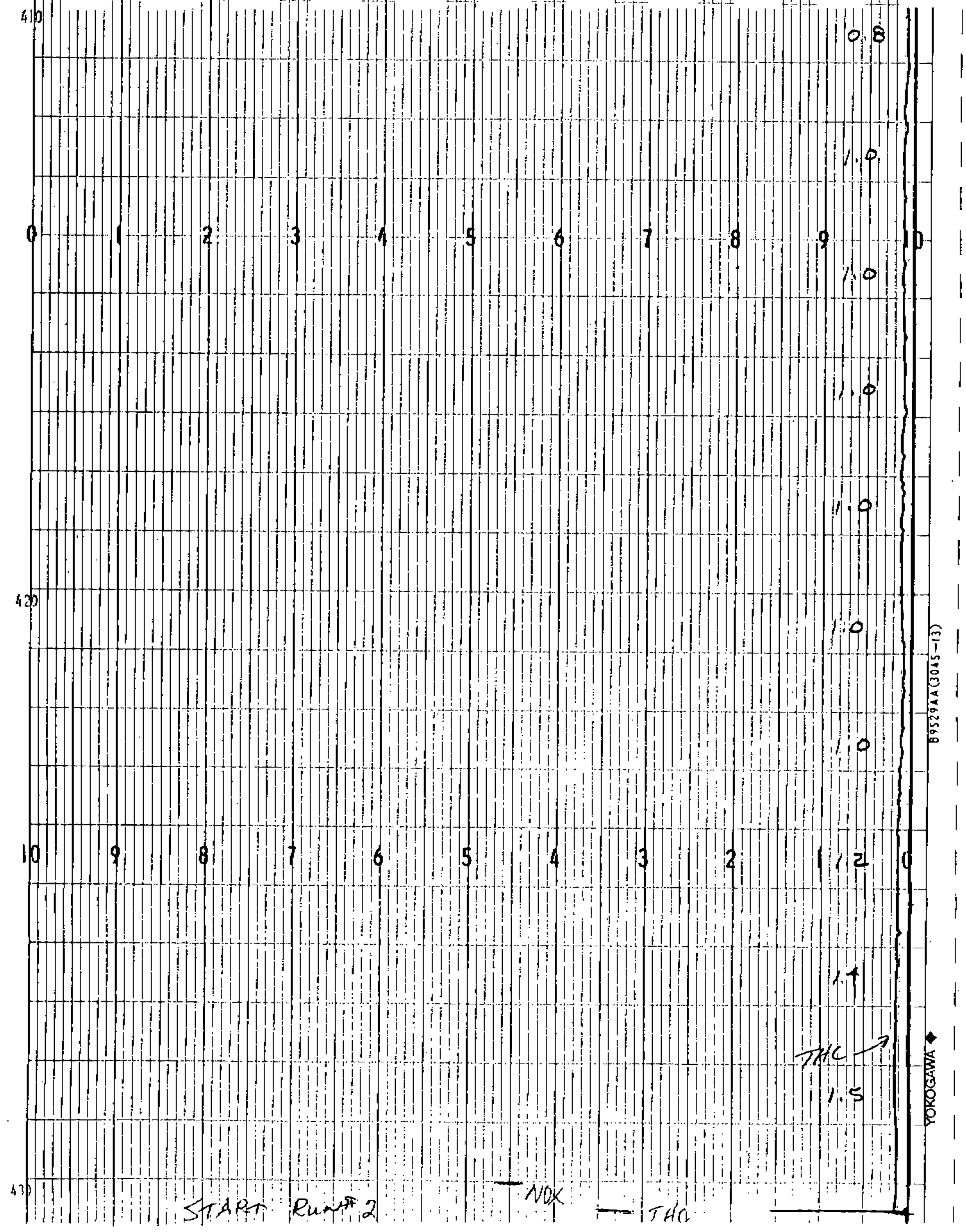
YOKOGAWA
B9529AA(3045-13)



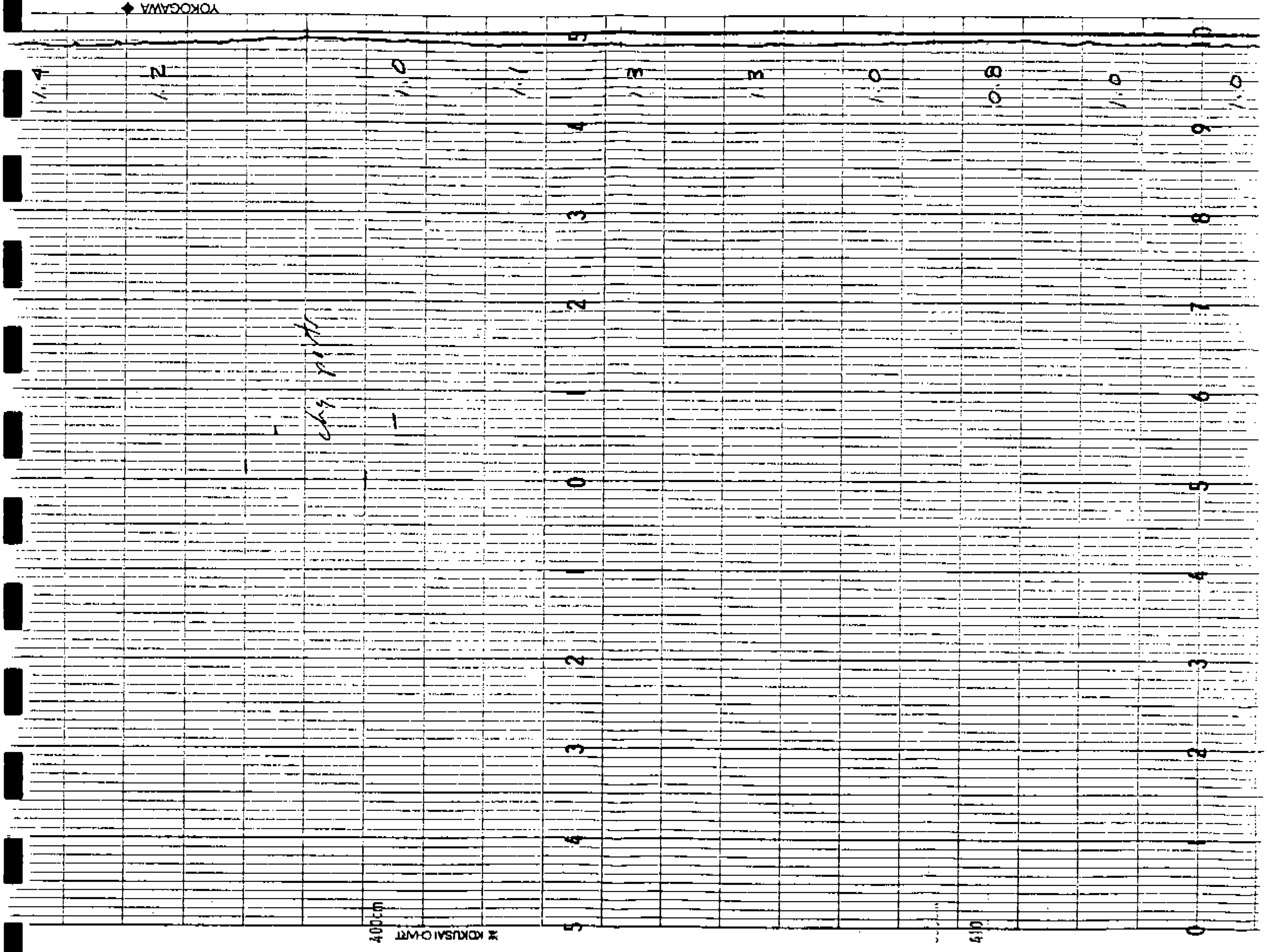
460
470
chg point


NO₂ —
THC —
END RUN #1
1438
0.9
0.8
0.7
0.8
1.0
0.8
0.4
1.2
1.3
450mm
460
YOKOGAWA
B9529AA(3045-13)

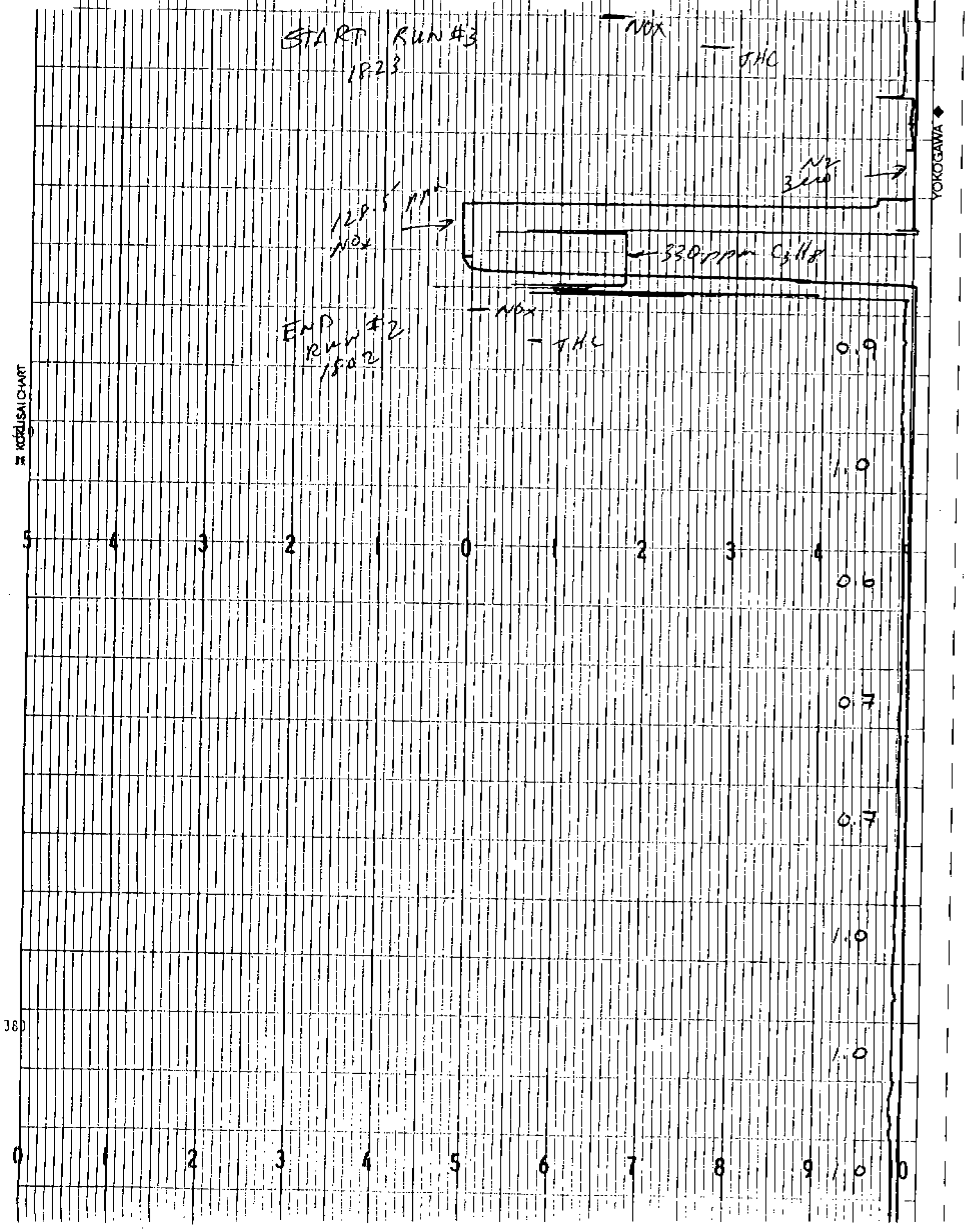

YOKOGAWA
START Run #2
1700
NOx
THC
330 ppm C3H8
END Run #1
NOx
THC
1.4
1.5
0.9
430
440
KOKUSAI CHART



0.8
1.0
1.0
1.0
1.0
1.0
1.0
1.2
1.4
THC
1.5
START Run #2
NOx
THC
B9529AA(3045-13)
YOKOGAWA

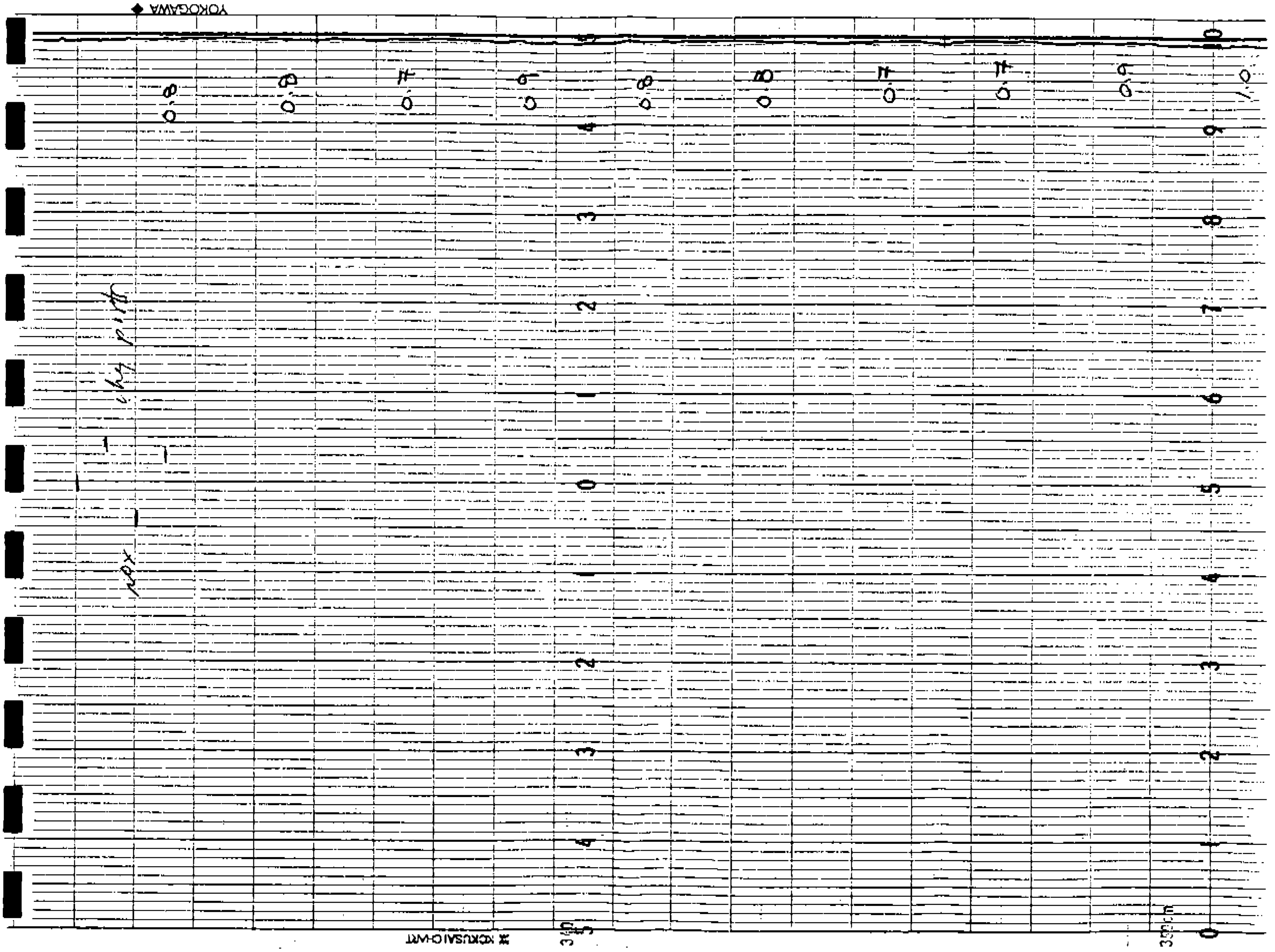

YOKOGAWA
KOKUSAI CHART
400cm
410

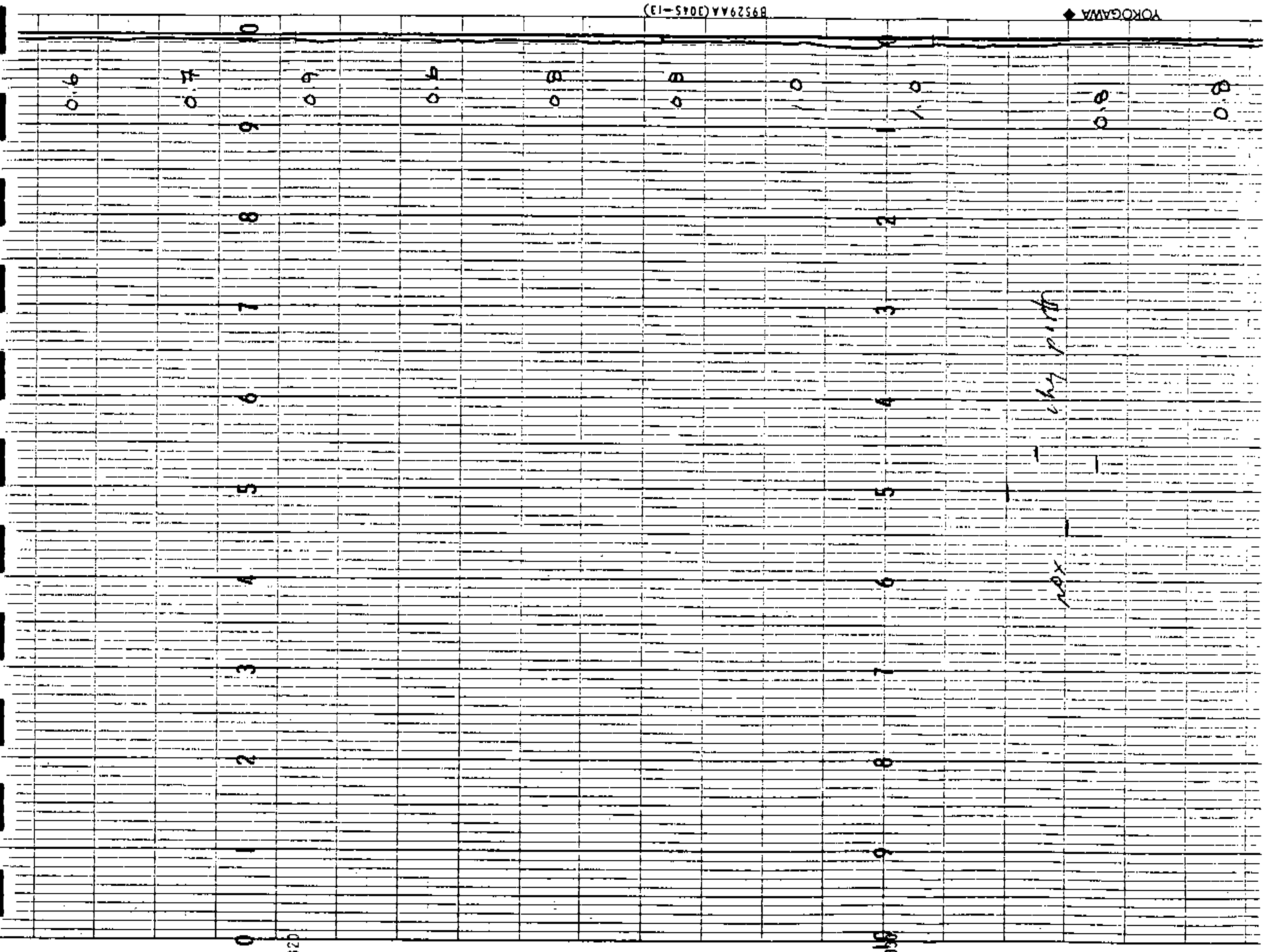

380
390



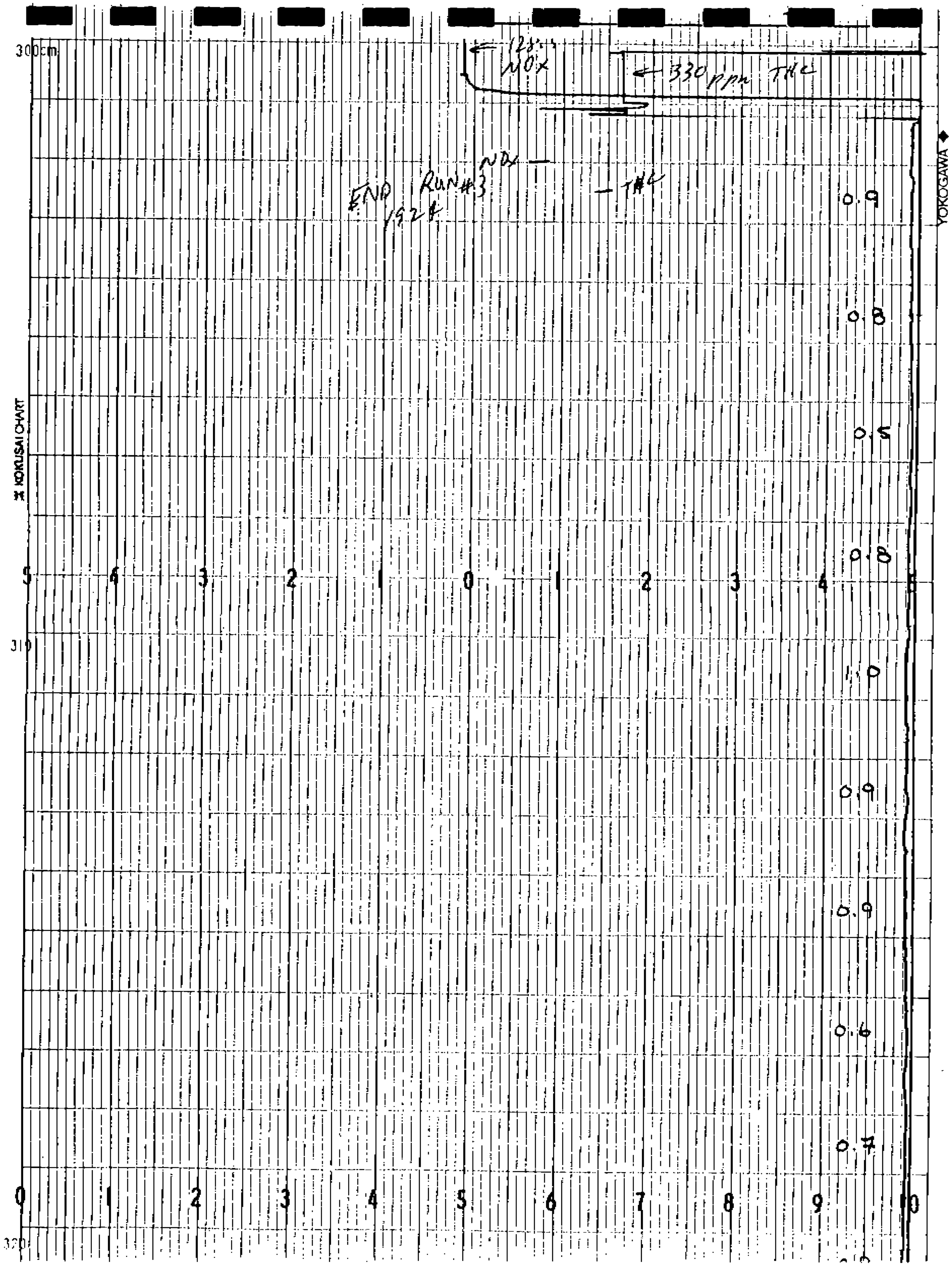
START RUN #3
1823
— NOx
— THC
YOKOGAWA
N2
zero
128.5 ppm
NOx
330 ppm C3H8
END
RUN #2
1802
— NOx
— THC
0.9
1.0
0.6
0.7
0.7
1.0
1.0
1.0
KOKUSAI CHART

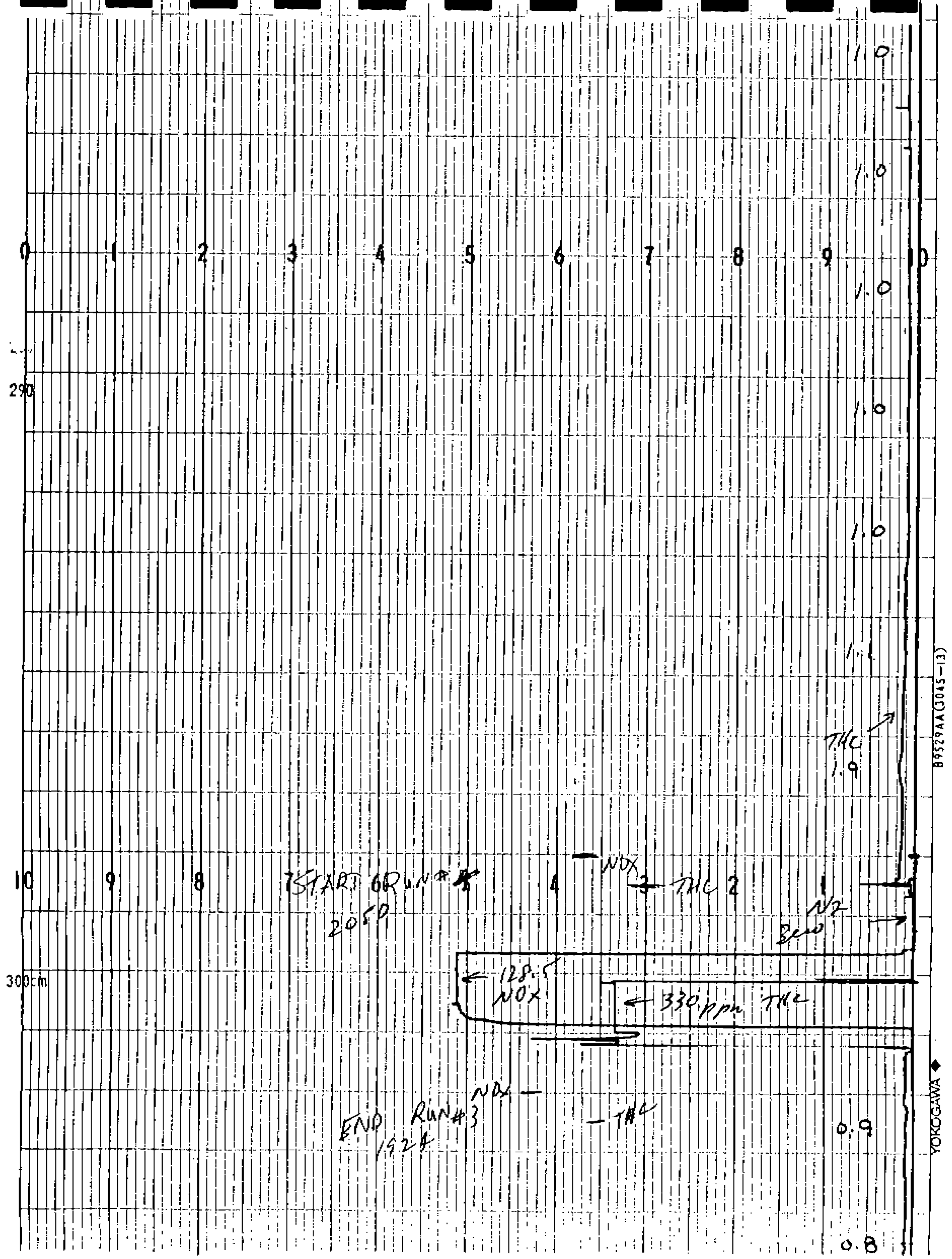

350cm
360
0.7
0.9
1.0
0.9
1.1
1.0
1.1
THC
1.5
START RUN #3
1823
NOX
THC
N2
zero
120.5 ppm
NOX
330 ppm C3H8
B9529AA(3045-13)
YOKOGAWA



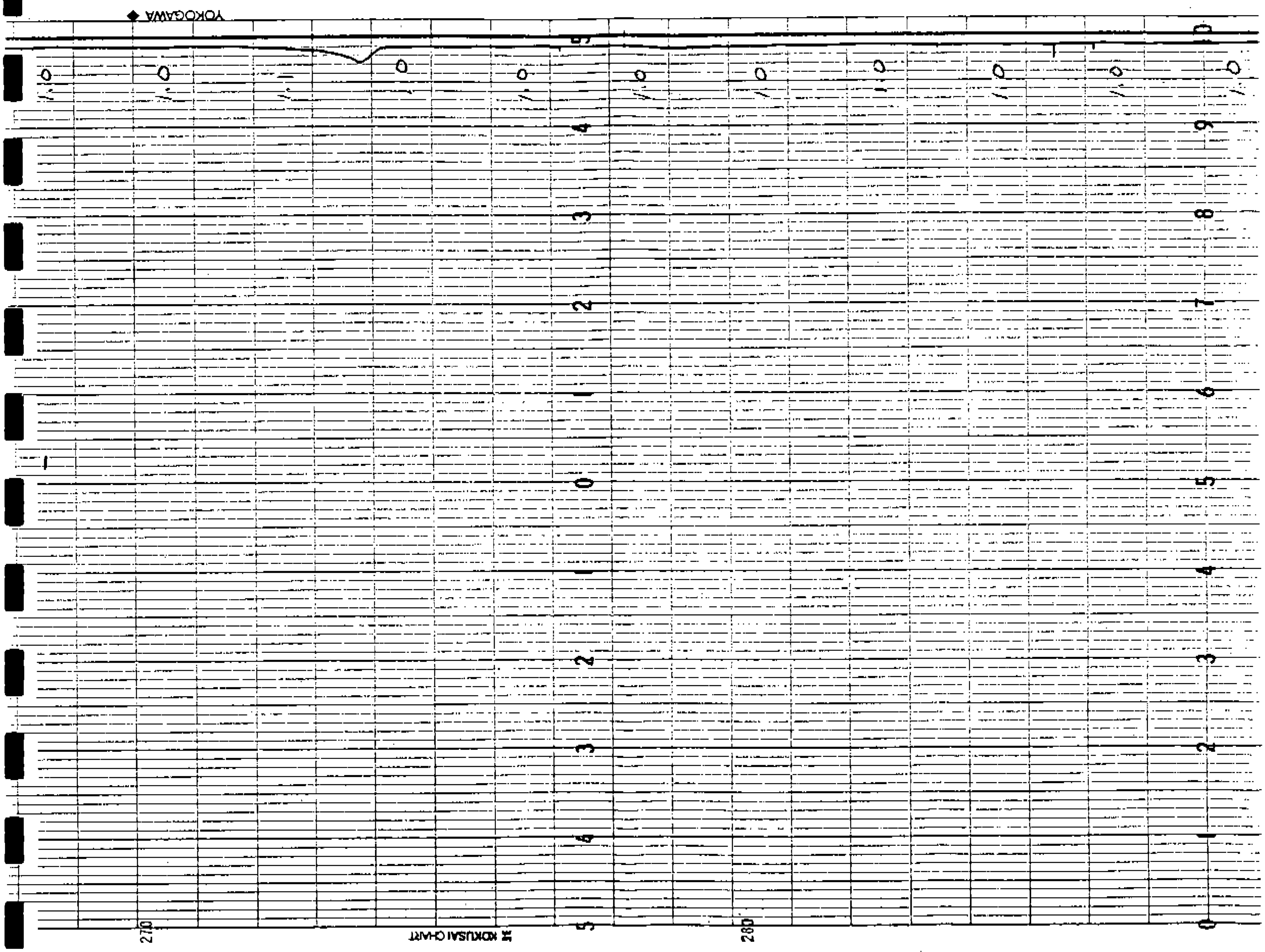


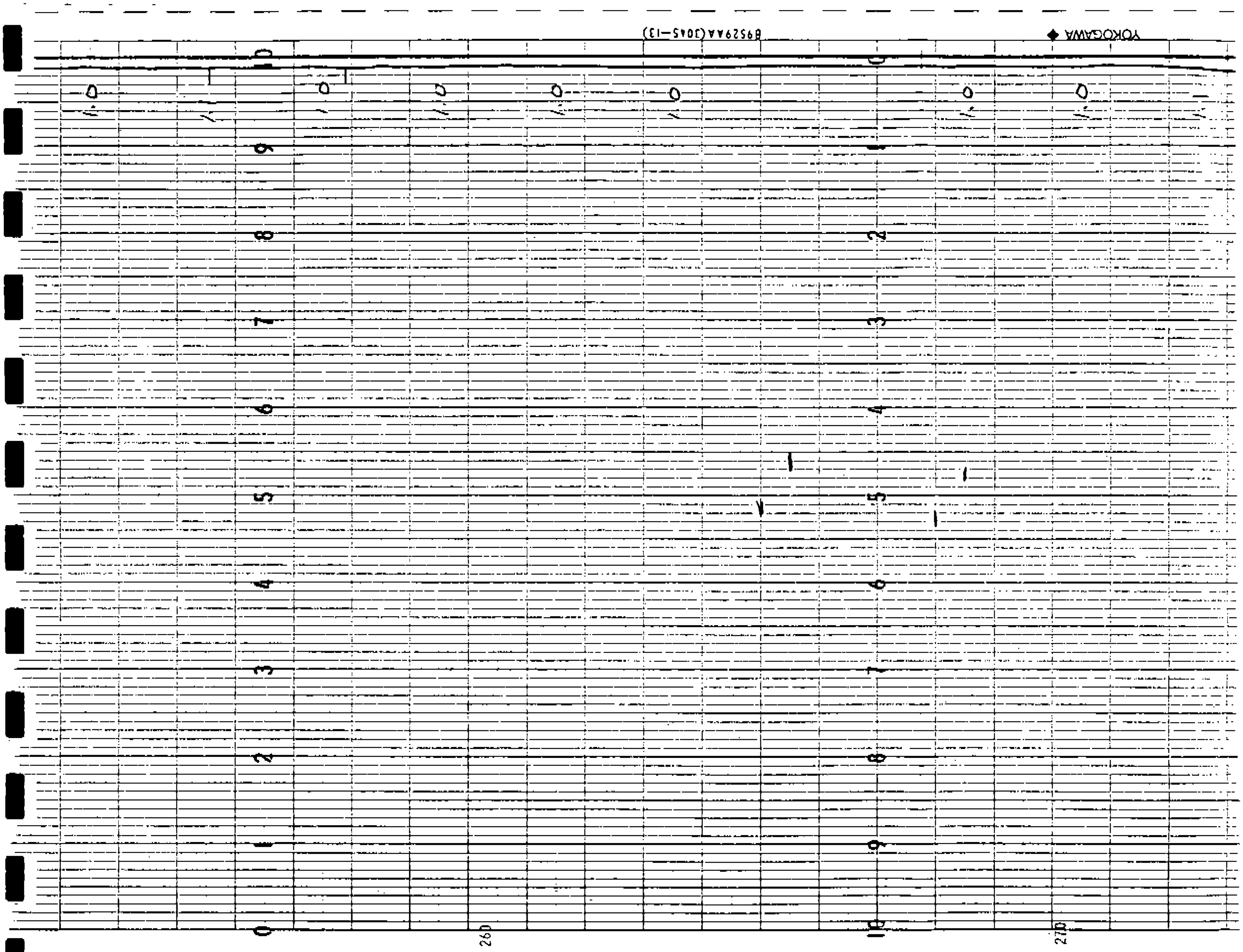
YOKOGAWA
B9529AA(3045-13)


300cm
310
320
KOKUSAI CHART
YOKOGAWA
← 128 ppm NOX
← 330 ppm THC
END RUN #3
1528
NOx
THC
0.9
0.8
0.5
0.8
1.0
0.9
0.9
0.6
0.7



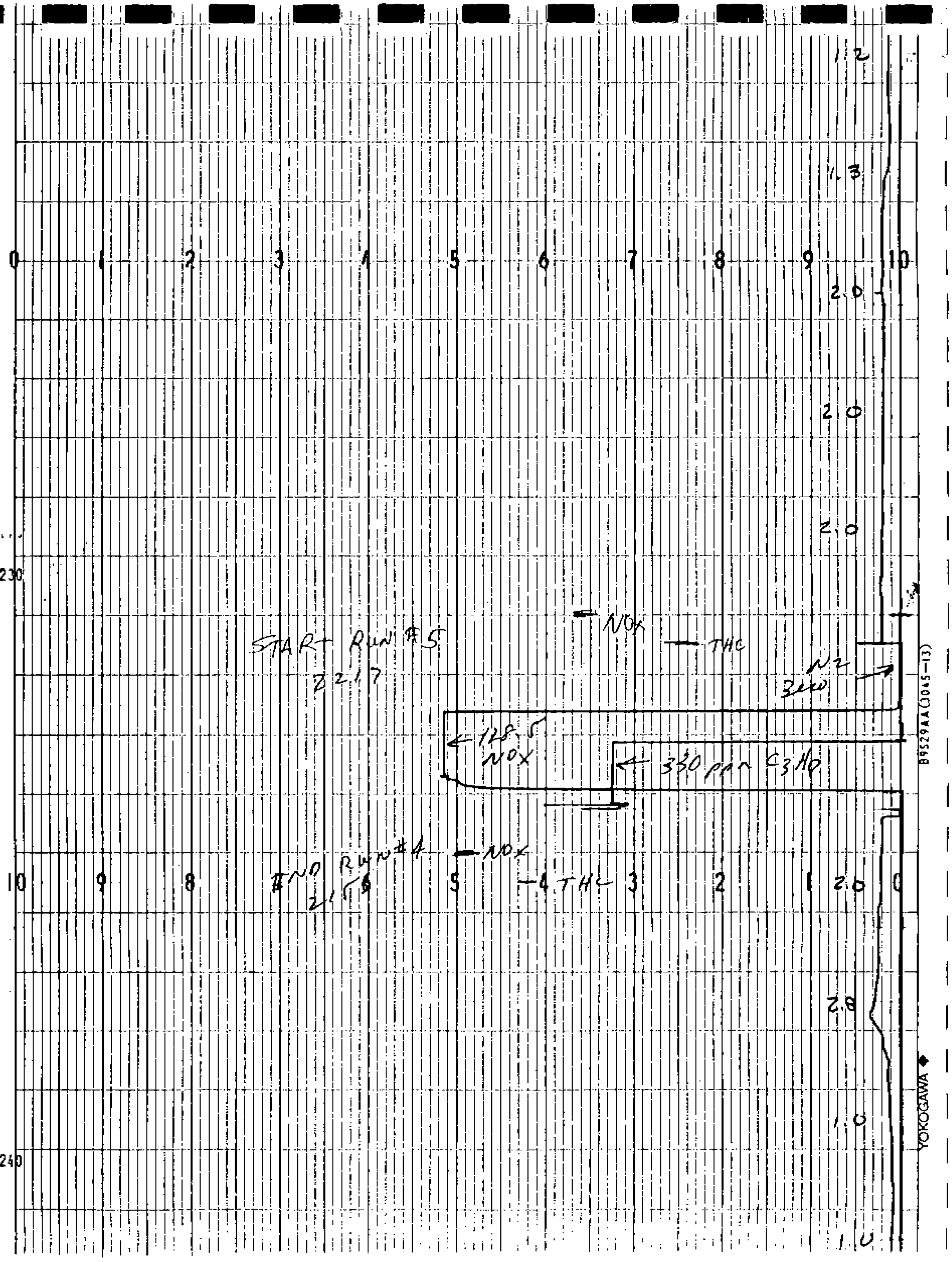
YOKOGAWA
B9529AA(3045-13)
290
300cm
THC 1.9
START 6 RUN #
2050
NOX
THC 2
N2 Zero
128.5 NOX
330 ppm THC
END RUN #3
1924
NOX
THC

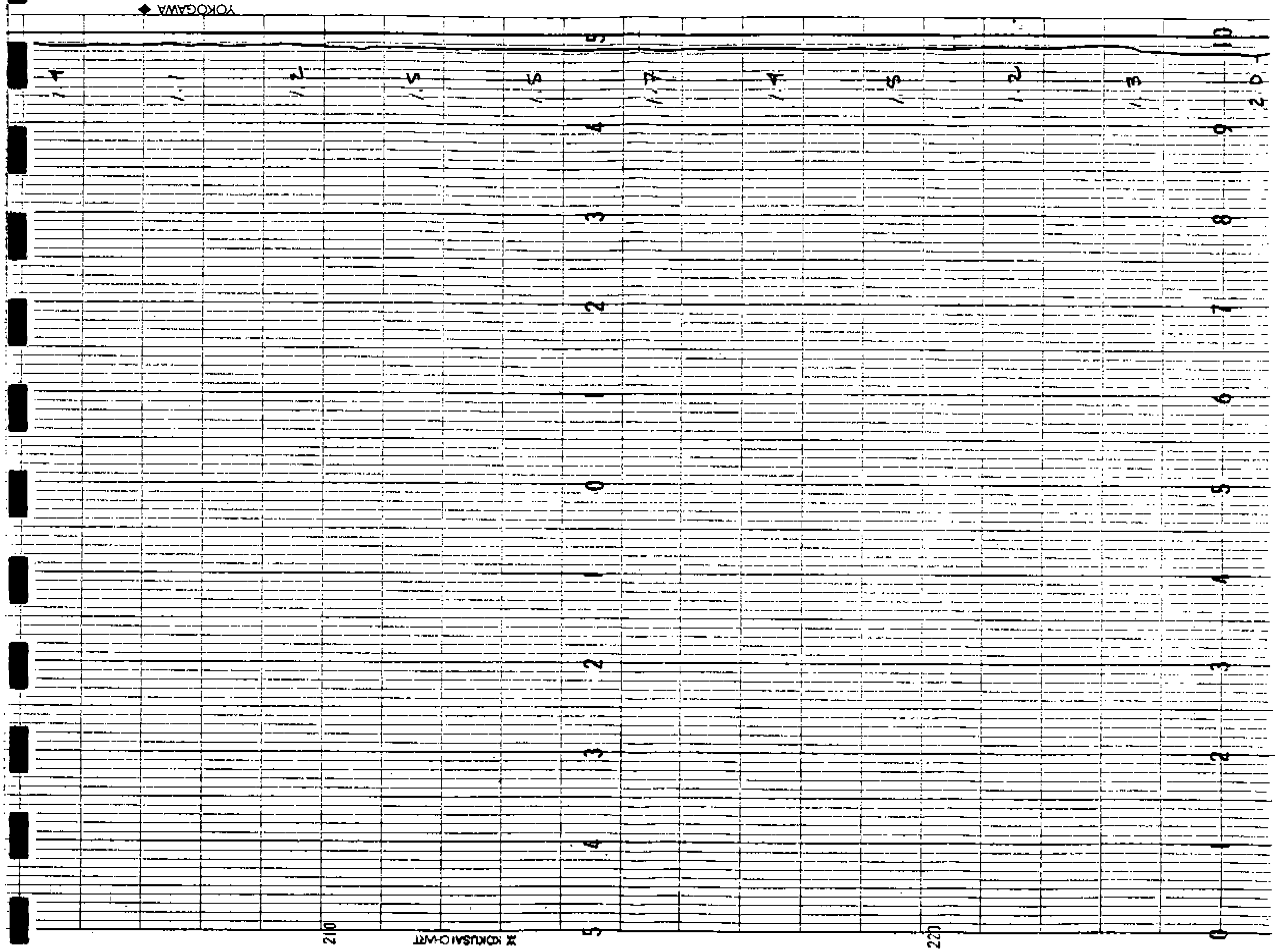


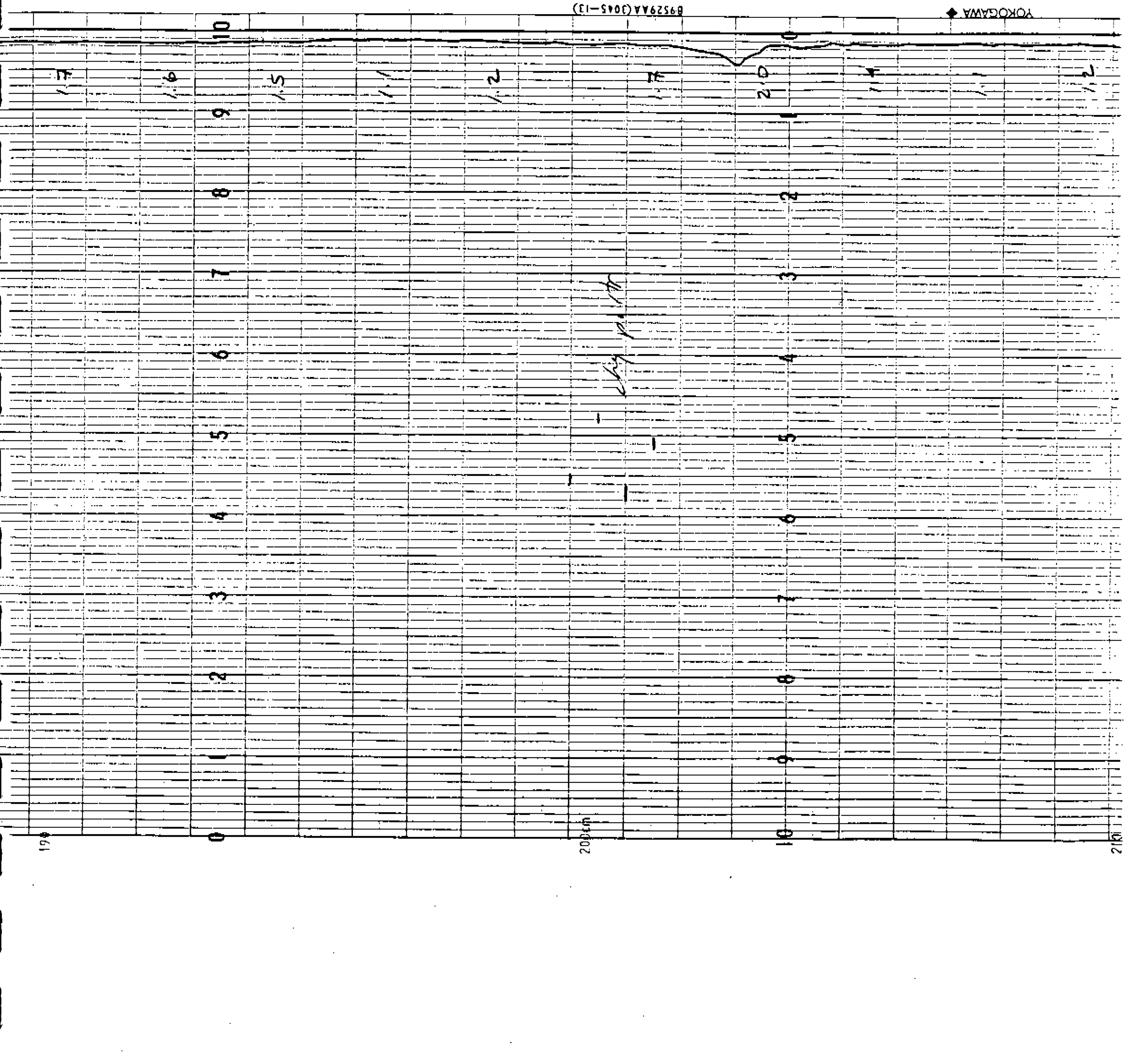


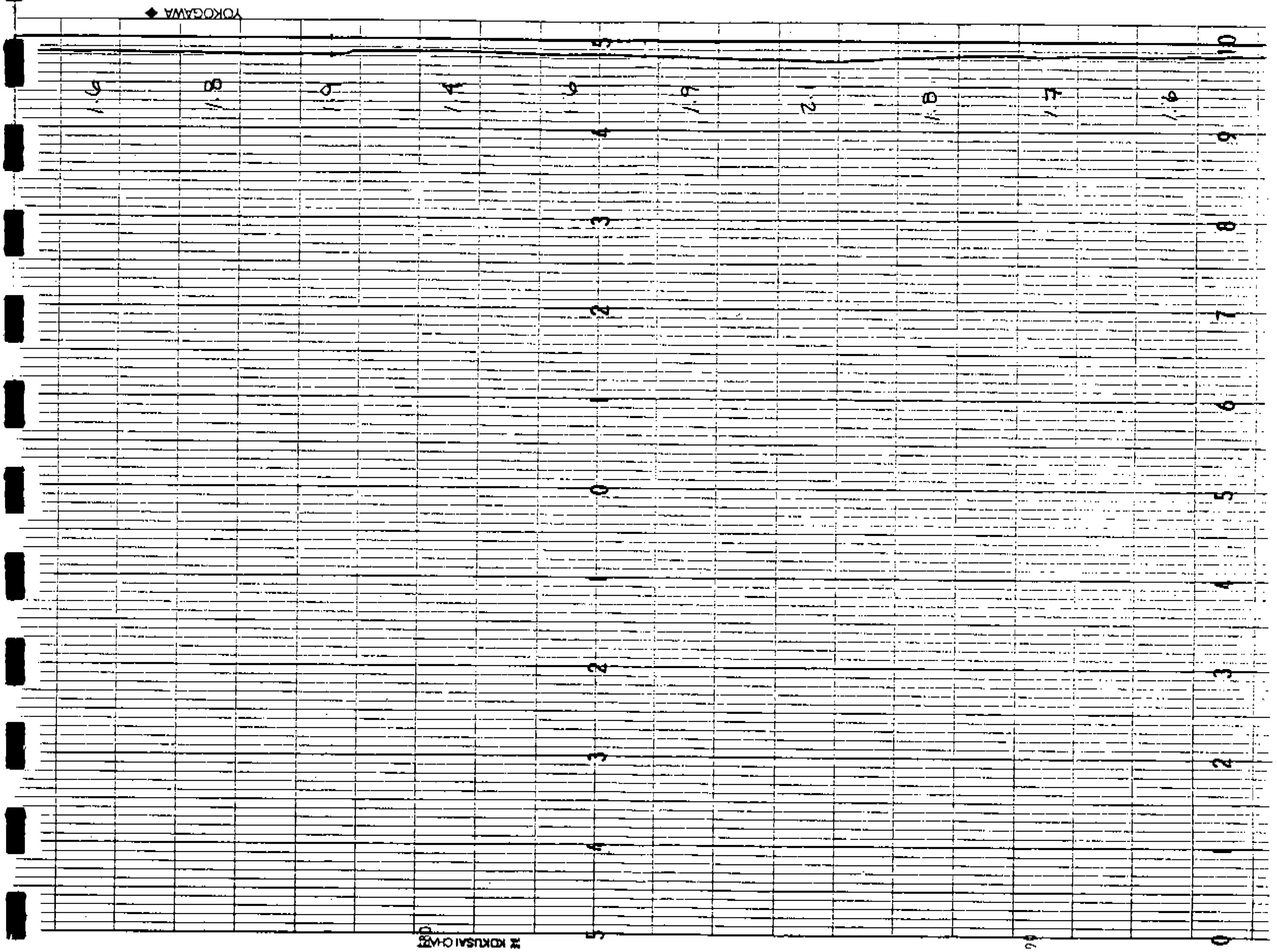
0 1 2 3 4 5 6 7 8 9 10
10 9 8 7 6 5 4 3 2 1 0
260
270

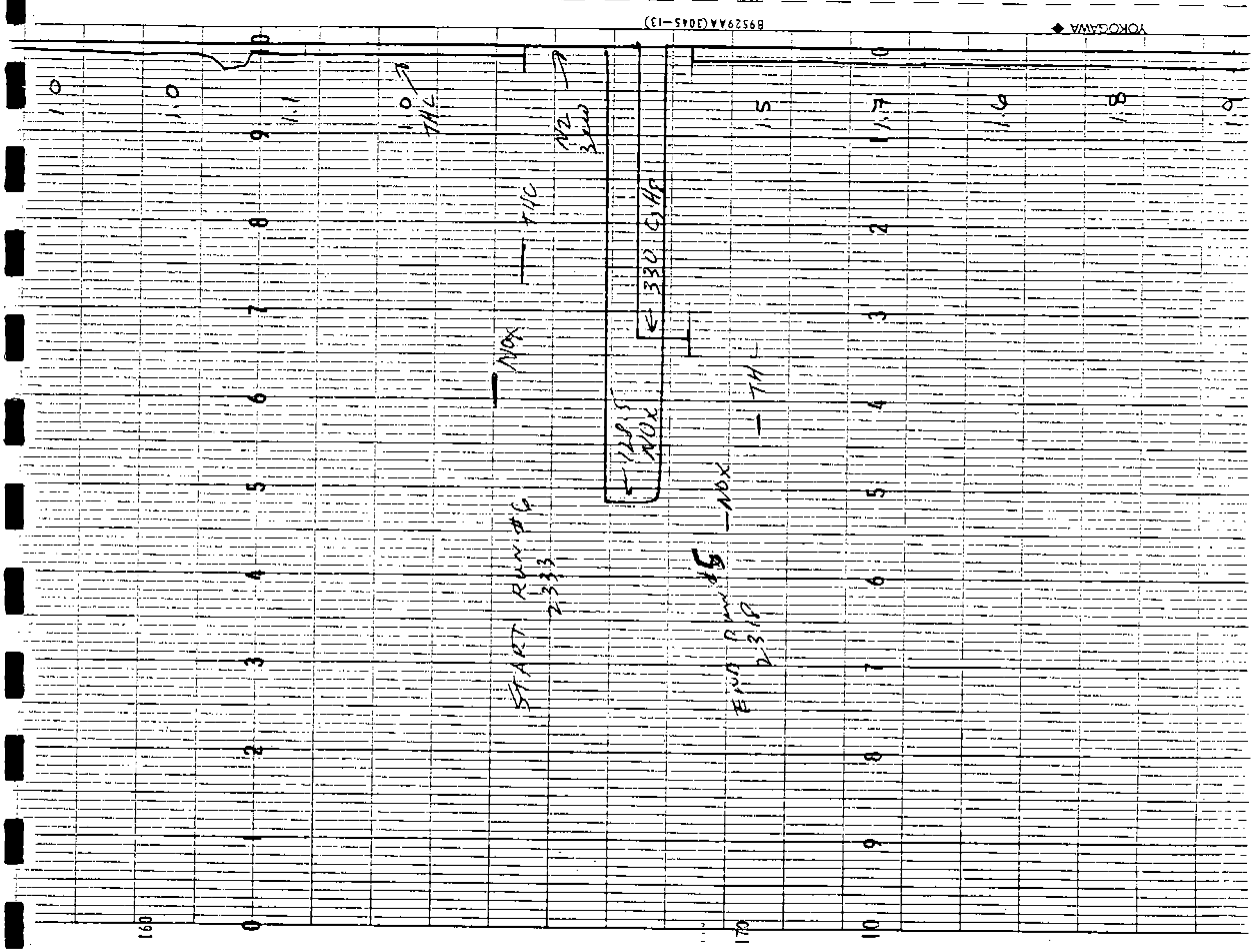
YOKOGAWA
KOKUSAI CHART
240
250 mm
2.8
1.0
1.0
1.0
1.2
1.0
1.0
1.0
1.0
1.1


START RUN #5
2217
END RUN #4
2156
NOX
THC
N2
3200
128.5
NOX
330 ppm C3H8
B9529AA(3045-13)
YOKOGAWA
230
240

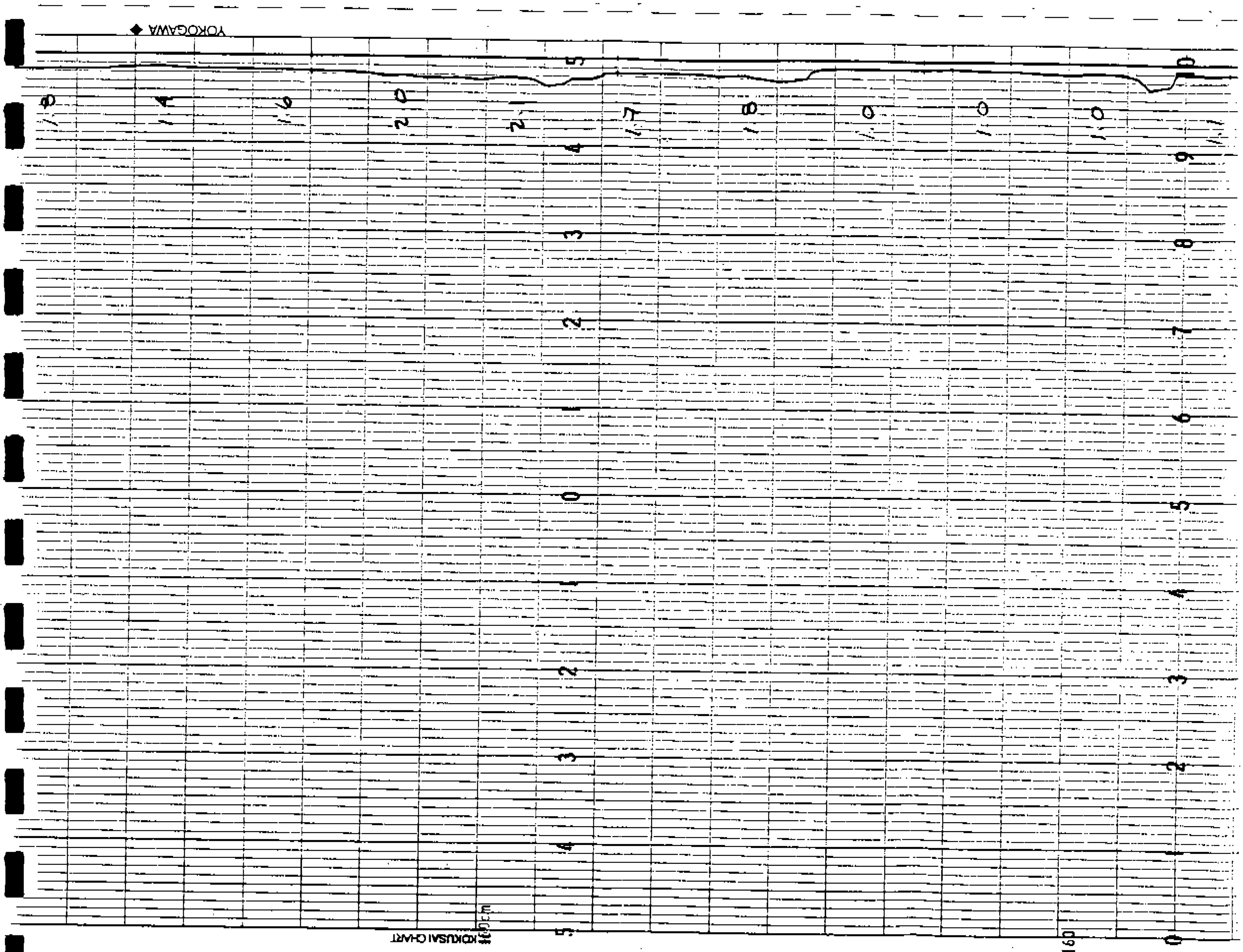

YOKOGAWA
KOKUSAI CHART
210
220

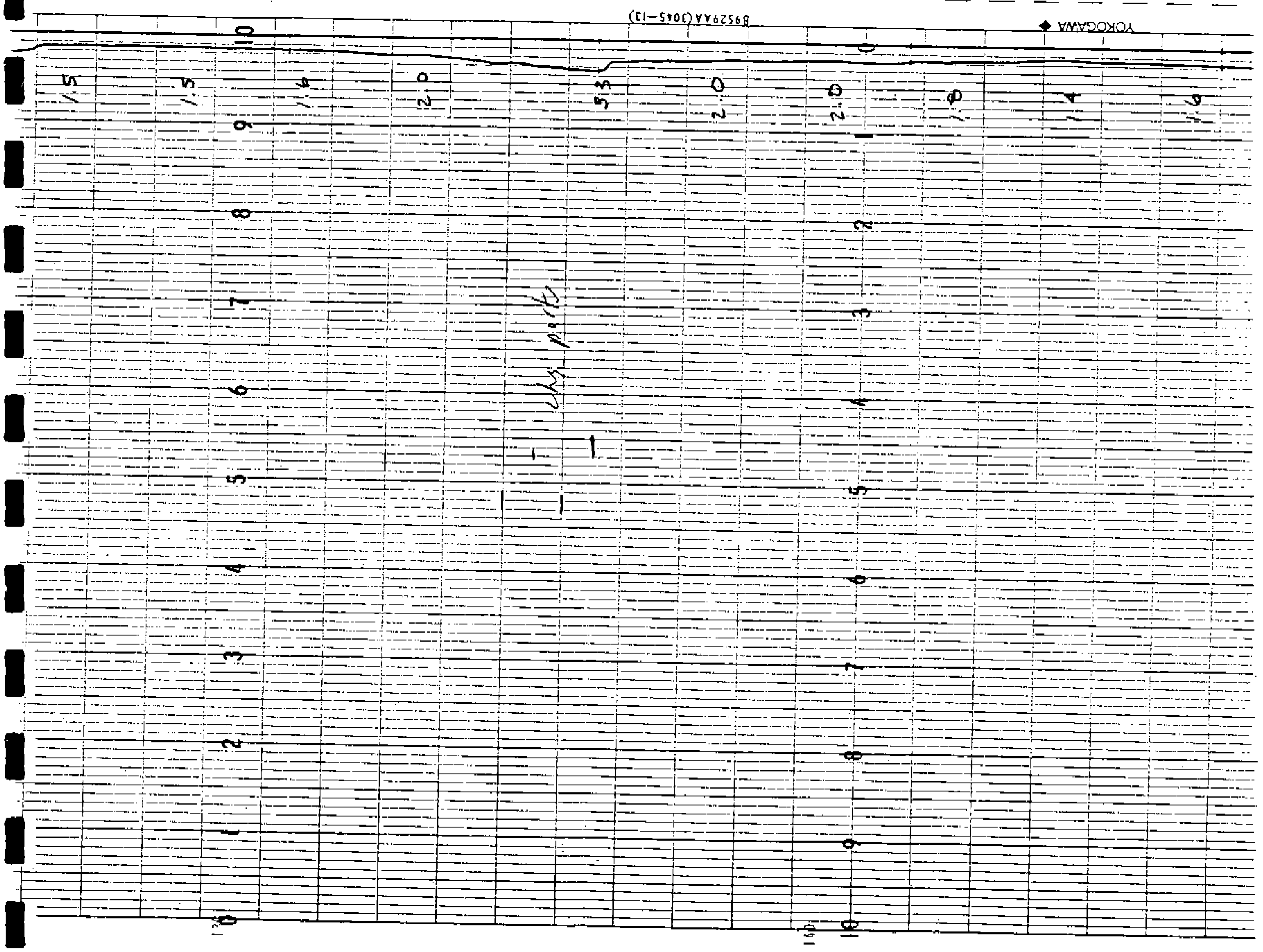

YOKOGAWA
B9529AA(3045-13)
200cm


YOKOGAWA
KOKUSAI CHART

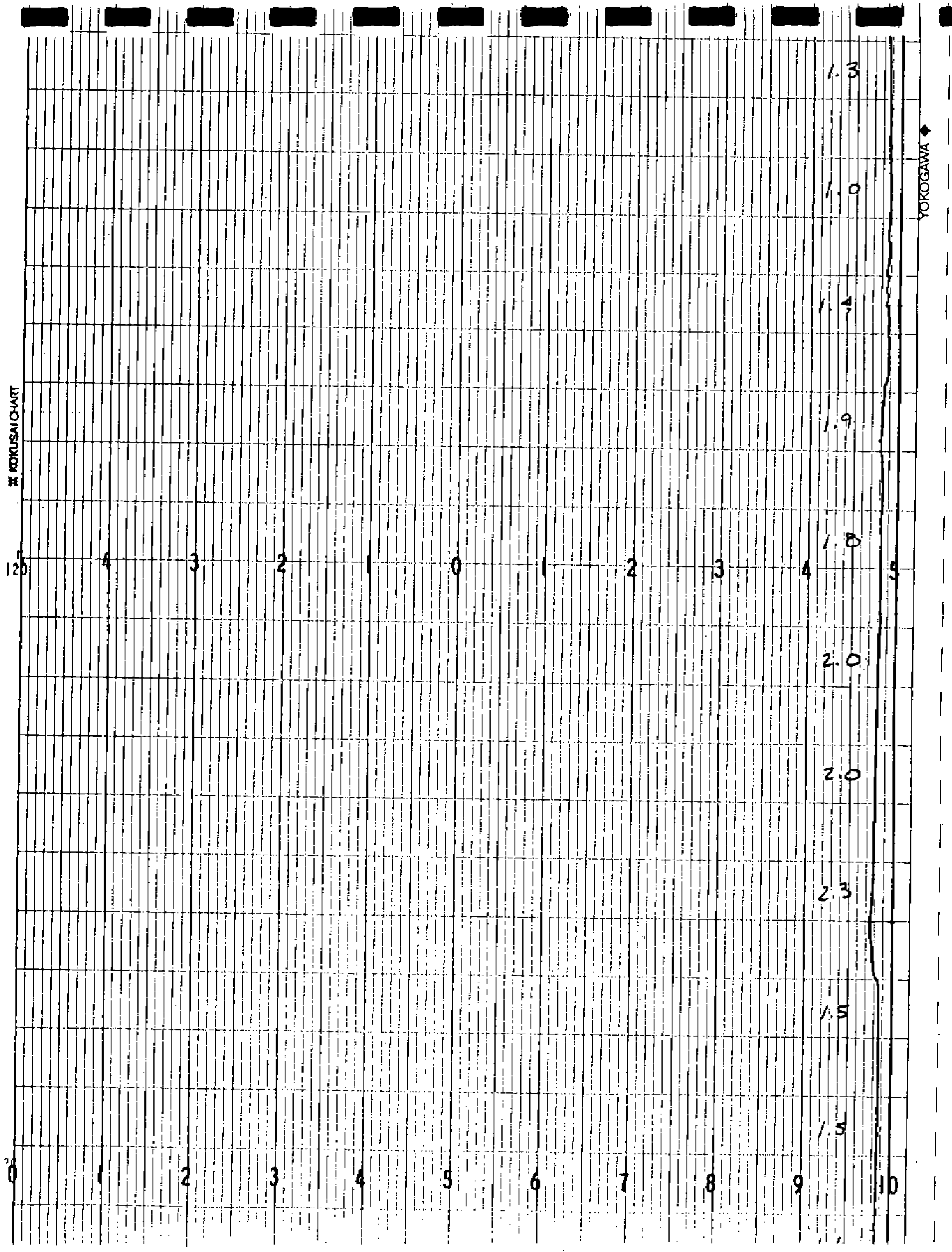


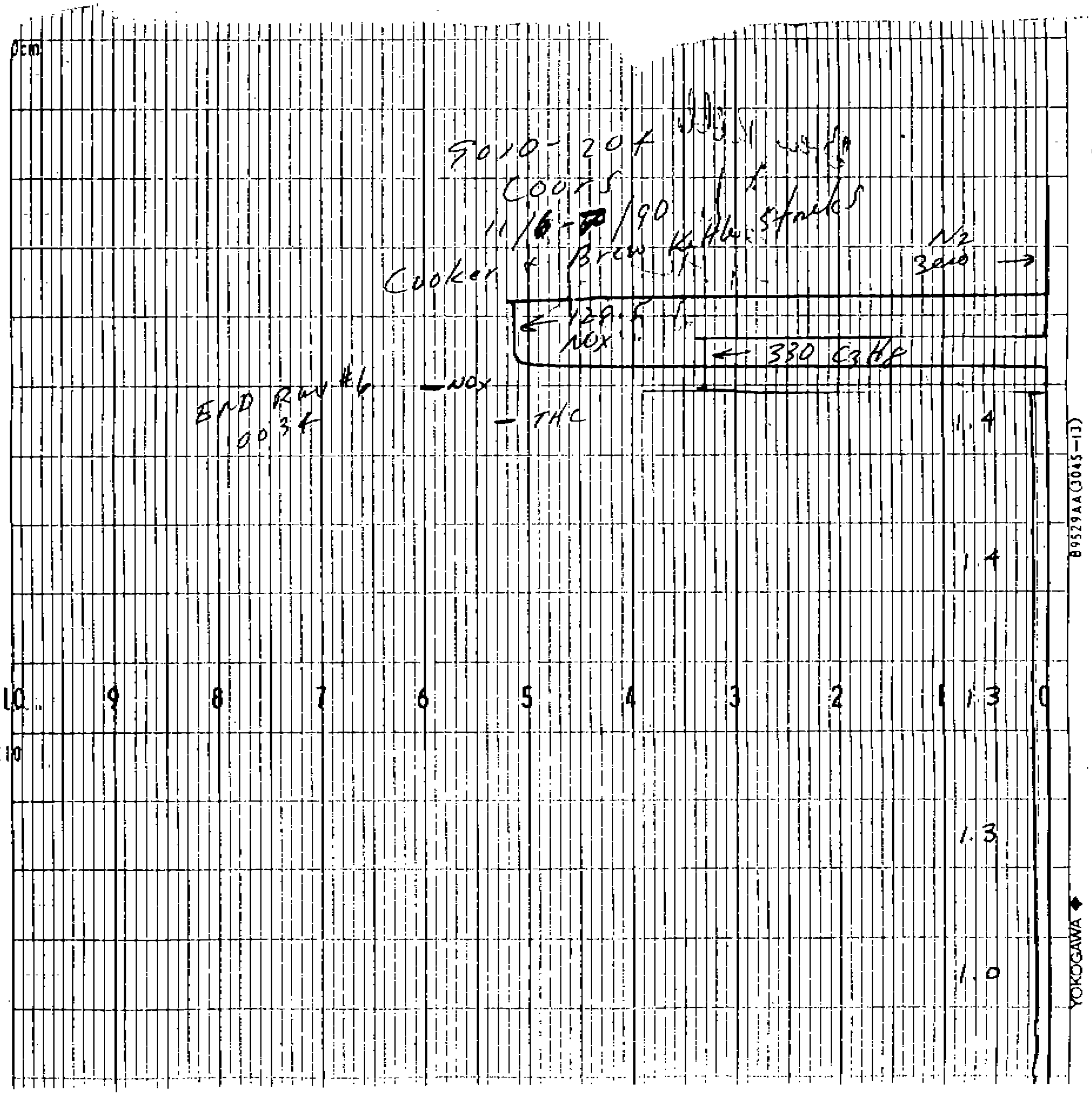
B9529AA(3045-13)
YOKOGAWA
START RUN #6
2333
THC
NOX
330 $C_3H_8$





B9529AA(3045-13)
YOKOGAWA


YOKOGAWA
KOKUSAI CHART
1.3
1.0
1.4
1.9
1.8
2.0
2.0
2.3
1.5
1.5



9010-20A
COORS
11/6-7/90
Cooker & Brew Kettle Stacks
$N_2$
3000
← 129.5
NOx
← 330 $C_3H_8$
— NOx
— THC
END RUN #6
0034
1.4
1.4
1.3
1.3
1.0
0 1 2 3 4 5 6 7 8 9 10
B9529AA(3045-13)
YOKOGAWA

APPENDIX E

Analytical Data

PARTICULATE

WESTERN ENVIRONMENTAL
SERVICES & TESTING, INC.

## PARTICULATE ANALYSIS

Job No. 9010-204

Name Coors

Source Name Cooker

---

Run No 1

Filter No T-471 Front Wash 175 ml Impinger Catch - Backhalf ____ ml

Final 0.6738 101.0079

Initial 0.6717 100.9959

0.0021 ⇒ 2.1 mg 0.0120 ⇒ 12.0 mg

- 2.0 BLANK

10.0 mg

MF 12.1 mg MT — mg

---

Run No 2

Filter No T-473 Front Wash 225 ml Impinger Catch - Backhalf ____ ml

Final 0.6700 104.9667

Initial 0.6692 104.9580

0.0008 ⇒ 0.8mg 0.0087 ⇒ 8.7 mg

- 2.6 BLANK

6.1 mg

MF 6.9 mg MT — mg

---

Run No 3

Filter No T-474 Front Wash 300 ml Impinger Catch - Backhalf ____ ml

Final 0.6700 98.6084

Initial 0.6680 98.5925

0.0020 ⇒ 2.0 mg 0.0159 ⇒ 15.9 mg

- 3.4 BLANK

12.5 mg

MF 14.5 mg MT — mg

---

Acetone Blank:

Volume 200 ml

Final 100.6169

Initial 100.6146

0.0023

Blank: 0.0115 mg/ml

Total Weight 2.3 mg

D.I. Blank:

Volume ____ ml

Final

Initial ____

Blank: ____ mg/ml

Total Weight ____ mg

WESTERN ENVIRONMENTAL
SERVICES & TESTING, INC.

## PARTICULATE ANALYSIS

Job No. 9010-204

Name Coors

Source Name Brew Kettle

---

Run No 1

Filter No T-475 Front Wash 325 ml Impinger Catch - Backhalf ____ ml

| | | |
|---|---|---|
| Final | 0.6710 | 106.9260 |
| Initial | 0.6698 | 106.9170 |
| | 0.0012 ⇒ 1.2 mg | 0.0090 ⇒ 9.0 mg<br>-3.7 BLANK<br>5.3 mg |

MF 6.5 mg MT ____ mg

---

Run No 2

Filter No T-476 Front Wash 325 ml Impinger Catch - Backhalf ____ ml

| | | |
|---|---|---|
| Final | 0.6750 | 106.3372 |
| Initial | 0.6736 | 106.3294 |
| | 0.0014 ⇒ 1.4 mg | 0.0078 ⇒ 7.8 mg<br>-3.7 BLANK<br>4.1 mg |

MF 5.5 mg MT ____ mg

---

Run No 3

Filter No T-477 Front Wash 325 ml Impinger Catch - Backhalf ____ ml

| | | |
|---|---|---|
| Final | 0.6658 | 100.8923 |
| Initial | 0.6649 | 100.8862 |
| | 0.0009 ⇒ 0.9 mg | 0.0061 ⇒ 6.1 mg<br>-3.7 BLANK<br>2.4 mg |

MF 3.3 mg MT ____ mg

---

Acetone Blank:

Volume 200 ml

Final 100.6169
Initial 100.6146
0.0023

Blank: 0.0115 mg/ml

Total Weight 2.3 mg

D.I. Blank:

Volume ____ ml

Final
Initial ____

Blank: ____ mg/ml

Total Weight ____ mg

WESTERN ENVIRONMENTAL
SERVICES & TESTING, INC.

PARTICULATE ANALYSIS

Job No. 9010-204

Name Coors

Source Name Brew Kettle

Run No 4

Filter No T-478 Front Wash 400 ml Impinger Catch - Backhalf ______ ml

| | | |
|---|---|---|
| Final | 0.6782 | 101.0079 |
| Initial | 0.6761 | 100.9959 |
| | 0.0021 ⇒ 2.1 mg | 0.0120 ⇒ 12.0 mg<br>− 4.6 BLANK<br>7.4 mg |

MF 9.5 mg MT ______ mg

Run No 5

Filter No T-479 Front Wash 325 ml Impinger Catch - Backhalf ______ ml

| | | |
|---|---|---|
| Final | 0.6712 | 104.9667 |
| Initial | 0.6699 | 104.9580 |
| | 0.0013 ⇒ 1.3 mg | 0.0087 ⇒ 8.7 mg<br>− 3.7 BLANK<br>5.0 mg |

MF 6.3 mg MT ______ mg

Run No 6

Filter No T-480 Front Wash 300 ml Impinger Catch - Backhalf ______ ml

| | | |
|---|---|---|
| Final | 0.6679 | 98.6084 |
| Initial | 0.6658 | 98.5925 |
| | 0.0021 ⇒ 2.1 mg | 0.0159 ⇒ 15.9 mg<br>− 3.4 BLANK<br>12.5 mg |

MF 14.6 mg MT ______ mg

Acetone Blank:

Volume 200 ml

Final 100.6169
Initial 100.6146
0.0023

Blank: 0.0115 mg/ml

Total Weight 2.3 mg

D.I. Blank:

Volume ______ ml

Final
Initial ______

Blank: ______ mg/ml

Total Weight ______ mg

# SULFUR DIOXIDE

Client ___Coors___ $SO_2$ EMISSION DATA Job No. ___9010 - 204___

Unit Tested ___Cooker Stack___

| Run Number | 1 | 2 | 3 | | |
|---|---|---|---|---|---|
| Date | 11/6/90 | 11/6/90 | 11/6/90 | | |
| Time | 0630 - 0755 | 0833 - 0935 | 1015 - 1117 | | |
| N - normality of Ba $Cl_2$ | 0.009871 | 0.009871 | 0.009871 | | |
| $ML_I$ - ml in impinger #1 | 240 | 176 | 200 | | |
| $ML_I$ - ml in impinger #2 | 226 | 120 | 134 | | |
| $ML_I$ - ml in impinger #3 | — | — | — | | |
| $ML_A$ - ml in aliquot #1 | 5 | 5 | 5 | | |
| $ML_A$ - ml in aliquot #2 | 5 | 5 | 5 | | |
| $ML_A$ - ml in aliquot #3 | — | — | — | | |
| $ML_B$ - ml of Ba $Cl_2$ to titrate #1 | 0.10 | 0.05 | 0.05 | | |
| $ML_B$ - ml of Ba $Cl_2$ to titrate #2 | 0.10 | 0.05 | 0.05 | | |
| $ML_B$ - ml of Ba $Cl_2$ to titrate #3 | — | — | — | | |
| $ML_{BB}$ - ml of Ba $Cl_2$ to titrate blank | 0.05 | 0.05 | 0.05 | | |
| $T_m$ - average gas meter temp., °F | 82 | 86 | 86 | | |
| $V_m$ - volume of dry gas sampled @ meter conditions, ft.$^3$ | 58.413 | 70.251 | 65.211 | | |
| $P_b$ - barometric pressure, "Hg Abs. | 24.24 | 24.24 | 24.24 | | |
| Qs - Stack gas volume dry @standard conditions, *SCFM | 4187 | 4898 | 4432 | | |
| $C_I$ - $SO_2$ in impinger #1, mgs | 0.76 | ND | ND | | |
| $C_I$ - $SO_2$ in impinger #2, mgs | 0.71 | ND | ND | | |
| $C_I$ - $SO_2$ in impinger #3, mgs | — | — | — | | |
| $C_T$ - total $SO_2$ in impingers, mgs | 1.47 | | | | |
| ppm $SO_2$ | 0.42 | ND | ND | | |
| $^cSO_2$ - emission rate of $SO_2$, lbs/day | 0.42 | | | | |
| $C_s$ - emission rate of S, lbs/day $SO_2$ lbs/hr | 0.02 | | | | |
| *68°F, 29.92 "Hg (20°C, 760 mm Hg) | | | | | |

$$C_I = \frac{ML_I \times (ML_B - ML_{BB}) \times N \times 32}{ML_A}$$

$$\text{ppm } SO_2 = \frac{0.7513 \times C_T \times (T_m + 460)}{V_m P_b}$$

$$C_T = C_I\ \#1 + C_I\ \#2 + C_I\ \#3$$

$$^cSO_2 = \text{ppm } SO_2 \times Q_s \times 239.2 \times 10^{-6}$$

$$C_s = \frac{^cSO_2}{2}$$

Client Coors SO2 EMISSION DATA Job No. 9010-204

Unit Tested Brew Kettle Stack - Heat Reclaim ON

| Run Number | 1 | 2 | 3 | | |
|---|---|---|---|---|---|
| Date | 11/6/90 | 11/6/90 | 11/6/90 | | |
| Time | 1336 - 1438 | 1700 - 1802 | 1823 - 1924 | | |
| N - normality of Ba $Cl_2$ | 0.009871 | 0.009871 | 0.009871 | | |
| $ML_I$ - ml in impinger #1 | 234 | 236 | 256 | | |
| $ML_I$ - ml in impinger #2 | 136 | 120 | 150 | | |
| $ML_I$ - ml in impinger #3 | — | — | — | | |
| $ML_A$ - ml in aliquot #1 | 5 | 5 | 5 | | |
| $ML_A$ - ml in aliquot #2 | 5 | 5 | 5 | | |
| $ML_A$ - ml in aliquot #3 | — | — | — | | |
| $ML_B$ - ml of Ba $Cl_2$ to titrate #1 | 0.10 | 0.10 | 0.07 | | |
| $ML_B$ - ml of Ba $Cl_2$ to titrate #2 | 0.10 | 0.10 | 0.07 | | |
| $ML_B$ - ml of Ba $Cl_2$ to titrate #3 | — | — | — | | |
| $ML_{BB}$ - ml of Ba $Cl_2$ to titrate blank | 0.05 | 0.05 | 0.05 | | |
| $T_m$ - average gas meter temp., °F | 82 | 82 | 84 | | |
| $V_m$ - volume of dry gas sampled @ meter conditions, ft.$^3$ | 42.966 | 42.838 | 50.152 | | |
| $P_b$ - barometric pressure, "Hg Abs. | 24.24 | 24.24 | 24.24 | | |
| Qs - Stack gas volume dry @standard conditions, *SCFM | 11019 | 11905 | 13610 | | |
| $C_I$ - $SO_2$ in impinger #1, mgs | 0.74 | 0.74 | 0.32 | | |
| $C_I$ - $SO_2$ in impinger #2, mgs | 0.43 | 0.38 | 0.19 | | |
| $C_I$ - $SO_2$ in impinger #3, mgs | — | — | — | | |
| $C_T$ - total $SO_2$ in impingers, mgs | 1.17 | 1.12 | 0.51 | | |
| ppm $SO_2$ | 0.4 | 0.4 | 0.2 | | |
| $^cSO_2$ - emission rate of $SO_2$, lbs/day | 1.05 | 1.14 | 0.65 | | |
| $C_e$ - emission rate of ~~C, lbs/day~~ $SO_2$ lbs/hr | 0.04 | 0.05 | 0.03 | | |
| *68°F, 29.92 "Hg (20°C, 760 mm Hg) | | | | | |

$$C_I = \frac{ML_I \times (ML_B - ML_{BB}) \times N \times 32}{ML_A}$$

$$\text{ppm } SO_2 = \frac{0.7513 \times C_T \times (T_m + 460)}{V_m P_b}$$

$$C_T = C_I\ \#1 + C_I\ \#2 + C_I\ \#3$$

$$^cSO_2 = \text{ppm } SO_2 \times Q_s \times 239.2 \times 10^{-8}$$

$$C_e = \frac{^cSO_2}{2}$$

Client Coors SO2 EMISSION DATA Job No. 9010-204

Unit Tested Brew Kettle Stack - Heat Reclaim Off

| Run Number | 4 | 5 | 6 | | |
|---|---|---|---|---|---|
| Date | 11/6/90 | 11/6/90 | 11/6/90 | | |
| Time | 2050 - 2153 | 2217 - 2318 | 2333 - 0034 | | |
| $\underline{N}$ - normality of Ba $Cl_2$ | 0.009871 | 0.009871 | 0.009871 | | |
| $ML_I$ - ml in impinger #1 | 304 | 309 | 425 | | |
| $ML_I$ - ml in impinger #2 | 134 | 160 | 206 | | |
| $ML_I$ - ml in impinger #3 | — | — | — | | |
| $ML_A$ - ml in aliquot #1 | 5 | 5 | 5 | | |
| $ML_A$ - ml in aliquot #2 | 5 | 5 | 5 | | |
| $ML_A$ - ml in aliquot #3 | — | — | — | | |
| $ML_B$ - ml of Ba $Cl_2$ to titrate #1 | 0.05 | 0.05 | 0.05 | | |
| $ML_B$ - ml of Ba $Cl_2$ to titrate #2 | 0.05 | 0.05 | 0.05 | | |
| $ML_B$ - ml of Ba $Cl_2$ to titrate #3 | — | — | - | | |
| $ML_{BB}$ - ml of Ba $Cl_2$ to titrate blank | 0.05 | 0.05 | 0.05 | | |
| $T_m$ - average gas meter temp., °F | 81 | 81 | 80 | | |
| $V_m$ - volume of dry gas sampled @ meter conditions, ft.$^3$ | 47.493 | 44.878 | 41.780 | | |
| $P_b$ - barometric pressure, "Hg Abs. | 24.24 | 24.24 | 24.24 | | |
| Qs - Stack gas volume dry @standard conditions, *SCFM | 14086 | 11797 | 10810 | | |
| $C_I$ - $SO_2$ in impinger #1, mgs | ND | ND | ND | | |
| $C_I$ - $SO_2$ in impinger #2, mgs | ND | ND | ND | | |
| $C_I$ - $SO_2$ in impinger #3, mgs | | | | | |
| $C_T$ - total $SO_2$ in impingers, mgs | | | | | |
| ppm $SO_2$ | ND | ND | ND | | |
| $^cSO_2$ - emission rate of $SO_2$, lbs/day | | | | | |
| $C_s$ - emission rate of S, lbs/day | | | | | |
| *68°F, 29.92 "Hg (20°C, 760 mm Hg) | | | | | |

$$C_I = \frac{ML_I \times (ML_B - ML_{BB}) \times N \times 32}{ML_A}$$

$$\text{ppm } SO_2 = \frac{0.7513 \times C_T \times (T_m + 460)}{V_m P_b}$$

$$C_T = C_I\ \#1 + C_I\ \#2 + C_I\ \#3$$

$$^cSO_2 = \text{ppm } SO_2 \times Q_s \times 239.2 \times 10^{-6}$$

$$C_s = \frac{^cSO_2}{2}$$

# STANDARDIZATION OF $SO_2$ REAGENTS

Standardized By: T. McCullough     Date: 11/12/90

(I) Standardization of 0.1 N Sulfuric Acid

| | grams $Na_2CO_3$ | ml $H_2SO_4$ | N $H_2SO_4$ |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |

Average N = ________

$$N\ H_2SO_4 = \frac{\text{grams } NA_2CO_3 \times 1000\ ml/l}{53.00\ g/eq \times \text{volume } H_2SO_4 \text{ in ml}}$$

N $H_2SO_4$ = ________

(II) Standardization of Barium Chloride

| | ml $BaCl_2$ | N $BaCl_2$ |
|---|---|---|
| 1. | 10.1 | |
| 2. | 10.1 | |
| 3. | | |

Average N $BaCl_2$ = 0.009871

1.0

$$N\ BaCl_2 = \frac{\text{Volume } H_2SO_4 \text{ in ml} \times N\ H_2SO_4}{\text{Volume } BaCl_2 \text{ used in ml}}$$

10.1

N $BaCl_2$ = 0.009871

$BaCl_2$ should be standardized once every three (3) months.

$SO_2$ TITRATION DATA

Job Name: Coors
Job Number: 9010-204
Unit Tested: Cooker + Brew Kettle
Date of Test: 11/6/90

Date: 11/12/90
Analyzed By: TM
Normality: 0.009871

| | Run/Impinger | Aliquot | 1st Titration | 2nd Titration | Average | Impinger Volume |
|---|---|---|---|---|---|---|
| Brew Kettle Stack | 1/1 | 5 ml | 0.10 | 0.10 | 0.10 | 234 |
| | /2 | 5 | 0.10 | 0.10 | 0.10 | 136 |
| | 2/1 | 5 | 0.10 | 0.10 | 0.10 | 236 |
| | /2 | 5 | 0.10 | 0.10 | 0.10 | 120 |
| | 3/1 | 5 | 0.05 | 0.10 | 0.07 | 256 |
| | /2 | 5 | 0.05 | 0.10 | 0.07 | 150 |
| | 4/1 | 5 | 0.05 | 0.05 | 0.05 | 304 |
| | /2 | 5 | 0.05 | 0.05 | 0.05 | 134 |
| | 5/1 | 5 | 0.05 | 0.05 | 0.05 | 309 |
| | /2 | 5 | 0.05 | 0.05 | 0.05 | 160 |
| | 6/1 | 5 | 0.05 | 0.05 | 0.05 | 425 |
| | /2 | 5 | 0.05 | 0.05 | 0.05 | 206 |
| Cooker Stack | 1/1 | 5 | 0.10 | 0.10 | 0.10 | 240 |
| | /2 | 5 | 0.10 | 0.10 | 0.10 | 226 |
| | 2/1 | 5 | 0.05 | 0.05 | 0.05 | 176 |
| | /2 | 5 | 0.05 | 0.05 | 0.05 | 120 |
| | 3/1 | 5 | 0.05 | 0.05 | 0.05 | 200 |
| | /2 | 5 | 0.05 | 0.05 | 0.05 | 134 |
| | Blank | 5 | 0.05 | 0.05 | 0.05 | — |

Replicate titrations must agree within 1.0 percent or 0.2 ml, whichever is larger.

WEST, INC.

Revised 10/85

ANALYZER DATA

TOTAL HYDROCARBONS

# THC CONTINUOUS ANALYSIS

Plant Coors — Date 11/6/90

Sample location Cooker Stack

Run number 1 — Time 0630-0755

Operator M. Reynolds — Intervals 2 min.

| Interval | Chart Recorder Deflection, % | ppm THC (from cal. curve) |
|---|---|---|
| 1 | 0.7 | |
| 2 | 0.0 | |
| 3 | 0.0 | |
| 4 | 0.0 | |
| 5 | 0.3 | |
| 6 | 2.7 | |
| 7 | 0.5 | |
| 8 | 0.3 | |
| 9 | 0.6 | |
| 10 | 0.7 | |
| 11 | 0.6 | |
| 12 | 0.3 | |
| 13 | 0.5 | |
| 14 | 0.1 | |
| 15 | 0.0 | |
| 16 | 0.0 | |
| 17 | 0.0 | |
| 18 | 0.0 | |
| 19 | 0.0 | |
| 20 | 0.0 | |
| 21 | 0.0 | |
| 22 | 0.0 | |
| 23 | 0.0 | |
| 24 | 0.0 | |
| 25 | 0.0 | |
| 26 | 0.0 | |
| 27 | 0.0 | |
| 28 | 0.0 | |
| 29 | 0.0 | |
| 30 | 0.0 | |
| Average | 0.2 | |

= 2 ppm (dry basis)

# THC CONTINUOUS ANALYSIS

Plant Coors Date 11/6/90

Sample location Cooker Stack

Run number 2 Time 0833-0935

Operator M. Reynolds Intervals 2 min.

| Interval | Chart Recorder Deflection, % | ppm THC (from cal. curve) |
|---|---|---|
| 1 | 0.6 | |
| 2 | 0.8 | |
| 3 | 0.5 | |
| 4 | 0.5 | |
| 5 | 0.2 | |
| 6 | 0.4 | |
| 7 | 0.4 | |
| 8 | 0.4 | |
| 9 | 0.4 | |
| 10 | 0.4 | |
| 11 | 0.5 | |
| 12 | 0.6 | |
| 13 | 0.5 | |
| 14 | 0.5 | |
| 15 | 0.5 | |
| 16 | 0.6 | |
| 17 | 0.7 | |
| 18 | 0.6 | |
| 19 | 0.5 | |
| 20 | 0.5 | |
| 21 | 0.4 | |
| 22 | 0.3 | |
| 23 | 0.4 | |
| 24 | 0.3 | |
| 25 | 0.5 | |
| 26 | 0.9 | |
| 27 | 0.7 | |
| 28 | 0.6 | |
| 29 | 0.6 | |
| 30 | 0.8 | |
| Average | 0.5 | |

= 5 ppm (dry basis)

## THC CONTINUOUS ANALYSIS

Plant Coors Date 11/6/90

Sample location Cooker Stack

Run number 3 Time 1015 - 1117

Operator M. Reynolds Intervals 2 min.

| Interval | Chart Recorder Deflection, % | ppm THC (from cal. curve) |
|---|---|---|
| 1 | 0.8 | |
| 2 | 1.0 | |
| 3 | 0.9 | |
| 4 | 0.6 | |
| 5 | 0.6 | |
| 6 | 0.7 | |
| 7 | 0.8 | |
| 8 | 0.7 | |
| 9 | 0.6 | |
| 10 | 0.6 | |
| 11 | 0.5 | |
| 12 | 0.5 | |
| 13 | 0.6 | |
| 14 | 0.5 | |
| 15 | 0.5 | |
| 16 | 0.3 | |
| 17 | 0.3 | |
| 18 | 0.4 | |
| 19 | 0.5 | |
| 20 | 0.6 | |
| 21 | 0.5 | |
| 22 | 0.5 | |
| 23 | 0.6 | |
| 24 | 0.7 | |
| 25 | 0.6 | |
| 26 | 0.6 | |
| 27 | 0.5 | |
| 28 | 0.4 | |
| 29 | 0.4 | |
| 30 | 0.5 | |
| Average | 0.6 | |

= 6 ppm (dry basis)

## THC CONTINUOUS ANALYSIS

Plant Coors Date 11/6/90

Sample location Brew Kettle

Run number 1 Time 1336-1438

Operator M. Reynolds Intervals 2 min.

| Interval | Chart Recorder Deflection, % | ppm THC (from cal. curve) |
|---|---|---|
| 1 | 1.1 | 11 |
| 2 | 1.0 | 10 |
| 3 | 2.4 | 24 |
| 4 | 1.0 | 10 |
| 5 | 0.4 | 4 |
| 6 | 1.1 | 11 |
| 7 | 0.8 | 8 |
| 8 | 0.9 | 9 |
| 9 | 1.0 | 10 |
| 10 | 1.0 | 10 |
| 11 | 1.0 | 10 |
| 12 | 0.9 | 9 |
| 13 | 0.8 | 8 |
| 14 | 0.4 | 4 |
| 15 | 0.9 | 9 |
| 16 | 1.0 | 10 |
| 17 | 1.3 | 13 |
| 18 | 1.7 | 17 |
| 19 | 1.3 | 13 |
| 20 | 1.5 | 15 |
| 21 | 1.0 | 10 |
| 22 | 1.3 | 13 |
| 23 | 1.2 | 12 |
| 24 | 0.4 | 4 |
| 25 | 0.8 | 8 |
| 26 | 1.0 | 10 |
| 27 | 0.8 | 8 |
| 28 | 0.7 | 7 |
| 29 | 0.8 | 8 |
| 30 | 0.9 | 9 |
| Average | 1.0 | 10 |

= 10 ppm (dry basis)

THC CONTINUOUS ANALYSIS

Plant Coors Date 11/6/90

Sample location Brew Kettle

Run number 2 Time 1700-1802

Operator M. Reynolds Intervals 2 min.

| Interval | Chart Recorder Deflection, % | ppm THC (from cal. curve) |
|---|---|---|
| 1 | 1.5 | |
| 2 | 1.4 | |
| 3 | 1.2 | |
| 4 | 1.0 | |
| 5 | 1.0 | |
| 6 | 1.0 | |
| 7 | 1.0 | |
| 8 | 1.0 | |
| 9 | 1.0 | |
| 10 | 0.8 | |
| 11 | 1.0 | |
| 12 | 1.3 | |
| 13 | 1.3 | |
| 14 | 1.1 | |
| 15 | 1.0 | |
| 16 | 1.2 | |
| 17 | 1.4 | |
| 18 | 1.0 | |
| 19 | 0.8 | |
| 20 | 1.2 | |
| 21 | 1.0 | |
| 22 | 0.8 | |
| 23 | 1.0 | |
| 24 | 1.0 | |
| 25 | 1.0 | |
| 26 | 0.7 | |
| 27 | 0.7 | |
| 28 | 0.6 | |
| 29 | 1.0 | |
| 30 | 0.9 | |
| Average | 1.0 | |

= 10 ppm (dry basis)

# THC CONTINUOUS ANALYSIS

Plant Coors — Date 11/6/90

Sample location Brew Kettle

Run number 3 — Time 1823- 1924

Operator M. Reynolds — Intervals 2 min.

| Interval | Chart Recorder Deflection, % | ppm THC (from cal. curve) |
|---|---|---|
| 1 | 1.5 | |
| 2 | 1.1 | |
| 3 | 1.0 | |
| 4 | 1.1 | |
| 5 | 0.9 | |
| 6 | 1.0 | |
| 7 | 0.9 | |
| 8 | 0.7 | |
| 9 | 0.7 | |
| 10 | 0.8 | |
| 11 | 0.8 | |
| 12 | 0.9 | |
| 13 | 0.7 | |
| 14 | 0.8 | |
| 15 | 0.8 | |
| 16 | 1.0 | |
| 17 | 1.0 | |
| 18 | 0.8 | |
| 19 | 0.8 | |
| 20 | 0.6 | |
| 21 | 0.9 | |
| 22 | 0.7 | |
| 23 | 0.6 | |
| 24 | 0.9 | |
| 25 | 0.9 | |
| 26 | 1.0 | |
| 27 | 0.8 | |
| 28 | 0.5 | |
| 29 | 0.8 | |
| 30 | 0.9 | |
| Average | 0.9 | |

= 9 ppm (dry basis)

THC CONTINUOUS ANALYSIS

Plant Coors | Date 11/6/90

Sample location Brew Kettle

Run number 4 | Time 2050-2153

Operator M. Reynolds | Intervals 2 min.

| Interval | Chart Recorder Deflection, % | ppm THC (from cal. curve) |
|---|---|---|
| 1 | 1.9 | |
| 2 | 1.1 | |
| 3 | 1.0 | |
| 4 | 1.0 | |
| 5 | 1.0 | |
| 6 | 1.0 | |
| 7 | 1.0 | |
| 8 | 1.0 | |
| 9 | 1.0 | |
| 10 | 1.0 | |
| 11 | 1.0 | |
| 12 | 1.0 | |
| 13 | 1.1 | |
| 14 | 1.0 | |
| 15 | 1.0 | |
| 16 | 1.0 | |
| 17 | 1.0 | |
| 18 | 1.0 | |
| 19 | 1.0 | |
| 20 | 1.1 | |
| 21 | 1.0 | |
| 22 | 1.0 | |
| 23 | 1.0 | |
| 24 | 1.0 | |
| 25 | 1.2 | |
| 26 | 1.0 | |
| 27 | 1.0 | |
| 28 | 1.0 | |
| 29 | 2.8 | |
| 30 | 2.0 | |
| Average | 1.1 | |

= 11 ppm (dry basis)

THC CONTINUOUS ANALYSIS

Plant Coors Date 11/6/90

Sample location Brew Kettle

Run number 5 Time 2217-2318

Operator M. Reynolds Intervals 2 min.

| Interval | Chart Recorder Deflection, % | ppm THC (from cal. curve) |
|---|---|---|
| 1 | 2.0 | |
| 2 | 2.0 | |
| 3 | 2.0 | |
| 4 | 1.3 | |
| 5 | 1.2 | |
| 6 | 1.5 | |
| 7 | 1.4 | |
| 8 | 1.7 | |
| 9 | 1.5 | |
| 10 | 1.5 | |
| 11 | 1.2 | |
| 12 | 1.1 | |
| 13 | 1.4 | |
| 14 | 2.0 | |
| 15 | 1.7 | |
| 16 | 1.2 | |
| 17 | 1.1 | |
| 18 | 1.5 | |
| 19 | 1.6 | |
| 20 | 1.7 | |
| 21 | 1.8 | |
| 22 | 2.1 | |
| 23 | 1.9 | |
| 24 | 1.6 | |
| 25 | 1.4 | |
| 26 | 1.9 | |
| 27 | 1.8 | |
| 28 | 1.6 | |
| 29 | 1.7 | |
| 30 | 1.5 | |
| Average | 1.6 | |

= 16 ppm (dry basis)

# THC CONTINUOUS ANALYSIS

Plant Coors Date 11/6-7/90

Sample location Brew Kettle

Run number 6 Time 2333-0034

Operator M. Reynolds Intervals 2 min.

| Interval | Chart Recorder Deflection, % | ppm THC (from cal. curve) |
|---|---|---|
| 1 | 1.0 | |
| 2 | 1.1 | |
| 3 | 1.0 | |
| 4 | 1.0 | |
| 5 | 1.0 | |
| 6 | 1.8 | |
| 7 | 1.7 | |
| 8 | 2.1 | |
| 9 | 2.0 | |
| 10 | 1.6 | |
| 11 | 1.4 | |
| 12 | 1.8 | |
| 13 | 2.0 | |
| 14 | 2.0 | |
| 15 | 3.3 | |
| 16 | 2.0 | |
| 17 | 1.6 | |
| 18 | 1.5 | |
| 19 | 1.5 | |
| 20 | 2.3 | |
| 21 | 2.0 | |
| 22 | 2.0 | |
| 23 | 1.8 | |
| 24 | 1.9 | |
| 25 | 1.4 | |
| 26 | 1.0 | |
| 27 | 1.3 | |
| 28 | 1.3 | |
| 29 | 1.4 | |
| 30 | 1.4 | |
| Average | 1.6 | |

= 16 ppm (dry basis)

OXIDES OF NITROGEN

METHOD 7E ANALYTICAL DATA & CALCULATIONS
CONTINUOUS ANALYSIS

Plant Coors Date 11/6-7/90

Sample location Cooker

Run number 1-3 Time 0630-1117

Operator M. Reynolds Intervals ______

| Interval | Chart Recorder Deflection, % | ppm NOx (from cal. curve) |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |
| 11 | | |
| 12 | | |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | | |
| 25 | | |
| 26 | | |
| 27 | | |
| 28 | | |
| 29 | | |
| 30 | | |
| Average | | |

= _____ ppm (dry basis)

* ALL RUNS READ LESS THAN 1 PPM.

METHOD 7E ANALYTICAL DATA & CALCULATIONS
CONTINUOUS ANALYSIS

Plant Coors Date 11/6-7/90

Sample location Brew Kettle

Run number 1-3 Time 1336-1924

Operator M. Reynolds Intervals ______

| Interval | Chart Recorder Deflection, % | ppm NOx (from cal. curve) |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |
| 11 | | |
| 12 | | |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | | |
| 25 | | |
| 26 | | |
| 27 | | |
| 28 | | |
| 29 | | |
| 30 | | |
| Average | | |

= _____ ppm (dry basis)

* ALL RUNS READ LESS THAN 1 PPM.

METHOD 7E ANALYTICAL DATA & CALCULATIONS
CONTINUOUS ANALYSIS

Plant Coors Date 11/6-7/90

Sample location Brew Kettle

Run number 4-6 Time 2050-0034

Operator M. Reynolds Intervals ______

| Interval | Chart Recorder Deflection, % | ppm NOx (from cal. curve) |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |
| 11 | | |
| 12 | | |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | | |
| 25 | | |
| 26 | | |
| 27 | | |
| 28 | | |
| 29 | | |
| 30 | | |
| Average | | |

= _____ ppm (dry basis)

* ALL RUNS READ LESS THAN 1 PPM.

# INTEGRATED BAG SAMPLES

WESTERN
ENVIRONMENTAL
SERVICES AND
TESTING INC.

6756 West Uranium Road
Casper, Wyoming 82604
307/234-5511

76 Imperial Drive, Unit I
Evanston, Wyoming 82930
307/789-6420

Client : Adolph Coors Company
Address: CE 125 Golden, CO 80401
Attention: Jere Zimmermon

LAB# : 90-2241-1

Sample Type : Air Bags
Submitted By: Western Environmental
Analyzed By : NR
Subject : 9010-204

Date Sampled : 11-06-90
Date Submitted: 11-12-90
Date Analyzed : 11-20-90

| Sample # | Sample I.D. | Parameter | Units | Level |
|---|---|---|---|---|
| 2241-1 | Cooker Stack Run #1-3 0800 hrs 11/06/90 | Methane | ppm | 1.7 |
| | | Ethane | ppm | 0.1 |
| | | C3 | ppm | *ND |
| | | C4 | ppm | 0.4 |
| | | C5 | ppm | 10.0 |

* = Not Detected

The C5 results are a conglomeration of little peaks with one major large constituent that may be something other than a straight chain hydrocarbon with a relatively different response factor.

Niels L Rasmussen
Analyst

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WESTERN ENVIRONMENTAL SERVICES AND TESTING INC.

6756 West Uranium Road
Casper, Wyoming 82604
307/234-5511

76 Imperial Drive, Unit I
Evanston, Wyoming 82930
307/789-6420

Client : Adolph Coors Company
Address: CE 125 Golden, CO 80401
Attention: Jere Zimmermon

LAB# : 90-2241-2

Sample Type : Air Bags
Submitted By: Western Environmental
Analyzed By : NR
Subject : 9010-204

Date Sampled : 11-06-90
Date Submitted: 11-12-90
Date Analyzed : 11-20-90

| Sample # | Sample I.D. | Parameter | Units | Level |
|---|---|---|---|---|
| 2241-2 | Brew Kettle Run #1-3 | Methane | ppm | 1.4 |
| | 1430 hrs 11-06-90 | Ethane | ppm | *ND |
| | | C3 | ppm | *ND |
| | | C4 | ppm | 0.4 |
| | | C5 | ppm | 11.7 |

* = Not Detected

The C5 results are a conglomeration of little peaks with one major large constituent that may be something other than a straight chain Hydrocarbon with a relatively different response factor.

Neil L Rasmussen

Analyst

the analysis, opinions or interpretations contained in this report are based on observations and material supplied by the client for whose exclusive and confidential use this report has been made. The interpretations or opinions expressed represent the best judgement of Western Environmental Services and Testing, Inc. Western Environmental assumes no responsibility and makes no warranty or representations, expressed or implied as to the productivity, proper operations, or profitableness however of any oil, gas, coal, mineral, property, well, sand, soil or any other application or connection with which this report is used or relied upon for any reason

WESTERN ENVIRONMENTAL SERVICES AND TESTING INC.

6756 West Uranium Road
Casper, Wyoming 82604
307/234-5511

76 Imperial Drive, Unit I
Evanston, Wyoming 82930
307/789-6420

Client : Adolph Coors Company
Address: CE 125 Golden, CO 80401
Attention: Jere Zimmermon

LAB# : 90-2241-3

Sample Type : Air Bags
Submitted By: Western Environmental
Analyzed By : NR
Subject : 9010-204

Date Sampled : 11-06-90
Date Submitted: 11-12-90
Date Analyzed : 11-20-90

| Sample # | Sample I.D. | Parameter | Units | Level |
|---|---|---|---|---|
| 2241-3 | Brew Kettle Run #4-6 2245 hrs 11-06-90 | Methane | ppm | 1.4 |
| | | Ethane | ppm | 1.0 |
| | | C3 | ppm | *ND |
| | | C4 | ppm | 1.9 |
| | | C5 | ppm | 7.5 |

* = Not Detected

The C5 results are a conglomeration of little peaks with one major large constituent that may be something other than a straight chain Hydrocarbon with a relatively different response factor.

Neils L Rasmussen

Analyst

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# APPENDIX F

Chain of Custody
and
Analysis Request

WESTERN ENVIRONMENTAL SERVICES AND TESTING, INC.

Chain of Custody and Analysis Request

Job Number 9010-204 Date(s) Sampled Nov. 6, 1990

Job Name Coors Number of Runs 3

Source Location Golden CO

Unit Tested Combined Cooke Stack

Absorbing Solution/Analysis For

| Run | Filter Number | Imp 1 | Imp 2 | Imp 3 | Imp 4 | Probe Wash |
|---|---|---|---|---|---|---|
| 1 | T-471 | 6% $H_2O_2$ / moist $SO_2$ | 6% $H_2O_2$ / moist. $SO_2$ | Dry / moist | silica gel / moist | Acetone / part |
| 2 | T-473 | " | " | " | " | " |
| 3 | T-474 | " | " | " | " | " |
| 4 | | | | | | |

$No_x$: monitor

Other

Total Number of Sample Bottles: 9

Total Number of Filters: 3

Comments: Integrated bag sample for ethane/methane analysis

Person Responsible for Samples: J. Menke

| Sample No. | Recovered by | Date | Time | Location |
|---|---|---|---|---|
| 1 | J Menke | 11/6/90 | 0830 | on site |
| 2 | J Menke | 11/6/90 | 0950 | on site |
| 3 | J. Menke | 11/6/90 | 1140 | on site |
| 4 | | | | |

Samples Received By J. Menke for transport Date: 11/9/90 Time: 1400

Samples Received at Lab by Nick L Rasmussen Date: 11/9/90 Time: 1930

Samples Analyzed by staff. N.B./JPM/NR/TM Date: 11/10-15/90 Time: —

WESTERN ENVIRONMENTAL SERVICES AND TESTING, INC.

Chain of Custody and Analysis Request

Job Number 9010-204 Date(s) Sampled 11/6/90

Job Name Coors Number of Runs 3

Source Location Golden CO

Unit Tested Brew Kettle Stack - Heat Reclaim On

Absorbing Solution/Analysis For

| Run | Filter Number | Imp 1 | Imp 2 | Imp 3 | Imp 4 | Probe Wash |
|---|---|---|---|---|---|---|
| 1 | T-475 | 6% $H_2O_2$ / moist $SO_2$ | 6% $H_2O_2$ / moist $SO_2$ | Dry / moist | Silica gel / moist | Acetone / part. |
| 2 | T-476 | " | " | " | " | " |
| 3 | T-477 | " | " | " | " | " |
| 4 | | | | | | |

$No_x$: monitor

Other

Total Number of Sample Bottles: 9

Total Number of Filters: 3

Comments: 3 Integrated bag sample for ethane/methane

Person Responsible for Samples: J Mendez

| Sample No. | Recovered by | Date | Time | Location |
|---|---|---|---|---|
| 1 | J Mendez | 11/6/90 | 1500 | on site |
| 2 | J Mendez | 11/6/90 | 1820 | on site |
| 3 | J Mendez | 11/6/90 | 1940 | on site |
| 4 | | | | |

Samples Received By J Mendez for transport Date: 11/9/90 Time: 1400

Samples Received at Lab by Niels L Rasmussen Date: 11/9/90 Time: 1930

Samples Analyzed by Staff NB/JPM/NR/TM Date: 11/10-15/90 Time: —

WESTERN ENVIRONMENTAL SERVICES AND TESTING, INC.

Chain of Custody and Analysis Request

Job Number 9010-204 Date(s) Sampled 11/6/90

Job Name Coors Number of Runs 3

Source Location Golden CO

Unit Tested Brew Kettle Stack - Heat Reclaim off

Absorbing Solution/Analysis For

| Run | Filter Number | Imp 1 | Imp 2 | Imp 3 | Imp 4 | Probe Wash |
|---|---|---|---|---|---|---|
| | | | | | | |
| ~~1~~ 4 | T-478 | 6% $H_2O_2$ / moist $SO_2$ | 6% $H_2O_2$ / moist $SO_2$ | Dry / moist | silica gel / moist | Acetone / part |
| ~~2~~ 5 | T-479 | " | " | " | " | " |
| ~~3~~ 6 | T-480 | " | " | " | " | " |
| 4 | | | | | | |

$No_x$: monitor

Other

Total Number of Sample Bottles: 9

Total Number of Filters: 3

Comments: Integrated bag samples for ethane/methane analysis

Person Responsible for Samples: J. Mendez

| Sample No. | Recovered by | Date | Time | Location |
|---|---|---|---|---|
| ~~1~~ 4 | J Mendez | 11/6/90 | 2200 | on site |
| ~~2~~ 5 | JM | 11/6/90 | 2340 | on site |
| ~~3~~ 6 | | 11/7/90 | 0100 | on site |
| 4 | | | | |

Samples Received By J Mendez for transport Date: 11/9/90 Time: 1400

Samples Received at Lab by Niels L Rasmussen Date: 11/9/90 Time: 1930

Samples Analyzed by staff NB/JPM/WR/TM Date: 11/10-15/90 Time: —

4/85

# APPENDIX G

Resumes of Test Personnel

JAMES E. MEADOR, JR.

| | |
|---|---|
| CURRENT:<br>06/01/81 to present | Vice President, Western Environmental Services and Testing, Inc., Casper, WY, and Evanston, WY; an environmental monitoring and consulting firm. |
| PROFESSIONAL:<br>12/01/78 to 05/31/81 | Partner, Air Quality Department, Kumpe and Associates, P.C., Casper, WY; an engineering and consulting firm. |
| 02/14/77 to 12/01/78 | Field Testing Supervisor, Ecology Audits, Inc., Dallas, TX; an environmental monitoring and consulting firm. |
| EDUCATION: | Bachelor of Science - Major - Biology; Minor - Chemistry; Southwest Texas State University, San Marcos, TX, December 1976 |
| TECHNICAL EXPERIENCE: | Managed over 800 source emission surveys throughout the United States; conducted over 30 ambient air studies in the past years throughout the southwest and western U.S. |
| TEACHING EXPERIENCE: | Assisted in short course "Performing and Observing Source Sampling," September 1977; conducted source sampling training for industrial personnel at various locations. As an undergraduate student, employed as laboratory instructor for botany classes. |
| PROFESSIONAL TRAINING: | Attended short course "Performing and Observing Source Sampling," July 1977. |
| CERTIFICATIONS: | Asbestos: Contractor/Supervisor<br>Visible Emissions Evaluator<br>Private Pilot - Single engine land |
| PROFESSIONAL MEMBERSHIPS: | Air Pollution Control Association<br>TP-7 Committee - Source Emissions Testing<br>Society of Mining Engineers of A.I.M.E.<br>Source Evaluation Society<br>Wyoming Mining Association<br>Colorado Mining Association |

MICHAEL E. REYNOLDS

CURRENT:
01/90
to present

Field Testing Supervisor, Western Environmental Services and Testing, Inc., Casper, Wyoming, and Evanston, Wyoming; an environmental monitoring and consulting firm.

PROFESSIONAL:
04/89 to 01/90

Senior Technician, Western Environmental Services and Testing, Inc., Casper, Wyoming, and Evanston, Wyoming; an environmental monitoring and consulting firm.

EDUCATION:

South Dakota School of Mines and Technology, Mining Engineering, September 1978 to May 1980.

University of Wyoming, Laramie, Undergraduate business courses consistent with M.B.A. program

Bachelor of Science, Petroleum Engineering, December 1983

TECHNICAL EXPERIENCE:

Assisted in over 75 source emissions surveys and the maintenance of various ambient air networks.